NOT FEMA APPROVED

White Tank Mountains
Fans 1 and 2

TECHNICAL DATA NOTEBOOK:

Approximate Zone A Floodplain Delineation Study

Fans 1 & 2

Flood Control District of Maricopa County

January 2009

Important Notice:

Not Yet Approved by FEMA

Subject to Change per FEMA Review

NOT FEMA APPROVED

TECHNICAL DATA NOTEBOOK :

APPROXIMATE ZONE A
FLOODPLAIN DELINEATION STUDY
of
WHITE TANK FANS 1 & 2

FCD CONTRACT NO. 2007 C051

Work Assignment #2

January 2009

Prepared for:

Flood Control District of Maricopa County

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Phoenix, AZ 85009

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Appendix H: Operations and Maintenance

ELECTRONIC DATA

Digital data files on electronic media.

EXHIBITS

A. Hydrology Plates
- Hydrologic Subbasins
- NRCS Soils and XKSAT
- Existing Land Use

B. Geomorphology Exhibit Maps
- Stage 1 - Landform Map
- Stage 2 - Stability Map
- Stage 3 – Floodplain Map

C. Floodplain Study Work Maps

SECTION 1: INTRODUCTION

1.1 Study Purpose

The purpose of this floodplain delineation study is to delineate an approximate method 100-year floodplain for alluvial fans Fan 1 and Fan 2 on the White Tank Piedmont as identified in the Buckeye Sun Valley Area Drainage Master Study (PBSJ, 2005). The names, Fan 1 and Fan 2, will be used frequently in this report to refer to the alluvial fans which are the subject of this report to distinguish them from other alluvial fans on the western and northern piedmont of the White Tank Mountains. This study incorporates the assessment methods for piedmont flood hazards as outlined in Piedmont Flood Hazard Assessment Manual for Maricopa County (PFHAM) (Hjalmarson, 2003) and for alluvial fans in the Guidelines and Specifications for Flood Hazard Mapping Partners, Appendix G: Guidance for Alluvial Fan Flooding Analyses and Mapping (FEMA Guidelines) (FEMA, 2002), as well as approximate method riverine floodplain delineations for reaches upstream of the alluvial fan apex.

1.2 Study Authority

The current study was authorized by the Flood Control District of Maricopa County (District) contract FCD 2007 C051, Work Assignment #2. The study was performed by JE Fuller/Hydrology & Geomorphology, Inc. on behalf of the District.

1.3 Study Location

Figure 1.1 shows the location of the White Tank Mountain Piedmont study area. Figure 1.2 shows the Fan 1 and Fan 2 alluvial fans and their watershed. The study area is located in western Maricopa County, Arizona, within the Town of Buckeye and portions of unincorporated Maricopa County. The watershed heads in the White Tank Mountains and generally drains toward Wagner Wash, a tributary of the Hassayampa River. Fan 1 drains primarily to Wagner Wash. Fan 2 lies on the divide between Wagner Wash and Trilby Wash and partially drains toward Trilby Wash, a tributary of the Agua Fria River.

The study area has a semi-arid desert climate with an average annual precipitation of generally less than 10 inches. Precipitation is typically divided between two seasons with comparable rainfall amounts: summer and winter. Summer storms are associated with warm, moist tropical air masses that enter the state from the Gulf of Mexico and Gulf of California, producing moderate to intense localized thundershowers. Winter precipitation usually originates from the Pacific Ocean and produces light to moderate precipitation over relatively large areas. A third source of precipitation is from dissipating

tropical storm and/or hurricane remnants, which typically occur in fall, and which generate moderate to high rainfall intensities of moderate to long duration.

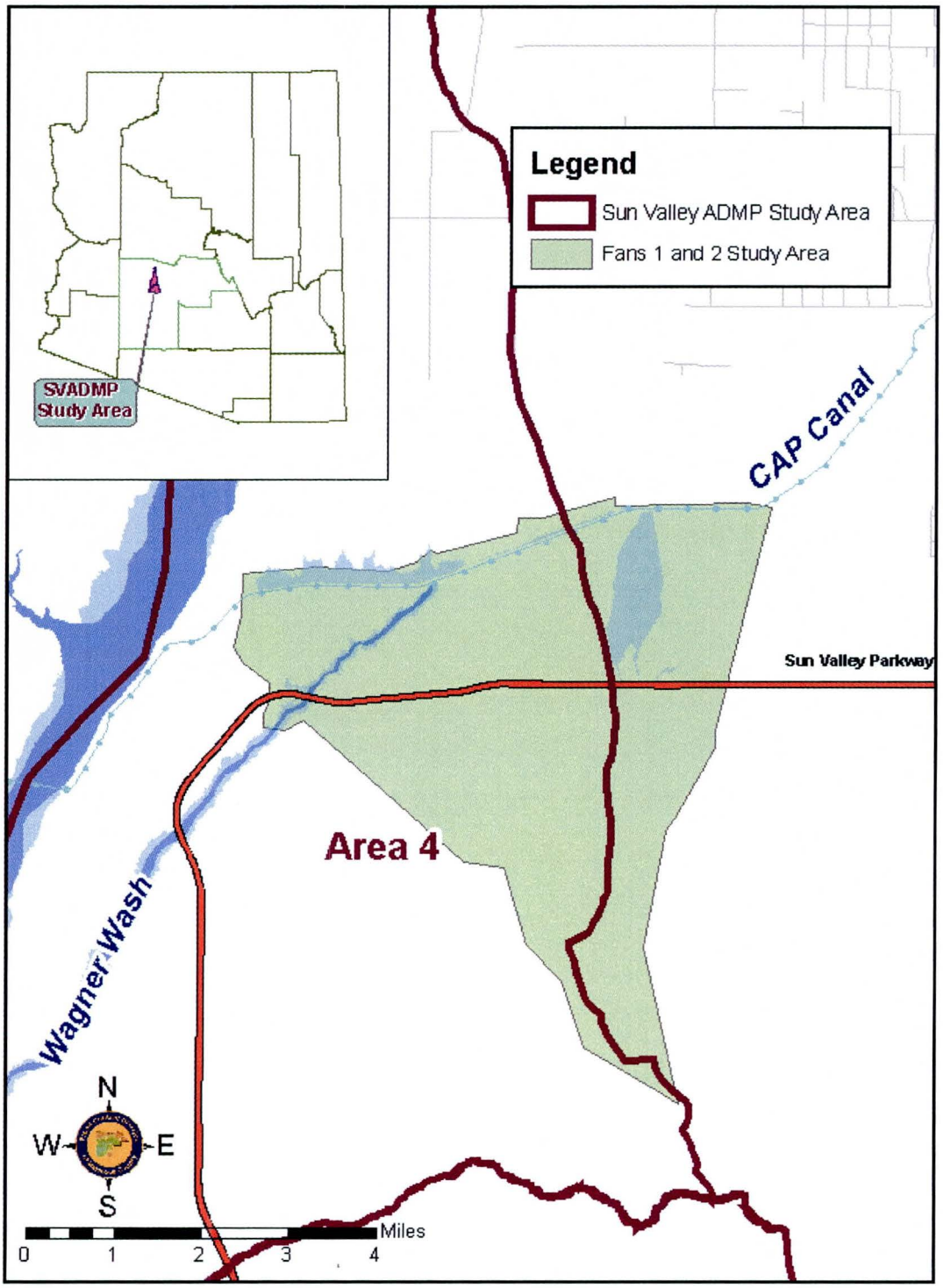

Figure 1.1 Location of Study Area

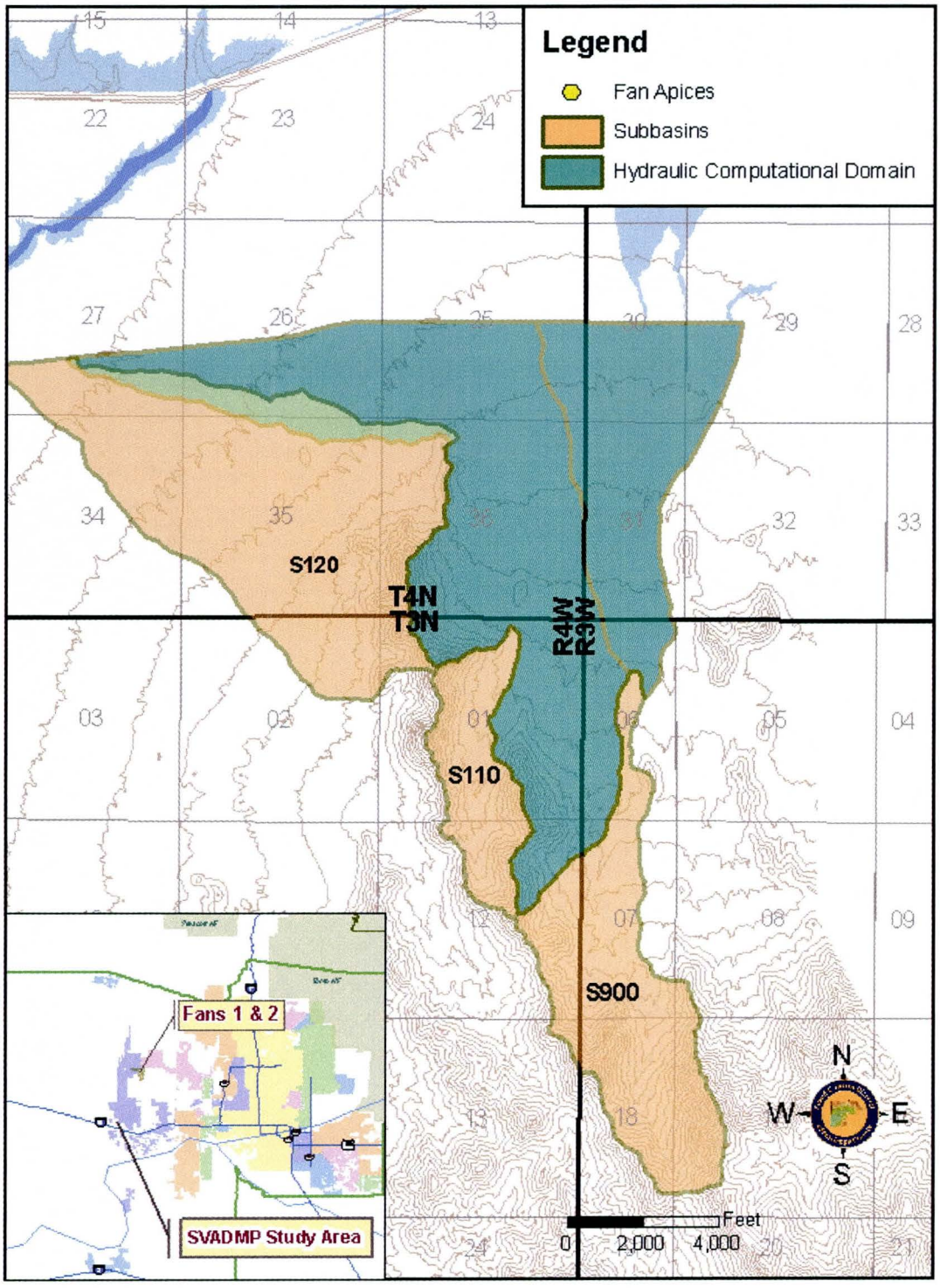

Figure 1.2 Location of Fan Study Area

1.4 Methodology

This study used methods outlined in the Drainage Design Manuals for Maricopa County. In addition, the study uses piedmont flood hazard assessment methods outlined in the District's PFHAM and in the FEMA Guidelines. These two documents were published in response to the National Research Council's Alluvial Fan Flooding report (NRC, 1996). The FEMA Guidelines are targeted at determination of flood hazards on alluvial fan landforms. The PFHAM, which is recommended for use in Maricopa County, Arizona, is applicable to the entire piedmont, not just alluvial fans. The PFHAM methodology incorporates geomorphic methods into the flood hazard assessment of piedmont surfaces. According to the FEMA Guidelines, the geomorphic approach is considered an "approximate method" (p. 12, Table 1) because no base flood elevations are calculated in the geomorphic approach.

1.4.1 Hydrology

The U.S. Army Corps of Engineers HEC-1 model (version 4.1) was used to compute runoff hydrographs and peak discharges. Parameters were processed into HEC-1 through the District's DDMSW version 3.2.8 software. In addition, two-dimensional hydrologic routing downstream of the hydrologic apexes was performed using FLO-2D software (version 2007.06 dated 6/4/2008). Documentation of the hydrologic modeling for this study is provided in Section 4.0 of this Technical Documentation Notebook (TDN).

1.4.2 Hydraulics

The U.S Army Corps of Engineers HEC-RAS software was used to compute the water surface profiles used for the riverine approximate floodplain delineations upstream of the alluvial fan hydrographic apexes (version 3.1.3) and within a constructed channel located upstream of and within the right-of-way of Sun Valley Parkway (version 4.0). HEC-RAS modeling of the Sun Valley Parkway channel was used to demonstrate flow containment only. No base flood elevations were generated as part of this delineation. FLO-2D software was used to model flow downstream of the hydrologic apexes across areas subject to alluvial fan flooding, and to address flow path uncertainty as it relates to delivery of flood peaks to downstream portions of the alluvial fan. A description of the approximate method riverine floodplain delineation HEC-RAS modeling and FLO2D modeling is provided in Section 5.0 of this TDN.

1.4.3 Geomorphology

Geomorphic methods that incorporate landform characteristics, surficial geologic mapping, soils mapping, field observations and aerial photograph interpretation as described in the PFHAM and FEMA Guidelines were used to delineate floodplains on alluvial fan surfaces. A description of the geomorphic method floodplain delineation is provided in Section 6B of this TDN.

1.5 Acknowledgements

This study was funded entirely by the District . Assistance and review from their staff was critical to the success of this project. In addition, staff at Coe and Van Loo Consulting and Pulte Homes supplied valuable information used in the completion of this project.

1.6 Study results

The study resulted in the delineation of 0.9 miles of approximate riverine 100-year floodplain and 5.2 square miles of alluvial fan floodplain. The inundation areas for the newly delineated floodplains are shown on the maps in Section 6B and 7 and the Exhibit Maps at the end of this notebook. The floodplain mapping also includes administrative flood hazard zones defined by the District for the local management of flood hazards on the alluvial fan. At the Sun Valley Parkway channel, the proposed floodplain is contained within the channel.

SECTION 2: ADWR/FEMA FORMS

2.1 Study Documentation Abstract for FEMA Submittals

Study Documentation Abstract For FEMA Submittals		Initial Study	Restudy	CLOMR	LOMR	X	Other
2.1.1	Date Study Accepted						
2.1.2	Study Prime Contractor	JE Fuller / Hydrology and Geomorphology, Inc.					
	Contact(s)	Jonathan E. Fuller, P.E., R.G., CFM					
	Address	8400 S. Kyrene Rd., Suite 201 Tempe, AZ 85284					
	Phone	(480) 752-2124					
	Internal Reference Number	FCDMC 2007 C051 Assignment #2					
2.1.2	Study Sub-Contractor	None					
	Contact(s)						
	Address						
	Phone						
	Internal Reference Number						
2.1.2	Sub Study Sub-Contractor						
	Contact(s)						
	Address						
	Phone						
	Internal Reference Number						
2.1.3	FEMA Technical Review Contractor	Michael Baker, Jr.					
	Contact(s)	Mounir Boudjemaa					
	Address	3600 Eisenhower Ave. Suite 600 Alexandria, VA 22304					
	Phone	703-960-8800					
	Internal Reference Number						
2.1.4	FEMA Regional Reviewer	Michael Baker, Jr. Engineering					
	Phone	(703) 960-8800					
2.1.5	State Technical Reviewer	None					
	Phone						
2.1.6	Local Technical Reviewer	Flood Control District of Maricopa County (FCDMC) Kathryn Gross, CFM					
	Phone	(602) 506-1501					
2.1.7	Reach Description	White Tank Mountains Fans 1, 2					
2.1.8	USGS Quad Sheet(s) with original photo date & latest photo revision date	Daggs Tank, Arizona, 1984 White Tank MTS. NE, Arizona, 1954, Photo revision 1971 White Tank MTS. SE, Arizona, 1954, Photo revision 1971					
2.1.9	Unique Conditions and Problems	Alluvial Fan Flooding					
2.1.10	Coordination of Peak Discharges (Agency, Date, Comments)	FCDMC – Sun Valley ADMS (2005); Sun Valley ADMP (2006) Existing Conditions HEC-1 Model Results					

2.2 FEMA Forms

FEDERAL EMERGENCY MANAGEMENT AGENCY

OVERVIEW & CONCURRENCE FORM

O.M.B No. 3067-0148
Expires September 30, 2005

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1 hour per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

A. REQUESTED RESPONSE FROM FEMA

This request is for a (check one):

☐ CLOMR: A letter from FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision, or proposed hydrology changes (See 44 CFR Ch. 1, Parts 60, 65 & 72).

☒ LOMR: A letter from FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See Parts 60 & 65 of the NFIP Regulations.)

B. OVERVIEW

1 The NFIP map panel(s) affected for all impacted communities is (are)

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
040037 040039	Maricopa County, Arizona and Unincorporated Areas Town of Buckeye	AZ	04013C	1095 H	9/30/2005
040037 040039	Maricopa County, Arizona and Unincorporated Areas Town of Buckeye	AZ	04013C	1115 H	9/30/2005
040037 040039	Maricopa County, Arizona and Unincorporated Areas Town of Buckeye	AZ	04013C	1105 H	9/30/2005

2 Flooding Source: White Tank Mountains Fans 1, 2

3 Project Name/Identifier: Approximate Riverine Floodplain Delineations Upstream of Alluvial Fan Apexes

4 FEMA zone designations affected: A (choices: A, AH, AO, A1-A30, A99, AE, AR, V, V1-V30, VE, B, C, D, X)

5 Basis for Request and Type of Revision:

a The basis for this revision request is (check all that apply)

☐ Physical Change ☒ Improved Methodology/Data

☐ Regulatory Floodway Revision ☐ Other (Attach Description)

Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.

b The area of revision encompasses the following types of flooding and structures (check all that apply)

Types of Flooding:	☒ Riverine	☐ Coastal	☐ Shallow Flooding (e.g., Zones AO and AH)
	☒ Alluvial fan	☐ Lakes	☐ Other (Attach Description)
Structures:	☐ Channelization	☐ Levee/Floodwall	☐ Bridge/Culvert
	☐ Dam	☐ Fill	☐ Other, Attach Description

C. REVIEW FEE

Has the review fee for the appropriate request category been included?	☐ Yes Fee amount: $_____ ☒ No, Explanation: New Delineation by Agency

Map changes based on flood hazard information meant to improve upon that shown on the flood map or within the flood study. **Please see the FEMA Web site at** http://www.fema.gov/mit/tsd/frm_fees.htm **for Fee Amounts and Exemptions.**

D. SIGNATURE

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: Kathryn Gross, CFM, Project Manager	Company: Flood Control District of Maricopa County	
Mailing Address: 2801 West Durango Street Phoenix, AZ 85009	Daytime Telephone No.: (602) 506 4732	Fax No.: 602-506-4601
	E-Mail Address: kag@mail.maricopa.gov	
Signature of Requester (required):		Date 12/9/09

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirement that no fill be placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title: Timothy S. Phillips, P.E., Chief Engineer & General Manager		Telephone No.: 602-506-1501
Community Name: Maricopa County, AZ	Community Official's Signature (required):	Date: 2/23/10

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name: Jonathan Fuller, PE	License No.: 26846	Expiration Date: March 31, 2011
Company Name: JE Fuller/Hydrology & Geomorphology, Inc.	Telephone No.: 480-752-2124	Fax No.: 480-839-2193
Signature:		Date: 1-30-2009

ENSURE THE FORMS THAT ARE APPROPRIATE TO YOUR REVISION REQUEST ARE INCLUDED IN YOUR SUBMITTAL.

Form Name and (Number)	Required if ...
☒ Riverine Hydrology and Hydraulics Form (Form 2)	New or revised discharges or water-surface elevations
☐ Riverine Structures Form (Form 3)	Channel is modified, addition/revision of bridge/culverts, addition/revision of levee/floodwall, addition/revision of dam
☐ Coastal Analysis Form (Form 4)	New or revised coastal elevations
☐ Coastal Structures Form (Form 5)	Addition/revision of coastal structure
☒ Alluvial Fan Flooding Form (Form 6)	Flood control measures on alluvial fans

Seal (Optional)

D. SIGNATURE (continued)

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001

Name: Kathryn Gross, CFM, Project Manager	Company: Flood Control District of Maricopa County	
Mailing Address: 2801 West Durango Street Phoenix, AZ 85009	Daytime Telephone No.: (602) 506 4732	Fax No.: 602-506-4601
	E-Mail Address: kag@mail.maricopa.gov	
Signature of Requester (required):		Date: 12/9/09

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirement that no fill be placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title: SCOTT W LOWE, PE, PUBLIC WORKS DIRECTOR		Telephone No.: 623 349 6815
Community Name: Town of Buckeye, AZ	Community Official's Signature (required):	Date: 24 MAR 2010

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name: Jonathan Fuller, PE	License No.: 26846	Expiration Date: March 31, 2011
Company Name: JE Fuller/Hydrology & Geomorphology, Inc.	Telephone No.: 480-752-2124	Fax No.: 480-839-2193
Signature:		Date: 1-30-2009

D. SIGNATURE (continued)

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: : Kathryn Gross, CFM, Project Manager	Company: Flood Control District of Maricopa County	
Mailing Address: 2801 West Durango Street Phoenix, AZ 85009	Daytime Telephone No.: (602) 506 4732	Fax No.: 602-506-4601
	E-Mail Address: kag@mail.maricopa.gov	
Signature of Requester (required):		Date: 3/25/2010

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirement that no fill be placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title: Robert Beckley, Public Works Director		Telephone No.: 6232226020
Community Name: City of Surprise, AZ	Community Official's Signature (required):	Date: 04-27-10

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name: Jonathan Fuller, PE	License No.: 26846	Expiration Date: March 31, 2011
Company Name: JE Fuller/Hydrology & Geomorphology, Inc.	Telephone No.: 480-752-2124	Fax No.: 480-839-2193
Signature:		Date: 1-30-09

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 3067-0148
Expires September 30, 2005

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 3 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

Flooding Source: White Tank Mountains Fan 1
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

1. Reason for New Hydrologic Analysis (check all that apply)

☐ Not revised (skip to section 2) ☒ No existing analysis ☒ Improved data
☐ Alternative methodology ☐ Proposed Conditions (CLOMR) ☐ Changed physical condition of watershed

2. Comparison of Representative 1%-Annual-Chance Discharges

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)

3. Methodology for New Hydrologic Analysis (check all that apply)

☐ Statistical Analysis of Gage Records ☒ Precipitation/Runoff Model HEC-1, FLO2D
☐ Regional Regression Equations ☐ Other (please attach description)

Please enclose all relevant models in digital format, maps, computations (including computation of parameters) and documentation to support the new analysis. The document, "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/mit/tsd/en_modl.htm.

4. Review/Approval of Analysis

If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. Impacts of Sediment Transport on Hydrology

Was sediment transport considered? ☐ Yes ☒ No If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation for why sediment transport was not considered. Explanation: Sediment transport is not an element in the local approved hydrologic modeling procedures, nor is it a variable in the local USGS discharge regression equations. Sediment transport is considered explicitly in the alluvial fan floodplain delineation.

B. HYDRAULICS

1. Reach to be Revised: No existing delineations are revised. New approximate riverine delineations are submitted upstream of fan apexes.

	Description	Cross Section	Water-Surface Elevations (ft.)	
			Effective	Proposed/Revised
Downstream Limit	See attached annotated FIRMs			
Upstream Limit	See attached annotated FIRMs			

2. Hydraulic Method Used

Hydraulic Analysis HEC-RAS [HEC-2 , HEC-RAS, Other (Attach description)]

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. These review programs verify that the hydraulic estimates and assumptions in the model data are in accordance with NFIP requirements, and that the data are comparable with the assumptions and limitations of HEC-2/HEC-RAS. CHECK-2 and CHECK-RAS identify areas of potential error or concern. These tools do not replace engineering judgment. CHECK-2 and CHECK-RAS can be downloaded from http://www.fema.gov/mit/tsd/frm_soft.htm. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS. If you disagree with a message, please attach an explanation of why the message is not valid in this case. Review of your submittal and resolution of valid modeling discrepancies will result in reduced review time.

HEC-2/HEC-RAS models reviewed with CHECK-2/CHECK-RAS? ☒ Yes ☐ No

4. Models Submitted

Duplicate Effective Model*	Natural File Name:		Floodway File Name:
Corrected Effective Model*	Natural File Name:		Floodway File Name:
Existing or Pre-Project Conditions Model	Natural File Name:	ZoneA12l & SVPkwy_chnl FLO2D models	Floodway File Name:
Revised or Post-Project Conditions Model	Natural File Name:		Floodway File Name:
Other - (attach description)	Natural File Name:		Floodway File Name:

*Not required for revisions to approximate 1%-annual-chance floodplains (Zone A) – for details, refer to the corresponding section of the instructions.

The document "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at:

http://www.fema.gov/mit/tsd/en_modl.htm.

C. MAPPING REQUIREMENTS

A **certified topographic map** must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach **a copy of the effective FIRM and/or FBFM,** annotated to show the boundaries of the revised 1%- and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%- and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area of revision.

D. COMMON REGULATORY REQUIREMENTS

1. For CLOMR requests, do Base Flood Elevations (BFEs) increase? ☐ Yes ☐ No

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:

- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

2. Does the request involve the placement or proposed placement of fill? ☐ Yes ☒ No

If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(a)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised? ☐ Yes ☒ No

If Yes, attach evidence of regulatory floodway revision notification. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being added. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For LOMR requests, does this request require property owner notification and acceptance of BFE increases? ☐ Yes ☒ No

If Yes, please attach proof of property owner notification and acceptance (if available). Elements of and examples of property owner notification can be found in the MT-2 Form 2 Instructions.

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 3067-0148
Expires September 30, 2005

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 3 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

Flooding Source: White Tank Mountains Fan 2
Note: Fill out one form for each flooding source studied

A. HYDROLOGY

3. Reason for New Hydrologic Analysis (check all that apply)

☐ Not revised (skip to section 2) ☒ No existing analysis ☒ Improved data
☐ Alternative methodology ☐ Proposed Conditions (CLOMR) ☐ Changed physical condition of watershed

2. Comparison of Representative 1%-Annual-Chance Discharges

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)

3. Methodology for New Hydrologic Analysis (check all that apply)

☐ Statistical Analysis of Gage Records ☒ Precipitation/Runoff Model HEC-1, FLO2D [
☐ Regional Regression Equations ☐ Other (please attach description)

Please enclose all relevant models in digital format, maps, computations (including computation of parameters) and documentation to support the new analysis. The document, "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at: http://www.fema.gov/mit/tsd/en_modl.htm.

4. Review/Approval of Analysis

If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. Impacts of Sediment Transport on Hydrology

Was sediment transport considered? ☐ Yes ☒ No If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation for why sediment transport was not considered. Explanation: Sediment transport is not an element in the local approved hydrologic modeling procedures, nor is it a variable in the local USGS discharge regression equations. Sediment transport is considered explicitly in the alluvial fan floodplain delineation.

B. HYDRAULICS

1. Reach to be Revised: No existing delineations are revised. New approximate riverine delineations are submitted upstream of fan apexes.

	Description	Cross Section	Water-Surface Elevations (ft.) Effective	Proposed/Revised
Downstream Limit	See attached annotated FIRMs			
Upstream Limit	See attached annotated FIRMs			

2. Hydraulic Method Used

Hydraulic Analysis HEC-RAS [HEC-2 , HEC-RAS, Other (Attach description)]

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. These review programs verify that the hydraulic estimates and assumptions in the model data are in accordance with NFIP requirements, and that the data are comparable with the assumptions and limitations of HEC-2/HEC-RAS. CHECK-2 and CHECK-RAS identify areas of potential error or concern. These tools do not replace engineering judgment. CHECK-2 and CHECK-RAS can be downloaded from http://www.fema.gov/mit/tsd/frm_soft.htm. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS. If you disagree with a message, please attach an explanation of why the message is not valid in this case. Review of your submittal and resolution of valid modeling discrepancies will result in reduced review time.

HEC-2/HEC-RAS models reviewed with CHECK-2/CHECK-RAS? ☒ Yes ☐ No

4. Models Submitted

Duplicate Effective Model*	Natural File Name:		Floodway File Name:
Corrected Effective Model*	Natural File Name:		Floodway File Name:
Existing or Pre-Project Conditions Model	Natural File Name:	ZoneA12 SVPkwy_chnl FLO2D models	Floodway File Name:
Revised or Post-Project Conditions Model	Natural File Name:		Floodway File Name:
Other - (attach description)	Natural File Name:		Floodway File Name:

*Not required for revisions to approximate 1%-annual-chance floodplains (Zone A) – for details, refer to the corresponding section of the instructions.

The document "Numerical Models Accepted by FEMA for NFIP Usage" lists the models accepted by FEMA. This document can be found at:

http://www.fema.gov/mit/tsd/en_modl.htm.

C. MAPPING REQUIREMENTS

A **certified topographic map** must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach **a copy of the effective FIRM and/or FBFM,** annotated to show the boundaries of the revised 1%- and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%- and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area of revision.

D. COMMON REGULATORY REQUIREMENTS

1. For CLOMR requests, do Base Flood Elevations (BFEs) increase? ☐ Yes ☐ No

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:

- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

4. Does the request involve the placement or proposed placement of fill? ☐ Yes ☒ No

If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(a)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

3. For LOMR requests, is the regulatory floodway being revised? ☐ Yes ☒ No

If Yes, attach evidence of regulatory floodway revision notification. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway. (Not required for revisions to approximate 1%-annual-chance floodplains [studied Zone A designation] unless a regulatory floodway is being added. Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.)

4. For LOMR requests, does this request require property owner notification and acceptance of BFE increases? ☐ Yes ☒ No

If Yes, please attach proof of property owner notification and acceptance (if available). Elements of and examples of property owner notification can be found in the MT-2 Form 2 Instructions.

FEDERAL EMERGENCY MANAGEMENT AGENCY

O.M.B. No. 3067-0148
Expires September 30, 2005

ALLUVIAL FAN FLOODING FORM

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 1 hour per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

Flooding Source: Fan 1

Note: Fill out one form for each flooding source studied

A. THREE-STAGE ANALYSIS (Based on FEMA Guidelines dated February 23, 2000)

1. Stage 1 Analysis
   a. The landform is composed of (check one) ☒ alluvial ☐ debris flow deposits.
   b. Source of data used to determine composition, morphology, and location of the landform:
      NRCS Soils Maps, AZ Geological Survey Geologic Maps, USGS Topographic Maps, Aerial Photos, Field Observation
   c. Is there an NRCS soils survey and soil survey map available? ☒ Yes ☐ No
      If Yes, please include a copy of the map and any pertinent sections of the soil survey
2. Stage 2 Analysis
   a. The alluvial fan exhibits ☐ active ☐ inactive ☒ a combination of active and inactive alluvial fan flooding.
   b. Approximate age of inactive fan surfaces (thousands of years): > 10,000 yrs.
   c. Is there an opportunity for avulsions that could lead channels or sheetfloods across the older fan surfaces?
      ☐ Yes ☒ No
   d. Is there evidence of headcutting that could lead to stream piracy? ☒ Yes ☐ No (Only in active, unstable areas)
   e. Is there geomorphic evidence of past avulsions during the Holocene epoch? ☒ Yes ☐ No (Only in active, unstable areas)
   f. The fan exhibits the following types of flooding (check one):
      ☒ Flooding along stable channels
      ☒ Sheetflow
      ☐ Debris flow
      ☒ Unstable flow path flooding
3. Stage 3 Analysis

   The boundaries of the 1%-annual-chance floodplain have been determined using (check one):

   ☐ Risk-Based Analysis
      ☐ FEMA FAN program (if discharge at the apex is different than that given in the effective FIS, then attach MT-2, Form 2 along with a plot of the flood frequency curve on log-normal probability paper and include the drainage area above the hydrographic apex, and the mean, standard deviation, and skew coefficient of the curve)
   ☐ Sheetflow Methods
   ☐ Hydraulic Analytical Methods
   ☒ Geomorphic Data, Post-Flood Hazard Verification, and Historical Information
   ☐ Composite Methods

B. STRUCTURAL FLOOD CONTROL MEASURES

1. The following structural flood control measures are proposed or built (check one): **Existing structure (channel) at Sun Valley Parkway**

   ☒ Channelization ☐ Levee/Floodwall ☐ Dam ☐ Sedimentation Basin

2. Do the constructed or proposed structural measures affect flood hazards (including velocity, scour, and sediment deposition) on other areas of the fan? ☒ Yes ☐ No

3. Attach completed Form 3 (Riverine Structures Form).

4. Sediment Transport Considerations:

   Was sediment transport considered? ☒Yes ☐ No If Yes, then fill out Form 3, Section F (Sediment Transport).

   If No, then attach your explanation for why sediment transport was not considered.

   Delineation was performed using approximate geomorphic methods. Sediment yield is reported from other studies. Sedimentation impacts to constructed channel capacity was modeled to assure capacity to contain regulatory discharge.

5. Please attach a copy of the formal Operations and Maintenance Plan. Attached.

C. MAPPING REQUIREMENTS

Attach a certified topographic work map showing the following:

- The boundaries of the alluvial fan including: toe, topographic and hydrographic apexes, and lateral boundaries
- The delineation of the active and inactive portions of the fan as determined by the Stage 2 analysis
- The revised 1%-annual-chance floodplain boundaries, as determined by the Stage 3 Analysis, that tie into the effective floodplain boundaries
- The correct alignment of all structural features
- The map scale

FEDERAL EMERGENCY MANAGEMENT AGENCY

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Expires September 30, 2005

ALLUVIAL FAN FLOODING FORM

PAPERWORK REDUCTION ACT

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Flooding Source: Fan 2

Note: Fill out one form for each flooding source studied

A. THREE-STAGE ANALYSIS (Based on FEMA Guidelines dated February 23, 2000)

1. Stage 1 Analysis

   a. The landform is composed of (check one) ☒ alluvial ☐ debris flow deposits.

   c. Source of data used to determine composition, morphology, and location of the landform:

   NRCS Soils Maps, AZ Geological Survey Geologic Maps, USGS Topographic Maps, Aerial Photos, Field Observation

   c. Is there an NRCS soils survey and soil survey map available? ☒ Yes ☐ No

   If Yes, please include a copy of the map and any pertinent sections of the soil survey

3. Stage 2 Analysis

   b. The alluvial fan exhibits ☐ active ☐ inactive ☒ a combination of active and inactive alluvial fan flooding.

   f. Approximate age of inactive fan surfaces (thousands of years): > 10,000 yrs.

   g. Is there an opportunity for avulsions that could lead channels or sheetfloods across the older fan surfaces?
   ☐ Yes ☒ No

   h. Is there evidence of headcutting that could lead to stream piracy? ☒ Yes ☐ No (Only in active, unstable areas)

   i. Is there geomorphic evidence of past avulsions during the Holocene epoch? ☒ Yes ☐ No (Only in active, unstable areas)

   f. The fan exhibits the following types of flooding (check one):

   ☒ Flooding along stable channels
   ☒ Sheetflow
   ☐ Debris flow
   ☒ Unstable flow path flooding

3. Stage 3 Analysis

   The boundaries of the 1%-annual-chance floodplain have been determined using (check one):

   ☐ Risk-Based Analysis

   ☐ FEMA FAN program (if discharge at the apex is different than that given in the effective FIS, then attach MT-2, Form 2 along with a plot of the flood frequency curve on log-normal probability paper and include the drainage area above the hydrographic apex, and the mean, standard deviation, and skew coefficient of the curve)

   ☐ Sheetflow Methods
   ☐ Hydraulic Analytical Methods
   ☒ Geomorphic Data, Post-Flood Hazard Verification, and Historical Information
   ☐ Composite Methods

B. STRUCTURAL FLOOD CONTROL MEASURES

2. The following structural flood control measures are proposed or built (check one): **Existing structure (channel) at Sun Valley Parkway**

☒ Channelization ☐ Levee/Floodwall ☐ Dam ☐ Sedimentation Basin

2. Do the constructed or proposed structural measures affect flood hazards (including velocity, scour, and sediment deposition) on other areas of the fan? ☒ Yes ☐ No

3. Attach completed Form 3 (Riverine Structures Form).

4. Sediment Transport Considerations:

Was sediment transport considered? ☒ Yes ☐ No If Yes, then fill out Form 3, Section F (Sediment Transport).

If No, then attach your explanation for why sediment transport was not considered.

Delineation was performed using approximate geomorphic methods. Sediment yield is reported from other studies. Culvert crossings and embankment of Sun Valley Parkway were modeled as if they had no impact on flooding downstream.

5. Please attach a copy of the formal Operations and Maintenance Plan.

C. MAPPING REQUIREMENTS

Attach a certified topographic work map showing the following:

- The boundaries of the alluvial fan including: toe, topographic and hydrographic apexes, and lateral boundaries
- The delineation of the active and inactive portions of the fan as determined by the Stage 2 analysis
- The revised 1%-annual-chance floodplain boundaries, as determined by the Stage 3 Analysis, that tie into the effective floodplain boundaries
- The correct alignment of all structural features
- The map scale

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

O.M.B. No. 3067-0148
Expires September 30, 2005

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 7 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

Flooding Source: White Tank Mountains Fan1
Note: Fill out one form for each flooding source studied

A. GENERAL

Complete the appropriate section(s) for each Structure listed below:

Channelization ..... complete Section B
Bridge/Culvert ..... complete Section C
Dam..... complete Section D
Levee/Floodwall ..... complete Section E
Sediment Transport..... complete Section F (if required)

Description Of Structure

1. Name of Structure: Sun Valley Pkwy Channel

Type (check one): ☒ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

Location of Structure: Located south adjacent to Sun Valley Pkwy

Downstream Limit/Cross Section: 0

Upstream Limit/Cross Section: 15089

2. Name of Structure:

Type (check one): ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

Location of Structure:

Downstream Limit/Cross Section:

Upstream Limit/Cross Section:

3. Name of Structure:

Type (check one) ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

Location of Structure:

Downstream Limit/Cross Section:

Upstream Limit/Cross Section:

NOTE: For more structures, attach additional pages as needed.

B. CHANNELIZATION

Flooding Source: White Tanks Mountains Fan 1

Name of Structure: Sun Valley Parkway Channel

1. Accessory Structures

The channelization includes (check one):

- ☐ Levees [Attach Section E (Levee/Floodwall)]
- ☐ Superelevated sections
- ☐ Debris basin/detention basin
- ☐ Other (Describe):
- ☒ Drop structures
- ☐ Transitions in cross sectional geometry
- ☒ Energy dissipator

2. Drawing Checklist

Attach the plans of the channelization certified by a registered professional engineer, as described in the instructions.

3. Hydraulic Considerations

The channel was designed to carry (cfs) and/or the 100-year flood.

The design elevation in the channel is based on (check one):

☒ Subcritical flow ☐ Critical flow ☐ Supercritical flow ☐ Energy grade line

If there is the potential for a hydraulic jump at the following locations, check all that apply and attach an explanation of how the hydraulic jump is controlled without affecting the stability of the channel.

☐ Inlet to channel ☐ Outlet of channel ☐ At Drop Structures ☐ At Transitions
☐ Other locations (specify):

4. Sediment Transport Considerations

Was sediment transport considered? ☒ Yes ☐ No If Yes, then fill out Section F (Sediment Transport).
If No, then attach your explanation for why sediment transport was not considered.

C. BRIDGE/CULVERT

Flooding Source:

Name of Structure:

1. This revision reflects (check one):

- ☐ New bridge/culvert not modeled in the FIS
- ☐ Modified bridge/culvert previously modeled in the FIS
- ☐ New analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8):
If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

- ☐ Dimensions (height, width, span, radius, length)
- ☐ Shape (culverts only)
- ☐ Material
- ☐ Beveling or Rounding
- ☐ Wing Wall Angle
- ☐ Skew Angle
- ☐ Distances Between Cross Sections
- ☐ Erosion Protection
- ☐ Low Chord Elevations – Upstream and Downstream
- ☐ Top of Road Elevations – Upstream and Downstream
- ☐ Structure Invert Elevations – Upstream and Downstream
- ☐ Stream Invert Elevations – Upstream and Downstream
- ☐ Cross-Section Locations

4. Sediment Transport Considerations

Was sediment transport considered? ☐ Yes ☐ No If yes, then fill out Section F (Sediment Transport).
If No, then attach your explanation for why sediment transport was not considered.

E. LEVEE/FLOODWALL (CONTINUED)

10. Operational Plan And Criteria

    a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP Regulations? ☐ Yes ☐ No

    b. Does the operation plan incorporate all the provisions for closure devices as required in Paragraph 65.10(c)(1) of the NFIP regulations? ☐ Yes ☐ No

    c. Does the operation plan incorporate all the provisions for interior drainage as required in Paragraph 65.10(c)(2) of the NFIP regulations? ☐ Yes ☐ No

    If the answer is No to any of the above, please attach supporting documentation.

11. Maintenance Plan

    a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP Regulations? ☐ Yes ☐ No
    If No, please attach supporting documentation.

12. Operations and Maintenance Plan

    Please attach a copy of the formal Operations and Maintenance Plan for the levee/floodwall.

F. SEDIMENT TRANSPORT

Flooding Source: White Tank Mountains Fan 1

Name of Structure: Sun Valley Parkway Channel

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the Base Flood Elevation (BFE); and/or based on the stream morphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including scour and deposition) to affect the BFEs, then provide the following information along with the supporting documentation:

Sediment load associated with the base flood discharge: Volume 122.3 acre-feet

Debris load associated with the base flood discharge: Volume 0 acre-feet

Sediment transport rate 0.0073 (percent concentration by volume)

Method used to estimate sediment transport: Sediment yield

Most sediment transport formulas are intended for a range of hydraulic conditions and sediment sizes; attach a detailed explanation for using the selected method.

Method used to estimate scour and/or deposition: Equilibrium Slope

Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport:
Please note that bulked flows are used to evaluate the performance of a structure during the base flood; however, FEMA does not map BFEs based on bulked flows.

Bed Elevation Change

If a sediment analysis has not been performed, an explanation as to why sediment transport (including scour and deposition) will not affect the BFEs or structures must be provided.

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

O.M.B. No. 3067-0148
Expires September 30, 2005

PAPERWORK REDUCTION ACT

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Flooding Source: White Tank Mountains Fan 2
Note: Fill out one form for each flooding source studied

A. GENERAL

Complete the appropriate section(s) for each Structure listed below:

Channelization ..... complete Section B
Bridge/Culvert ..... complete Section C
Dam..... complete Section D
Levee/Floodwall ..... complete Section E
Sediment Transport..... complete Section F (if required)

Description Of Structure

1. Name of Structure: Sun Valley Pkwy Channel

Type (check one): ☒ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

Location of Structure: Located south adjacent to Sun Valley Pkwy

Downstream Limit/Cross Section: 0

Upstream Limit/Cross Section: 15089

2. Name of Structure:

Type (check one): ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

Location of Structure:

Downstream Limit/Cross Section:

Upstream Limit/Cross Section:

3. Name of Structure:

Type (check one) ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

Location of Structure:

Downstream Limit/Cross Section:

Upstream Limit/Cross Section:

NOTE: For more structures, attach additional pages as needed.

B. CHANNELIZATION

Flooding Source: White Tanks Mountains Fan 2

Name of Structure: Sun Valley Parkway Channel

1. Accessory Structures

The channelization includes (check one):

- ☐ Levees [Attach Section E (Levee/Floodwall)]
- ☐ Superelevated sections
- ☐ Debris basin/detention basin
- ☐ Other (Describe):
- ☒ Drop structures
- ☐ Transitions in cross sectional geometry
- ☒ Energy dissipator

2. Drawing Checklist

Attach the plans of the channelization certified by a registered professional engineer, as described in the instructions.

3. Hydraulic Considerations

The channel was designed to carry (cfs) and/or the 100-year flood.

The design elevation in the channel is based on (check one):

☒ Subcritical flow ☐ Critical flow ☐ Supercritical flow ☐ Energy grade line

If there is the potential for a hydraulic jump at the following locations, check all that apply and attach an explanation of how the hydraulic jump is controlled without affecting the stability of the channel.

☐ Inlet to channel ☐ Outlet of channel ☐ At Drop Structures ☐ At Transitions
☐ Other locations (specify):

4. Sediment Transport Considerations

Was sediment transport considered? ☒ Yes ☐ No If Yes, then fill out Section F (Sediment Transport).
If No, then attach your explanation for why sediment transport was not considered.

C. BRIDGE/CULVERT

Flooding Source:

Name of Structure:

1. This revision reflects (check one):

- ☐ New bridge/culvert not modeled in the FIS
- ☐ Modified bridge/culvert previously modeled in the FIS
- ☐ New analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8):
If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

- ☐ Dimensions (height, width, span, radius, length)
- ☐ Shape (culverts only)
- ☐ Material
- ☐ Beveling or Rounding
- ☐ Wing Wall Angle
- ☐ Skew Angle
- ☐ Distances Between Cross Sections
- ☐ Erosion Protection
- ☐ Low Chord Elevations – Upstream and Downstream
- ☐ Top of Road Elevations – Upstream and Downstream
- ☐ Structure Invert Elevations – Upstream and Downstream
- ☐ Stream Invert Elevations – Upstream and Downstream
- ☐ Cross-Section Locations

4. Sediment Transport Considerations

Was sediment transport considered? ☐ Yes ☐ No If yes, then fill out Section F (Sediment Transport).
If No, then attach your explanation for why sediment transport was not considered.

E. LEVEE/FLOODWALL (CONTINUED)

10. Operational Plan And Criteria

a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP Regulations? ☐ Yes ☐ No

b. Does the operation plan incorporate all the provisions for closure devices as required in Paragraph 65.10(c)(1) of the NFIP regulations?
☐ Yes ☐ No

c. Does the operation plan incorporate all the provisions for interior drainage as required in Paragraph 65.10(c)(2) of the NFIP regulations?
☐ Yes ☐ No

If the answer is No to any of the above, please attach supporting documentation.

11. Maintenance Plan

a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP Regulations? ☐ Yes ☐ No
If No, please attach supporting documentation.

12. Operations and Maintenance Plan

Please attach a copy of the formal Operations and Maintenance Plan for the levee/floodwall.

F. SEDIMENT TRANSPORT

Flooding Source: White Tank Mountains Fan 2

Name of Structure: Sun Valley Parkway Channel

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the Base Flood Elevation (BFE); and/or based on the stream morphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including scour and deposition) to affect the BFEs, then provide the following information along with the supporting documentation:

Sediment load associated with the base flood discharge: Volume 122.3 acre-feet

Debris load associated with the base flood discharge: Volume 0 acre-feet

Sediment transport rate 0.0073 (percent concentration by volume)

Method used to estimate sediment transport: Sediment yield

Most sediment transport formulas are intended for a range of hydraulic conditions and sediment sizes; attach a detailed explanation for using the selected method.

Method used to estimate scour and/or deposition: Equilibrium Slope

Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport:
Please note that bulked flows are used to evaluate the performance of a structure during the base flood; however, FEMA does not map BFEs based on bulked flows.

Bed Elevation Change

If a sediment analysis has not been performed, an explanation as to why sediment transport (including scour and deposition) will not affect the BFEs or structures must be provided.

SECTION 3: MAPPING AND SURVEY INFORMATION

3.1 Field Survey Information

Ground control survey work associated with the topographic mapping was performed by RBF Consulting of Phoenix, Arizona under contract with the FCDMC. The survey data for this project is presented in the North American Datum of 1983 (NAD 83), 1992 Central Zone of Arizona State Plane Coordinate System. Elevations are referenced to the North American Vertical Datum of 1988 (NAVD88).

3.2 Mapping

The topographic mapping was provided by Landata Airborne Systems of Irvine California, under contract with the FCDMC in 2000/2001. The flight dates for the mapping were 12-16-00, 12-17-00, and 12-27-00. The topographic mapping was prepared by photogrammetric methods to national map accuracy standards for 1-inch equals 500 feet with a 10-foot contour interval

3.2 Supplemental Topography

In the vicinity of the Sun Valley Parkway, both north and south of the roadway, supplemental topography was provided by Coe and Van Loo, Inc (CVL). CVL is the engineering firm responsible for the preparation of the Festival Ranch Master Drainage Design. Festival Ranch is a Pulte Home development located immediately north of the Sun Valley Parkway. Supplemental topography consisted of 1-foot contour interval mapping. This topographic information was primarily used for hydraulic modeling of the drainage channel located parallel to and immediately south of the Sun Valley Parkway.

SECTION 4: HYDROLOGY

4.1 Hydrologic Modeling Methods

The HEC-1 modeling methods employed in this study were those outlined in the current Drainage Design Manual for Maricopa County, Volume I, Hydrology (1995) and 2003 draft revised Hydrology Manual. The DDMSW version 3.2.8 was used to assist in the development of the HEC-1 models. The U.S. Army Corps of Engineers HEC-1 model (version 4.1) was used to compute runoff hydrographs and peak discharges. Rainfall losses were calculated by use of the Green and Ampt infiltration equation with an allowance for surface retention loss within HEC-1. The Phoenix Mountain S-Graph was used to generate unit hydrographs. Channel routing was performed using the normal depth Modified Puls method. Peak discharges were estimated at various concentration points. Rainfall-runoff models were generated for the 100-year return period for the 6- and 24-hour durations. The larger estimate is recommended for use in the floodplain delineation.

FLO-2D (Version 2007.06) model development followed guidelines put forth in the FLO-2D Data Input Manual and Users Manual (O'Brien, 2007)., and adhered to drainage standards and guidelines put forth by the District. FLO-2D model review was performed by the District. FLO-2D modeling was used to route the 100-year discharges at the fan apexes to points of concern downstream, such as the Sun Valley Parkway channel and culverts under Sun Valley Parkway. The routings included modeling of "on-fan" and tributary runoff between the fan apexes and the downstream concentration points.

4.2 HEC-1 Parameter Estimation

4.2.1 Drainage Area Boundaries

The study area watershed and hydrologic subbasins are shown on Plate 1. The total watershed area modeled is approximately 1.47 square miles. Two individual subbasins were modeled varying in size from 0.43 to 1.035 square miles, with a concentration point for each alluvial fan apex. Subbasin boundaries were delineated in ArcGIS 9.1 based on examination of the 2005 0.8-ft-pixel color ortho-rectified aerial photographs and the 10-foot topography (dated 2001). Watershed areas were computed using XTools within ArcGIS.

4.2.2 Watershed work maps

Refer to Plate 1 for the watershed work map used for the HEC-1 modeling. Plate 2 shows the Natural Resource Conservation Service (NRCS) soils data and the distribution of

saturated conductivity values for the area. Plate 3 shows the existing conditions land use distributions for the watersheds.

4.2.3 Gage data

No streamflow gage data were available for the washes in the study area. Therefore, the results of the rainfall-runoff modeling are compared with the USGS regional regression equations and the previous studies discussed in Section 4.5.

Regional Historical Flooding Information

Field (1994) describes significant channel changes on White Tank Mountain Piedmont Fan 36 that resulted from a large tropical storm in 1951, as reported in Kangieser (1969). The National Weather Service (NWS) Buckeye station (#021026) recorded 1.00", 2.60", 0.75", and 0.80" of rainfall on August 27, 28, 29, and 30, 1951, respectively for a total of 5.15". This may be the rainfall event(s) responsible for the large channel changes reported by Field (1994) on Fan Site 36, which is located several miles south of the fans delineated in this study. Examination of the 1953 aerial photographs of the Fan 1 and 2 study areas indicates that minimal channel change occurred during the 1951 flood. The largest daily total during the period of record for the NWS Buckeye station is 4.90" recorded on September 2, 1894. The 2nd largest rainfall recorded since March 1893 occurred on September 8, 1916 when 3.29" of rainfall was recorded.

The SCS (1963) indicates that the August 1951 storm inundated 12,240 acres and was similar in magnitude to events in January 1916 and September 1939. In January 1916, 2.26" of rain was recorded over five consecutive days. During September 1939, 4.5" of precipitation was recorded between the 4th and 13th of the month. The highest single daily total during the period occurred on the 4th when 2.27" of rain was recorded at the NWS Buckeye station. It is unknown if the daily values recorded in August 1951 represent a single storm. If they do, it would be one of the highest storm totals in this long record.

4.2.4 Statistical parameters

The only statistical data used directly in the study were the precipitation statistics obtained from the NOAA Atlas 2, Arizona. The statistics from the NOAA Atlas were analyzed to develop the rainfall depth-duration-frequency table for the watershed. The analysis was performed using the PREFRE program within DDMSW. The program output is provided in Appendix D.

4.2.5 Precipitation

The rainfall depths used for the HEC-1 model were obtained from the NOAA Atlas 2 maps for Arizona. The NOAA Atlas 2 maps are reproduced in the District's Hydrology Manual and copies of these are included in Appendix D. Figure 4.1 shows the location of the Sun Valley ADMP study area on the NOAA maps for the data required for input into the PREFRE program. The multiple storm option (JD records) was used to determine the critical storm at each concentration point in the HEC-1 model. The depth-area reduction factors were applied as computed by the DDMSW computer program for use with HEC-1. Note that the point values used for the modeling were taken as the value over the mountainous area. This represents a conservative assessment of the rainfall potential over the primary runoff generating areas for the study area watershed contributing to alluvial fan apexes.

The 6- and 24-hour storm durations were modeled as described in the Drainage Design Manual for Maricopa County. Each 6-hour storm temporal distribution associated with a JD record was implemented via the DDMSW program. The 24-hour storm used was the SCS Type II distribution as coded by the DDMSW as PC records for HEC-1.

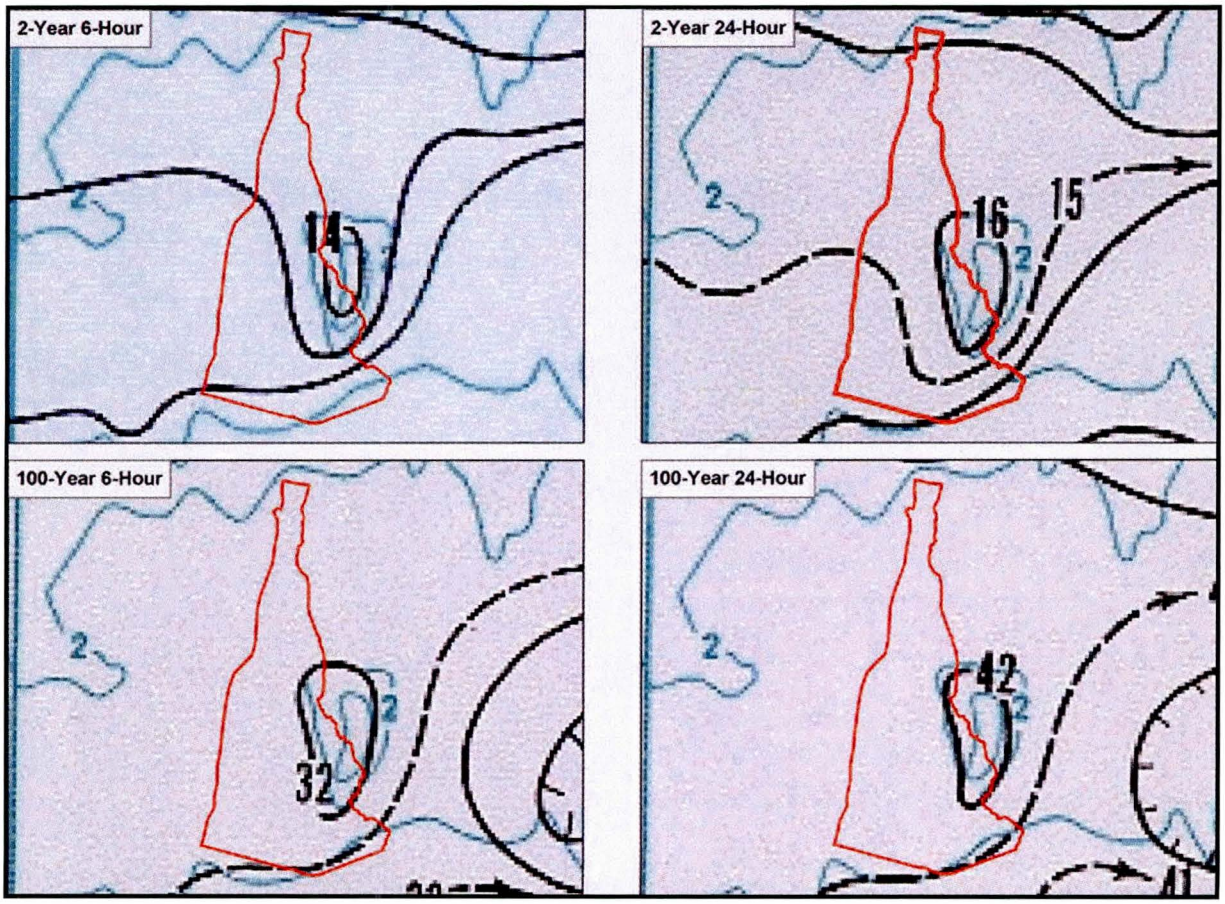

Figure 4.1. Watershed Location on NOAA Atlas II Maps

4.2.6 Physical parameters

Rainfall Losses

Rainfall losses were computed using the Green and Ampt method as outlined in the Drainage Design Manual for Maricopa County, Volume I, Hydrology. The County's preprocessing program for HEC-1, DDMSW, version 3.2.8 was used to perform the lumped parameter calculations and to develop the draft HEC-1 models. The development of the soils, land use, and subbasin data for use in the DDMSW is described briefly below.

Soils

The NRCS (formerly SCS) *Soil Survey of Aguila-Carefree Area* (Camp, 1986) and *Soil Survey of Maricopa County, Central Part* (Hartman, 1977) describes the soils in the study area watersheds. Appendix A and B of the Drainage Design Manual provide loss rate parameters for the map units for this soil survey. The loss rates from the Appendices of the Manual are integrated into the DDMSW. Natural rock outcrop percentages from the Manual were assumed to be 50 percent effective for the purposes of computing RTIMP.

The spatial distribution of the soil map units for the watershed area is shown on Plate 2. Plate 2 also shows the saturated conductivity values (XKSAT) for the soil units in the watershed. Note these values are based on the data in the Appendices of the Drainage Design Manual. Areas of each soil unit in each subbasin were computed using ArcMap – ArcView 9.1 software. These data were imported into the DDMSW. Average subbasin XKSAT values were then computed using logarithmic averaging as implemented in the DDMSW version 3.2.8.The subbasin soil data, soil map unit descriptions, and subbasin average results are provided in Appendix D.

Land Use

Existing land use conditions were evaluated based on examination of the aerial photographs and a slope map generated from the 10-foot contour data. Since the watershed area above the hydrologic apexes was essentially undeveloped at the time of this study, land use categories were assigned based on a range of observed slopes. Guidance from the Drainage Design Manual was used to differentiate three land use categories based on slope: 1) Natural Desert Rangeland (slopes 0-5%), 2) Natural Hillslopes, Sonoran Desert (slopes 5-10%), and 3) Natural Mountain Terrain (slopes > 10%). Figure 4.2 shows the shaded slope map overlain with the generalized land use categories. Existing land uses are also presented on Plate 3. Only the Natural Desert Rangeland and Natural Mountain Terrain categories were selected for the Fan 1 and 2 watersheds as shown on Figure 4.2.

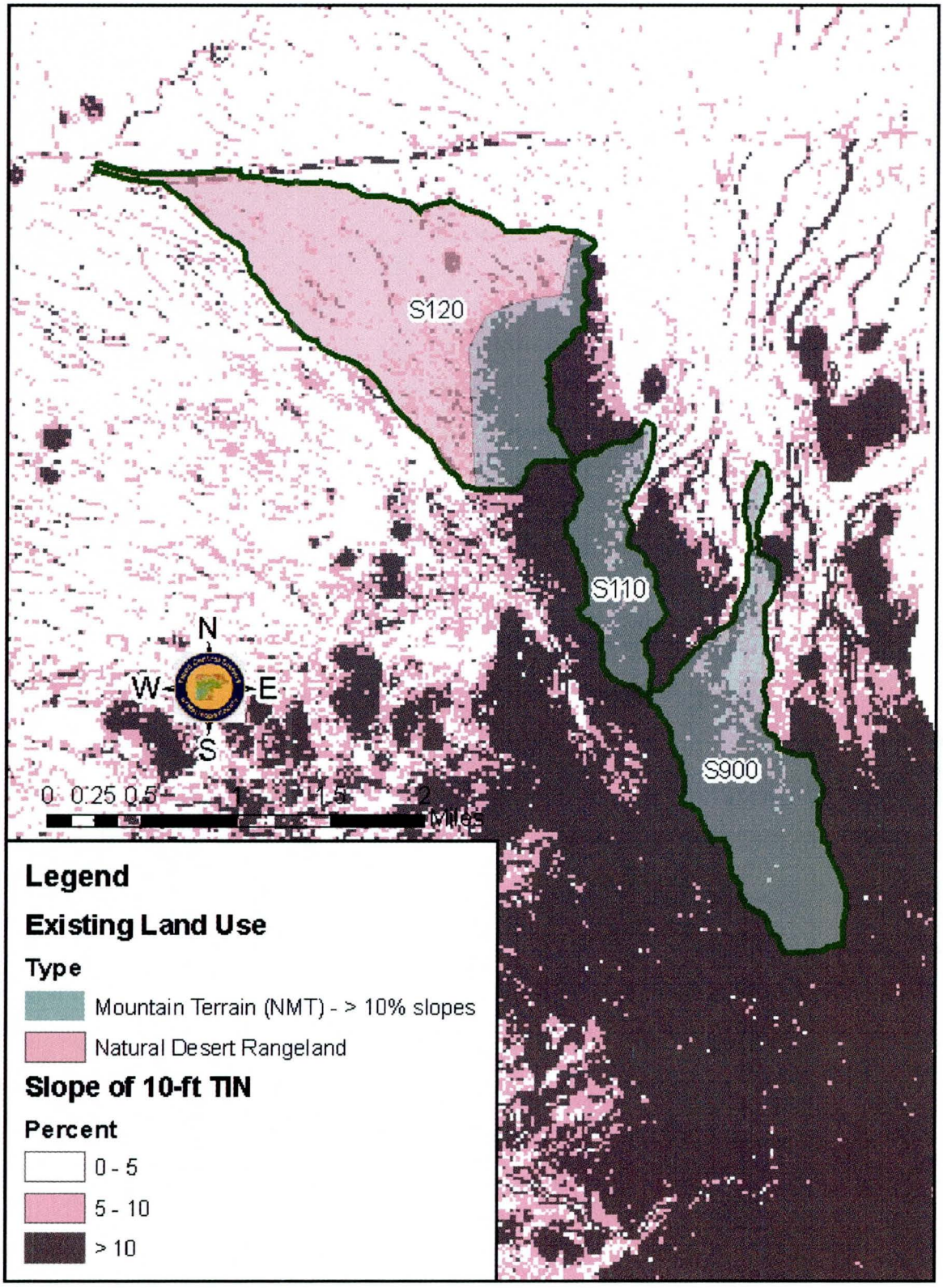

Figure 4.2. Slope and Assignment of Existing (Natural) Land Use Types

Table 4.1 summarizes the hydrologic parameters related to the land use categories used in the analyses for estimation of rainfall excess using the Green and Ampt method and Maricopa County procedures. These parameters include surface retention loss (IA), effective impervious area (RTIMP), basin roughness (Kn), vegetation cover (%), and antecedent moisture conditions (DTHETA Condition).

The subbasin existing land use data are provided in Appendix D.

Table 4.1. Land Use Types and Hydrologic Parameters

Land Use Code	Description	DTHETA Condition	Vegetation Cover (%)	RTIMP (%)*	IA (in)	Kn
930	Natural Mountain Terrain, slopes > 10 %	Dry	30	0	0.25	0.05
910	Natural desert rangeland, slopes 0 – 5 %	Dry	30	0	0.35	0.025

* Note: RTIMP for natural land use types taken from soils data and assumed 50% effective

Unit Hydrograph

The S-Graph unit hydrograph method as outlined in the Drainage Design Manual was used in the HEC-1 modeling of the watershed. Watershed drainage areas, lag time flow path lengths, Lca lengths, and slopes were delineated manually based on examination of the 2005 aerial photographs, and 2001 10-foot contour data for the area. Areas, lengths, and subbasin centroids were computed using ArcMap – ArcView 9.1 GIS software.

Dimensionless S-graphs were assigned based on whether the basin was predominantly mountainous terrain or not from examination of the existing land use data. The Fan 1 (S110), Fan1 (S120) and Fan 2 (S900) watersheds were interpreted as mountainous watersheds based on their slope and were therefore assigned the Phoenix Mountain S-graph as described in the Drainage Design Manual.

Surface roughness values were assigned as shown in Table 4.1 described above. These values come from guidance provided in Table 5.6 and Appendix D.2 of the 2003 Drainage Design Manual, Volume I, Hydrology. Lag times were calculated based on the geometric and land use parameters for each subbasin. Tables summarizing the lag time calculations and S-graph assignment are provided in Appendix D.

Routing Parameters

No explicit HEC-1 hydrologic routings were performed as part of the hydrology for this study. Hydrologic routing downstream of fan apexes was performed with FLO-2D and is discussed in Section 4.6 below.

4.3 Special HEC-1 Modeling Problems Encountered

4.3.1 Special problems and solutions

No special problems were encountered in the HEC-1 hydrologic modeling for this study.

4.3.2 Modeling warning and error messages

No warnings or error messages occur in the HEC-1 models.

4.4 HEC-1 Modeling Calibration

No calibration of the HEC-1 models was performed as part of this study. However, the results were compared to previous studies and regional regression equations and found to be reasonable, as described below. The methods used in this study have been designed for application to the area and have been found to produce reasonable results in hundreds of studies throughout Maricopa County.

4.5 HEC-1 Final Results

4.5.1 Hydrologic analysis results

Table 4.2 shows the peak discharges and total runoff volumes results. The 6-hour storm produces higher peak discharges and larger runoff volumes for both watersheds.

Table 4.2. 100-Year Peak Discharge and Total Runoff Volume to Fans 1 and 2 Apexes

		24-hour						6-hour			
		AREA	Q100	Time	Vol.	Vol.		Q100	Time	Vol.	Vol.
Fan #	KKID	(sq.mi.)	(cfs)	(hrs)	(in)	(ac-ft)		(cfs)	(hrs)	(in)	(ac-ft)
1	S110	0.43	532	12.17	1.422	33		662	4.25	1.640	38
1	S120	2.00	2032	12.33	1.158	124		1838	4.33	1.189	127
2	S900	1.03	853	12.50	1.417	78		936	4.50	1.535	85

4.5.2 *Verification of results*

Figure 4.3 shows plots of the peak discharge results for the 100-year models versus the USGS regional regression equations for Region 12 for Fan 1 and Fan 2. The model results fall below the 100-year regression curve for the region.

Given the predominance of sandy loam textured soils in the watersheds, these results are considered reasonable. It is noted that the average elevation for Fans 1 and 2 fall near the lower limit of the "cloud of common values" for Region 12. However, the data used to develop the Region 12 equations did not include watersheds with average elevations below about 2000 feet. Most of the gages included in the Region 12 datasets drain higher elevation areas from the Bradshaw Mountains and along the Mogollon Rim, including the Salt-Verde River basins. Those watersheds experience higher annual precipitation amounts and have higher 100-year point rainfall statistics than the White Tank Mountains. Therefore, results falling below the regional curves are not considered surprising or unreasonable.

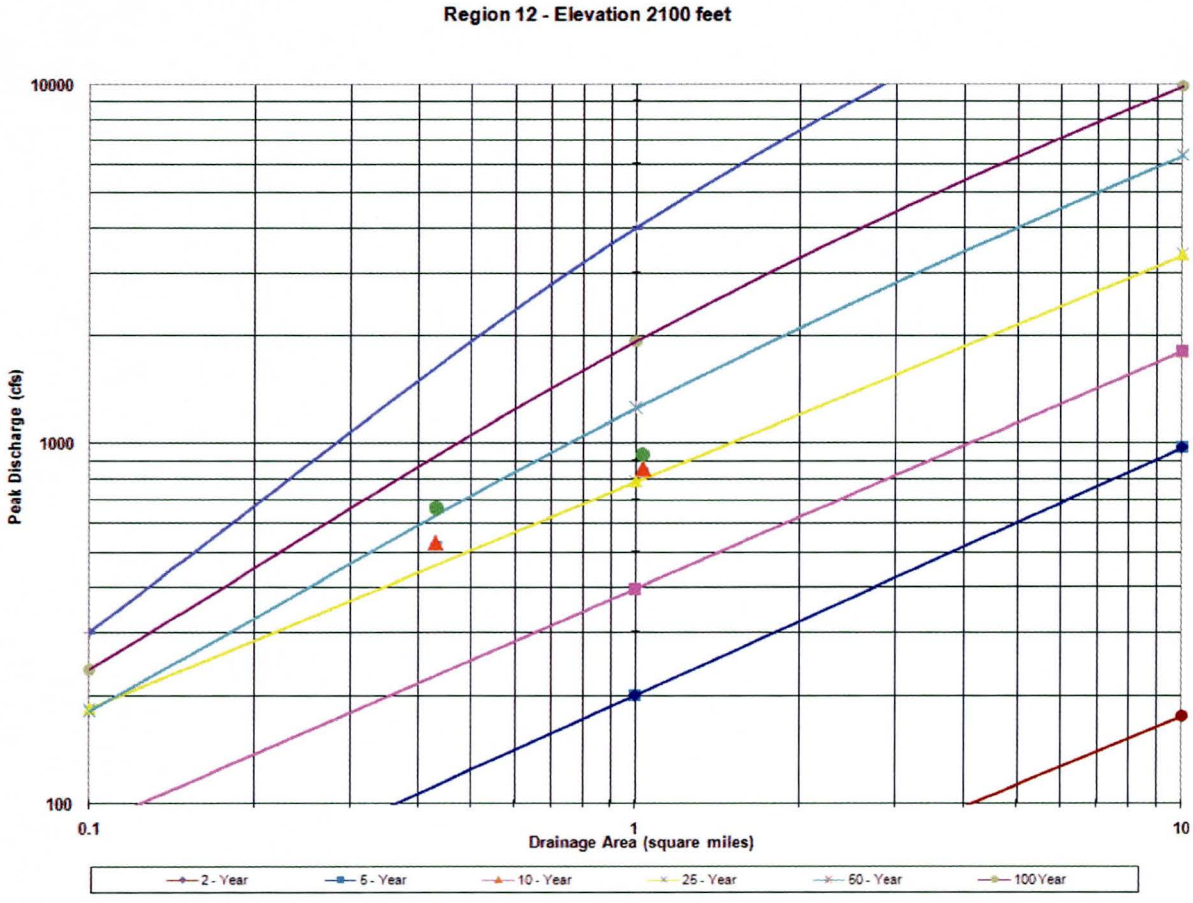

Figure 4.3. Comparison of 100-year HEC-1 Model Results with USGS Regression Equations For Fans 1 and 2

4.5.3 Comparison with Previous Studies

No previous FDS studies have been conducted for Fan 1 or Fan 2.

4.6 FLO-2D Modeling

FLO-2D uses conservation of volume to approximate two-dimensional routing of a rainfall runoff hydrograph over a system of square grid elements. The limits of inundation are primarily controlled by topography and resistance to flow (Manning's n-value). In addition to modeling unconfined, two-dimensional overland flow, the user has the option to model confined, one-dimensional channel flow. These elements interface together as channel capacity is exceeded. One-dimensional flow is computed using the dynamic wave approximation to the momentum equation, and is based on channel cross-section geometry, roughness and slope.

4.6.1 FLO-2D Model Purpose

The area downstream of the hydrologic apices of Fans 1 and 2 is subject to unconfined alluvial fan flooding. This type of flooding is characterized by an uncertain flow paths, complex distribution of flow in distributary channels, sheet flow, formation of new channels, and abandonment of former channels, resulting in varying distribution of flow over the fan surface during runoff events. Because FLO-2D is a two-dimensional routing model, branching and/or sheet flow can be simulated based on topography and resistance to flow, with more refined grid systems providing better approximations of split flows. In addition, flow path uncertainty scenarios may be modeled to determine conservative flood estimates. Therefore, multiple iterations of FLO-2D models were prepared to estimate the conservative flood peak estimates at seventeen concentration points below the fan apexes, sixteen of which are located along the Sun Valley Parkway (See Plate 4, FLO-2D Model Overview). These concentration points correspond to Sun Valley Parkway culvert locations or the natural wash confluences with the Sun Valley Parkway drainage channel.

The objective of the FLO-2D routings was to estimate appropriate peak discharges at concentration points on the alluvial fan surfaces downstream of the fan apexes, while considering the affect of flow path uncertainty on the fan surface. The following modeling approach was used to address flow path uncertainty. First, it was assumed that the greatest degree of flow path uncertainty occurred in the most active portion of the alluvial fan near the fan apex (Zone AFHH, as described in Section 6B of this report). The portions of the fan surface downstream of this high hazard zone are subject to flow path uncertainty, primarily associated with sheet flooding, but have less risk of extreme sediment deposition, channel avulsions, or channelized flow. The flow path uncertainties in these lower portions of the fan are primarily the result of alluvial fan processes occurring in the upstream (near-apex) portions of the fan.

Therefore, the FLO-2D models were set up to simulate the most extreme range of flow distribution possible within the high hazard portion of the fan. To achieve this, flow was blocked and diverted in the models so that flow would be routed along relatively narrow corridors to specific points on the downstream end of the high hazard zone. Each model scenario routed flow along a single corridor to a single concentration point. Downstream of these concentration points, flow was allowed to distribute itself according the existing fan topography and hydraulic modeling parameters.

Second, modeling results at the concentration points of concern along Sun Valley Parkway were evaluated to determine the routed peak discharge for each modeling scenario. Because Fan 1 and 2 coalesce, the flows from the two flooding sources were allowed to combine, using a variety of conservative modeling scenarios. The maximum discharge obtained for the range of modeling scenarios was then used as the peak discharge point at each concentration point. The following flood scenarios (shown on Plates D1 – D12, provided in Appendix D) were modeled using FLO-2D:

0. Baseline model with flows routed from Hydrologic Apexes 1 & 2 based upon existing terrain (Plates D1 and D6).
1. Flows from Hydrologic Apices 1 and 2 are forced to the west (Plates D2 and D3).
2. Flows from Hydrologic Apices 1 and 2 are forced to the east (Plates D4 and D5).
3. Flow from Hydrologic Apex 1 is forced to the east and flow from Hydrologic Apex 2 is forced to the center of the project area (Plates D7 and D8).
4. Flow from Hydrologic Apex 1 is forced to the east and flow from Hydrologic Apex 2 is initially forced to the west, then to the east (Plates D9 and D10).
5. Flow from Hydrologic Apex 1 is forced to the east and flow from Hydrologic Apex 2 is forced to the west (Plates D11 and D12).

The concept of uncertainty is also applied to the flows north of the Sun Valley Parkway. A separate model for the north area was used to determine the flow depths in part of the study area. Scenarios 2, 3 and 4 represented worst case scenario for this region as the other scenarios directed flow towards west into the Sun Valley Parkway Channel. The flows from the south model were used as inflows into the north model by using a one-to-one mapping of grid cells across the Sun Valley Parkway. In effect, such an approach is equivalent to modeling the flows without considering the presence of the flow obstruction caused by Sun Valley Parkway. Maximum flow depths from the combined scenarios of 2, 3 and 4 were used in determining the floodplain delineations and are presented in Appendix D.

4.6.2 FLO-2D Model Components and Methodology

Development of FLO-2D models included the following components: grid system, inflow hydrographs, rainfall, runoff losses and channel flow routing. FLO-2D model input data is provided in Appendix D.

Grid System

The FLO-2D grid system was comprised of 38,485 cells for south model and 33697 for the north model with each cell measuring 50 feet by 50 feet. The grid system overlaid the portion of the project area extending from the hydrologic apexes of Fans 1 and 2, to just north of the Sun Valley Parkway, which included the drainage channel located immediately to the south of the Sun Valley Parkway. The south FLO-2D model computational boundary (bounding the grid system) did not extend to Wagner Wash, but was rather terminated at the HEC-1 Subbasin S115 concentration point. The FLO-2D computational boundary is shown on Figure 1,2.

Initial roughness value (Manning's n-values) for grid elements was input as 0.045. This initial value was based on field reconnaissance, aerial photography and engineering judgment. Roughness values were then modified by FLO-2D to improve computational analysis; however, modifications were kept in check by setting the limiting Froude Number value to 0.95, which ensured subcritical flow within each grid element.

Grid element elevations (project area topography) were computed from a project TIN that was generated using the survey and mapping components of the project (see Section 3).

Inflow grid elements were located at the hydrologic apexes of Fans 1 and 2. In addition, an inflow grid element was located near the downstream limit of the modeling area (near northwest corner) to reflect the flow from HEC-1 Subbasin S120 that enters the drainage channel south of the Sun Valley Parkway. Outflow grid elements were located along the downstream most boundary of the grid system to prevent ponding. Inflow and outflow grid element locations are shown on Plate D1.

Inflow Hydrographs

Inflow hydrographs were computed with the 6- and 24-hour HEC-1 models discussed in Sections 4.1 – 4.5. Inflow hydrographs reflect the runoff characteristics at the hydrologic apexes of Fans 1 and 2, as well as runoff from HEC-1 Subbasin S120. Hydrographs at apexes were input into one grid element each, while the hydrograph from Subbasin S120 was divided over four grid elements. The flows from the south model were used as inflows into the north model by using a one-to-one mapping of grid cells across the Sun Valley Parkway. In effect, such an approach is equivalent to modeling the flows without considering the presence of the flow obstruction caused by Sun Valley Parkway.

Rainfall

In addition to the inflow hydrographs discussed above, runoff was generated from 6- and 24-hour rainfall events, which were modeled as a storm covering the entire computational domain (FLO-2D grid system) that represents the fan surface downstream of the alluvial fan apexes. Rainfall characteristics were based on the 6- and 24-hour point precipitation values and distributions used for SVADMP HEC-1 modeling (see Section 4.2.5). Depth-area reduction factors for the 6- and 24-hour duration storms were input based on Tables 2.1 and 2.2 of the FCDMC Hydrology Manual.

Runoff Losses (Infiltration)

Runoff losses for each grid element were modeled using the soils and land use characteristics documented in the Sun Valley Area Drainage Master Plan (SVADMP), discussed above in Section 4.2.6.

Channel Routing - Sun Valley Parkway Drainage Channel

The FLO-2D model was also used to route flow through the Sun Valley Parkway channel. The Sun Valley Parkway drainage channel runs adjacent to the roadway and collects runoff approaching from the south (see Plate D1, FLO-2D Model Overview, provided in Appendix D). The earthen channel slopes from east to west at a relatively flat gradient due to the construction of 44 drop structures along the channel's approximate 2.8 mile length. Drops vary in height from approximately 2 feet to 4 feet. The channel is trapezoidal in shape with a bottom width of approximately 80 feet, 4H:1V side slopes, and a depth that varies depending on existing ground elevation (however, typically exceeding 5 feet in depth). In addition, a trapezoidal, concrete-lined low flow channel has been constructed upstream from the confluence with Wagner Wash for about 2.2 miles. The low flow channel has a 20-foot bottom width, 3H:1V side slopes and is approximately 2 feet deep. Other than within the low flow channel, vegetation ranges between sparse to relatively thick. Photographs of the drainage channel are provided in Appendix D, as well as a photograph location exhibit (Plate D13).

FLO-2D represents a channel by grid element(s), cross-section geometry, average cross-section roughness and the length of channel within the grid element (referred to as a channel grid element). Channel flow conveyance is simulated as one-dimensional flow, routed with a dynamic wave approximation of the momentum equation. The discharge between channel grid elements is defined by the average flow hydraulics associated with the computed velocity and depth. Unlike the increase in n-value when modeling overland flow, the n-values assigned to each length of channel within a channel grid element is not globally increased. When channel width exceeds grid element size, a cross-section is reflected in the model by extension across contiguous channel grid elements, in the direction specified by the user. Channel slope is computed by FLO-2D as the difference between the channel element thalweg

elevations at each channel node, divided by the half-sum of the channel lengths within the adjoining channel elements.

The channel-floodplain flow interface is an internal sub-routine (there are no input data requirements for its application) that computes an overbank discharge when the channel capacity is exceeded. The interface computes how much overbank discharge will be routed as unconfined floodplain flow; and conversely, how much floodplain flow enters (or returns to) the channel. The channel-floodplain flow exchange is based on the difference in channel and floodplain water surface elevations. For example, when channel flow is less than channel capacity, and there is no floodplain flow, the channel-floodplain interface sub-routine in not initiated. The channel bank elevation is established by the user, allowing the channel water surface and floodplain water surface relationships to the bank elevation (channel capacity) to be computed by the model.

4.6.3 Special FLO-2D Modeling Problems Encountered

No special FLO-2D modeling problems were encountered.

4.6.4 FLO-2D Modeling Results

FLO-2D peak discharge results for the five modeling scenarios discussed above (see Section 4.6.1) are provided in Appendix D, shown on Plates D2 – D12. In addition, the maximum peak discharge, for all five flood scenarios at each comparison location, is provided below in Table 4.3.

Table 4.3. FLO-2D Maximum Peak Discharges

	FLO-2D, 6-Hr, 100-Yr Maximum Peak Discharge (cfs)							FLO-2D, 6-Hr, 100-Yr Maximum Peak Discharge (cfs)							Maximum of 6-hr and 24-hr events
	Flood Scenarios						Maximum of all 6-hr event	Flood Scenarios						Maximum of all 24-hr event	
Location ID	Base	1	2	3	4	5		Base	1	2	3	4	5		
1	1313	1315	1313	1315	1315	1758	1758	1459	1459	1455	1455	1456	1735	1735	1758
2	731	1162	654	657	643	1	1162	715	1184	632	617	678	1	1184	1184
3	734	1147	653	654	641	1720	1720	708	1158	623	612	671	1685	1685	1720
4	717	1022	640	646	622	1720	1720	680	1066	595	587	635	1722	1722	1722
5	715	1014	640	652	619	1710	1710	675	1052	591	585	631	1714	1714	1714
6	325	793	328	462	269	1398	1398	311	841	293	386	271	1409	1409	1409
7	61	553	83	164	59	796	796	83	599	95	170	83	795	795	796
8	22	127	22	99	22	23	127	40	127	40	101	40	40	127	127
9	33	29	33	265	81	29	265	46	35	48	266	100	38	266	266
10	129	51	98	139	298	52	298	131	82	118	144	313	82	313	313
11	71	39	80	39	79	39	80	65	47	78	47	75	47	78	80
12	45	29	48	29	47	29	48	43	35	47	35	46	35	47	48
13	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3
14	167	73	215	73	73	73	215	165	92	197	92	93	92	197	215
15	152	48	182	49	48	48	182	142	61	176	61	61	61	176	182
16	32	210	33	33	34	34	210	48	191	47	47	48	49	191	210
17	1835	1836	1835	1845	1834	1983	1983	2031	2019	2023	2021	2037	2268	2268	2268

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15. U.S. Geological Survey, 1982, Buckeye NW, Ariz. Quadrangle, 7.5 minute series, 1:24,000 (photo date 1955, originally published 1958; photo revised in 1982 using 1978 photography).

16. U.S. Geological Survey, 1982, Valencia, Ariz. Quadrangle, 7.5 minute series, 1:24,000 (original photo date 1954, originally published 1958; photo revised in 1982 using 1978 photography).

17. U.S. Geological Survey, 1978, White Tank Mtns NE, Ariz. Quadrangle, 7.5 minute series, 1:24,000 (original photo date 1954, published 1957; photo revised 1971, and photo inspected with no changes made in 1978).

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SECTION 5: HYDRAULIC ANALYSIS

5.1 HEC-RAS Method Description

HEC-RAS modeling was performed for riverine flows upstream of alluvial fan apices and to demonstrate containment of flow within the Sun Valley Parkway drainage channel (see Section 4.6.2).

5.1.1 HEC-RAS Modeling Upstream of Alluvial Fan Apexes

Approximate method hydraulic modeling was used to delineate riverine floodplains on reaches upstream of the alluvial fan apexes. Normal depth computations for representative cross sections were performed using HEC-RAS to estimate the depth and width of inundation from the 100-year flood. The resultant width was applied to the stream reach at each representative cross section. In some cases, adjustments to the computed floodplain widths were made based on aerial photograph interpretation and application of geomorphic principles.

The U.S. Army Corp of Engineers HEC-RAS v. 3.1.3 was used to perform the hydraulic rating calculations upstream of the hydrographic apexes of White Tank Fans 1 and 2. Cross section locations along the study reaches were selected based on the variability of the channel geometry. On average, the average cross section spacing for the channel upstream (south) of the Fan 1 hydrographic apex is approximately 470 feet and approximately 1070 feet for the channel upstream (south) of Fan 2 hydrographic apex. Cross section data were collected from the base map using various software tools available in AutoCAD Land Development Desktop 2005. The base map used includes that described in Section 5.2 (below). Appendix E includes the HEC-RAS cross sections and detailed input and output.

5.1.2 HEC-RAS Modeling of Sun Valley Parkway Drainage Channel

Flows within the Sun Valley Parkway drainage channel were modeled using HEC-RAS version 4.0. HEC-RAS input data were developed using project mapping information (see Section 3), ArcMap (v. 9.2) and HECGeoRAS (v. 4.1.1.92). Cross section locations were based on channel geometry variability, including cross sections located at the top and toe of each drop structures. As requested by the District, drop structures were modeled using the in-line weir option within HEC-RAS. The base map used for modeling of the drainage channel is discussed below in Section 5.2. In addition, Appendix E includes the HEC-RAS cross sections and detailed input and output.

5.2 HEC-RAS Study Work Maps

The Zone A delineations for Fans 1 and 2 and the Sun Valley Parkway drainage channel are shown on 1"= 400', 10' contour interval base mapping with orthographic aerial photography. The work study maps and Index Sheet are presented with this Technical Data Notebook (TDN) on 24"x36" sheets. Reduced-scale copies of the work maps are included on Figure 5.1. The full-size sheets are contained in Exhibit Map C of the TDN.

The work maps include cross-section locations, floodplain boundaries, zone designations, road names, state-plane coordinate grid, section lines, corporate boundaries and stream names/numbers. The flood zones delineated using approximate method hydraulic modeling of the reaches upstream of the alluvial fan apexes are shown as Zone A on the work maps and annotated FIRM panels.

Portions of the approximate method floodplain delineation for the alluvial fan overwrite and replaces existing (unnumbered) Zone A delineations downstream (north) of Sun Valley Parkway. The existing Zone A delineations, performed as part of the Sun Valley Parkway North Floodplain Delineation Study (A-N West, Inc, 1993) did not recognize the area as part of an alluvial fan and subject to alluvial fan flooding. Therefore, the alluvial fan floodplain delineations replace the previous riverine floodplain delineations on the effective FIRM in the areas where the studies overlap.

Joins Sun Valley Parkway North FDS FCD 90-40, Zone A

LIMIT OF STUDY

ZONE X (SHADED)

ZONE A

ZONE AAFF

ZONE AFHH

ZONE AFUFD

ZONE AFZA

ZONE D

MARICOPA COUNTY
TOWN OF BUCKEYE

T3N R3W
T3N R4W

MATCH SHEET 3

LEGEND

- 100-YR ADMINISTRATIVE FLOODWAY
- EFFECTIVE 100-YR FLOODPLAIN BOUNDARY
- EFFECTIVE 100-YR FLOODWAY
- SECTION BOUNDARY
- CROSS SECTION — 200 Q = 595 cfs
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- STATE PLANE COORDINATES — 1,046,800 N / 848,800 E

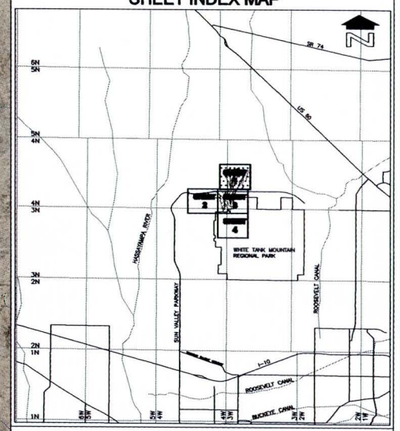
ZONE DESIGNATIONS

ZONE A	Approximate 100-year administrative floodway; riverine reaches upstream of hydrologic apex.
ZONE AFHH	Alluvial Fan High Hazard administrative floodway
ZONE AFUFD	Alluvial Fan Uncertain Flow Distribution Area administrative floodway
ZONE AAFF	Approximate Alluvial Fan Floodway administrative floodway
ZONE AFZA	Alluvial Fan Zone A floodplain
ZONE X (SHADED)	Areas flooded between 100- and 500-yr discharge, areas of 100-yr flooding depth less than 1 foot, or drainage area less than 1 square mile
ZONE X	Areas outside the 500-yr floodplain
ZONE D	Area not studied

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. VERTICAL DATUM IS NAVD88.

SHEET INDEX MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF WHITE TANK FANS

1 & 2

FCD NO. 2007 CO51
WHITE TANK MOUNTAINS FANS 1&2
WORK ASSIGNMENT #2
JANUARY, 2009

SCALE IN FEET
500' 0' 500' 1000'
CONTOUR INTERVAL = 10 FEET

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.

SHEET 1 OF 4

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"=600' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, DECEMBER 27, 2003. AERIAL UPDATE: NOVEMBER 2004.

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA

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LEGEND

- 100-YR ADMINISTRATIVE FLOODWAY
- EFFECTIVE 100-YR FLOODPLAIN BOUNDARY
- EFFECTIVE 100-YR FLOODWAY
- SECTION BOUNDARY
- CROSS SECTION — 200, Q = 595 cfs
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- STATE PLANE COORDINATES — 1,046,800 N, 648,800 E

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ZONE X	Areas outside the 500-yr floodplain
ZONE D	Area not studied

NOTES

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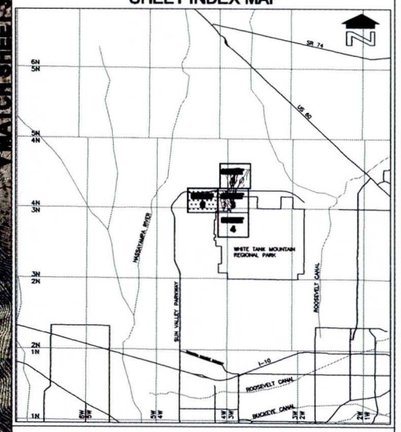
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. VERTICAL DATUM IS NAVD88.

SHEET INDEX MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF WHITE TANK FANS

1 & 2

FCD NO. 2007 CO51
WHITE TANK MOUNTAINS FANS 1&2
WORK ASSIGNMENT #2
JANUARY, 2009

SCALE IN FEET
500' 0' 500' 1000'
CONTOUR INTERVAL = 10 FEET

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.

SHEET 2 OF 4

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"=600' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.

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GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA

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LEGEND

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- EFFECTIVE 100-YR FLOODPLAIN BOUNDARY
- EFFECTIVE 100-YR FLOODWAY
- SECTION BOUNDARY
- CROSS SECTION — 200 Q = 595 cfs
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
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ZONE X	Areas outside the 500-yr floodplain
ZONE D	Area not studied

NOTES

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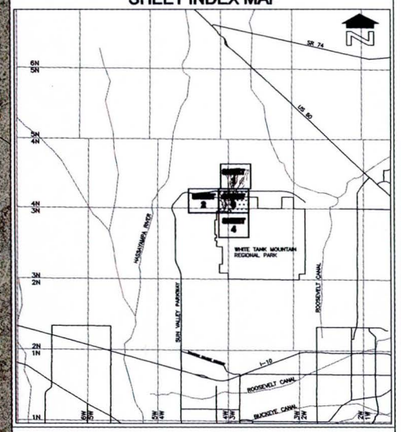
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. VERTICAL DATUM IS NAVD88.

SHEET INDEX MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF WHITE TANK FANS

1 & 2

FCD NO. 2007 CO51
WHITE TANK MOUNTAINS FANS 1&2
WORK ASSIGNMENT #2
JANUARY, 2009

SCALE IN FEET
500' 0' 500' 1000'
CONTOUR INTERVAL = 10 FEET

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.

SHEET 3 OF 4

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"=600' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, DECEMBER 27, 2000. AERIAL UPDATE: NOVEMBER 2004.

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA

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LEGEND

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- EFFECTIVE 100-YR FLOODPLAIN BOUNDARY
- EFFECTIVE 100-YR FLOODWAY
- SECTION BOUNDARY
- CROSS SECTION — 200 Q = 595 cfs
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NOTES

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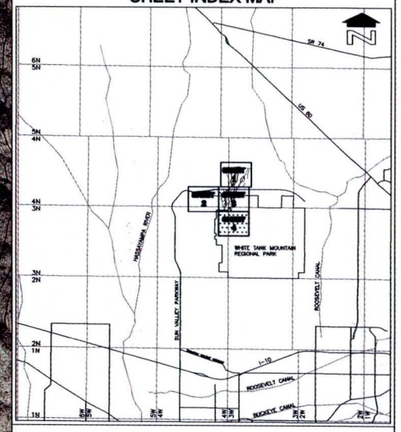
SHEET INDEX MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF WHITE TANK FANS

1 & 2

FCD NO. 2007 CO51
WHITE TANK MOUNTAINS FANS 1&2
WORK ASSIGNMENT #2
JANUARY, 2009

SCALE IN FEET
500' 0' 500' 1000'
CONTOUR INTERVAL = 10 FEET

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC

SHEET 4 OF 4

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"=500' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, DECEMBER 27, 2000. AERIAL UPDATE: NOVEMBER 2004.

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA

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5.3 HEC-RAS Parameter Estimation

HEC-RAS v3.1.3 was used to determine the flow width and depth for each cross section upstream of hydrologic apexes of Fans 1 and 2. HEC-RAS v 4.0 was used to determine the flow width and depth for each cross section reflecting the Sun Valley Parkway drainage channel. All reaches were modeled in the sub-critical flow regime and the downstream boundary conditions were set at normal depth.

5.3.1 HEC-RAS Roughness Coefficients

Manning's roughness coefficient (n value) describes the friction attributable to the channel, banks and overbank areas. The n value generally varies with depth of flow, so it is determined assuming a flow depth associated with the 100-year discharge. Manning's "n" values for riverine conditions upstream of the alluvial fan hydrologic apexes were determined using the methodology outlined in the USGS report titled, "Estimating Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona" by B.W. Thomsen and H.W. Hjalmarson, (April, 1991)[3]. Field reconnaissance was undertaken to photograph typical reaches in the study area and to document channel and overbank conditions. The findings of these field investigations were summarized in a separate Manning's n value report produced by JEF for this study for the FCDMC (see Appendix E.1). Manning's "n" values for the Sun Valley Parkway drainage channel were determined based on field reconnaissance and engineering judgment.

5.3.2 HEC-RAS Expansion and Contraction Coefficients

The expansion and contraction coefficients used throughout the study were 0.3 and 0.1, respectively. No abrupt changes in the floodplain width were encountered that would warrant modification of these coefficients.

5.4 HEC-RAS Cross-section descriptions

Cross section geometry was developed from the elevation contours and refined based on field reconnaissance and interpretation of surficial observations from the aerial base mapping. Cross section geometry stationing is from left to right if viewed in the downstream direction. The most typical refinements to the channel geometry upstream of the alluvial fan hydrologic apexes occur in the low flow channel areas that are not adequately represented by the 10' contour interval topography. Cross sections upstream of alluvial fan hydrologic apexes are labeled numerically in intervals of 100 increasing in the upstream direction.

Sun Valley Parkway drainage channel cross sections were generated using HEC-GeoRAS. Based on the stream centerline and a project DTM, a cross-section cut line defines a section's geometry, length, location (River Station), and alignment to the flow. This cross-section information is processed by HEC-GeoRAS and

converted to HEC-RAS format. Cross-section river stations are based on river-mile distances, and start at zero at the downstream limit of the stream centerline, and increases upstream based upon the length along the stream centerline.

HEC-RAS cross section plots are located in Appendix E.

5.5 HEC-RAS Modeling Considerations

5.5.1 Hydraulic Jump and drop analysis

No hydraulic jump or drop analyses were conducted in this study.

5.5.2 Bridge or Culverts

HEC-RAS bridge modeling was not required for this project. However, the maintenance road culvert crossing (2-10'x3' RCBC) of the Sun Valley Parkway drainage channel did require modeling. HEC-RAS input data for the culvert was obtained from as-built plans and site reconnaissance. No culverts are located upstream of the alluvial fan hydrologic apexes.

5.5.3 Levees and Dikes

There are no levees or dikes within the project area.

5.5.4 Islands and Flow Splits

In general, small islands were not delineated on the work maps.

5.5.5 Ineffective Flow Areas

No significant ineffective flow areas exist in the natural channels in this study. Ineffective flow was modeled upstream and downstream of the maintenance road culvert crossings of the Sun Valley Parkway drainage channel.

5.5.6 Supercritical Flow

Supercritical flow does not occur for significant lengths along any reach in this study.

5.6 HEC-RAS Floodway modeling

Floodway modeling was not conducted for this study. The District manages the approximate floodplain delineations as administrative floodways and shows them as such on the floodplain workmaps (i.e. floodplain = floodway). In addition, the District administers certain approximate method alluvial fan zone designations as administrative floodways. The alluvial fan delineations are described in Section 6B.

5.7 HEC-RAS Special problems encountered during the study

No special problems were encountered.

5.8 HEC-RAS Calibration

No hydraulic calibration was performed during this study.

5.9 HEC-RAS Final Results

Hydraulic modeling of riverine conditions upstream of the alluvial fan hydrologic apexes resulted in the 100-year Zone A floodplain delineations for 0.1 mile of Fan Wash 1 and 0.8 miles for Fan Wash 2. Hydraulic modeling of the Sun Valley Parkway drainage channel resulted in a 100-year Zone A (as opposed to the District alluvial fan zones) floodplain delineation for 3 miles of channel. Hydraulic analyses results are provided in the HEC-RAS Summary Table below (Tables 5.1A and 5.1B). Appendix E.3 contains the HEC-RAS model detailed input and output.

Hydraulic modeling of the Sun Valley Parkway channel was performed to demonstrate that the channel has adequate capacity to divert runoff without overtopping (or flowing against) the roadway embankment. The hydraulic modeling also included a conservative evaluation of potential sediment deposition in the channel resulting from alluvial fan flooding upstream of the channel. The sedimentation analyses are described in Section 6A of this report.

Table 5.1A Fan1 and Fan2 HEC-RAS Results Summary

River	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Fan 2	500	936	1975	1977.67	1977.67	1978.7	0.017161	8.2	118.77	64.69	0.97
Fan 2	400	936	1945	1947.02	1946.96	1947.58	0.017275	6.05	161.73	144.5	0.91
Fan 2	300	936	1919	1920.82	1920.82	1921.52	0.019504	6.75	143.05	112.9	0.98
Fan 2	200	936	1876	1877.86	1877.86	1878.61	0.017938	7.17	146.65	106.48	0.96
Fan 2	150	936	1864	1865.94	1865.94	1866.41	0.014867	6.7	241.52	259.79	0.88
Fan 2	100	936	1849	1850.59	1850.59	1851.04	0.019184	5.71	207.09	257.93	0.93
Fan 1	200	662	1879	1880.27	1880.27	1880.81	0.020087	6.13	122.15	119.66	0.96
Fan 1	150	662	1866.5	1867.69	1867.69	1868.08	0.019393	5.07	145.28	215.67	0.91

Table 5.1B Sun Valley Parkway Channel HEC-RAS Results Summary

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)	
15089.6	261	1665.42	1667.36		1667.66	0.01249	4.4	59.32	67.37	0.82
15049	261	1664.89	1666.86	1666.75	1667.11	0.01405	3.98	65.51	92.46	0.83
14945.9	261	1663.65	1665.02	1665.02	1665.29	0.02359	4.18	62.51	121.37	1.03
14937.5	261	1661.4	1663.34		1663.44	0.00258	2.56	102.13	78.96	0.4
14877.4	624	1660.46	1662.97		1663.22	0.00525	4.03	154.95	103.06	0.58
14841.6	624	1660.47	1662.63	1662.22	1663	0.00682	4.84	128.9	79.07	0.67
14809.3	624	1660.09	1662.42	1661.94	1662.78	0.00619	4.84	128.89	73.52	0.64
14708.8	624	1659.61	1661.47	1661.29	1661.98	0.01085	5.71	109.21	74.07	0.83
14651.7	624	1659.12	1661.09		1661.41	0.00716	4.51	138.34	98.06	0.67
14600.3	624	1658.58	1660.8		1661.07	0.00526	4.17	149.76	94.7	0.58
14567.5	624	1658.54	1660.61	1660.04	1660.9	0.00508	4.36	143.24	82.5	0.58
14523.7	624	1657.92	1660.48		1660.68	0.00462	3.6	173.51	85.09	0.44
14514.8	1230	1656.42	1660.18		1660.61	0.00646	5.24	234.8	84.02	0.55
14337.3	1230	1655.36	1659.32	1657.87	1659.63	0.00424	4.48	274.26	90.16	0.45
14274.7	1230	1655.23	1659.14		1659.54	0.01208	5.07	242.45	146.11	0.69
14216.4	1230	1654.53	1658.44		1658.89	0.00995	5.43	233.82	134.91	0.66
14142.1	1393	1654.26	1657.41	1657.04	1658.02	0.01374	6.24	223.57	112.34	0.77
14119.5	1393	1654.21	1656.61	1656.61	1657.58	0.02425	7.92	175.87	91.65	1.01
14115.2	1393	1652.63	1656.52		1657.09	0.00962	6.06	229.94	89.28	0.67
14085.2	1393	1652.31	1656.12		1656.76	0.01151	6.44	216.36	87.37	0.72
13942.9	1393	1651.47	1654.76		1655.26	0.00916	5.67	245.82	101.71	0.64
13758.6	1393	1650.15	1653.43	1652.54	1653.78	0.00644	4.77	291.91	121.19	0.54
13712.9	1463	1647.44	1651.24		1651.56	0.00491	4.59	318.52	113.22	0.48
13679.6	1463	1647.4	1651.01		1651.38	0.00605	4.86	301.04	114.89	0.53
13556	1463	1646.91	1650.14		1650.55	0.00733	5.15	283.87	114.72	0.58
13442	1459	1646.13	1649.27	1648.54	1649.68	0.00798	5.16	282.68	121.65	0.6
13413.5	1459	1643.91	1646.8		1647.35	0.01026	5.94	245.6	103.23	0.68
13392.3	1459	1642.81	1646.72		1647.13	0.00637	5.1	286.36	105.56	0.55
13283.2	1459	1642.58	1646.09		1646.45	0.00578	4.8	304.25	114.5	0.52
13148.6	1459	1641.92	1645.13	1644.39	1645.54	0.00797	5.17	281.94	120.76	0.6
13113.9	1457	1638.72	1642.15		1642.57	0.00696	5.19	280.64	107.89	0.57
13103.4	1457	1637.69	1642.18		1642.48	0.00416	4.41	330.36	109.76	0.45
12949	1457	1637.65	1641.37		1641.73	0.00584	4.78	305.08	116.42	0.52
12751.2	1457	1636.86	1640.01	1639.3	1640.36	0.00845	4.74	307.21	156.87	0.6
12710.3	1548	1633.82	1636.87		1637.35	0.00831	5.56	278.56	110.53	0.62
12684.1	1548	1632.23	1636.63		1637.12	0.0087	5.63	274.72	109.41	0.63
12570.4	1548	1632.39	1635.95		1636.29	0.00519	4.67	331.52	119.73	0.49

Table 5.1B Sun Valley Parkway Channel HEC-RAS Results Summary (continued)

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)	
12421.3	1548	1632.05	1634.92	1634.17	1635.34	0.00791	5.2	297.5	125.61	0.6
12387.6	1628	1628.34	1632.09		1632.46	0.00494	4.87	334.15	109.08	0.49
12358.3	1628	1628.04	1631.79		1632.28	0.00768	5.58	291.81	108.35	0.6
12244.5	1628	1627.33	1630.99		1631.42	0.0071	5.27	308.68	117.58	0.57
12160.7	1628	1626.97	1630.35	1629.55	1630.8	0.0078	5.36	303.94	121.48	0.6
12118.6	1709	1624.18	1627.97		1628.36	0.00572	5.04	339.42	118.01	0.52
12083.6	1709	1623.88	1627.67		1628.13	0.00783	5.44	314.11	122.94	0.6
12034.5	1709	1623.23	1627.17		1627.7	0.00943	5.84	292.58	118.09	0.65
11862	1709	1622.44	1625.8	1624.94	1626.24	0.00726	5.3	322.65	124.23	0.58
11825.1	1710	1619.92	1623.56		1623.98	0.00574	5.16	331.57	111.26	0.53
11794.3	1710	1619.67	1623.24		1623.76	0.00837	5.79	295.41	110.49	0.62
11660.1	1710	1618.82	1622.13		1622.62	0.0084	5.64	302.95	118.4	0.62
11583.4	1710	1618.29	1621.54	1620.73	1621.99	0.00768	5.41	316.36	123.33	0.59
11530.9	1719	1613.55	1618.35		1618.86	0.00558	6.62	318.22	105.12	0.55
11507.1	1719	1613.3	1618.1		1618.74	0.00259	7.34	326.04	104.13	0.62
11377.8	1719	1612.92	1617.29		1618.26	0.00499	8.95	270.2	112.11	0.8
11258.4	1718	1612.31	1616.53	1616.53	1617.63	0.00521	9.44	264.99	121.09	0.9
11240.5	1718	1608.86	1614.04		1614.95	0.00317	8.64	293.13	106.48	0.74
11224.9	1718	1608.95	1614.03		1614.88	0.0036	8.28	291.73	106.6	0.71
11094.8	1718	1608.91	1613.54		1614.38	0.00406	8.25	290.88	110.66	0.72
10964.5	1718	1608.37	1612.6	1612.6	1613.72	0.00603	9.58	258.46	117.79	0.89
10927.6	1717	1605.71	1610.45		1611.34	0.00339	8.83	296.97	107.44	0.76
10912	1717	1605.6	1609.89		1611.23	0.00507	10.41	244.83	102.76	0.93
10775.8	1717	1605.12	1609.28	1609.28	1610.49	0.00521	9.87	250.54	106.83	0.92
10628	1716	1603.01	1607.27	1607.27	1608.47	0.00614	9.91	247.56	104.31	0.91
10555.3	1716	1602.63	1607.06		1607.89	0.00341	8.31	300.95	112.23	0.74
10468.2	1716	1602.32	1606.31	1606.31	1607.48	0.00568	9.83	255.17	118.04	0.93
10428.1	1716	1598.89	1603.74		1604.9	0.00486	9.62	250.35	100.15	0.84
10407.6	1716	1599.05	1603.86		1604.72	0.00349	8.21	285.01	102.66	0.69
10274	1716	1598.75	1603.59		1604.23	0.00287	7.39	332.41	115.17	0.62
10162	1716	1598.33	1602.59	1602.59	1603.74	0.00633	9.63	249.49	111.71	0.9
10126.7	1713	1595.85	1601.14		1601.73	0.00212	7.15	351.61	107.53	0.58
10096.8	1713	1595.71	1600.85		1601.64	0.00271	8.01	307.93	103.9	0.65
9938.55	1713	1595.65	1600.53		1601.17	0.00273	7.38	330.96	114.23	0.62
9791.29	1713	1594.99	1599.39	1599.39	1600.6	0.00459	9.53	245.34	108.86	0.88
9702.69	1721	1592.03	1596.64		1597.6	0.00501	9.13	268.11	104.64	0.8
9682.94	1721	1591.83	1596.59		1597.49	0.00446	8.58	276.33	102.26	0.75
9588.97	1719	1591.46	1596.47		1597.05	0.00281	7.08	343.26	111.58	0.59
9456.98	1719	1591.25	1595.35	1595.35	1596.5	0.00532	9.64	256.85	115.61	0.9
9420.05	1718	1588.58	1593.15		1594.26	0.00476	9.57	258.37	103.89	0.83
9401.97	1718	1588.62	1593.21		1594.12	0.00408	8.8	279.64	104.68	0.76
9332.69	1718	1588.41	1593.13		1593.8	0.00299	7.62	325.6	112.88	0.65
9244.88	1718	1588.39	1592.31	1592.31	1593.39	0.00744	9.53	254.87	118.01	0.92
9214.03	1718	1585.32	1589.85	1589.85	1591.05	0.0063	9.89	245.94	106.87	0.89
9191.51	1718	1584.75	1589.37		1590.34	0.00544	9.01	267.83	106.02	0.8
9125.65	1718	1584.7	1589.08		1590.02	0.00418	8.9	284.43	111.44	0.8
9026.97	1707	1584.48	1588.44	1588.44	1589.48	0.0072	9.43	259.08	120.1	0.9
9015.42	1707	1581.84	1586.25		1587.47	0.00639	9.93	242.45	103.8	0.9

Table 5.1B Sun Valley Parkway Channel HEC-RAS Results Summary (continued)

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)	
8998.09	1707	1581.77	1586.58		1587.2	0.00289	7.41	330.63	107.87	0.62
8963.71	1707	1581.77	1586.47		1587.11	0.00256	7.47	336.27	111.19	0.64
8853.08	1707	1581.46	1585.55	1585.55	1586.68	0.00519	9.64	262.09	118.05	0.9
8815.78	1718	1579.34	1584.08		1584.97	0.00321	8.67	298.35	109.2	0.75
8799.2	1718	1579.48	1584.22		1584.84	0.00244	7.63	346.66	112.53	0.64
8661.45	1718	1579.33	1583.85		1584.49	0.00262	7.52	337.64	113.61	0.65
8500.55	1715	1578.79	1582.72	1582.72	1583.84	0.00679	9.69	254.43	114.32	0.92
8469.39	1715	1576.45	1580.93		1582.04	0.00499	9.5	258.3	102.15	0.83
8439.23	1715	1576.31	1581.14		1581.78	0.00308	7.54	331.17	114.32	0.64
8287.22	1715	1575.84	1580.72		1581.34	0.00264	7.41	342.65	116.55	0.62
8149.65	1715	1575.57	1579.67	1579.67	1580.81	0.0052	9.68	261.75	115.5	0.9
8122.69	1711	1572.64	1577.8	1577.8	1579.04	0.00486	9.88	247.59	103.82	0.85
8097.25	1711	1572.87	1578.04		1578.65	0.00204	7.2	345.53	107.65	0.58
7953.83	1711	1572.75	1577.71		1578.32	0.00257	7.28	342.58	113.69	0.61
7799.57	1711	1572.54	1576.61	1576.61	1577.72	0.00592	9.72	259.76	115.42	0.92
7773.18	1707	1570.51	1574.94	1574.94	1576.11	0.00545	10.02	251.94	106.6	0.9
7752.09	1707	1570.28	1574.77		1575.8	0.00405	9.47	273.88	107.04	0.83
7598.91	1707	1569.85	1574.42		1575.14	0.00334	7.92	314.99	118.17	0.69
7446.96	1707	1569.77	1573.43	1573.43	1574.46	0.00582	9.55	270.08	127.35	0.94
7419.39	1702	1565.87	1571.36		1571.89	0.00195	6.84	362.16	112.65	0.55
7379.58	1702	1566.52	1571.16		1571.79	0.00289	7.43	329.93	116.41	0.64
7217.64	1702	1566.09	1570.78		1571.35	0.00224	7.12	353.89	117.33	0.61
7057.08	1702	1565.81	1569.65	1569.65	1570.78	0.0055	9.78	260.76	117.35	0.94
7022.3	1694	1562.87	1567.78	1567.78	1569.02	0.00431	9.77	249.51	107.12	0.86
6999	1694	1562.84	1567.09		1568.15	0.00467	9.2	255.94	103.46	0.84
6854.42	1694	1562.38	1566.5		1567.48	0.00427	9.28	279.6	112.5	0.85
6732.24	1694	1561.61	1565.75	1565.75	1566.89	0.00507	9.81	262.97	116.69	0.91
6713.51	1691	1559.27	1564.52		1565.14	0.00195	7.4	356.04	112.08	0.59
6691.19	1691	1559.39	1564.37		1565.08	0.00241	7.74	323.19	109.47	0.65
6571.06	1691	1558.97	1564.16		1564.78	0.00213	7.33	347.64	115.19	0.61
6445.85	1691	1558.93	1563.21	1563.21	1564.36	0.00486	9.71	263.02	117.8	0.9
6416.44	1687	1556.38	1561.44	1561.44	1562.67	0.00417	9.9	258.55	111.16	0.84
6394.13	1687	1556.29	1561.09		1561.89	0.00292	8.18	304.19	110.64	0.71
6274.48	1687	1555.8	1560.89		1561.54	0.00223	7.48	343.19	117.06	0.63
6147.18	1687	1555.74	1559.98	1559.98	1561.09	0.00509	9.57	261.89	120.3	0.91
6113.42	1684	1553.2	1557.8		1558.63	0.00301	8.21	294.22	107.7	0.72
6094.42	1684	1553.17	1557.34		1558.53	0.00478	9.7	249.69	106.28	0.89
5972.07	1684	1552.54	1557.04		1557.93	0.00347	8.6	292.87	116.33	0.77
5841.37	1684	1552.63	1556.29	1556.29	1557.35	0.00564	9.64	267.17	124.02	0.95
5812.63	1684	1548.62	1553	1553	1554.22	0.00495	10.18	253.97	105.25	0.91
5786.39	1684	1548.05	1552.91		1553.82	0.00323	8.75	292.35	108.24	0.75
5687.19	1684	1547.64	1552.78		1553.47	0.00247	7.68	330.67	115.02	0.66
5448	1684	1547.74	1551.52	1551.52	1552.61	0.00549	9.7	264.14	120.36	0.94
5413.77	1681	1544.71	1549.08	1549.08	1550.3	0.00495	10.19	254.92	106.49	0.91
5381.12	1681	1544.2	1548.98		1549.83	0.00307	8.31	294.13	107.87	0.73
5275.22	1681	1544.13	1548.65		1549.49	0.00334	8.48	298.56	111.57	0.75
5132.59	1681	1543.65	1547.74	1547.74	1548.87	0.00527	9.72	256.85	115.55	0.92
5116.05	1680	1541.69	1546.17	1546.17	1547.38	0.00473	10.11	254.69	105.93	0.9

Table 5.1B Sun Valley Parkway Channel HEC-RAS Results Summary (continued)

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)	
5087.07	1680	1540.9	1545.31		1546.42	0.00425	9.48	258.34	101.97	0.85
4966.65	1680	1540.49	1545.08		1545.87	0.00319	8.31	307.78	116.19	0.74
4850.06	1680	1540.37	1544.28	1544.28	1545.38	0.0053	9.63	262.79	119.72	0.93
4818.56	1697	1537.7	1541.67	1541.67	1542.85	0.00563	10.21	254.3	106.19	0.96
4770.29	1758	1536.81	1541.49		1542.51	0.00381	9.18	281.94	106.99	0.81
4683.3	1758	1536.17	1541.39		1542.15	0.0027	8.1	330.24	115.61	0.69
4509.53	1758	1536.42	1540.38	1540.38	1541.49	0.00526	9.98	280.27	123.86	0.93
4488.65	1796	1534.05	1538.49	1538.49	1539.7	0.00492	10.14	272.46	112.53	0.91
4471.06	1796	1533.36	1537.69		1538.83	0.0044	9.77	275.37	105.78	0.87
4359.66	1796	1532.7	1537.52		1538.32	0.00286	8.32	327.57	115.38	0.71
4244.98	1796	1532.65	1536.71	1536.71	1537.87	0.00494	9.83	274.42	120.05	0.91
4187.93	1796	1532.62	1536.9		1537.38	0.00234	6.94	402.5	191.33	0.63
4151.16	1796	1532.51	1536.95		1537.25	0.00138	5.46	452.44	173.94	0.49
4129.04	1796	1532.53	1536.89		1537.22	0.00134	5.38	438.05	155.38	0.48
4115.48	1796	1532.43	1536.92		1537.18	0.00105	4.96	488.53	157.6	0.43
4094.12	2268	1532.3	1536.69		1537.13	0.00193	6.65	467.75	157.84	0.58
3972.55	2268	1531.36	1535.94		1536.78	0.00389	9.36	395.75	132.76	0.82
3852.91	2268	1530.84	1534.94	1534.94	1536.18	0.00599	10.77	331.23	130	1
3812.72	2268	1529.29	1534.49		1535.11	0.00246	8.09	460.5	134.41	0.66
3799.48	2268	1530.22	1534.45		1535.08	0.00296	8.35	443.49	134.98	0.72
3637.57	2268	1529.48	1534.09		1534.61	0.00241	7.6	481.16	138.76	0.65
3413.32	2268	1528.36	1532.58	1532.58	1533.79	0.00569	10.54	339.33	136.27	0.97
3400.52	2268	1526.46	1531.15	1531.15	1532.42	0.0052	10.61	332.94	127.42	0.94
3385.91	2268	1526.09	1531.2		1531.92	0.00271	8.69	434.97	129.55	0.7
3276.5	2268	1525.91	1530.79		1531.6	0.00301	8.72	411.74	134.11	0.73
3141.35	2268	1525.63	1529.82	1529.82	1531.04	0.00539	10.55	341.77	135.86	0.95
3110.39	2268	1523.35	1528.16		1529.05	0.00331	9.22	397.51	128.76	0.77
3085.98	2268	1522.96	1528.2		1528.93	0.00254	8.51	436.93	131.76	0.68
2987.29	2268	1522.47	1527.84		1528.67	0.00266	8.66	415.35	132.55	0.69
2859.92	2268	1522.51	1527.75		1528.28	0.00191	7.32	511.62	153.36	0.59
2838.55	2268	1522.4	1527.82		1528.2	0.00138	6.43	650.21	229.54	0.51
2833.94	2268	1520.61	1527.14	1527.14	1528.13	0.00368	9.33	426.44	216.35	0.8
2799.66	2268	1520.28	1526.85	1526.85	1527.85	0.00379	9.47	423.68	204.98	0.81
2766.31	2268	1520.69	1526		1526.4	0.00155	6.44	594.75	190.71	0.53
2655.14	2268	1520.86	1525.14		1526.1	0.00445	9.83	373.49	135.55	0.88
2538.67	2268	1520.36	1524.8		1525.59	0.00334	8.79	410.29	135.93	0.76
2421.01	2268	1519.79	1523.89	1523.89	1525.06	0.00571	10.56	346.23	140.29	0.97
2398.24	2268	1517.64	1521.65	1521.65	1522.91	0.00652	11.45	330.26	125.94	1.05
2384.66	2268	1517.42	1521.73		1522.53	0.00402	9.48	400.19	128.79	0.83
2297.67	2268	1516.46	1521.39		1522.21	0.00308	8.79	409.13	133.73	0.74
2145.71	2268	1516.13	1520.94		1521.74	0.00311	8.66	417.64	141.7	0.74
2110.81	2268	1516.1	1520.38	1520.38	1521.56	0.00552	10.57	347.47	139.56	0.96
2090.28	2268	1513.29	1518.21		1519.16	0.00361	9.23	377.79	128.79	0.79
2078.26	2268	1513.01	1518.3		1519.06	0.00284	8.61	421.59	130.32	0.7
2045.89	2268	1513.21	1518.1		1518.96	0.00311	8.82	397.9	130.35	0.74
1944.09	2268	1512.76	1517.77		1518.64	0.00319	8.98	405.53	137.91	0.75
1851.19	2268	1512.57	1517.03	1517.03	1518.24	0.00509	10.41	345.05	138.41	0.93
1804.03	2268	1509.5	1514.62		1515.65	0.0037	9.51	367.69	128.21	0.81

Table 5.1B Sun Valley Parkway Channel HEC-RAS Results Summary (continued)

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)	
1781.88	2268	1509.51	1514.78		1515.48	0.00244	8.07	437.49	131.03	0.66
1646	2268	1509.27	1514.5		1515.16	0.00222	7.91	461.48	141.06	0.64
1515.51	2268	1509.16	1513.5	1513.5	1514.7	0.0053	10.41	347.77	142.4	0.94
1495.85	2268	1506.34	1511.43		1512.27	0.00326	9.12	405.22	129.14	0.75
1479.89	2268	1506.43	1511.43		1512.21	0.0028	8.57	416.68	128.37	0.71
1344.96	2268	1505.87	1510.95		1511.81	0.00305	8.87	406.82	135.4	0.74
1266.46	2268	1505.52	1510.23	1510.23	1511.47	0.00506	10.54	341.49	133.36	0.92
1189.17	2268	1503.71	1508.1		1509.27	0.00493	10.42	345.33	126.75	0.92
1165.29	2268	1503.16	1508.28		1509.06	0.00279	8.63	419.73	130.8	0.71
1028.77	2268	1502.94	1507.99		1508.67	0.0025	8.13	465.24	154.5	0.67
998.516	2268	1503.3	1507.42	1507.42	1508.52	0.00546	10.31	365.67	155.16	0.95
982.15	2268	1499.31	1503.6		1504.59	0.00459	9.96	367.13	128.89	0.89
972.058	2268	1499.04	1503.75		1504.47	0.0029	8.48	428.24	133.75	0.72
866.937	2268	1498.37	1502.79	1502.79	1504.03	0.00504	10.51	342.43	135.67	0.93
799.086	2268	1498.3	1502.23	1502.23	1503.41	0.00607	10.64	342.79	139.41	1
783.019	2268	1495.94	1500.27	1500.14	1501.41	0.0052	10.68	348.8	126.5	0.94
772.655	2268	1495.81	1500.38		1501.29	0.00371	9.32	385.38	129.67	0.8
729.791	2268	1495.34	1500.29		1501.13	0.00304	8.8	399.92	131.83	0.74
582.701	2268	1494.73	1499.27	1499.27	1500.52	0.00524	10.67	341.79	135.56	0.95
541.154	2268	1492.98	1498.59		1499.21	0.00193	7.77	475.55	134.62	0.6
501.347	2268	1492.75	1498.38		1499.11	0.00225	8.32	444.62	132.24	0.65
383.545	2268	1493.14	1498.23		1498.82	0.00192	7.48	477.59	134.33	0.59
141.745	2268	1492.41	1496.71	1496.71	1498.04	0.00612	11.34	323.67	121.05	1.02
134.373	2268	1490.97	1496.26		1496.84	0.00181	6.95	444.31	117.97	0.57
114.163	2268	1489.77	1496.14		1496.8	0.00167	7.29	441.32	118.31	0.56
58.5981	2268	1490.86	1495.32	1495.32	1496.6	0.00647	9.52	279.48	114.19	1

5.10 HY-8 Hydraulic Modeling of Sun Valley Parkway Culverts

Within the project limits, eight culverts have been constructed to convey flow under the Sun Valley Parkway, which are listed in Table 5.1 below. Hydraulic modeling of the culverts was performed using the Federal Highway Administration's HY-8 software, version 7.0. Culvert input data, including 100-year peak discharges, were obtained from recorded as-built drawings. Culvert locations are shown in Figure 5.2 and HY-8 output tables are provided in Appendix D.

The flowpath uncertainties for the flows from Fan 1 and 2 are considered through the 5 scenarios presented in Section 4. The FLO-2D results are presented in Table 4.3 and the corresponding FLO-2D locations are presented in Table 5.2. The scenario 2, 3 and 4 represent the worst case scenarios for the culverts. Scenario 2 represents the worst-case for the culverts located on the West, Scenario 3 for the middle and Scenario 4 for the culverts located in the East. According to the 100-year flow hydraulic computations, all culverts function without roadway overtopping. However, because this is an approximate method study, the flow rate uncertainty in the upstream alluvial fan areas, and lack of certification of the road embankment, the floodplains are delineated showing road overtopping and continuous upstream and downstream floodplain boundaries.

The culvert at 1015+39.00 enters the Festival Ranch development. This culvert leads flows into a channel designed as part of drainage plan developed for Festival Ranch (Coe & Van Loo Consultants Inc., 2008). The design capacity of the channel is 155 cfs. A maximum flow of 127 cfs is estimated in Table 4.3 based on FLO-2D results. Therefore, the design capacity of the channel is estimated to be adequate. Appendix E contains the as-built plans of this channel.

Table 5.2. Sun Valley Parkway Culverts Located Within Project Limits

Construction Phase	Stationing	Culvert Type	FLO-2D Location ID
Phase I-A	4+30.50	10'x3' RCBC	9
Phase I-A	16+19.50	3-49"x33" CSPA	10
Phase I-A	26+06.25	10'x3' RCBC	11
Phase I-A	30+55.50	2-49"x33" CSPA	12
Phase I-A	33+07.50	28"x20" CSPA	13
Phase I-A	36+92.50	6-10'x4' RCBC	14
Phase I-A	38+84.50	2-10'x3' RCBC	15
Phase II-B	1015+39.00	57"x38" CSPA	8

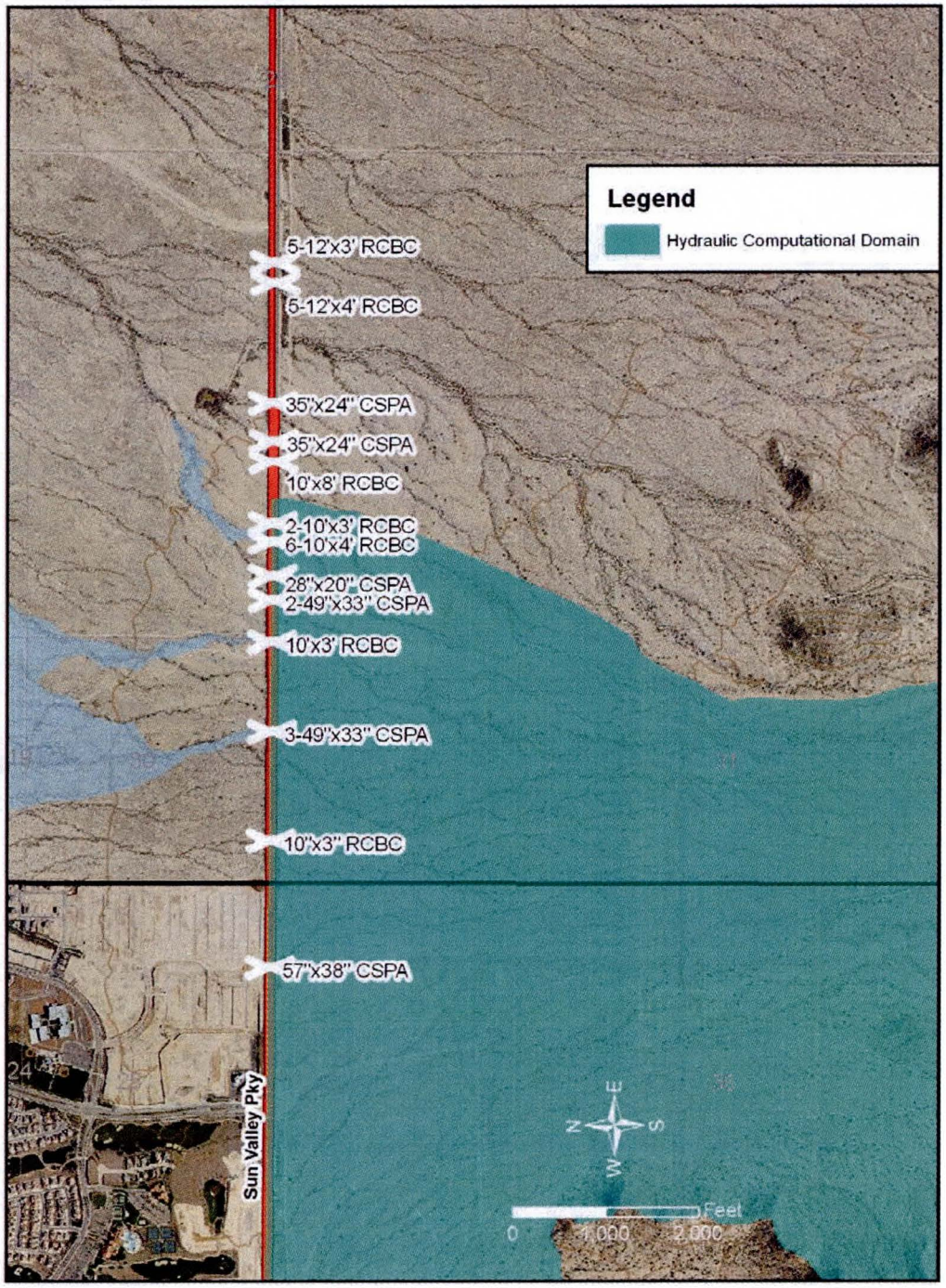

Figure 5.2 Culvert Locations

5.11 References

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2. Phillips, J. V. and Ingersoll, T.L., 1998, *Verification of Roughness Coefficients for Selected Natural and Constructed Stream Channels in Arizona*: U.S. Geological Survey Professional Paper 1584, 77 p.

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4. U.S. Army Corps of Engineers, HEC-RAS River Analysis System Users Manual, Version 3.1, November, 2002.

5. U.S. Army Corps of Engineers, HEC-RAS River Analysis System Hydraulic Reference Manual, Version 3.1, November, 2002.

6. U.S. Army Corps of Engineers, HEC-RAS River Analysis System, Version 3.1.3, May, 2005.

SECTION 6: SEDIMENT TRANSPORT/EROSION

SECTION 6A: EROSION AND SEDIMENT TRANSPORT

Sediment transport analyses were performed to determine the impact of aggradation on the hydraulic capacity of the Sun Valley Parkway Channel. The sediment delivery from the watershed was determined by computing sediment concentrations for a range of flows at the alluvial fan apexes. As a conservative approximation, it was assumed that the flows entering the Sun Valley Parkway channels had the same concentration as flows at the fan apexes. This is a conservative assumption because flows across the fan surface are likely to deposit sediment on the alluvial fan surfaces, since it is this type of deposition that give the fan its convex shape and geologically young age, i.e., fans are aggradational surfaces. This deposition on the fan surface would lower sediment concentrations, or at least the volume of sediment delivered to the Sun Valley Parkway channel. Therefore, it is anticipated that the concentrations of the flows entering the Sun Valley Parkway channel will be lesser than the concentrations estimated at the fan apexes.

The sediment concentrations at the fan apexes were estimated using the sediment yield analysis presented in Section 6A.1. The aggradation potential of the Sun Valley Parkway channel was determined using an equilibrium slope methodology, as presented in Section 6A.2. A post-aggradation hydraulic model was developed using the aggradation estimates from the equilibrium slope computations. The sedimentation analyses demonstrate that the Sun Valley Parkway channel has adequate capacity, even considering 100-year sediment delivery and deposition. Details of these analyses are presented in Section 6A.3.

6A.1 Sediment Yield

The sediment yield calculations were estimated at the apexes of Fans 1 and 2 as part of the District's Sun Valley Area Drainage Master Plan (SVADMP; JEF, 2006). Apex sediment yield was estimated using the Modified Universal Soil Loss Equation (MUSLE) approach in conjunction with the HEC1 model results. The HEC1 models used in this study represent the existing conditions and are not modified from SVADMP HEC1 models. That is, the wash load results were taken directly from the SVADMP without modifications. Because wash load is conveyed with flows without deposition, it was assumed that the wash-load component does not impact the capacity of the Sun Valley Parkway channel. A more detailed documentation of the MUSLE results from the SVADMP is included in Appendix F.

The bedload component of the sediment yield was estimated using the Zeller-Fullerton equation (ADWR, 1985). A typical cross-section of the wash immediately upstream of the apex locations was

used to determine the hydraulic parameters. Normal depth computations were used along with this cross-section to estimate representative hydraulic parameters. Sediment data were obtained from SVADMP sediment samples. An average of the sediment samples were used as representative gradation for the entire study area. The flow and sediment volume were estimated using the 100-year flow hydrographs obtained from the 6-hr and the 24-hr HEC1 models. A representative concentration was then obtained by using the ratio of sediment volume to flow volume. This sediment concentration ratio of 0.53 (See Figure 6A.1) was used to obtain the maximum sediment inflow volume of 64.82 acre-feet entering into the Sun Valley Parkway Channel.

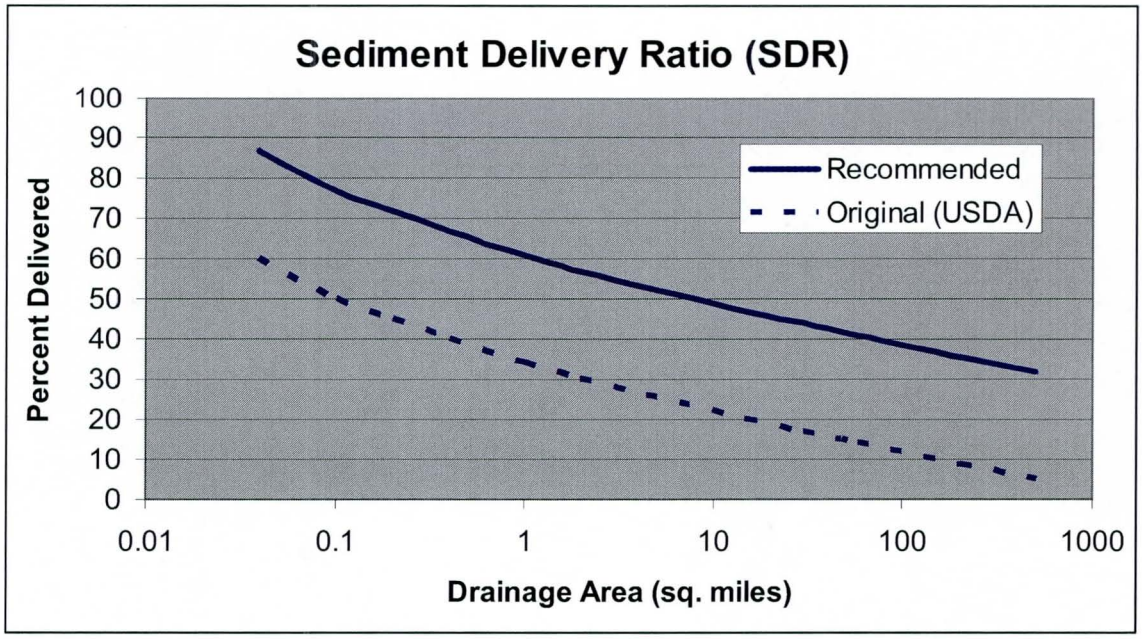

Figure 6A.1 Sediment Delivery Ratio

6A.2 Equilibrium Slope Analysis

Equilibrium slope is defined as the slope at which the channel bed is neither aggrading nor degrading. It could be interpreted as the slope the channel would evolve into, given continuous flows and sediment input for an extended period of time, and provides an idea as to what the long-term channel slope could become. In other words, over time, the natural trend is for the channel to transform its slope from the existing towards the equilibrium slope as a response to flow and sediment influx events.

The equilibrium slope calculations were performed using the procedures outlined in the Arizona Department of Water Resources (ADWR) manual (1985). According to this approach, the equilibrium slope is defined as the slope which causes the channel's sediment transport capacity to equal the incoming sediment supply. If the slope is too steep, flow velocities will be high and net erosion will occur. If the

slope is too flat, flow velocities will be low and net deposition will occur. The equilibrium slope is the slope that the undisturbed, natural channel will tend towards over the long term. The method could also be used to provide order-of-magnitude assessment of the likelihood of vertical channel adjustments.

Reach-averaged data required for application of the equilibrium slope equations to the study area were derived from the following sources:

- Topographic data
- Hydrologic data – ratio of 100-year FDS discharge
- Hydraulic data – normal-depth computations

6A.2.1 Hydrology

Most equilibrium slope equations are based on the mean annual flood, the "channel-forming" or "bankfull" discharge. On many perennial alluvial streams, particularly in humid climates, the mean annual flood and the channel-forming and bankfull discharges are nearly equivalent. However, on ephemeral streams in the arid west, where flow events are rare, the channel-forming discharge is often difficult to determine. The ADWR Manual suggests use of the 5- to 10-year flow rate to predict expected slope adjustments in ephemeral watercourses like those in the DMP study area. Based on ratios of the 100-year flow rate in the District's Hydrology Manual (2003), a value of 35% of the 100-year flow was used to compute equilibrium slopes. The 100-year discharges from the FLO-2D scenario 5 (see Section 5 of this report) were used as this scenario represents the highest discharge scenario for the Sun Valley Parkway channel.

6A.2.2 Hydraulics

Hydraulic calculations for the Sun Valley Parkway channel were performed using a normal depth (Manning's rating) approach. Channel cross-sections were obtained at specific locations along the study reach, approximately at 50-foot intervals. A triangular irregular network (TIN) surface was generated within ArcGIS using 1-foot contour-interval topographic mapping to obtain geometric data for the cross sections, Normal depth calculations were performed at these cross-sections to obtain hydraulic parameters such as velocity and flow depth. Reach-averaged values of these parameters were then obtained for each of the reaches to be used to estimate the sediment transport capacity for the equilibrium analysis.

6A.2.3 Sediment Transport Capacity

The Zeller-Fullerton equation from the ADWR Manual was used to compute sediment transport capacity for all channel reaches. The Zeller-Fullerton Equation is a total bed-material discharge equation, and is formulated as follows:

$$Q_s = 0.0064\, n^{1.77}\, V^{4.32}\, G^{0.45}\, Y_h^{-0.30}\, D_{50}^{-0.61}$$

Where: Q_s = sediment discharge rate (cfs)

n = Manning's roughness coefficient, channel

V = mean channel velocity (ft/s)

G = gradation coefficient

Y_h = hydraulic depth, channel (ft)

D_{50} = median bed sediment size (mm)

Hydraulic data required to apply the Zeller-Fullerton equation were obtained from the normal depth hydraulic calculations for each reach. The gradation coefficient and D_{50} were based on the sieve sample.

6A.2.4 Equilibrium Slope Computations

Sediment transport capacity values were used to compute the equilibrium slope for live bed reaches of the Sun Valley Parkway channel, using the sediment transport continuity approach outlined in the ADWR Manual. The equilibrium slope analysis computes the slope at which the sediment transport in the reach of concern matches the sediment inflows into that reach. The equilibrium slope analysis assumes that the there is infinite sediment supply available to be eroded and does not take into account the presence of pivotal hard points such as grade control structures. However, the equilibrium slope results are used between pivot points to estimate the depth of aggradation or degradation between two points. The long-term slope can be expected to be the same as the equilibrium slope when there is infinite sediment supply. As part of the study, the equilibrium slope calculations were performed for this wash to predict the trend of sedimentation (erosion and deposition) rather than to determine the long-term slope. Lack of sediment supply and the presence of bedrock will control the sedimentation characteristics in such reaches with the tendency of the flow leaning towards erosion. For the purposes of this study, a supply limited channel would result in net scour and increased hydraulic capacity. Therefore, the condition of limited sediment supply could be ignored.

The study reaches were subdivided into smaller segments using the grade control structures as reach break points. The equilibrium slope analysis was then performed for each of these subdivided segments. The procedure adopted is briefly outlined as follows:

1. The Zeller-Fullerton equation was used at the upstream-most cross-section of each reach to calculate the sediment transport capacity. Therefore, sediment inflows into each reach were estimated based on the sediment outflow from upstream reaches. The Zeller-Fullerton equation was also utilized to calculate sediment transport capacity for reaches truncated at the study area

boundary. In this instance, a reach cross-section was taken at the boundary, and used as the upper-most cross-section.

2. An initial estimate of the equilibrium slope was made. The existing slope was typically used to provide a starting condition.
3. Using the equilibrium slope estimate (which is the initial slope for first iteration), the long-term sediment transport capacity was obtained. The estimated equilibrium slope was applied to all cross-sections in the reach segment and hydraulics were estimated using normal depth calculations for each cross-section. Reach average values of velocity and flow depth were obtained from the hydraulics calculations. The reach average values were then used to estimate the sediment transport capacity for the entire reach using the Zeller-Fullerton equation.
4. The ADWR approach requires the matching of the long-term sediment transport to the total sediment inflows into the study reach. At this step, a comparison of the computed sediment inflows is made to the sediment transport computed in step 3.
5. Using the comparison as guidance, the equilibrium slope was adjusted. Steps 3 and 4 were repeated in an iteratively until adequate convergence of the equilibrium slope value was obtained. The equilibrium slope adjustment at each step was performed using a bisection algorithm.
6. The procedure was repeated for all reaches starting upstream and working downstream.

The Sun Valley Pkwy channel was subdivided in to sub-reaches with each sub-reach extending from the top of the grade control to the toe of the upstream grade control. The grade controls act as pivot points about which the channel slope evolves in the long-term. Each sub-reach was considered separately and the inflowing sediment load was identified accordingly. The two main sources of inflowing sediment load are the sediment from the upstream sub-reach and the sediment from the flow entering the sub-reach from the adjacent watershed. The sediment transport capacity of the upstream reach is used to represent the inflowing sediment load from the upstream sub-reach. The sediment concentration ratio was used to determine the sediment load from the overland flow. This is obtained by simply multiplying the concentration ratio with the flow discharge.

The depth of aggradation (or degradation) at a pivot point is based on the difference between exiting and equilibrium slopes bound between an upstream and downstream pivot point, with the difference equal to zero at the downstream pivot point (existing and equilibrium slopes are equal at this location) and at it maximum at the upstream pivot point. Using these estimates, the aggradation potential was determined.

6A.2.5 Equilibrium Slope Results

The results from equilibrium slope analysis indicated the possibility of moderate deposition within certain sub-reaches. The equilibrium slope analysis results are presented in Appendix F.

6A.3 Post-Sedimentation Hydraulic Model

A post-sedimentation HEC-RAS model was prepared using the results of the equilibrium slope analysis to investigate the impact of sedimentation on the hydraulic capacity of the Sun Valley Parkway channel. The equilibrium slope results were used to determine the post-aggradation channel bed elevations. It was assumed that the concrete grade control structures act as hard points and are not subject to any degradation. Only aggrading sub-reaches were adjusted since only aggradation can adversely impact the water surface elevations and channel capacity.

The results indicate that there is adequate capacity for the entire channel for the 100-year peak discharge. At the upstream end of the model, sedimentation impacts the capacity of the channel, but not to the degree that the 100-year capacity is compromised. The diminished capacity is not significant in light of the following conservative assumptions made in the analysis; (1) apex sediment concentrations, (2) no decrease of sediment concentration across the fan surface, and (3) use of maximum discharges from FLO2D modeling scenarios.
The 100-year water surface profile considering sediment aggradation relative to the channel overtopping elevation is shown in Figure 6A.2 and Table 6A.1.

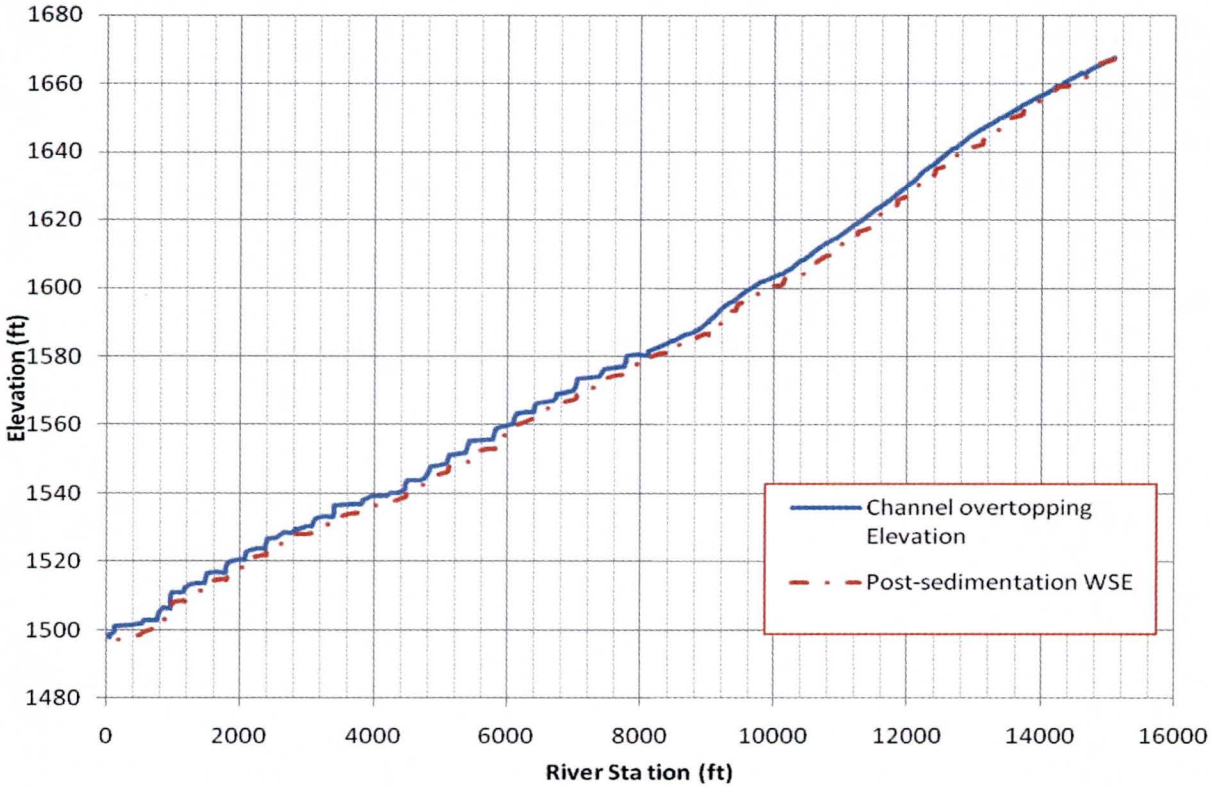

Figure 6A.2 100-year water surface under post-sedimentation channel

Table 6A.1. 100-year water surface elevation under post-sedimentation channel

Post Sedimentation Water Surface Elevations				Post Sedimentation Water Surface Elevations		
River Station (ft)	Channel Overtopping Elevation (ft)	Water Surface Elevation (ft)		River Station (ft)	Channel Overtopping Elevation (ft)	Water Surface Elevation (ft)
15089.58	1667.54	1667.35		11377.76	1620.89	1617.27
15048.99	1667.18	1666.87		11258.4	1619.14	1616.53
14945.94	1666.23	1666.32		11240.54	1618.89	1614.42
14937.48	1666.16	1666.33		11224.92	1618.71	1614.29
14877.43	1665.52	1666.11		11094.81	1616.82	1613.57
14841.55	1665.23	1665.42		10964.53	1615.01	1612.6
14809.29	1664.97	1664.78		10927.56	1614.53	1610.45
14708.76	1663.74	1662.86		10911.95	1614.45	1609.89
14651.74	1662.94	1661.62		10775.8	1612.95	1609.28
14600.25	1663.14	1660.88		10628.03	1611.12	1607.27
14567.53	1662.83	1660.69		10555.32	1609.83	1607.06
14514.8	1662.13	1660.03		10468.18	1608.61	1606.31
14337.25	1660.39	1659.32		10428.14	1608.09	1603.73
14274.69	1659.25	1659.15		10407.63	1607.92	1603.89
14216.35	1658.97	1658.45		10274	1606.14	1603.61
14142.06	1658.16	1657.41		10161.95	1604.75	1602.6
14119.48	1657.93	1656.61		10126.72	1604.05	1601.14
14115.15	1657.9	1656.52		10096.77	1603.82	1600.85
14085.17	1657.51	1656.12		9938.554	1602.52	1600.53
13942.92	1655.95	1654.76		9791.29	1601.63	1599.39
13758.6	1653.93	1653.43		9702.693	1600.54	1596.64
13712.92	1653.66	1651.24		9682.938	1600.15	1596.59
13679.62	1653.24	1651.02		9588.97	1599.26	1596.47
13555.95	1651.87	1650.14		9456.982	1597.25	1595.35
13441.98	1650.52	1649.27		9420.045	1596.66	1593.14
13413.49	1650.1	1646.81		9401.967	1596.4	1593.21
13392.26	1649.9	1646.73		9332.685	1595.63	1593.14
13283.16	1648.71	1646.1		9244.882	1594.39	1592.31
13148.64	1647.34	1645.14		9214.029	1593.95	1589.85
13113.85	1646.76	1642.18		9191.509	1593.56	1589.37
13103.41	1646.68	1642.19		9125.65	1592.26	1589.08
12948.99	1644.66	1641.37		9026.968	1590.13	1588.44
12751.2	1641.77	1640.01		9015.422	1589.85	1586.25
12710.3	1641.12	1636.89		8998.093	1589.69	1586.58
12684.08	1640.83	1636.64		8963.707	1589.15	1586.47
12570.39	1638.97	1635.95		8853.075	1587.55	1585.55
12421.26	1636.8	1634.92		8815.779	1587.32	1584.08
12387.58	1636.3	1632.1		8799.197	1586.93	1584.22
12358.28	1635.83	1631.8		8661.449	1586.02	1583.85
12244.5	1634.13	1630.99		8500.547	1584.58	1582.72
12160.68	1632.6	1630.35		8469.387	1584.33	1580.93
12118.62	1631.85	1627.98		8439.225	1584.1	1581.14
12083.58	1631.22	1627.68		8287.219	1582.95	1580.72
12034.51	1630.4	1627.18		8149.652	1581.7	1579.67
11861.96	1627.81	1625.8		8122.685	1581.37	1577.91
11825.08	1627.36	1623.56		8097.253	1580.62	1578.08
11794.31	1626.83	1623.24		7953.828	1579.87	1577.73
11660.13	1624.74	1622.13		7799.566	1578.58	1576.61
11583.43	1623.7	1621.54		7773.177	1578.17	1574.94
11530.86	1623.15	1618.51		7752.089	1578.26	1574.77
11507.12	1622.84	1618.22		7598.913	1576.72	1574.42

Table 6A.1. 100-year water surface elevation under post-sedimentation channel (continued)

Post Sedimentation Water Surface Elevations			Post Sedimentation Water Surface Elevations		
River Station (ft)	Channel Overtopping Elevation (ft)	Water Surface Elevation (ft)	River Station (ft)	Channel Overtopping Elevation (ft)	Water Surface Elevation (ft)
7446.958	1575.44	1573.43	3413.317	1534.89	1532.58
7419.387	1575.15	1571.35	3400.519	1534.76	1531.2
7379.578	1574.79	1571.16	3385.912	1534.63	1531.27
7217.642	1573.19	1570.78	3276.504	1533.75	1530.81
7057.082	1571.57	1569.65	3141.353	1532.45	1529.82
7022.299	1571.09	1567.79	3110.386	1532.31	1528.46
6998.997	1570.75	1567.21	3085.983	1531.55	1528.46
6854.423	1569.11	1566.73	2987.29	1529.52	1527.99
6732.243	1567.64	1565.9	2859.922	1528.89	1527.89
6713.511	1567.49	1565.11	2838.551	1528.75	1527.95
6691.186	1567.29	1564.98	2833.935	1528.79	1527.33
6571.056	1566.33	1564.57	2799.662	1528.66	1527.01
6445.849	1564.71	1563.46	2766.312	1528.66	1526.09
6416.444	1564.46	1562.33	2655.14	1528.17	1525.19
6394.126	1564.3	1561.99	2538.673	1527.47	1524.82
6274.483	1563.22	1561.06	2421.011	1526.21	1523.89
6147.176	1561.87	1560.03	2398.24	1525.92	1521.65
6113.42	1561.29	1557.77	2384.655	1525.82	1521.87
6094.42	1561.37	1557.4	2297.673	1524.86	1521.47
5972.07	1559.83	1557.05	2145.706	1523.24	1520.94
5841.366	1558.34	1556.29	2110.812	1522.78	1520.39
5812.631	1558.03	1552.99	2090.275	1522.55	1518.21
5786.387	1557.56	1553.01	2078.263	1522.45	1518.3
5687.19	1556.37	1552.84	2045.894	1522.18	1518.1
5448.002	1553.47	1551.52	1944.087	1520.76	1517.77
5413.769	1552.83	1549.08	1851.19	1519.77	1517.03
5381.124	1552.5	1549.03	1804.03	1519.15	1514.66
5275.222	1551.49	1548.73	1781.875	1518.91	1514.81
5132.593	1550.07	1547.79	1645.995	1517.06	1514.51
5116.053	1549.92	1546.59	1515.506	1515.63	1513.5
5087.074	1549.09	1546.1	1495.849	1514.93	1511.48
4966.653	1547.69	1545.56	1479.893	1515.16	1511.47
4850.062	1546.33	1544.48	1344.964	1513.85	1511.02
4818.556	1545.95	1543.55	1266.459	1512.99	1510.28
4770.29	1545.59	1542.95	1189.172	1511.88	1508.2
4683.298	1544.46	1541.81	1165.285	1511.88	1508.32
4509.527	1542.08	1540.42	1028.773	1510.29	1507.99
4488.645	1542.24	1538.8	998.5162	1509.67	1507.42
4471.064	1541.69	1538.69	982.1498	1509.5	1503.6
4359.662	1540.73	1538.13	972.0575	1509.37	1503.75
4244.98	1539.63	1537.03	866.9367	1507.09	1502.79
4187.928	1539.14	1537.02	799.0856	1505.91	1502.23
4151.155	1539.25	1537.03	783.0189	1505.42	1500.29
4129.04	1538.86	1536.95	772.6547	1505.38	1500.4
4115.484	1538.89	1536.98	729.7908	1504.37	1500.29
4094.117	1538.89	1536.76	582.7006	1502.83	1499.3
3972.552	1538.2	1536.02	541.1541	1502.14	1498.62
3852.914	1537.14	1534.95	501.3466	1501.88	1498.39
3812.718	1536.93	1534.49	383.5453	1500.83	1498.23
3799.484	1537.14	1534.45	141.745	1499.69	1496.71
3637.573	1536	1534.09	134.3734	1499.62	1496.31
			114.1627	1499.61	1496.1
			58.59812	1499.52	1495.32

SECTION 6B: GEOMORPHOLOGY

This section of the Technical Data Notebook describes the geomorphic methods used to delineate the flood hazards on the Site 1 and 2 alluvial fans. Section 6B is organized to follow the outline of the Piedmont Flood Hazard Assessment Manual (PFHAM) (Hjalmarson, 2003) format, as well as the FEMA Guidelines (FEMA, 2002). Hydrology and hydraulic data used in the delineation are described in Sections 4 and 5 of this TDN. Both the PFHAM and the FEMA Guidelines describe a three stage delineation process. The FEMA Guidelines are intended only for alluvial fans, whereas the PFHAM is applicable to a wider range of piedmont surfaces. The three stage delineation process includes the following steps:

- Stage 1: Recognizing and Characterizing Alluvial Fan Landforms
- Stage 2: Defining Active and Inactive Areas of Erosion and Deposition
- Stage 3: Defining the 100-Year Floodplain

Downstream of the hydrographic apex, geomorphic methods, historical data, and limited post-flood hazard verification data were used to delineate the flood hazard zones, as specified in Table G-1 of the FEMA Guidelines. Upstream of the hydrographic apex, geomorphic methods were used to complement and refine conventional approximate normal-depth hydraulic methods, as described in Section 5 of the TDN.

6B.1 Previous Studies

Several previous studies of the geomorphology and relative flood hazards have been conducted in and around the study area. These studies include the following:

- Hjalmarson and Kemna (1991) *Flood Hazards of Distributary-Flow Areas in Southwestern Arizona*: U.S. Geological Survey Water Resources Investigations Report 91-4171.

  This report identified White Tank Piedmont Sites 36-39 and described methods of identifying flood hazards associated with distributary flow networks.

- CH2M Hill (1992) *Alluvial Fan Data Collection and Monitoring Study*: Tempe, Arizona, CH2M Hill and R.H. French, Ph.D., P.E. Consulting Engineer for the Flood Control District of Maricopa County, 204 p.

  This report identified Site 36 as an active alluvial fan, included geomorphic mapping and historical data, and recommended a flood monitoring and data collection program.

- Field & Pearthree (1991), *Surficial Geology around the White Tank Mountains, Central Arizona.* AZGS Open File Report 91-8.

  This mapping effort included nine 7.5' quadrangles around the White Tank Mountain piedmont. Piedmont mapping distinguished Holocene fans (Y) from Pleistocene fans (M).

- Field & Pearthree (1992), *Geologic Mapping of Flood Hazards in Arizona: An Example from the White Tank Mountains, Maricopa County*. AZGS Open File Report 91-10.

  This mapping effort related surficial characteristics to the degree flood hazard on piedmont surfaces surrounding the White Tank Mountains. Primary flow paths were also identified.

- Alpha Engineering Group, Inc., 1994, *White Tanks Wash Flood Insurance Study, FCD No. 90-64*: for FCDMC, Phoenix, Arizona.

  This detailed riverine floodplain delineation for White Tank Wash, the axial drainage for White Tank Piedmont Sites 6, and 36-39. The delineation extended from the Buckeye FRS to Sun Valley Parkway and included a tributary that is one of the primary flow paths for Fan 39.

- A-N West, 1991, Sun Valley Parkway North Floodplain Delineation Study (90-04) performed by AN-West for FCDMC, Phoenix, Arizona

  This detailed riverine floodplain delineation for unnamed washes downstream of Sun Valley Parkway into which Fan Site #2 drains. The washes were delineated using detailed methods, but were converted to unnumbered A Zones due to upstream flow splits and bifurcations in the watershed.

- Field (1994), Surficial Processes on Two Fluvially Dominated Alluvial Fans in Arizona, AZGS Open File Report 94-12. Also: Field (1994), *Processes of Channel Migration on Fluvially Dominated Alluvial Fans in Arizo*na, AZGS Open File Report OFR-94-13.

  These studies document the importance of stream piracy processes in developing distributary flow networks and causing channel movement on fans dominated by fluvial processes. Historical evidence from White Tank Piedmont Site 36 is used as one of five case histories presented.

- Hjalmarson (1994), *Potential Flood Hazards and Hydraulic Characteristics of Distributary-Flow Areas in Maricopa County, Arizona*: U.S. Geological Survey Water Resources Investigations Report 93-4169, 56 p.

  This study defined measurable parameters intended to assess the degree of flood hazard on distributary flow systems. White Tank Piedmont Sites 36-39 were used as example sites.

- JE Fuller/Hydrology & Geomorphology, Inc. (1999), *Approximate Floodplain Delineation Study for White Tank Fan (Site 36)*. TDN prepared for the Flood Control District of Maricopa County.

  This approximate method floodplain delineation study used the NRC three-stage process to delineate the floodplain for Site 36. The study established the TDN format for alluvial fan floodplain delineation studies in Maricopa County.

- Alluvial Fan Floodplain Delineations by JE Fuller/Hydrology & Geomorphology, Inc. for the Flood Control District of Maricopa County Sun Valley ADMP:
  - White Tank Piedmont Fan Sites 10-11-20
  - White Tank Piedmont Fan Sites 1-2 (this report)
  - White Tank Piedmont Fan Sites 4-5
  - White Tank Piedmont Fan Site 6
  - White Tank Piedmont Fan Sites 3-13-16
  - White Tank Piedmont Fan Sites 7-8-9-12
  - White Tank Piedmont Fan Sites 17-19

- Robinson (2002), *Cosmogenic Nuclides, Remote Sensing, and Field Studies Applied to Desert Piedmonts*. ASU Geology Department PhD Dissertation.

  This study used remote sensing techniques to perform geomorphic mapping of portions of the White Tank Piedmont.

- Ferguson and others (2004), *Geologic Map of the Wagner Wash Well 7.5' Quadrangle, Maricopa County, Arizona.*

  This mapping project is the most recent AZGS geologic and surficial mapping of the White Tank Piedmont area.

- Field and others (2004), *Geologic Map of the Buckeye NW 7.5' Quadrangle, Maricopa County, Arizona.*

  This mapping project is the most recent AZGS geologic and surficial mapping of the White Tank Piedmont area.

- Ayres Associates (2004), Buckeye Sun Valley ADMP Piedmont Landform Delineations Technical Memorandum to the Flood Control District of Maricopa County.

This report describes the results of Stage 1 and Stage 2 delineations from the NRC three-stage alluvial fan delineation process. In general, the Ayres results were not relied on for the current delineation study.

- Ayres Associates (2004), Buckeye Sun Valley ADMP Sediment Yield Analysis. Technical Memorandum to the Flood Control District of Maricopa County.

  This report summarizes an analysis of potential sediment yield to the Buckeye FRS.

The following alluvial fan floodplain delineations on the White Tank Mountain piedmont have been or are being prepared by others, and are in various stages of the review/approval process:

- White Tank Piedmont Fan Site 37 and Portions of Fan Site 36. TDN prepared by Coe & Van Loo Consulting, Inc. for Lennar Properties.
- White Tank Piedmont Fan Site 38. TDN prepared by David Evans & Associates for Stardust Properties.
- White Tank Piedmont Fan Site 39. TDN prepared by CMX, Inc for Pulte Homes.

An alluvial fan floodplain delineation was also previously prepared by the Flood Control District of Maricopa County for the Skyline Wash Alluvial Fan, which is located on the southern flank of the White Tank Mountain Piedmont, as documented in the PFHAM Section 5.3. Finally, preliminary alluvial fan delineations (Stage 1-2) were prepared but not finalized by WEST Consultants, Inc. for portions of the northeast flank of the White Tank Piedmont as part of the Flood Control District of Maricopa County Wittmann Area Drainage Master Study Update. Except where specifically referenced or noted as such, this study does not rely on any of the previous or on-going alluvial fan floodplain delineation studies cited above.

6B.2 Data Sources

6B.2.1 NRCS Soils Map Unit Interpretation

The soils data used in this study were derived from two NRCS soil survey reports entitled *Soil Survey of Maricopa County, Arizona, Central Part* (Hartman, 1977) and *Soil Survey of Aguila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona* (Camp, 1986). These detailed soil surveys were developed for use by land planners, farmers, ranchers, agronomists, rangeland managers, community officials, geologists, engineers, developers, builders, home buyers, and watershed and wildlife managers. In 1999 the NRCS converted the soil survey data from the Hartman (1977) report to a digital database and GIS format. The Camp (1986) soil survey data was converted to a digital format in 2001. Digital versions of the NRCS soils data obtained from the NRCS web site were used for this study.

6B.2.2 AZGS Map Unit Interpretation

The Arizona Geological Survey (AZGS) published multiple surficial geologic maps at varying scales within the White Tank Mountains area, as listed in Table 6B.1.

Table 6B.1. Collected AZGS Geology Maps

Map Name	Map Format	Scale	Year	Authors
Geologic Map of Wagner Wash Well 7.5' Quadrangle, Maricopa County	Scanned raster	1:24,000	2004	C.A. Ferguson, J.E. Spencer, P.A. Pearthree, A. Youberg, J.J. Field
Geologic Map of the Buckeye NW 7.5' Quadrangle, Maricopa County, Arizona	Scanned raster	1:24,000	2004	J.J. Field, P.A. Pearthree, C.A. Ferguson
Geologic Map of the Vulture Mine 7.5' Quadrangle, Maricopa County, Arizona	Scanned raster	1:24,000	2004	M.J. Grubensky, T.C. Shipman
Geologic Map of the Daggs Tank 7.5' Quadrangle, Maricopa County, Arizona	Scanned raster	1:24,000	2004	P.A. Pearthree, A. Youberg, J.J. Field, C.A. Ferguson, J.W. Spencer
Geologic Map of the White Tank Mountains, Central Arizona	Scanned raster	1:24,000	2002	S.J. Reynolds, S.E. Wood, P.A. Pearthree, J.J. Field
Geologic Map of the Wickenburg SW 7.5' Quadrangle, Maricopa County	Scanned raster	1:24,000	2004	T.C. Shipman, M.J. Grubensky
Geologic Map for the Buckeye 7.5' Quadrangle, Maricopa County, Arizona	Scanned raster	1:24,000	2002	S.J. Skotnicki
Geologic Map of the Phoenix North 30' x 60' Quadrangle, Central Arizona	Digital GIS	1:100,000	1997	S.J. Reynolds, M.J. Grubensky
Geologic Map of the Phoenix South 30' x 60' Quadrangle, Central Arizona	Digital GIS	1:100,000	1997	S.J. Reynolds, S.J. Skotnicki
Geologic Mapping of Flood Hazards in Arizona: An Example from the White Tank Mountains Area, Maricopa County	Scanned raster	1:24,000	1992	Field, J.J., Pearthree, P.A.

6B.2.3 Aerial Photography

Modern Orthophotography

Color, digital, orthophotography covering the entire study area was provided by the Flood Control District of Maricopa County. Over 400 image tiles were collected, each covering approximately 0.90 square miles at a resolution of 1-foot/pixel.

Historical Aerial Photography

Limited historical aerial photography was collected from the Flood Control District of Maricopa County. The photos were provided as digital image files scanned from the original photo prints. Table 6B.2 lists the years of historical photos coverage used in this study.

Table 6B.2. Collected historical aerial photography		
Photo Year	**Original Photo Print Scale**	**Format**
1942	1:15,000	B&W scanned
1949	1:20,000	B&W scanned
1953	1:20,000	B&W scanned
1954	1:20,000	B&W scanned

6B.2.4 Topographic Mapping

The primary mapping source used in this study was 10-foot contour interval, digital topography provided by the Flood Control District of Maricopa County. The mapping was performed county-wide scale in December 2000. Additional 2- to 4-foot digital topography was provided by the Flood Control District of Maricopa County for limited areas within the White Tank Mountains study area. Table 6B.3 lists the digital topographic data collected for this study.

Table 6B.3. Collected digital topography		
Contour Interval	**Mapping Year**	**FCDMC Source Project**
10-foot	2000	County-wide mapping
2-foot	1990	White Tanks-Agua Fria ADMS
4-foot	1990	Wickenburg ADMS
2-foot	1997	Skyline Wash FDS
2-foot	2002	Buckeye/Sun Valley Mapping
2-foot	2002	Wittmann ADMP Mapping
2-foot	2002	Hassayampa North Extension Mapping
1-foot	2007	Pulte Homes/Sun City Festival Mapping

6B.3 Method Description

The PFHAM alluvial fan floodplain delineation methodology is based on the three stage process outlined in the National Research Council's (NRC, 1996) report, *Alluvial Fan Flooding*. Both the PFHAM and NRC documents describe a three stage method used to identify alluvial fan flood hazards, which was later adapted for the FEMA Guidelines Appendix G (2002). The PFHAM broadens the three-stage delineation approach to cover a variety of piedmont landforms.

Stage 1 of the PFHAM/FEMA alluvial fan methodology is the recognition and characterization of piedmont landforms. The intent of the Stage 1 analysis is to distinguish alluvial fan landforms from riverine,

sheet flow, ponding, or coastal landforms.[1] If the landform in question is identified as an alluvial fan, then the delineation may proceed using the PFHAM/FEMA Stage 2 and 3 procedures. If the landform is not an alluvial fan, then more traditional floodplain delineation procedures should be applied. The Stage 1 delineation relies on the following types of information:

- Composition. Alluvial fans are composed of loose, unconsolidated materials transported by fluvial or debris flow processes (a.k.a., "alluvium").
- Morphology. Alluvial fans have the shape of a partially or fully extended fan as observed on topographic maps or aerial photographs.
- Location. Alluvial fans are usually found at a topographic break where stream channels become less confined than upstream of the break.
- Boundaries. The downstream boundary of an alluvial fan is called the "toe," which is located at an axial stream, lake or landform not dominated by alluvial fan flooding processes. The lateral boundaries of the fan are defined by a transition from alluvial fan flooding processes to riverine processes, although an alluvial fan may also coalesce into adjacent alluvial fans to form a bajada.[2]

Data sources for the Stage 1 delineation included topographic maps, NRCS soil surveys, geologic mapping, aerial photographs, and field observations. These data were used to differentiate piedmont landforms which included mountains, inselbergs, alluvial fans, pediments, and riverine floodplains. The locations of the topographic and hydrographic apexes on the alluvial fan were also identified in Stage 1. The topographic apex is the extreme upstream extent of the alluvial fan landform, which is often located at the mountain front or within a mountain front embayment. The hydrographic apex is the location at which flow of water and sediment becomes unconfined and spreads out rapidly. Sudden expansion of flow at the hydrographic apex causes sediment deposition, uncertain flood flow paths, and uncertain flow distribution below the apex. The complex hydraulics associated with this flow expansion and sediment deposition create significant uncertainties (unpredictability) that "cannot be set aside in the realistic assessment of the flood hazard" (FEMA, 2002), which is the defining characteristic for alluvial fan flooding.

The White Tank Piedmont consists of an extensive bajada that rings the White Tank Mountains, rather than a series of distinct, separate alluvial fans. The active fan areas within the bajada are located well away from the mountain front, and are inset within the original alluvial fans, sometimes with two or more hydrographic apexes on what was once (in geologic time) a single alluvial fan landform. This bajada

[1] FEMA Guidelines, p. G-6, 1st paragraph.

[2] A bajada is "a low-lying area of confluent pediment slopes and alluvial fans at the base of mountains around a desert" (The New Penguin Dictionary of Geology, 1996).

landform, in conjunction with the complicated hydrographic apex locations, makes delineating individual alluvial fan landforms somewhat problematic. Therefore, because of the bajada condition, and because JE Fuller/ Hydrology & Geomorphology, Inc. was under contract to delineate alluvial fan floodplain over much of the White Tank Piedmont, the Stage 1 delineation was performed for the entire White Tank Piedmont area, rather than just the portion of the bajada surrounding the Site 1 and 2 alluvial fans.

Stage 2 of the PFHAM/FEMA alluvial fan methodology consists of defining active and inactive[1] portions of the alluvial fan landform. Active areas are those locations where uncertainties about channel geometry and hydraulic conditions of water and sediment discharge cannot be set aside in the realistic assessment of flood hazard. Active areas on alluvial fans experience sediment deposition, erosion and unstable flow paths in addition to flood inundation. Generally, active alluvial fans have experienced these processes within the past 10,000 years (the Holocene Epoch). Inactive alluvial fan areas are the portions of the alluvial fan where active fan processes do not occur. Generally, inactive alluvial fans have not experienced such processes within the past 10,000 years, but may have done so during much older geologic periods (the Pleistocene Epoch or Tertiary Period). Stage 2 also identifies portions of the piedmont subject to various types of flooding such as stable riverine flooding, active alluvial fan flooding, inactive alluvial fan flooding, and sheet flooding.

According to FEMA Guidelines, a Stage 2 delineation may be completed using a geomorphic-based approach if the alluvial fan has little or no urbanization (Table G-1, FEMA, 2002). In the geomorphic approach, surficial stability characteristics were compiled and evaluated from the following sources:

- Detailed Soils Mapping. Detailed soils maps prepared by the USDA Natural Resource Conservation Service (NRCS) are available for the entire study area. NRCS soils maps describe soil composition, as well as provide some degree of landform interpretation.
- Surficial Geologic Mapping. The Arizona Geological Survey (AZGS) has prepared several types of surficial geology and flood hazard assessment maps for the entire study area. The AZGS maps indicate surface age, degree of flood hazard, and landform type.
- Topographic Mapping. Topographic data to be considered include the fan profile, crenulation index (degree of incision), fan shape, and slope. 10-foot contour interval topographic data are available for the study area. Topographic data are also used to estimate flow containment when defining fan boundaries. The topographic data were also used to construct longitudinal profiles of the alluvial fans.
- Vegetation. Vegetation patterns can be used to identify flow paths or areas of more frequent inundation (dense vegetation), sheet flow (uniform vegetation), the degree soil development (e.g.,

[1] FEMA uses the terms "active" and "inactive." The PFHAM uses "stable" and "unstable," respectively, for the same concept.

ocotillo are a marker species for carbonate soil horizons), soil material (e.g., saguaro cacti prefer rocky, well drained soils), surface age (e.g., old surfaces have more slow growing species, creosote clone rings are wider on older surfaces), and surface boundaries (e.g., vegetation suites change with soil types and landform).

- Surficial Characteristics. Older, inactive surfaces tend to have well developed surficial features such as desert varnish, desert pavement, soil reddening, and incised, well-defined drainage patterns.
- Sediment Delivery Potential Sediment yield estimates can be used to estimate fan aggradation rates and define a zone of aggradation more likely to experience active fan processes.
- Drainage Pattern. Inactive fans tend to have tributary drainage patterns with well defined divides. Active fans tend to have distributary drainage patterns with poorly defined divides and/or perched flow paths.
- Historical Aerial Photographs. Channel positions from historical 1953 aerial photographs were digitized and compared with channel positions on 2005 aerial photographs to identify areas of known channel movement and changes in channel pattern.

The White Tank Piedmont Fan Site described in this TDN included active and inactive alluvial fan areas, but also included extensive flow corridors located downstream of the primary active alluvial fan areas in which flow distribution uncertainty exists. These flow paths downstream of the active fan areas are often relatively stable, at least within an engineering time scale of several hundred years, and are typically separated by stable, older, topographically-higher surfaces. Because of the flow path uncertainty in the active, unstable area upstream, accurate determination of peak discharge for the downstream (more stable) flow corridors is not possible. Also, because these downstream flow corridors often have complicated distributary channel patterns, and because the study area has "little or no urbanization" (FEMA Guidelines, Table G-1), the downstream flow corridor floodplains where delineated using geomorphic methods.

Stage 3 of the PFHAM/FEMA alluvial fan methodology involves identifying the areas subject to flooding in a 100-year flood event. Stage 3 methodologies range from conventional detailed or approximate hydraulic methods using fixed-bed hydraulic models, such as Manning's equation, to geomorphic interpretation based field observations and aerial photographs. For this study, geomorphic methods were used for all of the alluvial fan reaches downstream of the hydrographic apex, including the "stable" reaches downstream of unstable, active alluvial fan areas.

6B.4 Stage 1: Recognizing and Characterizing Piedmont Landforms

Stage 1 of the PFHAM/FEMA alluvial fan methodology consists of recognizing and characterizing piedmont landforms. The primary objective of the Stage 1 analysis is to distinguish alluvial fan landforms

from riverine, sheet flow, ponding, or coastal landforms. If an alluvial fan landform is identified, the locations of the topographic and hydrographic apexes also must be determined. The Stage 1 assessment uses geomorphic characteristics obtained from soils maps, surficial geology maps, topographic maps, and aerial photographs, as well as field observations. As described above, a Stage 1 delineation was performed for the entire White Tank Piedmont, which includes the Site 1 and 2 alluvial fans.

The White Tank Mountain Piedmont consists of an alluvial fan bajada that rings the entire White Tank Mountains. Although minor portions of the upper White Tank Mountain Piedmont have been mapped as a pediment, and a large number of inselbergs crop out within the bajada, the vast majority of the piedmont is composed of alluvium deposited below the mountain front in a radiating (albeit coalesced) pattern. The White Tank Piedmont is bounded by the Wagner Wash floodplain to the north and northwest and the Hassayampa River floodplain to the west. Today, a portion of the toe of the north end of the White Tank Mountain Piedmont is truncated by the Central Arizona Project (CAP) canal. The CAP embankment impounds and/or diverts flow from the piedmont west to Wagner Wash or east to tributaries of Trilby Wash.

6B.4.1 Composition

NRCS soils maps (Figure 6.1; adapted from Camp, 1986; Hartman, 1977) and AZGS surficial geology maps (Figure 6.2; adapted from Field and Pearthree, 1991) show that the entire White Tank Mountain Piedmont is composed of alluvial sediments, with the exception of a few inselbergs.

6B.4.1.1 Soils Data

Figure 6.1 shows the NRCS soil map units overlain on the USGS topographic quadrangles. The soil unit polygons were obtained from the Soil Survey of Aguila-Carefree Area (Camp, 1986) and the Soil Survey of Maricopa County, Central Part (Hartman, 1977). Table 6B.2 gives a list and description of the NRCS soil units within the study area. In addition to showing the map unit boundaries and designations, Figure 6.1 shows by color the setting or type of landforms generally

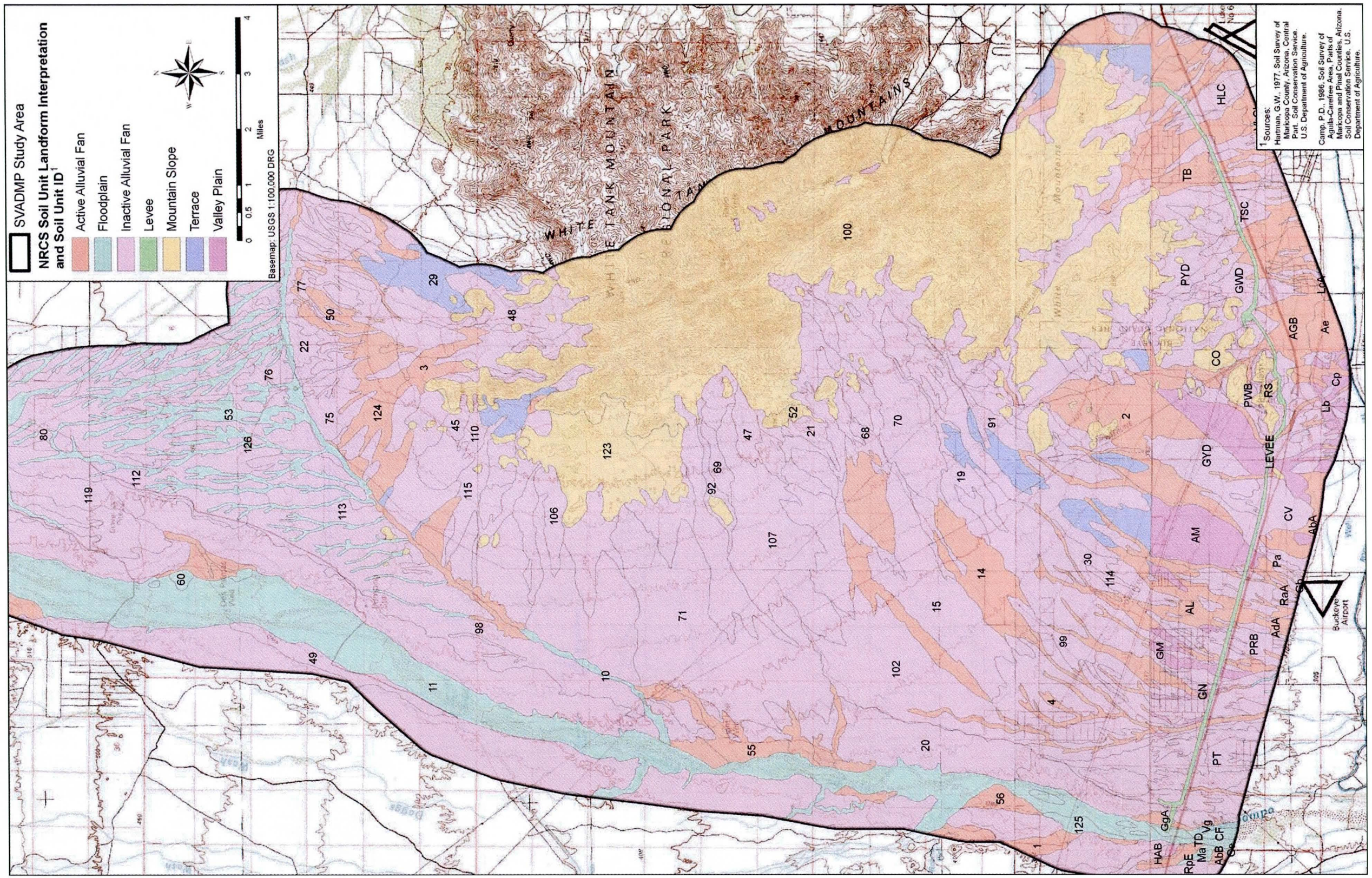

Figure 6.1. NRCS soils mapping with landform interpretations

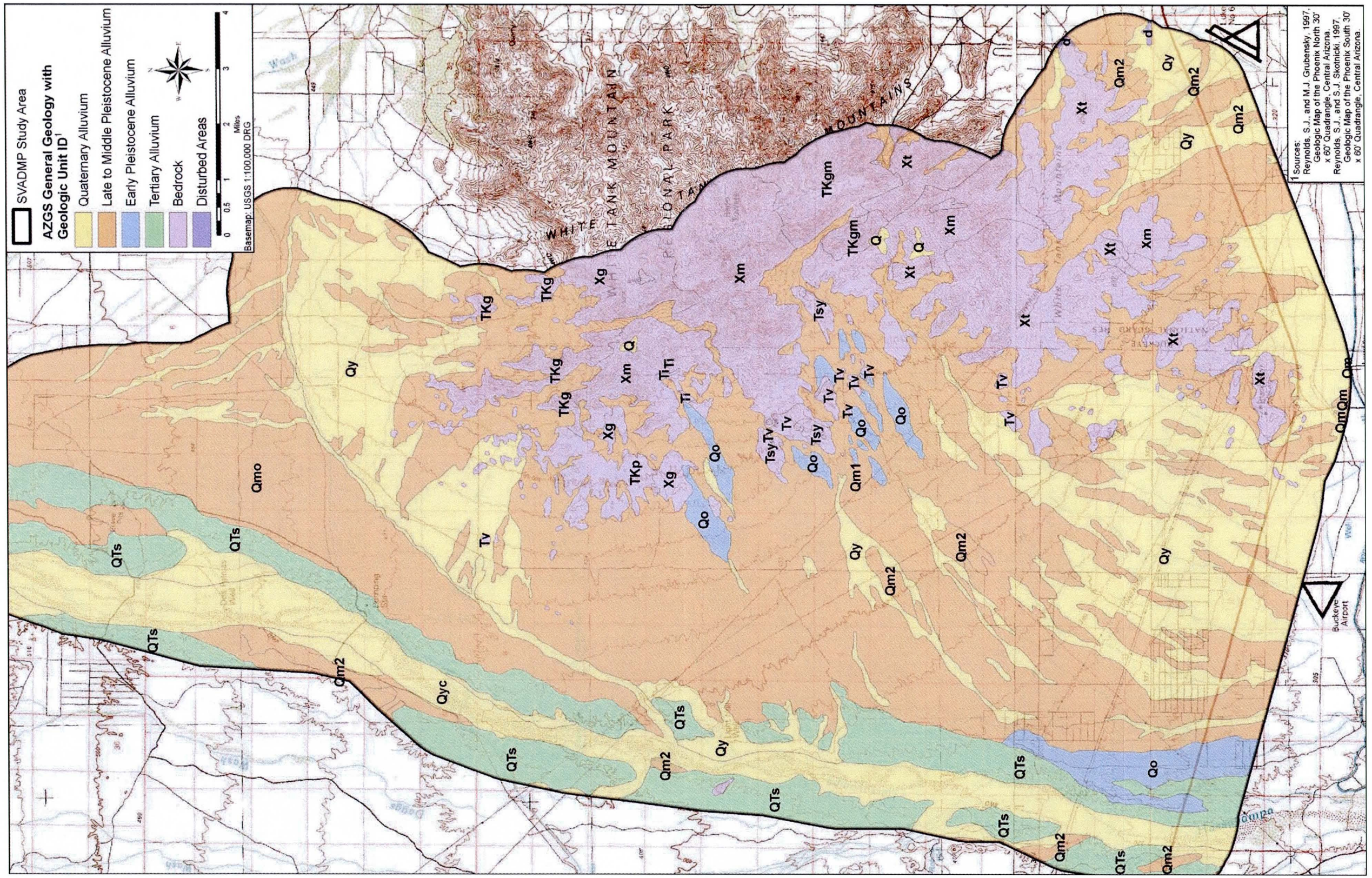

Figure 6.2. AZGS geologic mapping (1:100,000 scale)

associated with each of the various map units as distinguished by the NRCS. The three main categories of landforms distinguished by the NRCS map unit descriptions are: 1) drainageways, floodplains, and alluvial fans, 2) alluvial fan terraces, and 3) mountains and hillslopes. Complete soil unit descriptions for the study area are provided in Camp (1986) and Hartman (1977).

The NRCS soils map units are grouped into broad soil associations as shown on the General Soils Maps provided in the NRCS soils reports. On the General Soils Maps, the bedrock areas of the White Tank Mountains are mapped as the Gachado-Rock Outcrop-Quilotosa Association (Camp, 1986), or as the Cherioni-Rock Outcrop Association (Hartman, 1977), both of which consist of very shallow and shallow gravelly soils and rock outcrop on hill slopes and mountain slopes. The majority of the piedmont bounding the mountain bedrock core is mapped as Gunsight-Rillito-Chuckawalla Association (Camp, 1986), which is found on gently to moderately steep slopes and consists of gravelly and very gravelly loamy soils on fan terraces, or the Gunsight-Rillito-Perryville Association (Hartman, 1977), which is found on nearly level to moderately steep surfaces and consists of gravelly loams and loams on old alluvial fans and valley plains. The northern portion of the piedmont is mapped (Camp, 1986) as the Mohall-Contine Association, which consists of loamy and clayey soils on fan terraces. Hartman (1977) mapped portions of the southern piedmont near the Buckeye FRS as the Antho-Valencia Association, a sandy loam soil on recent alluvial fans and valley plains.

Table 6B.4 also shows the relationship between the detailed NRCS soil map units and the White Tank Piedmont landforms. As can be seen from Table 6B.4, each soil map unit is actually comprised of several soil series. Each series has its own associated position or landform which is identified in the table. Characteristics important to the soil series age, stability, and flood history are also presented in Table 6B.4. These characteristics help identify the landform type, as well as the stability and the flood history and flood potential of the unit, as described in the Stage 2 analysis.

The key facts derived from the NRCS soils mapping with respect to the Stage 1 delineation are that the piedmont area is underlain by alluvium and that soils are associated with alluvial fans, fan terraces (inactive alluvial fans), and alluvial plains. The NRCS soil descriptions provided in Table 6B.4 are consistent with the common soil types for alluvial fans shown in Table 2.1 of the PFHAM.

6B.4.1.2 Surficial Geology

Figure 6.2 shows the 1:100,000 scale surficial geologic mapping of the White Tank Piedmont adapted from Reynolds and Grubensky (1997) and Reynolds and Skotnicki (1997) of the Arizona Geological Survey (AZGS). Figure 6.2 shows the entire piedmont study area is composed of alluvium of either Pleistocene or Holocene in age. More detailed AZGS surficial mapping at a scale 1:24,000 indicates that pediment surfaces are located near the deeply embayed mountain front and around many of the bedrock inselbergs. Phil Pearthree (personal communication, 1999) indicated that the pediment

designation was identified solely on the basis of the inselbergs and that no subsurface data were used in the delineation of the pediment boundary shown on the AZGS maps. The 1:24,000 scale surficial mapping is difficult to interpret when illustrating the entire study area (as in Figure 6.2), thus the 1:100,000 scale mapping was used. The more detailed 1:24,000 scale mapping is shown later in this report in Figure 6.21.

Complete descriptions of the surficial geologic units are provided in Field and Pearthree (1991). The following units were mapped by the AZGS in the study area:

- Holocene Alluvial Fans & Drainageways (Y1 and Y2). These surfaces have experienced active deposition and erosion during the last 10,000 years. The Y2 unit is the youngest unit. It is found on alluvial fans, low terraces, and active channels
- Pleistocene Alluvial Fans (M1 and M2). The M units are of Pleistocene age, that is, greater than 10,000 years old, and have been subject to erosion and transport in recent geologic time.
- Older Alluvial Fans (O). The O units represent very old Pleistocene to Pliocene aged surfaces of relict alluvial fans greater than 1 million years old.
- Bedrock Units (X and T). Bedrock units occur within the White Tank Mountains, on pediments, and as inselbergs that crop out on the piedmont.

The surficial geology as mapped by the AZGS shows a general pattern of decreasing alluvial surface age moving downslope from the White Tank Mountains, and generally broader extent of younger surfaces with distance from the mountain front. Field and Pearthree (1991) hypothesized that the location of active alluvial fan and distributary flow areas on the piedmont has not shifted significantly since the Pleistocene, and that the younger M2, Y1, and Y2 surfaces in the middle and lower piedmont were derived primarily by erosion of the M1 and O surfaces on the upper piedmont. That is, most of the sediment deposited on the lower piedmont is being eroded from older upstream piedmont surfaces, rather than from the upper mountainous watersheds. The differing sediment source areas may be responsible for the contrast in sediment size and surface texture between the gravelly active alluvial fan areas on the piedmont immediately below the hydrographic apexes and the silty-sand younger surfaces near the toe of portions of the piedmont.

In addition to the surficial geology, the AZGS generated a series of flood hazard maps for the White Tank Mountains (Field and Pearthree, 1992). These maps identify areas of high, intermediate, and low flood hazard. Figure 6.3 is an example map for a portion of the White Tank Piedmont. Figure 6.22 shows the site-specific flood hazard mapping for this analysis.

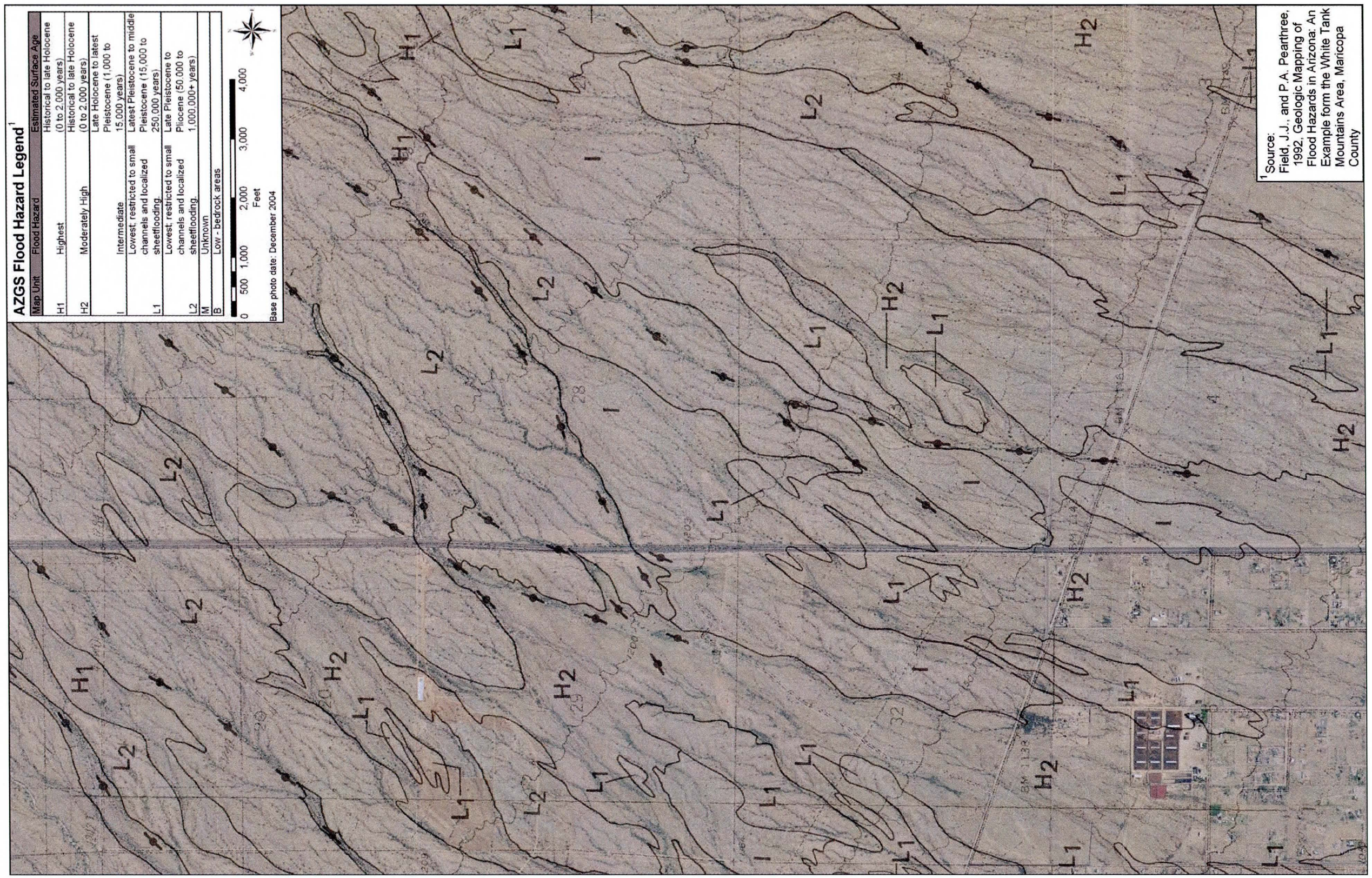

Figure 6.3 Example of AZGS flood hazard mapping

6B.4.1.3 Field Observations

Detailed field work was completed as part of the alluvial fan floodplain delineations studies performed by JE Fuller/Hydrology & Geomorphology, Inc. In addition, aerial photography was inspected to identify features consistent with alluvial deposits. Field observations made throughout the White Tank Piedmont and aerial photographic interpretation confirm that the piedmont is composed of alluvial materials, except where inselbergs crop out.

6B.4.1.4 Summary

The NRCS soils mapping, AZGS surficial geologic mapping, and field observations all report similar findings regarding the alluvial composition of the White Tank Piedmont. Therefore, it is concluded that the White Tank Piedmont is composed of non-consolidated alluvium deposited by fluvial processes, which meets the composition criteria specified in the PFHAM and FEMA Guidelines.

6B.4.2 Morphology

According to the National Research Council definition (1996), "alluvial fans are landforms that have the shape of a fan, either partly or fully extended." The White Tank Piedmont study area consists of a series of coalescing landforms each with the shape of a partially extended alluvial fan. These coalescing alluvial fans comprise a bajada (Figure 6.5) which also shows a somewhat distorted, partially extended fan shape wrapped around the White Tank Mountains. The coalesced fan shape is readily visible on aerial photographs of the study area (Figure 6.4).

Topographic contour data also support the morphological definition of an alluvial fan. The USGS 7.5-minute quadrangle topographic maps, as well as the District's 10-foot contour interval mapping (Figure 6.5), show slightly radial patterns across the piedmont surface. The contour crenulations, which range from highly crenulated to smooth radial lines, indicate the degree of fan incision and channel confinement, but uniformly depict an extended fan shape. The central west portion of the bajada is the most highly crenulated, whereas the northern and southern portions of the piedmont have the smoothest contours.

Other morphologic features which support delineation of the White Tank Piedmont as an alluvial fan landform include the slope, drainage patterns, and surficial characteristics. The piedmont slope ranges from less than one percent to almost four percent (1-4%), which is much steeper than nearly all valley riverine drainage systems in central Arizona, which typically have slopes of less than one percent. Steep slopes are characteristic of alluvial fan landforms, which provide a transition from steep mountain slopes to flatter axial valley streams. The drainage pattern on the White Tank Piedmont includes vast areas of distributary channels, as illustrated by the plot of flow bifurcations in Figure 6.6 and the stream channel network plot shown in Figure 6.7. Surficial characteristics indicative of an alluvial fan landform observed in the study area on aerial

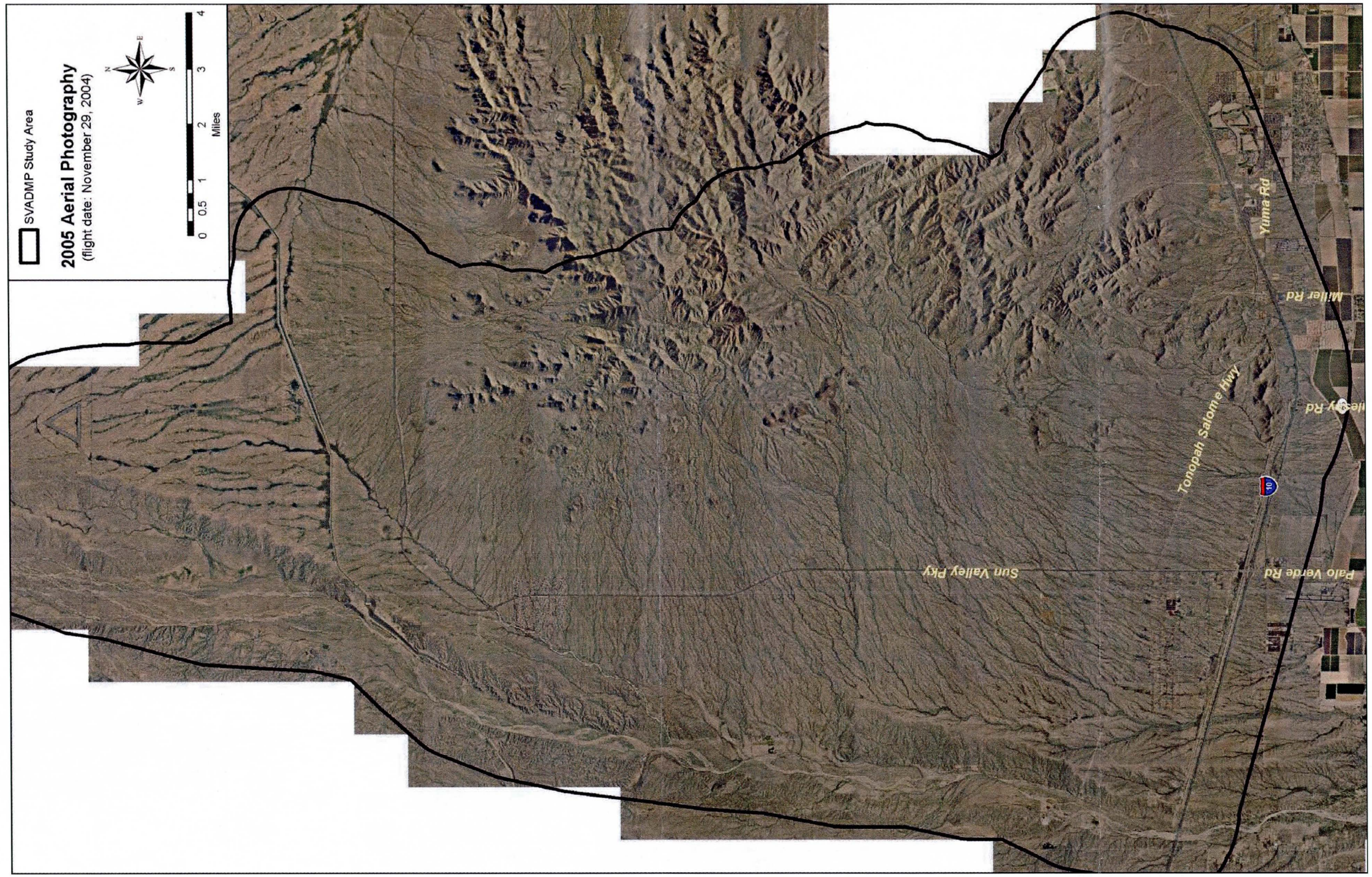

Figure 6.4. 2005 aerial photography

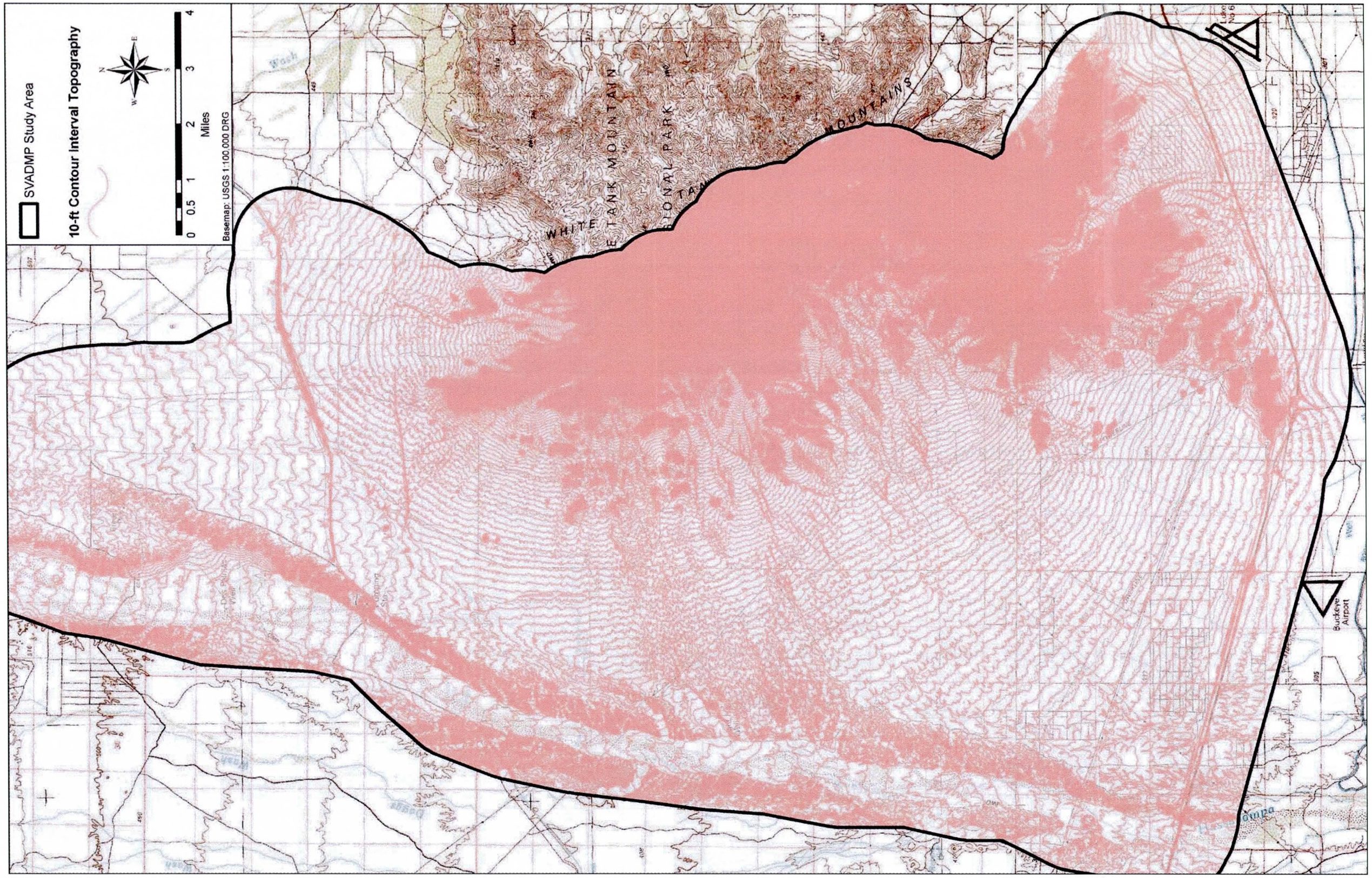

Figure 6.5. 10-foot contour interval topography

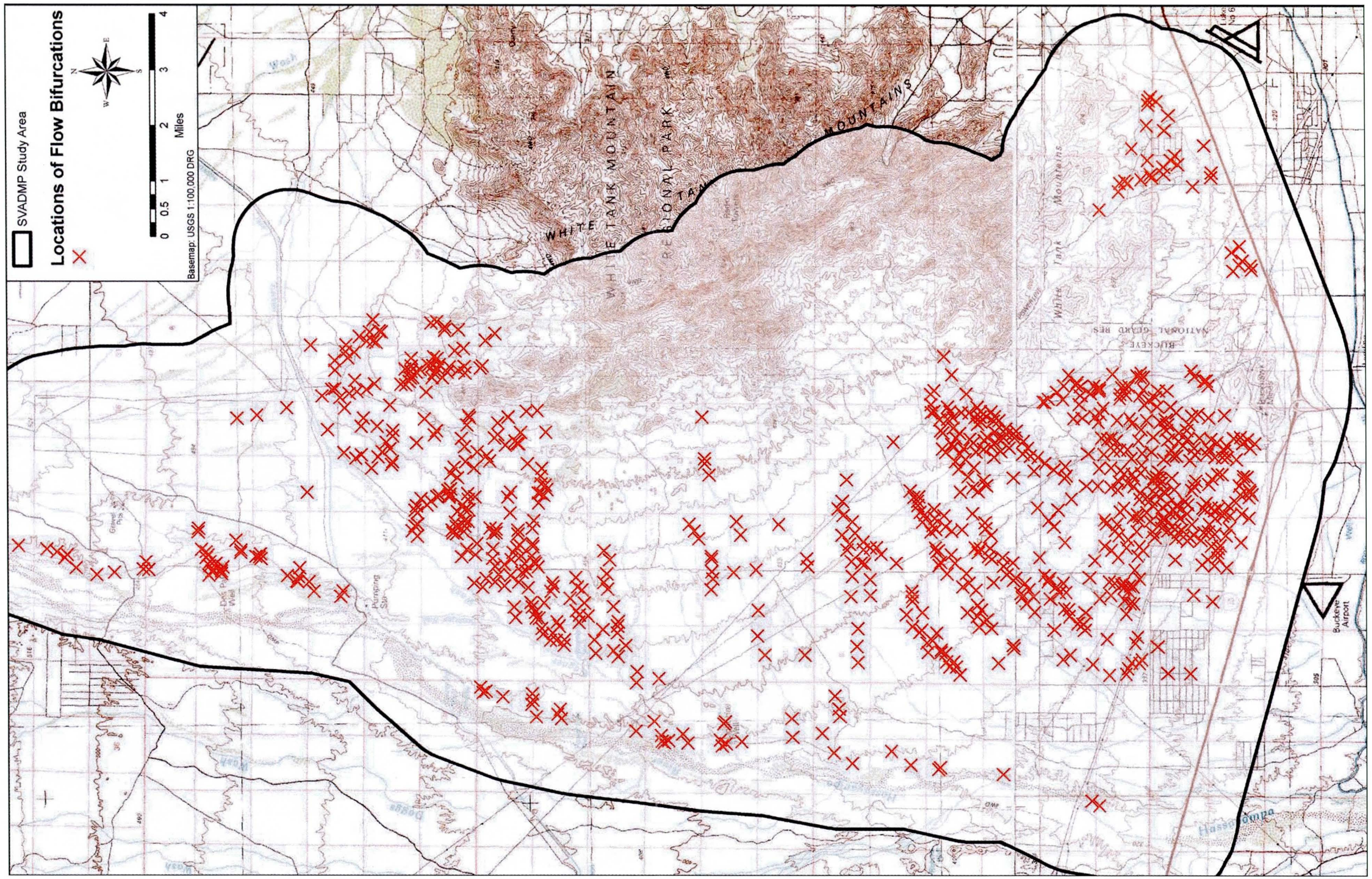

Figure 6.6. Locations of flow bifurcations

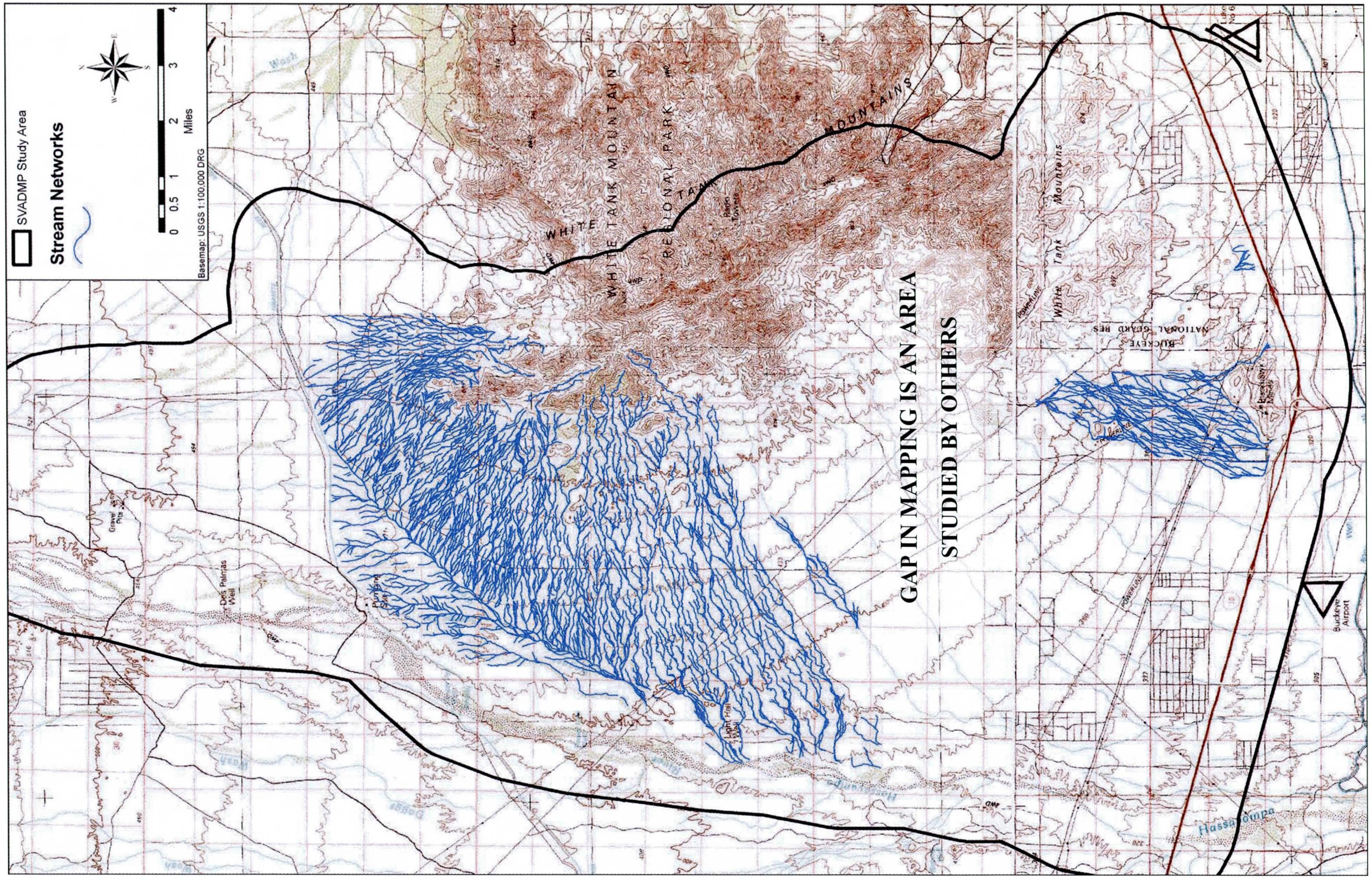

Figure 6.7. Stream channel networks

photographs and in the field included non-linear (i.e., riverine) and radial surface distributions, low divides between adjacent flow paths, small poorly integrated channels, perched flow paths, decreasing channel widths and depths in the downstream direction transitioning to sheet flow, and a rapid decrease in bed sediment sizes.

Based on the analysis of the topographic and morphologic data, it is concluded that the shape of the White Tank Piedmont meets the PFHAM/FEMA Guidelines definition of an alluvial fan landform.

6B.4.3 Location

The NRC (1996) definition of an alluvial fan landform states that "alluvial fan landforms are located at a topographic break where long-term channel migration and sediment accumulation become markedly less confined than upstream of the break." The White Tank Piedmont abuts the steep mountain front of the White Tank Mountains as indicated by the change in the topographic contour density shown on Figure 6.5. The mountain front is deeply embayed, which reflects the age and long erosion history of the mountains and creates a sinuous upstream boundary at the topographic break. At the mountain front, the fluvial environment transitions from one of net erosion and bedrock outcrop to a depositional environment and alluvium. A second topographic break occurs at the toe of the piedmont where alluvial fan landform is truncated by Wagner Wash and the Hassayampa River, the (riverine) axial valley streams.

6B.4.4 Hydrographic and Topographic Apex Location

Topographic apexes occur at the mountain front, and represent the extreme upstream extent of the alluvial fan landform. For the White Tank Piedmont, the topographic apexes reflect locations where deposition of alluvium began in the geologic past. In all cases, the topographic apexes are located on relict or inactive alluvial fans, and are well upstream of the hydrographic apexes. Topographic apexes were identified by aerial photograph interpretation, consideration of AZGS surficial and geologic mapping, field observations, and review of topographic and morphologic features in the study area. The topographic apex locations identified for the White Tank Piedmont are shown in Figure 6.8.

Hydrographic apexes are located at the highest point on an alluvial fan landform where there is physical evidence of flow bifurcation and/or significant flow outside the defined channel. The hydrographic apexes were defined by plotting the location of flow bifurcations observed on aerial photographs (Figure 6.6), in conjunction with field observations and geomorphic mapping. In some cases, the point of flow bifurcation is indicated a split stream symbol or a stippled pattern (deposition) on the USGS topographic maps. Interestingly, the longitudinal profiles often have a slight hump at the hydrographic apex, which probably reflects recent local aggradation. Experience indicates that the hydrographic apexes should be located where the Holocene surfaces that bound the main channels are pinched out by older, stable surfaces, points which are often upstream of the existing channel bifurcations (JEF, 2000). These Holocene surfaces represent areas that are still receiving alluvial deposits and are subject to overbank flows, and thus are vulnerable to flow path movement, either by avulsion or piracy. In some cases, the upstream limits of the Holocene surfaces were

coincident with the flow bifurcation points. The hydrographic apex locations identified for the White Tank Piedmont are shown in Figure 6.8, and use the alluvial fan numbering conventions established by Hjalmarson and Kemna (1994) and continued by Ayres (2004) for the Sun Valley Buckeye ADMS. Note that five new hydrographic apexes were defined (#16-20) by JE Fuller/Hydrology & Geomorphology, Inc. for the Sun Valley ADMP.

6B.4.5 Boundaries

The lateral and distal limits of the White Tank Piedmont alluvial fan landform were determined from examination of the NRCS soil and AZGS surficial geologic mapping, field observations, interpretation of recent and historical aerial photographs, and experience. The extreme northeast and southeast lateral limits of the landform shown in Figure 6.9 were dictated by the scope of services, but were extended to logical limits with defined physical characteristics. That is, the White Tank Piedmont also extends along the east flank of the White Tank Mountains, but that area is outside the limits of the District's authorized study areas. The southeast study limit was extended to a bedrock ridge that extends from the mountain area to the Buckeye FRS #3 just west of Skyline Wash. The northeast study limit was extended to the Pleistocene-aged inactive alluvial fan and Holocene active fan surfaces that topographically, geologically, and hydraulically contain active flow paths that originate at Fan Site #2.

The upper limit of the White Tank Piedmont alluvial fan landform is defined by the mountain front, as indicated by the topographic break described above. The toe or distal terminus of the White Tank Piedmont alluvial fan landform is defined by the intersection of the long sloping piedmont plain with the flatter slopes of the Hassayampa River and White Tank Wash floodplains on the west, the Wagner Wash and Trilby Wash tributary floodplains to the west and north, and the Gila River geologic floodplain on the south. In the existing condition, the Buckeye FRS truncates the southern margin of the White Tank Piedmont, and now forms the effective toe of the alluvial fan landform, at least with respect to alluvial fan flooding. The Buckeye FRS impounds, stores and diverts the entire 100-year hydrograph and sediment load.[1] Further, the Flood Control District of Maricopa County established the FRS as the downstream limit of study for the Sun Valley ADMP floodplain mapping tasks.

6B.4.6 Conclusion

The NRCS soil mapping, AZGS surficial geologic mapping data, and field observations clearly show that the White Tank Piedmont is composed of sedimentary deposits (alluvium). The topographic mapping shows that the White Tank Piedmont landform is located at the base of a mountain front and has the shape of a partially extended fan, has steep slopes, and radiating contours. Morphologic data, such as the drainage

[1] Studies are currently underway by the Flood Control District of Maricopa County to evaluate the Probable Maximum Flood (PMF) capacity of the Buckeye FRS and to upgrade, repair, or replace the FRS. Regardless of the outcome of the PMF and FRS evaluation, the FRS is known to control at least the 100-year event and remove any alluvial fan flooding from downstream reaches.

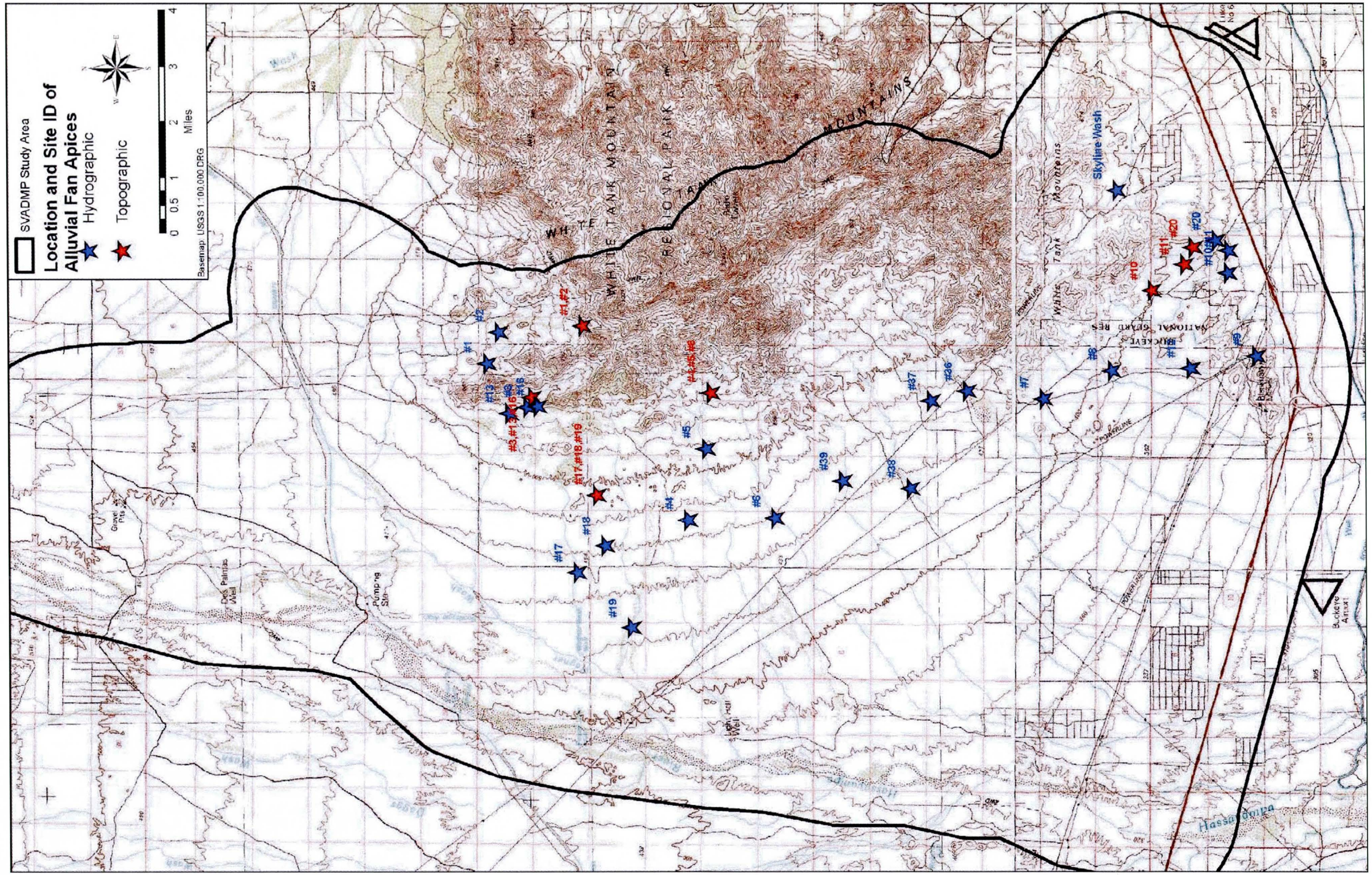

Figure 6.8. Alluvial fan apex locations

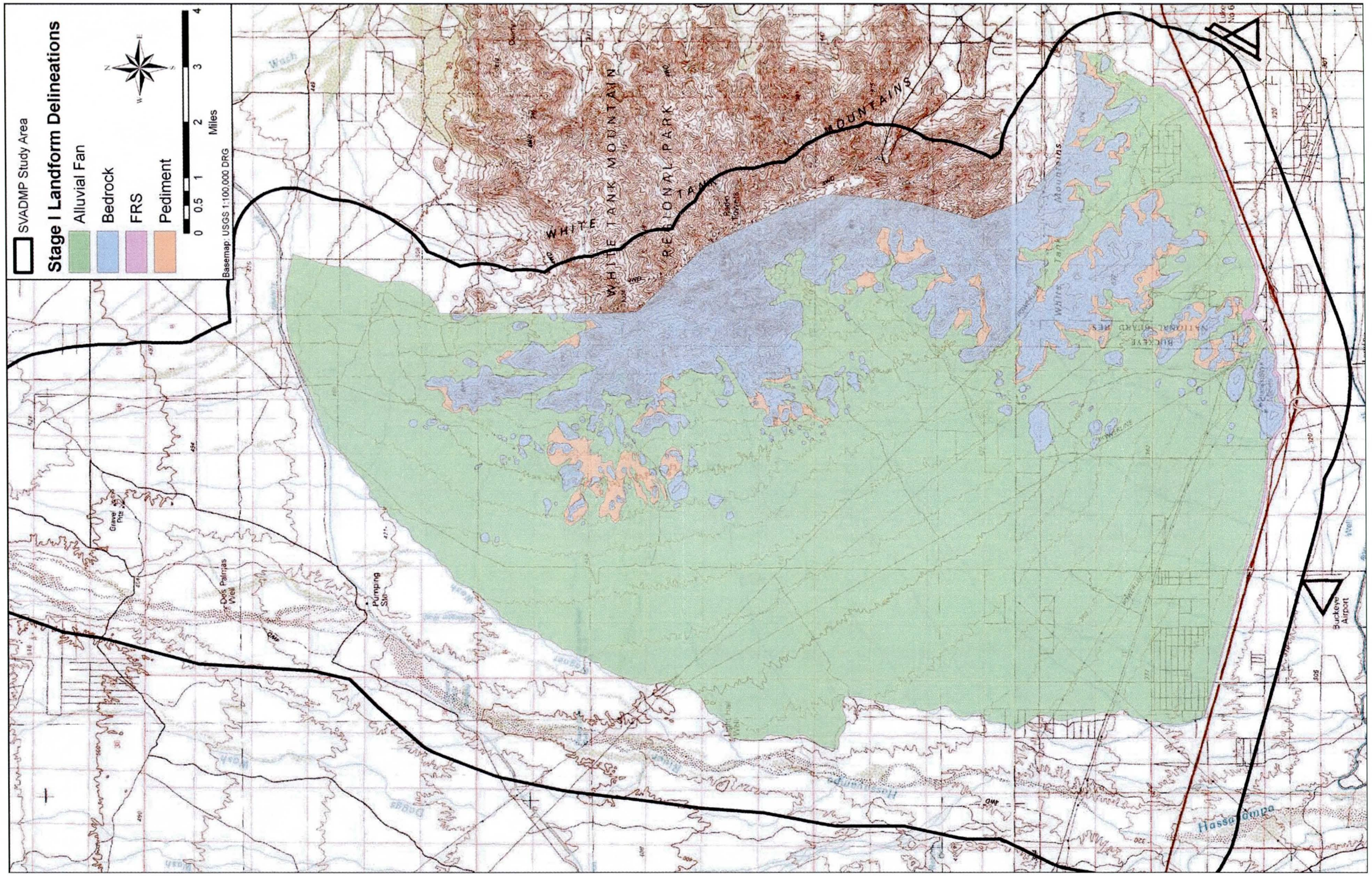

Figure 6.9. Stage I delineations

Figure 6.10. Close-up of the SE study area

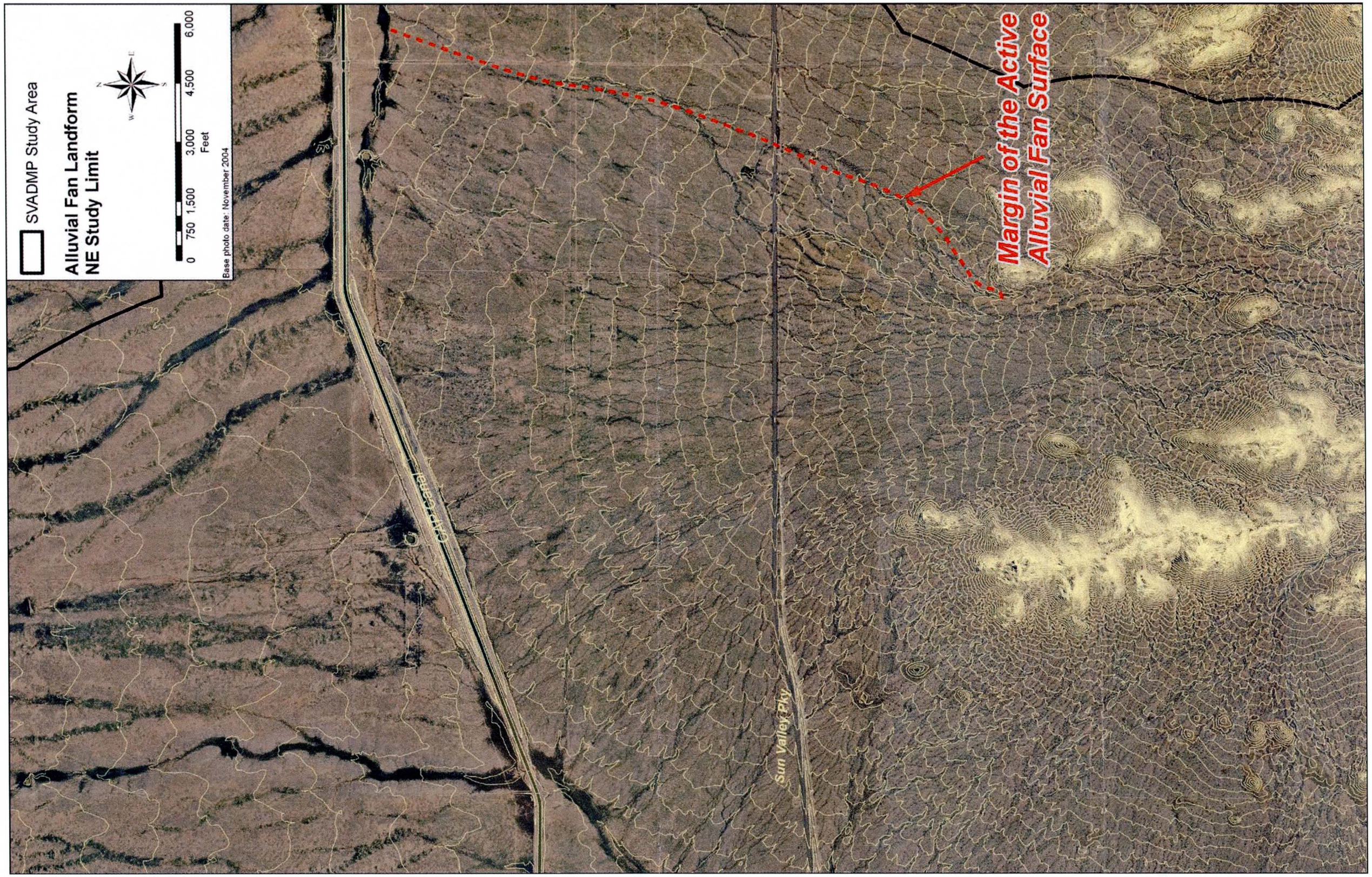

Figure 6.11. Close-up of the NE study area

pattern, surface distribution, relief, and channel geometry, are also characteristic of an alluvial fan landform. Therefore, it can be concluded that, with the exception of a few bedrock islands, the White Tank Piedmont in the study area is an alluvial fan landform and that the FEMA and PFHAM Guidelines apply.

6B.5 Stage 2: Defining Active and Inactive Areas

Stage 2 of the PFHAM/FEMA alluvial fan methodology consists of defining active and inactive areas within specific portions of the White Tank Piedmont alluvial fan landform, as well as characterizing the nature and types of flooding that are associated with a specific hydrographic apex. The hydrographic apexes for the Site 1 and 2 alluvial fans were identified in the Stage 1 analysis and are located as shown in Figure 6.8. Active areas on an alluvial fan consist of those portions of the landform where uncertainties about channel geometry and hydraulic conditions of water and sediment discharge cannot be realistically set aside in the assessment of the flood hazard. Active areas on alluvial fans experience sediment deposition, erosion and unstable flow paths in addition to flood inundation. Inactive alluvial fan areas are the portions of the alluvial fan landform where active fan processes do not occur. In other words, inactive portions of the alluvial fan are those areas where flow path uncertainty can "be set aside in realistic assessments of flood risk."

6B.5.1 Overview of Stage 2 Methodology Concepts

The physical characteristics of a landform provide clues as to its depositional history, existing level of stability, and future flood potential. If a portion of the landform becomes isolated from its original watershed and watercourse, it ceases to receive new deposits and its surface will begin to age and develop specific physical characteristics indicative of its age. These physical characteristics include soil profile development, an integrated tributary drainage network, desert varnish, desert pavement, topographic relief, color, and distinctive vegetative suites.

In a semi-arid environment like that of the White Tank Piedmont, the degree of soil development is directly proportional to surface age. As the surface ages, a soil profile develops, and its structure, color and content changes. Clay and calcium carbonate accumulate in the soil from aeolian sources and chemical weathering of the parent material, forming distinct soil horizons (Figure 6.12). The degree of soil profile development, particularly in the clay and carbonate horizons, can be used as a proxy for surface age. The soil surface also tends to become reddish in color with time due to oxidation of iron (rubification) as well as accumulation and weathering of clay. Young, active surfaces lack soil profile development, and on active alluvial fans consist of stream bed alluvium (Figure 6.13).

Geomorphic surfaces may also develop an accumulation of pebbles and cobbles at the surface as they age. These gravel coverings are known as desert pavement, which form as a byproduct of windblown silt and clay accumulation in the soil column. Repeated wetting by precipitation causes the fine-grained materials to

swell, lifting the larger gravels to the surface. Repeated surface drying creates cracks into which more fine windblown material may accumulate. Over thousands of years these processes form a mantle of closely packed gravels that resembles asphalt pavement (Dohrenwend, 1987; Vanden Dolder, 1992). The pebbles and cobbles that form the pavement surface, if they contain sufficient ferromagnesian minerals, will develop a dark black patina on their tops and an orange coating underneath that is known as desert varnish (Figure 6.14).

Landform surfaces free from new deposition will also begin to erode due to direct rainfall and the ensuing runoff on the surface. As the surface erodes, new tributary channel networks develop which become more incised and integrated with time. The channels gradually deepen and widen, creating a greater degree of relief between the channel bottoms and the ridges which separate them. The degree of relief can be directly observed in the field or on aerial photographs (Figure 6.15), but can also be detected by the examining the crenulation (curviness) of topographic map contours (Figure 6.16).

The degree of relief of an apparently inactive landform relative to adjacent active, young surfaces is also an important characteristic. Because active alluvial fans are aggrading landforms, it follows that some older surfaces may gradually become buried by sediment deposition derived from the adjacent younger active alluvial fan (Figure 6.17). Therefore, where there is little topographic difference between younger and older surfaces, the investigator must take care to evaluate the rate of, and potential for, long-term aggradation of the fan (Figure 6.18). Typically, the rate of fan aggradation is greatest near the hydrographic apex, with lower accumulation rates as the distance from the apex increases and/or the active fan widens.

In a semi-arid environment, it takes thousands of years for many of these geomorphic characteristics to develop. Therefore, surfaces that exhibit well developed soils, red color, significant carbonate development, desert pavement composed of strongly varnished gravels, and tributary drainage networks have been relatively free from flooding for thousands of years. These features provide a record of non-inundation that extends back thousands of years. The non-inundation record can be interpreted and used as a historical record of fan behavior in the same way as historical records of flood peaks are used to predict future flood peaks. As such, without external disturbance, it can be reasonably assumed that the flood hazard potential on geomorphically old (stable) surfaces will be low in the future.

The NRCS soils survey data and AZGS surficial geology mapping differentiate surfaces based on the types of geomorphic characteristics discussed above. Therefore, the map data also provide information about surface age, stability, and flood potential. Young surfaces with little soil development are likely to continue to experience flood inundation, sediment deposition, and channel movement. Older surfaces are unlikely to experience such processes. Older surfaces with cemented soils and entrenched channels also tend to be more stable because their soils are more resistant due to the cohesion provided by clay, carbonate, and pavement, as well as due to containment of flow within defined, vegetation-lined channels. That is, the likelihood of the

channel changing its location over time is greatly diminished. Conversely, areas with non-cohesive, coarse soil materials and little lateral relief are more susceptible to lateral changes in channel position.

Active alluvial fans are those where the uncertainty associated with flow path location is so great that it cannot be set aside in realistic assessments of the flood risk. Where risk of flow path change is not so great, that portion of the alluvial fan landform is considered inactive. The Stage 2 geomorphic analyses are intended to distinguish active, unstable, young landforms from inactive, stable, or old landforms.

Figure 6.12. Typical Pleistocene-Aged (Inactive Surface) Soil Profile With Well-Developed Carbonate and Clay Horizons.

Figure 6.13 Typical Late Holocene-Aged (Active Surface) Soil Profiles With No Soil Development.

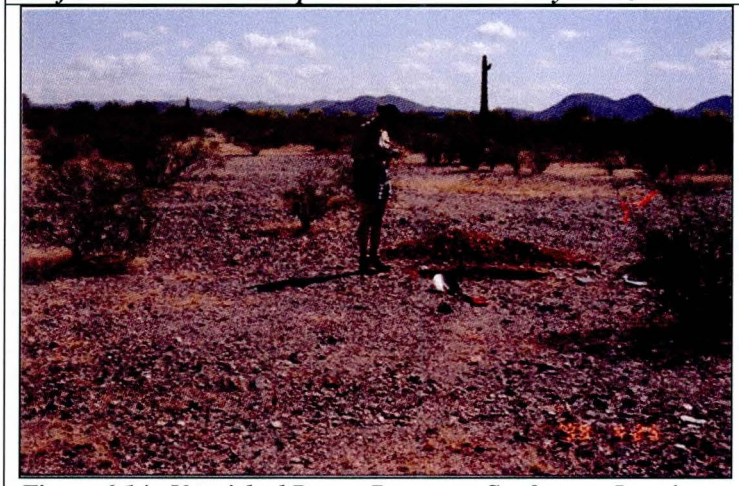

Figure 6.14. Varnished Desert Pavement Surface on Inactive Portion of an Alluvial Fan Landform. Note the reddened clay-rich soil excavated from the soil pit.

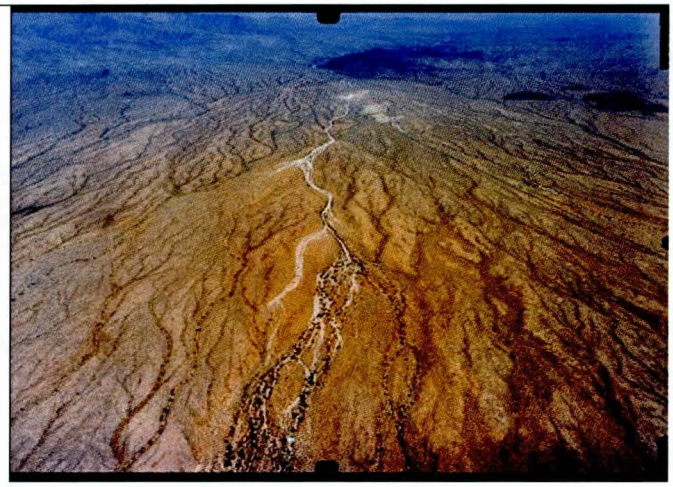

Figure 6.15. Aerial Photograph Showing Tributary Drainage Network on Old, Inactive Surface Adjacent to Distributary & Sheet Flow Pattern in Active Area.

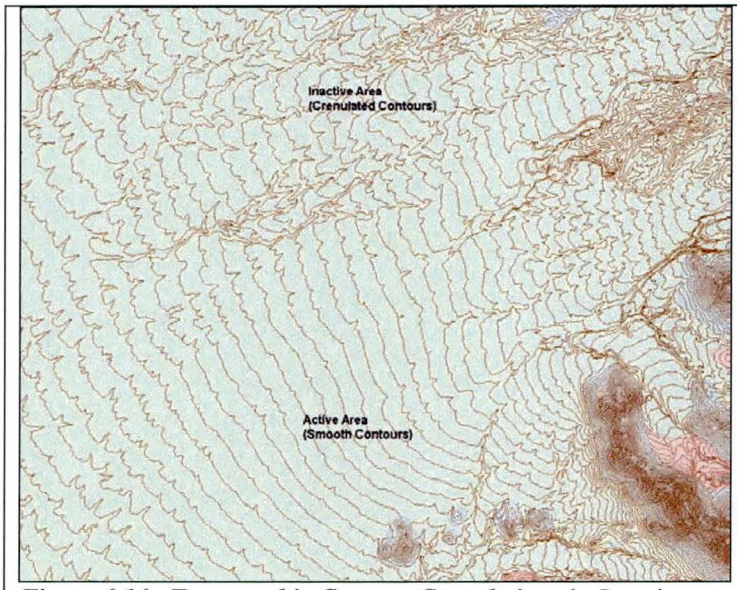

Figure 6.16. Topographic Contour Crenulations in Inactive and Active Areas of an Alluvial Fan Landform.

Figure 6.17. Photograph of Older Varnished Pavement Surface Partially Buried by Recent Flood Deposition (Tiger Wash, Maricopa County, Arizona).

Figure 6.18. Photograph of Active Surface Topographically Confined by Older Surface.

6B.5.2 Overview of Flooding on Site 1 and 2 Piedmont

Fan Sites 1 and 2 are located within the northernmost portion of White Tank Mountain piedmont, in portions of Townships 3 North, Range 3 West (Sections 6, 7); 3 North, 4 West (Section 1); 4 North, 3 West (Sections 16 to 21, 29 to 32); and 4 North, 4 West (Sections 13, 22 to 28, 35, 36). The topographic apex of the alluvial fan landform, which includes both the Site 1 and 2 fans, is located at the mountain front-piedmont boundary in Section 7 of Township 3 North, Range 3 West (Figure 6.8).[1] The drainage areas above the Fan 1

[1] Alternatively, if a separate topographic apex for Fan 1 were delineated it would be coincident with its hydrographic apex.

and 2 hydrographic apexes are approximately 0.4 and 1.0 square miles, respectively. The alluvial fan areas below the hydrographic apexes for Fans 1 and 2 are approximately 1.1 and 7.3 square miles, respectively.[1] Between the topographic apex at the mountain front and the hydrographic apex, flood flow is conveyed in a well-defined tributary drainage system. Channel depths in the confined drainage channels upstream of the hydrographic apex range from approximately 10 feet near the topographic apex to less than four feet immediately upstream of the hydrographic apex. Channel slopes in the well-defined channels above the hydrographic apexes range from about 0.034 to 0.023 feet/feet, decreasing in the downstream direction. At the hydrographic apexes, the drainage networks change from well-defined tributary patterns to unconfined distributary patterns on active alluvial fans.

The hydrographic apex for Fan 1 is located upstream of a prominent bedrock inselberg (Figure 6.19) in Section 1 of Township 3 North, Range 4 West. Loss of flow containment to the east below this hydrographic apex is supported by field evidence that included the low bank height along the main channel, fluvial sculpting expressed in the topography of the overbank area, linear alignment of coarse sediments along overbank flow paths that head at the main channel, and vegetative and topographic characteristics that suggest geologically recent flow conveyance. Flow that potentially breaks out to the east of the main channel below the hydrographic apex is initially poorly confined in a network of small, interconnected channels, but transitions within about 1,000 feet to a more defined, stable distributary network. These stable distributary channels rejoin the Fan 1 active fan area immediately downstream of the bedrock inselberg.

The main channel of Fan 1 downstream of the hydrographic apex flows west of the inselberg into the most active portion of the alluvial fan. The active fan area extends downstream approximately one mile where it coalesces with Fan 2. Near the point where Fan 1 coalesces into Fan 2, the drainage network becomes slightly more tributary, although the divides between adjacent flow paths are extremely low, and do not represent long-term barriers to flow.

Fan 1 also has a secondary hydrographic apex in Section 35 of Township 4 North, Range 4 West located along a channel that heads on, and is hydraulically connected to, the Fan 1 active alluvial fan (Figure 6.19). The channel that leads to the secondary hydrographic apex flows around the point of the bedrock ridge that forms the northernmost extension of the White Tank Mountains. This channel appears to collect much of the runoff that flows along the west side of the Fan 1 active alluvial fan area, and drains toward an unnamed stock tank located in Section 26 of Township 4 North, Range 4 West. The stock pond lies near the historical hydrographic apex of the secondary active alluvial fan. However, the stock tank is not an engineered facility,

[1] The Fan 1 area depends on where the boundary between the coalesced Fan 1 and 2 is delineated. In this case, the Fan 1-Fan 2 boundary was delineated as if Fan 1 were tributary to Fan 2. The measured fan areas include minor areas of non-floodplain surfaces between the delineated floodprone areas.

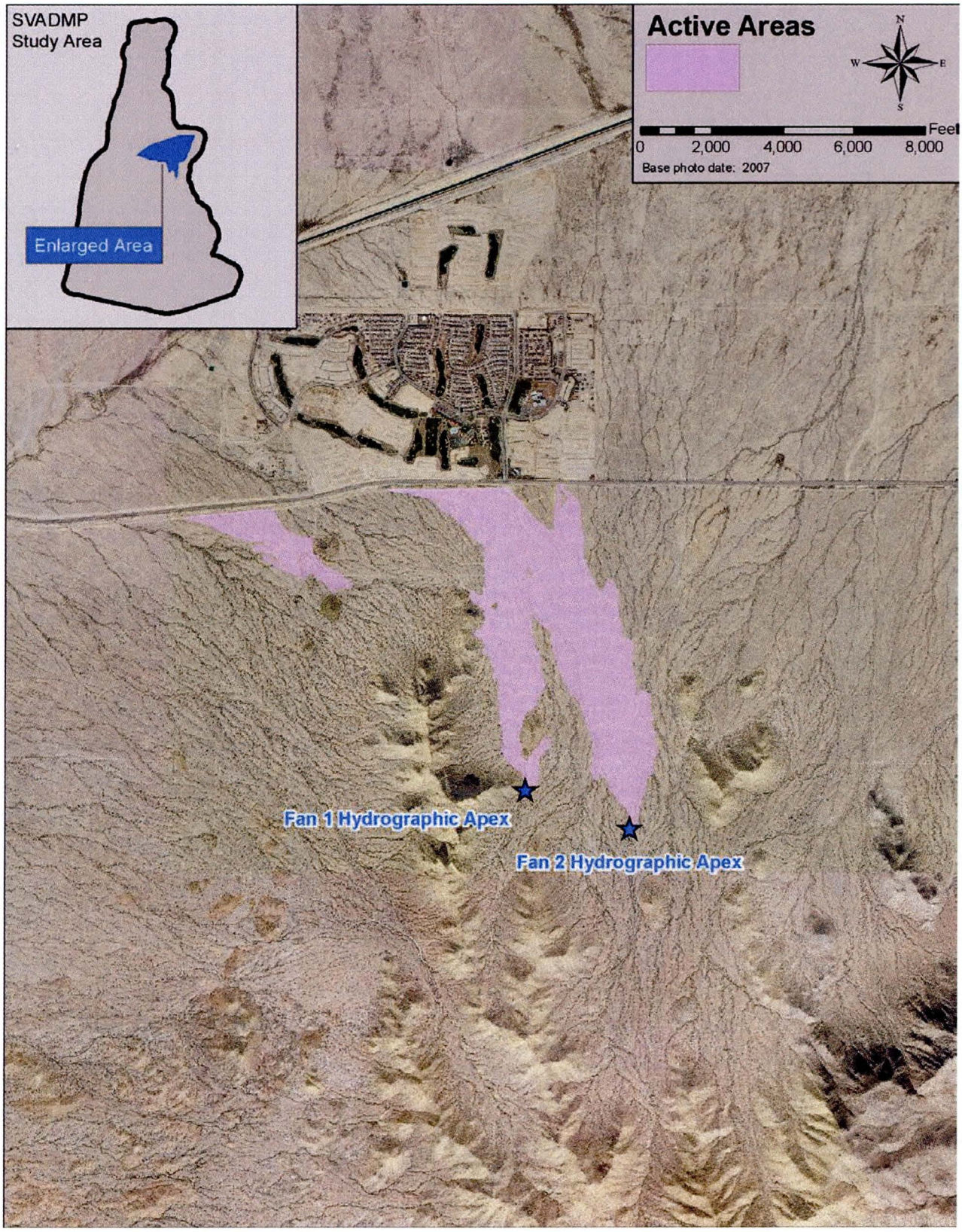

Figure 6.19. Fan 1 and 2 active areas (Stage 2).

nor is it publicly maintained. Therefore, following FEMA Guidelines, the floodplain delineation was performed assuming the stock tank was not in place during the regulatory event. Historically, an active alluvial fan area existed between the stock tank and Wagner Wash, the ultimate outfall for Fan 1. This active fan area is now disturbed not only by the stock tank impoundment, but also by Sun Valley Parkway and a large diversion channel ("the Sun Valley Parkway Channel") located immediately upstream of the road.

The Fan 2 hydrographic apex is located in Section 6 of Township 3 North, Range 3 West, approximately 1.6 miles north and downstream of the topographic apex (Figure 6.19). Fan 2 is one of the largest active alluvial fans on the White Tank Piedmont and exhibits the most classic alluvial fan features, including a prominent radial fan shape, active distributary channel patterns that transition to a broad alluvial plain subject to sheet flow at the toe of the fan, and a transition to the axial valley stream. A breakout at the hydrographic apex is conveyed in the left (west) overbank around a low, stable island before joining the active alluvial fan area downstream. The main channel on Fan 2 flows east of the low island where it immediately divides multiple times into a highly distributary channel pattern. Flow along the east side of the active fan area exits the alluvial fan area via stable distributary and tributary flow paths that flow toward another alluvial fan system to the east, outside of the study area. Several of the flow paths that exit the east side of the active alluvial fan area converge and then diverge, forming an active braided channel fan system along the far eastern boundary of the study area that extends downstream of Sun Valley Parkway to the Trilby Wash corridor. The active area downstream of this secondary hydrographic apex on Fan 2 coalesces with the unnamed alluvial fan to the east of Fan 2.

Approximately ½ mile upstream of Sun Valley Parkway, the distributary and sheet flow drainage pattern in the active alluvial fan becomes more defined and begins to take on a more tributary pattern, although the divides between adjacent flow paths are extremely low and a number of bifurcations exist. Downstream of Sun Valley Parkway, the drainage pattern, topography and vegetative patterns indicate that sheet flow is the dominant form of conveyance, especially in the central and eastern portions of the fan that drain to the CAP and the Trilby Wash tributaries. In the western portion of the toe of Fan 2, downstream of Sun Valley Parkway, recent headcutting has altered the sheet flow pattern, and a more distributary pattern developed within the sheet flow environment. This downstream area could have been considered part of the active alluvial fan since it has been an aggradational landform during the recent Holocene and was dominated by sheet flow. However, given the expected very low flow depths and extremely low rates of sediment accumulation on the surface, the area was designated as stable (or inactive).

Currently, the Festival Ranch master planned community has been constructed over a large part of the alluvial fan landform downstream of Sun Valley Parkway, obscuring much of the natural drainage pattern. In addition, Sun Valley Parkway itself alters the natural flow conveyance patterns on Fans 1 and 2 by concentrating unconfined flow at culverts and by diverting flow along a constructed channel located upstream

of the roadway on the western third of the alluvial fan. Additional hydrologic and hydraulic modeling using HEC-1 and FLO2D were performed (See Sections 4 & 5 of this report) were performed to demonstrate that the Sun Valley Parkway has adequate capacity to capture and divert alluvial fan flooding and deliver it to Wagner Wash without overtopping Sun Valley Parkway, including sedimentation impacts (See Section 6 of this report). Based on the conclusions of the hydraulic modeling of the Sun Valley Parkway Channel, the downstream portions of the alluvial fan protected by the channel are considered no longer part of the active alluvial fan, if they ever were. Likewise, the FLO-2D analysis demonstrated that the flow reaching the one culvert that conveys runoff through the Festival Ranch subdivision is less than the design discharge used for the culvert and the engineered channel downstream.

The active alluvial fan areas downstream of the hydrographic apexes are bounded laterally by older, stable surface with tributary drainage patterns, except along the far eastern margin of Fan 2 near Sun Valley Parkway and the toe of Fan 2. The eastern lateral boundary of Fan 2 near its toe is defined by the edge of an adjacent (presumably active) alluvial fan. An effort was made to delineate this eastern margin along an effective approximate method floodplain delineation (Sun Valley North FDS, A-N West, 1992). The toe of the western portion of Fan 1 is defined by Wagner Wash. The toe of Fan 2 is formed by a combination of Wagner Wash, the CAP embankment, and a tributary to Trilby Wash. Fan 2 spans the divide between Wagner Wash and Trilby Wash.

6B.5.3 Identification of Active Areas

Field and Pearthree (1991) suggest that the younger sediments (active areas) on the lower portions of the White Tank Piedmont are eroded primarily from older surfaces in the middle and upper piedmont at or below the hydrographic apex, rather than from the upper mountain watershed. During more the frequent runoff events, flood water and sediment originate from both the middle and lower piedmont. Only the largest, most rare runoff events translate significant flood water and sediment across the entire piedmont downstream of the hydrographic apex to the toe of the piedmont. High infiltration rates in the broad areas of sand and gravel within the active areas transmit the most frequent runoff events into the subsurface before runoff can pass to the lower piedmont. Field evidence of significant transmission losses includes lines of flotsam within channels on the active fan that indicate where surface flow stopped. Also, channel sediment size decreases down piedmont, yielding lower infiltration rates. The highest rates of aggradation and the most active alluvial fan flooding occurs in the following localized areas on the Site 1 and 2 landform (Figure 6.19):

- Fan 1: Immediately downstream of the hydrographic apex
- Fan 1: Secondary hydrographic apex near the unnamed stock tank
- Fan 2: Immediately downstream of the hydrographic apex

The limits of the active areas of the Site 1 and 2 alluvial fans are shown in Figure 6.19. These areas were identified through the use of NRCS soils surveys, AZGS surficial geology mapping, historical aerial photographs, interpretation of USGS 7.5 minute contour maps and FCDMC 10-ft contour interval topographic mapping, field observations, surficial characteristics, and other geomorphic features. The relationship of each of these types of evidence to the limits of active and inactive areas is discussed below.

6B.5.3.1 NRCS Soils Data

The NRCS soils map for the Fan 1 and 2 alluvial fan study area is shown in Figure 6.20. The NRCS maps the following soil units as (active) alluvial fans:

- Antho gravelly sandy loam (Unit #2)
- Antho-Carrizo-Maripo complex (Unit #3)
- Estrella loam (Unit #50)
- Gilman loam (Unit #55)
- Valencia sandy loam (Unit #124)

The NRCS describes these units (Table 6B.4) as young soils located in drainageways and active alluvial fans subject to frequent flooding and erosion. The boundaries of the NRCS alluvial soil units are broadly similar, but slightly different from the active fans delineated for this study for several reasons. First, the NRCS mapping was performed at a 1:24,000 scale, with few soil test pits per Township, leading to some inaccuracies in delineation. The geomorphic mapping performed for this alluvial fan floodplain delineation study was performed at a much more detailed scale. Therefore, many of the smaller drainageways and active floodways ignored by the NRCS could be identified and mapped in detail. Second, the NRCS map units apply regionally over a much larger area and therefore may not account for local variations and characteristics. Third, the NRCS mapping was primarily concerned with soil characteristics rather than the morphologic function. Therefore, the lower portions of the alluvial fan were mapped as inactive by the NRCS, rather than as directly connected to the alluvial fan flooding source. The NRCS designation of the toe-area sheet flow zones as inactive probably reflects a very low rate of aggradation and a higher level of channel stability. The NRCS soil descriptions confirm the presence of two alluvial fan flooding areas (Fan 1 and 2), as well as the presence of the secondary hydrographic apex and alluvial fan on the western extension of Fan 1 downstream of the unnamed stock pond. The NRCS alluvial fan soil units are characterized by minimal soil profile development (Torrifluvents) and minimal clay or carbonate accumulation.

The inactive alluvial fan areas on Fan Sites 1 and 2 bound the active areas laterally and in the upstream direction. The upper piedmont above the Fan 1 and 2 hydrographic apexes is underlain by the following soil units:

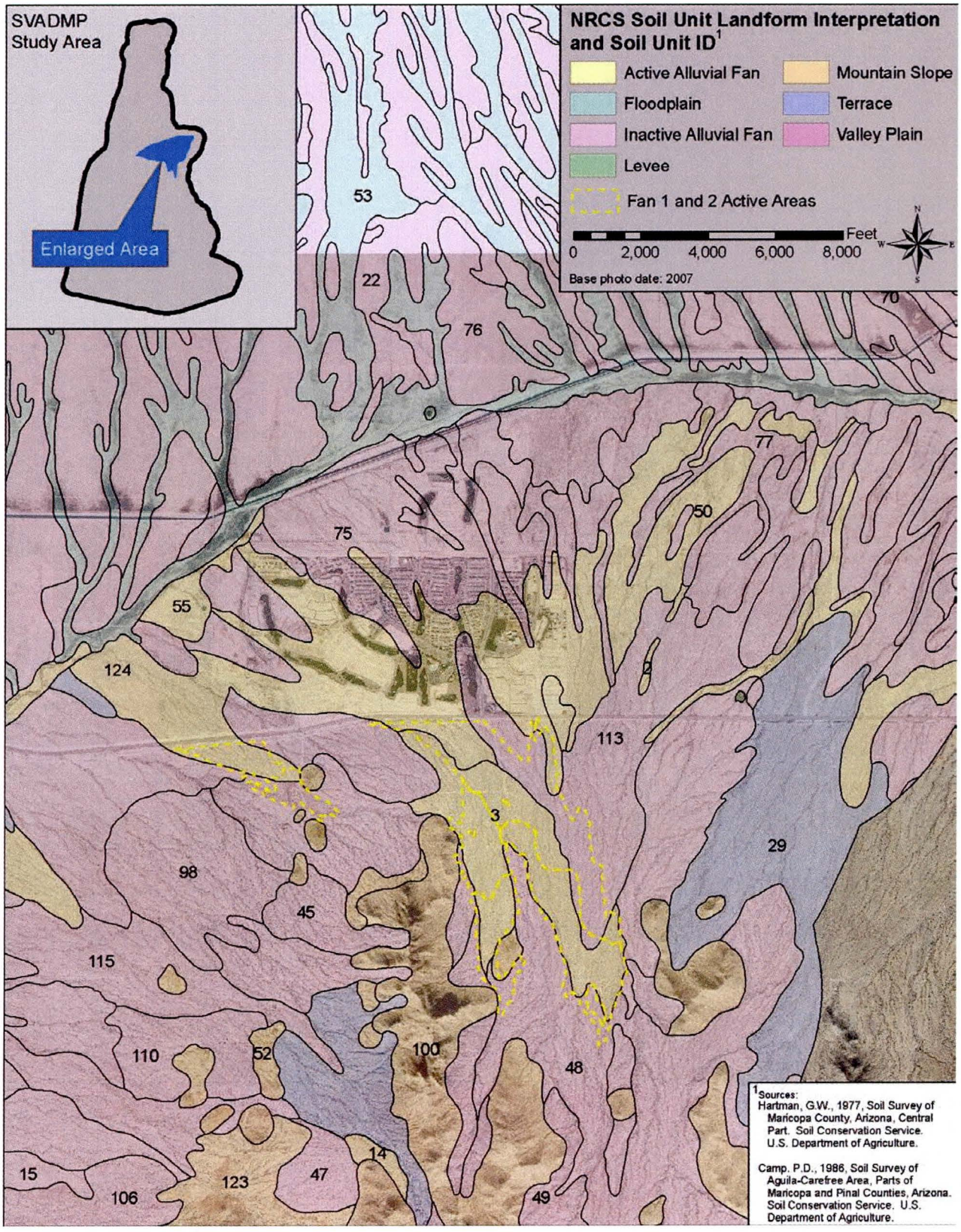

Figure 6.20. NRCS soils mapping near Fan 1 and 2.

Table 6B.4 NRCS Soil Unit Descriptions for Fans 1 and 2						
Map Symbol	**Soil Unit Name**	**Geomorphic Position**	**Characteristics**	**Soil Subgroup & Order**	**Geologic Age**	**PFHAM Landform**
2	Antho gravelly sandy loams	Floodplains, alluvial fans, and drainageways	55% with non-calcareous surface layer & calcareous below, 25% calcareous throughout; main limitation to development is hazard of flooding. Rare flooding.	Typic Torrifluvents Entisols	Few hundred to 800 years	Active Alluvial Fan
3	Antho-Carrizo-Maripo complex	Floodplains, alluvial fans, and drainageways	Subject to occasional flooding; hazard due to water erosion is severe; channeling, deposition, and streambank erosion occur during flooding; subject to rare periods of flooding.	Typic Torrifluvents Entisols	Few hundred to 1,000 years	Active Alluvial Fan
22	Contine clay loam	Fan terraces	Slow runoff, slight erosion hazard.	Typic Haplargids Aridsols	-	Inactive Alluvial Fan
29	Denure-Momoli-Carrizo complex	Stream and fan terraces	Calcareous below about 8 inches; B horizon development; buried calcic or argillic horizon present in some pedons; strongly effervescent at depth.	Typic Camborthids Aridisols	-	Inactive Alluvial Fan
48	Ebon-Pinamt complex, 3-20% slopes	Fan and stream terraces	Yellowish red color, high clay content, calcareous at depth; yellowish red B horizons which are strongly to violently effervescent.	Typic Haplargids, Typic Calciorthids Aridisols	900,000 years	Inactive Alluvial Fan
49	Ebon-Pinamt complex, 20-40% slopes	Fan and stream terraces	Yellowish red color, high clay content, calcareous at depth; yellowish red B horizons which are strongly to violently effervescent.	Typic Haplargids, Typic Calciorthids Aridisols	900,000 years	Inactive Alluvial Fan
50	Estrella loams	Alluvial fans	Slow runoff, slight erosion hazard. Where unprotected, soils are subject to rare periods of flooding.	Typic Torrifluvents Entisols	-	Active Alluvial Fan
52	Gachado-Lomitas-Rock outcrop, 7-55%	Mountain and hill slopes	Runoff is medium to rapid, erosion hazard is moderate. Depth to bedrock is 10 inches.	Lithic Haplargids, Lithic Camborthids Aridisols	-	Mountain Slope
53	Gadsden clay	Floodplains	Runoff is slow, erosion hazard is slight. Soil is subject to ponding following prolonged, high intensity storms. Where unprotected, soil is subject to rare periods of flooding.	Vertic Torrifluvents Entisols	-	Floodplain
55	Gilman loams	Floodplains and alluvial fans	Slow runoff, slight erosion hazard. Where unprotected, the soils are subject to rare periods of flooding.	Typic Torrifluvents Entisols	Few hundred to 1,000 yea	Active Alluvial Fan

Table 6B.4 NRCS Soil Unit Descriptions for Fans 1 and 2						
Map Symbol	**Soil Unit Name**	**Geomorphic Position**	**Characteristics**	**Soil Subgroup & Order**	**Geologic Age**	**PFHAM Landform**
75	Mohall loam	Fan terraces	Runoff is slow, slight erosion hazard. Depth to calcic horizon is 6 to 40 inches.	Typic Haplargids Aridisols	7,000 to 10,000 years	Inactive Alluvial Fan
76	Mohall loam, calcareous	Fan terraces	Runoff is slow, slight erosion hazard. Depth to calcic horizon is 6 to 40 inches.	Typic Haplargids Aridisols	7,000 to 10,000 years	Inactive Alluvial Fan
77	Mohall clay loam	Fan terraces	Runoff is slow, slight erosion hazard. Depth to calcic horizon is 6 to 40 inches.	Typic Haplargids Aridisols	7,000 to 10,000 years	Inactive Alluvial Fan
98	Pinamt-Tremant complex, 1-10% slopes	Fan terraces	Yellowish red B horizons which are strongly to violently effervescent; light reddish brown B horizons, calcic horizon at 5 to 24 inches, strongly to violently effervescent	Typic Haplargids Aridisols	900,000 years	Inactive Alluvial Fan
100	Quilotosa-Vaiva-Rock outcrop, 20-65% slopes	Hill and mountain slopes	Mapped on surfaces with 20 to 65% slopes; basically thin hillslope soils in the mountains	Lithic Torriorthents Entisols	-	Mountain Slope
110	Suncity-Cipriano complex, 1-7% slopes	Fan terraces	Silica-lime cemented hardpan at depth of 9 inches. Runoff is slow to medium, erosion hazard is slight.	Typic Durargids, Typic Durorthid Aridisols	-	Inactive Alluvial Fan
112	Tremant gravelly sandy loams	Fan terraces	Runoff is slow, erosion hazard is slight. Soil is generally noncalcareous in the upper 9 inches and calcareous below, with some areas being calcareous throughout.	Typic Haplargids Aridisols	7,000 to 10,000 years	Inactive Alluvial Fan
113	Tremant gravelly loams	Fan terraces	Runoff is slow, erosion hazard is slight. Soil is generally noncalcareous in the upper 9 inches and calcareous below, with some areas being calcareous throughout.	Typic Haplargids Aridisols	7,000 to 10,000 years	Inactive Alluvial Fan
115	Tremant-Antho complex, 1-5% slopes	Fan and stream terraces, and floodplains	Tremant soil is generally on fan terraces, and Antho is generally on narrow floodplains. Runoff is slow, erosion hazard is slight. Where unprotected, this soil is subject to erosion.	Typic Haplargids, Typic Torriflu Aridisols, Entisols	7,000 to 10,000 years	Inactive Alluvial Fan
124	Valencia sandy loams	Alluvial fans	Runoff is slow, erosion hazard is slight. Where unprotected, these soils are subject to rare periods of flooding.	Typic Torrifluvents Entisols	-	Active Alluvial Fan

- Ebon-Pinant complex (Unit #48, 49)
- Suncity-Cipriano complex (Unit #110)
- Tremant-Antho complex (Unit #115)

These units described by the NRCS as old (inactive) alluvial fans, with well-developed soil profiles and high clay and carbonate content. Rock outcrop areas (Unit #52- Gachado-Lomitas rock outcrop; Unit #100- Quilotosa Vaiva rock outcrop) are also mapped by the NRCS near the margins of Fans 1 and 2.

6B.5.3.2 AZGS Surficial Geology

The AZGS surficial geology mapping (Figures 6.21 and 6.22) shows a young alluvial unit (Qy) extending north from the north end of the White Tank Mountains in the area of Fan 1 and 2. Most of the upper piedmont is mapped as unit M1b, a middle to late Pleistocene-aged alluvial fan unit. The M1b surfaces are described as composed of poorly sorted, angular to subangular sand and gravel materials with weakly developed argillic and stage II calcic horizons. The M1b surfaces themselves are moderately dissected in the upper piedmont, with decreased dissection in the downstream direction, and with abundant varnished desert pavement areas.

The AZGS mapped the active areas of Fan 1 and 2 as late Holocene alluvial fan surfaces (Y2). The AZGS Y2 surface is composed of very gravelly sands and silts. The Y2 surfaces are typically not dissected and have distributary drainage patterns. No desert pavement, varnish or soil development are typically found on the Y2 surfaces, which area subject to frequent flooding and erosion. M1b surfaces form stable islands between the Y2 active fan surfaces. The AZGS mapped active alluvial fan areas downstream of the secondary hydrographic apexes on Fans 1 and 2. At the toe of the extreme east and west side of Fan 2, secondary entrenchment exposed a low scarp of older geomorphic surfaces adjacent to Wagner Wash and the Trilby Wash tributary.

The AZGS also prepared flood hazard mapping (Figure 6.22) for the White Tank Piedmont, including the areas near Fans 1 and 2. The AZGS flood hazard mapping categorizes the Y2 surfaces as having the highest flood hazard zone (H1), or as H2 surfaces, which carries a slightly lower level of high hazard. The remainder of the Fan 1 and 2 piedmont, mostly in the areas around the periphery of Site 1 and 2, is mapped as L2, which is the lowest flood hazard zone. The AZGS flood hazard map also depicts several flow path bifurcations near the Fan 1 hydrographic apex. The AZGS mapping has some of the same scale issues as those described for the NRCS mapping.

The NRCS and AZGS mapping, and the stable/unstable area delineations performed for this study are compared in Figure 6.23. The NRCS, AZGS, and TDN mapping are broadly similar. The minor differences are attributed to the lower resolution, large scale mapping performed by the NRCS

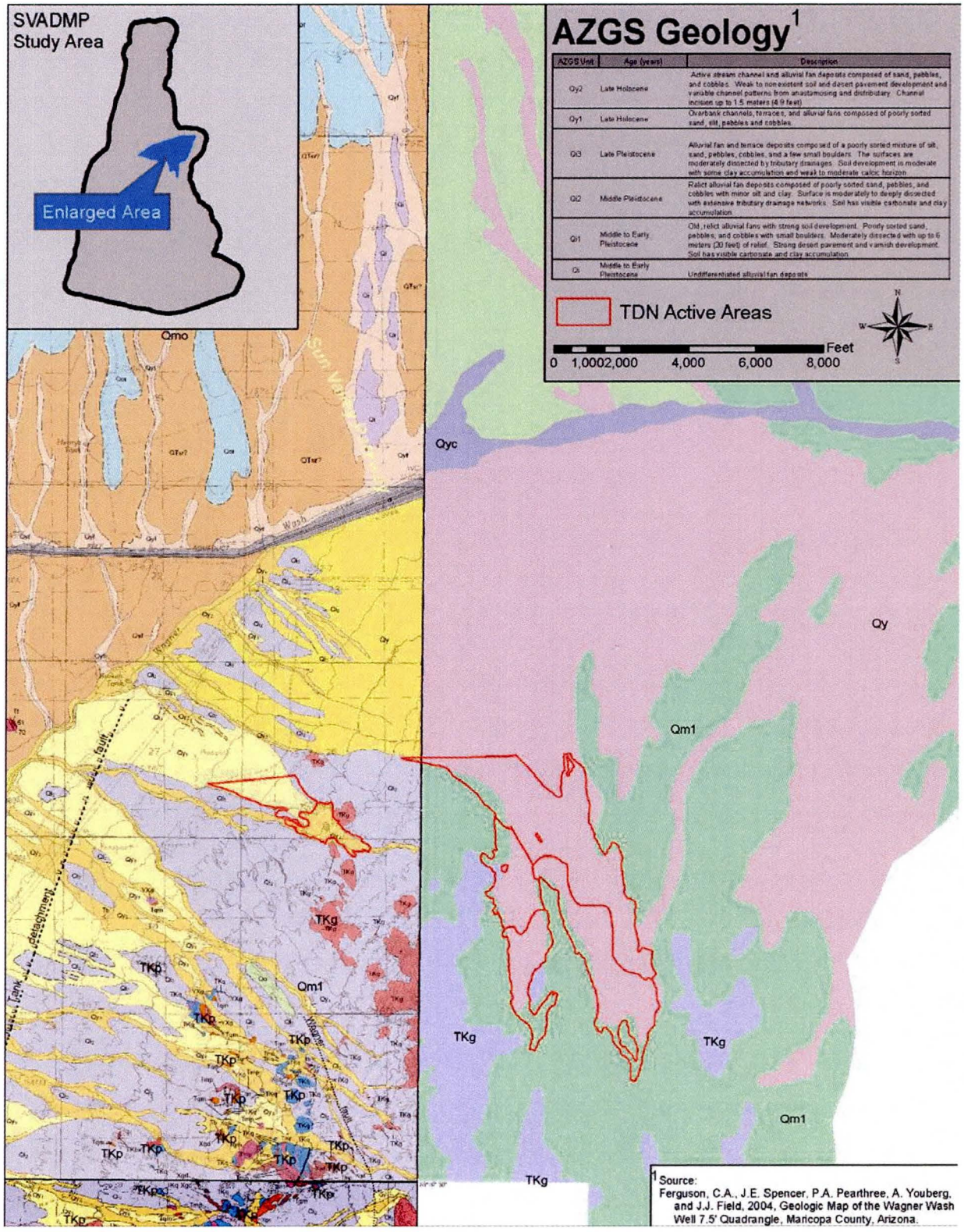

Figure 6.21. AZGS surficial geology mapping near Fan 1 and 2.

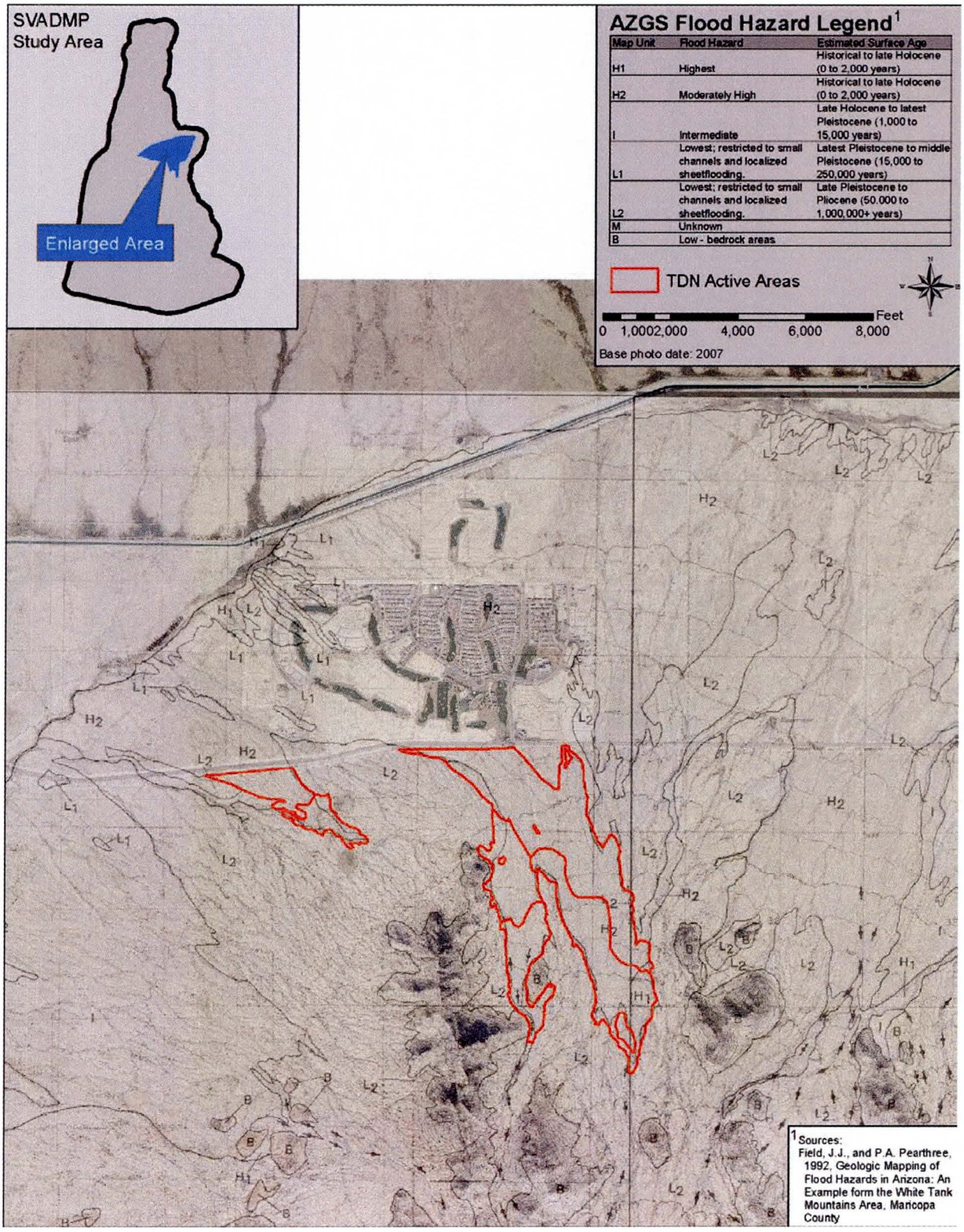

Figure 6.22. AZGS flood hazard mapping near Fan 1 and 2.

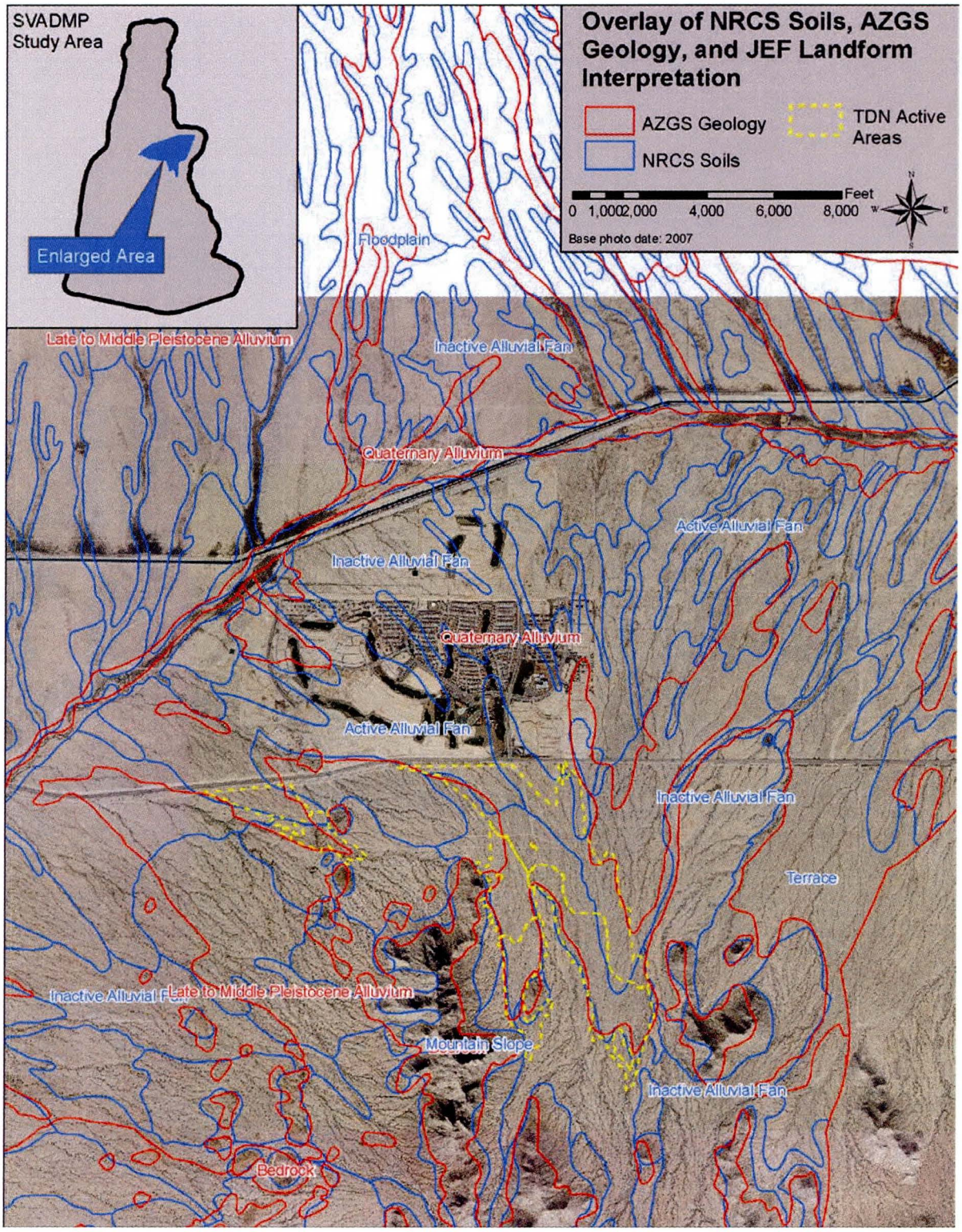

Figure 6.23. NRCS, AZGS and unstable area mapping overlay.

and AZGS, as well as rectification issues associated with converting paper maps to digital coverages. The NRCS, AZGS, and TDN mapping all identify unstable, active alluvial fan areas downstream of the hydrographic apexes of Fans 1 and 2 and extending to the toe of the fans, as well as inactive, stable piedmont surfaces for the remainder of the piedmont.

6B.5.3.3 Interpretation of Topography

Topographic data were available from USGS 7.5-minute quadrangle maps and from FCDMC 10-foot contour interval mapping. Topographic data can be used in the following ways to identify stable and unstable (active/inactive) portions of alluvial fan landforms:

- Contour crenulation. Contour crenulations are "wiggles" in topographic contour lines. Since older, stable surfaces tend to have greater internal relief, better developed drainage networks, and are largely erosive landforms, the contours over such surfaces are more crenulated. Contours over younger, active, unstable surfaces tend to be smoother, reflecting the more uniform, less incised topography.
- Contour shape. Contours on active, unstable alluvial fan surfaces tend to bend downstream (convex) in a smooth radial pattern. Contours on inactive or relict fans tend to be more parallel (or concave) to the mountain front.
- Contour direction. A marked change in the contour orientation occurs at the toe of the alluvial fan, where it enters the floodplain of the axial stream, which is frequently orthogonal to the fan contour orientation.
- Relief. The boundaries of active fan areas are typically confined by older, higher inactive surfaces which constrain alluvial fan flooding to topographically lower unstable surfaces. Topographic relief is addressed more directly in the Stage 3 analysis.
- Longitudinal profile. A longitudinal profile is a plot of elevation versus distance. A profile of an actively aggrading alluvial fan usually in convex (steepens downstream), whereas inactive alluvial fans typically have concave profiles (flattens downstream).
- Map symbols. Symbols on the USGS topographic maps useful for fan identification include stream channel bifurcation, stippling of depositional areas, termination of stream symbols in the downstream direction.

The 10-foot contour topographic mapping for Fan 1 and 2 is shown in Figure 6.24. The topographic contours within the active, unstable area of Fan 1 and 2 are less crenulated than the adjacent, stable portions of the piedmont, indicating that the most active surfaces are not incised and

that the flow paths are shallow with significant overland and sheet flow components. Near the toe of the fan, recent secondary incision created more relief along flow paths cut into the former

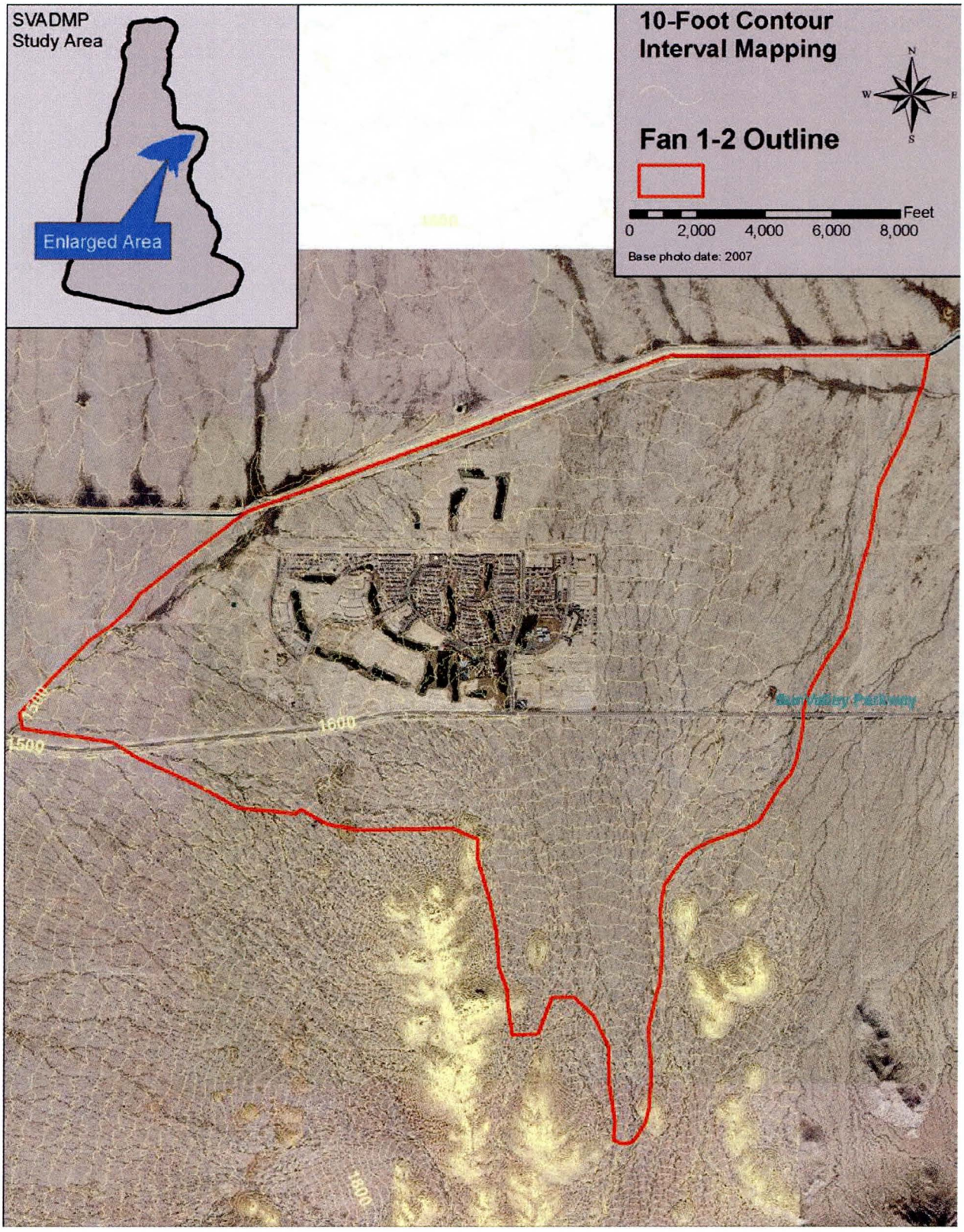

Figure 6.24. 10-foot contour topographic mapping for Fan 1 and 2.

sheet flow areas. The topographic data indicate that the inactive portions of the piedmont are incised by up to 10 feet in place. In addition, the topographic contours bend noticeably downstream within the active portion of Fan 2. Fan 1 has less downfan contour bending in the active fan area than Fan 2, probably due to the smaller drainage areas, lower sediment supply rate, and lower rate of net aggradation.

The topographic data for the fan also helps define the fan boundaries. The degree of relief at the margins of the active portions of Fans 1 and 2 decreases in the downstream direction, but remains sufficient to contain runoff to the active portions of the fan. At the hydrographic apexes, the channel inverts are about four feet below the surrounding inactive surface. Upstream of Sun Valley Parkway, the older, inactive surfaces are less than three feet above the active surfaces. At the toe of the fans, the contour orientation changes drastically, shifting to perpendicular to the axial drainage system, rather than the flow direction across the alluvial fan landform.

The longitudinal profiles for Fan 1 and 2 are shown in Figure 6.25. The longitudinal profile for Fan 1 has an overall concave up profile, which is not a classic indicator of an active alluvial fan, although there is a slight bulge in the profile in the immediate vicinity of the hydrographic apex. Similarly, the longitudinal profile for Fan 2 has an overall concave up profile, with a slight bulge in the profile in the immediate vicinity of the hydrographic apex. The USGS topographic maps do not have any map symbols indicative of active alluvial fans in the vicinity of Fan 1 and 2.

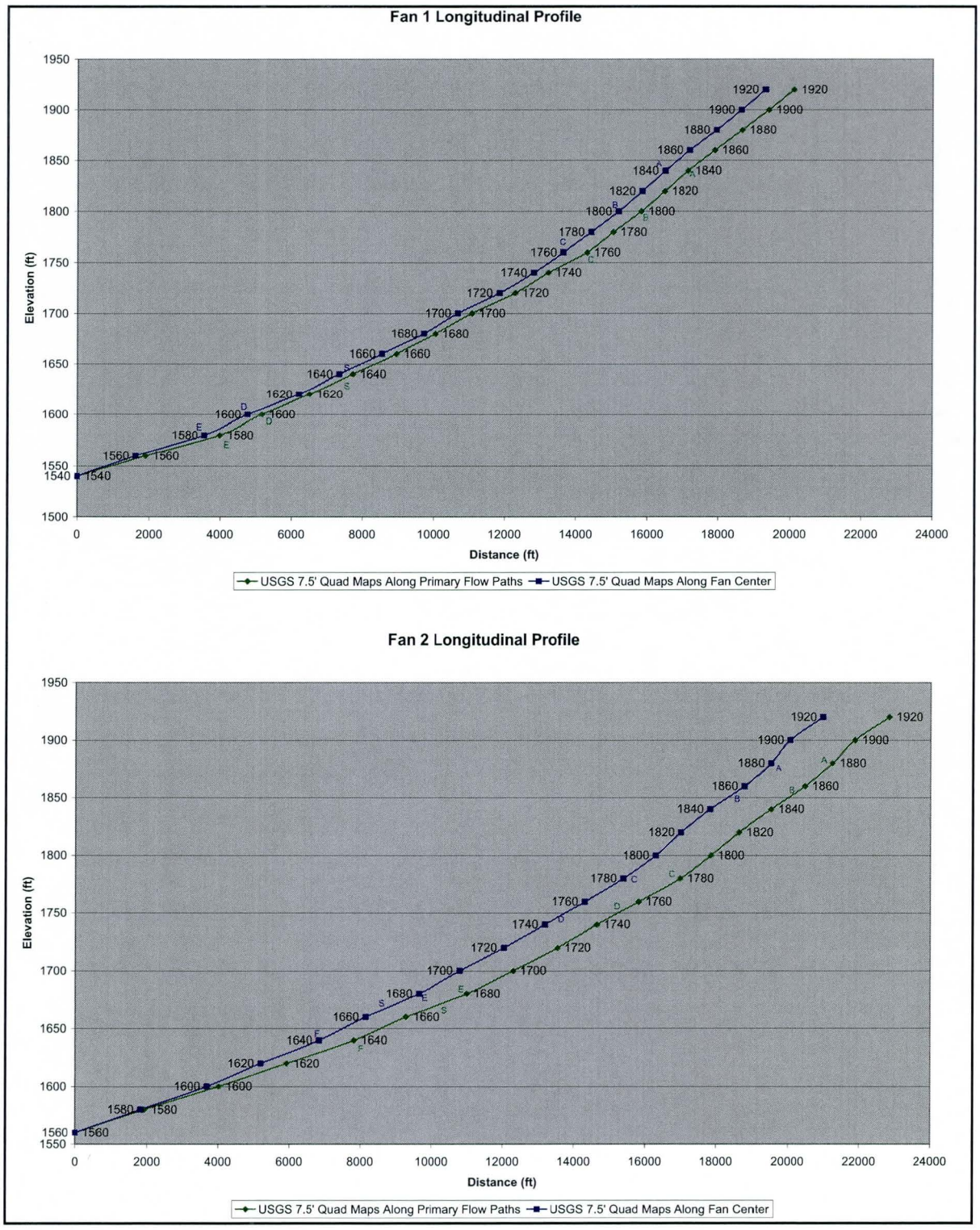

Figure 6.25 Longitudinal Profiles for Fan 1 and 2. Fan 1 and 2 hydrographic apexes both at elevation 1865.

6B.5.3.4 Historical Aerial Photography

Historical aerial photographic coverage from 1953 and 2005 were available for the Site 1 and 2 alluvial fans (Figure 6.26). The 1953 aerial photographs were scanned and semi-rectified using geographic features on the 2005 digital aerial photographs provided by the FCDMC. Channel thalweg locations were plotted on the 1953 and 2005 aerials to identify channel movement, channel avulsions, or other changes in channel characteristics (Figure 6.27). Unfortunately, aerial photographs pre-dating the August 1951 flood documented in the Site 36 Alluvial Fan Floodplain Delineation Technical Documentation Notebook (JEF, 1999), were not available for the Site 1 and 2 fans. The general appearance of the 1953 aerials indicates that the 1951 event may not have been significant in the Fan 1 and 2 study area as it was in the southern portions of the White Tank Mountain Piedmont.

Table 6B.5 List of Historical Aerial Photographs of White Tank Fan Study Area

Source	Photo Date	Scale	Type	Digital
FCDMC Archives (US AMS, 1953)	1953	~ 1:14,400	Black & white prints	Scanned
FCDMC	2005	1:32,000	Color orthophotos	Yes

The comparison of thalweg locations shown in Figure 6.27 indicates that there has been definite channel movement within the active fan areas during 56 year period of record, with almost no discernable channel change in the stable areas. New channels have formed within the most active portions of the alluvial fans, and formerly active channels have been abandoned. Another area of prominent new channel formation was near the toe of Fan 2 at the confluence with Wagner Wash, where recent incision resulted in headward erosion along several new flow paths. There were no significant changes in vegetative cover, distribution or density that could be discerned at the scale of the aerial photographs. The primary human impacts on Fans 1 and 2 were construction of Sun Valley Parkway, the CAP, and a stock tank on Fan 1.

6B.5.3.5 Drainage Pattern

Drainage pattern is indicative of alluvial fan stability. Inactive, stable alluvial fans typically have a tributary, well-defined drainage pattern, with channels that generally increase in size with distance downstream. Active, unstable alluvial fans typically have poorly defined distributary or sheet flow drainage patterns, which have channels that often decrease (or disappear) in the downstream direction. The drainage pattern can be readily identified from aerial photographs (Figure 6.19) by the

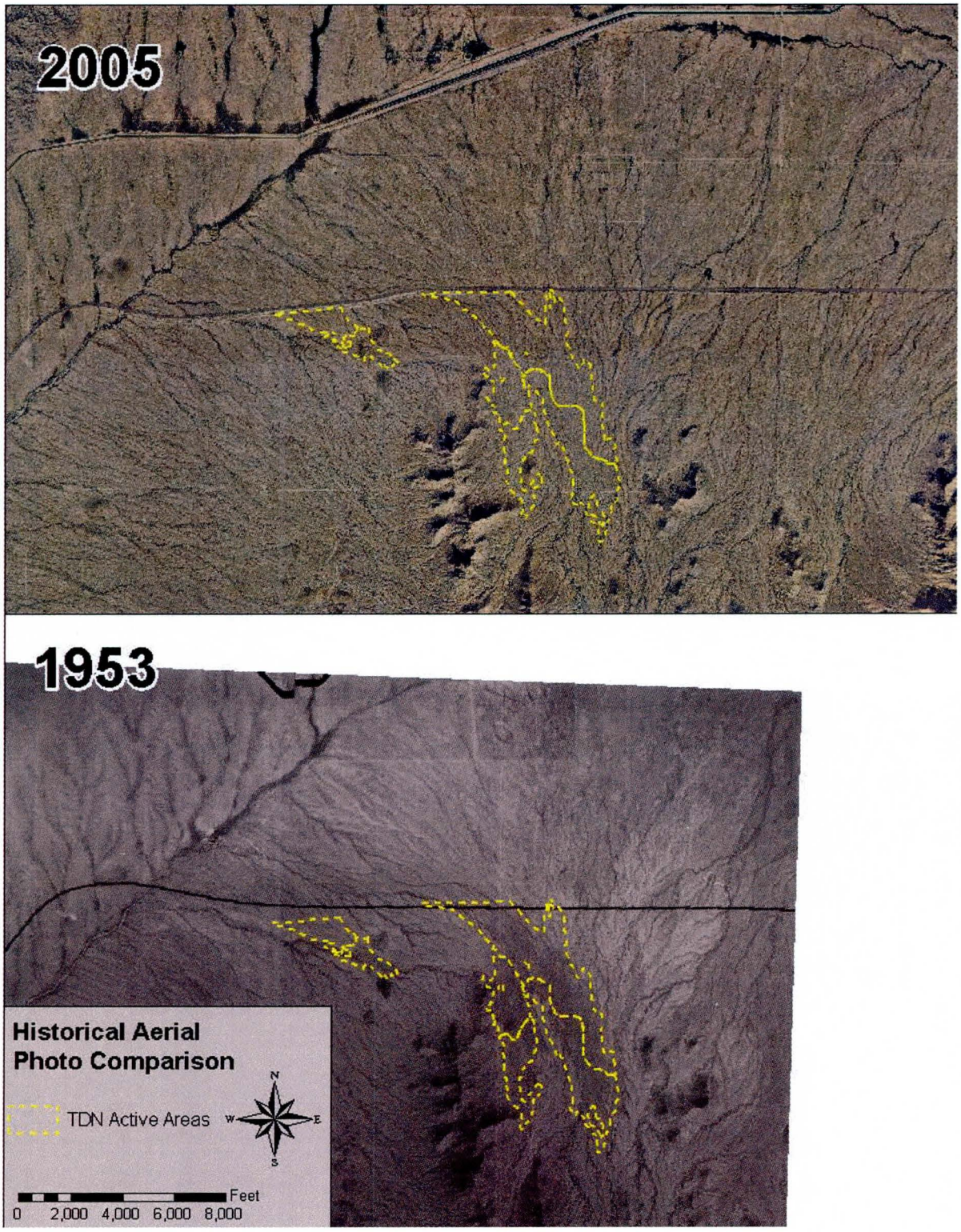

Figure 6.26. Historical and recent aerial photograph comparison.

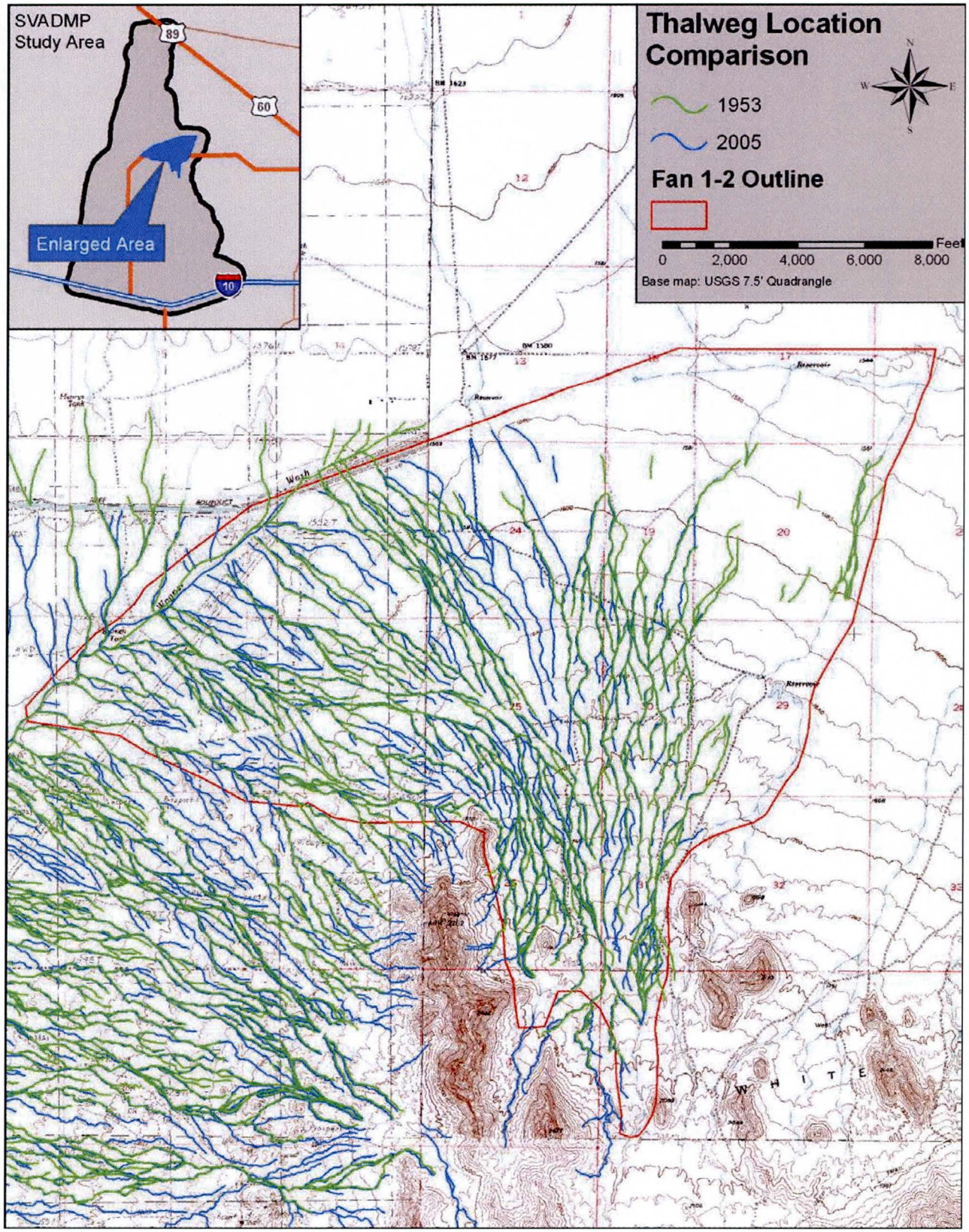

Figure 6.27. Historical thalweg location comparison (1953-2005).

light-toned sandy channel bed materials and/or the bank vegetation which is usually denser and with different species than floodplain and terrace areas.

The drainage pattern in the unstable portions of Fans 1 and 2 is distributary with strong components of unconfined and sheet flow. Sheet flow is the dominant flow condition in the lower portions of the fans downstream of Sun Valley Parkway. Field observations suggest that large percentages of the active areas are inundated during significant floods. The most stable portions of the piedmont have a well-defined tributary drainage pattern, and unstable portions have distributary or poorly defined drainage patterns. The drainage pattern changes from tributary to distributary at the hydrographic apex. The distributary pattern persists from the hydrographic apexes to the toes of the fans at Wagner Wash and the Trilby Wash tributary, although some mid-fan portions of Fan 2 have elements of an incipient tributary network.

6B.5.3.6 Surficial Characteristics

Surficial landform characteristics can be used to identify stable and unstable alluvial fan surfaces, as described in Section 6B.5.1 and the PFHAM. Landform characteristics were identified during field visits, by interpretation of aerial photographs, and from NRCS soils and AZGS geologic maps. Key surficial characteristics considered for the Site 1 and 2 alluvial fan floodplain delineation included the following:

- Surface Texture
- Surface Color
- Desert Varnish
- Desert Pavement

The active, unstable fan areas shown in Figure 6.19 generally lacked surface reddening, desert varnish and desert pavement, and had relatively uniform surface texture. Inactive, stable surfaces had distinct surface texture, soil reddening, and desert varnish and pavement areas. Areas of apparent geologic age were observed on the east sides of both Fan 1 and 2 several hundred feet downstream of the primary hydrographic apexes. In spite of evidence of geologic age, such as desert pavements, distinct vegetative suites (i.e., Ocotillo and Saguaro), and soil development, these areas were included in the active alluvial fan delineation because of their lack of topographic relief relative to the active areas and proximity to the relatively high rates of aggradation near the apex.

Surface texture and color were identified primarily from the 2005 color aerial photographs (Figures 1.2 and 6.4). Areas with significant desert pavement accumulation could also be identified on the 2005 aerial photographs, but were also identified during field visits.

6B.5.3.7 Vegetation

Vegetation was used in the following ways to distinguish stable and unstable alluvial fan surfaces on the Site 1 and 2 Fans:

- Vegetative Suites. The types of vegetation on any geomorphic surface are a function of the micro-climate (aspect, elevation, etc.), soil substrate, frequency and concentration of runoff, soil permeability, and soil chemistry. Because adjacent geomorphic surfaces on alluvial fan landforms differ in degree of clay and carbonate accumulation (substrate, chemistry, permeability), incision (runoff characteristics), and frequency of inundation, the vegetation suites on each surface are likely to vary slightly, either by species type and/or by species density or robustness.
- Marker Species. Certain species are almost always found in specific geomorphic and fluvial environments. For example: (1) ocotillo thrive in carbonate rich soils, and often indicate that a caliche layer underlies the surface, (2) saguaro, barrel, and cholla cacti grow well in rocky, well-drained soils are usually found outside the active floodplain, (3) ironwood, palo verde, and mesquite trees typically are found on channel banks or where runoff concentrates frequently.
- Species Age. The apparent age of vegetation is used to distinguish geomorphic surface age. The age of vegetation is directly proportional to overall plant size, as well as trunk diameter (woody trees), presence or number of branches (saguaro cacti branch after about 70 to 100 years), or other factors (creosote clone ring diameter). Old vegetation is indicative of stability or at least non-erosion.
- Burial or Exposure. Burial of the plant base by sediment deposition may indicate aggradation or active alluvial fan flooding. Exposure of a plant's roots by erosion indicates scour or lateral erosion which may be associated with either stable or unstable surfaces, depending on other geomorphic characteristics.

Vegetation characteristics for the Site 1 and 2 fans were identified in the field and on aerial photographs. The extensive sheet flow areas in the lower portions of Fans 1 and 2 were readily identified in the field and on aerial photographs by the highly uniform vegetative cover (Figure 6.28), which often consisted of grass, low brush and creosote. The non-sheet flow areas typically had more diverse vegetative suites, with denser plant concentrations along the more prominent flow paths.

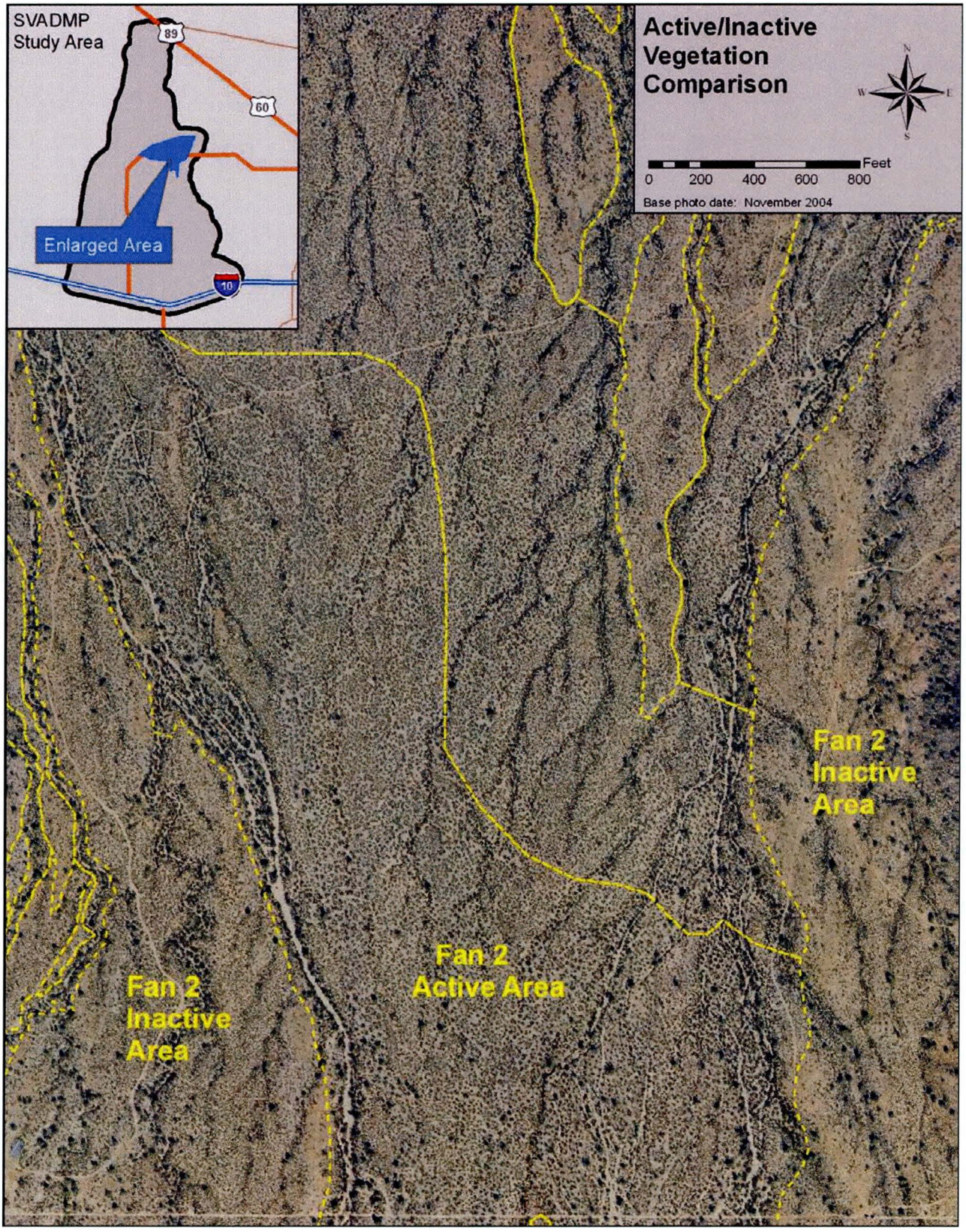

Figure 6.28. Active/Inactive surface vegetation characteristics.

Differences in vegetation between stable and unstable portions of the piedmont near Fan 1 and 2 include vegetative density, distribution, size, and type. Active fan areas had denser vegetative cover, with larger plant sizes, especially on the interfluve areas than the inactive surfaces. Channel bank vegetation in the active fans areas tended to be smaller than along channels on inactive surfaces. Inactive surfaces tended to have more cholla and saguaro cacti than active surfaces.

6B.5.3.8 Sediment Delivery Potential

Sediment yield was estimated by Ayres (2005) for the Buckeye Sun Valley ADMP for Area 3 using the Revised Universal Soil Loss Equation (RUSLE). The Ayres results indicated 100-year sediment yield rates ranging from 0.48 to 3.61 acre-feet/square mile, and average annual sediment yield ranging from 0.35 to 1.05 acre-feet/square mile/year. Using the most conservative value computed by Ayres, the sediment yield at the Site 1 and 2 hydrographic apexes is shown in Table 6B.6, and which would result in very low rates of aggradation if distributed over the entire active, unstable portion of the fans. The sediment yield data indicate that most avulsions in the active areas are probably due to local phenomena (stream capture, debris clogging, local deposition) rather than overall fan aggradation. The sediment data also suggest that minimal topographic relief is required to contain flooding within the active surfaces. The low sediment yield rates suggest minimal potential for system-wide channel clogging, as well as high probability for water runoff to flow around depositional areas without leaving the active portions of the alluvial fan.

Table 6B.6. Sediment Yield Estimates Based on Ayres (2005)

Value	Fan 1	Fan 2
Average Annual Sediment Yield (AF/yr)	0.4	1.1
100-Year Sediment Yield (AF)	1.55	3.72
Average Annual Depth of Deposition in Active Fan Area (ft)	0.003	0.004
100-Year Average Depth of Deposition in Active Fan Area (ft)	0.01	0.01

6B.5.3.9 Summary

Active and inactive portions of the Site 1 and 2 alluvial fan landforms were identified using the geomorphic characteristics described above. The characteristics are best used in conjunction with each other, since no single characteristic is universally diagnostic of the level of stability. The stable/unstable landform delineation for the Site 1 and 2 fans are shown in Figure 6.19.

6B.5.4 Alluvial Fan Floodplains Downstream of Active Unstable Areas

The active unstable alluvial fan areas on the White Tank Piedmont that experience alluvial fan flooding with flow path uncertainty are located immediately downstream of a hydrographic apex, either the primary hydrographic apex, or a secondary inset hydrographic apex located further downstream. Runoff that passes through the entire active unstable portion of the alluvial fan before reaching the toe of the alluvial fan landform is conveyed downstream through one or more of the following types of drainage networks:

- Stable Distributary Systems
- Stable Tributary Systems
- Sheet Flow Areas

Because they are interpreted as stable, both distributary and tributary throughflow channels were mapped as inactive portions of Sites 1 and 2. The same geomorphic characteristics described in Section 6B.5.3 were used to identify stable throughflow channels downstream of the unstable active alluvial fan areas. Note that significant flood hazards exist along the throughflow channels, as delineated in the Stage 3 analyses below, and that flow along the throughflow channels is still considered a form of alluvial fan flooding because of uncertainty associated with the flow rate in any given corridor. The stable tributary and distributary flow areas are located on the margins of the main active fan area, and consist of channels that convey flow to adjacent drainages or to secondary hydrographic apexes.

Sheet flow areas downstream of active fan areas were interpreted to have flow path uncertainty, although the degree of the uncertainty may not reach the level defined in the FEMA/PFHAM Guidelines ("cannot be set aside in realistic assessments of flood risk.") Although small channels do exist within the broad sheet flooding areas, and the distribution of flow in these very small channels (widths less than 10 feet, depths less than 2 feet) undoubtedly varies from flood to flood, and historical analysis indicates that the channel position can change with time, the overall character of flooding is not significantly impacted by such changes. That is, flood flow during the design event is likely to be shallow, consisting primarily of unconfined overbank runoff spread out over wide portions of the alluvial fan landform. However, the sheet flow zones do meet the FEMA definition of active alluvial fan flooding (Holocene age, depositional, uncertainty in flow path location and distribution, lack of geomorphic surficial characteristics indicating age and stability). Therefore, sheet flow areas upstream of Sun Valley Parkway most directly connected to the most active zones near the fan apexes were included within the active alluvial fan areas shown on Figure 6.19, and delineated as such in the Stage 3 analysis.

6B.5.5 Identification of Inactive Areas

Along with the active alluvial fan areas at Sites 1 and 2, Figure 6.19 also shows the inactive alluvial fan areas. Basically, the inactive areas are those portions of the alluvial fan landform that are not active, as

described in the Section 6B.5.3. As shown in Figure 6.19, the majority of the Site 1 and 2 alluvial fan landform consists of active, stable surfaces. Inactive surfaces occur along the margins of Site 1 and 2, as bedrock inselbergs, or as islands of older surfaces of varying size surrounded by active areas.

6B.5.6 Types of Flooding on the Piedmont

Based on the evaluation of active and inactive areas at Sites 1 and 2, the following locations and types of flood hazards were defined.

6B.5.6.1 Flooding Along Stable Channels: Upstream of the Hydrographic Apex

Riverine flooding upstream of the hydrographic apex was delineated using approximate method riverine delineation techniques, as described in Section 5. The riverine reach upstream of the hydrographic apex is considered stable surface flooding, and was delineated using approximate method riverine techniques.

6B.5.6.2 Unstable Flow Path Flooding

Active alluvial fan flooding on the Site 1 piedmont occurs in the broad area between the primary hydrographic apex and the point where Fan 1 is absorbed into Fan 2. A second active alluvial fan area on Site 1 occurs below the secondary hydrographic apex above the unnamed stock pond on the far west side of the Site 1 landform. Active alluvial fan flooding on the Site 2 piedmont occurs in the broad area downstream of the hydrographic apex. Additional small, inset active alluvial fan flooding areas occur within the distributary flow area along the east margin of Site 2. These unstable flow path areas represent significant flood and sediment hazards.

6B.5.6.3 Flooding Along Stable Channels: Downstream of the Hydrographic Apex

Downstream of the active fan areas some of the flooding is conveyed in a series of sub-parallel channels that cut through older stable geomorphic surfaces. The channels in these areas have been stable over (at least) the past 50 years as indicated by the historical aerial photographs and possibly the past few thousand to tens of thousands of years as indicated by the surficial geology. Flood hazards along these corridors can be expected to be confined to the existing channel network. However, uncertainties in the discharges delivered to each channel make detailed quantitative evaluation of these hazards difficult. Until the discharge distribution uncertainty created by the active area upstream can be resolved, this study suggests that an approximate method relying on geomorphic surface interpretation can adequately and realistically evaluate the location and lateral extent of these hazards.

Flooding along stable channels occurs on Site 1 where overbank flow at the hydrographic apex collects into a defined channel system before returning to the active fan, along a break out channel that conveys runoff to the active alluvial fan near the unnamed stock tank along the western side of the fan, and in an area of entrenchment at the toe of the fan. Flooding along stable channels occurs on Site 2 along the eastern margin where flow exits the active fan toward the adjacent fan outside the study area as well as upstream of Sun Valley Parkway on the east side of Fan 2.

6B.5.6.4 Sheetflow Areas

Sheetflow occurs over very broad areas on Sites 1 and 2, but primarily in the lower half and near the toe of the alluvial fan. The sheet flow area cannot be considered to be a riverine alluvial plain, because it has the radial, extended shape of an alluvial fan, and is oriented perpendicular to the valley axis. A significant component of flow is conveyed as unconfined overbank flow (a.k.a., sheet flow) in the transition zone at the downstream end of the active alluvial fan area.

A portion of the lower piedmont also is subject to sheetflow. Broad areas of geologically young surfaces attest to their repeated inundation over the past few thousand years. Within these areas a few more prominent washes do exist, which can be expected to convey portions of the flood discharge, as well as local runoff derived from the fan surface itself, and which are likely to receive flood water much more frequently than other (non-channel) areas on the lower piedmont. Additionally, the fine-grained soils of the lower piedmont are capable of creating more frequent local runoff due to low infiltration rates.

6B.5.6.5 Debris Flow Areas

No evidence of debris flows was observed in the field, on topographic maps, or on aerial photographs. The NRCS soils mapping and AZGS geologic mapping do not mention debris flow hazards or deposits within the study area. The hydrographic apexes are located too far from the mountain front for debris flows to be of concern for the flood hazard inundation areas mapped in this study.

6B.5.7 Summary of Stage 2 Delineation

Figure 6.19 shows the limits of the active and inactive areas within the Site 1 and 2 piedmont. The Stage 2 active/inactive area delineation is the foundation for the Stage 3 floodplain delineation. The most active areas of the Site 1 and 2 piedmont are areas about 0.2 and 1.0 square miles in extent, respectively, downstream of the hydrographic apexes.

6B.6 Stage 3: Defining the Approximate 100-Year Floodplain

The 100-year flood hazard assessment is an outgrowth of the information and results identified and generated in Stages 1 and 2. In Stage 1, Sites 1 and 2 were identified as part of an alluvial fan landform. In Stage 2, the unstable (active) and stable (inactive) portions of the alluvial fan landform were identified. According to the FEMA Guidelines, "the delineated floodprone areas of Stage 2 should approximate the largest possible extent of the 100-year flood." In Stage 3, floodplain limits for the 100-year (1%) flood are delineated for each of the types of the following types of flooding identified in Section 6B.5:

- Flooding Along Stable Channels: Upstream of the Hydrographic Apex. The floodplain along the main channel upstream of the hydrographic apex was delineated using riverine approximate method techniques, as described in Section 5.0.
- Unstable Flow Path Flooding. The floodplain in the areas with unstable flow path flooding (active alluvial fan flooding) downstream of the hydrographic apex were delineated using geomorphic data. In general, the 100-year floodplain delineated in the active alluvial fan areas is coincident with the Stage 2 unstable area delineation.
- Flooding Along Stable Channels: Downstream of the Hydrographic Apex. The floodplain along stable distributary and tributary channels located downstream of the active alluvial fan areas were delineated using geomorphic data.
- Sheetflow. Areas of sheet flooding were delineated using geomorphic data.

Flood hazards for all portions of the alluvial fan downstream of the hydrographic apex were delineated using geomorphic techniques, but were verified using the results of the FLO2D modeling described in Section 5 of this report. Application of geomorphic mapping techniques to the unstable portions of the alluvial fan is the preferred delineation method in Maricopa County. Application of geomorphic techniques to the remaining portions of the alluvial fan downstream of the hydrographic apex is required by the site conditions and the available information. The stable distributary and tributary channels systems downstream of the hydrographic apex are referred to as throughflow channel corridors. Within some of the throughflow channel corridors, channel changes were observed in the historical aerial photo record or in the field, although the changes were confined within the corridors. The corridors are bounded by higher, older, stable geomorphic surfaces. Channel changes along the throughflow corridors are analogous to minor channel changes in a braided riverine system that do not affect the flood limits or overall stream morphology. That is, there is only minimal flow path uncertainty which can be "set aside in a realistic assessment of flood risk." There is, however, significant flow *rate* uncertainty due to the uncertain flow *path* distribution in the active unstable area upstream. This flow rate uncertainty invalidates traditional riverine floodplain delineation techniques for the throughflow channels because the 100-year discharge is unknown.

The availability of FLO2D modeling provides an interesting comparison of geomorphic mapping techniques and deterministic modeling results. The geomorphic data incorporates a long record of geologic and surficial information that describe flood and sedimentation processes (or lack thereof) on the landform surface, but are not necessarily reflective of a 1% chance probability. The FLO2D model depict the results of a mathematical prediction of the inundation limits of a single 1% chance hydrograph, and all of the modeling assumptions and inaccuracies inherent in the hydrologic, hydraulic and sedimentation aspects of the modeling code, but does not reflect the long-term change characteristic of active alluvial fan flooding. In the case of Fan 1 and 2, the FLO2D modeling indicates that significant flow attenuation occurs over the surface of the fan, and that flow depths greater than a few feet are unlikely outside of the high hazard areas near the apexes. The FLO2D results indicate that some obvious flow paths, readily observable on aerial photographs, are predicted to have no flow during a 100-year flood, which may be either an artifact of topographic map accuracy or a product of the assumption of constant ground elevations during the flood (no scour or fill). The FLO2D model results did not predict flow outside the boundaries of the geomorphic floodplain, nor did the geomorphic mapping predict flood hazards significantly different than the composite FLO2D results.

Flooding along the throughflow channels downstream of active unstable alluvial fan areas has the following characteristics of alluvial fan flooding, as defined by FEMA: (1) it occurs on an alluvial fan landform, (2) it originates at a hydrographic apex, (3) it is characterized by high velocity flow, (4) it is characterized by processes of erosion, sediment transport, and deposition, (5) and it is hydraulically connected to areas that experience unpredictable flow paths. According to Table G-1 in the FEMA Guidelines, floodplain delineation using geomorphic data is acceptable for alluvial fans with little or no urbanization. Most of the White Tank Piedmont has little or no urbanization upstream of Sun Valley Parkway. Therefore, use of geomorphic data as the basis of the floodplain delineation is acceptable for the areas immediately downstream of the hydrographic apex. Downstream of Sun Valley Parkway, recent development precludes use of geomorphic methods alone, so a composite method using HEC-RAS modeling (Sun Valley Parkway Channel), HY-8 modeling (Sun Valley Parkway culverts), and FLO2D modeling was used to identify floodplain limits.

The Stage 3 100-year floodplain delineation for the Site 1 and 2 alluvial fans are shown in Figure 6.29.

6B.6.1 Flood Hazard Zones

Table 6B.7 lists and describes the flood hazard zones identified and shown in Figure 6.29 and the Stage 3 – 100-year Floodplain Map in the Floodplain Delineation Exhibits included in the TDN Appendix. These zones are defined for use in piedmont flood hazard delineation in Maricopa County by the Flood Control District of Maricopa County, and were approved the Maricopa County Board of Supervisors on

November 1, 2000. The flood hazard zones shown on Figure 6B.29 are given in Table 6B.7. The resulting flood hazard map is similar in nature to the one shown in Example 4 (Figure G-9) in FEMA Guidelines.

The unstable areas delineated in the Stage 2 analysis were used to identify the location of the Zone A – Administrative Floodway Active Alluvial Fan (Zone AFHH). The AFHH (active alluvial fan) zone lies within the unstable areas nearest the hydrographic apex, in the zones where the greatest risk of flow path uncertainty exists. The AFUFD (uncertain flow distribution) zone encompasses the remainder of the unstable area as well as an additional buffer area along the downstream edge of the unstable area identified in Stage 2. This buffer area was determined by use of the soils, surficial geology data, interpretation of recent and historical aerial photographs, and engineering judgment. The AFUFD zone also includes the portions of the active alluvial fan areas not included in the AFHH (highest hazard) zones. Typically, the AFUFD zones include active areas subject to sheet flow. Both the AFHH and AFUFD zones are considered floodways, not appropriate for development without significant engineering analyses, structures, and/or whole-fan structural solutions.

Zone A – Administrative Floodway Inactive Alluvial Fan (Local Community Zone AAFF) were intended to be used along stable throughflow channel corridors which traverse the inactive portions of an alluvial fan landform. The Zone A - Inactive Alluvial Fan (AFZA) designation was intended to be used for inactive fan areas, particularly those subject to shallow sheet flooding, stable overbank flow and local runoff. Development within these non-floodway areas would be allowed given an adequately engineered site specific evaluation of the flood hazard and flood mitigation measures. The AFZA zone is generally characterized by sheet flooding and flooding within relatively small stable channels. These small channels may either represent small distributary drainages connected to the primary floodways, small local drainages, or various paths where broad sheet flooding recollects as it flows down the piedmont in an effort to reorganize itself.

Inactive alluvial fan areas surrounded by active alluvial fan areas were mapped as shaded Zone X. Inselbergs surrounded by active fan areas were not mapped as shaded Zone X.

Table 6B.7 Flood Hazard Zones Mapped in White Tank Fan 1 and 2 Approximate FDS

Zone Name	Local Community Zone Designation	Description
Zone A	Zone A	Approximate 100-year floodplain; riverine reaches upstream of hydrographic apex, and shallow flooding areas downstream of Sun Valley Parkway as indicated by FLO2D modeling.
Zone A – Administrative Floodway Riverine	Zone A	Approximate 100-year floodplain, riverine reaches upstream of hydrographic apex, managed as a floodway district.
Zone A – Administrative Floodway Active Alluvial Fan	AFHH – Administrative Floodway	Alluvial Fan High Hazard, community to treat as a floodway district

Zone A – Administrative Floodway Active Alluvial Fan	AFUFD – Administrative Floodway	Alluvial Fan Uncertain Flow Distribution Area; transitional area downstream of AFHH zone characterized by channelized and sheet flooding generally becoming more stable and less uncertain with increasing downstream distance from the AFHH zone; community to treat as a floodway district
Zone A – Administrative Floodway Inactive Alluvial Fan	AAFF - Administrative Floodway	Approximate Alluvial Fan Floodway; corridors for conveyance of water and sediment on a stable alluvial fan surface downstream of the AFHH and AFUFD; community to treat as a floodway district
Zone A – Inactive Alluvial Fan	AFZA	Alluvial Fan Zone A; areas within the 100-year floodplain on an inactive alluvial fan characterized by shallow channelized flow and sheet flooding in stable channels; zone is considered approximate because no base flood elevations are provided; flood hazards within this zone are not necessarily equal throughout, that is, the frequency and magnitude of flooding with respect to depth and velocity of flow may vary within the AFZA zone; floodplain managers should consult available aerial photographs and topographic maps for more detailed evaluation of site specific flood hazard within this zone; development will be allowed in this zone given demonstration of adequacy of site and/or design which addresses safety from inundation and sedimentation hazards
X (shaded) – Inactive Alluvial Fan	X (shaded)	Areas flooded between 100-yr and 500-yr discharge; or areas of flooding with depth of 100-year flood less than 1 foot; or drainage area less than 1 square mile
X (unshaded)	X (unshaded)	Areas outside the 500-year floodplain; shown only on rocky hills
D	D	Area not studied

Between many of the mapped floodprone areas are large islands of older stable geomorphic surfaces. These were mapped using a shaded Zone X designation. These zones include areas of possible flood hazards from local drainage areas smaller than one square mile as well as stable areas potentially flooded by events less frequent than the 100-year flood (e.g. the 500-year flood). Inselbergs were mapped as unshaded Zone X. Also, because approximate methods were used, islands smaller than five (5) acres were not delineated.

6B.6.2 Verification of Results

Figure 6B.15 shows a comparison of the results of the Stage 3 analysis with the flood hazard evaluation by Field and Pearthree (1992). Figure 6B.16 shows the relationship of the Field and Pearthree surficial geology mapping to their flood hazard evaluation.

In general, everything shown by Field and Pearthree as H1 or H2 surfaces has been mapped as within one of the various 100-year flood hazard areas. H1 surfaces are characterized as "very high flood potential." H1 surfaces included areas with the "potential for localized, high-velocity, relatively deep, channelized flows and sheet flooding" with "some potential for drastic shifts in channel position." H2 surfaces were evaluated as

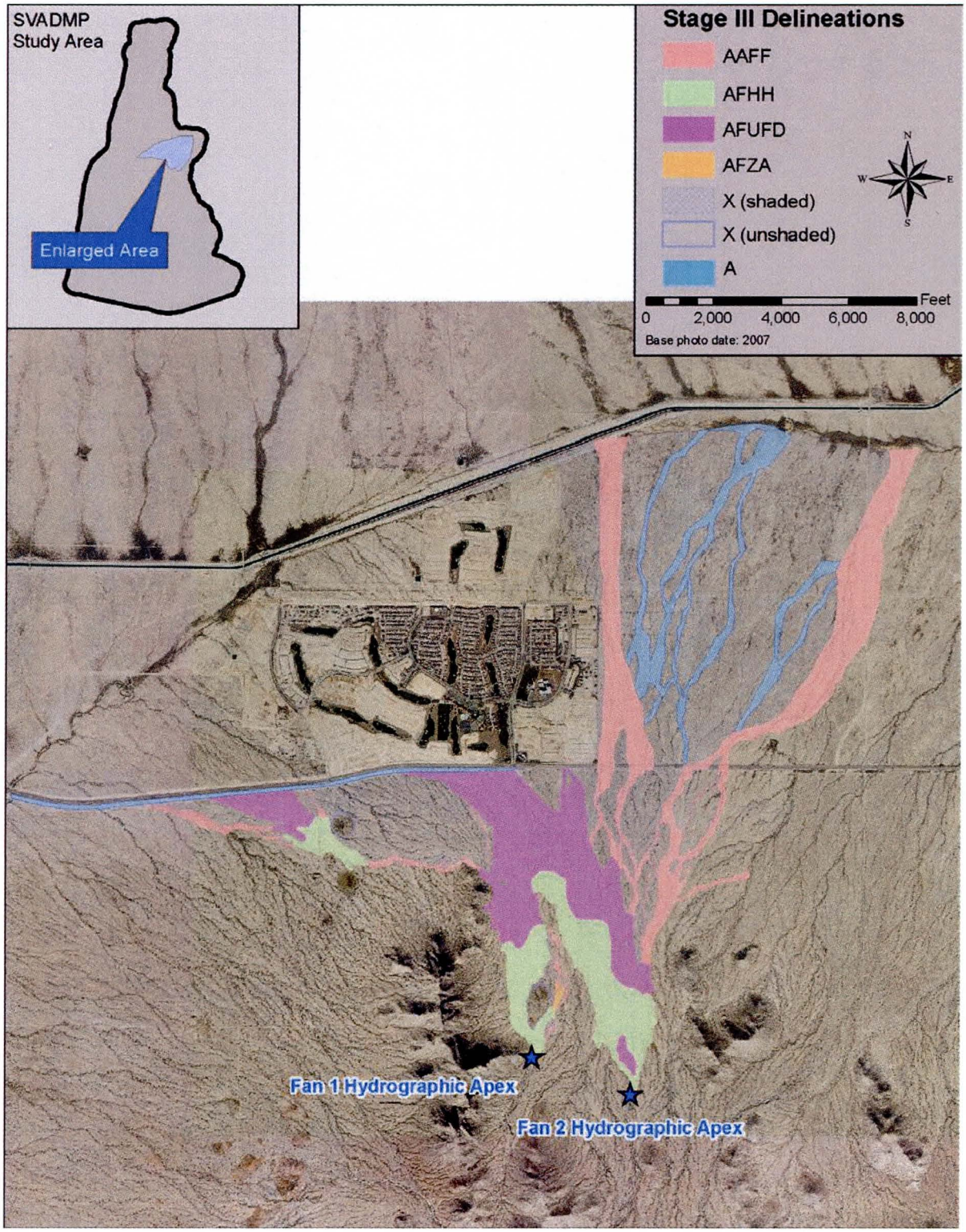

Figure 6.29. Stage III floodplain zone delineations for Fan 1 and 2.

having a "high flood potential" characterized by "predominantly shallow sheet flooding; channelized flow very limited in extent" with "broad areas probably inundated in large floods." The H1 areas mapped by the AZGS correspond with the AFHH zones mapped in this study, but the AFHH areas also include some of the H1 areas near the hydrographic apexes. H1 zones are also shown within the AAFF zone administrative floodways. The AFUFD zones generally correspond to the AZGS H2 delineations.

The Field and Pearthree evaluation differs from the current study where approximate alluvial fan floodways (AAFF) cross L2 surfaces. The AAFF corridors follow stable channels or channels confined between older surfaces from the active fan upstream to the broad areas of sheet flooding downstream. L2 surfaces are described as "very low flood potential; areas not flooded for at least 10,000 years or longer; spatially or topographically separate from distributary drainage networks." Another difference between the current FDS and the Field and Pearthree evaluation is the exclusion of small islands of L1 in the lower piedmont. As indicated above, some islands smaller than about 5 acres were not separated out in the current study. Finally, a number of areas identified as L2 surfaces by Field and Pearthree have been given a Shaded X designation in this study. The authors of this study made the judgment that these areas, while having some geologic flood potential, lie outside the one percent chance limits. The Shaded X area reasonably represents the fact that while flood prone at some level, the frequency of flooding on those surfaces is less than one percent. Additionally, these areas receive floodwaters from local tributary drainage and as such are not completely flood free. Consequently, designation as Zone X (unshaded) is unwarranted.

Verification using HEC-RAS cross sections was not performed for the Site 1 and 2 delineation because the geomorphic data were adequate to define the flood hazard. The extremely wide flood hazard area would undoubtedly contain the full apex discharge (e.g., the combined apex discharge of 1,598 cfs would require a width of only 319 feet to convey the 100-year peak at an average depth of one foot and velocity of five feet per second). The maximum width of the Site 2 fan is approximately 20,000 feet.

Overall, the 100-year flood hazard assessment of the Site 1 and 2 piedmont and alluvial fan is believed to be reasonable, sound, and defensible based on the data presented in this Technical Data Notebook. However, revisions to the mapping presented here could be justified based on more detailed topographic mapping, hydrologic and hydraulic analyses in the future.

6B.6.3 Limitations

Every modeling and mapping methodology has limitations. The limitations of the approximate geomorphic floodplain delineation method used for the Site 1 and 2 alluvial fan are summarized below.

6B.6.3.1 Scale of mapping

The mapping for this study was compiled onto 1:12000 scale maps. The 2004 aerial photographs used are of excellent resolution that did not limit interpretation at the map scale. Nevertheless, the size of the alluvial fan landforms considered precludes the level of detail possible when mapping at an individual lot basis.

6B.6.3.2 Accuracy of mapping

Map accuracy is also a limitation for some of the data sources used such as NRCS and AZGS soils and flood hazard mapping. These maps were scanned and semi-rectified, but some horizontal displacement remained. Additionally, in the process of transferring field and photo interpretations to the DOQs, the accuracy is limited to one's ability to identify precisely identical locations on each photograph. Through the use of landmarks, distinctive channel features and patterns, large trees, etc. it is believed that these errors have been minimized.

6B.6.3.3 Time period of historical photo record

Period of record for historical aerial photos spans 50 years. While this is a reasonably long period, it does not ensure that a 100-year event occurred during this time period, or that the full range of expected alluvial fan processes has been observed. However, use of geomorphic data extends the period of record significantly.

6B.7 Work Study Maps

This study includes geomorphic mapping and floodplain delineation of parts of the Site 1 and 2 alluvial fans. The figures for Section 6B, including a cover sheet showing the project location and 11" x 17" versions of the Stage 1 Landform map, Stage 2 Stability map, and Stage 3 Floodplain map, are located at the end of Section 6B of the Technical Data Notebook.

Portions of the approximate method floodplain delineation for the alluvial fan overwrite and replaces existing (unnumbered) Zone A delineations downstream of Sun Valley Parkway in the areas where the current study overlaps the effective study. The existing Zone A delineations, performed as part of the Sun Valley Parkway North Floodplain Delineation Study (A-N West, Inc, 1993) did not recognize the area as part of an alluvial fan and subject to alluvial fan flooding. Therefore, the alluvial fan floodplain delineations replace the previous riverine approximate method floodplain delineations on the effective FIRM in the areas of overlap.

6B.8 References

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SECTION 7: DRAFT FIS

7.1 Summary of Discharges

See Section 4 and Table 4.2 for detail regarding the origin of the discharges presented below.

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Year	50-year	100-Year	500-Year
White Tank Fan 1 – Section 200 (S110)	0.43			662	
White Tank Fan 2 – Section 500 (S900)	1.03			936	

7.2 Floodway Data

Floodway data tables are not presented in this TDN.

7.3 Annotated Flood Insurance Rate Maps

See Exhibit C of this TDN.

7.4 Flood Profiles

Flood profiles are not presented in this TDN.

Appendix A

References

1. Aerial Mapping Company, 1999, Color stereographic aerial photographs of White Tank fan approximate delineation study area, flight date 9-25-99, scale 1:9,600 and flight date 10-6-99, scale 1:32,000.

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Appendix B

Correspondence

APPENDIX B

B.1 Special Problem Reports

B.2 Contact (telephone) Reports

B.3 Meeting Minutes or Reports

B.4 General Correspondence

B.5 Contract Documents

B.6 Public Notification

B.7 FEMA Correspondence

B.1 Special Problem Reports

B.2 Contact (telephone) Reports

B.3 Meeting Minutes or Reports

FCD 2007C051
Assignment #2
White Tank Mountains Alluvial Fan #1 and #2 Floodplain Delineation Study

August 5, 2008 Kickoff Meeting Minutes

1. Introductions

- Attendance: See attached sign in sheet

2. Scope Overview

- Perform hydrologic, geomorphic and hydraulic analyses to determine extent of the flood hazard associated with Fans 1 and 2
- Will incorporate the impacts of the Sun Valley Parkway drainage features
  - Impacted subdivisions are Sun City Festival and Festival Foothills
- Will keep Buckeye and the developer informed regarding the project's status and results
- We have up to 4 meetings included in the assignment to share and discuss information
- The schedule does not really allow for a full formal review by the developer's engineer
  - When the District receives information it will be forwarded to Pulte/CVL with the understanding that it has not been reviewed by the District
- Time is tight for completion by end of the year. FCD staff will be expected to turn reviews around in roughly a week. You will be provided a "heads up" regarding when submittal is coming to make room your schedules.
  - Where appropriate, JEF will break submittals up when certain sections are complete to ease the review process and timeline.
- At some point FCD will need to contact MCDOT about O&M plans regarding the SVP channel. Valerie will contact Dick Wallace and start the coordination process
- FCD will coordinate with the Town of Buckeye. Point of contact to be determined
- Intent is the final product will go to FEMA. Public meeting will occur prior to going to FEMA. Buckeye's signature is required prior to going to FEMA as well.
  - Hans stated that the meeting could be held at the Festival Recreation Center
- If issues arise during the analysis we will work through them but most likely if the issue is large enough it will be resolved under another assignment/contract

3. Personnel Assignments

Kathryn Gross	Project Manager, Floodplain Delineation review, if necessary Richard Harris will assist in reviews
Julie Cox	Hydrology
Bing Zhao/Apurba Borah/ Richard Waskowsky	Sediment Yield and Transport

Hans Koppenhoefer will be the point of contact for Pulte
A point of contact for the Town of Buckeye and Scoutten Engineering will be established in the near future

Discussion will be had with Tim M. and Amir regarding which of their two branches the FLO-2D review should take place in. Might be staff schedule dependent.

4. Data Collection Issues

- CVL contour cds
  - JEF will look the data over and ask any questions over the next week
  - CVL will verify datum
- FCD database – delivered at meeting
- SVP channel report and rough survey of channel and drop structures – JEF would like a copy
- CVL – status of as-builts, Hans discussed the status of the as-builts for the subdivision. As-builts will become an issue later in the project. If we do not have as-builts by December we will still be able to go to FEMA and will just wait and see if FEMA requests them
- CVL mass points and breakline file
  - Valerie reported that one file was missing.
  - Having Steve Bruffy in our office create a DTM and contour file.
  - CVL stated they will provide us with the missing file.
- FCD requested 2 copies of the Master Drainage Report for Sun City Festival. One for FCD, one for JEF

5. Hydrology

- Starting from the original Fan 1 and 2 hydrology
- No refinement above the apex
- Which NOAA to use was discussed. Kathryn will discuss with Tim M./Amir/Julie and answer will be provided by end of the week
- Possibility for using FLO-2D for routing
- Geomorphic capacity for breakout to 3-13-16
- Attempting to determine best discharges to use:
  - At the parkway channel, 3 significant inflow points and 3-13-16 breakout
  - At the parkway at culverts east of channel
- If possible, run one FLO-2D model with only Fan #1's incoming discharge to see if those flows make it to the land east of the Sun Valley Parkway channel

6. Floodplain Delineation

- Use geomorphic methods, see if any refinement of zones possible south of parkway with the topography/FLO-2D results
- Hydraulic methods for roadway and through Sun City Festival
- As analysis moves forward we will determine what FEMA levee or embankment issues may need to be addressed. Currently, we anticipate that any raised embankment (above natural grade) be modeled as if it were not there (for downstream flows) and as if it functioned (for diverted flow), i.e., worst case conditions.
- If analysis of the Sun Valley Parkway channel shows lack of capacity we will need to demonstrate where the out of channel flow will go if the Sun Valley Road Embankment is not in place. We are allowed to use the Sun City Festival contours for the analysis
- If we wanted to treat Sun Valley Parkway as a levee we would need it to meet all levee criteria, geotech would be needed as well as a letter from MCDOT saying it is certified as a levee and that MCDOT will oversee and maintain it as such. Most likely addressing Sun Valley Parkway as an embankment will be a better way to go

- Regarding other flows reaching the Sun Valley Parkway embankment and culverts, the analysis will need to treat Sun Valley Parkway as not in place and show how flows would continue through the subdivision. Culvert cannot decrease downstream discharge
- Resulting delineation will be Zone A; however, the analysis will essentially be detailed

7. Sediment Transport

- Yield to and Transport through the Channel will be computed
- Yield to the culverts will be computed
- Analysis will determine the sediment transport capacity at the apex and as well as the summed sediment transport capacity of the downstream distributary channels
- Sediment size data will be taken from the Sun Valley ADMP report.
- Only 100-year sediment modeling is scoped.

8. Deliverables

- Interim digital submittals are fine
- TDN – follow same outline and deliverables as the other White Tank Fan TDNs
- HIS – provide what is listed in the scope

9. Schedule

- Project to be completed by 12/31/08, as noted in scope of services.
- The schedule starts when JEF acknowledges that all requested data has been provided.

Action Items:

FCDMC

1. District will supply the initial survey and hydraulic analysis of the Sun Valley Parkway Channel to JEF by end of the week (COMPLETED)
2. District will inform JEF which NOAA Atlas to use by the end of the week (COMPLETED)
3. District will provide JEF with the mass points TIN by the end of the week (COMPLETED)
4. Kathryn will meet with Amir and Tim regarding FLO-2D reviews
5. Valerie will contact Dick Wallace at MCDOT regarding Sun Valley Channel operations and maintenance
6. Kathryn will establish a point of contact at the Town of Buckeye and Scoutten Engineering, if applicable

CVL

1. CVL will provide the datum information (horizontal and vertical) for the contour data provided to the District
2. CVL will provide the missing breakline data to the District (COMPLETED)
3. CVL will provide two copies of the Sun City Festival Master Drainage Report to the District and JEF (COMPLETED)
4. CVL will provide pertinent as-builts when they become available/are needed (COMPLETED)

JEFULLER

1. Will review all the data over the next week and determine if any additional information is needed

FCD 2007C051
Assignment #2
White Tank Mountains Alluvial Fan #1 and #2
Floodplain Delineation Study
September 24, 2008 Progress Meeting

Meeting Minutes

1. Data Collection

- Anything outstanding? – None.
- Topography/ TIN development issues/concerns
    i. District did download the TIN – no review yet
        1. Fuller did have to revise the original District created "Festivaltin" after noticing some issues at the Sun Valley Channel
        2. Using the original data points from the Pulte mapping provided by CVL cleared up the issue
        3. This recompiling of the TIN was not anticipated but does not appear to be impacting project schedule or budget
        4. Hans Koppenhoefer said that he could get Vistoso's project manager information (Dick Mays) to Jon to attempt to get their mapping product for the portion of the watershed west of Pulte's piece. Jon would handle contacting him.
    ii. District 10 ft mapping issues (break lines)
        1. JEFuller identified areas in the 10 foot mapping where there appear to be errors in the break line data
        2. JEFuller submitted a shape file showing the locations
        3. Bing recommended that Hari go in and check the specific break lines to see if they are coded wrong or if the problem lies in the compilation of the TIN. Hari said he would check with Kathryn stating the check should not be too involved as to start impacted budget and timeline. The break line issue occurs in most watersheds so most likely the break lines are coded wrong.
        4. As a resolution, it was decided that in areas where the break lines are in error, only the mass points will be used.

2. Hydrology

- Status of hydrologic analysis
- FLO-2D hydrology model
    i. FLO-2D model is being used below the hydrographic apexes
    ii. The 6-hour storm appears to be in control
    iii. At present there are 3 inflow points into the model – apexes and a tributary near the toe of the fan and Sun Valley Channel

iv. The present grid is 100 ft. The District expressed an interest in having a smaller grid of 50 ft. JEFuller said they would create one and evaluate which may be better.
v. Significant infiltration occurs in the model
vi. Bing recommended testing a section of the watershed with a smaller grid to see the impacts on rainfall infiltration and runoff

- Comparison to Sun Valley hydrology model
    1. Example subbasin S115: HEC-1 in 1000s of cfs versus FLO-2D in 100s of cfs
    2. Example downstream combination point C115D: HEC-1 at 1700 cfs versus FLO-2D of close to 1700 cfs (however, the FLO-2D includes a HEC-1 subbasin that does not combine with C115D; this downstream point in HEC-1 is 2700 cfs)
    3. Overall, the FLO-2D values are deviating from the Sun Valley ADMP hydrology numbers. It was decided that was ok and to continue to move forward with the FLO-2D analysis.
- Discussion regarding a FLO-2D-only hydrology and implications for revisions by others
    i. Kathryn warned that using FLO-2D for the hydrology would essentially require anyone in the study area to use it in the future to make sure there were not discrepancies in discharge. Julie said that the Hydrology Branch was aware of the implications regarding using FLO-2D for the hydrology.
    ii. Hans was informed that since there was a high level of sheet flow and infiltration in the natural condition that Pulte's development would have to address and handle how the discharge would change due to development and ensure that a worse condition discharge was not delivered to Sun Valley Parkway in the developed condition.

3. Hydraulics

- Status of hydraulic analysis
- Sun Valley Parkway channel
    i. Started with District model and updated.
    ii. Cross-sections taken at the top and bottom of all drop structures
    iii. Bing recommended modeling the drop structures as in-line weirs. JEFuller said they would look into it
    iv. Channel capacity is determined up to edge of channel and is based on the lowest capacity identified for a given reach
    v. Initial analysis shows that capacity quickly increases in the channel and that there is roughly capacity for 4000 cfs in the middle and lower channel reaches
- HY8 for culverts
    i. HY8 analysis for the culverts is being performed

4. Sediment Yield and Transport

- Status of analysis – will start when hydrology and hydraulics are further along

i. Bing mentioned that he may want a different sediment equation used instead of the one listed in the scope. JEFuller will check with Bing regarding which equations to use prior to undertaking any of the sediment analysis tasks.

5. Floodplain Delineation

- Status of analysis – will come after hydrology and hydraulics are complete

6. Schedule

- JEFuller anticipates that the FLO-2D, RAS channel analysis, and HY8 analysis will be submitted on October 6th.
- Analyses are being done concurrently which makes the FLO-2D hydrology appear behind schedule and the hydraulics ahead of schedule
- Overall the project is on schedule

7. Other/Miscellaneous

- none

B.4 General Correspondence

JE Fuller/ Hydrology & Geomorphology, Inc.

Jon Fuller, PE, RG, PH, CFM, DWRE	Brian Iserman, PE, CFM	Brian Fry, PE, CFM	John Wallace, PE, CFM
Ted Lehman, PE	Jeff Despain, PE, CFM	Brian Schalk, PE, CFM	Robert Shand, PE
W. Scott Ogden, PE, CFM	Patricia Quinn, PE, RLS	Jon Ahern, PE, CFM	Ian Sharp, PE, CFM
Robert Lyons, PE, CFM	Dave Meyer, GIT	Skyler Witalison, BS	Chris Rod, PE
Mike Kellogg, RG, CFM	Dwight Nield, BS	Nate Vaughan, PE	Joaquin Solis, PE
Hari Sundararaghavan, PhD, PE, CFM	Annette Griffin, AAS	Cory Helton, EIT, MS	Cyrus Miller, PE, CFM
			Marti Craft, MS, CFM

Date: 1/13/09

Kathryn Gross,
Project Manager,
Planning & Project Management Division
FCDMC

RE: **Response to Review Comments on Sediment Yield to Sun Valley Parkway by JEFuller Hydrology and Geomorphology, dated December 19, 2008**

Dear Kathryn:

Following are the responses by JE Fuller to the comments on the Sediment Yield:

FLO-2D Basic model and Hydrology model

1. Is it possible to trim the Area 4 Hydrology models to generate a modified model that includes only the contributing area for the project (Fans 1 and 2 and other parts of the watershed contributing to SVP channel)?
   JEF Response: JEF will trim the HEC1 models to Fans 1 and 2 areas only.

2. It is recommended that a map be submitted with the FLO-2D cross sections and results shown.
   JEF Response: JEF will include a map showing FLO-2D output locations along with results.

3. There are some discrepancies between the HEC-1 hydrographs and the hydrographs included in the FLO-2D model. Please look into the differences. See table below for HEC-1 vs FLO-2D peak flows. The FLO-2D inflow hydrographs should be identical to the HEC-1 inflow hydrographs. The bold discharges show the differences.
   JEF Response: The peak values in FLO-2D model hydrographs were missed by a 15 minute discretization compared to 5 minute discretization on HEC1 models. The peaks are adjusted in FLO-2D to match the HEC1 model peaks.

4. Regarding S120, when the hydrograph is divided up between the different inflow points, the sum of the points differs from the total peak flow. Please verify.
   JEF Response: The issue is related to comment 3. JEF will adjust the hydrograph to match total peak flow.
5. Was the 3.12" for the 100-yr 6-hr storm areally reduced from the point rainfall of 3.2"?
   JEF Response: Yes.

8400 S. Kyrene Rd., Ste 201	1 West Deer Valley Rd., Ste 101	523 N. Beaver St., 2nd Floor	40 E. Helen Street
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480-839-2193 (fax)	480-839-2193 (fax)	928-214-0887 (fax)	520-623-3130 (fax)

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6. RTIMP was input as 0% for the FLO-2D models. RTIMP values should be the same as RTIMP values in the Sun Valley ADMP Area 4 Hydrology models or modified based on aerial photography.
JEF Response: JEF will use the RTIMP values from Table 1 (page 16) of the Area 4 Hydrology TDN (2006).

7. It is recommended that the consultant use 0.1 instead of 0.2 for the shallow n value.
JEF Response: JEF will use a value of 0.1 in the FLO-2D models.

8. Please re-evaluate the ground elevation used in the vicinity of the points listed in the attached shapefile. For some of the points the aerial photography reveals a channel diversion that the flow data is not recognizing. A few points mark where the model results show a linear pattern in the data. Can either of these issues be resolved?
JEF Response: Based on the recommendation, the topography will be adjusted in the FLO-2D grid.

Scenario Models

9. 5 scenario models were reviewed No specific concerns regarding the methods used to address the flow path uncertainty.
JEF Response: No response

Sincerely,

JE Fuller/Hydrology & Geomorphology, Inc.

Hari Sundararaghavan
Project Engineer

JE Fuller/ Hydrology & Geomorphology, Inc.

Jon Fuller, PE, RG, PH, CFM, DWRE	Brian Iserman, PE, CFM	Brian Fry, PE, CFM	John Wallace, PE, CFM
Ted Lehman, PE	Jeff Despain, PE, CFM	Brian Schalk, PE, CFM	Robert Shand, PE
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			Marti Craft, MS, CFM

Date: 1/13/09

Kathryn Gross,
Project Manager,
Planning & Project Management Division
FCDMC

RE: **Response to Review Comments on Sediment Yield to Sun Valley Parkway by JEFuller Hydrology and Geomorphology, dated December 19, 2008**

Dear Kathryn:

Following are the responses by JE Fuller to the comments on the Sediment Yield:

1. The statement "The results indicate adequate capacity for the entire channel. At the upstream end of the model, there is significant impact on the capacity of the channel" is contradictory. A better quantitative explanation or analysis is needed. Based on the submitted HEC-RAS results, we did not see the capacity issue in the upstream end.
   JEF Response: The text will be modified as per FCDMC recommendation.
2. ChannelDischarges.xls: Units for column values are missing in worksheet1. Column headers are mismatched in worksheet 2 and worksheet 3.
   JEF Response: Column Headers will be fixed.
3. Please verify all the excel worksheets as column headers are missing (For example: Sediment Gradations.xls) in many worksheets. Also a title at the top of the worksheet will aid readers to review the information easily.
   JEF Response: Column headers will be added.
4. Manning's n values range from 0.025 to 0.045 in HEC-RAS simulation, however n=0.04 is used in sediment capacity calculations in eq_slope.xls. Is there any reason for not using similar n values for the cross sections?
   JEF Response : The Mannings n values will be changed to match the conveyance weighted HEC-RAS Manning's n values.
5. We recommend that the consultant show the aggrading thalweg and existing thalweg of the Sun Valley Parkway Channel in Appendix. This effort will be minimum as the data are already present in eq_slope.xls (HecrasChlDepths worksheet).
   JEF Response: The data from HecrasChlDepths worksheet will be presented in the Appendix

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6. Notes on sediment transport need to be expanded and to be put in appendix so that reader can review it easily.
JEF Response: JEF will expand the notes on sediment transport in the TDN.

Sincerely,

JE Fuller/Hydrology & Geomorphology, Inc.

Hari Sundararaghavan
Project Engineer

Memorandum JE Fuller/ Hydrology & Geomorphology, Inc.

DATE: January 30, 2009

TO: Kathryn Gross/FCDMC

FROM: Jon Fuller, PE

RE: 2007C051- Task 2: Fan 1-2 Delineation

CC: File

The District has reviewed the above report and has the following comments.

Hydrology Analysis

1. Please address the comments from Julie Cox regarding the hydrology. (Attached below)

JEF Response: Julie Cox's comments have been addressed (See below).

2. Make sure the appropriate updates to Appendix D are made for the inclusion of subbasin S120's parameter documentation.

JEF Response: S120 is incorporated into Appendix D.

Sediment Analysis

1. Please address the comments from Apurba Borah regarding the sediment analysis and Section 6A and Appendix F of the TDN.
JEF Response: All sediment analysis comments have been addressed.

Hydraulic Analysis

Upstream Zone A Floodplains

1. Modeling of upstream floodplains seems reasonable.

JEF Response: Concur.

2. All supporting documentation was provided in the TDN.

JEF Response: Concur.

Sun Valley Parkway Channel Modeling

1. Channel modeling appears reasonable

JEF Response: Concur.

2. Selection of discharges from the FLO-2D for use in the RAS models appears reasonable.

JEF Response: Concur.

FLO-2D modeling north of Sun Valley Parkway

1. Please include these models in the TDN package and add text describing the scenarios and that the combined scenarios were used to assist in the floodplain delineation determination north of the Parkway.

JEF Response: JEF has included the models in TDN package and included text as well.

2. Add a figure or exhibit showing the combined scenario FLO-2D limits.

JEF Response: Requested figure has been added.

3. Models submitted after the formal submittal appear reasonable.

JEF Response: Concur.

HY8 Analysis

1. No comments.

TDN Comments

1. Page 1-2, Figure 1.1. Can the figure only include the Fan 1 and 2 watersheds?

JEF Response: Done.

2. Page 1-4 section 1.4.1. Please provide the specific FLO-2D version in the text (i.e. 2007.06).

JEF Response: Done.

3. Page 3-1, section 3.2. Remove last sentence. It is not necessary in the mapping description section.

JEF Response: Done.

4. Page 4-6, Table 4.1. Subbasin S120 needs to be included in the table and the discussions.

JEF Response: Done. The comment should refer to Table 4.2 rather than 4.1.

5. Page 5-2, section 5.2, second paragraph. May need to revise the text. Officially, the District does not use administrative floodways anymore. Can be discussed further.

JEF Response: Done.

6. Page 5-2, section 5.2, third paragraph. Need to discuss possible text change regarding the Sun Valley Parkway North study.

JEF Response: Done.

Page 5-6, section 5.9. Please add a statement regarding the Sun Valley Parkway channel having capacity within the channel limits.

JEF Response: Done.

7. Page 5-7, Table 5.1. Should the Sun Valley Parkway RAS results be shown here as well?

JEF Response: Done.

8. Page 5-8, section 5.10, first paragraph. Change the text to Table 5.2 instead of Table 5.1.

JEF Response: Done.

9. Page 6-11 and 6-12. The Sun Valley ADMP Fan TDNS are FEMA approved. Should they be shifted into the previous list of conducted studies?

JEF Response: Done.

10. Page 6-12, studies by others. White Tank Fans Sites 7, 8, 12, 9 was performed by JEF, not David Evans and Associates.

JEF Response: Done.

Page 6-13, section 6B.2.3 Modern Orthophotography. Should the reference to SVADMP be removed here?

JEF Response: Done.

11. Page 6-14, Table 6B.3. Consider reducing the table to the topography sets for the White Tank Fan 1 and 2 areas. Also, consider adding to the table and the discussion. The Pulte mapping product.

JEF Response: Done.

12. Page 6-40, second paragraph. The paragraph mentions a lack of flow containment to the east that is reflected in the RAS model. The RAS model does not show this eastern lack of containment. Please revisit the text in this section.

JEF Response: Done.

13. Page 6-42, first partial paragraph on page. Please add "by" between "disturbed not only.." and "the stock tank."

JEF Response: Done.

14. Page 6-42, second paragraph. SVADMP is listed in the paragraph, should it be removed and just state "the study area" versus "the SVADMP study area?"

JEF Response: Done.

15. Page 6-42, third paragraph. Can the text be rephrased to remove "the District preferred". How about discussion again regarding "uncertainty" can be set aside in this area?

JEF Response: Done.

16. Page 6-43, top paragraph. Correct the "FLO-2D *were used* (See Sec. 4 and 5) *were performed*".

JEF Response: Done.

17. Page 6-57, Historical Aerial Photography. Can the digitally rectified 1950's image be included on the cd?

JEF Response: Done.

18. Page 6-61, last paragraph. Should the figure number be 6.28 instead of 6.29?

JEF Response: Done.

19. Page 6-67, Flooding Along Stable Channels bullet. Text refers to verification using RAS across the fan. Was that performed? Should that analysis be included?

JEF Response: Done.

20. Page 6-69, Table 6B.7. Consider removing the reference to the Buckeye FRS structures. Possibly include the downstream A zones north of Sun Valley Parkway.

JEF Response: Done.

21. Page 6-71, Figure 6.29. It appears that the Zone As north of Sun Valley Parkway are not included in the legend and are coded the same as X unshaded. Please correct.

JEF Response: Done.

22. Page 6-73, section 6B.7. Need to discuss possible text change regarding the Sun Valley Parkway North study.

JEF Response: Done.

23. Section 1.6 (page 1-5). In the study results discussion please consider adding a sentence stating that the floodplain is contained within the Sun Valley Parkway channel.

JEF Response: Done.

24. Appendix E. Could the Sun Valley Parkway Channel HEC-RAS cross-section sheets be published as 24x36 sheets and include the contours (plus index contour labels) from the detailed topography from Pulte? This may help FEMA verify the cross-section info.

25. On the cd, please include the 10-ft county contours and the Pulte contours, if possible.

JEF Response: Done.

26. Please create an Appendix H for the Operations and Maintenance information for Sun Valley Parkway Channel.

JEF Response: Done.

27. Along with the Festival As-builts, please include an excerpt of the drainage report to document the design capacity of the channel through the subdivision.

JEF Response: Done.

FEMA Form Comments

1. Buckeye signature page. Scott Lowe no longer signs FEMA forms. It is Jeanine Guy. If you like, you can leave all but the Community name blank and they can fill in the rest.

JEF Response: Done.

2. Fan 1 H&H form, section A number 3. Should FLO-2D be listed as a used hydrology model?

JEF Response: Done.

3. Fan 1 H&H form, section B number 4. Two hydraulic models actually support this study: ZoneA12 and SVPkwy_chnl.

JEF Response: Done.

4. Fan 2 H&H form. Fix first page.

JEF Response: Done.

5. Fan 2 H&H form, section A number 3. Should FLO-2D be listed as a used hydrology model?

JEF Response: Done.

6. Fan 1 H&H form, section B number 4. Two hydraulic models actually support this study: ZoneA12 and SVPkwy_chnl.

JEF Response: Done.

7. Fan 2 Riverine structures form, section A, B, F. Is this form needed? Make sure that the Riverine structures forms and Alluvial Fan Flooding forms state consistent info.

JEF Response: Done.

8. Fan 1 Alluvial Fan Flooding Form, section B number 1. Instead of stating no structural measures are proposed, state that a channel was built.

JEF Response: Done.

9. Fan 2 Alluvial Fan Flooding Form, section B number 1. Instead of stating no structural measures are proposed, state that a channel was built. Unless this does not apply to Fan 2. Make sure that the Riverine structures forms and Alluvial Fan Flooding forms state consistent info.

JEF Response: Done.

10. Fan 2 Alluvial Fan Flooding Form, section B number 4. Should sediment information be provided? Make sure that the Riverine structures forms and Alluvial Fan Flooding forms state consistent info.

JEF Response: Done.

3 Stage Exhibits

1. For all exhibits please address the following:

- Correct the spelling of Exhibit in the Title.
- Please include Township, Range, and Sections on the maps.
- Please consider printing all the maps at the same scale and areal extent.
- Possibly add the contour information including index contour labels.
- Consider adding contour lines and index contour labels to the exhibits.
-

JEF Response: Done.

2. Stage 3 Exhibit. The Zone As north of Sun Valley Parkway are either not shown or are coded as X (shaded). Also, the Zone As need to be added to the Legend. Please correct.

JEF Response: Done.

Floodplain Workmaps

1. For all workmaps please re-verify the legend scale and map space scales.

JEF Response: Done.

2. For all workmaps, please add a statement about the vertical datum to the notes section.

JEF Response: Done.

3. For all workmaps, could a more recent aerial photo be used for the background?

JEF Response: 2007 aerials were used where possible.

4. For Sheet 1 of 4:
    - Correct the Match Sheet number from 2 to 3.
    - Change the line symbol from a dashed line to a solid line for non-floodway delineations.

JEF Response: Done.

5. For Sheet 2 of 4:
    - Please add a "flows contained in channel" note for the Sun Valley Parkway channel.
    - Change the line symbol from a dashed line to a solid line for non-floodway delineations.

JEF Response: Done.

6. For Sheet 3 of 4:
    - Need to discuss the UFD limits at the Parkway.
    - Change the line symbol from a dashed line to a solid line for non-floodway delineations.
    - Need to add a note about the channel capacity in Sun City Festival.

JEF Response: Done.

7. For Sheet 4 of 4:
    - Need to discuss appropriate line symbol for delineation above the hydrographic apex.

JEF Response: Done.

Annotated Panels

1. For all panels, consider placing the administrative floodway note within the map panel itself.

JEF Response: Done.

1. For panels 1115H and 1095H, please add a "flows contained in channel" note to the Sun Valley Parkway Zone A and for panel 1115H, please add a "flow contained in channel" note with arrow pointing to the constructed Pulte channel

JEF Response: Done.

FLO-2D/Hydrology

1. In the FLO-2D models, the 6-hr point rainfall of 3.2" was areally reduced to 3.12". The 24-hr point rainfall of 4.2" was not areally reduced. Check FLO-2D models and change as necessary.

JEF Response: The value 1.0 was used for areal reduction as a conservative approach for this approximate study.

1. Page 1 of the letter refers to sediment yield. Change as necessary.

JEF Response: Done.

2. Why is sub-basin 120 not included in the HEC-1 models, DDMSW, and Table 4.2 for informational purposes?

JEF Response: S120 is included in the Appendices and Table 4.2.

2. I redlined Plates 1-3. You can provide the consultant with the originals so they can see what needs to be changed.

JEF Response: Redlines addressed and new plates generated.

3. Report, Page 1-1, Section 1.1. Replace "Buckeye Sun Valley Area Drainage Master Study (PBS&J 2005)" with "Sun Valley Area Drainage Master Plan".

JEF Response: Not done per guidance from Kathryn Gross, Project Manager.

4. The SVP_EX6.OUT file provided is empty. Please resubmit the CD with this model included.

JEF Response: File is fixed and included in DVD.

3. The FLO-2D modeling scenarios and results seem reasonable.

JEF Response: Concur.

4. The map of "Peak Discharges Estimated Using FLO-2D" needs to be cleaned up. The Q for XS #17 is not shown. The Q for XS #13 is 3 cfs. The Q for XS #14 is 215 cfs. The Q for XS #15 is 182 cfs.

JEF Response: Map cleaned up.

B.5 Contract Documents

FLOOD CONTROL DISTRICT of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009
(602) 506-1501
Fax (602) 506-4601

LETTER OF TRANSMITTAL

TO: Jonathan Fuller, PE
JE Fuller/Hydrology & Geomorphology, Inc.
8400 S. Kyrene Road, Suite 201
Tempe, AZ 85284

July 29, 2008

SUBJECT: Contract No. 2007C051
Assignment No. 2
White Tank Mountain Alluvial Fans #1 and #2 Floodplain Delineation Study

WE ARE SENDING YOU THE FOLLOWING ITEMS:
( ) Enclosed ( ) Under separate cover

	Shop Drawings	Prints	Legal Description	Samples
	Specification	Change Order	Copy of Letter	Plans
X	Notice to Proceed			
X	Certificate of Performance			
X	Scope of Work			

THESE ARE TRANSMITTED:

	For Approval	Approved as submitted
X	For your use	Approved as noted
	As requested	Returned for corrections
	Resubmit ( ) copies for approval	For review and comments
	Submit ( ) copies for distribution	Return ( ) corrected prints
	FOR ESTIMATE DUE:	Borrowed prints being returned

Remarks: Please specify assignment number on all correspondence.

SIGNED: _____

Kathryn Gross
Senior Hydrologist

FLOOD CONTROL DISTRICT of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009
(602) 506-1501
Fax (602) 506-4601

NOTICE TO PROCEED

TO: Jonathan Fuller, PE
JE Fuller/Hydrology & Geomorphology, Inc.
8400 S. Kyrene Road, Suite 201
Tempe, AZ 85284

July 30, 2008

SUBJECT:

PCN	003.01.03	Low Org	9176
FCD Contract No.	2007C051		
Assignment No.	2		

White Tank Mountain Alluvial Fans #1 and #2 Floodplain Delineation Study

Your not-to-exceed cost estimate of $107,332.92 for Assignment No. 2 has been received and accepted for this project with a completion date of 1/9/2009. You are hereby authorized to proceed with the work for the referenced project as originally described in the Scope of Work. Please specify the contract title, contract number, assignment number, and the dates of the completed service on all related correspondence, including the invoice. Send the invoices and certificates of performance to the attention of Finance Department, Flood Control District of Maricopa County. The certificate of performance must be dated on or after the final invoice date and must accompany the final invoices.

The purpose of Assignment #2 is to refine and finalize the floodplain delineation study for White Tank Mountains Alluvial Fans #1 and #2. The delineation study will be a mix of geomorphic and hydraulic methods to determine the floodplain limits south of Sun Valley Parkway and north of the Parkway including the recently constructed Sun City Festival subdivisions. The influence of the Sun Valley Parkway channel and Sun Valley Parkway culverts and embankment will be analyzed and incorporated into the delineation where appropriate.

If at any time during the project assignment a material change in the scope of services to be provided occurs, causing an increase in the original cost estimate shown here, you must provide the District with a written explanation of the additional work along with an estimate of additional costs. No additional work shall commence prior to written authorization by the District. No claims for additional work shall be accepted that have not received prior District approval.

SIGNED:

Kathryn Gross
Senior Hydrologist

Timothy S. Phillips, P.E.
Chief Engineer and General Manager

Copy to: LMM (Finance)

COORD: MRB LMM EAR DUR CJF DAW GLJ VAS TMM

INFO:

FILE: 2007C051

Flood Control District
of Maricopa County

INTEROFFICE MEMORANDUM

Date: July 29, 2008

To: Tim Phillips, P.E. TSP 8/4/08

From: Kathryn Gross, CFM, Senior Hydrologist

Subject: Project Title: White Tank Mountains Alluvial Fans # 1 and # 2 Floodplain Delineation Study
Contract Number: FCD2007C051
Consultant / Contractor Name: JEFuller Hydrology and Geomorphology
Change Order or Assignment Number: Assignment # 2

The purpose of Assignment # 2 is to refine and finalize the floodplain delineation study for White Tank Mountains Alluvial Fans # 1 and # 2. These delineations were originally developed as part of the Sun Valley ADMP floodplain delineations; but additional analysis is needed to determine the impact of Sun Valley Parkway. These impacts include the Sun Valley embankment and associated drainage facilities which will be analyzed and then incorporated into the existing delineation. It is anticipated this analysis will show a reduction to the current draft identified floodplain limits.

All analyses will be completed within 4 months with an additional month to finalize the report. Results of this study and its methods will be included in method evaluations that will be performed under FCD2008C007.

This additional work has been anticipated since the draft results of the floodplain delineation study in early 2006. Funding is now available and the project's priority has been elevated due to a request to Tim Phillips by the Town of Buckeye and the Sun City Festival developers.

The need for this assignment was not generated by error or oversight.

Kathryn Gross

2801 West Durango Street Phoenix, Arizona 85009 Phone: 602-506-1501 Fax: 602-506-4601

	Intl	Date
Chief Engineer/General Manager		
9 Phillips	TP	
Medina		
PIO		
Munoz		
D.Smith		
Scheider		
Wegner		
Human Resources		
Trottie		
Simpson		
Facilities Mgt.		
Robinson		
Admin. Support		
Mendenhall		
Harrington		
Charles		
Figueroa		
Wu		
Hernandez		
Aguirre		
Regester		
Administration Division		
Lopez		
Contract Services		
Woosley		
7 Bauer ✓	MMB	8-1-08
McGuire		
Financial Services		
6 Mardian	Lm/M	7/31/08
Janinski		
Turner		
Scott		
Rose		
Mageo		
Arteaga		
Stevens		
Engineering Division		
5 Raleigh		
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Hathaway		
2b Jones		7/29/08
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Lokey		
Terry		
2a Swick	KB	7/29/08
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Structures Management Branch		
Renckly		
Lambert		
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Velasco		
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Gutierrez		
King		
Valenzuela		
Stanczyk		
FMS Management & Services		
Sertich		
Gorbenko		
FMS Management		
Thomas		
Development Review		
DeRoulhac		
DeVlieg		
Balozian		
FMS Admin		
Collins		
Gattuso		
Baranowski		
Gease		
Mendoza(P&D)		
LeBeau		
Castillo		
Enforcement /Inspections		
Gregg		
Smith		
Carroll		
South		
Bancod		

Central Files.

File#

Comments

Originator: KAG

Date: 7/29/08

Certificate of Performance of Engineering Open Order Contract and Payment of All Claims

I, _____, hereby certify to the Flood Control District of Maricopa County (FCDMC) that all lawful claims for labor, rental of equipment, material used, and any other claims by company, or its subcontractors in connection with the specific assignment described below and as authorized by the terms of the FCDMC Contract 2007C051 have been paid.

Company understands that with receipt of payment for previously invoiced amounts plus any retained funds, that this is a settlement of all claims of every nature and kind against the FCDMC arising out of the performance of the FCDMC's specific assignment through FCDMC Contract 2007C051 for Assignment No. 2 relating to the material, equipment, and work covered in and required by the contract.

The undersigned hereby certifies that to his/her knowledge, no contractual disputes exist in regard to this contract and that he/she has no knowledge of any pending or potential claims in regard to this contract.

Upon submission of this document and a separate invoice for any retained funds to the FCDMC, invoice processing will be completed within forty-five (45) calendar days.

Signed the _____ day of _____, 200__.

_____

Signature

Title: _____

JE Fuller/Hydrology & Geomorphology, Inc.

FCDMC 2007C051
Work Assignment #2
Scope of Services
For
Approximate Method Alluvial Fan Floodplain Delineation Study – Fans 1 & 2

Background

The District delineated approximate method alluvial fan floodplains for Fans 1 and 2 as part of the Sun Valley ADMP. Fans 1 and 2 are located on the northern flank of the White Tank Mountain piedmont. The approximate method delineation used did not include sufficient detail to evaluate the impact of Sun Valley Parkway and the Parkway Channel on flood hazards to the north, as well as to determine the nature of flow that crosses Sun Valley Parkway east of the channel. More detailed analysis of Sun Valley Parkway and the constructed channel is required to determine if existing development to the north is subject to 100-year flood hazards. The approximate delineation will cover the floodplains of Fans 1 and 2 from just upstream of the fan apexes (approximate method riverine delineations) to the confluence with Wagner Wash or to the CAP embankment. Any flow leaving the Sun Valley ADMP study limit boundaries and entering the Wittmann ADMP study area will be marked with a limit of study with no further mapping.

Scope of Services

Task 1. Approximate Floodplain Delineations. Approximate floodplain delineations will be performed using appropriate riverine and alluvial fan methodologies as described in DISTRICT and FEMA guidelines. The CONSULTANT shall conduct the study using the guidelines established in FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners, February 2002, Arizona Department of Water Resources' State Standard 1-97 "Requirement for Flood Study Technical Documentation, and the District's Piedmont Flood Hazard Assessment Manual (PFHAM).

1.1.1. Approximate Alluvial Fan Floodplain Delineations for Fans 1 and 2 will be based on a three stage process where landforms are first identified (Stage 1), then the stability of the landforms are determined (Stage 2), and the formal floodplain delineation is delineated based on hydraulic indicators and the results of Stage 1 and Stage 2 (Stage 3).

1.1.2. Fan Areas and Riverine Floodplains Located Upstream of Sun Valley Parkway. Approximate method alluvial fan and riverine floodplain delineations previously submitted to the District will be used for the areas upstream of Sun Valley Parkway will be used for this task. The previous delineation upstream of Sun Valley Parkway will be qualitatively cross-checked using any new topography delivered to JEF within two weeks of notice to proceed for this work assignment. No significant changes in the previously submitted Fan 1-2 delineations are anticipated.

1.1.3. Hydrology. 100-year peak discharges developed for Fans 1 and 2 for the previously submitted TDN will be used for each fan apex using District Hydrology Manual procedures and will be generally compatible with the Sun Valley ADMP HEC-1 modeling results. Additional HEC-1 hydrologic or FLO-2D modeling will be required to route apex discharges to Sun Valley Parkway and to account for tributary inflows. The CONSULTANT will develop the following hydrologic data:

1.1.3.1. Peak discharges at the Sun Valley Parkway Channel. Peak discharges will be developed from a HEC-1 model either developed for this study or obtained from the SVADMP HEC-1 models at the upstream end of the channel and at up to three significant inflow points along the channel, as well as at the breakout flow path toward Fan 3-13. At the CONSULTANT's discretion, a large grid (+100 ft) FLO-2D model may be used to develop and route 100-year peak discharges downstream of the fan apexes. If HEC-1 is used, a discharge for the Fan 3-13 breakout flow path will be estimated using the geomorphic capacity approach.

1.1.3.2. Peak discharge at Sun Valley Parkway East of the Channel. Peak discharges for the portion of the fan located east of the Parkway channel will be estimated to reflect the potential for avulsive channel movement upstream, the upstream flow corridor capacity, and the routed hydrograph results.

1.1.4. Hydraulic Modeling

1.1.4.1. Sun Valley Parkway Channel. The capacity (before overtopping Sun Valley Parkway) of the existing channel will be estimated using a HEC-RAS or FLO-2D model developed by the CONSULTANT. The HEC-RAS model will include topographic information for the channel as well as the road profile and left overbank area. Topographic data for the channel modeling will be provided at no cost to JEF by the District, or by area developers. If sufficient mapping is not available from the District or area developers, JEF's survey subconsultant will develop the data under a separate work assignment. The HEC-RAS or FLO-2D model will be used to model the extent of the floodplain along the Parkway Channel.

1.1.4.2. Sun Valley Parkway Culverts. The maximum capacity of culverts under Sun Valley Parkway east of the existing channel will be estimated using HEC-RAS or HY-8. Clogging factors for each culvert will be estimated using District guidelines and the results of the sedimentation engineering analysis.

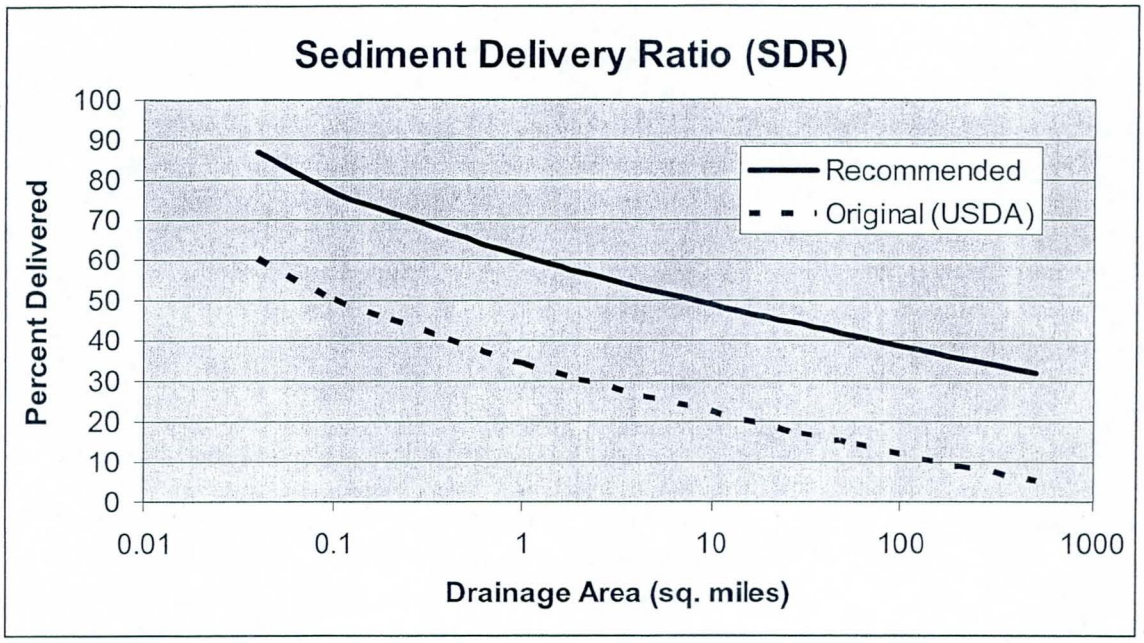
1.1.4.3. Sun Valley Parkway Overtopping. For the portion of Sun Valley Parkway east of the existing channel, the capacity of flow diverted by Sun Valley Parkway will be computed.

1.1.4.4. FEMA Levee Criteria. The CONSULTANT will use current FEMA criteria for levees, levee-like structures, or "topographic features/embankments" to determine the impact of Sun Valley Parkway on the floodplain delineation with the confines of the overall purpose of this work assignment as an approximate floodplain delineation. Levee certification is not part of this scope of services. If FEMA determines, during the course of their review, that Sun Valley Parkway needs to be certified as a levee, the scope and/or approach will be modified via a change order to provide levee certification or map the floodplain assuming "levee" failure.

1.1.4.5. Flow Paths Downstream of Sun Valley Parkway. Depending on the results of the culvert capacity analysis and upstream delineations, flow paths downstream of Sun Valley Parkway located east of the Parkway Channel will be mapped either using approximate method alluvial fan (geomorphology) or riverine (HEC-RAS) techniques. The delineations in this area may tie in to or replace effective approximate method delineations downstream of Sun Valley Parkway.

1.1.5. Sedimentation Engineering. The CONSULTANT will compute the following sediment data:

1.1.5.1 Sediment yield to Sun Valley Parkway Channel. To estimate the 100-year sediment yield to Sun Valley Parkway Channel, the 100-year sediment yield at the fan apex must be first estimated. The 100-year sediment yield at the fan apex is equal to BedL+ SDR*WashL where BedL is the bed material load, SDR is the sediment delivery ratio for wash load, and WashL is the wash load. The bed material load can be computed based on Zeller-Fullerton bed material transport capacity equation for the channel reach upstream of the fan apex with the assumption that the channel reach is already at its equilibrium condition. The 100-year wash load is based MUSLE method or the result from Sun Valley ADMP 100-year sediment yield for CAP Sub-Area by JE Fuller (2006). Sediment delivery ratio (SDR) measures the ratio of sediment yield for wash load at the watershed outlet (point of interest) to gross erosion in the entire watershed. The SDR can be estimated by the following figure. The bed load discharge based on Zeller-Fullerton equation has to be converted to tons for the entire hydrograph before it can be added to wash load (given in tons). First, the bed load per unit width must be multiplied by the average flow width which can be defined as wetted cross-section area divided by maximum channel depth to obtain the result in cubic feet per second. Then, to obtain the total bed load volume for the total flood duration, it is reasonable to assume that the sediment discharge hydrograph follows the same shape of the water flow hydrograph. Therefore, $V_S = V_W \left(\frac{Q_S}{Q} \right)$ can be used to compute the bed load volume, where Q_S = the sediment discharge hydrograph ordinates (cfs); V_S = total volume of sediment under the sediment discharge hydrograph, (ft^3); Q = the water flow discharge hydrograph ordinates, (cfs); V_W = total volume of water under the water flow hydrograph, (ft^3). Using the peak flow discharge for Q and peak sediment discharge for Q_s, the sediment volume can be computed. Then, $W = 125 - 7D_{50}^{0.21}$ can be used to compute the sediment weight based on the sediment volume, where W = specific weight (lbs/ft^3) and D_{50} = median sediment size (feet). The D50 will be obtained from the Sun Valley ADMP (JEF, 2006) sampling results. Once the sediment yield (including both bed load and wash load) is computed for the fan apex, the sediment amount that will transport to the Sun Valley Parkway Channel shall be estimated. As a conservative estimate, the sediment yield at the fan apex may be assumed to be the same as that at the Sun Valley Parkway Channel. FLO-2D may be used to estimate a more accurate sediment amount that enters into the Sun Valley Parkway Channel.



1.1.5.2 Sediment Transport at Sun Valley Parkway Channel. The Sun Valley Parkway Channel is an unlined channel with many drop structures to reduce the overall channel slope. The equilibrium slope method (for sediment-laden condition based on ADWR method) shall be used to verify if the channel is already at its equilibrium slope. If it is at its equilibrium condition or has a smaller equilibrium slope than the existing channel bed slope, then no sediment transport analysis shall be performed because there is no aggradation problem. If the equilibrium slope analysis indicates an aggradation problem, then an analysis shall be performed to assess the aggradation in the channel. Such analyses may include a simple sediment balance approximation based on Zeller-Fullerton sediment capacity equation or an HEC-6T analysis.

1.1.5.3 Sediment yield to Sun Valley Parkway Culverts. The sediment delivery to the culverts will be computed based on the same procedures for fan apex documented above at 1.1.5.1.

1.1.6. Survey Data. The following survey data will be collected:

1.1.6.1.Culverts. As-built plans for Sun Valley Parkway prepared by Collar Williams & White will be used to obtain topographic and modeling information.

1.1.6.2.Channel As-built plans for Sun Valley Parkway prepared by Collar Williams & White will be used to obtain topographic and modeling information.

1.1.6.3.Road profile. Detailed topographic mapping provided to JEF by the District will be used to determine elevation data along Sun Valley Parkway median island high point, which will be assumed to be the top of curb on the median. This profile will extend from the Wagner Wash culvert to the eastern study limit, and will be used to determine overtopping potential for flow in the channel as well as culvert capacity for the crossings located east of the channel.

1.1.6.4.Check Sections/FEMA Mapping Criteria. Surveyed check sections or other survey tasks to assure compliance with FEMA mapping criteria are not included in this scope of services. It is assumed that such tests are not needed because it is an approximate method delineation.

1.1.7. The CONSULTANT will prepare a TDN summarizing the results of the delineation. The District is responsible for submitting the TDN for FEMA review as well as any associated fees.

1.1.8. The CONSULTANT will make revisions to the delineation in response to District review comments. Response to FEMA comments will be performed under separate work assignment and is not part of this scope of services.

1.2. Meetings & Coordination. JEF will participate in up to four meetings with area developers and District staff.

Fee

This task order will be billed monthly on a time and material basis. The fee estimate is summarized in Table 1.

Schedule

All work items for this Task Order, except FEMA review and response to FEMA comments, will be completed within five months of notice to proceed, assuming one three week maximum review period for the TDN submittal made by the CONSULTANT. The proposed schedule is as follows:

- The schedule begins (Day 1) upon delivery of all required topographic mapping in an acceptable format for modeling.
- Day 30. Complete initial hydrologic modeling (Task 1.1.3)
- Day 45. Receive Task 1.1.3 review comments from District
- Day 75. Complete initial hydraulic modeling (Task 1.1.4) and sedimentation engineering (Task 1.1.5)
- Day 90. Receive Task 1.1.4 & 1.1.5 review comments from District
- Day 120. Complete TDN (Task 1.1.7)
- Day 135. Receive Task 1.1.7 review comments from District
- Day 150. Complete project.

Deliverables

1. TDN for Fans 1-2 (one document) – one hard copy and one PDF digital file.
2. HIS digital data following the District Consultant Guidelines will be provided for fpznfcd, fpxfcd, fpblnfcd, landform (Stage 1), and stability (Stage 2) layers.

Notes

- The District will provide any required aerial photography, digital topographic mapping and existing information to be used in the delineations.
- Maricopa County is responsible for maintenance and operation of the Sun Valley Parkway Channel and culverts. A statement to this affect will need to be provided in the TDN to demonstrate public maintenance of the flood control facility.
- The District will provide GIS shapefiles, HEC-RAS models, and topographic mapping for the effective floodplain delineations from the Sun Valley Parkway North Floodplain Delineation Study (A-N West, 1993).

Table 1									
FCD 2007C051	**Staff Hours**								
Work Assignment #2	**Principal**	**PM**	**EIT**			**Admin**			**Subtask**
Task	**130.35**	**109.175**	**79.75**			**61.38**		**Expenses**	**Fee**
1.1.1 Methodology									**$0.00**
1.1.2 Fan Delineation		24		24					**$4,534.20**
1.1.3 Hydrology		40	24						**$6,281.00**
1.1.4 Hydraulic Modeling	24	160	240	80				250	**$46,366.40**
1.1.5 Sedimentation	8	124	100						**$22,555.50**
1.1.6 Survey		8							**$873.40**
1.1.7 TDN/Documentation	32	32	64			40		500	**$15,724.00**
1.1.8 FEMA Revisions	8	24	40			24			**$8,326.12**
1.2 Meetings	16	4						150	**$2,672.30**
								Total:	**$107,332.92**

B.6 Public Notification

Flood Control District
of Maricopa County

Board of Directors
Fulton Brock, District 1
Don Stapley, District 2
Andrew Kunasek, District 3
Max Wilson, District 4
Mary Rose Wilcox, District 5

www.fcd.maricopa.gov

2801 West Durango Street
Phoenix, Arizona 85009
Phone: 602-506-1501
Fax: 602-506-4601
TT: 602-505-5897

February 25, 2010

To Whom It May Concern:

The Flood Control District of Maricopa County (District) invites all interested persons to attend an open house presenting the results of the floodplain/administrative floodway delineation performed for the White Tank Mountain Alluvial Fans # 1 and #2. Based on property ownership records, your property is near or within this recently identified floodplain.

The delineation study will result in the establishment of the 1% annual chance (Zone A) floodplain for White Tank Mountain Alluvial Fans #1 and #2 within the area bounded by the Central Arizona Project Canal on the north and the Bell Road alignment on the south, 283rd Avenue on the west, and 243rd Avenue on the east.

The District is hosting an open house from 5:30-7:00 p.m. on March 10, 2010 at the Flood Control District, 2801 W. Durango St. Phoenix, AZ 85009. Exhibits of the floodplain delineation will be on display and representatives from the District will be available to answer any questions.

The study resulted in 0.9 miles of Zone A riverine delineation and 5.2 square miles of Zone A Alluvial Fan Floodplains and Alluvial Fan Administrative Floodways. Alluvial fans are fan-shaped deposits of sediment and debris formed by the flow of water and sediment over time. Alluvial fan flooding is a special flood hazard area that occurs on alluvial fans and is characterized by unstable channels and changeable flow patterns.

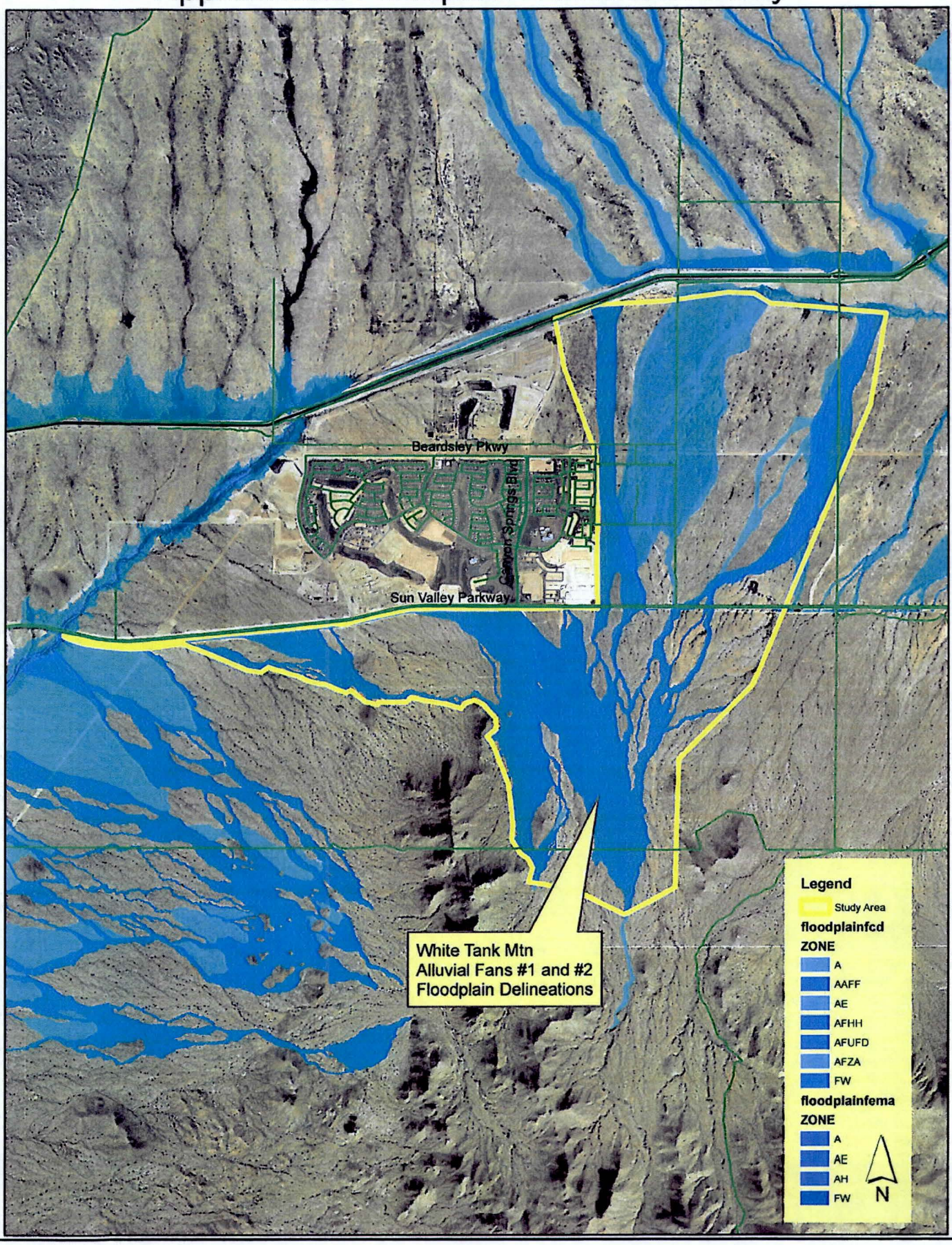
The District's delineation study will be submitted to the Federal Emergency Management Agency (FEMA) for adoption. The approval process may take one year or longer. FEMA will use the study data to update the Flood Insurance Rate Maps for the National Flood Insurance Program. In the interim the District and other jurisdictions will use the data as the "best available information" for floodplain management. Persons with buildings on their property in floodplain/floodway will not be required to purchase flood insurance until after the floodplain is adopted by FEMA and the Flood Insurance Rate Maps are updated. The District, however, recommends that property owners protect buildings on their property with flood insurance.

If you have any questions about the delineations please contact Kathryn Gross, Senior Hydrologist, at (602) 506-4837 or by email at kag@mail.maricopa.gov.

Sincerely,

Kathryn Gross
Senior Hydrologist

White Tank Mountain Alluvial Fans #1 and #2
Approximate Floodplain Delineation Study



Tax Address 1	Tax Address 2	Tax City	Tax State	Tax Zip
1013 VICTORIA LN		GLENDALE HTS	IL	601394512
1121 W WARNER RD 109		TEMPE	AZ	852842819
12 HIGHLAND RD		COVENTRY	CT	062382709
1511 N PIMA RD STE 100		SCOTTSDALE	AZ	85260
15111 N PIMA RD STE 100		SCOTTSDALE	AZ	852602779
1532 N 107TH PL		MESA	AZ	852074539
16661 N 84TH AVE STE 180		PEORIA	AZ	853824777
1678 EAGLE VALLEY		PRESCOTT	AZ	863015454
1707 W YEARLING RD		PHOENIX	AZ	850850615
17429 W PEORIA		WADDELL	AZ	853559706
17429 W PEORIA AVE		WADDELL	AZ	853559706
17982 N PETRIFIED FOREST DR		SURPRISE	AZ	853746278
20011 W MINNEZONA AVE		LITCHFIELD PARK	AZ	85340
201 N CENTRAL AVE STE 2200		PHOENIX	AZ	850040608
2209 E EGERET COURT		GILBERT	AZ	852343803
26844 N 89TH DR		PEORIA	AZ	85383
3	9502 W CAMINO DE ORO	PEORIA	AZ	853831114
4638 WATERLOO RD		BURLINGTON	KY	410058613
4776 E GUADALUPE RD APT 1056		HIGLEY	AZ	852367585
5930 W BENT TREE DR		PHOENIX	AZ	850856563
6028 N 129TH AVE		LITCHFIELD PK	AZ	853409430
7505 E 6TH AVE STE 100		SCOTTSDALE	AZ	852513551
757 LAKE AVE APT 12		BRISTOL	CT	060107387
8432 E SHEA BLVD STE 100		SCOTTSDALE	AZ	852606668
8738 E VISTA DR		SCOTTSDALE	AZ	852507446
9502 W CAMINO DE ORO		PEORIA	AZ	853831114
ATTN BRANDON WOLFSWINKEL	1121 W WARNER STE 109	TEMPE	AZ	852842819
ELLIOTT D POLLACK	7505 E 6TH AVE STE 100	SCOTTSDALE	AZ	85251
P O BOX 1957		SURPRISE	AZ	853781957
PO BOX 1877		GILBERT	AZ	852991877
PO BOX 232		WITTMANN	AZ	853610232
PO BOX 3285		OGDEN	UT	844091285
PO BOX 533		WITTMANN	AZ	853610533
REAL ESTATE SERVICES	301 W JEFFERSON STE 960	PHOENIX	AZ	850032111
W U S V HOLDINGS LLC	1121 W WARNER RD STE 109	TEMPE	AZ	852842819
WOLFGANG MONTHOFER	6918 N HIGHLANDS DR	PARADISE VLY	AZ	852533263
Public Works Department	423 Arizona Eastern Ave	Buckeye	AZ	85326
Water Resources	423 Arizona Eastern Ave	Buckeye	AZ	85326
Public Works Department	1600 N. Civic Center Plaza	Surprise	AZ	85374
Arizona State Land Department	1616 W. Adams St.	PHOENIX	AZ	85007

B.7 FEMA Correspondence

Flood Control District
of Maricopa County

Board of Directors
Fulton Brock, District 1
Don Stapley, District 2
Andrew Kunasek, District 3
Max Wilson, District 4
Mary Rose Wilcox, District 5

www.fcd.maricopa.gov

2801 West Durango Street
Phoenix, Arizona 85009
Phone: 602-506-1501
Fax: 602-506-4601
TT: 602-505-5897

March 1, 2011

LOMR Manager
LOMC Clearinghouse
6730 Santa Barbara Court
Elkridge, MD 21075

Subject: FLO-2D model and executable submittal for the White Tank Mountains Alluvial Fans #1 and #2 Approximate Floodplain Delineation Study (FCD contract 2007C051-2), by JEFuller Hydrology and Geomorphology

Communities: Unincorporated Maricopa County, Community No. 040037
Town of Buckeye, Community No. 040039
City of Surprise, Community No. 040053

Flooding Sources: White Tank Mountain Alluvial Fans #1 and #2

FIRM panels affected: 04013C1105H 04013C1095H 04013C1115H

LOMR Manager:

Enclosed are two CDs to continue the review of the District's White Tank Mountains Alluvial Fans #1 and #2 Approximate Floodplain Delineation Study. The original submittal of the White Tank Mountains Alluvial Fan #1 and #2 Approximate Floodplain Delineation Study was reviewed under Case No.10-09-2402P. However, due to a delay in getting the FLO-2D data and licensing information to FEMA the Case was closed.

Being provided for this submittal are 2CDs and the Alluvial Fan LOMR review fee. The first CD- entitled "White Tank Mountains Fans 1 and 2: TDN Fans 1 and 2 Electronic Data Jan 2009 FLO-2D Scenarios"- contains the FLO-2D modeling used for the floodplain delineation. The second CD entitled -"FLO-2D Version 2007.06 White Tank Mountain Alluvial Fans #1 and #2 West Central Maricopa County"- contains the FLO-2D executable and other files along with the licensing agreement for use with this study.

If you have any questions, please contact me at (602) 506-4837, or kag@mail.maricopa.gov.

Sincerely,

Kathryn Gross, CFM, M.A.
Hydrology and Hydraulics Branch

Copy to:

Beth Norton
Engineering Management Section
Mitigation Division
Federal Emergency Management Agency
500 C Street SW
Washington, D.C. 20472-0001

Brian Cosson, CFM
NFIP State Coordinator
Arizona Department of Water Resources
Office of Dam Safety and Flood Mitigation
3550 N. Central Ave.
Phoenix, AZ 85012

Ed Curtis
Federal Emergency Management Agency
Region IX
1111 Broadway, Suite 1200
Oakland, CA 94607

Jon Fuller, P.E., R.G., CFM
JEFuller Hydrology and Geomorphology
8400 S. Kyrene Rd., Suite 201
Tempe, AZ 85284

NATIONAL FLOOD INSURANCE PROGRAM

FEMA PRODUCTION AND TECHNICAL SERVICES CONTRACTOR

FLOOD CONTROL DISTRICT
RECEIVED
OCT 18 '10

	CH & GM		FINANCE
	PIO		R.E.D.
	ADMIN		O & M
	FMS		P & PM
✓	ENG		FILE
	CONTRACTS		
	ROUTING		

October 12, 2010

Ms. Kathryn Gross, CFM
Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009

IN REPLY REFER TO:
Case No.: 10-09-2402P
Communities: Town of Buckeye and
Maricopa County, AZ
Community Nos.: 040039 and 040037

316-AD

Dear Ms. Gross:

This responds to your submittal dated September 3, 2010, concerning an April 28, 2010, request that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) issue a conditional revision to the Flood Insurance Rate Map (FIRM) for Maricopa County, Arizona and Incorporated Areas. Pertinent information about the request is listed below.

Identifier:	Approximate Riverine Floodplain Delineation Upstream of Alluvial Fan Apexes
Flooding Source:	White Tank Mountains Fans 1 & 2
FIRM Panel(s) Affected:	04013C1095 H, 04013C1105 H, and 04013C1115 H

The data required to complete our review, which must be submitted within 90 days of the date of this letter, are listed on the enclosed summary.

If we do not receive the required data within 90 days, we will suspend our processing of your request. Any data submitted after 90 days will be treated as an original submittal and will be subject to all submittal/payment procedures, including the flat review and processing fee for requests of this type established by the current fee schedule. A copy of the notice summarizing the current fee schedule, which was published in the *Federal Register*, is enclosed for your information.

FEMA receives a very large volume of requests and cannot maintain inactive requests for an indefinite period of time. Therefore, we are unable to grant extensions for the submission of required data/fee for revision requests. If a requester is informed by letter that additional data are required to complete our review of a request, the data/fee **must** be submitted within 90 days of the date of the letter. Any fees already paid will be forfeited for any request for which the requested data are not received within 90 days.

If you have general questions about your request, FEMA policy, or the National Flood Insurance Program, please call the FEMA Map Information eXchange (FMIX), toll free, at 1-877-FEMA MAP (1-877-336-2627). If you have specific questions concerning your request, please contact your case reviewer, Paul Anderson, P.E., CFM, by e-mail at PMAnderson@mbakercorp.com or by telephone at 720-514-1121, or the Revisions Coordinator for your request, Mrs. Jaclyn Bloor, CFM, at jbloor@mbakercorp.com or at (720) 479-3160.

Sincerely,

Syed Qayum

Syed Qayum, CFM
LOMR Technical Manager
BakerAECOM

Enclosures

cc: Mr. Timothy S. Phillips, P.E.
Chief Engineer and General Manager
Maricopa County

Mr. Scott W. Lowe, P.E.
Public Works Director
Town of Buckeye

Mr. Jonathan Fuller, P.E.
JE Fuller/Hydrology & Geomorphology

NATIONAL FLOOD INSURANCE PROGRAM

FEMA PRODUCTION AND TECHNICAL SERVICES CONTRACTOR

Summary of Additional Data Required to Support a
Letter of Map Revision (LOMR)

Case No.: 10-09-2402P

Requester: Ms. Kathryn Gross, CFM

Communities: Town of Buckeye and
Maricopa County, AZ

Community Nos.: 040039 and 040037

The issues listed below must be addressed before we can continue the review of your request.

1. Please submit equations for the hydrologic results in Appendix D of the submitted report entitled "White Tank Mountains Fans 1 and 2, Technical Data Notebook Approximate Zone A Floodplain Delineation Study, Fans 1 and 2" prepared by JE Fuller Hydrology and Geomorphology Inc., dated January 2009 and revised November 2009. Also, please submit equations for the lag times and any times of concentration used in the hydrologic analysis.

2. Please provide a more detailed table or description of the origin of the flows used in the existing conditions HEC-RAS analysis for the Sun Valley Parkway drainage channel.

3. The above-referenced report states that output tables for the HY8 analyses could be found in Appendix D. However, those output tables could not be located. Please submit any output tables or HY8 modeling results as necessary.

4. An ineffective flow area is defined as the area of a cross section that will contain water that is not actively being conveyed. It is used to describe portions of a cross section in which water will pond, but the velocity in the downstream direction is close to zero. Our review of the submitted existing conditions HEC-RAS hydraulic model revealed that the levee option was used at several locations along the existing reach of the Sun Valley Parkway drainage channel to model the ineffective flow areas. However, the use of the ineffective flow area option may be more appropriate. Please provide documentation to support using the levee option, or make the appropriate changes.

5. The submitted work maps entitled "Flood Control District of Maricopa County, Approximately Zone A Floodplain Delineation Study of White Tank Fans 1 and 2" prepared by JE Fuller Hydrology and Geomorphology Inc., dated January 2009 state that the Vertical Datum is the North American Vertical Datum of 1988. However the effective Maricopa County FIRMs are in the National Geodetic Vertical Datum of 1929. Please submit models and any hydraulic work maps both in the NAVD 88 and NGVD 29 datum, or submit the datum shift that was used.

6. Please submit documentation of individual legal notices that were sent to property owners who are adversely impacted by any increases in and/or shifting of the base (1-percent-annual-chance) floodplain for the White Tanks Mountains Fans 1 and 2 and the Sun Valley Parkway drainage channel. Legal notice may take the form of certified mailing receipts or certification that all property owners have been notified, with an accompanying mailing list and a copy of the letter sent. If the requester is

the sole property owner who will be adversely affected by the increase(s) in width and/or shifting of the base floodplain, then a certified letter stating that fact must be submitted.

7. The submitted 6-hr and 24-hr FLO-2D models do not run. Please submit FLO-2D models that do not contain any errors when running the program.

8. Please submit a map or maps that show the layout of the FLO-2D grid system for the submitted existing conditions FLO-2D models. This can be in paper or digital form.

Please send the required data and/or fee directly to us at the address shown at the bottom of the first page. For identification purposes, please include the case number referenced above on all correspondence.

Federal Emergency Management Agency

Washington, D.C. 20472

FEE SCHEDULE FOR PROCESSING REQUESTS FOR MAP CHANGES

This notice contains the fee schedule for processing certain types of requests for changes to National Flood Insurance Program (NFIP) maps. The fee schedule allows FEMA to further reduce the expenses to the NFIP by more fully recovering the costs associated with processing conditional and final map change requests. The fee schedule for map changes is effective for all requests dated January 13, 2010, or later and supersedes the fee schedule that was established on October 1, 2007.

To develop the fee schedule for conditional and final map change requests, FEMA evaluated the actual costs of reviewing and processing requests for Conditional Letters of Map Amendment (CLOMAs), Conditional Letters of Map Revision – Based on Fill (CLOMR-Fs), Conditional Letters of Map Revision (CLOMRs), Letters of Map Revision – Based on Fill (LOMR-Fs), and Letters of Map Revision (LOMRs).

Based on our review of actual cost data for Fiscal Years 2007 and 2008, FEMA has maintained the following review and processing fees, which are to be submitted with all requests that are not otherwise exempted under 44 CFR 72.5.

Fee Schedule for Requests for CLOMAs, CLOMR-Fs, and LOMR-Fs

Request for single-lot/single-structure CLOMA and CLOMR-F	$500
Request for single-lot/single structure LOMR-F	$425
Request for single-lot/single-structure LOMR-F based on as-built information (CLOMR-F previously issued by FEMA)	$325
Request for multiple-lot/multiple-structure CLOMA	$700
Request for multiple-lot/multiple-structure CLOMR-F and LOMR-F	$800
Request for multiple-lot/multiple-structure LOMR-F based on as-built information (CLOMR-F previously issued by FEMA)	$700

Based on our review of actual cost data for Fiscal Years 2005 and 2006, FEMA has established the following review and processing fees, which are to be submitted with all requests that are not otherwise exempted.

Fee Schedule for Requests for CLOMRs

Request based on new hydrology, bridge, culvert, channel, or combination of any of these	$4,400
Request based on levee, berm, or other structural measure	$6,050

Fee Schedule for Requests for Map Revisions

Requesters must submit the review and processing fees shown below with requests for LOMRs that are not based on structural measures or alluvial fans.

Request based on bridge, culvert, channel, or combination of these	$5,300
Request based on levee, berm, or other structural measure	$7,150
Request based on as-built information submitted as follow-up to CLOMR	$5,000

Fees for CLOMRs, LOMRs, and PMRs Based on Structural Measures on Alluvial Fans

FEMA has maintained the initial fee for requests for CLOMRs and LOMRs based on structural measures on alluvial fans to $5,600. FEMA will also continue to recover the remainder of the review and processing costs by invoicing the requester before issuing a determination letter, consistent with current practice. The prevailing private-sector labor rate charged to FEMA ($60 per hour) will be used to calculate the total reimbursable fees.

Payment Submission Requirements

Requesters must make fee payments for non-exempt requests before we render services. This payment must be in the form of a check or money order or by credit card payment. Please make all checks and money orders in U.S. funds payable to the *National Flood Insurance Program.* Please mail all payments to the LOMC Clearinghouse, 6730 Santa Barbara Court, Elkridge, MD 21075. FEMA will deposit all fees collected to the National Flood Insurance Fund, which is the source of funding for providing these services.

Flood Control District
of Maricopa County

Board of Directors
Fulton Brock, District 1
Don Stapley, District 2
Andrew Kunasek, District 3
Max Wilson, District 4
Mary Rose Wilcox, District 5

www.fcd.maricopa.gov

2801 West Durango Street
Phoenix, Arizona 85009
Phone: 602-506-1501
Fax: 602-506-4601
TT: 602-505-5897

September 3, 2010

LOMR Manager
LOMC Clearinghouse
6730 Santa Barbara Court
Elkridge, MD 21075

Subject: White Tank Mountain Alluvial Fans #1 and #2 Approximate Floodplain Delineation Study (FCD contract 2007C051-2), by JEFuller Hydrology and Geomorphology

Case No.: 10-09-2402P

Communities: Unincorporated Maricopa County, Community No. 040037
Town of Buckeye, Community No. 040039
City of Surprise, Community No. 040053

Flooding Sources: White Tank Mountain Alluvial Fans #1 and #2

FIRM panels affected: 04013C1105H 04013C1095H 04013C1115H

Dear Mr. Anderson:

We are in receipt of your June 25, 2010 letter and are providing the following responses to the comments.

Question 1: Provide a signed Community Acknowledgment and Concurrence form for the City of Surprise.

Response: A Community Acknowledgment and Concurrence form signed by the City of Surprise has been included in this submittal.

Question 2: Please submit digital shape files that show all applicable items described in Section C of Form 2 Riverine Hydrology and Hydraulics Form including the following information:

- Boundary conditions of the currently effective base floodplain, 0.2 percent-annual-chance-floodplain, and regulatory floodway.
- Logical tie-ins between the revised and current effective flood hazard boundary delineations.
- The flow line used in the hydraulic model.

To answer the above question a series of maps and shape files are included in our submittal package.

- A DVD entitled "Floodplain Data and FY09/10 1 ft Orthophotography Tiles for the White Tanks Fan 1 and 2 Area" contains shape files of the current effective floodplain and floodway delineations in the area as well as the proposed delineations in the area including the White Tank Fans 1 and 2 delineations. There is no separate .2 percent-annual-chance-floodplain delineation in this area. And since the study is a Zone A study no .2 percent-annual-chance-floodplain delineation was developed. Also included is aerial photography for the area.
- A CD titled "White Tank Fans 1 and 2 FDS Case No. 10-09-2402P Study Shape Files" has also been included. This CD contains shape files of the contour data for the study area, cross-sections and inline weirs, and a flowline for the Sun Valley Parkway Channel associated with the RAS model, and the study floodplain shape file.
- Based on a phone conversation held with Alison Fraze, it was also requested to include modified FIRM panels that reflected what we would anticipate the floodplain to look like when the LOMR was issued. This was to aid in the tie-in review. Annotated panels have been provided for the three impacted FEMA panels and one modified map was also created to help clarify what the floodplain would look like in the area along the FIRM panel edges.

If you have any questions, please contact me at (602) 506-4837, or kag@mail.maricopa.gov.

Sincerely,

Kathryn Gross, CFM, M.A.
Hydrology and Hydraulics Branch

Enclosures: 3

Copy to:

Beth Norton
Engineering Management Section
Mitigation Division
Federal Emergency Management Agency
500 C Street SW
Washington, D.C. 20472-0001

Brian Cosson, CFM
NFIP State Coordinator
Arizona Department of Water Resources
Office of Dam Safety and Flood Mitigation
3550 N. Central Ave.
Phoenix, AZ 85012

Ed Curtis
Federal Emergency Management Agency
Region IX
1111 Broadway, Suite 1200
Oakland, CA 94607

Jon Fuller, P.E., R.G., CFM
JEFuller Hydrology and Geomorphology
8400 S. Kyrene Rd., Suite 201
Tempe, AZ 85284

NATIONAL FLOOD INSURANCE PROGRAM

FEMA PRODUCTION AND TECHNICAL SERVICES CONTRACTOR

June 25, 2010

Ms. Kathryn Gross, CFM
Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009

IN REPLY REFER TO:
Case No.: 10-09-2402P
Communities: Town of Buckeye and
Maricopa County, AZ
Community Nos.: 040039 and 040037

316-AD

Dear Ms. Gross:

This responds to your request dated April 28, 2010, that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) issue a revision to the Flood Insurance Rate Map (FIRM) for Maricopa County, Arizona and Incorporated Areas. Pertinent information about the request is listed below.

Identifier:	Approximate Riverine Floodplain Delineation Upstream of Alluvial Fan Apexes
Flooding Source:	White Tank Mountains Fans 1 & 2
FIRM Panel(s) Affected:	04013C1095 H, 04013C1105 H, and 04013C1115 H

The data required to complete our review, which must be submitted within 90 days of the date of this letter, are listed on the enclosed summary.

If we do not receive the required data within 90 days, we will suspend our processing of your request. Any data submitted after 90 days will be treated as an original submittal.

FEMA receives a very large volume of requests and cannot maintain inactive requests for an indefinite period of time. Therefore, we are unable to grant extensions for the submission of required data/fee for revision requests. If a requester is informed by letter that additional data are required to complete our review of a request, the data/fee **must** be submitted within 90 days of the date of the letter.

If you have general questions about your request, FEMA policy, or the National Flood Insurance Program, please call the FEMA Map Information eXchange (FMIX), toll free, at 1-877-FEMA MAP (1-877-336-2627). If you have specific questions concerning your request, please contact your case reviewer, Ms. Alison Fraze, by e-mail at afraze@mbakercorp.com or by telephone at (720) 514-1117, or the Revisions Coordinator for your request, Ms. Jaclyn Bloor, CFM, at jbloor@mbakercorp.com or at (720) 479-3160.

Sincerely,

Syed Qayum

Syed Qayum, CFM
LOMR Technical Manager
BakerAECOM

Enclosure

cc: Mr. Timothy S. Phillips, P.E.
Chief Engineer and General Manager
Maricopa County

Mr. Scott W. Lowe, P.E.
Public Works Director
Town of Buckeye

Mr. Jonathan Fuller, P.E.
JE Fuller/Hydrology & Geomorphology

NATIONAL FLOOD INSURANCE PROGRAM

FEMA PRODUCTION AND TECHNICAL SERVICES CONTRACTOR

Summary of Additional Data Required to Support a
Letter of Map Revision (LOMR)

Case No.: 10-09-2402P

Requester: Ms. Kathryn Gross, CFM

Communities: Town of Buckeye and
Maricopa County, AZ

Community Nos.: 040039 and 040037

The issues listed below must be addressed before we can continue the review of your request.

1. Our review of your request revealed that the City of Surprise is affected by this revision. Please provide community acknowledgment in the form of a letter stating that the city has reviewed the revision request and understands the effects of the revision on flooding conditions in the community, and that any existing or proposed structures to be removed from the Special Flood Hazard Area (SFHA), the area that would be inundated by the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood), are reasonably safe from flooding. Alternatively, please submit Application/Certification Form 1, entitled "Overview & Concurrence Form," signed by a community official.

2. The digital topographic work map data does not provide essential information required to complete our review of this request. Please submit additional digital shapefiles, that show all applicable items listed in Section C of Application/Certification Form 2, entitled "Riverine Hydrology & Hydraulics Form," including the following information:

    a. Boundary delineations of the currently effective base floodplain, 0.2-percent-annual-chance floodplain, and regulatory floodway;
    b. Logical tie-ins between the revised and effective flood hazard boundary delineations;
    c. The flow line used in the hydraulic model.

Please send the required data and/or fee directly to us at the address shown at the bottom of this page. For identification purposes, please include the case number referenced above on all correspondence.

Flood Control District
of Maricopa County

Board of Directors
Fulton Brock, District 1
Don Stapley, District 2
Andrew Kunasek, District 3
Max Wilson, District 4
Mary Rose Wilcox, District 5

www.fcd.maricopa.gov

2801 West Durango Street
Phoenix, Arizona 85009
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April 28, 2010

LOMR Manager
LOMC Clearinghouse
6730 Santa Barbara Court
Elkridge, MD 21075

Subject: White Tank Mountain Alluvial Fans #1 and #2 Approximate Floodplain Delineation Study (FCD contract 2007C051-2), by JEFuller Hydrology and Geomorphology

Communities: Unincorporated Maricopa County, Community No. 040037
Town of Buckeye, Community No. 040039
City of Surprise, Community No. 040053

Flooding Sources: White Tank Mountain Alluvial Fans #1 and #2

FIRM panels affected: 04013C1105H 04013C1095H 04013C1115H

LOMR Manager:

Enclosed is the technical supporting data for the White Tank Mountain Alluvial Fans #1 and #2 Approximate Floodplain Delineation Study. This study delineates newly identified floodplains for a portion of the White Tank Mountain Piedmont. The study used hydrology developed in the Sun Valley Area Drainage Master Plan and the alluvial fan floodplains were delineated using a combination of FLO-2D hydraulic models and geomorphic methods based on the District's Piedmont Flood Hazard Assessment Manual. The study resulted in .9 miles of Zone A riverine delineations and 5.2 square miles of Zone A Alluvial Fan Floodplain/Administrative Floodways. The study is located within the west central portion of Maricopa County.

The resulting floodplains are Zone A floodplains, some with locally administered floodways. The results are presented in two Technical Data Notebooks. Hydrologic and hydraulic information is located in Section 4 and 5. Sedimentation and geomorphic information is located in Section 6 and Appendix G (second notebook). The FEMA forms are located in Section 2. A full-size set of floodplain delineation work maps along with the Annotated FIRM panels are located at the back of the Notebook. Digital versions of the hydrologic and hydraulic analysis are included on two CD/DVDs in the front pocket.

If you have any questions, please contact me at (602) 506-4837, or kag@mail.maricopa.gov.

Sincerely,

Kathryn Gross, CFM, M.A.
Hydrology and Hydraulics Branch

Copy to:

Beth Norton
Engineering Management Section
Mitigation Division
Federal Emergency Management Agency
500 C Street SW
Washington, D.C. 20472-0001

Brian Cosson, CFM
NFIP State Coordinator
Arizona Department of Water Resources
Office of Dam Safety and Flood Mitigation
3550 N. Central Ave.
Phoenix, AZ 85012

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Federal Emergency Management Agency
Region IX
1111 Broadway, Suite 1200
Oakland, CA 94607

Jon Fuller, P.E., R.G., CFM
JEFuller Hydrology and Geomorphology
8400 S. Kyrene Rd., Suite 201
Tempe, AZ 85284

Appendix C

Survey Field Notes

Additional survey field notes were not gathered for this study.

Appendix D

Hydrologic Analysis Supporting Documentation

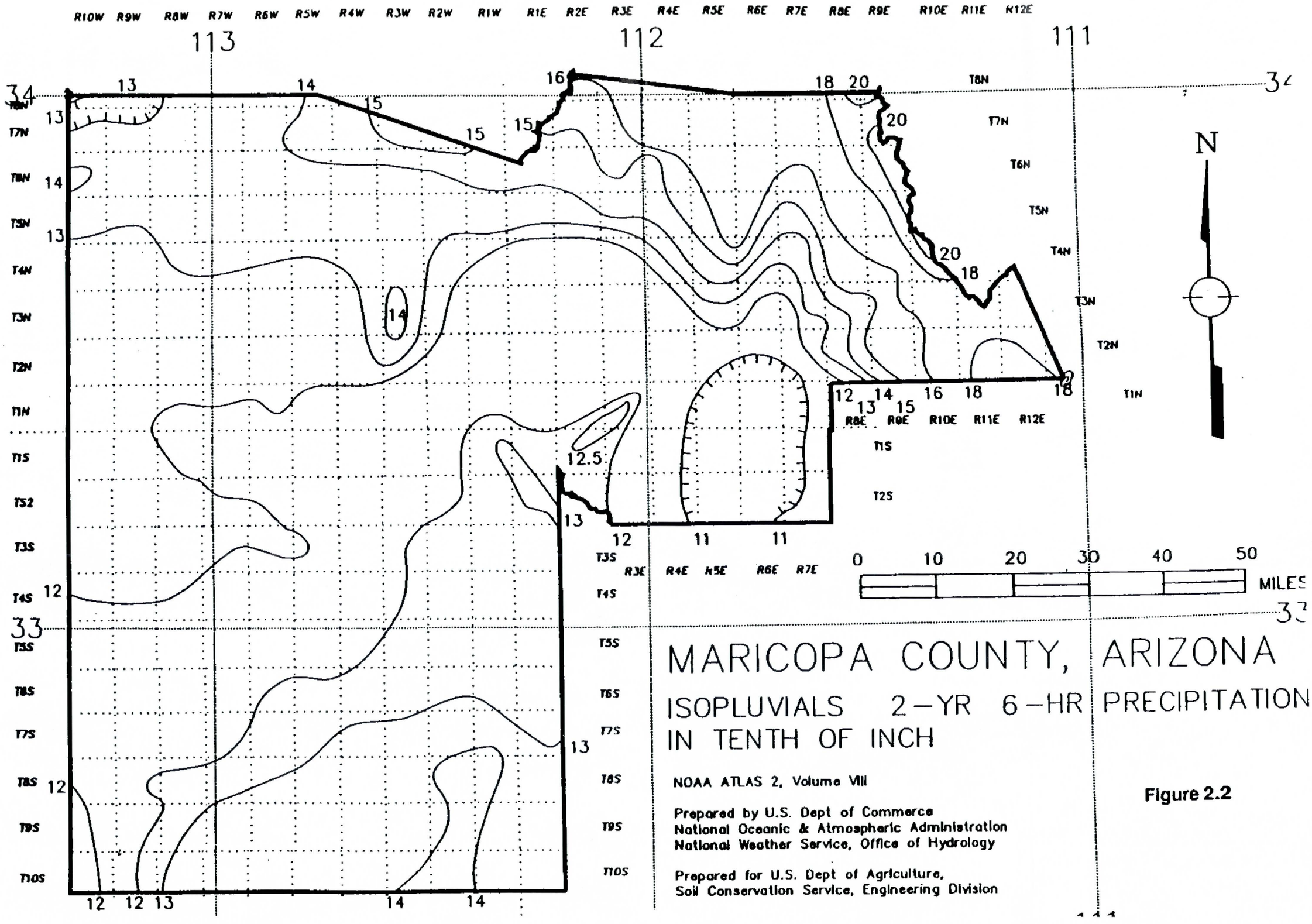
APPENDIX D

D.1 Precipitation Data

D.2 Physical Parameter Calculations

D.3 Hydrologic Calculations

D.1 Precipitation Data



MARICOPA COUNTY, ARIZONA

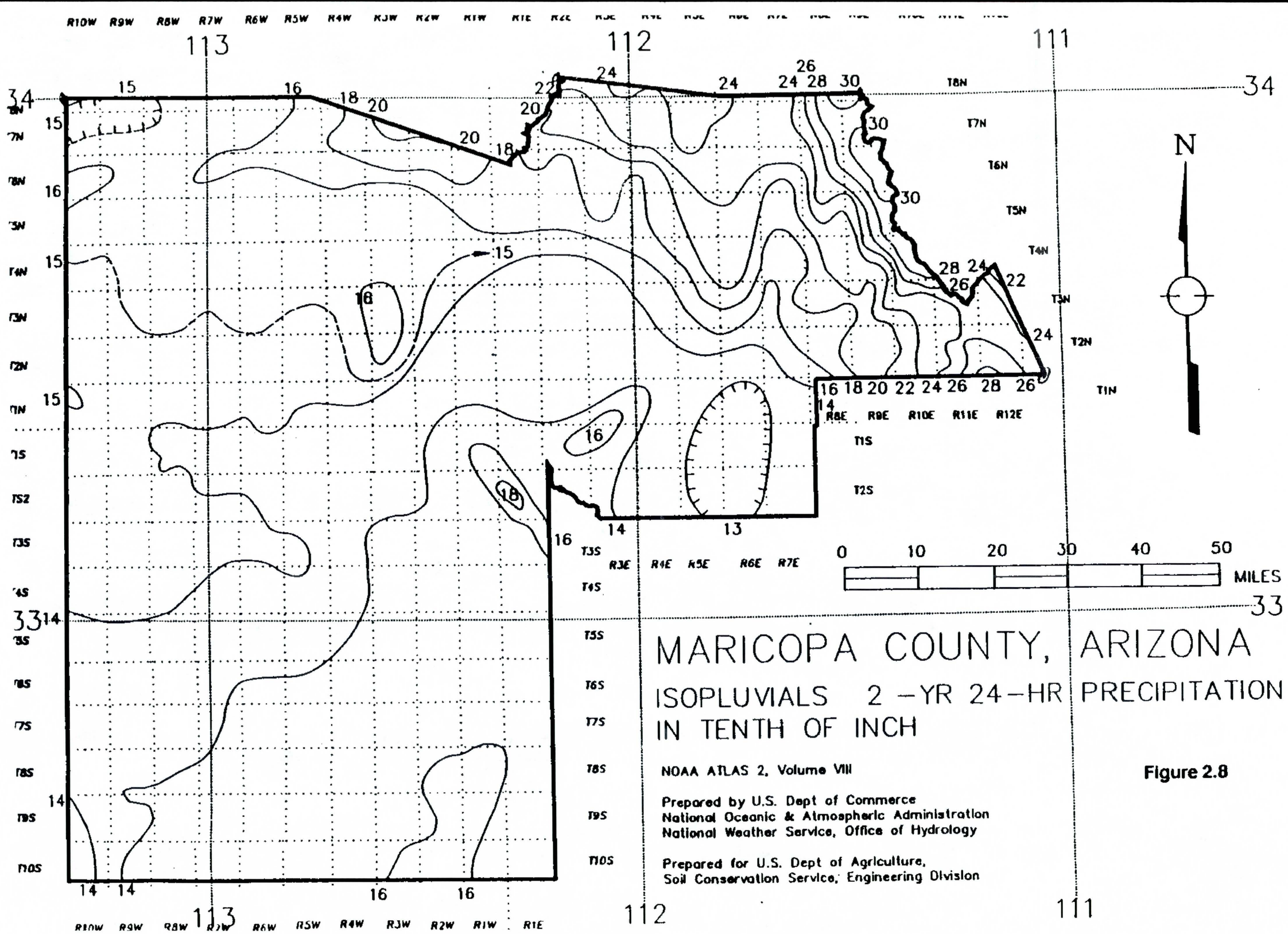
ISOPLUVIALS 2-YR 6-HR PRECIPITATION IN TENTH OF INCH

NOAA ATLAS 2, Volume VIII

Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division

Figure 2.2



MARICOPA COUNTY, ARIZONA

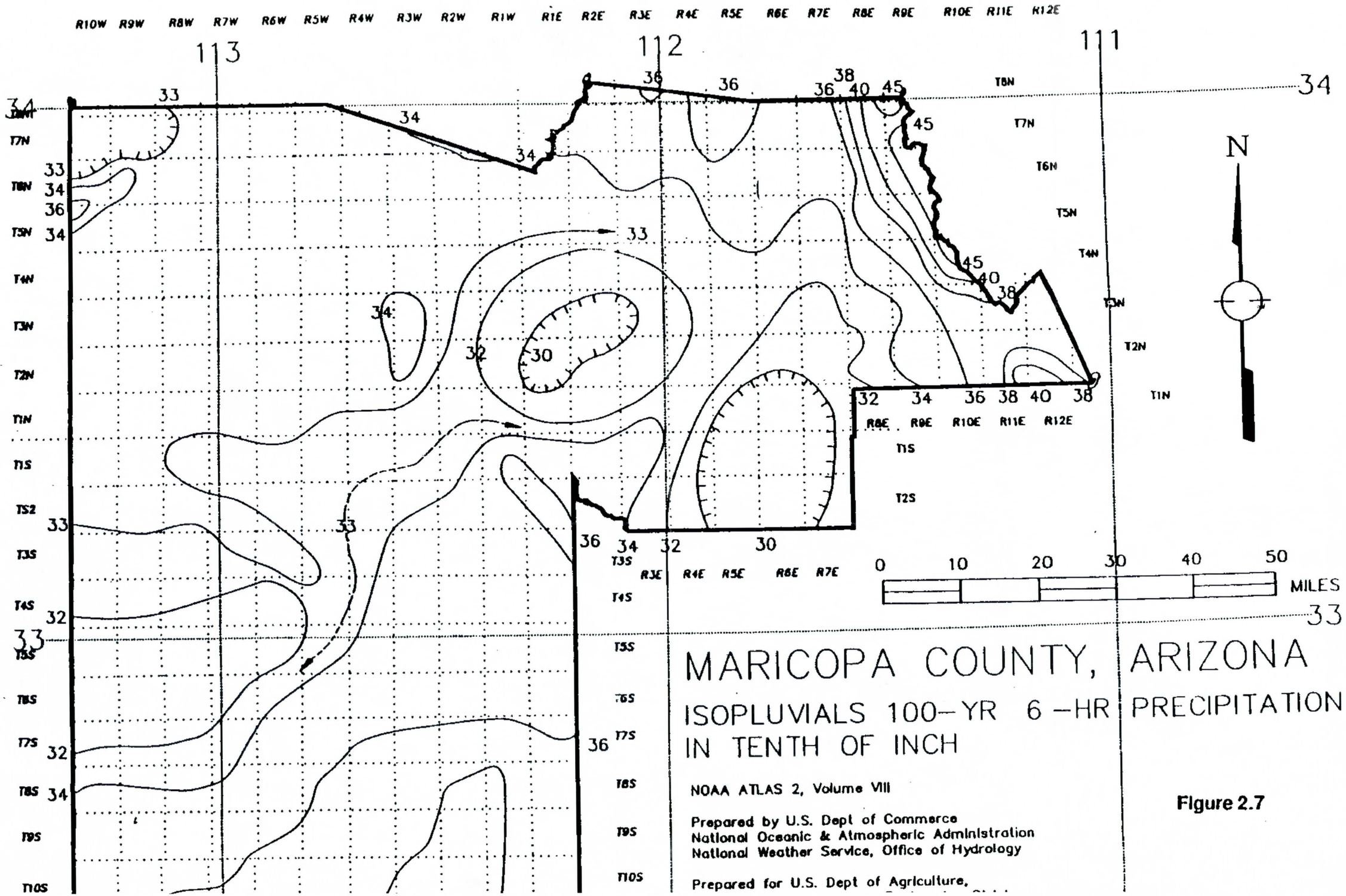
ISOPLUVIALS 2 –YR 24–HR PRECIPITATION IN TENTH OF INCH

NOAA ATLAS 2, Volume VIII

Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division

Figure 2.8



MARICOPA COUNTY, ARIZONA

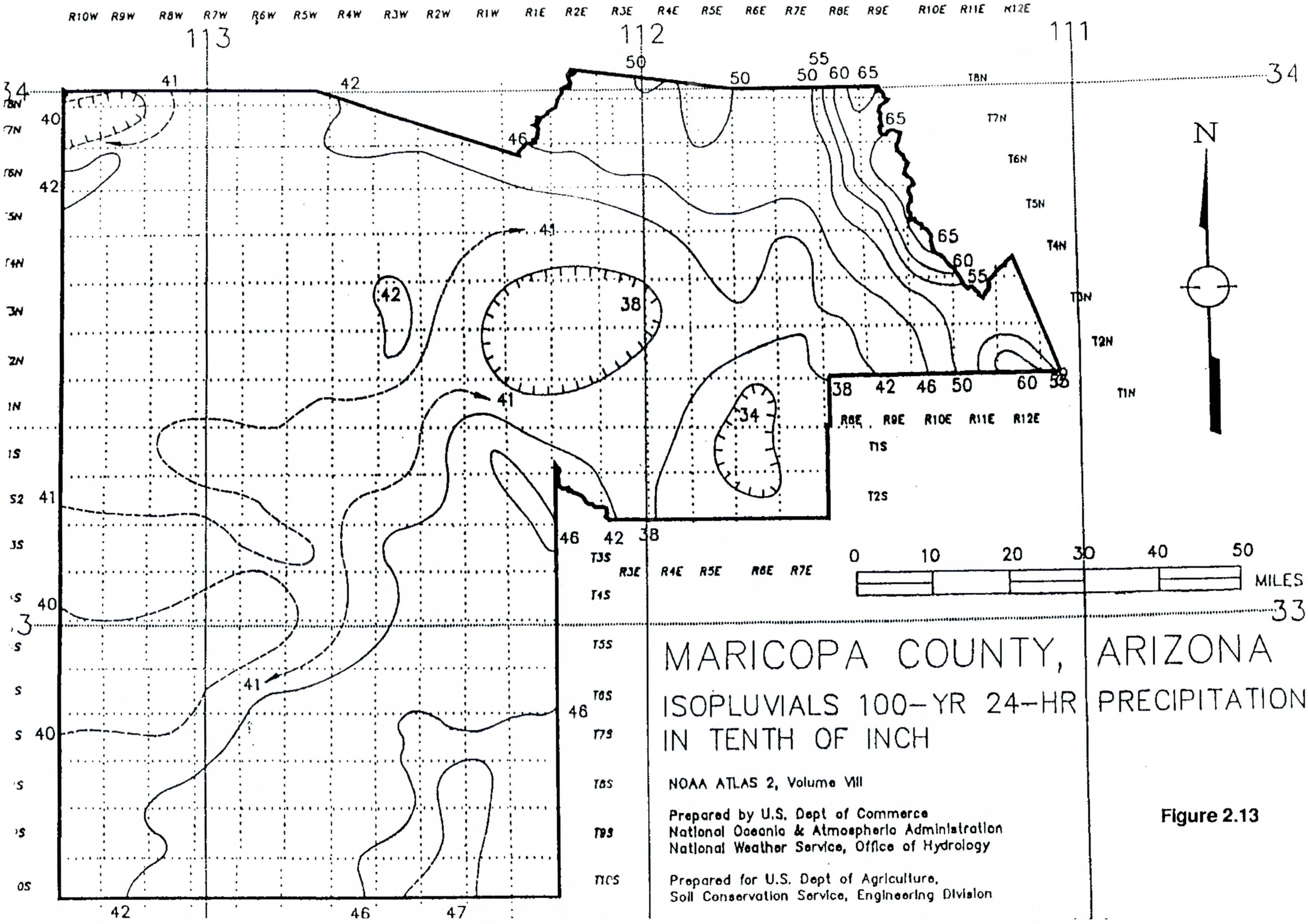
ISOPLUVIALS 100–YR 6 –HR PRECIPITATION IN TENTH OF INCH

NOAA ATLAS 2, Volume VIII

Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Dept of Agriculture,

Figure 2.7



MARICOPA COUNTY, ARIZONA

ISOPLUVIALS 100-YR 24-HR PRECIPITATION IN TENTH OF INCH

NOAA ATLAS 2, Volume VIII

Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division

Figure 2.13

Duration	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
Rainfall Method: NOAA						
5 MIN	0.39	0.46	0.51	0.58	0.64	0.70
10 MIN	0.58	0.69	0.77	0.89	0.98	1.07
15 MIN	0.71	0.86	0.97	1.13	1.25	1.38
30 MIN	0.94	1.15	1.30	1.52	1.70	1.87
1 HOUR	1.14	1.42	1.62	1.90	2.12	2.33
2 HOUR	1.23	1.56	1.79	2.12	2.38	2.63
3 HOUR	1.29	1.66	1.91	2.27	2.55	2.83
6 HOUR	1.40	1.83	2.13	2.55	2.88	3.20
12 HOUR	1.50	2.04	2.41	2.91	3.31	3.70
24 HOUR	1.60	2.25	2.68	3.28	3.74	4.20

D.2 Physical Parameter Calculations

Area ID	Area	Length	Slope	S-Graph	Lca	Lag	Velocity	Kn	IA	DTHETA	PSIF	XKSAT	RTIMP
	(sq.mi.)	(mi)	(ft/mi)		(mi)	(min)	(ft/s)		(in)		(in)	(in/hr)	(%)
S110	0.430	1.72	430.3	MOUNTAIN	0.82	26	3.5	0.050	0.25	0.37	5.20	0.25	6
S900	1.035	3.21	420.5	MOUNTAIN	1.94	46	3.7	0.050	0.25	0.37	5.30	0.24	6
S120	2.004	3.47	265.5	DESERT/RANGELAND	2.04	33	5.6	0.031	0.33	0.35	4.65	0.32	1

Soil Data

Subbasin ID	Soil ID	Area (sq mi)	Area (%)	XKSAT	Rock Percent	Effective Rock %
S110	64548	0.0355	8.3	0.06	0	50
S110	64549	0.0411	9.6	0.06	0	50
S110	645100	0.2418	56.3	0.4	20	50
S110	645110	0.1113	25.9	0.13	0	50
S120	6453	0.0013	0.1	0.58	0	50
S120	6453	0.0101	0.5	0.58	0	50
S120	64529	0.1087	5.4	0.34	0	50
S120	64545	0.2031	10.1	0.03	0	50
S120	64552	0.0178	0.9	0.16	20	50
S120	64598	0.4582	22.9	0.37	0	50
S120	645100	0.0033	0.2	0.4	20	50
S120	645100	0.0064	0.3	0.4	20	50
S120	645100	0.0138	0.7	0.4	20	50
S120	645100	0.2243	11.2	0.4	20	50
S120	645110	0.1833	9.1	0.13	0	50
S120	645113	0.2351	11.7	0.39	0	50
S120	645115	0.0013	0.1	0.39	0	50
S120	645115	0.4525	22.6	0.39	0	50
S120	645123	0.0129	0.6	0.37	0	50
S120	645123	0.0157	0.8	0.37	0	50
S120	645123	0.0546	2.7	0.37	0	50
S120	645124	0.0014	0.1	0.39	0	50
S900	64548	0.1396	13.5	0.06	0	50
S900	64549	0.2376	23	0.06	0	50
S900	645100	0.0019	0.2	0.4	20	50
S900	645100	0.6319	61.1	0.4	20	50
S900	645115	0.0024	0.2	0.39	0	50
S900	645115	0.0213	2.1	0.39	0	50

Land Use

Subbasin ID	Land Use Code	Area (sq mi)	Area %	Initial Loss (IA)	% Impervious (RTIMP)	Vegetative Cover (%)	Kn	DTHETA
S110	930	0.4297	100	0.25	0	30	0.05	DRY
S120	910	1.5238	76	0.35	0	30	0.025	DRY
S120	930	0.4801	24	0.25	0	30	0.05	DRY
S900	930	1.0347	100	0.25	0	30	0.05	DRY

Soil ID	Book Number	XKSAT	% Rock Outcrop	Description	Type
64548	645	0.06	0	Ebon-Pinamt complex, 3 to 20 percent slopes	48
645100	645	0.4	20	Quilotosa-Vaiva-Rock outcrop complex, 20 to 65 percent slopes	100
645110	645	0.13	0	Suncity-Cipriano complex, 1 to 7 percent slopes	110
645115	645	0.39	0	Tremant-Antho complex, 1 to 5 percent slopes	115
64549	645	0.06	0	Ebon-Pinamt complex, 20 to 40 percent slopes	49

D.3 Hydrologic Calculations

```
1 ****************************************
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 *             JUN   1998               *
 *           VERSION 4.1                *
 *                                      *
 *  RUN DATE   27JAN09  TIME  17:33:15  *
 *                                      *
 ****************************************
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```
 ************************************
 *                                  *
 *    U.S. ARMY CORPS OF ENGINEERS  *
 *    HYDROLOGIC ENGINEERING CENTER *
 *         609 SECOND STREET        *
 *       DAVIS, CALIFORNIA 95616    *
 *           (916) 756-1104         *
 *                                  *
 ************************************
```

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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

   1          ID   SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
   2          ID    JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
   3          ID    FILENAME: A4_EX24.DAT
   4          ID    DATE: JUNE 16, 2006
   5          ID
   6          ID    100-YEAR 24-HOUR MODEL
   7          ID    EXISTING CONDITIONS
   8          ID    AREA 4 WATERSHED AREA = 90.5 SQ. MILES
   9          ID           MODELED AREA = 76.8 SQ. MILES
  10          ID
  11          ID    GREEN-AMPT LOSS METHOD
  12          ID    S-GRAPH UNIT HYDROGRAPHS
  13          ID     - MOUNTAIN
  14          ID     - DESERT/RANGELAND
  15          ID    NORMAL-DEPTH CHANNEL ROUTING
  16          ID    LAND USE DATA FROM EXAMINATION OF SLOPE FROM 10-FT DTM TO DISTINGUISH
  17          ID     - UNDEVELOPED DESERT RANGELAND (NDR) - SLOPES < 5 %
  18          ID     - HILLSLOPES, SONORAN DESERT (NHS) - SLOPES 5 - 10 %
  19          ID     - MOUNTAIN TERRAIN (NMT) - SLOPES > 10 %
  20          ID   SOILS DATA FROM FCDMC GIS DATABASE (RECEIVED FROM FCDMC JULY 2005)
  21          ID
  22          ID   ***************************************************************************
  23          ID
  24          ID    MODIFIED BY JE FULLER/HYDROLOGY & GEOMORPHOLOGY - DECEMBER 2008
  25          ID
  26          ID    PROJECT:  FCDMC, 2007C051, TASK ORDER NO. 2, ALLUVIAL FANS 1 AND 2.
  27          ID
  28          ID    MODIFICATION ENTAILED STRIPPING OF ALL HEC-1 COMPONENTS THAT DO NOT
  29          ID    CONTRIBUTE TO C120, WHICH IS LOCATED AT THE CONFLUENCE OF THE SUN VALLEY
  30          ID    PARKWAY CHANNEL AND WAGNER WASH.  NO MODIFICATIONS OR CHANGES WERE MADE TO
  31          ID    THE HEC-1 INPUT DATA.
  32          ID
  33          ID   ***************************************************************************
  34          ID
  35          IT       5  1JAN99    1200    2000
  36          IN      15
  37          IO       3
              *DIAGRAM
              *
  38          JD   4.198  0.1000
  39          PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
  40          PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
  41          PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
  42          PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
  43          PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
  44          PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
  45          PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
  46          PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
  47          PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
  48          PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
  49          JD   3.990    10.0
  50          JD   3.780    30.0
  51          JD   3.654    60.0
  52          JD   3.578    90.0
              *
              *
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  53          KK    S110   BASIN
  54          BA   0.430
  55          LG    0.25    0.37    5.20    0.25       6
  56          UI      56     166     335     449     587     358     291     241     188     140
  57          UI     121      86      68      56      43      32      27      22      11      11
  58          UI      10      11      11       0       0       0       0       0       0       0
  59          UI       0       0       0       0       0       0       0       0       0       0
  60          UI       0       0       0       0       0       0       0       0       0       0
  61          KM        Compute runoff from subbasin 110
  62          ZW   A=S110 C=FLOW F=CALC
              *

  63          KK  11015I   ROUTE
  64          RS       2    FLOW      -1
  65          RC   0.045   0.035   0.045    3783  0.0267  102.00
  66          RX    0.00   50.00  100.00  110.00  120.00  130.00  180.00  230.00
  67          RY  102.00  101.50  101.00  100.00  100.00  101.00  101.50  102.00
  68          KM        Route flow from C105 through subbasin 110 to C115.
  69          KM        Slope = (1847-1746) / 3783
              *

  70          KK    D15I  DIVERT
  71          DT    CF5I     0.0     0.0
  72          DI     0.0    100.0  1000.0 10000.0     0.0     0.0     0.0     0.0     0.0     0.0
  73          DQ     0.0     20.0   200.0  2000.0     0.0     0.0     0.0     0.0     0.0     0.0
  74          KM        Divert flows to the left into S120
              *

  75          KK  15I15R   ROUTE
  76          RS       8    FLOW      -1
  77          RC   0.035   0.030   0.035   14128  0.0151  105.00
  78          RX    0.00   25.00   58.00   65.00   85.00   92.00  125.00  150.00
  79          RY  105.00  102.50  102.00  100.00  100.00  102.00  102.50  105.00
  80          KM        Route flows from split through S115 to C115.
  81          KM        Slope = (1746-1532) / 14128
              *

  82          KK    S115   BASIN
  83          BA   2.247
  84          LG    0.32    0.35    4.80    0.30       2
  85          UI     160     163     434     709     984    1212    1401    1530    1539    1465
  86          UI    1351    1100     918     773     632     528     444     351     304     252
  87          UI     203     170     140     110     110      85      39      39      40      39
  88          UI      39      39      40      39       0       0       0       0       0       0
  89          UI       0       0       0       0       0       0       0       0       0       0
  90          KM        Compute runoff from subbasin 115
              *

  91          KK   C115U COMBINE
  92          HC       2   2.677
  93          KM        Combine runoff from S115 with routed flow.
              *
1                                        HEC-1 INPUT                                        PAGE  3

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  94          KK    CF5IRETRIEVE
  95          DR    CF5I
  96          KM        Retrieve diverted flow from D15I
              *

  97          KK  15I15L   ROUTE
  98          RS       7    FLOW      -1
  99          RC   0.045   0.045   0.045   12775  0.0168  104.00
 100          RX    0.00   50.00  100.00  130.00  170.00  200.00  250.00  300.00
 101          RY  104.00  103.00  102.00  100.00  100.00  102.00  103.00  104.00
 102          KM        Route flows from split through S120 to C115.
 103          KM        Slope =(1746-1532) / 12775
              *

 104          KK   C115D COMBINE
 105          HC       2   2.677
 106          KM        Combine routed flows from split with remainder of flows in SVP channel
 107          KM        just D/S of C115.
              *

 108          KK  115120   ROUTE
 109          RS       2    FLOW      -1
 110          RC   0.030   0.025   0.030    4077  0.0093  105.00
 111          RX    0.00   30.00   75.00   80.00  105.00  110.00  155.00  190.00
 112          RY  105.00  101.50  101.00  100.00  100.00  101.00  101.50  105.00
 113          KM        Route total flows from C115 to C120. Slope =(1532-1494) / 4077
              *

 114          KK    S120   BASIN
 115          BA   2.004
 116          LG    0.33    0.35    4.65    0.32       1
 117          UI     206     408     954    1419    1824    1969    1911    1637    1230     944
 118          UI     731     551     418     336     234     186     143     120      50      51
 119          UI      50      51      51       0       0       0       0       0       0       0
```

```
          120          UI       0       0       0       0       0       0       0       0       0       0
          121          UI       0       0       0       0       0       0       0       0       0       0
          122          KM        Compute runoff from subbasin 120
          123          ZW   A=S120 C=FLOW F=CALC
                       *

          124          KK    C120 COMBINE
          125          HC       2   4.681
          126          KM        Combine flows at Wagner Wash at outlet of channel along SVP
                       *

          127          KK    S900   BASIN
          128          BA   1.035
          129          LG   0.25    0.37    5.30    0.24       6
          130          UI     75      77     215     338     472     551     650     871     671     496
          131          UI    448     394     356     320     277     233     197     180     165     140
          132          UI    116      97      89      83      65      59      58      37      38      37
          133          UI     37      23      14      15      14      15      14      15      15      14
          134          UI     15      14       0       0       0       0       0       0       0       0
          135          ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK

 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    53        S110
                 V
                 V
    63      11015I
                 .
                 .
    71           .-------->    CF5I
    70        D15I
                 V
                 V
    75      15I15R
                 .
                 .
    82           .        S115
                 .           .
                 .           .
    91       C115U............
                 .
                 .
    95           .           .<-------    CF5I
    94           .        CF5I
                 .           V
                 .           V
    97           .      15I15L
                 .           .
                 .           .
   104       C115D............
                 V
                 V
   108      115120
                 .
                 .
   114           .        S120
                 .           .
                 .           .
   124        C120............
                 .
                 .
   127           .        S900

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*               JUN   1998              *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   27JAN09  TIME  17:33:15   *
*                                       *
*****************************************

*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*            (916) 756-1104             *
*                                       *
*****************************************

 SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
 JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
 FILENAME: A4_EX24.DAT
 DATE: JUNE 16, 2006

 100-YEAR 24-HOUR MODEL
 EXISTING CONDITIONS
 AREA 4 WATERSHED AREA = 90.5 SQ. MILES
        MODELED AREA = 76.8 SQ. MILES

 GREEN-AMPT LOSS METHOD
 S-GRAPH UNIT HYDROGRAPHS
  - MOUNTAIN
```

```
                     - DESERT/RANGELAND
                    NORMAL-DEPTH CHANNEL ROUTING
                    LAND USE DATA FROM EXAMINATION OF SLOPE FROM 10-FT DTM TO DISTINGUISH
                     - UNDEVELOPED DESERT RANGELAND (NDR) - SLOPES < 5 %
                     - HILLSLOPES, SONORAN DESERT (NHS) - SLOPES 5 - 10 %
                     - MOUNTAIN TERRAIN (NMT) - SLOPES > 10 %
                   SOILS DATA FROM FCDMC GIS DATABASE (RECEIVED FROM FCDMC JULY 2005)

                   ***************************************************************************

                    MODIFIED BY JE FULLER/HYDROLOGY & GEOMORPHOLOGY - DECEMBER 2008

                    PROJECT:  FCDMC, 2007C051, TASK ORDER NO. 2, ALLUVIAL FANS 1 AND 2.

                    MODIFICATION ENTAILED STRIPPING OF ALL HEC-1 COMPONENTS THAT DO NOT
                    CONTRIBUTE TO C120, WHICH IS LOCATED AT THE CONFLUENCE OF THE SUN VALLEY
                    PARKWAY CHANNEL AND WAGNER WASH.  NO MODIFICATIONS OR CHANGES WERE MADE TO
                    THE HEC-1 INPUT DATA.

                   ***************************************************************************

  37 IO         OUTPUT CONTROL VARIABLES
                      IPRNT          3  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

  36 IN         TIME DATA FOR INPUT TIME SERIES
                      JXMIN         15  TIME INTERVAL IN MINUTES
                     JXDATE     1JAN99  STARTING DATE
                     JXTIME       1200  STARTING TIME

     IT         HYDROGRAPH TIME DATA
                       NMIN          5  MINUTES IN COMPUTATION INTERVAL
                      IDATE     1JAN99  STARTING DATE
                      ITIME       1200  STARTING TIME
                         NQ       2000  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     8JAN99  ENDING DATE
                     NDTIME       1035  ENDING TIME
                      ICENT         19  CENTURY MARK

                  COMPUTATION INTERVAL     .08 HOURS
                       TOTAL TIME BASE  166.58 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT

  38 JD         INDEX STORM NO. 1
                       STRM       4.20  PRECIPITATION DEPTH
                       TRDA        .10  TRANSPOSITION DRAINAGE AREA

  39 PI           PRECIPITATION PATTERN
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .01      .00      .01
                      .01      .01      .01      .01      .01      .01      .01      .01      .03      .03
                      .03      .09      .09      .09      .01      .01      .01      .01      .01      .01
                      .01      .01      .01      .01      .01      .01      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00

  49 JD         INDEX STORM NO. 2
                       STRM       3.99  PRECIPITATION DEPTH
                       TRDA      10.00  TRANSPOSITION DRAINAGE AREA

   0 PI           PRECIPITATION PATTERN
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
                      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .01      .00      .01
           .01      .01      .01      .01      .01      .01      .01      .01      .03      .03
           .03      .09      .09      .09      .01      .01      .01      .01      .01      .01
           .01      .01      .01      .01      .01      .01      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00

50 JD        INDEX STORM NO. 3
                STRM        3.78  PRECIPITATION DEPTH
                TRDA       30.00  TRANSPOSITION DRAINAGE AREA

 0 PI          PRECIPITATION PATTERN
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .01      .00      .01
           .01      .01      .01      .01      .01      .01      .01      .01      .03      .03
           .03      .09      .09      .09      .01      .01      .01      .01      .01      .01
           .01      .01      .01      .01      .01      .01      .00      .00      .00      .00
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           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00

51 JD        INDEX STORM NO. 4
                STRM        3.65  PRECIPITATION DEPTH
                TRDA       60.00  TRANSPOSITION DRAINAGE AREA

 0 PI          PRECIPITATION PATTERN
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .01      .00      .01
           .01      .01      .01      .01      .01      .01      .01      .01      .03      .03
           .03      .09      .09      .09      .01      .01      .01      .01      .01      .01
           .01      .01      .01      .01      .01      .01      .00      .00      .00      .00
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           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
           .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
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                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00

 52 JD          INDEX STORM NO. 5
                  STRM        3.58  PRECIPITATION DEPTH
                  TRDA       90.00  TRANSPOSITION DRAINAGE AREA

  0 PI            PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .01       .00       .01
                    .01       .01       .01       .01       .01       .01       .01       .01       .03       .03
                    .03       .09       .09       .09       .01       .01       .01       .01       .01       .01
                    .01       .01       .01       .01       .01       .01       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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              *            *
 53 KK        *      S110  *        BASIN
              *            *
              **************
                              Compute runoff from subbasin 110

                 SUBBASIN RUNOFF DATA

 54 BA             SUBBASIN CHARACTERISTICS
                     TAREA         .43  SUBBASIN AREA

 55 LG             GREEN AND AMPT LOSS RATE
                     STRTL         .25  STARTING LOSS
                       DTH         .37  MOISTURE DEFICIT
                      PSIF        5.20  WETTING FRONT SUCTION
                     XKSAT         .25  HYDRAULIC CONDUCTIVITY
                     RTIMP        6.00  PERCENT IMPERVIOUS AREA

 54 UI             INPUT UNITGRAPH,  23 ORDINATES,  VOLUME = 1.00
                     56.0      166.0      335.0      449.0      587.0      358.0      291.0      241.0      188.0      140.0
                    121.0       86.0       68.0       56.0       43.0       32.0       27.0       22.0       11.0       11.0
                     10.0       11.0       11.0

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     ***             ***             ***             ***             ***

                       HYDROGRAPH AT STATION     S110
                      TRANSPOSITION AREA       .1 SQ MI

    TOTAL RAINFALL =     4.20, TOTAL LOSS =     2.74, TOTAL EXCESS =     1.46

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     543.     12.17                   64.          17.           6.           2.
                (INCHES)       1.383        1.456        1.457        1.457
                 (AC-FT)          32.          33.          33.          33.

                 CUMULATIVE AREA =      .43 SQ MI


     ***             ***             ***             ***             ***

                       HYDROGRAPH AT STATION     S110
                      TRANSPOSITION AREA     10.0 SQ MI

    TOTAL RAINFALL =     3.99, TOTAL LOSS =     2.64, TOTAL EXCESS =     1.35

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
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                                        6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                          (CFS)
+     506.     12.17                     59.          16.           5.           2.
                         (INCHES)      1.279        1.348        1.348        1.348
                         (AC-FT)         29.          31.          31.          31.

                        CUMULATIVE AREA =      .43 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION      S110
                       TRANSPOSITION AREA      30.0 SQ MI

     TOTAL RAINFALL =    3.78, TOTAL LOSS =    2.54, TOTAL EXCESS =    1.24

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                          (CFS)
+     468.     12.17                     54.          14.           5.           2.
                         (INCHES)      1.172        1.237        1.238        1.238
                         (AC-FT)         27.          28.          28.          28.

                        CUMULATIVE AREA =      .43 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION      S110
                       TRANSPOSITION AREA      60.0 SQ MI

     TOTAL RAINFALL =    3.65, TOTAL LOSS =    2.48, TOTAL EXCESS =    1.18

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                          (CFS)
+     445.     12.17                     51.          14.           5.           2.
                         (INCHES)      1.108        1.171        1.172        1.172
                         (AC-FT)         25.          27.          27.          27.

                        CUMULATIVE AREA =      .43 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION      S110
                       TRANSPOSITION AREA      90.0 SQ MI

     TOTAL RAINFALL =    3.58, TOTAL LOSS =    2.44, TOTAL EXCESS =    1.14

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                          (CFS)
+     431.     12.17                     50.          13.           4.           2.
                         (INCHES)      1.071        1.133        1.134        1.134
                         (AC-FT)         25.          26.          26.          26.

                        CUMULATIVE AREA =      .43 SQ MI

    -----DSS---ZOPEN:  New File Opened,  File: SVP_EX24.DSS
                       Unit:  71;  DSS Version: 6-JG
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S110/S110/FLOW/01JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S110/S110/FLOW/02JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S110/S110/FLOW/03JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S110/S110/FLOW/04JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S110/S110/FLOW/05JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S110/S110/FLOW/06JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S110/S110/FLOW/07JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S110/S110/FLOW/08JAN1999/5MIN/CALC/
      ***             ***             ***             ***             ***


                        INTERPOLATED HYDROGRAPH AT     S110

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                          (CFS)
+     532.     12.17                     62.          16.           5.           2.
                         (INCHES)      1.350        1.422        1.422        1.422
                         (AC-FT)         31.          33.          33.          33.

                        CUMULATIVE AREA =      .43 SQ MI


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          **************
          *            *
63 KK     *   11015I   *       ROUTE
          *            *
          **************
                              Route flow from C105 through subbasin 110 to C115.
                              Slope = (1847-1746) / 3783

            HYDROGRAPH ROUTING DATA

64 RS         STORAGE ROUTING
                   NSTPS          2  NUMBER OF SUBREACHES
                   ITYP       FLOW  TYPE OF INITIAL CONDITION
                  RSVRIC      -1.00 INITIAL CONDITION
                       X        .00 WORKING R AND D COEFFICIENT

65 RC         NORMAL DEPTH CHANNEL
                    ANL       .045  LEFT OVERBANK N-VALUE
                   ANCH       .035  MAIN CHANNEL N-VALUE
                    ANR       .045  RIGHT OVERBANK N-VALUE
                  RLNTH      3783.  REACH LENGTH
                    SEL      .0267  ENERGY SLOPE
                  ELMAX      102.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                        CROSS-SECTION DATA
                              --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
67 RY         ELEVATION    102.00   101.50   101.00   100.00   100.00   101.00   101.50   102.00
66 RX         DISTANCE        .00    50.00   100.00   110.00   120.00   130.00   180.00   230.00

                                                  ***

                                        COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00      .10      .22      .36      .52      .70      .89     1.11     1.35     1.60
          OUTFLOW        .00     1.70     5.63    11.60    19.64    29.85    42.35    57.26    74.71    94.83
        ELEVATION     100.00   100.11   100.21   100.32   100.42   100.53   100.63   100.74   100.84   100.95

          STORAGE       1.90     2.36     3.02     3.88     4.92     6.16     7.59     9.21    11.02    13.03
          OUTFLOW     120.37   153.46   194.14   244.32   305.64   379.62   467.62   570.97   690.92   828.66
        ELEVATION     101.05   101.16   101.26   101.37   101.47   101.58   101.68   101.79   101.89   102.00

     ***           ***           ***           ***           ***

                      HYDROGRAPH AT STATION   11015I
                     TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                    (CFS)
+     467.     12.42                64.         17.          6.          2.
                  (INCHES)       1.383       1.455       1.457       1.457
                  (AC-FT)          32.         33.         33.         33.

 PEAK STORAGE   TIME                      MAXIMUM AVERAGE STORAGE
                                  6-HR       24-HR       72-HR    166.58-HR
+  (AC-FT)      (HR)
        4.     12.42                 1.          0.          0.          0.

  PEAK STAGE    TIME                      MAXIMUM AVERAGE STAGE
                                  6-HR       24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
    101.68     12.42              100.47      100.17      100.06      100.02

                     CUMULATIVE AREA =      .43 SQ MI

     ***           ***           ***           ***           ***

                      HYDROGRAPH AT STATION   11015I
                     TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                    (CFS)
+     433.     12.42                59.         16.          5.          2.
                  (INCHES)       1.279       1.347       1.348       1.348
                  (AC-FT)          29.         31.         31.         31.

 PEAK STORAGE   TIME                      MAXIMUM AVERAGE STORAGE
                                  6-HR       24-HR       72-HR    166.58-HR
+  (AC-FT)      (HR)
        4.     12.42                 1.          0.          0.          0.

  PEAK STAGE    TIME                      MAXIMUM AVERAGE STAGE
                                  6-HR       24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
    101.64     12.42              100.45      100.16      100.05      100.02

                     CUMULATIVE AREA =      .43 SQ MI

     ***           ***           ***           ***           ***
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HYDROGRAPH AT STATION 11015I
TRANSPOSITION AREA 30.0 SQ MI

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR	
+ (CFS)	(HR)					
		(CFS)				
+ 399.	12.42	54.	14.	5.	2.	
		(INCHES) 1.172	1.237	1.238	1.238	
		(AC-FT) 27.	28.	28.	28.	

PEAK STORAGE	TIME		MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR	
+ (AC-FT)	(HR)					
3.	12.42	0.	0.	0.	0.	

PEAK STAGE	TIME		MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR	
+ (FEET)	(HR)					
101.60	12.42	100.43	100.16	100.05	100.02	

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 11015I
TRANSPOSITION AREA 60.0 SQ MI

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR	
+ (CFS)	(HR)					
		(CFS)				
+ 378.	12.42	51.	14.	5.	2.	
		(INCHES) 1.108	1.171	1.172	1.172	
		(AC-FT) 25.	27.	27.	27.	

PEAK STORAGE	TIME		MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR	
+ (AC-FT)	(HR)					
3.	12.42	0.	0.	0.	0.	

PEAK STAGE	TIME		MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR	
+ (FEET)	(HR)					
101.58	12.42	100.43	100.15	100.05	100.02	

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 11015I
TRANSPOSITION AREA 90.0 SQ MI

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR	
+ (CFS)	(HR)					
		(CFS)				
+ 366.	12.42	50.	13.	4.	2.	
		(INCHES) 1.071	1.133	1.134	1.134	
		(AC-FT) 25.	26.	26.	26.	

PEAK STORAGE	TIME		MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR	
+ (AC-FT)	(HR)					
3.	12.42	0.	0.	0.	0.	

PEAK STAGE	TIME		MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR	
+ (FEET)	(HR)					
101.56	12.42	100.42	100.15	100.05	100.02	

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

INTERPOLATED HYDROGRAPH AT 11015I

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR	
+ (CFS)	(HR)					
		(CFS)				
+ 456.	12.42	62.	16.	5.	2.	
		(INCHES) 1.350	1.421	1.422	1.422	
		(AC-FT) 31.	33.	33.	33.	

CUMULATIVE AREA = .43 SQ MI

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*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
 70 KK      *      D15I  *       DIVERT
            *            *
            **************
                                Divert flows to the left into S120

     DT          DIVERSION
                       ISTAD        CF5I  DIVERSION HYDROGRAPH IDENTIFICATION

     DI             INFLOW         .00    100.00   1000.00  10000.00

     DQ      DIVERTED FLOW         .00     20.00    200.00   2000.00

                                                                  ***

      ***             ***             ***             ***             ***

                          DIVERSION HYDROGRAPH     CF5I
                        TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+      93.     12.42                 13.           3.           1.           0.
                        (INCHES)      .277         .291         .291         .291
                         (AC-FT)        6.           7.           7.           7.

                          CUMULATIVE AREA =      .43 SQ MI


      ***             ***             ***             ***             ***

                          HYDROGRAPH AT STATION     D15I
                        TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+     373.     12.42                 51.          13.           4.           2.
                        (INCHES)     1.107        1.164        1.165        1.165
                         (AC-FT)       25.          27.          27.          27.

                          CUMULATIVE AREA =      .43 SQ MI


      ***             ***             ***             ***             ***

                          DIVERSION HYDROGRAPH     CF5I
                        TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+      87.     12.42                 12.           3.           1.           0.
                        (INCHES)      .256         .269         .270         .270
                         (AC-FT)        6.           6.           6.           6.

                          CUMULATIVE AREA =      .43 SQ MI


      ***             ***             ***             ***             ***

                          HYDROGRAPH AT STATION     D15I
                        TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+     346.     12.42                 47.          12.           4.           2.
                        (INCHES)     1.023        1.078        1.079        1.079
                         (AC-FT)       23.          25.          25.          25.

                          CUMULATIVE AREA =      .43 SQ MI


      ***             ***             ***             ***             ***

                          DIVERSION HYDROGRAPH     CF5I
                        TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                          (CFS)
+      80.     12.42                 11.           3.           1.           0.
                        (INCHES)      .234         .247         .248         .248
                         (AC-FT)        5.           6.           6.           6.
```

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION D15I
TRANSPOSITION AREA 30.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 319.	12.42	43.	11.	4.	2.
		(INCHES) .937	.989	.990	.990
		(AC-FT) 21.	23.	23.	23.

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

DIVERSION HYDROGRAPH CF5I
TRANSPOSITION AREA 60.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 76.	12.42	10.	3.	1.	0.
		(INCHES) .222	.234	.234	.234
		(AC-FT) 5.	5.	5.	5.

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION D15I
TRANSPOSITION AREA 60.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 303.	12.42	41.	11.	4.	2.
		(INCHES) .886	.936	.937	.937
		(AC-FT) 20.	21.	21.	21.

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

DIVERSION HYDROGRAPH CF5I
TRANSPOSITION AREA 90.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 73.	12.42	10.	3.	1.	0.
		(INCHES) .214	.227	.227	.227
		(AC-FT) 5.	5.	5.	5.

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION D15I
TRANSPOSITION AREA 90.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 293.	12.42	40.	10.	3.	2.
		(INCHES) .857	.906	.907	.907
		(AC-FT) 20.	21.	21.	21.

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

INTERPOLATED DIVERSION HYDROGRAPH AT CF5I

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 91.	12.42	12.	3.	1.	0.
		(INCHES) .270	.284	.284	.284

```
                    (AC-FT)        6.          7.          7.          7.

                    CUMULATIVE AREA =     .43 SQ MI

      ***           ***           ***           ***           ***


                    INTERPOLATED HYDROGRAPH AT     D15I

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                     (CFS)
+     365.     12.42                50.         13.          4.          2.
                   (INCHES)      1.080       1.137       1.138       1.138
                    (AC-FT)       25.         26.         26.         26.

                    CUMULATIVE AREA =     .43 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  75 KK     *    15I15R  *        ROUTE
            *            *
            **************
                          Route flows from split through S115 to C115.
                          Slope = (1746-1532) / 14128

               HYDROGRAPH ROUTING DATA

  76 RS          STORAGE ROUTING
                      NSTPS           8  NUMBER OF SUBREACHES
                       ITYP        FLOW  TYPE OF INITIAL CONDITION
                      RSVRIC       -1.00  INITIAL CONDITION
                          X         .00 WORKING R AND D COEFFICIENT

  77 RC          NORMAL DEPTH CHANNEL
                       ANL        .035  LEFT OVERBANK N-VALUE
                      ANCH        .030  MAIN CHANNEL N-VALUE
                       ANR        .035  RIGHT OVERBANK N-VALUE
                     RLNTH       14128.  REACH LENGTH
                       SEL       .0151  ENERGY SLOPE
                     ELMAX       105.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                    CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
  79 RY        ELEVATION    105.00    102.50    102.00    100.00    100.00    102.00    102.50    105.00
  78 RX        DISTANCE        .00     25.00     58.00     65.00     85.00     92.00    125.00    150.00

                                                  ***

                                    COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00      1.79      3.73      5.83      8.09     10.50     13.07     15.80     18.91     24.48
          OUTFLOW        .00     13.38     43.15     86.30    141.97    209.86    289.95    382.35    494.41    643.47
        ELEVATION     100.00    100.26    100.53    100.79    101.05    101.32    101.58    101.84    102.11    102.37

          STORAGE      32.70     41.69     51.12     61.00     71.34     82.12     93.35    105.03    117.16    129.74
          OUTFLOW     843.66   1098.08   1397.67   1740.65   2126.23   2554.16   3024.48   3537.45   4093.45   4692.95
        ELEVATION     102.63    102.89    103.16    103.42    103.68    103.95    104.21    104.47    104.74    105.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN     1741. TO     4693.
                THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

      ***           ***           ***           ***           ***

                    HYDROGRAPH AT STATION   15I15R
                   TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                     (CFS)
+     331.     12.83                51.         13.          4.          2.
                   (INCHES)      1.106       1.164       1.165       1.165
                    (AC-FT)       25.         27.         27.         27.

 PEAK STORAGE   TIME                    MAXIMUM AVERAGE STORAGE
                                  6-HR       24-HR       72-HR    166.58-HR
+  (AC-FT)      (HR)
        2.     12.83                 0.          0.          0.          0.

  PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                                  6-HR       24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
    101.70     12.83              100.40      100.11      100.04      100.02
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CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 15I15R
TRANSPOSITION AREA 10.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 306.	12.83	47.	12.	4.	2.
		(INCHES) 1.022	1.077	1.079	1.079
		(AC-FT) 23.	25.	25.	25.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)				
2.	12.83	0.	0.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)				
101.63	12.83	100.39	100.11	100.04	100.02

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 15I15R
TRANSPOSITION AREA 30.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 281.	12.83	43.	11.	4.	2.
		(INCHES) .937	.989	.990	.990
		(AC-FT) 21.	23.	23.	23.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)				
2.	12.83	0.	0.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)				
101.55	12.83	100.37	100.10	100.03	100.01

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 15I15R
TRANSPOSITION AREA 60.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 266.	12.83	41.	11.	4.	2.
		(INCHES) .886	.936	.937	.937
		(AC-FT) 20.	21.	21.	21.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)				
2.	12.83	0.	0.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)				
101.50	12.83	100.36	100.10	100.03	100.01

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 15I15R
TRANSPOSITION AREA 90.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 257.	12.83	40.	10.	3.	2.
		(INCHES) .856	.906	.907	.907
		(AC-FT) 20.	21.	21.	21.

PEAK STORAGE TIME MAXIMUM AVERAGE STORAGE

```
                                        6-HR        24-HR        72-HR    166.58-HR
+  (AC-FT)       (HR)
        2.     12.83                     0.           0.           0.           0.

  PEAK STAGE    TIME                                MAXIMUM AVERAGE STAGE
                                        6-HR        24-HR        72-HR    166.58-HR
+   (FEET)       (HR)
    101.47     12.83                  100.35       100.10       100.03       100.01

                          CUMULATIVE AREA =      .43 SQ MI

      ***             ***             ***             ***             ***


                          INTERPOLATED HYDROGRAPH AT   15I15R

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+     323.     12.83                    50.          13.           4.           2.
                          (INCHES)     1.079        1.136        1.138        1.138
                          (AC-FT)        25.          26.          26.          26.

                          CUMULATIVE AREA =      .43 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  82 KK     *      S115  *        BASIN
            *            *
            **************
                              Compute runoff from subbasin 115

               SUBBASIN RUNOFF DATA

  83 BA          SUBBASIN CHARACTERISTICS
                      TAREA         2.25  SUBBASIN AREA

  84 LG          GREEN AND AMPT LOSS RATE
                      STRTL          .32  STARTING LOSS
                        DTH          .35  MOISTURE DEFICIT
                       PSIF         4.80  WETTING FRONT SUCTION
                      XKSAT          .30  HYDRAULIC CONDUCTIVITY
                      RTIMP         2.00  PERCENT IMPERVIOUS AREA

  83 UI          INPUT UNITGRAPH,  34 ORDINATES,  VOLUME = 1.00
                    160.0     163.0     434.0     709.0     984.0    1212.0    1401.0    1530.0    1539.0    1465.0
                   1351.0    1100.0     918.0     773.0     632.0     528.0     444.0     351.0     304.0     252.0
                    203.0     170.0     140.0     110.0     110.0      85.0      39.0      39.0      40.0      39.0
                     39.0      39.0      40.0      39.0

                                                                                                          ***

      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S115
                       TRANSPOSITION AREA       .1 SQ MI

     TOTAL RAINFALL =    4.20, TOTAL LOSS =    2.92, TOTAL EXCESS =    1.28

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    1789.     12.50                   304.          77.          26.          11.
                          (INCHES)     1.256        1.280        1.281        1.281
                          (AC-FT)        151.         153.         153.         153.

                          CUMULATIVE AREA =    2.25 SQ MI

      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S115
                       TRANSPOSITION AREA     10.0 SQ MI

     TOTAL RAINFALL =    3.99, TOTAL LOSS =    2.81, TOTAL EXCESS =    1.18

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                            (CFS)
+    1647.     12.50                   278.          71.          24.          10.
                          (INCHES)     1.152        1.175        1.175        1.175
                          (AC-FT)        138.         141.         141.         141.

                          CUMULATIVE AREA =    2.25 SQ MI
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      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S115
                       TRANSPOSITION AREA     30.0 SQ MI

     TOTAL RAINFALL =    3.78, TOTAL LOSS =    2.70, TOTAL EXCESS =    1.08

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+    1510.     12.50                255.         65.         22.          9.
                (INCHES)          1.054       1.075       1.076       1.076
                 (AC-FT)            126.        129.        129.        129.

                        CUMULATIVE AREA =    2.25 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S115
                       TRANSPOSITION AREA     60.0 SQ MI

     TOTAL RAINFALL =    3.65, TOTAL LOSS =    2.64, TOTAL EXCESS =    1.02

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+    1429.     12.50                241.         61.         20.          9.
                (INCHES)          .996       1.017       1.017       1.017
                 (AC-FT)            119.        122.        122.        122.

                        CUMULATIVE AREA =    2.25 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S115
                       TRANSPOSITION AREA     90.0 SQ MI

     TOTAL RAINFALL =    3.58, TOTAL LOSS =    2.59, TOTAL EXCESS =     .98

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+    1379.     12.50                232.         59.         20.          9.
                (INCHES)          .961        .982        .982        .982
                 (AC-FT)            115.        118.        118.        118.

                        CUMULATIVE AREA =    2.25 SQ MI

      ***             ***             ***             ***             ***


                        INTERPOLATED HYDROGRAPH AT     S115

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+    1693.     12.50                287.         73.         24.         11.
                (INCHES)          1.186       1.209       1.209       1.209
                 (AC-FT)            142.        145.        145.        145.

                        CUMULATIVE AREA =    2.25 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  91 KK     *     C115U  *      COMBINE
            *            *
            **************
                          Combine runoff from S115 with routed flow.

  92 HC           HYDROGRAPH COMBINATION
                        ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                                    ***

      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION    C115U
                       TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
```

```
+   (CFS)        (HR)
                                (CFS)
+    1962.      12.58                355.          91.          30.          13.
                              (INCHES)      1.231        1.261        1.262        1.262
                               (AC-FT)       176.         180.         180.         180.

                              CUMULATIVE AREA =    2.68 SQ MI


      ***            ***            ***            ***            ***

                              HYDROGRAPH AT STATION    C115U
                            TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                    6-HR         24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                                (CFS)
+    1790.      12.67                325.          83.          28.          12.
                              (INCHES)      1.130        1.159        1.160        1.160
                               (AC-FT)       161.         165.         166.         166.

                              CUMULATIVE AREA =    2.68 SQ MI


      ***            ***            ***            ***            ***

                              HYDROGRAPH AT STATION    C115U
                            TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                    6-HR         24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                                (CFS)
+    1632.      12.67                298.          76.          25.          11.
                              (INCHES)      1.034        1.061        1.062        1.062
                               (AC-FT)       148.         151.         152.         152.

                              CUMULATIVE AREA =    2.68 SQ MI


      ***            ***            ***            ***            ***

                              HYDROGRAPH AT STATION    C115U
                            TRANSPOSITION AREA     60.0 SQ MI

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                    6-HR         24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                                (CFS)
+    1539.      12.67                281.          72.          24.          10.
                              (INCHES)       .978        1.004        1.005        1.005
                               (AC-FT)       140.         143.         143.         143.

                              CUMULATIVE AREA =    2.68 SQ MI


      ***            ***            ***            ***            ***

                              HYDROGRAPH AT STATION    C115U
                            TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                    6-HR         24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                                (CFS)
+    1484.      12.67                272.          70.          23.          10.
                              (INCHES)       .944         .969         .970         .970
                               (AC-FT)       135.         138.         138.         138.

                              CUMULATIVE AREA =    2.68 SQ MI


      ***            ***            ***            ***            ***


                              INTERPOLATED HYDROGRAPH AT    C115U

  PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                    6-HR         24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                                (CFS)
+    1839.      12.58                334.          86.          29.          12.
                              (INCHES)      1.159        1.188        1.189        1.189
                               (AC-FT)       166.         170.         170.         170.

                              CUMULATIVE AREA =    2.68 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

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                *              *
 94 KK          *      CF5I    *     RETRIEVE
                *              *
                ***************
                          Retrieve diverted flow from D15I
                                                                      ***
      ***               ***               ***               ***               ***

                            HYDROGRAPH AT STATION     CF5I
                          TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                           (CFS)
+      93.     12.42                     13.           3.           1.           0.
                         (INCHES)       .044         .047         .047         .047
                          (AC-FT)          6.           7.           7.           7.

                          CUMULATIVE AREA =      .43 SQ MI

      ***               ***               ***               ***               ***

                            HYDROGRAPH AT STATION     CF5I
                          TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                           (CFS)
+      87.     12.42                     12.           3.           1.           0.
                         (INCHES)       .041         .043         .043         .043
                          (AC-FT)          6.           6.           6.           6.

                          CUMULATIVE AREA =      .43 SQ MI

      ***               ***               ***               ***               ***

                            HYDROGRAPH AT STATION     CF5I
                          TRANSPOSITION AREA      30.0 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                           (CFS)
+      80.     12.42                     11.           3.           1.           0.
                         (INCHES)       .038         .040         .040         .040
                          (AC-FT)          5.           6.           6.           6.

                          CUMULATIVE AREA =      .43 SQ MI

      ***               ***               ***               ***               ***

                            HYDROGRAPH AT STATION     CF5I
                          TRANSPOSITION AREA      60.0 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                           (CFS)
+      76.     12.42                     10.           3.           1.           0.
                         (INCHES)       .036         .038         .038         .038
                          (AC-FT)          5.           5.           5.           5.

                          CUMULATIVE AREA =      .43 SQ MI

      ***               ***               ***               ***               ***

                            HYDROGRAPH AT STATION     CF5I
                          TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                           (CFS)
+      73.     12.42                     10.           3.           1.           0.
                         (INCHES)       .034         .036         .036         .036
                          (AC-FT)          5.           5.           5.           5.

                          CUMULATIVE AREA =      .43 SQ MI

      ***               ***               ***               ***               ***


                        INTERPOLATED HYDROGRAPH AT     CF5I

  PEAK FLOW     TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR     166.58-HR
```

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+   (CFS)        (HR)
                          (CFS)
+       91.      12.42                12.          3.          1.          0.
                       (INCHES)       .270        .284        .284        .284
                        (AC-FT)        6.          7.          7.          7.

                      CUMULATIVE AREA =      .43 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


              **************
              *            *
   97 KK      *    15I15L  *        ROUTE
              *            *
              **************
                                Route flows from split through S120 to C115.
                                Slope =(1746-1532) / 12775

                 HYDROGRAPH ROUTING DATA

   98 RS           STORAGE ROUTING
                        NSTPS           7  NUMBER OF SUBREACHES
                         ITYP        FLOW  TYPE OF INITIAL CONDITION
                       RSVRIC       -1.00  INITIAL CONDITION
                            X         .00 WORKING R AND D COEFFICIENT

   99 RC           NORMAL DEPTH CHANNEL
                          ANL        .045  LEFT OVERBANK N-VALUE
                         ANCH        .045  MAIN CHANNEL N-VALUE
                          ANR        .045  RIGHT OVERBANK N-VALUE
                        RLNTH      12775.  REACH LENGTH
                          SEL       .0168  ENERGY SLOPE
                        ELMAX       104.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                          CROSS-SECTION DATA
                                --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
  101 RY        ELEVATION    104.00    103.00    102.00    100.00    100.00    102.00    103.00    104.00
  100 RX        DISTANCE        .00     50.00    100.00    130.00    170.00    200.00    250.00    300.00

                                                      ***

                                          COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

            STORAGE        .00      2.66      5.72      9.16     13.00     17.22     21.84     26.84     32.24     38.02
            OUTFLOW        .00     13.16     43.16     87.79    146.88    220.73    309.87    414.89    536.44    675.21
          ELEVATION     100.00    100.21    100.42    100.63    100.84    101.05    101.26    101.47    101.68    101.89

            STORAGE      44.31     51.78     60.56     70.63     82.00     94.68    108.65    123.92    140.49    158.37
            OUTFLOW     848.07   1060.67   1303.15   1579.92   1894.78   2251.18   2652.37   3101.41   3601.21   4154.59
          ELEVATION     102.11    102.32    102.53    102.74    102.95    103.16    103.37    103.58    103.79    104.00

       ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION   15I15L
                       TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                          (CFS)
+       47.     13.58                13.          3.          1.          0.
                       (INCHES)       .276        .291        .291        .291
                        (AC-FT)        6.          7.          7.          7.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR       72-HR     166.58-HR
+  (AC-FT)      (HR)
         1.     13.58                 0.          0.          0.          0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR       72-HR     166.58-HR
+   (FEET)      (HR)
     100.44     13.58              100.16      100.04      100.01      100.01

                      CUMULATIVE AREA =      .43 SQ MI

       ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION   15I15L
                       TRANSPOSITION AREA      10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR       72-HR     166.58-HR
+   (CFS)       (HR)
                          (CFS)
+       42.     13.67                12.          3.          1.          0.
                       (INCHES)       .255        .269        .270        .270
                        (AC-FT)        6.          6.          6.          6.
```

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)				
1.	13.67	0.	0.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)				
100.41	13.67	100.15	100.04	100.01	100.01

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 15I15L
TRANSPOSITION AREA 30.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 38.	13.67	11.	3.	1.	0.
		(INCHES) .234	.247	.248	.248
		(AC-FT) 5.	6.	6.	6.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)				
1.	13.67	0.	0.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)				
100.38	13.67	100.14	100.04	100.01	100.01

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 15I15L
TRANSPOSITION AREA 60.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 35.	13.67	10.	3.	1.	0.
		(INCHES) .221	.234	.234	.234
		(AC-FT) 5.	5.	5.	5.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)				
1.	13.67	0.	0.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)				
100.36	13.67	100.13	100.04	100.01	100.01

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 15I15L
TRANSPOSITION AREA 90.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 34.	13.75	10.	3.	1.	0.
		(INCHES) .213	.226	.227	.227
		(AC-FT) 5.	5.	5.	5.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)				
1.	13.75	0.	0.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)				
100.35	13.75	100.13	100.04	100.01	100.01

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

INTERPOLATED HYDROGRAPH AT 15I15L

```
  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                    (CFS)
+      45.     13.58                12.           3.           1.           0.
                (INCHES)          .269         .284         .284         .284
                 (AC-FT)            6.           7.           7.           7.

                 CUMULATIVE AREA =     .43 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  104 KK    *     C115D  *      COMBINE
            *            *
            **************
                           Combine routed flows from split with remainder of flows in SVP channel
                           just D/S of C115.

  105 HC          HYDROGRAPH COMBINATION
                        ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                    ***

       ***             ***             ***             ***             ***

                         HYDROGRAPH AT STATION    C115D
                       TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                    (CFS)
+    1963.     12.58                367.          94.          31.          14.
                (INCHES)         1.275        1.308        1.309        1.309
                 (AC-FT)           182.         187.         187.         187.

                 CUMULATIVE AREA =    2.68 SQ MI


       ***             ***             ***             ***             ***

                         HYDROGRAPH AT STATION    C115D
                       TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                    (CFS)
+    1791.     12.67                337.          87.          29.          12.
                (INCHES)         1.170        1.202        1.203        1.203
                 (AC-FT)           167.         172.         172.         172.

                 CUMULATIVE AREA =    2.68 SQ MI


       ***             ***             ***             ***             ***

                         HYDROGRAPH AT STATION    C115D
                       TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                    (CFS)
+    1633.     12.67                308.          79.          26.          11.
                (INCHES)         1.071        1.101        1.102        1.102
                 (AC-FT)           153.         157.         157.         157.

                 CUMULATIVE AREA =    2.68 SQ MI


       ***             ***             ***             ***             ***

                         HYDROGRAPH AT STATION    C115D
                       TRANSPOSITION AREA     60.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                    (CFS)
+    1540.     12.67                291.          75.          25.          11.
                (INCHES)         1.012        1.041        1.042        1.042
                 (AC-FT)           145.         149.         149.         149.

                 CUMULATIVE AREA =    2.68 SQ MI


       ***             ***             ***             ***             ***
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HYDROGRAPH AT STATION C115D
TRANSPOSITION AREA 90.0 SQ MI

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	166.58-HR
		(CFS)				
1484.	12.67		281.	72.	24.	10.
		(INCHES)	.977	1.005	1.006	1.006
		(AC-FT)	139.	144.	144.	144.

CUMULATIVE AREA = 2.68 SQ MI

*** *** *** *** ***

INTERPOLATED HYDROGRAPH AT C115D

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	166.58-HR
		(CFS)				
1840.	12.58		346.	89.	30.	13.
		(INCHES)	1.200	1.232	1.233	1.233
		(AC-FT)	171.	176.	176.	176.

CUMULATIVE AREA = 2.68 SQ MI

*** ***

108 KK * 115120 * ROUTE

Route total flows from C115 to C120. Slope =(1532-1494) / 4077

HYDROGRAPH ROUTING DATA

109 RS STORAGE ROUTING

NSTPS	2	NUMBER OF SUBREACHES
ITYP	FLOW	TYPE OF INITIAL CONDITION
RSVRIC	-1.00	INITIAL CONDITION
X	.00	WORKING R AND D COEFFICIENT

110 RC NORMAL DEPTH CHANNEL

ANL	.030	LEFT OVERBANK N-VALUE
ANCH	.025	MAIN CHANNEL N-VALUE
ANR	.030	RIGHT OVERBANK N-VALUE
RLNTH	4077.	REACH LENGTH
SEL	.0093	ENERGY SLOPE
ELMAX	105.0	MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

CROSS-SECTION DATA

		--- LEFT OVERBANK ---		+ ------ MAIN CHANNEL -------			+ --- RIGHT OVERBANK ---		
112 RY	ELEVATION	105.00	101.50	101.00	100.00	100.00	101.00	101.50	105.00
111 RX	DISTANCE	.00	30.00	75.00	80.00	105.00	110.00	155.00	190.00

***

COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

STORAGE	.00	.65	1.36	2.14	3.00	4.68	7.48	10.66	13.95	17.37
OUTFLOW	.00	15.80	51.17	102.71	171.30	274.01	433.42	662.76	946.41	1280.64
ELEVATION	100.00	100.26	100.53	100.79	101.05	101.32	101.58	101.84	102.11	102.37
STORAGE	20.90	24.56	28.34	32.23	36.25	40.39	44.65	49.03	53.53	58.15
OUTFLOW	1663.38	2093.36	2569.83	3092.34	3660.68	4274.80	4934.78	5640.78	6393.04	7191.86
ELEVATION	102.63	102.89	103.16	103.42	103.68	103.95	104.21	104.47	104.74	105.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN 3661. TO 7192.
THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

*** *** *** *** ***

HYDROGRAPH AT STATION 115120
TRANSPOSITION AREA .1 SQ MI

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	166.58-HR
		(CFS)				
1925.	12.75		367.	94.	31.	14.
		(INCHES)	1.274	1.308	1.309	1.309
		(AC-FT)	182.	187.	187.	187.

PEAK STORAGE TIME MAXIMUM AVERAGE STORAGE

		6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)				
12.	12.75	3.	1.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)				
102.79	12.75	100.98	100.28	100.10	100.04

CUMULATIVE AREA = 2.68 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 115120
TRANSPOSITION AREA 10.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 1760.	12.75	337.	87.	29.	12.
		(INCHES) 1.170	1.202	1.203	1.203
		(AC-FT) 167.	172.	172.	172.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)				
11.	12.75	3.	1.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)				
102.69	12.75	100.94	100.27	100.09	100.04

CUMULATIVE AREA = 2.68 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 115120
TRANSPOSITION AREA 30.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 1602.	12.75	308.	79.	26.	11.
		(INCHES) 1.070	1.101	1.102	1.102
		(AC-FT) 153.	157.	157.	157.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)				
10.	12.75	2.	1.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)				
102.59	12.75	100.91	100.26	100.09	100.04

CUMULATIVE AREA = 2.68 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 115120
TRANSPOSITION AREA 60.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 1511.	12.75	291.	75.	25.	11.
		(INCHES) 1.012	1.041	1.042	1.042
		(AC-FT) 144.	149.	149.	149.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)				
10.	12.75	2.	1.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)				
102.53	12.75	100.89	100.26	100.09	100.04

CUMULATIVE AREA = 2.68 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 115120
TRANSPOSITION AREA 90.0 SQ MI

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  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+    1455.     12.75                281.          72.          24.          10.
                    (INCHES)        .977        1.005        1.006        1.006
                    (AC-FT)         139.         144.         144.         144.

 PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)      (HR)
        9.     12.75                  2.           1.           0.           0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+   (FEET)      (HR)
    102.49     12.75              100.87       100.25       100.08       100.04

                          CUMULATIVE AREA =     2.68 SQ MI

      ***             ***             ***             ***             ***


                          INTERPOLATED HYDROGRAPH AT   115120

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+    1807.     12.75                345.          89.          30.          13.
                    (INCHES)       1.200        1.232        1.233        1.233
                    (AC-FT)         171.         176.         176.         176.

                          CUMULATIVE AREA =     2.68 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  114 KK    *      S120  *        BASIN
            *            *
            **************
                              Compute runoff from subbasin 120

               SUBBASIN RUNOFF DATA

  115 BA          SUBBASIN CHARACTERISTICS
                        TAREA        2.00  SUBBASIN AREA

  116 LG          GREEN AND AMPT LOSS RATE
                        STRTL         .33  STARTING LOSS
                          DTH         .35  MOISTURE DEFICIT
                         PSIF        4.65  WETTING FRONT SUCTION
                        XKSAT         .32  HYDRAULIC CONDUCTIVITY
                        RTIMP        1.00  PERCENT IMPERVIOUS AREA

  115 UI          INPUT UNITGRAPH,  23 ORDINATES,  VOLUME = 1.00
                      206.0     408.0     954.0    1419.0    1824.0    1969.0    1911.0    1637.0    1230.0     944.0
                      731.0     551.0     418.0     336.0     234.0     186.0     143.0     120.0      50.0      51.0
                       50.0      51.0      51.0

                                                                ***

      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S120
                       TRANSPOSITION AREA       .1 SQ MI

     TOTAL RAINFALL =    4.20, TOTAL LOSS =    2.97, TOTAL EXCESS =    1.23

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+    2138.     12.33                261.          66.          22.           9.
                    (INCHES)       1.211        1.223        1.224        1.224
                    (AC-FT)         129.         131.         131.         131.

                          CUMULATIVE AREA =     2.00 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S120
                       TRANSPOSITION AREA     10.0 SQ MI

     TOTAL RAINFALL =    3.99, TOTAL LOSS =    2.86, TOTAL EXCESS =    1.13

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
```

```
+   (CFS)        (HR)
                  (CFS)
+    1976.      12.33                239.          60.          20.           9.
                (INCHES)             1.111        1.122        1.123         1.123
                 (AC-FT)               119.         120.         120.          120.

                 CUMULATIVE AREA =     2.00 SQ MI


       ***             ***             ***             ***             ***

                   HYDROGRAPH AT STATION     S120
                 TRANSPOSITION AREA     30.0 SQ MI

     TOTAL RAINFALL =    3.78, TOTAL LOSS =    2.75, TOTAL EXCESS =    1.03

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+    1817.      12.33                219.          55.          18.           8.
                (INCHES)             1.016        1.027        1.027         1.027
                 (AC-FT)               109.         110.         110.          110.

                 CUMULATIVE AREA =     2.00 SQ MI


       ***             ***             ***             ***             ***

                   HYDROGRAPH AT STATION     S120
                 TRANSPOSITION AREA     60.0 SQ MI

     TOTAL RAINFALL =    3.65, TOTAL LOSS =    2.68, TOTAL EXCESS =     .97

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+    1721.      12.33                207.          52.          17.           8.
                (INCHES)              .959         .969         .970          .970
                 (AC-FT)               102.         104.         104.          104.

                 CUMULATIVE AREA =     2.00 SQ MI


       ***             ***             ***             ***             ***

                   HYDROGRAPH AT STATION     S120
                 TRANSPOSITION AREA     90.0 SQ MI

     TOTAL RAINFALL =    3.58, TOTAL LOSS =    2.64, TOTAL EXCESS =     .94

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+    1662.      12.33                199.          50.          17.           7.
                (INCHES)              .924         .934         .934          .934
                 (AC-FT)               99.         100.         100.          100.

                 CUMULATIVE AREA =     2.00 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.    1:  /S120/S120/FLOW/01JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S120/S120/FLOW/02JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S120/S120/FLOW/03JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S120/S120/FLOW/04JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S120/S120/FLOW/05JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S120/S120/FLOW/06JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S120/S120/FLOW/07JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S120/S120/FLOW/08JAN1999/5MIN/CALC/
       ***             ***             ***             ***             ***


                 INTERPOLATED HYDROGRAPH AT     S120

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)        (HR)
                  (CFS)
+    2032.      12.33                247.          62.          21.           9.
                (INCHES)             1.146        1.158        1.158         1.158
                 (AC-FT)               122.         124.         124.          124.

                 CUMULATIVE AREA =     2.00 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  124 KK    *      C120  *      COMBINE
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*           *
**************
                    Combine flows at Wagner Wash at outlet of channel along SVP

 125 HC          HYDROGRAPH COMBINATION
                       ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                    ***

      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     C120
                      TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                        (CFS)
+    3434.     12.42                628.         160.          53.          23.
                     (INCHES)      1.247        1.272        1.272        1.272
                      (AC-FT)        311.         317.         318.         318.

                      CUMULATIVE AREA =    4.68 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     C120
                      TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                        (CFS)
+    3150.     12.42                576.         147.          49.          21.
                     (INCHES)      1.144        1.168        1.169        1.169
                      (AC-FT)        286.         292.         292.         292.

                      CUMULATIVE AREA =    4.68 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     C120
                      TRANSPOSITION AREA     30.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                        (CFS)
+    2875.     12.42                527.         135.          45.          19.
                     (INCHES)      1.047        1.069        1.070        1.070
                      (AC-FT)        261.         267.         267.         267.

                      CUMULATIVE AREA =    4.68 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     C120
                      TRANSPOSITION AREA     60.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                        (CFS)
+    2706.     12.42                498.         127.          42.          18.
                     (INCHES)       .989        1.010        1.011        1.011
                      (AC-FT)        247.         252.         252.         252.

                      CUMULATIVE AREA =    4.68 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     C120
                      TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                        (CFS)
+    2605.     12.42                480.         123.          41.          18.
                     (INCHES)       .954         .975         .976         .976
                      (AC-FT)        238.         243.         244.         244.

                      CUMULATIVE AREA =    4.68 SQ MI

      ***             ***             ***             ***             ***


                      INTERPOLATED HYDROGRAPH AT     C120

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
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                                        6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                      (CFS)
+    3197.      12.42                   585.         149.          50.          22.
                     (INCHES)          1.161        1.185        1.186        1.186
                      (AC-FT)           290.         296.         296.         296.

                     CUMULATIVE AREA =     4.68 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
 127 KK     *      S900  *        BASIN
            *            *
            **************

               SUBBASIN RUNOFF DATA

 128 BA          SUBBASIN CHARACTERISTICS
                       TAREA        1.03  SUBBASIN AREA

 129 LG          GREEN AND AMPT LOSS RATE
                       STRTL         .25  STARTING LOSS
                         DTH         .37  MOISTURE DEFICIT
                        PSIF        5.30  WETTING FRONT SUCTION
                       XKSAT         .24  HYDRAULIC CONDUCTIVITY
                       RTIMP        6.00  PERCENT IMPERVIOUS AREA

 128 UI          INPUT UNITGRAPH,  42 ORDINATES,  VOLUME = 1.00
                     75.0      77.0     215.0     338.0     472.0     551.0     650.0     871.0     671.0     496.0
                    448.0     394.0     356.0     320.0     277.0     233.0     197.0     180.0     165.0     140.0
                    116.0      97.0      89.0      83.0      65.0      59.0      58.0      37.0      38.0      37.0
                     37.0      23.0      14.0      15.0      14.0      15.0      14.0      15.0      15.0      14.0
                     15.0      14.0

                                                                    ***

      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S900
                       TRANSPOSITION AREA       .1 SQ MI

    TOTAL RAINFALL =    4.20, TOTAL LOSS =    2.73, TOTAL EXCESS =    1.47

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                      (CFS)
+     885.     12.50                   156.          41.          14.           6.
                     (INCHES)          1.398        1.471        1.472        1.472
                      (AC-FT)           77.          81.          81.          81.

                     CUMULATIVE AREA =     1.03 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S900
                       TRANSPOSITION AREA     10.0 SQ MI

    TOTAL RAINFALL =    3.99, TOTAL LOSS =    2.63, TOTAL EXCESS =    1.36

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                      (CFS)
+     822.     12.50                   144.          38.          13.           5.
                     (INCHES)          1.293        1.362        1.363        1.363
                      (AC-FT)           71.          75.          75.          75.

                     CUMULATIVE AREA =     1.03 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S900
                       TRANSPOSITION AREA     30.0 SQ MI

    TOTAL RAINFALL =    3.78, TOTAL LOSS =    2.53, TOTAL EXCESS =    1.25

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                      (CFS)
+     758.     12.50                   132.          35.          12.           5.
                     (INCHES)          1.186        1.252        1.253        1.253
                      (AC-FT)           65.          69.          69.          69.

                     CUMULATIVE AREA =     1.03 SQ MI
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*** *** *** *** ***

HYDROGRAPH AT STATION S900
TRANSPOSITION AREA 60.0 SQ MI

TOTAL RAINFALL = 3.65, TOTAL LOSS = 2.47, TOTAL EXCESS = 1.19

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
(CFS)	(HR)				
		(CFS)			
719.	12.50	125.	33.	11.	5.
		(INCHES) 1.121	1.185	1.186	1.186
		(AC-FT) 62.	65.	65.	65.

CUMULATIVE AREA = 1.03 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION S900
TRANSPOSITION AREA 90.0 SQ MI

TOTAL RAINFALL = 3.58, TOTAL LOSS = 2.43, TOTAL EXCESS = 1.15

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
(CFS)	(HR)				
		(CFS)			
696.	12.50	121.	32.	11.	5.
		(INCHES) 1.083	1.145	1.146	1.146
		(AC-FT) 60.	63.	63.	63.

CUMULATIVE AREA = 1.03 SQ MI

*** *** *** *** ***

INTERPOLATED HYDROGRAPH AT S900

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
(CFS)	(HR)				
		(CFS)			
853.	12.50	150.	39.	13.	6.
		(INCHES) 1.345	1.416	1.417	1.417
		(AC-FT) 74.	78.	78.	78.

CUMULATIVE AREA = 1.03 SQ MI

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
	HYDROGRAPH AT	S110	532.	12.17	62.	16.	5.	.43		
	ROUTED TO	11015I	456.	12.42	62.	16.	5.	.43		
	DIVERSION TO	CF5I	91.	12.42	12.	3.	1.	.43		
	HYDROGRAPH AT	D15I	365.	12.42	50.	13.	4.	.43		
	ROUTED TO	15I15R	323.	12.83	50.	13.	4.	.43		
	HYDROGRAPH AT	S115	1693.	12.50	287.	73.	24.	2.25		
	2 COMBINED AT	C115U	1839.	12.58	334.	86.	29.	2.68		
	HYDROGRAPH AT	CF5I	91.	12.42	12.	3.	1.	.43		
	ROUTED TO	15I15L	45.	13.58	12.	3.	1.	.43		
	2 COMBINED AT	C115D	1840.	12.58	346.	89.	30.	2.68		
	ROUTED TO	115120	1807.	12.75	345.	89.	30.	2.68		
	HYDROGRAPH AT									

```
+                        S120      2032.   12.33         247.         62.         21.       2.00
        2 COMBINED AT
+                        C120      3197.   12.42         585.        149.         50.       4.68
        HYDROGRAPH AT
+                        S900       853.   12.50         150.         39.         13.       1.03


 *** NORMAL END OF HEC-1 ***


    -----DSS---ZCLOSE Unit:  71,   File: SVP_EX24.DSS
               Pointer Utilization:    .25
               Number of Records:     16
               File Size:     32.6  Kbytes
               Percent Inactive:     .0
```

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN   1998               *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   27JAN09  TIME  17:32:42   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```

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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

   1          ID    SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
   2          ID    JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
   3          ID    FILENAME: A4_EX6.DAT
   4          ID    DATE:  JUNE 16, 2006
   5          ID
   6          ID    100-YEAR 6-HOUR MODEL
   7          ID    EXISTING CONDITIONS
   8          ID    AREA 4 WATERSHED AREA = 90.5 SQ. MILES
   9          ID           MODELED AREA = 76.8 SQ. MILES
  10          ID
  11          ID    GREEN-AMPT LOSS METHOD
  12          ID    S-GRAPH UNIT HYDROGRAPHS
  13          ID      - MOUNTAIN
  14          ID      - DESERT/RANGELAND
  15          ID    NORMAL-DEPTH CHANNEL ROUTING
  16          ID    LAND USE DATA FROM EXAMINATION OF SLOPE FROM 10-FT DTM TO DISTINGUISH
  17          ID      - UNDEVELOPED DESERT RANGELAND (NDR) - SLOPES < 5 %
  18          ID      - HILLSLOPES, SONORAN DESERT (NHS) - SLOPES 5 - 10 %
  19          ID      - MOUNTAIN TERRAIN (NMT) - SLOPES > 10 %
  20          ID    SOILS DATA FROM FCDMC GIS DATABASE (RECEIVED FROM FCDMC JULY 2005)
  21          ID
  22          ID   ************************************************************************
  23          ID
  24          ID    MODIFIED BY JE FULLER/HYDROLOGY & GEOMORPHOLOGY - DECEMBER 2008
  25          ID
  26          ID    PROJECT:  FCDMC, 2007C051, TASK ORDER NO. 2, ALLUVIAL FANS 1 AND 2.
  27          ID
  28          ID    MODIFICATION ENTAILED STRIPPING OF ALL HEC-1 COMPONENTS THAT DO NOT
  29          ID    CONTRIBUTE TO C120, WHICH IS LOCATED AT THE CONFLUENCE OF THE SUN VALLEY
  30          ID    PARKWAY CHANNEL AND WAGNER WASH.  NO MODIFICATIONS OR CHANGES WERE MADE TO
  31          ID    THE HEC-1 INPUT DATA.
  32          ID
  33          ID   ************************************************************************
  34          ID
  35          IT       5  1JAN99    1200    2000
  36          IN      15
  37          IO       3
              *DIAGRAM
              *
  38          JD   3.196  0.1000
  39          PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
  40          PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
  41          PC   0.962   0.972   0.983   0.991   1.000
  42          JD   3.181  0.5000
  43          PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
  44          PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
  45          PC   0.962   0.972   0.983   0.991   1.000
  46          JD   3.120     2.8
  47          PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.068   0.077
  48          PC   0.088   0.101   0.121   0.164   0.253   0.451   0.694   0.836   0.900   0.938
  49          PC   0.950   0.963   0.975   0.988   1.000
  50          JD   2.950    16.0
  51          PC   0.000   0.015   0.020   0.030   0.048   0.063   0.076   0.090   0.105   0.119
  52          PC   0.135   0.152   0.175   0.222   0.304   0.472   0.670   0.796   0.868   0.912
  53          PC   0.946   0.960   0.973   0.987   1.000
```

1 HEC-1 INPUT PAGE 2

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LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  54          JD   2.592    90.0
  55          PC   0.000   0.021   0.035   0.051   0.071   0.087   0.105   0.125   0.143   0.160
  56          PC   0.179   0.201   0.232   0.281   0.364   0.500   0.658   0.773   0.841   0.888
  57          PC   0.927   0.945   0.964   0.982   1.000
              *
              *

  58          KK    S110   BASIN
  59          BA   0.430
  60          LG    0.25    0.37    5.20    0.25       6
  61          UI      56     166     335     449     587     358     291     241     188     140
  62          UI     121      86      68      56      43      32      27      22      11      11
  63          UI      10      11      11       0       0       0       0       0       0       0
  64          UI       0       0       0       0       0       0       0       0       0       0
  65          UI       0       0       0       0       0       0       0       0       0       0
  66          KM        Compute runoff from subbasin 110
  67          ZW   A=S110 C=FLOW F=CALC
              *

  68          KK  11015I   ROUTE
  69          RS       2    FLOW      -1
  70          RC   0.045   0.035   0.045    3783  0.0267  102.00
  71          RX    0.00   50.00  100.00  110.00  120.00  130.00  180.00  230.00
  72          RY  102.00  101.50  101.00  100.00  100.00  101.00  101.50  102.00
  73          KM       Route flow from C105 through subbasin 110 to C115.
  74          KM       Slope = (1847-1746) / 3783
              *

  75          KK    D15I  DIVERT
  76          DT    CF5I     0.0     0.0
  77          DI     0.0   100.0  1000.0 10000.0     0.0     0.0     0.0     0.0     0.0     0.0
  78          DQ     0.0    20.0   200.0  2000.0     0.0     0.0     0.0     0.0     0.0     0.0
  79          KM       Divert flows to the left into S120
              *

  80          KK  15I15R   ROUTE
  81          RS       8    FLOW      -1
  82          RC   0.035   0.030   0.035   14128  0.0151  105.00
  83          RX    0.00   25.00   58.00   65.00   85.00   92.00  125.00  150.00
  84          RY  105.00  102.50  102.00  100.00  100.00  102.00  102.50  105.00
  85          KM       Route flows from split through S115 to C115.
  86          KM       Slope = (1746-1532) / 14128
              *

  87          KK    S115   BASIN
  88          BA   2.247
  89          LG    0.32    0.35    4.80    0.30       2
  90          UI     160     163     434     709     984    1212    1401    1530    1539    1465
  91          UI    1351    1100     918     773     632     528     444     351     304     252
  92          UI     203     170     140     110     110      85      39      39      40      39
  93          UI      39      39      40      39       0       0       0       0       0       0
  94          UI       0       0       0       0       0       0       0       0       0       0
  95          KM       Compute runoff from subbasin 115
              *
1                                      HEC-1 INPUT                                          PAGE  3
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  96          KK   C115U COMBINE
  97          HC       2   2.677
  98          KM       Combine runoff from S115 with routed flow.
              *

  99          KK    CF5IRETRIEVE
 100          DR    CF5I
 101          KM       Retrieve diverted flow from D15I
              *

 102          KK  15I15L   ROUTE
 103          RS       7    FLOW      -1
 104          RC   0.045   0.045   0.045   12775  0.0168  104.00
 105          RX    0.00   50.00  100.00  130.00  170.00  200.00  250.00  300.00
 106          RY  104.00  103.00  102.00  100.00  100.00  102.00  103.00  104.00
 107          KM       Route flows from split through S120 to C115.
 108          KM       Slope =(1746-1532) / 12775
              *

 109          KK   C115D COMBINE
 110          HC       2   2.677
 111          KM       Combine routed flows from split with remainder of flows in SVP channel
 112          KM       just D/S of C115.
              *

 113          KK  115120   ROUTE
 114          RS       2    FLOW      -1
 115          RC   0.030   0.025   0.030    4077  0.0093  105.00
 116          RX    0.00   30.00   75.00   80.00  105.00  110.00  155.00  190.00
 117          RY  105.00  101.50  101.00  100.00  100.00  101.00  101.50  105.00
 118          KM       Route total flows from C115 to C120. Slope =(1532-1494) / 4077
              *

 119          KK    S120   BASIN
```

```
          120          BA   2.004
          121          LG    0.33    0.35    4.65    0.32       1
          122          UI     206     408     954    1419    1824    1969    1911    1637    1230     944
          123          UI     731     551     418     336     234     186     143     120      50      51
          124          UI      50      51      51       0       0       0       0       0       0       0
          125          UI       0       0       0       0       0       0       0       0       0       0
          126          UI       0       0       0       0       0       0       0       0       0       0
          127          KM        Compute runoff from subbasin 120
          128          ZW   A=S120 C=FLOW F=CALC
                       *

          129          KK    C120 COMBINE
          130          HC       2   4.681
          131          KM        Combine flows at Wagner Wash at outlet of channel along SVP
                       *
1                                                HEC-1 INPUT                                          PAGE  4

         LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

          132          KK    S900   BASIN
          133          BA   1.035
          134          LG    0.25    0.37    5.30    0.24       6
          135          UI      75      77     215     338     472     551     650     871     671     496
          136          UI     448     394     356     320     277     233     197     180     165     140
          137          UI     116      97      89      83      65      59      58      37      38      37
          138          UI      37      23      14      15      14      15      14      15      15      14
          139          UI      15      14       0       0       0       0       0       0       0       0
          140          KM        Compute runoff from subbasin 900
          141          ZW   A=S900 C=FLOW F=CALC
          142          ZZ
1
               SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE       (V) ROUTING           (--->) DIVERSION OR PUMP FLOW

   NO.       (.) CONNECTOR         (<---) RETURN OF DIVERTED OR PUMPED FLOW

    58         S110
               V
               V
    68       11015I
             .
             .
    76       .------->    CF5I
    75         D15I
               V
               V
    80       15I15R
             .
             .
    87       .         S115
             .           .
             .           .
    96        C115U.............
             .
             .
   100       .           .<-------    CF5I
    99       .         CF5I
             .           V
             .           V
   102       .       15I15L
             .           .
             .           .
   109        C115D.............
               V
               V
   113       115120
             .
             .
   119       .         S120
             .           .
             .           .
   129         C120.............
               .
               .
   132       .         S900

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998               *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   27JAN09  TIME  17:32:42   *
 *                                       *
 *****************************************

 ***************************************
 *                                     *
 *    U.S. ARMY CORPS OF ENGINEERS     *
 *    HYDROLOGIC ENGINEERING CENTER    *
 *          609 SECOND STREET          *
 *        DAVIS, CALIFORNIA 95616      *
 *           (916) 756-1104            *
 *                                     *
 ***************************************

          SUN VALLEY AREA DRAINAGE MASTER PLAN (SVADMP) - FCD 2004C049
          JE FULLER / HYDROLOGY & GEOMORPHOLOGY, INC.
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                    FILENAME: A4_EX6.DAT
                    DATE:  JUNE 16, 2006

                    100-YEAR 6-HOUR MODEL
                    EXISTING CONDITIONS
                    AREA 4 WATERSHED AREA = 90.5 SQ. MILES
                           MODELED AREA = 76.8 SQ. MILES

                    GREEN-AMPT LOSS METHOD
                    S-GRAPH UNIT HYDROGRAPHS
                      - MOUNTAIN
                      - DESERT/RANGELAND
                    NORMAL-DEPTH CHANNEL ROUTING
                    LAND USE DATA FROM EXAMINATION OF SLOPE FROM 10-FT DTM TO DISTINGUISH
                      - UNDEVELOPED DESERT RANGELAND (NDR) - SLOPES < 5 %
                      - HILLSLOPES, SONORAN DESERT (NHS) - SLOPES 5 - 10 %
                      - MOUNTAIN TERRAIN (NMT) - SLOPES > 10 %
                    SOILS DATA FROM FCDMC GIS DATABASE (RECEIVED FROM FCDMC JULY 2005)

                    ************************************************************************

                    MODIFIED BY JE FULLER/HYDROLOGY & GEOMORPHOLOGY - DECEMBER 2008

                    PROJECT:  FCDMC, 2007C051, TASK ORDER NO. 2, ALLUVIAL FANS 1 AND 2.

                    MODIFICATION ENTAILED STRIPPING OF ALL HEC-1 COMPONENTS THAT DO NOT
                    CONTRIBUTE TO C120, WHICH IS LOCATED AT THE CONFLUENCE OF THE SUN VALLEY
                    PARKWAY CHANNEL AND WAGNER WASH.  NO MODIFICATIONS OR CHANGES WERE MADE TO
                    THE HEC-1 INPUT DATA.

                    ************************************************************************

37 IO          OUTPUT CONTROL VARIABLES
                     IPRNT          3  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE

36 IN          TIME DATA FOR INPUT TIME SERIES
                     JXMIN         15  TIME INTERVAL IN MINUTES
                    JXDATE      1JAN99  STARTING DATE
                    JXTIME        1200  STARTING TIME

   IT          HYDROGRAPH TIME DATA
                     NMIN          5  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1JAN99  STARTING DATE
                    ITIME        1200  STARTING TIME
                       NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      8JAN99  ENDING DATE
                   NDTIME        1035  ENDING TIME
                    ICENT          19  CENTURY MARK

                 COMPUTATION INTERVAL      .08 HOURS
                      TOTAL TIME BASE  166.58 HOURS

          ENGLISH UNITS
               DRAINAGE AREA         SQUARE MILES
               PRECIPITATION DEPTH   INCHES
               LENGTH, ELEVATION     FEET
               FLOW                  CUBIC FEET PER SECOND
               STORAGE VOLUME        ACRE-FEET
               SURFACE AREA          ACRES
               TEMPERATURE           DEGREES FAHRENHEIT

38 JD            INDEX STORM NO. 1
                       STRM       3.20  PRECIPITATION DEPTH
                       TRDA        .10  TRANSPOSITION DRAINAGE AREA

39 PI              PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                    .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00

42 JD            INDEX STORM NO. 2
                       STRM       3.18  PRECIPITATION DEPTH
                       TRDA         .50  TRANSPOSITION DRAINAGE AREA

43 PI              PRECIPITATION PATTERN
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00       .00       .01       .01       .01       .01       .01       .01       .03
                    .03       .03       .05       .05       .05       .15       .15       .15       .03       .03
                    .03       .01       .01       .01       .01       .01       .01       .00       .00       .00
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00

46 JD            INDEX STORM NO. 3
                       STRM       3.12  PRECIPITATION DEPTH
                       TRDA       2.80  TRANSPOSITION DRAINAGE AREA
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```
 47 PI            PRECIPITATION PATTERN
                      .00       .00       .00       .00       .00       .00       .00       .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00       .00
                      .00       .00       .00       .01       .01       .01       .01       .01       .03
                      .03       .03       .07       .07       .07       .08       .08       .08       .05       .05
                      .05       .02       .02       .02       .01       .01       .01       .00       .00       .00
                      .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                      .00       .00

 50 JD          INDEX STORM NO. 4
                     STRM       2.95  PRECIPITATION DEPTH
                     TRDA      16.00  TRANSPOSITION DRAINAGE AREA

 51 PI            PRECIPITATION PATTERN
                      .01       .01       .00       .00       .00       .00       .00       .00       .00       .01
                      .01       .01       .00       .01       .00       .00       .00       .00       .00       .00
                      .00       .00       .01       .00       .00       .00       .00       .01       .01       .01
                      .01       .01       .01       .01       .01       .01       .02       .02       .02       .03
                      .03       .03       .06       .06       .06       .07       .07       .07       .04       .04
                      .04       .02       .02       .02       .01       .01       .01       .01       .01       .01
                      .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                      .00       .00

 54 JD          INDEX STORM NO. 5
                     STRM       2.59  PRECIPITATION DEPTH
                     TRDA      90.00  TRANSPOSITION DRAINAGE AREA

 55 PI            PRECIPITATION PATTERN
                      .01       .01       .01       .00       .00       .00       .01       .01       .01       .01
                      .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                      .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                      .01       .01       .01       .01       .01       .01       .02       .02       .02       .03
                      .03       .03       .05       .05       .05       .05       .05       .05       .04       .04
                      .04       .02       .02       .02       .02       .02       .02       .01       .01       .01
                      .01       .01       .01       .01       .01       .01       .01       .01       .01       .01
                      .01       .01

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
 58 KK    *    S110    *        BASIN
          *            *
          **************
                              Compute runoff from subbasin 110

                 SUBBASIN RUNOFF DATA

 59 BA            SUBBASIN CHARACTERISTICS
                     TAREA        .43  SUBBASIN AREA

 60 LG            GREEN AND AMPT LOSS RATE
                     STRTL        .25  STARTING LOSS
                       DTH        .37  MOISTURE DEFICIT
                      PSIF       5.20  WETTING FRONT SUCTION
                     XKSAT        .25  HYDRAULIC CONDUCTIVITY
                     RTIMP       6.00  PERCENT IMPERVIOUS AREA

 59 UI            INPUT UNITGRAPH,  23 ORDINATES,  VOLUME = 1.00
                     56.0      166.0      335.0      449.0      587.0      358.0      291.0      241.0      188.0      140.0
                    121.0       86.0       68.0       56.0       43.0       32.0       27.0       22.0       11.0       11.0
                     10.0       11.0       11.0

                                                                  ***

     ***             ***             ***             ***             ***

                       HYDROGRAPH AT STATION     S110
                      TRANSPOSITION AREA       .1 SQ MI

    TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.54, TOTAL EXCESS =    1.66

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                    (CFS)
+     666.      4.25                  76.          19.          6.           3.
                   (INCHES)      1.650       1.651       1.651       1.651
                    (AC-FT)        38.          38.          38.          38.

                      CUMULATIVE AREA =     .43 SQ MI

     ***             ***             ***             ***             ***

                       HYDROGRAPH AT STATION     S110
                      TRANSPOSITION AREA       .5 SQ MI

    TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.54, TOTAL EXCESS =    1.64
```

```
  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     662.      4.25                76.          19.          6.           3.
                (INCHES)         1.638        1.639        1.639        1.639
                 (AC-FT)          38.          38.          38.          38.

                 CUMULATIVE AREA =     .43 SQ MI


      ***           ***            ***           ***           ***

                   HYDROGRAPH AT STATION     S110
                  TRANSPOSITION AREA      2.8 SQ MI

    TOTAL RAINFALL =    3.12, TOTAL LOSS =    1.77, TOTAL EXCESS =    1.35

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     413.      4.25                62.          16.          5.           2.
                (INCHES)         1.347        1.349        1.349        1.349
                 (AC-FT)          31.          31.          31.          31.

                 CUMULATIVE AREA =     .43 SQ MI


      ***           ***            ***           ***           ***

                   HYDROGRAPH AT STATION     S110
                  TRANSPOSITION AREA     16.0 SQ MI

    TOTAL RAINFALL =    2.95, TOTAL LOSS =    1.90, TOTAL EXCESS =    1.05

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     301.      4.25                48.          12.          4.           2.
                (INCHES)         1.047        1.050        1.050        1.050
                 (AC-FT)          24.          24.          24.          24.

                 CUMULATIVE AREA =     .43 SQ MI


      ***           ***            ***           ***           ***

                   HYDROGRAPH AT STATION     S110
                  TRANSPOSITION AREA     90.0 SQ MI

    TOTAL RAINFALL =    2.59, TOTAL LOSS =    1.95, TOTAL EXCESS =     .65

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     176.      4.25                30.           7.          2.           1.
                (INCHES)          .642         .644         .644         .644
                 (AC-FT)          15.          15.          15.          15.

                 CUMULATIVE AREA =     .43 SQ MI

   -----DSS---ZOPEN:  New File Opened,  File: SVP_EX6.DSS
                      Unit:  71;  DSS Version: 6-JG
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S110/S110/FLOW/01JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S110/S110/FLOW/02JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S110/S110/FLOW/03JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S110/S110/FLOW/04JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S110/S110/FLOW/05JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S110/S110/FLOW/06JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S110/S110/FLOW/07JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S110/S110/FLOW/08JAN1999/5MIN/CALC/
      ***           ***            ***           ***           ***


                 INTERPOLATED HYDROGRAPH AT     S110

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     662.      4.25                76.          19.          6.           3.
                (INCHES)         1.639        1.640        1.640        1.640
                 (AC-FT)          38.          38.          38.          38.

                 CUMULATIVE AREA =     .43 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
          **************
          *            *
 68 KK    *   11015I   *       ROUTE
          *            *
          **************
                              Route flow from C105 through subbasin 110 to C115.
                              Slope = (1847-1746) / 3783

               HYDROGRAPH ROUTING DATA

 69 RS           STORAGE ROUTING
                      NSTPS          2  NUMBER OF SUBREACHES
                       ITYP       FLOW  TYPE OF INITIAL CONDITION
                     RSVRIC      -1.00  INITIAL CONDITION
                          X        .00 WORKING R AND D COEFFICIENT

 70 RC           NORMAL DEPTH CHANNEL
                       ANL       .045  LEFT OVERBANK N-VALUE
                      ANCH       .035  MAIN CHANNEL N-VALUE
                       ANR       .045  RIGHT OVERBANK N-VALUE
                     RLNTH      3783.  REACH LENGTH
                       SEL      .0267  ENERGY SLOPE
                     ELMAX      102.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                        CROSS-SECTION DATA
                              --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
 72 RY        ELEVATION    102.00    101.50    101.00    100.00    100.00    101.00    101.50    102.00
 71 RX        DISTANCE        .00     50.00    100.00    110.00    120.00    130.00    180.00    230.00

                                                   ***

                                        COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00       .10       .22       .36       .52       .70       .89      1.11      1.35      1.60
          OUTFLOW        .00      1.70      5.63     11.60     19.64     29.85     42.35     57.26     74.71     94.83
        ELEVATION     100.00    100.11    100.21    100.32    100.42    100.53    100.63    100.74    100.84    100.95

          STORAGE       1.90      2.36      3.02      3.88      4.92      6.16      7.59      9.21     11.02     13.03
          OUTFLOW     120.37    153.46    194.14    244.32    305.64    379.62    467.62    570.97    690.92    828.66
        ELEVATION     101.05    101.16    101.26    101.37    101.47    101.58    101.68    101.79    101.89    102.00

     ***             ***             ***             ***             ***

                       HYDROGRAPH AT STATION   11015I
                      TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                    (CFS)
+     574.      4.42                 76.         19.          6.          3.
                 (INCHES)         1.648       1.651       1.651       1.651
                  (AC-FT)            38.         38.         38.         38.

 PEAK STORAGE   TIME                       MAXIMUM AVERAGE STORAGE
                                    6-HR       24-HR       72-HR    166.58-HR
+  (AC-FT)      (HR)
        5.      4.42                  1.          0.          0.          0.

  PEAK STAGE    TIME                       MAXIMUM AVERAGE STAGE
                                    6-HR       24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
    101.79      4.42                100.47      100.12      100.04      100.02

                       CUMULATIVE AREA =     .43 SQ MI

     ***             ***             ***             ***             ***

                       HYDROGRAPH AT STATION   11015I
                      TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                    (CFS)
+     570.      4.42                 76.         19.          6.          3.
                 (INCHES)         1.636       1.639       1.639       1.639
                  (AC-FT)            38.         38.         38.         38.

 PEAK STORAGE   TIME                       MAXIMUM AVERAGE STORAGE
                                    6-HR       24-HR       72-HR    166.58-HR
+  (AC-FT)      (HR)
        5.      4.42                  1.          0.          0.          0.

  PEAK STAGE    TIME                       MAXIMUM AVERAGE STAGE
                                    6-HR       24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
    101.79      4.42                100.47      100.12      100.04      100.02

                       CUMULATIVE AREA =     .43 SQ MI
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      ***            ***            ***            ***            ***

                       HYDROGRAPH AT STATION   11015I
                     TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     376.      4.42                62.          16.           5.           2.
                (INCHES)        1.346        1.349        1.349        1.349
                 (AC-FT)           31.          31.          31.          31.

 PEAK STORAGE   TIME                      MAXIMUM AVERAGE STORAGE
                                  6-HR        24-HR        72-HR    166.58-HR
+  (AC-FT)      (HR)
        3.      4.42                 1.           0.           0.           0.

  PEAK STAGE    TIME                        MAXIMUM AVERAGE STAGE
                                  6-HR        24-HR        72-HR    166.58-HR
+   (FEET)      (HR)
    101.57      4.42              100.46       100.12       100.04       100.02

                       CUMULATIVE AREA =      .43 SQ MI

      ***            ***            ***            ***            ***

                       HYDROGRAPH AT STATION   11015I
                     TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     275.      4.50                48.          12.           4.           2.
                (INCHES)        1.046        1.050        1.050        1.050
                 (AC-FT)           24.          24.          24.          24.

 PEAK STORAGE   TIME                      MAXIMUM AVERAGE STORAGE
                                  6-HR        24-HR        72-HR    166.58-HR
+  (AC-FT)      (HR)
        2.      4.50                 0.           0.           0.           0.

  PEAK STAGE    TIME                        MAXIMUM AVERAGE STAGE
                                  6-HR        24-HR        72-HR    166.58-HR
+   (FEET)      (HR)
    101.42      4.50              100.44       100.11       100.04       100.02

                       CUMULATIVE AREA =      .43 SQ MI

      ***            ***            ***            ***            ***

                       HYDROGRAPH AT STATION   11015I
                     TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     165.      4.50                30.           7.           2.           1.
                (INCHES)         .640         .644         .644         .644
                 (AC-FT)           15.          15.          15.          15.

 PEAK STORAGE   TIME                      MAXIMUM AVERAGE STORAGE
                                  6-HR        24-HR        72-HR    166.58-HR
+  (AC-FT)      (HR)
        1.      4.50                 0.           0.           0.           0.

  PEAK STAGE    TIME                        MAXIMUM AVERAGE STAGE
                                  6-HR        24-HR        72-HR    166.58-HR
+   (FEET)      (HR)
    101.19      4.50              100.38       100.10       100.03       100.01

                       CUMULATIVE AREA =      .43 SQ MI

      ***            ***            ***            ***            ***


                     INTERPOLATED HYDROGRAPH AT   11015I

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     570.      4.42                76.          19.           6.           3.
                (INCHES)        1.637        1.640        1.640        1.640
                 (AC-FT)           38.          38.          38.          38.

                       CUMULATIVE AREA =      .43 SQ MI
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*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
  75 KK     *      D15I  *       DIVERT
            *            *
            **************
                                Divert flows to the left into S120

     DT          DIVERSION
                       ISTAD        CF5I  DIVERSION HYDROGRAPH IDENTIFICATION

     DI             INFLOW          .00    100.00   1000.00  10000.00

     DQ      DIVERTED FLOW          .00     20.00    200.00   2000.00

                                                                   ***

      ***             ***             ***             ***             ***

                        DIVERSION HYDROGRAPH     CF5I
                       TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                     (CFS)
+     115.      4.42                15.          4.           1.           1.
                    (INCHES)       .330         .330         .330         .330
                    (AC-FT)         8.           8.           8.           8.

                        CUMULATIVE AREA =      .43 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     D15I
                       TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                     (CFS)
+     459.      4.42                61.         15.           5.           2.
                    (INCHES)      1.318        1.321        1.321        1.321
                    (AC-FT)        30.          30.          30.          30.

                        CUMULATIVE AREA =      .43 SQ MI


      ***             ***             ***             ***             ***

                        DIVERSION HYDROGRAPH     CF5I
                       TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                     (CFS)
+     114.      4.42                15.          4.           1.           1.
                    (INCHES)       .327         .328         .328         .328
                    (AC-FT)         8.           8.           8.           8.

                        CUMULATIVE AREA =      .43 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     D15I
                       TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                     (CFS)
+     456.      4.42                61.         15.           5.           2.
                    (INCHES)      1.309        1.311        1.311        1.311
                    (AC-FT)        30.          30.          30.          30.

                        CUMULATIVE AREA =      .43 SQ MI


      ***             ***             ***             ***             ***

                        DIVERSION HYDROGRAPH     CF5I
                       TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                     (CFS)
+      75.      4.42                12.          3.           1.           0.
                    (INCHES)       .269         .270         .270         .270
```

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                    (AC-FT)        6.          6.          6.          6.

                    CUMULATIVE AREA =     .43 SQ MI


      ***           ***           ***           ***           ***

                      HYDROGRAPH AT STATION     D15I
                    TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                   (CFS)
+     301.      4.42                50.         12.          4.          2.
                 (INCHES)      1.076       1.079       1.079       1.079
                  (AC-FT)        25.         25.         25.         25.

                    CUMULATIVE AREA =     .43 SQ MI


      ***           ***           ***           ***           ***

                      DIVERSION HYDROGRAPH     CF5I
                    TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                   (CFS)
+      55.      4.50                10.          2.          1.          0.
                 (INCHES)       .209        .210        .210        .210
                  (AC-FT)         5.          5.          5.          5.

                    CUMULATIVE AREA =     .43 SQ MI


      ***           ***           ***           ***           ***

                      HYDROGRAPH AT STATION     D15I
                    TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                   (CFS)
+     220.      4.50                39.         10.          3.          1.
                 (INCHES)       .836        .840        .840        .840
                  (AC-FT)        19.         19.         19.         19.

                    CUMULATIVE AREA =     .43 SQ MI


      ***           ***           ***           ***           ***

                      DIVERSION HYDROGRAPH     CF5I
                    TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                   (CFS)
+      33.      4.50                 6.          1.          0.          0.
                 (INCHES)       .128        .129        .129        .129
                  (AC-FT)         3.          3.          3.          3.

                    CUMULATIVE AREA =     .43 SQ MI


      ***           ***           ***           ***           ***

                      HYDROGRAPH AT STATION     D15I
                    TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                   (CFS)
+     132.      4.50                24.          6.          2.          1.
                 (INCHES)       .512        .516        .516        .516
                  (AC-FT)        12.         12.         12.         12.

                    CUMULATIVE AREA =     .43 SQ MI

      ***           ***           ***           ***           ***


                INTERPOLATED DIVERSION HYDROGRAPH AT     CF5I

  PEAK FLOW     TIME                        MAXIMUM AVERAGE FLOW
                                  6-HR        24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                   (CFS)
+     114.      4.42                15.          4.          1.          1.
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                    (INCHES)       .327        .328        .328        .328
                     (AC-FT)        8.          8.          8.          8.

                    CUMULATIVE AREA =      .43 SQ MI

      ***           ***           ***           ***           ***


                    INTERPOLATED HYDROGRAPH AT     D15I

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                     (CFS)
+     456.      4.42              61.         15.          5.          2.
                    (INCHES)     1.310       1.312       1.312       1.312
                     (AC-FT)      30.         30.         30.         30.

                    CUMULATIVE AREA =      .43 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


           **************
           *            *
  80 KK    *    15I15R  *        ROUTE
           *            *
           **************
                          Route flows from split through S115 to C115.
                          Slope = (1746-1532) / 14128

             HYDROGRAPH ROUTING DATA

  81 RS        STORAGE ROUTING
                    NSTPS           8  NUMBER OF SUBREACHES
                     ITYP        FLOW  TYPE OF INITIAL CONDITION
                   RSVRIC       -1.00  INITIAL CONDITION
                        X         .00 WORKING R AND D COEFFICIENT

  82 RC        NORMAL DEPTH CHANNEL
                     ANL        .035  LEFT OVERBANK N-VALUE
                    ANCH        .030  MAIN CHANNEL N-VALUE
                     ANR        .035  RIGHT OVERBANK N-VALUE
                   RLNTH      14128.  REACH LENGTH
                     SEL       .0151  ENERGY SLOPE
                   ELMAX       105.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                  CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
  84 RY        ELEVATION    105.00    102.50    102.00    100.00    100.00    102.00    102.50    105.00
  83 RX        DISTANCE        .00     25.00     58.00     65.00     85.00     92.00    125.00    150.00

                                                  ***

                                  COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00      1.79      3.73      5.83      8.09     10.50     13.07     15.80     18.91     24.48
          OUTFLOW        .00     13.38     43.15     86.30    141.97    209.86    289.95    382.35    494.41    643.47
        ELEVATION     100.00    100.26    100.53    100.79    101.05    101.32    101.58    101.84    102.11    102.37

          STORAGE      32.70     41.69     51.12     61.00     71.34     82.12     93.35    105.03    117.16    129.74
          OUTFLOW     843.66   1098.08   1397.67   1740.65   2126.23   2554.16   3024.48   3537.45   4093.45   4692.95
        ELEVATION     102.63    102.89    103.16    103.42    103.68    103.95    104.21    104.47    104.74    105.00

*** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN     1741. TO     4693.
                THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

      ***           ***           ***           ***           ***

                    HYDROGRAPH AT STATION   15I15R
                   TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                     (CFS)
+     411.      4.75              61.         15.          5.          2.
                    (INCHES)     1.317       1.321       1.321       1.321
                     (AC-FT)      30.         30.         30.         30.

 PEAK STORAGE   TIME                     MAXIMUM AVERAGE STORAGE
                                  6-HR       24-HR       72-HR    166.58-HR
+  (AC-FT)      (HR)
        2.      4.75               0.          0.          0.          0.

  PEAK STAGE    TIME                     MAXIMUM AVERAGE STAGE
                                  6-HR       24-HR       72-HR    166.58-HR
+   (FEET)      (HR)
    101.91      4.75            100.43      100.11      100.04      100.02
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CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 15I15R
TRANSPOSITION AREA .5 SQ MI

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR	
+ (CFS)	(HR)					
		(CFS)				
+ 407.	4.75	60.	15.	5.	2.	
		(INCHES)	1.307	1.311	1.311	1.311
		(AC-FT)	30.	30.	30.	30.

PEAK STORAGE	TIME		MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR	
+ (AC-FT)	(HR)					
2.	4.75	0.	0.	0.	0.	

PEAK STAGE	TIME		MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR	
+ (FEET)	(HR)					
101.90	4.75	100.43	100.11	100.04	100.02	

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 15I15R
TRANSPOSITION AREA 2.8 SQ MI

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR	
+ (CFS)	(HR)					
		(CFS)				
+ 282.	4.83	50.	12.	4.	2.	
		(INCHES)	1.075	1.079	1.079	1.079
		(AC-FT)	25.	25.	25.	25.

PEAK STORAGE	TIME		MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR	
+ (AC-FT)	(HR)					
2.	4.83	0.	0.	0.	0.	

PEAK STAGE	TIME		MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR	
+ (FEET)	(HR)					
101.55	4.83	100.40	100.10	100.03	100.01	

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 15I15R
TRANSPOSITION AREA 16.0 SQ MI

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR	
+ (CFS)	(HR)					
		(CFS)				
+ 206.	4.92	39.	10.	3.	1.	
		(INCHES)	.834	.840	.840	.840
		(AC-FT)	19.	19.	19.	19.

PEAK STORAGE	TIME		MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR	
+ (AC-FT)	(HR)					
1.	4.92	0.	0.	0.	0.	

PEAK STAGE	TIME		MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR	
+ (FEET)	(HR)					
101.30	4.92	100.35	100.09	100.03	100.01	

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 15I15R
TRANSPOSITION AREA 90.0 SQ MI

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR	
+ (CFS)	(HR)					
		(CFS)				
+ 118.	5.00	24.	6.	2.	1.	
		(INCHES)	.509	.516	.516	.516
		(AC-FT)	12.	12.	12.	12.

```
 PEAK STORAGE    TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR         24-HR         72-HR     166.58-HR
+  (AC-FT)       (HR)
        1.       5.00                   0.            0.            0.            0.

  PEAK STAGE     TIME                           MAXIMUM AVERAGE STAGE
                                      6-HR         24-HR         72-HR     166.58-HR
+   (FEET)       (HR)
    100.94       5.00                100.27        100.07        100.02        100.01

                          CUMULATIVE AREA =      .43 SQ MI

      ***             ***             ***             ***             ***


                          INTERPOLATED HYDROGRAPH AT   15I15R

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR         72-HR     166.58-HR
+   (CFS)        (HR)
                             (CFS)
+     408.       4.75                 61.           15.            5.            2.
                          (INCHES)    1.308         1.312         1.312         1.312
                          (AC-FT)      30.           30.           30.           30.

                          CUMULATIVE AREA =      .43 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *             *
  87 KK     *      S115   *        BASIN
            *             *
            **************
                              Compute runoff from subbasin 115

               SUBBASIN RUNOFF DATA

  88 BA          SUBBASIN CHARACTERISTICS
                       TAREA        2.25  SUBBASIN AREA

  89 LG          GREEN AND AMPT LOSS RATE
                       STRTL         .32  STARTING LOSS
                         DTH         .35  MOISTURE DEFICIT
                        PSIF        4.80  WETTING FRONT SUCTION
                       XKSAT         .30  HYDRAULIC CONDUCTIVITY
                       RTIMP        2.00  PERCENT IMPERVIOUS AREA

  88 UI          INPUT UNITGRAPH,  34 ORDINATES,  VOLUME = 1.00
                     160.0     163.0     434.0     709.0     984.0    1212.0    1401.0    1530.0    1539.0    1465.0
                    1351.0    1100.0     918.0     773.0     632.0     528.0     444.0     351.0     304.0     252.0
                     203.0     170.0     140.0     110.0     110.0      85.0      39.0      39.0      40.0      39.0
                      39.0      39.0      40.0      39.0

                                                                  ***

      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S115
                       TRANSPOSITION AREA       .1 SQ MI

    TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.69, TOTAL EXCESS =    1.51

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR         72-HR     166.58-HR
+   (CFS)        (HR)
                             (CFS)
+    2166.       4.58                364.           91.           30.           13.
                          (INCHES)    1.506         1.507         1.507         1.507
                          (AC-FT)      181.          181.          181.          181.

                          CUMULATIVE AREA =    2.25 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S115
                       TRANSPOSITION AREA       .5 SQ MI

    TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.68, TOTAL EXCESS =    1.50

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR         24-HR         72-HR     166.58-HR
+   (CFS)        (HR)
                             (CFS)
+    2149.       4.58                361.           90.           30.           13.
                          (INCHES)    1.494         1.495         1.495         1.495
                          (AC-FT)      179.          179.          179.          179.

                          CUMULATIVE AREA =    2.25 SQ MI
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      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S115
                       TRANSPOSITION AREA      2.8 SQ MI

     TOTAL RAINFALL =    3.12, TOTAL LOSS =    1.93, TOTAL EXCESS =    1.19

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+    1526.      4.58                286.         72.         24.          10.
                (INCHES)      1.183       1.185       1.185       1.185
                 (AC-FT)       142.        142.        142.        142.

                        CUMULATIVE AREA =    2.25 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S115
                       TRANSPOSITION AREA     16.0 SQ MI

     TOTAL RAINFALL =    2.95, TOTAL LOSS =    2.07, TOTAL EXCESS =     .88

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+    1101.      4.58                213.         53.         18.          8.
                (INCHES)       .882        .883        .883        .883
                 (AC-FT)       106.        106.        106.        106.

                        CUMULATIVE AREA =    2.25 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S115
                       TRANSPOSITION AREA     90.0 SQ MI

     TOTAL RAINFALL =    2.59, TOTAL LOSS =    2.11, TOTAL EXCESS =     .48

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+     595.      4.58                115.         29.         10.          4.
                (INCHES)       .476        .477        .477        .477
                 (AC-FT)        57.         57.         57.         57.

                        CUMULATIVE AREA =    2.25 SQ MI


      ***             ***             ***             ***             ***


                        INTERPOLATED HYDROGRAPH AT     S115

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                 (CFS)
+    1605.      4.58                296.         74.         25.          11.
                (INCHES)      1.223       1.224       1.224       1.224
                 (AC-FT)       147.        147.        147.        147.

                        CUMULATIVE AREA =    2.25 SQ MI


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            **************
            *            *
  96 KK     *     C115U  *      COMBINE
            *            *
            **************
                          Combine runoff from S115 with routed flow.

  97 HC           HYDROGRAPH COMBINATION
                       ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                  ***

      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION    C115U
                       TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
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```
                                        6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                    (CFS)
+    2426.       4.67                   424.         106.         35.          15.
                (INCHES)               1.474        1.477       1.477        1.477
                 (AC-FT)               210.         211.         211.         211.

                 CUMULATIVE AREA =     2.68 SQ MI


      ***          ***          ***          ***          ***

                  HYDROGRAPH AT STATION    C115U
                 TRANSPOSITION AREA        .5 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                    (CFS)
+    2406.       4.67                   421.         105.         35.          15.
                (INCHES)               1.462        1.465       1.465        1.465
                 (AC-FT)               209.         209.         209.         209.

                 CUMULATIVE AREA =     2.68 SQ MI


      ***          ***          ***          ***          ***

                  HYDROGRAPH AT STATION    C115U
                 TRANSPOSITION AREA        2.8 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                    (CFS)
+    1712.       4.67                   335.          84.         28.          12.
                (INCHES)               1.164        1.168       1.168        1.168
                 (AC-FT)               166.         167.         167.         167.

                 CUMULATIVE AREA =     2.68 SQ MI


      ***          ***          ***          ***          ***

                  HYDROGRAPH AT STATION    C115U
                 TRANSPOSITION AREA        16.0 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                    (CFS)
+    1222.       4.67                   251.          63.         21.           9.
                (INCHES)               .871         .876        .876         .876
                 (AC-FT)               124.         125.         125.         125.

                 CUMULATIVE AREA =     2.68 SQ MI


      ***          ***          ***          ***          ***

                  HYDROGRAPH AT STATION    C115U
                 TRANSPOSITION AREA        90.0 SQ MI

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                    (CFS)
+     629.      4.75                   138.          35.         12.           5.
                (INCHES)               .478         .483        .483         .483
                 (AC-FT)               68.          69.          69.          69.

                 CUMULATIVE AREA =     2.68 SQ MI


      ***          ***          ***          ***          ***


                 INTERPOLATED HYDROGRAPH AT    C115U

  PEAK FLOW      TIME                              MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                    (CFS)
+    1730.       4.67                   337.          85.         28.          12.
                (INCHES)               1.172        1.175       1.175        1.175
                 (AC-FT)               167.         168.         168.         168.

                 CUMULATIVE AREA =     2.68 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
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          **************
          *            *
 99 KK    *      CF5I  *     RETRIEVE
          *            *
          **************
                          Retrieve diverted flow from D15I
                                                                      ***

     ***             ***             ***             ***             ***

                       HYDROGRAPH AT STATION     CF5I
                     TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                        (CFS)
+     115.      4.42                15.           4.           1.           1.
                      (INCHES)      .053         .053         .053         .053
                       (AC-FT)       8.           8.           8.           8.

                       CUMULATIVE AREA =     .43 SQ MI


     ***             ***             ***             ***             ***

                       HYDROGRAPH AT STATION     CF5I
                     TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                        (CFS)
+     114.      4.42                15.           4.           1.           1.
                      (INCHES)      .053         .053         .053         .053
                       (AC-FT)       8.           8.           8.           8.

                       CUMULATIVE AREA =     .43 SQ MI


     ***             ***             ***             ***             ***

                       HYDROGRAPH AT STATION     CF5I
                     TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                        (CFS)
+      75.      4.42                12.           3.           1.           0.
                      (INCHES)      .043         .043         .043         .043
                       (AC-FT)       6.           6.           6.           6.

                       CUMULATIVE AREA =     .43 SQ MI


     ***             ***             ***             ***             ***

                       HYDROGRAPH AT STATION     CF5I
                     TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                        (CFS)
+      55.      4.50                10.           2.           1.           0.
                      (INCHES)      .034         .034         .034         .034
                       (AC-FT)       5.           5.           5.           5.

                       CUMULATIVE AREA =     .43 SQ MI


     ***             ***             ***             ***             ***

                       HYDROGRAPH AT STATION     CF5I
                     TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR    166.58-HR
+   (CFS)       (HR)
                        (CFS)
+      33.      4.50                 6.           1.           0.           0.
                      (INCHES)      .021         .021         .021         .021
                       (AC-FT)       3.           3.           3.           3.

                       CUMULATIVE AREA =     .43 SQ MI


     ***             ***             ***             ***             ***


                       INTERPOLATED HYDROGRAPH AT     CF5I

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
```

```
                                        6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                      (CFS)
+     114.      4.42                    15.          4.          1.          1.
                    (INCHES)          .327         .328        .328        .328
                    (AC-FT)             8.           8.          8.          8.

                   CUMULATIVE AREA =     .43 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
102 KK    *    15I15L  *        ROUTE
          *            *
          **************
                              Route flows from split through S120 to C115.
                              Slope =(1746-1532) / 12775

            HYDROGRAPH ROUTING DATA

103 RS        STORAGE ROUTING
                   NSTPS           7  NUMBER OF SUBREACHES
                    ITYP        FLOW  TYPE OF INITIAL CONDITION
                  RSVRIC       -1.00  INITIAL CONDITION
                       X         .00 WORKING R AND D COEFFICIENT

104 RC        NORMAL DEPTH CHANNEL
                     ANL        .045  LEFT OVERBANK N-VALUE
                    ANCH        .045  MAIN CHANNEL N-VALUE
                     ANR        .045  RIGHT OVERBANK N-VALUE
                   RLNTH      12775.  REACH LENGTH
                     SEL       .0168  ENERGY SLOPE
                   ELMAX       104.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                    CROSS-SECTION DATA
                          --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
106 RY        ELEVATION    104.00    103.00    102.00    100.00    100.00    102.00    103.00    104.00
105 RX        DISTANCE        .00     50.00    100.00    130.00    170.00    200.00    250.00    300.00

                                                  ***

                                    COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00      2.66      5.72      9.16     13.00     17.22     21.84     26.84     32.24     38.02
          OUTFLOW        .00     13.16     43.16     87.79    146.88    220.73    309.87    414.89    536.44    675.21
        ELEVATION     100.00    100.21    100.42    100.63    100.84    101.05    101.26    101.47    101.68    101.89

          STORAGE      44.31     51.78     60.56     70.63     82.00     94.68    108.65    123.92    140.49    158.37
          OUTFLOW     848.07   1060.67   1303.15   1579.92   1894.78   2251.18   2652.37   3101.41   3601.21   4154.59
        ELEVATION     102.11    102.32    102.53    102.74    102.95    103.16    103.37    103.58    103.79    104.00


      ***           ***           ***           ***           ***

                      HYDROGRAPH AT STATION   15I15L
                    TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                      (CFS)
+       61.      5.50                    15.          4.          1.          1.
                    (INCHES)          .328         .330        .330        .330
                    (AC-FT)             8.           8.          8.          8.

 PEAK STORAGE   TIME                    MAXIMUM AVERAGE STORAGE
                                        6-HR        24-HR       72-HR    166.58-HR
+  (AC-FT)      (HR)
        1.      5.50                     0.           0.          0.          0.

  PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                                        6-HR        24-HR       72-HR    166.58-HR
+   (FEET)       (HR)
    100.51      5.50                  100.17       100.04      100.01      100.01

                   CUMULATIVE AREA =     .43 SQ MI


      ***           ***           ***           ***           ***

                      HYDROGRAPH AT STATION   15I15L
                    TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                      (CFS)
+       61.      5.50                    15.          4.          1.          1.
                    (INCHES)          .326         .328        .328        .328
                    (AC-FT)             7.           8.          8.          8.
```

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)				
1.	5.50	0.	0.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)				
100.50	5.50	100.17	100.04	100.01	100.01

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 15I15L
TRANSPOSITION AREA 2.8 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 44.	5.67	12.	3.	1.	0.
		(INCHES) .268	.270	.270	.270
		(AC-FT) 6.	6.	6.	6.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)				
1.	5.67	0.	0.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)				
100.42	5.67	100.15	100.04	100.01	100.01

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 15I15L
TRANSPOSITION AREA 16.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 31.	5.83	10.	2.	1.	0.
		(INCHES) .207	.210	.210	.210
		(AC-FT) 5.	5.	5.	5.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)				
1.	5.83	0.	0.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)				
100.34	5.83	100.13	100.03	100.01	100.00

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 15I15L
TRANSPOSITION AREA 90.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
		(CFS)			
+ 14.	6.17	6.	1.	0.	0.
		(INCHES) .126	.129	.129	.129
		(AC-FT) 3.	3.	3.	3.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)				
0.	6.17	0.	0.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)				
100.22	6.17	100.09	100.02	100.01	100.00

CUMULATIVE AREA = .43 SQ MI

*** *** *** *** ***

INTERPOLATED HYDROGRAPH AT 15I15L

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	166.58-HR
(CFS)	(HR)	(CFS)			
61.	5.50	15.	4.	1.	1.
		(INCHES) .326	.328	.328	.328
		(AC-FT) 7.	8.	8.	8.

CUMULATIVE AREA = .43 SQ MI

*** ***

109 KK — C115D — COMBINE

Combine routed flows from split with remainder of flows in SVP channel just D/S of C115.

110 HC HYDROGRAPH COMBINATION
ICOMP 2 NUMBER OF HYDROGRAPHS TO COMBINE

***

*** *** *** *** ***

HYDROGRAPH AT STATION C115D
TRANSPOSITION AREA .1 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	166.58-HR
(CFS)	(HR)	(CFS)			
2427.	4.67	439.	110.	37.	16.
		(INCHES) 1.525	1.530	1.530	1.530
		(AC-FT) 218.	218.	218.	218.

CUMULATIVE AREA = 2.68 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION C115D
TRANSPOSITION AREA .5 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	166.58-HR
(CFS)	(HR)	(CFS)			
2407.	4.67	435.	109.	36.	16.
		(INCHES) 1.512	1.518	1.518	1.518
		(AC-FT) 216.	217.	217.	217.

CUMULATIVE AREA = 2.68 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION C115D
TRANSPOSITION AREA 2.8 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	166.58-HR
(CFS)	(HR)	(CFS)			
1713.	4.67	347.	87.	29.	13.
		(INCHES) 1.205	1.211	1.211	1.211
		(AC-FT) 172.	173.	173.	173.

CUMULATIVE AREA = 2.68 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION C115D
TRANSPOSITION AREA 16.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	166.58-HR
(CFS)	(HR)	(CFS)			
1223.	4.67	260.	66.	22.	9.
		(INCHES) .903	.910	.910	.910
		(AC-FT) 129.	130.	130.	130.

CUMULATIVE AREA = 2.68 SQ MI

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      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION    C115D
                      TRANSPOSITION AREA      90.0 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                          (CFS)
+     629.       4.75                143.          36.          12.           5.
                        (INCHES)      .496         .504         .504          .504
                        (AC-FT)        71.          72.          72.           72.

                        CUMULATIVE AREA =     2.68 SQ MI

      ***             ***             ***             ***             ***


                        INTERPOLATED HYDROGRAPH AT    C115D

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                          (CFS)
+    1731.       4.67                349.          88.          29.           13.
                        (INCHES)     1.213        1.219        1.219         1.219
                        (AC-FT)       173.         174.         174.          174.

                        CUMULATIVE AREA =     2.68 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  113 KK    *    115120  *        ROUTE
            *            *
            **************
                              Route total flows from C115 to C120. Slope =(1532-1494) / 4077

               HYDROGRAPH ROUTING DATA

  114 RS         STORAGE ROUTING
                      NSTPS           2  NUMBER OF SUBREACHES
                       ITYP        FLOW  TYPE OF INITIAL CONDITION
                     RSVRIC       -1.00  INITIAL CONDITION
                          X         .00 WORKING R AND D COEFFICIENT

  115 RC         NORMAL DEPTH CHANNEL
                        ANL        .030  LEFT OVERBANK N-VALUE
                       ANCH        .025  MAIN CHANNEL N-VALUE
                        ANR        .030  RIGHT OVERBANK N-VALUE
                      RLNTH       4077.  REACH LENGTH
                        SEL       .0093  ENERGY SLOPE
                      ELMAX       105.0  MAX. ELEV. FOR STORAGE/OUTFLOW CALCULATION

                                    CROSS-SECTION DATA
                              --- LEFT OVERBANK --- + ------ MAIN CHANNEL ------- + --- RIGHT OVERBANK ---
  117 RY        ELEVATION    105.00    101.50    101.00    100.00    100.00    101.00    101.50    105.00
  116 RX        DISTANCE        .00     30.00     75.00     80.00    105.00    110.00    155.00    190.00

                                                    ***

                                    COMPUTED STORAGE-OUTFLOW-ELEVATION DATA

          STORAGE        .00       .65      1.36      2.14      3.00      4.68      7.48     10.66     13.95     17.37
          OUTFLOW        .00     15.80     51.17    102.71    171.30    274.01    433.42    662.76    946.41   1280.64
        ELEVATION     100.00    100.26    100.53    100.79    101.05    101.32    101.58    101.84    102.11    102.37

          STORAGE      20.90     24.56     28.34     32.23     36.25     40.39     44.65     49.03     53.53     58.15
          OUTFLOW    1663.38   2093.36   2569.83   3092.34   3660.68   4274.80   4934.78   5640.78   6393.04   7191.86
        ELEVATION     102.63    102.89    103.16    103.42    103.68    103.95    104.21    104.47    104.74    105.00

 *** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN     3661. TO     7192.
                 THE ROUTED HYDROGRAPH SHOULD BE EXAMINED FOR OSCILLATIONS OR OUTFLOWS GREATER THAN PEAK INFLOWS.
                 THIS CAN BE CORRECTED BY DECREASING THE TIME INTERVAL OR INCREASING STORAGE (USE A LONGER REACH.)

      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION   115120
                      TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW      TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR        24-HR        72-HR     166.58-HR
+   (CFS)        (HR)
                          (CFS)
+    2383.       4.75                439.         110.          37.           16.
                        (INCHES)     1.524        1.530        1.530         1.530
                        (AC-FT)       218.         218.         218.          218.
```

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)				
13.	4.75	3.	1.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)				
103.05	4.75	101.02	100.26	100.09	100.04

CUMULATIVE AREA = 2.68 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 115120
TRANSPOSITION AREA .5 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
	(CFS)				
+ 2363.	4.75	435.	109.	36.	16.
	(INCHES)	1.512	1.518	1.518	1.518
	(AC-FT)	216.	217.	217.	217.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)				
13.	4.75	3.	1.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)				
103.04	4.75	101.02	100.26	100.09	100.04

CUMULATIVE AREA = 2.68 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 115120
TRANSPOSITION AREA 2.8 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
	(CFS)				
+ 1681.	4.75	347.	87.	29.	13.
	(INCHES)	1.205	1.211	1.211	1.211
	(AC-FT)	172.	173.	173.	173.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)				
11.	4.75	3.	1.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)				
102.64	4.75	100.96	100.25	100.08	100.04

CUMULATIVE AREA = 2.68 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 115120
TRANSPOSITION AREA 16.0 SQ MI

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
		6-HR	24-HR	72-HR	166.58-HR
+ (CFS)	(HR)				
	(CFS)				
+ 1191.	4.83	260.	66.	22.	9.
	(INCHES)	.902	.910	.910	.910
	(AC-FT)	129.	130.	130.	130.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (AC-FT)	(HR)				
8.	4.83	2.	1.	0.	0.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	166.58-HR
+ (FEET)	(HR)				
102.30	4.83	100.87	100.23	100.08	100.03

CUMULATIVE AREA = 2.68 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION 115120
TRANSPOSITION AREA 90.0 SQ MI

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  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+     612.      4.83                143.          36.          12.           5.
                   (INCHES)         .496         .504         .504          .504
                    (AC-FT)          71.          72.          72.           72.

 PEAK STORAGE   TIME                        MAXIMUM AVERAGE STORAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+  (AC-FT)      (HR)
        5.      4.83                  1.           0.           0.            0.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                    6-HR        24-HR        72-HR     166.58-HR
+   (FEET)      (HR)
    101.78      4.83              100.69       100.18       100.06        100.03

                          CUMULATIVE AREA =    2.68 SQ MI

      ***            ***            ***           ***           ***


                          INTERPOLATED HYDROGRAPH AT   115120

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+    1699.      4.75                349.          88.          29.           13.
                   (INCHES)        1.213        1.219        1.219         1.219
                    (AC-FT)          173.         174.         174.          174.

                          CUMULATIVE AREA =    2.68 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  119 KK    *      S120  *        BASIN
            *            *
            **************
                              Compute runoff from subbasin 120

               SUBBASIN RUNOFF DATA

  120 BA         SUBBASIN CHARACTERISTICS
                       TAREA        2.00  SUBBASIN AREA

  121 LG         GREEN AND AMPT LOSS RATE
                       STRTL         .33  STARTING LOSS
                         DTH         .35  MOISTURE DEFICIT
                        PSIF        4.65  WETTING FRONT SUCTION
                       XKSAT         .32  HYDRAULIC CONDUCTIVITY
                       RTIMP        1.00  PERCENT IMPERVIOUS AREA

  120 UI         INPUT UNITGRAPH,  23 ORDINATES,  VOLUME = 1.00
                    206.0     408.0     954.0    1419.0    1824.0    1969.0    1911.0    1637.0    1230.0     944.0
                    731.0     551.0     418.0     336.0     234.0     186.0     143.0     120.0      50.0      51.0
                     50.0      51.0      51.0

                                                                ***
      ***            ***            ***           ***           ***

                        HYDROGRAPH AT STATION     S120
                       TRANSPOSITION AREA       .1 SQ MI

     TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.73, TOTAL EXCESS =    1.46

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                     (CFS)
+    2611.      4.33                314.          79.          26.           11.
                   (INCHES)        1.457        1.458        1.458         1.458
                    (AC-FT)          156.         156.         156.          156.

                          CUMULATIVE AREA =    2.00 SQ MI


      ***            ***            ***           ***           ***

                        HYDROGRAPH AT STATION     S120
                       TRANSPOSITION AREA       .5 SQ MI

     TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.73, TOTAL EXCESS =    1.45

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
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                                        6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                      (CFS)
+    2592.       4.33                  311.         78.         26.          11.
                    (INCHES)          1.445       1.445       1.445        1.445
                     (AC-FT)            154.        154.        154.         154.

                     CUMULATIVE AREA =    2.00 SQ MI


      ***           ***           ***           ***           ***

                     HYDROGRAPH AT STATION     S120
                    TRANSPOSITION AREA      2.8 SQ MI

    TOTAL RAINFALL =    3.12, TOTAL LOSS =    1.99, TOTAL EXCESS =    1.13

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                      (CFS)
+    1657.       4.33                  243.         61.         20.          9.
                    (INCHES)          1.127       1.128       1.128        1.128
                     (AC-FT)            120.        121.        121.         121.

                     CUMULATIVE AREA =    2.00 SQ MI


      ***           ***           ***           ***           ***

                     HYDROGRAPH AT STATION     S120
                    TRANSPOSITION AREA     16.0 SQ MI

    TOTAL RAINFALL =    2.95, TOTAL LOSS =    2.12, TOTAL EXCESS =     .83

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                      (CFS)
+    1168.       4.33                  178.         45.         15.          6.
                    (INCHES)           .826        .827        .827         .827
                     (AC-FT)            88.         88.         88.          88.

                     CUMULATIVE AREA =    2.00 SQ MI


      ***           ***           ***           ***           ***

                     HYDROGRAPH AT STATION     S120
                    TRANSPOSITION AREA     90.0 SQ MI

    TOTAL RAINFALL =    2.59, TOTAL LOSS =    2.17, TOTAL EXCESS =     .42

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                      (CFS)
+     618.      4.42                   91.         23.          8.          3.
                    (INCHES)           .422        .422        .422         .422
                     (AC-FT)            45.         45.         45.          45.

                     CUMULATIVE AREA =    2.00 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.    1:  /S120/S120/FLOW/01JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S120/S120/FLOW/02JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S120/S120/FLOW/03JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S120/S120/FLOW/04JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S120/S120/FLOW/05JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S120/S120/FLOW/06JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S120/S120/FLOW/07JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S120/S120/FLOW/08JAN1999/5MIN/CALC/
       ***           ***           ***           ***           ***


                     INTERPOLATED HYDROGRAPH AT     S120

  PEAK FLOW     TIME                            MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR       72-HR    166.58-HR
+   (CFS)        (HR)
                      (CFS)
+    1838.       4.33                  256.         64.         21.          9.
                    (INCHES)          1.189       1.189       1.189        1.189
                     (AC-FT)            127.        127.        127.         127.

                     CUMULATIVE AREA =    2.00 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

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 129 KK     *      C120  *      COMBINE
            *            *
            **************
                          Combine flows at Wagner Wash at outlet of channel along SVP

 130 HC          HYDROGRAPH COMBINATION
                      ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                                    ***

      ***            ***            ***            ***            ***

                       HYDROGRAPH AT STATION     C120
                      TRANSPOSITION AREA       .1 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                        (CFS)
+    4189.      4.42                752.        189.         63.          27.
                      (INCHES)     1.494       1.499       1.499        1.499
                       (AC-FT)      373.        374.        374.         374.

                       CUMULATIVE AREA =    4.68 SQ MI

      ***            ***            ***            ***            ***

                       HYDROGRAPH AT STATION     C120
                      TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                        (CFS)
+    4155.      4.42                746.        187.         62.          27.
                      (INCHES)     1.482       1.487       1.487        1.487
                       (AC-FT)      370.        371.        371.         371.

                       CUMULATIVE AREA =    4.68 SQ MI

      ***            ***            ***            ***            ***

                       HYDROGRAPH AT STATION     C120
                      TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                        (CFS)
+    2900.      4.50                589.        148.         49.          21.
                      (INCHES)     1.170       1.175       1.175        1.175
                       (AC-FT)      292.        293.        293.         293.

                       CUMULATIVE AREA =    4.68 SQ MI

      ***            ***            ***            ***            ***

                       HYDROGRAPH AT STATION     C120
                      TRANSPOSITION AREA     16.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                        (CFS)
+    2041.      4.58                437.        110.         37.          16.
                      (INCHES)      .868        .874        .874         .874
                       (AC-FT)      217.        218.        218.         218.

                       CUMULATIVE AREA =    4.68 SQ MI

      ***            ***            ***            ***            ***

                       HYDROGRAPH AT STATION     C120
                      TRANSPOSITION AREA     90.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                        (CFS)
+    1042.      4.58                233.         59.         20.           9.
                      (INCHES)      .462        .469        .469         .469
                       (AC-FT)      115.        117.        117.         117.

                       CUMULATIVE AREA =    4.68 SQ MI

      ***            ***            ***            ***            ***


                       INTERPOLATED HYDROGRAPH AT     C120
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  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                        (CFS)
+    2645.      4.50                544.         137.          46.          20.
                      (INCHES)     1.081        1.087        1.087        1.087
                       (AC-FT)       270.         271.         271.         271.

                      CUMULATIVE AREA =    4.68 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


            **************
            *            *
  132 KK    *      S900  *        BASIN
            *            *
            **************
                              Compute runoff from subbasin 900

               SUBBASIN RUNOFF DATA

  133 BA         SUBBASIN CHARACTERISTICS
                      TAREA        1.03  SUBBASIN AREA

  134 LG         GREEN AND AMPT LOSS RATE
                      STRTL         .25  STARTING LOSS
                        DTH         .37  MOISTURE DEFICIT
                       PSIF        5.30  WETTING FRONT SUCTION
                      XKSAT         .24  HYDRAULIC CONDUCTIVITY
                      RTIMP        6.00  PERCENT IMPERVIOUS AREA

  133 UI         INPUT UNITGRAPH,  42 ORDINATES,  VOLUME = 1.00
                     75.0      77.0     215.0     338.0     472.0     551.0     650.0     871.0     671.0     496.0
                    448.0     394.0     356.0     320.0     277.0     233.0     197.0     180.0     165.0     140.0
                    116.0      97.0      89.0      83.0      65.0      59.0      58.0      37.0      38.0      37.0
                     37.0      23.0      14.0      15.0      14.0      15.0      14.0      15.0      15.0      14.0
                     15.0      14.0

                                                                                ***

      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S900
                      TRANSPOSITION AREA       .1 SQ MI

     TOTAL RAINFALL =    3.20, TOTAL LOSS =    1.53, TOTAL EXCESS =    1.67

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                        (CFS)
+    1087.      4.50                185.          46.          15.           7.
                      (INCHES)     1.663        1.668        1.668        1.668
                       (AC-FT)        92.          92.          92.          92.

                      CUMULATIVE AREA =    1.03 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S900
                      TRANSPOSITION AREA       .5 SQ MI

     TOTAL RAINFALL =    3.18, TOTAL LOSS =    1.52, TOTAL EXCESS =    1.66

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                        (CFS)
+    1080.      4.50                184.          46.          15.           7.
                      (INCHES)     1.651        1.656        1.656        1.656
                       (AC-FT)        91.          91.          91.          91.

                      CUMULATIVE AREA =    1.03 SQ MI


      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION     S900
                      TRANSPOSITION AREA      2.8 SQ MI

     TOTAL RAINFALL =    3.12, TOTAL LOSS =    1.75, TOTAL EXCESS =    1.37

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                    6-HR        24-HR        72-HR     166.58-HR
+   (CFS)       (HR)
                        (CFS)
+     738.     4.50                152.          38.          13.           5.
                      (INCHES)     1.362        1.368        1.368        1.368
                       (AC-FT)        75.          76.          76.          76.
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                    CUMULATIVE AREA =    1.03 SQ MI

     ***            ***            ***            ***            ***

                      HYDROGRAPH AT STATION     S900
                     TRANSPOSITION AREA     16.0 SQ MI

    TOTAL RAINFALL =    2.95, TOTAL LOSS =    1.88, TOTAL EXCESS =    1.07

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     546.      4.50                118.         30.         10.          4.
                (INCHES)         1.060       1.068       1.068       1.068
                (AC-FT)           59.         59.         59.         59.

                    CUMULATIVE AREA =    1.03 SQ MI

     ***            ***            ***            ***            ***

                      HYDROGRAPH AT STATION     S900
                     TRANSPOSITION AREA     90.0 SQ MI

    TOTAL RAINFALL =    2.59, TOTAL LOSS =    1.93, TOTAL EXCESS =     .66

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     324.      4.50                 73.         18.          6.          3.
                (INCHES)          .653        .662        .662        .662
                (AC-FT)           36.         37.         37.         37.

                    CUMULATIVE AREA =    1.03 SQ MI

 -----DSS---ZWRITE Unit  71; Vers.    1:  /S900/S900/FLOW/01JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S900/S900/FLOW/02JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S900/S900/FLOW/03JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S900/S900/FLOW/04JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S900/S900/FLOW/05JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S900/S900/FLOW/06JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S900/S900/FLOW/07JAN1999/5MIN/CALC/
 -----DSS---ZWRITE Unit  71; Vers.    1:  /S900/S900/FLOW/08JAN1999/5MIN/CALC/
      ***            ***            ***            ***            ***

                    INTERPOLATED HYDROGRAPH AT     S900

  PEAK FLOW     TIME                      MAXIMUM AVERAGE FLOW
                                  6-HR       24-HR       72-HR    166.58-HR
+   (CFS)       (HR)
                  (CFS)
+     936.      4.50                170.         43.         14.          6.
                (INCHES)         1.529       1.535       1.535       1.535
                (AC-FT)           84.         85.         85.         85.

                    CUMULATIVE AREA =    1.03 SQ MI

1
                                    RUNOFF SUMMARY
                                FLOW IN CUBIC FEET PER SECOND
                              TIME IN HOURS,  AREA IN SQUARE MILES

                                                PEAK   TIME OF     AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN     MAXIMUM     TIME OF
         OPERATION       STATION                FLOW   PEAK                                           AREA      STAGE     MAX STAGE
+                                                                   6-HOUR     24-HOUR     72-HOUR
         HYDROGRAPH AT
+                          S110                  662.   4.25          76.         19.          6.       .43
         ROUTED TO
+                         11015I                 570.   4.42          76.         19.          6.       .43
         DIVERSION TO
+                          CF5I                  114.   4.42          15.          4.          1.       .43
         HYDROGRAPH AT
+                          D15I                  456.   4.42          61.         15.          5.       .43
         ROUTED TO
+                         15I15R                 408.   4.75          61.         15.          5.       .43
         HYDROGRAPH AT
+                          S115                 1605.   4.58         296.         74.         25.      2.25
         2 COMBINED AT
+                          C115U                1730.   4.67         337.         85.         28.      2.68
         HYDROGRAPH AT
+                          CF5I                  114.   4.42          15.          4.          1.       .43
```

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          ROUTED TO
+                        15I15L        61.    5.50         15.          4.          1.         .43
          2 COMBINED AT
+                         C115D      1731.    4.67        349.         88.         29.        2.68
          ROUTED TO
+                        115120      1699.    4.75        349.         88.         29.        2.68
          HYDROGRAPH AT
+                          S120      1838.    4.33        256.         64.         21.        2.00
          2 COMBINED AT
+                          C120      2645.    4.50        544.        137.         46.        4.68
          HYDROGRAPH AT
+                          S900       936.    4.50        170.         43.         14.        1.03


 *** NORMAL END OF HEC-1 ***


    -----DSS---ZCLOSE Unit:  71,   File: SVP_EX6.DSS
               Pointer Utilization:    .25
               Number of Records:     24
               File Size:     51.6  Kbytes
               Percent Inactive:     .0
```

Plate D1 - 24 Hour Rainfall - Existing Terrain

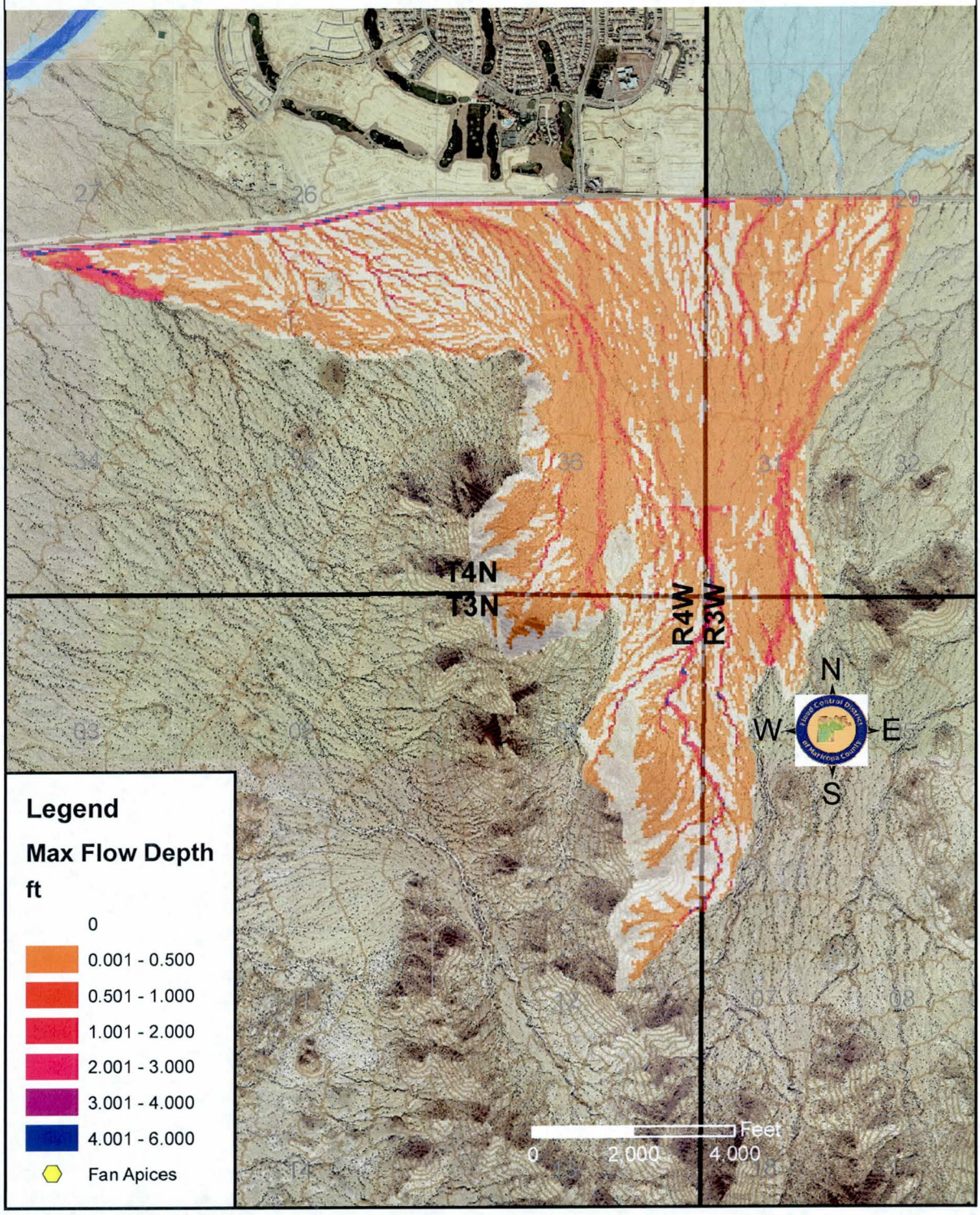


Plate D2 - 24 Hour Rainfall - Scenario 1

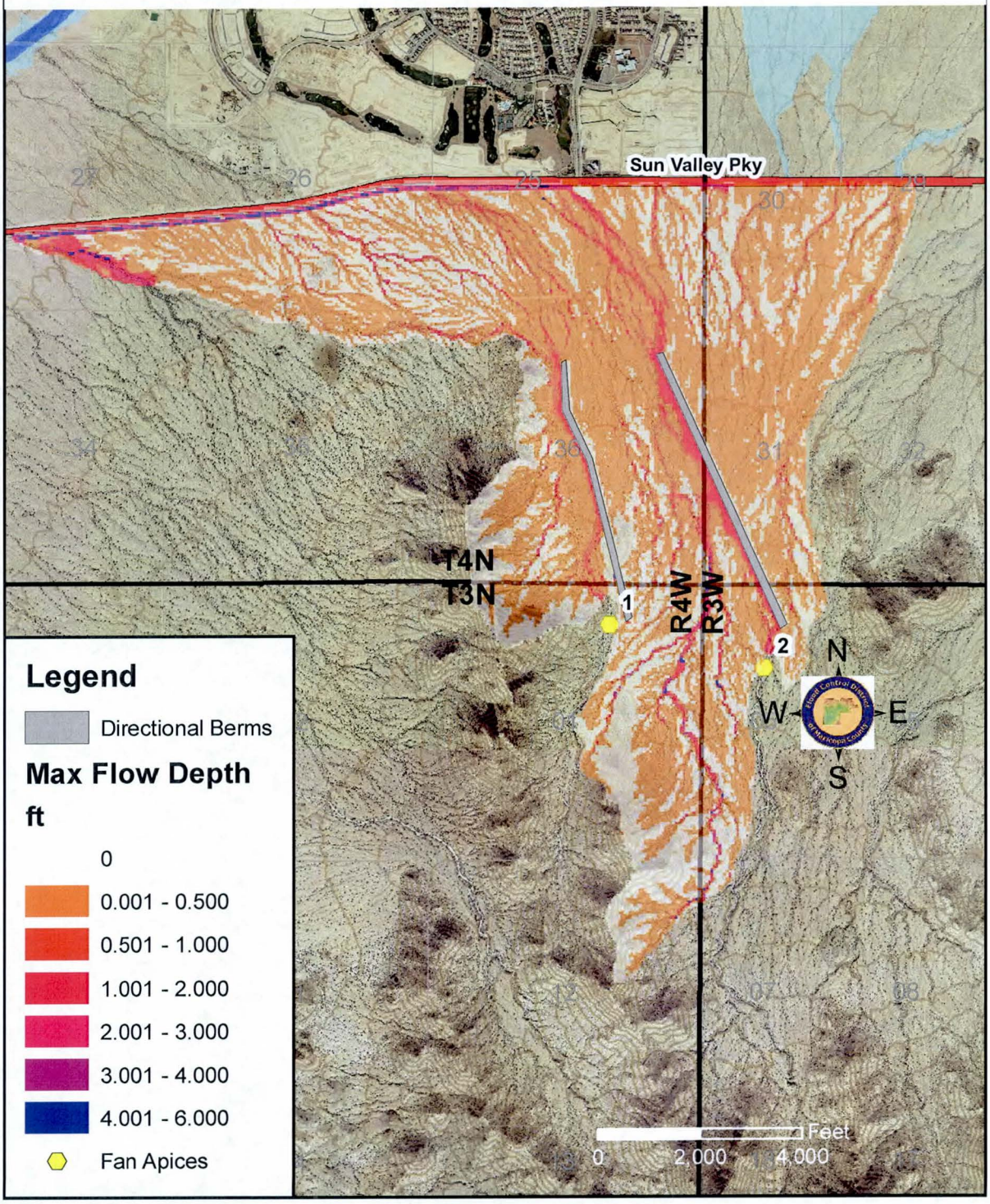


Plate D3 - 24 Hour Rainfall - Scenario 2

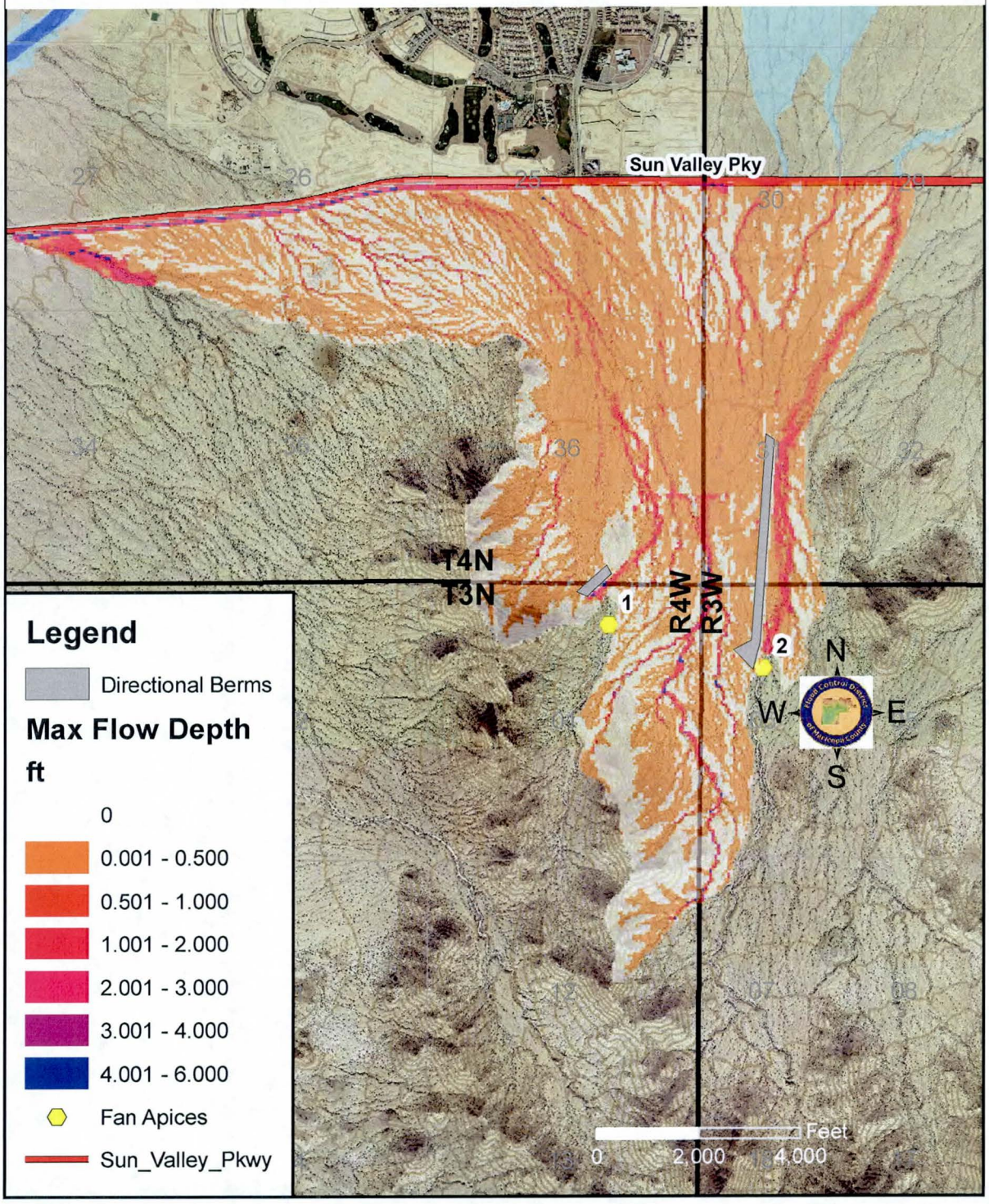


Plate D4 - 24 Hour Rainfall - Scenario 3

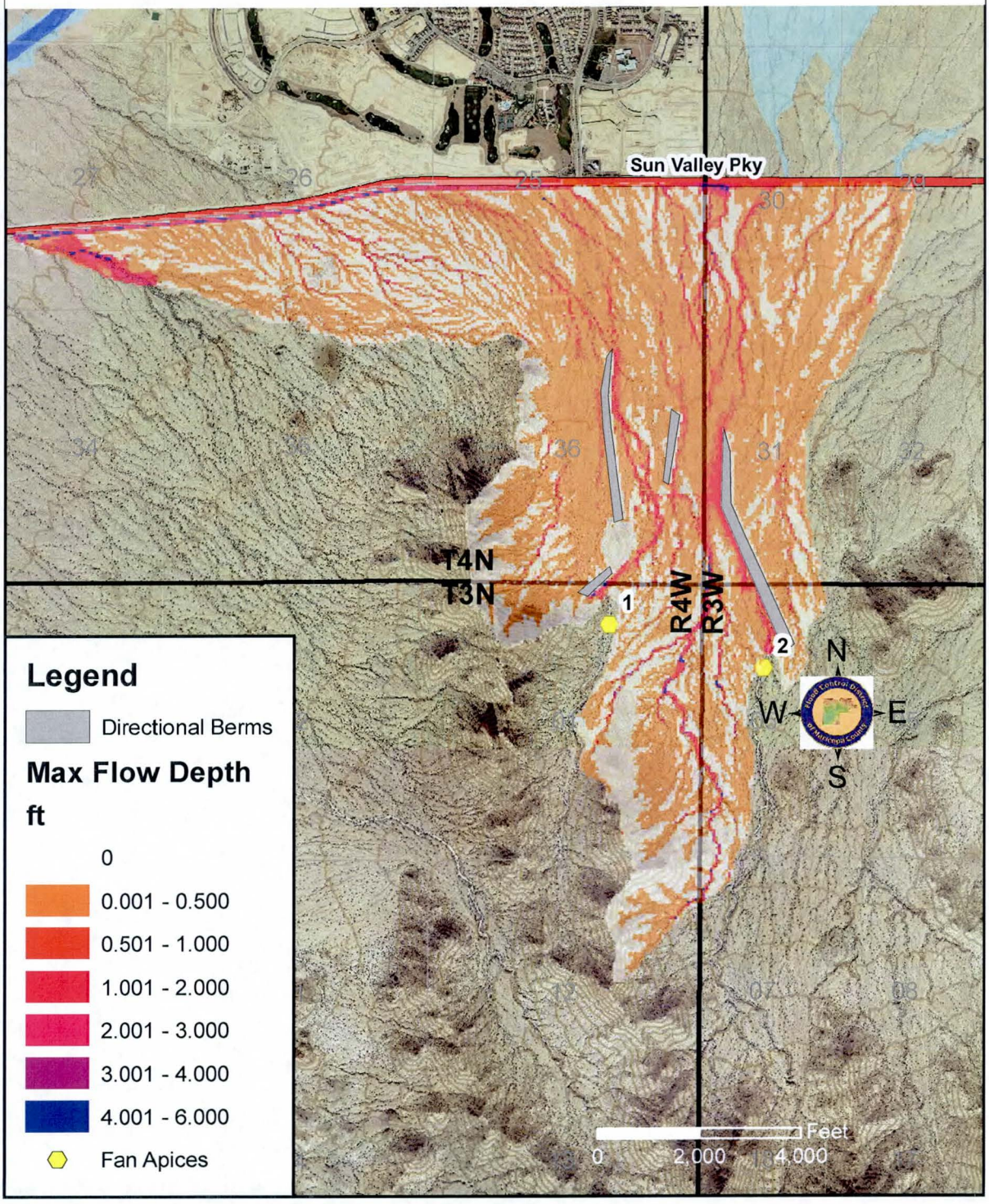


Plate D5 - 24 Hour Rainfall - Scenario 4

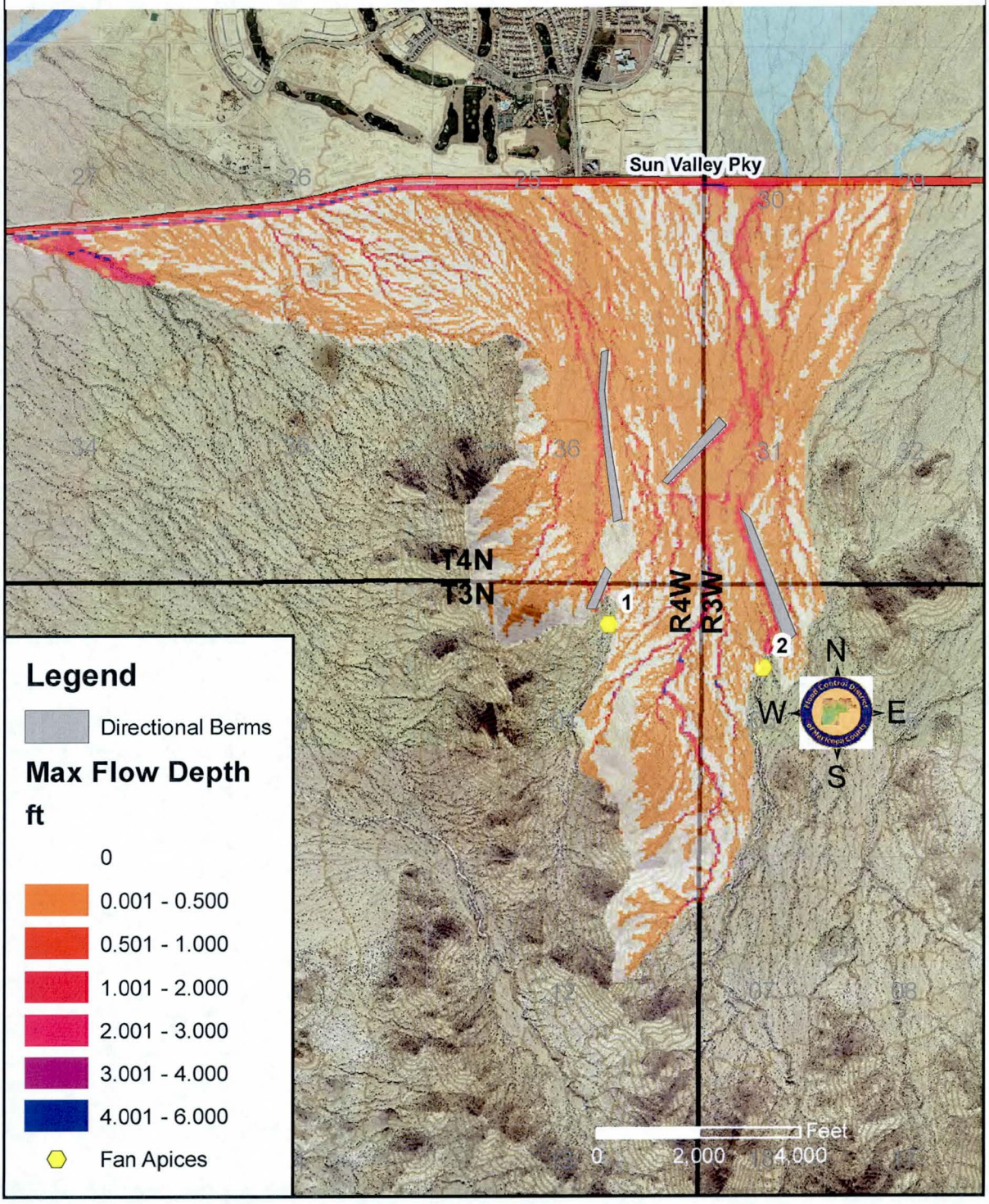


Plate D6 - 24 Hour Rainfall - Scenario 5

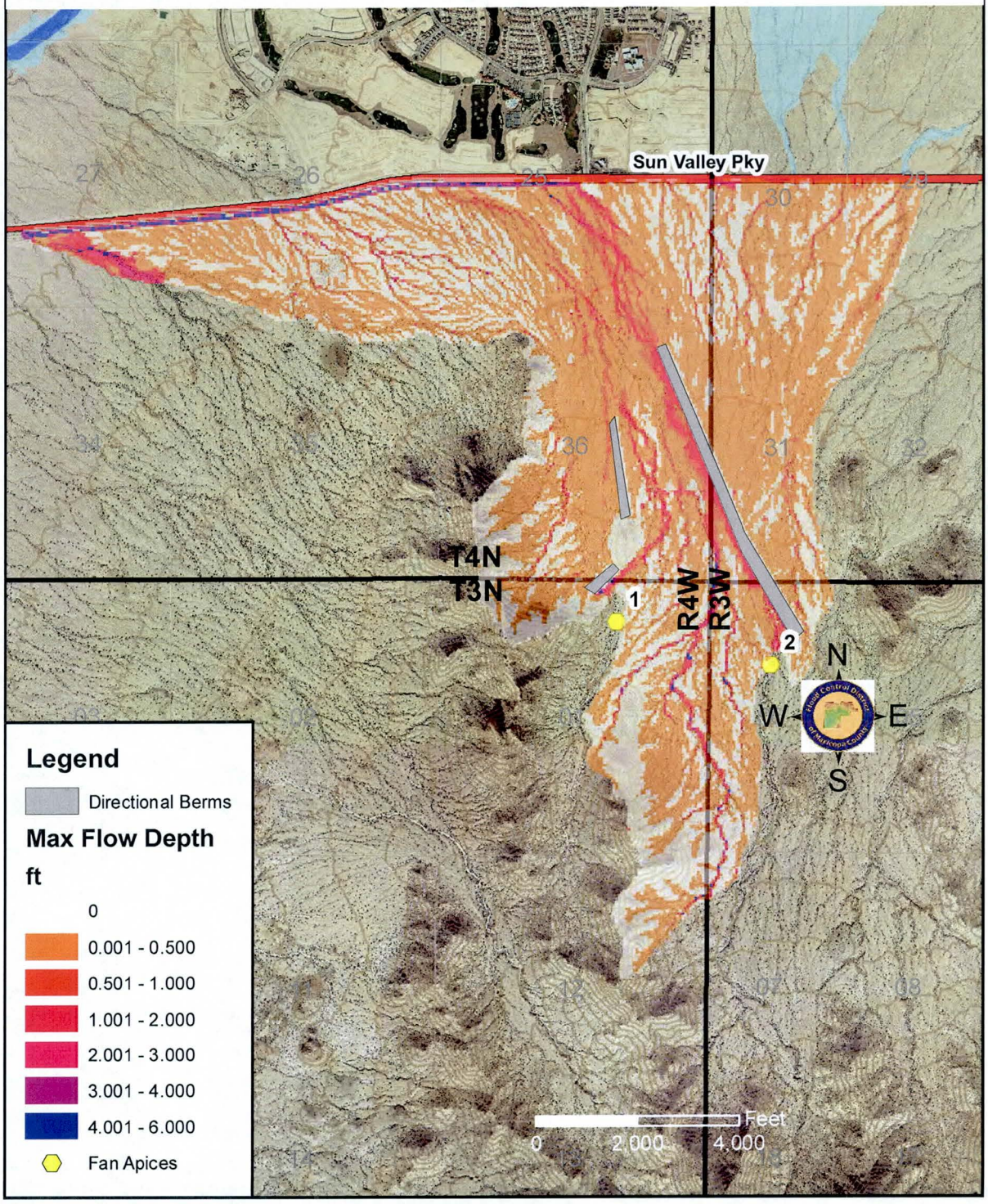


Plate D7 - 6 Hour Rainfall - Existing Terrain

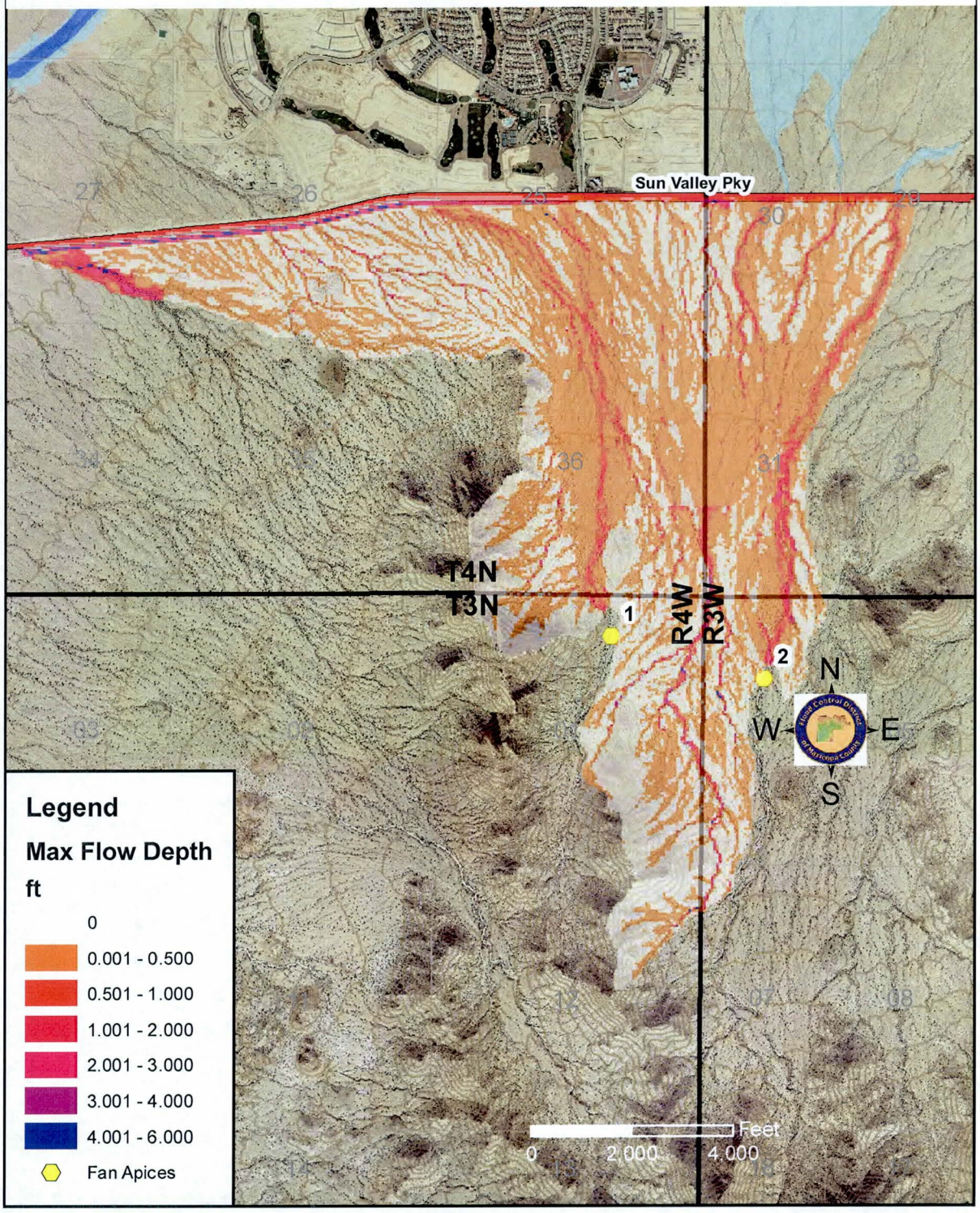


Plate D8 - 6 Hour Rainfall - Scenario 1

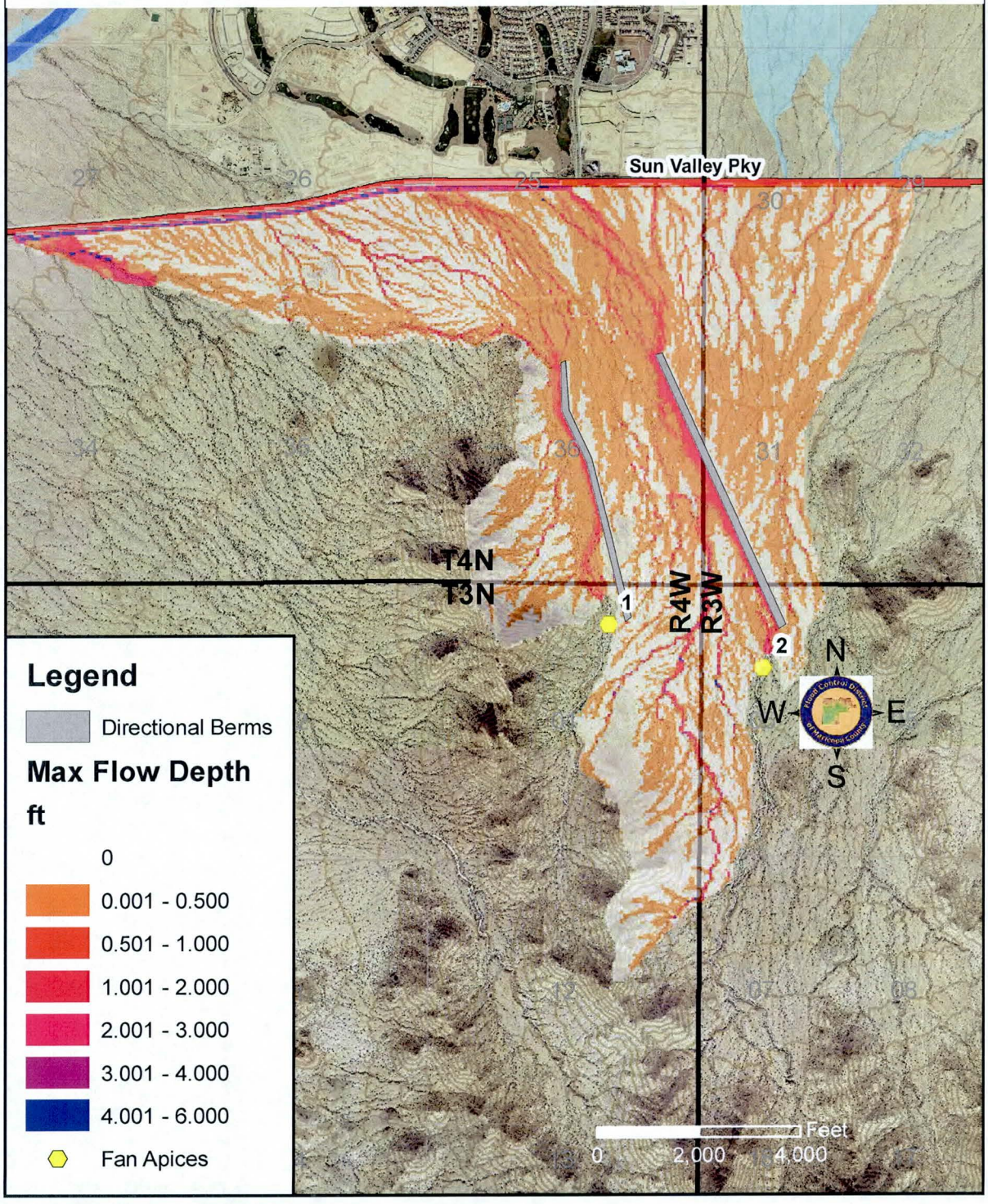


Plate D9 - 6 Hour Rainfall - Scenario 2

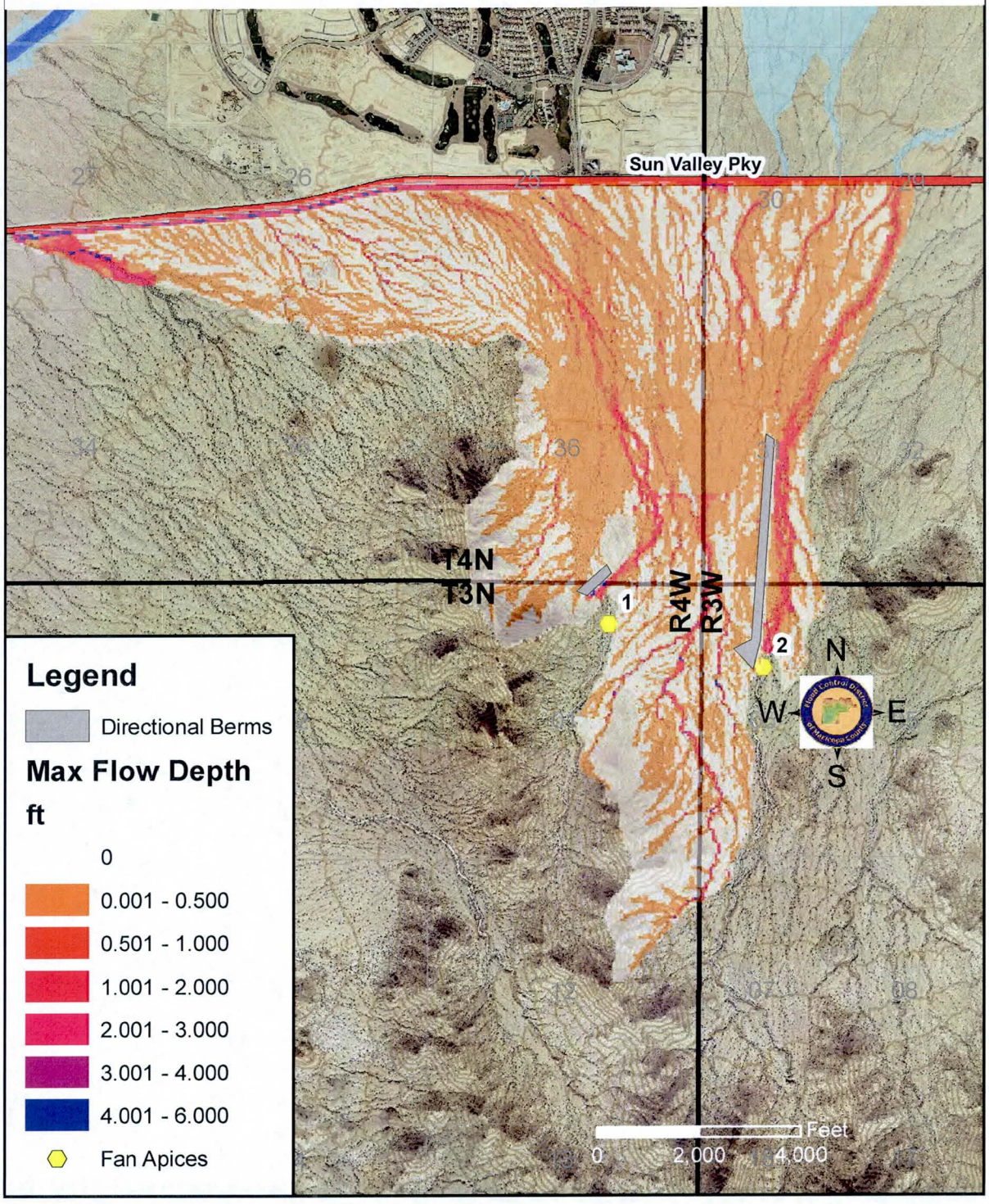


Plate D10 - 6 Hour Rainfall - Scenario 3

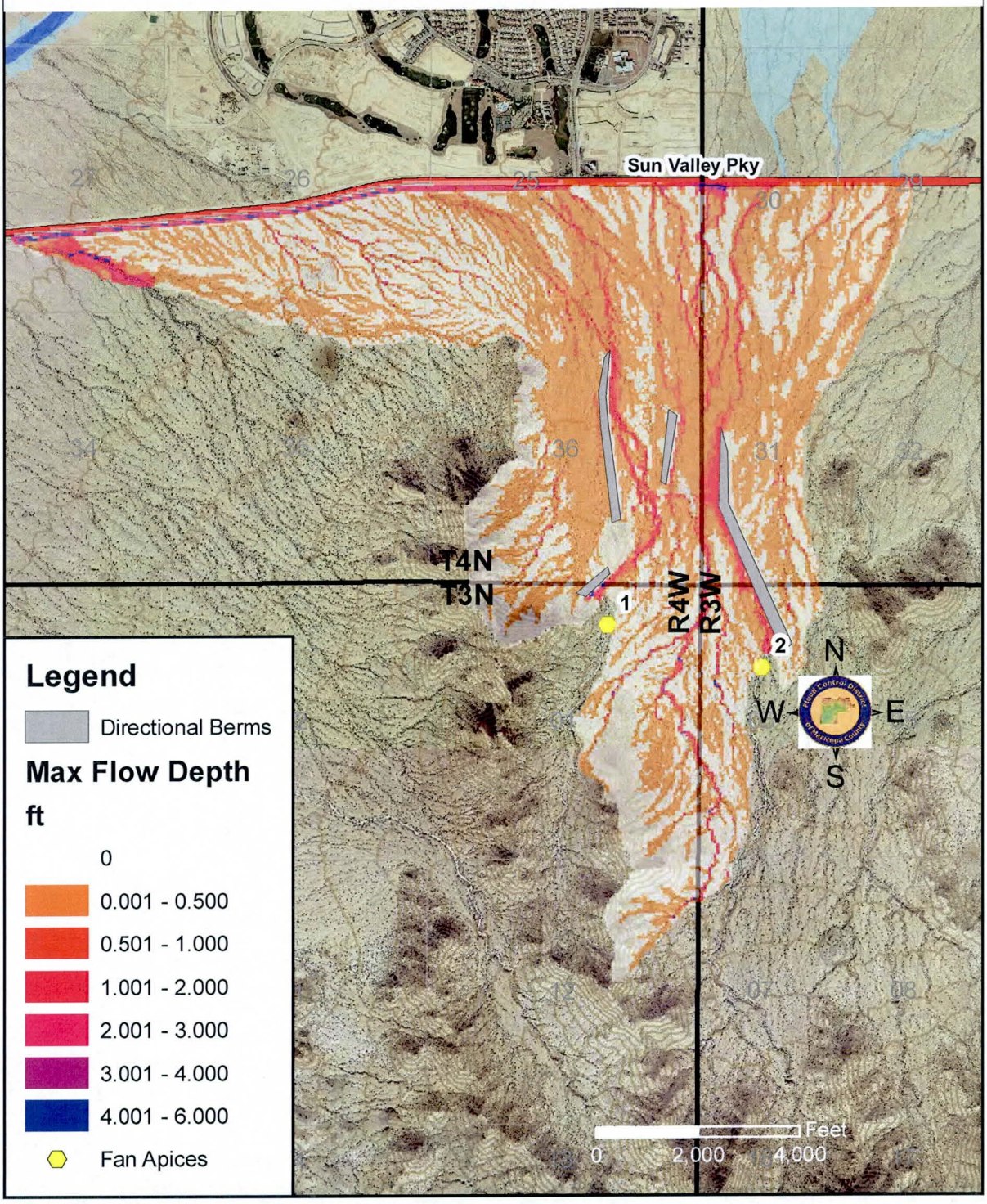


Plate D11 - 6 Hour Rainfall - Scenario 4

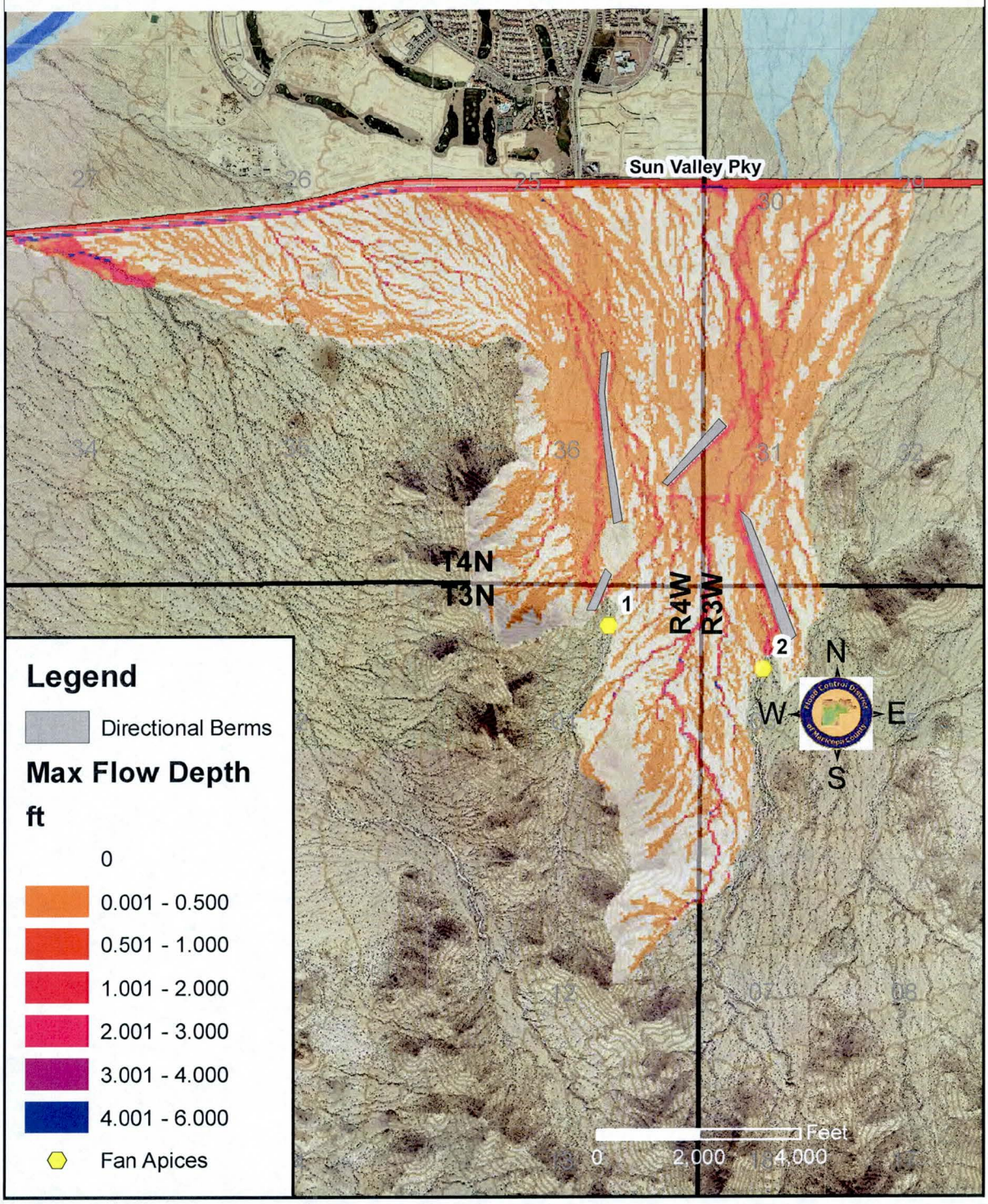
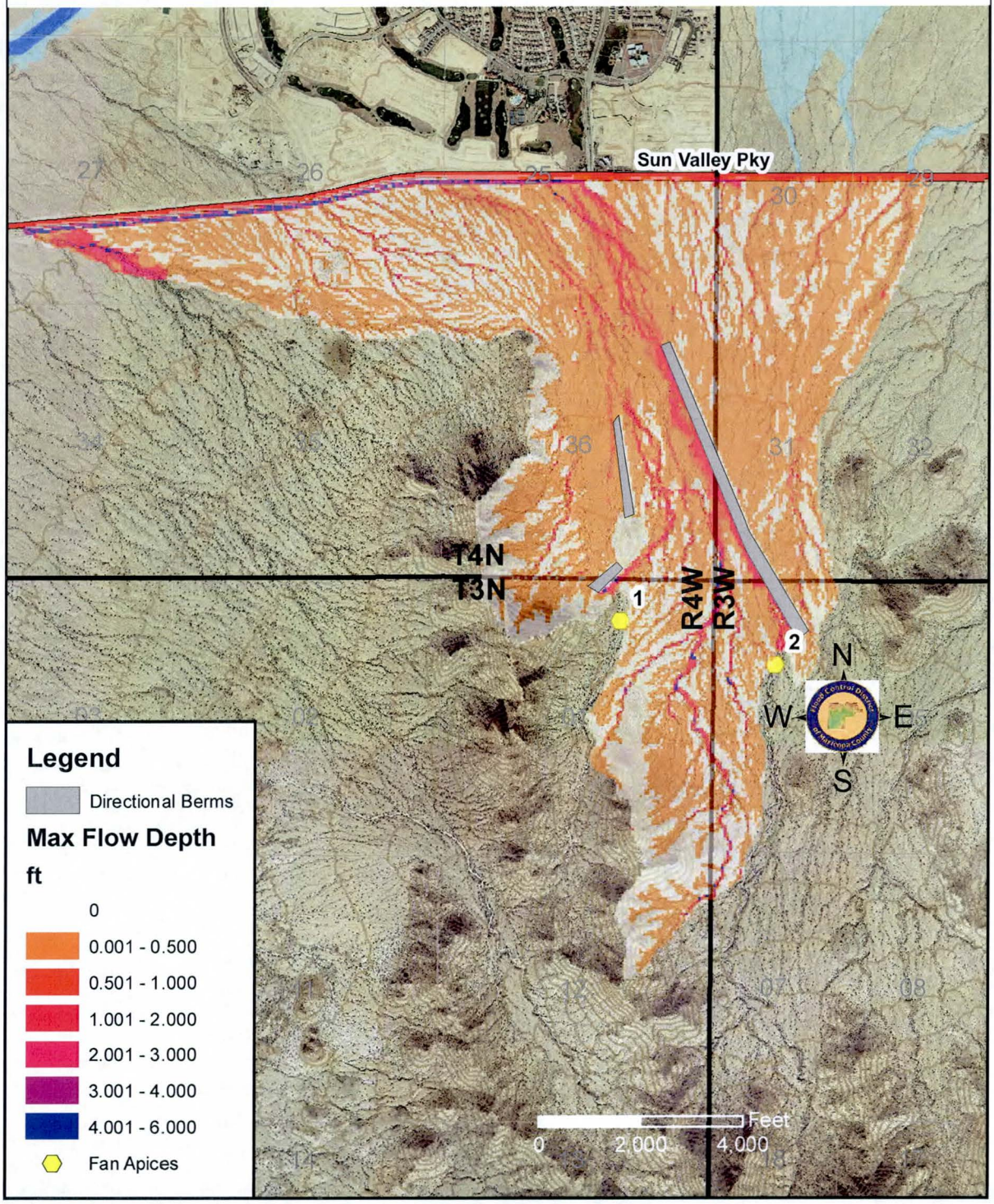
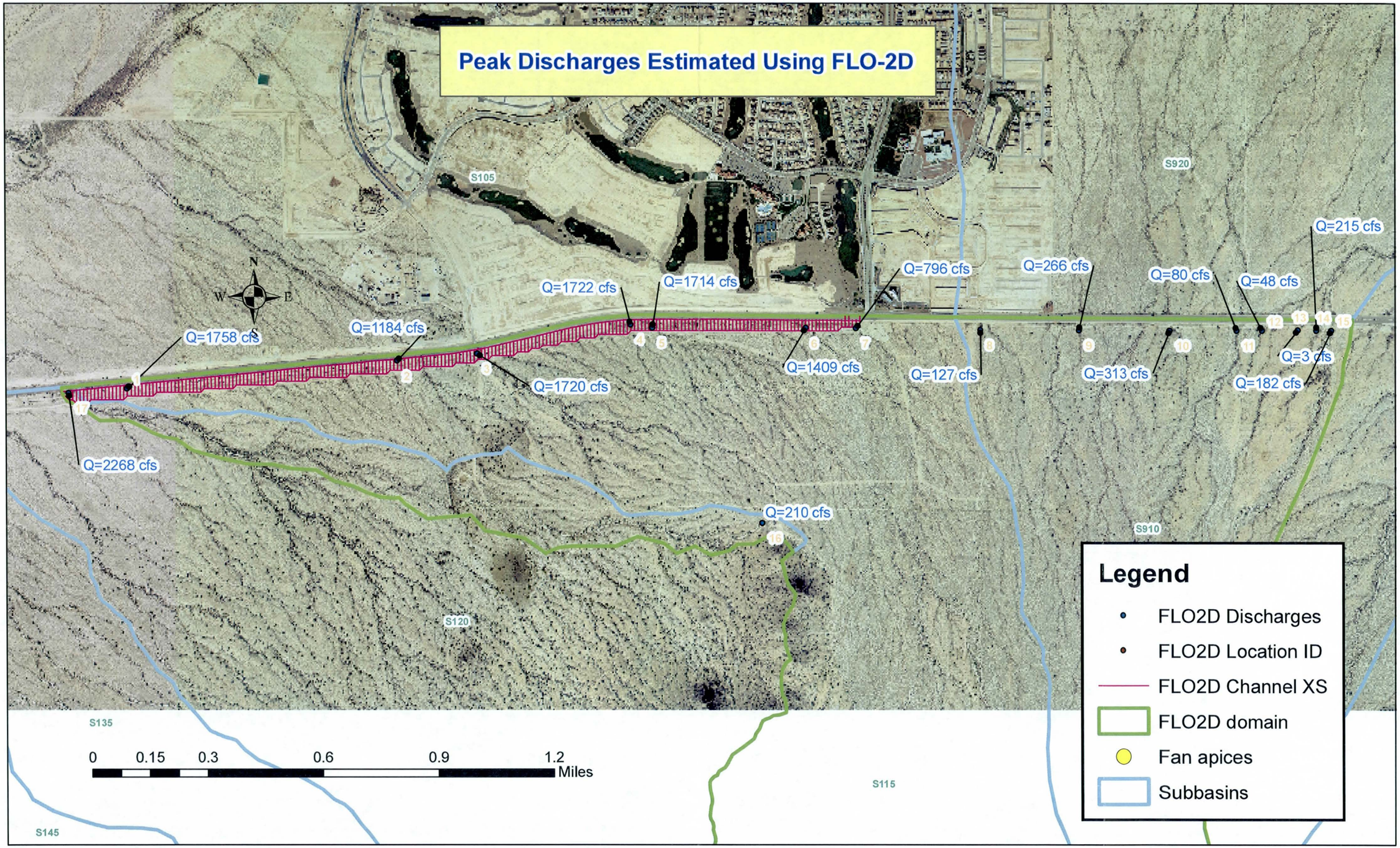
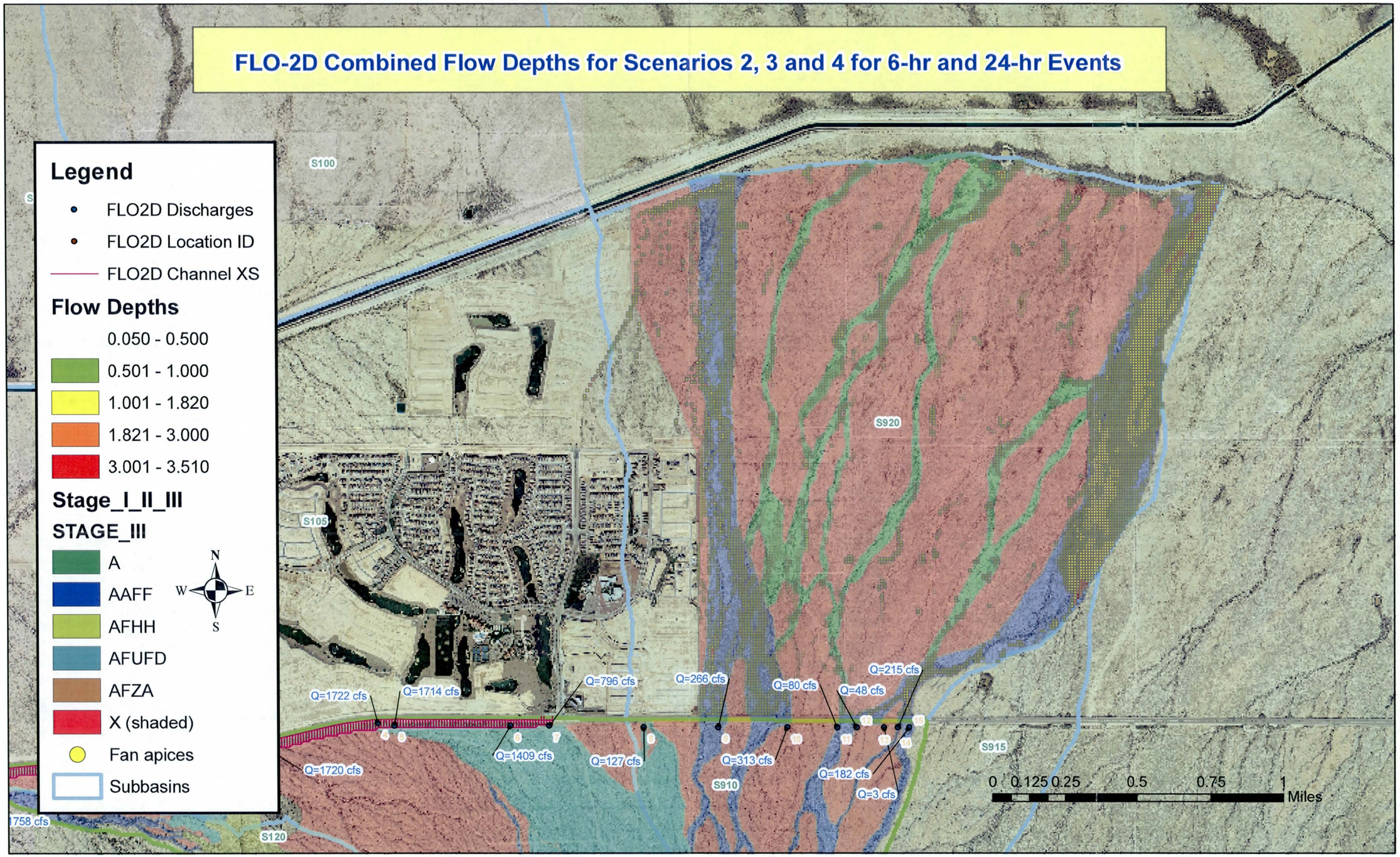


Plate D12 - 6 Hour Rainfall - Scenario 5




Peak Discharges Estimated Using FLO-2D
S105
S920
N
W
E
S
Q=1758 cfs
Q=1184 cfs
Q=1722 cfs
Q=1714 cfs
Q=796 cfs
Q=266 cfs
Q=80 cfs
Q=48 cfs
Q=215 cfs
Q=1720 cfs
Q=1409 cfs
Q=127 cfs
Q=313 cfs
Q=182 cfs
Q=3 cfs
Q=2268 cfs
Q=210 cfs
S910
S120
S135
S115
S145
0 0.15 0.3 0.6 0.9 1.2
Miles
Legend
FLO2D Discharges
FLO2D Location ID
FLO2D Channel XS
FLO2D domain
Fan apices
Subbasins

FLO-2D Combined Flow Depths for Scenarios 2, 3 and 4 for 6-hr and 24-hr Events



Appendix E

Hydraulic Analysis Supporting Documentation

E.1: Roughness Coefficient Determination

E.2: Cross Section Plots

E.3 Detailed HEC-RAS Output

E.1 Roughness Coefficient Estimation

PREFACE

The following report describes the evaluation of Manning's roughness coefficients for this floodplain delineation study.

FLOODPLAIN DELINEATION STUDY
of
Fan Apex Containment Reaches – Fans 1, 2, 3, 4, 5, 10, 11, 13E, 13W, 17, 18, & 19
SUN VALLEY AREA DRAINAGE MASTER PLAN

Reconnaissance Report
Appendix E, Part 7, Volume 4

FCD 2004CO049

For
Flood Control District of Maricopa County
2801 W Durango St
Phoenix, AZ 85009

By
JE Fuller Hydrology & Geomorphology, Inc.
8400 S Kyrene Road Suite 201
Tempe, Arizona 85284
480-752-2124

September, 2005, Revised August, 2006

1. Introduction

JE Fuller/Hydrology & Geomorphology, Inc., (JEF), performed field reconnaissance along 12 selected water courses studies during the months of August and September 2005. The reconnaissance was performed to document channel and overbank conditions for the purpose of determining Manning's Roughness Coefficient for the selected 12 water courses throughout the study area.

2. Manning's "n" Values

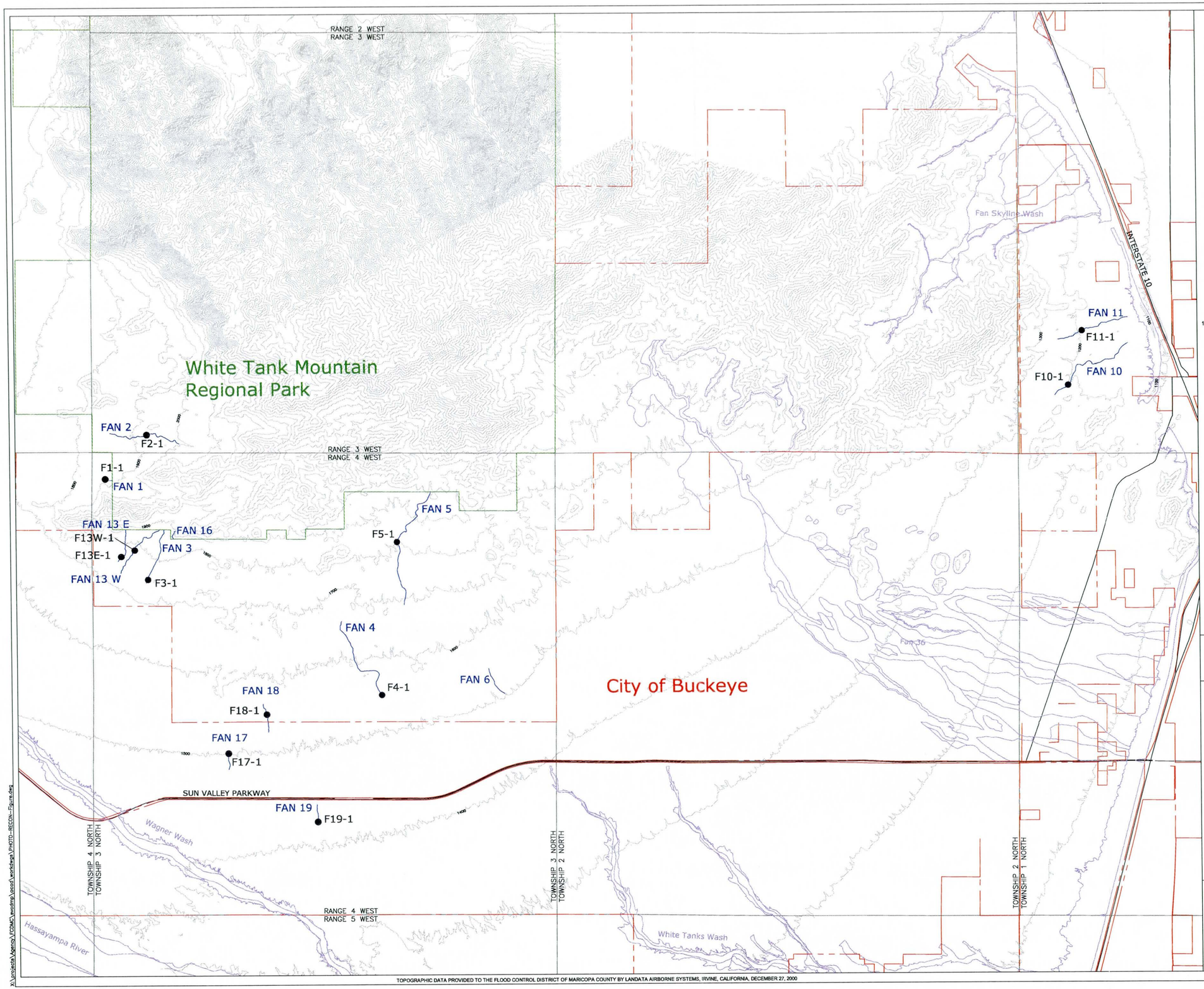
Manning's "n" values were determined using the methodology outlined in the USGS report titled, "Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona" by B.W. Thomsen and H.W. Hjalmarson, (April, 1991). Reach designations were assigned based on distinctions in general channel morphology, vegetation, and channel and overbank soil characteristics.

This floodplain delineation study has 12 selected water courses. The table below identifies each water courses name and the approximate study reach mileage.

Table 1

Name	Study Mileage	Name	Study Mileage
FAN 1	0.1	FAN 11	1.0
FAN 2	1.0	FAN 13W	0.9
FAN 3	0.8	FAN 13E	0.5
FAN 4	1.3	FAN 17	0.2
FAN 5	1.8	FAN 18	0.4
FAN 10	1.4	FAN 19	0.2

On the following pages, photographs showing typical reach conditions are preceded by the worksheet used to determine the reach-average Manning's "n" values for the reach depicted in the photographs. Figure 1 illustrates the field reconnaissance photo locations as well as the study reaches. References to left bank and right bank associated with a downstream viewing orientation.



LEGEND

PHOTOGRAPHY LOCATION

FAN APEX CONTAINMENT REACH

N

NOTES

1. PHOTOGRAPHY WAS TAKEN IN THE FOLLOWING ORDER AT EACH LOCATION: UPSTREAM, DOWNSTREAM, LEFT BANK, RIGHT BANK

TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, DECEMBER 27, 2000

X:\projects\Agency\FCDMC\existing\ocos\workshops\PHOTO--RECON--Figure.dwg

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

FLOODPLAIN DELINEATION STUDY OF
FAN APEX CONTAINMENT REACHES
FANS 1, 2, 3, 4, 5, 10, 11, 13E, 13W,
17, 18, AND 19

FIGURE 1:
PHOTO LOCATIONS

FCD 2004CO49

SUN VALLEY
AREA DRAINAGE MASTER PLAN
AUGUST, 2006

SCALE IN FEET
3000' 0' 3000' 6000'

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.
PHONE: 480-753-2124
FAX: 480-829-2183

SHEET 1 OF 1

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

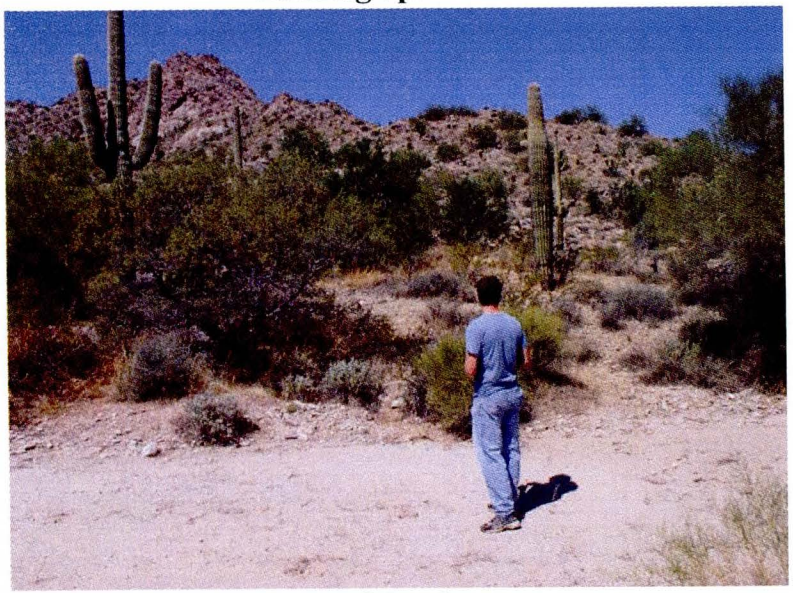
Project: Sun Valley Area Drainage Master Plan
Location: FAN 1
Location: F1-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032			
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035		0.026	0.026
	Gravel		0.028-0.035	0.03		
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015		0.01	
	Appreciable		0.020-0.030	0.02		0.02
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010		0.005	0.008
	Medium		0.010-0.025	0.01		
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.062	0.043	0.056
			Use	**0.06**	**0.04**	**0.055**

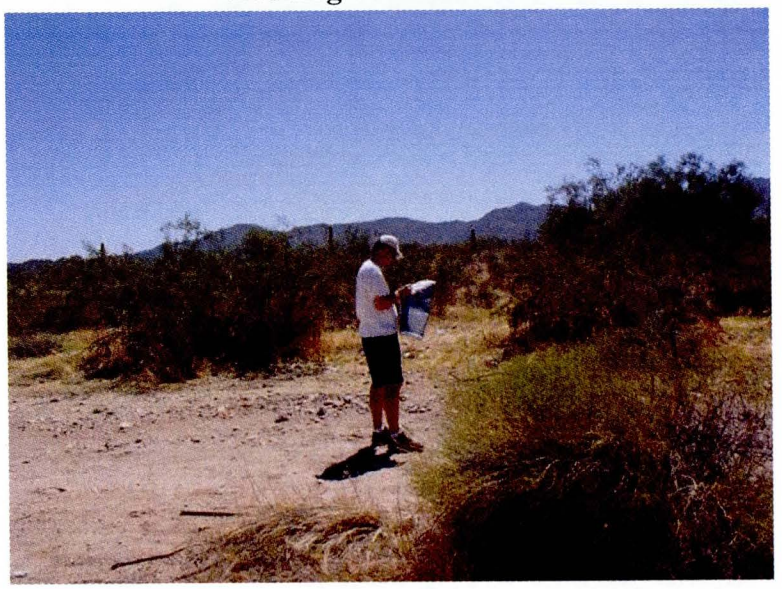
Location: F1-1

Looking upstream

Looking downstream



Left bank



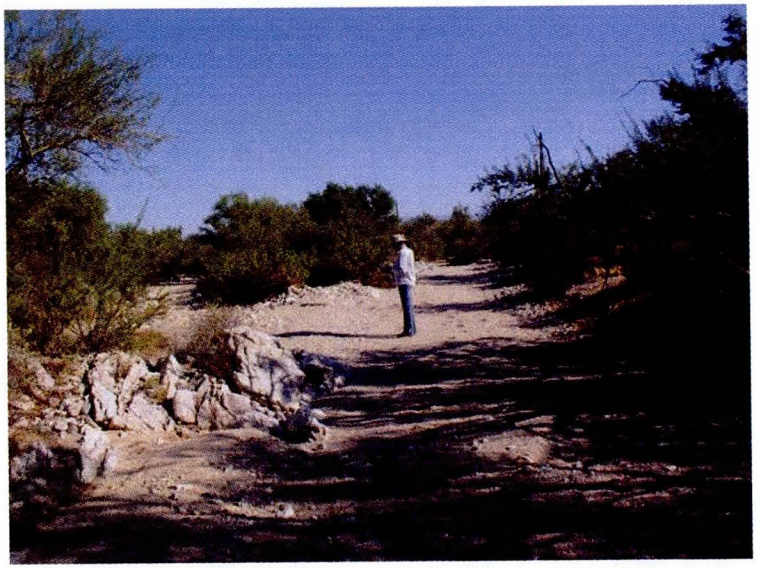
Right bank

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

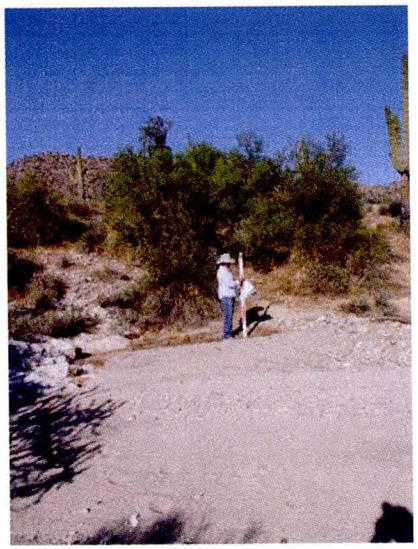
Project: Sun Valley Area Drainage Master Plan
Location: FAN 2
Location: F2-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032			
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035		0.026	
	Gravel		0.028-0.035	0.03		0.03
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015		0.01	
	Appreciable		0.020-0.030	0.02		0.02
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010		0.002	
	Medium		0.010-0.025	0.015		0.01
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.067	0.04	0.062
			Use	**0.07**	**0.04**	**0.06**

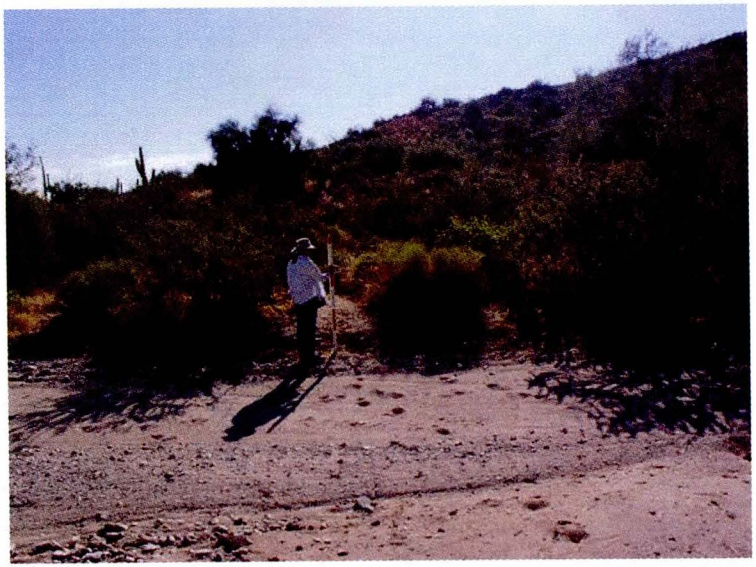
Looking upstream



Looking downstream



Left bank



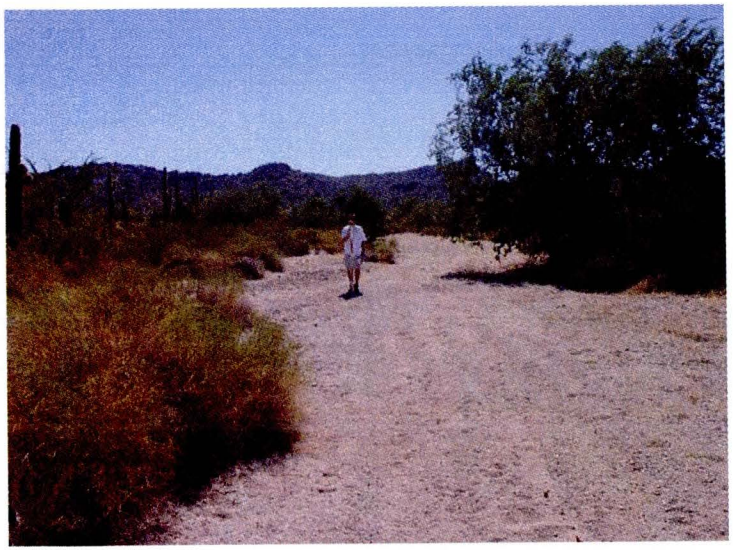
Right bank

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 3
Location: F3-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032			
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035		0.026	
	Gravel		0.028-0.035	0.028		0.028
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015		0.01	
	Appreciable		0.020-0.030	0.02		0.02
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010	0.008	0.002	
	Medium		0.010-0.025			0.01
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.058	0.04	0.06
			Use	**0.06**	**0.04**	**0.06**

Location: F3-1



Looking upstream

Looking downstream

Left bank

Right bank

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

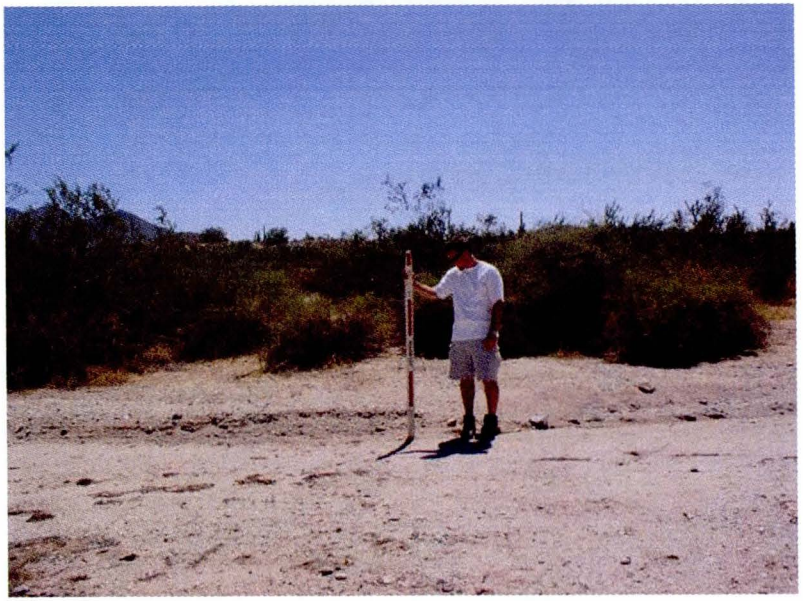
Project: Sun Valley Area Drainage Master Plan
Location: FAN 4
Location: F4-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032			
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035		0.026	
	Gravel		0.028-0.035	0.026		0.026
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015		0.01	
	Appreciable		0.020-0.030	0.02		0.02
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010	0.008	0.002	.008
	Medium		0.010-0.025			
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.056	0.04	0.056
			Use	**0.055**	**0.04**	**0.055**

Looking upstream

Looking downstream

Left bank



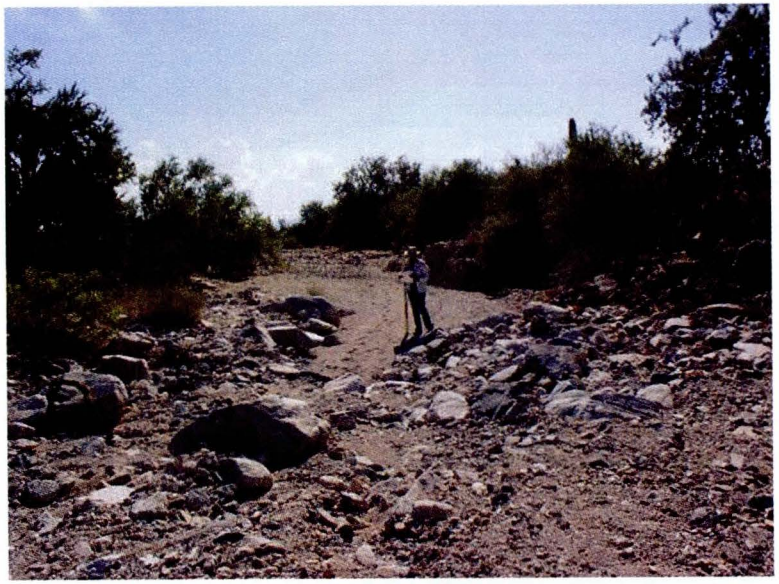
Right bank

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 5
Location: F5-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032			
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035			
	Gravel		0.028-0.035		0.03	
	Cobble		0.030-0.050	0.030		.030
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015			
	Appreciable		0.020-0.030	0.02	0.02	0.02
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010		0.002	
	Medium		0.010-0.025	0.015		0.015
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.067	0.054	0.067
			Use	**0.065**	**0.055**	**0.065**

Looking upstream



Looking downstream

Left bank

Right bank

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 10
Location: F10-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032			
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035		0.026	
	Gravel		0.028-0.035	0.028		0.028
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015	0.015	0.005	0.015
	Appreciable		0.020-0.030			
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010		0.002	
	Medium		0.010-0.025	0.010		0.010
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.055	0.035	0.055
			Use	**0.055**	**0.035**	**0.055**

Looking upstream

Looking downstream

Left bank

Right bank

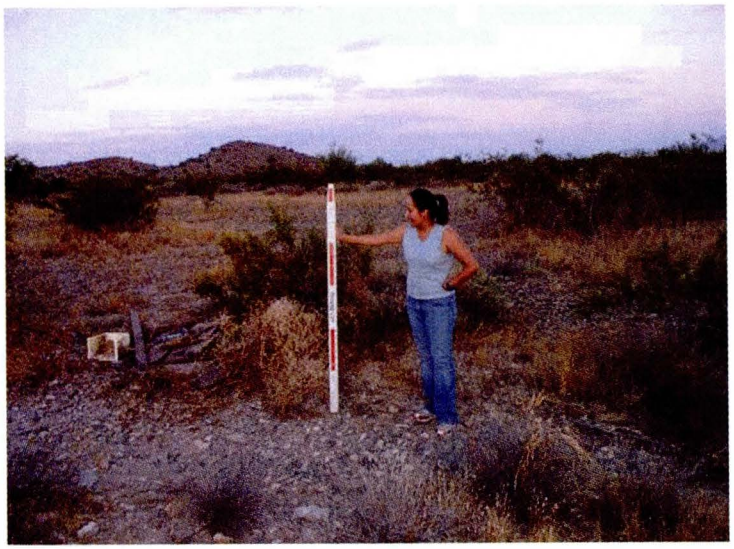
DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 11
Location: F11-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032			
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035			
	Gravel		0.028-0.035	0.028	0.028	0.028
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015			
	Appreciable		0.020-0.030	0.015	0.015	0.015
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010	0.007	0.007	0.007
	Medium		0.010-0.025			
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.052	0.052	0.052
			Use	**0.05**	**0.05**	**0.05**

Looking upstream

Looking downstream



Left bank

Right bank

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 13E
Location: F13E-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032			
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035		0.026	
	Gravel		0.028-0.035	0.028		0.028
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015		0.01	
	Appreciable		0.020-0.030	0.015		0.015
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010	0.008	0.005	
	Medium		0.010-0.025			0.01
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.053	0.043	0.053
			Use	**0.055**	**0.04**	**0.055**

Looking upstream

Looking downstream

Left bank

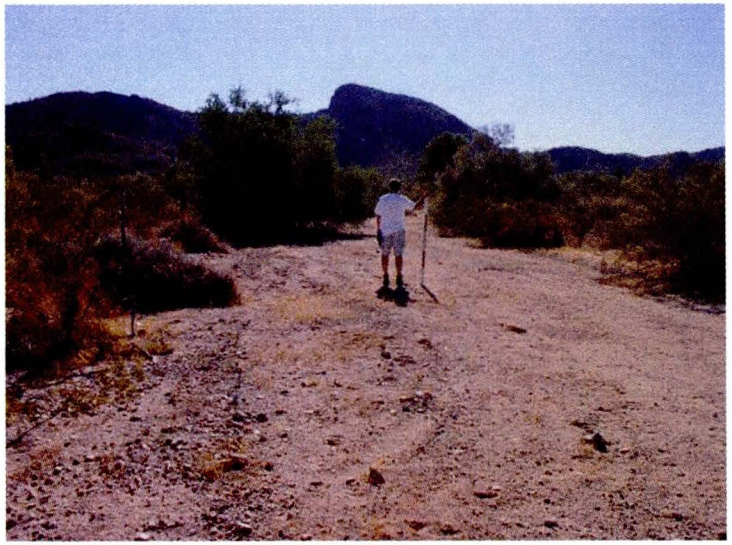
Right bank

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 13W
Location: F13W-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032			
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035		0.026	
	Gravel		0.028-0.035	0.028		0.028
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015		0.015	
	Appreciable		0.020-0.030	0.02		0.02
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010	0.008	0.002	.009
	Medium		0.010-0.025			
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.058	0.045	0.059
			Use	**0.06**	**0.045**	**0.06**

Location: F13W-1



Looking upstream

Looking downstream

Left bank

Right bank

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 17
Location: F17-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032	0.028		0.028
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035		0.026	
	Gravel		0.028-0.035			
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015		0.015	
	Appreciable		0.020-0.030	0.02		0.02
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010	0.009	0.002	0.009
	Medium		0.010-0.025			
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.059	0.045	0.059
			Use	**0.06**	**0.045**	**0.06**

Location: F17-1

Looking Upstream at Channel and Left Bank

Looking Downstream at Channel and Right Bank

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 18
Location: F18-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032	0.028		0.028
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035		0.026	
	Gravel		0.028-0.035			
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015		0.015	
	Appreciable		0.020-0.030	0.02		0.02
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010	0.009	0.007	0.009
	Medium		0.010-0.025			
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.059	0.05	0.059
			Use	**0.06**	**0.05**	**0.06**

Location: F18-1

Looking Upstream at Channel and Banks

Looking Downstream at Channel and Banks

DETERMINATION OF MANNING'S ROUGHNESS COEFFICIENTS BY FCDMC METHOD

Project: Sun Valley Area Drainage Master Plan
Location: FAN 19
Location: F19-1

Channel Conditions		Manning's n Adjustment		Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n0	0.012-0.018			
	Rock Cut		0.025			
	Firm Soil		0.025-0.032	0.028		0.028
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035		0.026	
	Gravel		0.028-0.035			
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n1	0			
	Minor		0.001-0.005	0.002	0.002	0.002
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Effects of Obstructions	Negligible	n2	0.000-0.004			
	Minor		0.005-0.015		0.015	
	Appreciable		0.020-0.030	0.02		0.02
	Severe		0.040-0.060			
Vegetation	Small	n3	0.002-0.010	0.009	0.002	0.009
	Medium		0.010-0.025			
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Variations in the Channel Cross Section	Gradual	n4	0	0	0	0
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Degree of Meandering	Minor	m	1	1	1	1
	Appreciable		1.15			
	Severe		1.3			
n=(n0+n1+n2+n3+n4)m				0.059	0.045	0.059
			Use	**0.06**	**0.045**	**0.06**

Location: F19-1

Looking Upstream at Channel and Banks

Looking Downstream at Channel and Banks

3. Significant Hydraulic Structures

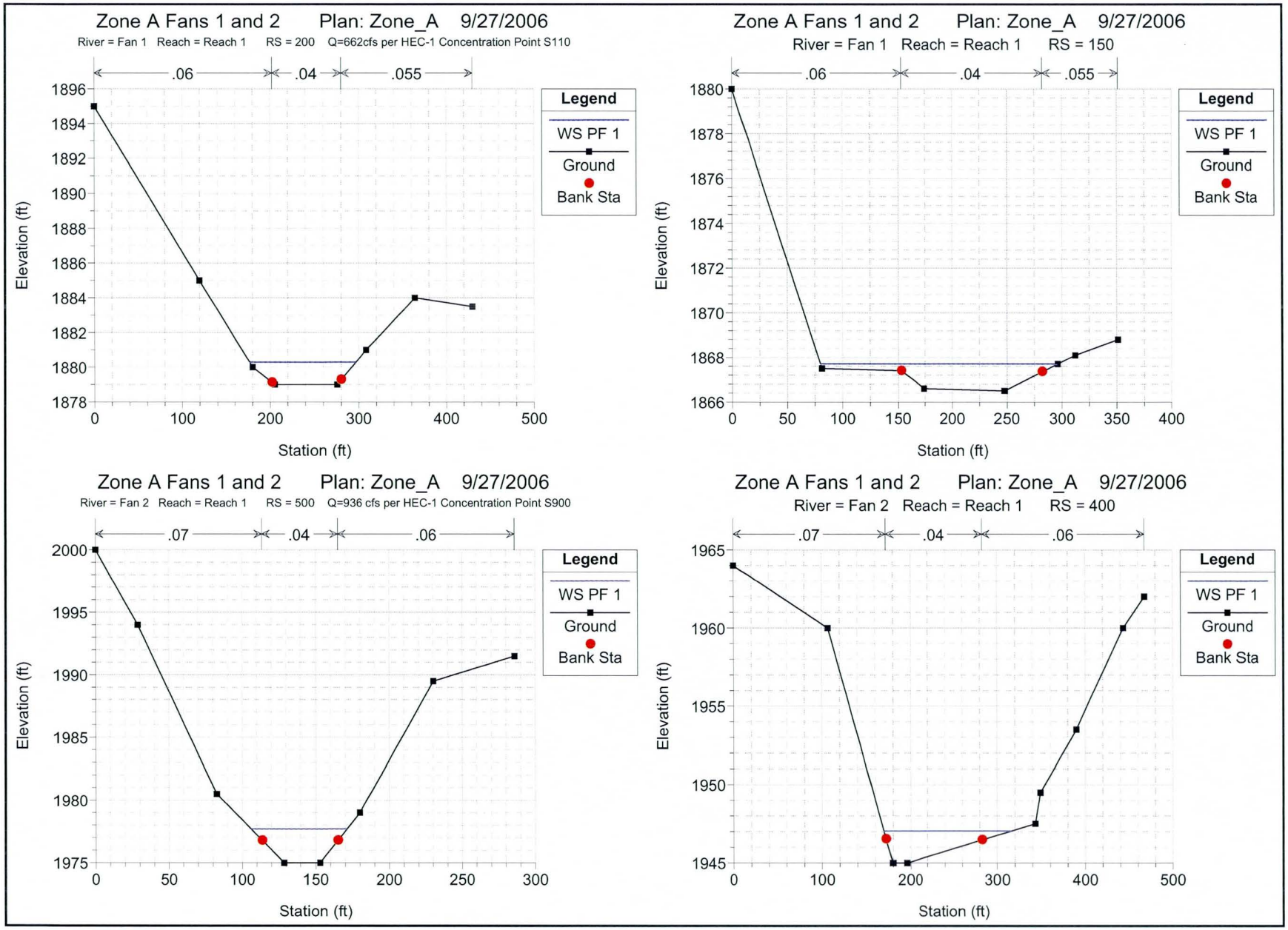
All 12 study areas were free of hydraulic structures.

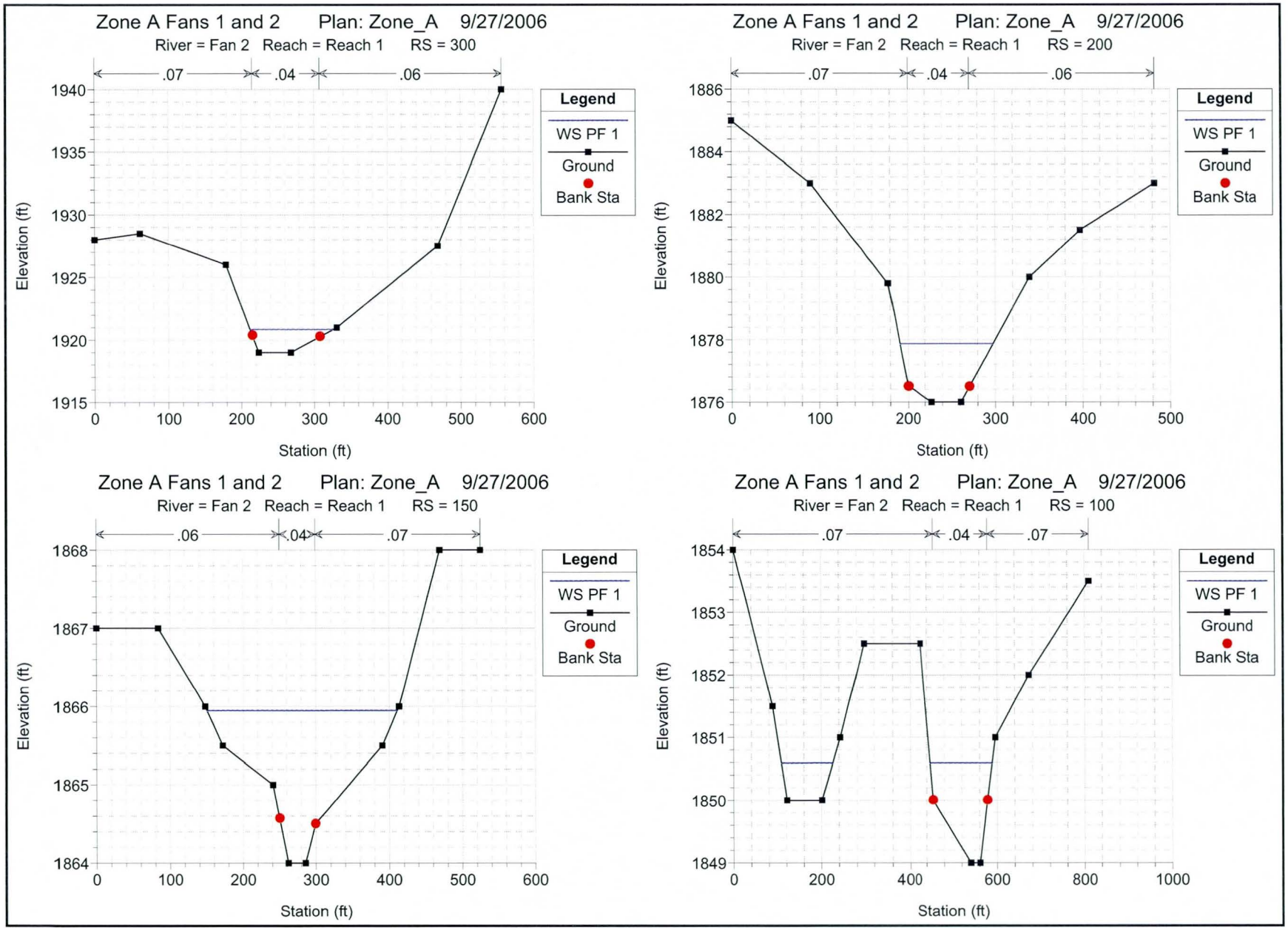
4. General Floodplain Conditions

The study areas generally consist of gravelly to cobbly channel bottoms in the main channels to small cobbles and coarse sands in the overbank areas. Main channels are moderately well defined.

In general, the study area is covered by the Upper Sonoran plant community. Vegetation throughout the study reaches include trees such as mesquite, little leaf palo verde, creosote and ocotillo, cacti including saguaro, barrel, staghorn, and teddy bear cholla, and various shrubs such as desert broom, jojoba, brittle bush and hackberry.

E.2 Cross Section Plots


Zone A Fans 1 and 2 Plan: Zone_A 9/27/2006
River = Fan 1 Reach = Reach 1 RS = 200 Q=662cfs per HEC-1 Concentration Point S110
.06
.04
.055
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Zone A Fans 1 and 2 Plan: Zone_A 9/27/2006
River = Fan 1 Reach = Reach 1 RS = 150
.06
.04
.055
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Zone A Fans 1 and 2 Plan: Zone_A 9/27/2006
River = Fan 2 Reach = Reach 1 RS = 500 Q=936 cfs per HEC-1 Concentration Point S900
.07
.04
.06
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
Zone A Fans 1 and 2 Plan: Zone_A 9/27/2006
River = Fan 2 Reach = Reach 1 RS = 400
.07
.04
.06
Legend
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)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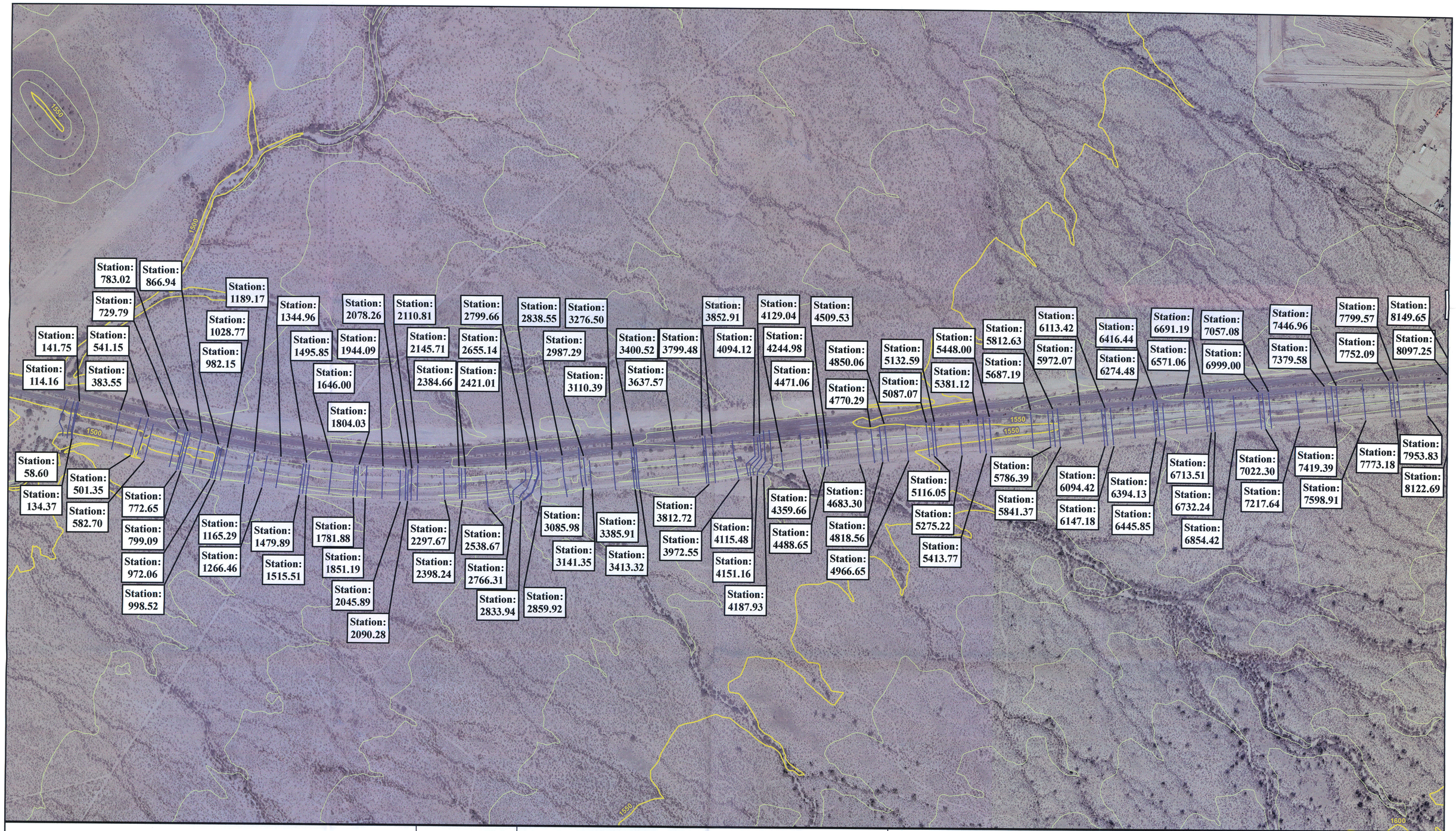
.07
.04
.06
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Zone A Fans 1 and 2 Plan: Zone_A 9/27/2006
River = Fan 2 Reach = Reach 1 RS = 200
.07
.04
.06
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Zone A Fans 1 and 2 Plan: Zone_A 9/27/2006
River = Fan 2 Reach = Reach 1 RS = 150
.06
.04
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta
Zone A Fans 1 and 2 Plan: Zone_A 9/27/2006
River = Fan 2 Reach = Reach 1 RS = 100
.07
.04
.07
Elevation (ft)
Station (ft)
Legend
WS PF 1
Ground
Bank Sta



0 250 500 1,000 1,500 2,000 Feet

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.

N

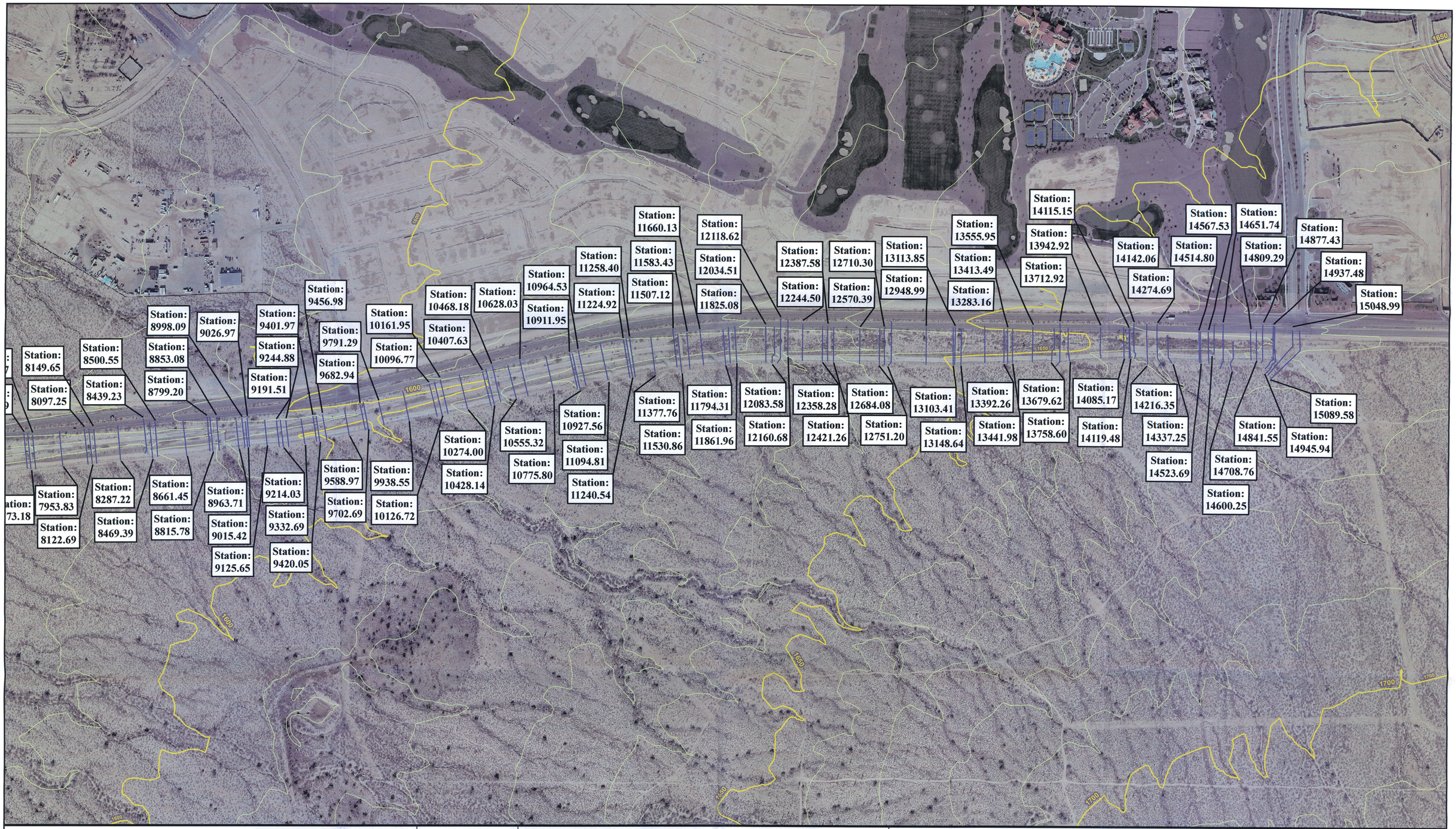
Legend

HEC-RAS Cross Section Location

Station: 10274.22 HEC-RAS Station Identifier

APPENDIX E
HEC-RAS CROSS SECTIONS

SHEET 1 OF 2



0 250 500 1,000 1,500 2,000 Feet

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.

N

Legend

HEC-RAS Cross Section Location

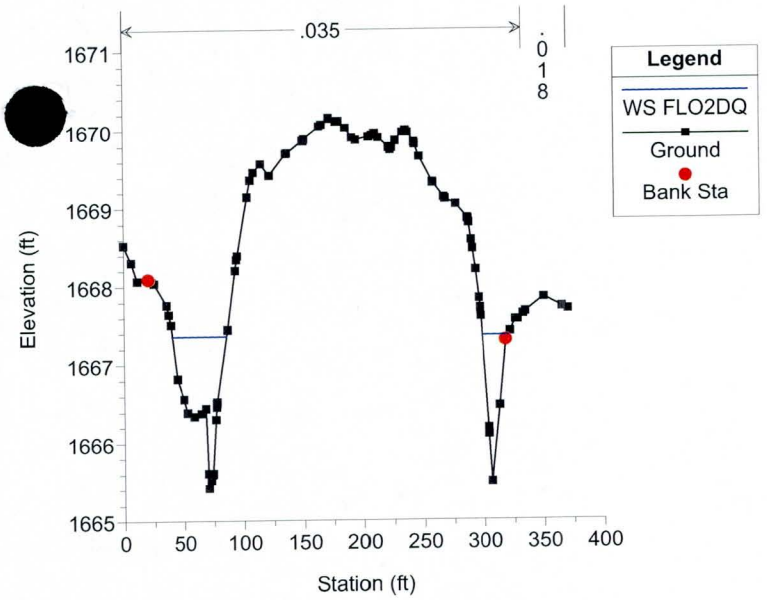
Station: 10274.22 HEC-RAS Station Identifier

APPENDIX E
HEC-RAS CROSS SECTIONS

SHEET 2 OF 2

Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 15089.58



Sun Valley Parkway Channel Plan: Existing 1/19/2009

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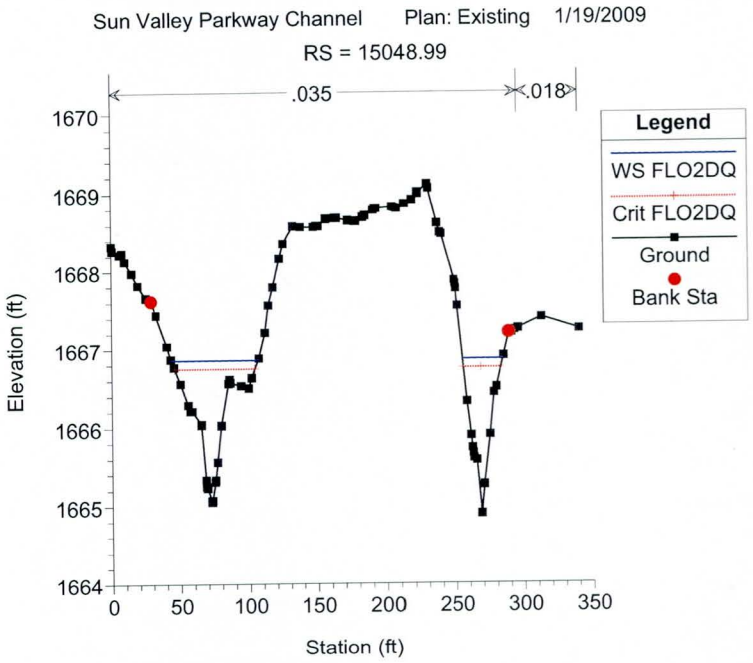

Sun Valley Parkway Channel Plan: Existing 1/19/2009

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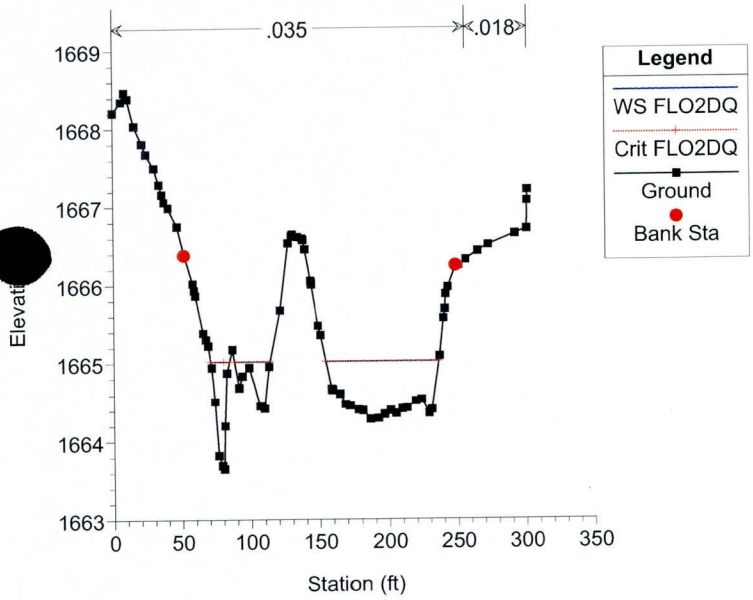

Sun Valley Parkway Channel Plan: Existing 1/19/2009

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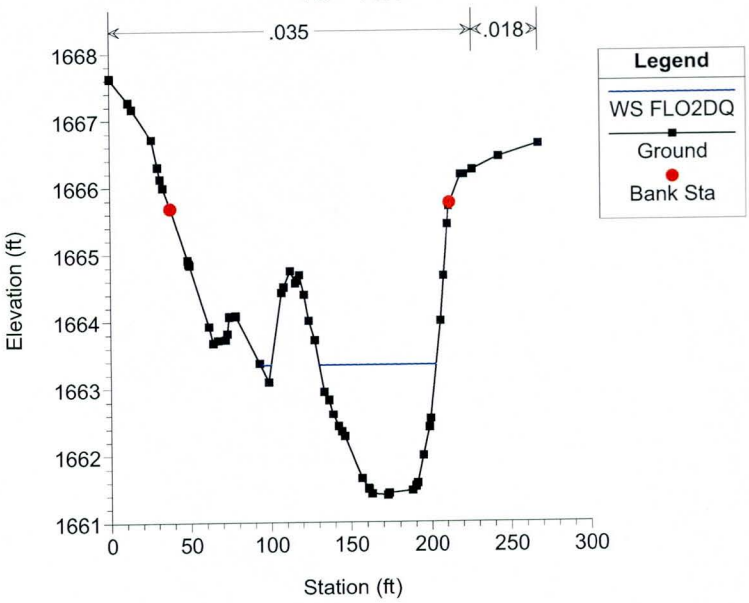

Sun Valley Parkway Channel Plan: Existing 1/19/2009

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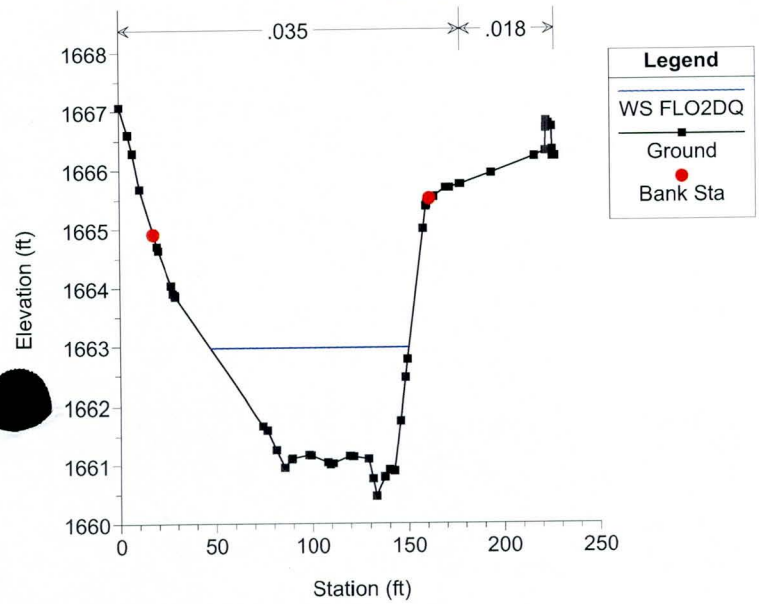

Sun Valley Parkway Channel Plan: Existing 1/19/2009

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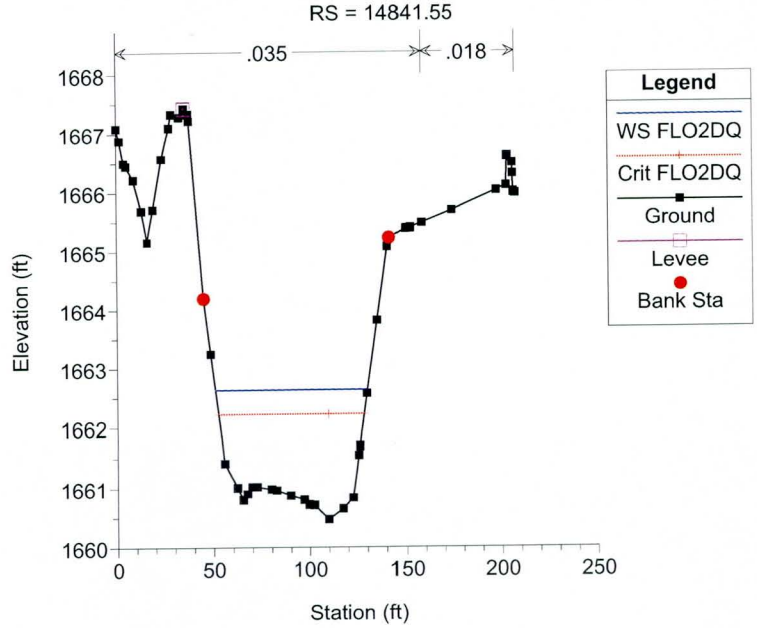

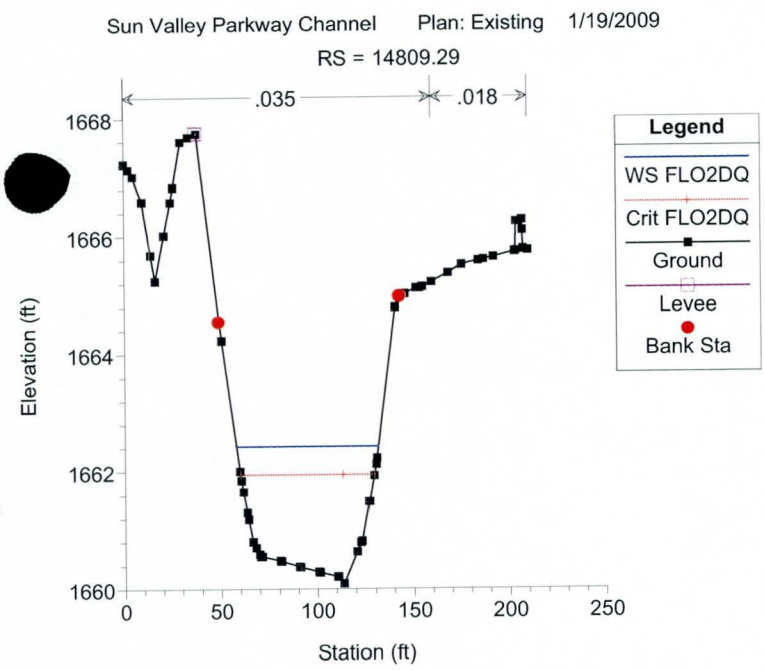
Sun Valley Parkway Channel Plan: Existing 1/19/2009
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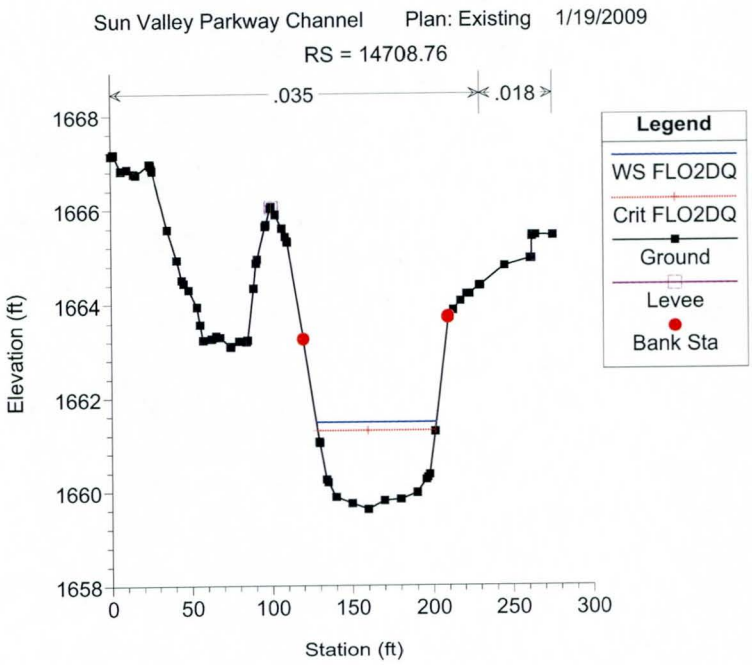
.018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)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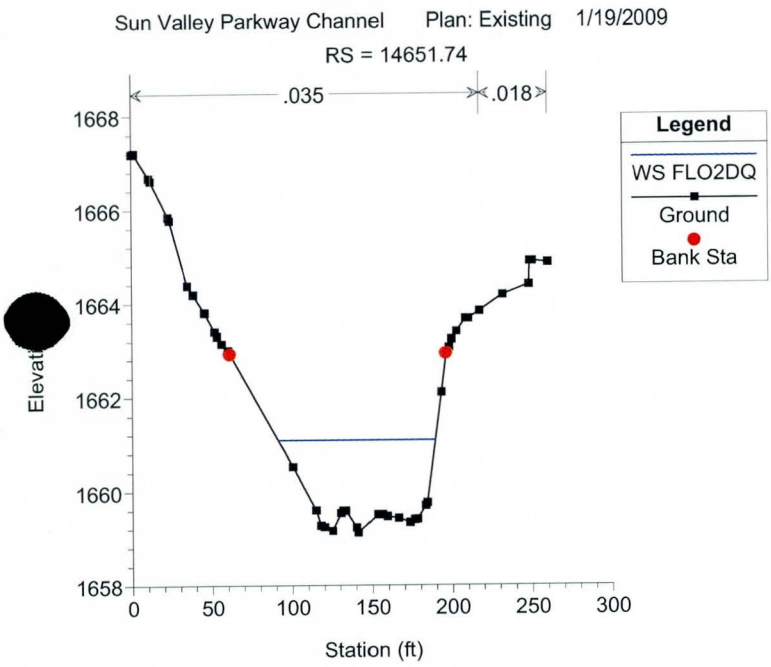
.018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)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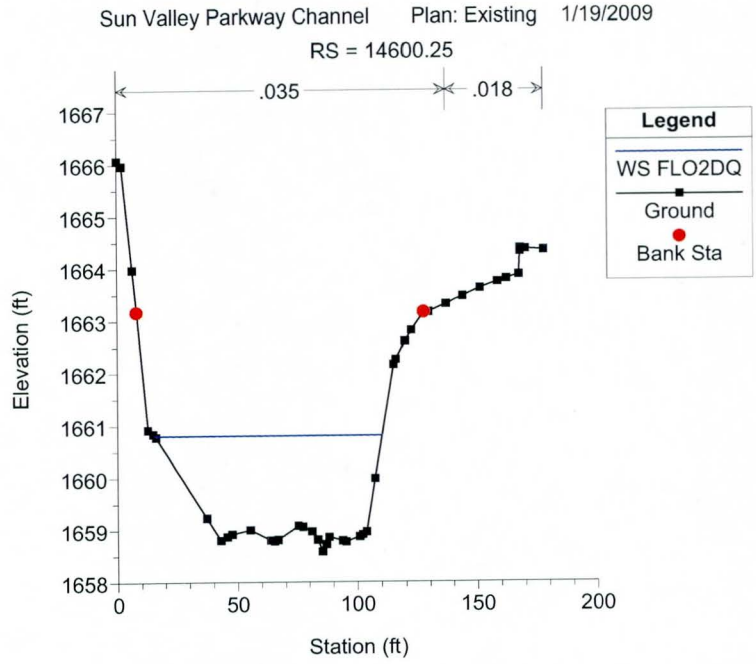
.018
Legend
WS FLO2DQ
Ground
Bank Sta
Station (ft)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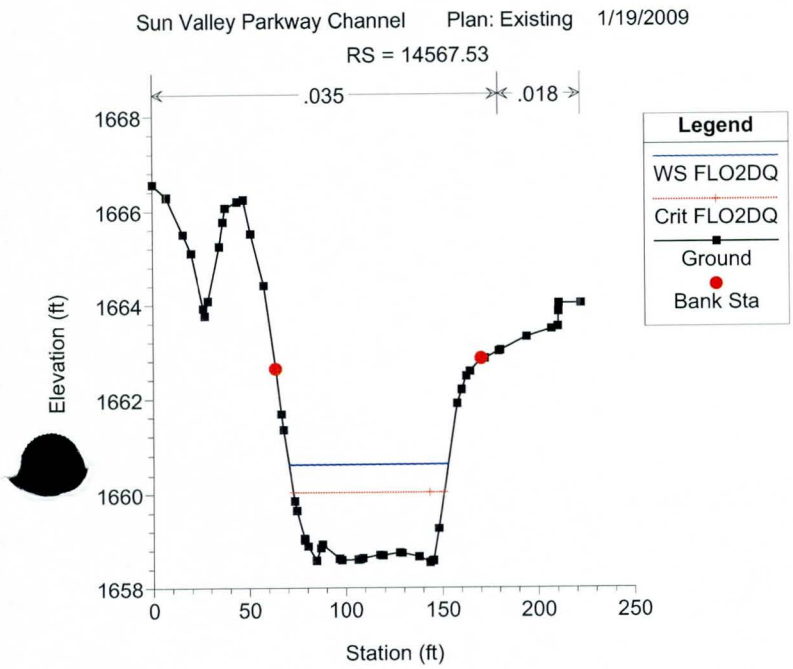
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)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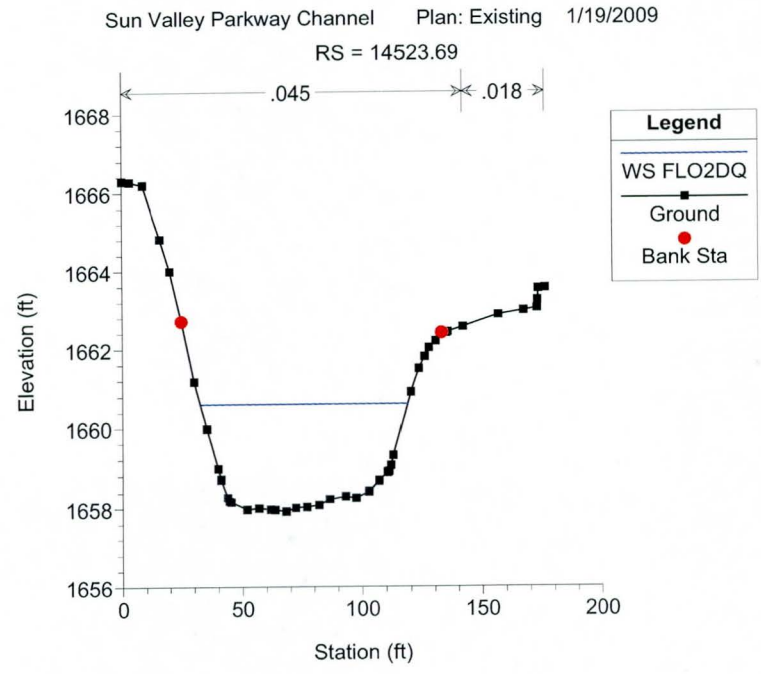
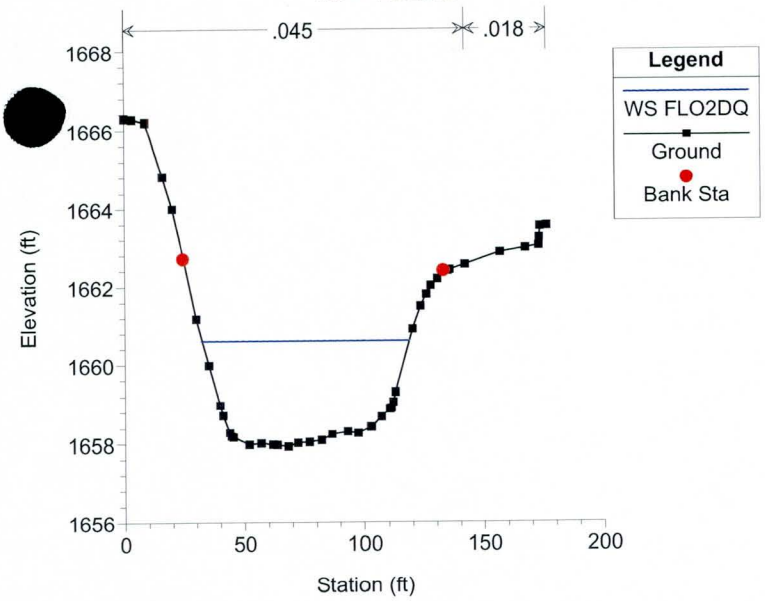
.018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 14523.69
.045
.018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 14523.69



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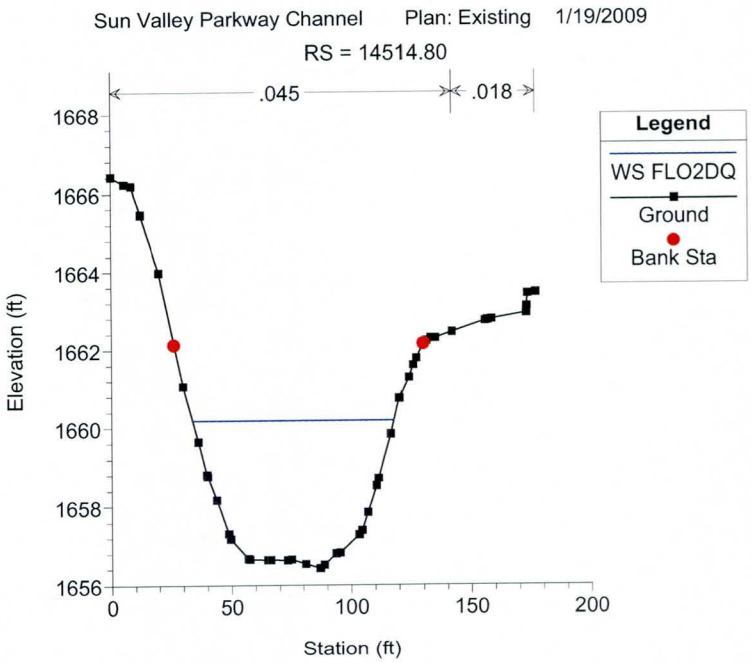

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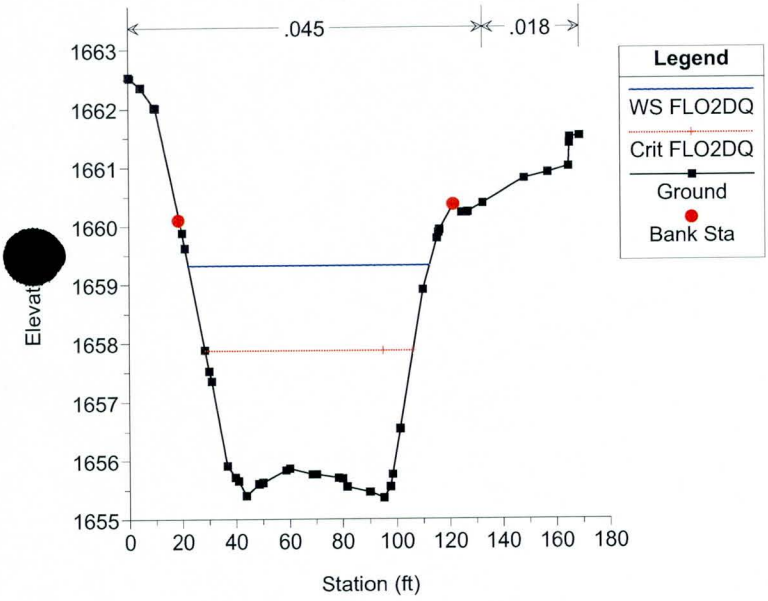
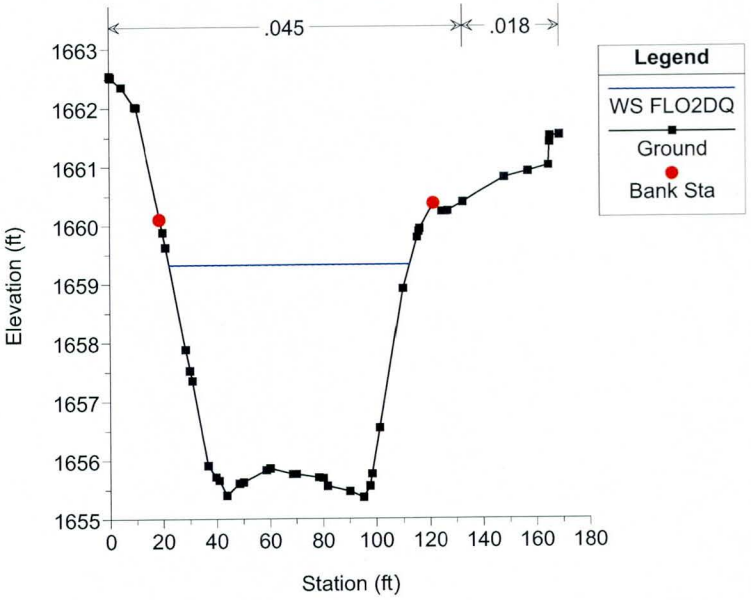


Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 14300 IS



Sun Valley Parkway Channel Plan: Existing 1/19/2009

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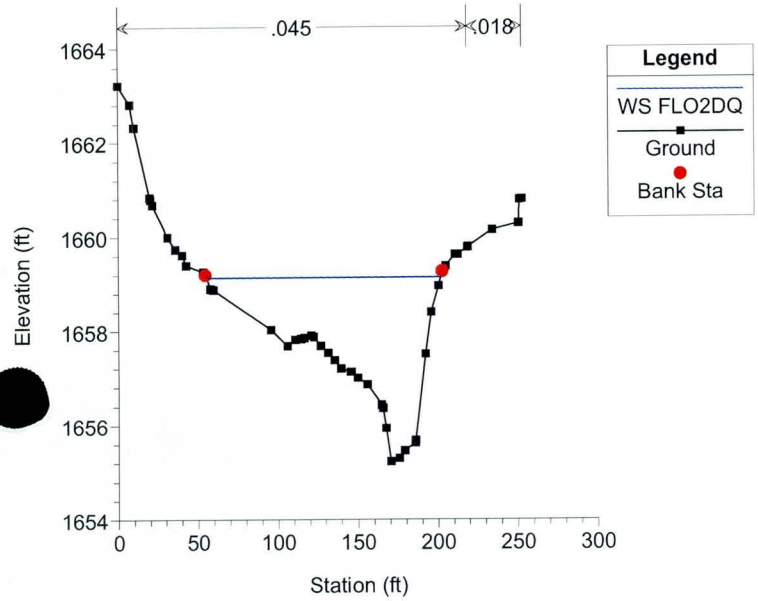

Sun Valley Parkway Channel Plan: Existing 1/19/2009

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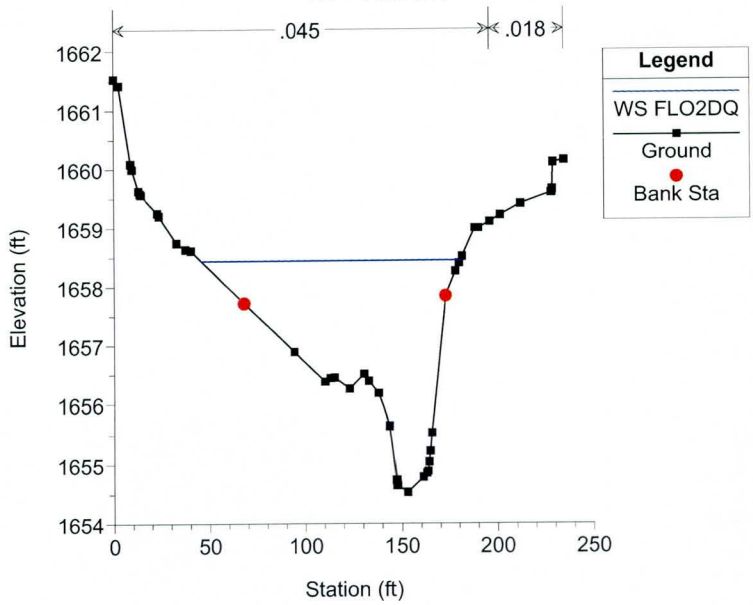

Sun Valley Parkway Channel Plan: Existing 1/19/2009

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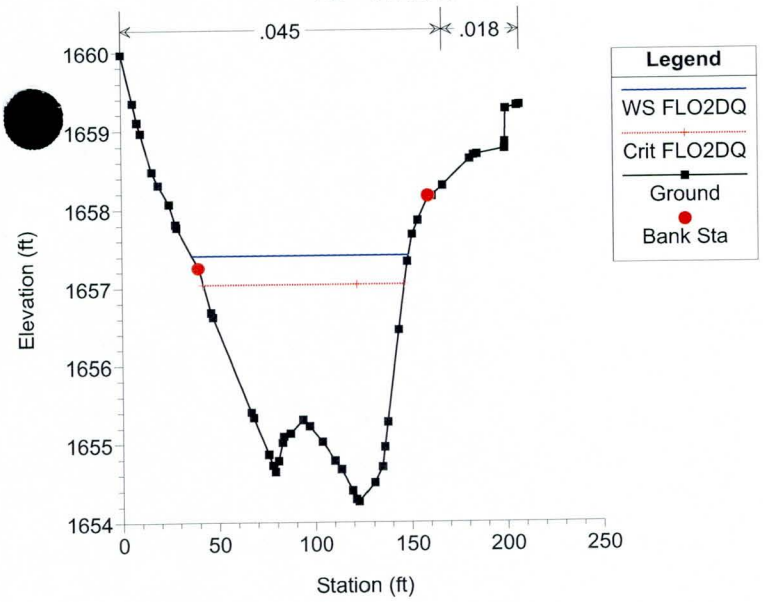

Sun Valley Parkway Channel Plan: Existing 1/19/2009

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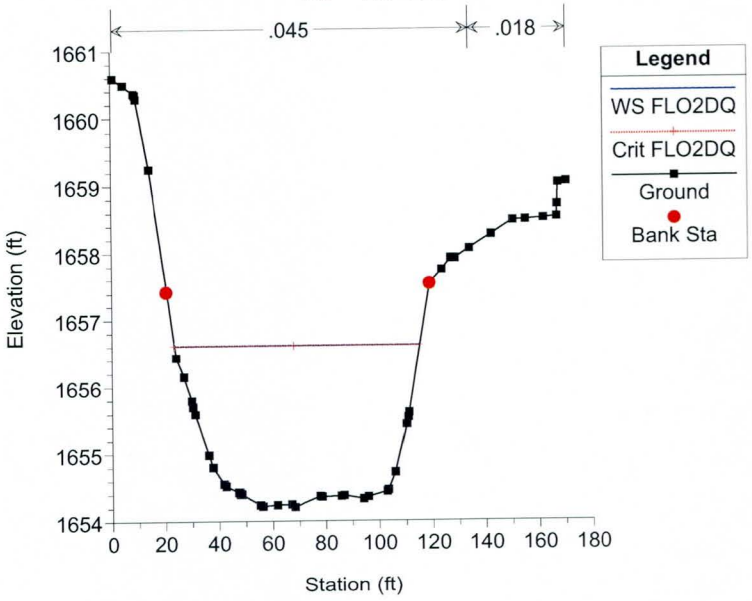

Sun Valley Parkway Channel Plan: Existing 1/19/2009

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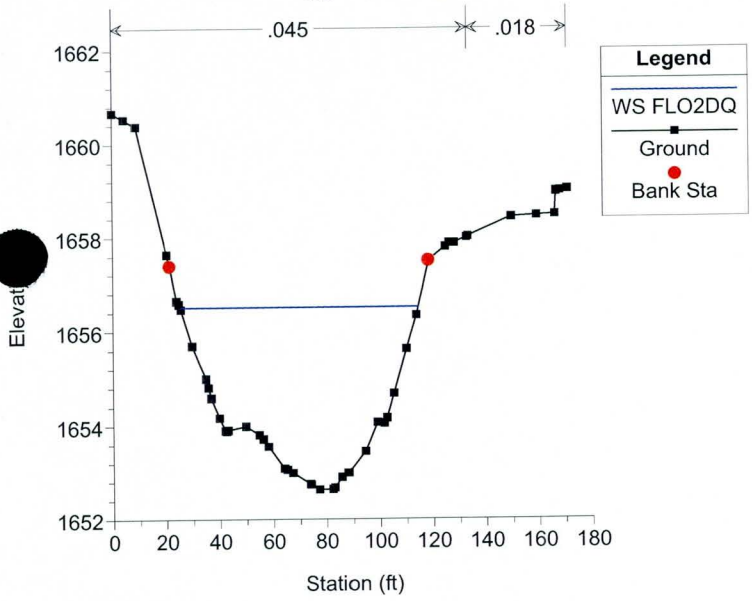

Sun Valley Parkway Channel Plan: Existing 1/19/2009

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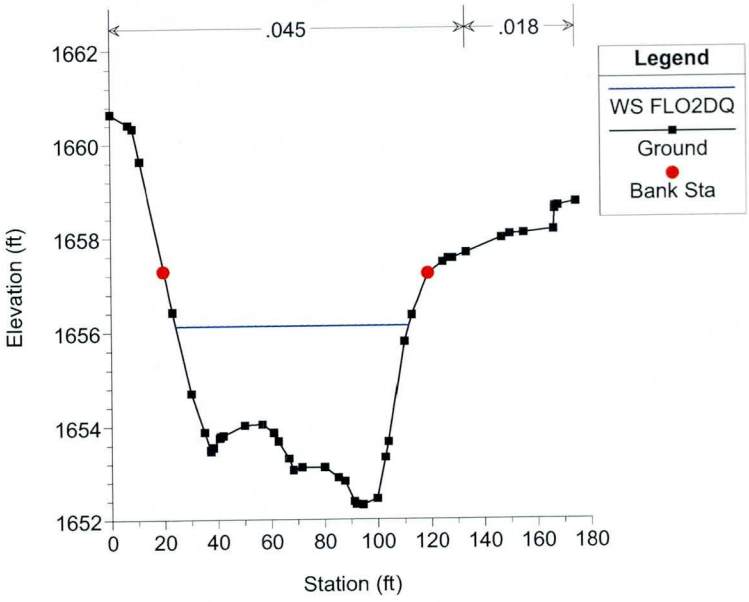

Sun Valley Parkway Channel Plan: Existing 1/19/2009

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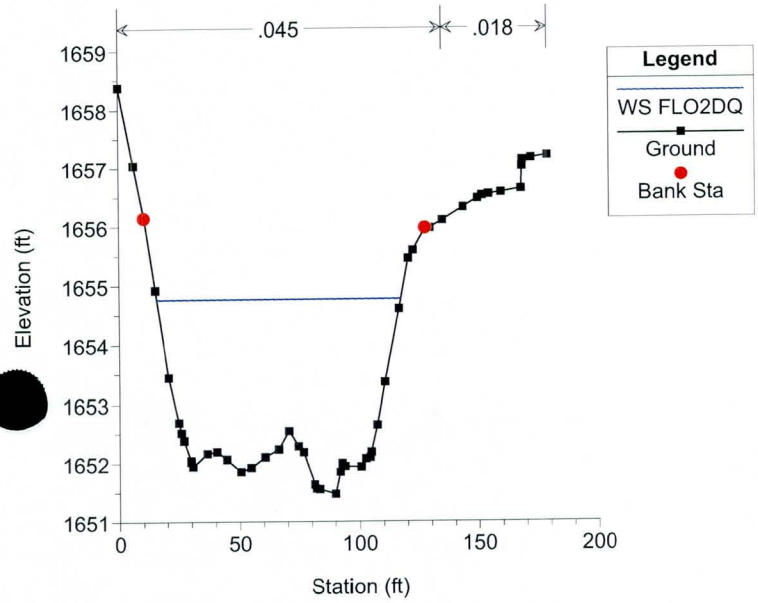

Sun Valley Parkway Channel Plan: Existing 1/19/2009

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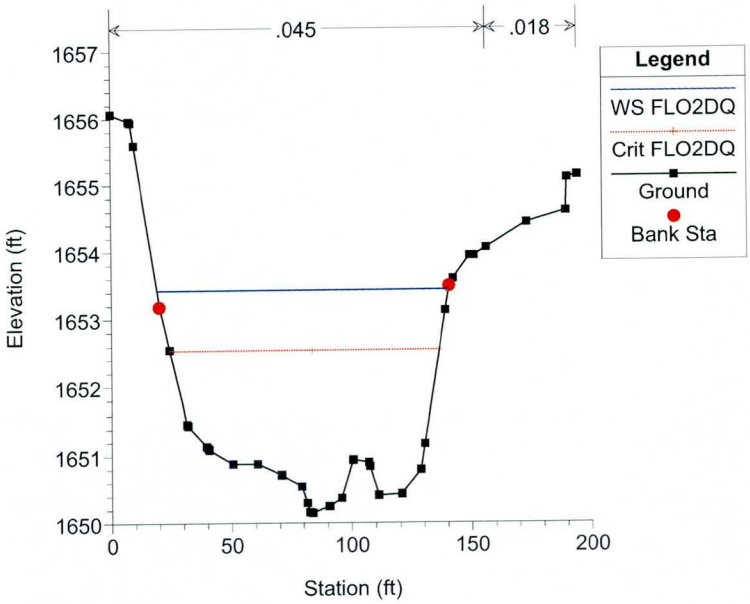
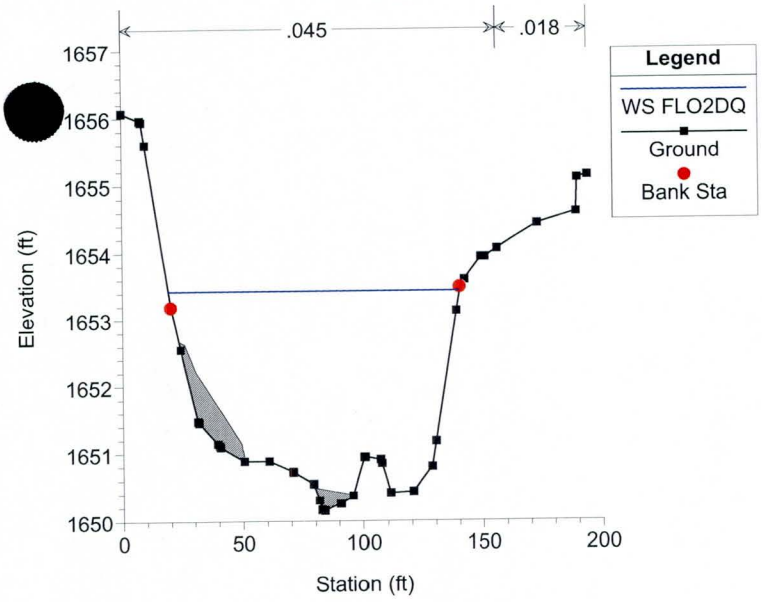


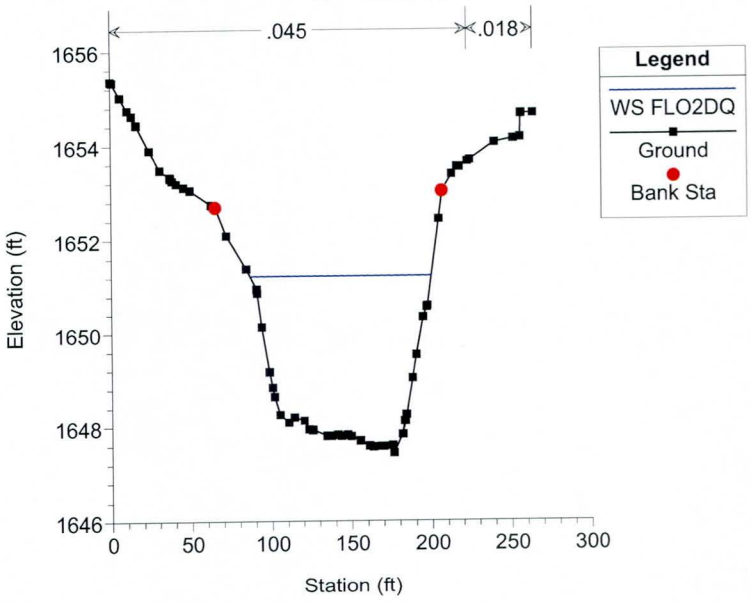
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 13720.10 IS



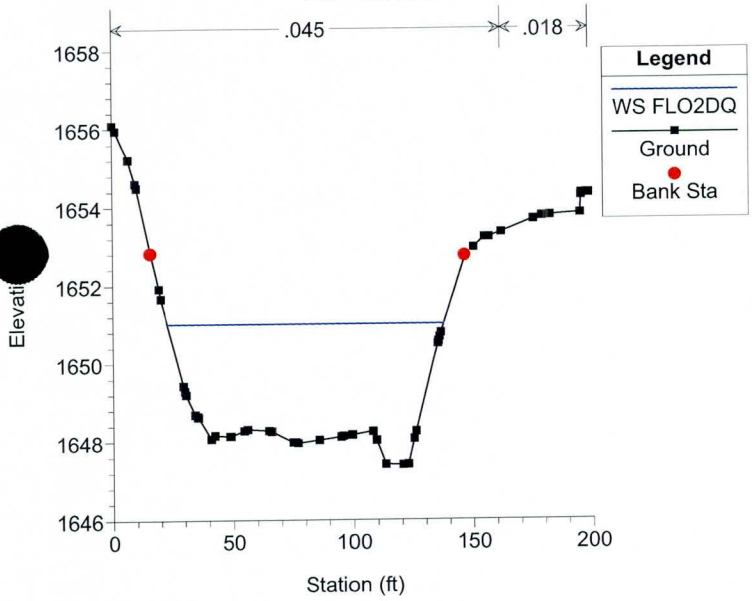
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 13712.92



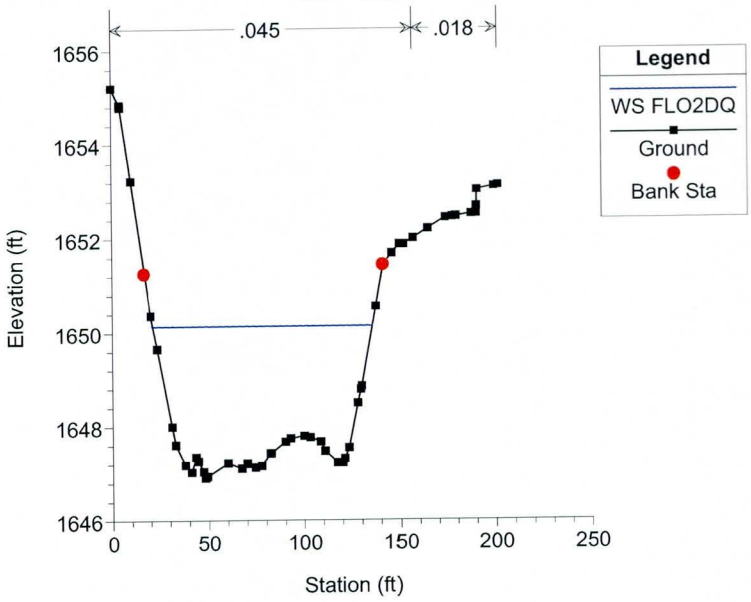
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 13679.62



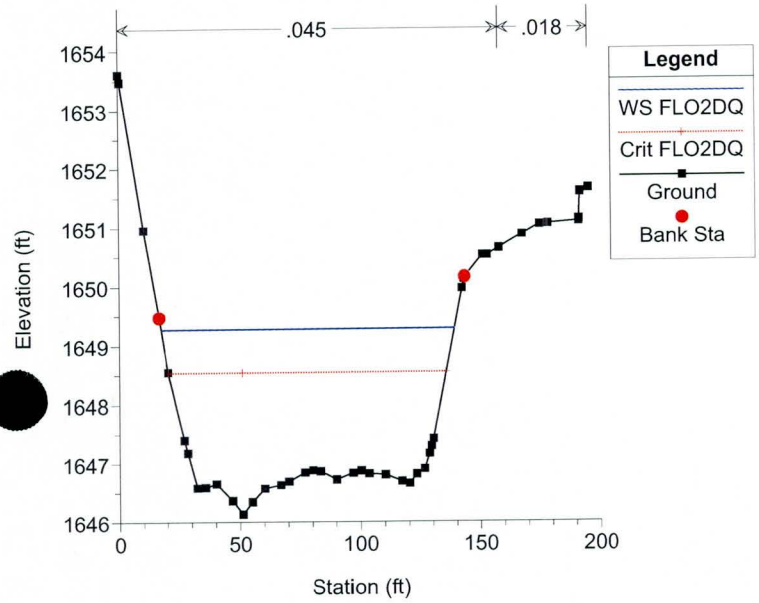
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 13555.95



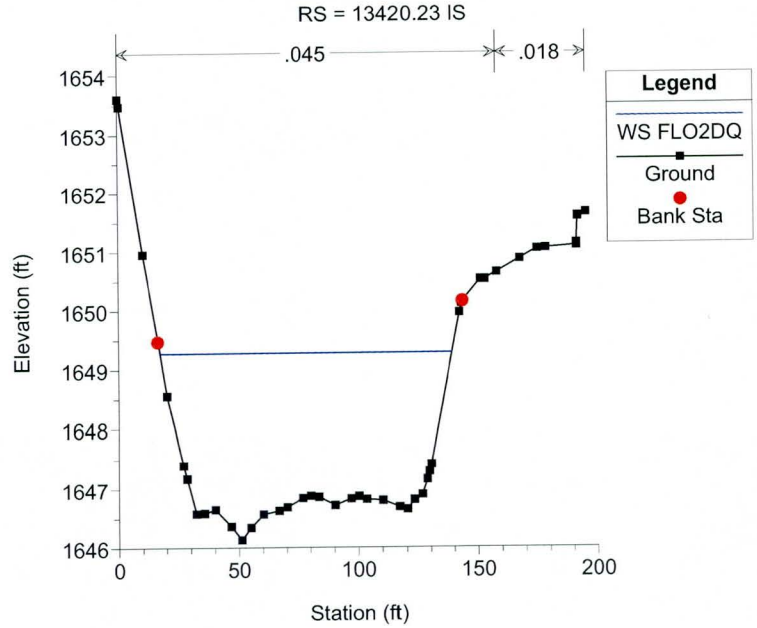
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 13441.98



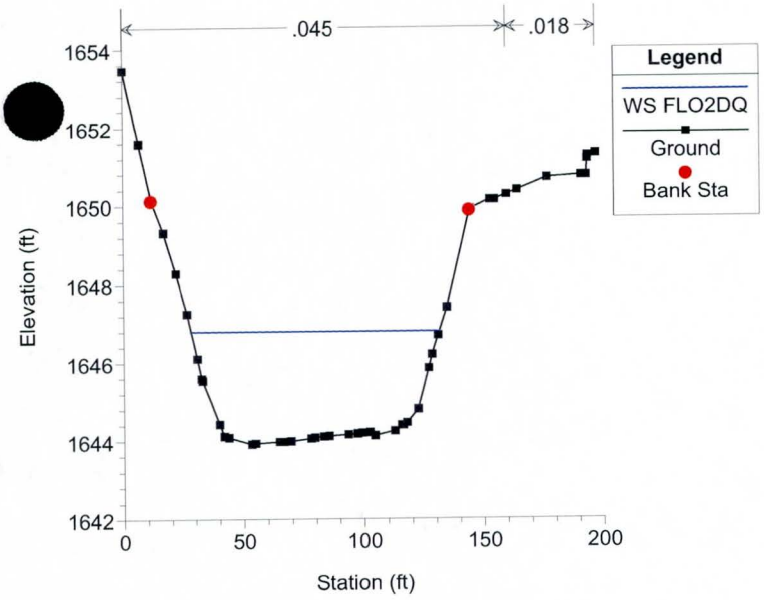
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 13420.23 IS



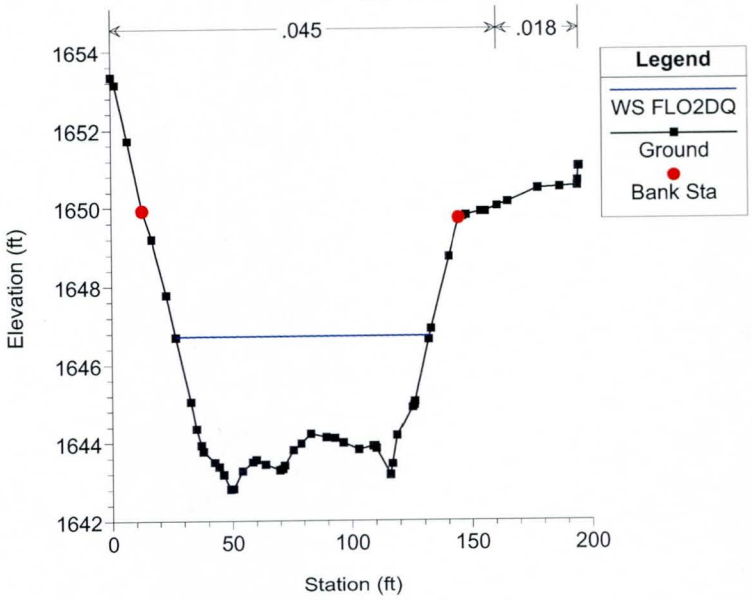
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 13413.49



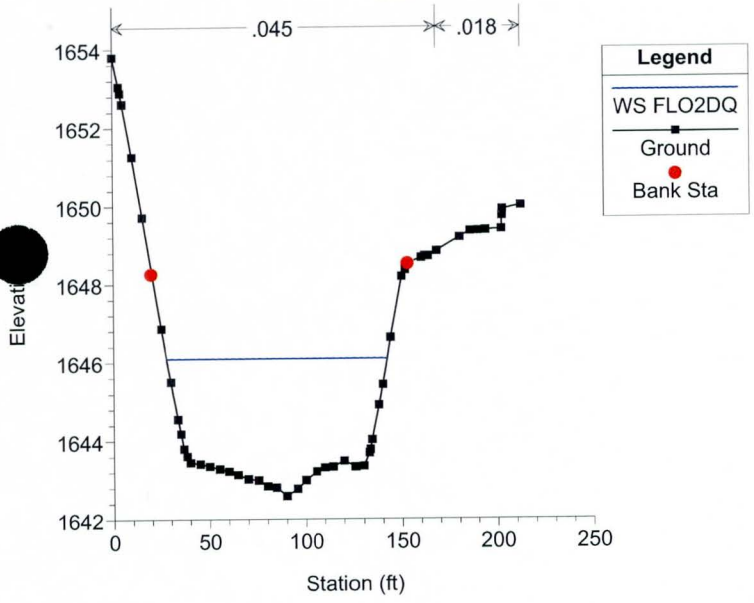
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 13392.26



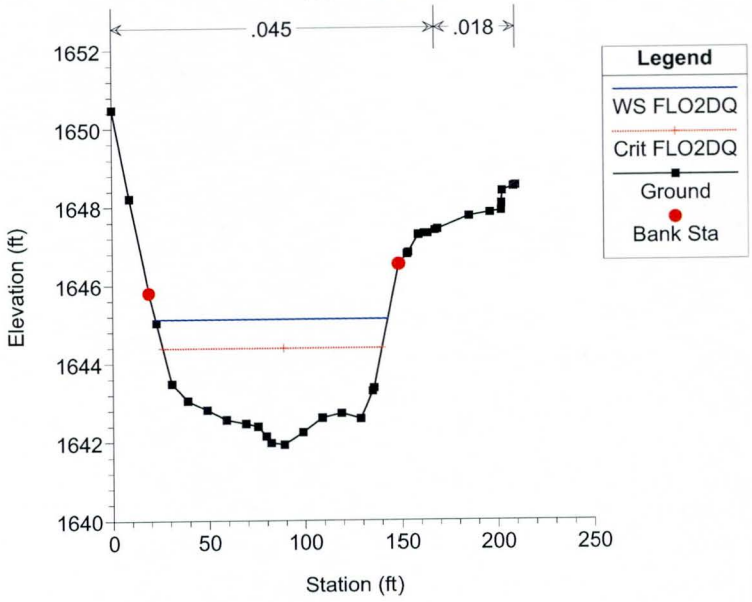
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 13283.16



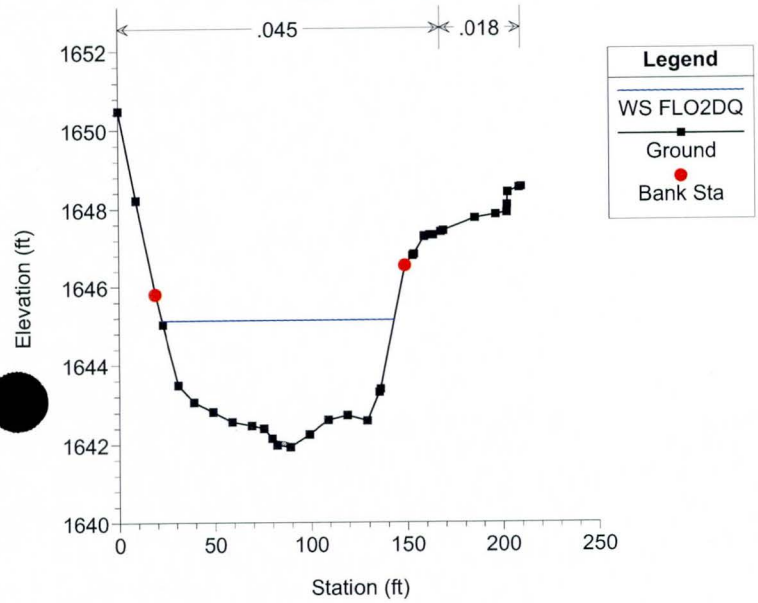
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 13148.64



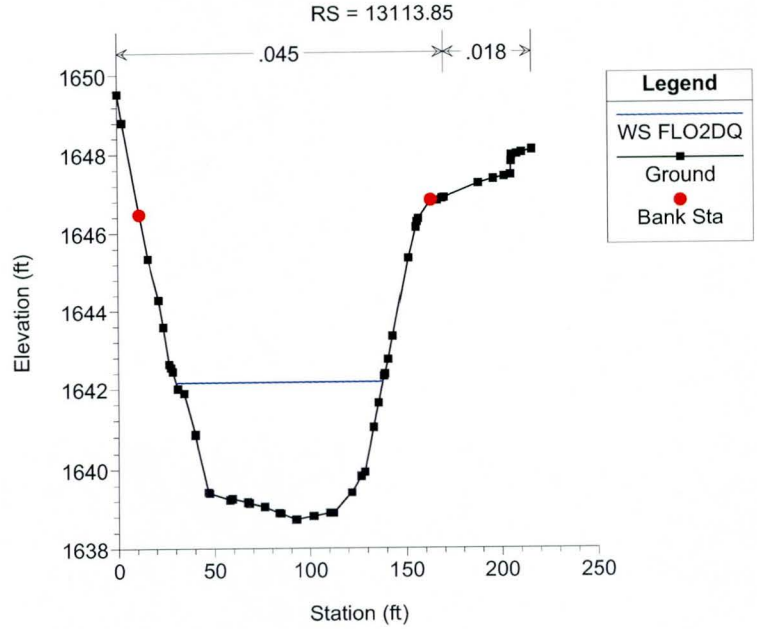
Sun Valley Parkway Channel Plan: Existing 1/19/2009

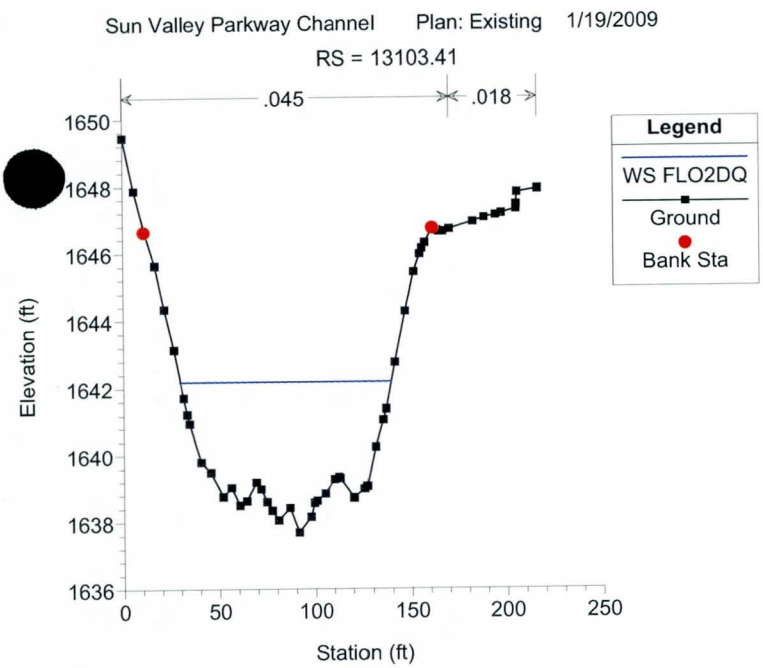
RS = 13121.90 IS

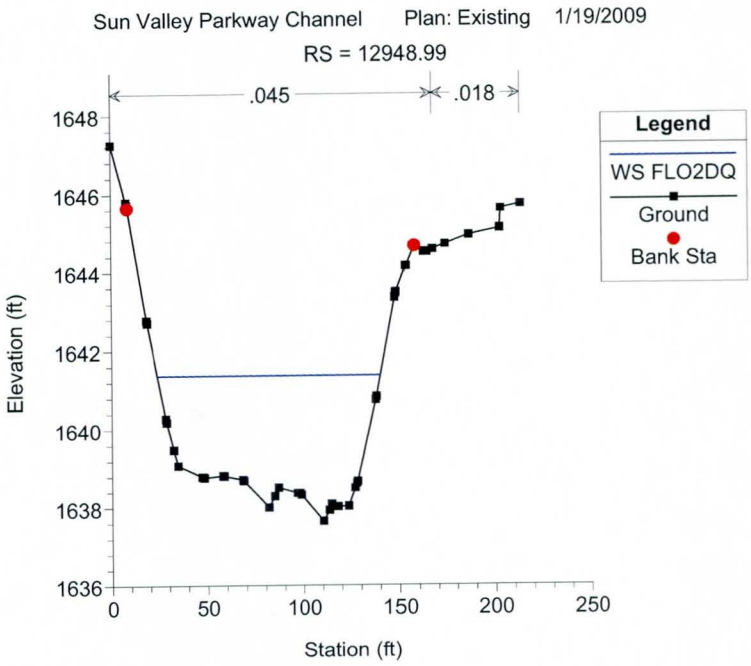


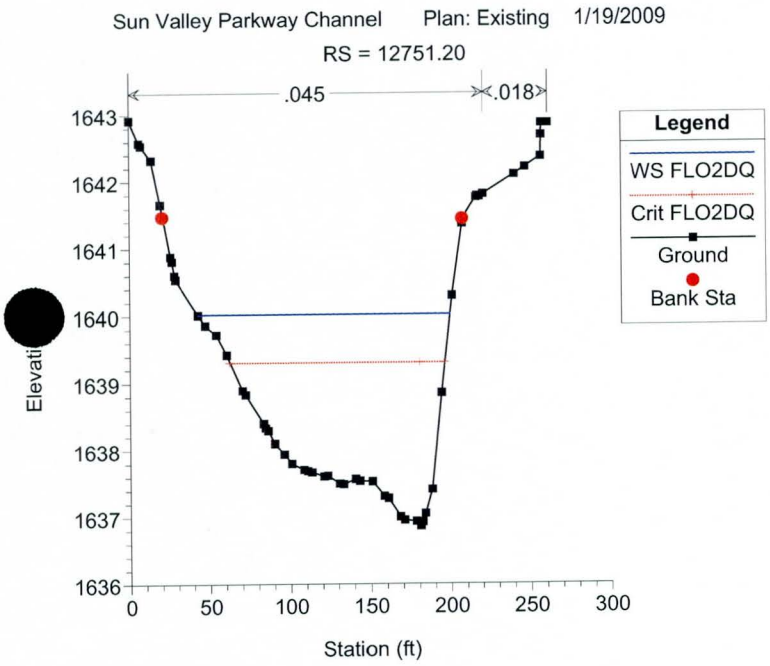
Sun Valley Parkway Channel Plan: Existing 1/19/2009

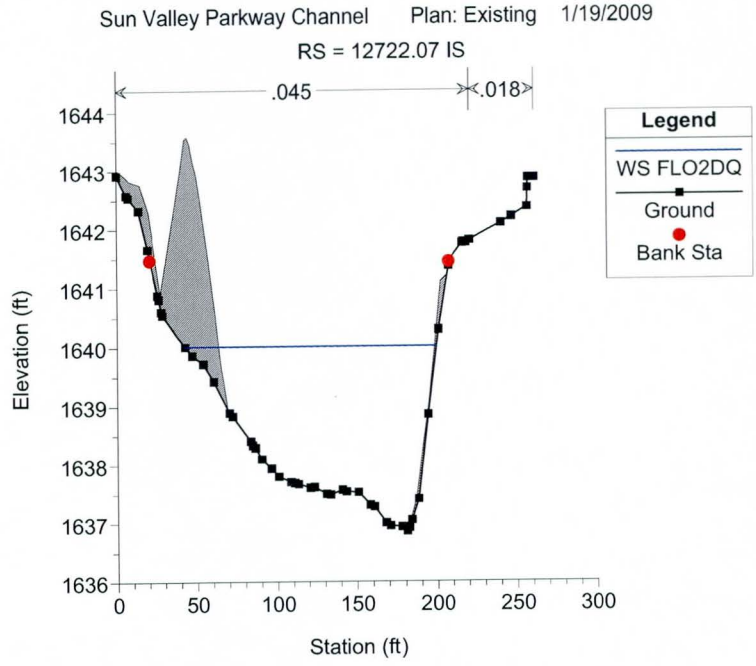
RS = 13113.85




Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 13103.41
.045
.018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 12948.99
.045
.018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 12751.20
.045
.018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 12722.07 IS
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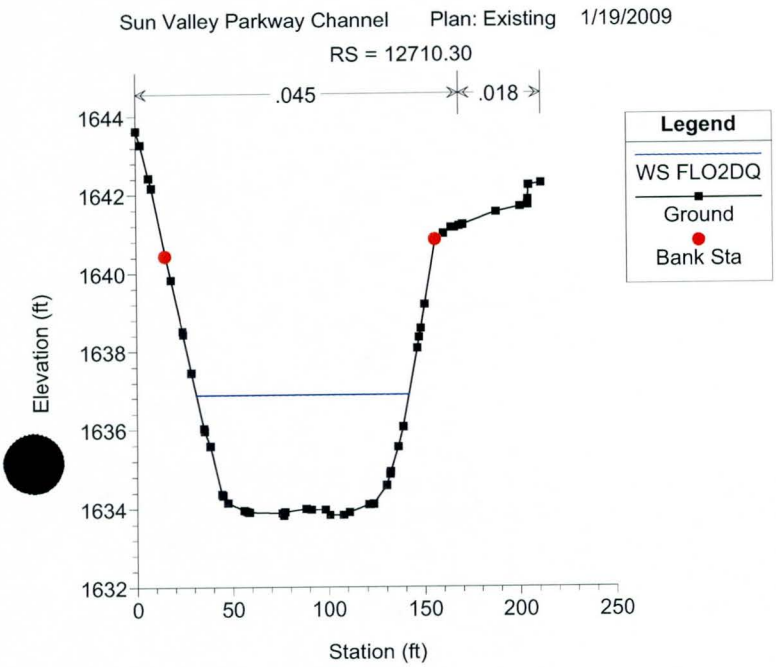
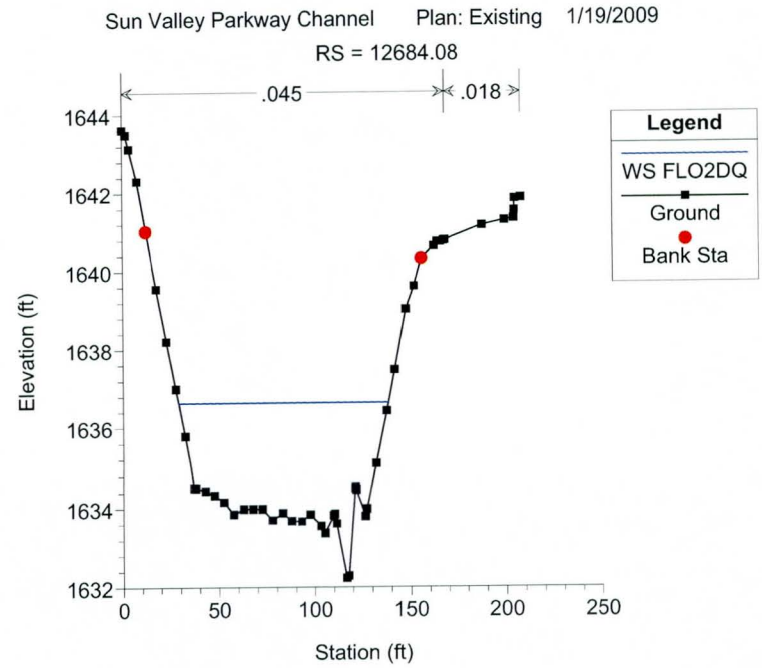
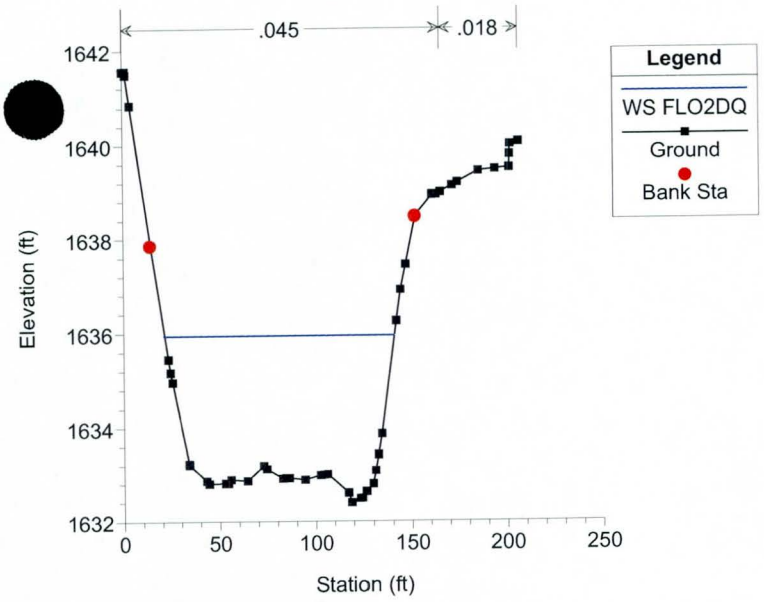
.018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 12710.30
.045
.018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 12684.08
.045
.018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

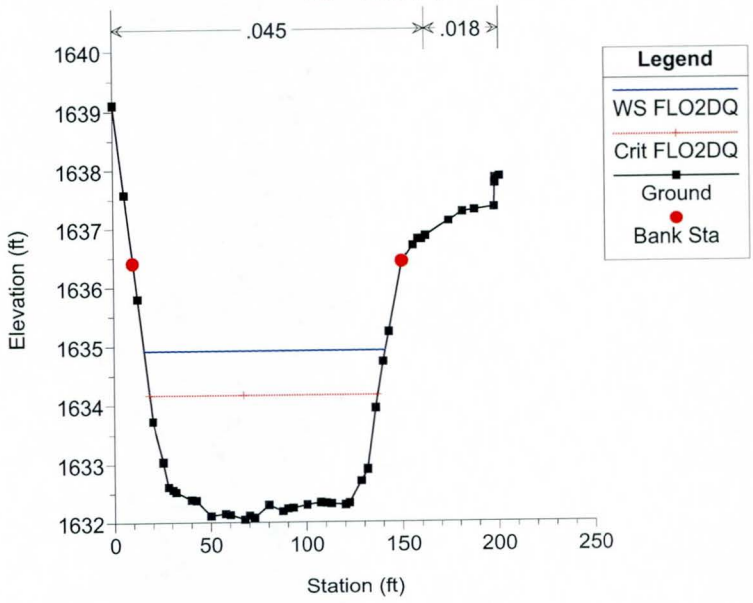
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 12570.39



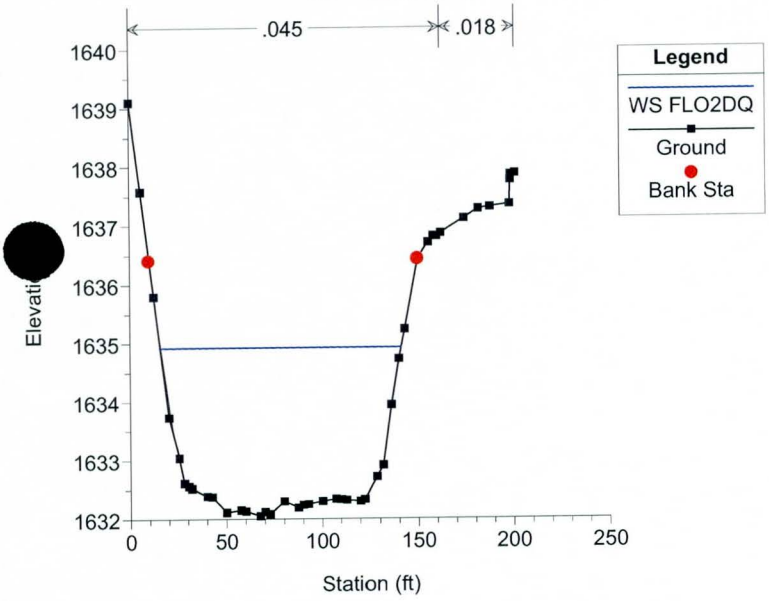
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 12421.26



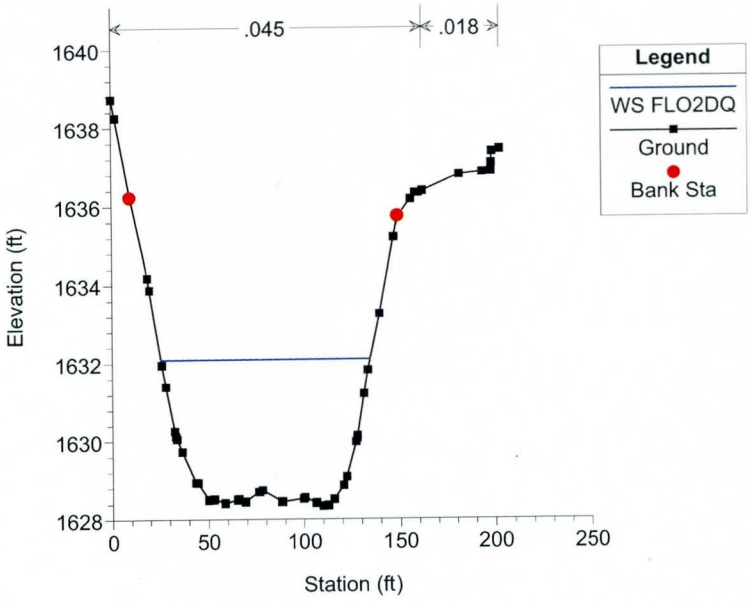
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 12398.37 IS



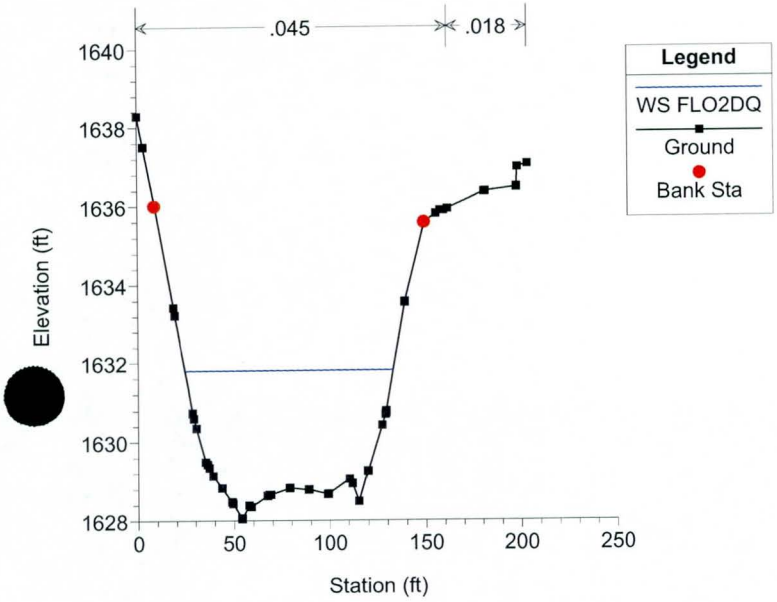
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 12387.58



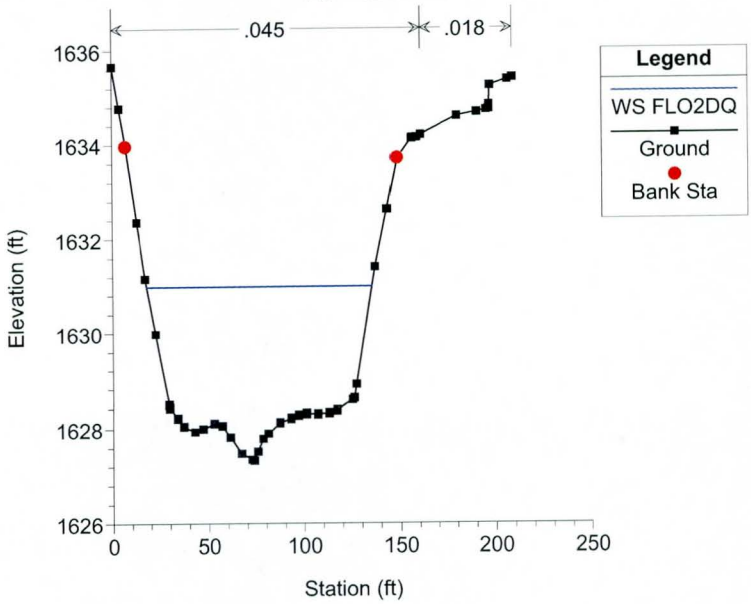
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 12358.28



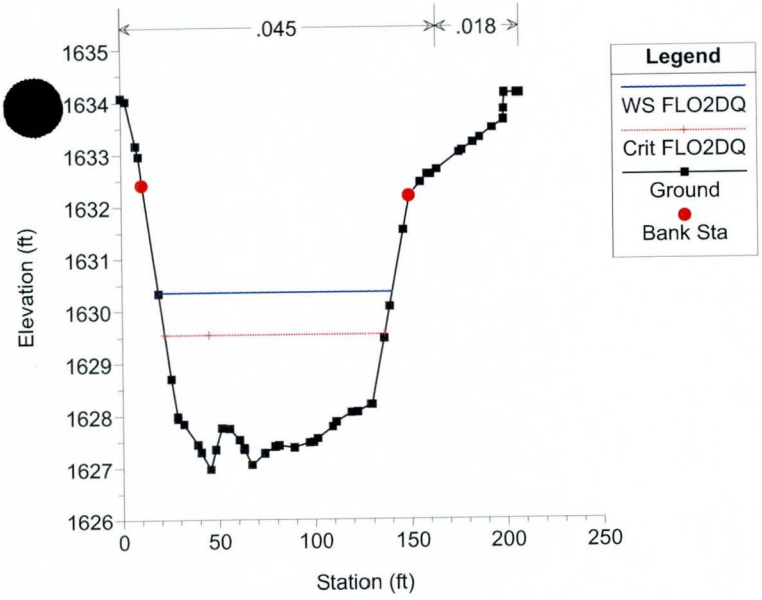
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 12244.50



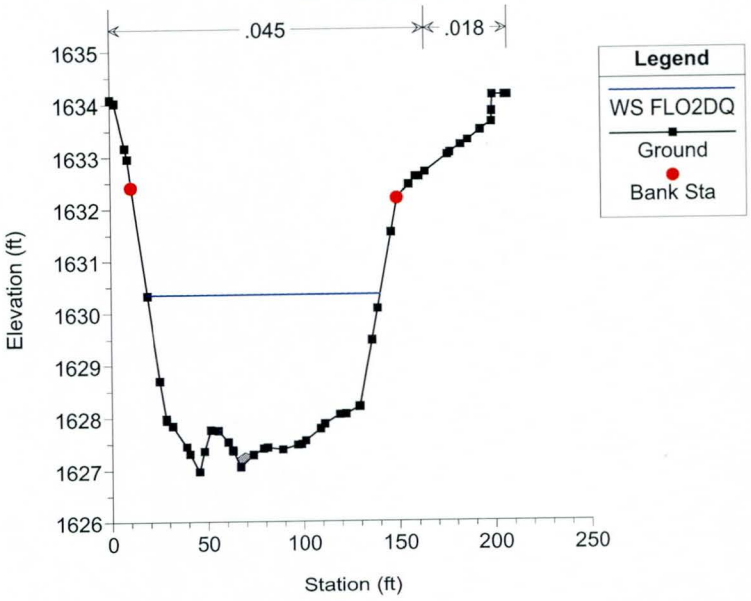
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 12160.68



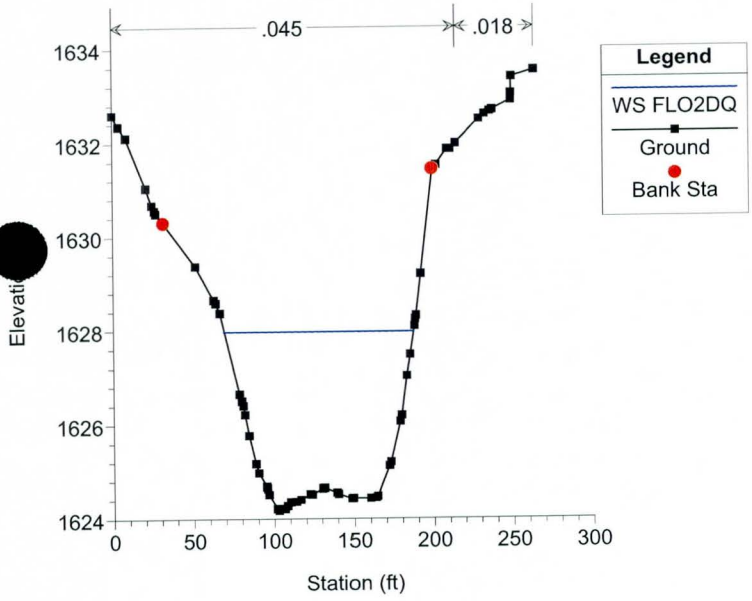
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 12125.61 IS



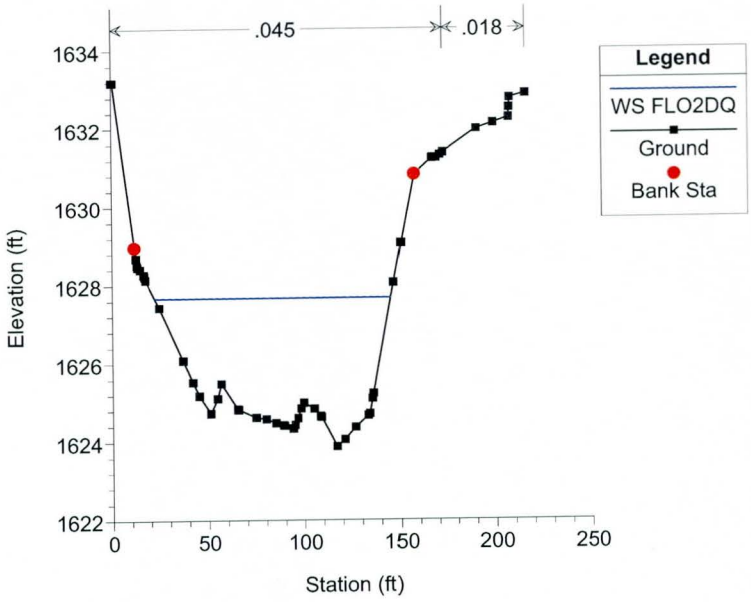
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 12118.62



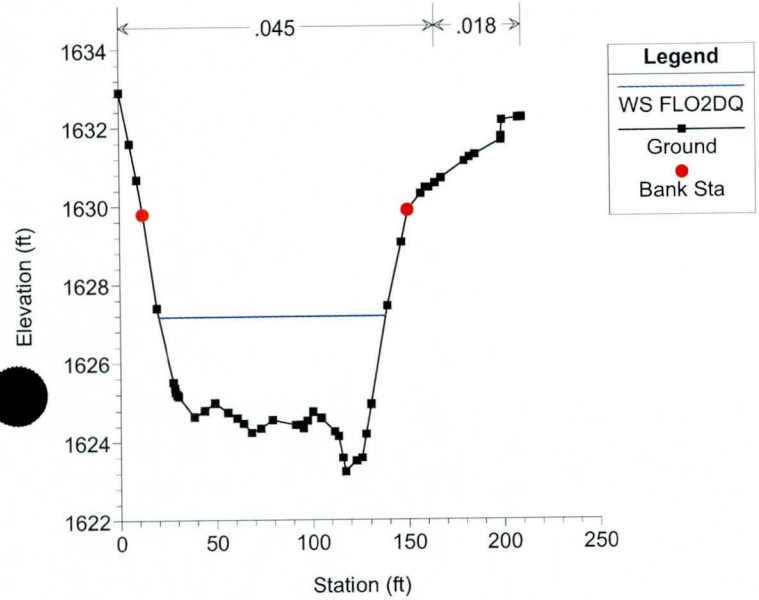
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 12083.58



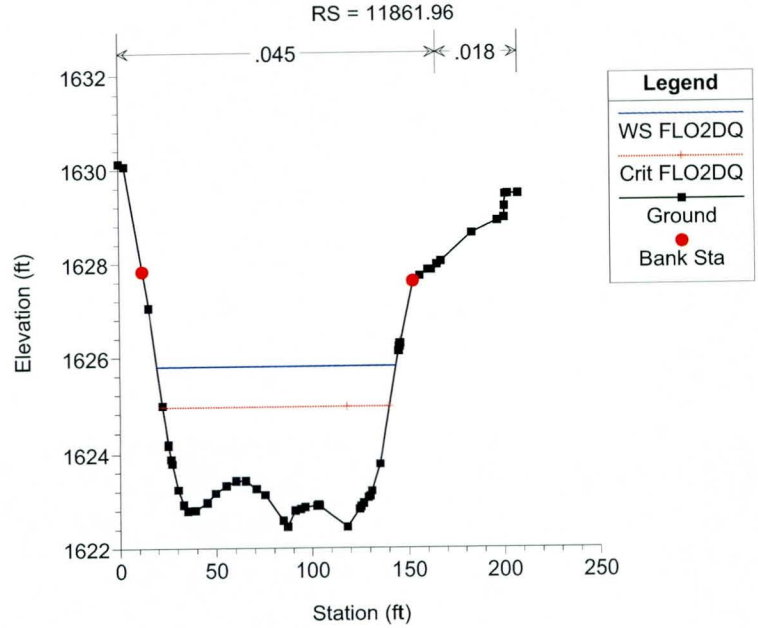
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 12034.51



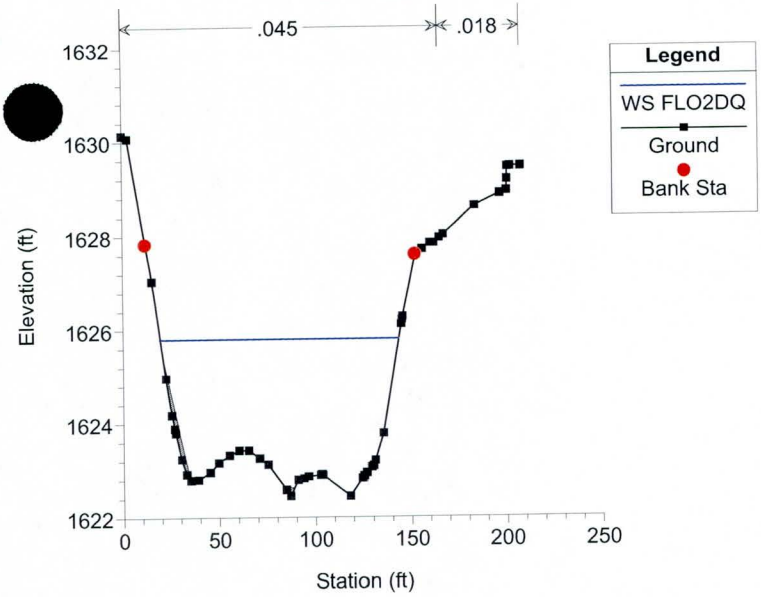
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 11861.96



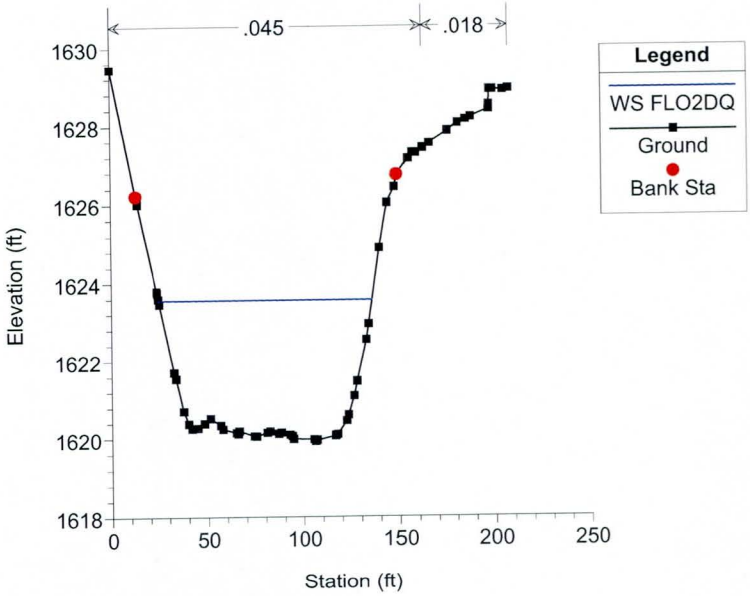
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 11832.55 IS



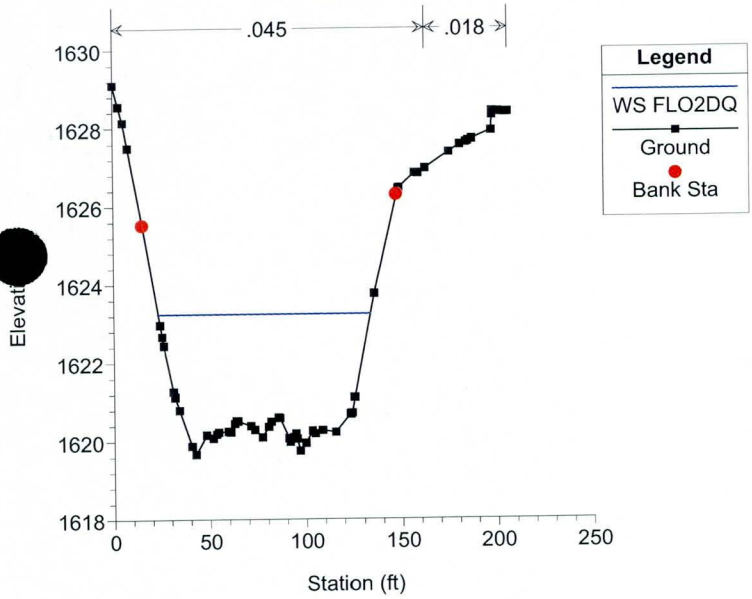
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 11825.08



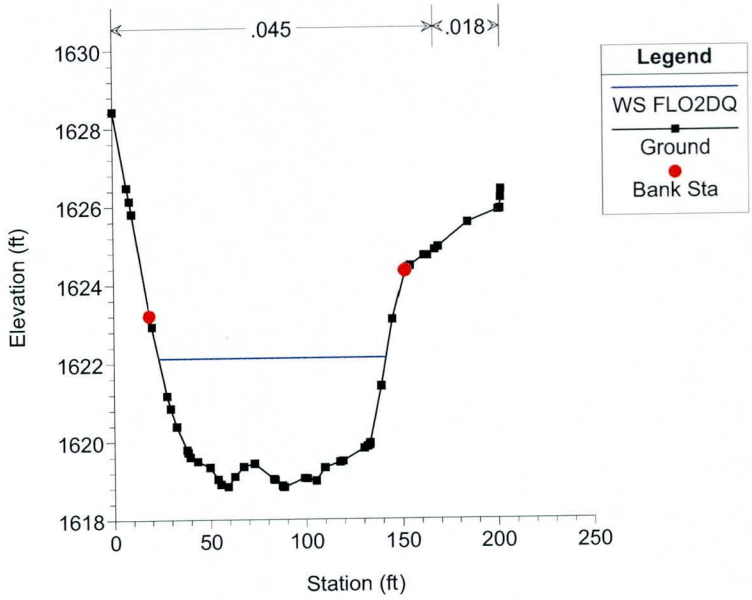
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 11794.31



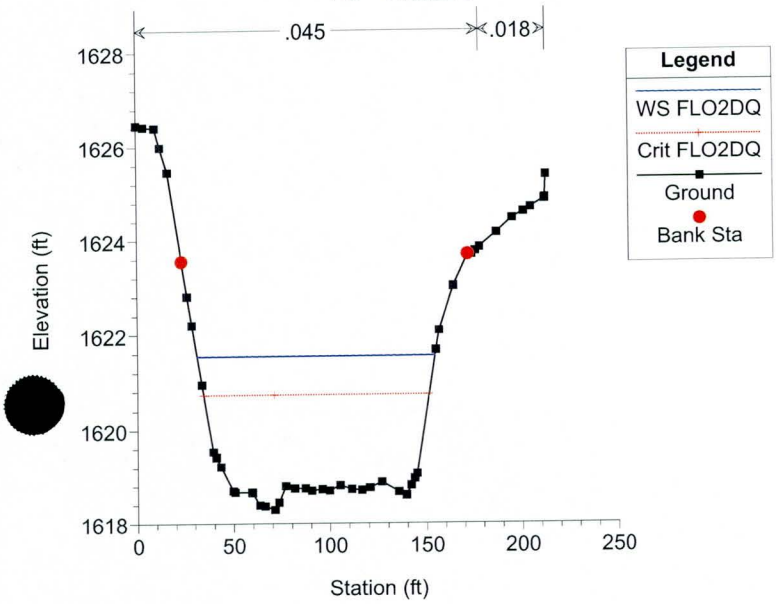
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 11660.13



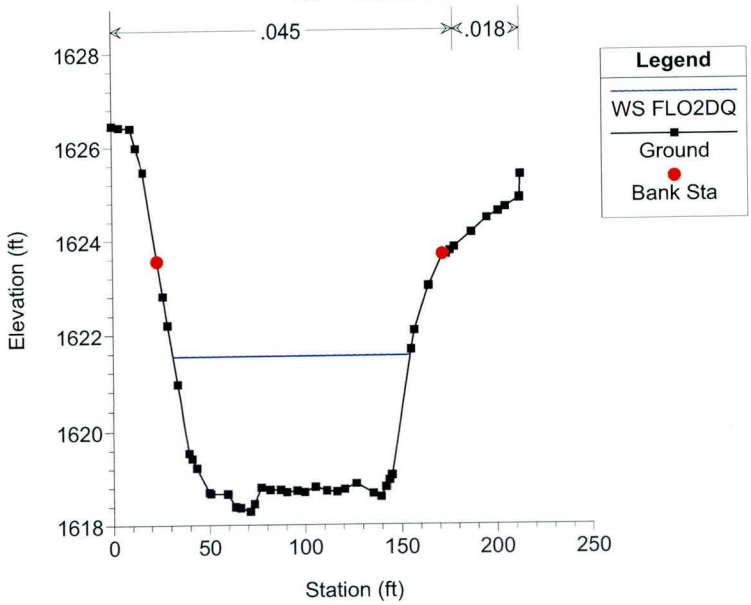
Sun Valley Parkway Channel Plan: Existing 1/19/2009

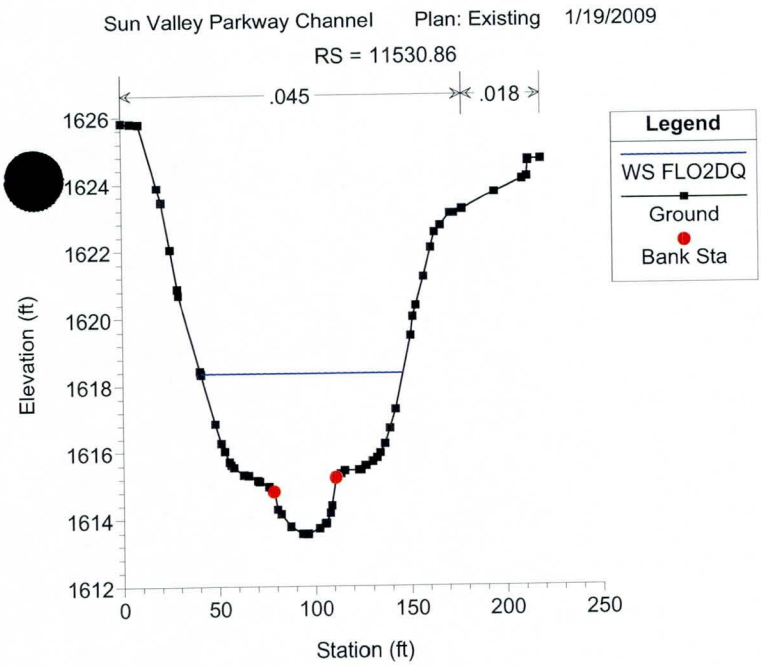
RS = 11583.43

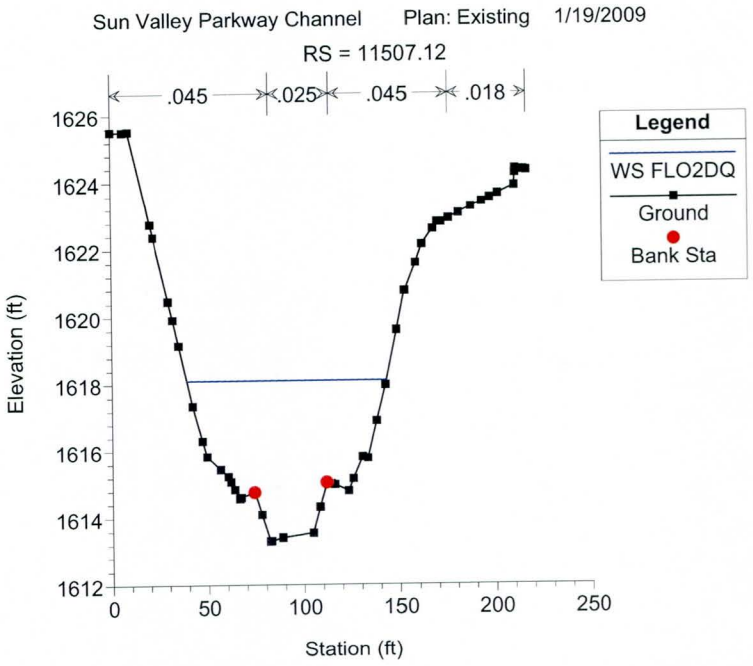


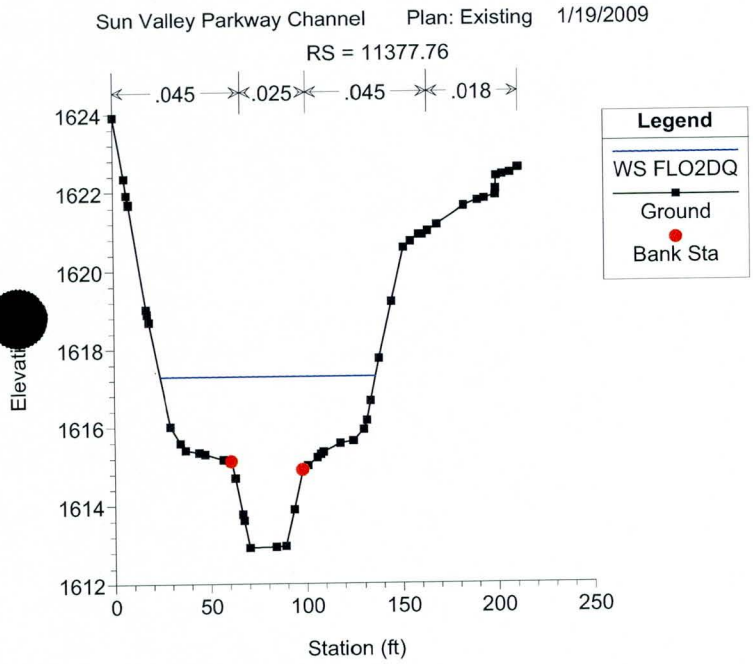
Sun Valley Parkway Channel Plan: Existing 1/19/2009

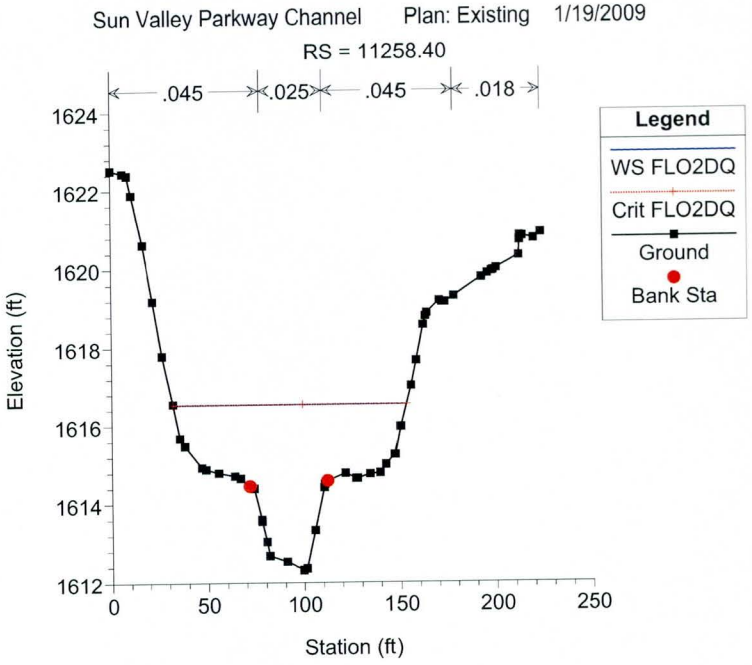
RS = 11538.79 IS

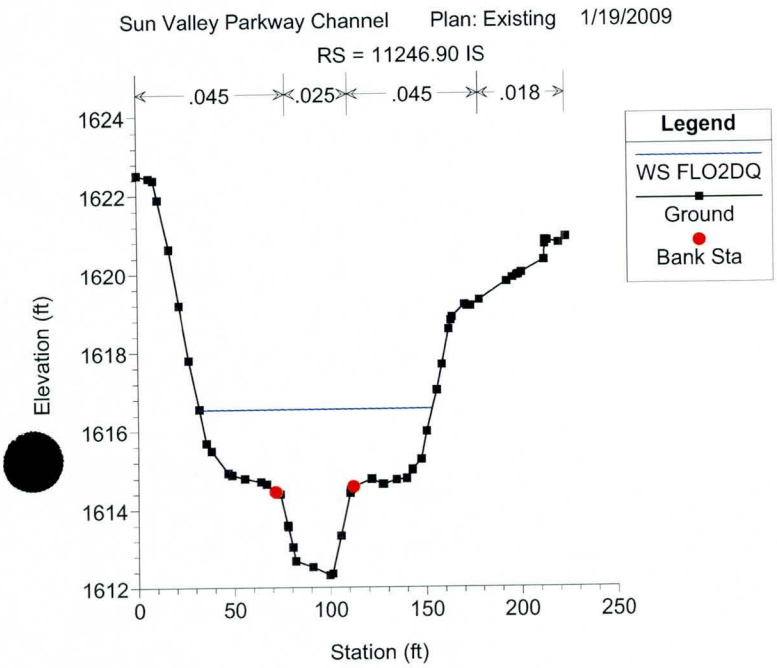


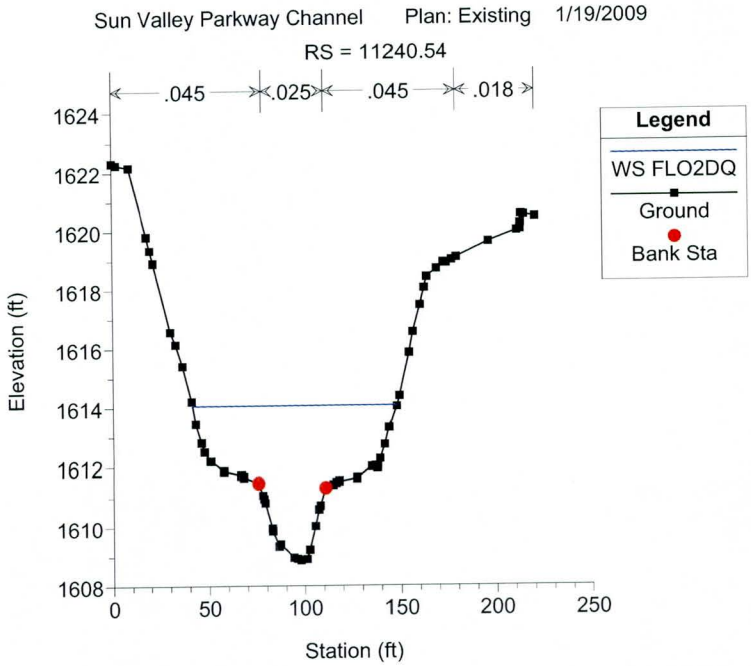

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 11530.86
.045
.018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

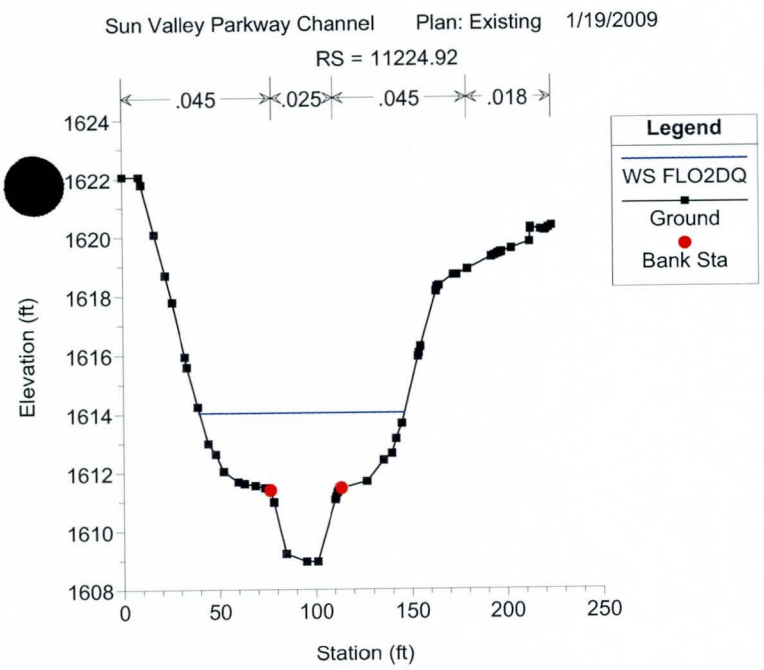

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 11507.12
.045
.025
.045
.018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

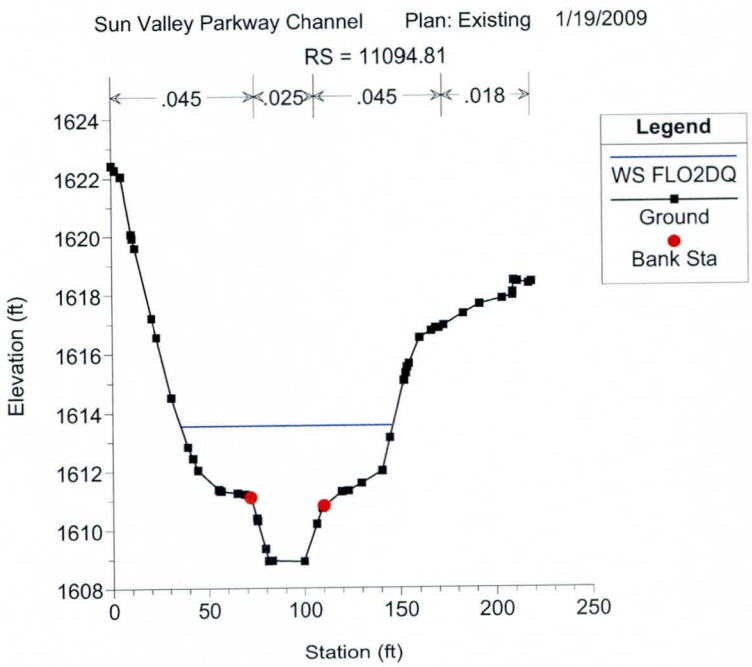

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 11377.76
.045
.025
.045
.018
Legend
WS FLO2DQ
Ground
Bank Sta
Station (ft)

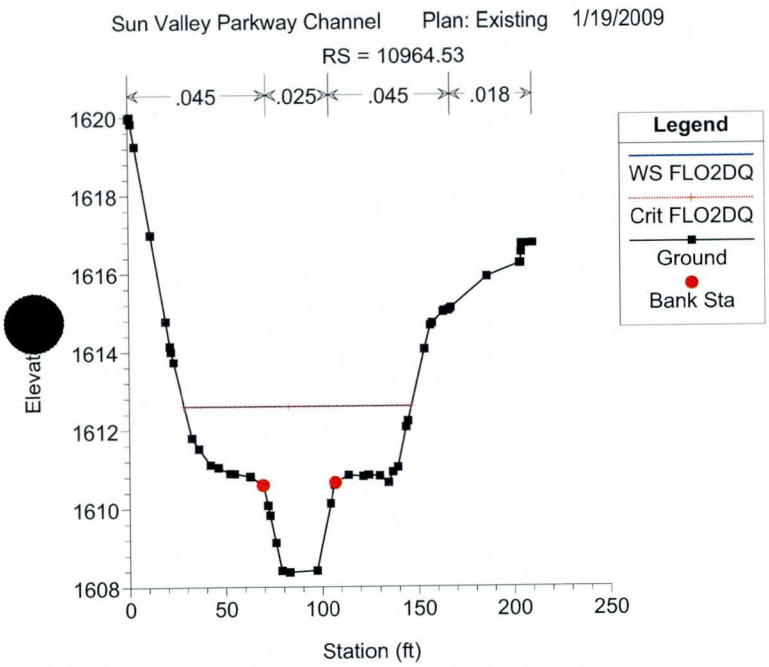

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 11258.40
.045
.025
.045
.018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

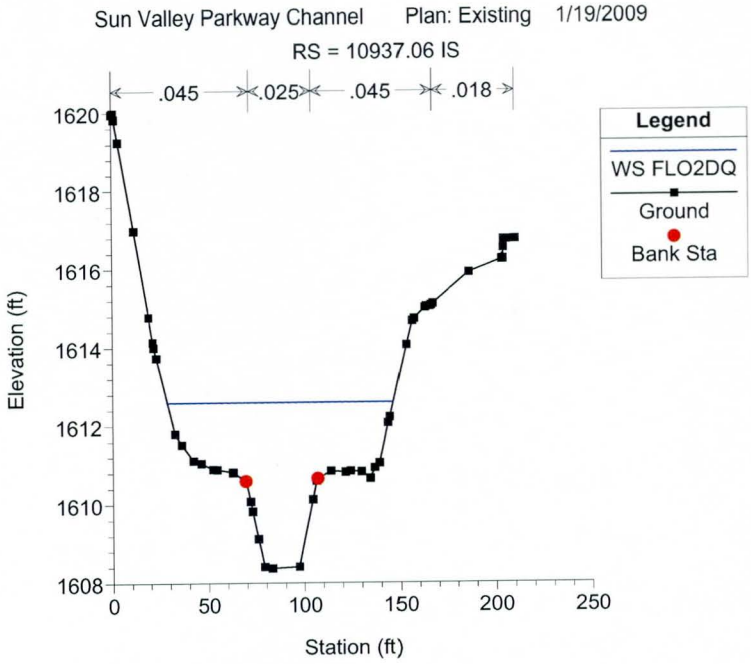

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 11246.90 IS
.045
.025
.045
.018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

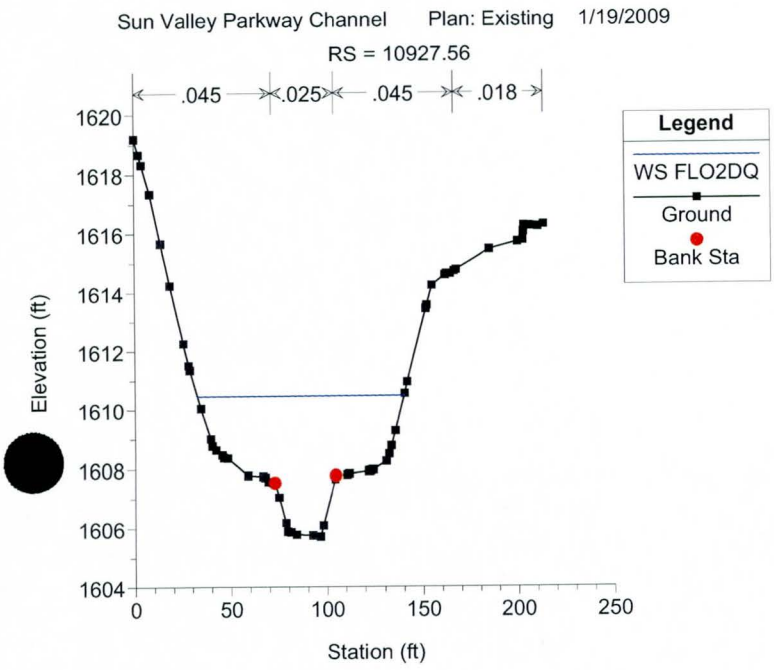

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 11240.54
.045
.025
.045
.018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

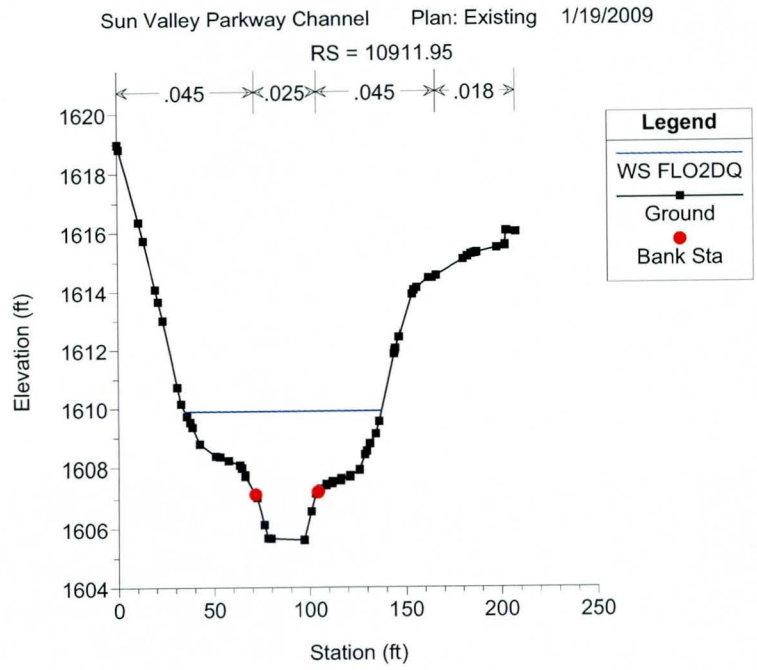

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 11224.92
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 11094.81
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 10964.53
.045 .025 .045 .018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 10937.06 IS
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 10927.56
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 10911.95
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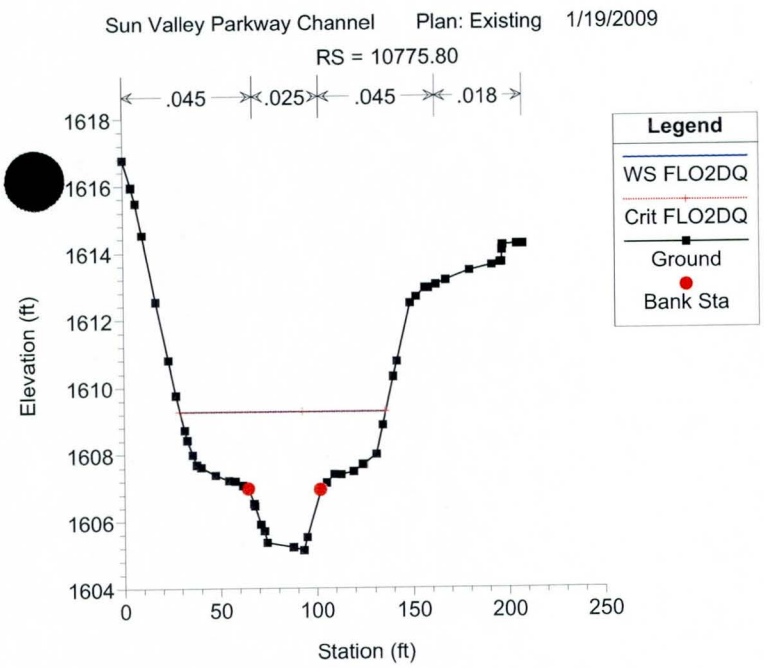
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 10775.80
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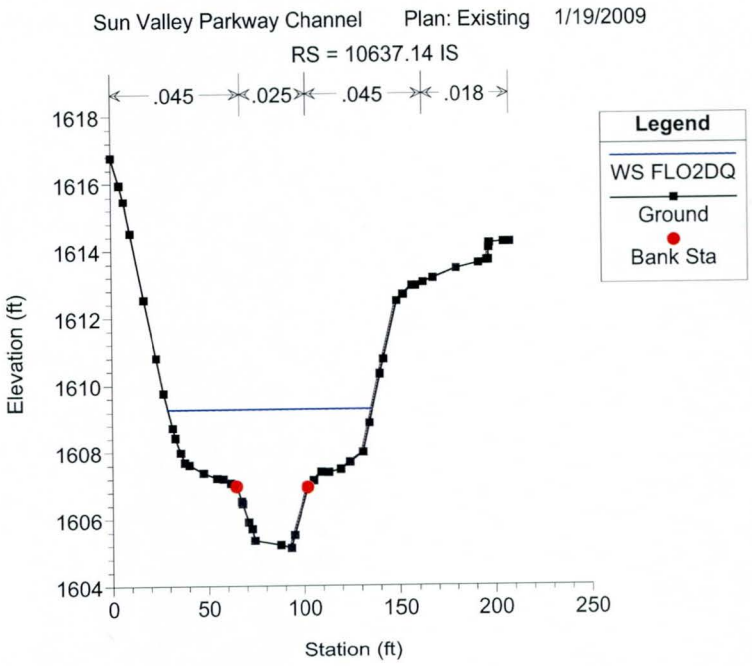
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 10637.14 IS
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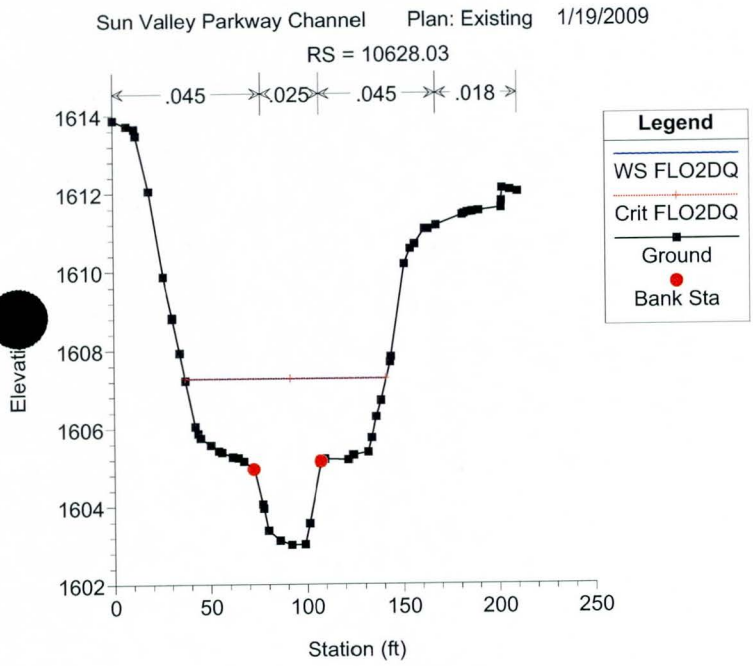
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 10628.03
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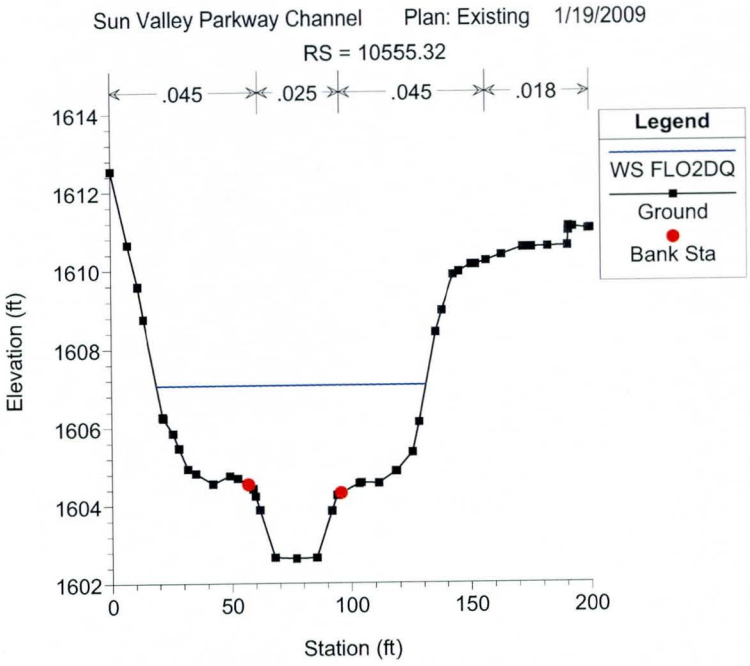
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 10555.32
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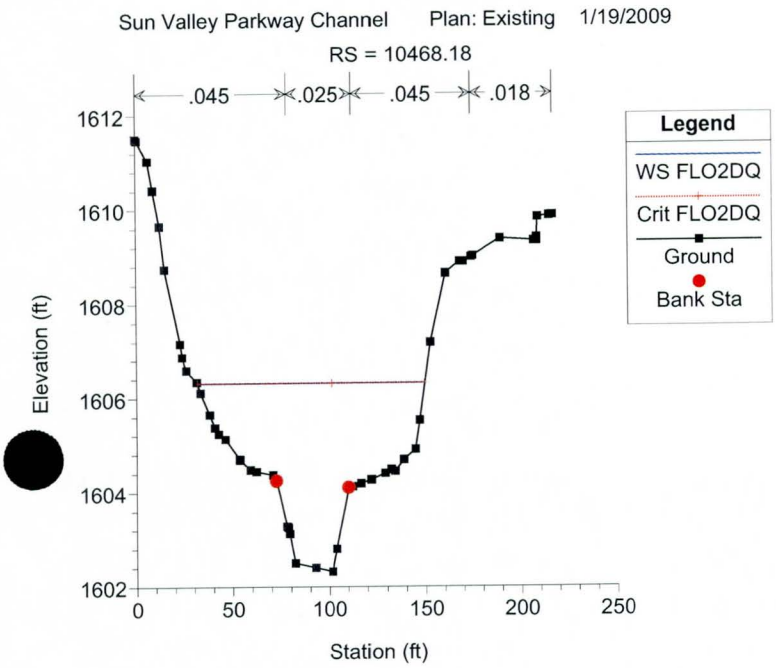
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 10468.18
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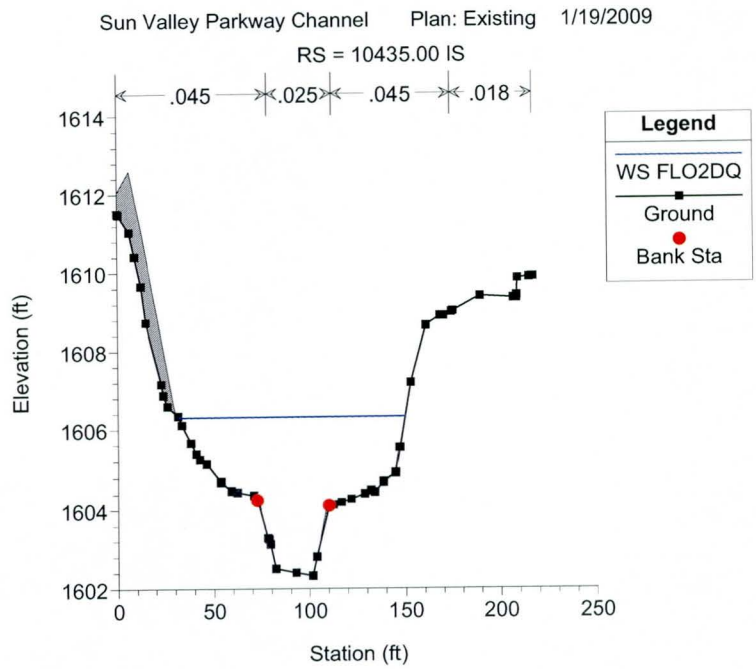
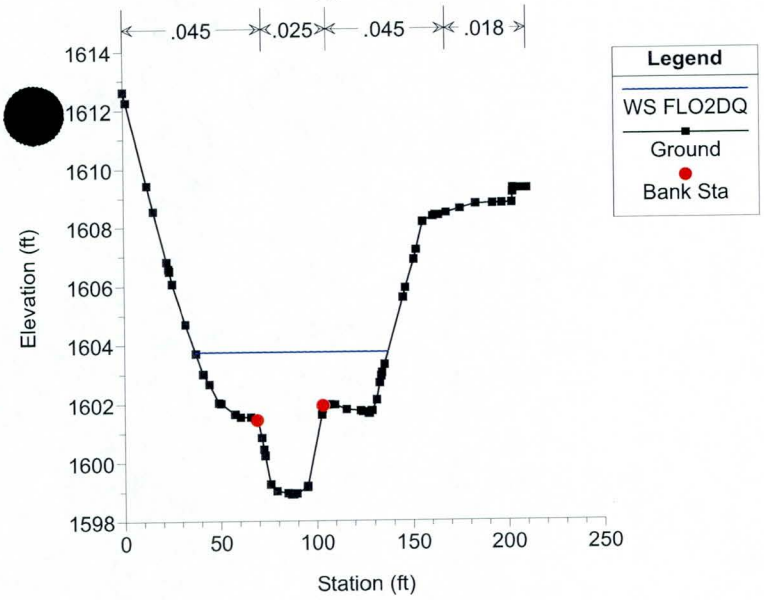
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 10435.00 IS
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

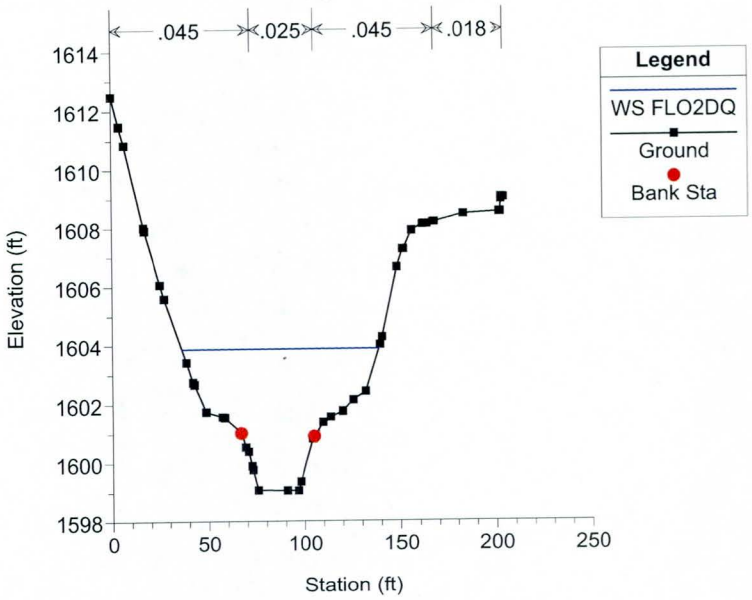
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 10428.14



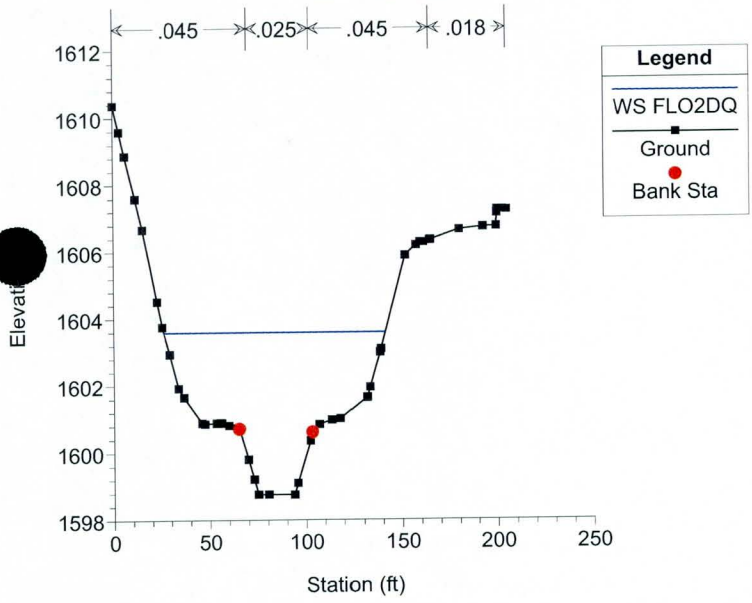
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 10407.63



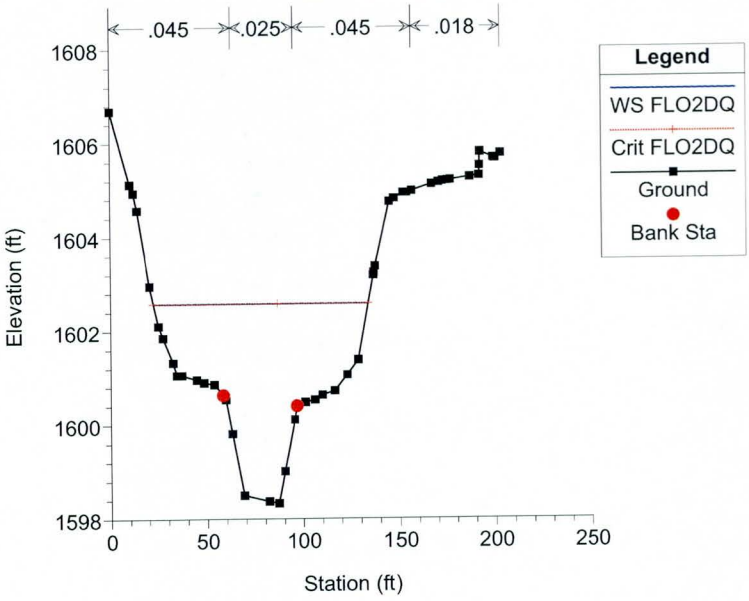
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 10274.00



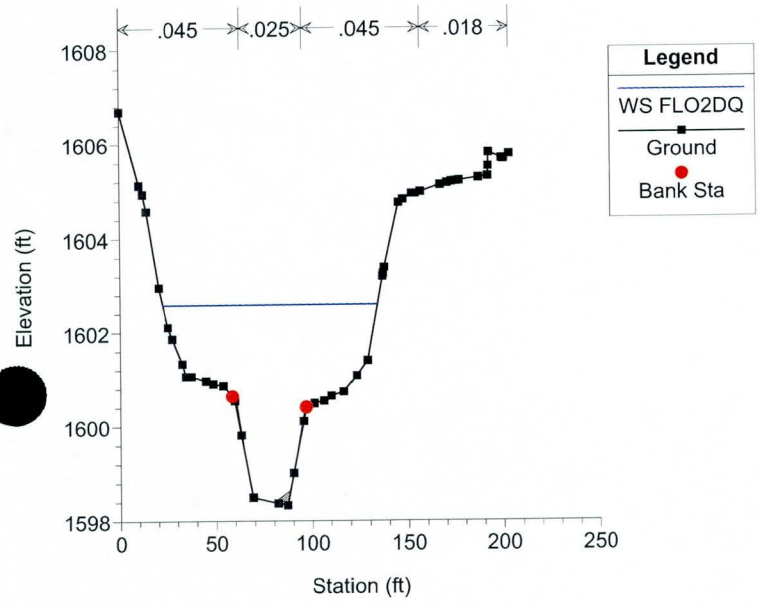
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 10161.95



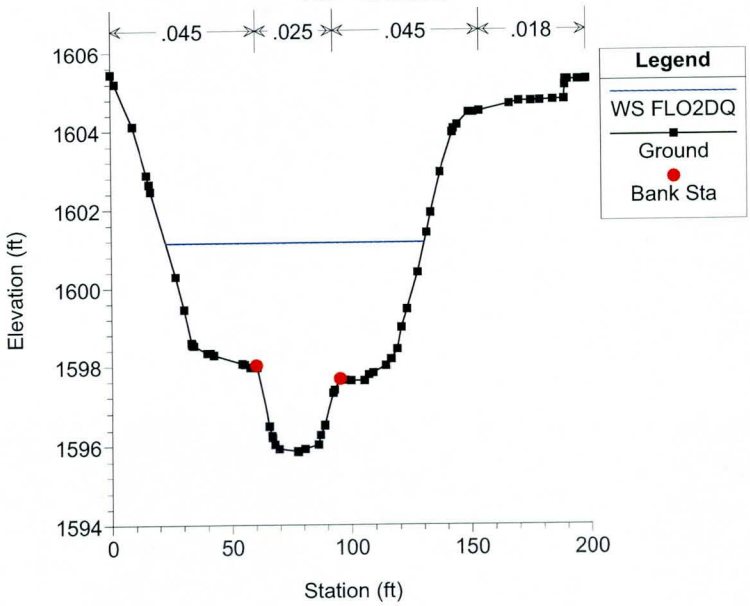
Sun Valley Parkway Channel Plan: Existing 1/19/2009

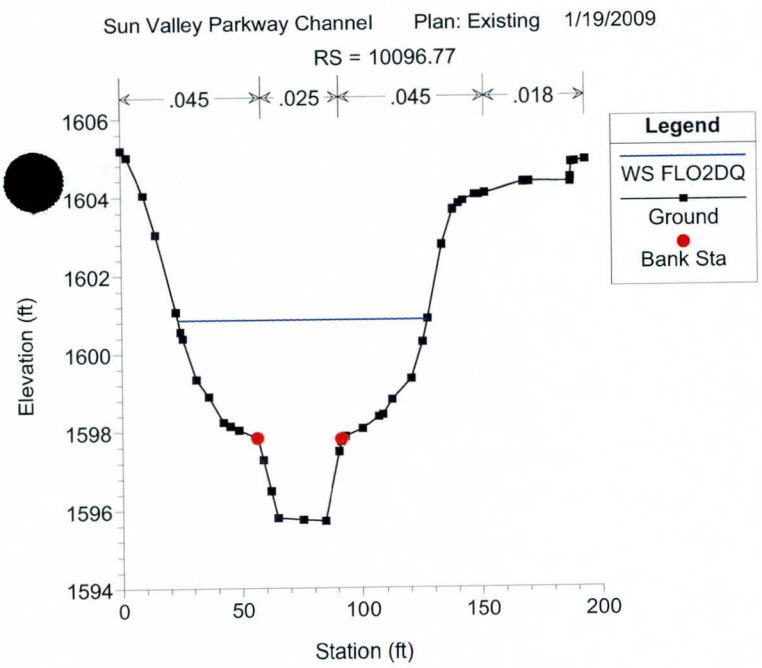
RS = 10136.06 IS

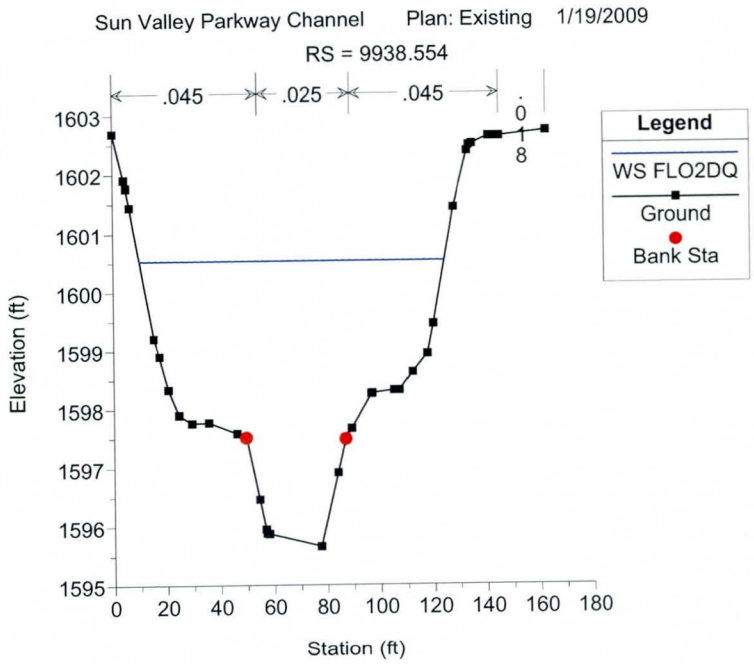


Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 10126.72




Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 10096.77
.045
.025
.045
.018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 9938.554
.045
.025
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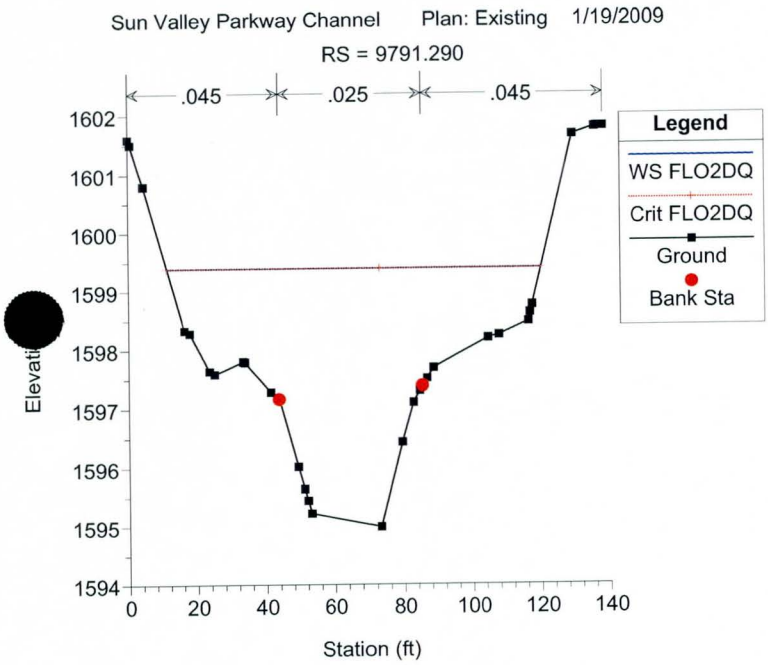
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 9791.290
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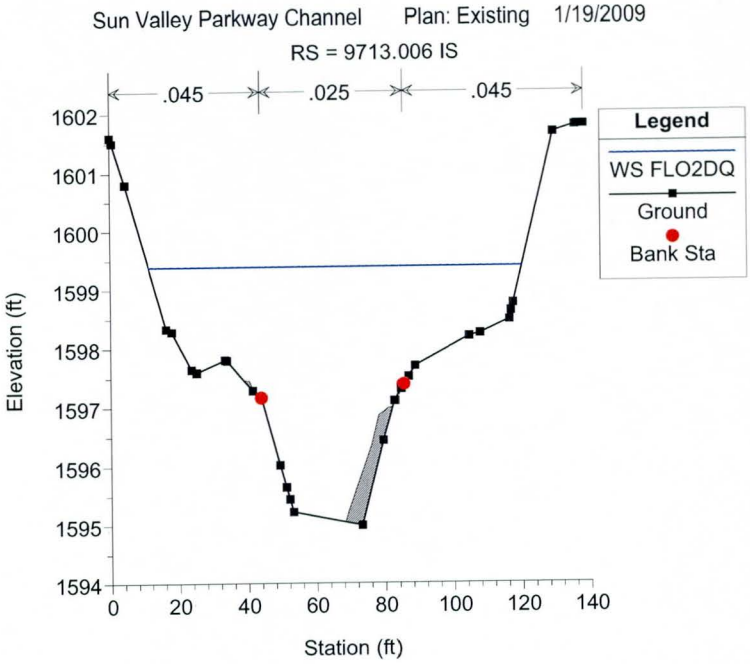
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 9713.006 IS
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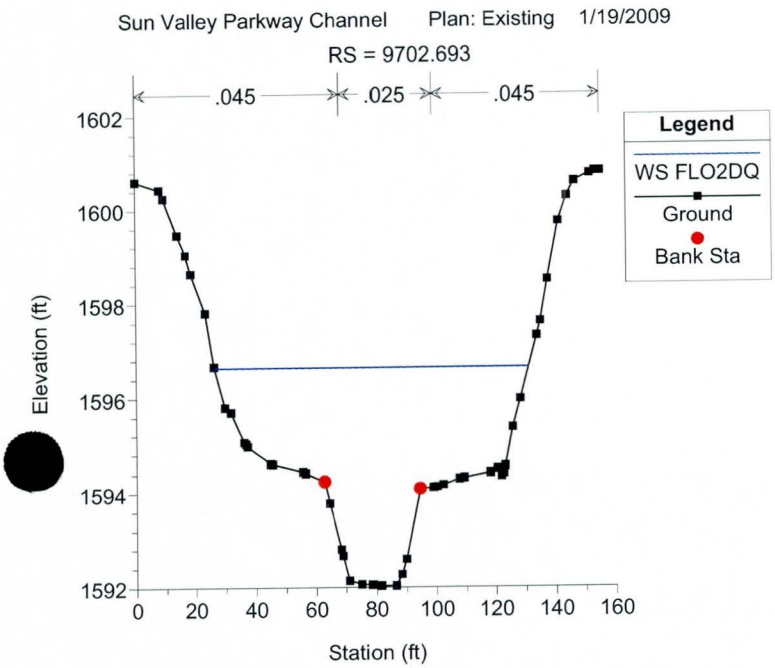
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
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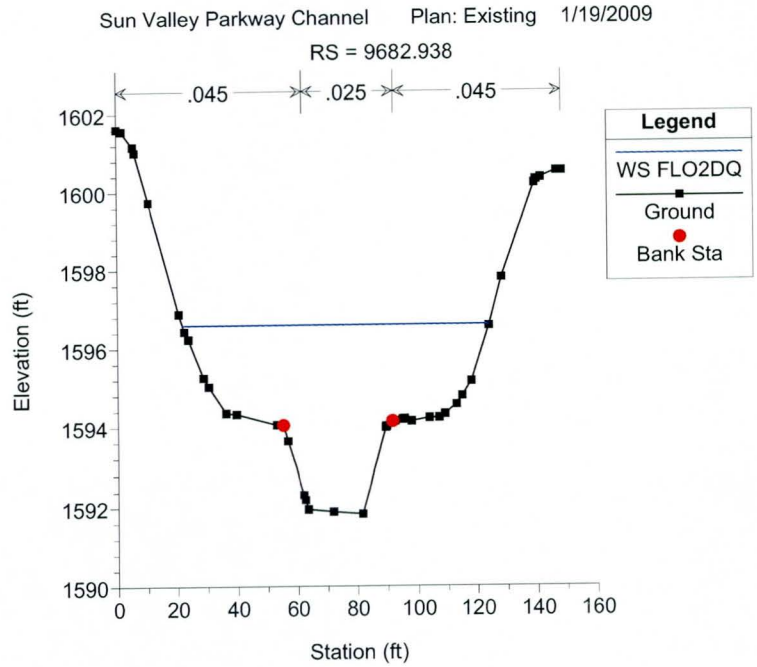
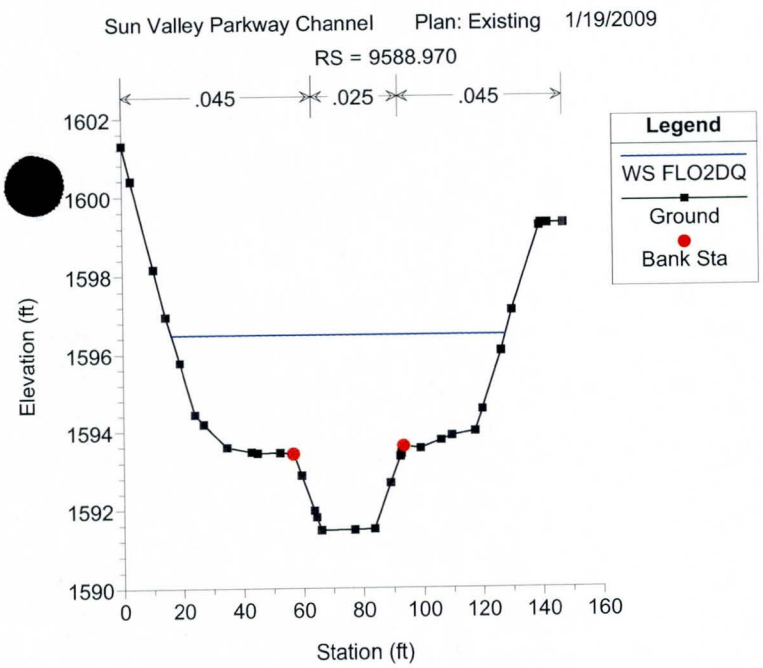
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 9682.938
.045
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 9588.970
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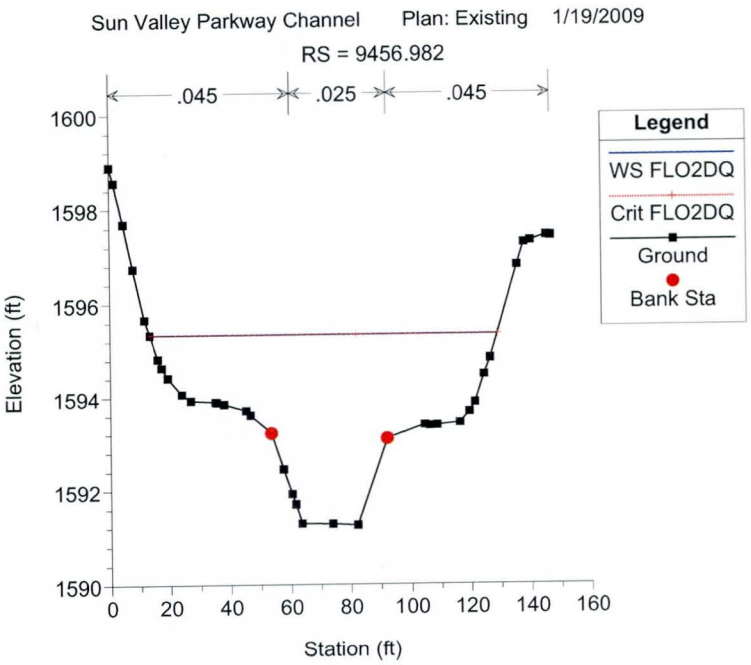
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 9456.982
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.025
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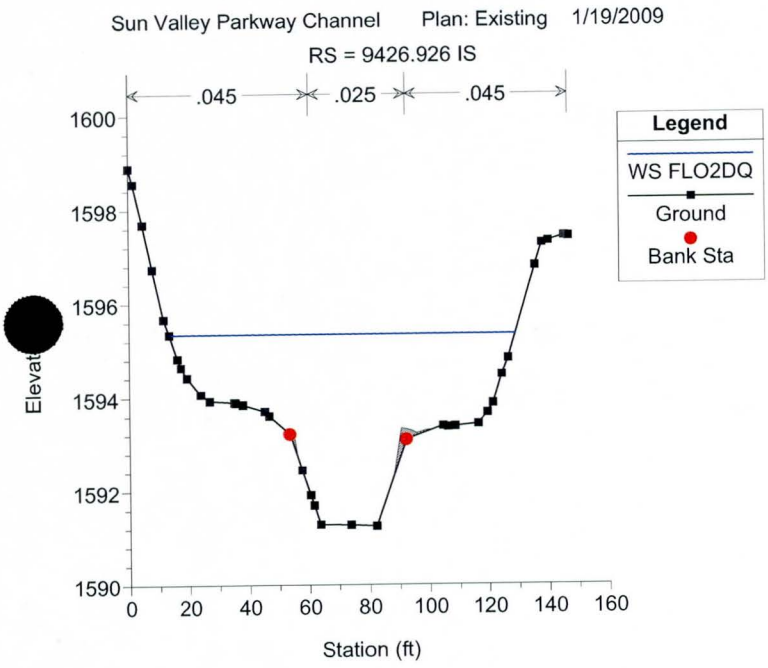
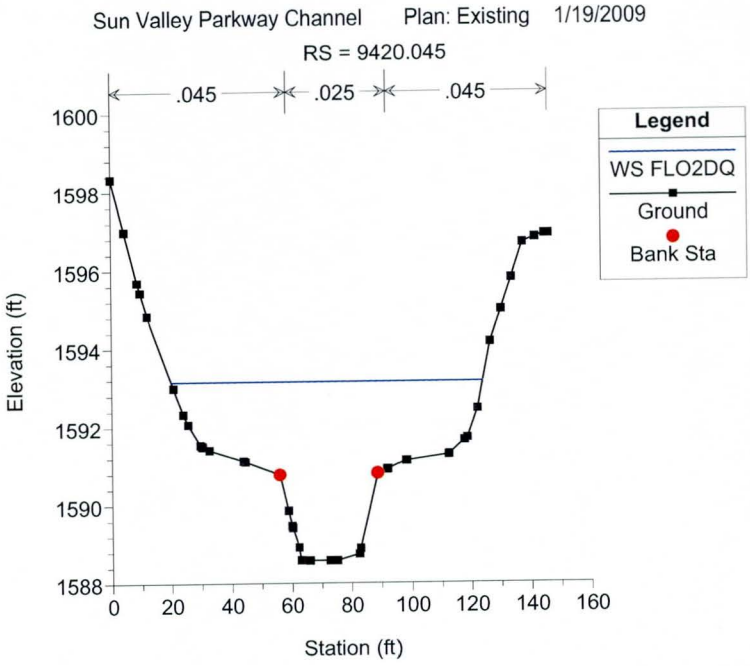
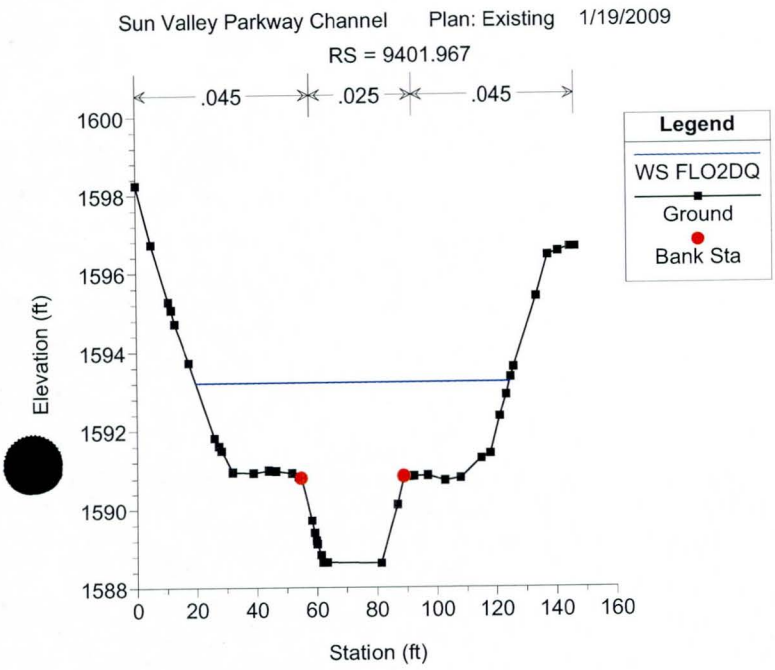
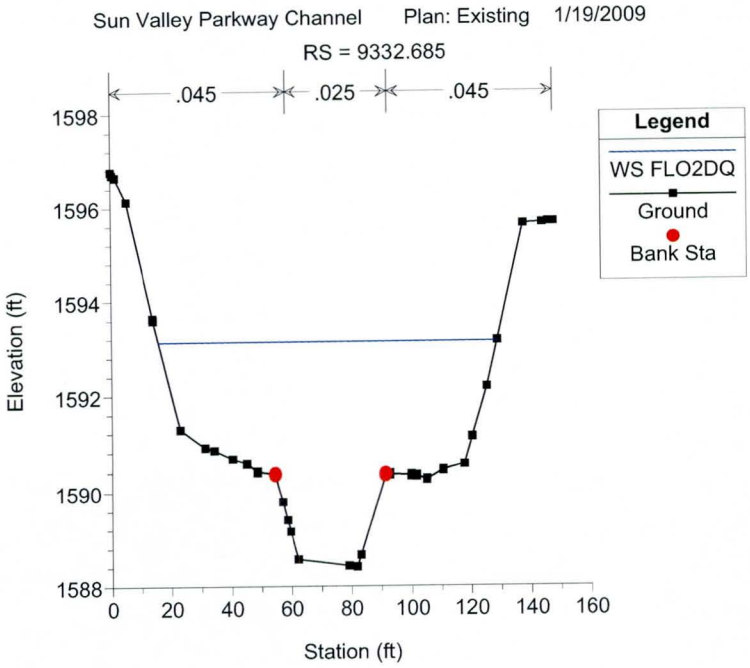
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 9426.926 IS
.045
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 9420.045
.045
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 9401.967
.045
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 9332.685
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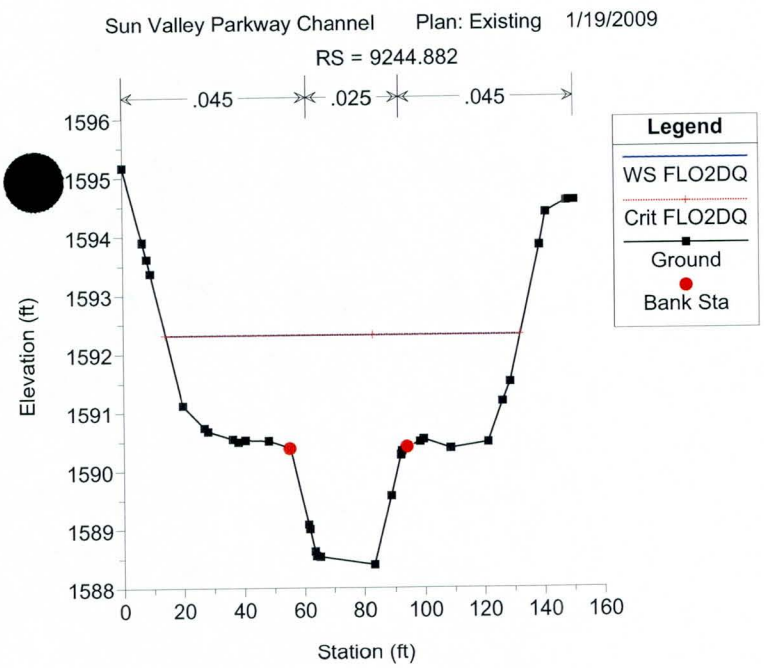
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 9244.882
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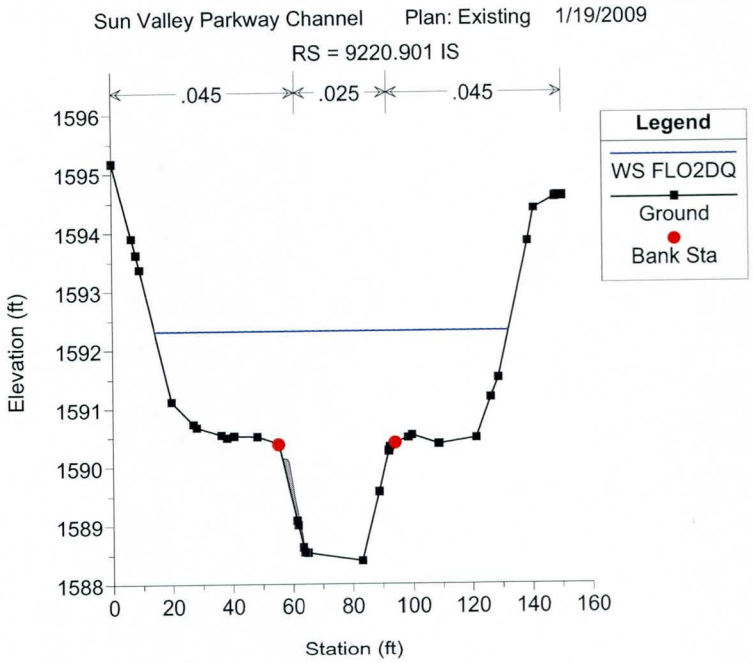
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 9220.901 IS
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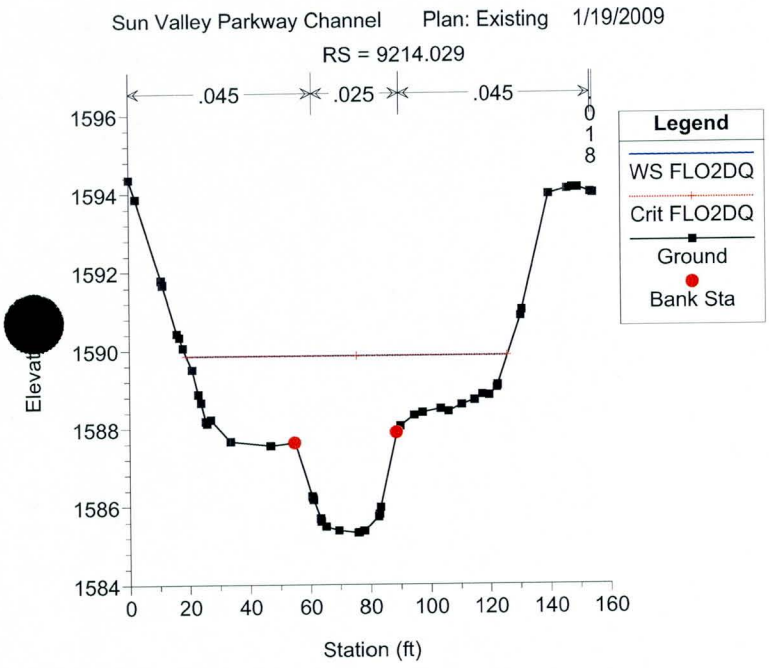
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 9214.029
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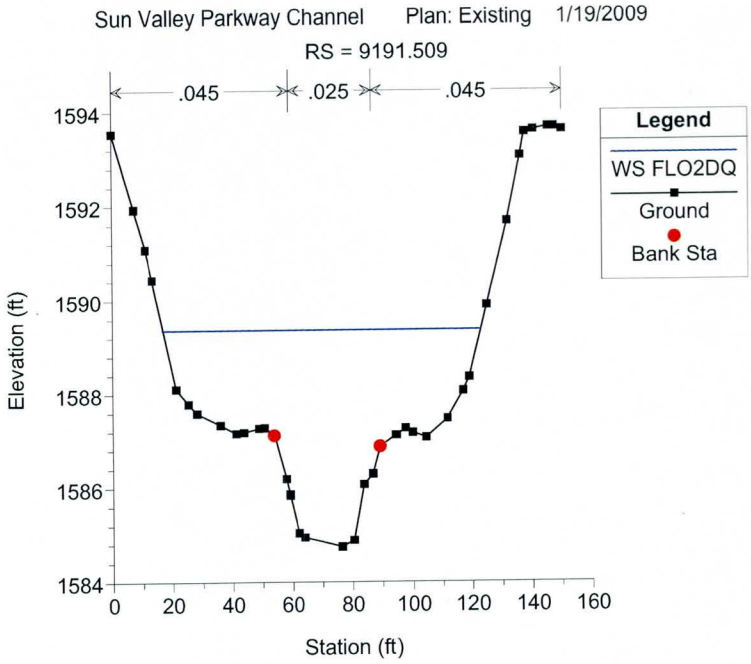
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 9191.509
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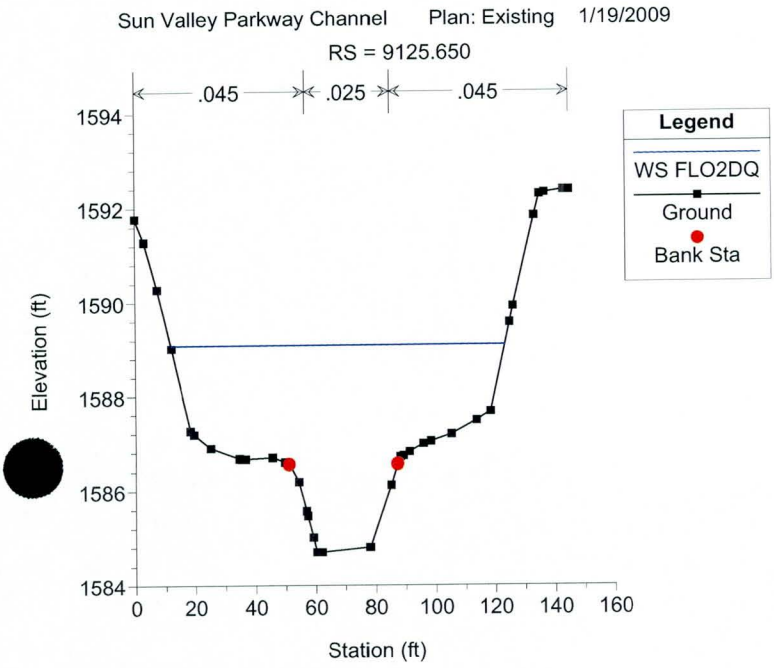
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 9125.650
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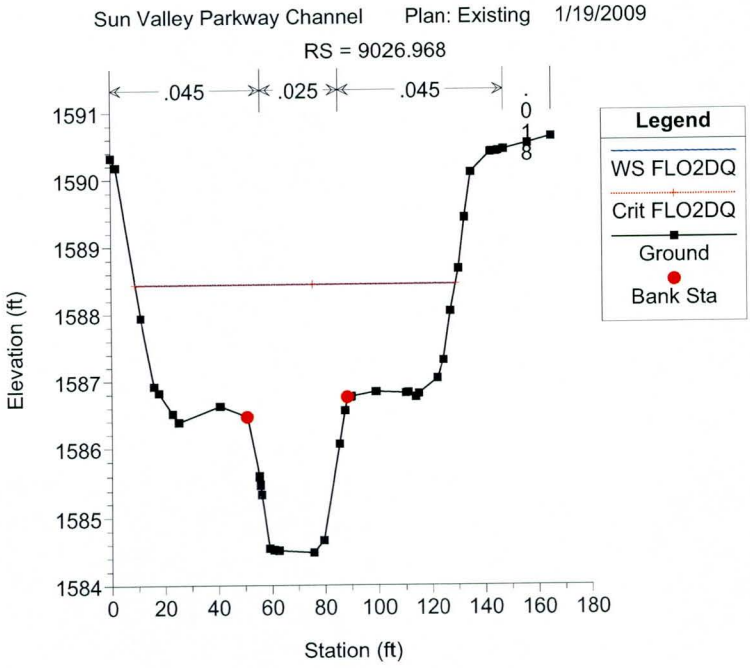
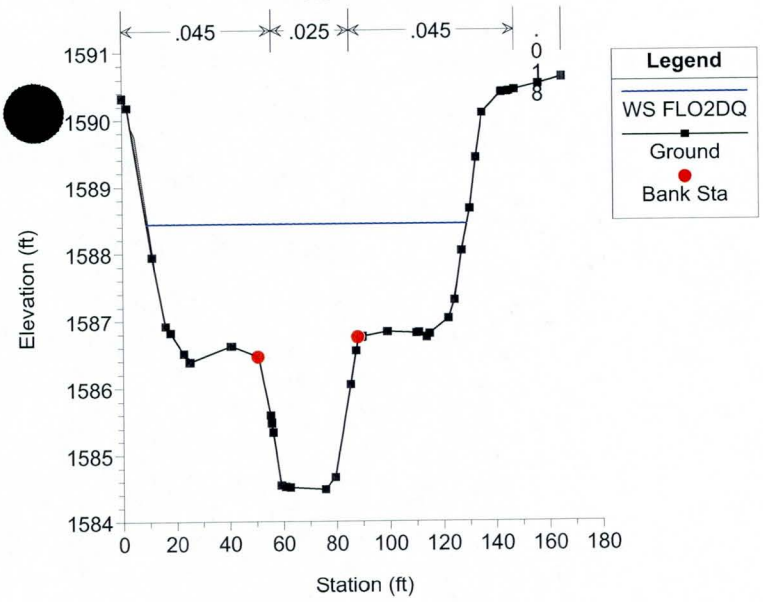
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 9026.968
.045 .025 .045
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

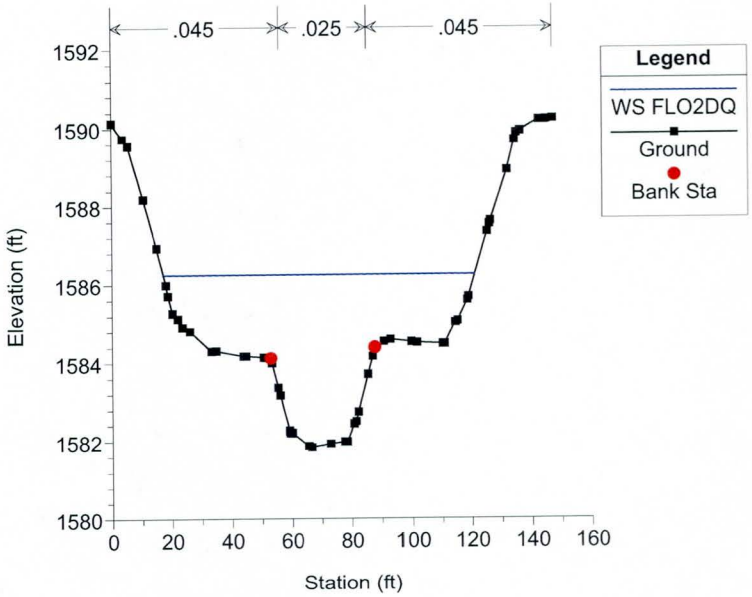
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 9019.372 IS



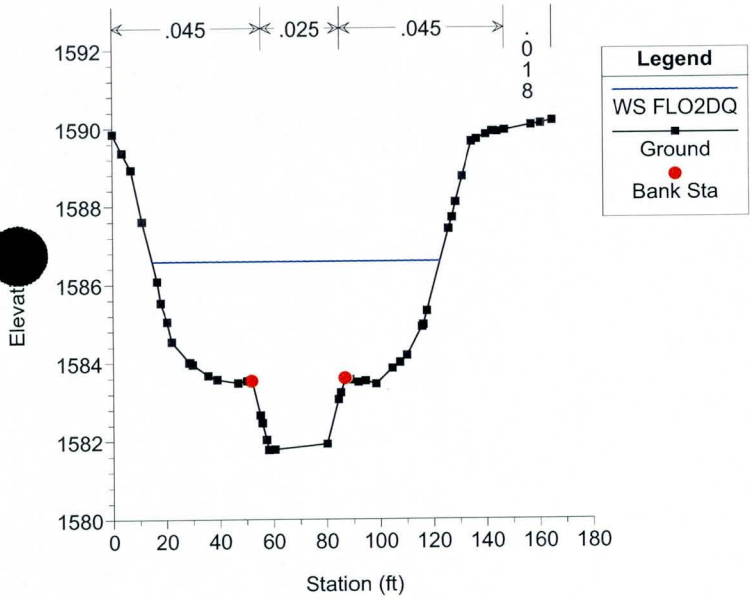
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 9015.422



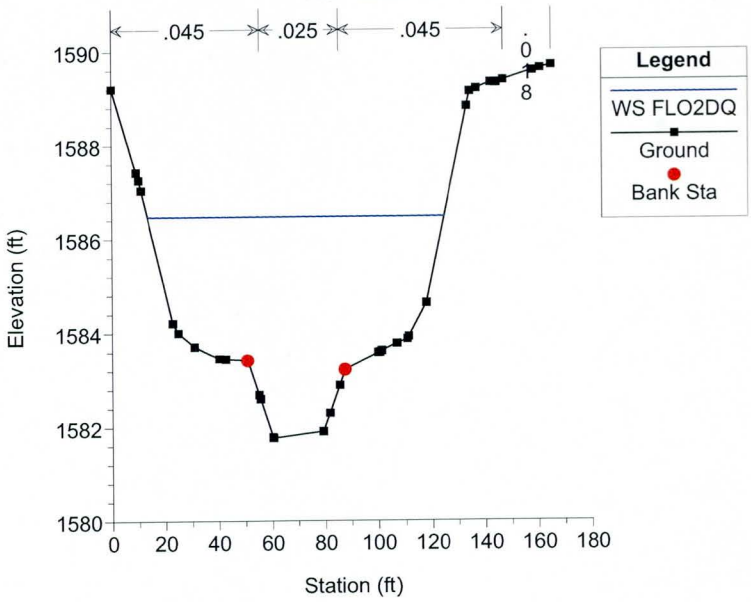
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 8998.093



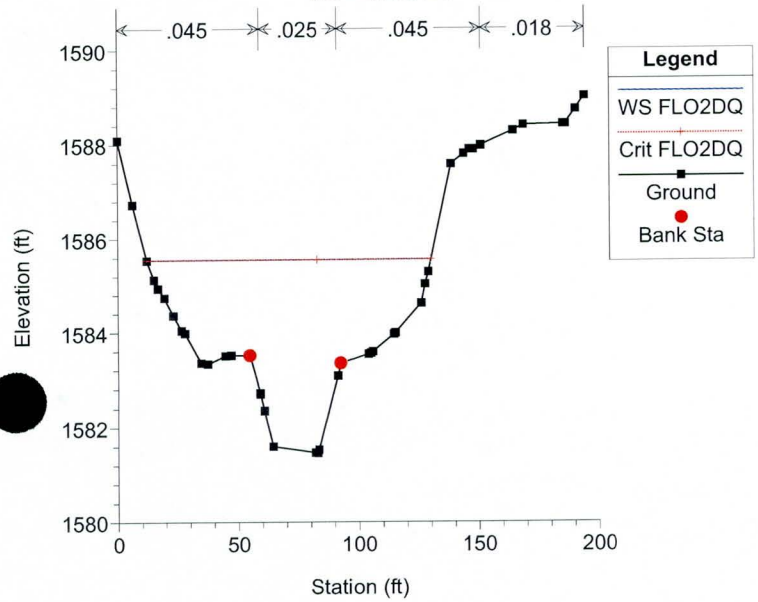
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 8963.707



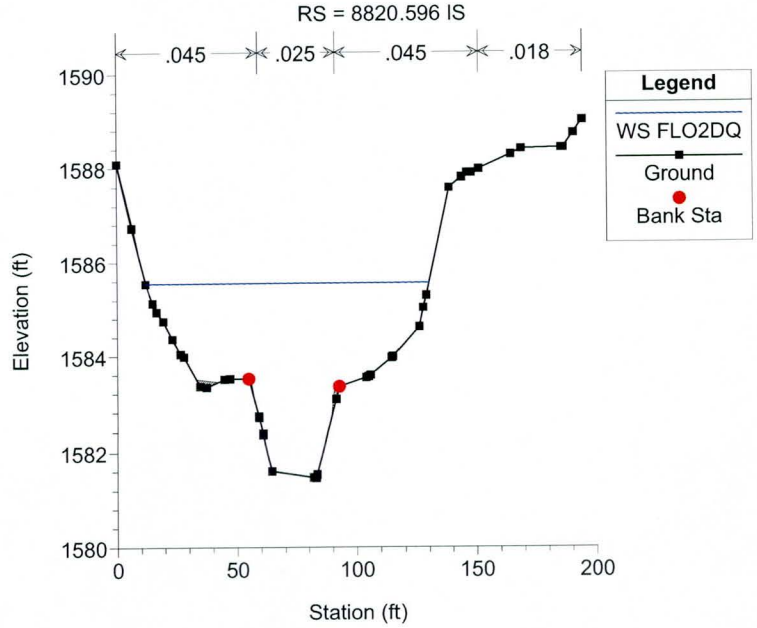
Sun Valley Parkway Channel Plan: Existing 1/19/2009

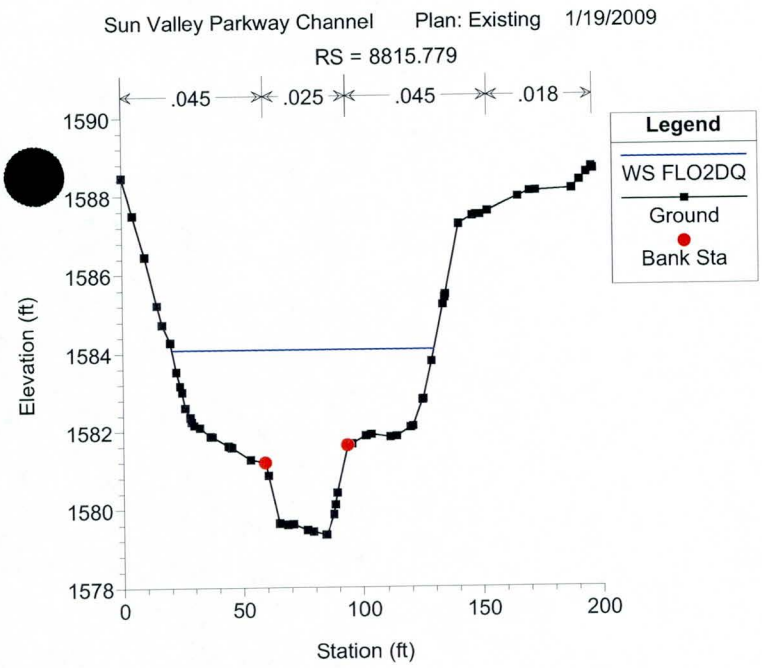
RS = 8853.075



Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 8820.596 IS




Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 8815.779
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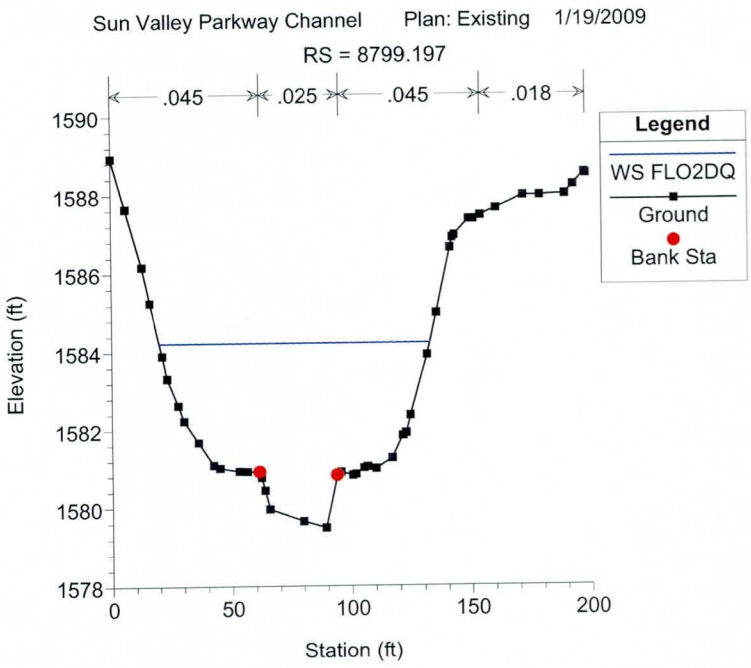
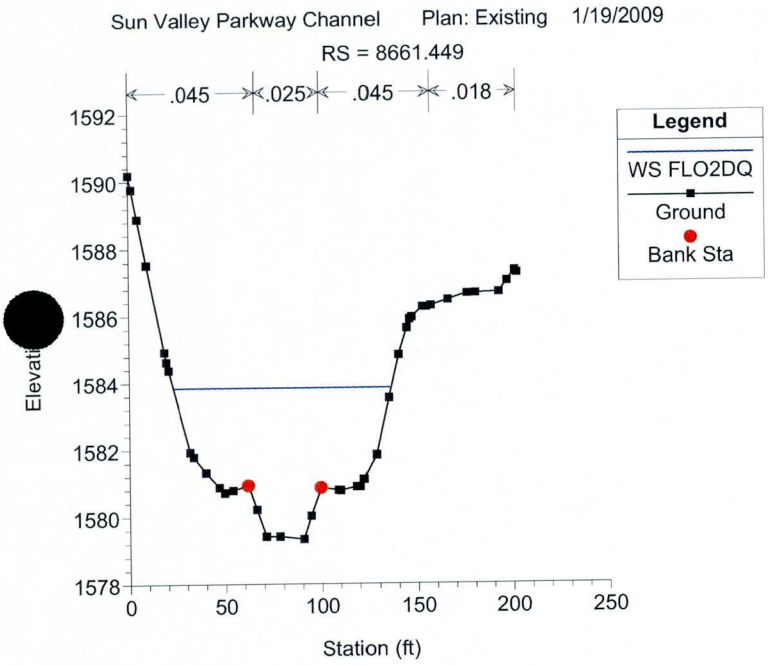
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 8799.197
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 8661.449
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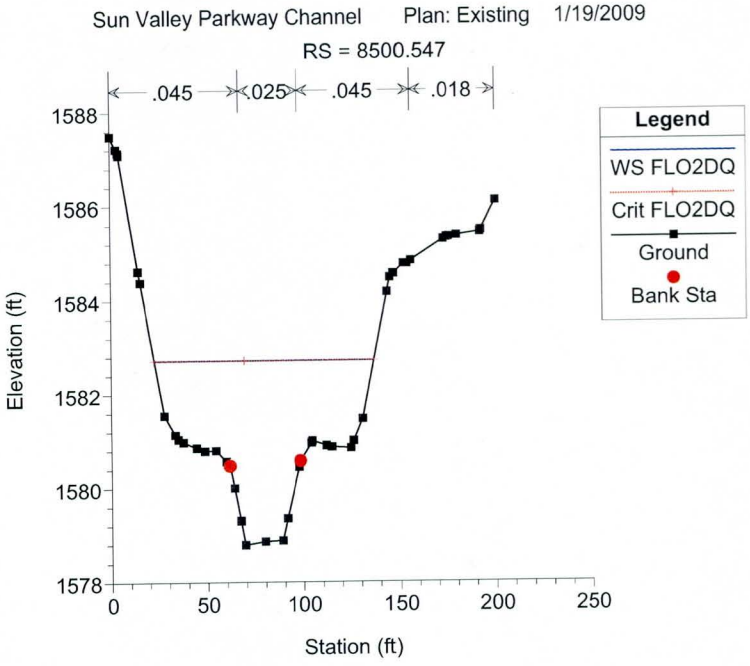
Legend
WS FLO2DQ
Ground
Bank Sta
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 8500.547
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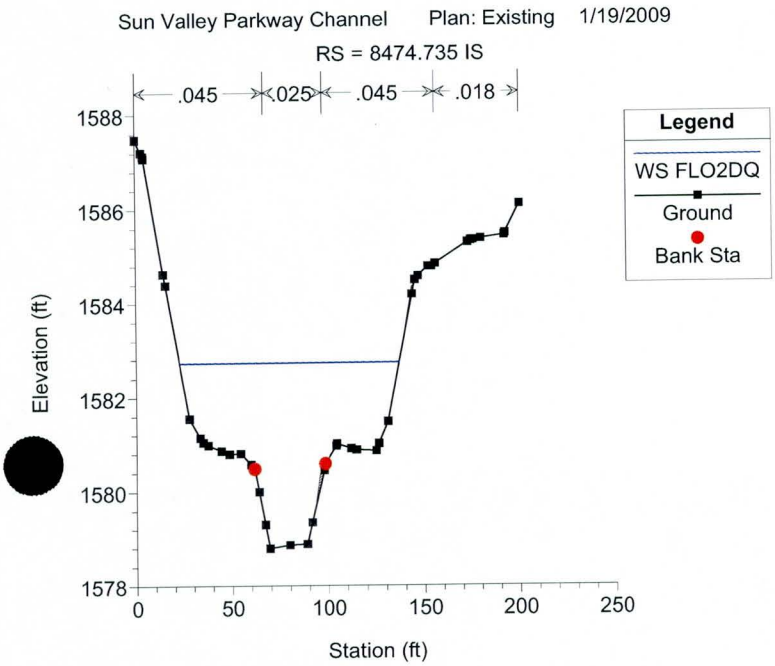
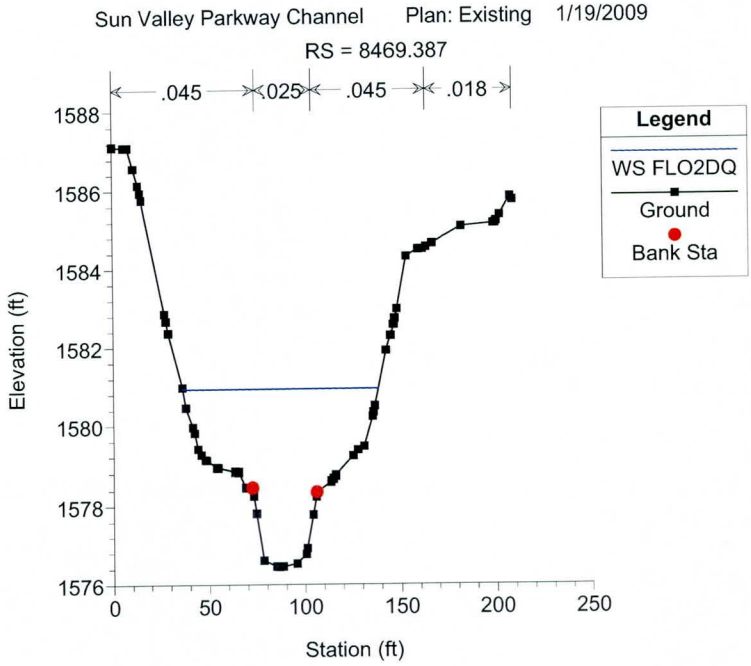
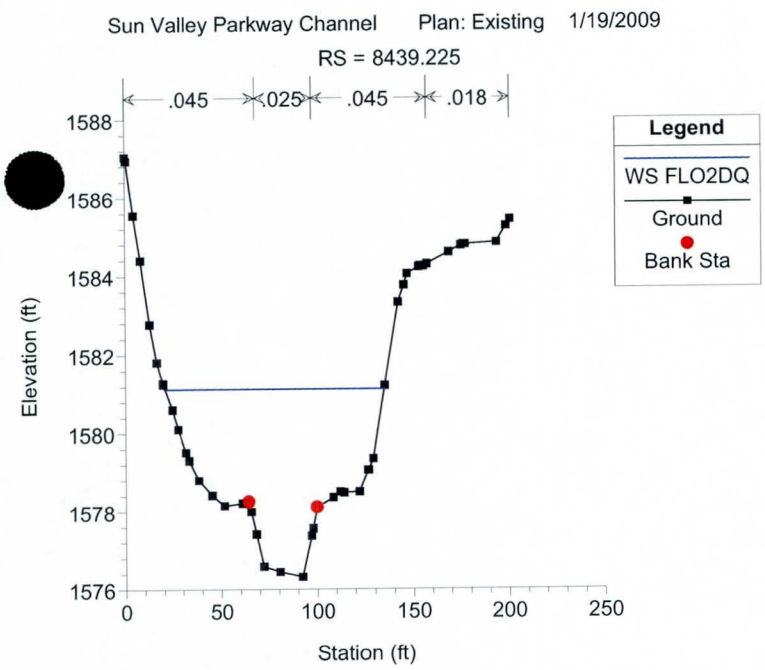
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 8474.735 IS
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 8469.387
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 8439.225
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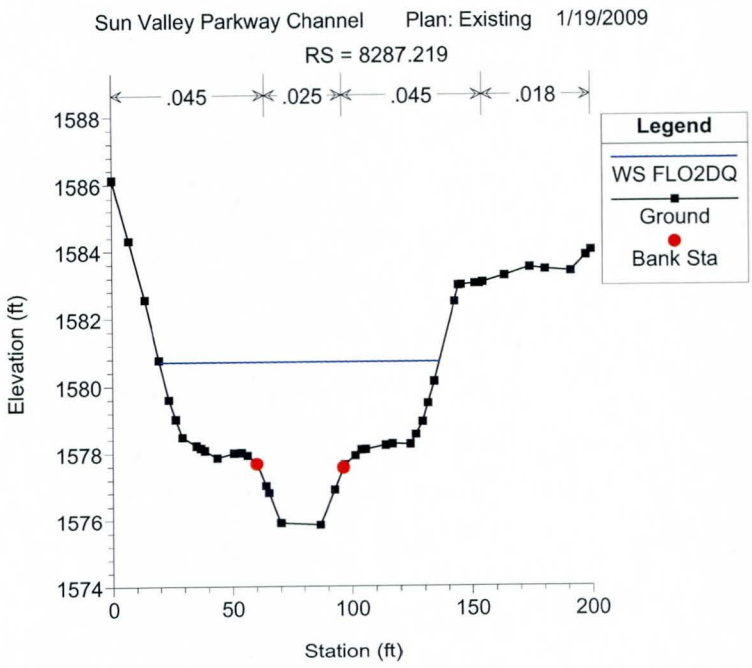
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 8287.219
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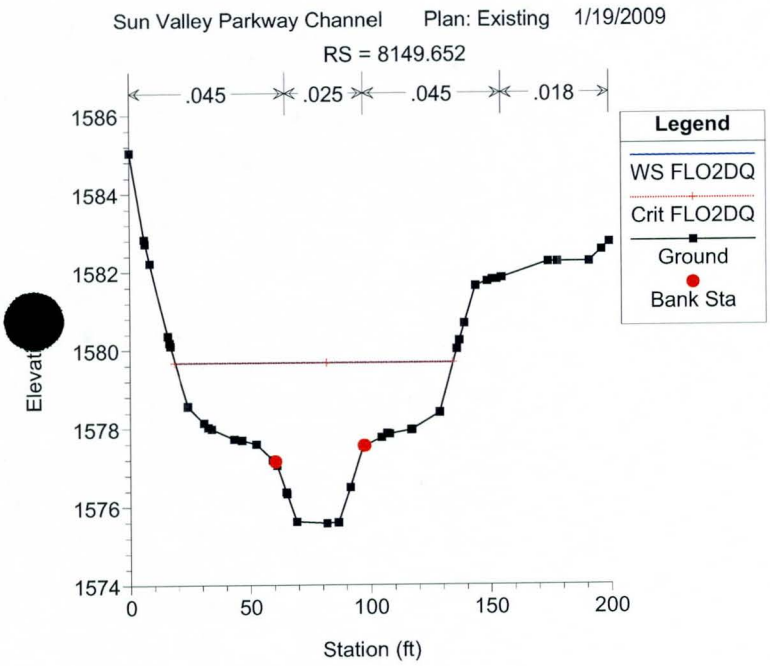
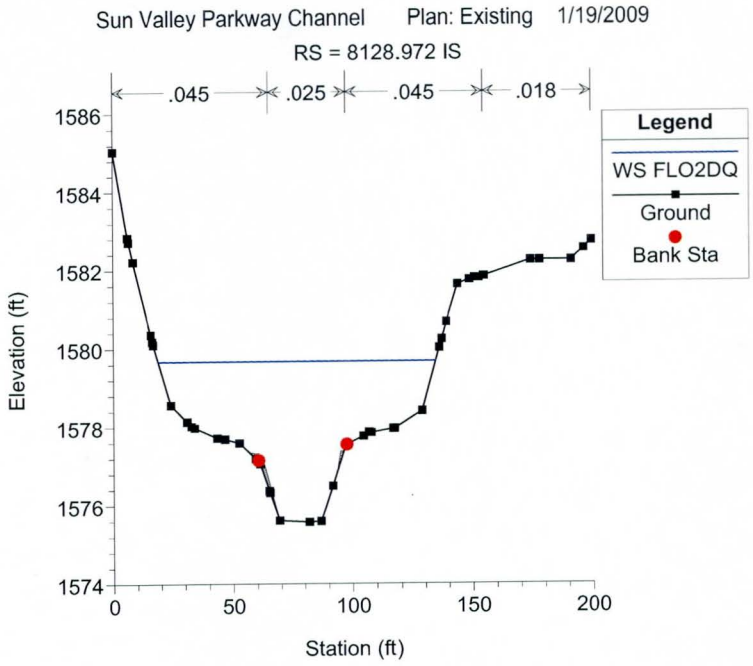
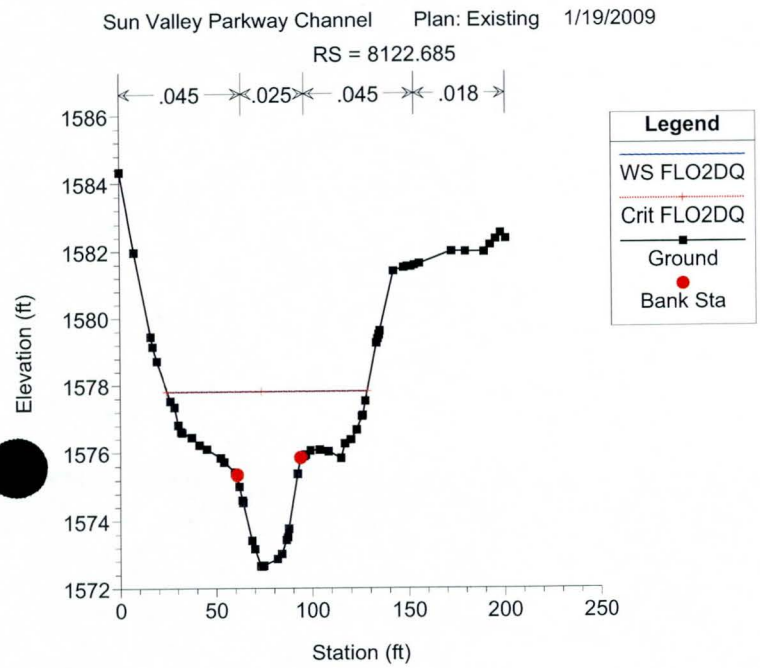
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 8149.652
.045 .025 .045 .018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 8128.972 IS
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 8122.685
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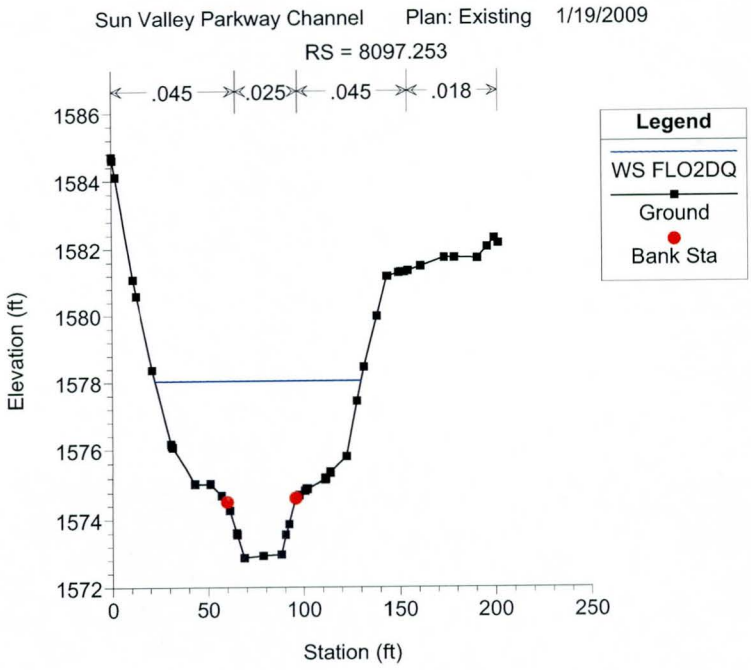
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 8097.253
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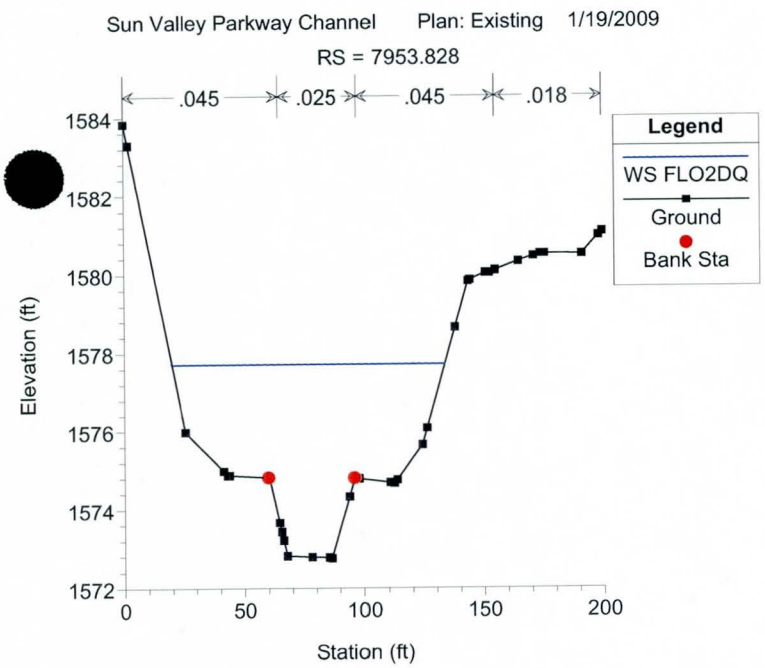
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 7953.828
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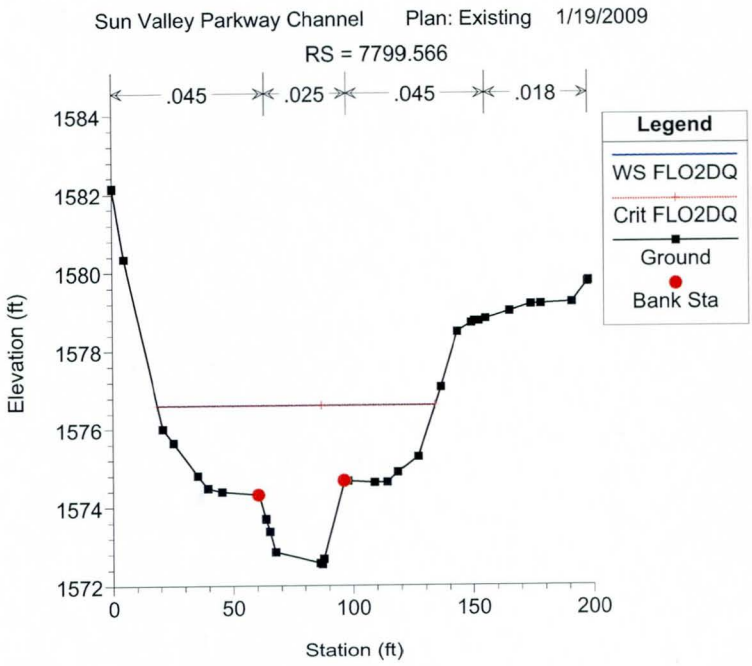
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 7799.566
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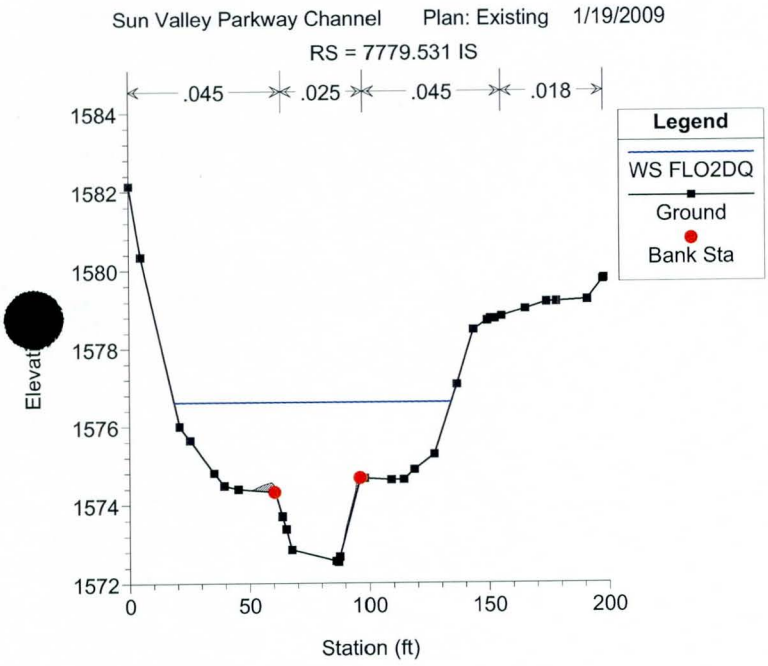
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 7779.531 IS
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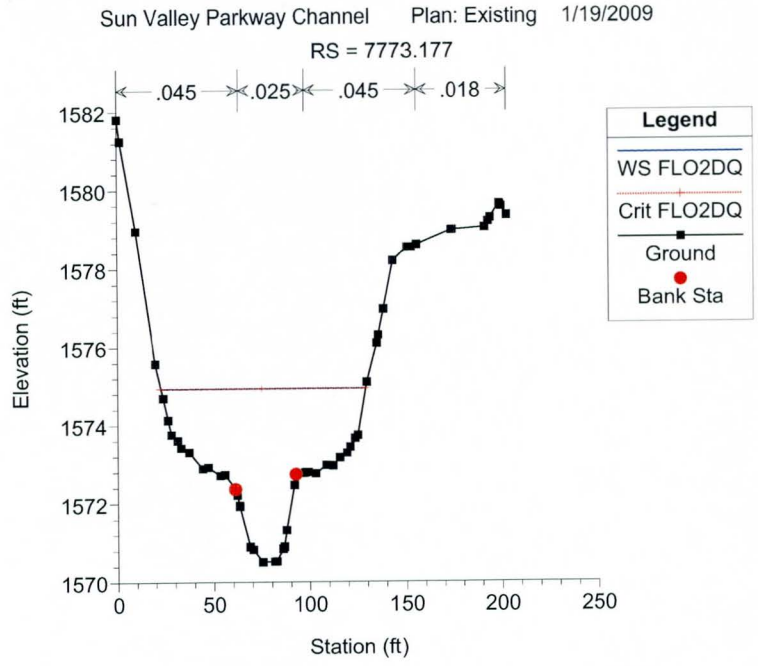
Legend
WS FLO2DQ
Ground
Bank Sta
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
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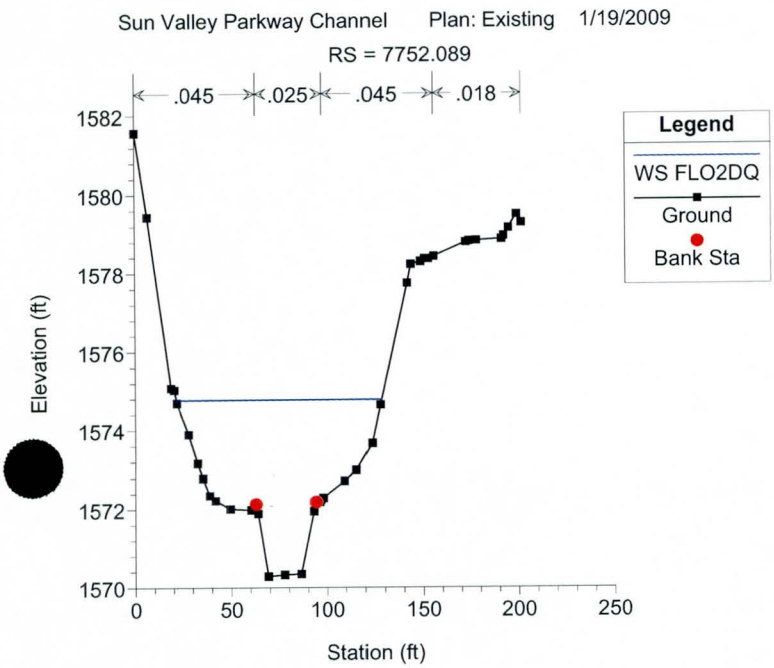
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 7752.089
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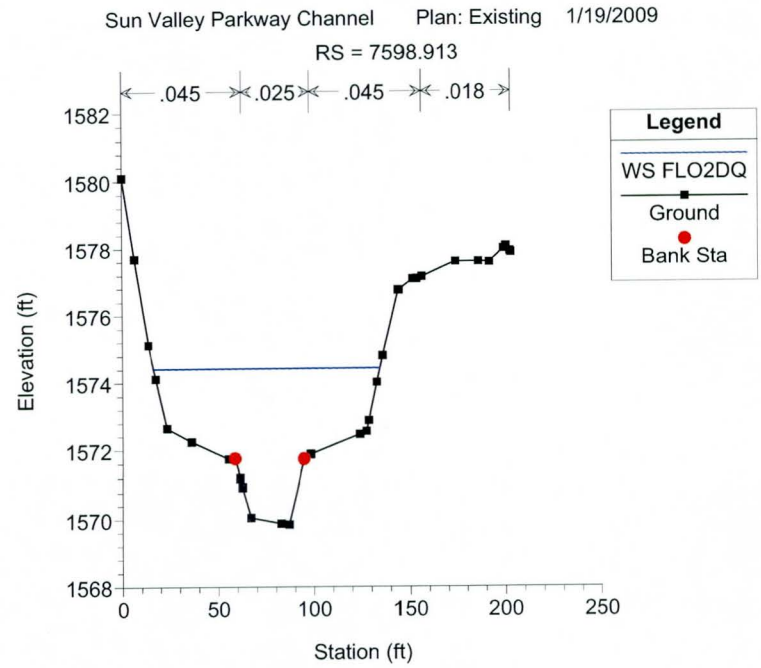
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 7598.913
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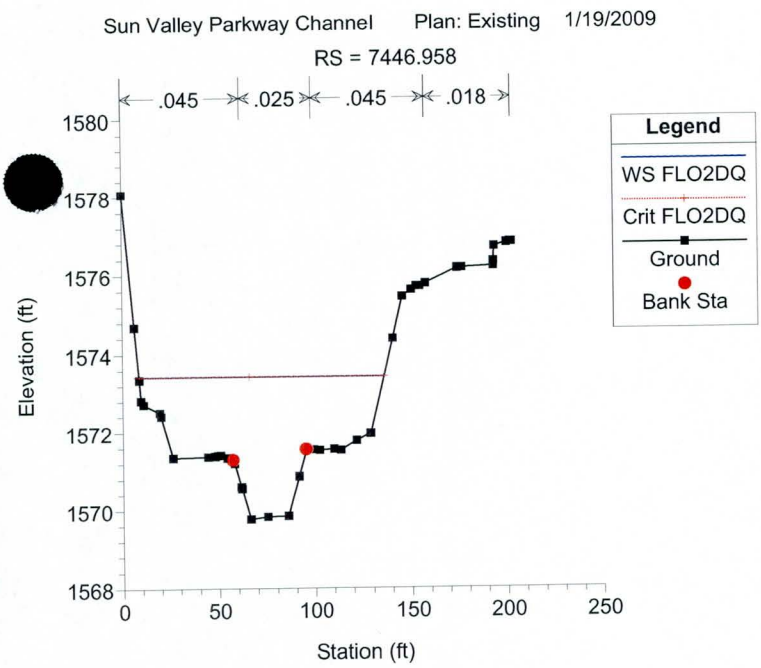
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 7446.958
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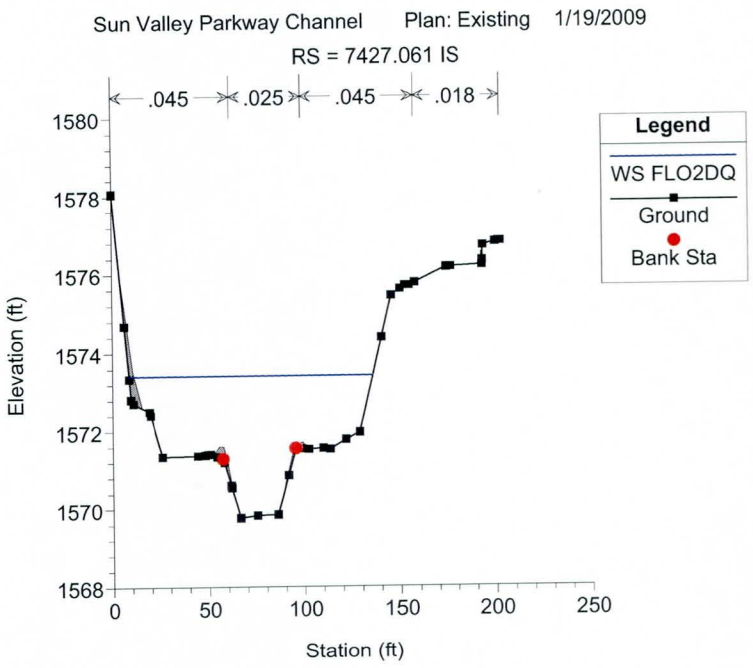
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 7427.061 IS
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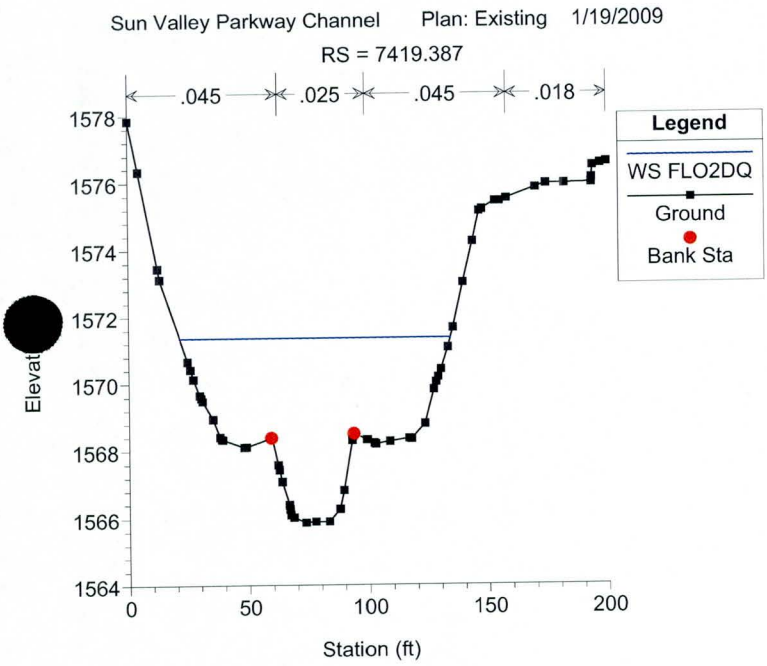
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)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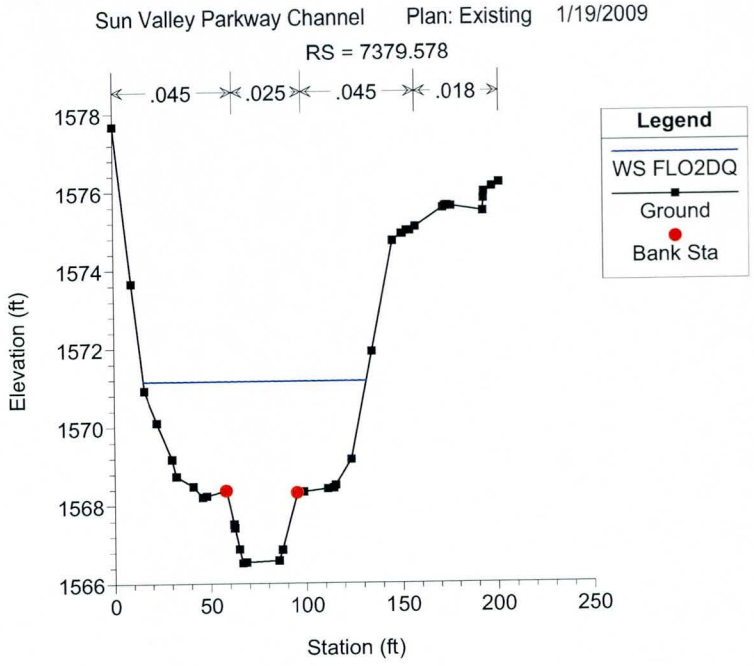
Legend
WS FLO2DQ
Ground
Bank Sta
Station (ft)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RS = 7379.578
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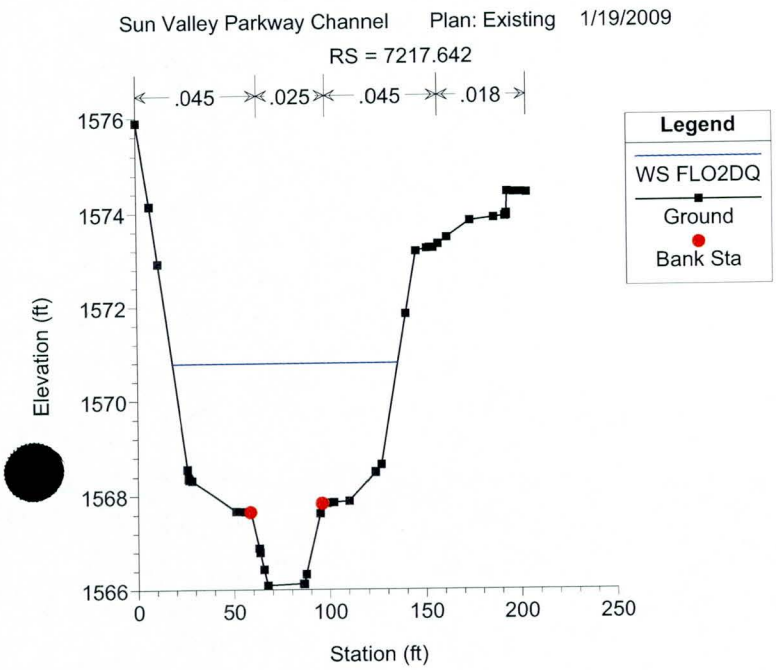
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
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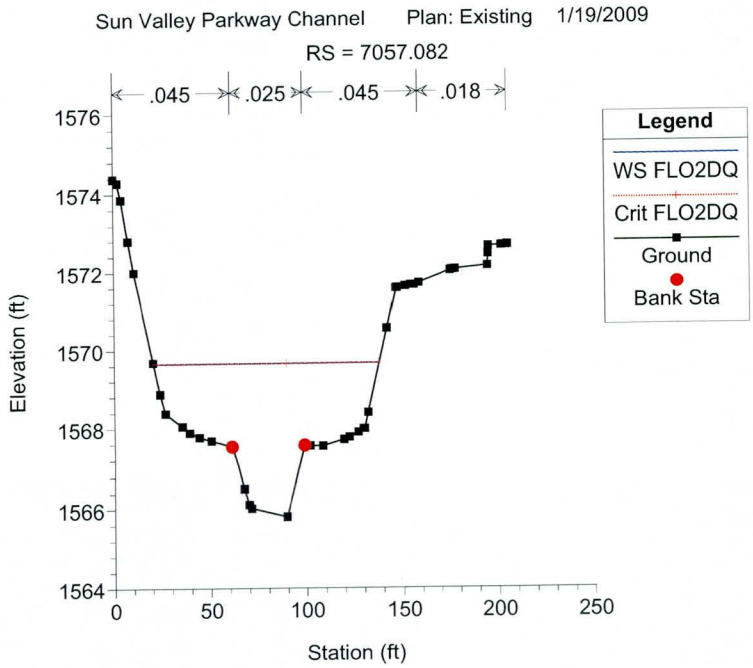
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 7057.082
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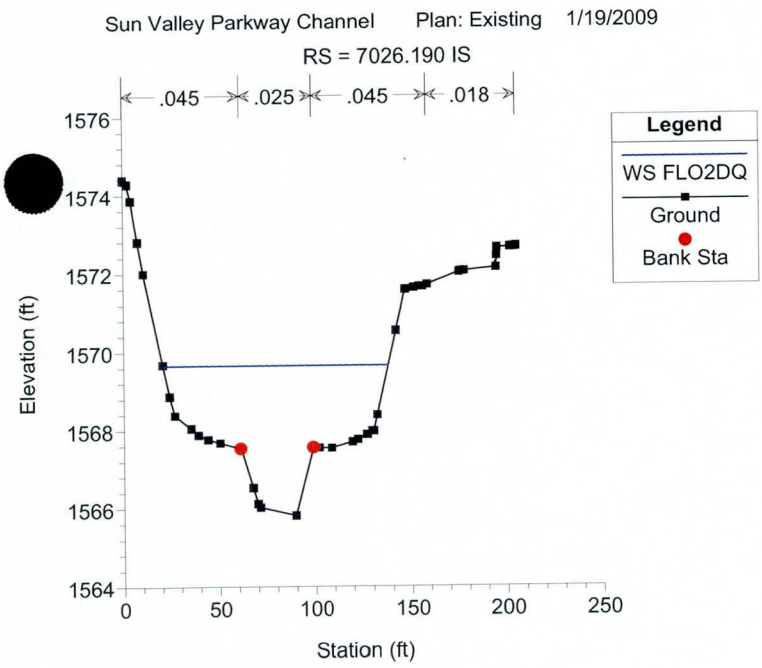
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 7026.190 IS
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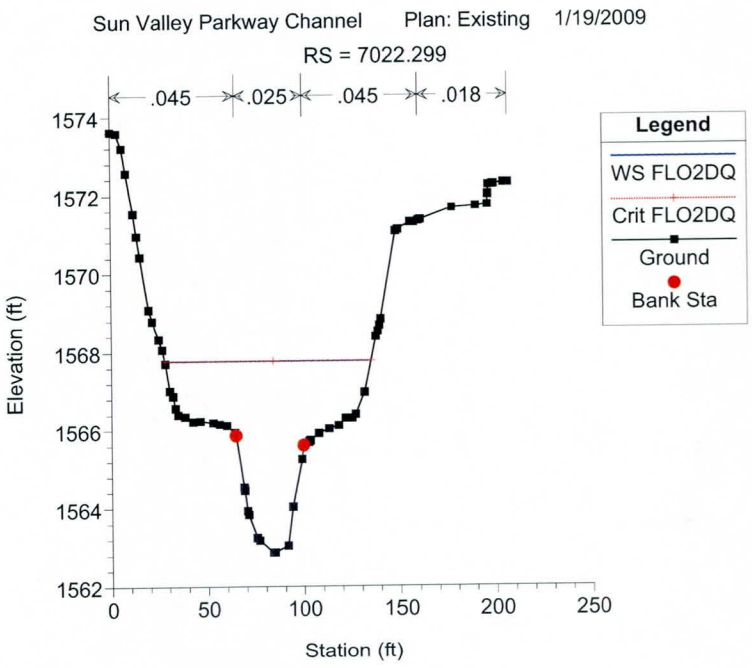
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 7022.299
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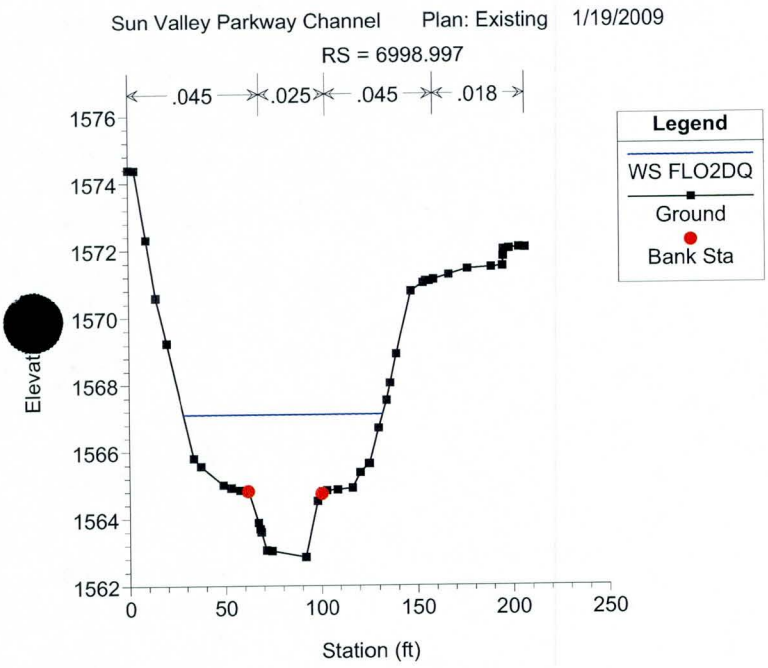
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
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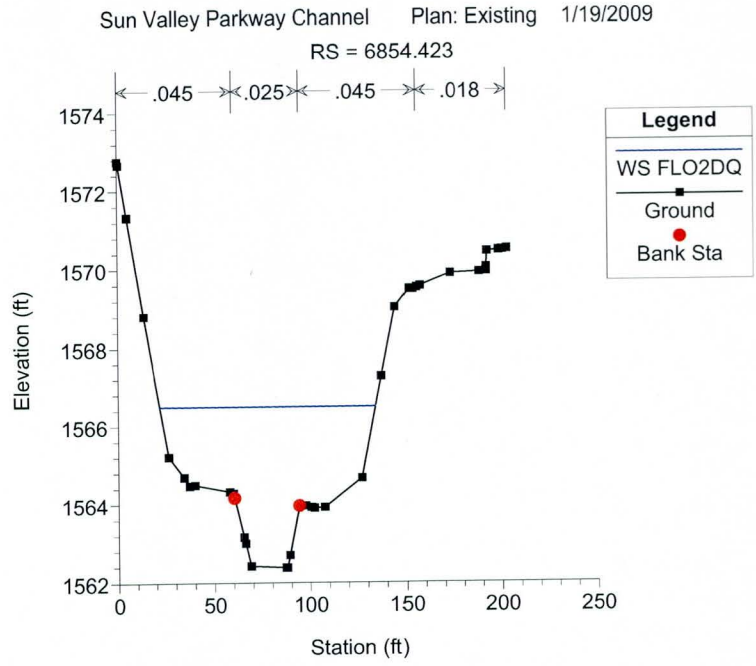
Legend
WS FLO2DQ
Ground
Bank Sta
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 6854.423
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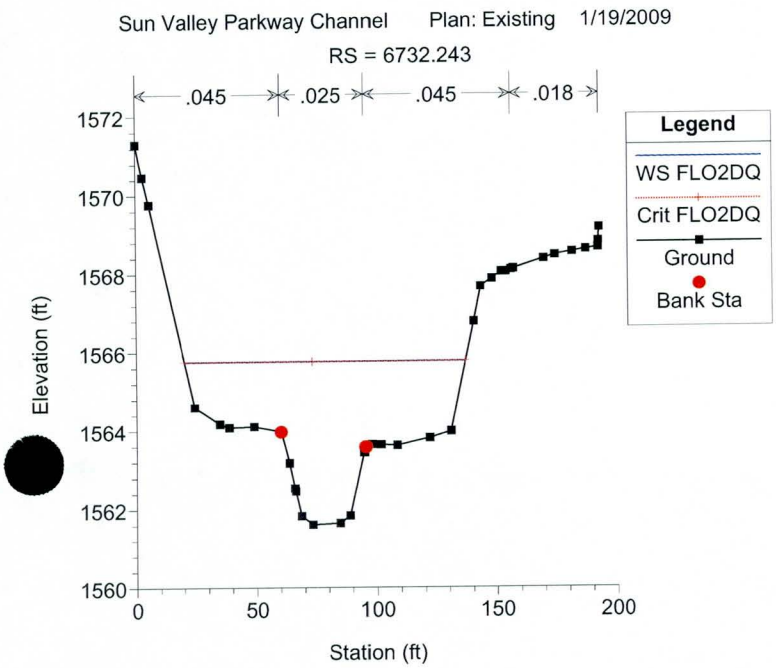
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 6732.243
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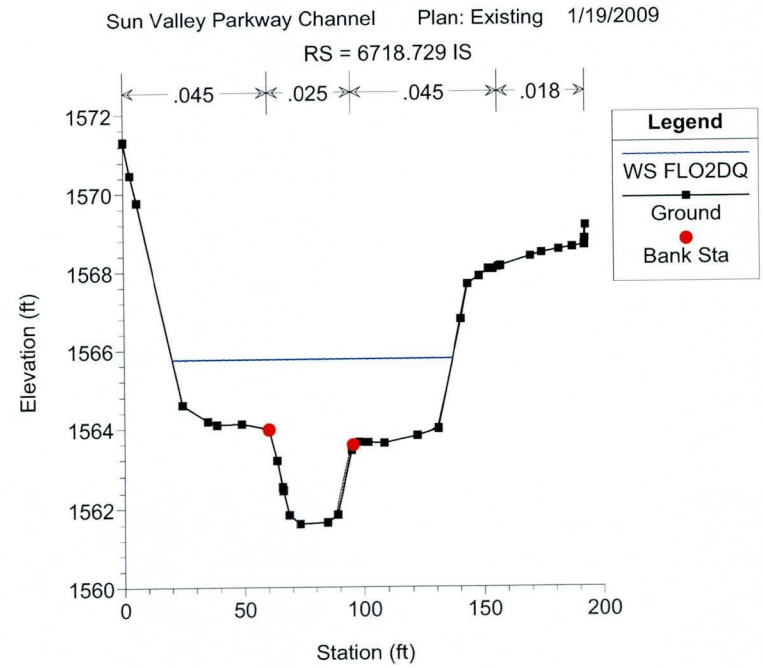
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 6718.729 IS
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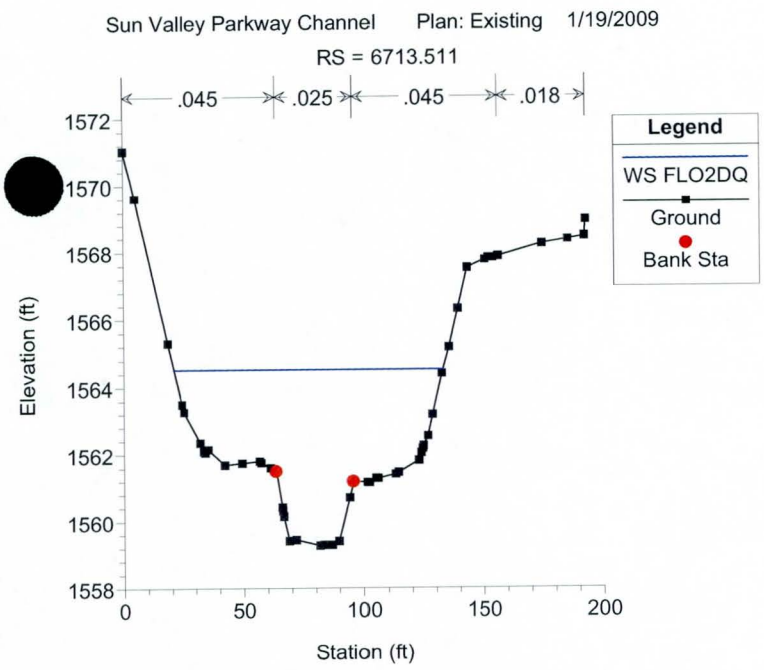
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 6713.511
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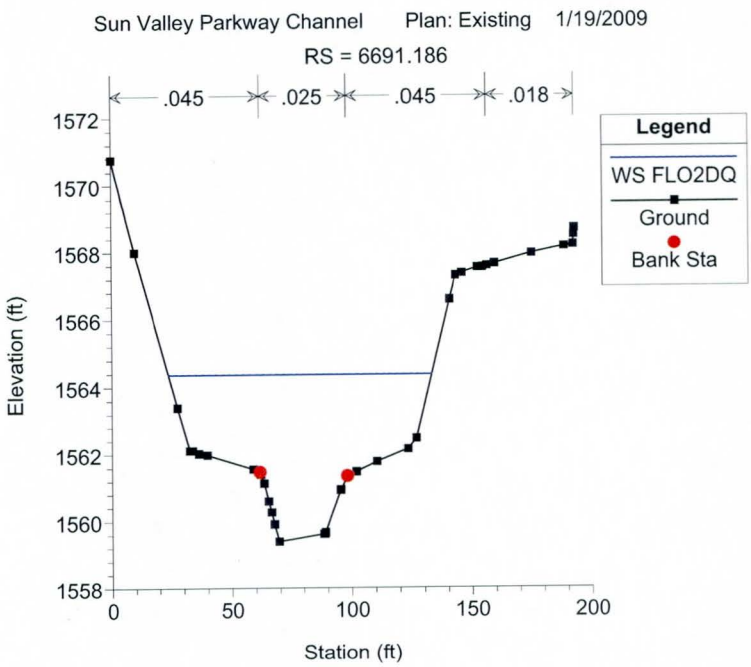
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)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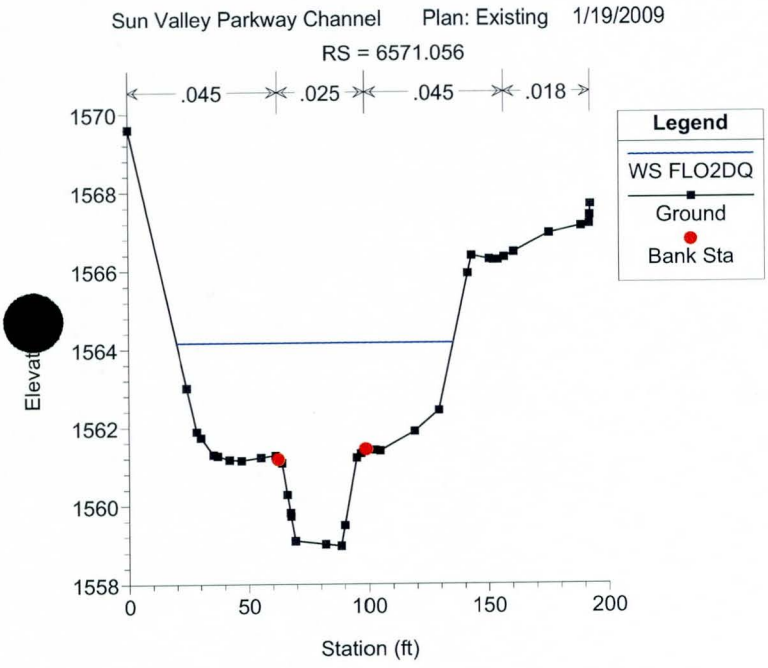
Ground
Bank Sta
Elevation (ft)
Station (ft)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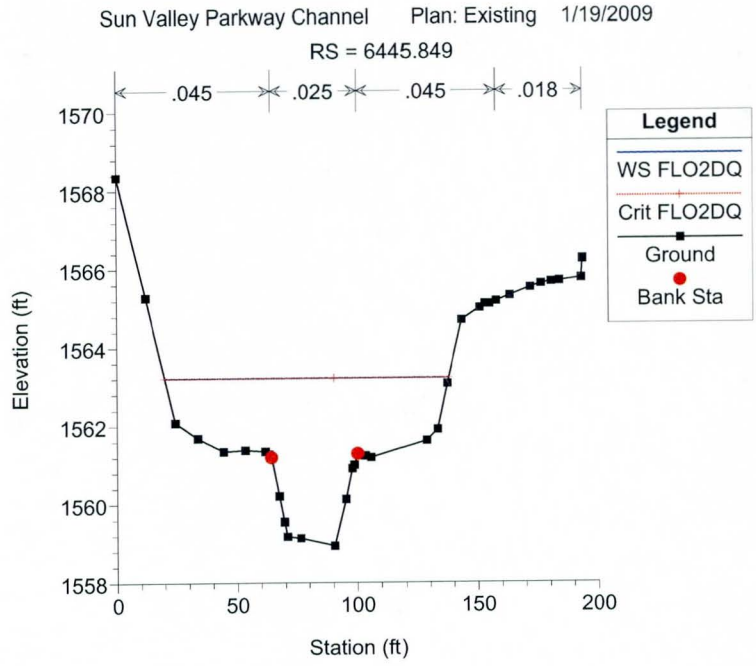
WS FLO2DQ
Ground
Bank Sta
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 6445.849
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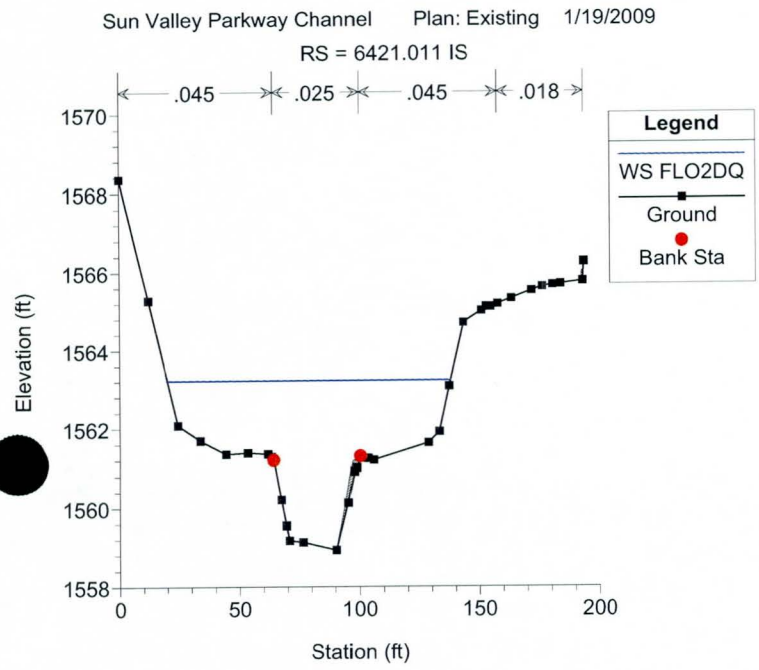
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 6421.011 IS
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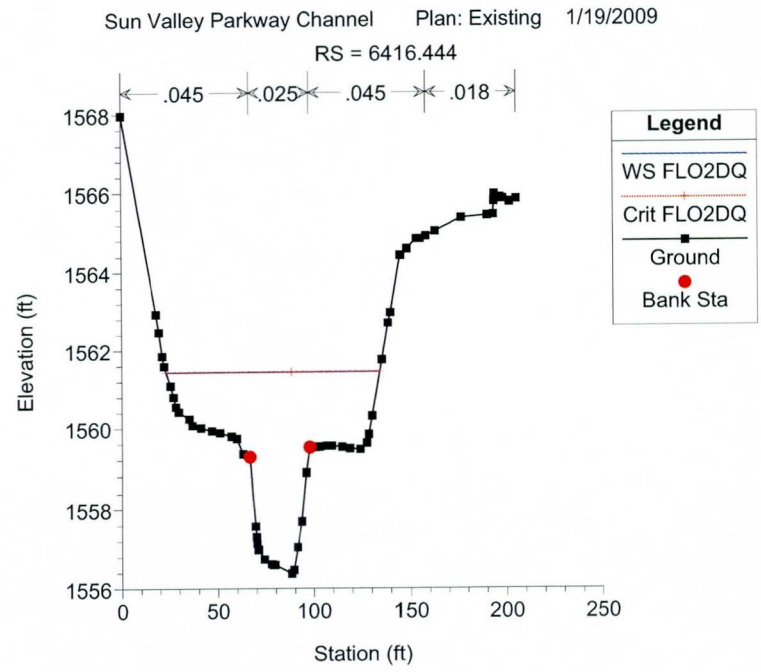
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
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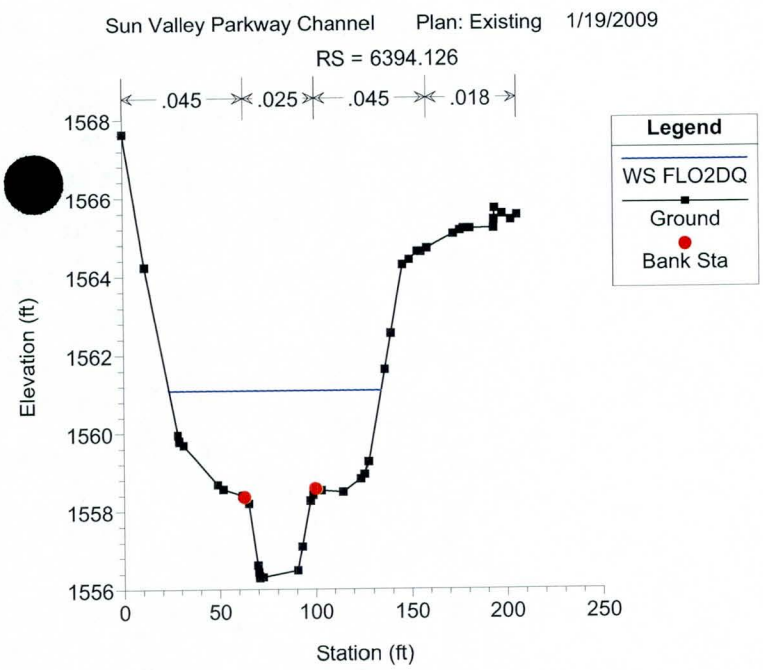
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)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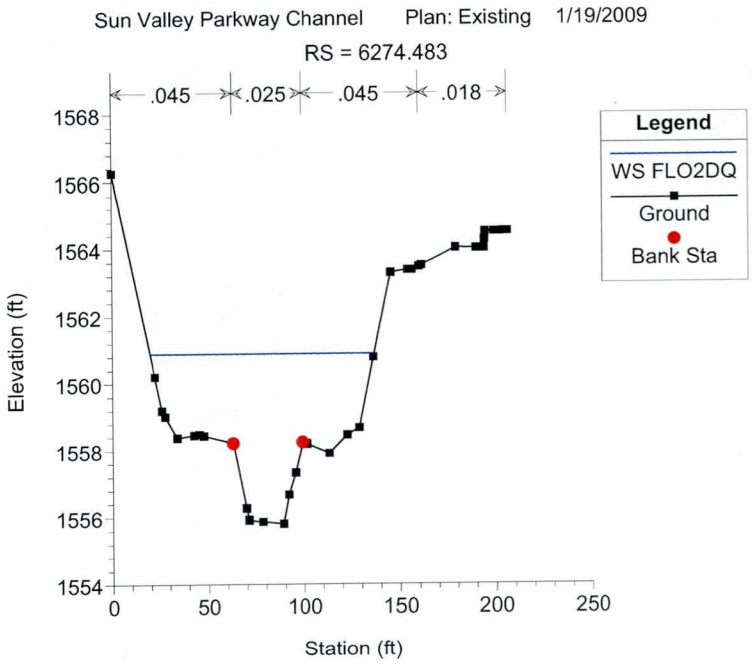
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 6274.483
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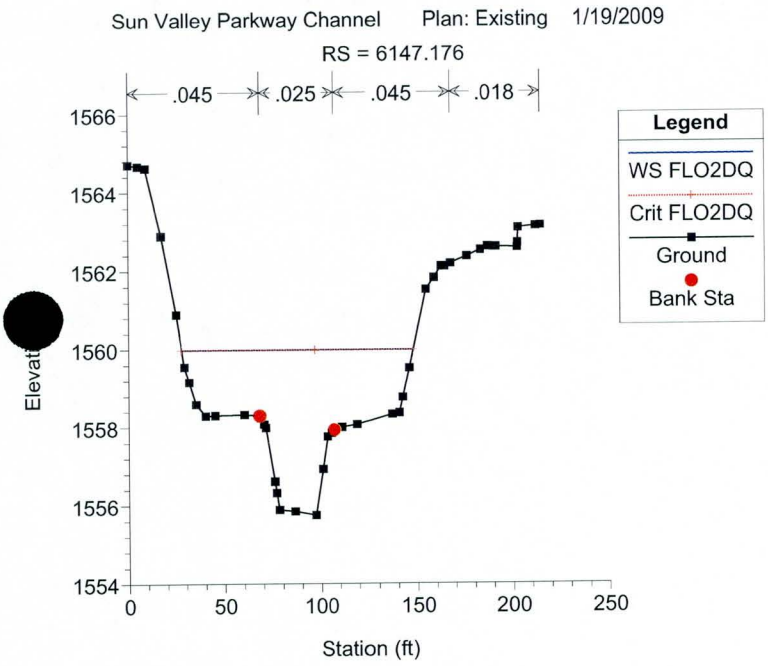
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
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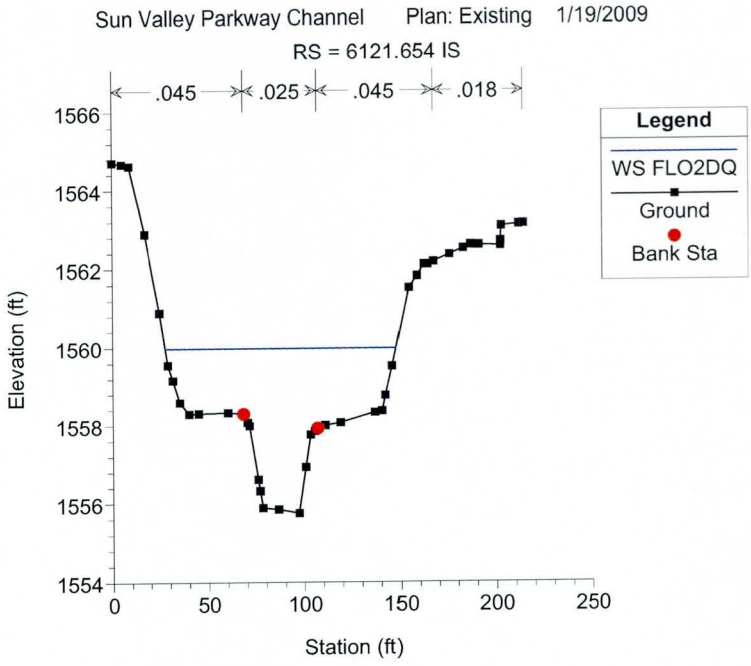
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 6121.654 IS
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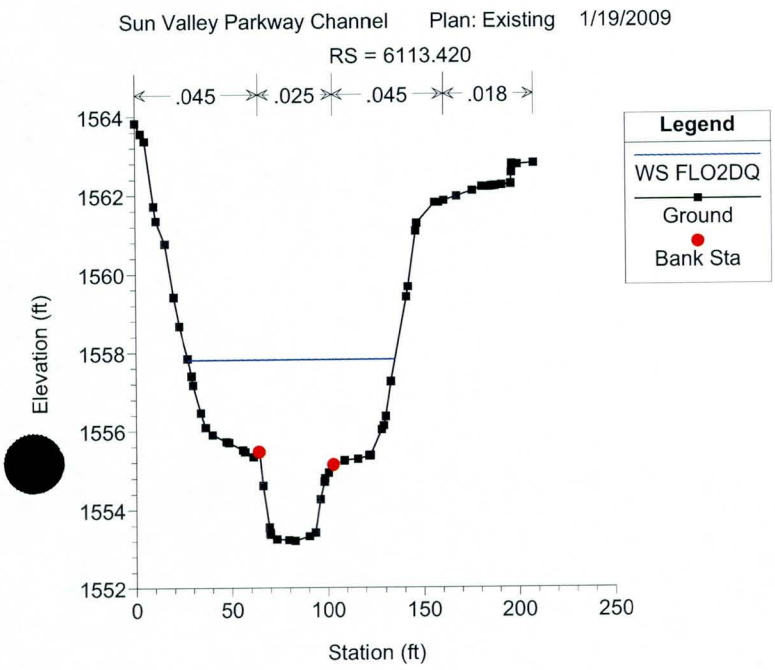
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 6113.420
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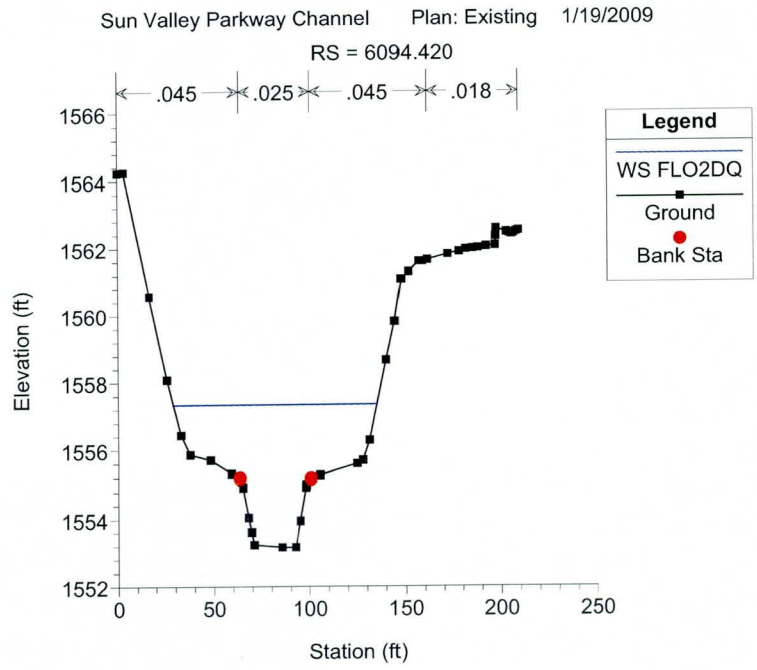
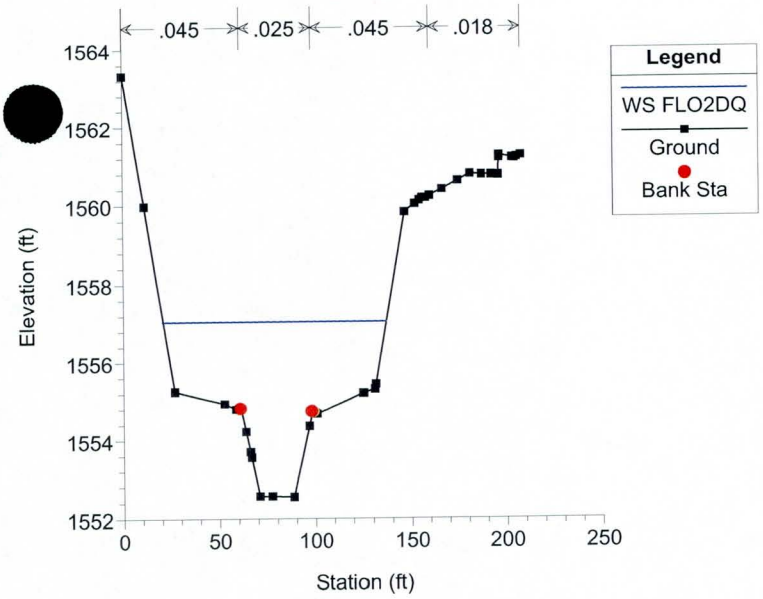
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 6094.420
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

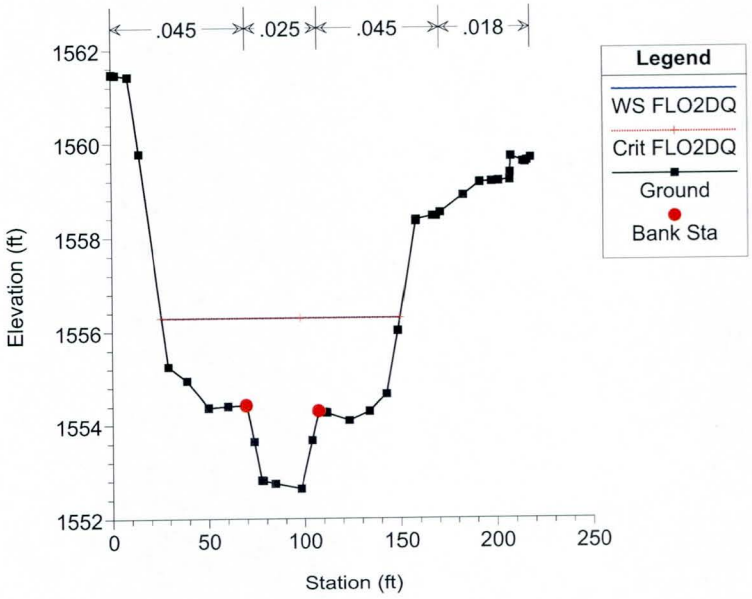
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 5972.070



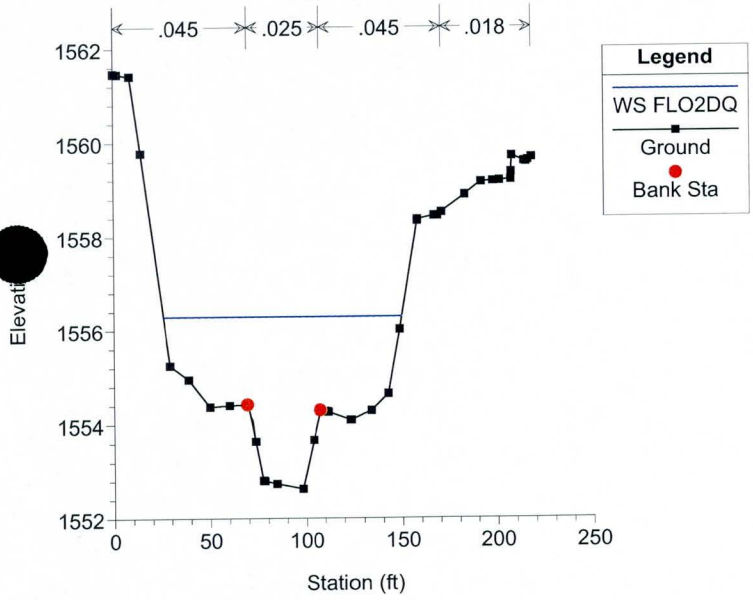
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 5841.366



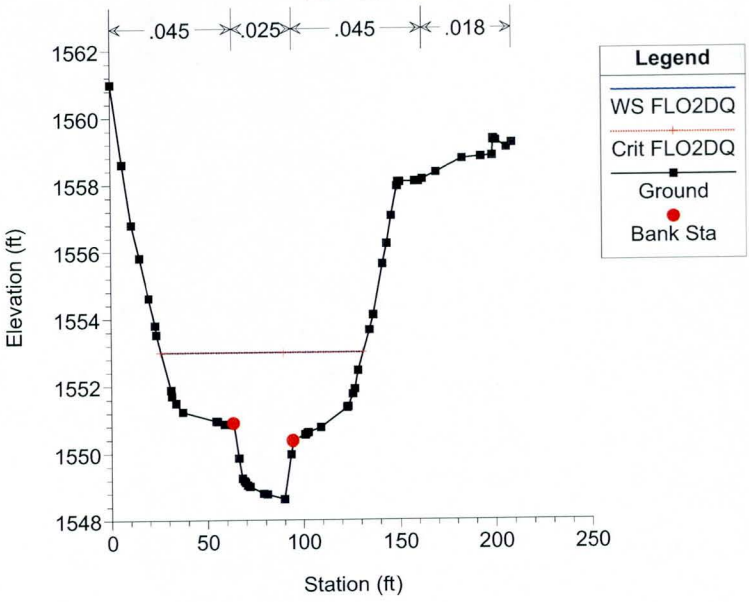
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 5820.431 IS



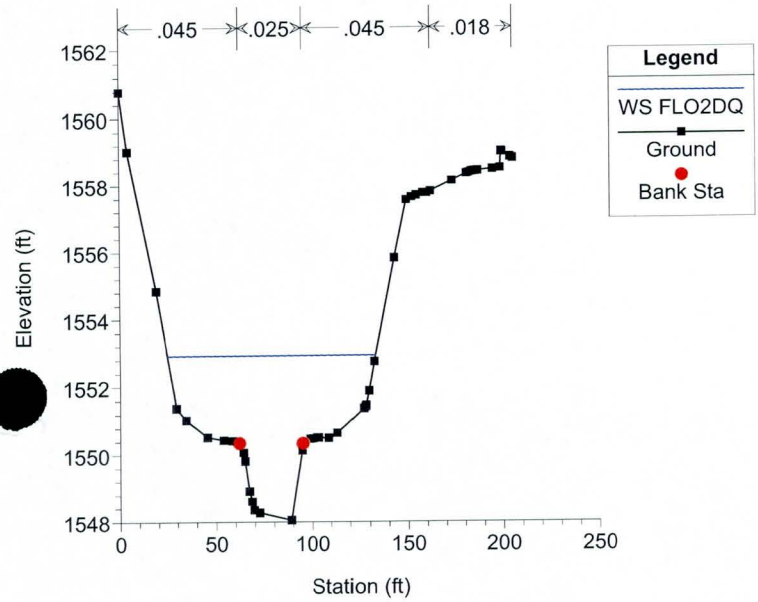
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 5812.631



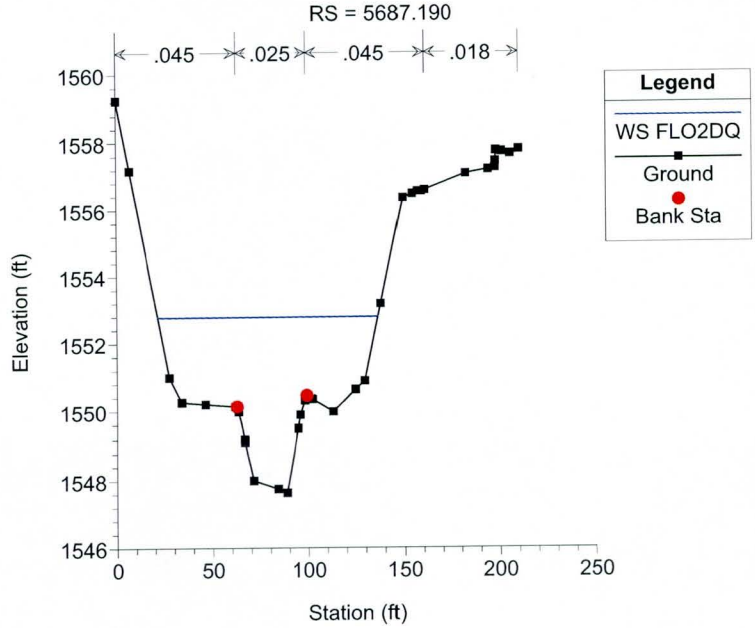
Sun Valley Parkway Channel Plan: Existing 1/19/2009

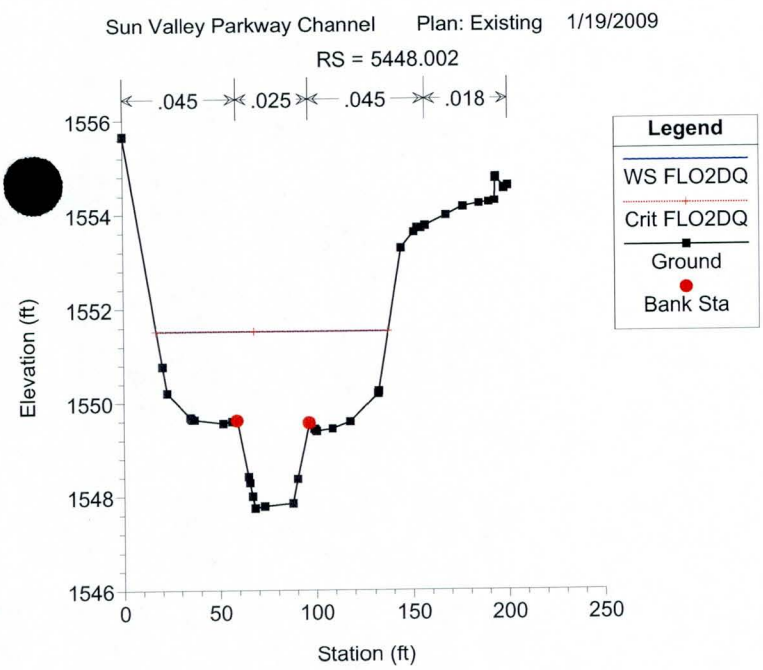
RS = 5786.387

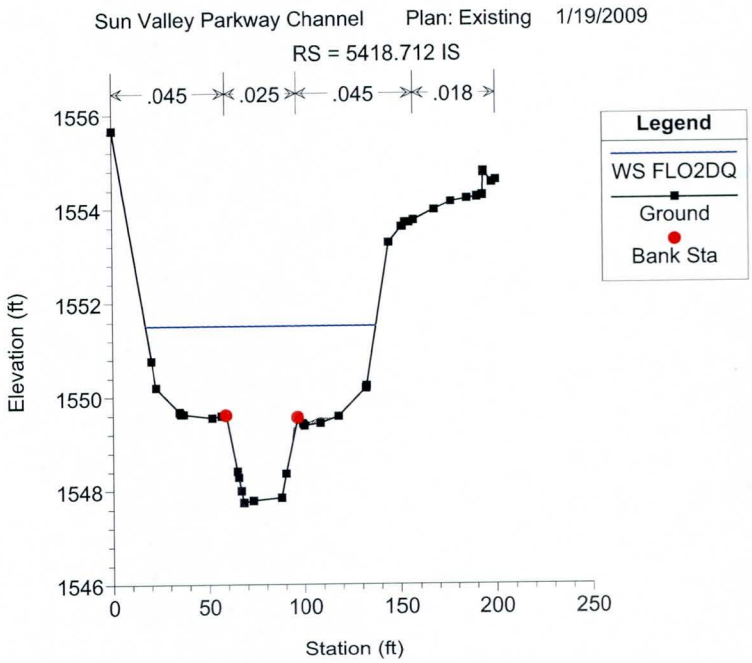


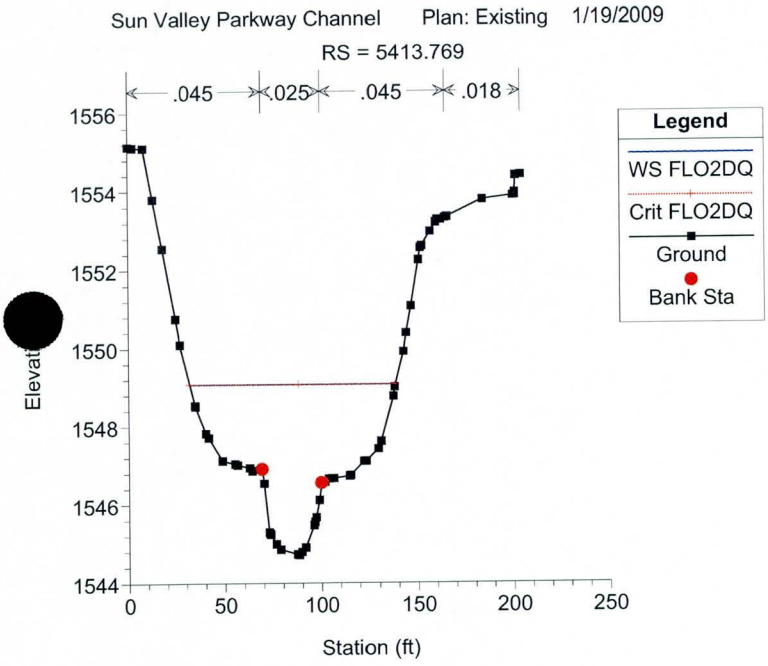
Sun Valley Parkway Channel Plan: Existing 1/19/2009

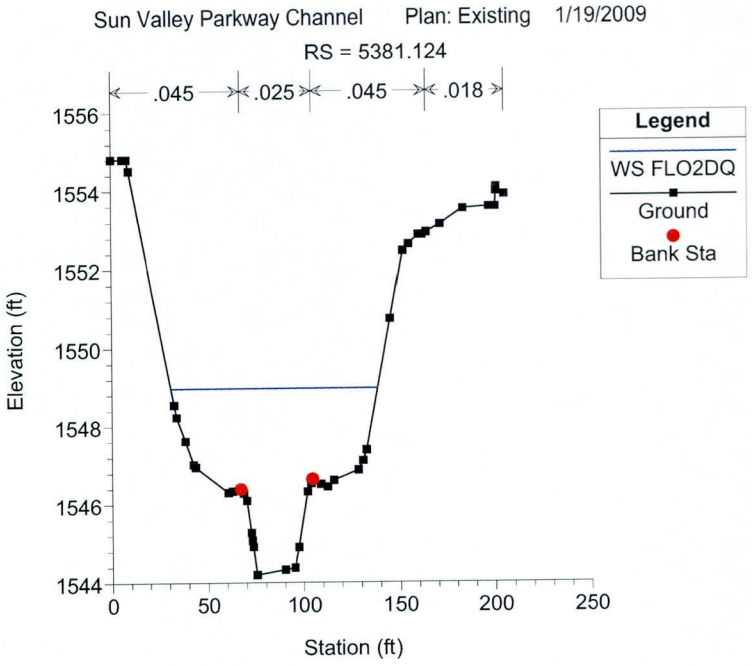
RS = 5687.190

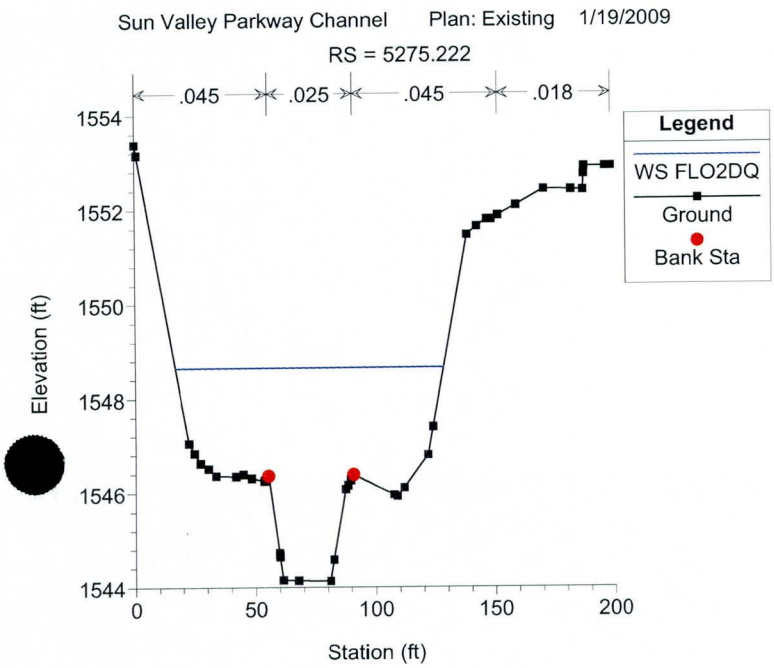


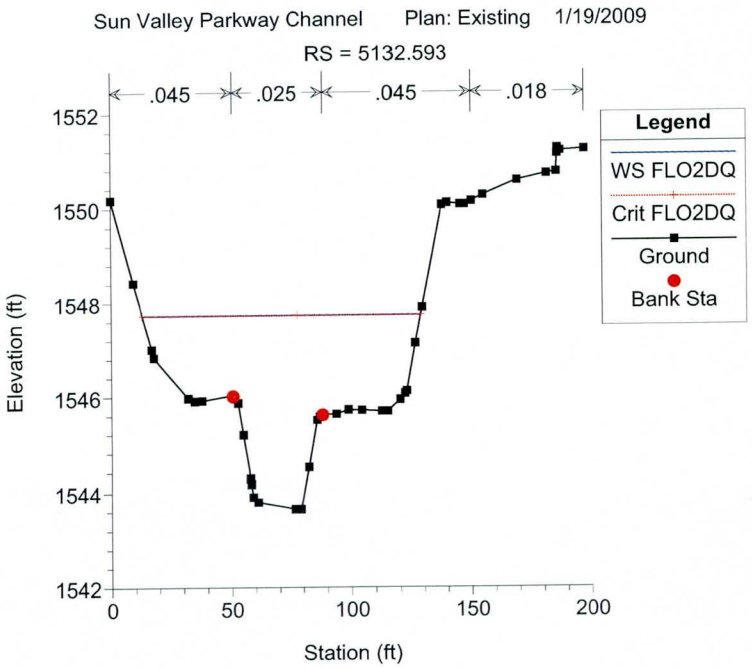

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 5448.002
.045 .025 .045 .018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

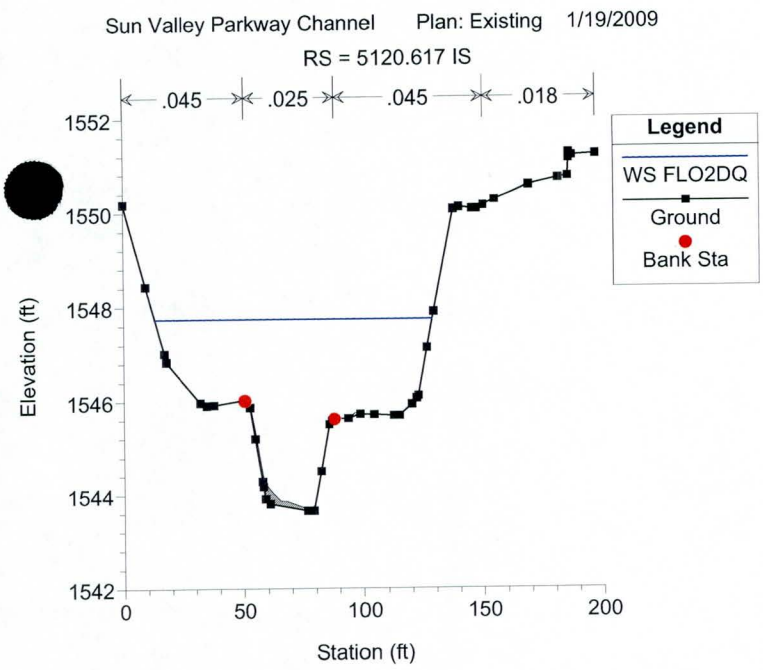

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 5418.712 IS
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

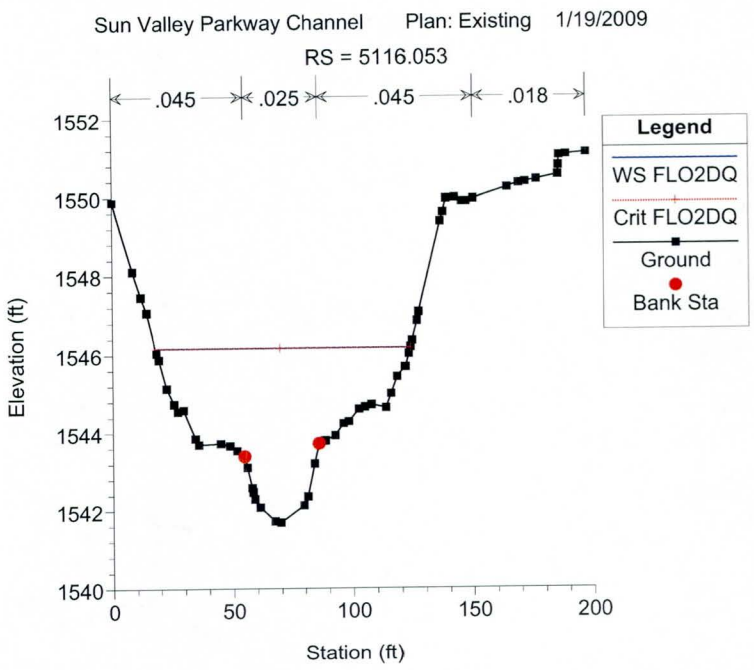

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 5413.769
.045 .025 .045 .018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Station (ft)

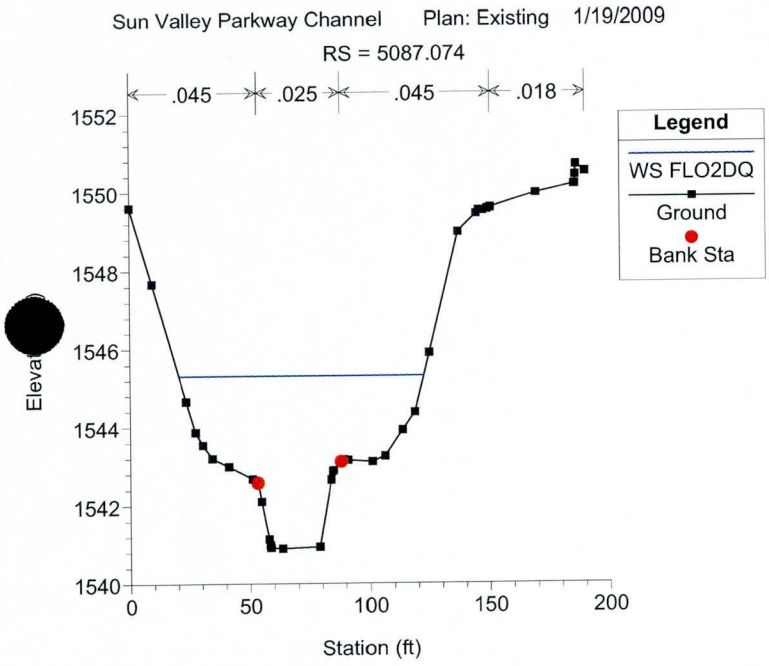

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 5381.124
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

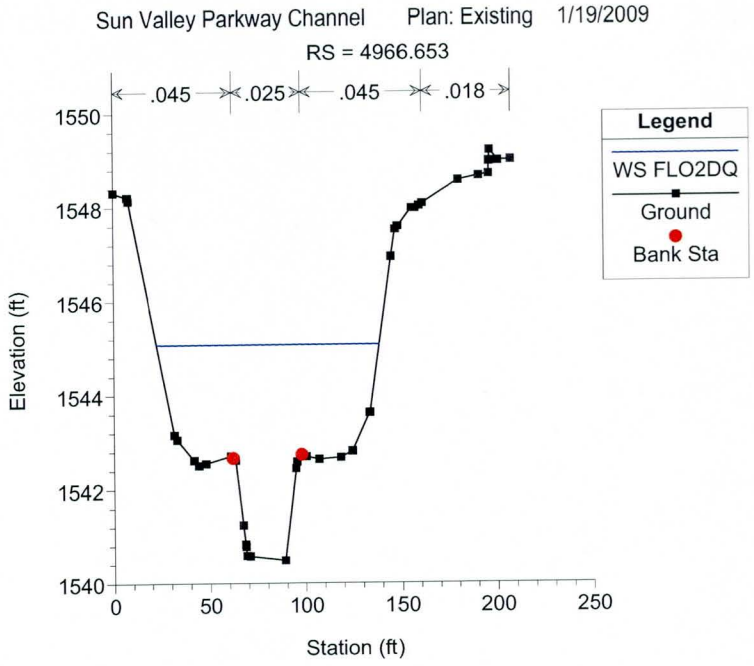

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 5275.222
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

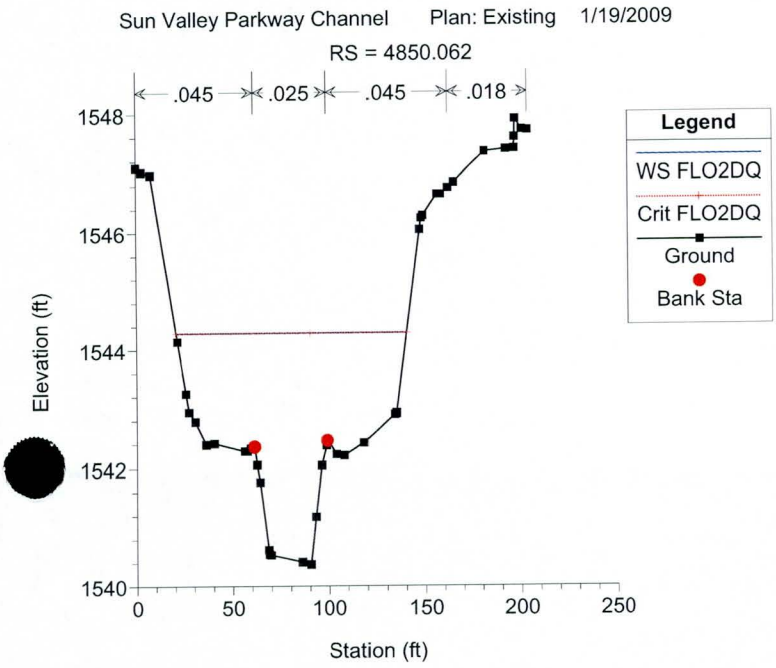

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 5132.593
.045 .025 .045 .018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

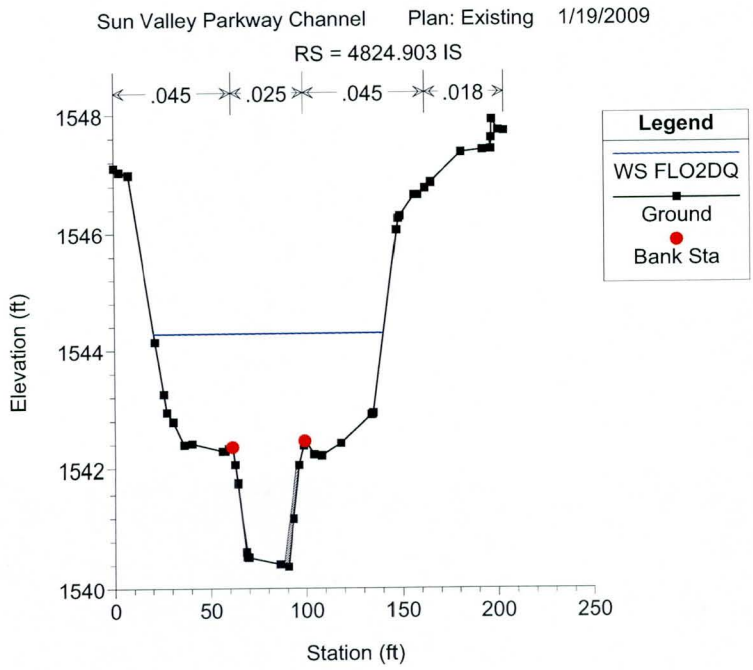

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 5120.617 IS
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 5116.053
.045 .025 .045 .018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 5087.074
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Station (ft)

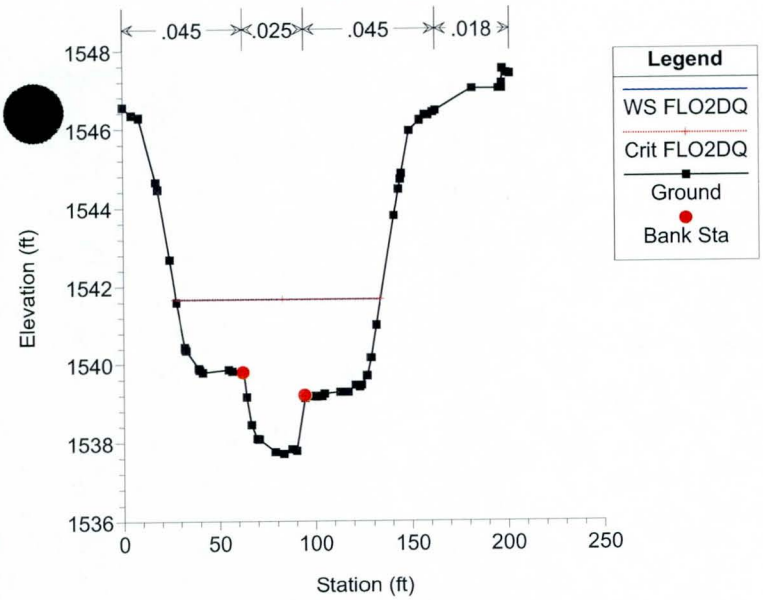

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 4966.653
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 4850.062
.045 .025 .045 .018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 4824.903 IS
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

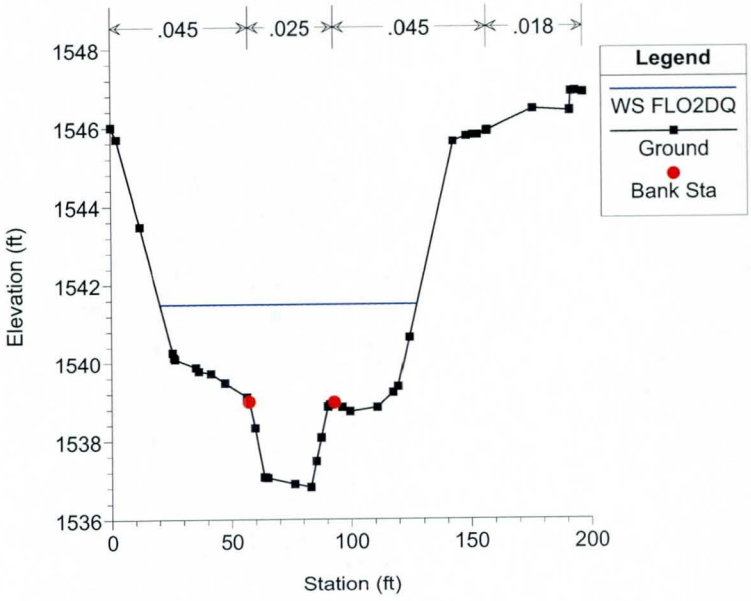
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 4818.556



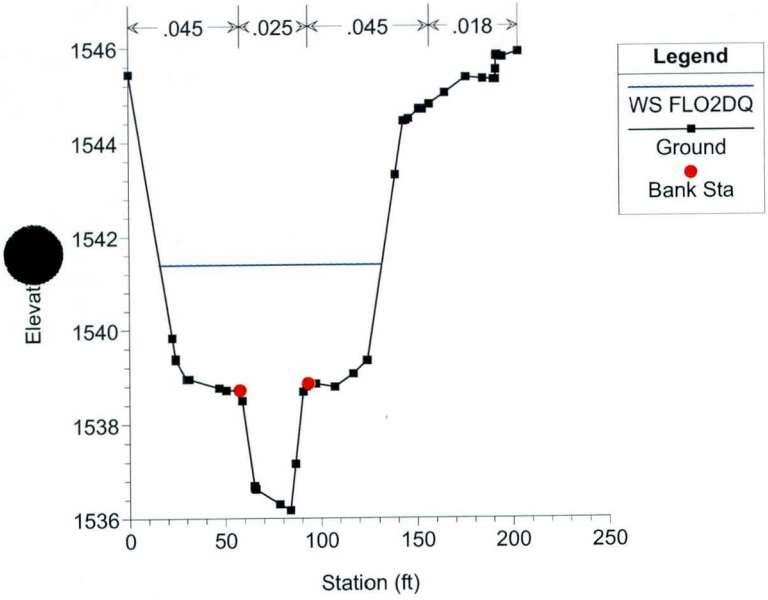
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 4770.290



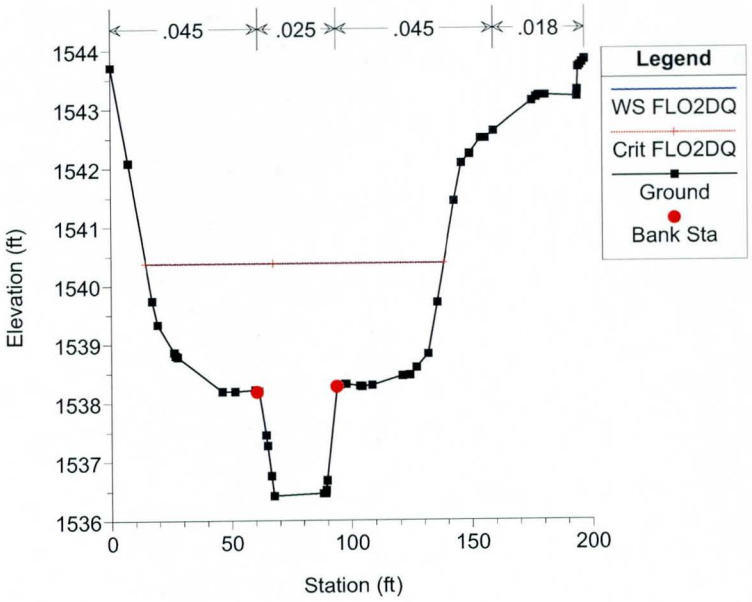
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 4683.298



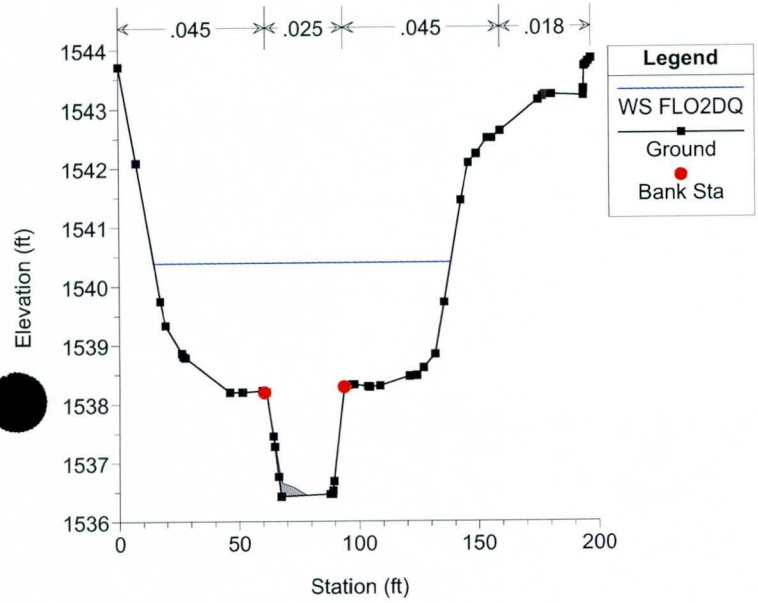
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 4509.527



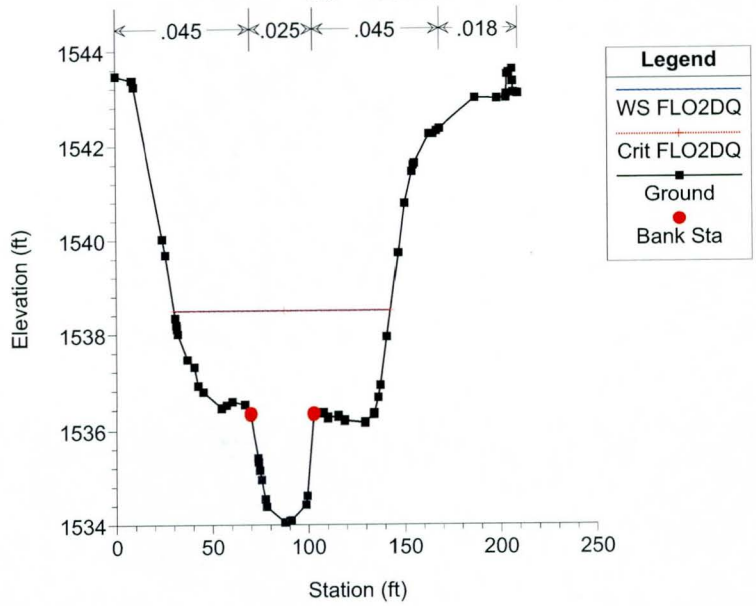
Sun Valley Parkway Channel Plan: Existing 1/19/2009

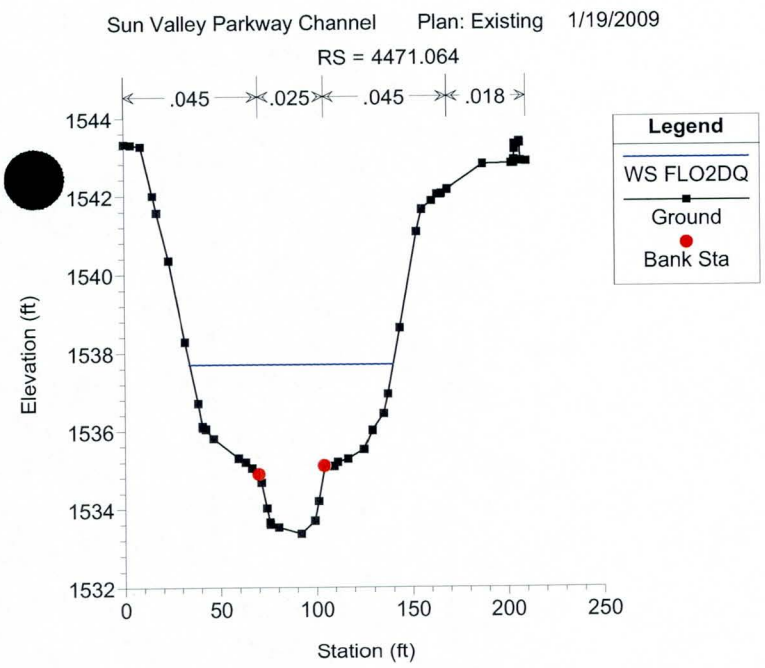
RS = 4494.152 IS

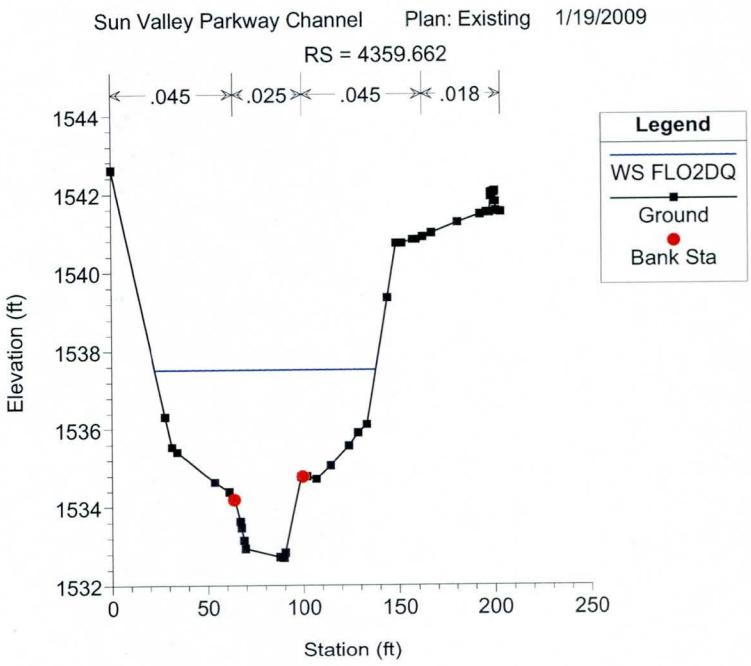


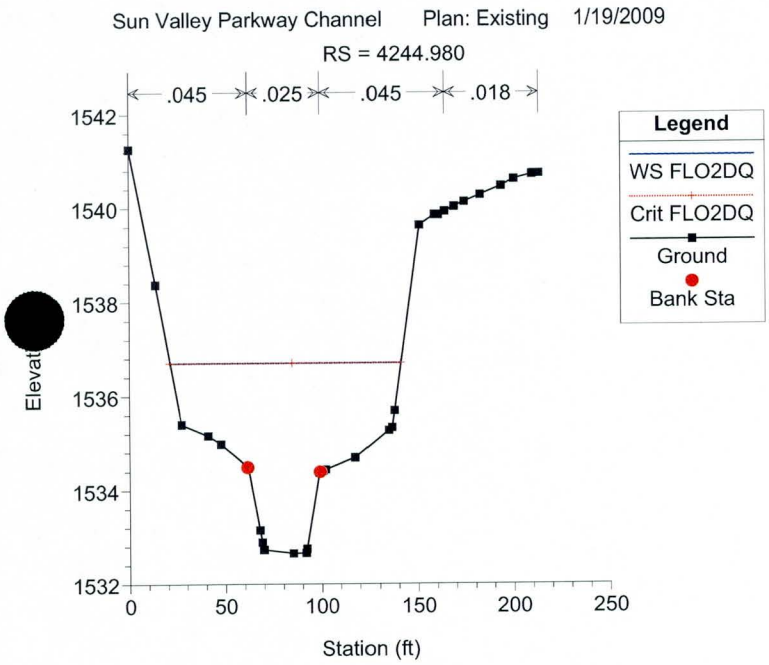
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 4488.645




Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 4471.064
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 4359.662
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 4244.980
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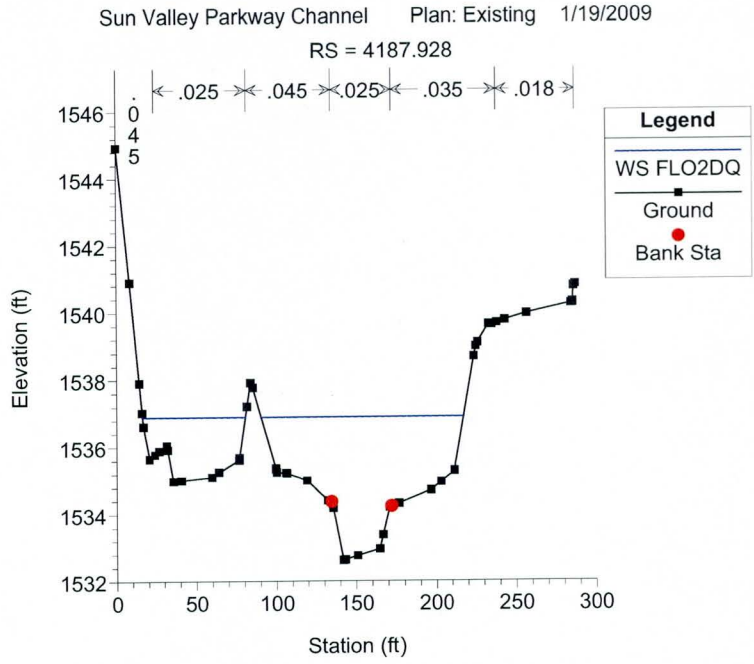
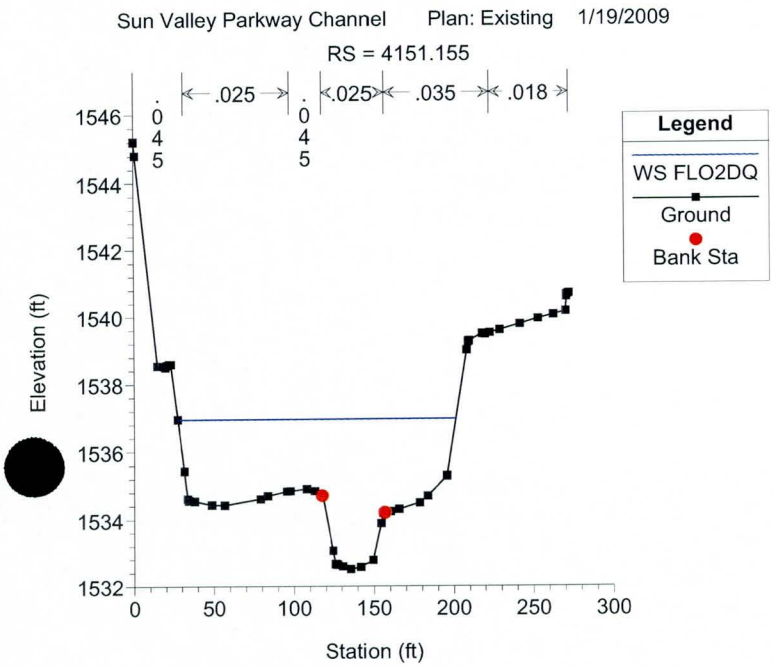
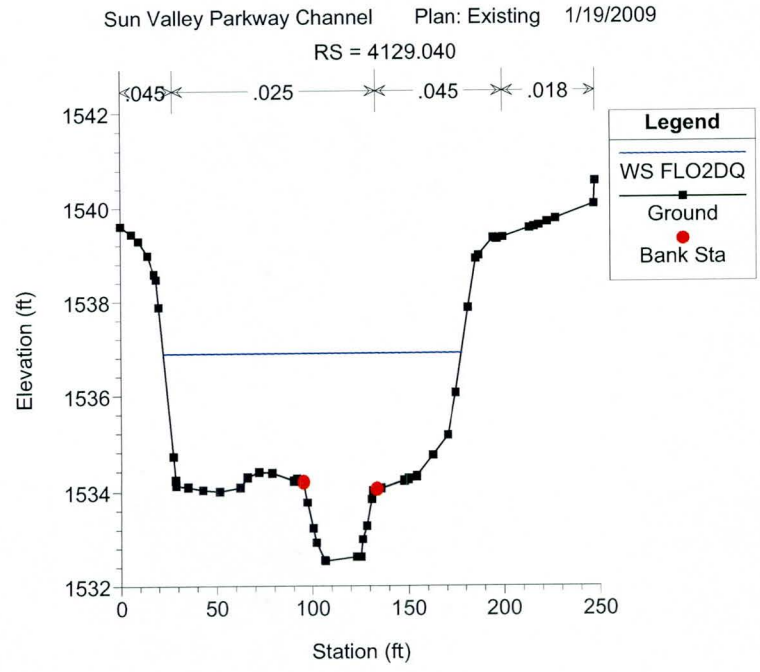
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Station (ft)

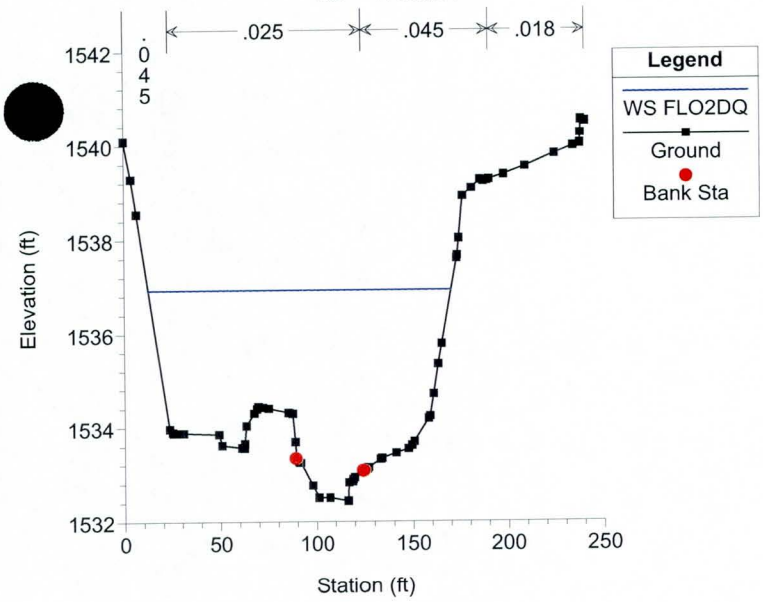

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 4187.928
.045 .025 .045 .025 .035 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 4151.155
.045 .025 .045 .025 .035 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 4129.040
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

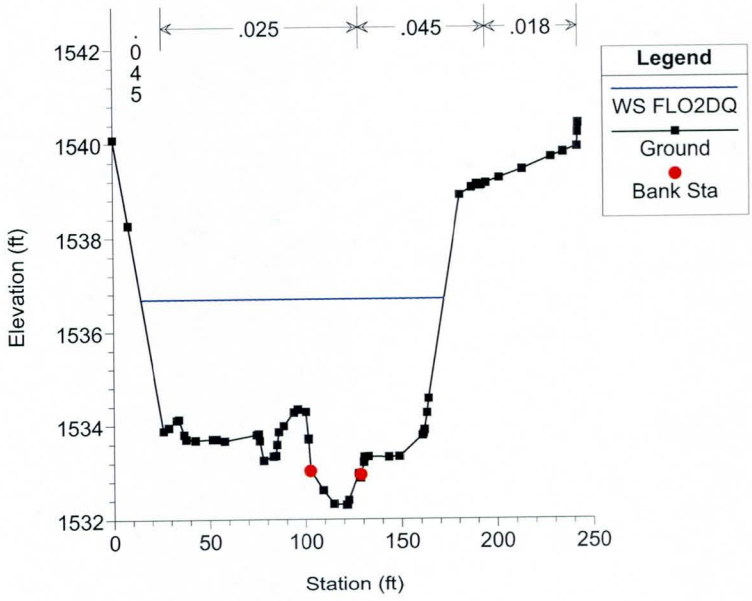
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 4115.484



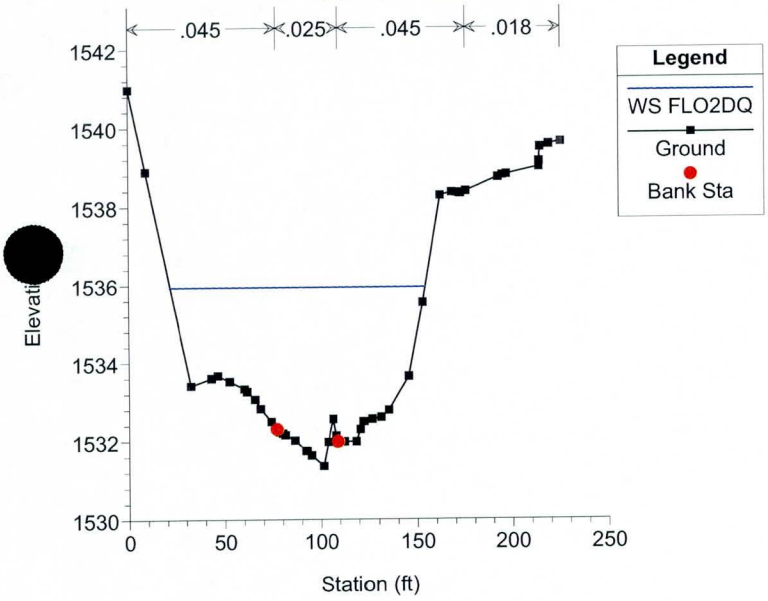
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 4094.117



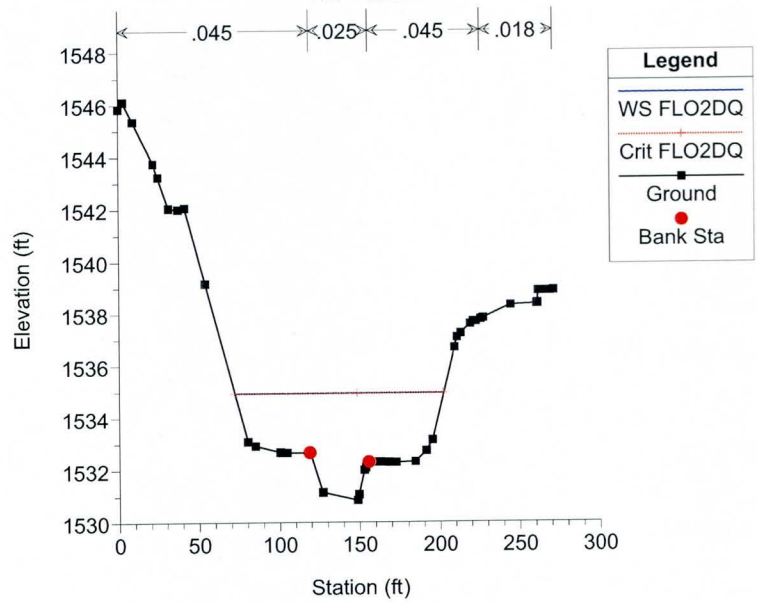
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 3972.552



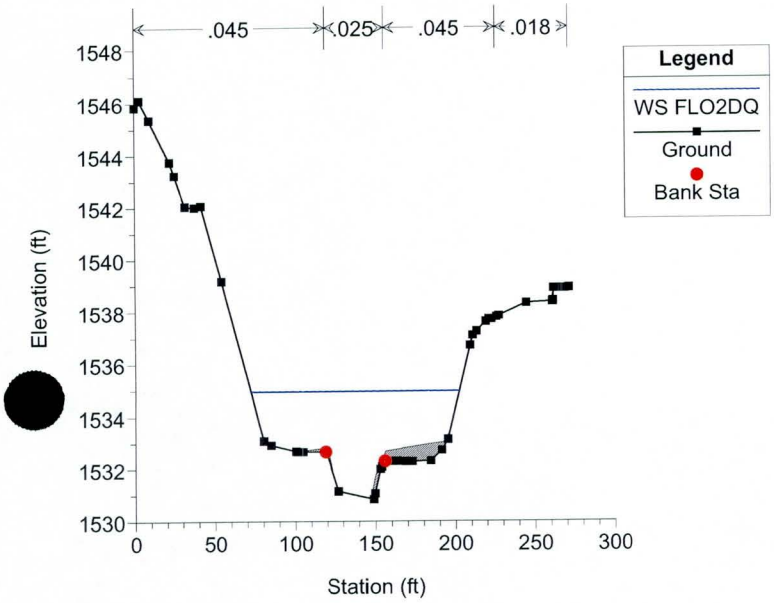
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 3852.914



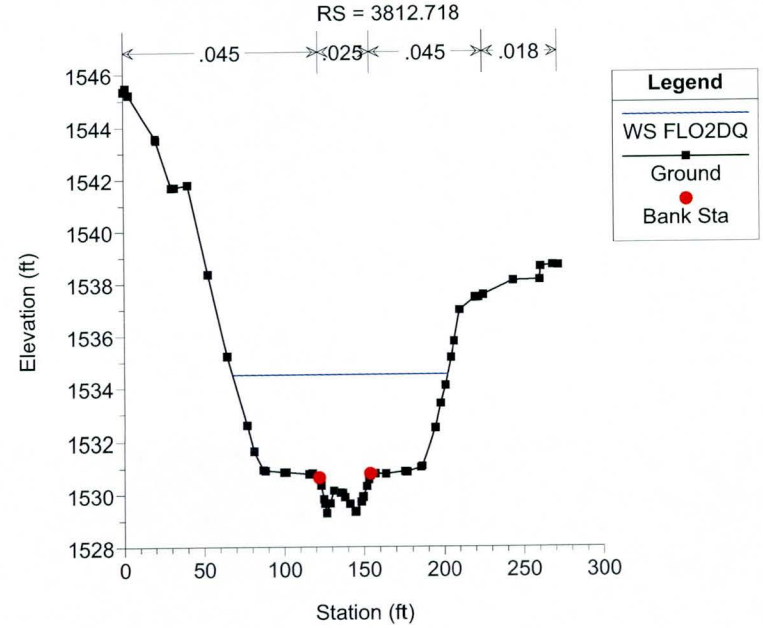
Sun Valley Parkway Channel Plan: Existing 1/19/2009

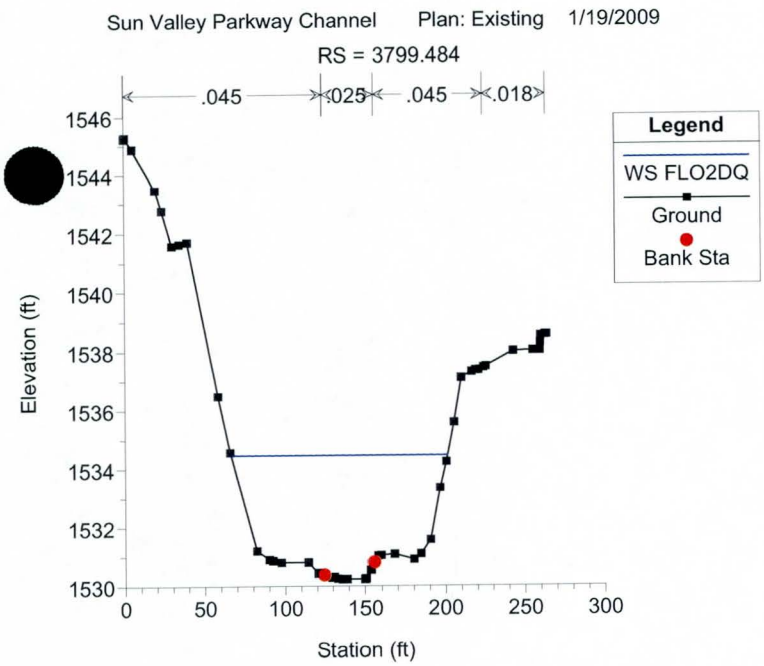
RS = 3816.660 IS

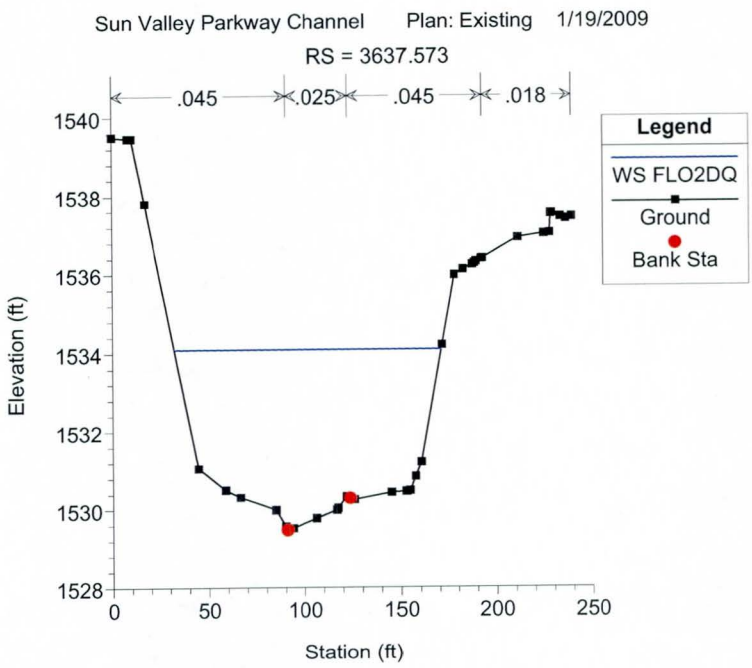


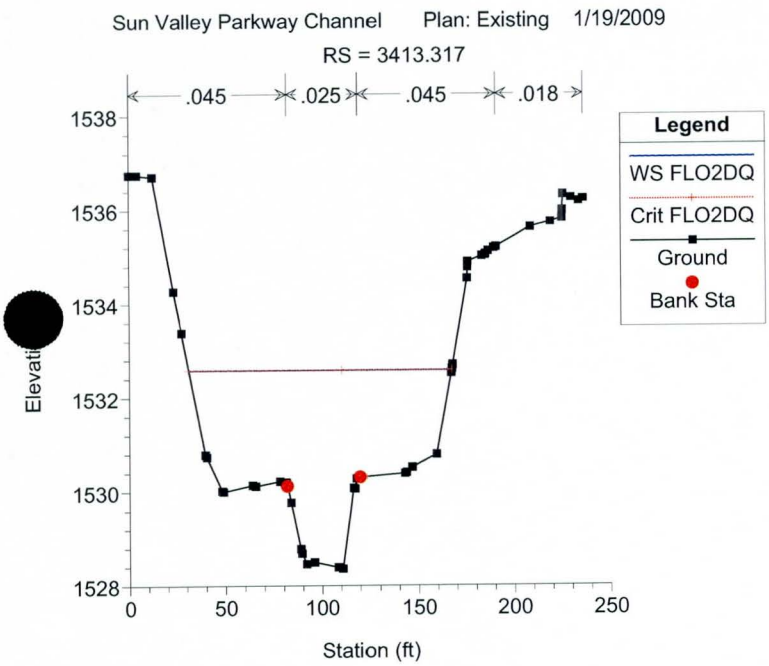
Sun Valley Parkway Channel Plan: Existing 1/19/2009

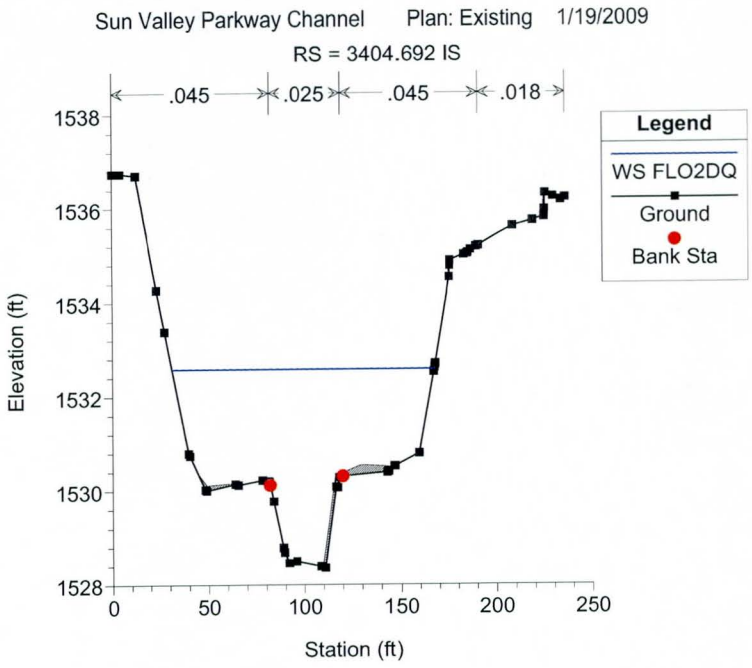
RS = 3812.718

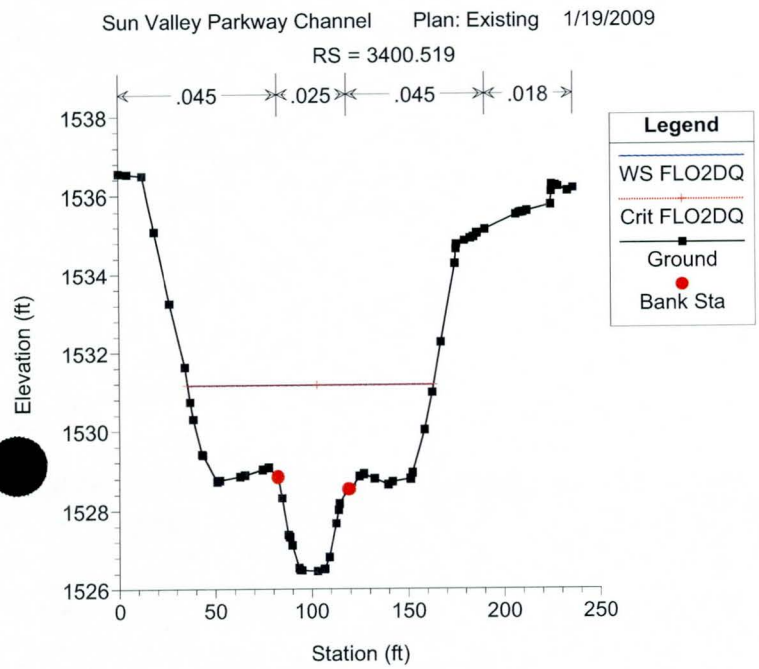


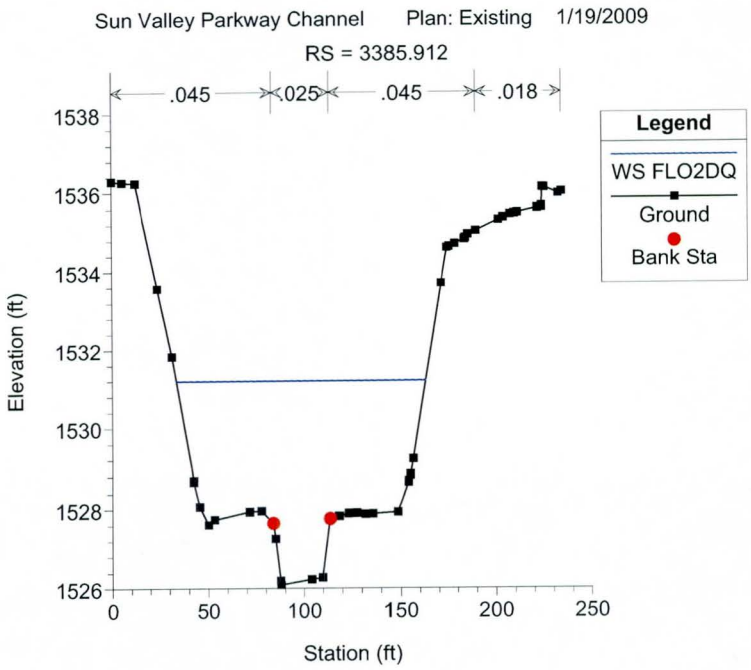

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 3799.484
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 3637.573
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 3413.317
.045 .025 .045 .018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Station (ft)

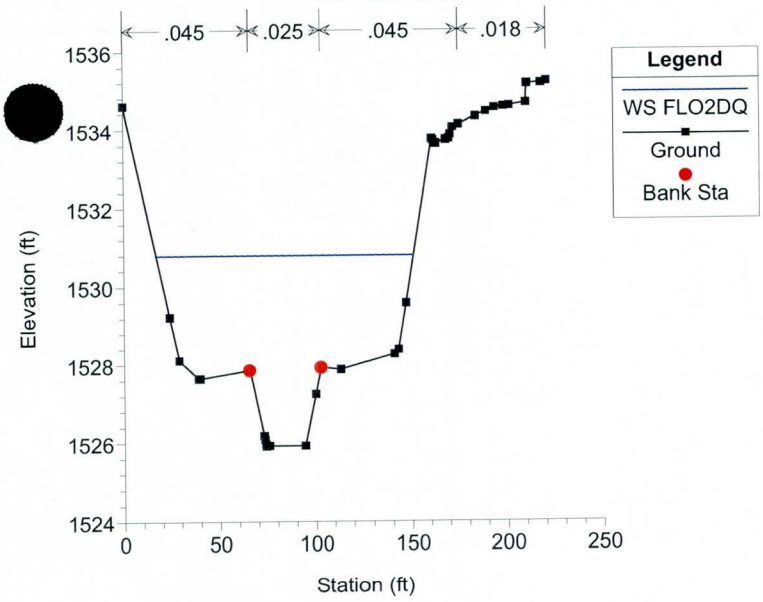

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 3404.692 IS
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 3400.519
.045 .025 .045 .018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 3385.912
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

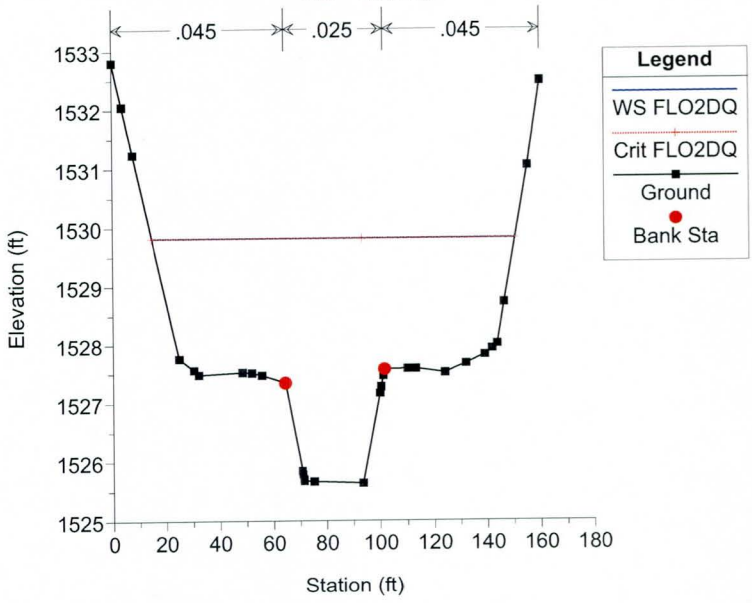
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 3276.504



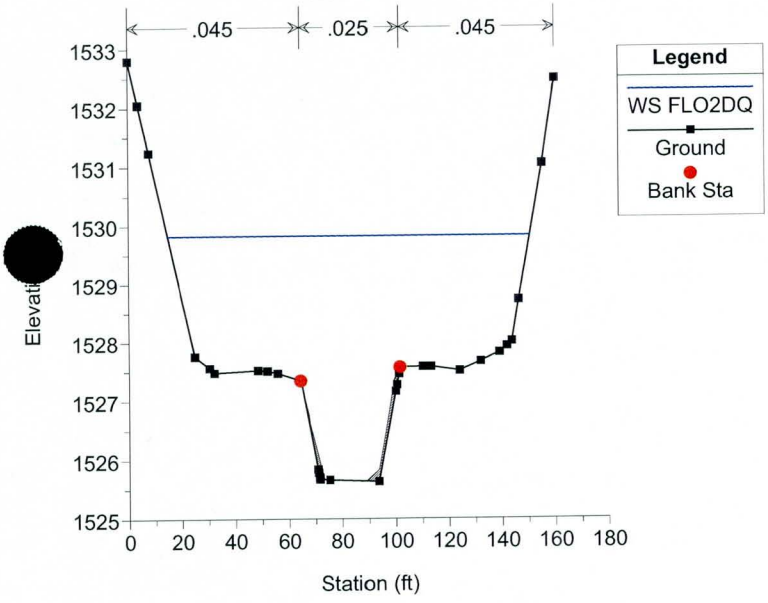
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 3141.353



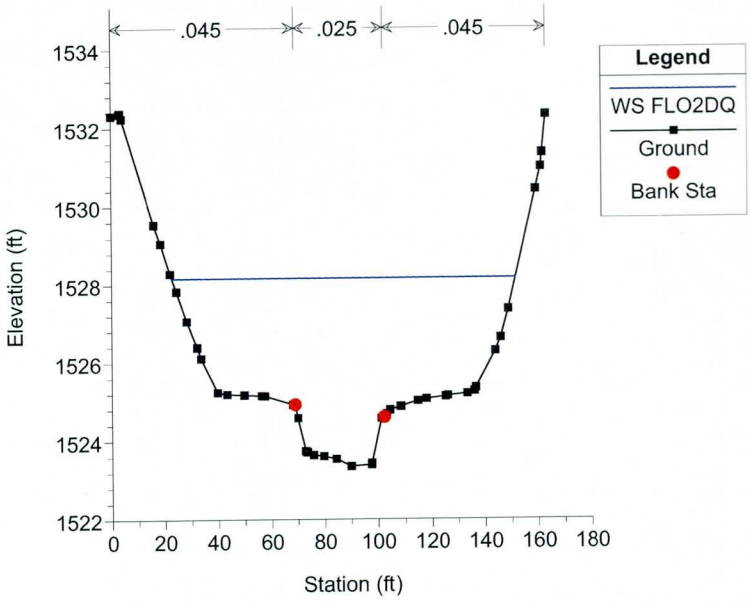
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 3116.898 IS



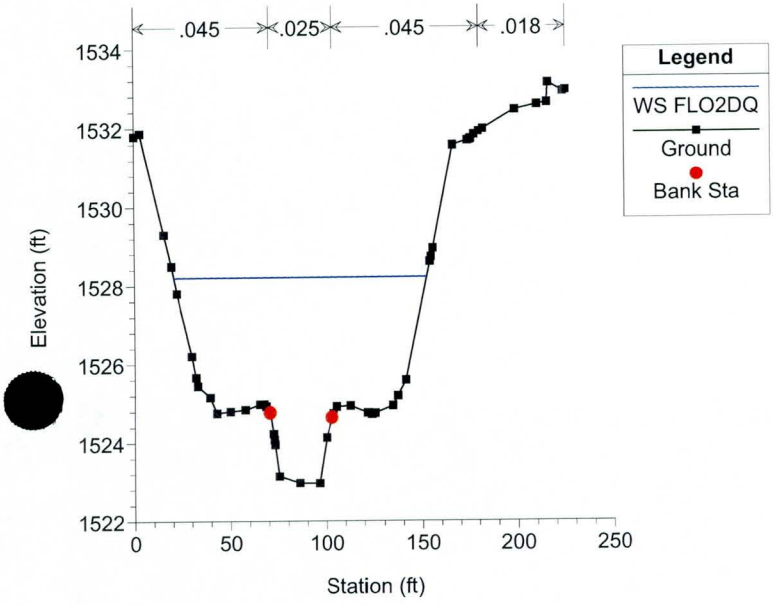
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 3110.386



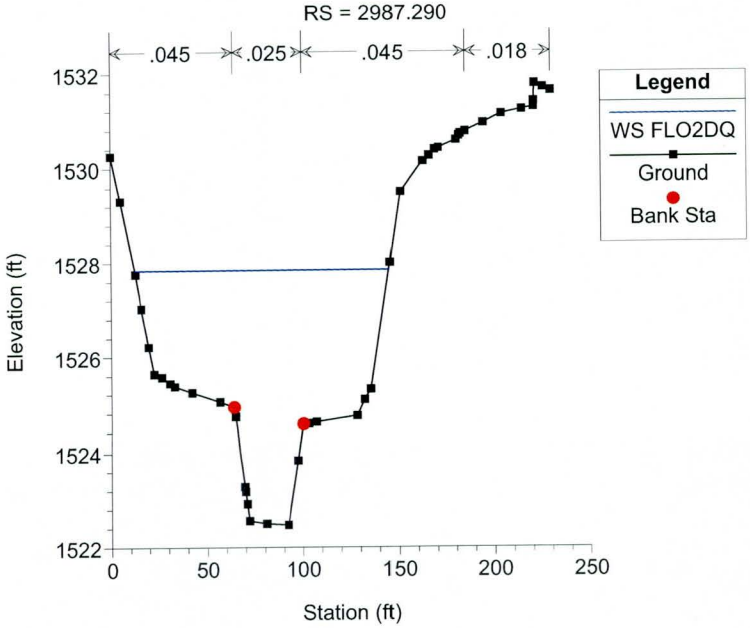
Sun Valley Parkway Channel Plan: Existing 1/19/2009

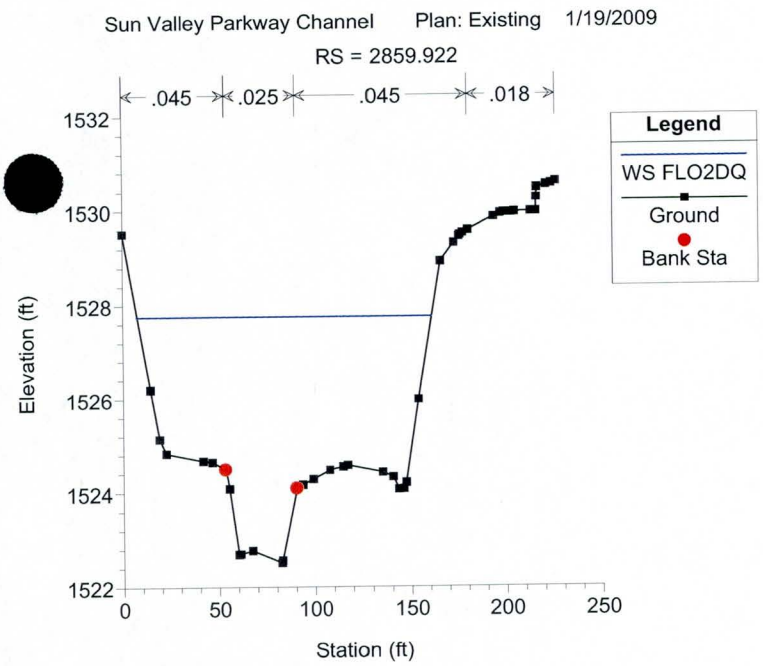
RS = 3085.983

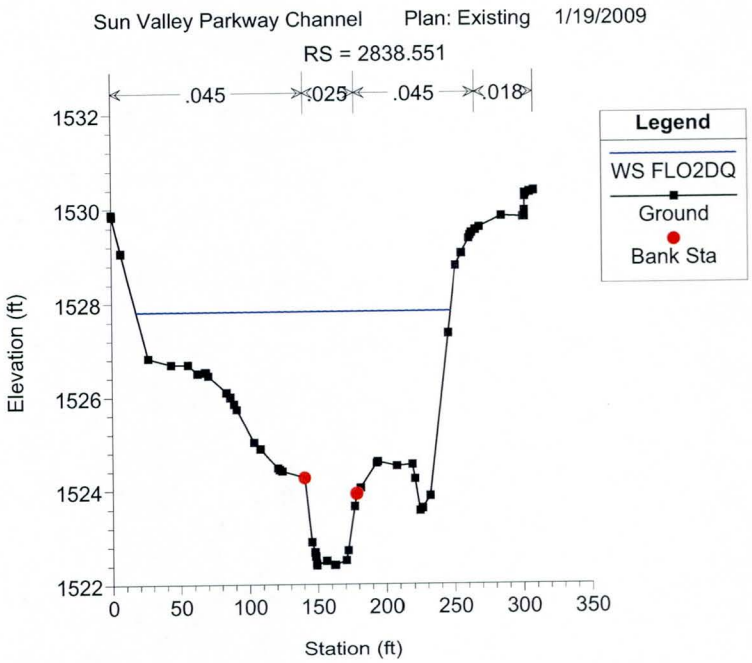


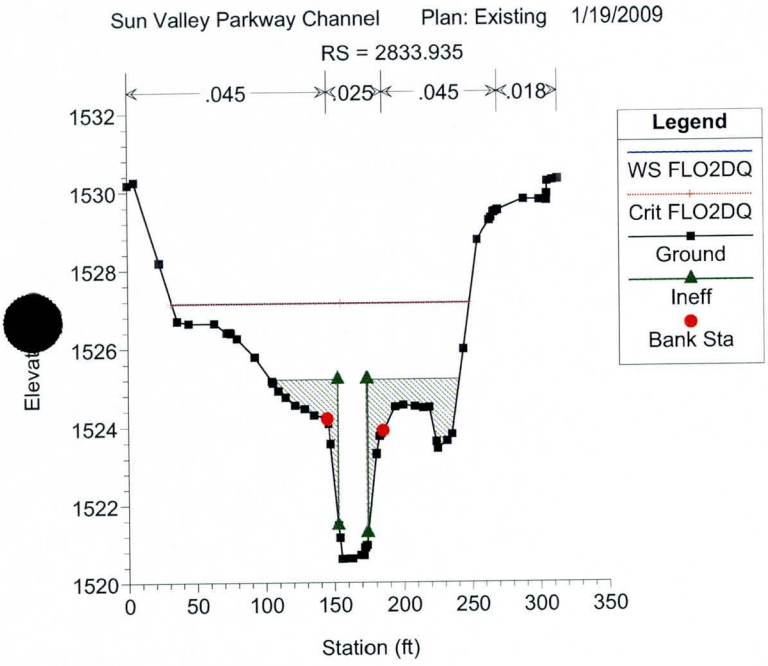
Sun Valley Parkway Channel Plan: Existing 1/19/2009

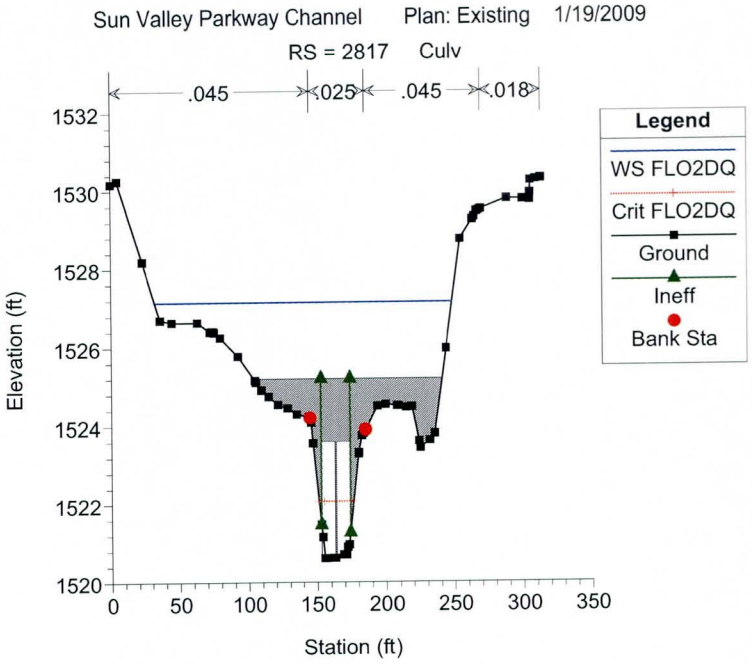
RS = 2987.290

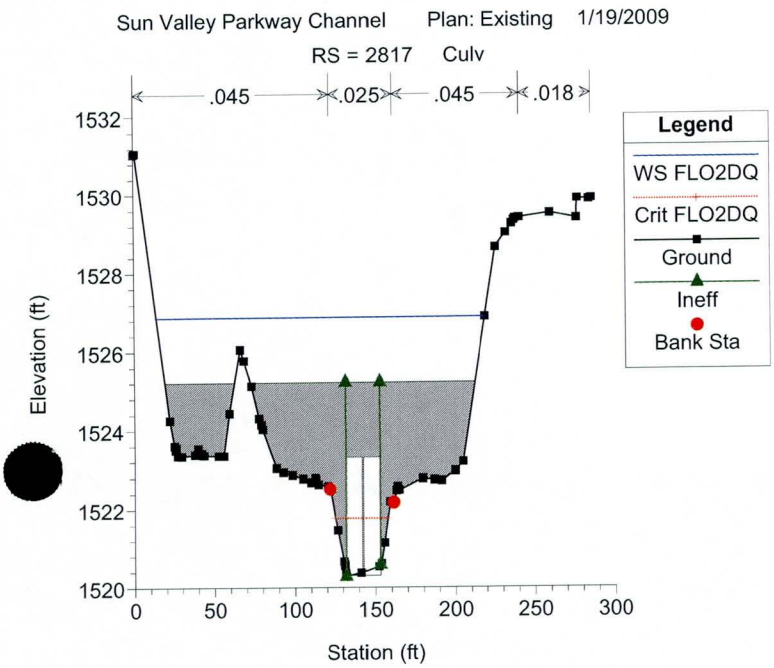


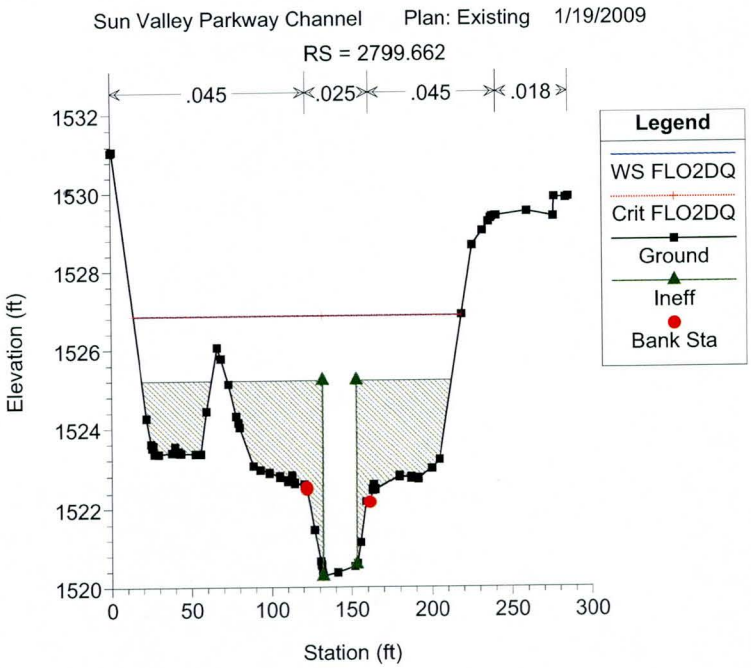

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 2859.922
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

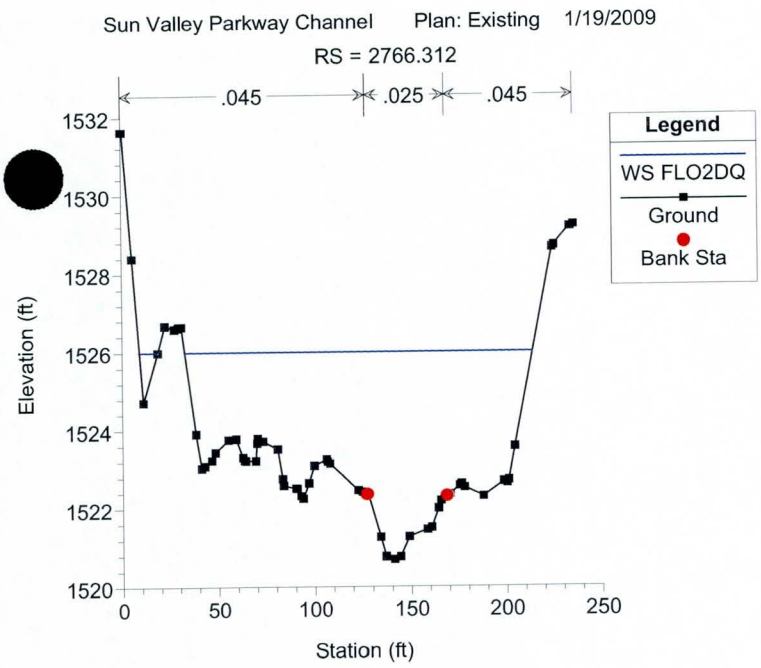

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 2838.551
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

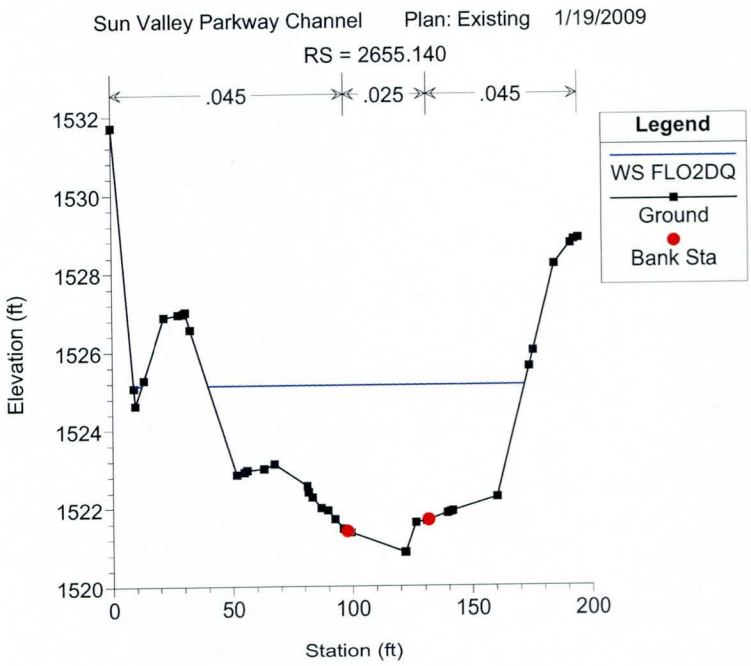

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 2833.935
.045 .025 .045 .018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Ineff
Bank Sta
Station (ft)

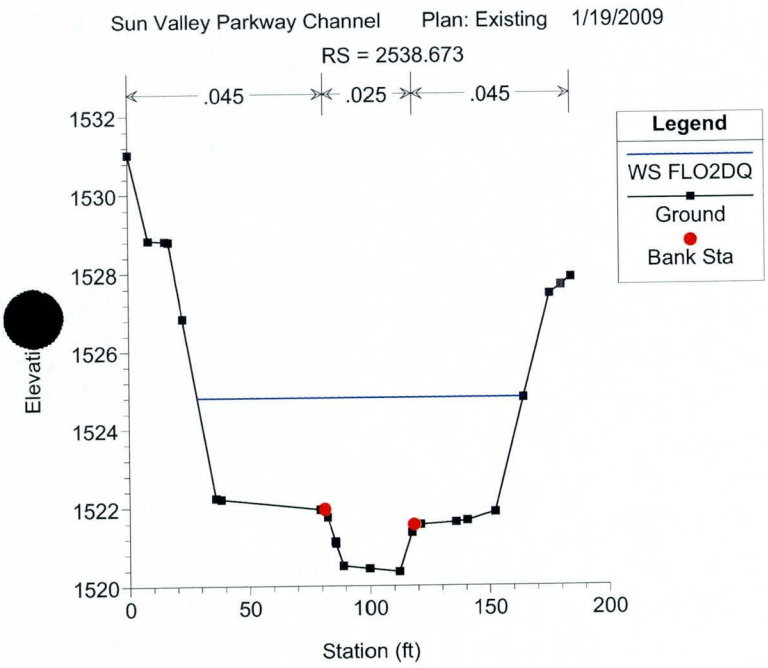

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 2817 Culv
.045 .025 .045 .018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

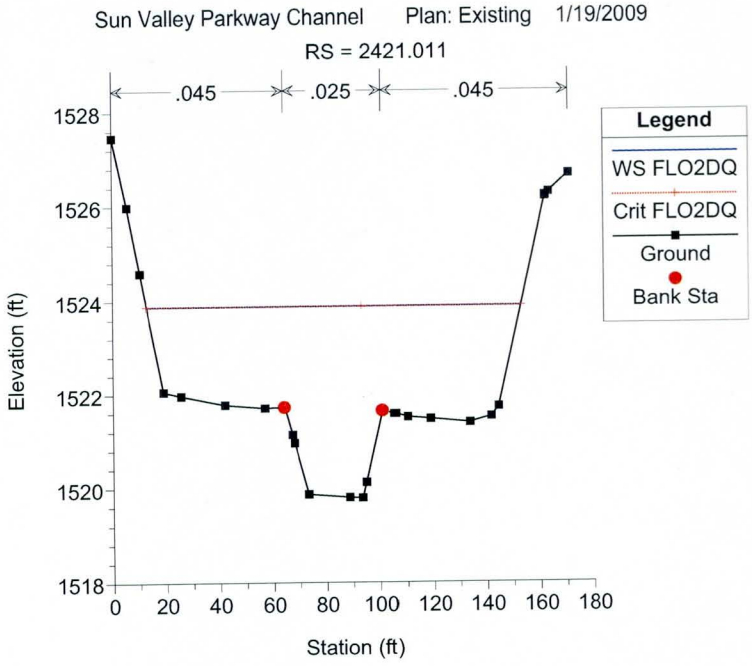

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 2817 Culv
.045 .025 .045 .018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

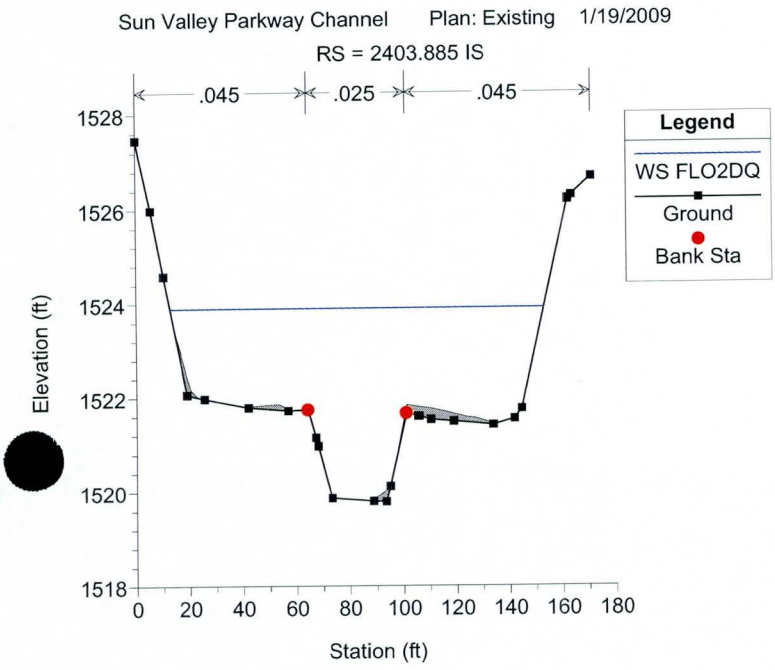

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 2799.662
.045 .025 .045 .018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 2766.312
.045
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 2655.140
.045
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 2538.673
.045
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 2421.011
.045
.025
.045
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 2403.885 IS
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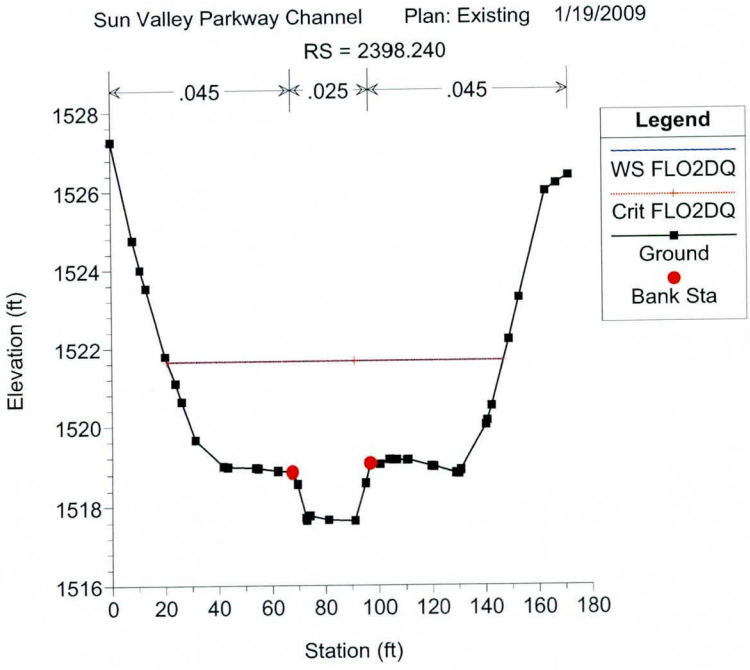
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 2398.240
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.025
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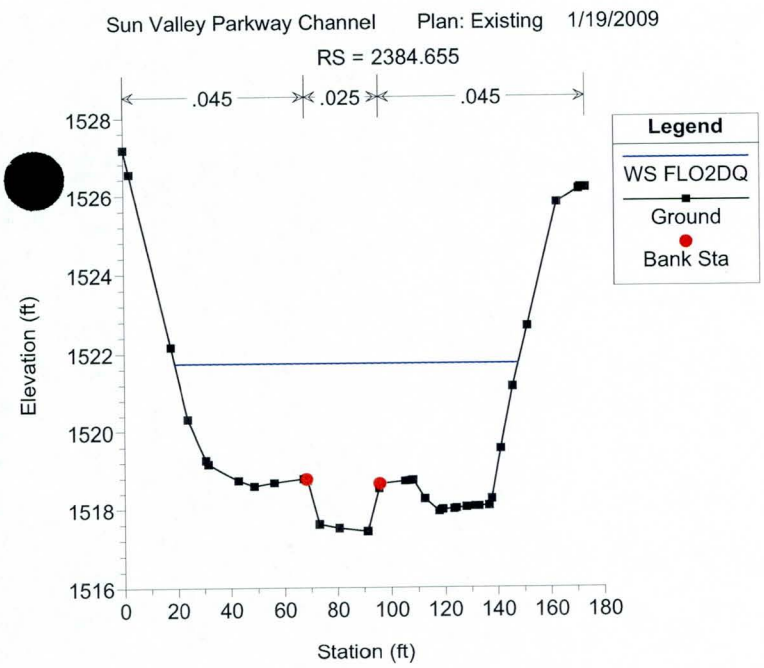
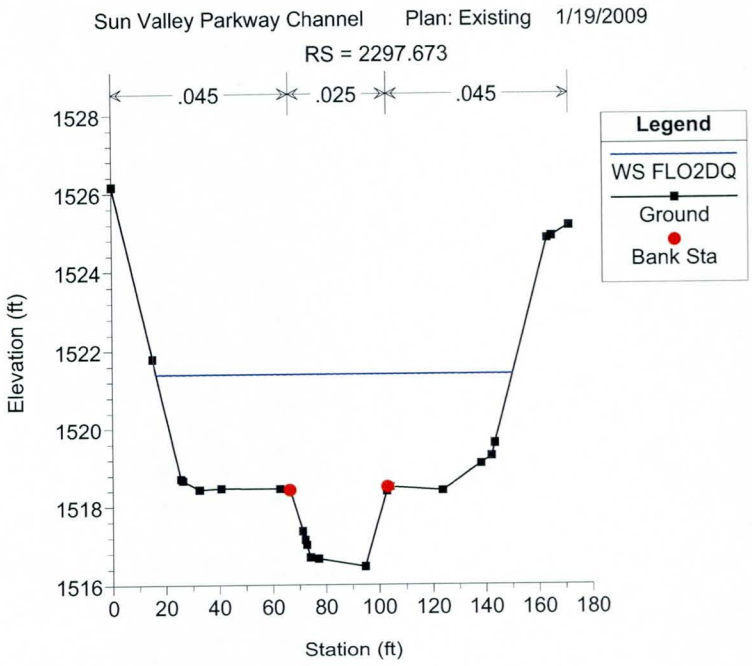
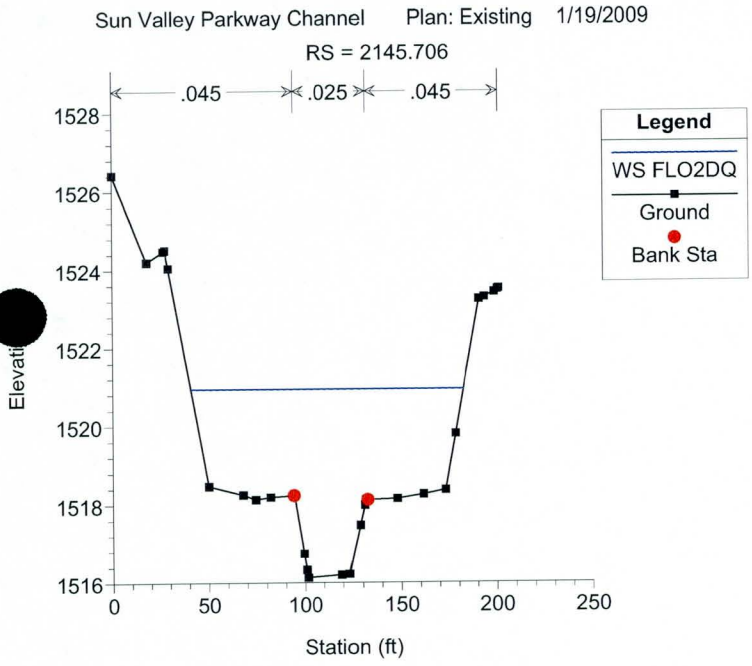
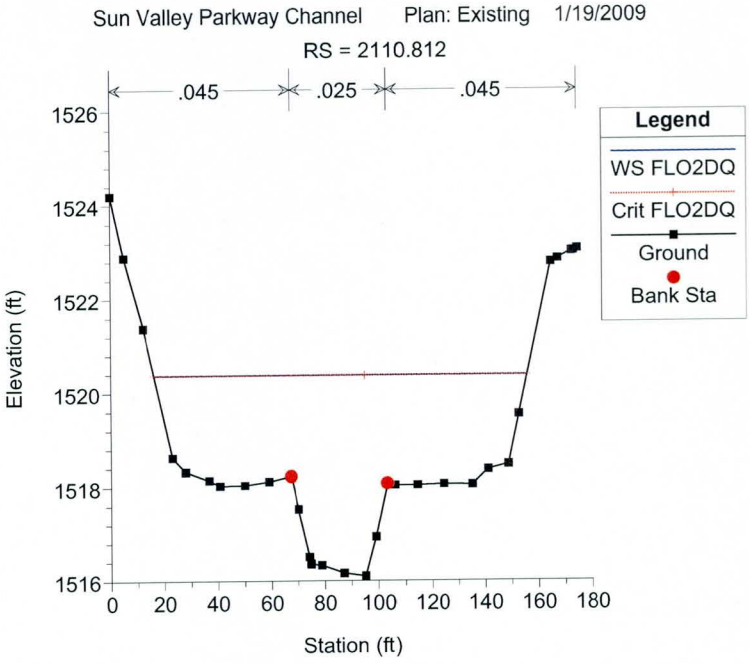
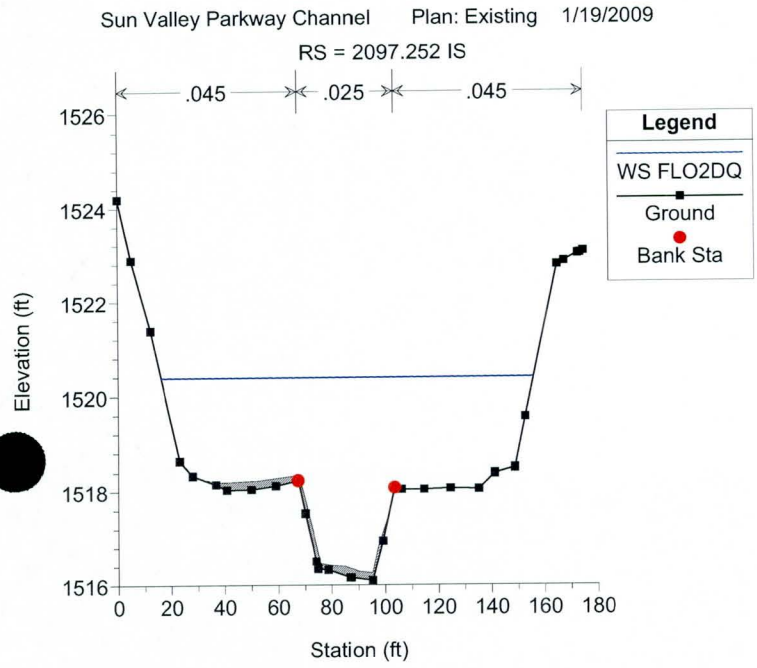
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

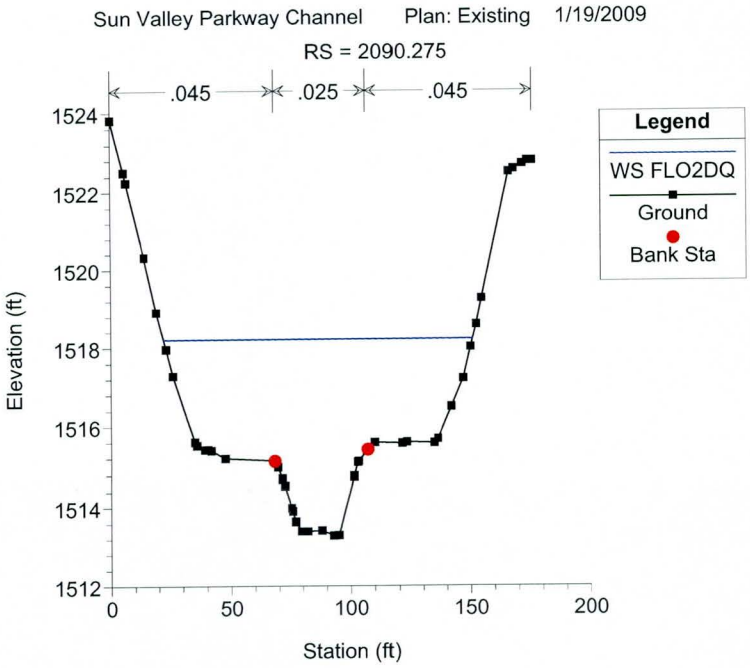

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 2384.655
.045
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

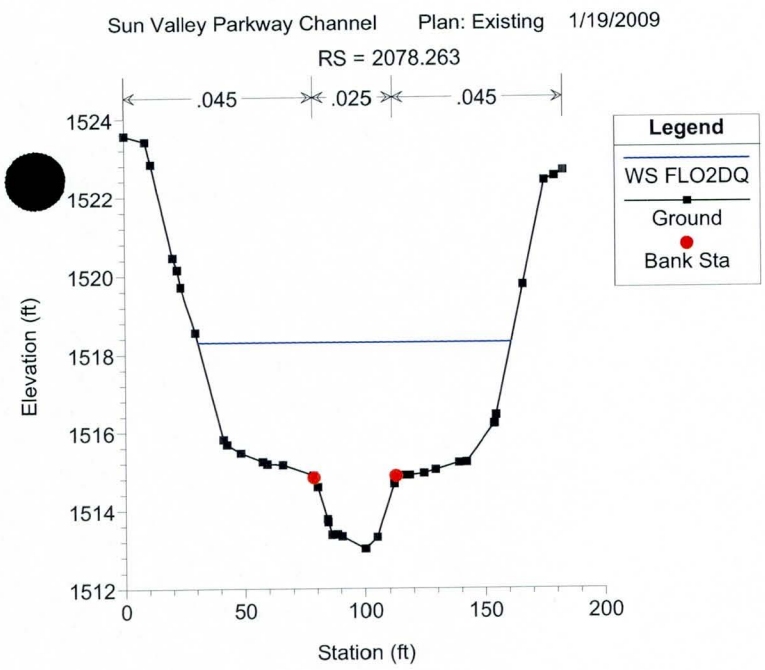

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 2297.673
.045
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

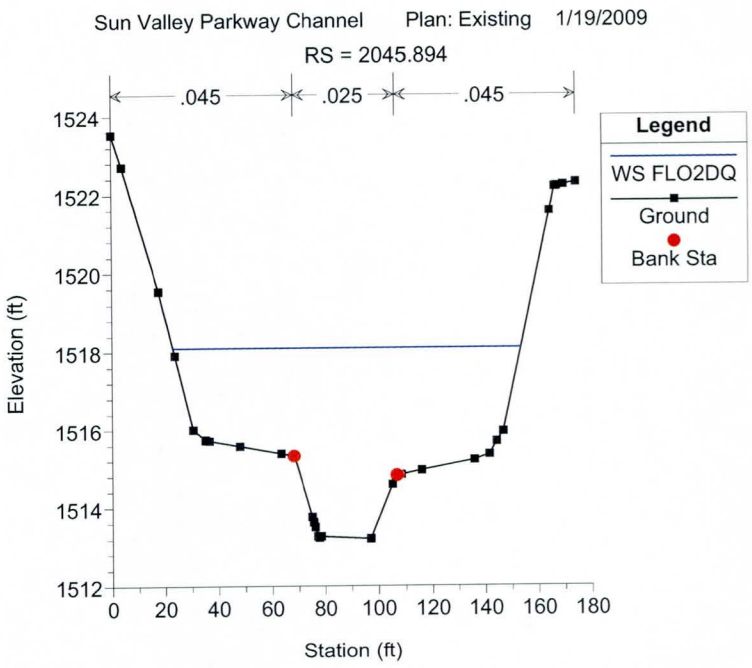

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 2145.706
.045
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Station (ft)

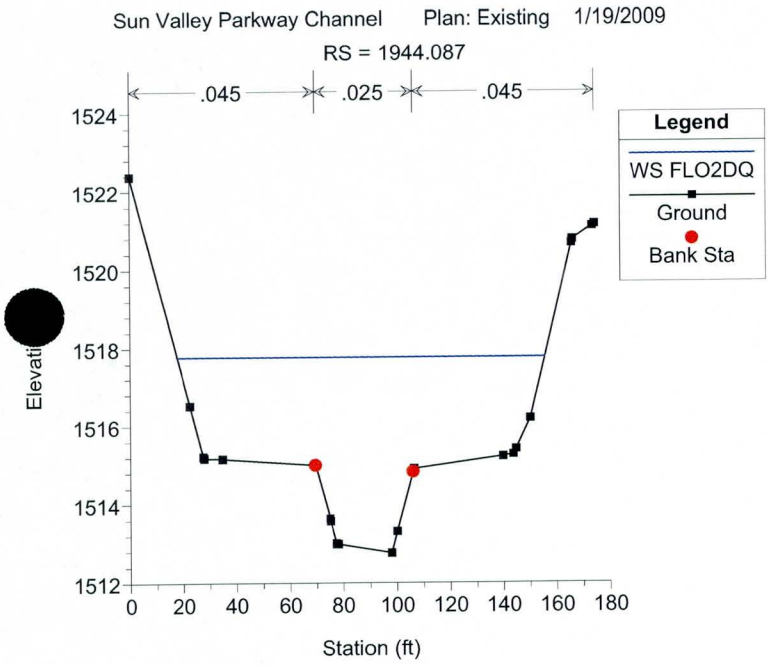

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 2110.812
.045
.025
.045
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 2097.252 IS
.045
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 2090.275
.045
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 2078.263
.045 .025 .045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 2045.894
.045 .025 .045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 1944.087
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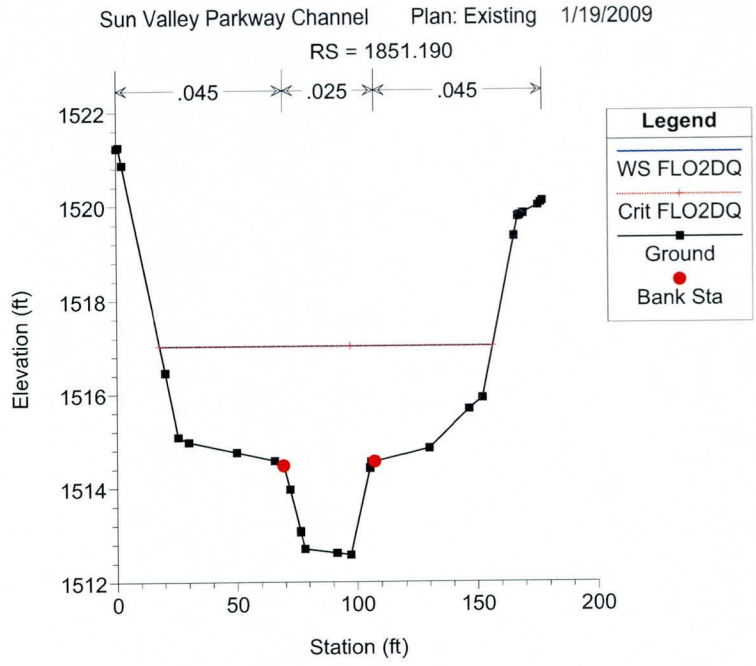
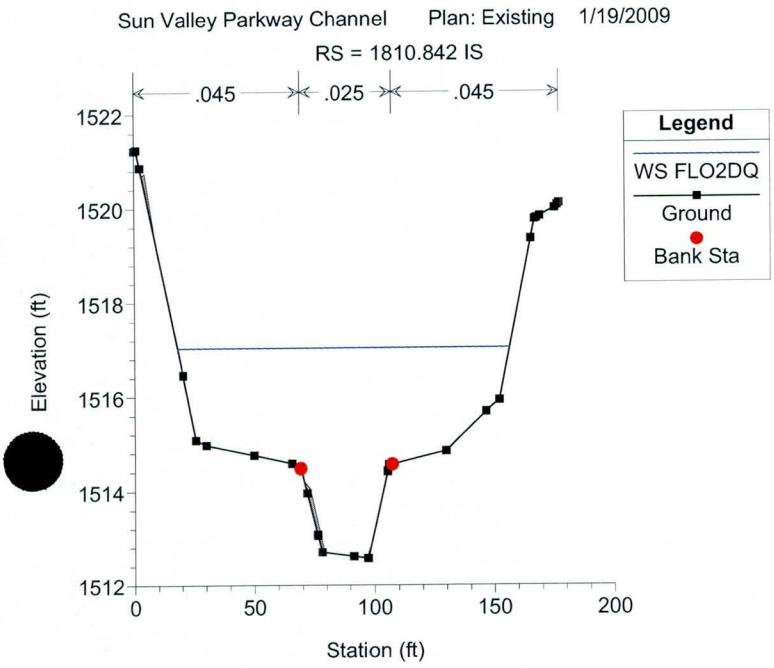
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 1851.190
.045 .025 .045
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 1810.842 IS
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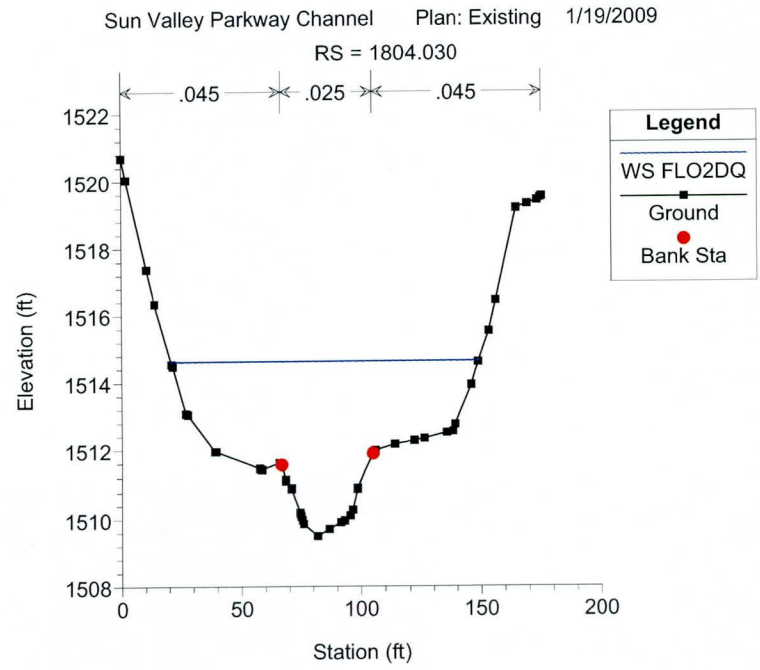
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 1804.030
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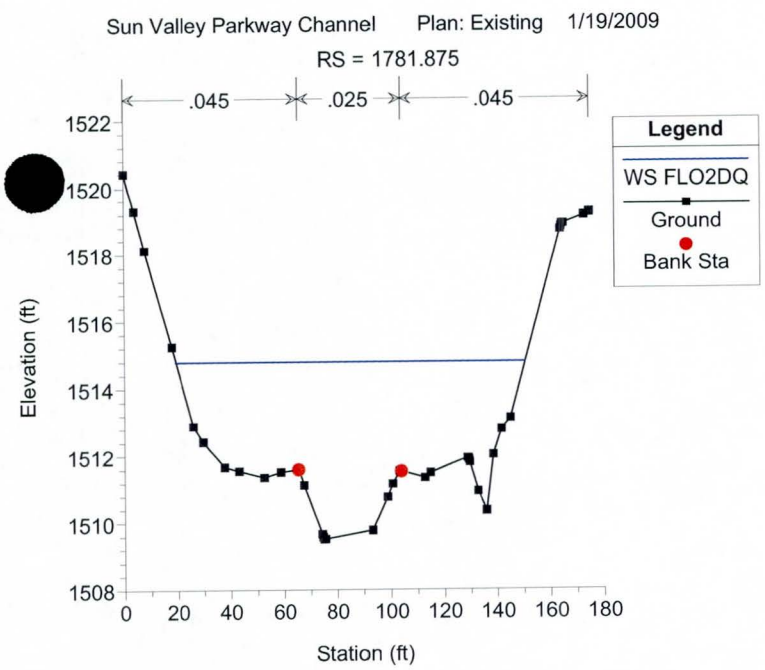
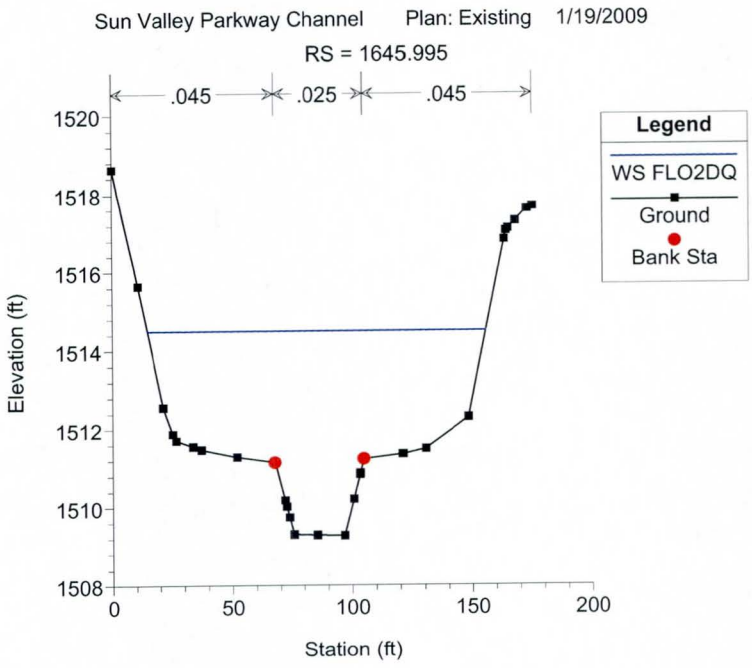
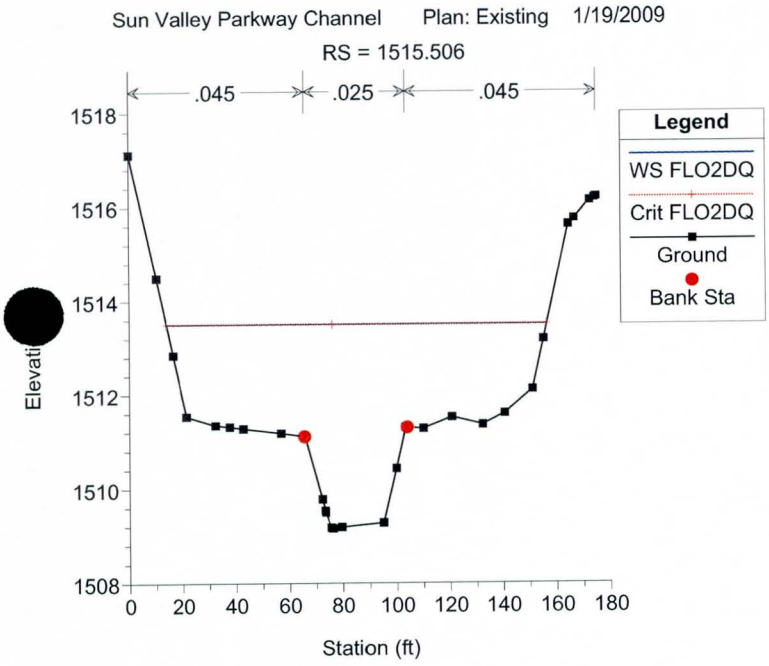
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 1781.875
.045
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 1645.995
.045
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 1515.506
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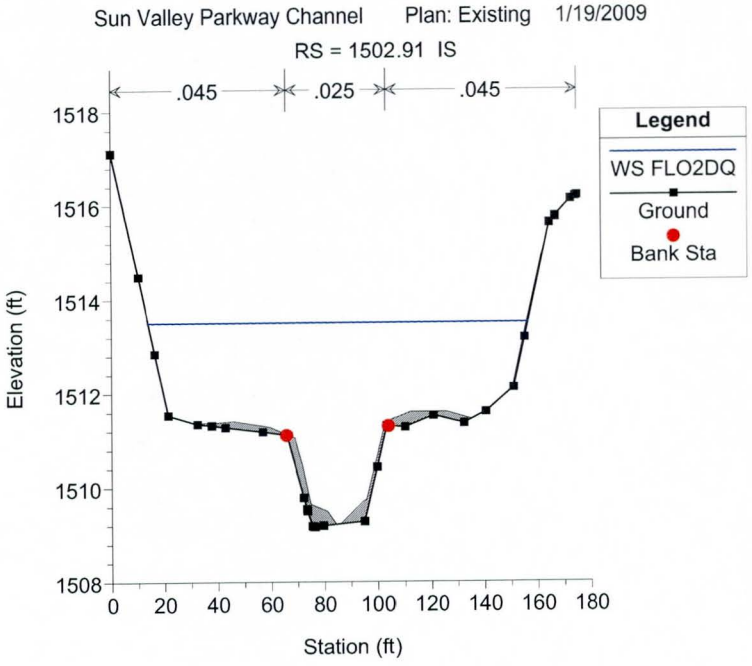
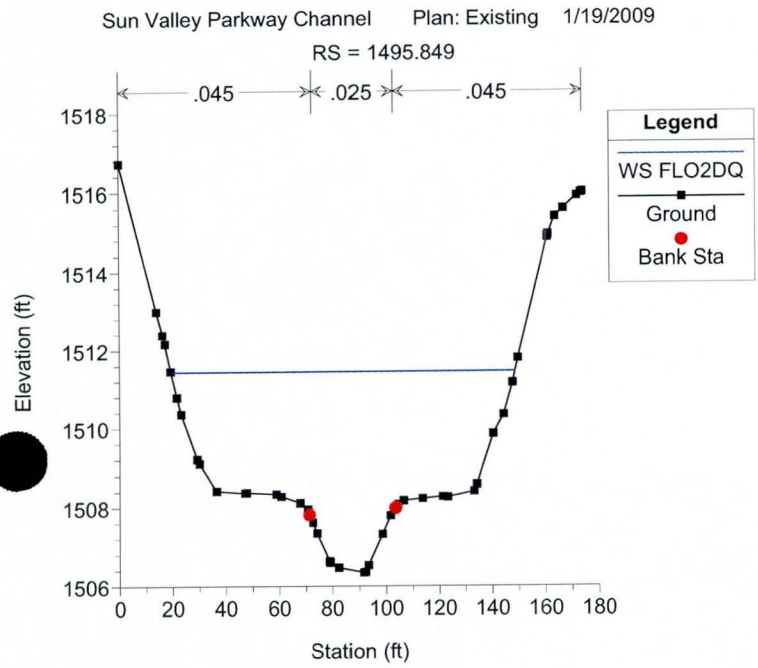
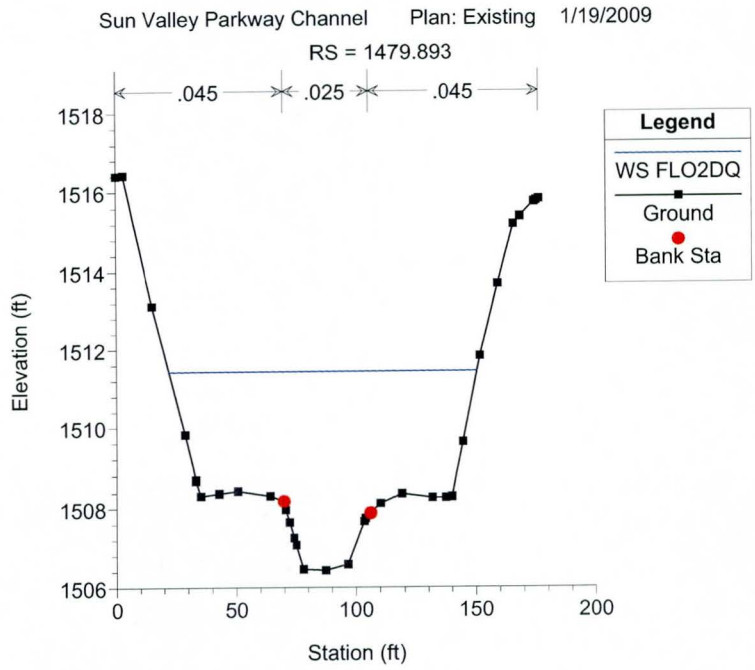
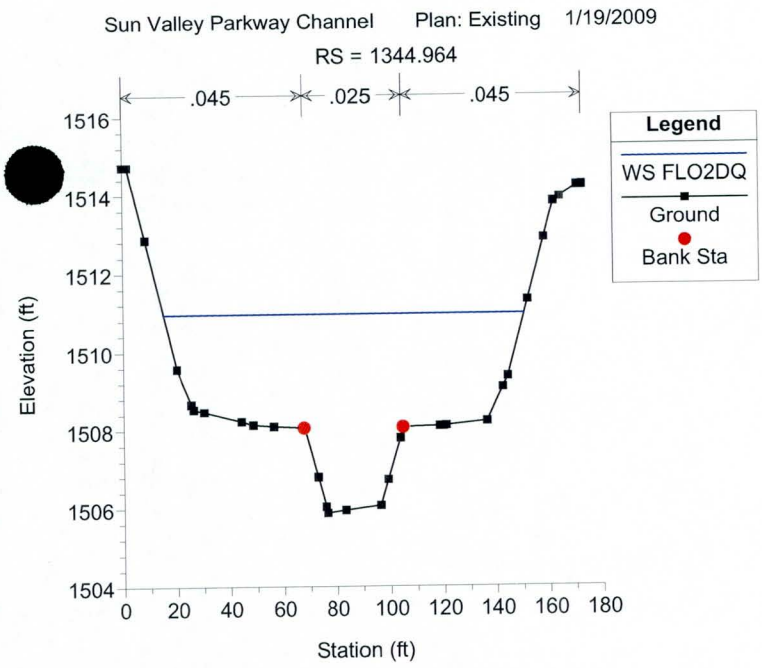
.025
.045
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 1502.91 IS
.045
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 1495.849
.045
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 1479.893
.045
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 1344.964
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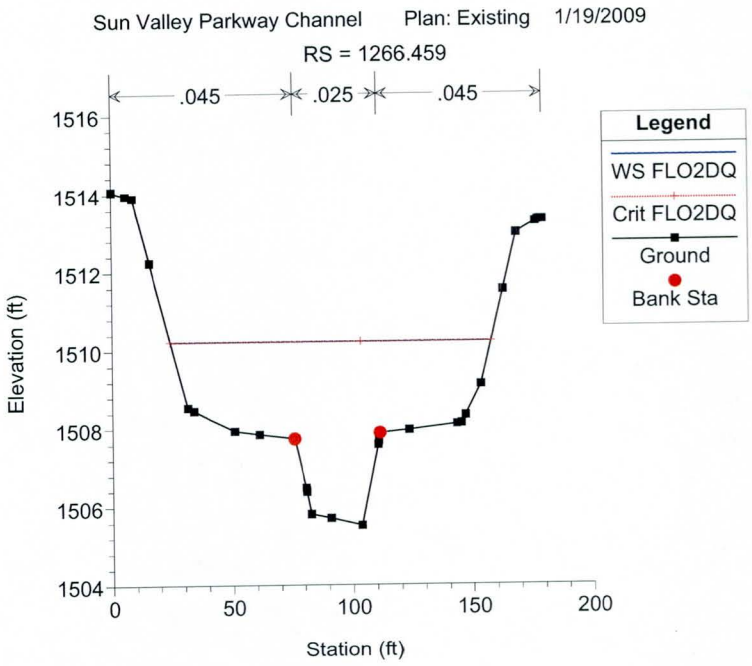
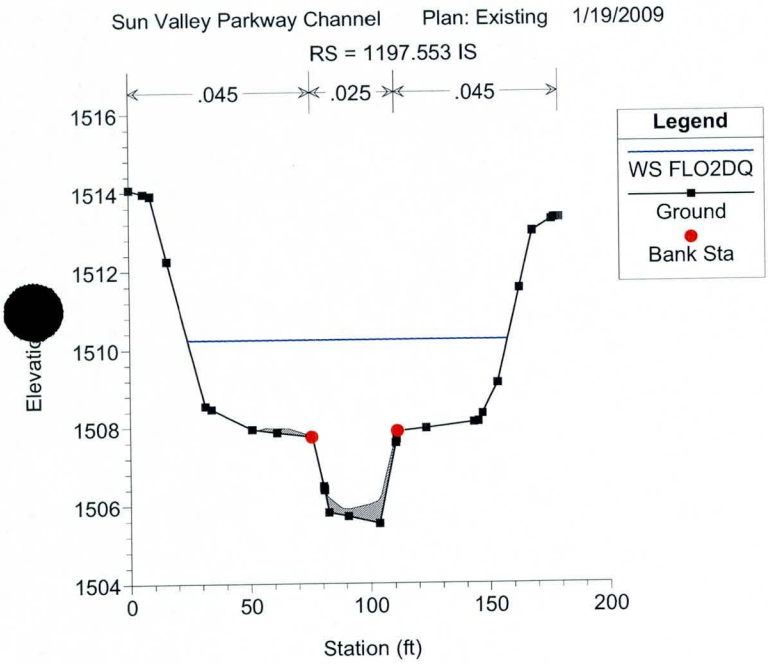
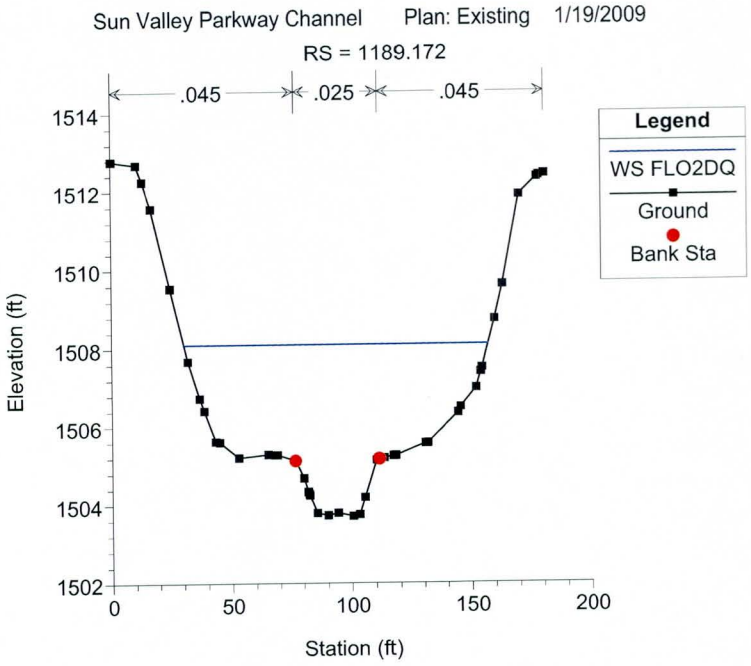
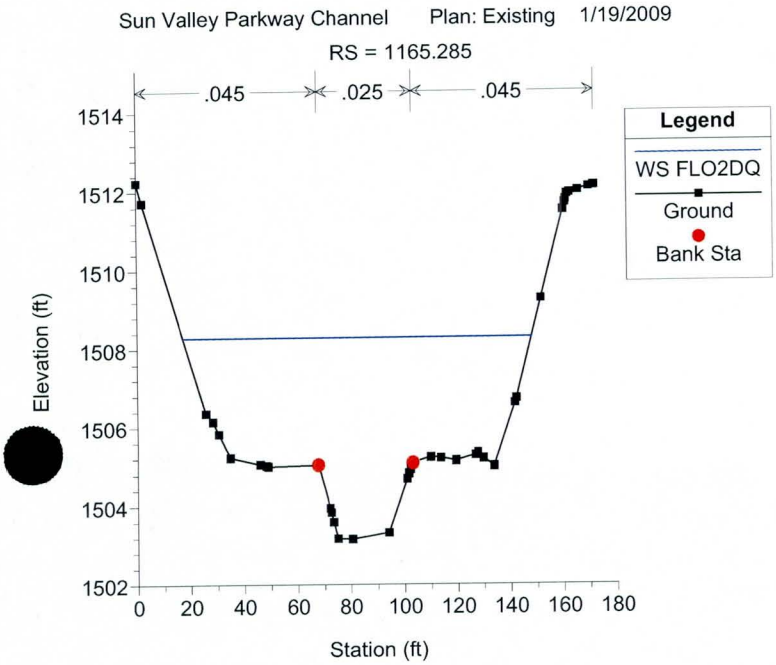
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 1266.459
.045 .025 .045
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 1197.553 IS
.045 .025 .045
Legend
WS FLO2DQ
Ground
Bank Sta
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 1189.172
.045 .025 .045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 1165.285
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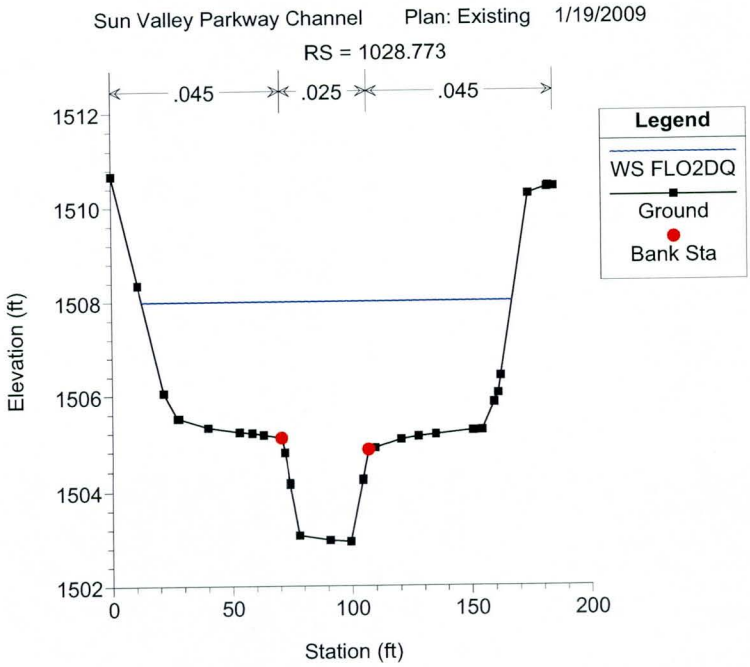
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 1028.773
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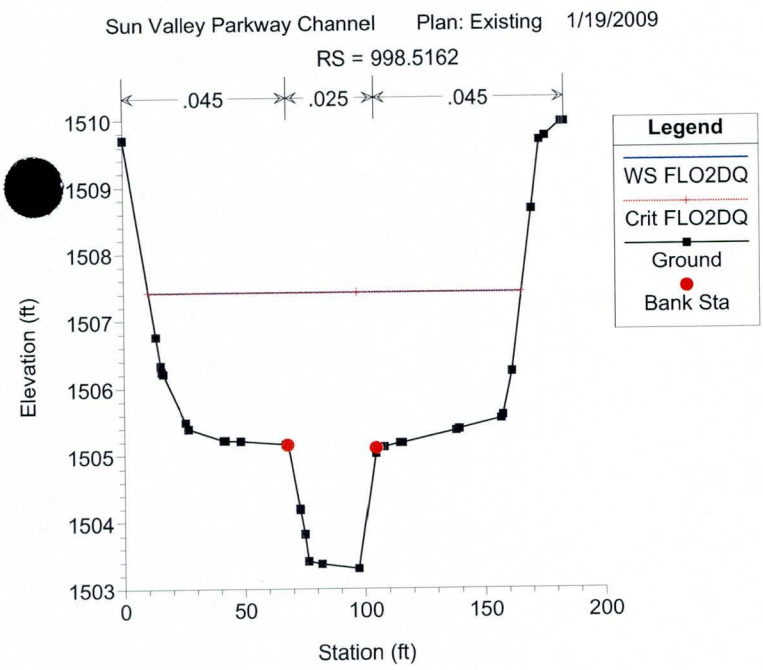
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 998.5162
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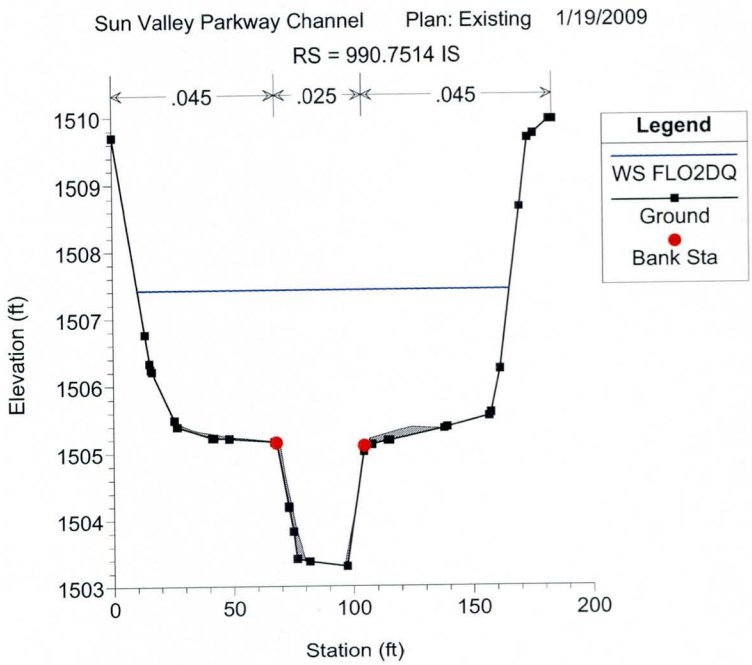
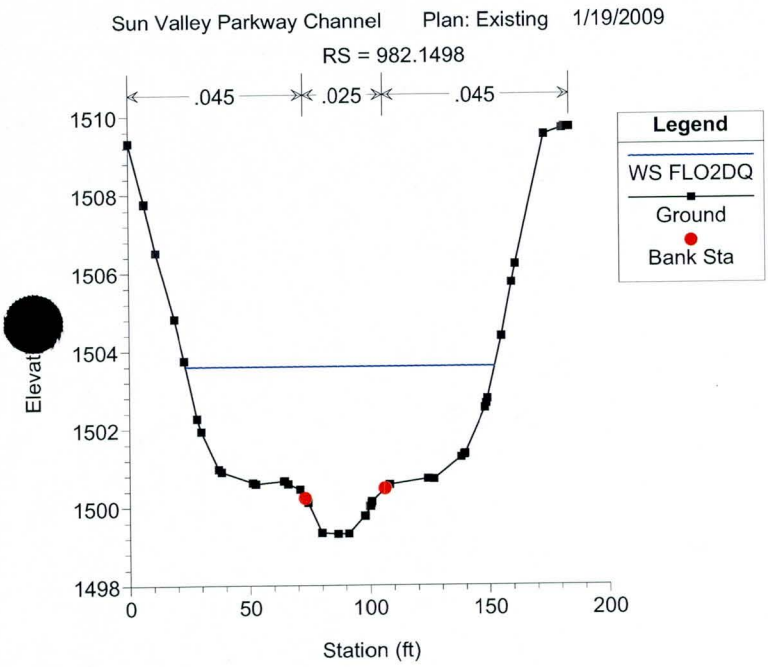
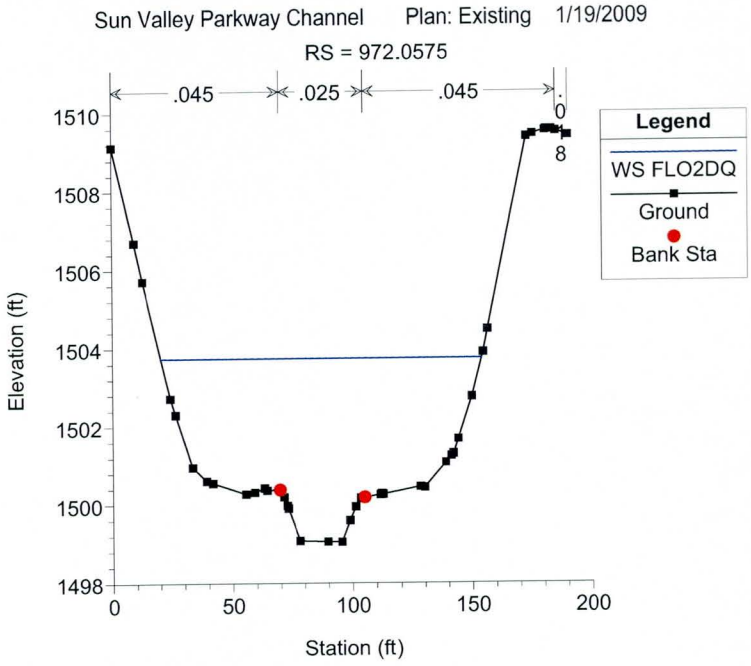
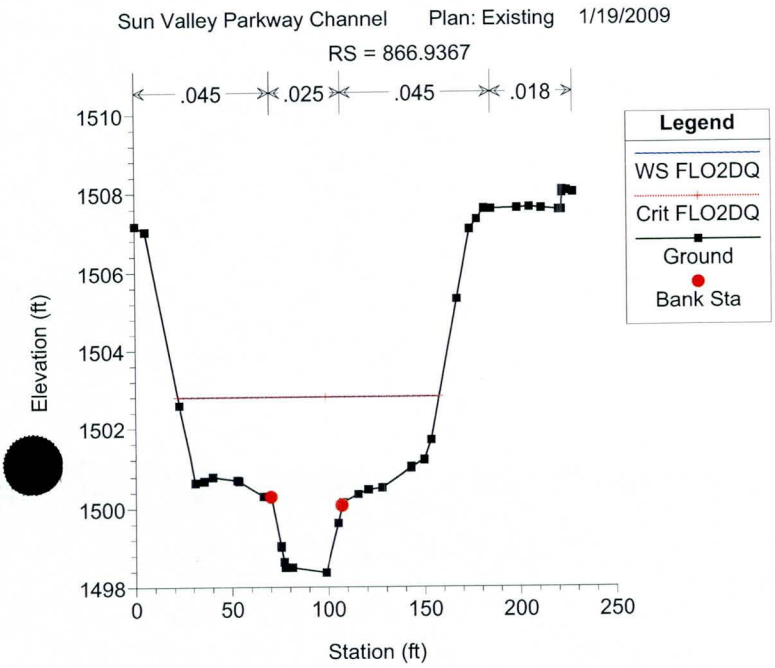
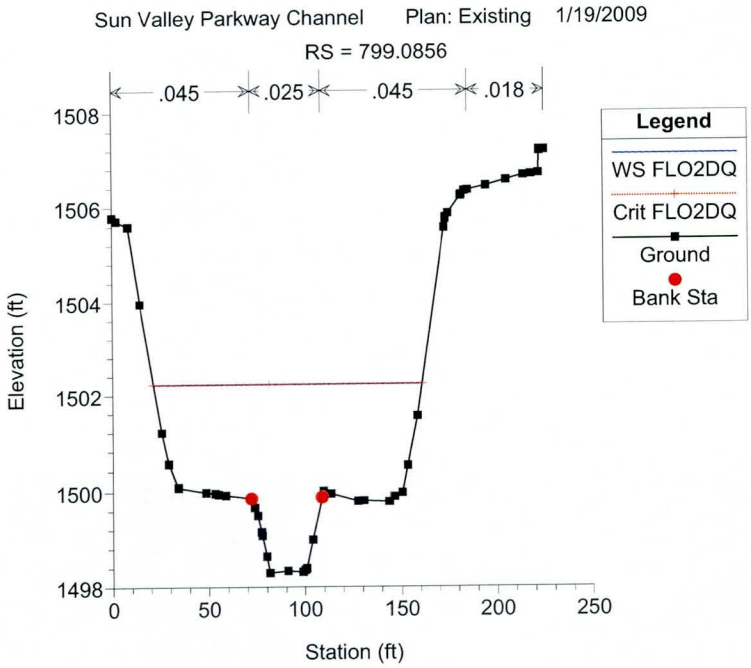
.025
.045
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

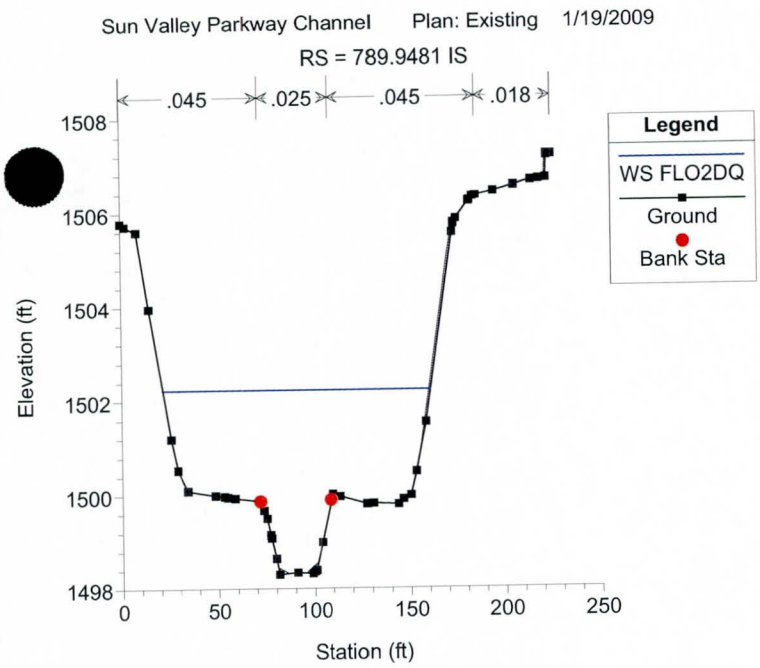

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 990.7514 IS
.045
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

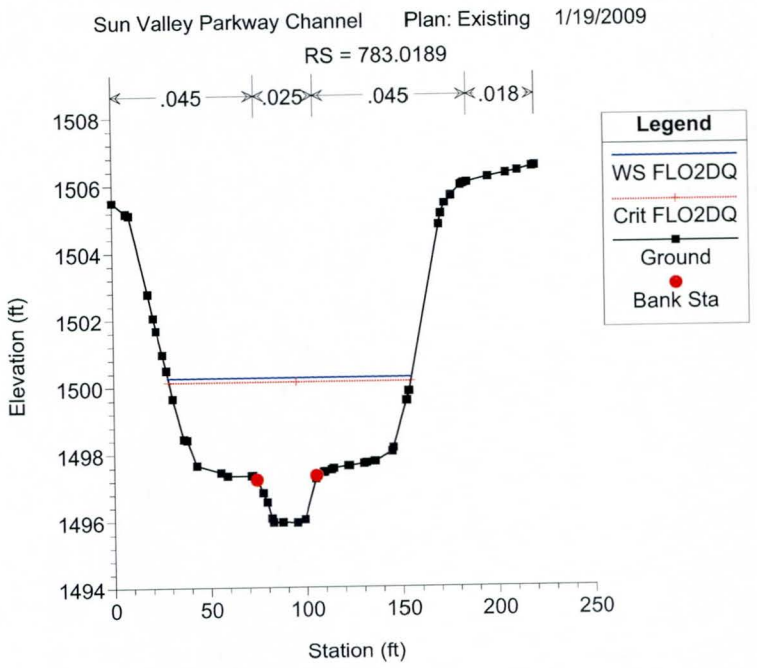

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 982.1498
.045
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Station (ft)

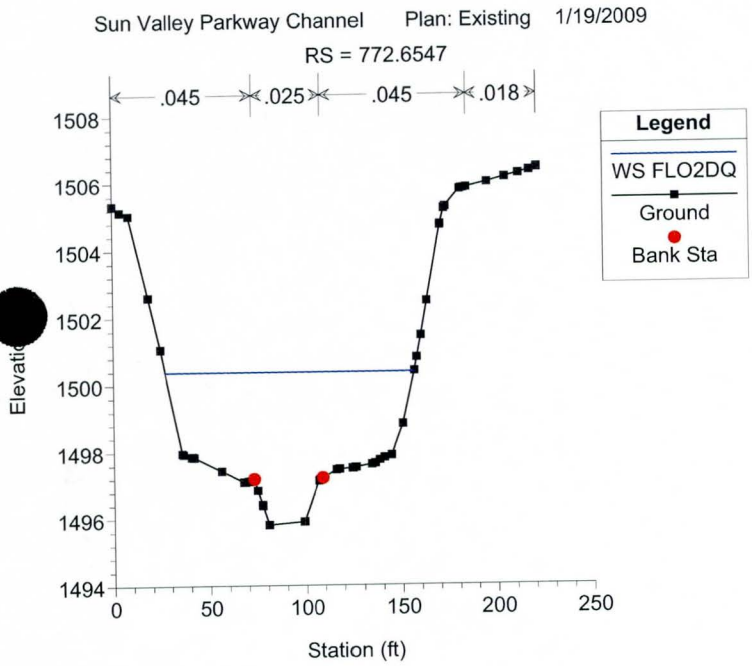

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 972.0575
.045
.025
.045
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

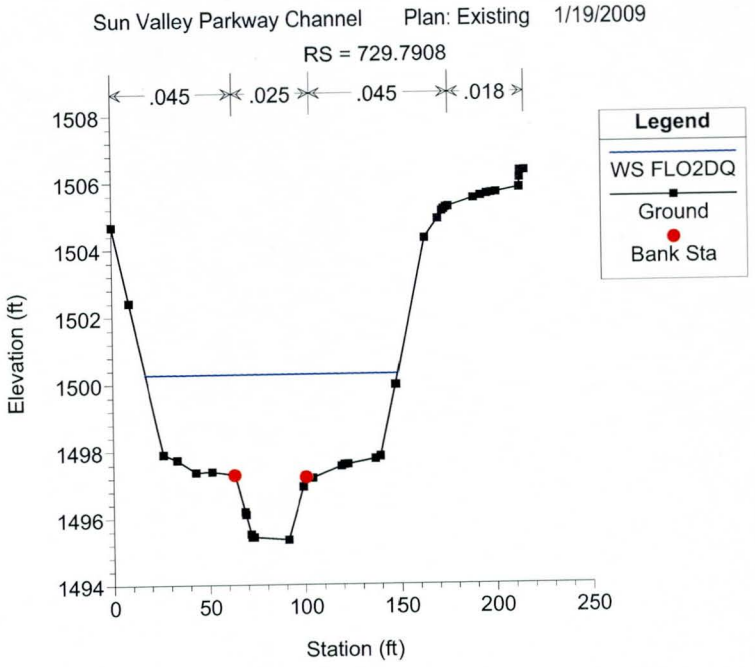

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 866.9367
.045
.025
.045
.018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

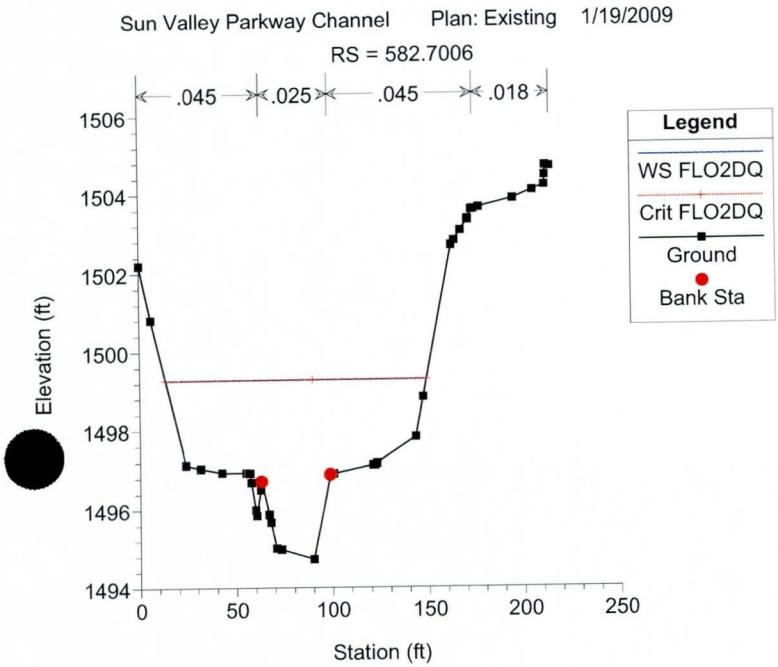

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 799.0856
.045
.025
.045
.018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

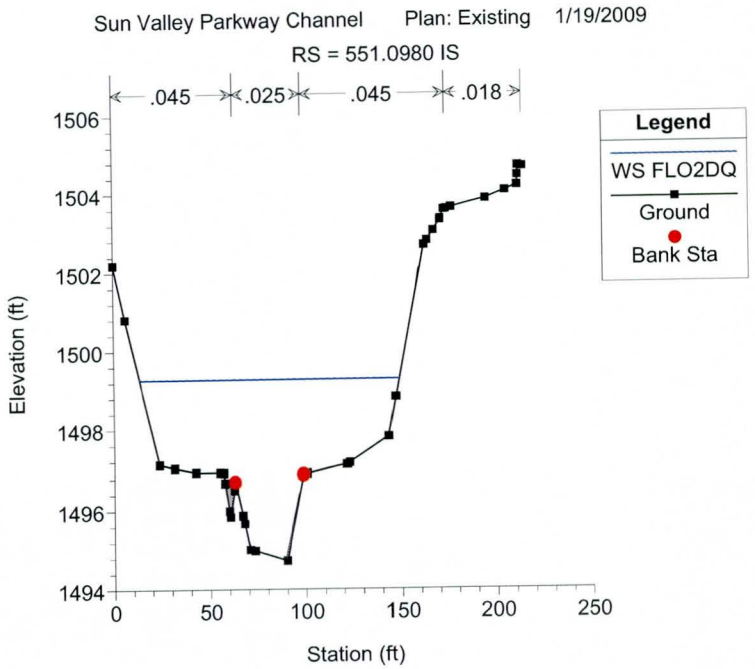

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 789.9481 IS
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 783.0189
.045 .025 .045 .018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 772.6547
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Station (ft)

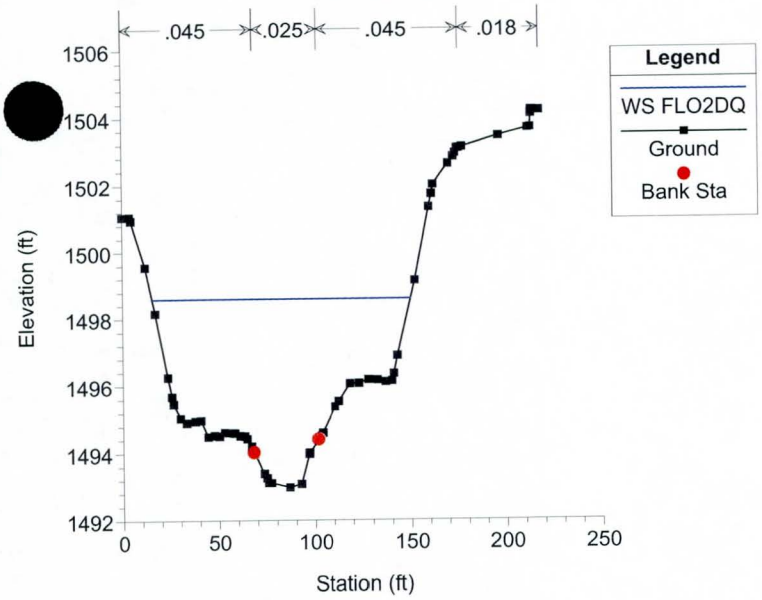

Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 729.7908
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 582.7006
.045 .025 .045 .018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)


Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 551.0980 IS
.045 .025 .045 .018
Legend
WS FLO2DQ
Ground
Bank Sta
Elevation (ft)
Station (ft)

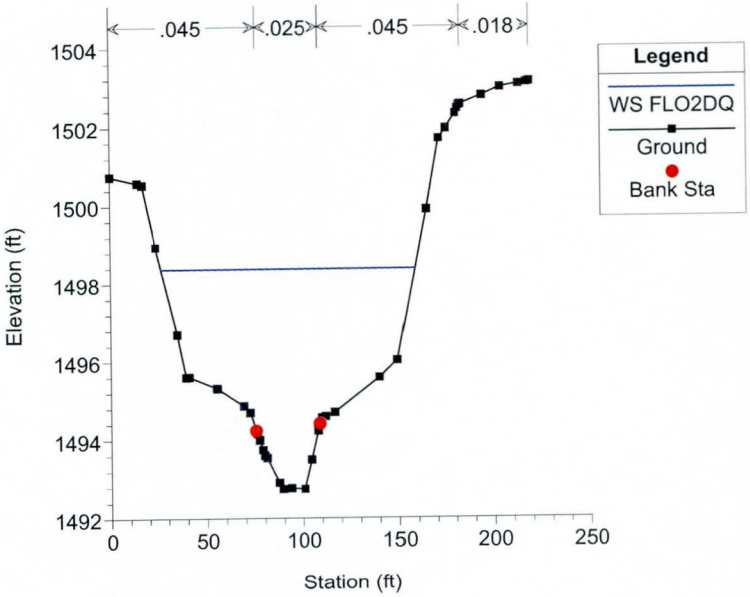
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 541.1541



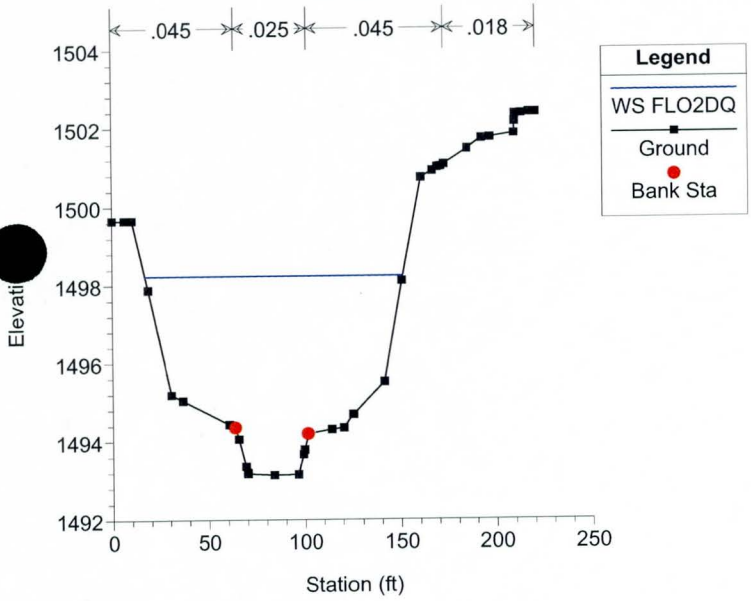
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 501.3466



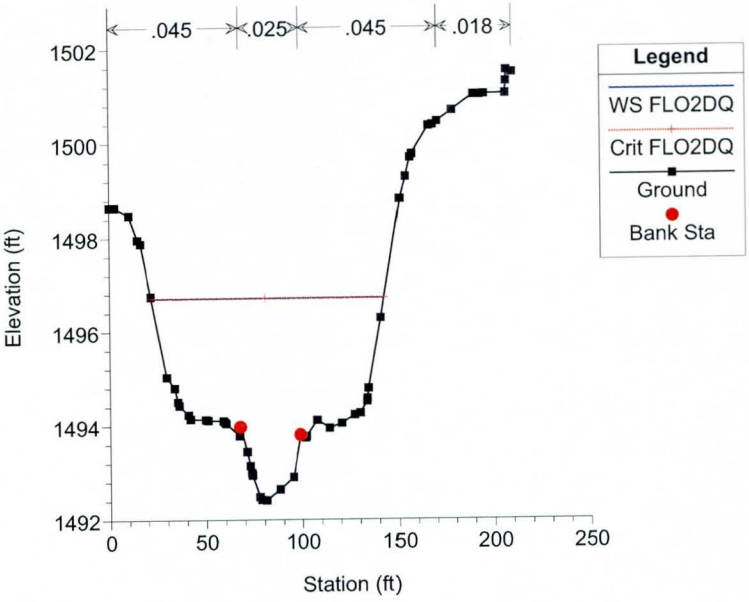
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 383.5453



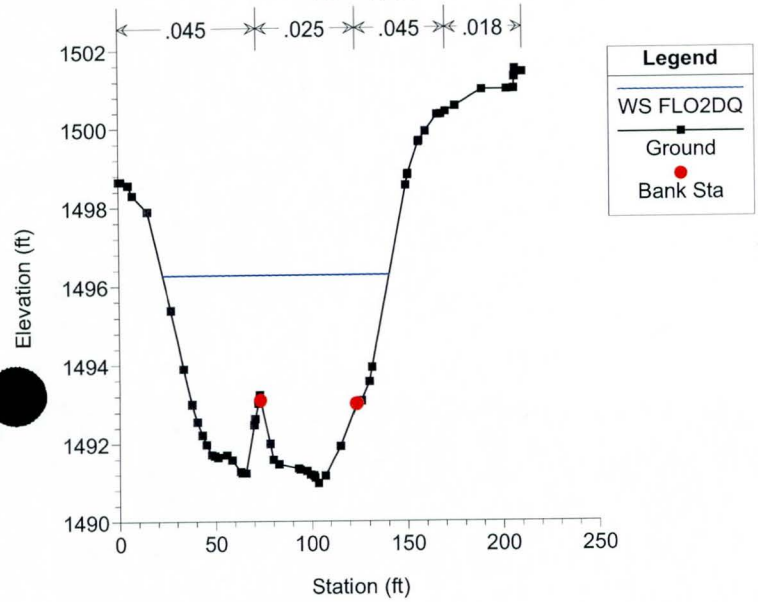
Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 141.7450



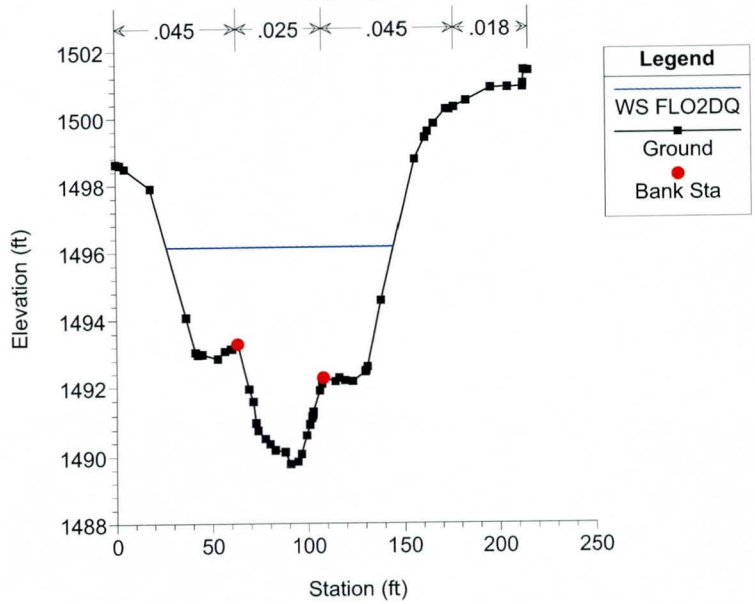
Sun Valley Parkway Channel Plan: Existing 1/19/2009

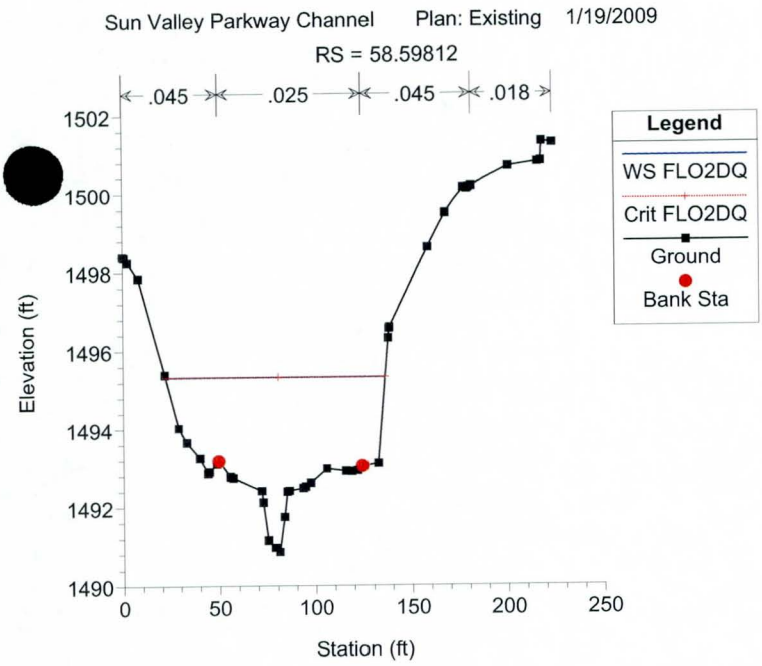
RS = 134.3734



Sun Valley Parkway Channel Plan: Existing 1/19/2009

RS = 114.1627




Sun Valley Parkway Channel Plan: Existing 1/19/2009
RS = 58.59812
.045
.025
.045
.018
Legend
WS FLO2DQ
Crit FLO2DQ
Ground
Bank Sta
Elevation (ft)
1502
1500
1498
1496
1494
1492
1490
0
50
100
150
200
250
Station (ft)

E.3 Detailed HEC-RAS Output

HEC-RAS Version 3.1.3 May 2005
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
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: Zone A Fans 1 and 2
Project File : ZonaA12.prj
Run Date and Time: 9/27/2006 1:56:06 PM

Project in English units

Project Description:
Approximate Zone A Floodplain Delineation Study for select washes on the White Tank Mountains upstream of the alluvial fan apecies. This study was performed under contract to the Flood Control District of Maricopa County (2004C0049), by JE Fuller Hydrology & Geomorphology, Inc., in June, 2006. The Flood Control District Project Manager is Valerie Swick. This model was developed in HEC-RAS v3.1.3 (May 2005), Based on 1"=500', 10' contour interval topographic mapping provided by FCDMC, Flown by Landata Airborne Systems, Flight Date = December 2000, vertical datum = NAVD88, horizontal projection = NAD83. Discharges are from HEC-1 modeling produced from this same contract by JEF, Inc. Starting water surface elevation determined using normal depth proceedures. This run assumes sub-critical flow conditions.

PLAN DATA

Plan Title: Zone_A
Plan File : X:\projects\Agency\FCDMC\SVADMP\hec-ras\Fans1-2\ZonaA12.p01

Geometry Title: zone_a
Geometry File : X:\projects\Agency\FCDMC\SVADMP\hec-ras\Fans1-2\ZonaA12.g01

Flow Title : zone_a
Flow File : X:\projects\Agency\FCDMC\SVADMP\hec-ras\Fans1-2\ZonaA12.f01

Plan Summary Information:

Number of:	Cross Sections	= 8	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

Computational Information

Water surface calculation tolerance	= 0.01
Critical depth calculation tolerance	= 0.01
Maximum number of iterations	= 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

FLOW DATA

Flow Title: zone_a
Flow File : X:\projects\Agency\FCDMC\SVADMP\hec-ras\Fans1-2\ZonaA12.f01

Flow Data (cfs)

River	Reach	RS	PF 1
Fan 1	Reach 1	200	662
FAN 10	Reach 1	500	1387
Fan 11	Reach 1	400	595
FAN 13E	Reach 1	300	202
FAN 13E	Reach 1	100	356
FAN 13W	Reach 1	400	524
FAN 13W Split	Reach 1	200	154
Fan 2	Reach 1	500	936
FAN 3	Reach 1	200	836
FAN 4	Reach 1	500	1047
FAN 5	Reach 1	600	2063

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Fan 1	Reach 1	PF 1		Normal S = 0.024
Fan 2	Reach 1	PF 1		Normal S = 0.023

GEOMETRY DATA

Geometry Title: zone_a
Geometry File : X:\projects\Agency\FCDMC\SVADMP\hec-ras\Fans1-2\ZonaA12.g01

CROSS SECTION

RIVER: Fan 1
REACH: Reach 1 RS: 200

INPUT
Description: Q=662cfs per HEC-1 Concentration Point S110
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1895	119.69	1885	179.93	1880	2021879.123		205.1	1879
275.349	1879	2801879.281		308.496	1881	363.807	1884	429.794	1883.5

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	202	.04	280	.055

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
202	280	452	469	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1880.81	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.54	Wt. n-Val.	0.060	0.040	0.055
W.S. Elev (ft)	1880.27	Reach Len. (ft)	452.00	469.00	487.00
Crit W.S. (ft)	1880.27	Flow Area (sq ft)	16.02	98.06	8.07
E.G. Slope (ft/ft)	0.020087	Area (sq ft)	16.02	98.06	8.07
Q Total (cfs)	662.00	Flow (cfs)	41.45	601.27	19.28
Top Width (ft)	119.66	Top Width (ft)	25.30	78.00	16.36
Vel Total (ft/s)	5.42	Avg. Vel. (ft/s)	2.59	6.13	2.39
Max Chl Dpth (ft)	1.27	Hydr. Depth (ft)	0.63	1.26	0.49
Conv. Total (cfs)	4670.9	Conv. (cfs)	292.4	4242.5	136.0
Length Wtd. (ft)	468.47	Wetted Per. (ft)	25.33	78.01	16.39
Min Ch El (ft)	1879.00	Shear (lb/sq ft)	0.79	1.58	0.62
Alpha	1.18	Stream Power (lb/ft s)	2.05	9.67	1.48
Frctn Loss (ft)	9.25	Cum Volume (acre-ft)	0.17	1.20	0.06
C & E Loss (ft)	0.05	Cum SA (acres)	0.51	1.12	0.17

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Profile #PF 1

	Pos	Left Sta (ft)	Right Sta (ft)	Flow (cfs)	Area (sq ft)	W.P. (ft)	Percent Conv	Hydr Depth(ft)	Velocity (ft/s)
1	LOB	161.60	202.00	41.45	16.02	25.33	6.26	0.63	2.59
2	Chan	202.00	213.14	85.16	13.94	11.15	12.86	1.25	6.11
3	Chan	213.14	224.29	87.13	14.13	11.14	13.16	1.27	6.17
4	Chan	224.29	235.43	87.13	14.13	11.14	13.16	1.27	6.17
5	Chan	235.43	246.57	87.13	14.13	11.14	13.16	1.27	6.17
6	Chan	246.57	257.71	87.13	14.13	11.14	13.16	1.27	6.17
7	Chan	257.71	268.86	87.13	14.13	11.14	13.16	1.27	6.17
8	Chan	268.86	280.00	80.47	13.48	11.15	12.16	1.21	5.97
9	ROB	280.00	309.96	19.28	8.07	16.39	2.91	0.49	2.39

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Fan 1
REACH: Reach 1 RS: 150

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

```
      0    1880  81.249  1867.5 152.766  1867.4 173.825  1866.6 247.789  1866.5
   2821867.353     2961867.702 311.975  1868.1 351.086  1868.8

Manning's n Values         num=        3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .06 152.766     .04     282    .055

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       152.766     282                0       0       0             .1      .3

CROSS SECTION OUTPUT  Profile #PF 1

  E.G. Elev (ft)           1868.08    Element                 Left OB    Channel   Right OB
  Vel Head (ft)               0.38    Wt. n-Val.                0.060      0.040      0.055
  W.S. Elev (ft)           1867.69    Reach Len. (ft)
  Crit W.S. (ft)           1867.69    Flow Area (sq ft)         17.53     125.42       2.32
  E.G. Slope (ft/ft)      0.019393    Area (sq ft)              17.53     125.42       2.32
  Q Total (cfs)             662.00    Flow (cfs)                23.41     635.90       2.69
  Top Width (ft)            215.67    Top Width (ft)            72.77     129.23      13.66
  Vel Total (ft/s)            4.56    Avg. Vel. (ft/s)           1.34       5.07       1.16
  Max Chl Dpth (ft)           1.19    Hydr. Depth (ft)           0.24       0.97       0.17
  Conv. Total (cfs)         4753.8    Conv. (cfs)              168.1     4566.4       19.3
  Length Wtd. (ft)                    Wetted Per. (ft)          72.79     129.26      13.66
  Min Ch El (ft)           1866.50    Shear (lb/sq ft)           0.29       1.17       0.21
  Alpha                       1.19    Stream Power (lb/ft s)     0.39       5.96       0.24
  Frctn Loss (ft)                     Cum Volume (acre-ft)
  C & E Loss (ft)                     Cum SA (acres)

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth
         is below critical depth). Water surface set to critical depth.

  Profile #PF 1

             Pos          Left Sta    Right Sta       Flow       Area       W.P.    Percent       Hydr   Velocity
                          (ft)        (ft)            (cfs)    (sq ft)      (ft)       Conv  Depth(ft)     (ft/s)
  1          LOB          61.11       91.66            2.49       2.21      11.68       0.38       0.19       1.13
  2          LOB          91.66       122.21           8.98       7.01      30.55       1.36       0.23       1.28
  3          LOB          122.21      152.77          11.94       8.31      30.55       1.80       0.27       1.44
  4          Chan         152.77      171.23          44.38      11.89      18.48       6.70       0.64       3.73
  5          Chan         171.23      189.69         107.63      20.23      18.46      16.26       1.10       5.32
  6          Chan         189.69      208.15         112.86      20.81      18.46      17.05       1.13       5.42
  7          Chan         208.15      226.61         117.06      21.28      18.46      17.68       1.15       5.50
  8          Chan         226.61      245.08         121.32      21.74      18.46      18.33       1.18       5.58
  9          Chan         245.08      263.54          96.39      18.94      18.47      14.56       1.03       5.09
  10         Chan         263.54      282.00          36.27      10.53      18.47       5.48       0.57       3.44
  11         ROB          282.00      295.82           2.69       2.32      13.66       0.41       0.17       1.16

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth
         is below critical depth). Water surface set to critical depth.

CROSS SECTION


RIVER: Fan 2
REACH: Reach 1            RS: 500

INPUT
Description: Q=936 cfs per HEC-1 Concentration Point S900
Station Elevation Data     num=      10
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0     2000   28.729     1994   82.559   1980.5   113.71976.788 128.695     1975
 153.011     1975   165.11976.794 179.962     1979 230.204  1989.5 285.883  1991.5

Manning's n Values         num=        3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .07   113.7     .04   165.1     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         113.7   165.1              1115    1207     934             .1      .3

CROSS SECTION OUTPUT  Profile #PF 1

  E.G. Elev (ft)           1978.70    Element                 Left OB    Channel   Right OB
  Vel Head (ft)               1.03    Wt. n-Val.                0.070      0.040      0.060
  W.S. Elev (ft)           1977.67    Reach Len. (ft)        1115.00    1207.00     934.00
  Crit W.S. (ft)           1977.67    Flow Area (sq ft)         3.26     112.94       2.58
  E.G. Slope (ft/ft)      0.017161    Area (sq ft)              3.26     112.94       2.58
  Q Total (cfs)             936.00    Flow (cfs)                5.22     926.00       4.79
  Top Width (ft)             64.69    Top Width (ft)            7.39      51.40       5.89
  Vel Total (ft/s)            7.88    Avg. Vel. (ft/s)          1.60       8.20       1.86
  Max Chl Dpth (ft)           2.67    Hydr. Depth (ft)          0.44       2.20       0.44
  Conv. Total (cfs)         7145.0    Conv. (cfs)              39.8     7068.6       36.5
  Length Wtd. (ft)          1204.31   Wetted Per. (ft)          7.44      51.64       5.96
  Min Ch El (ft)            1975.00   Shear (lb/sq ft)          0.47       2.34       0.46
  Alpha                       1.07    Stream Power (lb/ft s)    0.75      19.21       0.86
  Frctn Loss (ft)            20.74    Cum Volume (acre-ft)      1.36      16.04       1.97
  C & E Loss (ft)             0.14    Cum SA (acres)            2.44      10.43       3.59

Warning: The energy equation could not be balanced within the specified number of iterations.  The
         program used critical depth for the water surface and continued on with the calculations.
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.
```

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Profile #PF 1

	Pos	Left Sta (ft)	Right Sta (ft)	Flow (cfs)	Area (sq ft)	W.P. (ft)	Percent Conv	Hydr Depth(ft)	Velocity (ft/s)
1	LOB	90.96	113.70	5.22	3.26	7.44	0.56	0.44	1.60
2	Chan	113.70	121.04	54.43	9.68	7.39	5.81	1.32	5.62
3	Chan	121.04	128.39	127.16	16.11	7.39	13.59	2.19	7.89
4	Chan	128.39	135.73	176.95	19.59	7.35	18.91	2.67	9.03
5	Chan	135.73	143.07	177.07	19.60	7.34	18.92	2.67	9.04
6	Chan	143.07	150.41	177.07	19.60	7.34	18.92	2.67	9.04
7	Chan	150.41	157.76	151.91	17.93	7.39	16.23	2.44	8.47
8	Chan	157.76	165.10	61.40	10.43	7.42	6.56	1.42	5.89
9	ROB	165.10	189.26	4.79	2.58	5.96	0.51	0.44	1.86

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Fan 2
REACH: Reach 1 RS: 400

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1964	106.878	1960	172.51	1946.531	179.957	1945	195.847	1945
282.81	1946.476	343.09	1947.5	348.987	1949.5	389.788	1953.5	443.393	1960
467.538	1962								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	172.5	.04	282.8	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
172.5	282.8	1244	1420	1459	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1947.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.56	Wt. n-Val.	0.070	0.040	0.060
W.S. Elev (ft)	1947.02	Reach Len. (ft)	1244.00	1420.00	1459.00
Crit W.S. (ft)	1946.96	Flow Area (sq ft)	0.57	152.55	8.60
E.G. Slope (ft/ft)	0.017275	Area (sq ft)	0.57	152.55	8.60
Q Total (cfs)	936.00	Flow (cfs)	0.62	923.68	11.71
Top Width (ft)	144.50	Top Width (ft)	2.37	110.30	31.83
Vel Total (ft/s)	5.79	Avg. Vel. (ft/s)	1.07	6.05	1.36
Max Chl Dpth (ft)	2.02	Hydr. Depth (ft)	0.24	1.38	0.27
Conv. Total (cfs)	7121.5	Conv. (cfs)	4.7	7027.7	89.1
Length Wtd. (ft)	1420.26	Wetted Per. (ft)	2.42	110.47	31.83
Min Ch El (ft)	1945.00	Shear (lb/sq ft)	0.26	1.49	0.29
Alpha	1.08	Stream Power (lb/ft s)	0.27	9.02	0.40
Frctn Loss (ft)	26.05	Cum Volume (acre-ft)	1.31	12.36	1.85
C & E Loss (ft)	0.01	Cum SA (acres)	2.31	8.19	3.18

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.

Profile #PF 1

	Pos	Left Sta (ft)	Right Sta (ft)	Flow (cfs)	Area (sq ft)	W.P. (ft)	Percent Conv	Hydr Depth(ft)	Velocity (ft/s)
1	LOB	138.00	172.50	0.62	0.57	2.42	0.07	0.24	1.07
2	Chan	172.50	188.26	167.73	26.07	15.91	17.92	1.65	6.43
3	Chan	188.26	204.01	227.89	31.21	15.76	24.35	1.98	7.30
4	Chan	204.01	219.77	184.37	27.48	15.76	19.70	1.74	6.71
5	Chan	219.77	235.53	139.70	23.27	15.76	14.93	1.48	6.00
6	Chan	235.53	251.29	100.13	19.05	15.76	10.70	1.21	5.25
7	Chan	251.29	267.04	66.02	14.84	15.76	7.05	0.94	4.45
8	Chan	267.04	282.80	37.83	10.63	15.76	4.04	0.67	3.56
9	ROB	282.80	319.75	11.71	8.60	31.83	1.25	0.27	1.36

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: Fan 2
REACH: Reach 1 RS: 300

INPUT

Description:
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1928	61.451	1928.5	178.794	1926	214.919	20.358	223.589	1919
267.808	1919	307.6	1920.27	330.452	1921	468.637	1927.5	556.486	1940

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	214.9	.04	307.6	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
214.9	307.6	1596	1651	1590	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1921.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.70	Wt. n-Val.	0.070	0.040	0.060
W.S. Elev (ft)	1920.82	Reach Len. (ft)	1596.00	1651.00	1590.00
Crit W.S. (ft)	1920.82	Flow Area (sq ft)	0.69	137.62	4.75
E.G. Slope (ft/ft)	0.019504	Area (sq ft)	0.69	137.62	4.75
Q Total (cfs)	936.00	Flow (cfs)	0.76	928.29	6.95
Top Width (ft)	112.90	Top Width (ft)	2.96	92.70	17.24
Vel Total (ft/s)	6.54	Avg. Vel. (ft/s)	1.11	6.75	1.46
Max Chl Dpth (ft)	1.82	Hydr. Depth (ft)	0.23	1.48	0.28
Conv. Total (cfs)	6702.2	Conv. (cfs)	5.4	6647.0	49.8
Length Wtd. (ft)	1648.81	Wetted Per. (ft)	3.00	92.83	17.25
Min Ch El (ft)	1919.00	Shear (lb/sq ft)	0.28	1.81	0.34
Alpha	1.05	Stream Power (lb/ft s)	0.31	12.18	0.49
Frctn Loss (ft)	30.83	Cum Volume (acre-ft)	1.29	7.63	1.63
C & E Loss (ft)	0.01	Cum SA (acres)	2.24	4.88	2.36

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Profile #PF 1

	Pos	Left Sta (ft)	Right Sta (ft)	Flow (cfs)	Area (sq ft)	W.P. (ft)	Percent Conv	Hydr Depth(ft)	Velocity (ft/s)
1	LOB	171.92	214.90	0.76	0.69	3.00	0.08	0.23	1.11
2	Chan	214.90	228.14	112.15	18.21	13.35	11.98	1.38	6.16
3	Chan	228.14	241.39	179.98	24.11	13.24	19.23	1.82	7.46
4	Chan	241.39	254.63	179.98	24.11	13.24	19.23	1.82	7.46
5	Chan	254.63	267.87	179.98	24.11	13.24	19.23	1.82	7.46
6	Chan	267.87	281.11	146.17	21.29	13.25	15.62	1.61	6.87
7	Chan	281.11	294.36	87.91	15.69	13.25	9.39	1.18	5.60
8	Chan	294.36	307.60	42.13	10.09	13.25	4.50	0.76	4.17
9	ROB	307.60	357.38	6.95	4.75	17.25	0.74	0.28	1.46

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Fan 2
REACH: Reach 1 RS: 200

INPUT
Description:
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1885	89.688	1883	177.549	1879.8	200.028	1876.5	227.46	1876
260.975	1876	270.51	1876.489	338.882	1880	396.794	1881.5	482.142	1883

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	200.028	.04	270.5	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
200.028	270.5	535	525	517	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1878.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.75	Wt. n-Val.	0.070	0.040	0.060
W.S. Elev (ft)	1877.86	Reach Len. (ft)	535.00	525.00	517.00
Crit W.S. (ft)	1877.86	Flow Area (sq ft)	6.31	121.99	18.34
E.G. Slope (ft/ft)	0.017938	Area (sq ft)	6.31	121.99	18.34
Q Total (cfs)	936.00	Flow (cfs)	13.79	874.92	47.29
Top Width (ft)	106.48	Top Width (ft)	9.27	70.47	26.73
Vel Total (ft/s)	6.38	Avg. Vel. (ft/s)	2.18	7.17	2.58
Max Chl Dpth (ft)	1.86	Hydr. Depth (ft)	0.68	1.73	0.69
Conv. Total (cfs)	6988.6	Conv. (cfs)	103.0	6532.5	353.1

Length Wtd. (ft)	524.75	Wetted Per. (ft)	9.37	70.49	26.77
Min Ch El (ft)	1876.00	Shear (lb/sq ft)	0.75	1.94	0.77
Alpha	1.19	Stream Power (lb/ft s)	1.65	13.90	1.98
Frctn Loss (ft)	8.55	Cum Volume (acre-ft)	1.16	2.71	1.21
C & E Loss (ft)	0.08	Cum SA (acres)	2.01	1.79	1.56

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Profile #PF 1

	Pos	Left Sta (ft)	Right Sta (ft)	Flow (cfs)	Area (sq ft)	W.P. (ft)	Percent Conv	Hydr Depth(ft)	Velocity (ft/s)
1	LOB	160.02	200.03	13.79	6.31	9.37	1.47	0.68	2.18
2	Chan	200.03	210.10	92.99	14.63	10.07	9.93	1.45	6.36
3	Chan	210.10	220.16	113.37	16.48	10.07	12.11	1.64	6.88
4	Chan	220.16	230.23	134.49	18.25	10.07	14.37	1.81	7.37
5	Chan	230.23	240.30	140.51	18.74	10.07	15.01	1.86	7.50
6	Chan	240.30	250.37	140.51	18.74	10.07	15.01	1.86	7.50
7	Chan	250.37	260.43	140.51	18.74	10.07	15.01	1.86	7.50
8	Chan	260.43	270.50	112.54	16.41	10.08	12.02	1.63	6.86
9	ROB	270.50	312.83	47.29	18.34	26.77	5.05	0.69	2.58

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Fan 2
REACH: Reach 1 RS: 150

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1867	83.81	1867	148.13	1866	172.09	1865.5	240.94	1865
250.12	1864.57	262.31	1864	285.59	1864	299.37	1864.5	390.51	1865.5
413.55	1866	469.42	1868	524.93	1868				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.06	250.12	.04	299.37	.07

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
250.12	299.37	526	540	526	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1866.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.47	Wt. n-Val.	0.060	0.040	0.070
W.S. Elev (ft)	1865.94	Reach Len. (ft)	526.00	540.00	526.00
Crit W.S. (ft)	1865.94	Flow Area (sq ft)	62.75	88.63	90.14
E.G. Slope (ft/ft)	0.014867	Area (sq ft)	62.75	88.63	90.14
Q Total (cfs)	936.00	Flow (cfs)	139.70	593.75	202.55
Top Width (ft)	259.79	Top Width (ft)	99.12	49.25	111.42
Vel Total (ft/s)	3.88	Avg. Vel. (ft/s)	2.23	6.70	2.25
Max Chl Dpth (ft)	1.94	Hydr. Depth (ft)	0.63	1.80	0.81
Conv. Total (cfs)	7676.6	Conv. (cfs)	1145.8	4869.6	1661.2
Length Wtd. (ft)	536.60	Wetted Per. (ft)	99.13	49.27	111.43
Min Ch El (ft)	1864.00	Shear (lb/sq ft)	0.59	1.67	0.75
Alpha	2.02	Stream Power (lb/ft s)	1.31	11.18	1.69
Frctn Loss (ft)	9.03	Cum Volume (acre-ft)	0.74	1.44	0.56
C & E Loss (ft)	0.01	Cum SA (acres)	1.35	1.07	0.74

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Profile #PF 1

	Pos	Left Sta (ft)	Right Sta (ft)	Flow (cfs)	Area (sq ft)	W.P. (ft)	Percent Conv	Hydr Depth(ft)	Velocity (ft/s)
1	LOB	150.07	200.10	30.47	19.81	49.10	3.26	0.40	1.54
2	LOB	200.10	250.12	109.23	42.94	50.04	11.67	0.86	2.54
3	Chan	250.12	257.16	64.72	10.80	7.04	6.91	1.53	5.99
4	Chan	257.16	264.19	88.53	13.03	7.04	9.46	1.85	6.80
5	Chan	264.19	271.23	95.73	13.65	7.04	10.23	1.94	7.01

6	Chan	271.23	278.26	95.73	13.65	7.04	10.23	1.94	7.01
7	Chan	278.26	285.30	95.73	13.65	7.04	10.23	1.94	7.01
8	Chan	285.30	292.33	86.24	12.82	7.04	9.21	1.82	6.72
9	Chan	292.33	299.37	67.08	11.03	7.04	7.17	1.57	6.08
10	ROB	299.37	344.48	140.72	53.80	45.11	15.03	1.19	2.62
11	ROB	344.48	389.59	57.57	31.47	45.11	6.15	0.70	1.83
12	ROB	389.59	434.71	4.25	4.87	21.20	0.45	0.23	0.87

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
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.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Fan 2
REACH: Reach 1 RS: 100

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1854	88.72	1851.5	121.28	1850	201.44	1850	242.69	1851
297.93	1852.5	424.67	1852.5	454.72	1850	540.43	1849	561.1	1849
578	1850	596.06	1851	671.73	1852	809.64	1853.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	454.72	.04	578	.07

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
454.72	578	0	0	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1851.04	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.45	Wt. n-Val.	0.070	0.040	0.070
W.S. Elev (ft)	1850.59	Reach Len. (ft)			
Crit W.S. (ft)	1850.59	Flow Area (sq ft)	59.81	144.18	3.10
E.G. Slope (ft/ft)	0.019184	Area (sq ft)	59.81	144.18	3.10
Q Total (cfs)	936.00	Flow (cfs)	108.67	823.31	4.01
Top Width (ft)	257.93	Top Width (ft)	124.07	123.28	10.58
Vel Total (ft/s)	4.52	Avg. Vel. (ft/s)	1.82	5.71	1.30
Max Chl Dpth (ft)	1.59	Hydr. Depth (ft)	0.48	1.17	0.29
Conv. Total (cfs)	6757.8	Conv. (cfs)	784.6	5944.2	29.0
Length Wtd. (ft)		Wetted Per. (ft)	124.12	123.32	10.59
Min Ch El (ft)	1849.00	Shear (lb/sq ft)	0.58	1.40	0.35
Alpha	1.42	Stream Power (lb/ft s)	1.05	8.00	0.45
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: Divided flow computed for this cross-section.
Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.

Profile #PF 1

	Pos	Left Sta (ft)	Right Sta (ft)	Flow (cfs)	Area (sq ft)	W.P. (ft)	Percent Conv	Hydr Depth(ft)	Velocity (ft/s)
1	LOB	90.94	181.89	75.49	39.22	73.33	8.07	0.53	1.92
2	LOB	181.89	272.83	30.53	18.53	43.72	3.26	0.42	1.65
3	LOB	272.83	363.78						
4	LOB	363.78	454.72	2.65	2.06	7.06	0.28	0.29	1.29
5	Chan	454.72	472.33	46.92	12.12	17.61	5.01	0.69	3.87
6	Chan	472.33	489.94	72.52	15.74	17.61	7.75	0.89	4.61
7	Chan	489.94	507.55	102.39	19.36	17.61	10.94	1.10	5.29
8	Chan	507.55	525.17	136.22	22.98	17.61	14.55	1.30	5.93
9	Chan	525.17	542.78	173.47	26.57	17.61	18.53	1.51	6.53
10	Chan	542.78	560.39	188.52	27.93	17.61	20.14	1.59	6.75
11	Chan	560.39	578.00	103.28	19.48	17.64	11.03	1.11	5.30
12	ROB	578.00	624.33	4.01	3.10	10.59	0.43	0.29	1.30

Warning: Divided flow computed for this cross-section.
Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.

SUMMARY OF MANNING'S N VALUES

River:Fan 1

Reach	River Sta.	n1	n2	n3
Reach 1	200	.06	.04	.055
Reach 1	150	.06	.04	.055

River:Fan 2

Reach	River Sta.	n1	n2	n3
Reach 1	500	.07	.04	.06
Reach 1	400	.07	.04	.06
Reach 1	300	.07	.04	.06
Reach 1	200	.07	.04	.06
Reach 1	150	.06	.04	.07
Reach 1	100	.07	.04	.07

SUMMARY OF REACH LENGTHS

River: Fan 1

Reach	River Sta.	Left	Channel	Right
Reach 1	200	452	469	487
Reach 1	150	0	0	0

River: Fan 2

Reach	River Sta.	Left	Channel	Right
Reach 1	500	1115	1207	934
Reach 1	400	1244	1420	1459
Reach 1	300	1596	1651	1590
Reach 1	200	535	525	517
Reach 1	150	526	540	526
Reach 1	100	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Fan 1

Reach	River Sta.	Contr.	Expan.
Reach 1	200	.1	.3
Reach 1	150	.1	.3

River: Fan 2

Reach	River Sta.	Contr.	Expan.
Reach 1	500	.1	.3
Reach 1	400	.1	.3
Reach 1	300	.1	.3
Reach 1	200	.1	.3
Reach 1	150	.1	.3
Reach 1	100	.1	.3

HEC-RAS Version 4.0.0 March 2008
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

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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: Sun Valley Parkway Channel
Project File : SVPkwy_Chnl.prj
Run Date and Time: 1/19/2009 3:59:35 PM

Project in English units

PLAN DATA

Plan Title: Existing
Plan File : x:\projects\Agency\FCDMC\2007C051\TO2_Fan1_2\hec-ras\SVPkwy_Chnl.p01

Geometry Title: Existing
Geometry File : x:\projects\Agency\FCDMC\2007C051\TO2_Fan1_2\hec-ras\SVPkwy_Chnl.g01

Flow Title : Existing
Flow File : x:\projects\Agency\FCDMC\2007C051\TO2_Fan1_2\hec-ras\SVPkwy_Chnl.f01

Plan Summary Information:
Number of: Cross Sections = 207 Multiple Openings = 0
Culverts = 1 Inline Structures = 44
Bridges = 0 Lateral Structures = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 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: Program Selects Appropriate method
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: Existing
Flow File : x:\projects\Agency\FCDMC\2007C051\TO2_Fan1_2\hec-ras\SVPkwy_Chnl.f01

Flow Data (cfs)

River	Reach	RS	FLO2DQ
SunValley	Reach1	15089.58	261
SunValley	Reach1	14945.94	261
SunValley	Reach1	14937.48	261
SunValley	Reach1	14877.43	624
SunValley	Reach1	14514.80	1230
SunValley	Reach1	14142.06	1393
SunValley	Reach1	14119.48	1393
SunValley	Reach1	13712.92	1463
SunValley	Reach1	13441.98	1459
SunValley	Reach1	13413.49	1459
SunValley	Reach1	13113.85	1457
SunValley	Reach1	12710.30	1548
SunValley	Reach1	12387.58	1628
SunValley	Reach1	12118.62	1709
SunValley	Reach1	12083.58	1709
SunValley	Reach1	11825.08	1710
SunValley	Reach1	11794.31	1710
SunValley	Reach1	11530.86	1719
SunValley	Reach1	11258.40	1718
SunValley	Reach1	10927.56	1717
SunValley	Reach1	10628.03	1716
SunValley	Reach1	10428.14	1716
SunValley	Reach1	10126.72	1713
SunValley	Reach1	9702.693	1721
SunValley	Reach1	9588.970	1719
SunValley	Reach1	9420.045	1718
SunValley	Reach1	9244.882	1718

SunValley	Reach1	9026.968	1707
SunValley	Reach1	8815.779	1718
SunValley	Reach1	8500.547	1715
SunValley	Reach1	8469.387	1715
SunValley	Reach1	8122.685	1711
SunValley	Reach1	7773.177	1707
SunValley	Reach1	7419.387	1702
SunValley	Reach1	7022.299	1694
SunValley	Reach1	6713.511	1691
SunValley	Reach1	6416.444	1687
SunValley	Reach1	6113.420	1684
SunValley	Reach1	5812.631	1684
SunValley	Reach1	5413.769	1681
SunValley	Reach1	5116.053	1680
SunValley	Reach1	4818.556	1697
SunValley	Reach1	4770.290	1758
SunValley	Reach1	4488.645	1796
SunValley	Reach1	4094.117	2268
SunValley	Reach1	3972.552	2268
SunValley	Reach1	998.5162	2268

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
SunValley	Reach1	FLO2DQ	Normal S = 0.008	Normal S = 0.009

GEOMETRY DATA

Geometry Title: Existing
Geometry File : x:\projects\Agency\FCDMC\2007C051\TO2_Fan1_2\hec-ras\SVPkwy_Chnl.g01

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 15089.58

INPUT
Description:
Station Elevation Data num= 92

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1668.53	6.45	1668.31	11.3	1668.07	20.91	1668.09	23.07	1668.06
25.14	1668.04	35.38	1667.76	37.22	1667.64	38.98	1667.51	44.29	1666.82
49.84	1666.56	52.83	1666.39	58.44	1666.34	64.6	1666.38	68.23	1666.44
70.13	1665.61	70.59	1665.42	72.33	1665.52	73.79	1665.6	73.99	1665.61
76.64	1666.3	77.25	1666.46	77.36	1666.5	77.68	1666.52	86.73	1667.44
86.77	1667.45	93.22	1668.2	94.36	1668.34	95.1	1668.39	103.6	1669.14
106.19	1669.36	108.95	1669.46	115.02	1669.57	122.04	1669.42	122.15	1669.42
135.88	1669.7	136.61	1669.71	149.73	1669.86	150.38	1669.86	151.07	1669.88
163.57	1670.05	165.53	1670.07	171.6	1670.15	177.41	1670.11	179.99	1670.11
185.75	1670.03	191.26	1669.9	194.45	1669.87	205.1	1669.91	207.74	1669.93
209.94	1669.96	212.81	1669.9	221.4	1669.78	222.67	1669.75	224.03	1669.78
226.91	1669.86	232.79	1669.97	235.26	1670	235.38	1670	237.08	1669.97
242.42	1669.84	242.94	1669.82	246.81	1669.66	257.56	1669.33	257.79	1669.32
257.96	1669.32	267.09	1669.13	268.14	1669.11	277.09	1669.04	286.5	1668.86
287.1	1668.85	287.58	1668.8	289.64	1668.58	290.69	1668.47	293.15	1668.2
295.95	1667.83	296.92	1667.71	297.1	1667.68	297.44	1667.6	303.63	1666.18
303.88	1666.1	306.37	1665.49	312.94	1666.46	318.2	1667.3	321.73	1667.41
326.26	1667.56	328.06	1667.56	332.61	1667.63	334.56	1667.66	349.89	1667.84
365.03	1667.72	370.02	1667.69						

Manning's n Values num= 2

Sta	n Val	Sta	n Val
0	.035	332.61	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
20.91	318.2	34.42	40.59	39.56	.1	.3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 15048.99

INPUT
Description:
Station Elevation Data num= 94

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1668.33	.56	1668.27	5.92	1668.22	7.65	1668.24	9.65	1668.13
14.74	1667.98	19.11	1667.82	24.98	1667.66	28.92	1667.62	32.31	1667.44
40.31	1667.04	43.1	1666.87	45.5	1666.77	50.19	1666.56	55.64	1666.29
57.28	1666.21	58.56	1666.21	65.23	1666.04	68.39	1665.33	68.69	1665.25
69.37	1665.23	72.46	1665.06	72.61	1665.05	72.83	1665.07	75.1	1665.31
75.35	1665.33	76.77	1665.56	79.68	1666.03	84.88	1666.56	85.64	1666.61
86.3	1666.57	94	1666.53	99.5	1666.5	101.68	1666.63	106.99	1666.88
111.48	1667.21	114.01	1667.56	117.37	1667.79	122.16	1668.16	125.07	1668.35
132.28	1668.58	137.87	1668.57	147.6	1668.57	149.46	1668.58	151.06	1668.58
156.55	1668.67	162.93	1668.68	164.26	1668.68	172.46	1668.65	177.45	1668.64
177.83	1668.64	178.26	1668.64	183.29	1668.69	184.91	1668.71	190.95	1668.78
191.99	1668.8	193.09	1668.8	204.69	1668.82	206.13	1668.81	207.67	1668.8

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  213.21 1668.86  218.43 1668.91  222.25    1669  222.76 1668.99  229.58  1669.1
  230.42 1669.05  236.58 1668.61   238.6 1668.49  239.73 1668.47  248.98 1667.87
  249.59 1667.83  249.66 1667.82  249.98 1667.76  251.22 1667.54  258.16 1666.32
  261.23 1665.89  262.11 1665.73  262.66 1665.66  263.21  1665.6   265.3 1665.57
  268.63 1664.89  268.66 1664.89  270.59 1665.26  274.87  1665.9  277.81 1666.43
  279.71  1666.5  284.87  1666.9  289.01  1667.2  289.03  1667.2  290.81  1667.2
  292.76 1667.23  295.61 1667.25  312.73 1667.39  339.86 1667.24

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
       0    .035  295.61    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         28.92  289.03             18.08  103.04  102.59             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 14945.94

INPUT
Description:
Station Elevation Data    num=      85
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1668.21    6.01 1668.35    8.42 1668.47   10.56 1668.39    15.5 1668.04
   21.06 1667.81   23.94 1667.68   29.67  1667.5   33.25 1667.29   35.39 1667.16
   36.93 1667.06   39.96 1666.99   46.61 1666.75    51.8 1666.38   57.83 1666.02
   58.87 1665.93   59.71 1665.86   65.35 1665.38   67.34  1665.3   68.92 1665.22
   71.38 1664.94   73.67 1664.51    76.4 1663.82   78.98 1663.69   80.27 1663.65
    80.9  1664.2    82.4 1664.87   86.47 1665.17   91.28 1664.68   91.41 1664.68
   93.65 1664.83   98.62 1664.94  106.63 1664.45  107.79 1664.45  109.65 1664.42
  113.01 1664.95  121.16 1665.67  127.02 1666.53  129.51 1666.62  130.24 1666.64
  133.89 1666.61  137.18 1666.59   137.8 1666.57   139.1 1666.45  143.26 1666.05
  143.56 1666.03   143.6 1666.02  143.79    1666  148.63 1665.47  150.66 1665.35
  158.51 1664.66   159.4 1664.65  164.76  1664.6  168.62 1664.47  171.64 1664.45
  177.59  1664.4  180.83 1664.39  186.33 1664.28  192.17 1664.29   196.6 1664.34
  200.96 1664.39   204.9 1664.35  209.52 1664.41  212.89 1664.42  219.39 1664.51
  223.25 1664.53  223.65 1664.53  229.02 1664.35  230.99  1664.4  236.74 1665.08
  239.73 1665.56   240.7 1665.68  241.26 1665.87  242.98 1665.96  248.88 1666.24
  250.32 1666.24  250.68 1666.24  256.14 1666.31  265.06 1666.42  272.73  1666.5
  292.11 1666.64   300.7  1666.7  301.05 1667.06   301.2  1667.2  301.48  1667.2

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
       0    .035  256.14    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          51.8  248.88             19.16    8.46    8.56             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 14937.48

INPUT
Description:
Station Elevation Data    num=      63
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1667.63     .15 1667.62   11.55 1667.27   13.79 1667.17   26.34 1666.71
   30.11  1666.3   31.57 1666.12   33.29 1665.99   37.98 1665.68   48.58 1664.91
   49.08 1664.86   49.26 1664.85   49.63 1664.83    61.6 1663.92   64.19 1663.67
   67.27 1663.71   71.91 1663.72   72.99 1663.81   74.16 1664.06   74.33 1664.07
   78.14 1664.08   78.27 1664.07   92.99 1663.37   98.56 1663.09  106.82 1664.42
  108.21  1664.5  112.26 1664.74  115.55 1664.56  116.61  1664.6  118.23 1664.68
  121.22 1664.39   124.1    1664  127.78 1663.71  133.47 1662.94  136.48 1662.82
  138.94 1662.61  142.22 1662.43  144.39 1662.35  146.12 1662.28  156.79 1661.65
  160.85  1661.5  161.14 1661.49  162.94 1661.42  172.72  1661.4  173.49 1661.43
  187.67 1661.47  189.88 1661.53  190.04 1661.54   190.9 1661.58  194.62 1661.99
  198.48 1662.41  199.27 1662.54   205.8 1663.99  207.89 1664.66  210.52 1665.43
  211.36  1665.7  212.26 1665.75  219.25 1666.17  221.05 1666.17  226.56 1666.24
  242.93 1666.43  243.16 1666.43  267.95 1666.62

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
       0    .035  226.56    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         37.98  212.26             95.42   60.05   59.99             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 14877.43

INPUT
Description:
Station Elevation Data    num=      53
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1667.07    4.38  1666.6    6.85 1666.29   10.47 1665.68   17.53 1664.91
   19.31 1664.71   19.96 1664.64   26.75 1664.04   27.67  1663.9   28.63 1663.87
   28.89 1663.85   74.25 1661.66   76.51 1661.59   81.15 1661.26   85.46 1660.95
   89.11 1661.09   89.43 1661.11   98.11 1661.17   99.43 1661.16  108.08 1661.04
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  109.43    1661  110.79 1661.02  119.43 1661.15  121.13 1661.14  128.97  1661.1
   131.3 1660.76  133.12 1660.46  137.43 1660.79  139.84 1660.91  142.45 1660.89
  145.67 1661.74  148.34 1662.45  149.43 1662.76  157.92 1664.99  159.43 1665.37
  159.82  1665.4  161.31  1665.5  163.67 1665.53  169.92 1665.68   170.2 1665.68
  171.72 1665.68  177.04 1665.74  177.56 1665.74  193.72 1665.93  216.28 1666.21
  221.93  1666.3  222.31 1666.68  222.43  1666.8  223.61 1666.76  225.23 1666.71
  225.61 1666.32  225.73 1666.21  226.86 1666.21

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
       0    .035  177.56    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         17.53  161.31            36.15   35.88   35.55            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 14841.55

INPUT
Description:
Station Elevation Data    num=      56
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1667.09     1.61 1666.88     3.84  1666.5     4.95 1666.45     8.82 1666.22
   12.87 1665.69    15.98 1665.16    19.08 1665.71    23.65 1666.57    27.59  1667.1
   28.75 1667.33    32.83 1667.28    35.27 1667.42    37.41 1667.33    37.87 1667.22
   45.05 1664.19    48.65 1663.24    55.69 1661.41    62.15 1661.01    62.19     1661
   65.18  1660.8    67.35  1660.9    69.75 1661.02    72.41 1661.02    79.75 1660.98
   82.43 1660.96    89.75 1660.87    97.04  1660.8    99.75 1660.72   102.47 1660.71
  109.75 1660.47   117.24 1660.65   122.48 1660.83   125.43 1661.54   126.07 1661.69
  129.75 1662.56   135.28 1663.81   140.66 1665.07   141.72 1665.22   149.91 1665.37
  150.48 1665.38   152.26 1665.38   152.28 1665.38    152.4 1665.39   158.33 1665.47
  174.23 1665.68   197.44 1666.02   202.55  1666.1   203.03 1666.59   203.05  1666.6
  203.15  1666.6   205.74 1666.48   205.92  1666.3   206.22     1666   206.24 1665.98
  207.18 1665.97

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
       0    .035  158.33    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         45.05  141.72            31.93   32.26   32.66            .1       .3
Left Levee      Station=    35.24      Elevation= 1667.43

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 14809.29

INPUT
Description:
Station Elevation Data    num=      64
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1667.23     2.26 1667.14     4.64 1667.02     9.38 1666.59    13.81 1665.69
   16.09 1665.25    20.66 1666.02    24.07 1666.58    25.39 1666.84    29.44  1667.6
   33.37 1667.68    37.86 1667.74    49.32 1664.55    50.53 1664.23    59.88     1662
   60.53 1661.84    61.61 1661.65    63.64  1661.3    64.28 1661.18    66.49  1660.8
   68.09  1660.7    69.92 1660.59    70.53 1660.55    71.14 1660.55    80.53 1660.48
    81.1 1660.47    90.53 1660.38    91.05 1660.37   100.53 1660.29   101.01 1660.28
  110.53 1660.21   110.93  1660.2   113.72 1660.09   120.63 1660.63   122.67 1660.79
  123.25 1660.81   126.95 1661.48    129.4 1661.92   130.53 1662.12   130.88 1662.22
  140.53 1664.79   140.63  1664.8   142.92 1664.98   145.59 1665.02   151.49 1665.12
   153.1 1665.12   153.29 1665.12   154.72 1665.14   159.52 1665.22   168.17 1665.37
  175.19 1665.51   183.84 1665.58    186.7  1665.6   191.95 1665.64   202.87 1665.73
  203.18 1665.74   203.19 1665.74   203.68 1666.24   203.84 1666.24   203.97 1666.24
   206.7 1666.27   206.88 1666.09    207.2 1665.77   209.62 1665.75

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
       0    .035  159.52    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         49.32  142.92            100.8  100.54  100.16            .1       .3
Left Levee      Station=    37.67      Elevation= 1667.75

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 14708.76

INPUT
Description:
Station Elevation Data    num=      84
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1667.13     1.18 1667.16     1.35 1667.17     1.73 1667.16      6.3 1666.82
    9.99 1666.85    14.21 1666.76    15.59 1666.74    23.94 1666.96    24.48 1666.95
    24.8 1666.93    25.51 1666.86     25.9 1666.82    35.25 1665.58    41.11 1664.93
   44.24 1664.51    45.46 1664.44    48.39  1664.3    53.58 1663.94    55.48 1663.57
   57.18 1663.23    57.35 1663.23    62.72 1663.26     65.4 1663.32    67.86 1663.29
   74.23  1663.1    74.41  1663.1     74.5 1663.09    74.63  1663.1    79.73 1663.21
   84.16  1663.2    84.99 1663.23    88.73 1664.33    90.34 1664.86    91.11 1664.94
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  96.17 1665.64   96.64 1665.68   99.34 1666.02   99.73 1666.07  102.38 1665.89
 106.52  1665.6  108.58 1665.42  109.74 1665.32  109.89  1665.3  119.77 1663.25
 129.67 1661.06  129.77 1661.04  129.83 1661.03  134.02 1660.25  134.94 1660.19
 139.73 1659.88  139.77 1659.88  149.69 1659.74  149.77 1659.74   159.7 1659.61
 159.77 1659.61  159.84 1659.61  169.77  1659.8  179.72 1659.83  179.77 1659.83
 189.73 1659.97  189.77 1659.97  189.84 1659.97  195.57 1660.25  196.43  1660.3
 197.63 1660.36  201.19 1661.27  209.72 1663.72  209.77 1663.74  209.78 1663.74
 212.91 1663.86  217.57 1664.05  221.47  1664.2  222.25  1664.2  223.27  1664.2
 229.31 1664.37  230.01 1664.38  245.09 1664.79  261.17 1664.94  261.91 1664.94
 262.38 1665.41  262.41 1665.44  264.62 1665.44  275.27 1665.43

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .035  230.01    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        119.77  209.72             56.95   57.01   57.06            .1       .3
Left Levee      Station=   99.91      Elevation= 1666.05

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 14651.74

INPUT
Description:
Station Elevation Data     num=      51
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1667.19     1.49 1667.21   10.79 1666.68    11.8 1666.62   22.76 1665.85
   23.59 1665.78    34.8 1664.38   38.42 1664.19   45.44 1663.81    45.7  1663.8
   51.89  1663.4   53.34  1663.3   56.28 1663.14   60.14     1663   60.34 1662.99
   60.68 1662.97   60.93 1662.95   61.45 1662.92  100.36 1660.53   114.8  1659.6
   117.8 1659.27  119.97 1659.24  125.31 1659.16  130.58 1659.54  131.85 1659.59
  133.46 1659.59  140.27 1659.23  141.25 1659.12  153.33 1659.51  156.28 1659.51
  159.23 1659.47  166.28 1659.43  173.33 1659.34  176.28  1659.4  178.06 1659.41
  183.07  1659.7  184.14 1659.76  193.21  1662.1  196.28 1662.93  198.06 1663.06
  199.71 1663.23  202.81 1663.39  208.41 1663.67  210.21 1663.67  217.24 1663.83
     232 1664.17  248.19 1664.39  248.29 1664.39  248.79 1664.89  250.32 1664.89
  260.01 1664.86

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .035  217.24    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         61.45  196.28             51.25    51.5   51.82            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 14600.25

INPUT
Description:
Station Elevation Data     num=      45
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1666.07     1.97 1665.97    6.31 1663.98    8.11 1663.17   12.64 1660.92
   14.87 1660.84    16.14 1660.78   37.13 1659.23   42.95  1658.8   45.61 1658.87
   47.64 1658.92    55.24     1659   63.72  1658.8   65.24 1658.78   66.75 1658.81
   75.24 1659.08    77.25 1659.06   81.05 1658.97   83.48 1658.81   85.46 1658.58
   87.07 1658.72    88.21 1658.86   93.85 1658.79   95.25 1658.77  100.88 1658.87
  102.17 1658.91   103.74 1658.96  107.34 1659.98  115.25 1662.15  116.17 1662.25
  119.85  1662.6   122.44 1662.81  127.71 1663.16  128.53 1663.16  129.51 1663.16
  136.84 1663.31      144 1663.46  151.34 1663.61  158.58 1663.73  162.28 1663.79
  167.53 1663.87  167.97 1664.31  168.03 1664.37   170.2 1664.36  177.81 1664.34

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .035  136.84    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          8.11  127.71             32.76   32.72   32.64            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 14567.53

INPUT
Description:
Station Elevation Data     num=      54
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1666.56     7.24 1666.29   15.74  1665.5   20.02  1665.1   26.24 1663.92
   27.07 1663.76    28.72 1664.08   34.69 1665.24    36.6 1665.77   37.75 1666.07
   44.03  1666.2   47.32 1666.24   51.07 1665.51   57.75 1664.41   63.88 1662.63
   66.69 1661.67   67.75 1661.34   73.42 1659.85   74.49 1659.65    78.5 1659.05
   78.66 1659.02    80.3 1658.89   84.62 1658.58   86.95 1658.85   87.75 1658.93
   96.58 1658.62   97.75 1658.59  106.55  1658.6  107.75 1658.61  108.96 1658.63
  117.75  1658.7     119 1658.69  127.75 1658.75  129.03 1658.74  137.75 1658.66
  143.48 1658.54   144.7 1658.57  145.33 1658.58  148.07 1659.26  157.75 1661.89
  160.09 1662.18  162.56 1662.46  164.44 1662.56  170.42 1662.84  171.31 1662.84
  172.22 1662.84  179.53 1662.99  180.53 1663.01  194.13 1663.29  206.98 1663.46
```

```
  210.28 1663.51  210.61 1663.83  210.78 1664.01  222.24 1664.01

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
       0    .035  179.53    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         63.88  170.42             52.66   52.72    52.8             .1      .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 14523.69

INPUT
Description:
Distance from Upstream XS =    43.84
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       46
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
      38  1666.3    41.19 1666.28    46.63  1666.2    53.94 1664.82       58    1664
   62.75 1662.71       68 1661.17    73.21 1659.98    77.84 1658.97    79.03 1658.71
   81.84 1658.28    82.49 1658.18    83.32 1658.16    89.86 1657.97     94.8    1658
   99.77 1657.97   101.54 1657.96   106.13 1657.92    110.2 1658.01   114.99 1658.03
  120.08 1658.08   124.53 1658.23   131.08  1658.3   135.46 1658.26   140.75 1658.42
  144.95 1658.67   148.48 1658.87   149.04 1658.89   149.86 1659.04   150.79 1659.29
     158  1660.9   161.32 1661.49   163.81 1661.79   165.63 1662.02    168.4 1662.19
  170.98  1662.4   172.52  1662.4   172.78  1662.4   173.55 1662.42   179.93 1662.55
  194.74 1662.86   205.25 1662.97   210.85 1663.03   211.05 1663.24   211.35 1663.53
  214.13 1663.55

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 14523.69

INPUT
Description:
Station Elevation Data    num=       46
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0  1666.3     3.19 1666.28     8.63  1666.2    15.94 1664.82       20    1664
   24.75 1662.71       30 1661.17    35.21 1659.98    39.84 1658.97    41.03 1658.71
   43.84 1658.28    44.49 1658.18    45.32 1658.16    51.86 1657.97     56.8    1658
   61.77 1657.97    63.54 1657.96    68.13 1657.92     72.2 1658.01    76.99 1658.03
   82.08 1658.08    86.53 1658.23    93.08  1658.3    97.46 1658.26   102.75 1658.42
  106.95 1658.67   110.48 1658.87   111.04 1658.89   111.86 1659.04   112.79 1659.29
     120  1660.9   123.32 1661.49   125.81 1661.79   127.63 1662.02    130.4 1662.19
  132.98  1662.4   134.52  1662.4   134.78  1662.4   135.55 1662.42   141.93 1662.55
  156.74 1662.86   167.25 1662.97   172.85 1663.03   173.05 1663.24   173.35 1663.53
  176.13 1663.55

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
       0    .045  141.93    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         24.75  132.98             8.48    8.88    9.48             .1      .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 14514.80

INPUT
Description:
Station Elevation Data    num=       47
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1666.42     5.51 1666.23     8.42 1666.19    12.28 1665.46       20 1663.98
    26.3 1662.13       30 1661.06    36.25 1659.64    39.78 1658.81       40 1658.76
   43.83 1658.17    48.83 1657.31     49.6 1657.17    56.94 1656.67    57.55 1656.65
   65.01 1656.64    66.12 1656.64    73.28 1656.63    74.85 1656.65    80.97 1656.53
   87.04 1656.42    88.68 1656.51    93.67  1656.8    95.38 1656.82   103.33 1657.28
  104.52 1657.39   106.94 1657.84   110.57 1658.52   111.43 1658.71   116.57 1659.83
     120 1660.75   123.98 1661.28   125.74  1661.6   127.08 1661.78     130 1662.15
  131.33 1662.22   133.07 1662.29   133.99 1662.29   134.87 1662.29   141.96 1662.44
  155.84 1662.73   156.82 1662.75   158.52 1662.77   172.94 1662.93   173.12  1663.1
  173.44 1663.43   176.83 1663.46

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
       0    .045  141.96    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          26.3     130            177.35  177.56  177.91             .1      .3
```

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 14337.25

INPUT
Description:
Station Elevation Data num= 45

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1662.54	.4	1662.52	4.5	1662.36	9.55	1662.02	10	1662.01
18.96	1660.1	20	1659.88	21.06	1659.62	28.46	1657.88	30	1657.52
30.95	1657.35	36.72	1655.91	39.69	1655.71	40.88	1655.65	43.78	1655.4
48.5	1655.6	50	1655.62	58.59	1655.83	60	1655.86	68.5	1655.76
70	1655.76	78.41	1655.7	80	1655.69	81.63	1655.55	90	1655.46
95.17	1655.36	97.61	1655.55	98.39	1655.76	101.3	1656.54	110	1658.9
115.31	1659.78	115.9	1659.88	116.29	1659.93	121.57	1660.36	124.56	1660.22
126.21	1660.22	126.36	1660.22	126.9	1660.23	132.57	1660.38	148.13	1660.8
156.97	1660.9	164.73	1661	165.12	1661.39	165.23	1661.5	168.87	1661.52

Manning's n Values num= 2

Sta	n Val	Sta	n Val
0	.045	132.57	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
18.96	121.57	62.9	62.56	62.03	.1	.3

INLINE STRUCTURE

RIVER: SunValley
REACH: Reach1 RS: 14300

INPUT
Description:
Distance from Upstream XS = 36
Deck/Roadway Width = 5
Weir Coefficient = 2.6
Weir Embankment Coordinates num = 59

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-59	1664.23	-58.93	1664.23	-57.61	1664.16	-50.33	1663.46	-44.93	1663.02
-38.97	1662.27	-30.71	1661.2	-28.51	1660.93	-24.79	1660.38	-20.71	1659.83
-19.48	1660.01	-17.06	1660.46	-12.24	1661.21	-1.01	1662.45	-.16	1662.54
.24	1662.52	4.34	1662.36	9.39	1662.02	9.84	1662.01	18.8	1660.1
19.84	1659.88	20.9	1659.62	28.3	1657.88	29.84	1657.52	30.79	1657.35
36.56	1655.91	39.53	1655.71	40.72	1655.65	43.62	1655.4	48.34	1655.6
49.84	1655.62	58.43	1655.83	59.84	1655.86	68.34	1655.76	69.84	1655.76
78.25	1655.7	79.84	1655.69	81.47	1655.55	89.84	1655.46	95.01	1655.36
97.45	1655.55	98.23	1655.76	101.14	1656.54	109.84	1658.9	115.15	1659.78
115.74	1659.88	116.13	1659.93	121.41	1660.36	124.4	1660.22	126.05	1660.22
126.2	1660.22	126.74	1660.23	132.41	1660.38	147.97	1660.8	156.81	1660.9
164.57	1661	164.96	1661.39	165.07	1661.5	168.71	1661.52		

Upstream Embankment side slope = 100 horiz. to 1.0 vertical
Downstream Embankment side slope = 2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Weir crest shape = Broad Crested

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 14274.69

INPUT
Description:
Station Elevation Data num= 52

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1663.23	7.44	1662.82	9.9	1662.33	19.72	1660.84	20.16	1660.79
21.4	1660.68	30.96	1660	35.98	1659.74	40.14	1659.62	42.7	1659.4
53.41	1659.26	54.43	1659.23	54.91	1659.2	57.86	1658.9	58.26	1658.89
59.64	1658.88	95.52	1658.02	105.88	1657.68	110.82	1657.81	114.34	1657.83
116.47	1657.85	120.73	1657.9	122.46	1657.87	126.95	1657.68	131.57	1657.53
135.59	1657.37	139.56	1657.19	145.59	1657.12	149.59	1656.99	155.59	1656.85
164.39	1656.42	165.3	1656.36	167.34	1655.94	170.29	1655.23	175.59	1655.3
178.96	1655.46	185.51	1655.63	185.68	1655.68	192.05	1657.5	195.59	1658.39
200.31	1658.95	202.55	1659.26	204.76	1659.37	210.61	1659.62	212.43	1659.62
218.36	1659.77	219	1659.78	234.21	1660.13	250.33	1660.27	250.66	1660.28
251.16	1660.78	252.79	1660.79						

Manning's n Values num= 2

Sta	n Val	Sta	n Val
0	.045	218.36	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
54.91	202.55	57.78	58.34	59.33	.1	.3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 14216.35

INPUT
Description:
Station Elevation Data num= 48

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1661.54	2.62	1661.43	8.76	1660.09	9.32	1660	9.49	1659.99
12.82	1659.63	13.57	1659.58	14.08	1659.56	22.84	1659.25	23.62	1659.2
32.84	1658.74	37.5	1658.63	40.27	1658.61	67.94	1657.71	94.1	1656.88
110.18	1656.37	112.85	1656.43	115.01	1656.44	122.85	1656.25	130.46	1656.5
132.85	1656.38	137.96	1656.17	143.65	1655.64	147.25	1654.73	147.59	1654.64
147.72	1654.64	152.86	1654.53	160.98	1654.78	162.82	1654.85	163.48	1654.88
164.04	1655.04	164.56	1655.22	165.51	1655.53	172.86	1657.83	178	1658.25
179.88	1658.39	181.47	1658.5	188.18	1658.98	189.31	1658.98	189.98	1658.98
195.82	1659.09	201.33	1659.2	211.9	1659.39	227.86	1659.58	228.28	1659.59
228.33	1659.64	228.78	1660.09	234.49	1660.13				

Manning's n Values num= 2

Sta	n Val	Sta	n Val
0	.045	195.82	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
67.94	172.86	74.27	74.29	73.71	.1	.3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 14142.06

INPUT
Description:
Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1659.97	6	1659.35	8.21	1659.11	9.94	1658.97	15.67	1658.48
18.89	1658.31	24.48	1658.07	27.85	1657.81	28.42	1657.77	40.05	1657.25
46.16	1656.68	47.12	1656.62	66.75	1655.4	67.93	1655.33	75.68	1654.86
77.68	1654.72	79.03	1654.64	80.69	1654.78	82.8	1655.01	83.47	1655.09
86.94	1655.13	93.47	1655.3	96.86	1655.22	103.47	1655.02	110.19	1654.78
113.47	1654.67	119.24	1654.4	121.23	1654.29	122.59	1654.26	130.51	1654.5
134.61	1654.7	135.87	1654.95	137.48	1655.27	143.47	1656.45	148.16	1657.33
150.78	1657.67	153.73	1657.85	159.34	1658.16	160.07	1658.16	161.14	1658.16
166.69	1658.29	180.89	1658.63	182.98	1658.68	184.84	1658.69	199.38	1658.76
199.46	1658.84	199.88	1659.26	205.65	1659.3	207.11	1659.31		

Manning's n Values num= 2

Sta	n Val	Sta	n Val
0	.045	166.69	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
40.05	159.34	22.53	22.58	22.41	.1	.3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 14119.48

INPUT
Description:
Station Elevation Data num= 53

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
.71	1660.59	4.6	1660.49	8.62	1660.36	9.09	1660.34	9.35	1660.28
14.18	1659.25	20.82	1657.42	24.13	1656.43	27.04	1656.15	29.87	1655.79
30.33	1655.7	31.14	1655.59	36.19	1654.98	37.75	1654.8	41.79	1654.55
42.56	1654.52	47.21	1654.43	47.54	1654.43	47.87	1654.41	47.98	1654.4
48.38	1654.4	55.27	1654.24	56.23	1654.22	61.72	1654.24	67.07	1654.25
68.27	1654.21	77.84	1654.37	78.57	1654.36	85.72	1654.37	86.82	1654.38
94.08	1654.33	95.86	1654.36	102.95	1654.44	103.29	1654.46	103.45	1654.46
106.02	1654.72	110.25	1655.43	110.75	1655.54	111.08	1655.61	118.97	1657.53
123.52	1657.74	126.87	1657.91	128.05	1657.91	128.67	1657.91	134.04	1658.05
142.25	1658.26	150.39	1658.47	155.06	1658.48	161.84	1658.5	166.78	1658.52
166.97	1658.7	167.28	1659.02	170.35	1659.04				

Manning's n Values num= 2

Sta	n Val	Sta	n Val
.71	.045	134.04	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
20.82	118.97	5.15	4.33	3.87	.1	.3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 14115.15

INPUT
Description:
Station Elevation Data num= 52

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1660.67	4.31	1660.53	8.8	1660.38	20.19	1657.64	21.37	1657.39
23.94	1656.65	24.73	1656.58	25.52	1656.47	29.69	1655.7	34.75	1655
35.65	1654.81	36.73	1654.59	39.82	1654.17	41.98	1653.9	42.42	1653.89
43.02	1653.91	49.64	1653.99	54.64	1653.81	56.15	1653.72	58.06	1653.56
64.08	1653.09	65.17	1653.06	67.2	1652.99	73.81	1652.75	74.12	1652.74

```
    77.3 1652.63   82.34 1652.64   83.06 1652.67   85.73  1652.9   88.04 1652.99
   94.41 1653.45   98.95 1654.07  101.51 1654.05  102.57 1654.16  102.58 1654.17
  105.21 1654.68     110 1655.63  113.76 1656.34  118.53  1657.5   124.7 1657.79
  126.17 1657.87  127.76 1657.87  127.97 1657.87   132.7 1657.99  133.31 1658.01
  149.66 1658.42  159.19 1658.45  166.06 1658.47  166.53 1658.95  166.56 1658.97
  167.98 1658.98  170.74 1659.01

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .045  133.31    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         21.37  118.53             29.6   29.98   30.67             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 14085.17

INPUT
Description:
Station Elevation Data     num=      46
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1660.65    6.63 1660.42     8.3 1660.34   10.94 1659.64   20.01 1657.28
   23.14 1656.42   30.01  1654.7   34.92 1653.88   37.17  1653.5   37.31 1653.47
   38.22 1653.55    40.6 1653.75   40.88 1653.78   41.94  1653.8   50.01 1654.02
   56.58 1654.04   60.84 1653.86   62.59 1653.68   66.45 1653.31   68.21 1653.06
   71.56 1653.12   80.01 1653.12   85.12  1652.9   87.56 1652.82   91.12 1652.38
   91.89 1652.32   94.33 1652.31   99.71 1652.44  102.77 1653.33  103.91 1653.66
  110.01 1655.78  112.81 1656.34  118.96 1657.22  124.49 1657.46  126.47 1657.54
  126.87 1657.54  128.27 1657.54  133.43 1657.66  146.76 1657.97  149.83 1658.05
  155.09 1658.07  166.25 1658.14   166.7 1658.58  166.75 1658.64  167.89 1658.65
  174.62 1658.73

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .045  133.43    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         20.01  118.96           142.61  142.24  140.94             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 13942.92

INPUT
Description:
Station Elevation Data     num=      51
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1658.38     6.2 1657.04    10.5 1656.14   14.99 1654.92    20.5 1653.44
   24.77 1652.69    25.8 1652.51   26.85 1652.38   29.69 1652.04   29.79 1652.02
   30.51 1651.94   36.47 1652.16   40.51 1652.19   44.61 1652.06   50.51 1651.85
   54.68 1651.92   60.51  1652.1   66.25 1652.23   70.51 1652.54   74.44 1652.28
   76.62 1652.18   81.25 1651.63    81.9 1651.56   83.53 1651.55   90.06 1651.47
   92.03 1651.84   92.81 1651.99   94.05 1651.94  100.51 1651.93  102.48 1652.07
   104.3 1652.09  104.79 1652.18  107.26 1652.64  110.51 1653.35  116.52 1654.59
  120.51 1655.44  122.46 1655.58  127.73 1655.96  129.16 1655.96  129.53 1655.96
  134.77 1656.09  143.61 1656.31  149.69 1656.46  151.54 1656.51  154.31 1656.53
   159.5 1656.56  167.92 1656.62   168.3 1657.01  168.42 1657.12  172.09 1657.15
  178.89 1657.19

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .045  134.77    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         10.5  127.73           180.72  184.32  184.77             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 13758.60

INPUT
Description:
Station Elevation Data     num=      40
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1656.07     7.5 1655.96    8.04 1655.94    9.59  1655.6   20.26 1653.18
   24.27 1652.55   31.38 1651.47   31.85 1651.45   39.52 1651.14   40.21 1651.11
   40.62 1651.09   50.49 1650.88   60.73 1650.88   70.62 1650.72   70.77 1650.71
   79.16 1650.54   81.51  1650.3   82.57 1650.16   83.78 1650.15   90.44 1650.25
    90.8 1650.25   95.76 1650.37  100.49 1650.93  100.62 1650.94  107.05  1650.9
  107.54 1650.84  111.13 1650.41  120.59 1650.43   128.5 1650.79  130.18 1651.17
  138.96 1653.12  140.62 1653.48   142.3 1653.59  149.19 1653.93  150.99 1653.93
  156.11 1654.05  172.97 1654.42  189.27 1654.59  189.77 1655.09     194 1655.13

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .045  156.11    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
```

```
        20.26  140.62            50.99   45.68   45.83            .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 13720.10

INPUT
Description:
Distance from Upstream XS =     38.5
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       66
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     -40 1655.44  -30.88 1654.67  -30.01  1654.6  -23.38 1654.21  -17.16 1653.94
  -16.31 1653.89   -15.4 1653.85   -3.92 1653.41   -3.45 1653.36   -2.88 1653.33
   -2.01 1653.29    -.19 1653.21     .54 1653.19    1.87 1653.17    3.02 1653.15
   22.11  1652.7      26 1652.63   30.64 1652.21   48.45  1651.2   49.52 1651.13
   49.87 1651.03   50.08 1651.04   51.07 1650.84    57.2 1650.59   58.09 1650.56
   59.68  1650.5   61.43 1650.44   67.09 1650.47   74.01 1650.52   74.79 1650.52
   88.18 1650.43   88.39 1650.43   88.59 1650.43  101.84 1650.34   102.4 1650.31
  115.04 1650.21  115.94  1650.2  123.41 1650.13  124.54 1650.11  131.86 1650.05
  133.21 1650.05  141.66    1650  143.26 1650.02  147.29 1650.07  149.63 1650.18
  150.67  1650.2  156.26 1650.71  156.28 1650.71  156.71 1650.78  157.82 1651.02
  166.11 1652.99  171.46 1653.37  175.53  1653.6  175.84  1653.6  176.99  1653.6
  177.33  1653.6  182.47 1653.72  197.93 1654.08  199.43 1654.11  200.56 1654.12
  202.12 1654.13  215.57 1654.24  215.84 1654.51  216.07 1654.74  221.65 1654.75
  224.68 1654.75

Upstream Embankment side slope             =     100 horiz. to 1.0 vertical
Downstream Embankment side slope           =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins        =
Weir crest shape                           = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 13712.92

INPUT
Description:
Station Elevation Data    num=      68
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1655.36      .9 1655.34    5.92 1655.02   10.43 1654.75      13 1654.63
   15.85 1654.44   23.89  1653.9    30.8 1653.48   37.09 1653.33   37.15 1653.32
   37.29  1653.3   38.45 1653.25   40.96 1653.19    45.6 1653.11   49.56 1653.05
   62.74 1652.74   65.42 1652.69   72.09 1652.09   84.41 1651.39    90.8 1650.95
   91.08 1650.87   93.91 1650.14   98.63 1649.17  100.54 1648.84  101.71 1648.64
  105.05 1648.26  110.47 1648.09  113.99  1648.2  120.28 1648.13  123.41 1647.94
  125.54 1647.92  125.86 1647.93  134.53  1647.8  137.17  1647.8  141.24 1647.82
  143.55  1647.8  147.48 1647.82  149.69 1647.79  155.34  1647.7  161.17 1647.59
  163.49 1647.57  168.76 1647.58  169.94 1647.58  175.48  1647.6  176.37 1647.44
  181.57 1647.83  183.11 1648.12  183.98 1648.26  187.81 1649.03   190.2 1649.53
  194.47 1650.34  196.86 1650.56  197.29 1650.59  204.67 1652.43  206.96 1653.02
  213.12 1653.38  216.16 1653.53  216.85 1653.53  217.96 1653.53  223.11 1653.65
  224.53 1653.68  240.06 1654.05  251.84 1654.13  256.19 1654.16  256.68 1654.65
  256.69 1654.66  256.86 1654.66  264.16 1654.66

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
       0    .045  223.11    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         65.42  206.96            45.39    33.3   33.73            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 13679.62

INPUT
Description:
Station Elevation Data    num=      54
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1656.09    1.22 1655.95    6.62 1655.22    9.49 1654.61      10  1654.5
   15.81 1652.82   19.16 1651.92      20 1651.66    29.4 1649.43      30 1649.29
   30.45  1649.2   34.17 1648.69   35.24 1648.64   35.49 1648.62   40.82 1648.07
   42.38 1648.16   48.69 1648.14   48.99 1648.14   54.57 1648.28   55.86 1648.31
   64.79 1648.28   65.86 1648.26   74.84 1647.98   75.86 1647.98   76.88 1647.96
   85.86 1648.04   94.94 1648.12   95.86 1648.14   99.52 1648.17  107.98 1648.26
   109.4 1648.03  113.21 1647.41  120.44  1647.4  122.62 1647.41  125.09 1648.07
  125.86 1648.26  135.15  1650.5  135.43 1650.56  135.86 1650.67   136.4 1650.78
  146.76 1652.75  150.35 1652.96  154.96 1653.22  155.68 1653.22  156.76 1653.22
   161.9 1653.34  175.37 1653.67  178.87 1653.75  182.32 1653.77  194.91 1653.82
  195.36 1654.27  195.41 1654.32  197.52 1654.33  198.46 1654.33

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
       0    .045   161.9    .018
```

```
Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.    Expan.
         15.81  146.76             112.29  123.67  122.67              .1        .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 13555.95

INPUT
Description:
Station Elevation Data     num=      55
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1655.21     4.17 1654.85     4.28 1654.84     4.43  1654.8       10 1653.24
   16.85 1651.26       20 1650.37    23.39 1649.66    30.98    1648    32.78 1647.61
   37.76 1647.18    41.01 1647.03    43.38 1647.35    44.52 1647.26    47.25 1647.04
   48.22 1646.91    49.24 1646.94       60 1647.22    67.19 1647.11       70 1647.21
   74.28 1647.13    77.55 1647.16    82.13 1647.42    82.22 1647.42    82.47 1647.43
      90 1647.67    92.65 1647.74      100 1647.79   103.04 1647.76   108.48 1647.67
  110.84 1647.47   117.31 1647.22      120 1647.22   121.01 1647.31    123.3 1647.54
  127.95 1648.49   129.57 1648.78      130 1648.85   137.65 1650.55   141.51 1651.44
  145.99 1651.68   150.01 1651.87   150.61 1651.87   151.81 1651.87   156.87    1652
  164.59  1652.2   173.84 1652.43   177.36 1652.45   179.44 1652.46   187.53 1652.51
  190.05 1652.52    190.2 1652.67   190.55 1653.02   199.29  1653.1   201.48 1653.12

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .045  156.87    .018

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.    Expan.
         16.85  141.51             113.19  113.97  114.96              .1        .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 13441.98

INPUT
Description:
Station Elevation Data     num=      47
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1653.61      .51 1653.48    10.21 1650.96    16.58 1649.47    20.21 1648.55
   26.98  1647.4    28.41 1647.18    32.33 1646.58     35.7 1646.59    40.21 1646.65
   46.84 1646.36    51.14 1646.13    55.03 1646.34    60.21 1646.57    66.82 1646.63
   70.21 1646.69    76.87 1646.84    80.21 1646.88    83.52 1646.86    90.21 1646.72
   96.96 1646.83   100.21 1646.87   103.43 1646.82   110.21  1646.8   117.06 1646.69
  120.21 1646.65   123.13 1646.81   126.47  1646.9   128.51 1647.16   129.42 1647.29
  130.21 1647.41   142.25 1649.95   143.11 1650.11   143.68 1650.14   151.03 1650.51
  151.63 1650.51   152.83 1650.51   157.84 1650.63   167.55 1650.86   174.84 1651.03
  178.26 1651.04   191.19 1651.08   191.23 1651.12   191.68 1651.57   191.69 1651.58
  191.73 1651.58   195.15 1651.64

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .045  157.84    .018

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.    Expan.
         16.58  143.68             28.51   28.49   28.47              .1        .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 13420.23

INPUT
Description:
Distance from Upstream XS =    21.76
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       59
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
     -37 1653.02   -28.45 1652.71    -22.6 1651.46   -21.23 1651.18   -19.46 1651.54
    -13.5 1652.75   -11.32 1653.09    -9.78 1653.33     -.93 1653.47      .15 1653.49
      .31 1653.49      .62  1653.4     2.68 1652.82    11.85 1650.29       13    1650
    21.85 1648.22    23.79 1647.89    30.74 1646.44    30.96 1646.44    33.04 1646.36
    35.87 1646.25    37.12 1646.23    49.05 1646.09    49.09 1646.09    49.13 1646.09
    64.75 1646.31    65.25 1646.31     73.9 1646.37    74.68 1646.37     83.1 1646.42
    84.13 1646.42    91.91 1646.36    98.91  1646.3   100.84 1646.31   104.89 1646.29
   106.94  1646.2   112.96 1646.16    115.2 1646.22   121.12 1646.18   125.01 1646.27
   127.66 1646.35   130.88 1646.96   130.98 1646.98   135.87  1647.8   138.64 1648.43
   144.51 1649.95   149.86 1650.14   151.07 1650.18   152.79 1650.23   152.99 1650.23
   154.59 1650.23   157.43  1650.3   159.64 1650.36    176.6 1650.78   186.65 1650.82
   193.01 1650.84   193.26 1651.08   193.51 1651.34   198.89 1651.44

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION
```

```
RIVER: SunValley
REACH: Reach1             RS: 13413.49

INPUT
Description:
Station Elevation Data    num=      50
     Sta    Elev     Sta     Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1653.46    6.57 1651.59   11.82 1650.12   16.69 1649.32   21.82 1648.29
   26.58 1647.25   30.81 1646.11   32.55 1645.59   32.96 1645.53   39.96 1644.42
   41.88 1644.11   43.82 1644.08   53.25 1643.91   54.81 1643.93   64.77 1643.97
   66.53 1643.97   69.45 1643.98   77.83 1644.05   79.38 1644.07   83.13  1644.1
   85.54 1644.11   93.53 1644.15   97.27 1644.17   99.29 1644.19   102.4  1644.2
  104.47 1644.12  112.68 1644.24  112.77 1644.24  115.63 1644.39  116.19 1644.39
  117.82 1644.45  122.46 1644.79  126.94 1645.85  128.32  1646.2   130.9 1646.69
  134.59 1647.39  144.11 1649.86  144.26  1649.9  144.35  1649.9  152.81 1650.13
  153.79 1650.13  154.61 1650.13  159.65 1650.26  164.09 1650.38  176.61 1650.69
  190.89 1650.75  193.04 1650.75  193.46 1651.17  193.54 1651.25  196.96 1651.31

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
       0    .045  159.65    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11.82  144.11             21.2   21.23   21.26             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 13392.26

INPUT
Description:
Station Elevation Data    num=      57
     Sta    Elev     Sta     Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1653.34    1.52 1653.14    6.81 1651.72   12.83 1649.92   16.76  1649.2
   22.83 1647.77   26.71  1646.7   32.83 1645.04   35.08 1644.35   37.11 1643.93
   37.92 1643.77   42.55 1643.49   44.44 1643.37    46.3 1643.17   49.12 1642.81
   50.34 1642.82   54.07 1643.26   58.39 1643.49    59.9 1643.55   63.73 1643.43
   69.74 1643.28   70.95 1643.31   71.73  1643.4   75.41  1643.8   78.73 1643.96
   82.83 1644.21   89.25 1644.12   92.83  1644.1   96.38 1643.98  102.83 1643.81
  108.86  1643.9  109.63  1643.9  110.12 1643.84  115.97 1643.16  116.73 1643.44
   118.7 1644.17  125.04 1644.88  125.65 1644.94  125.74 1644.95  125.96 1645.03
  131.83 1646.63  132.83  1646.9  140.52 1648.73  144.71 1649.71  146.22 1649.75
  147.79 1649.78  153.97 1649.87  154.48 1649.87  155.78 1649.87   160.8 1650.01
  165.21 1650.12  177.76 1650.46  186.86 1650.49   194.2 1650.52  194.33 1650.65
   194.7 1651.02  195.01 1651.03

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
       0    .045   160.8    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         12.83  144.71            108.89   109.1  109.36             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 13283.16

INPUT
Description:
Station Elevation Data    num=      54
     Sta    Elev     Sta     Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  1653.8    3.13 1653.05     3.8 1652.89    4.89 1652.61      10 1651.27
   15.11 1649.72      20 1648.26   24.98 1646.86      30  1645.5   33.56 1644.55
    35.1 1644.18   36.67  1643.8   38.26 1643.61   40.01 1643.45   45.14 1643.41
   50.01 1643.35   55.21 1643.28   60.01 1643.22   64.72 1643.13   70.01 1643.02
   75.37 1642.99   80.01 1642.84   84.57  1642.8   90.01 1642.58   95.53 1642.77
  100.01 1642.99   105.6 1643.21  110.01 1643.31  114.34 1643.33  120.01 1643.48
  125.76 1643.33  130.01 1643.35  132.84 1643.69  133.34 1643.77  134.32 1644.02
   137.9  1644.9  140.01 1645.42  144.11 1646.62  150.01 1648.18  151.85 1648.35
  153.27 1648.51  160.22 1648.66  162.01  1648.7  162.15  1648.7  163.81  1648.7
  168.27 1648.83  180.25 1649.18  185.69 1649.34  189.77 1649.35  193.88 1649.36
  202.18 1649.39  202.52 1649.73  202.68 1649.89  212.39 1649.99

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
       0    .045  168.27    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            20  153.27            135.15  134.52  133.84             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 13148.64

INPUT
Description:
Station Elevation Data    num=      55
     Sta    Elev     Sta     Elev     Sta    Elev     Sta    Elev     Sta    Elev
```

```
      0 1650.48    8.95 1648.22    8.98 1648.21    8.99 1648.21   18.98  1645.8
     19  1645.8   22.92 1645.03   30.83 1643.48   38.97 1643.05   38.98 1643.05
  48.97 1642.81   48.98 1642.81   48.99 1642.81   58.98 1642.56   68.97 1642.46
  68.98 1642.46   68.99 1642.46   75.32 1642.39   79.61 1642.14   82.15 1641.97
  88.97 1641.93   88.98 1641.92   88.99 1641.93   98.98 1642.24  108.97  1642.6
 108.98  1642.6  108.99  1642.6  118.98 1642.72  128.97 1642.58  128.98 1642.58
 129.01 1642.58  135.17 1643.28  135.88 1643.36  148.93 1646.52  148.98 1646.53
 149.08 1646.54   152.9 1646.77  153.05 1646.78  153.59 1646.81  158.85 1647.26
 158.98 1647.27  158.99 1647.27     159 1647.27  161.87  1647.3  162.47  1647.3
 163.67  1647.3  167.57 1647.38  168.89 1647.41  185.58 1647.74  196.38 1647.83
 202.23 1647.88  202.41 1648.06  202.73 1648.38  208.66  1648.5   209.7 1648.52

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .045  167.57    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           19  148.93             35.55   34.79   33.98             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 13121.90

INPUT
Description:
Distance from Upstream XS =   26.74
Deck/Roadway Width        =       5
Weir Coefficient          =     2.6
 Weir Embankment Coordinates    num =       61
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
      -41 1649.76   -39.29 1649.72   -37.13 1649.51   -29.47 1648.78   -25.73 1648.02
  -22.75 1647.41   -19.84 1647.95   -15.33 1648.72   -12.71 1649.13    -9.89 1649.63
   -4.94 1649.76     -.34 1649.78      7.6 1647.49    10.71 1646.63    17.88 1644.83
   20.71 1644.05    22.41 1643.69    23.81  1643.4    26.52 1642.73    28.67 1642.51
   33.55 1642.36    38.45 1642.24     47.1  1642.2    48.47  1642.2    60.54 1642.28
    62.3 1642.22    64.09 1642.24    73.37 1642.16       75 1642.14    86.62 1642.06
   88.18 1642.03   100.28 1641.99   101.78 1642.03   106.17 1642.03   107.62 1642.12
  121.11 1642.11   122.34 1642.06   123.59 1642.02   132.54 1642.07   135.61 1642.24
  139.68 1642.46   139.74 1642.46   139.81 1642.48   150.71 1645.32   154.77 1646.19
  155.44 1646.33   156.21 1646.42   163.25 1646.92   163.86 1646.92    164.8 1646.92
  165.66 1646.92   169.36 1646.99   176.52 1647.13   187.51 1647.35   193.95 1647.41
  202.54  1647.5   204.28 1647.52   204.34 1647.58   204.78 1648.02   207.47 1648.07
  215.32 1648.19

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 13113.85

INPUT
Description:
Station Elevation Data     num=      55
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1649.53     2.49 1648.81    11.23 1646.47     15.7 1645.34    21.23 1644.28
   23.65 1643.58    26.64 1642.63    27.56 1642.54    28.45 1642.44    31.05     1642
   34.29 1641.88    40.04 1640.84     46.9 1639.42    47.45 1639.39    57.92 1639.22
   59.15 1639.25     67.1 1639.16    68.07 1639.14    76.04 1639.05    83.63 1638.89
   84.61 1638.88    92.23 1638.72    93.04 1638.72   101.63 1638.81    102.1 1638.81
  110.23 1638.89   112.15 1638.89   121.74  1639.4   126.62 1639.82   128.56 1639.92
  133.02 1640.99   135.68 1641.61   138.65  1642.3   139.09 1642.36   140.79 1642.73
  143.08 1643.32   151.23 1645.33   155.15 1646.11   155.78 1646.25   156.52 1646.33
  163.21 1646.81   164.46  1646.8   166.04  1646.8   166.26  1646.8   168.83 1646.85
  169.91 1646.87   188.09 1647.23    195.8 1647.34   201.46  1647.4   204.86 1647.44
   205.2 1647.78   205.36 1647.94   208.08 1647.97   210.53 1648.01   215.94 1648.08

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .045  169.91    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          11.23  163.21             9.35   10.44   11.63             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 13103.41

INPUT
Description:
Station Elevation Data     num=      59
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1649.44     5.85 1647.88    11.41 1646.63    16.53 1645.64    21.41 1644.34
   26.35 1643.14    31.41 1641.71    33.41 1641.23    34.56 1640.95    40.54  1639.8
   45.56 1639.49    51.89 1638.76     56.2 1639.03    60.61  1638.5    64.17 1638.63
```

```
   69.22 1639.19    71.6 1638.98   74.65  1638.6   77.31 1638.34   80.65 1638.05
   86.61 1638.42   91.41 1637.69   97.59 1638.15   99.38 1638.57  100.76 1638.63
  105.04 1638.84  109.97 1639.27  112.37 1639.34  113.05  1639.3  120.15 1638.72
  120.29 1638.71  120.35 1638.72  125.54 1638.98  126.88 1639.05   126.9 1639.06
  126.93 1639.06  131.41 1640.24  135.27 1641.05  136.84 1641.37  141.41 1642.75
  146.88 1644.26  151.42 1645.43  154.57 1645.96  155.69 1646.13  157.26 1646.29
  161.42 1646.73  163.71 1646.66  164.75 1646.63  166.07 1646.63  166.55 1646.63
   170.1  1646.7  182.43 1646.92  188.37 1647.04   194.5 1647.12   197.5 1647.17
  205.12  1647.3  205.25 1647.44  205.62  1647.8   216.2  1647.9

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .045   170.1    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11.41  161.42           154.85  154.42  153.97            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 12948.99

INPUT
Description:
Station Elevation Data     num=      53
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1647.25     7.85 1645.81     8.27 1645.73     8.55 1645.65   18.27 1642.78
   18.56 1642.71    28.27 1640.28    28.71 1640.19     32.4 1639.49   34.62 1639.08
   47.24 1638.79    47.96 1638.78    48.27 1638.77    57.95 1638.82   58.27 1638.81
   58.59 1638.81    68.27 1638.72    68.68 1638.69    81.66     1638   84.77 1638.29
   86.75 1638.51    96.69 1638.37    97.92 1638.37    98.27 1638.35   98.85 1638.32
  110.39 1637.65   113.46 1637.93   114.61 1638.08   118.06 1638.02  123.56 1638.03
  126.99  1638.5   127.91 1638.62   128.27 1638.67   137.89 1640.75  138.27 1640.83
  147.88 1643.35   148.27 1643.46   148.48 1643.48    153.6 1644.15  158.05 1644.66
  158.27 1644.68   158.82 1644.66   162.74 1644.51   163.25 1644.51  164.54 1644.51
  167.41 1644.57   173.97  1644.7   186.54 1644.93   202.56  1645.1  202.66 1645.11
  202.67 1645.12   203.16 1645.61   213.36 1645.73

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .045   167.41    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          8.55  158.05           198.07  197.79  197.49            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 12751.20

INPUT
Description:
Station Elevation Data     num=      59
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1642.92       6 1642.58     7.22 1642.54    13.65 1642.32   19.27 1641.66
    20.9 1641.47   25.54 1640.88    26.4 1640.81    27.86  1640.6   28.61 1640.54
   42.79 1640.01   47.19 1639.86    54.08 1639.72    60.55 1639.42    70.3 1638.89
   72.21 1638.83   83.41  1638.4    83.42  1638.4    84.56 1638.33   86.19 1638.29
   90.25  1638.1   96.17 1637.94   100.82  1637.8   108.42 1637.71  110.82 1637.69
  113.24 1637.67  120.82 1637.61   123.29 1637.62   130.82  1637.5  133.33 1637.49
  140.82 1637.57  143.37 1637.54   150.82 1637.53   158.21 1637.31  160.82 1637.28
  168.17    1637  170.82 1636.95   178.13 1636.93   180.82 1636.86  182.15 1636.92
  183.71 1637.05  188.03 1637.41   194.17 1638.85   200.82 1640.29  207.31 1641.36
  207.71 1641.43  207.84 1641.45   215.99 1641.75   216.59 1641.77   216.7 1641.77
  218.39 1641.76  220.41  1641.8   220.74  1641.8   240.23 1642.09  246.88  1642.2
  256.61 1642.36  256.92 1642.68   257.11 1642.86   261.02 1642.86

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .045   220.74    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          20.9  207.71            39.48    40.9   42.42            .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1              RS: 12722.07

INPUT
Description:
Distance from Upstream XS =    29.13
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       63
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1643.01      .98    1643     4.52 1642.92     8.05 1642.82   14.52 1642.76
   19.15 1642.36    20.12 1642.27    20.39 1642.22    27.25 1640.89   33.13 1641.84
   34.78  1642.1    39.84 1642.96     42.8 1643.54    44.22 1643.58   45.97 1643.46
   47.94 1643.15    50.05 1642.93    52.39 1642.51    56.73 1641.61   61.48 1640.58
   64.98 1639.72    68.65 1639.08    74.21 1637.87    77.38 1637.65   80.19 1637.49
   81.07 1637.44    83.08 1637.28    91.94 1637.12    94.66 1637.07   97.37 1637.08
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  107.17 1637.01  109.48 1637.04  117.47 1637.06  119.87    1637  127.77 1637.01
  130.25 1637.16  137.72 1637.14  140.08 1637.07  147.67 1637.05   149.9 1637.01
  156.33 1636.89  159.36 1636.79  165.23 1636.67  168.92 1636.55  177.57 1636.66
  178.02 1636.69  181.52 1636.94  186.55 1637.41  191.42 1638.43  194.52 1639.03
  197.74 1639.85  202.22  1641.1  208.63 1641.28  210.49 1641.32  212.08 1641.32
  212.29 1641.32  214.64 1641.36  225.59 1641.56  234.16 1641.71  243.57 1641.83
  250.55 1641.91  250.77 1642.13  250.84 1642.19

Upstream Embankment side slope             =     100 horiz. to 1.0 vertical
Downstream Embankment side slope           =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins        =
Weir crest shape                           = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 12710.30

INPUT
Description:
Station Elevation Data    num=      52
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1643.63    2.28 1643.28    6.59 1642.43    7.99 1642.17   15.26 1640.43
   17.99 1639.83   23.94 1638.51   24.31 1638.43   28.56 1637.45   34.99 1636.02
   35.33 1635.95   38.21 1635.57   44.26 1634.37   44.87 1634.33   47.33 1634.15
   55.89 1633.95   56.85 1633.93   57.83 1633.91   58.54  1633.9   75.67 1633.88
    76.4 1633.82   77.02 1633.91   88.15 1633.99   90.81 1633.97   98.11 1633.97
  100.57 1633.83   107.8 1633.83  110.85  1633.9  121.02  1634.1  123.13 1634.11
  129.92 1634.58  131.76 1634.86  132.07 1634.91  135.98 1635.53   138.6 1636.04
  146.15 1638.05  147.01 1638.33     148 1638.56  150.11 1639.17  155.74 1640.83
  160.03 1640.98  164.06 1641.13  164.29 1641.13  165.86 1641.13  168.19 1641.17
  170.04  1641.2  187.75 1641.52  200.23 1641.66  204.19  1641.7  204.32 1641.84
  204.69  1642.2   211.1 1642.26

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
       0    .045  168.19    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         15.26  155.74             28.03   26.22   24.28             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 12684.08

INPUT
Description:
Station Elevation Data    num=      54
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1643.62    1.73  1643.5     3.5 1643.14    7.63 1642.32   12.35 1641.03
   17.64 1639.56   22.83 1638.21   27.64    1637   32.35 1635.79   37.07 1634.52
   37.97 1634.51   42.92 1634.44   47.64 1634.33   52.57 1634.16   57.64 1633.85
    62.8 1633.98   67.64 1633.98   72.39 1633.98   77.64  1633.7   82.98 1633.88
   87.64 1633.68   93.07 1633.67   97.64 1633.84  103.24 1633.55   105.3 1633.37
  109.77 1633.82  110.41 1633.85  111.38 1633.61  116.62 1632.23  117.68 1632.29
  121.13  1634.5  121.18 1634.53  121.66 1634.46  126.29 1633.79  126.43  1633.8
  127.16 1633.98  131.93 1635.08  137.64 1636.41  141.77 1637.46  147.64 1639.01
  151.82  1639.6  155.78 1640.31  162.25 1640.63  163.86 1640.74   165.5 1640.74
  165.66 1640.74  167.18 1640.77     168 1640.78  187.59 1641.15  199.25 1641.28
  204.08 1641.33  204.29 1641.53  204.58 1641.83  207.73 1641.85

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
       0    .045     168    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         12.35  155.78            113.73  113.69  113.65             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 12570.39

INPUT
Description:
Station Elevation Data    num=      52
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1641.56    1.34 1641.57    1.61 1641.49    3.85 1640.86   14.35 1637.86
   23.24 1635.45   24.35 1635.17    25.4 1634.96   34.08 1633.24   34.21 1633.21
    43.1 1632.86   44.35  1632.8   52.96 1632.81   54.35 1632.81   55.77 1632.89
   64.35 1632.86   72.77 1633.19   74.35 1633.12   82.68 1632.91   84.35 1632.92
   86.05 1632.92   94.35 1632.88   102.5 1632.98  104.35 1632.99  106.25    1633
  117.13  1632.6  118.83 1632.39  123.39 1632.48  124.35 1632.49  126.35 1632.63
  129.72 1632.79  131.03 1633.08  132.51 1633.42  134.35 1633.86  142.12 1636.25
  144.35 1636.91  147.08 1637.45  152.28 1638.47  161.05 1638.93  161.29 1638.94
  161.41 1638.94  161.48 1638.94  163.09 1638.94  165.44 1638.99  171.56 1639.13
  174.33  1639.2   185.3 1639.44  194.15 1639.48  201.52 1639.51   201.8 1639.79
  202.02 1640.01  206.39 1640.06
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```
Manning's n Values          num=       2
     Sta   n Val     Sta   n Val
       0    .045  165.44    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         14.35  152.28             148.78  149.13  149.54            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1               RS: 12421.26

INPUT
Description:
Station Elevation Data     num=      45
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0   1639.1    5.71 1637.58    10.1 1636.41   12.39   1635.8    20.1 1633.73
    25.5 1633.04   28.25 1632.61   30.58 1632.56   32.05 1632.52    40.1 1632.39
   42.53 1632.38    50.1 1632.11   57.61 1632.15    60.1 1632.13   67.56 1632.05
   70.11 1632.12   72.67 1632.08   80.11  1632.3   87.47 1632.19   90.11 1632.24
   92.77 1632.25  100.11  1632.3  107.38 1632.34  110.11 1632.33  112.86 1632.32
  120.11  1632.3   122.2 1632.33  128.48 1632.71  131.77 1632.91   136.1 1633.94
  140.11 1634.73  143.15 1635.23  150.11 1636.43  155.56  1636.7  158.18 1636.81
  158.78 1636.81  159.98 1636.81  162.16 1636.86  174.34 1637.11  181.87 1637.27
  188.08  1637.3  198.26 1637.35  198.68 1637.76  198.76 1637.85  201.12 1637.87

Manning's n Values          num=       2
     Sta   n Val     Sta   n Val
       0    .045  162.16    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          10.1  150.11             33.43   33.67   33.97            .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1               RS: 12398.37

INPUT
Description:
Distance from Upstream XS =    22.89
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       58
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
     -30 1638.09  -28.96 1638.03  -25.22 1637.31   -22.2 1636.71  -15.05 1637.88
  -14.09 1638.04  -12.85 1638.25   -9.59 1638.79   -1.22 1638.86     .98 1638.87
    9.54  1636.5   10.91 1636.14   19.79 1634.03   20.91 1633.77   22.07 1633.53
   26.65  1632.7   30.11  1632.6   30.56 1632.55   31.97 1632.46   35.79  1632.4
   40.29 1632.32   41.72 1632.27   50.14 1631.93   50.56 1631.92   52.16 1631.93
   60.72 1631.88   61.17 1631.89   70.11 1632.02   71.18 1632.02    71.5 1632.03
   80.47 1632.19   81.51 1632.21    90.8 1632.02   91.26 1632.02  100.83 1632.08
  101.08 1632.08  110.29 1632.04  110.91 1632.04  120.78 1632.28  120.91 1632.28
  129.17 1632.09  130.66 1632.05  131.27 1632.09  135.15 1632.58  140.13 1633.79
  140.92 1633.98  148.04 1635.53  150.57 1635.94  152.96 1636.07  159.22  1636.5
  161.02  1636.5  163.13 1636.54  181.46 1636.93  182.73 1636.96   184.1 1636.96
   199.2 1637.03   199.7 1637.53  203.39 1637.58

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1               RS: 12387.58

INPUT
Description:
Station Elevation Data     num=      55
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1638.73    1.94 1638.26    9.68 1636.23   18.55 1634.18   19.68 1633.87
   26.07 1631.95    28.1  1631.4   32.63 1630.26    33.1 1630.12   33.71 1630.05
   36.48 1629.73    43.5 1628.94   44.52 1628.93    50.1  1628.5   52.34 1628.51
   53.02 1628.52   58.62 1628.42   65.16  1628.5   65.68 1628.52   69.14 1628.45
   76.15  1628.7   76.48 1628.69   78.06 1628.74   88.06 1628.45    88.6 1628.45
   99.72 1628.52  100.44 1628.55   106.3 1628.42  109.87 1628.34   112.5 1628.35
  112.63 1628.36  112.69 1628.36  115.62 1628.51  120.51 1628.86  122.25 1629.08
  127.13 1629.97  127.69 1630.06  127.89 1630.13  131.37 1631.21  133.44 1631.81
  139.68 1633.25     147  1635.2  149.28 1635.74  155.73 1636.16  158.07 1636.32
  158.24 1636.32  159.87 1636.32  161.96 1636.36  162.04 1636.37  181.57 1636.78
  193.48 1636.84  198.02 1636.86  198.23 1637.07  198.52 1637.36  202.51 1637.42

Manning's n Values          num=       2
     Sta   n Val     Sta   n Val
       0    .045  161.96    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          9.68  149.28             29.56    29.3   29.02            .1       .3
```

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 12358.28

INPUT
Description:
Station Elevation Data num= 57

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1638.29	3.09	1637.51	9.11	1636.01	18.45	1633.43	19.11	1633.23
28.5	1630.74	29.11	1630.6	30.43	1630.35	35.22	1629.49	36.23	1629.43
37.09	1629.34	39.13	1629.13	43.71	1628.83	48.78	1628.48	49.11	1628.47
49.44	1628.43	54.02	1628.06	54.23	1628.04	54.25	1628.04	54.32	1628.05
57.76	1628.39	58.92	1628.35	67.36	1628.63	68.31	1628.66	69.11	1628.66
78.73	1628.82	79.11	1628.83	88.78	1628.78	89.11	1628.79	98.82	1628.67
99.11	1628.67	99.34	1628.68	110.39	1629.05	111.89	1628.94	115.23	1628.49
119.89	1629.25	127.17	1630.42	128.91	1630.7	129.11	1630.73	129.25	1630.77
139.11	1633.54	139.23	1633.56	149.55	1635.57	155.48	1635.79	157.71	1635.87
158.28	1635.87	159.51	1635.87	161.59	1635.91	180.72	1636.35	181.08	1636.35
181.2	1636.36	181.31	1636.36	181.43	1636.36	197.7	1636.46	197.71	1636.47
198.2	1636.96	203.44	1637.04						

Manning's n Values num= 2

Sta	n Val	Sta	n Val
0	.045	161.59	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9.11	149.55	113.64	113.78	113.98	.1	.3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 12244.50

INPUT
Description:
Station Elevation Data num= 50

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1635.67	3.69	1634.78	7.05	1633.97	12.76	1632.36	17.05	1631.16
22.5	1629.98	29.39	1628.48	29.74	1628.41	33.87	1628.21	37.05	1628.05
42.83	1627.94	47.05	1628	52.85	1628.11	57.05	1628.06	61.23	1627.82
67.05	1627.48	72.46	1627.35	73.67	1627.33	75.53	1627.52	78.23	1627.79
80.98	1627.9	87.05	1628.12	92.95	1628.2	97.05	1628.26	101.13	1628.29
107.05	1628.28	113	1628.3	117.05	1628.35	125.04	1628.56	125.89	1628.59
125.94	1628.6	127.09	1628.89	137.05	1631.4	143.27	1632.62	148.74	1633.7
156.09	1634.11	156.27	1634.12	156.49	1634.13	158.26	1634.13	158.29	1634.13
158.76	1634.14	160.88	1634.19	180.02	1634.59	190.39	1634.67	195.3	1634.72
196.74	1634.74	196.83	1634.83	197.24	1635.24	206.3	1635.37	208.86	1635.41

Manning's n Values num= 2

Sta	n Val	Sta	n Val
0	.045	160.88	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
7.05	148.74	83.79	83.82	83.88	.1	.3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 12160.68

INPUT
Description:
Station Elevation Data num= 52

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1634.08	2.22	1634.02	7.57	1633.17	8.93	1632.96	10.86	1632.41
18.93	1630.33	25.25	1628.7	28.46	1627.98	28.66	1627.94	31.74	1627.84
38.93	1627.44	40.65	1627.3	45.52	1626.97	48.12	1627.35	51.41	1627.76
55.41	1627.75	60.51	1627.53	62.82	1627.37	63.09	1627.35	66.95	1627.06
73.56	1627.28	78.93	1627.4	80.99	1627.42	88.93	1627.38	96.85	1627.47
98.93	1627.48	101.02	1627.55	108.93	1627.78	111.04	1627.87	118.93	1628.05
122.15	1628.06	129.09	1628.2	129.45	1628.2	135.91	1629.47	138.93	1630.07
146.24	1631.54	149.5	1632.19	155.22	1632.45	158.79	1632.6	159.28	1632.6
160.59	1632.6	163.83	1632.69	175.54	1633.02	176.98	1633.06	182.71	1633.21
186.47	1633.3	193.05	1633.49	198.94	1633.64	199.13	1633.84	199.44	1634.14
205.77	1634.14	207.31	1634.14						

Manning's n Values num= 2

Sta	n Val	Sta	n Val
0	.045	163.83	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
10.86	149.5	42.62	42.07	41.33	.1	.3

INLINE STRUCTURE

RIVER: SunValley
REACH: Reach1 RS: 12125.61

INPUT

```
Description:
Distance from Upstream XS =    35.08
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       59
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
      -57 1633.29   -50.63 1632.76   -43.52 1632.22   -40.63 1631.96   -37.72 1631.74
   -36.58 1631.58   -26.66 1630.66   -19.36 1630.59    -1.83 1629.52     6.81 1629.11
    12.65 1628.74    21.16   1628.5    25.33 1628.02    28.66 1627.68     29.6 1627.52
    30.58 1627.49    32.51 1627.43    36.85 1626.99    39.76 1626.92    44.06 1626.92
    47.88 1626.92    52.29 1626.92     55.8 1626.99    60.78 1627.11    63.97 1627.19
    69.11 1627.32    74.01 1627.25    77.55 1627.23    82.16 1627.17    86.25  1627.1
    89.48 1627.08    95.42 1627.04    98.94 1627.01   105.24 1626.97   108.34 1626.93
   113.23 1626.99   116.86 1626.95    121.5    1627   125.58 1627.19   129.05 1627.38
   129.33 1627.41   131.32 1627.62   134.34 1627.78   136.74 1628.08   139.38 1628.45
   143.47 1629.61   150.46 1631.45   154.26 1631.72   159.46 1631.97   160.29 1631.97
   161.26 1631.97   164.72 1632.09   170.88 1632.29   183.17 1632.68   194.88 1632.91
   199.67    1633   199.77 1633.09   200.17  1633.5   208.24 1633.56

Upstream Embankment side slope             =     100 horiz. to 1.0 vertical
Downstream Embankment side slope           =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins        =
Weir crest shape                           = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 12118.62

INPUT
Description:
Station Elevation Data    num=      65
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0   1632.6     3.82 1632.36     8.45 1632.12    20.73 1631.05    24.42 1630.68
   25.98 1630.56    26.74   1630.5    31.8   1630.3    51.53 1629.37     62.8 1628.65
   64.08 1628.58    66.63 1628.37    78.67 1626.65    80.01   1626.5    80.87  1626.4
   81.91 1626.21    84.43 1625.77    88.62 1625.17    90.31 1624.97    95.18 1624.68
   95.74 1624.64    96.64 1624.51   101.71 1624.21   102.87 1624.18   106.69 1624.21
  108.24 1624.27    110.2 1624.35   113.58 1624.36   116.44   1624.4   122.33 1624.52
  123.73 1624.51   130.42 1624.64   131.55 1624.65   139.32 1624.55   140.25 1624.52
  148.61 1624.42   149.24 1624.43   160.07 1624.43   163.47 1624.44   164.46 1624.47
  171.97 1625.12   172.86   1625.2   178.82 1626.06   179.72 1626.19   183.03 1627.03
   185.2 1627.48   187.98 1628.09   188.44 1628.24   188.97 1628.31    192.1  1629.2
  199.83 1631.44    202.1 1631.52   209.11 1631.86   209.49 1631.86   210.91 1631.86
  214.39 1631.98   229.36 1632.49   232.77  1632.6   236.11 1632.66   237.71 1632.69
  249.32 1632.89   249.47 1633.04   249.82 1633.39   263.79 1633.53   263.87 1633.53

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
       0    .045  214.39    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          31.8  199.83             32.56   35.03   36.81             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 12083.58

INPUT
Description:
Station Elevation Data    num=      55
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1633.19       .6 1633.19    11.71 1628.97    12.43 1628.69    12.84 1628.51
   13.19 1628.46    14.47 1628.41    16.43 1628.27    16.81 1628.22     17.4 1628.14
   24.62 1627.43    36.92 1626.08    41.91 1625.53    45.19 1625.18    51.11 1624.73
   54.71 1625.11    56.59 1625.49    65.12 1624.84    65.35 1624.82    65.61 1624.82
   74.68 1624.62    79.91 1624.58    84.89 1624.48    88.88 1624.42    89.42 1624.41
   93.97 1624.34    95.09 1624.43    96.54   1624.6    98.16 1624.85    99.76 1624.99
  105.16 1624.84   108.37 1624.65   108.85 1624.63   116.89 1623.88   121.03 1624.06
   126.6 1624.37   133.21 1624.67   134.01 1624.71   135.43   1625.1   135.94 1625.23
   146.6 1628.05   150.57 1629.06   157.64 1630.82   166.68 1631.23   167.09 1631.24
  168.81 1631.24   168.89 1631.24    170.9 1631.31   172.49 1631.37   190.34 1631.97
  198.99 1632.12   207.14 1632.26   207.38 1632.51   207.64 1632.76   215.84 1632.87

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
       0    .045  172.49    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         11.71  157.64             49.87   49.08   49.47             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 12034.51

INPUT
Description:
Station Elevation Data    num=      51
```

```
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0  1632.9     5.34  1631.6        9 1630.68    12.04 1629.79       19  1627.4
   27.58  1625.5    28.27 1625.35    28.67 1625.25    29.57 1625.18    30.31 1625.14
   38.42 1624.65    43.74  1624.8       49 1624.98     55.9 1624.75    60.72 1624.61
   64.02 1624.47    68.13 1624.23    72.91 1624.34       79 1624.56    91.07 1624.43
   93.89 1624.44    95.03 1624.34    97.15 1624.54   100.12 1624.76   104.32 1624.61
  104.71  1624.6   111.53 1624.25   113.57 1624.13   115.79 1623.58   117.23 1623.23
  122.68  1623.5   125.48 1623.58   127.62 1624.18   130.29 1624.93   139.01 1627.42
  146.46 1629.04      150 1629.86   156.79 1630.28   159.14 1630.44   159.63 1630.44
  160.94 1630.44   164.24 1630.55    167.4 1630.67   179.62  1631.1   182.31  1631.2
  185.43 1631.27   198.93 1631.64   199.01 1631.73   199.43 1632.14   207.78  1632.2
  209.67 1632.21

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .045  164.24    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         12.04     150           169.66  172.55  176.11             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 11861.96

INPUT
Description:
Station Elevation Data    num=      54
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1630.13     2.81 1630.07       12 1627.83     15.2 1627.05    22.27 1624.97
   25.21 1624.18    26.64 1623.89    27.11 1623.79    30.32 1623.24    33.08 1622.92
   35.23 1622.79    39.08  1622.8    45.24 1622.96    49.66 1623.16    55.25 1623.32
   60.27 1623.42    65.27 1623.42    70.83 1623.25    75.28 1623.12    84.69 1622.58
   86.95 1622.45    90.93 1622.79     93.9 1622.82    96.31 1622.86   102.58 1622.89
  103.16 1622.91   103.35 1622.91   103.74 1622.89   118.25 1622.44   124.65 1622.82
  125.36 1622.87   126.74 1622.94   129.23 1623.06   130.12 1623.09   131.02  1623.2
  135.37 1623.77   144.94 1626.11   145.39 1626.21    145.7 1626.28   152.59  1627.6
  156.08 1627.71   160.28 1627.84   160.71 1627.84   162.08 1627.84   165.01 1627.95
  167.16 1628.02   183.58 1628.62   196.89 1628.88   200.39 1628.94   200.62 1629.18
  200.89 1629.44    202.2 1629.45   207.63 1629.45    207.7 1629.46

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .045  165.01    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          12  152.59           36.64   36.88   37.17             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 11832.55

INPUT
Description:
Distance from Upstream XS =    29.41
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       67
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     -47 1628.74   -42.48 1628.86    -41.2 1628.83   -36.27 1628.57   -27.95 1628.15
  -24.74 1627.98   -22.66 1627.75   -17.65 1627.27    -14.4 1627.84    -9.54 1628.71
     .08 1629.32      4.1 1629.57     8.81  1628.4    17.62 1626.07    19.47 1625.66
   26.89 1624.26    27.64 1624.12     33.2 1623.12    34.83 1622.79    36.76 1622.65
   37.27 1622.58    42.05 1622.48    44.08 1622.56    48.08 1622.65    51.98 1622.72
   55.14 1622.86     60.3 1622.82    63.52 1622.75    70.21 1622.65    72.78 1622.58
   80.68 1622.67    82.74 1622.62    89.82 1622.63    90.57 1622.69    98.64 1622.53
  101.14 1622.46    102.3  1622.5   110.89 1622.44   113.21  1622.4   119.53 1622.53
  122.04 1622.61    127.6 1622.78   129.57 1622.85   131.56 1622.83   135.48 1623.06
  136.22 1623.09   137.04 1623.13   142.62 1624.49   147.84  1625.7   149.65 1626.12
  153.33 1626.94   154.84 1627.05   161.27 1627.41   161.61 1627.41   163.07 1627.41
  166.04 1627.51   166.51 1627.53   184.91 1628.16   199.74 1628.47    201.4 1628.51
  201.57 1628.68    201.9 1629.01   205.52    1629   208.67    1629   210.24 1629.02
  212.15 1629.04   212.27 1629.04

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 11825.08

INPUT
Description:
Station Elevation Data    num=      63
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1629.45    13.01 1626.22    13.79 1626.02    23.63  1623.8    23.81 1623.77
```

```
   23.98 1623.74   24.52  1623.6   25.11 1623.46   32.51 1621.71   33.57 1621.55
    37.4 1620.71   39.99 1620.38   41.59 1620.26   44.77 1620.27   48.17 1620.39
   51.27 1620.52   56.64 1620.34   57.77 1620.24   64.79 1620.15   65.72 1620.12
   66.17 1620.19   74.14 1620.06    75.2 1620.05    80.8 1620.15   82.27 1620.18
   86.76 1620.12   88.18 1620.15    92.7 1620.09   93.82 1620.06   94.52 1619.98
  105.41 1619.97  106.24 1619.92  107.04 1619.96  107.08 1619.95  116.57 1620.06
  116.84 1620.08  117.72  1620.1  122.46 1620.45  123.36  1620.6  126.38 1621.09
  127.99 1621.47  132.84 1622.53  134.11 1622.94  139.84 1624.89     144 1626.03
  147.82 1626.43  149.18 1626.74  155.03 1627.15  157.05  1627.3  157.24  1627.3
  158.85  1627.3  162.45 1627.42  165.94 1627.54  175.32 1627.86  180.79 1628.05
   185.1 1628.14  187.78  1628.2   197.2  1628.4   197.3 1628.51   197.7  1628.9
  199.03  1628.9  204.48 1628.89  207.38 1628.92

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .045  162.45    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
         13.01  149.18             28.68   30.77   33.36              .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 11794.31

INPUT
Description:
Station Elevation Data    num=      65
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1629.11    2.93 1628.56    5.13 1628.15     7.7  1627.5   15.17 1625.52
   24.04 1622.97    25.2 1622.67   26.04 1622.44   31.06 1621.27   31.82 1621.14
   31.89 1621.13   34.11  1620.8   40.51 1619.88   42.61 1619.67   48.13 1620.16
   51.58 1620.08   53.47 1620.18   54.42 1620.23   59.56 1620.25   60.66 1620.23
   62.78 1620.45   63.65 1620.52   64.44 1620.51   71.09 1620.39   73.11 1620.29
   77.07  1620.1   80.34 1620.37    81.7  1620.5   85.51  1620.6   86.22 1620.59
   90.94 1620.07   91.61 1619.98   93.41  1620.1   94.57 1620.19   95.13 1620.06
   96.77 1619.75    99.7 1619.95  103.21 1620.26  104.79 1620.19  108.67 1620.27
  115.54 1620.22   123.2 1620.68  123.25 1620.69  123.76 1620.71  125.31 1621.11
  135.61 1623.75  147.69 1626.28  148.42 1626.43  148.85 1626.45  156.98 1626.83
  157.96 1626.83  158.78 1626.82  162.47 1626.95     175 1627.36  180.63 1627.55
  183.88 1627.61  184.96 1627.64  187.12 1627.69   197.2  1627.9   197.6  1628.3
   197.7  1628.4  200.75 1628.39   202.5 1628.38  204.41 1628.37  205.81 1628.38

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .045  162.47    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
         15.17  147.69            131.95  134.18   136.6              .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 11660.13

INPUT
Description:
Station Elevation Data    num=      52
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1628.43    7.05 1626.49    8.45 1626.14    9.61 1625.81   18.65 1623.21
   19.87 1622.93   27.68 1621.17   29.45 1620.85   32.56 1620.39   37.79 1619.79
   38.41 1619.72   39.47  1619.6   43.25 1619.49   49.72 1619.34   53.87 1619.03
   55.33  1618.9   59.14 1618.84   62.64  1619.1   67.16 1619.35   72.86 1619.43
   82.82 1619.03   83.51 1619.01   87.36 1618.86   87.88 1618.82   88.33 1618.82
   99.03 1619.05  100.58 1619.04   105.2 1618.98  109.68 1619.32  109.81 1619.32
  117.62 1619.46  119.16 1619.48   130.3 1619.81  131.91 1619.86  133.05 1619.89
  133.09  1619.9  133.28 1619.94  139.29 1621.39  145.15 1623.09  151.83 1624.33
  153.11 1624.41  154.37 1624.45  161.51 1624.71  162.86 1624.71  163.31 1624.71
  167.12 1624.86  168.95 1624.93  184.64 1625.55  200.53 1625.87  201.48 1625.89
  201.77 1626.17  201.98 1626.39

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .045  167.12    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
         18.65  151.83             78.37   76.71   74.69              .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 11583.43

INPUT
Description:
Station Elevation Data    num=      55
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1626.46    3.67 1626.43    9.55 1626.41   12.32 1625.99   16.15 1625.46
   23.35 1623.55   26.19 1622.81   28.55  1622.2   33.66 1620.95   39.42 1619.54
   40.95 1619.42   43.37 1619.22   49.77  1618.7   50.62 1618.67   59.35 1618.67
   59.56 1618.66    63.4 1618.39    66.1 1618.37   71.14 1618.29   73.23 1618.45
   76.84  1618.8   81.47 1618.75      87 1618.75    90.3  1618.7   95.81 1618.73
```

```
   99.75  1618.7  105.29 1618.81  111.24 1618.73  116.57 1618.71  120.52 1618.76
  126.61 1618.88  135.42 1618.67  139.41  1618.6  141.91 1618.81  143.73 1618.96
  144.95 1619.06  155.05 1621.66  156.74 1622.07  164.28    1623   164.3    1623
  164.31    1623  164.42 1623.01  171.94 1623.68  172.23 1623.68  173.74 1623.68
  175.81 1623.75   178.1 1623.83  187.03 1624.14  195.16 1624.45  201.04 1624.59
  204.73 1624.68  212.01 1624.86  212.21 1624.87  212.22 1624.88  212.71 1625.37

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .045   178.1    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         23.35  171.94             50.9   52.57   54.46             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 11538.79

INPUT
Description:
Distance from Upstream XS =    44.64
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       71
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   -62.5 1626.99  -61.75 1627.02  -59.86    1627  -57.54 1626.98  -49.81 1626.91
  -46.32  1626.8  -39.75 1626.57  -35.89 1626.46  -34.69 1626.41  -33.17 1626.36
   -29.7 1626.18  -25.32 1625.52  -19.65 1624.58  -17.29 1624.33  -13.29 1624.02
   -6.91 1624.87   -2.16 1625.43     .66 1625.87    8.75 1625.84    9.66 1625.83
   11.56 1625.45   20.57 1623.65   21.12 1623.48   29.25 1620.86   34.36 1620.06
   40.13 1619.03   41.96 1618.76   45.62 1618.63   48.42  1618.4    51.7 1618.31
   52.57 1618.27   62.39 1617.95   62.98 1617.93   64.07 1617.93   75.73 1617.96
   76.93 1617.98   86.73 1618.18   86.99 1618.18   97.95 1618.21   98.99 1618.22
  108.36 1618.23  109.35 1618.22  120.69 1618.16  122.12 1618.12  130.04 1617.95
  133.28 1618.05  136.09 1618.06  139.81 1618.08  141.34 1618.15  143.29 1618.28
  150.15  1619.6  153.59 1620.32  157.28 1621.28  161.09 1622.08  163.65 1622.65
  166.95 1622.87  171.82 1623.18  172.69 1623.18  173.62 1623.18  178.42 1623.33
  185.35 1623.54   195.1 1623.84  198.67 1623.93  200.16 1623.97  203.78 1624.07
  212.12 1624.28  212.47 1624.63  212.62 1624.78  217.84 1624.82  219.32 1624.82
  220.83 1624.83

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 11530.86

INPUT
Description:
Station Elevation Data    num=      71
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1625.82    4.63  1625.8    9.06 1625.78    18.4 1623.88    20.6 1623.44
   25.08 1622.04    28.7 1620.87   29.34 1620.69   40.35 1618.43   40.74 1618.35
   40.81 1618.33   40.87 1618.32   48.13 1616.85   51.23 1616.27   53.07 1616.02
   55.43  1615.7   56.29 1615.61   57.71 1615.53   62.85 1615.31   65.38 1615.29
    70.1 1615.14   71.01 1615.11    75.8 1614.96    78.7 1614.81   80.23 1614.28
   82.06 1614.14   87.12 1613.77   93.27 1613.56   95.51 1613.55   95.69 1613.55
   95.88 1613.55   96.27 1613.56  102.03 1613.72  105.12 1613.85  105.21 1613.85
  105.61 1613.87  107.82 1614.17   108.6 1614.39  111.09 1615.22  113.46 1615.34
  115.47 1615.43  122.89 1615.45  124.02 1615.45  126.33 1615.58  129.83  1615.7
  129.84 1615.71   132.1 1615.81  133.75 1615.96  136.25 1616.24  138.95  1616.7
  141.91 1617.27  150.01 1619.47  151.22 1620.02  152.87 1620.36  156.97  1621.2
  160.86 1622.07  162.87 1622.52  165.89 1622.72   171.1 1623.09  171.44 1623.09
   172.9 1623.09  177.26 1623.21  177.45 1623.21  194.38 1623.72  208.75  1624.1
  211.39 1624.17  211.85 1624.63  211.89 1624.67  212.06 1624.67   218.5 1624.69
  218.52 1624.69

Manning's n Values         num=       2
     Sta   n Val     Sta   n Val
       0    .045  177.45    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          78.7  111.09             33.78   23.74   23.86             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 11507.12

INPUT
Description:
Station Elevation Data    num=      53
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1625.51    6.16  1625.5    9.04 1625.52   20.43 1622.77   22.01 1622.38
   29.73 1620.47   32.08 1619.92   35.03 1619.16   42.14 1617.35   47.11  1616.3
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  49.43 1615.83   56.41 1615.44    60.4 1615.23   61.73 1615.07   63.74 1614.84
  66.34 1614.57   67.03  1614.6   74.16 1614.76   77.75 1614.09   82.07  1613.3
  82.59 1613.31   82.67 1613.31   88.59 1613.41  104.75 1613.54  108.33 1614.31
 111.99 1615.05  114.23 1615.01  115.99 1614.98  123.24 1614.79   125.7 1615.15
 130.63 1615.81  133.36 1615.77  138.12 1616.89   142.8 1617.96  148.68 1619.59
 152.86 1620.75  158.47 1621.58  161.96 1622.13  167.55 1622.59  169.95  1622.8
 170.57  1622.8  171.75  1622.8  175.77 1622.91  181.09 1623.06  187.65 1623.25
 193.27 1623.41  197.51 1623.52  201.61 1623.64  210.33 1623.87   210.7 1624.24
 210.83 1624.37  214.86 1624.34  216.65 1624.32

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   82.59    .025  114.23    .045  175.77    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        74.16  111.99             142.2  129.36  130.85             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 11377.76

INPUT
Description:
Station Elevation Data    num=      50
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1623.92    5.68 1622.35     6.8 1621.92    7.89 1621.69   16.67 1619.02
   17.12 1618.89   18.08 1618.69   29.15 1616.01   34.33 1615.58      37  1615.4
   44.06 1615.34   47.09  1615.3    56.6 1615.16   60.96 1615.12   62.82 1614.69
   66.62 1613.77   67.29 1613.61   70.14 1612.92   83.83 1612.94   88.93 1612.96
   93.43 1613.89   97.98  1614.9  100.64 1615.01  105.63 1615.21  107.59 1615.29
  108.97 1615.35  117.68 1615.57  124.38 1615.63  129.69 1615.92  131.36 1616.15
  133.38 1616.65  137.84 1617.74   144.5 1619.19  151.01 1620.56  154.66 1620.72
  159.03 1620.89  159.58 1620.89  160.83 1620.89  163.71 1620.98  168.56 1621.14
  182.69 1621.61  189.99 1621.74  193.48 1621.79  199.18 1621.87  199.35 1622.04
  199.68 1622.37  202.82 1622.41  206.87 1622.45   210.9 1622.57  211.18 1622.58

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   66.62    .025  100.64    .045  163.71    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        60.96   97.98             118.53  119.36  121.77             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 11258.40

INPUT
Description:
Station Elevation Data    num=      57
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1622.52    6.16 1622.44    8.47 1622.39   10.71 1621.89   16.49 1620.63
   21.73 1619.19   26.61 1617.79   32.02 1616.55   35.51 1615.68   38.15 1615.48
   46.85 1614.93    48.9 1614.88   55.51 1614.79   63.95 1614.71   66.84 1614.65
   71.78 1614.45   73.91 1614.39    77.7 1613.59   77.89 1613.55   80.36 1613.03
   81.78 1612.67   90.75 1612.52   99.62 1612.31  101.26 1612.35  105.68 1613.32
  110.47 1614.41  110.84  1614.5  112.35 1614.58  121.53 1614.77  127.06 1614.64
  127.74 1614.64  134.39 1614.75  139.66 1614.78  142.68 1614.99  147.24 1615.24
  150.21 1615.95  155.56    1617  158.36 1617.65  161.97 1618.55  163.19 1618.78
  163.87 1618.86   170.4 1619.18  171.71 1619.14     173 1619.14  173.51 1619.14
  178.15 1619.29  192.53 1619.76  195.58 1619.86   197.8 1619.92  198.58 1619.94
  200.23 1619.99  212.07 1620.31  212.47  1620.7  212.57 1620.81  213.78  1620.8
  219.68 1620.74   223.4 1620.89

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045    77.7    .025  110.47    .045  178.15    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        71.78  112.35             17.22   17.86   19.63             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 11246.90

INPUT
Description:
Distance from Upstream XS =     11.5
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       82
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   -43.7 1624.01  -40.87 1623.93  -35.03 1623.48  -32.07 1623.25  -29.67 1623.05
  -25.95 1622.67  -22.54 1622.04   -19.3 1621.54  -11.69 1620.43   -6.05 1621.42
    -.11  1622.4    6.38 1622.24    8.52 1622.21   12.27 1621.25   18.61  1619.8
   22.99 1618.54   30.34 1616.47   31.73 1616.12   36.05 1615.42   36.96 1615.26
   38.06 1615.09   40.34 1614.97   45.69  1614.8   47.15 1614.77    54.9  1614.8
   57.19 1614.75   67.04  1614.6   73.41 1614.39   73.79 1614.36   75.54 1613.89
    77.1 1613.26   78.07 1612.98   78.21 1612.94   78.66 1612.81    83.7 1612.49
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  84.36 1612.43   92.27 1612.23   93.61 1612.15   93.76 1612.14  100.43 1612.11
 100.64 1612.11  100.74 1612.13  104.63 1612.61  104.67 1612.62  108.47 1613.64
 108.55 1613.66  110.62 1614.02   111.5 1614.17  112.03 1614.16  117.36 1614.43
 117.55 1614.44   119.5 1614.51   129.2 1614.61  129.45 1614.61  130.55 1614.61
  143.8 1614.69   144.7 1614.74  148.69 1614.89  149.21 1614.92  150.11 1615.15
 158.73 1617.23  159.84  1617.5  162.98 1618.41  163.49 1618.55  163.89 1618.57
 172.07 1618.98  173.36 1618.98  173.87 1618.98  175.68 1619.04  178.88 1619.14
 184.56 1619.33  195.87  1619.7  204.47 1619.91  208.42 1620.02  212.38 1620.12
 212.81 1620.55  212.88 1620.62  214.43 1620.61  217.92 1620.57  220.11 1620.55
 222.24 1620.64  222.42 1620.65

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 11240.54

INPUT
Description:
Station Elevation Data    num=      72
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1622.32    2.17 1622.26    8.84 1622.17   18.04 1619.82   19.84 1619.35
   21.52 1618.92   30.33 1616.57   32.98 1616.14   36.47  1615.4    41.1  1614.2
   43.16 1613.44   46.03  1612.8   47.52 1612.49   50.51 1612.18   50.76 1612.18
   50.95 1612.17   57.51 1611.85   57.78 1611.84   66.55 1611.72   66.69 1611.72
   66.93 1611.71   67.99 1611.66   75.78 1611.48   77.91 1611.07   78.39 1610.96
    78.5 1610.94   79.09 1610.81   82.83 1609.96   83.03 1609.86   86.35 1609.34
   87.07 1609.41   94.21 1608.95   96.15 1608.91   97.87 1608.86  101.08  1608.9
  102.52 1609.22  105.46 1610.03  107.28 1610.58  108.05 1610.71  110.85 1611.32
  111.03 1611.36  114.87 1611.41  116.39 1611.48  117.98 1611.52  127.17 1611.62
  134.97 1611.97  136.74 1611.99  137.76 1611.93     138 1611.95  139.17 1612.23
  141.71 1612.71  143.88 1613.29  147.84     1614   149.3 1614.36  154.44 1615.82
  156.46 1616.53  160.22 1617.44  162.42 1618.03  163.76 1618.41  168.87 1618.69
   172.4 1618.89  173.24 1618.89   174.2 1618.89  176.96 1618.98   179.4 1619.06
  196.11  1619.6  210.95 1619.97  212.67 1620.02  212.86 1620.21  213.17 1620.52
  214.54  1620.5  220.43 1620.43

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   78.39    .025  110.85    .045   179.4    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
         75.78  110.85             15.56   15.62    15.8              .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 11224.92

INPUT
Description:
Station Elevation Data    num=      60
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1622.07    8.58 1622.07     9.7 1621.79    16.5 1620.09   22.08 1618.69
   25.69 1617.78   32.19 1615.93   33.26 1615.58   38.85 1614.24   44.31 1612.98
   48.15 1612.61   52.19 1612.03   59.76 1611.67   63.03 1611.61   68.72 1611.54
   73.69 1611.46   76.65 1611.38   76.68 1611.38   76.75 1611.36   78.12 1610.98
   78.23 1610.95   84.49 1609.22   95.11 1608.95  100.93 1608.95  110.31 1611.06
  110.76 1611.16  111.37  1611.3  111.87 1611.34  112.91 1611.43  113.78 1611.45
  126.68 1611.68   135.4  1612.4   139.7 1612.63  141.94 1613.13   144.9 1613.65
  153.51 1615.92  154.04 1616.04  154.87 1616.25  163.08 1618.13  163.48 1618.27
  164.57 1618.32  172.12 1618.68  173.33 1618.68  173.92 1618.68   179.6 1618.87
  192.38 1619.29  194.15 1619.34  195.66 1619.39  196.77 1619.42  197.58 1619.44
  202.76 1619.56  212.32 1619.79  212.76 1620.22  212.82 1620.29  218.09 1620.22
  219.77  1620.2  220.23 1620.19  220.76 1620.22  222.14 1620.28  223.75 1620.35

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   78.12    .025  110.31    .045   179.6    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
         76.65  113.78             128.46  130.11   134.5              .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 11094.81

INPUT
Description:
Station Elevation Data    num=      54
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1622.41    1.66 1622.27    4.75 1622.06   10.04 1620.08   10.53 1619.93
   11.81 1619.59   20.49  1617.2   22.97 1616.55   30.73 1614.51    39.3 1612.83
   41.91 1612.43   44.46 1612.03   55.22 1611.37   55.78 1611.32   56.05 1611.33
   56.53 1611.31   65.03 1611.24   68.96  1611.2   71.97 1611.09      75 1610.37
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   75.34 1610.29    79.4 1609.34   80.95 1608.93   82.92 1608.94   99.69 1608.91
  106.43 1610.18  109.29 1610.72  109.51 1610.76  109.73 1610.77  110.35  1610.8
  119.47 1611.28  122.93 1611.31  129.76 1611.57  140.63 1611.99  144.69 1613.11
  152.01 1615.06  152.99 1615.31  153.67 1615.51  154.55 1615.63  160.13 1616.49
  166.21 1616.73  168.36 1616.83  169.81 1616.83  170.16 1616.83  172.66 1616.92
  183.19 1617.31  191.73 1617.63  203.41 1617.82  208.77 1617.92  208.87 1618.02
  209.27 1618.42  211.27 1618.39  217.09 1618.32  218.53 1618.38

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045      75    .025  106.43    .045  172.66    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         71.97  110.35           130.13  130.28  130.52            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 10964.53

INPUT
Description:
Station Elevation Data    num=      54
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1619.96     .71 1619.99    1.27 1619.83    3.33 1619.25   11.41 1616.99
   18.99 1614.78   21.17 1614.14   21.66    1614    23.1 1613.73   32.64  1611.8
   36.16 1611.52   42.17 1611.11   46.26 1611.04   52.42 1610.89   54.62 1610.88
   62.67 1610.81   62.95  1610.8    69.6 1610.59   71.82 1610.07   72.87 1609.82
   75.87 1609.12   78.97 1608.41   82.98 1608.37   97.18 1608.41  104.44 1610.12
  106.46 1610.59  106.62 1610.63  107.24 1610.65  113.93 1610.84  121.53 1610.81
  124.18 1610.84  129.89 1610.82  134.43 1610.65  136.79 1610.92   139.3 1611.04
  143.76 1612.06  144.68 1612.21  153.36 1614.05  156.39 1614.66  157.44 1614.72
  163.09    1615  163.74 1615.03  163.93 1615.03  165.32 1615.03  165.54 1615.03
  166.22 1615.06  167.19  1615.1  186.35  1615.9  203.31 1616.23  203.85 1616.24
  204.13 1616.52  204.35 1616.74  205.81 1616.74  210.21 1616.75

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   71.82    .025  104.44    .045  167.19    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          69.6  107.24            37.05   36.97   36.69            .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 10937.06

INPUT
Description:
Distance from Upstream XS =    27.47
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       91
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
      -73 1619.97  -66.05 1619.94  -64.72 1619.95  -64.14 1619.93  -63.03 1619.97
    -59.3 1620.08   -58.6  1620.1  -58.47 1620.11  -57.83 1620.09  -48.24 1619.83
   -43.87 1619.79  -37.75 1619.18  -34.81 1618.89  -31.88 1618.32  -23.91 1617.26
   -21.52 1617.36  -15.11  1618.1  -14.13 1618.26   -9.52 1619.25   -6.23 1619.28
     -.17 1619.48    4.27 1618.45     6.1 1618.14   10.22 1616.77   16.33 1614.98
    18.65 1614.37   27.54 1611.75   29.15 1611.44   32.97 1610.82   34.82 1610.69
    37.53 1610.49   38.86 1610.49   42.54  1610.4   43.21  1610.4   45.82 1610.41
    48.98 1610.41    51.4 1610.36   55.28 1610.37   58.68 1610.35   64.16  1610.3
    65.73 1610.29   66.66 1610.27   68.11 1610.21   70.08 1610.07   71.37 1609.96
    72.05 1609.91   72.54 1609.79   75.24 1609.15   78.57 1608.13   79.44 1608.11
    83.21 1607.96   87.62 1607.79   87.92 1607.78   92.11 1607.98   93.18    1608
    93.21 1608.01   98.22 1608.14   99.65 1608.44  103.97 1609.73  104.83 1609.99
   107.53 1610.11  114.54 1610.39  119.16 1610.49  127.91 1610.42  130.82  1610.4
   133.95 1610.39  138.52 1610.49  140.95 1610.67  144.68 1611.76  148.26 1612.65
   151.58 1613.45     154 1614.08  155.01 1614.33  158.78 1614.53  162.44 1614.73
   162.74 1614.73  164.24 1614.73   166.2 1614.81  170.13 1614.97  178.33  1615.3
   185.04 1615.57  190.61 1615.66  193.35 1615.71  201.41 1615.86  202.62 1615.88
   202.72 1615.98  203.12 1616.38  208.26 1616.36  210.51 1616.35  211.49 1616.37
    211.7 1616.37

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 10927.56

INPUT
Description:
Station Elevation Data    num=      65
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1619.21    2.32 1618.68     3.8 1618.33    8.05 1617.35   13.54 1615.67
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   18.29 1614.25   25.38 1612.26   28.14 1611.51   28.71 1611.35   34.45 1610.04
   39.42    1609   40.23 1608.76   42.15 1608.62   45.35 1608.46   46.11 1608.37
   48.18 1608.35   58.76 1607.78   66.63 1607.75   67.69 1607.71   69.29 1607.57
   71.68 1607.56   72.78 1607.56   72.84 1607.54   74.86 1607.04   78.44 1606.18
   79.22 1605.88   80.98 1605.86   83.95 1605.78    92.4 1605.75   96.37 1605.71
   97.93 1606.09  104.27 1607.66  104.73 1607.77  110.57  1607.8  111.47 1607.83
  111.71 1607.83  121.78 1607.91  122.03 1607.92  122.51 1607.94  123.79 1607.96
  130.63 1608.23  132.08 1608.47  133.25 1608.75  135.45 1609.25  140.39 1610.52
  141.67 1610.92  151.55 1613.41  151.71 1613.45  152.08 1613.54  154.86 1614.22
  161.57 1614.57  162.44 1614.61  162.57 1614.61  164.24 1614.61   166.3  1614.7
  167.49 1614.74  185.03 1615.44  199.83 1615.69   202.6 1615.74   202.9 1616.03
   203.1 1616.24  205.72 1616.23  206.55 1616.22  210.46  1616.2  213.42 1616.27

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   71.68    .025  104.27    .045   166.3    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         72.84  104.73             15.25   15.61   16.41            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 10911.95

INPUT
Description:
Station Elevation Data     num=      63
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1618.98      .7 1618.82   10.87 1616.36   13.29 1615.73   19.65 1614.08
   21.13 1613.65   23.51    1613   30.89 1610.72   32.82 1610.15   35.91 1609.72
   37.58 1609.52   38.68 1609.35   42.44 1608.78   50.87 1608.36   53.04 1608.34
   57.54 1608.21   63.33 1608.06   64.36 1607.96   66.12 1607.73   71.68 1607.15
   72.05 1607.11   72.32 1607.04   76.13 1606.12   78.01 1605.66   79.56 1605.65
   97.02  1605.6  100.77 1606.56  103.04 1607.18  103.57 1607.18  104.29 1607.23
  105.65 1607.33  108.54 1607.45  111.73 1607.52  116.22 1607.61  120.97  1607.7
  125.84 1607.89  128.73  1608.4  129.73 1608.52  131.26 1608.77  134.39  1609.1
  136.21 1609.52  144.09 1611.83  144.43 1611.94  144.75 1612.02  146.55  1612.4
  153.41 1613.88  154.23 1614.02  155.86  1614.1  161.99 1614.43  163.04 1614.43
  163.79 1614.43  166.03 1614.51  180.31 1615.07   182.6 1615.16  184.57 1615.24
   186.2 1615.27  187.48 1615.29  197.82 1615.45  202.12 1615.52  202.15 1615.54
  202.62 1616.02  203.03 1616.01  207.67 1615.98

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   71.68    .025  104.29    .045  166.03    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         71.68  104.29             136.28  136.15  135.78            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 10775.80

INPUT
Description:
Station Elevation Data     num=      52
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1616.77    4.27 1615.95     6.5 1615.47    9.84 1614.52   16.75 1612.53
   23.14  1610.8   27.01 1609.76   31.61 1608.72   32.99 1608.42   35.73 1607.98
    37.8 1607.68    40.1 1607.61   47.53 1607.37    54.5 1607.21   57.78 1607.19
   61.61 1607.06   64.75 1606.97    67.3 1606.52   67.72 1606.45   70.85  1605.9
   72.65  1605.7   74.05 1605.35   87.58 1605.21   93.04 1605.12   94.81 1605.51
  102.09 1606.94  102.39    1607  105.18 1607.14  109.07 1607.39  112.95 1607.38
  119.33 1607.47  124.12 1607.68  130.93 1607.98  134.34 1608.85  139.84  1610.3
  141.81 1610.74  148.83 1612.47     152 1612.66  156.56 1612.92  157.47 1612.92
  158.36 1612.92   162.3 1613.02   167.5 1613.15  179.84 1613.44  191.66  1613.6
  196.07 1613.68  196.69 1613.69  197.06 1614.05  197.19 1614.19  197.47 1614.19
   204.7 1614.22  207.85 1614.22

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   67.72    .025  102.09    .045   162.3    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         64.75  102.09             147.49  147.77  148.45            .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1              RS: 10637.14

INPUT
Description:
Distance from Upstream XS =  138.66
Deck/Roadway Width        =       5
Weir Coefficient          =     2.6
 Weir Embankment Coordinates    num =       64
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     -54 1616.77  -49.55 1616.83   -44.5 1616.97  -38.03 1616.04  -35.62 1615.66
  -32.09 1615.44  -24.67 1614.75  -21.19 1614.96  -15.11  1615.7  -10.23 1616.51
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   -9.57 1616.64   -7.85 1616.67   -1.09 1616.77    3.18 1615.95    5.41 1615.47
    8.75 1614.52   15.66 1612.53   22.05  1610.8   25.92 1609.76   30.52 1608.72
    31.9 1608.42   34.64 1607.98   36.71 1607.68   39.01 1607.61   46.44 1607.37
   53.41 1607.21   56.69 1607.19   60.52 1607.06   63.66 1606.97   66.21 1606.52
   66.63 1606.45   69.76  1605.9   71.56  1605.7   72.96 1605.35   86.49 1605.21
   91.95 1605.12   93.72 1605.51     101 1606.94   101.3    1607  104.09 1607.14
  107.98 1607.39  111.86 1607.38  118.24 1607.47  123.03 1607.68  129.84 1607.98
  133.25 1608.85  138.75  1610.3  140.72 1610.74  147.74 1612.47  150.91 1612.66
  155.47 1612.92  156.38 1612.92  157.27 1612.92  161.21 1613.02  166.41 1613.15
  178.75 1613.44  190.57  1613.6  194.98 1613.68   195.6 1613.69  195.97 1614.05
   196.1 1614.19  196.38 1614.19  203.61 1614.22  206.76 1614.22

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 10628.03

INPUT
Description:
Station Elevation Data    num=      56
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1613.87    6.94 1613.72   10.92 1613.65   11.74 1613.48   18.32 1612.06
   25.81 1609.87   30.37 1608.83   30.51  1608.8   34.32 1607.93   37.21 1607.22
   42.19 1606.05   43.68 1605.87   44.94 1605.75   50.21 1605.57   54.33 1605.42
      56 1605.38    61.5 1605.26   64.47 1605.24   67.25 1605.15   72.69 1604.95
   76.88 1604.05   77.39 1603.94   79.81 1603.38    85.8 1603.12   91.82 1603.01
   98.83 1603.02  101.19 1603.56  107.37 1605.11  107.53 1605.15  109.38 1605.21
  121.55 1605.19   124.1 1605.31  131.69 1605.38  133.58 1605.75  135.92 1606.29
  138.51  1606.7   143.3 1607.68  143.72 1607.82  150.91 1610.17  154.08 1610.56
  156.33 1610.68  161.55 1611.06  162.44 1611.06  163.35 1611.06  167.56 1611.15
  181.17 1611.42  182.23 1611.45  183.85 1611.48  185.66 1611.49  186.64  1611.5
  189.88 1611.52  201.59  1611.6  201.76 1611.77  202.09  1612.1  206.14 1612.06
  210.18 1612.01

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   76.88    .025  107.37    .045  167.56    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         72.69  107.53             71.72   72.71   75.25             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 10555.32

INPUT
Description:
Station Elevation Data    num=      48
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1612.54    6.93 1610.65   11.03 1609.59   13.46 1608.76   21.38 1606.27
   21.66 1606.23   25.67 1605.85   28.01 1605.47   31.73 1604.94   35.06 1604.82
   42.08 1604.55   49.16 1604.76   52.43 1604.69   57.03 1604.54   58.84 1604.42
   59.82 1604.23   61.58 1603.88   67.85 1602.66   76.83 1602.63   85.46 1602.65
   91.84 1603.85   94.02 1604.25   95.81 1604.31   95.89 1604.31  103.37 1604.55
  104.17 1604.57  111.52 1604.56  118.59 1604.87  125.37 1605.35  128.15 1606.12
  135.22  1608.4  137.85 1608.95   142.8 1609.86  145.17 1609.94  150.45 1610.12
  151.26 1610.12  152.25 1610.12  156.64 1610.21  163.09 1610.36  171.96 1610.55
  175.56 1610.55  182.34 1610.56  190.59 1610.58  190.97 1610.96  191.09 1611.08
  192.77 1611.06  199.11 1611.01  199.85 1611.02

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   61.58    .025   95.89    .045  156.64    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         57.03   95.81             87.97   87.15   85.03             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 10468.18

INPUT
Description:
Station Elevation Data    num=      58
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1611.51     .54 1611.48    6.19 1611.04    8.91 1610.42   12.27 1609.66
   14.77 1608.74   22.84 1607.16   23.83 1606.87   25.95 1606.59   31.44 1606.34
   33.35 1606.11   38.08 1605.65   40.77 1605.37   42.65 1605.23   46.15 1605.12
   53.55  1604.7   53.69 1604.69   53.73 1604.69    59.1 1604.48   62.22 1604.44
   70.76 1604.37   72.69 1604.25      78 1603.28   78.46 1603.26   78.69 1603.25
   79.32 1603.12   82.19  1602.5   92.82  1602.4  101.65 1602.32  103.85  1602.8
  110.34 1604.11  112.18 1604.13  112.38 1604.13  116.72 1604.19  121.86 1604.27
  128.91  1604.4  132.14 1604.48  134.12 1604.44  138.59 1604.68  144.67 1604.89
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  146.96 1605.51  152.72 1607.17  160.64 1608.63  160.66 1608.64   160.7 1608.64
  168.07 1608.88  168.62 1608.88  169.87 1608.88     174 1608.98  174.89    1609
  189.27 1609.37  206.73 1609.32  208.28 1609.32  208.35 1609.39  208.78 1609.82
  214.76 1609.85  216.27 1609.86  216.67 1609.86

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   78.46    .025  112.38    .045     174    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         72.69  110.34             39.9   40.03    40.4             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 10435.00

INPUT
Description:
Distance from Upstream XS =   33.17
Deck/Roadway Width        =       5
Weir Coefficient          =     2.6
 Weir Embankment Coordinates    num =       73
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     -36 1611.77  -34.73 1611.74  -33.37 1611.68  -22.87 1611.31  -20.59 1610.98
  -18.94 1610.74  -15.35 1610.25   -8.88 1611.12   -6.66 1611.47   -3.22 1611.76
    6.22  1612.6   13.23  1610.9   16.66 1609.99   20.74 1608.93    29.3 1606.58
   34.88 1605.65    37.1 1605.26   39.66    1605   43.51 1604.73   44.58 1604.68
   50.39  1604.4   57.44 1604.37   59.14 1604.32   61.04 1604.28   67.62 1604.31
   69.87 1604.29   73.95 1604.25   75.65 1603.46   78.47 1602.82   78.99  1602.7
   79.11 1602.67   80.21 1602.43   83.48 1602.36   85.13  1602.3   90.42 1602.19
   91.12 1602.18   93.95 1602.23  100.91 1602.35  103.07 1602.38  106.01 1603.35
  108.89 1604.09  109.23 1604.08  110.73 1604.09  111.71 1604.08  112.19 1604.08
   117.1 1604.07  123.32 1604.12  130.46 1604.01  132.08 1604.02  137.09 1604.01
  141.28 1604.05  143.71 1604.16  145.42 1604.39  151.16 1605.41  153.87 1606.34
  156.39 1606.87  159.71 1607.78  161.32 1608.21  164.45 1608.34  168.05 1608.47
  169.13 1608.47  169.85 1608.47  173.11 1608.54  173.91 1608.55  189.27 1608.88
   207.5  1608.9  208.34  1608.9  208.44    1609  208.84  1609.4  209.62  1609.4
  211.27  1609.4  216.72  1609.4  218.84  1609.4

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 10428.14

INPUT
Description:
Station Elevation Data    num=      67
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1612.61    1.45 1612.26   12.13 1609.42   15.51 1608.54   22.22 1606.81
   23.19 1606.57   23.53 1606.49   25.07 1606.07   31.97 1604.69   37.38 1603.69
   40.93    1603   41.26 1602.99    44.3 1602.65   49.18 1602.03   50.35 1602.01
   57.46 1601.64   57.81 1601.63   60.48 1601.53   65.77 1601.53   69.35 1601.43
   71.33 1600.83   72.44 1600.43   73.04 1600.22   75.83 1599.24   79.05 1599.01
    84.8 1598.94   86.61 1598.89   87.77 1598.89   89.32 1598.93   94.99 1599.14
   95.12 1599.18  102.61  1601.6  103.06 1601.81  103.51 1601.93  105.58 1601.95
  106.13 1601.96  106.97 1601.97  109.61 1601.96  115.71 1601.79  123.09 1601.75
  124.27 1601.71  127.25 1601.65  128.82 1601.75   131.2 1602.11  132.78 1602.68
  133.58 1602.92  134.05 1603.03   135.4  1603.3  145.13 1605.58  146.34 1605.91
  150.84 1606.86  152.09 1607.19  155.59 1608.15  160.91 1608.34  162.05 1608.38
  163.65 1608.38  163.85 1608.38  167.85 1608.46   175.1  1608.6  183.25 1608.77
  192.27 1608.78   197.1 1608.79  202.33  1608.8  202.69 1609.16  202.83  1609.3
  205.61 1609.29   210.1 1609.29

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   72.44    .025  106.13    .045  167.85    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         69.35  103.51             20.27   20.51   21.16             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 10407.63

INPUT
Description:
Station Elevation Data    num=      49
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1612.48    3.91 1611.49    6.59 1610.84   16.52 1608.02    16.9 1607.91
   25.06 1606.06   27.22 1605.59   38.61 1603.42   41.94 1602.75   42.72 1602.67
   48.73 1601.75   57.23 1601.58   58.17 1601.57   58.39 1601.55   67.12 1601.02
   69.19 1600.54   70.61 1600.39   72.44  1599.9   72.91 1599.77   75.56 1599.07
   90.74 1599.06   96.69 1599.05   97.99 1599.36  104.29 1600.82  105.26  1600.9
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  105.29  1600.9  105.78 1600.95  109.75 1601.39  113.76 1601.57  120.07 1601.76
  125.54 1602.13     132 1602.42  139.61    1604   140.7 1604.26  148.51 1606.63
  151.58 1607.25  155.99 1607.89  161.65  1608.1  162.15 1608.12  162.57 1608.12
  163.95 1608.12  167.28 1608.18  167.81 1608.19  183.26 1608.46  201.92 1608.53
  202.39 1608.53  202.81 1608.95  202.88 1609.03  204.16 1609.02

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   72.44    .025  105.78    .045  167.81    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         67.12  105.29             133.9  133.63  132.83             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 10274.00

INPUT
Description:
Station Elevation Data    num=      48
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1610.37    3.18 1609.59     6.1 1608.87   11.37  1607.6   15.11 1606.68
   22.64 1604.52    25.4 1603.76   29.28 1602.94   33.81 1601.92   36.61 1601.65
   45.99 1600.88   47.46 1600.86   53.45 1600.88   55.73 1600.89   56.29 1600.88
   59.91 1600.81   64.48 1600.73   65.45 1600.71   69.92  1599.8   72.83 1599.21
   75.04 1598.76   80.35 1598.76   93.86 1598.75   95.55  1599.1  102.28 1600.36
  103.59 1600.61  107.14 1600.84  113.63 1600.97  118.06 1601.01  131.72 1601.63
  131.91 1601.64   133.4 1601.94  138.65 1602.99   139.1 1603.09  151.79 1605.87
   157.4 1606.18  159.48 1606.27  160.18 1606.27  161.28 1606.27  164.48 1606.33
  165.04 1606.34  179.99 1606.64  192.54 1606.72  199.44 1606.74  199.83 1607.13
  199.94 1607.24   202.8 1607.24  204.83 1607.23

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   69.92    .025  102.28    .045  164.48    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         65.45  103.59            112.55  112.04  110.67             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 10161.95

INPUT
Description:
Station Elevation Data    num=      53
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1606.69   10.19 1605.13   11.98 1604.94    13.9 1604.58   20.33 1602.96
   24.97 1602.11   27.33 1601.86   32.43 1601.33   34.42 1601.06   37.03 1601.06
   44.68 1600.96   48.42  1600.9   53.72 1600.86    58.5 1600.63    59.5 1600.59
   59.73 1600.54   63.06 1599.81      69  1598.5   81.99 1598.37   86.95 1598.33
   90.16 1599.01   95.52 1600.11    96.9  1600.4  101.18 1600.48  106.23 1600.53
  110.09 1600.63  116.49 1600.72  123.04 1601.06  128.76 1601.38  136.71 1603.18
  137.01 1603.24  137.63 1603.37  145.17 1604.74  147.43 1604.81  152.07 1604.93
  152.55 1604.93  153.87 1604.93   156.6 1604.97  166.91 1605.11  170.44 1605.15
  172.69 1605.18  175.11 1605.19  176.85  1605.2  187.09 1605.26  191.89 1605.29
   192.1  1605.5  192.39 1605.79  199.08 1605.67  199.79 1605.66  199.88 1605.66
  199.94 1605.66   200.2 1605.67  203.03 1605.76

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   63.06    .025   95.52    .045   156.6    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          58.5    96.9             34.93   35.23   35.99             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 10136.06

INPUT
Description:
Distance from Upstream XS =    25.89
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       61
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   -40.4 1605.25  -29.79 1604.45  -27.17 1604.07  -21.94 1603.31  -15.94  1604.3
  -13.49 1604.74    -4.2 1605.32    1.72 1605.68     4.9 1605.19    9.19 1604.65
   13.84 1603.63   18.71 1602.67   24.13 1601.68      29 1600.81   29.92 1600.76
    30.9 1600.71   34.39 1600.59   36.69 1600.62   41.89 1600.63   44.12 1600.67
    49.4 1600.67   51.96 1600.64   59.38 1600.61   60.91 1600.47   62.62 1600.04
   64.28 1599.63   66.32    1599   68.57 1598.45   74.14 1598.41   79.43 1598.39
   88.36 1598.64   90.08 1598.99   95.07 1600.17   96.15 1600.42  100.99 1600.42
  106.61 1600.47  109.98 1600.48   113.2 1600.49  119.38 1600.63  123.68 1600.61
  125.98 1600.74  130.32 1601.28  133.54 1601.83  136.85 1602.64  139.82 1603.21
  144.44 1604.17  145.05  1604.3  146.13 1604.35  151.45 1604.59  152.75 1604.59
  153.25 1604.59   155.9 1604.63  163.45 1604.74  172.39 1604.85  180.39 1604.89
  191.32 1604.92  191.34 1604.94  191.82 1605.42  192.58 1605.42  199.65 1605.38
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201.09 1605.41

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Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested
```

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 10126.72

INPUT
Description:
Station Elevation Data num= 67

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1605.45	1.57	1605.21	8.99	1604.12	14.84	1602.88	15.91	1602.64
16.5	1602.46	26.75	1600.29	30.25	1599.45	33.25	1598.59	33.36	1598.56
33.5	1598.53	34.17	1598.51	39.79	1598.32	40.99	1598.32	42.43	1598.27
54.2	1598.05	55.31	1598.03	57.54	1597.95	60.19	1598.01	60.4	1597.95
65.48	1596.5	66.59	1596.26	66.78	1596.21	67.8	1596.03	69.55	1595.92
77.41	1595.86	77.73	1595.85	80.54	1595.92	86.12	1596.03	86.95	1596.28
88.81	1596.52	92.27	1597.29	92.86	1597.37	95.27	1597.66	97.27	1597.62
99.78	1597.61	105.31	1597.61	107.07	1597.76	108.99	1597.81	114.15	1597.99
116.26	1598.16	118.73	1598.41	120.51	1598.97	122.85	1599.44	127.39	1600.38
131.18	1601.39	132.96	1601.9	137.04	1602.92	142.34	1603.94	142.76	1604.03
144.37	1604.13	149.16	1604.45	150.27	1604.45	150.96	1604.45	153.59	1604.48
166.25	1604.66	170.24	1604.73	175.23	1604.73	179.05	1604.74	184.43	1604.76
189.06	1604.77	189.42	1605.13	189.56	1605.27	190.39	1605.27	194.82	1605.27
197.52	1605.27	198.12	1605.28						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.045	60.4	.025	92.86	.045	153.59	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
60.19	95.27	29.84	29.95	30.21	.1	.3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 10096.77

INPUT
Description:
Station Elevation Data num= 48

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1605.19	2.48	1605.01	9.25	1604.05	14.36	1603.05	22.71	1601.07
24.65	1600.56	25.62	1600.39	31.22	1599.33	36.35	1598.89	42.41	1598.23
45.22	1598.13	48.82	1598.03	56.7	1597.82	58.87	1597.27	62.02	1596.48
64.82	1595.79	75.35	1595.74	84.61	1595.71	90.6	1597.48	91.5	1597.73
91.75	1597.79	93.25	1597.86	100.43	1598.06	106.94	1598.37	108.72	1598.42
112.54	1598.8	120.58	1599.33	125.38	1600.28	127.51	1600.87	133.59	1602.76
138.28	1603.65	140.63	1603.8	142.53	1603.87	147.49	1604.03	148.56	1604.03
149.29	1604.03	151.81	1604.07	167.93	1604.33	168.5	1604.34	168.9	1604.34
169.19	1604.34	169.49	1604.34	170.19	1604.34	187.4	1604.33	187.51	1604.44
187.9	1604.83	189.23	1604.84	193.58	1604.89				

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.045	58.87	.025	91.5	.045	151.81	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
56.7	91.75	159.16	158.22	155.84	.1	.3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 9938.554

INPUT
Description:
Station Elevation Data num= 37

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1602.7	4.12	1601.91	4.91	1601.77	6.22	1601.44	15.13	1599.21
17.2	1598.9	20.54	1598.33	24.53	1597.9	29.34	1597.76	35.58	1597.77
46.18	1597.58	49.64	1597.51	54.41	1596.46	56.76	1595.95	57.07	1595.88
58.01	1595.87	77.64	1595.65	84.02	1596.91	87.01	1597.48	89.27	1597.66
96.7	1598.25	96.93	1598.26	105.19	1598.31	107.15	1598.31	111.94	1598.62
117.52	1598.93	119.84	1599.44	127.6	1601.42	132.96	1602.38	133.67	1602.48
134.8	1602.5	141.09	1602.63	142.28	1602.63	142.89	1602.63	144.82	1602.63
144.97	1602.63	162.47	1602.72						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.045	54.41	.025	89.27	.045	144.97	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
49.64	87.01	146.24	147.26	149.88	.1	.3

```
CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 9791.290

INPUT
Description:
Station Elevation Data    num=      31
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  1601.6     .61 1601.51    4.42  1600.8    16.3 1598.33   17.97 1598.28
   23.66 1597.64   25.12 1597.59    33.4  1597.8   33.95 1597.79   41.38 1597.28
    43.9 1597.16   49.25 1596.02   51.05 1595.64   52.02 1595.44   53.04 1595.22
   73.19 1594.99   79.46 1596.43   82.74  1597.1   84.64  1597.3   85.45 1597.38
   86.75 1597.51   88.69 1597.69  104.66 1598.19  107.83 1598.24  116.36 1598.47
  116.83 1598.62  117.49 1598.75  129.38 1601.66  135.82 1601.78  136.43 1601.79
  138.23 1601.79

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045    43.9    .025   85.45    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          43.9   85.45             89.95   88.59   84.96             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 9713.006

INPUT
Description:
Distance from Upstream XS =   78.28
Deck/Roadway Width        =       5
Weir Coefficient          =     2.6
 Weir Embankment Coordinates    num =       60
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     -44 1599.82  -43.52  1599.8  -39.64 1599.48  -37.72 1599.48  -32.55 1599.49
  -23.24 1599.32  -21.75  1599.4  -17.12 1599.48   -7.46 1598.94   -6.54 1598.92
   -4.49 1598.64     .27 1598.37     4.9 1598.11    6.35 1597.99   10.83 1597.81
   16.16 1597.54   25.94 1597.51   32.27 1597.49   40.41 1597.45   42.57 1597.13
   48.68 1595.26   49.51 1595.01   49.77 1594.93   54.49 1594.71   57.34  1594.7
   62.62 1594.58   68.14    1595   69.21 1595.23   75.96 1596.34   78.17 1596.86
   79.66 1596.92   80.95 1596.98   82.94    1597   86.67 1597.05   88.66 1597.06
   94.58  1597.1  101.53 1597.02  106.29 1597.11  109.06 1597.14  113.21  1597.5
  115.14 1597.75  116.67 1598.26  119.45 1599.23   123.1 1600.01  126.75 1600.73
  130.44 1600.84  133.69 1600.94  135.08 1600.94  135.49 1600.94  138.82 1600.82
  143.31 1600.67  156.59 1600.19  169.42 1599.74  172.14 1599.64  173.33  1599.4
  173.55 1599.36  174.01 1599.82  174.05 1599.86  174.59 1599.86  176.19 1599.89

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 9702.693

INPUT
Description:
Station Elevation Data    num=      52
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1600.61    7.93 1600.44    9.28 1600.25   13.93 1599.47   16.75 1599.04
   18.59 1598.64   23.32 1597.81   26.14 1596.67   29.71  1595.8   31.71  1595.7
   36.04 1595.06   36.67 1595.02   37.16 1594.97    44.8  1594.6   45.48 1594.59
   55.53 1594.44   56.45 1594.41   62.82 1594.24   64.54 1593.78   68.42  1592.8
   68.96 1592.66   71.05 1592.14   75.15 1592.06    78.7 1592.05   81.44 1592.03
   86.43 1592.03   88.36 1592.27   89.89 1592.59   94.55 1594.09   98.95 1594.11
   99.17 1594.12  100.22 1594.13  102.22 1594.17  107.65 1594.29  109.24 1594.31
   118.1 1594.41  120.41 1594.49  121.78 1594.35  122.47  1594.4  122.99 1594.54
  125.52 1595.36  128.13 1595.96  133.67  1597.3  134.91 1597.61  137.38 1598.49
  141.02 1599.73  143.91 1600.27  146.45 1600.59  151.54 1600.75  153.21  1600.8
  154.23  1600.8  155.01  1600.8

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   68.42    .025   99.17    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          62.82  94.55             19.42   19.75   20.69             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 9682.938

INPUT
Description:
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Station Elevation Data    num=      43
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1601.62    1.63 1601.57    5.42 1601.17    5.99 1601.02   10.55 1599.74
   20.59 1596.88   22.39 1596.43   23.71 1596.23   28.72 1595.25   30.41 1595.02
   36.15 1594.35   39.58 1594.32   52.98 1594.05   55.18 1594.04   56.64 1593.63
   62.02 1592.32   62.57 1592.19   63.53 1591.95   71.86 1591.89   81.64 1591.83
   89.35 1593.97   89.47    1594   89.65 1594.01   91.64 1594.13   92.44 1594.14
      95 1594.18   95.49 1594.19   97.78 1594.13  103.79 1594.21  107.03 1594.22
  108.96 1594.31  112.94 1594.55  114.89 1594.77  117.94 1595.14  123.89 1596.55
  128.16 1597.78  139.17  1600.2  139.59 1600.29  139.84 1600.29  141.31 1600.34
   146.5 1600.51  146.72 1600.51   148.3 1600.51

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   62.02    .025   92.44    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         55.18   91.64             94.59   93.97    92.1             .1      .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 9588.970

INPUT
Description:
Station Elevation Data    num=      33
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1601.31    2.87  1600.4   10.26 1598.16   14.21 1596.95   18.95 1595.77
   23.99 1594.43   26.87 1594.18   34.58 1593.58   42.72 1593.46   44.76 1593.43
   52.26 1593.44   56.88 1593.41    59.4 1592.86    63.6 1591.96   64.36 1591.79
   65.91 1591.46   77.15 1591.47   83.52 1591.49   88.94 1592.66   92.24 1593.34
   92.57 1593.41   93.52  1593.6   98.98 1593.54  105.86 1593.75  109.49 1593.87
  117.28 1593.98  119.81 1594.55  126.22 1596.05  129.86 1597.09  139.13 1599.23
   139.6 1599.29  141.78 1599.29  147.12 1599.29

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045    63.6    .025   92.24    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         56.88   93.52            132.45  131.99  130.73             .1      .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 9456.982

INPUT
Description:
Station Elevation Data    num=      42
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1598.89    1.46 1598.56    4.61 1597.69    7.78 1596.74   11.47 1595.67
   13.31 1595.34   16.02 1594.83   17.27 1594.64   19.28 1594.42   23.92 1594.07
   26.87 1593.93   35.08  1593.9    35.5 1593.89   37.89 1593.85   45.23 1593.71
   46.66 1593.61   53.63 1593.22   57.56 1592.45   60.35 1591.92   61.51  1591.7
   63.63 1591.29   73.88 1591.28    82.2 1591.25   92.25 1593.09   92.28  1593.1
   92.32  1593.1   92.33  1593.1   92.54 1593.11   92.67 1593.11  104.51 1593.39
  106.17 1593.37  108.55 1593.38  116.32 1593.43  119.49 1593.67  121.36 1593.87
  124.38 1594.47  126.48 1594.82  135.55 1596.79  137.87 1597.27  140.02 1597.31
  145.27 1597.42   146.7 1597.41

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   60.35    .025   92.54    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         53.63   92.32             38.02   36.94   34.17             .1      .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 9426.926

INPUT
Description:
Distance from Upstream XS =    30.06
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       72
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
      -51 1598.48  -49.71 1598.43  -48.49  1598.4  -47.77 1598.34  -41.98 1597.99
  -41.03 1597.91  -39.45 1597.85  -29.27 1597.29  -27.74 1597.04  -25.44 1596.66
  -22.08 1596.11   -15.5 1597.07  -14.03 1597.29  -13.24 1597.34     .49 1598.42
    6.14 1597.01    9.85 1595.94    14.5 1595.03    20.9 1593.75   25.11 1593.62
   27.66 1593.58   33.98 1593.47   40.64 1593.22   48.91 1593.09   53.31 1593.04
   53.95 1593.12   54.89 1593.24   56.22  1592.7   59.58 1591.85   60.95 1591.51
   61.12 1591.47   62.56 1591.02   64.73 1590.86   70.24 1590.86   73.04 1590.79
   74.27 1590.81   76.44 1590.86   81.56 1590.97    83.9 1591.27   88.27 1592.43
   90.57 1593.34   92.44 1593.32   92.74 1593.31   93.81 1593.29   95.67 1593.23
   98.97  1593.3  103.64 1593.32  105.35 1593.32  112.75 1593.27  116.18 1593.26
  121.64 1593.35  124.58 1593.59  125.88 1594.02  130.27 1595.01  134.87 1596.08
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  137.87 1596.78  144.84 1596.99  145.24    1597  146.94    1597  147.04    1597
  149.02 1596.96  158.49 1596.76  170.76  1596.5  184.26 1596.01  191.71 1595.74
  195.55  1595.6  196.44  1595.6  196.85  1595.6  197.87 1595.61  198.72 1595.62
  201.21 1595.63  201.36 1595.62

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1            RS: 9420.045

INPUT
Description:
Station Elevation Data    num=      44
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1598.33    4.42 1596.99    8.69  1595.7    9.66 1595.44   11.99 1594.84
   20.76 1592.99   23.97 1592.33   25.57 1592.07   29.64 1591.54   30.12 1591.51
   30.36 1591.49   32.61 1591.41   43.89 1591.13   44.53 1591.11   56.05 1590.78
   58.82 1589.86      60 1589.47   60.22 1589.42   62.32 1588.92   63.02 1588.59
   65.99 1588.58   72.65 1588.58    75.1 1588.58   82.52 1588.75   82.93 1588.89
   88.82 1590.81   89.04 1590.81   91.89 1590.91    92.2 1590.92   98.11 1591.13
   98.31 1591.13  112.22 1591.28  112.49 1591.29  112.51 1591.29  117.72 1591.65
  118.63 1591.71  122.12 1592.45  126.38 1594.15  130.03 1594.98  133.55 1595.79
  137.33 1596.68  141.47 1596.81  144.68  1596.9  145.93  1596.9

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   58.82    .025    92.2    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         56.05   88.82             17.74   18.08   18.94            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1            RS: 9401.967

INPUT
Description:
Station Elevation Data    num=      46
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1598.25       5 1596.73   10.64 1595.27   11.57 1595.07   12.74 1594.72
   17.46 1593.72   25.87 1591.81   27.32  1591.6   28.18 1591.48   31.94 1590.96
   38.85 1590.94   43.89 1590.99   46.33 1590.98   51.68 1590.93   53.92 1590.84
   54.88 1590.81   58.27 1589.71   59.22  1589.4   59.79  1589.2   60.03 1589.11
   61.32 1588.83   61.89 1588.64   63.41 1588.64   81.32 1588.62   86.72 1590.11
   88.92 1590.85   89.77 1590.85   90.67 1590.84    91.6 1590.85   91.87 1590.85
   92.22 1590.85   96.84 1590.86  102.63 1590.74  107.86  1590.8  114.81 1591.26
  117.89 1591.38  121.09 1592.32  123.29 1592.87  124.78 1593.32  125.78 1593.57
  133.46 1595.36  137.39 1596.41  140.84 1596.51  144.69 1596.62  145.73 1596.62
  146.49 1596.62

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   58.27    .025   92.22    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         54.88   88.92             69.29   69.28    69.2            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1            RS: 9332.685

INPUT
Description:
Station Elevation Data    num=      36
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1596.77     .41  1596.7     1.4 1596.65     5.2 1596.13   13.89 1593.64
   14.03  1593.6   22.91 1591.28   31.14  1590.9   34.13 1590.84   40.24 1590.66
   44.94 1590.56   48.52  1590.4   54.52 1590.36   56.99 1589.79   58.59 1589.41
   59.67 1589.16   62.18 1588.57   79.13 1588.43   81.85 1588.41    83.1 1588.66
   91.45 1590.35    92.2 1590.35   92.61 1590.35   99.73 1590.33  101.55 1590.32
  104.97 1590.25  110.47 1590.42  117.58 1590.53  120.27 1591.11  125.21 1592.17
  128.76 1593.15  137.62 1595.63  143.91 1595.65  145.88 1595.67  147.32 1595.67
  147.68 1595.67

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   58.59    .025   92.61    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         54.52   91.45             89.49    87.8   83.87            .1       .3

CROSS SECTION
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```
RIVER: SunValley
REACH: Reach1             RS: 9244.882

INPUT
Description:
Station Elevation Data    num=      37
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1595.17     6.5  1593.9    7.92 1593.62    9.09 1593.37   19.74 1591.12
   26.89 1590.73   28.05 1590.67   36.23 1590.54   38.11 1590.49   40.45 1590.52
   48.17 1590.51   55.18 1590.39   55.42 1590.38   61.32 1589.08   61.72    1589
   63.44 1588.62   63.85 1588.54   65.11 1588.53    83.1 1588.39    88.8 1589.57
   92.03 1590.26   92.11 1590.27   92.39 1590.33    94.3  1590.4   98.47 1590.49
   99.64 1590.53  108.54 1590.38  108.73 1590.38  121.26 1590.48  126.11 1591.18
  128.66 1591.51  138.62 1593.83  140.77 1594.39  147.67 1594.59   148.4  1594.6
  150.06  1594.6   150.2  1594.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   61.32    .025   92.03    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         55.42    94.3             30.7   30.85   31.22             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 9220.901

INPUT
Description:
Distance from Upstream XS =    23.98
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       74
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
   -48.5 1593.77  -48.23 1593.77  -39.47 1593.96  -38.31 1593.99   -37.8 1593.95
  -27.32 1593.12   -24.3 1592.63  -20.24 1591.97  -19.88 1591.91  -19.38    1592
  -18.39 1592.15  -11.67 1593.17  -10.68 1593.31   -2.07 1594.26    1.92 1594.59
    9.86 1592.77   12.16 1592.21   14.14 1591.66    16.7 1590.99   20.44 1590.62
   22.35 1590.49    28.8 1590.35   32.94 1590.22   40.49 1590.06   48.41 1590.17
   52.76 1590.14   53.63 1590.17   56.47 1590.14   58.11 1590.13   58.78 1590.08
   60.57  1589.5   62.92 1588.89    63.2 1588.82   64.71 1588.43   69.94 1588.29
   71.63 1588.23   75.05 1588.17   79.19 1588.26   84.28  1588.3   85.38 1588.44
   90.97 1590.05   91.31 1590.14   91.39 1590.14   92.54 1590.15   92.56 1590.15
   95.36 1590.16  100.02 1590.24  104.69 1590.13  108.68 1589.93  113.81 1589.97
  119.76 1590.01  123.41 1590.01  124.72 1589.96  127.33 1590.06  129.13 1590.36
  132.36 1590.89  138.27 1592.94  141.89 1594.12  144.15 1594.17  149.78 1594.26
  150.11 1594.26  151.58 1594.26   155.9 1594.14   156.2 1594.13  171.94 1593.66
  178.59 1593.32  188.88 1592.82  190.05 1592.82  190.18 1592.82  192.04 1592.96
  193.26 1593.05   198.4 1593.43  201.08 1593.24  203.53 1593.05

Upstream Embankment side slope             =     100 horiz. to 1.0 vertical
Downstream Embankment side slope           =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins        =
Weir crest shape                           = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 9214.029

INPUT
Description:
Station Elevation Data    num=      58
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1594.36    2.16 1593.86    10.6 1591.79      11 1591.68   15.71 1590.43
   16.62 1590.33   17.82 1590.06   20.87  1589.5   22.91 1588.87   23.82 1588.66
   25.35 1588.18   25.75 1588.12   27.01 1588.22   33.48 1587.66   33.52 1587.66
   33.53 1587.66   33.54 1587.66    46.7 1587.55   46.79 1587.54   54.59 1587.62
   54.97 1587.62   60.51 1586.25   60.72 1586.21   60.95 1586.16   63.29 1585.68
   63.49 1585.61   65.12 1585.48   69.51 1585.38   75.87 1585.32   76.23 1585.33
   77.85 1585.37   82.56 1585.73   82.83 1585.79    83.2 1585.97   88.76 1587.88
   89.89 1588.05   89.91 1588.05   89.93 1588.05   94.55 1588.32   97.32 1588.39
  103.35 1588.49  105.94 1588.42  110.39 1588.59  114.62 1588.71  117.26 1588.85
  119.67 1588.83  122.23 1589.03  122.46 1589.07  122.51 1589.09  130.17 1590.86
  130.63 1591.01  139.71 1593.96  145.82 1594.09   147.5 1594.12  149.22 1594.12
   149.3 1594.12  153.59    1594  154.36 1593.98

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   60.95    .025   89.89    .045  153.59    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         54.97   88.76             22.59   22.52   22.34             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 9191.509
```

```
INPUT
Description:
Station Elevation Data    num=       40
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1593.55     7.25 1591.94    11.06 1591.09     13.3 1590.44    21.25 1588.11
   25.38 1587.79    28.18 1587.59    35.97 1587.34    41.26 1587.16    43.76 1587.18
   48.78 1587.27    50.59 1587.28    53.97 1587.12    57.88 1586.19    59.08 1585.86
   59.16 1585.84    62.09 1585.04    64.05 1584.95    76.48 1584.75    80.38 1584.89
   83.82 1586.07    86.78 1586.29    86.79  1586.3    89.32 1586.88    94.47 1587.12
   97.49 1587.27    99.89 1587.17   104.43 1587.07    111.7 1587.47   116.98 1588.06
  119.09 1588.35   124.95 1589.89   131.83 1591.67   136.22 1593.06   137.75 1593.56
  140.66 1593.61    145.6 1593.67    146.3 1593.67    147.4 1593.67   150.22 1593.61

Manning's n Values        num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
       0    .045    59.16    .025    86.79    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
         53.97   89.32             66.02   65.86   65.44              .1        .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 9125.650

INPUT
Description:
Station Elevation Data    num=       38
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1591.78       3 1591.28     7.29 1590.28    11.98 1589.02    18.26 1587.26
   19.44 1587.18    25.01 1586.89    34.46 1586.67    35.41 1586.66    36.53 1586.66
   45.47 1586.69     49.6 1586.59    51.09 1586.55     54.3 1586.19    56.79 1585.57
   57.22 1585.47    59.08 1585.01    60.24  1584.7    62.03  1584.7    78.08  1584.8
   85.03 1586.12    87.29 1586.55    88.08  1586.7    89.06 1586.72    91.13  1586.8
   95.77 1586.97    98.27 1587.02   105.13 1587.17   113.51 1587.46   118.36 1587.65
  124.77 1589.55   125.94  1589.9   133.14 1591.82   134.96 1592.27   136.63  1592.3
  142.94 1592.36   143.13 1592.36   144.74 1592.36

Manning's n Values        num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
       0    .045    56.79    .025    85.03    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
         51.09   87.29             99.28   98.68    97.1              .1        .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 9026.968

INPUT
Description:
Station Elevation Data    num=       46
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1590.32     1.88 1590.18    10.97 1587.94    15.96 1586.92    17.78 1586.82
   22.86 1586.51    24.99 1586.38    25.22 1586.38    40.42 1586.62    40.62 1586.62
    40.8 1586.62    50.79 1586.46    50.81 1586.46    55.19 1585.59    55.58 1585.48
   56.08 1585.34    59.02 1584.54    60.68 1584.52    62.48 1584.51    75.67 1584.48
   79.47 1584.66    85.34 1586.05    87.44 1586.55     88.4 1586.75    89.48 1586.75
   89.84 1586.76    98.95 1586.83    99.15 1586.83   109.97 1586.81    110.9 1586.82
  113.77 1586.75   114.91  1586.8   121.99 1587.03   124.29  1587.3   127.03 1588.03
  130.13 1588.66   132.47 1589.42   134.91 1590.09   142.16 1590.39   142.49  1590.4
  142.54  1590.4   144.29  1590.4   145.05 1590.41   147.15 1590.43   156.12 1590.52
  164.97 1590.62

Manning's n Values        num=       4
     Sta   n Val      Sta   n Val      Sta   n Val      Sta   n Val
       0    .045    56.08    .025    85.34    .045   147.15    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
         50.81    88.4             11.35   11.55   12.07              .1        .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 9019.372

INPUT
Description:
Distance from Upstream XS =       7.6
Deck/Roadway Width        =         3
Weir Coefficient          =       2.6
 Weir Embankment Coordinates    num =       80
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
      -36 1589.63   -35.85 1589.62   -35.42 1589.59   -29.46 1589.08     -29 1589.04
  -26.05  1588.5   -21.44 1587.64   -21.33 1587.62   -21.13 1587.66   -20.7 1587.73
  -13.43 1589.02    -9.82 1589.89    -9.62 1589.94    -9.53 1589.96   -9.35 1589.96
    -.33 1590.21      .44 1590.15     4.76 1589.74     10.9 1588.08   14.73 1587.01
   15.19    1587    16.74 1586.85    21.38 1586.53    21.51 1586.52   21.75 1586.51
   27.22  1586.4     29.2 1586.33    29.37 1586.32    37.53  1586.4   37.94  1586.4
   44.84 1586.36    45.27 1586.35    45.32 1586.35    52.15 1586.11    54.5 1585.06
```

```
  55.1 1584.91   55.71 1584.76   55.87 1584.72   57.67 1584.43   64.17 1584.39
 70.57 1584.28   70.77 1584.27   77.83 1584.16   78.39 1584.16   78.74 1584.23
 81.92 1584.51   85.04 1585.58   85.23 1585.64   85.36 1585.68   85.59 1585.75
 88.49 1586.59   88.55 1586.59   97.26 1586.76   97.37 1586.76  105.39 1586.68
105.73 1586.68   109.6 1586.66  112.18 1586.58  112.23 1586.58  116.93 1586.59
 117.5 1586.61  121.93  1586.9  122.03 1586.92  131.22 1588.84  131.74 1589.01
 132.4  1589.2  134.66 1589.93  139.65 1590.16  142.14 1590.27  143.94 1590.27
146.81  1590.3  148.26 1590.31  164.65  1590.5  179.03  1590.2  180.96 1590.15
182.26 1590.15  185.43 1590.36  186.73 1590.44  190.63 1590.69  191.35 1590.64

Upstream Embankment side slope                =     100 horiz. to 1.0 vertical
Downstream Embankment side slope              =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins           =
Weir crest shape                              = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 9015.422

INPUT
Description:
Station Elevation Data    num=      59
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1590.14    3.63 1589.74    5.45 1589.56   10.52 1588.19   14.97 1586.93
   18.07 1585.99   18.69 1585.71   20.26 1585.27   22.03 1585.13   23.49 1584.91
   26.02 1584.81   33.15  1584.3   34.66 1584.31   43.81 1584.17   44.63 1584.17
   50.51 1584.14   51.06 1584.13   52.94 1584.12   53.23 1583.99   55.33 1583.37
   55.99 1583.17   59.04 1582.26    59.3 1582.21   59.92  1582.2   65.54 1581.87
   65.65 1581.87   66.61 1581.84   72.86 1581.93   77.64 1581.98   78.43 1581.98
   80.71 1582.43   81.39 1582.49   82.14 1582.74   85.37  1583.7   86.93 1584.16
   87.74 1584.39   90.66 1584.54   92.94 1584.59   99.61 1584.53   101.5 1584.51
   110.1 1584.48  110.74 1584.48  114.24 1585.03  114.52 1585.03  115.19 1585.07
  118.47 1585.59  118.88 1585.68  125.17 1587.34  125.91 1587.54  126.28 1587.62
  131.86 1588.92   134.3 1589.69  134.96 1589.87  136.26 1589.92  142.45  1590.2
  143.62  1590.2  144.25  1590.2   144.9 1590.21  147.11 1590.23

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   55.99    .025   85.37    .045  147.11    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         52.94   87.74             16.81   17.33   18.71             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 8998.093

INPUT
Description:
Station Elevation Data    num=      49
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1589.85    3.54 1589.37    6.9 1588.93   10.96 1587.61   16.52 1586.08
   17.85 1585.53   20.34 1585.05   22.07 1584.54    28.6 1584.01   28.83    1584
   29.84 1583.95   35.62 1583.67   38.95 1583.57   46.73 1583.48   50.19 1583.53
      52 1583.53   55.09 1582.66   55.81 1582.46   57.35 1582.03   58.23 1581.77
   60.56 1581.78   80.21 1581.92   84.51 1583.06   85.37 1583.23   87.19  1583.6
   88.61 1583.56   91.71  1583.5   94.43 1583.53   98.44 1583.45  104.53 1583.85
  107.43    1584  110.05 1584.18  115.76 1584.91  116.25 1584.96  117.61 1585.31
  125.79  1587.4  127.16 1587.69  128.46 1588.08    131 1588.74   134.6 1589.64
  136.54  1589.7  140.01 1589.82  142.37  1589.9  142.85  1589.9  144.17 1589.89
  147.05 1589.93  157.05 1590.06  160.62  1590.1  164.98 1590.17

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   55.81    .025   85.37    .045  147.05    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            52   87.19             34.49   34.39   34.13             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 8963.707

INPUT
Description:
Station Elevation Data    num=      37
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1589.21    9.13 1587.43   10.06 1587.26   10.94 1587.04   22.86 1584.21
   24.91    1584   30.91 1583.71   40.24 1583.46   42.63 1583.45   50.84 1583.42
      55 1582.69   55.54  1582.6   60.15 1581.79   60.23 1581.77   60.35 1581.77
   79.18 1581.91   81.67  1582.3   85.43 1582.89   87.49 1583.22   99.87 1583.58
  100.59 1583.59  101.21 1583.62  106.83 1583.77  110.65 1583.87  111.13 1583.92
  117.77 1584.63  133.22 1588.82  134.42 1589.14  136.86  1589.2  142.25 1589.33
   143.9 1589.32  144.05 1589.32  144.44 1589.33  146.97 1589.38  158.03 1589.58
  160.81 1589.63     165 1589.69

Manning's n Values        num=       4
```

```
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   55.54    .025   85.43    .045  146.97    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         50.84   87.49             111.1  110.63  109.38            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 8853.075

INPUT
Description:
Station Elevation Data    num=      45
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1588.09    6.13 1586.73   11.94 1585.54   14.89 1585.13   16.51 1584.94
   19.31 1584.74   23.06 1584.36   26.44 1584.04   27.83 1583.98   34.55 1583.35
   37.24 1583.33    44.6  1583.5   46.94 1583.51   54.82 1583.51   58.89 1582.71
   58.98 1582.69    60.7 1582.35   64.31  1581.6    81.9 1581.47   83.02 1581.46
   83.41 1581.53    91.3 1583.07    92.7 1583.34  103.88 1583.53  104.87 1583.55
   105.7 1583.58  114.46 1583.95  114.91 1583.97  115.08 1583.98  125.85 1584.61
  127.48 1585.02  128.83 1585.28  138.47 1587.57  143.78 1587.79  146.07 1587.88
  146.63 1587.88  147.87 1587.88  150.96 1587.96  164.39 1588.27  168.73 1588.39
  185.26 1588.41  186.17 1588.41  190.42 1588.72  194.17    1589  194.23    1589

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   58.89    .025   91.3    .045  150.96    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         54.82   92.7              37.25   37.3   37.42            .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 8820.596

INPUT
Description:
Distance from Upstream XS =   32.48
Deck/Roadway Width        =       3
Weir Coefficient          =     2.6
 Weir Embankment Coordinates    num =       71
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     -37 1587.63  -35.71 1587.55  -31.77 1587.19  -23.83 1586.41  -23.01 1586.18
   -22.7 1586.09  -22.08 1586.16  -21.67 1586.21  -10.04 1588.17   -2.83 1588.36
    -1.1 1588.37    3.24 1587.47    7.49 1586.57    8.99  1586.2   14.93  1584.8
   19.78 1584.14   21.12 1583.94   22.13 1583.82   28.76 1583.75   29.81 1583.65
   33.34  1583.5   37.89 1583.47   42.75 1583.44   44.54 1583.45   49.71 1583.43
   50.82 1583.51   55.61 1583.52   58.23 1582.79   58.91 1582.59      59 1582.57
   60.69  1582.1   62.47 1581.43   64.37 1581.32   65.09 1581.27   67.96 1581.11
   69.65 1581.09    81.5 1581.14   83.45 1581.28   83.47 1581.29   88.83 1582.52
   90.79 1583.38   90.83 1583.38   91.94 1583.37   97.32 1583.35   99.15  1583.4
  104.92 1583.48  107.19 1583.45  114.71 1583.35  117.65 1583.37  119.52 1583.47
  122.99 1583.67  123.96 1583.61  125.14 1583.62  127.03 1584.06   131.9 1585.19
  132.52 1585.44  137.65 1587.03  138.72 1587.36  139.77  1587.4  146.05 1587.53
  146.72 1587.53  147.86 1587.53     151 1587.62   154.1 1587.71  168.64 1588.12
   176.2 1588.16  186.13  1588.2  189.17 1588.39   190.2 1588.46  194.39 1588.73
  194.78  1588.7

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 8815.779

INPUT
Description:
Station Elevation Data    num=      63
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1588.47    4.46  1587.5    9.42 1586.45   14.36 1585.22   16.45 1584.73
   19.81 1584.27   22.23 1583.52   23.84 1583.16    24.7    1583   26.03  1582.6
   28.19 1582.36    28.7 1582.24   29.68 1582.15   32.08 1582.09   36.58 1581.86
   37.23 1581.85   43.96 1581.61   44.68 1581.59   45.34 1581.57   53.15 1581.25
   53.17 1581.25   59.31 1581.18   59.32 1581.18   60.49 1580.85   64.92 1579.63
   68.42  1579.6   70.63 1579.61   76.52 1579.46   78.97 1579.42   84.26 1579.34
   84.69 1579.34   87.63 1579.85   88.39  1580.1   89.17  1580.4   93.77 1581.62
   95.49 1581.66  101.24 1581.86  103.34  1581.9  111.19 1581.83  113.91 1581.85
  119.66 1582.08  120.68 1582.11  124.69 1582.78     125  1582.8  128.53 1583.76
  133.43 1585.21   134.2 1585.39  134.23  1585.4  134.47 1585.47  140.25 1587.25
  145.96 1587.46  147.51 1587.49  149.15 1587.49  149.31 1587.49  152.46 1587.58
  165.15 1587.95  170.09 1588.09  172.66  1588.1  187.59 1588.15  190.79 1588.36
   193.7 1588.55  195.83 1588.69  196.41 1588.64

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
```

```
      0    .045   59.31    .025   93.77    .045  152.46    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         59.32   93.77             16.81   16.58   15.96            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 8799.197

INPUT
Description:
Station Elevation Data    num=      47
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1588.93    5.94 1587.65   12.71 1586.17   15.99 1585.26   21.15  1583.9
   23.18 1583.32   27.77 1582.63   30.09 1582.23   36.11 1581.68   42.39 1581.09
   44.98 1581.01   53.01 1580.93   56.34 1580.92   61.51 1580.92   62.18 1580.77
   63.64 1580.44   65.61 1579.96   79.71 1579.65    89.2 1579.48   93.97 1580.83
   95.49  1580.9  100.44 1580.82  101.75 1580.85  105.08 1581.01   106.6 1581.04
  110.16 1580.99  116.87 1581.26  121.18 1581.84  122.53 1581.91  124.25 1582.36
  131.31 1583.91  135.28 1584.98  141.11 1586.63  142.15 1586.89  143.07 1586.95
  149.17 1587.36  149.19 1587.36  150.97 1587.36  154.05 1587.45  154.08 1587.45
  160.41 1587.63  171.83 1587.96  178.78 1587.96  189.24 1587.99  192.68 1588.22
  197.42 1588.53  197.94  1588.5

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   62.18    .025   95.49    .045  154.08    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         61.51   93.97            136.47  137.75  141.13            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 8661.449

INPUT
Description:
Station Elevation Data    num=      42
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1590.19    1.47 1589.77    4.54 1588.89    9.25 1587.53    18.3 1584.93
   19.33 1584.63   20.45 1584.38   31.63 1581.93    33.5 1581.79   39.91 1581.32
   46.79 1580.87   49.58 1580.71   53.96 1580.78   61.95 1580.93   66.23 1580.21
   70.99 1579.41   78.09 1579.41   90.61 1579.33   94.39 1580.02   99.77 1580.86
  108.85 1580.78  110.07 1580.77  118.46 1580.88  120.15 1580.88  121.99  1581.1
  128.62 1581.83   135.2 1583.53  140.31 1584.82  144.59 1585.62  146.03 1585.88
  147.28 1585.94  152.96 1586.24  153.81 1586.24  154.76 1586.24  157.26 1586.28
  166.16 1586.45  176.15 1586.64  180.46 1586.65   192.9 1586.68  197.12 1587.01
  201.13 1587.32  202.23 1587.25

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   66.23    .025   99.77    .045  157.26    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         61.95   99.77            162.11   160.9  157.74            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 8500.547

INPUT
Description:
Station Elevation Data    num=      46
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1587.49    3.06 1587.22    4.05 1587.14     4.3 1587.09    14.2 1584.63
   15.36 1584.39    27.7 1581.55   33.31 1581.14   34.87 1581.04   37.46 1580.98
   44.33 1580.86   48.54 1580.79   54.37  1580.8   59.81 1580.57   61.72 1580.48
   63.95    1580   67.06 1579.31   67.13  1579.3   69.43 1578.79   79.73 1578.86
    88.8 1578.88   91.39 1579.35   97.73 1580.45   98.47 1580.58  104.24 1580.96
  104.58    1581  111.95  1580.9  114.62 1580.87  114.89 1580.87  124.67 1580.85
  126.14    1581  130.97 1581.47   143.8 1584.17  145.28 1584.48     147 1584.56
  152.16 1584.77  153.03 1584.77  153.96 1584.77  155.93 1584.83  172.93 1585.28
  174.51 1585.32  175.57 1585.33  179.89 1585.36   192.1 1585.43  192.54 1585.47
  200.11 1586.09

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   67.06    .025   97.73    .045  155.93    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         61.72   98.47             31.01   31.16   31.56            .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 8474.735

INPUT
```

```
Description:
Distance from Upstream XS =   25.81
Deck/Roadway Width        =       5
Weir Coefficient          =     2.6
 Weir Embankment Coordinates    num =       76
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     -38 1585.66  -36.89 1585.61  -34.88 1585.55  -31.79 1585.57  -30.44 1585.61
  -26.69 1585.42  -23.98 1585.19  -23.55  1585.3  -23.37 1585.35   -18.7 1585.88
  -15.48 1586.44  -12.64 1586.85  -10.82 1587.18   -6.43 1587.19   -1.43  1587.2
     .93 1586.77    4.63 1586.16    8.56 1585.15   16.78 1583.14   18.27 1582.84
   21.18 1582.25   24.14  1581.7   26.94 1581.19   28.12 1581.12   29.62 1580.98
   32.15 1580.87   37.32 1580.71   38.33 1580.69   42.64 1580.69   45.73 1580.65
      50 1580.65   53.08 1580.58   61.15 1580.49   61.24 1580.51   65.33 1579.25
    65.7 1579.14   67.92 1578.72   70.29  1578.7   71.43  1578.7   76.08 1578.67
   76.93 1578.66   78.74 1578.64   87.37 1578.51    88.8 1578.63   90.15 1578.88
   91.83 1579.33   95.11 1580.23   95.93 1580.46   96.55 1580.45  105.98 1580.48
   109.2 1580.49  113.69 1580.52  116.59 1580.53  120.84 1580.55  126.23 1580.68
  127.05 1580.72  127.46 1580.75  134.29  1581.9  137.16 1582.76   142.4 1584.03
  143.56 1584.33  144.99 1584.38  148.16 1584.47  150.18 1584.53  150.74 1584.53
  151.98 1584.53  153.91 1584.59  168.29 1584.99  172.57  1585.1  177.19 1585.13
  190.17  1585.2  193.17 1585.46   197.9 1585.86  198.06 1585.87  198.18 1585.86
  199.86 1585.73

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 8469.387

INPUT
Description:
Station Elevation Data    num=      64
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1587.13    5.87 1587.11    7.98 1587.11   10.88 1586.58   13.37 1586.15
   14.37 1585.95   15.11 1585.77   26.99 1582.86   27.71 1582.67   28.87 1582.37
   36.09 1580.98   37.88 1580.46   41.45 1579.96   42.34 1579.81   44.09  1579.4
   45.75 1579.25   47.92 1579.12   48.59 1579.11   53.75 1578.93    54.5 1578.92
   63.23 1578.83   65.16 1578.82   68.98 1578.46    72.5 1578.46    73.1 1578.25
    74.5 1577.81   78.24 1576.61   85.02 1576.46   86.25 1576.45   88.23 1576.46
   95.76 1576.53  100.55 1576.77  101.03 1576.92  104.23 1577.78  105.93 1578.23
  106.26 1578.35  113.57  1578.6  114.83 1578.66  115.96 1578.73  125.14 1579.21
  127.63 1579.36  130.83 1579.45  135.39 1580.22  135.81 1580.33  136.53 1580.49
  142.47  1581.9  144.67 1582.28  146.29 1582.56  146.84 1582.72  147.84 1582.96
  152.88  1584.3   159.1 1584.48  159.45 1584.49  160.62 1584.49  161.25 1584.49
  163.17 1584.54  166.42 1584.63  181.84 1585.06  198.45 1585.14  199.44 1585.15
  200.08  1585.2  201.77 1585.35  207.31 1585.82  208.49 1585.73

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045    74.5    .025  104.23    .045  163.17    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          72.5  106.26             29.35   30.16   32.22             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 8439.225

INPUT
Description:
Station Elevation Data    num=      49
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1587.04      .6 1586.94    4.41 1585.55    8.08  1584.4   12.77 1582.77
   16.42 1581.81   19.48 1581.29    19.5 1581.28   19.61 1581.26   24.46 1580.61
   27.55  1580.1    31.6 1579.51   33.31  1579.3   38.28 1578.79   45.17 1578.41
   51.65 1578.15   61.06 1578.21   64.46 1578.25   65.48 1577.99   68.16 1577.42
   68.18 1577.41   72.02 1576.58   80.46 1576.44   92.12 1576.31   96.94 1577.37
   97.72 1577.56   99.93 1578.11   108.3 1578.35  112.08 1578.49  114.07 1578.47
  122.15 1578.49  126.62 1579.05  129.01 1579.34  135.14 1581.22  142.29 1583.32
  145.27 1583.76  147.04 1584.05  153.07 1584.22  153.73 1584.24  155.24 1584.24
  155.53 1584.24  157.38 1584.29  168.78 1584.59     175 1584.76  176.15 1584.79
  177.24 1584.79  193.78 1584.84  198.73 1585.26  200.78 1585.43

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   68.18    .025   97.72    .045  157.38    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          64.46  99.93             153.05  152.01  149.35             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 8287.219
```

```
INPUT
Description:
Station Elevation Data    num=      48
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1586.13     7.02 1584.31     13.6 1582.56    19.51 1580.77    23.64  1579.6
   26.46 1579.02    29.17 1578.47    35.05 1578.22    36.81 1578.15    38.48 1578.08
   43.72 1577.86    50.64    1578    53.76 1578.01    56.22 1577.93    60.21 1577.68
   63.86 1577.02    65.05  1576.8    69.92 1575.92    70.04  1575.9    70.13  1575.9
   86.72 1575.84    92.71 1576.89     96.4 1577.55    96.45 1577.56    96.95 1577.65
  101.35 1577.92   103.96 1578.09   105.79  1578.1     114 1578.22   116.82 1578.26
  124.04 1578.25   126.34 1578.54   129.17 1578.93   131.42 1579.48   134.08 1580.12
  142.72 1582.48   144.47 1582.97   145.57 1582.98   151.32 1583.02   151.75 1583.02
  153.12 1583.02   154.58 1583.06   163.61 1583.25   174.14 1583.49   180.54 1583.43
  191.19 1583.37   197.49 1583.84   199.61    1584

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   63.86    .025    96.4    .045  154.58    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         60.21   96.45           137.53  137.57  137.67             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 8149.652

INPUT
Description:
Station Elevation Data    num=      47
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1585.04     6.06 1582.84     6.37 1582.72     8.35 1582.22    15.74 1580.36
   16.41 1580.18    16.78  1580.1    24.14 1578.56    30.81 1578.14    32.61 1578.02
   33.99 1577.98    43.35 1577.72    46.54 1577.69    52.56 1577.59     59.3 1577.19
   60.58 1577.15    61.13 1577.05    64.92 1576.37    65.21 1576.32    69.18 1575.61
   81.85 1575.57    86.68 1575.59    91.64 1576.49    97.07 1577.53    97.47 1577.54
   97.57 1577.55   104.48 1577.76   106.78 1577.86   107.78 1577.85   116.82 1577.95
  117.12 1577.96   128.64  1578.4   135.84 1580.01   136.91 1580.23   138.94 1580.67
   143.7 1581.62    148.7 1581.74   150.87 1581.79   151.08 1581.79   152.67 1581.79
  154.51 1581.83   154.74 1581.83   174.06 1582.23   177.89 1582.23   191.03 1582.23
  196.22 1582.53   199.43 1582.73

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   64.92    .025   97.47    .045  154.51    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         60.58   97.57            26.77   26.97   27.47             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 8128.972

INPUT
Description:
Distance from Upstream XS =    20.68
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       65
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     -36 1583.99   -34.77 1583.99   -28.39 1583.15   -22.53 1582.37   -19.61 1582.82
  -11.31 1584.11     -8.6 1584.58    -4.43 1584.68     -.11 1584.84      7.9 1582.21
    8.18 1582.12     8.47 1582.04    18.68  1579.2    20.95 1578.79    25.63 1578.25
   26.31 1578.13    27.82 1578.02    32.51 1577.55    37.11 1577.53     44.8 1577.39
   49.37 1577.37    56.12 1577.36    59.19 1577.32    60.47 1577.33    62.35 1577.17
   64.87  1576.6    65.16 1576.53    67.34 1576.03    68.99 1575.67    73.96 1575.24
    81.5  1575.2    85.58 1575.29     87.8 1575.37    92.05 1576.31     94.9 1577.38
   95.08 1577.37    97.54 1577.39    97.66 1577.39   100.19  1577.4   104.05 1577.45
  110.27  1577.4   114.42 1577.35   118.17 1577.38   123.66 1577.65   126.37  1577.8
   127.7 1577.82   128.85    1578   134.57 1579.11   136.05 1579.39   142.55 1581.22
   143.5 1581.45   144.89 1581.48   150.74 1581.59   151.48 1581.59   152.54 1581.59
  154.45 1581.63    160.7 1581.76   173.92 1582.04   186.35 1582.02   190.92 1582.02
  194.09 1582.22   196.97 1582.41   199.44 1582.56    200.5  1582.5   202.13  1582.4

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 8122.685

INPUT
Description:
Station Elevation Data    num=      65
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1584.33     7.43 1581.97    15.97 1579.45    16.96 1579.15     19.1 1578.72
```

```
   26.25 1577.52   28.38 1577.34   30.27 1576.81   31.68 1576.61   32.37 1576.58
   37.28 1576.44   41.27 1576.21   45.09 1576.09   52.24 1575.83   54.08 1575.71
   59.71 1575.42      61 1575.34   61.91 1575.01   63.54  1574.6   63.82 1574.53
   68.38 1573.41   69.94 1573.16   73.02 1572.65   73.66 1572.64   73.96 1572.65
   74.54 1572.66   81.67 1572.86   83.96 1573.01   86.31 1573.43    87.1 1573.51
   87.63 1573.76   92.22 1575.37   93.82 1575.83   95.54 1575.88   96.25 1575.91
   96.37 1575.92   98.95 1576.04   103.9 1576.06  108.43 1576.01   114.9 1575.81
  116.95 1576.24  119.88 1576.36  122.84 1576.65   125.6 1577.05     126 1577.08
  127.37  1577.5   133.3 1579.24  133.95 1579.37  134.47 1579.47  134.56 1579.49
  134.97  1579.6  142.22 1581.39  147.52  1581.5   149.4 1581.53  150.53 1581.53
   151.2 1581.53  153.12 1581.57  155.69 1581.62  172.49 1581.97  179.79 1581.96
  189.58 1581.95  192.73 1582.16  195.52 1582.34  198.12 1582.52   200.8 1582.35

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   63.54    .025   96.25    .045  153.12    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
            61   93.82             25.2   25.43   25.99             .1      .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 8097.253

INPUT
Description:
Station Elevation Data     num=      49
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  1584.7     .27 1584.61    1.79 1584.11   10.94 1581.08   12.76 1580.59
   20.99 1578.37   30.67 1576.17   30.96  1576.1   31.47 1576.06   42.94 1575.04
   42.96 1575.04   43.08 1575.04   51.15 1575.04   56.92 1574.71   59.95 1574.52
   61.23 1574.26   64.76  1573.6   65.02 1573.55   68.64 1572.87   78.53 1572.93
   88.02 1572.97    90.3 1573.55   92.16 1573.86   95.79 1574.63   97.39 1574.71
   97.75 1574.72  100.63 1574.85  101.41  1574.9  102.08  1574.9   111.1 1575.16
  111.47 1575.17  113.82 1575.33  122.32 1575.78  127.87 1577.42  131.57 1578.44
  138.38 1579.96  143.62 1581.16  149.45 1581.27  150.58 1581.29  150.94 1581.29
  152.38 1581.29   154.3 1581.33   160.9 1581.46  173.29 1581.71  178.72 1581.71
   190.7 1581.69  195.81 1582.03  199.43 1582.29  201.53 1582.14

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   64.76    .025   97.39    .045   154.3    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         59.95   95.79           143.63  143.43  142.94             .1      .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 7953.828

INPUT
Description:
Station Elevation Data     num=      37
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1583.84    1.79  1583.3   25.54 1575.98   41.37 1574.98      43 1574.87
   43.82 1574.87   60.37 1574.81   64.56 1573.66   65.39 1573.43   66.18 1573.21
   67.68 1572.81   78.08 1572.78   85.31 1572.77   86.52 1572.75   93.95 1574.32
   96.22  1574.8   97.44 1574.79   97.94 1574.78  110.67 1574.68  112.34 1574.66
   113.6 1574.75  124.12 1575.64  126.07 1576.07  137.89 1578.65  143.32 1579.83
  144.06 1579.86  150.58 1580.04  150.98 1580.04  152.38 1580.04  154.77  1580.1
  164.53 1580.32  170.73 1580.46  173.59 1580.52  175.41 1580.52  190.95 1580.51
  197.84 1580.98  199.38 1581.08

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   64.56    .025   97.44    .045  154.77    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         60.37   96.22           154.35  154.26  154.06             .1      .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 7799.566

INPUT
Description:
Station Elevation Data     num=      34
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1582.14    4.86 1580.34    20.9    1576   25.39 1575.64   35.31  1574.8
   39.49 1574.48   45.38 1574.39   60.66 1574.31   63.52 1573.71   63.62 1573.69
   65.19 1573.37   67.55 1572.85   86.19 1572.56   87.16 1572.54   87.72 1572.67
   96.42 1574.67   97.87 1574.66  109.01 1574.62  114.22 1574.63  118.62 1574.88
  126.93 1575.27  136.46 1577.06  143.41 1578.47  149.37  1578.7  150.73 1578.75
  151.21 1578.75  152.53 1578.75  155.32 1578.81  165.23    1579  174.07 1579.17
   178.2 1579.18  191.07 1579.22  197.56 1579.74  197.92 1579.77

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   63.62    .025   97.87    .045  155.32    .018
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         60.66   96.42             26.33   26.38   26.51            .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 7779.531

INPUT
Description:
Distance from Upstream XS =    20.03
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       68
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
     -30 1579.72  -28.48 1579.67  -24.11 1579.23  -23.24 1579.15  -21.49 1579.54
  -19.79  1579.9   -19.2 1580.03  -17.22 1580.32   -8.06 1581.61   -4.42 1581.73
    -.24 1581.87    7.48 1579.01    18.2 1575.99   20.12 1575.85   25.01 1575.07
   25.04 1575.06   25.07 1575.05   25.11 1575.05   32.86 1574.17   36.71 1574.13
   42.63 1574.15   46.28 1574.26   51.73 1574.39   55.59  1574.5   59.22 1574.56
   60.27 1574.48   61.19 1574.23   63.11 1573.74   63.18 1573.72   65.96 1573.02
   66.29 1572.92   66.75 1572.81   71.71 1572.58   83.86 1572.57   87.07  1572.5
   88.09 1572.74   90.23 1573.39   94.28 1574.34   95.35  1574.8   97.43 1574.73
   97.69 1574.72   98.18 1574.71  100.33 1574.56  105.86 1574.59  110.48 1574.46
   117.8 1574.26  121.91 1574.21  124.92 1574.58  125.66 1574.61  129.22 1574.99
  132.57 1575.62  135.23 1576.39  139.82  1577.5  143.13 1578.27  146.83 1578.42
  150.59 1578.59     151 1578.59  152.39 1578.59  155.22 1578.64     160 1578.74
  173.83 1579.02  180.11 1579.04  190.92 1579.08  192.97 1579.24  193.91 1579.32
  198.44 1579.67  201.98  1579.4  202.37 1579.37

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 7773.177

INPUT
Description:
Station Elevation Data    num=      60
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1581.81     1.51 1581.25     9.62 1578.96    19.66 1575.58    23.86 1574.69
   26.32 1574.13    28.03 1573.76    31.34 1573.61    33.03 1573.42    37.16 1573.31
   44.15 1572.89    47.06 1572.92    53.28 1572.71    55.68 1572.73    61.28 1572.36
    62.1 1572.21    63.29 1571.94    63.36 1571.92    68.65  1570.9    70.31 1570.83
   75.16 1570.51    81.44 1570.52    82.42 1570.53    85.74 1570.85    86.45  1570.9
   87.58 1571.32    91.71 1572.46    92.77 1572.74    96.41 1572.77    97.68 1572.78
   97.96 1572.79    99.24 1572.79   103.12 1572.76   108.58 1572.97   112.05 1572.96
  115.65 1573.16   119.43 1573.28   121.05 1573.43   123.59 1573.66   125.06 1573.73
  129.79 1575.09    135.1 1576.09   135.83  1576.3   138.56 1576.96   143.49 1578.19
  150.76 1578.53   150.85 1578.53   152.64 1578.53   152.65 1578.53   155.52 1578.59
  173.52 1578.96   174.06 1578.97   174.35 1578.97   191.18 1579.03   193.06 1579.18
  194.16 1579.27   198.77 1579.63   199.03 1579.61   199.72 1579.56   202.63 1579.33

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   63.36    .025   97.68    .045  155.52    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         61.28   92.77             20.89   21.09   21.57            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 7752.089

INPUT
Description:
Station Elevation Data    num=      44
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1581.58     6.46 1579.44    18.65 1575.08    20.27 1575.03    21.74 1574.69
   27.81 1573.89    32.47 1573.16    35.31 1572.79    38.81 1572.35    41.77 1572.22
   49.57 1572.01    60.27 1571.98    62.02 1572.05    63.06 1572.14    63.09 1572.13
   63.91 1571.89    69.19 1570.28    77.67 1570.32     86.3 1570.34    92.98 1571.95
   94.39 1572.18    96.12 1572.18    96.76 1572.24    97.75 1572.28    97.97 1572.29
  109.25 1572.72    115.3 1572.98   123.42 1573.65    127.8 1574.63   141.82 1577.73
  143.76 1578.21   148.76 1578.28   150.94 1578.35    151.4 1578.35   152.74 1578.35
  155.64 1578.41   172.44 1578.78      174 1578.81   177.93 1578.82   191.22 1578.86
  192.31 1578.94    194.8 1579.14   199.05 1579.48   201.55 1579.27

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   63.09    .025   97.75    .045  155.64    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         63.09   94.39            153.22  153.18  153.06            .1       .3
```

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 7598.913

INPUT
Description:
Station Elevation Data num= 37

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1580.1	6.45	1577.69	13.64	1575.12	17.5	1574.12	23.31	1572.65
36.04	1572.24	55.38	1571.73	58.65	1571.75	61.3	1571.19	62.49	1570.95
66.95	1570.05	82.69	1569.88	86.87	1569.85	94.73	1571.73	98.18	1571.86
98.23	1571.86	98.43	1571.87	123.93	1572.45	127.38	1572.54	128.66	1572.86
132.86	1574	135.94	1574.79	144.12	1576.74	151.41	1577.07	151.45	1577.07
152.13	1577.07	153.23	1577.07	153.26	1577.07	153.43	1577.08	156.14	1577.14
173.94	1577.58	185.96	1577.58	191.66	1577.56	199.09	1577.98	200.24	1578.05
202.33	1577.9	202.83	1577.86						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.045	62.49	.025	98.18	.045	156.14	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
58.65	94.73	152.41	151.96	150.89	.1	.3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 7446.958

INPUT
Description:
Station Elevation Data num= 45

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1578.07	6.21	1574.69	8.7	1573.35	9.56	1572.82	10.85	1572.72
19.23	1572.51	19.92	1572.41	25.98	1571.35	44.4	1571.37	48.09	1571.38
49.52	1571.4	50.91	1571.41	54.29	1571.34	57.52	1571.29	58.15	1571.19
61.53	1570.6	61.83	1570.55	66.34	1569.77	75.05	1569.83	85.8	1569.85
91.53	1570.86	95.46	1571.56	99.07	1571.55	102.28	1571.53	109.87	1571.56
113.47	1571.53	121.75	1571.78	128.86	1571.96	140.47	1574.38	145.59	1575.44
150.16	1575.61	152.79	1575.7	154.35	1575.7	154.59	1575.7	157.57	1575.77
174.07	1576.16	174.35	1576.17	174.54	1576.17	176.42	1576.17	193.09	1576.21
193.21	1576.33	193.59	1576.71	199.92	1576.8	201.57	1576.82	202.62	1576.82

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.045	61.83	.025	99.07	.045	157.57	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
57.52	95.46	27.19	27.57	28.46	.1	.3

INLINE STRUCTURE

RIVER: SunValley
REACH: Reach1 RS: 7427.061

INPUT
Description:
Distance from Upstream XS = 19.9
Deck/Roadway Width = 5
Weir Coefficient = 2.6
Weir Embankment Coordinates num = 68

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-21	1575.87	-19.69	1576.16	-18.43	1576.45	-11.36	1577.48	-9	1577.8
-6.15	1577.83	-1.16	1577.9	8.63	1574.26	10.55	1573.56	18.84	1571.93
22.53	1571.18	22.89	1571.17	23.28	1571.15	26.57	1570.99	32.31	1570.91
34.92	1570.95	40.3	1570.98	43.37	1571.03	48.5	1571.18	51.23	1571.3
55.56	1571.61	57.1	1571.61	57.78	1571.6	59.11	1571.35	60.74	1570.93
61.18	1570.82	63.37	1570.26	64.57	1569.61	66.3	1569.55	67.37	1569.36
75.23	1569.24	76.01	1569.24	76.31	1569.26	81.28	1569.43	81.81	1569.48
86.24	1569.62	89.81	1570.65	90.28	1570.74	90.64	1570.81	91.05	1570.9
94.52	1571.59	95.95	1571.69	97.99	1571.7	98.92	1571.71	106.36	1571.33
109.37	1571.33	115.69	1571.32	118.64	1571.3	123.36	1571.31	124.99	1571.33
128.6	1571.4	131.96	1571.41	135.67	1572.47	137.89	1573.16	143.3	1574.72
144.99	1575.21	147.15	1575.3	151.81	1575.5	153.5	1575.5	153.61	1575.5
154.7	1575.52	156.56	1575.57	173.18	1576.01	180.74	1576.02	186.13	1576.03
192.13	1576.04	192.6	1576.5	192.63	1576.54				

Upstream Embankment side slope = 100 horiz. to 1.0 vertical
Downstream Embankment side slope = 2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Weir crest shape = Broad Crested

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 7419.387

```
INPUT
Description:
Station Elevation Data    num=      63
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1577.85    4.25 1576.34   12.18 1573.45      13 1573.13   24.64 1570.66
   25.78 1570.42   26.96 1570.13   29.62 1569.66   30.21 1569.57   30.79 1569.48
   35.07 1568.94   37.99 1568.41   38.67 1568.34   39.16 1568.33   47.95  1568.1
    48.1  1568.1   48.89 1568.11   59.45 1568.38   62.02 1567.58    62.5 1567.43
   63.62 1567.08   66.51 1566.39   66.78 1566.26   67.16  1566.1   68.43 1566.02
   73.44 1565.87   77.51  1565.9    83.3  1565.9   87.86 1566.26    89.5 1566.82
   93.07  1568.3   93.45 1568.44   93.97  1568.5   99.18 1568.32  102.06 1568.22
  102.65 1568.19  108.58 1568.27  116.52 1568.36  116.78 1568.36  117.57 1568.34
  123.22 1568.79  126.97 1569.81  127.96 1570.03  128.82 1570.18  129.99 1570.41
  132.94 1571.06  135.07 1571.65  139.31    1573  143.44 1574.22  146.29 1575.13
  147.51 1575.18  153.02 1575.42  153.62 1575.42  154.82 1575.42  157.76  1575.5
  169.87 1575.82  174.32 1575.94  181.96 1575.94  193.35 1575.96  193.48 1576.09
  193.86 1576.46  196.98 1576.53  199.63 1576.57

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045    62.5    .025   99.18    .045  157.76    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         59.45   93.97             39.44   39.81   40.69            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 7379.578

INPUT
Description:
Station Elevation Data    num=      41
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1577.68    9.16 1573.66   15.72 1570.92   22.24  1570.1   30.06 1569.17
   32.25 1568.74   40.95 1568.48   45.76  1568.2   47.97 1568.23   58.17 1568.37
      62 1567.51   62.39 1567.42    64.8 1566.88   66.45 1566.52   68.42 1566.54
   85.36 1566.58    87.2 1566.86   95.21 1568.31   98.61 1568.33  111.26 1568.41
  114.29 1568.43   115.3  1568.5  123.55 1569.15  134.54  1571.9  145.65 1574.72
  150.44  1574.9  152.65 1574.98  153.33 1574.98  154.45 1574.98  157.33 1575.08
  171.85 1575.56  172.87  1575.6  173.57 1575.62  174.68 1575.61  176.34  1575.6
  193.01 1575.47  193.33 1575.79  193.51 1575.97   197.6  1576.1   201.3  1576.2
  201.49  1576.2

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   62.39    .025   98.61    .045  157.33    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         58.17   95.21            161.81  161.94  162.32            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 7217.642

INPUT
Description:
Station Elevation Data    num=      42
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1575.89    6.71 1574.15   10.98 1572.92   25.86 1568.55   26.51 1568.37
    26.9 1568.34   28.28 1568.32   51.24 1567.67   55.81 1567.66   58.74 1567.65
      63 1566.88   63.47 1566.79   65.46 1566.43   67.34 1566.09   85.97 1566.13
    86.3 1566.12   87.43 1566.33   94.83 1567.62   95.98 1567.83   98.68 1567.84
  102.11 1567.85  110.19 1567.88  123.63 1568.48  126.73 1568.63   139.9 1571.83
  145.41 1573.17  151.11 1573.23  152.48 1573.24   152.8 1573.24  154.28 1573.24
  156.99 1573.32  161.59 1573.46  173.64 1573.82  186.31 1573.88  192.21 1573.91
  192.86 1573.92   192.9 1573.96  193.36 1574.42  197.02 1574.41   200.5 1574.41
  203.43  1574.4  203.44  1574.4

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045      63    .025   98.68    .045  156.99    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         58.74   95.98            161.2  160.56  158.96            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 7057.082

INPUT
Description:
Station Elevation Data    num=      49
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1574.39    2.11 1574.29    4.05 1573.86    7.56 1572.81   10.47    1572
   20.39 1569.68   23.92 1568.87   26.63 1568.38   35.31 1568.05   39.08 1567.88
   44.06 1567.77   50.29 1567.68   61.15 1567.53   67.31 1566.52   67.33 1566.52
   69.84 1566.11   71.06 1566.02   89.55 1565.81   98.94 1567.56   99.02 1567.56
  101.64 1567.55  101.83 1567.55  108.47 1567.54  119.37  1567.7  122.19 1567.76
  126.86 1567.88   129.6 1567.97   130.1 1567.97  132.03 1568.38  141.86 1570.53
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  146.69 1571.57  147.05 1571.58  151.36 1571.62  154.07 1571.65  154.14 1571.65
  155.87 1571.65  158.38  1571.7  175.03 1572.02  175.88 1572.04  176.48 1572.04
  177.57 1572.05  194.48 1572.13  194.78 1572.43  194.98 1572.63  201.71 1572.65
   202.5 1572.66  202.83 1572.66  203.85 1572.66  204.83 1572.67

Manning's n Values          num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   61.15    .025   98.94    .045  158.38    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         61.15   99.02             34.73   34.78   34.92             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 7026.190

INPUT
Description:
Distance from Upstream XS =    30.89
Deck/Roadway Width        =        3
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       80
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     -33 1572.99  -29.07 1572.71  -25.22 1572.23  -23.01 1572.05   -20.1 1571.95
  -19.02 1571.92  -17.64 1571.84  -17.63 1571.84  -14.01 1571.97   -9.58 1572.27
   -9.06 1572.29   -8.72  1572.3   -5.73 1572.34     -.3 1572.45    1.35 1572.22
    5.73 1571.74    6.87 1571.57   11.47 1570.49   15.22 1569.35   16.27 1569.19
   24.77 1568.05   26.42 1567.81   29.31 1567.62   30.65  1567.5   37.15 1567.45
    39.3  1567.4      47 1567.45   47.67 1567.45   49.95 1567.44   55.32 1567.31
    59.1 1567.28   61.25 1567.27   61.75  1567.2   64.46 1566.74   66.24 1566.31
   66.47 1566.26   66.72  1566.2   67.09 1566.07   68.89 1565.73    69.3 1565.67
    79.2  1565.1   80.49 1565.05   88.45 1565.31   89.33 1565.32   93.55 1566.24
   93.61 1566.26   93.71 1566.28   93.92 1566.37    96.7 1567.12   97.31 1567.13
   100.7  1567.2  100.94  1567.2   104.5 1567.28  105.54 1567.31  114.78 1567.33
  117.41 1567.35  122.93 1567.32   125.1 1567.39  126.92 1567.45  129.93 1567.59
  131.65 1567.81  136.84 1568.78  140.97  1569.8  145.65 1571.12  151.72  1571.3
   152.9 1571.34  153.19 1571.34   154.7 1571.34  157.12 1571.38   165.2 1571.53
  174.73  1571.7  181.92 1571.73  187.66 1571.76  193.29 1571.78  193.61 1572.09
  193.79 1572.28  196.28  1572.3  196.37  1572.3  201.58 1572.34  203.73 1572.34

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 7022.299

INPUT
Description:
Station Elevation Data    num=      70
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1573.62    3.04 1573.59    5.85  1573.2    7.94 1572.57   11.68 1571.54
    13.4 1570.96   15.03 1570.43   19.46 1569.08   21.37 1568.79   24.81 1568.33
    26.6 1568.07   28.25 1567.71   30.48 1567.01   32.11 1566.87   33.39 1566.57
   34.71  1566.4   38.31 1566.35   42.31 1566.22   46.15 1566.23   52.85 1566.19
   56.11 1566.15   59.92 1566.12   64.07 1565.94   64.66 1565.86    68.7 1564.53
   68.86 1564.48   68.98 1564.44   70.44 1563.93   71.01 1563.83   75.31 1563.24
   76.53 1563.17   83.68 1562.87   84.18 1562.87   84.25 1562.87    84.4 1562.87
    91.3 1563.04   93.94 1564.03   98.91 1565.25   99.84 1565.61  102.66 1565.69
   103.2 1565.72  103.44 1565.73  107.88 1565.91  113.14 1566.03  118.15 1566.11
  121.72  1566.3   125.2  1566.3  127.04  1566.4   131.5 1566.95  131.66 1566.96
  137.54 1568.38  138.68 1568.52  139.48 1568.67  140.12 1568.83  148.03 1571.07
  149.22 1571.11  155.37  1571.3  156.43  1571.3  157.17  1571.3  159.58 1571.34
  160.67 1571.36   177.2 1571.66  189.67 1571.71  195.76 1571.74  196.02     1572
  196.26 1572.24  198.28 1572.25  198.84 1572.26  204.08  1572.3   206.3  1572.3

Manning's n Values          num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   64.66    .025   99.84    .045  159.58    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         64.66   99.84             23.19    23.3   23.59             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 6998.997

INPUT
Description:
Station Elevation Data    num=      45
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1574.39    3.2 1574.38    9.17 1572.31   14.11 1570.59   19.77 1569.24
   33.63  1565.8   37.4 1565.56   48.96    1565   53.01 1564.91   57.58 1564.84
   61.36 1564.79   62.06 1564.81   67.06 1563.87   68.04 1563.68   68.51 1563.59
   71.27 1563.05   73.98 1563.03   91.63 1562.84   98.01 1564.51   100.3 1564.73
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  100.66  1564.8  102.98 1564.83  108.68 1564.85  116.39  1564.9  120.45 1565.36
  124.97 1565.62  129.75 1566.68  134.01 1567.51  135.98 1568.03  139.22  1568.9
  147.03 1570.76  153.32    1571  154.69 1571.06  155.11 1571.06  156.49 1571.06
  158.84  1571.1  166.87 1571.24  176.54 1571.41  189.16 1571.46  195.08 1571.49
  195.37 1571.78  195.58 1571.99  198.39 1572.01  203.55 1572.05  206.77 1572.04

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   68.51    .025  102.98    .045  158.84    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         62.06   100.3             144.86  144.57  143.82             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 6854.423

INPUT
Description:
Station Elevation Data     num=      40
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1572.76     .43 1572.67     4.9 1571.33   13.52 1568.81   26.38 1565.21
   34.28 1564.69    37.1 1564.47   39.98 1564.49   58.03 1564.32   59.92 1564.28
   60.48 1564.16   65.27 1563.16   66.06    1563   68.86 1562.42   87.13 1562.38
   87.76 1562.38    89.1  1562.7   94.24 1563.96   94.78 1563.97   97.62 1563.96
  100.57 1563.92  100.88 1563.92  102.19  1563.9  107.68 1563.92  127.05 1564.66
  137.31 1567.27  144.32 1569.03  151.65 1569.49  153.45 1569.49  155.55 1569.53
   157.4 1569.57  173.23 1569.88  188.41 1569.92  192.07 1569.94  192.17 1570.04
  192.57 1570.44  198.52 1570.47   200.1 1570.48  200.56 1570.48  202.81  1570.5

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   59.92    .025   94.78    .045  155.55    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         60.48   94.24             121.52  122.18  124.03             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 6732.243

INPUT
Description:
Station Elevation Data     num=      42
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1571.31    2.82 1570.47    5.52 1569.77   24.31  1564.6   34.74 1564.17
   38.57 1564.08    48.9  1564.1   59.87 1563.97   60.21 1563.96    63.5 1563.16
   65.83 1562.54   66.14 1562.46   68.52 1561.83   73.18 1561.61   84.74 1561.65
   88.89 1561.84   94.68 1563.42   95.16 1563.55    95.4 1563.56   97.82 1563.63
  101.46 1563.62  101.57 1563.62  108.27  1563.6  121.78 1563.79  130.65 1563.96
  130.66 1563.96  130.66 1563.97   140.3 1566.75  143.27 1567.65   148.1 1567.85
  152.04 1568.03  153.48 1568.03  153.84 1568.03  156.01 1568.08  156.99  1568.1
  169.59 1568.35  174.24 1568.44  181.41 1568.52  187.07 1568.58  192.13 1568.63
  192.29 1568.79  192.64 1569.13

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   60.21    .025   95.16    .045  156.01    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         60.21    95.4             19.23   18.73   17.35             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1              RS: 6718.729

INPUT
Description:
Distance from Upstream XS =    13.51
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       63
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
     -27 1568.87  -24.19  1568.6  -22.57 1568.87  -13.21 1570.42   -8.83 1571.11
    -2.5 1571.09    -.71 1571.09    3.01 1569.99   18.13 1565.25    21.8 1564.49
   23.07 1564.29   32.67 1564.09   35.44    1564   41.25 1563.95   47.24 1563.89
    49.7 1563.86   55.77 1563.76   59.42 1563.64   59.76 1563.63   60.08 1563.63
   64.05 1562.84   65.25 1562.47    65.5 1562.39   65.83 1562.29   68.03 1561.25
   68.74 1561.21   76.94 1560.95   79.05 1560.93    86.1 1561.33    86.7 1561.37
   89.68 1562.36   90.42 1562.53   90.61 1562.59   94.49 1563.57   95.87 1563.34
   97.19 1563.31   100.9 1563.34  100.99 1563.34  104.42 1563.37  108.47 1563.36
  115.78 1563.43  121.35 1563.62   124.6 1563.81  130.24 1564.01   134.6 1565.16
   134.9 1565.24  135.78 1565.51   142.5 1567.58  146.53 1567.71  151.41 1567.88
  152.38 1567.88  153.21 1567.88  155.39 1567.93  159.64 1568.01  173.75 1568.29
     189 1568.47  191.47 1568.51  191.88 1568.91  191.97 1569.01  192.18    1569
  198.21 1568.85  199.99  1568.8  200.22 1568.81

Upstream Embankment side slope             =     100 horiz. to 1.0 vertical
Downstream Embankment side slope           =       2 horiz. to 1.0 vertical
```

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Maximum allowable submergence for weir flow =      .98
Elevation at which weir flow begins          =
Weir crest shape                             = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 6713.511

INPUT
Description:
Station Elevation Data    num=      57
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1571.02     4.88 1569.62    18.36  1565.3    24.37  1563.5    25.15 1563.27
   31.96 1562.35    33.47 1562.09    34.04 1562.06    35.25 1562.15    42.13 1561.69
   42.19 1561.69    49.37 1561.74    49.45 1561.74    56.63  1561.8    57.28 1561.75
   61.11  1561.6    63.57  1561.5       66 1560.41    66.23 1560.31    66.58 1560.15
   68.85 1559.41    71.75 1559.44    81.68 1559.27    83.46 1559.29       87 1559.29
   89.72  1559.4    94.23  1560.7    95.93 1561.19   101.68 1561.16   101.77 1561.16
  102.27 1561.15   105.03 1561.29   105.83 1561.28   113.17 1561.41   114.38 1561.46
  114.44 1561.46   122.91 1561.81   123.89 1562.04    124.5 1562.17   124.84 1562.25
  126.69 1562.54   128.61 1563.18   132.56  1564.4   135.53 1565.17   139.25 1566.31
   143.2 1567.52   150.55 1567.76   152.16 1567.82   153.65 1567.82   153.96 1567.82
  156.15 1567.86   156.39 1567.87   174.56 1568.23   185.26 1568.36   192.21 1568.45
  192.22 1568.47   192.71 1568.95

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   63.57    .025   95.93    .045  156.15    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         63.57   95.93             21.88   22.33    23.6             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 6691.186

INPUT
Description:
Station Elevation Data    num=      42
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1570.75     9.61     1568    27.41  1563.4    32.52 1562.11    33.71 1562.11
   36.24 1562.02    39.84 1561.98    58.96 1561.55    61.57 1561.49    61.64 1561.47
   61.99  1561.4    63.33 1561.13    65.23 1560.59    66.35 1560.26    66.37 1560.26
   67.57 1559.91     69.5 1559.39    88.32 1559.62    88.84 1559.63    88.98 1559.67
    95.3 1560.92    95.53 1560.94    98.31 1561.35   101.96 1561.47   102.01 1561.47
  110.54 1561.77   123.24 1562.14   126.67 1562.46   140.69 1566.58   143.17 1567.29
  145.95 1567.36   152.36 1567.53   154.03 1567.53   154.16 1567.53   154.62 1567.54
  156.39 1567.58   159.53 1567.64   175.03 1567.94   188.54 1568.15   192.34  1568.2
  192.63  1568.5   192.84  1568.7

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   61.99    .025   98.31    .045  156.39    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         61.64   98.31             120.42  120.13  119.34             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 6571.056

INPUT
Description:
Station Elevation Data    num=      40
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0  1569.6    24.29     1563    28.41 1561.89    30.14 1561.73    35.37 1561.29
   37.08 1561.26    42.01 1561.16    46.99 1561.14    55.11 1561.22    61.15 1561.27
   62.39 1561.18    63.78 1561.08    66.01 1560.27    67.32 1559.81    67.56 1559.72
   69.33 1559.09    81.97 1559.01    88.58 1558.97     90.1 1559.49    95.12 1561.21
   96.93 1561.32    98.96 1561.43   102.47 1561.41   102.51 1561.41   104.68 1561.39
  119.08 1561.89   129.18 1562.42   141.36 1565.92   142.99 1566.37   150.54 1566.28
  152.31 1566.26   152.75 1566.26   154.11 1566.26   156.68 1566.33   160.73 1566.46
  175.48 1566.94   188.79 1567.12    192.2 1567.17   192.41 1567.39    192.7 1567.67

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   62.39    .025   98.96    .045  156.68    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         62.39   98.96             125.19  125.21  125.25             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 6445.849

INPUT
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```
Description:
Station Elevation Data    num=      39
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1568.35   12.05 1565.28   24.39 1562.08   33.67 1561.69   44.37 1561.35
   53.35 1561.38   61.73 1561.35   63.23 1561.28   64.23  1561.2   67.41 1560.21
   69.48 1559.56   69.56 1559.54   70.72 1559.17   76.39 1559.13   90.45 1558.93
   95.23 1560.13    97.9 1560.91   98.78    1561  100.24 1561.29  103.02 1561.24
  103.49 1561.23  105.76 1561.19  128.59 1561.62  133.11  1561.9  137.24 1563.06
  143.34 1564.69  150.93    1565  153.01  1565.1  153.73  1565.1  154.81  1565.1
   157.7 1565.17  163.41 1565.31  171.89 1565.51  176.34 1565.61  180.59 1565.66
  183.97 1565.68  193.12 1565.75  193.59 1566.23  193.62 1566.25

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   64.23    .025  100.24    .045   157.7    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        64.23  100.24             29.58   29.41   28.87             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 6421.011

INPUT
Description:
Distance from Upstream XS =   24.84
Deck/Roadway Width        =       3
Weir Coefficient          =     2.6
 Weir Embankment Coordinates    num =       62
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     -26 1565.49  -24.03 1565.29  -17.89 1566.55  -10.88 1567.98   -5.28 1568.03
   -1.08 1568.03   11.56  1564.5   18.28 1562.67   19.45 1562.35   21.78 1561.85
   25.65 1561.32   32.46 1561.26   38.55 1561.18   45.69  1561.1   49.19 1561.08
   56.43 1560.99   58.65 1561.06   64.91 1560.97   64.96 1560.96   68.42 1559.88
   68.85 1559.74   70.73 1559.15   70.81 1559.13    78.5 1558.73    80.5 1558.71
   85.52 1558.66   88.55 1558.71   89.55 1558.85   90.46 1558.98   93.95 1560.07
   96.94 1561.16   97.45 1561.19  101.74 1561.11  102.08 1561.11  102.89 1561.09
  107.79 1561.06  114.29 1560.99  122.65 1560.87  125.79 1560.96   128.5 1561.07
  131.19 1561.19  133.64  1561.8  137.31 1562.86  140.79  1563.6  143.72 1564.46
  150.93 1564.82  152.08 1564.87  152.66 1564.87  153.88 1564.87  156.93 1564.95
  159.71 1565.01  166.93 1565.19  175.56 1565.41  183.86 1565.44  188.78 1565.48
  192.18  1565.5  192.39 1565.71  192.68    1566  198.06  1565.9  200.45 1565.85
  201.77 1565.87  202.83 1565.89

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 6416.444

INPUT
Description:
Station Elevation Data    num=      64
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1567.97   18.01 1562.93   19.54 1562.46   21.16 1561.85   22.16 1561.59
   25.47 1561.09   26.98  1560.8   28.23 1560.55   29.63 1560.42   35.15 1560.24
   36.71 1560.07   41.16 1560.01   46.83 1559.93   51.04 1559.88   57.03 1559.79
   59.76 1559.73   62.94 1559.34   66.54 1559.27   69.52 1557.57   70.01  1557.3
   70.28 1557.14   70.73 1556.98   71.07 1556.98   74.06 1556.74   77.79 1556.62
   78.81  1556.6   79.45  1556.6    88.2 1556.38   89.38 1556.47   91.42 1557.04
   93.55 1557.69       96 1558.87   97.86 1559.51  100.98 1559.51  102.78 1559.52
   103.1 1559.52   106.7 1559.54  109.19 1559.54  114.59 1559.51  118.68 1559.47
  124.06 1559.45  127.45 1559.61  128.52 1559.83  130.27  1560.3   135.4 1561.74
  138.63 1562.68  139.91 1562.95  144.96 1564.42  148.22 1564.58   153.2 1564.83
  153.25 1564.83  154.51 1564.83     155 1564.83  158.08  1564.9  162.94 1565.02
   176.8 1565.37  190.21 1565.43   193.3 1565.45  193.63 1565.78  193.81 1565.95
   196.8 1565.87  198.18 1565.84  201.69 1565.76  205.22 1565.83

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   66.54    .025   97.86    .045  158.08    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        66.54   97.86             22.28   22.32   22.42             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 6394.126

INPUT
Description:
Station Elevation Data    num=      49
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1567.63   11.04 1564.23   28.16 1559.95   28.72 1559.81   28.88 1559.78
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  31.12 1559.69   48.93 1558.67    51.9 1558.55   61.76 1558.39   62.76  1558.4
  63.19 1558.35   65.07 1558.19   69.64 1556.61   70.12 1556.44   70.41 1556.34
  70.57 1556.29   72.41 1556.31   90.43 1556.48   92.84 1557.09   97.13 1558.26
  98.58  1558.4  100.27 1558.56  102.02 1558.52  102.71 1558.52  102.91 1558.52
  114.5 1558.48  123.82 1558.81  125.55 1558.93  127.67 1559.25  136.17 1561.62
 139.48 1562.54  145.71 1564.28  149.22 1564.41  153.44 1564.62  154.27 1564.62
 155.24 1564.61  158.45  1564.7  172.23 1565.06  175.77 1565.15  177.56  1565.2
 178.54  1565.2  179.09  1565.2  180.97  1565.2  193.54 1565.21  193.76 1565.43
 194.04 1565.71  197.94 1565.57  202.45 1565.42  205.66 1565.54

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   63.19    .025  100.27    .045  158.45    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
         63.19  100.27            120.05  119.64  118.51             .1        .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 6274.483

INPUT
Description:
Station Elevation Data    num=      41
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1566.26   22.21 1560.21   25.95  1559.2   27.65 1559.02    33.9 1558.38
    42.6 1558.46   45.41 1558.48   47.71 1558.44   63.14 1558.22   69.72 1556.28
   69.77 1556.26   70.91 1555.93   71.02  1555.9   78.28 1555.86   89.09  1555.8
   91.94 1556.67   95.51 1557.33    99.3 1558.25  101.06 1558.21  101.37  1558.2
  101.74 1558.19  113.24 1557.91  122.61 1558.46  128.96 1558.67  136.39 1560.78
  145.62 1563.28  154.38 1563.36  154.44 1563.36  154.46 1563.36  156.24 1563.36
  159.93 1563.46  161.22  1563.5  179.25 1564.01     190    1564  194.12    1564
  194.38 1564.26  194.62  1564.5  199.37  1564.5  202.03  1564.5  204.04 1564.51
  206.23 1564.51

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   63.14    .025    99.3    .045  159.93    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
         63.14    99.3            126.69  127.31  129.07             .1        .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 6147.176

INPUT
Description:
Station Elevation Data    num=      48
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1564.71    4.97 1564.67    8.85 1564.62   17.05 1562.89   24.71 1560.89
   28.96 1559.55   31.56 1559.16   35.09 1558.59   39.99 1558.29   44.97  1558.3
   60.23 1558.32   68.39 1558.29    68.9 1558.23   70.34 1558.07   71.23 1557.98
   75.77 1556.61    76.7 1556.32   76.72 1556.31   78.11 1555.88    86.3 1555.84
   97.14 1555.74  100.84 1556.92  103.36 1557.75  105.52 1557.84  107.19 1557.92
  107.37 1557.93     111 1557.99  118.99 1558.06  136.91 1558.32  140.65 1558.36
  142.38 1558.76  145.85 1559.51   154.6 1561.51  158.85 1561.81  162.53  1562.1
  163.52  1562.1  164.33  1562.1  167.43 1562.17  175.94 1562.35  183.18 1562.51
  187.03  1562.6  189.98 1562.59  191.34 1562.59  202.46 1562.57  202.57 1562.69
  202.96 1563.07  211.96 1563.12  214.35 1563.13

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   68.39    .025  107.19    .045  167.43    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
         68.39  107.19             34.03   33.75      33             .1        .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 6121.654

INPUT
Description:
Distance from Upstream XS =    25.52
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       65
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     -43 1564.22  -38.01 1564.14  -34.07 1564.04  -22.15 1563.25  -20.31 1563.12
  -18.49 1562.95   -9.32 1561.81   -8.84 1561.76      -7 1561.75   -3.52 1562.07
   -1.99 1562.14    2.16  1562.2    5.13  1562.2    8.81 1562.04   11.21  1561.8
   18.43 1560.79   19.29 1560.55   20.58 1560.34   33.26 1558.42   34.58 1558.15
   35.44 1558.04   37.29 1558.03   44.02 1557.88   45.52 1557.81   53.84 1557.76
   57.62 1557.76   60.74  1557.8   70.61 1557.73   74.87  1556.4   75.56 1556.19
   75.58 1556.18   76.11 1556.02   86.15 1555.62   87.33  1555.6   96.76 1555.57
   97.66 1555.82  104.37 1557.53  104.67 1557.53  106.43 1557.56  106.55 1557.56
  110.54 1557.62  116.91 1557.62  122.48 1557.65  126.54 1557.68  130.26  1557.7
  136.23 1557.85  139.94 1557.89  142.14 1558.28  144.69 1558.97  148.06 1559.64
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  152.12 1560.87   153.7 1561.41  157.99 1561.65  162.19 1561.87  162.84 1561.87
  163.99 1561.87  166.93 1561.92  171.95 1562.01  186.76  1562.3  198.07 1562.32
  202.14 1562.35  202.27 1562.48  202.64 1562.85  207.55 1562.86  210.05 1562.87

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 6113.420

INPUT
Description:
Station Elevation Data    num=      71
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1563.83    2.83 1563.56    4.89 1563.37    9.49 1561.72   10.67 1561.35
   15.27 1560.77   19.72 1559.41   22.74 1558.67   27.06 1557.84   29.03 1557.39
   29.81 1557.16   33.81 1556.45   36.24 1556.08    36.3 1556.08   39.83 1555.89
   47.02 1555.71   48.37 1555.69   55.62  1555.5   56.73 1555.45   61.05 1555.32
   64.16 1555.45   66.06 1554.61   69.25 1553.55   69.27 1553.54   69.66 1553.41
   69.81 1553.36   69.82 1553.36   73.18 1553.24   79.39 1553.22   82.73  1553.2
   90.12 1553.32   93.35 1553.41   95.91 1554.26      98  1554.7   98.26 1554.78
  100.24 1554.92  100.31 1554.92  103.01 1555.12  103.25 1555.12  108.57 1555.22
  108.76 1555.23  115.72 1555.26  121.64 1555.34  121.81 1555.35  122.01 1555.36
  127.89 1556.01  128.97 1556.11  130.07 1556.34  132.78 1557.23  141.02 1559.39
   141.9 1559.65  145.98 1561.07  146.52 1561.26  146.67 1561.27  156.12 1561.79
  156.98 1561.79  157.92 1561.79   160.8 1561.84  167.47 1561.95  175.73 1562.09
  180.72 1562.19  184.46 1562.19  185.99  1562.2  187.75 1562.21   191.3 1562.23
  196.07 1562.26  196.36 1562.54  196.57 1562.76  199.39 1562.74  199.44 1562.74
  207.89 1562.77

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   64.16    .025  103.01    .045   160.8    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         64.16  103.01             18.73      19   19.76             .1      .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 6094.420

INPUT
Description:
Station Elevation Data    num=      52
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1564.24     3.2 1564.26   16.51 1560.57   25.69 1558.08   32.91 1556.44
    37.6 1555.86    48.2  1555.7   59.08  1555.3   63.57 1555.18    64.3  1555.1
   65.13 1554.92   67.96 1554.05   69.48 1553.63   69.53 1553.61   70.88 1553.24
    85.4 1553.17   92.66 1553.17   95.09 1553.95   98.17 1554.93   98.33 1554.98
   98.46 1554.99  100.76 1555.16  100.81 1555.16  101.25  1555.2  101.75 1555.18
  105.45 1555.25   124.8 1555.58  127.83 1555.68  131.27 1556.27  140.01 1558.65
  144.45  1559.8  147.97 1561.07  151.65 1561.29  156.97  1561.6  157.65  1561.6
  158.77  1561.6  161.51 1561.64  172.25 1561.81  178.28 1561.89  181.62 1561.96
  185.21 1561.98  188.07    1562  192.33 1562.04  196.93 1562.07   197.2 1562.34
  197.44 1562.57  202.82 1562.47   204.3 1562.44  205.43 1562.41  206.46 1562.44
  207.83 1562.48  209.16 1562.51

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   63.57    .025  100.81    .045  161.51    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         63.57  100.76            122.11  122.35  123.02             .1      .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 5972.070

INPUT
Description:
Station Elevation Data    num=      38
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1563.34   11.13 1559.98   26.63 1555.25    52.7 1554.94   58.69 1554.79
   61.22 1554.81   63.77 1554.22   65.98  1553.7   66.57 1553.56   70.78 1552.56
   77.15 1552.56   88.54 1552.54   96.75 1554.36   98.48 1554.74   99.94  1554.7
  100.84 1554.67  125.12  1555.2  130.96  1555.3  131.45 1555.43  146.78 1559.82
  152.13 1560.03  154.34 1560.12  155.81 1560.18     156 1560.18  157.61 1560.18
  159.78 1560.23  166.33  1560.4  174.58 1560.62  180.95 1560.79  187.17 1560.77
  192.43 1560.77  195.91 1560.76  196.34  1561.2  196.41 1561.26  203.24  1561.2
  204.19 1561.19   205.5 1561.22  207.69 1561.26

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   61.22    .025   98.48    .045  159.78    .018
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         61.22   98.48            131.25  130.71  129.23             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 5841.366

INPUT
Description:
Station Elevation Data    num=      44
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1561.47    1.94 1561.46    8.58 1561.42   14.25 1559.78   29.25 1555.25
   38.84 1554.95   49.95 1554.37   60.13  1554.4   69.72 1554.42   73.53 1553.64
   77.46 1552.81   77.52 1552.81   78.09  1552.8   84.47 1552.74   98.08 1552.63
  103.96 1553.67  107.63  1554.3  109.82 1554.28  111.14 1554.27  111.66 1554.26
   123.3 1554.09  133.84 1554.29  142.73 1554.65  148.69 1556.01  158.03 1558.33
  158.13 1558.35  158.15 1558.36  158.16 1558.36  158.19 1558.36  166.82 1558.44
  167.68 1558.44  168.62 1558.44  170.77 1558.51   183.1 1558.88  191.71 1559.15
  197.85 1559.17  201.32 1559.18  207.28  1559.2  207.44 1559.36  207.78  1559.7
  214.15 1559.59   215.1 1559.58  216.12 1559.61  218.04 1559.67

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   69.72    .025  107.63    .045  170.77    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         69.72  107.63            28.72   28.73   28.76             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 5820.431

INPUT
Description:
Distance from Upstream XS =   20.93
Deck/Roadway Width        =       5
Weir Coefficient          =     2.6
 Weir Embankment Coordinates    num =       65
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     -18 1558.71  -15.51 1558.58  -13.19 1558.45  -10.24 1559.04   -5.89 1559.91
    -.05 1561.09    8.46 1561.06    8.61 1561.06    9.08 1560.87   19.31 1556.97
   23.39 1555.99   27.32 1555.11   29.78 1554.95    32.2 1554.85   34.66 1554.68
    41.4 1554.41   49.82 1554.28   61.86 1554.23   69.15 1554.25   70.69 1554.21
   72.27 1554.08   74.94 1553.25   77.21 1552.52   77.59 1552.51   78.19 1552.49
   81.66  1552.4   86.68 1552.46   89.48 1552.44   95.94 1552.45   98.81 1552.44
  101.08 1552.99  106.23 1554.11   109.6 1554.04  110.99 1554.01  111.16    1554
  116.05 1553.92  121.93 1553.88   127.9 1553.84  133.15 1553.89  137.56 1554.05
  141.34 1554.19  144.69 1554.51   148.4 1555.09  151.96 1556.18  154.54 1557.07
  155.02 1557.23  156.51 1557.66   158.2 1558.14  166.72 1558.17  166.76 1558.17
  166.82 1558.17  166.83 1558.17  168.62 1558.17   168.8 1558.18  170.75 1558.23
  191.77 1558.86  206.76 1558.93  207.33 1558.93   207.4 1559.01  207.83 1559.43
  210.67 1559.34  214.68 1559.21  214.76 1559.21  214.83 1559.21  214.96 1559.21

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 5812.631

INPUT
Description:
Station Elevation Data    num=      64
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1560.99    5.91  1558.6   10.64  1556.8   14.77 1555.81   19.61 1554.61
   22.98  1553.8   23.59 1553.52   31.17 1551.88   31.55  1551.7   33.68 1551.49
   37.22 1551.23   54.46 1550.95   55.33 1550.94   58.77 1550.85   59.37 1550.86
   59.53 1550.85   63.55 1550.89   66.18 1549.85   67.92 1549.25   68.98 1549.17
   69.58 1549.12    70.6 1549.04   71.64    1549   71.87    1549   78.96 1548.79
   80.82 1548.77   89.76 1548.62    93.3 1549.96   94.59 1550.37  100.87 1550.54
  101.11 1550.55  101.93 1550.59  102.53 1550.61  109.12 1550.76  109.14 1550.76
   122.8 1551.35   122.9 1551.36  122.99 1551.37  123.32 1551.38  125.79 1551.75
  126.78  1551.9  128.54 1552.45  134.55 1553.65  136.59 1554.09  141.49 1555.61
  143.72 1556.22  146.12 1557.05  149.13 1557.93  149.58 1558.06  150.17 1558.06
  158.19 1558.08  159.33 1558.08  159.99 1558.08   162.1 1558.14  169.18 1558.34
  183.16 1558.75   192.9  1558.8   198.7 1558.83  199.16 1559.29   199.2 1559.33
   199.6 1559.32  200.55 1559.28   206.1 1559.07  208.79 1559.21

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   63.55    .025   94.59    .045   162.1    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         63.55   94.59            26.12   26.24   26.58             .1       .3
```

```
CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 5786.387

INPUT
Description:
Station Elevation Data    num=      53
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1560.79    4.28 1559.02   18.93 1554.84    29.4 1551.38   34.44 1551.04
   45.53 1550.53   53.84 1550.44   58.43 1550.42   61.65  1550.4   62.29 1550.35
   64.19 1550.07   64.93 1549.81   67.22 1548.91   68.49 1548.61   69.57 1548.35
   72.46 1548.27   89.03 1548.05   94.74 1550.13    95.3 1550.34   95.89 1550.34
   98.86 1550.48  100.48 1550.49  102.41 1550.51  103.47 1550.51  108.69  1550.5
  113.25 1550.65  126.98 1551.36  127.75 1551.42  128.01 1551.44  129.51 1551.86
  132.39 1552.73     143 1555.81  149.32 1557.54  152.12 1557.63  154.55 1557.68
   158.1 1557.75  159.27 1557.75   159.9 1557.75  161.97  1557.8  173.25 1558.11
  180.94 1558.33   181.9 1558.35  183.13 1558.38  183.99 1558.39  185.37  1558.4
  186.88 1558.41  194.62 1558.46  198.64 1558.49  199.12 1558.97  199.14 1558.99
   199.6 1558.97   203.8 1558.82  205.14 1558.78

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   62.29    .025    95.3    .045  161.97    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         62.29    95.3             99.31    99.2   98.87             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 5687.190

INPUT
Description:
Station Elevation Data    num=      41
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1559.24    6.87 1557.18   27.39 1550.99   33.68 1550.27   33.82 1550.26
   33.97 1550.26   46.16  1550.2   61.69 1550.13   62.72 1550.13   63.36 1549.97
   66.49 1549.18   66.68 1549.13   71.17    1548   83.98 1547.75   88.68 1547.64
    94.5 1549.48   95.75 1549.88   98.19  1550.3   99.28 1550.45  100.01 1550.42
  101.53 1550.36  102.11 1550.34  112.99 1549.97  124.66 1550.62  129.47 1550.87
  137.89 1553.17   149.5 1556.34  154.34 1556.46  157.11 1556.53  158.45 1556.53
  158.91 1556.53  160.66 1556.57  160.85 1556.57  182.45 1557.06  194.11 1557.18
  197.72 1557.23  197.92 1557.42  198.22 1557.73  201.06  1557.7  205.57 1557.64
  210.07 1557.77

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   62.72    .025   99.28    .045  160.85    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         62.72   99.28            239.11  239.19  239.36             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 5448.002

INPUT
Description:
Station Elevation Data    num=      41
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1555.66   20.19 1550.77   22.58  1550.2   34.76 1549.68   35.32 1549.65
   35.91 1549.63   36.87 1549.63   51.78 1549.55   56.57 1549.59   59.11 1549.61
   64.76 1548.41   65.41 1548.28   66.79 1547.99   68.05 1547.74   73.01 1547.78
   87.71 1547.84   90.15 1548.36   96.45 1549.56   99.08 1549.43   99.44 1549.41
  100.02 1549.38  108.42 1549.43  117.83 1549.58  132.07 1550.18  132.25 1550.19
  132.44 1550.24  144.31 1553.27  150.96 1553.61  152.69  1553.7  154.13  1553.7
  154.49  1553.7  156.84 1553.75  167.74 1553.97  176.58 1554.15  185.03 1554.22
  190.27 1554.25  193.26 1554.28  193.74 1554.75  193.76 1554.78  198.02 1554.55
  200.12  1554.6

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   59.11    .025   96.45    .045  156.84    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         59.11   96.45            33.97   34.23   34.92             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 5418.712

INPUT
Description:
Distance from Upstream XS =   29.29
Deck/Roadway Width        =       3
Weir Coefficient          =     2.6
```

```
 Weir Embankment Coordinates    num =       68
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
      -34 1554.97   -28.76 1554.09   -21.97 1552.96   -16.58 1553.85    -8.16 1555.23
   -1.31 1555.17     -.29 1555.16      .74  1554.9     9.76 1552.63    15.42 1551.12
   19.46 1550.27    23.89 1549.71    26.12 1549.54    30.21 1549.49    34.69 1549.43
   36.94 1549.35    41.53 1549.34    42.47 1549.35    47.25 1549.33    52.72 1549.31
   55.05 1549.34    55.21 1549.34    56.11 1549.34    59.76 1549.28    60.64 1549.27
   61.21 1549.08    64.98 1547.99    65.33 1547.89    65.94 1547.72    69.91 1547.58
   70.95 1547.59    81.39 1547.43    83.56 1547.43    83.75 1547.44    87.29 1547.61
   90.24 1547.74    90.81 1547.94    92.53 1548.66    94.21 1549.33    97.65 1549.38
   98.56 1549.39   103.87 1549.47   107.18 1549.53   107.67 1549.54   118.97 1549.53
  119.27 1549.53   125.06 1549.58   129.46 1549.57   130.11 1549.65   130.53 1549.69
  133.99 1550.02   135.38 1550.29   138.49 1551.15   139.66 1551.48   143.64 1552.67
  149.54  1553.1   152.32 1553.33   153.57 1553.33   154.13 1553.33   156.45 1553.38
  163.12 1553.51   176.03 1553.81   187.14 1553.88   192.83 1553.93   193.29 1554.38
  193.33 1554.43   194.98 1554.44   198.02 1554.47

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 5413.769

INPUT
Description:
Station Elevation Data    num=      66
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1555.14     2.35 1555.12     7.87 1555.11    12.85  1553.8    17.79 1552.55
   24.52 1550.76     26.8  1550.1    34.63 1548.54    34.74 1548.52    34.79 1548.52
   34.85  1548.5    40.21 1547.82     41.6 1547.71    48.75 1547.12    55.26 1547.04
   56.54 1547.01    62.83 1546.94    64.09 1546.86    69.23 1546.91    70.13 1546.54
   72.77 1545.29    73.17 1545.26    73.46 1545.23     76.4 1544.99     78.6 1544.85
   87.45 1544.73    88.29 1544.71     89.7 1544.79    91.58  1544.9    95.96 1545.47
   96.44 1545.55    97.13 1545.67    98.82 1546.11   100.03 1546.56   101.97 1546.57
  103.63 1546.66   104.28 1546.66   105.54 1546.67   106.55 1546.67    114.8 1546.73
  115.35 1546.75   122.32  1547.1   123.11 1547.11   129.45 1547.42   130.94 1547.61
  137.33 1548.76   138.03    1549   142.67 1549.91   144.07 1550.38   146.59 1551.07
  150.61 1552.24   151.64 1552.55   152.37  1552.6   156.77 1552.97   159.62  1553.2
   160.4 1553.27   160.66 1553.27    162.2 1553.27   164.51 1553.32   165.51 1553.34
  184.08 1553.77   199.98 1553.87   200.88 1553.88   200.95 1553.95   201.38 1554.38
     204  1554.4

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   69.23    .025  100.03    .045  164.51    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         69.23  100.03             32.76   32.65   32.35             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 5381.124

INPUT
Description:
Station Elevation Data    num=      46
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1554.81     5.85 1554.81     7.99 1554.81     9.14 1554.52    32.54 1548.55
   33.77 1548.23     38.3 1547.62    42.47 1547.02    43.58 1546.95    60.52  1546.3
   62.78 1546.33     67.3 1546.39    68.51 1546.28    70.11 1546.09     72.4 1545.27
   72.95 1545.07    73.39 1544.91    75.37  1544.2    90.06 1544.33    95.24 1544.38
   97.34  1544.9   102.05 1546.32   103.92 1546.53   103.94 1546.54    104.8 1546.64
  105.55 1546.62      109 1546.51   112.46 1546.44   115.74 1546.61   128.55 1546.87
  130.99 1547.11   132.75 1547.38   145.26 1550.74    151.8 1552.46   154.76 1552.63
  159.95 1552.87   160.62 1552.87   161.75 1552.87   164.02 1552.93   171.23 1553.13
  183.49 1553.52   197.07 1553.57   200.28 1553.57   200.68 1553.97   200.78 1554.07
  204.93 1553.89

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045    67.3    .025   104.8    .045  164.02    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          67.3   104.8            105.94   105.9   105.8             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 5275.222

INPUT
Description:
Station Elevation Data    num=      44
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1553.38     .81 1553.16    22.31 1547.05    24.55 1546.83    27.13 1546.62
```

```
  30.45 1546.51   33.59 1546.36   41.88 1546.35   44.87 1546.39   48.35 1546.31
  53.56 1546.25   53.98 1546.27   55.38 1546.36   59.78 1544.73   59.88 1544.69
  60.02 1544.64   61.36 1544.15   67.75 1544.14   81.15 1544.13   82.58 1544.58
   87.6 1546.08   88.55 1546.16   89.73 1546.27   90.97 1546.38   91.17 1546.37
  107.5 1545.96  108.82 1545.93  111.73 1546.11  121.62 1546.78  123.73 1547.38
 138.22 1551.46  142.24 1551.64  146.75 1551.79  147.53 1551.79  148.55 1551.79
 151.26 1551.87  158.86 1552.08  170.49 1552.41  181.91  1552.4  186.87 1552.39
  187.2 1552.72  187.37 1552.89  196.13 1552.89  198.42 1552.89

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   55.38    .025   90.97    .045  151.26    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         55.38   90.97             142.93  142.63  141.87             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 5132.593

INPUT
Description:
Station Elevation Data     num=      47
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1550.18    9.24 1548.43   16.97 1547.02   17.77 1546.84   31.98 1545.97
   34.61 1545.91   37.69 1545.92   50.47 1546.03   50.73 1546.01    52.7 1545.87
   54.78 1545.19   57.72 1544.28   58.09 1544.17   58.91 1543.91   60.89  1543.8
   76.51 1543.65   79.07 1543.65    82.2  1544.5   85.66  1545.5   86.74 1545.57
   88.06 1545.61    88.3 1545.62   88.46 1545.62   93.71 1545.63    98.7 1545.72
  104.26 1545.71   112.5 1545.69  114.78 1545.69  119.93 1545.93  121.95 1546.06
  122.67 1546.11  126.26 1547.13  129.17 1547.89  137.55 1550.06  139.88  1550.1
  145.36 1550.07  145.69 1550.07  147.16 1550.07  150.12 1550.14  154.92 1550.26
  169.13 1550.57  181.33 1550.71  185.41 1550.75  185.79 1551.13  185.91 1551.25
  187.08 1551.19  197.01 1551.22

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   50.73    .025   88.46    .045  150.12    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         50.73   88.06             16.43   16.54   16.82             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1              RS: 5120.617

INPUT
Description:
Distance from Upstream XS =    11.98
Deck/Roadway Width        =        3
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       76
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
     -37 1548.38  -29.87 1548.29  -28.33 1548.05  -25.58  1547.6  -24.56 1547.65
  -22.98 1547.69  -22.06 1547.89   -20.9 1548.13  -20.81 1548.15  -16.58 1548.83
    -9.9  1549.9   -2.25 1549.89     .49 1549.92    4.94 1548.97   12.53 1547.52
    15.8 1546.98   16.73 1546.78   20.08 1546.14   22.61 1546.03   25.02 1545.94
   26.46  1545.9   32.51 1545.89   38.68 1545.86   40.17 1545.87   52.48 1545.94
   52.82 1545.91   53.31 1545.79   54.78 1545.38   58.32 1544.31   58.43 1544.28
   58.69 1544.26    60.9 1544.11   62.02 1544.04   65.14 1543.87    66.5 1543.86
   67.58 1543.86   77.21 1543.68    81.3 1543.84    81.9 1543.99   83.78 1544.41
   85.54 1544.78   87.84 1545.42   88.69 1545.44   89.13 1545.45   91.29 1545.51
   96.48 1545.75  102.51 1545.69  106.04 1545.68  115.08 1545.65  115.96 1545.64
  122.74 1545.85  123.34 1545.87  123.48  1545.9  123.63 1545.94  126.65 1546.78
  127.58 1547.02  136.23 1549.26  136.84 1549.43  137.04 1549.49  137.22 1549.56
  139.07 1550.07  140.63 1550.08  146.03 1549.91  147.08 1549.91  147.83 1549.91
  150.84 1549.97  157.78 1550.12  169.77 1550.38  177.09 1550.47  186.13 1550.59
  186.21 1550.67  186.63 1551.09  188.86 1550.97  189.45 1550.96   197.4 1550.91
  197.71 1550.93

Upstream Embankment side slope             =     100 horiz. to 1.0 vertical
Downstream Embankment side slope           =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins        =
Weir crest shape                           = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 5116.053

INPUT
Description:
Station Elevation Data     num=      61
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1549.88    8.37 1548.11   11.78 1547.46   14.17 1547.07   18.26 1546.04
    19.3 1545.87   22.55 1545.14    25.6 1544.74   27.11 1544.55   29.51 1544.59
   34.35 1543.85   35.73 1543.69   44.83 1543.72   48.67 1543.66   51.56 1543.53
   54.74 1543.39   55.82 1543.11   57.74 1542.58   58.14 1542.47   58.83 1542.29
```

```
  61.04 1542.08   67.24 1541.72   69.62 1541.69   79.39 1542.13   81.12 1542.35
  83.94  1543.2   85.89 1543.71   88.12 1543.78   88.59 1543.79   92.57 1543.92
  96.08 1544.23   98.25 1544.28  102.47  1544.6  104.95 1544.65  107.69 1544.71
 113.74 1544.63  115.85 1544.99  118.36 1545.42  121.59 1545.67  123.04 1546.01
 123.76 1546.18  124.44 1546.34  126.45 1546.84  127.17 1547.06   136.3 1549.36
 137.45 1549.59  138.77 1549.95  142.46 1549.97  145.45 1549.87  146.02 1549.87
 147.25 1549.87  150.28 1549.94  164.43 1550.22  169.17 1550.33  171.86 1550.36
 176.55 1550.42  185.54 1550.54  185.77 1550.77  186.04 1551.04  188.86 1551.06
 197.12 1551.11

Manning's n Values          num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   54.74    .025   85.89    .045  150.28    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
         54.74   85.89             28.35   28.98   30.57             .1        .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1               RS: 5087.074

INPUT
Description:
Station Elevation Data     num=      41
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1549.61    9.35 1547.67   23.54 1544.66   27.37 1543.87    30.4 1543.54
   34.32  1543.2   41.21 1542.99      51 1542.67   52.69 1542.58   53.44 1542.57
   54.75  1542.1    57.8 1541.14    58.3 1540.98   58.51 1540.92   63.43  1540.9
   78.94 1540.94   83.85 1542.65   84.42 1542.87   84.98 1542.89   88.26 1543.11
   88.82 1543.15   89.02 1543.16   90.99 1543.15  100.87 1543.11  106.16 1543.25
   113.5 1543.92  118.68 1544.37  124.77 1545.89  136.94 1548.97  144.55 1549.44
  145.63 1549.52  147.23 1549.52  147.43 1549.52   149.3 1549.56  150.59 1549.59
  169.47 1549.96  185.46 1550.18  185.73 1550.19  185.96 1550.42  186.23 1550.69
  190.02 1550.51

Manning's n Values          num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   53.44    .025   88.26    .045  150.59    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
         53.44   88.26            120.85  120.42  119.34             .1        .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1               RS: 4966.653

INPUT
Description:
Station Elevation Data     num=      45
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1548.32    7.16 1548.22    7.39 1548.22    7.79 1548.14   31.52 1543.16
      33 1543.06   41.73 1542.62   44.21 1542.51   47.87 1542.55   60.74 1542.71
   62.03 1542.67   63.23 1542.62   67.14 1541.24    68.3 1540.83   68.43 1540.79
      69 1540.59   70.57 1540.58   88.92 1540.49   94.84 1542.45   95.24 1542.58
   95.45 1542.59   97.91 1542.74   97.97 1542.74   98.9  1542.73  100.33  1542.7
  107.07 1542.64  118.38 1542.68  124.47 1542.81  133.49 1543.62  133.67 1543.63
  144.87 1546.94  147.02 1547.52  148.17 1547.59  155.38 1547.97  157.05 1547.97
  157.18 1547.97  159.23 1548.02  160.89 1548.07  179.95 1548.57  190.63 1548.66
   195.8  1548.7  196.08 1548.97   196.3  1549.2  200.66 1548.98   207.3     1549

Manning's n Values          num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   62.03    .025   97.97    .045  160.89    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
         62.03   97.91            115.98  116.59  118.21             .1        .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1               RS: 4850.062

INPUT
Description:
Station Elevation Data     num=      48
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  1547.1    2.78 1547.03    7.55 1546.98   21.26 1544.14   25.74 1543.25
   27.28 1542.94   30.57 1542.78   36.14 1542.39   40.26 1542.41   56.18 1542.28
   57.38 1542.28   59.24 1542.32   61.28 1542.35   62.56 1542.05   64.09 1541.77
   68.47 1540.62    68.8 1540.54   69.66 1540.53   85.94 1540.41   90.41 1540.37
   93.11 1541.18    96.1 1542.04   98.58 1542.37   99.14 1542.45   99.23 1542.46
   99.29 1542.47   99.44 1542.46  103.95 1542.22  107.94  1542.2  118.03 1542.41
  134.03 1542.89  134.73  1542.9  134.91 1542.92  147.32 1546.04  148.16 1546.24
  148.95 1546.28  156.43 1546.64  157.34 1546.64  158.23 1546.64  162.02 1546.75
  165.09 1546.84  181.17 1547.35  192.28 1547.39  196.69  1547.4  196.89 1547.59
  197.19  1547.9  200.56 1547.72  203.49 1547.71

Manning's n Values          num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   61.28    .025   99.14    .045  162.02    .018
```

```
Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.   Expan.
         61.28   99.14              31.83   31.51    30.7             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 4824.903

INPUT
Description:
Distance from Upstream XS =    25.16
Deck/Roadway Width        =       5
Weir Coefficient          =     2.6
 Weir Embankment Coordinates    num =       73
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
     -27 1545.65   -26.7 1545.65  -23.84 1545.14  -18.67 1544.25  -16.99 1544.25
  -15.23 1544.34      -6 1545.97   -1.19 1546.83     .69 1546.76    6.04 1546.49
     8.9 1545.97    16.4 1544.58   20.86 1543.13   21.34 1543.02   27.96 1542.18
   28.09 1542.18   30.28 1542.16   34.39 1542.05    34.9 1542.02   41.06 1541.82
   48.12 1542.12   49.92 1542.13    50.4 1542.12   59.17 1542.13   59.75  1542.1
   62.23 1541.97   63.46 1541.93   65.72 1541.38   67.67 1540.95   68.58 1540.75
   69.38 1540.58   73.84 1540.47   77.37 1540.39   78.57 1540.38   81.33  1540.4
   88.07 1540.44   94.35 1541.99   94.76 1542.08   97.08 1542.13   97.34 1542.12
   97.75 1542.11   99.16 1542.09   99.25 1542.09  103.54 1542.02  104.34 1542.01
   113.1 1541.89  113.56  1541.9  122.28 1541.78  122.75 1541.79  127.97 1542.03
  129.97 1542.06  134.13 1542.77  135.94 1543.12  136.37 1543.18  137.19 1543.37
  139.54 1543.97  142.74 1544.82  146.32 1545.83  147.03 1546.02  148.81 1546.11
  155.23 1546.41  156.28 1546.41  157.03 1546.41  160.85 1546.52  164.91 1546.65
  180.03 1547.09  187.74 1547.09  193.74  1547.1  195.48  1547.1  195.69  1547.3
  195.99  1547.6  200.23 1547.36  201.61 1547.29

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 4818.556

INPUT
Description:
Station Elevation Data    num=      60
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1546.55    4.58 1546.35    8.29 1546.29   17.01 1544.65   17.98 1544.46
   24.16 1542.69   27.77 1541.59   32.09 1540.44    32.3 1540.39   32.78 1540.35
   39.29 1539.88   39.81 1539.84   41.34 1539.78   54.83 1539.85   56.59 1539.81
   62.65 1539.78   64.07 1539.15   66.47 1538.44   69.44 1538.09   69.45 1538.09
   70.32 1538.08    70.6 1538.08   78.83 1537.75   83.25  1537.7   87.58 1537.82
   89.98 1537.78   94.45 1539.13   94.64 1539.19   94.89 1539.19   99.02 1539.17
   99.39 1539.17  100.66 1539.16  103.17 1539.17  104.57 1539.23  112.98 1539.27
  117.11 1539.27  120.88 1539.45  123.03  1539.4  123.94 1539.45  126.74 1539.69
  128.79 1540.15  131.49    1541  140.79 1543.79  143.22 1544.45  144.18 1544.71
   144.7 1544.85  148.83 1545.94   154.3 1546.21  156.93 1546.34  157.22 1546.34
  158.73 1546.34  161.14 1546.41  162.55 1546.45  181.74 1547.01  195.67 1547.01
  197.18 1547.01  197.31 1547.15  197.68 1547.51  199.64 1547.41  201.44 1547.39

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   62.65    .025   94.45    .045  162.55    .018

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.   Expan.
         62.65   94.64              47.68   48.27   49.79             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 4770.290

INPUT
Description:
Station Elevation Data    num=      45
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1546.01    2.31  1545.7   11.96 1543.48   25.56 1540.26   26.12 1540.13
   26.48 1540.09   35.18 1539.87   36.38 1539.77   41.45 1539.71   47.26 1539.47
   56.41 1539.11   57.39 1538.99   59.73 1538.32   63.63 1537.07   64.23 1537.06
   65.02 1537.05   76.19 1536.89   83.11 1536.81   85.35 1537.47   87.45 1538.07
   90.21 1538.86   91.08 1538.91    92.6 1538.98   93.01 1538.97   93.08 1538.97
   96.22 1538.85    99.5 1538.74  110.91 1538.84  117.45 1539.22  119.49 1539.37
  124.21 1540.64   142.7 1545.62  148.29 1545.76  151.11 1545.79  152.11 1545.79
  152.91 1545.79  156.68 1545.89  157.03  1545.9   175.9 1546.44  191.25 1546.39
  191.29 1546.39  191.32 1546.41  191.79 1546.89  193.57  1546.9  196.82 1546.87

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   57.39    .025   93.08    .045  156.68    .018

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.   Expan.
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        57.39   93.01            87.27   86.99   86.24            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 4683.298

INPUT
Description:
Station Elevation Data    num=      45
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1545.44   22.28 1539.83   24.02 1539.39   24.25 1539.36   30.01 1538.95
   31.21 1538.95   46.91 1538.76   50.57 1538.71   58.09 1538.71   58.83 1538.49
      65 1536.69   65.18 1536.64   65.79 1536.62   78.16  1536.3   83.73 1536.17
    86.5 1537.16   90.64 1538.68   92.38 1538.79   93.42 1538.85   93.61 1538.85
   93.75 1538.85   97.19 1538.85  107.34 1538.78  116.97 1539.06  124.06 1539.34
  138.83  1543.3  143.21 1544.44  144.55 1544.45  145.91 1544.49   151.4 1544.69
  152.78 1544.69   153.2 1544.69  156.74 1544.79  156.83 1544.79  164.85 1545.03
  175.91 1545.36  184.75 1545.33  190.57 1545.31  191.42 1545.31  191.63 1545.52
  191.92 1545.81  192.23 1545.83  192.91  1545.8  194.93 1545.79  203.18  1545.9

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   58.09    .025   93.75    .045  156.83    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         58.09   93.61            174.81  173.77  171.35            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 4509.527

INPUT
Description:
Station Elevation Data    num=      53
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1543.71    7.27 1542.09   17.15 1539.74   19.41 1539.33   26.26 1538.86
   26.75  1538.8   27.62 1538.78   46.07 1538.19   51.38 1538.19   59.75 1538.21
   60.67 1538.18   61.38 1538.19   64.23 1537.45    64.8 1537.27   66.39 1536.76
   67.46 1536.42   88.09 1536.46    88.9 1536.46   89.09 1536.46   89.26 1536.52
   89.67 1536.68   93.99 1538.27   95.23  1538.3   97.22 1538.31   97.27 1538.31
   97.68 1538.31  103.52 1538.28  104.32 1538.27  108.56 1538.29  120.93 1538.45
  124.03 1538.46  126.78 1538.59  131.67 1538.82  135.49  1539.7  142.69 1541.43
  145.85 1542.07  149.24 1542.22  153.85 1542.49  154.76 1542.49  155.65 1542.49
  159.18 1542.61  175.12 1543.12  176.86 1543.18  177.89 1543.21   178.8 1543.21
  179.29 1543.21   180.7 1543.21  193.92 1543.19  194.03  1543.3  194.42 1543.69
  195.14 1543.72  196.03 1543.77  197.06 1543.82

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   61.38    .025   93.99    .045  159.18    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         60.67   93.99             20.74   20.89   21.2             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 4494.152

INPUT
Description:
Distance from Upstream XS =    15.38
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       72
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     -29 1542.27  -28.06 1542.12  -25.66 1541.71  -23.01 1541.26  -18.9 1542.02
  -15.51 1542.65  -14.27 1542.82    -9.4 1543.49   -5.35 1543.45   -.45 1543.46
    6.91 1541.68   14.73 1539.98   16.72 1539.56   17.79 1539.44  23.16 1538.78
   23.56 1538.73   26.03 1538.45   30.76 1538.29   32.95 1538.25  37.73 1538.09
   41.96 1538.02    47.2 1538.02   52.06 1538.01   55.53 1537.99  61.01 1537.92
   62.23 1537.94   62.55 1537.93   64.49 1537.46   65.28 1537.27  66.09 1537.06
   66.98 1536.82   67.91 1536.65   72.65 1536.58   78.68 1536.43  81.89 1536.42
   85.88 1536.44   89.62 1536.49   92.44 1537.54   93.56 1537.97   93.8 1537.98
   97.24 1538.13   97.58 1538.15   99.76 1538.24  105.52 1538.26 116.54  1538.2
  124.28 1538.05  127.47 1538.07   130.4 1538.39  130.94  1538.4  132.62 1538.82
  140.13  1540.7  140.29 1540.73  140.67 1540.84  140.83 1540.87  145.34 1541.72
  146.97 1541.82  153.66 1542.32  154.39 1542.32  155.46 1542.32  158.96 1542.43
  161.26  1542.5  177.63 1543.06  191.81 1543.05  193.77 1543.05  194.19 1543.47
  194.27 1543.55  194.66 1543.57  196.85 1543.68  196.88 1543.65  196.99 1543.54
  197.35 1543.18  199.25 1543.16

Upstream Embankment side slope             =     100 horiz. to 1.0 vertical
Downstream Embankment side slope           =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins        =
Weir crest shape                           = Broad Crested


CROSS SECTION
```

RIVER: SunValley
REACH: Reach1 RS: 4488.645

INPUT
Description:
Station Elevation Data num= 67

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1543.47	8.41	1543.38	8.78	1543.38	9.37	1543.24	24.16	1540.02
25.77	1539.68	30.69	1538.34	31.29	1538.19	31.51	1538.13	31.59	1538.11
32.08	1538	36.92	1537.46	40.48	1537.3	42.46	1536.9	45.12	1536.77
54.55	1536.43	57.13	1536.49	60.11	1536.56	66.66	1536.5	69.9	1536.32
73.54	1535.41	73.81	1535.33	74.51	1535.15	75.41	1534.95	77.31	1534.54
77.94	1534.38	87.45	1534.05	90.02	1534.08	90.99	1534.09	98.65	1534.42
99.28	1534.61	102.83	1536.32	106.67	1536.33	106.99	1536.33	107.78	1536.33
110.01	1536.24	115.52	1536.27	118.8	1536.19	129.46	1536.15	133.92	1536.31
134.06	1536.32	134.17	1536.32	136.2	1536.64	137.31	1536.9	140.74	1537.93
146.79	1539.71	150	1540.76	153.83	1541.44	154.57	1541.58	155.16	1541.62
163.01	1542.24	164.54	1542.24	164.81	1542.24	166.69	1542.3	168.3	1542.35
186.95	1542.98	198.32	1542.97	203.13	1542.98	203.22	1543.06	203.63	1543.48
204.48	1543.52	206.21	1543.59	206.47	1543.33	206.71	1543.09	206.91	1543.09
208.27	1543.08	209.12	1543.07						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.045	69.9	.025	102.83	.045	168.3	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
69.9	102.83	17.41	17.58	17.97	.1	.3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 4471.064

INPUT
Description:
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1543.32	3.52	1543.3	8.63	1543.26	14.79	1542	16.92	1541.57
23.1	1540.35	31.66	1538.28	38.5	1536.71	40.66	1536.11	40.78	1536.08
42.35	1536.04	46.39	1535.8	59.36	1535.29	63.04	1535.19	66.32	1535.04
70.21	1534.89	71.22	1534.67	74.01	1534.01	75.56	1533.65	75.76	1533.6
80.12	1533.52	91.92	1533.36	99	1533.69	100.96	1534.19	104.34	1535.1
107.19	1535.09	107.38	1535.09	109.34	1535.09	111.24	1535.19	116.54	1535.27
124.75	1535.51	129.07	1536	134.93	1536.43	137.16	1536.94	143.54	1538.63
152.42	1541.07	155.21	1541.64	160.27	1541.86	163.24	1542.03	164.99	1542.03
165.04	1542.03	165.48	1542.05	168.53	1542.15	187.11	1542.78	202.11	1542.8
203.42	1542.8	203.51	1542.89	203.79	1543.16	203.92	1543.3	206.26	1543.36
206.5	1543.37	206.54	1543.33	207	1542.86	209.85	1542.85		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.045	70.21	.025	104.34	.045	168.53	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
70.21	104.34	111.79	111.4	110.55	.1	.3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 4359.662

INPUT
Description:
Station Elevation Data num= 45

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1542.6	27.93	1536.31	31.5	1535.53	34.12	1535.4	53.63	1534.63
61.09	1534.38	63.91	1534.18	66.82	1533.62	67.42	1533.46	68.64	1533.14
69.42	1532.93	87.44	1532.72	89.09	1532.71	89.55	1532.7	90.12	1532.83
98.56	1534.77	99.71	1534.77	99.96	1534.78	101.91	1534.78	106.69	1534.71
114.21	1535.05	123.77	1535.56	128.65	1535.89	133.19	1536.1	144.1	1539.35
148.71	1540.73	151.32	1540.73	157	1540.82	157.92	1540.82	158.8	1540.82
162.25	1540.89	166.94	1540.99	180.75	1541.26	192.58	1541.46	195.8	1541.51
197.51	1541.51	197.97	1541.93	198.04	1542	198.71	1542.02	199.72	1542.03
200.09	1542.05	200.38	1541.79	200.64	1541.55	202.63	1541.53	203.3	1541.52

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.045	63.91	.025	99.96	.045	162.25	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
63.91	99.71	113.56	114.68	117.21	.1	.3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 4244.980

INPUT
Description:

```
Station Elevation Data    num=      38
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1541.26    13.65 1538.37    27.03  1535.4    41.03 1535.16    47.64 1534.98
   61.78 1534.49    67.72 1533.15    68.92 1532.89    69.64 1532.73    69.93 1532.73
   85.02 1532.65    91.77 1532.66    92.19 1532.75     98.7 1534.37    99.41 1534.39
  100.61 1534.41   101.98 1534.44    117.5 1534.69   134.86 1535.27   136.52 1535.33
  137.79 1535.69   151.01 1539.63   158.94 1539.85   159.02 1539.85   159.08 1539.85
  160.84 1539.85   164.12 1539.92   169.15 1540.02   174.39 1540.12   182.75 1540.27
  193.72 1540.46   200.34 1540.61   209.74 1540.71   210.07 1540.72   210.51 1540.73
  211.01 1540.73   211.25 1540.73    213.3 1540.73

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   61.78    .025   99.41    .045  164.12    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
         61.78   99.41             57.44   57.05   56.33             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 4187.928

INPUT
Description:
Station Elevation Data    num=      56
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1544.93     8.31  1540.9    14.22 1537.91     15.9 1537.03    16.67 1536.62
    20.6 1535.65    23.97 1535.78     26.9 1535.89    31.56 1536.05    32.17 1535.92
   35.69 1534.99    40.61 1535.01    59.73 1535.11    64.05 1535.26    76.78 1535.61
   76.92 1535.68    81.63 1537.21    83.78 1537.91    85.22 1537.77    99.46 1535.37
   99.57 1535.35   100.09 1535.25   106.03 1535.24   106.51 1535.22   119.24    1535
  132.26 1534.41   134.78 1534.38   135.55 1534.19   141.93 1532.62   142.57 1532.63
  143.23 1532.64   150.84 1532.76   164.71 1532.96   166.78 1533.38   170.89 1534.21
  172.19 1534.24   172.62 1534.25   176.42 1534.32   196.44 1534.71   202.83 1534.96
  211.29 1535.29    223.8 1538.68   224.97 1538.98   226.22 1539.09   232.94 1539.64
  233.83 1539.63   234.89 1539.63   237.92 1539.68   243.04 1539.76   256.67 1539.95
  284.42 1540.25   285.38 1540.26   285.41  1540.3   285.88 1540.76   286.02 1540.77
  287.04 1540.82

Manning's n Values        num=       6
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   23.97    .025   81.63    .045  134.78    .025  172.62    .035
  237.92    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
        134.78  172.19             41.13   36.77   33.71             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 4151.155

INPUT
Description:
Station Elevation Data    num=      56
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1545.21     .76 1544.82    14.59 1538.54    18.61 1538.53    19.57  1538.5
   20.47 1538.56    21.78 1538.59    22.84 1538.59    27.26 1536.95    31.37 1535.43
   33.61 1534.61    34.31 1534.56    37.86 1534.54    48.63 1534.43    56.66 1534.42
   79.08  1534.6     83.6 1534.69    95.47 1534.83    96.04 1534.83    97.71 1534.84
  107.99  1534.9   112.98 1534.84   117.87  1534.7   124.52 1533.06   126.21 1532.66
   126.6 1532.65   127.34 1532.64   130.63 1532.59   135.66 1532.51   141.98 1532.57
  149.28 1532.78   154.32 1533.88   155.79 1534.19    156.8  1534.2    156.88  1534.2
  160.17 1534.23   165.58  1534.3   178.39 1534.48   183.49 1534.68    195.5 1535.27
  208.13 1538.98      209 1539.23   209.55 1539.25    217.9 1539.47   218.32 1539.46
  219.83 1539.45   222.81 1539.49   228.93 1539.57   241.61 1539.75   253.02 1539.91
  262.62 1540.03   270.28 1540.13   270.73 1540.57   270.78 1540.63   271.49 1540.65
  272.32 1540.67

Manning's n Values        num=       6
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   31.37    .025   97.71    .045  117.87    .025   156.8    .035
  222.81    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
        117.87  156.88             24.9   22.11    23.6             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 4129.040

INPUT
Description:
Station Elevation Data    num=      57
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1539.61     5.65 1539.44     9.29 1539.29    14.17 1538.98    17.45 1538.59
   17.49 1538.58    18.61 1538.47    20.01 1537.88    27.43 1534.71    28.56 1534.23
   28.78 1534.13    35.02  1534.1    42.78 1534.04     51.5 1534.01    62.17 1534.09
   65.86 1534.28    71.82 1534.38    78.66 1534.36    89.96 1534.21    91.65 1534.24
   95.29 1534.19     97.3 1533.77   100.38 1533.23   102.1 1532.92   106.37 1532.55
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  106.73 1532.53  123.15 1532.62  125.31 1532.62  126.19 1532.99  128.41 1533.28
  130.93 1533.84  131.65 1534.02  133.42 1534.04  133.61 1534.05  135.77 1534.07
  147.72 1534.21  149.71 1534.24  154.04 1534.29  162.45 1534.72   170.4 1535.14
  174.53 1536.04  181.27 1537.85  185.37 1538.89   186.9 1538.96  194.53 1539.34
  195.78 1539.32  196.43 1539.31   199.4 1539.35  213.35 1539.55  215.73 1539.58
  218.23 1539.61  222.53 1539.68  226.97 1539.75  246.91 1540.06   247.4 1540.55
  247.41 1540.56  247.51 1540.56

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   27.43    .025  133.42    .045   199.4    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         95.29  133.61             15.84   13.56   13.79             .1      .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 4115.484

INPUT
Description:
Station Elevation Data     num=      72
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1540.09     3.73 1539.29     6.61 1538.55    23.31 1533.97    24.92  1533.9
    25.4 1533.88    25.95 1533.88    26.67 1533.88    29.87 1533.88    30.49 1533.88
    30.8 1533.88    49.19 1533.85    50.81 1533.62    61.14 1533.57    62.38 1533.56
   62.58 1533.65    63.42 1534.03    67.48  1534.3    68.91 1534.39    69.69 1534.44
   71.99 1534.42    74.98  1534.4    85.33 1534.31    86.04  1534.3    87.47 1534.29
    88.8 1533.69    89.43 1533.34    90.02  1533.3    90.66 1533.26    91.12 1533.24
   91.55 1533.24    97.91 1532.76   101.08  1532.5    106.9  1532.5   116.43 1532.43
   116.9 1532.82   118.85 1532.84   119.15 1532.89   119.84 1532.93   124.41 1533.06
  124.66 1533.07   126.13 1533.11   126.76 1533.14   133.12 1533.32   133.77 1533.34
  141.18 1533.45   147.59 1533.54   149.42 1533.61   150.68 1533.69    158.2 1534.18
  158.89 1534.23   160.87  1534.7   163.29 1535.34   165.17 1535.78   173.13  1537.6
  173.51 1537.66   174.36 1538.02   176.39 1538.91   181.09 1539.08   185.52 1539.26
  187.21 1539.23   187.42 1539.23    189.3 1539.25   190.39 1539.27   198.15 1539.37
  209.26 1539.54   224.64 1539.81   234.35 1539.97   237.92 1540.02   238.14 1540.24
  238.42 1540.52   240.55 1540.49

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   23.31    .025  124.41    .045   190.39    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         89.43  124.66             22.15   21.37   21.37             .1      .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 4094.117

INPUT
Description:
Station Elevation Data     num=      60
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1540.08     7.82 1538.27    25.99 1533.88    28.69 1533.95    32.8 1534.11
   33.95 1534.13    36.63  1533.8    37.74  1533.7    42.51 1533.68   51.55  1533.7
   51.63  1533.7    53.34  1533.7    57.68 1533.66    74.31 1533.79   75.33 1533.81
    75.9 1533.66    77.98 1533.25    83.17 1533.34     84.3 1533.35   84.91 1533.58
   85.82 1533.85    88.44 1533.98    93.74 1534.27    95.84 1534.33  100.19 1534.28
  101.48 1533.71   101.53 1533.69   102.76 1533.02   109.12 1532.61  114.61 1532.32
  121.33  1532.3   121.72  1532.3   122.39  1532.4   127.63 1532.97  128.62 1532.87
  128.99 1532.94   130.28 1533.21    130.6 1533.32   132.69 1533.33  143.34 1533.32
  148.69 1533.33   160.57 1533.77   161.17 1533.81   161.55 1533.89  162.99 1534.25
  163.85 1534.55   180.84 1538.89   186.94 1539.05   189.74 1539.12   191.5 1539.09
  191.66 1539.09    192.2  1539.1   194.59 1539.14   201.53 1539.25  213.55 1539.43
   228.5 1539.69   234.83 1539.79   242.14  1539.9   242.46 1540.21  242.64  1540.4

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   25.99    .025  128.62    .045   194.59    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        102.76  128.99            121.42  121.57  123.68             .1      .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 3972.552

INPUT
Description:
Station Elevation Data     num=      51
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1540.98     8.99 1538.89    32.39 1533.41      43  1533.6   46.38 1533.67
   52.49 1533.52    60.15 1533.33    61.54 1533.26    65.72 1533.06   68.55 1532.82
   74.08 1532.49     77.2  1532.3    77.22  1532.3     78.5 1532.22   80.01 1532.19
   81.31 1532.15    86.34 1532.01    92.05 1531.75    92.69 1531.74      95 1531.63
  101.29 1531.36   103.85 1531.97   106.41 1532.55   108.04 1532.13  108.59 1531.98
   109.1 1531.98   109.66 1531.98    110.8 1531.98    112.3 1531.98  118.54 1531.98
  120.73 1532.29   122.28 1532.49    126.5 1532.55   131.24  1532.6  135.21 1532.78
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  145.64 1533.64  152.99 1535.54  162.32 1538.27   168.3 1538.35  170.91 1538.34
  172.35 1538.33  172.91 1538.32  175.74 1538.38  192.76 1538.73  194.94 1538.78
  197.14  1538.8  214.08 1538.99  214.22 1539.13  214.58 1539.49  219.21 1539.56
  225.43 1539.62

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045    77.2    .025  109.66    .045  175.74    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         77.22   109.1             122  119.64  116.59            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 3852.914

INPUT
Description:
Station Elevation Data    num=      48
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1545.84    2.94 1546.11    9.05 1545.36   21.74 1543.75   24.76 1543.23
   31.44 1542.04   37.39    1542   41.45 1542.06   54.14 1539.16   80.17 1533.08
   84.84 1532.92  100.36 1532.68  101.36 1532.66  101.95 1532.66  104.64 1532.66
  119.24 1532.66  126.93 1531.14  127.03 1531.14  148.78 1530.84  149.54 1531.06
  152.97 1531.99   153.8 1532.08  155.98  1532.3  158.08  1532.3  158.44  1532.3
  162.92  1532.3  168.41 1532.29  172.68 1532.28  184.36 1532.31  191.23 1532.72
  195.08 1533.13  209.09 1536.68  210.69 1537.07   213.2 1537.22  219.19 1537.59
  220.96 1537.69  222.32 1537.69   222.8 1537.68  225.75 1537.77  227.23 1537.81
  244.55  1538.3  260.75 1538.35  261.16 1538.35  261.19 1538.38  261.66 1538.85
  266.65 1538.85  268.95 1538.85   271.2 1538.87

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045  119.24    .025  155.98    .045  225.75    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        119.24  155.98            40.17   40.19   40.37            .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 3816.660

INPUT
Description:
Distance from Upstream XS =    36.25
Deck/Roadway Width        =        3
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       80
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1545.37    1.59 1545.52    5.43 1545.05   20.37 1543.58   22.19 1543.25
   23.24 1543.05   30.32 1541.73   35.25 1541.75   40.51 1541.81   48.19 1539.68
    64.7 1535.26   74.25 1533.18   74.29 1533.17    74.3 1533.17   75.06 1533.09
   80.07 1532.45   84.95 1532.44   86.06 1532.39   91.26 1532.38   92.02 1532.41
  100.73 1532.67  103.37 1532.69  114.49 1532.78   115.1 1532.78  116.31 1532.74
   118.1 1532.74  120.13 1532.75  120.73 1532.71   120.8 1532.71  121.55 1532.49
  125.17 1531.41  125.77 1531.23  126.34 1531.06  128.81 1530.95   134.4 1530.96
  137.71 1530.91  138.47  1530.9  140.98 1530.92  147.07 1530.92  149.73 1531.72
  150.13 1531.79  150.23 1531.81  152.14 1532.12  153.21 1532.26  155.76 1532.62
  156.34 1532.69  156.96 1532.69  157.21  1532.7  165.62 1532.78  166.64  1532.8
     176 1532.89  183.87 1532.96  191.73 1533.02  192.22 1533.03  195.88 1533.39
  198.57 1533.55  199.06 1533.64  203.38 1534.86  204.58 1535.21   208.5 1536.47
  209.85 1536.91  213.57  1537.1  220.03 1537.46  221.19 1537.46  222.03 1537.46
  224.95 1537.55   230.9 1537.72  237.82 1537.93  243.76  1538.1  248.11 1538.11
  250.53 1538.12  259.05 1538.14  260.38 1538.14  260.49 1538.25  260.88 1538.64
  262.78 1538.65  264.39 1538.66  268.34 1538.69  271.29 1538.68  273.07 1538.68

Upstream Embankment side slope             =     100 horiz. to 1.0 vertical
Downstream Embankment side slope           =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins        =
Weir crest shape                           = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 3812.718

INPUT
Description:
Station Elevation Data    num=      64
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1545.34    1.31 1545.46    3.32 1545.21    20.1 1543.56   20.49 1543.49
   30.15 1541.68   31.89 1541.69    40.3 1541.79   52.62 1538.36   64.39 1535.21
   76.58 1532.56   81.11 1531.66   86.78 1530.94   88.11 1530.91   99.77 1530.85
  101.02 1530.85  115.79 1530.78  117.64 1530.81  117.76 1530.81  122.13 1530.67
  122.19 1530.65  123.14 1530.35   124.9 1529.82   125.5 1529.65  126.68 1529.29
  128.74 1529.66  131.04 1530.15  135.41 1530.07   135.8 1530.06  136.66 1530.06
  137.96 1529.89  141.14 1529.64  144.51 1529.33  145.05 1529.36  148.39 1529.72
  149.37 1529.89  149.53 1529.92  151.79 1530.32  153.03 1530.58  153.75 1530.72
```

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 153.96 1530.77  154.15  1530.8  156.71  1530.8  156.93  1530.8  163.66 1530.79
 175.63 1530.88  176.48 1530.86  185.26 1531.04  185.99 1531.09  194.12 1532.44
  197.5 1533.37  200.62 1534.06  204.29 1535.13  206.24 1535.76  209.87 1536.95
 219.66 1537.43  219.78 1537.44  221.81 1537.44  224.73 1537.53  243.52 1538.08
 260.15 1538.11  260.65 1538.61  268.15 1538.67  271.65 1538.66

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045  122.13    .025  154.15    .045  224.73    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
        122.19  154.15             12.91   13.23   14.34             .1        .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 3799.484

INPUT
Description:
Station Elevation Data     num=      52
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1545.23      .49 1545.28     5.18 1544.88    19.52 1543.47    23.62 1542.77
   29.87 1541.58    34.48 1541.63    39.68  1541.7    58.46 1536.48    65.96 1534.55
   82.27 1531.19    90.01 1530.89    92.25 1530.85    97.52 1530.79   114.34  1530.8
  120.46 1530.42   121.33 1530.44   124.06 1530.38   124.64 1530.37   129.21 1530.27
  130.91  1530.3   133.11 1530.24   136.09 1530.22   138.84 1530.22   149.97 1530.22
  150.42 1530.25    153.5 1530.53   155.88 1530.79    156.1 1530.82   157.96 1531.02
  159.81 1531.03   168.17 1531.07   180.24 1530.89   184.62 1531.08   190.59 1531.56
  196.62 1533.34   200.62 1534.22   205.49 1535.58   210.04 1537.09    216.6  1537.3
  219.11 1537.35   219.93 1537.35   221.14 1537.36   224.03 1537.45   225.63 1537.49
  242.87    1538   255.16 1538.02   259.47 1538.02   259.72 1538.28   259.97 1538.52
  262.56 1538.55   263.63 1538.56

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045  124.06    .025   156.1    .045  224.03    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
        124.64  155.88            162.02  161.91  161.64             .1        .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 3637.573

INPUT
Description:
Station Elevation Data     num=      42
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1539.52      8.2 1539.48    10.11 1539.48    16.96 1537.81    44.66 1531.05
    58.7 1530.51    66.46 1530.32    84.83 1529.99    89.98 1529.57    90.65 1529.51
   90.96 1529.48    91.05 1529.48    93.83 1529.52   106.24 1529.78   116.78 1529.99
  117.42 1530.04    121.8 1530.34   122.98 1530.32   123.73  1530.3   125.89 1530.26
  145.07 1530.44    152.8 1530.47   154.43 1530.49   157.33 1530.84   160.44 1531.21
  171.35  1534.2      178 1535.97   182.64 1536.12   187.53 1536.24   188.64 1536.28
  189.47 1536.32   192.13 1536.39   192.79  1536.4   211.24 1536.92   224.68 1537.02
  227.81 1537.04   228.29 1537.52   228.31 1537.54   228.81 1537.54   233.27 1537.45
   236.1  1537.4   239.23 1537.45

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   90.65    .025  122.98    .045  192.79    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
         91.05  123.73            224.71  224.26  223.15             .1        .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 3413.317

INPUT
Description:
Station Elevation Data     num=      56
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1536.75     4.12 1536.75    12.23 1536.71    23.12 1534.27    27.32 1533.38
   39.61 1530.79    40.32 1530.74    48.26 1530.02    48.48 1530.02    48.93     1530
   63.93 1530.14    65.47 1530.12    78.01 1530.22    81.22  1530.2    81.64 1530.18
   82.11 1530.12    83.87 1529.77    88.86 1528.79    88.91 1528.78     89.4 1528.69
   91.82 1528.46    95.92  1528.5   108.55 1528.39   110.84 1528.36   116.55 1530.08
   117.3 1530.06   118.11 1530.28   119.23  1530.3   119.25  1530.3   120.13 1530.31
  143.01 1530.39   143.78 1530.41   146.75 1530.52   159.45 1530.79   167.11 1532.52
  167.51 1532.61   167.74 1532.67   167.89  1532.7   175.43 1534.53   175.69 1534.77
  175.78 1534.88   183.21 1535.01   184.91 1535.03    185.3 1535.05   186.68 1535.11
  189.59 1535.18   190.71  1535.2   208.54 1535.62      219 1535.73   225.03 1535.81
   225.2 1535.97   225.53 1536.31   229.64 1536.24   233.66 1536.17   235.79 1536.22
  236.01 1536.22

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   82.11    .025  119.25    .045  190.71    .018
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         82.11  120.13             12.77   12.79   12.91             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 3404.692

INPUT
Description:
Distance from Upstream XS =     8.62
Deck/Roadway Width        =        3
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =        59
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
   -31.5 1540.39  -27.12 1540.68  -25.28 1539.95  -22.06 1538.68  -10.82 1534.36
    -.47 1536.62    11.8 1536.56   20.81 1534.55   25.68 1533.42   32.49 1532.02
   36.04 1531.27   39.83 1530.66   40.78 1530.58   49.12 1530.11   50.96 1530.12
    63.3 1530.16   70.18 1530.13   73.31 1530.16   78.46 1530.07   80.69 1530.06
   83.12 1529.55   87.15 1528.78   88.05 1528.71    88.1  1528.7   89.57 1528.59
   92.44 1528.36   94.15  1528.2  104.54 1528.29  104.59 1528.29   109.1 1528.27
  112.81 1529.33  116.11 1530.33  118.47 1530.37  119.21 1530.38  120.36  1530.4
  122.51 1530.42  128.74 1530.53  131.32 1530.54  143.46 1530.51  151.12 1530.44
  152.82 1530.47  157.99 1530.48  162.39 1531.17  163.67 1531.47  165.67 1531.99
  174.33 1534.34  174.48 1534.46  174.98 1534.79  184.13 1534.97  185.15 1535.02
  185.91 1535.06  189.98 1535.15  207.77 1535.57  224.25 1535.76  224.75 1536.26
  227.76 1536.21  232.91 1536.11  235.08 1536.16  235.53 1536.16

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 3400.519

INPUT
Description:
Station Elevation Data    num=      69
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1536.55    4.47 1536.53   12.26 1536.49   18.51 1535.09   26.51 1533.25
   34.38 1531.62   37.02 1530.73   38.59 1530.29   43.12  1529.4   43.45 1529.37
   50.97 1528.73   52.28 1528.76    62.8 1528.85   65.18 1528.88   74.36 1529.01
   77.44 1529.06   82.53 1528.84   84.56 1528.31    87.8 1527.38   88.32 1527.33
    88.4 1527.33    88.6 1527.31   89.79 1527.11   93.36 1526.54    93.8 1526.49
   94.74 1526.48   103.1 1526.46  106.62 1526.51  106.87 1526.52  109.27 1526.81
  112.78 1527.67  114.07 1528.01  114.59 1528.17  118.73 1528.51  119.01 1528.54
  119.42 1528.54  120.58 1528.57  124.52 1528.85  126.87  1528.9  132.47 1528.79
  139.56 1528.65   141.8 1528.72  151.05 1528.79  151.22 1528.78  152.15 1528.92
  158.42    1530  162.45 1530.95  167.08 1532.24  174.46 1534.25  175.04 1534.62
  175.26 1534.75  179.59 1534.84  182.71  1534.9  184.41 1534.93  185.95 1535.02
   186.2 1535.03  190.29 1535.12  206.39  1535.5  208.07 1535.54  208.99 1535.55
  209.98 1535.56  212.21 1535.59  224.54 1535.74  224.86 1536.06  225.04 1536.24
  226.88 1536.21  228.37 1536.18  233.22 1536.07  236.14 1536.14

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   82.53    .025  118.73    .045  190.29    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         82.53  119.42             14.6   14.61   14.63             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 3385.912

INPUT
Description:
Station Elevation Data    num=      51
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0  1536.3     5.4 1536.27   12.21 1536.25   23.79 1533.57   31.27 1531.83
   42.37 1528.69    45.5 1528.07   50.11 1527.62   53.32 1527.75    71.5 1527.94
   77.67 1527.96   83.53 1527.67    83.9 1527.66   84.97 1527.26   87.55  1526.2
   87.81 1526.09  103.99 1526.23  109.68 1526.28   113.5 1527.74  113.59 1527.77
  113.65 1527.77  118.01 1527.83  118.54 1527.83  123.22  1527.9  127.46 1527.91
  131.93 1527.88  135.88 1527.89  148.41 1527.93  154.05 1528.67  154.89 1528.82
  156.45 1529.21  171.39 1533.69  174.61 1534.61  175.63 1534.64   178.7 1534.71
  183.75 1534.82  184.25 1534.85  185.57 1534.94  189.69 1535.03   201.5 1535.31
  203.91 1535.37  207.43 1535.45  209.68 1535.47  211.31 1535.49  221.66  1535.6
  223.89 1535.62  223.92 1535.65  224.39 1536.12  225.23 1536.11  232.63 1535.96
  234.39 1536.01

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   83.53    .025  113.65    .045  189.69    .018
```

```
Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.   Expan.
          83.9  113.65            109.13  109.41  110.24             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 3276.504

INPUT
Description:
Station Elevation Data    num=      39
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1534.61   23.79 1529.23   28.79 1528.11   39.04 1527.64   39.68 1527.64
   65.75 1527.85   72.83 1526.18   73.22 1526.08   73.74 1525.96   73.93 1525.91
   75.55 1525.92    94.3 1525.92   99.87 1527.24  102.72 1527.92   102.9 1527.92
  103.14 1527.92  113.19 1527.87  140.83 1528.26  143.01 1528.38  146.99 1529.57
  160.74 1533.75  161.53 1533.71  162.88 1533.63   168.1 1533.73  169.82 1533.76
  170.47 1533.86  171.75 1534.05   174.8 1534.12  183.66 1534.32  189.15 1534.44
   193.6 1534.54  198.31 1534.57   201.3 1534.59     210 1534.66  210.49 1535.14
   210.5 1535.16  210.69 1535.16   217.9 1535.17   220.8 1535.22

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   65.75    .025  103.14    .045   174.8    .018

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.   Expan.
         65.75   102.9             135.74  135.15  134.13             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 3141.353

INPUT
Description:
Station Elevation Data    num=      30
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  1532.8    3.64 1532.05    7.74 1531.24    24.9 1527.76   30.36 1527.56
   32.15 1527.48    48.5 1527.52   51.98 1527.51   55.78 1527.47   64.59 1527.34
    70.8 1525.84   71.04 1525.78   71.38  1525.7   71.49 1525.67   75.27 1525.66
   93.53 1525.63     100 1527.16  100.45 1527.27  101.25 1527.46  101.75 1527.57
  110.25 1527.58  113.22 1527.58  124.07 1527.51  132.04 1527.67  139.12 1527.82
  141.87 1527.93  143.76 1528.01  146.33 1528.72   155.3 1531.04  160.09 1532.48

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   64.59    .025  101.75    .045

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.   Expan.
         64.59  101.75            30.98   30.96   31.09             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 3116.898

INPUT
Description:
Distance from Upstream XS =    24.45
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       70
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
      -3 1532.48    -.51 1532.49    6.08 1531.12   12.47  1529.7   19.61 1528.33
   19.95 1528.25   22.63  1527.9   23.02 1527.86   27.11 1527.32   35.14 1527.39
    35.4 1527.39   38.42 1527.41   42.93 1527.34    43.3 1527.35   50.57 1527.25
   51.45 1527.25   61.06 1527.37   63.92 1527.34   64.08 1527.34   64.77 1527.28
   67.47 1526.76   67.96  1526.6   69.51 1526.33   69.95 1526.25   73.28 1525.66
   73.49 1525.61   74.55 1525.61   80.06 1525.52   80.32 1525.51   86.63  1525.4
   87.11 1525.47    87.8  1525.6   93.58 1525.83   96.59 1526.57   98.78 1527.18
   99.51 1527.38   99.73 1527.38   102.2 1527.32  106.51 1527.43  114.66 1527.45
  117.61 1527.45  125.62 1527.47  126.04 1527.47  133.15 1527.53  133.89 1527.55
  141.03 1527.61  145.54 1527.78  145.88 1527.86  156.77    1531  157.18 1531.09
   157.3 1531.16   159.3 1532.36  159.45 1532.34  162.44 1531.96  165.84 1531.98
  169.42 1532.03  170.91 1532.17   171.6 1532.23  174.02 1532.29  181.75  1532.5
  193.01 1532.79  200.18 1532.89  206.57 1532.97  209.61 1533.01  209.79 1533.18
  210.11 1533.51  210.95 1533.49  212.36 1533.46  217.85 1533.36  218.06 1533.37

Upstream Embankment side slope             =     100 horiz. to 1.0 vertical
Downstream Embankment side slope           =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins        =
Weir crest shape                           = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 3110.386

INPUT
```

Description:
Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1532.32	3	1532.37	3.34	1532.38	3.93	1532.25	16.09	1529.54
18.57	1529.06	22.12	1528.29	24.43	1527.83	28.3	1527.06	32.11	1526.39
33.54	1526.11	39.71	1525.24	43.3	1525.19	49.69	1525.17	56.31	1525.15
57.37	1525.14	67.92	1524.92	68.86	1524.92	69.92	1524.58	72.81	1523.74
72.85	1523.74	73.25	1523.72	73.49	1523.71	75.74	1523.64	79.61	1523.61
84.28	1523.54	89.88	1523.35	97.44	1523.39	97.58	1523.43	101.23	1524.57
102.07	1524.58	102.29	1524.6	103.21	1524.68	104.4	1524.78	108.3	1524.87
114.66	1525.01	117.82	1525.06	125.1	1525.12	126.01	1525.14	133.32	1525.19
136.02	1525.26	136.53	1525.34	143.85	1526.28	145.92	1526.62	148.77	1527.35
159.13	1530.42	161.11	1530.99	161.66	1531.34	163.11	1532.31		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	68.86	.025	102.29	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
68.86	102.29	24.24	24.4	24.86	.1	.3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 3085.983

INPUT
Description:
Station Elevation Data num= 54

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1531.8	3.09	1531.87	15.42	1529.3	19.34	1528.49	22.21	1527.8
29.87	1526.2	32.03	1525.66	32.94	1525.44	39.36	1525.15	42.92	1524.76
49.97	1524.8	57.69	1524.84	65.33	1524.97	67.33	1524.97	68.49	1524.92
70.64	1524.77	72.36	1524.23	72.78	1524.07	73.1	1523.95	75.22	1523.14
85.95	1522.97	96.36	1522.96	100.18	1524.13	102.93	1524.65	103.07	1524.68
103.67	1524.74	105.41	1524.91	112.52	1524.93	112.59	1524.93	121.57	1524.76
123.37	1524.73	123.82	1524.74	125.2	1524.75	134.39	1524.93	136.91	1525.17
141.21	1525.57	153.94	1528.58	154.5	1528.7	155.47	1528.92	166.14	1531.55
173.89	1531.67	175.19	1531.69	175.56	1531.71	177.34	1531.81	179.85	1531.89
182.09	1531.95	198.71	1532.43	210.19	1532.56	215.43	1532.61	215.93	1533.1
215.93	1533.11	216.04	1533.11	223.57	1532.89	224.99	1532.92		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.045	70.64	.025	103.67	.045	179.85	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
70.64	102.93	96.26	98.69	97.66	.1	.3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 2987.290

INPUT
Description:
Station Elevation Data num= 46

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1530.26	5	1529.32	12.75	1527.76	15.78	1527.03	19.64	1526.22
22.5	1525.64	26.46	1525.57	30.71	1525.44	33.11	1525.37	42.1	1525.24
56.58	1525.04	64.04	1524.93	64.72	1524.73	69.54	1523.29	69.9	1523.18
70.78	1522.92	71.96	1522.56	80.84	1522.5	92.24	1522.47	97.5	1523.84
100.27	1524.57	102.87	1524.58	102.96	1524.58	107.03	1524.61	128.25	1524.74
132.18	1525.08	135.41	1525.3	145.51	1527.99	151.07	1529.5	162.78	1530.13
165.94	1530.25	168.79	1530.38	170.98	1530.41	180.21	1530.58	181.66	1530.67
182.39	1530.71	185.02	1530.76	194.37	1530.94	203.83	1531.13	214.43	1531.22
220.58	1531.27	220.71	1531.4	221.08	1531.77	225.45	1531.69	229.46	1531.62
229.47	1531.62								

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.045	64.04	.025	100.27	.045	185.02	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
64.04	100.27	136.21	127.37	123.69	.1	.3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 2859.922

INPUT
Description:
Station Elevation Data num= 46

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1529.52	14.26	1526.2	18.89	1525.14	22.33	1524.83	41.72	1524.67
46.44	1524.64	53.63	1524.49	55.38	1524.08	60.16	1522.69	60.19	1522.69
61.06	1522.7	67.25	1522.77	82.48	1522.51	82.79	1522.56	90.47	1524.09
93.45	1524.16	99	1524.28	107.7	1524.47	114.81	1524.54	117.17	1524.57
135.01	1524.42	140.41	1524.32	143.46	1524.06	145.92	1524.07	147.25	1524.2
153.87	1525.98	165.61	1528.92	172.69	1529.31	175.32	1529.45	175.92	1529.48
177.25	1529.52	180.08	1529.58	193.72	1529.86	197.14	1529.93	198.94	1529.95

```
  200.66 1529.95  201.46 1529.95  202.41 1529.95  204.51 1529.96  212.95 1529.97
  215.72 1529.97  216.01 1530.26  216.22 1530.47  220.95 1530.53  223.62 1530.56
  226.05  1530.6

Manning's n Values          num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   53.63    .025   90.47    .045  180.08    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         53.63   90.47             35.43   21.37   17.22            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 2838.551

INPUT
Description:
Station Elevation Data     num=      59
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1529.88      .24 1529.84     6.72 1529.07    26.38 1526.83    43.32 1526.69
   55.73 1526.69    62.54  1526.5    68.06 1526.53    68.65 1526.52    70.39 1526.45
   83.56 1526.09    86.42 1525.99     89.1 1525.85    90.91 1525.73   103.45 1525.02
     108 1524.88    120.7 1524.47   122.04 1524.43   123.86  1524.4   140.65 1524.26
  145.63  1522.9   147.92 1522.68   148.36 1522.59     149 1522.44   149.19  1522.4
  156.25  1522.5   162.03 1522.41    162.7 1522.41   170.59 1522.51   172.06 1522.72
  176.94 1523.65   178.26  1523.9    178.7 1523.92   181.26 1524.04   192.96 1524.57
   193.8  1524.6   207.83 1524.51   218.64 1524.54   220.49 1524.23   224.27 1523.56
  225.96 1523.61   231.66 1523.87   245.43 1527.34   251.01 1528.78   255.55 1529.04
  261.05 1529.35   262.01 1529.42   263.04 1529.47   265.84 1529.53   268.81 1529.59
  284.81 1529.82   300.59  1529.8   301.46  1529.8   301.59 1529.93    301.9 1530.24
  301.96  1530.3   302.25  1530.3   305.27 1530.33   308.43 1530.36

Manning's n Values          num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045  140.65    .025  178.26    .045  265.84    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        140.65   178.7              4.4    4.62    5.59            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 2833.935

INPUT
Description:
Station Elevation Data     num=      64
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1530.18     4.64 1530.26    22.95 1528.19    35.91  1526.7    44.44 1526.64
   62.98 1526.64     72.2  1526.4    73.65 1526.41    74.52  1526.4    75.11 1526.38
   79.56 1526.25    92.39 1525.78   104.78 1525.16   105.41 1525.11   109.38 1524.91
  114.67 1524.75   121.45 1524.54    128.5 1524.45   135.16 1524.29   144.42 1524.21
  145.29  1524.2   145.72 1524.08   147.09 1523.56   152.99 1521.47    153.9 1521.15
   155.4 1520.61   161.58 1520.62    162.3 1520.62   163.01 1520.62   168.98 1520.71
  170.73  1520.7   171.96  1520.9   173.06 1520.96   180.17 1523.29   180.33 1523.32
  182.66 1523.75   183.82 1523.82   185.35 1523.89   185.57  1523.9   194.03  1524.5
  199.97 1524.54   208.38 1524.51   214.45 1524.47   218.72 1524.48   223.92 1523.61
  224.86 1523.44   231.63 1523.63   235.24  1523.8   243.83 1525.96    254.6 1528.74
  263.55 1529.25   264.75 1529.32   266.52 1529.45   266.76 1529.46   268.09 1529.48
  269.55 1529.51   288.56 1529.78   299.87 1529.76   305.17 1529.74   305.35 1529.92
  305.67 1530.24   309.32 1530.27      313 1530.29   313.25  1530.3

Manning's n Values          num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045  145.29    .025  185.57    .045  269.55    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        145.29  185.57             34.95   34.27   33.65            .3       .5
Ineffective Flow      num=       2
   Sta L   Sta R    Elev  Permanent
       0     153  1525.2          T
     174  313.25  1525.2          T

CULVERT


RIVER: SunValley
REACH: Reach1             RS: 2817

INPUT
Description:
Distance from Upstream XS =       12
Deck/Roadway Width        =       20
Weir Coefficient          =      2.6
Upstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
       0  1525.2    1520      320  1525.2    1520

Upstream Bridge Cross Section Data
Station Elevation Data     num=      64
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
```

```
      0 1530.18    4.64 1530.26   22.95 1528.19   35.91  1526.7   44.44 1526.64
  62.98 1526.64    72.2  1526.4   73.65 1526.41   74.52  1526.4   75.11 1526.38
  79.56 1526.25   92.39 1525.78  104.78 1525.16  105.41 1525.11  109.38 1524.91
 114.67 1524.75  121.45 1524.54   128.5 1524.45  135.16 1524.29  144.42 1524.21
 145.29  1524.2  145.72 1524.08  147.09 1523.56  152.99 1521.47   153.9 1521.15
  155.4 1520.61  161.58 1520.62   162.3 1520.62  163.01 1520.62  168.98 1520.71
 170.73  1520.7  171.96  1520.9  173.06 1520.96  180.17 1523.29  180.33 1523.32
 182.66 1523.75  183.82 1523.82  185.35 1523.89  185.57  1523.9  194.03  1524.5
 199.97 1524.54  208.38 1524.51  214.45 1524.47  218.72 1524.48  223.92 1523.61
 224.86 1523.44  231.63 1523.63  235.24  1523.8  243.83 1525.96   254.6 1528.74
 263.55 1529.25  264.75 1529.32  266.52 1529.45  266.76 1529.46  268.09 1529.48
 269.55 1529.51  288.56 1529.78  299.87 1529.76  305.17 1529.74  305.35 1529.92
 305.67 1530.24  309.32 1530.27     313 1530.29  313.25  1530.3

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045  145.29    .025  185.57    .045  269.55    .018

Bank Sta: Left   Right    Coeff Contr.   Expan.
        145.29  185.57             .3       .5
Ineffective Flow      num=        2
   Sta L   Sta R    Elev  Permanent
       0     153  1525.2        T
     174  313.25  1525.2        T

Downstream  Deck/Roadway Coordinates
    num=        2
     Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
       0  1525.2    1520      320  1525.2    1520

Downstream Bridge Cross Section Data
Station Elevation Data     num=       70
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1531.05      .68 1531.08   21.87 1524.26   24.73 1523.61   25.45  1523.5
   25.98 1523.56    26.68 1523.35   29.35 1523.34   37.73 1523.38    39.7 1523.54
    41.7 1523.42    42.31 1523.37   43.38 1523.36   52.55 1523.35   55.71 1523.35
   59.39 1524.43    66.19 1526.05   68.48 1525.77    73.1 1525.12   77.79  1524.3
   79.16 1524.14    79.98 1524.02   88.44 1523.03   92.73 1522.93   98.47 1522.86
  105.01 1522.77   109.97 1522.68  112.55 1522.79  112.85 1522.76  114.54 1522.63
  120.53 1522.59   122.28 1522.51  126.85 1521.46   130.6 1520.66  130.99 1520.58
   131.2 1520.54   131.73 1520.36  131.98 1520.28  141.24 1520.37  152.06 1520.53
  153.64 1520.61   155.65 1521.14  159.08 1522.19  161.37 1522.16  161.47 1522.17
  161.73 1522.19   163.09 1522.48  163.73 1522.58  164.65 1522.49  179.46 1522.77
  186.84 1522.74   191.31 1522.72  199.75 1522.95  204.68 1523.18  218.88 1526.87
  225.68 1528.64      232 1529.01  235.86 1529.24  237.26 1529.33  237.97 1529.37
  240.23 1529.39   240.68 1529.39  259.75  1529.5  276.26 1529.37  276.27 1529.37
  276.28 1529.37   276.77 1529.87  276.85 1529.87  284.08 1529.85  285.63 1529.88

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045  122.28    .025  161.47    .045  240.68    .018

Bank Sta: Left   Right    Coeff Contr.   Expan.
        122.28  161.47             .3       .5
Ineffective Flow      num=        2
   Sta L   Sta R    Elev  Permanent
       0     132  1525.2        T
     153  285.63  1525.2        T

Upstream Embankment side slope                =       0 horiz. to 1.0 vertical
Downstream Embankment side slope              =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =      .98
Elevation at which weir flow begins           =
Energy head used in spillway design           =
Spillway height used in design                =
Weir crest shape                              = Broad Crested

Number of Culverts =  1

Culvert Name      Shape      Rise    Span
Culvert #1            Box        3      10
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss Coef
                 12      20     .017     .017        0                  .4                1
Number of Barrels =  2
Upstream   Elevation =  1520.6
Centerline Stations
    Sta.    Sta.
     158     169
Downstream Elevation =  1520.3
Centerline Stations
    Sta.    Sta.
     137     148

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 2799.662

INPUT
Description:
Station Elevation Data     num=       70
```

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1531.05	.68	1531.08	21.87	1524.26	24.73	1523.61	25.45	1523.5
25.98	1523.56	26.68	1523.35	29.35	1523.34	37.73	1523.38	39.7	1523.54
41.7	1523.42	42.31	1523.37	43.38	1523.36	52.55	1523.35	55.71	1523.35
59.39	1524.43	66.19	1526.05	68.48	1525.77	73.1	1525.12	77.79	1524.3
79.16	1524.14	79.98	1524.02	88.44	1523.03	92.73	1522.93	98.47	1522.86
105.01	1522.77	109.97	1522.68	112.55	1522.79	112.85	1522.76	114.54	1522.63
120.53	1522.59	122.28	1522.51	126.85	1521.46	130.6	1520.66	130.99	1520.58
131.2	1520.54	131.73	1520.36	131.98	1520.28	141.24	1520.37	152.06	1520.53
153.64	1520.61	155.65	1521.14	159.08	1522.19	161.37	1522.16	161.47	1522.17
161.73	1522.19	163.09	1522.48	163.73	1522.58	164.65	1522.49	179.46	1522.77
186.84	1522.74	191.31	1522.72	199.75	1522.95	204.68	1523.18	218.88	1526.87
225.68	1528.64	232	1529.01	235.86	1529.24	237.26	1529.33	237.97	1529.37
240.23	1529.39	240.68	1529.39	259.75	1529.5	276.26	1529.37	276.27	1529.37
276.28	1529.37	276.77	1529.87	276.85	1529.87	284.08	1529.85	285.63	1529.88

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.045	122.28	.025	161.47	.045	240.68	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
122.28	161.47	39.66 33.35	37.94	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	132	1525.2	T
153	285.63	1525.2	T

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 2766.312

INPUT
Description:
Station Elevation Data num= 66

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1531.63	.48	1531.63	5.45	1528.4	10.98	1524.72	18.55	1525.99
22.22	1526.67	27.23	1526.59	29.24	1526.62	29.69	1526.64	31.04	1526.64
38.47	1523.91	41.27	1523.03	42.89	1523.09	46.66	1523.23	48.48	1523.44
55.28	1523.76	59.26	1523.78	62.76	1523.31	63.58	1523.23	64.3	1523.22
69.47	1523.22	70.07	1523.67	70.45	1523.79	73.21	1523.72	80.85	1523.52
83.32	1522.76	83.83	1522.59	90.22	1522.52	90.95	1522.51	92.98	1522.32
94	1522.25	96.95	1522.65	99.85	1523.09	106.27	1523.25	106.83	1523.19
108.07	1523.14	122.8	1522.46	124.92	1522.42	127.55	1522.36	134.01	1521.26
136.8	1520.77	136.83	1520.76	136.87	1520.76	141.21	1520.69	144.38	1520.76
148.93	1521.27	158.46	1521.45	160.64	1521.5	164.27	1521.99	165.62	1522.19
168.56	1522.29	168.97	1522.31	170.23	1522.36	175.3	1522.58	176.21	1522.62
177.85	1522.53	187.7	1522.3	198.51	1522.68	200.31	1522.65	201.11	1522.72
204.35	1523.57	224.45	1528.65	225.44	1528.7	233.61	1529.17	234.08	1529.17
235.67	1529.22								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	127.55	.025	168.56	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
127.55	168.97	79.48 111.17	106.16	.1	.3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 2655.140

INPUT
Description:
Station Elevation Data num= 41

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1531.72	8.88	1525.08	9.45	1524.63	13.04	1525.28	21.68	1526.88
27.55	1526.95	29.59	1526.97	30.59	1527.01	32.58	1526.56	51.76	1522.85
54.89	1522.91	55.98	1522.96	63.1	1523	67.37	1523.12	81.1	1522.55
81.7	1522.4	83.33	1522.27	87.01	1521.99	89.68	1521.93	92.74	1521.7
96.24	1521.46	97.37	1521.42	97.39	1521.42	98.05	1521.4	99.35	1521.36
121.79	1520.86	126.14	1521.61	130.69	1521.66	131.58	1521.68	131.61	1521.68
139.33	1521.85	140.33	1521.88	141.11	1521.89	141.71	1521.91	160.3	1522.27
173.91	1525.6	175.55	1526	184.53	1528.21	191.4	1528.72	192.8	1528.82
194.67	1528.86								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	97.37	.025	131.58	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
98.05	131.61	119.9 116.47	117.94	.1	.3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 2538.673

INPUT
Description:
Station Elevation Data num= 26

```
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1531.02     8.33 1528.84     15.2 1528.82    16.63  1528.8    22.43 1526.84
   36.06 1522.23    38.21  1522.2    79.46 1521.94    81.49 1521.95    82.48 1521.75
    85.7 1521.13    85.94 1521.08    88.96 1520.51     99.8 1520.44   112.11 1520.36
  117.41 1521.35   118.56 1521.55   119.79 1521.56      121 1521.56   135.78 1521.62
  140.46 1521.66   152.31 1521.87   164.34 1524.79   175.53 1527.45   180.35 1527.67
   184.5 1527.86

Manning's n Values         num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
       0    .045    81.49    .025   118.56    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
         81.49  118.56             120.1  117.66  112.04              .1        .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 2421.011

INPUT
Description:
Station Elevation Data     num=      28
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1527.46     5.49 1525.99    10.23 1524.59    18.99 1522.06    25.56 1521.97
   41.97 1521.78    56.84 1521.71    64.28 1521.73    67.12 1521.14    67.14 1521.14
   67.98 1520.96    73.23 1519.87    88.57  1519.8    93.41 1519.79    94.87 1520.12
  101.05 1521.65   105.38 1521.58   105.79 1521.58   110.25 1521.51   118.77 1521.47
  133.75 1521.39   141.68 1521.52   144.45 1521.73   162.03 1526.19   162.08 1526.21
  162.16 1526.21   163.46 1526.28   170.96 1526.67

Manning's n Values         num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
       0    .045    64.28    .025   101.05    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
         64.28  101.05             22.81   22.77   22.72              .1        .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1              RS: 2403.885

INPUT
Description:
Distance from Upstream XS =    17.13
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       64
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
     -19 1528.19   -18.95 1528.28   -18.39  1529.3   -10.57 1527.24    -9.45 1526.96
   -8.73 1526.98     -.07 1527.29     3.26 1526.24    11.23 1524.07    17.81 1522.72
   18.83 1522.47    20.51 1522.16    24.21 1521.93    28.57 1521.66    29.79 1521.52
   41.24 1521.77    41.46 1521.76    43.48 1521.81    52.91 1521.85    53.79 1521.84
   65.36 1521.48    67.21     1521   67.29 1520.98    70.69 1520.09    71.59 1519.95
   74.44 1519.87    76.68 1519.65     77.8 1519.64    88.23  1519.7    89.08 1519.85
   94.73 1520.08    96.22 1520.46   101.11 1521.82   105.47 1521.78    106.3 1521.77
  111.66 1521.73    114.3 1521.69   119.06 1521.62   124.02 1521.55   126.56 1521.54
  136.37 1521.38   145.12 1521.63   145.92 1521.72   148.58 1522.22   156.37 1524.34
  162.54 1526.03   169.58 1526.36   171.35 1526.44   172.91 1526.39   173.25 1526.37
  175.46 1526.29    187.4 1525.89    193.8 1525.68   195.49 1525.62   196.77 1525.55
  197.89 1525.49   210.34  1524.8   210.51  1524.8   211.84  1524.8    212.3 1525.25
  212.34  1525.3   212.68  1525.3    220.1 1525.33   222.84  1525.4

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 2398.240

INPUT
Description:
Station Elevation Data     num=      43
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1527.25     7.97 1524.76    10.76     1524   13.05 1523.53    20.06 1521.78
   23.83 1521.09    26.13 1520.62    31.23 1519.64    41.61 1518.98    43.23 1518.96
   53.76 1518.94    54.62 1518.92       62 1518.86    67.53 1518.84    67.68 1518.84
   67.76 1518.84    69.56 1518.56    72.77 1517.71       73 1517.65    74.23 1517.76
   81.21 1517.66    91.09 1517.64    95.06 1518.58    96.83 1519.04   100.39 1519.01
  103.83 1519.13   105.39 1519.12   106.37 1519.12   110.18 1519.11   110.72 1519.12
  119.41 1518.96   120.36 1518.95   128.74  1518.8   129.95 1518.79   130.61 1518.87
  140.04     1520  140.57 1520.11   142.23 1520.48   148.81 1522.18   152.69 1523.25
  162.59 1525.97   166.75 1526.17   171.38 1526.37

Manning's n Values         num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
```

```
      0    .045   67.53    .025   96.83    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         67.68   96.83             13.22   13.59   14.43            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 2384.655

INPUT
Description:
Station Elevation Data    num=      44
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0  1527.18     2.08  1526.54    17.53  1522.16    23.85  1520.31    30.58  1519.25
   31.47  1519.15    42.74  1518.73     48.6  1518.58    56.02  1518.67    66.99  1518.77
   68.11  1518.79    68.34  1518.79    68.45  1518.76    68.59  1518.72    72.93   1517.6
   80.54   1517.5    91.09  1517.42    95.31  1518.52    95.77  1518.64   105.06  1518.71
  106.38  1518.72   107.43  1518.73   107.54  1518.73   107.63  1518.73   108.03  1518.74
  112.36  1518.25   117.71  1517.93   118.77  1517.97   119.16  1517.98   123.34  1517.99
  124.21  1518.01      128  1518.04   131.34  1518.06   132.75  1518.06   136.62  1518.08
  137.61  1518.25   141.02  1519.55   145.62  1521.14   151.21  1522.68    162.5  1525.81
  170.72  1526.15    171.3  1526.18   171.51  1526.18   173.31  1526.18

Manning's n Values        num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
       0    .045    68.11    .025    95.77    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         68.45   95.77             87.32   86.98    86.3            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 2297.673

INPUT
Description:
Station Elevation Data    num=      24
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0  1526.16    15.08  1521.79    25.67  1518.71    26.39  1518.67    32.57  1518.43
   40.66  1518.46    62.68  1518.45    66.45  1518.42    71.19  1517.36    72.17  1517.14
   72.74  1517.01    74.12  1516.69    77.21  1516.66    94.73  1516.46   102.85  1518.39
  103.32   1518.5   104.17   1518.5   123.51   1518.4   138.23  1519.09   142.19  1519.29
   143.4  1519.61    163.3  1524.84   164.87  1524.89    171.5  1525.16

Manning's n Values        num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
       0    .045    66.45    .025   103.32    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         66.45  103.32             154.29  151.97  147.14            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 2145.706

INPUT
Description:
Station Elevation Data    num=      31
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0  1526.42    17.91   1524.2    26.53  1524.48    27.47  1524.51    29.22  1524.05
   50.01  1518.47    67.86  1518.25    74.38  1518.13       82  1518.19    94.47  1518.23
   99.38  1516.74   100.79  1516.33   101.49  1516.13   101.59  1516.13    119.1   1516.2
  122.92  1516.22   128.68  1517.47   131.06  1517.99   131.63  1518.12   131.97  1518.12
  132.71  1518.12   132.73  1518.12   147.92  1518.15    161.5  1518.26   173.03  1518.37
  178.32   1519.8   190.93  1523.24    193.6  1523.29   198.83  1523.42    200.5  1523.49
  201.16  1523.51

Manning's n Values        num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
       0    .045    94.47    .025   131.97    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         94.47  132.73             34.99   34.89   34.69            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 2110.812

INPUT
Description:
Station Elevation Data    num=      31
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0   1524.2     5.03  1522.89    12.23  1521.38    23.05  1518.63    27.94  1518.33
    36.7  1518.15    40.73  1518.03    49.96  1518.04    59.06  1518.12    67.47  1518.23
   70.07  1517.53    74.17  1516.51    74.75  1516.37    74.84  1516.35    78.77  1516.33
   87.08  1516.16    95.16   1516.1    99.11  1516.94   103.56  1518.08   106.07  1518.04
  114.47  1518.04    124.4  1518.06   135.14  1518.05   141.07  1518.37   148.67  1518.48
```

```
   152.6 1519.54  164.75 1522.78  167.35 1522.85  172.52 1523.01  173.27 1523.02
   174.6 1523.06

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   67.47    .025  103.56    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         67.47  103.56             20.47   20.54   20.67             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1               RS: 2097.252

INPUT
Description:
Distance from Upstream XS =   13.56
Deck/Roadway Width        =       5
Weir Coefficient          =     2.6
 Weir Embankment Coordinates    num =       64
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
     -26 1525.62  -17.32 1524.71   -7.84 1523.72    -.17 1523.94     .24 1523.95
     .71 1523.84      .8 1523.82   13.97 1520.43   18.84 1519.08   21.84 1518.34
   26.94  1518.3   29.18 1518.23   33.62 1518.24    35.4 1518.19    42.2  1518.2
   48.95 1518.22   52.66 1518.23   66.08 1518.33   68.38 1518.21   73.23  1517.1
   75.11 1516.65   75.62 1516.53   75.92 1516.46   80.16 1516.42   85.15  1516.4
   86.91 1516.36   90.19 1516.29   95.14 1516.26   97.25  1516.8   103.2 1517.85
  103.44 1517.89  103.61 1517.89  106.41  1517.9  107.01 1517.91  112.05 1517.93
  115.49 1517.94  123.41 1517.96  128.47 1517.96  135.81 1517.96  140.85 1517.95
   144.6 1517.95  145.72 1518.01  149.38 1518.01  150.27 1518.23  152.09 1518.82
  157.43 1520.19  165.85 1522.59  172.72 1522.82  173.59 1522.85  175.51 1522.87
  175.63 1522.87   176.6 1522.84  177.16 1522.82  197.63 1522.13  204.47 1521.86
  212.71 1521.51  214.17 1521.51  214.21 1521.51  214.22 1521.52  214.71 1522.01
  215.22 1521.99   217.5 1521.95  222.13 1521.86  226.78 1521.98

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1               RS: 2090.275

INPUT
Description:
Station Elevation Data     num=      48
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1523.82     5.46 1522.51     6.45 1522.25   13.97 1520.32   19.07 1518.91
   23.08 1517.96   25.93 1517.28   34.88 1515.61   35.74 1515.52      39 1515.41
   40.29 1515.42   41.71 1515.39   47.47 1515.19   67.68 1515.13   68.23 1515.12
   69.37 1514.97   71.26  1514.7   72.37 1514.54   75.26 1513.98   75.71  1513.9
   77.05 1513.64   79.51  1513.4   82.07  1513.4   87.98 1513.42   92.93 1513.29
   95.05  1513.3  101.33 1514.75  102.83 1515.09  103.26 1515.11  106.56 1515.36
  107.02 1515.39  107.14  1515.4  109.93 1515.58  121.14 1515.56  123.09 1515.59
  134.55 1515.57   136.1 1515.67  141.84 1516.49  146.82  1517.2  149.96    1518
  152.37 1518.58  154.64 1519.25  166.07  1522.5  168.12 1522.57  171.73  1522.7
  173.82 1522.78  174.29 1522.78  175.82 1522.78

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   68.23    .025  106.56    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         68.23  107.14             12.14   12.01   11.76             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1               RS: 2078.263

INPUT
Description:
Station Elevation Data     num=      40
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1523.57     8.66 1523.42   11.06 1522.84   20.06 1520.46   21.89 1520.15
   23.46 1519.71   29.55 1518.56   41.12 1515.81   42.56 1515.68   48.31 1515.46
   57.34 1515.23   59.18 1515.17   65.66 1515.15   78.36 1514.88   78.82 1514.82
    80.1 1514.58   84.17 1513.76   84.51 1513.69   86.07 1513.37   88.52 1513.38
   90.42 1513.33     100 1513.01  104.84 1513.31  111.93 1514.66   112.8 1514.86
  113.19 1514.88  115.46 1514.88  116.03 1514.88  118.37 1514.88  124.34 1514.93
  129.18 1515.02  138.96  1515.2  142.08 1515.21  153.74  1516.2  153.92 1516.22
  154.59 1516.43  165.97 1519.75  175.05 1522.41  179.22 1522.52  182.86 1522.66

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   78.82    .025  111.93    .045
```

```
Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.   Expan.
         78.82   112.8              32.76   32.37   31.59             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 2045.894

INPUT
Description:
Station Elevation Data    num=      34
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1523.53    3.92 1522.71    17.7 1519.54   23.73 1517.91   30.51 1516.01
      35 1515.75   35.21 1515.73   36.54 1515.72   47.95 1515.58   63.39 1515.39
   68.32 1515.33   75.09 1513.76   75.62 1513.63   75.69 1513.62   76.22  1513.5
    77.2 1513.27   77.76 1513.24   78.54 1513.27   97.04 1513.21  105.12 1514.59
  106.32 1514.81  106.45 1514.81  106.93 1514.82  108.26 1514.84  115.94 1514.95
  135.87 1515.22  141.51 1515.36  144.19 1515.69  146.66 1515.95  164.25 1521.57
   166.2 1522.19  166.95  1522.2  169.47 1522.24  174.21  1522.3

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   68.32    .025  106.45    .045

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.   Expan.
         68.32  106.93             101.6  101.81   102.2             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 1944.087

INPUT
Description:
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1522.38   22.57 1516.52   27.57 1515.22   27.93 1515.18   34.83 1515.16
   69.64    1515   75.03 1513.63   75.25 1513.57   77.47 1513.01   77.54 1512.99
    78.1 1512.99   97.92 1512.76  100.04 1513.31  106.11 1514.83  106.31 1514.88
  106.42 1514.91  139.93 1515.22  143.75 1515.27  144.76 1515.41  150.15 1516.19
   165.8 1520.67  166.12 1520.76  173.54  1521.1  174.39 1521.15

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   69.64    .025  106.31    .045

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.   Expan.
         69.64  106.11             94.19    92.9   90.45             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 1851.190

INPUT
Description:
Station Elevation Data    num=      30
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1521.23    .82 1521.25    2.34 1520.87   20.23 1516.46   25.56 1515.08
   29.99 1514.97   49.83 1514.75   65.51 1514.57   69.25 1514.47   71.88 1513.96
   76.19 1513.08   76.34 1513.05   78.06  1512.7   91.44 1512.61   97.24 1512.57
  105.29 1514.41  105.84 1514.54  106.21 1514.54  107.25 1514.55  107.34 1514.55
  129.69 1514.83  146.45 1515.67  152.02 1515.91  165.29 1519.34  166.88 1519.76
  167.62 1519.78  169.06 1519.82  175.24 1519.99  176.35 1520.05   177.1 1520.09

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   69.25    .025  107.34    .045

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.   Expan.
         69.25  107.25             47.44   47.16   46.62             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 1810.842

INPUT
Description:
Distance from Upstream XS =    40.35
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       61
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
      -12 1521.68   -5.45 1520.69   -3.48  1520.4   -2.22 1520.45    4.38 1520.75
    10.43 1518.77    14.6 1517.47   19.11 1516.09   21.18 1515.51   25.07 1515.03
    27.65 1514.81   34.78 1514.64   43.94 1514.79    49.8 1514.74   63.25 1514.58
    65.89 1514.52   73.19 1514.05   78.58 1512.81   79.11 1512.63   79.35 1512.55
    80.17 1512.28   81.88 1512.26   84.88 1512.21   89.61 1512.13   92.53 1512.16
    99.26 1512.24  104.46 1513.38  107.87 1514.12  109.46 1514.16  109.53 1514.16
   119.05  1514.4  122.21 1514.47  130.54 1514.59  137.41 1514.68  139.92 1514.73
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  146.68 1514.83  149.91 1514.97  153.19  1515.2  156.51 1515.37  157.81 1515.58
  166.68 1518.48  169.07 1519.27  172.08 1519.36  177.83 1519.51  178.78 1519.57
  179.63 1519.63  182.15 1519.54  184.91 1519.45  202.23 1518.88  216.22 1518.17
  216.68 1518.14   216.8 1518.14  217.52 1518.14  218.18 1518.14  218.64  1518.6
  218.68 1518.65   222.1 1518.59  225.54 1518.53  226.19 1518.52     227 1518.53
  227.89 1518.55

Upstream Embankment side slope                =     100 horiz. to 1.0 vertical
Downstream Embankment side slope              =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins           =
Weir crest shape                              = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 1804.030

INPUT
Description:
Station Elevation Data    num=      47
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1520.69    1.95 1520.05   10.47 1517.38   13.87 1516.34   20.98 1514.54
   21.45 1514.48   26.89 1513.08   27.73 1513.05   38.87 1511.95   39.36 1511.95
   57.55 1511.44   58.42 1511.41   65.73 1511.61   66.64 1511.55   68.33 1511.12
   70.79  1510.9   74.38 1510.19   74.64 1510.13   74.91 1510.07   75.41 1509.97
   75.91 1509.86   81.82  1509.5   86.68 1509.71   91.54 1509.91   93.12 1509.96
   95.46 1510.11   96.53 1510.28   98.47  1510.9   104.9 1511.88  104.97  1511.9
   105.2 1511.93  105.89 1511.97  113.98 1512.15  121.83 1512.26     126 1512.32
  135.38 1512.49  138.12 1512.53  139.02 1512.74  145.85 1513.91  148.69 1514.59
  153.15 1515.51  156.12 1516.42  164.66 1519.17   169.2  1519.3  173.33 1519.41
  174.65 1519.49  175.22 1519.52

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   66.64    .025  104.97    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        66.64   104.9             22.53   22.16   21.42             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 1781.875

INPUT
Description:
Station Elevation Data    num=      44
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1520.41    3.85 1519.31    7.75 1518.12   17.89 1515.25   25.96 1512.89
   29.67 1512.43   37.62 1511.67   43.11 1511.55   52.44 1511.36   58.66 1511.52
   65.58 1511.59   67.39 1511.13   74.15 1509.66   74.49 1509.58    74.8 1509.51
   75.35 1509.52   93.02 1509.77   98.61 1510.77  100.49 1511.16  103.14 1511.54
  104.01 1511.53  104.06 1511.53  104.12 1511.53  112.61 1511.34  114.75 1511.49
  128.65 1511.93  128.99 1511.93  129.18 1511.88  129.47  1511.8  132.67 1510.94
  135.86 1510.36  135.91 1510.35  135.92 1510.35  138.49 1512.03   141.6 1512.79
  144.91 1513.12  163.79 1518.73  164.14 1518.82  164.35 1518.89  164.57  1518.9
   164.9 1518.91   172.7 1519.15  174.55 1519.23  174.79 1519.24

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   65.58    .025  104.06    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        65.58  104.01            138.03  135.88  131.47             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 1645.995

INPUT
Description:
Station Elevation Data    num=      29
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1518.63   10.81 1515.65   21.25 1512.56   25.21 1511.88   26.64 1511.71
   33.64 1511.56   37.18 1511.48   51.96 1511.29   67.75 1511.15   71.88 1510.18
   72.54 1510.02   73.74 1509.74   75.57  1509.3   85.47 1509.28   96.82 1509.27
  100.73 1510.21  103.33 1510.84  103.46 1510.87  104.97 1511.24  120.98 1511.36
  130.56 1511.49  148.43  1512.3  163.55 1516.83   164.3 1517.06  165.19 1517.12
  168.18 1517.31  172.98 1517.61  173.32 1517.62  175.33 1517.68

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   67.75    .025  104.97    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        67.75  104.97            131.53  130.49  128.21             .1       .3

CROSS SECTION
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RIVER: SunValley
REACH: Reach1             RS: 1515.506

INPUT
Description:
Station Elevation Data     num=      32
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1517.12   10.24 1514.49   16.43 1512.85   21.46 1511.54   32.36 1511.35
   37.69 1511.32   42.77 1511.28   56.84 1511.18   65.83 1511.11    72.2 1509.78
   73.34 1509.54   73.54  1509.5   75.45 1509.18   75.85 1509.17   76.42 1509.16
   79.55 1509.19   95.02 1509.28   99.82 1510.43  103.37 1511.31  103.47 1511.31
  104.14  1511.3  110.02 1511.28  120.68 1511.52  132.32 1511.36  140.58  1511.6
     151 1512.11  155.13 1513.18  164.49 1515.62  166.67 1515.75  172.51 1516.12
  174.22 1516.18  174.86  1516.2

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   65.83    .025  103.47    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         65.83  104.14             19.66   19.66   19.61            .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 1502.91

INPUT
Description:
Distance from Upstream XS =     12.6
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       61
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
      -36 1515.24  -35.81 1515.23  -22.33 1514.69  -18.83 1515.21  -16.87  1515.5
   -9.56 1516.69   -4.33  1516.8   -1.22 1516.86     .11 1516.87    2.83 1516.14
   16.68 1512.53   19.71 1511.82   21.13 1511.52   28.41 1511.39   30.73 1511.36
   37.64 1511.39   38.59 1511.38   45.81 1511.41   57.11 1511.31   59.67 1511.28
   68.92 1511.05   71.69 1510.49   71.75 1510.48   73.01 1510.14   74.86 1509.64
   79.47 1509.53   79.74 1509.53    81.1 1509.49   85.12 1509.16   85.56  1509.2
   94.45  1509.7   95.81 1509.75  102.52  1511.3  102.88 1511.39  103.33  1511.4
  103.88 1511.41  111.32 1511.58  112.19  1511.6  119.08  1511.6  125.63  1511.6
  127.65 1511.57  133.61 1511.47  139.39 1511.38  141.39 1511.48  150.18 1512.02
   154.4 1513.15  161.31  1514.9  162.55 1515.14  164.05 1515.46   166.7 1515.63
   172.2 1515.97  173.03 1516.01  174.41 1516.06   176.1    1516  189.77 1515.54
  196.24 1515.32   203.3 1514.99  211.17  1514.6  212.17  1514.6  212.67  1514.6
  212.93 1514.86

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 1495.849

INPUT
Description:
Station Elevation Data     num=      50
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1516.73    13.9 1512.99   16.22 1512.39    17.2 1512.16   19.36 1511.46
   21.61 1510.79   23.28 1510.36   29.22 1509.21   30.07  1509.1   36.52 1508.42
   47.11 1508.37   47.74 1508.38   58.86 1508.34   60.73 1508.28   67.79 1508.11
   70.64 1507.95   71.03 1507.88   71.44 1507.81   72.63 1507.61   74.25 1507.34
   78.94 1506.63    79.1  1506.6   79.23  1506.6   82.42 1506.47   91.62 1506.34
   92.32 1506.36   93.35 1506.53   98.56 1507.32  101.57 1507.79  103.07 1507.93
  103.56 1507.98  104.56 1508.07  106.54 1508.17  113.62 1508.22  121.19 1508.27
  123.07 1508.26  133.21 1508.41  134.22 1508.58  140.32 1509.83  144.26 1510.32
  147.65 1511.14  149.69 1511.77  160.73 1514.85  160.95  1514.9  161.12 1514.93
  163.61 1515.38   166.8 1515.58  171.88 1515.89  173.41 1515.96  173.97 1515.98

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   72.63    .025  103.07    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         71.44  103.56             16.86   15.96    13.9            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 1479.893

INPUT
Description:
Station Elevation Data     num=      35
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
```

```
      0 1516.41    3.03 1516.43   15.12 1513.12   28.72 1509.82   33.07 1508.69
   35.2 1508.32   42.81 1508.38   50.62 1508.44   64.07 1508.32   69.86 1508.19
  70.45 1507.96    72.1 1507.65   74.09 1507.25   75.01 1507.07   78.08 1506.46
  87.28 1506.43   96.61 1506.58  103.46 1507.67  103.89 1507.74     104 1507.75
 105.69 1507.86  106.08 1507.88   110.2 1508.13  118.87 1508.37  131.62 1508.27
 137.29 1508.27  139.96 1508.29  144.51 1509.61   151.7 1511.81  159.21 1513.67
 165.82 1515.18  168.54 1515.37   174.4 1515.73  175.26 1515.76  176.41  1515.8

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   69.86    .025  105.69    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         69.86  106.08            135.81  134.93  133.03             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 1344.964

INPUT
Description:
Station Elevation Data     num=      33
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1514.72    1.75 1514.72    8.37 1512.86   20.11 1509.57   25.46 1508.66
   26.31 1508.53   30.28 1508.47   44.26 1508.22   48.59 1508.13   56.26 1508.09
   67.89 1508.05   72.78  1506.8   72.86 1506.78   75.81 1506.03   76.43 1505.87
   83.33 1505.94   96.21 1506.06   99.04 1506.72  103.68 1507.79  104.87 1508.06
  118.52 1508.09  119.88 1508.09  120.92  1508.1  136.46 1508.21  142.39 1509.08
  144.34 1509.36  151.94  1511.3  158.15 1512.88  161.78 1513.81  164.14 1513.92
  170.58 1514.22  171.91 1514.22  172.52 1514.23

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   67.89    .025  104.87    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         67.89  104.87             78.43   78.51   78.68             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1              RS: 1266.459

INPUT
Description:
Station Elevation Data     num=      29
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1514.07    5.77 1513.96     8.7 1513.91   15.68 1512.25   31.46 1508.54
   33.98 1508.46   50.83 1507.94   61.13 1507.85   75.83 1507.74   80.42 1506.48
   80.64 1506.42   80.76 1506.38   82.62 1505.81   90.83 1505.71  103.63 1505.52
   110.5 1507.59  110.82 1507.68  111.49 1507.88   123.2 1507.96  143.21 1508.11
  145.18 1508.13  146.92 1508.33  153.39 1509.12  162.66 1511.53  168.24 1512.98
  176.21 1513.27  177.22 1513.31     178 1513.32   179.2 1513.32

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   75.83    .025  110.82    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         75.83  111.49             78.59   77.2974.43999             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1              RS: 1197.553

INPUT
Description:
Distance from Upstream XS =    68.91
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       64
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     -22 1511.84  -21.77 1511.84  -18.95 1511.52  -13.44 1510.77   -8.68 1511.64
    -.26 1512.97    8.69 1512.88    9.87 1512.87   12.77 1512.39   16.45 1511.73
   25.12 1509.48   29.88 1508.26   32.11 1508.05   33.55 1508.02   37.33 1507.96
   40.96 1507.91   45.62  1507.8   50.74 1507.88   56.11 1507.97   66.04 1507.96
   70.86 1507.86   75.61 1507.76   81.13  1506.4   81.21 1506.38   81.38 1506.33
   81.84 1506.24   82.43  1506.2   88.24 1505.92   91.43  1505.9   99.14 1506.01
  103.12  1506.1  104.39 1506.24  105.61 1506.58   110.5 1507.77  110.84 1507.85
  116.17 1507.82  118.47  1507.8  124.13  1507.8  129.69 1507.81  136.79 1507.75
  142.64 1507.65  145.25 1507.65  150.88 1507.56  154.52 1508.09  157.58 1508.62
  158.89 1508.83  165.87 1511.03  168.89 1511.91  171.83 1512.11  177.09 1512.47
  177.83 1512.48  179.47 1512.51  181.43 1512.46  188.97 1512.26  201.63 1511.92
  209.86 1511.49  216.46 1511.14  216.77 1511.14  217.96 1511.14  218.18 1511.35
  218.46 1511.64  222.22 1511.62  227.24  1511.6   228.8 1511.59

Upstream Embankment side slope             =     100 horiz. to 1.0 vertical
Downstream Embankment side slope           =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins        =
```

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Weir crest shape                        = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 1189.172

INPUT
Description:
Station Elevation Data    num=      48
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1512.78     .24 1512.78    10.4 1512.69      13 1512.26   16.69 1511.57
   24.55 1509.54   31.86 1507.69   36.62 1506.74   38.52 1506.42   43.25 1505.63
   44.88 1505.61   52.75 1505.21   64.97 1505.29   67.93 1505.28    68.8 1505.28
   76.57 1505.13   80.05 1504.68   81.88 1504.33   82.28 1504.27   82.48 1504.24
   85.54 1503.79   90.02 1503.73   94.27 1503.79  100.49 1503.71  103.14 1503.75
  105.45 1504.19   110.3 1505.14  111.53 1505.17  111.56 1505.17  111.81 1505.17
  113.39  1505.2   117.4 1505.25  118.12 1505.26  130.62 1505.57  131.36 1505.57
  131.63 1505.58  144.37 1506.36  145.47  1506.5  151.96 1506.99  153.92  1507.4
  154.44 1507.51  159.74 1508.74  163.12 1509.61  170.13 1511.89  177.55 1512.34
  178.36 1512.38  180.57 1512.42  180.67 1512.42

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   76.57    .025  111.53    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         76.57  111.56             23.62   23.89    24.5            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 1165.285

INPUT
Description:
Station Elevation Data    num=      41
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1512.24     2.05 1511.72   25.74 1506.35   28.31 1506.14   30.45 1505.82
   34.74 1505.22   45.99 1505.05   48.17 1505.02   48.94     1505   67.94 1505.03
   72.14 1503.95   72.57 1503.84   73.54 1503.59   75.19 1503.17   80.63 1503.16
   94.02 1503.32  100.91 1504.69  101.59 1504.82  101.64 1504.83  102.24 1504.92
  103.23 1505.07  103.39 1505.09  109.76 1505.21  113.52 1505.19  119.28 1505.12
  126.62 1505.26  127.56 1505.33  129.65 1505.18   133.8 1504.99  141.61 1506.59
  142.25 1506.71  151.65 1509.25  160.07  1511.5   160.8 1511.69  161.12 1511.77
  161.64 1511.91  162.56 1511.94  165.75    1512  169.76 1512.09  171.55 1512.12
  171.85 1512.13

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   67.94    .025  103.39    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         67.94  103.23            137.96  136.51  133.48            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 1028.773

INPUT
Description:
Station Elevation Data    num=      33
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 1510.67    10.8 1508.35   21.52 1506.05   27.22 1505.51   27.31 1505.51
    27.8 1505.51   39.89 1505.31   52.96 1505.21   58.19 1505.19   63.03 1505.15
   70.57 1505.09   71.84 1504.77   74.03 1504.17    74.1 1504.15   78.07 1503.07
    90.8 1502.97   99.39 1502.94  104.55 1504.23  106.88 1504.83  109.65 1504.87
  120.22 1505.05  127.44 1505.11  134.81 1505.15  150.47 1505.23   154.2 1505.24
  159.25 1505.83  160.94 1506.02  162.06 1506.39  173.91 1510.26  181.72  1510.4
  182.23 1510.42  182.32 1510.41   184.4 1510.41

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   70.57    .025  106.88    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         70.57  106.88             30.78   30.26    29.2            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 998.5162

INPUT
Description:
Station Elevation Data    num=      36
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  1509.7   13.22 1506.76   15.12 1506.33   15.57 1506.24   16.17 1506.21
   25.51 1505.49    26.6 1505.39    26.7 1505.39    41.2 1505.22    41.9 1505.22
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  48.29 1505.21   67.07 1505.16   68.03 1505.15   72.82  1504.2   72.95 1504.18
  74.77 1503.82   76.25 1503.41   81.72 1503.37   97.26  1503.3  104.43 1505.02
 104.76  1505.1  107.14 1505.12  107.81 1505.12  114.48 1505.18  114.93 1505.18
 115.37 1505.18  137.75 1505.36  139.01 1505.38  156.68 1505.54  157.44 1505.59
 161.29 1506.23  169.71 1508.66  173.23 1509.68  175.57 1509.74  182.25 1509.95
 183.59 1509.95

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   68.03    .025  104.43    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         68.03  104.76             16.47   16.36   16.15             .1       .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 990.7514

INPUT
Description:
Distance from Upstream XS =     7.76
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       59
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
      -27 1507.67   -26.43   1507.6   -22.63 1507.03   -14.18 1508.37    -8.2 1509.35
    -.97 1509.44      .07 1509.47     1.47 1509.13    13.06 1506.51   16.47 1505.87
   21.12 1505.63    22.67 1505.51    32.72 1505.35     35.7 1505.32   41.99 1505.28
   43.32 1505.27    49.59 1505.23    53.69 1505.22     69.3 1505.16   71.42 1504.67
   73.05 1504.38    73.25 1504.35    76.04 1503.85     80.9 1503.27   83.51 1503.24
   95.69 1503.23   101.91 1504.37   102.74 1504.56    106.8  1505.2  106.83 1505.21
  107.31 1505.21   108.36 1505.22   121.94 1505.36   124.25 1505.38  133.58 1505.36
  142.85 1505.35   144.81 1505.36   157.67 1505.43   159.02 1505.73  161.34 1506.22
  162.72 1506.57   168.41 1508.15   171.33 1508.96    173.5 1509.59  177.61  1509.7
  182.25 1509.82   182.96 1509.82   184.31 1509.82   185.95 1509.78  194.94 1509.59
  206.06 1509.31   218.97 1508.95   221.27 1508.89   222.07 1508.89  222.77 1508.89
  223.19  1509.3   223.27 1509.39   224.22 1509.38   227.57 1509.35

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 982.1498

INPUT
Description:
Station Elevation Data    num=      46
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1509.32     6.49 1507.76    11.22 1506.52    18.76 1504.82   22.87 1503.75
    28.1 1502.27    29.84 1501.94    37.06 1500.97    38.21  1500.9   51.23 1500.62
   52.41 1500.59    64.06 1500.66    64.48 1500.67    65.88 1500.59   70.87 1500.45
   72.84 1500.25    73.15 1500.22    74.16 1500.11    79.83 1499.34    86.8 1499.31
   91.23 1499.32    97.92 1499.77   100.12 1500.02   100.41 1500.09  100.64 1500.14
     106 1500.45   106.33 1500.47   108.12 1500.57   108.14 1500.57  123.98 1500.72
  124.27 1500.72   126.52 1500.71      138 1501.27   139.25 1501.34  139.57 1501.36
  148.13 1502.53   148.73 1502.64    149.2 1502.76   155.13 1504.36  159.41 1505.73
  161.03  1506.2    173.3 1509.51   180.77 1509.67    181.8  1509.7  182.11  1509.7
  183.83  1509.7

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   72.84    .025     106    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         73.15  106.33             10.77   10.09    8.59             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 972.0575

INPUT
Description:
Station Elevation Data    num=      45
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0 1509.14     9.14  1506.7    12.68 1505.71    24.17 1502.72   26.32  1502.3
   33.38 1500.96    39.13 1500.61    41.76 1500.55    55.46 1500.27   59.15 1500.31
   63.21 1500.42    64.25 1500.36    69.85 1500.38    71.33 1500.19   72.69 1499.97
   73.09  1499.9    78.08 1499.07    89.62 1499.05    95.49 1499.04   98.92 1499.59
   101.3 1499.94   103.37 1500.16   105.12 1500.18   105.24 1500.18  111.66 1500.25
  112.21 1500.28   112.81 1500.26   128.09 1500.45   129.87 1500.43   138.8 1501.07
   141.2 1501.24   142.07 1501.29   142.13  1501.3    144.1 1501.67  149.84 1502.75
  154.56 1503.89   156.45 1504.47   173.02 1509.38   175.57 1509.45  180.75 1509.54
  181.36 1509.56   181.49 1509.56   183.36 1509.56   185.13 1509.52   190.3 1509.41
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Manning's n Values          num=        4
     Sta   n Val     Sta    n Val     Sta   n Val     Sta   n Val
       0    .045   69.85     .025  105.12    .045  185.13    .018

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.    Expan.
         69.85  105.24              104.64  105.12  106.02             .1        .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1               RS: 866.9367

INPUT
Description:
Station Elevation Data     num=       44
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1507.17     5.24 1507.03     22.7 1502.58     30.9 1500.65    35.43 1500.69
   39.96 1500.79    52.68 1500.71    52.84 1500.71    53.66 1500.69    66.36  1500.3
   70.24 1500.29    75.28 1499.04    75.41 1499.01    76.88 1498.64    77.42  1498.5
   81.22  1498.5    98.69 1498.37   105.11 1499.62   107.23 1500.05   107.31 1500.07
  107.68 1500.14   115.57 1500.35    120.7 1500.47   127.73 1500.52    142.85    1501
  149.64 1501.17    153.3 1501.67   167.01  1505.3   173.72 1507.07   177.48 1507.32
  181.22 1507.59   182.37 1507.58   183.15 1507.58    185.1 1507.58    198.71  1507.6
  205.06 1507.62   211.34 1507.59   220.39 1507.55   221.39 1507.55   221.79 1507.55
  222.21 1507.97   222.29 1508.05   224.47 1508.03   227.71 1507.99

Manning's n Values          num=        4
     Sta   n Val     Sta    n Val     Sta   n Val     Sta   n Val
       0    .045   70.24     .025  107.23    .045  185.1     .018

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.    Expan.
         70.24  107.31              68.75   67.85   65.97             .1        .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1               RS: 799.0856

INPUT
Description:
Station Elevation Data     num=       52
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
       0 1505.79      2.2 1505.72     8.21  1505.6    14.4 1503.96    25.55  1501.2
   29.02 1500.54     34.1  1500.1    34.19 1500.09    48.53 1499.99    53.32 1499.97
   54.97 1499.95     58.8 1499.93    72.16 1499.86    73.67 1499.67    75.24  1499.5
   77.12 1499.15    77.52 1499.08     79.9 1498.64    81.46  1498.3    90.94 1498.34
    98.9 1498.32   100.03 1498.36    100.8 1498.39   104.03 1498.99   108.84 1499.87
  108.97 1499.89   109.63 1500.01   113.55 1499.96   127.53  1499.8   130.62 1499.81
  143.68 1499.79    146.3  1499.9   150.29 1499.98   153.14 1500.49   158.32 1501.54
  172.65 1505.56   173.32 1505.75    173.4 1505.78   174.86 1505.86    181.4 1506.23
  181.78 1506.25   183.44 1506.33   185.08 1506.35   194.65 1506.44    205.2 1506.56
  214.13 1506.66   218.09 1506.68   221.94  1506.7   222.42 1507.18   222.44  1507.2
  223.11  1507.2   224.81  1507.2

Manning's n Values          num=        4
     Sta   n Val     Sta    n Val     Sta   n Val     Sta   n Val
       0    .045   72.16     .025  108.84    .045  185.08    .018

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.    Expan.
         72.16  108.97              15.77   16.07   16.69             .1        .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1               RS: 789.9481

INPUT
Description:
Distance from Upstream XS =     9.14
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       61
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
     -23 1503.44   -20.02 1503.37   -16.04  1503.3    -4.76 1505.04     -.83 1505.64
      .8 1505.56     7.65 1505.34     9.58 1504.86     20.1 1502.09     23.7 1501.11
    25.3 1500.76    29.72 1500.24    30.04 1500.21    36.42 1499.88     37.1 1499.87
   46.94  1499.9    47.16  1499.9     57.1 1499.92    57.78 1499.92    58.67 1499.87
   72.57 1499.43    75.76 1498.86    76.38 1498.81     76.6 1498.78    79.98 1498.47
   87.63 1498.29    90.87 1498.03    91.53 1498.02    93.75 1498.26    97.05  1498.4
   99.72  1498.5   101.22 1498.55    103.5 1498.87   108.07 1499.64   108.22 1499.66
  108.52 1499.71   116.68 1499.78   120.05 1499.74   128.26 1499.79   134.73 1499.72
  138.58 1499.72   145.16 1499.65   146.31 1499.67   151.27 1499.99   153.39 1500.41
  165.35  1503.8   169.92 1505.12   171.71 1505.53   172.05 1505.58   175.61 1505.79
  180.44 1506.07   181.95 1506.13   182.49 1506.15   183.16 1506.16   184.09 1506.17
  204.21 1506.41   218.23 1506.56   220.93  1506.6   221.35 1507.02   221.43  1507.1
  226.32  1507.1

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested
```

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 783.0189

INPUT
Description:
Station Elevation Data num= 58

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1505.51	6.96	1505.18	8.66	1505.13	18.13	1502.78	20.85	1502.06
22.27	1501.67	25.58	1500.96	27.56	1500.49	30.68	1499.65	36.33	1498.45
38.01	1498.42	43.02	1497.66	55.44	1497.44	58.88	1497.34	71.31	1497.34
71.97	1497.35	74.31	1497.23	74.35	1497.23	77.22	1496.84	77.34	1496.83
79.4	1496.55	81.79	1496.07	82.56	1495.95	87.46	1495.95	94.99	1495.94
99.13	1496.03	104.91	1497.26	105.19	1497.34	105.42	1497.34	108.93	1497.44
109.05	1497.44	109.58	1497.46	113.09	1497.52	114.13	1497.56	121.72	1497.63
122.48	1497.63	129.99	1497.7	131.38	1497.72	135.52	1497.76	136	1497.76
144.78	1498.05	145.48	1498.16	152.37	1499.56	153.5	1499.84	169.68	1504.8
170.7	1505.12	170.78	1505.13	172.79	1505.44	176.12	1505.66	181.14	1505.96
182.21	1505.99	183.2	1506.02	184.78	1506.04	195.7	1506.19	204.89	1506.3
211.04	1506.37	218.54	1506.49	219.99	1506.51				

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.045	74.31	.025	105.19	.045	184.78	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
74.31	105.42	10.26	10.36	10.58	.1 .3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 772.6547

INPUT
Description:
Station Elevation Data num= 57

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1505.33	3.85	1505.15	8.33	1505.04	18.25	1502.6	24.51	1501.06
35.62	1497.96	36.31	1497.93	40.57	1497.85	41.1	1497.86	41.72	1497.84
56.1	1497.43	67.56	1497.1	68.37	1497.1	70.07	1497.12	73.15	1497.19
74.71	1496.85	77.05	1496.42	77.23	1496.39	80.5	1495.81	98.8	1495.9
98.92	1495.9	98.95	1495.9	99	1495.91	106.74	1497.14	107.2	1497.15
107.58	1497.16	108.98	1497.21	109.1	1497.22	116.05	1497.46	117.65	1497.48
124.43	1497.51	124.52	1497.51	125.97	1497.53	134.17	1497.62	135.97	1497.65
138.28	1497.75	140.77	1497.82	144.54	1497.89	150.51	1498.82	156.71	1500.4
157.95	1500.8	160.18	1501.45	163.36	1502.47	170.46	1504.72	170.64	1504.75
172.67	1505.22	173.4	1505.27	180.96	1505.79	181.89	1505.81	183.03	1505.82
184.56	1505.84	195.5	1505.99	204.68	1506.14	211.83	1506.25	217.52	1506.34
221.4	1506.41	221.44	1506.44						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.045	73.15	.025	108.98	.045	184.56	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
73.15	109.1	42.92	42.86	42.75	.1 .3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 729.7908

INPUT
Description:
Station Elevation Data num= 37

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1504.67	8.72	1502.41	26.2	1497.9	33.4	1497.74	43	1497.37
51.43	1497.39	63.46	1497.29	68.45	1496.18	68.82	1496.1	71.5	1495.51
71.94	1495.42	73.02	1495.42	91.04	1495.34	99.16	1496.93	100.78	1497.22
104.01	1497.19	119.13	1497.54	120.62	1497.59	122.56	1497.6	136.83	1497.75
139.55	1497.82	147.57	1499.95	163.14	1504.29	170.08	1504.86	172.35	1505.09
173.27	1505.14	174.37	1505.2	175.83	1505.22	189.1	1505.47	192.74	1505.54
195.94	1505.6	198.18	1505.62	200.8	1505.64	212.83	1505.78	213.12	1506.07
213.33	1506.28	215.61	1506.29						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.045	63.46	.025	104.01	.045	175.83	.018

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
63.46	100.78	147.69	147.09	145.8	.1 .3

CROSS SECTION

RIVER: SunValley
REACH: Reach1 RS: 582.7006

INPUT

```
Description:
Station Elevation Data    num=      41
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0   1502.2        6  1500.81    23.65  1497.13    31.44  1497.04    42.54  1496.94
   55.12  1496.93    57.07  1496.92    57.73  1496.68    59.95  1495.99    60.41  1495.84
   62.61   1496.5    63.13  1496.71    66.83  1495.88     66.9  1495.86    67.74  1495.67
   70.69  1495.01    73.14  1494.98    89.97  1494.73    98.72  1496.86    98.81  1496.88
   98.85  1496.88   100.77   1496.9   121.23  1497.11   121.85  1497.11   122.85  1497.15
  143.18   1497.8   147.13  1498.81   162.22  1502.67   163.82  1502.79   167.13  1503.04
  170.76  1503.31   170.96  1503.34   172.74  1503.58   173.81  1503.59   176.71  1503.63
  194.68  1503.85   204.92  1504.06   211.18  1504.19   211.43  1504.44   211.68  1504.69
  213.88  1504.67

Manning's n Values        num=       4
     Sta   n Val      Sta   n Val      Sta   n Val      Sta   n Val
       0    .045    63.13    .025    98.72    .045   173.81    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
         63.13   98.85             43.17   41.54   38.04              .1        .3

INLINE STRUCTURE


RIVER: SunValley
REACH: Reach1             RS: 551.0980

INPUT
Description:
Distance from Upstream XS =     31.6
Deck/Roadway Width        =        5
Weir Coefficient          =      2.6
 Weir Embankment Coordinates    num =       57
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
      -4  1501.61       .97  1501.46     5.09  1500.52    14.95  1498.03    20.3   1496.79
   20.43  1496.77    26.72  1496.86    38.34  1496.91    39.18   1496.9   47.16   1496.75
   47.76  1496.74    49.58  1496.72    56.96  1496.58    59.59  1496.73   60.51   1496.72
   62.81  1496.51    64.86  1496.14    65.34  1496.06    66.45  1495.86   70.34   1495.17
   70.81  1495.09    71.34  1495.09    78.98  1494.85    88.25  1494.78   88.97   1494.77
   90.55  1495.12    96.36  1496.41    98.82  1496.65    98.87  1496.65  100.64   1496.67
  102.73  1496.69   119.19  1496.78   120.99  1496.78   124.71  1496.84  138.05   1497.13
  139.84  1497.15   144.57  1497.73   150.64  1499.52   156.32  1501.17  157.06    1501.4
  159.05  1502.06    168.7  1502.88   169.24  1502.92   169.47  1502.95  171.11   1503.17
  171.23  1503.18   172.13   1503.2   178.73  1503.29    189.7  1503.46  193.04   1503.51
  195.89  1503.56   207.51  1503.76   209.58   1503.8   210.07  1504.29  210.08    1504.3
  210.33  1504.29    213.1  1504.28

Upstream Embankment side slope              =     100 horiz. to 1.0 vertical
Downstream Embankment side slope            =       2 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Weir crest shape                            = Broad Crested


CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 541.1541

INPUT
Description:
Station Elevation Data    num=      65
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0  1501.05     3.84  1501.06     4.59  1500.95    11.84  1499.56   16.86  1498.16
   23.29  1496.26    25.41  1495.68     26.2  1495.46    29.86  1495.04   33.19   1494.9
   37.71  1494.95    40.57  1494.97    44.32  1494.49     47.6  1494.52   50.22   1494.5
   52.96  1494.61    57.34   1494.6    58.25  1494.59    61.04  1494.51   63.34   1494.5
   64.61  1494.42    66.91   1494.2    68.32  1494.02     68.6  1493.99    73.4  1493.39
   74.85  1493.26    75.71  1493.11    77.13  1493.11    86.62  1492.98   92.63  1493.08
   96.82  1493.97    96.93  1493.99    97.06     1494   101.99   1494.4   103.2  1494.49
  103.23   1494.5   104.01  1494.59   110.38  1495.36   112.43  1495.52  118.39  1496.05
  123.09  1496.06   128.05  1496.17   132.52  1496.16   136.77   1496.1  140.02  1496.13
  141.05  1496.35   142.92  1496.88    152.2  1499.13   159.66  1501.33  161.05  1501.72
  161.95     1502    169.8  1502.61   172.59  1502.82   173.51  1502.93  174.58  1503.07
  175.44  1503.08   177.15  1503.11   196.38  1503.43   211.71  1503.67  212.95  1503.69
  213.35  1504.09   213.45  1504.19    214.1  1504.19   215.44  1504.18  217.64  1504.18

Manning's n Values        num=       4
     Sta   n Val      Sta   n Val      Sta   n Val      Sta   n Val
       0    .045     68.6    .025   101.99    .045   175.44    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
         68.32  101.99             39.48   39.81   40.48              .1        .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1             RS: 501.3466

INPUT
Description:
Station Elevation Data    num=      41
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0  1500.75    14.12  1500.59    16.76  1500.54    23.62  1498.95   34.77   1496.7
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  39.34  1495.6   40.92 1495.61   55.13 1495.32    55.5 1495.31   69.11 1494.86
  72.32 1494.69   75.61 1494.23   76.18 1494.15   77.21 1493.99   78.81 1493.74
  79.86  1493.6   81.04 1493.54   87.29 1492.91   89.36 1492.75   93.77 1492.77
 100.75 1492.75   104.5 1493.49    108 1494.22   109.03  1494.4  109.88 1494.55
 111.83 1494.59  116.66 1494.69  139.99 1495.58  149.25 1496.02  164.79 1499.89
 171.36 1501.69  175.01 1501.95  180.13 1502.32  181.27 1502.45  182.11 1502.53
 182.89 1502.55  194.26 1502.77  203.77 1502.98  213.31 1503.06  217.54  1503.1
 218.84 1503.12

Manning's n Values          num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   76.18    .025  109.03    .045  182.89    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         75.61  109.03             115.27   117.8  123.19             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1               RS: 383.5453

INPUT
Description:
Station Elevation Data     num=      39
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1499.66    6.36 1499.66    10.3 1499.66   18.57 1497.88   30.65 1495.19
   36.57 1495.04   60.68 1494.43   63.93 1494.35   65.55 1494.05   69.18 1493.36
      70  1493.2   70.17 1493.17   83.8 1493.14   96.37 1493.15   99.07 1493.66
   99.68 1493.78  101.72 1494.19  101.83 1494.19   114.1  1494.3  120.45 1494.34
  125.29 1494.68  141.42 1495.51  150.76  1498.1  160.95 1500.73  166.84  1500.9
  169.31 1500.99  170.19    1501  171.33 1501.01  172.88 1501.06  185.11 1501.46
  192.83 1501.72  197.18 1501.74  209.73 1501.84  210.04 1502.14  210.23 1502.34
  213.35 1502.35  217.55 1502.38  218.51 1502.38  220.96 1502.38

Manning's n Values          num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   63.93    .025  101.72    .045  172.88    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         63.93  101.83             241.51   241.8  243.35             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1               RS: 141.7450

INPUT
Description:
Station Elevation Data     num=      60
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1498.65    2.83 1498.65   10.15 1498.48   14.55 1497.96   16.11 1497.88
   21.49 1496.75   29.61 1495.03   33.73  1494.8   35.35 1494.51      36 1494.43
   40.75 1494.23   41.76 1494.14   49.69 1494.13   50.34 1494.12   50.97 1494.11
   58.86  1494.1   59.58 1494.07    60.3 1494.04    67.2 1493.78   67.68 1493.97
   70.97 1493.44   72.57 1493.14   73.32 1492.99   73.63 1492.94   77.47 1492.48
   78.37 1492.42   80.93 1492.41   87.99 1492.64   95.15  1492.9   99.03  1493.8
  100.89 1493.75  101.66 1493.74  101.76 1493.75  102.11 1493.77  107.66 1494.11
  114.08 1493.94  120.49 1494.04  127.21 1494.22  130.14 1494.26  133.64 1494.51
  133.82 1494.57  134.45 1494.78     141 1496.28  151.01 1498.81  153.97 1499.28
  156.35 1499.69  157.34 1499.76  166.15 1500.36  166.24 1500.36  166.26 1500.36
  168.17 1500.38  170.55 1500.45  178.62 1500.68  189.88 1501.01  192.85 1501.01
   195.3 1501.02  206.45 1501.03  206.71 1501.29  206.95 1501.53  209.85 1501.48

Manning's n Values          num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045   67.68    .025   99.03    .045  170.55    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         67.68   99.03               7.3    7.37   7.96             .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1               RS: 134.3734

INPUT
Description:
Station Elevation Data     num=      59
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0 1498.65    1.13 1498.65    4.94 1498.56    7.19  1498.3    14.9 1497.89
   26.85 1495.38   33.39 1493.89    37.7 1492.99   40.51 1492.55   43.08 1492.21
   45.17 1491.97   47.96 1491.71   49.55 1491.68   51.21 1491.64   55.87  1491.7
   58.52 1491.57   63.02 1491.27   63.77 1491.23   65.69 1491.23   70.01 1492.47
   70.43 1492.63   70.61 1492.62    72.1 1493.01   72.86 1493.21   73.45 1493.08
   78.29 1491.99   79.88 1491.58    82.8 1491.46   93.04 1491.35   93.92 1491.32
   97.37 1491.28   99.28 1491.19  101.05 1491.17  101.13 1491.16   101.7 1491.11
  103.45 1490.97   107.2 1491.16  115.12 1491.92  123.66 1492.99  125.76 1493.06
  129.93 1493.54  131.37 1493.91  149.54 1498.53  150.48 1498.79  150.69 1498.82
  156.17 1499.63  156.52 1499.66  159.88  1499.9  166.06 1500.33  166.47 1500.33
  167.97 1500.34  170.35 1500.41  175.37 1500.55  189.67 1500.97  202.47 1500.98
  206.26 1500.99  206.57 1501.29  206.76 1501.49  210.64 1501.41
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Manning's n Values          num=        4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045    72.1    .025  123.66    .045  170.35    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         73.45  123.66             20.74   20.21   20.83            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1               RS: 114.1627

INPUT
Description:
Station Elevation Data      num=       58
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0  1498.63     2.03   1498.6     4.49  1498.49    18.06   1497.9    36.41  1494.06
   41.22  1493.03     42.3  1492.96    42.66  1492.96    44.67  1492.97     52.8  1492.84
   56.55  1493.06    59.68  1493.13    60.15  1493.12    63.19  1493.28    68.85  1491.93
   71.02  1491.56    72.51  1490.98    73.59  1490.77    77.36  1490.52    79.73  1490.36
   82.47  1490.18     87.7  1490.12    90.51  1489.77    94.52  1489.84    96.28  1490.06
   99.18  1490.62   100.84  1490.94    101.9  1491.13    102.4  1491.19   102.49  1491.25
   105.9  1491.88   107.02  1492.08   107.99  1492.26   114.04  1492.15   116.09  1492.26
  119.14  1492.18   123.13  1492.15    129.8  1492.44   130.08  1492.48   130.91  1492.59
  138.07  1494.55   155.69  1498.74   161.09  1499.38   161.14  1499.39   162.49  1499.56
  165.74   1499.8    172.2  1500.24   172.86  1500.24   174.18  1500.23   176.56   1500.3
  183.06  1500.49   195.91  1500.87   204.74  1500.88   212.66  1500.89   212.76  1500.99
  213.16  1501.39   214.55  1501.38   215.42  1501.37

Manning's n Values          num=        4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045    63.19    .025  107.99    .045  176.56    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         63.19  107.99             34.28   55.56   42.21            .1       .3

CROSS SECTION


RIVER: SunValley
REACH: Reach1               RS: 58.59812

INPUT
Description:
Station Elevation Data      num=       49
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0   1498.4     .76  1498.38     2.48  1498.25     8.05  1497.84    21.61  1495.39
   28.86  1494.03    33.21  1493.66    39.95  1493.25    44.08  1492.86    44.72   1492.9
   48.65   1493.1       50  1493.17    55.59  1492.78    55.86  1492.76     57.1  1492.74
    71.8  1492.41    72.59  1492.11    75.15  1491.15    78.76  1490.97    81.06  1490.86
    83.6  1491.74    85.14  1492.39     86.1  1492.41    93.39  1492.48    94.67  1492.51
   97.29  1492.61   105.77  1492.97   115.76  1492.91   118.88   1492.9   121.92  1492.92
  124.51  1493.03   132.44   1493.1    137.8  1496.31   138.22  1496.56   138.47  1496.59
  158.51  1498.62   167.57  1499.49   167.65  1499.49   167.75   1499.5   177.13  1500.14
  178.67  1500.13   179.01  1500.12    179.8  1500.15   181.28  1500.18    200.7  1500.68
  215.95  1500.79    217.7  1500.81    218.2  1501.31   223.56  1501.27

Manning's n Values          num=        4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045      50    .025  124.51    .045  181.28    .018

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           50  124.51             5.22    58.6   106.5            .1       .3


SUMMARY OF MANNING'S N VALUES

River:SunValley

      Reach          River Sta.       n1        n2        n3        n4        n5        n6

 Reach1               15089.58          .035      .018
 Reach1               15048.99          .035      .018
 Reach1               14945.94          .035      .018
 Reach1               14937.48          .035      .018
 Reach1               14877.43          .035      .018
 Reach1               14841.55          .035      .018
 Reach1               14809.29          .035      .018
 Reach1               14708.76          .035      .018
 Reach1               14651.74          .035      .018
 Reach1               14600.25          .035      .018
 Reach1               14567.53          .035      .018
 Reach1               14523.69      Inl Struct
 Reach1               14523.69          .045      .018
 Reach1               14514.80          .045      .018
 Reach1               14337.25          .045      .018
 Reach1               14300         Inl Struct
 Reach1               14274.69          .045      .018
 Reach1               14216.35          .045      .018
 Reach1               14142.06          .045      .018
 Reach1               14119.48          .045      .018
 Reach1               14115.15          .045      .018
 Reach1               14085.17          .045      .018
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Reach1	13942.92	.045	.018		
Reach1	13758.60	.045	.018		
Reach1	13720.10	Inl Struct			
Reach1	13712.92	.045	.018		
Reach1	13679.62	.045	.018		
Reach1	13555.95	.045	.018		
Reach1	13441.98	.045	.018		
Reach1	13420.23	Inl Struct			
Reach1	13413.49	.045	.018		
Reach1	13392.26	.045	.018		
Reach1	13283.16	.045	.018		
Reach1	13148.64	.045	.018		
Reach1	13121.90	Inl Struct			
Reach1	13113.85	.045	.018		
Reach1	13103.41	.045	.018		
Reach1	12948.99	.045	.018		
Reach1	12751.20	.045	.018		
Reach1	12722.07	Inl Struct			
Reach1	12710.30	.045	.018		
Reach1	12684.08	.045	.018		
Reach1	12570.39	.045	.018		
Reach1	12421.26	.045	.018		
Reach1	12398.37	Inl Struct			
Reach1	12387.58	.045	.018		
Reach1	12358.28	.045	.018		
Reach1	12244.50	.045	.018		
Reach1	12160.68	.045	.018		
Reach1	12125.61	Inl Struct			
Reach1	12118.62	.045	.018		
Reach1	12083.58	.045	.018		
Reach1	12034.51	.045	.018		
Reach1	11861.96	.045	.018		
Reach1	11832.55	Inl Struct			
Reach1	11825.08	.045	.018		
Reach1	11794.31	.045	.018		
Reach1	11660.13	.045	.018		
Reach1	11583.43	.045	.018		
Reach1	11538.79	Inl Struct			
Reach1	11530.86	.045	.018		
Reach1	11507.12	.045	.025	.045	.018
Reach1	11377.76	.045	.025	.045	.018
Reach1	11258.40	.045	.025	.045	.018
Reach1	11246.90	Inl Struct			
Reach1	11240.54	.045	.025	.045	.018
Reach1	11224.92	.045	.025	.045	.018
Reach1	11094.81	.045	.025	.045	.018
Reach1	10964.53	.045	.025	.045	.018
Reach1	10937.06	Inl Struct			
Reach1	10927.56	.045	.025	.045	.018
Reach1	10911.95	.045	.025	.045	.018
Reach1	10775.80	.045	.025	.045	.018
Reach1	10637.14	Inl Struct			
Reach1	10628.03	.045	.025	.045	.018
Reach1	10555.32	.045	.025	.045	.018
Reach1	10468.18	.045	.025	.045	.018
Reach1	10435.00	Inl Struct			
Reach1	10428.14	.045	.025	.045	.018
Reach1	10407.63	.045	.025	.045	.018
Reach1	10274.00	.045	.025	.045	.018
Reach1	10161.95	.045	.025	.045	.018
Reach1	10136.06	Inl Struct			
Reach1	10126.72	.045	.025	.045	.018
Reach1	10096.77	.045	.025	.045	.018
Reach1	9938.554	.045	.025	.045	.018
Reach1	9791.290	.045	.025	.045	
Reach1	9713.006	Inl Struct			
Reach1	9702.693	.045	.025	.045	
Reach1	9682.938	.045	.025	.045	
Reach1	9588.970	.045	.025	.045	
Reach1	9456.982	.045	.025	.045	
Reach1	9426.926	Inl Struct			
Reach1	9420.045	.045	.025	.045	
Reach1	9401.967	.045	.025	.045	
Reach1	9332.685	.045	.025	.045	
Reach1	9244.882	.045	.025	.045	
Reach1	9220.901	Inl Struct			
Reach1	9214.029	.045	.025	.045	.018
Reach1	9191.509	.045	.025	.045	
Reach1	9125.650	.045	.025	.045	
Reach1	9026.968	.045	.025	.045	.018
Reach1	9019.372	Inl Struct			
Reach1	9015.422	.045	.025	.045	.018
Reach1	8998.093	.045	.025	.045	.018
Reach1	8963.707	.045	.025	.045	.018
Reach1	8853.075	.045	.025	.045	.018
Reach1	8820.596	Inl Struct			
Reach1	8815.779	.045	.025	.045	.018
Reach1	8799.197	.045	.025	.045	.018
Reach1	8661.449	.045	.025	.045	.018
Reach1	8500.547	.045	.025	.045	.018
Reach1	8474.735	Inl Struct			
Reach1	8469.387	.045	.025	.045	.018
Reach1	8439.225	.045	.025	.045	.018
Reach1	8287.219	.045	.025	.045	.018
Reach1	8149.652	.045	.025	.045	.018

Reach1	8128.972	Inl Struct					
Reach1	8122.685	.045	.025	.045	.018		
Reach1	8097.253	.045	.025	.045	.018		
Reach1	7953.828	.045	.025	.045	.018		
Reach1	7799.566	.045	.025	.045	.018		
Reach1	7779.531	Inl Struct					
Reach1	7773.177	.045	.025	.045	.018		
Reach1	7752.089	.045	.025	.045	.018		
Reach1	7598.913	.045	.025	.045	.018		
Reach1	7446.958	.045	.025	.045	.018		
Reach1	7427.061	Inl Struct					
Reach1	7419.387	.045	.025	.045	.018		
Reach1	7379.578	.045	.025	.045	.018		
Reach1	7217.642	.045	.025	.045	.018		
Reach1	7057.082	.045	.025	.045	.018		
Reach1	7026.190	Inl Struct					
Reach1	7022.299	.045	.025	.045	.018		
Reach1	6998.997	.045	.025	.045	.018		
Reach1	6854.423	.045	.025	.045	.018		
Reach1	6732.243	.045	.025	.045	.018		
Reach1	6718.729	Inl Struct					
Reach1	6713.511	.045	.025	.045	.018		
Reach1	6691.186	.045	.025	.045	.018		
Reach1	6571.056	.045	.025	.045	.018		
Reach1	6445.849	.045	.025	.045	.018		
Reach1	6421.011	Inl Struct					
Reach1	6416.444	.045	.025	.045	.018		
Reach1	6394.126	.045	.025	.045	.018		
Reach1	6274.483	.045	.025	.045	.018		
Reach1	6147.176	.045	.025	.045	.018		
Reach1	6121.654	Inl Struct					
Reach1	6113.420	.045	.025	.045	.018		
Reach1	6094.420	.045	.025	.045	.018		
Reach1	5972.070	.045	.025	.045	.018		
Reach1	5841.366	.045	.025	.045	.018		
Reach1	5820.431	Inl Struct					
Reach1	5812.631	.045	.025	.045	.018		
Reach1	5786.387	.045	.025	.045	.018		
Reach1	5687.190	.045	.025	.045	.018		
Reach1	5448.002	.045	.025	.045	.018		
Reach1	5418.712	Inl Struct					
Reach1	5413.769	.045	.025	.045	.018		
Reach1	5381.124	.045	.025	.045	.018		
Reach1	5275.222	.045	.025	.045	.018		
Reach1	5132.593	.045	.025	.045	.018		
Reach1	5120.617	Inl Struct					
Reach1	5116.053	.045	.025	.045	.018		
Reach1	5087.074	.045	.025	.045	.018		
Reach1	4966.653	.045	.025	.045	.018		
Reach1	4850.062	.045	.025	.045	.018		
Reach1	4824.903	Inl Struct					
Reach1	4818.556	.045	.025	.045	.018		
Reach1	4770.290	.045	.025	.045	.018		
Reach1	4683.298	.045	.025	.045	.018		
Reach1	4509.527	.045	.025	.045	.018		
Reach1	4494.152	Inl Struct					
Reach1	4488.645	.045	.025	.045	.018		
Reach1	4471.064	.045	.025	.045	.018		
Reach1	4359.662	.045	.025	.045	.018		
Reach1	4244.980	.045	.025	.045	.018		
Reach1	4187.928	.045	.025	.045	.025	.035	.018
Reach1	4151.155	.045	.025	.045	.025	.035	.018
Reach1	4129.040	.045	.025	.045	.018		
Reach1	4115.484	.045	.025	.045	.018		
Reach1	4094.117	.045	.025	.045	.018		
Reach1	3972.552	.045	.025	.045	.018		
Reach1	3852.914	.045	.025	.045	.018		
Reach1	3816.660	Inl Struct					
Reach1	3812.718	.045	.025	.045	.018		
Reach1	3799.484	.045	.025	.045	.018		
Reach1	3637.573	.045	.025	.045	.018		
Reach1	3413.317	.045	.025	.045	.018		
Reach1	3404.692	Inl Struct					
Reach1	3400.519	.045	.025	.045	.018		
Reach1	3385.912	.045	.025	.045	.018		
Reach1	3276.504	.045	.025	.045	.018		
Reach1	3141.353	.045	.025	.045			
Reach1	3116.898	Inl Struct					
Reach1	3110.386	.045	.025	.045			
Reach1	3085.983	.045	.025	.045	.018		
Reach1	2987.290	.045	.025	.045	.018		
Reach1	2859.922	.045	.025	.045	.018		
Reach1	2838.551	.045	.025	.045	.018		
Reach1	2833.935	.045	.025	.045	.018		
Reach1	2817	Culvert					
Reach1	2799.662	.045	.025	.045	.018		
Reach1	2766.312	.045	.025	.045			
Reach1	2655.140	.045	.025	.045			
Reach1	2538.673	.045	.025	.045			
Reach1	2421.011	.045	.025	.045			
Reach1	2403.885	Inl Struct					
Reach1	2398.240	.045	.025	.045			
Reach1	2384.655	.045	.025	.045			
Reach1	2297.673	.045	.025	.045			
Reach1	2145.706	.045	.025	.045			

Reach1	2110.812	.045	.025	.045	
Reach1	2097.252	Inl Struct			
Reach1	2090.275	.045	.025	.045	
Reach1	2078.263	.045	.025	.045	
Reach1	2045.894	.045	.025	.045	
Reach1	1944.087	.045	.025	.045	
Reach1	1851.190	.045	.025	.045	
Reach1	1810.842	Inl Struct			
Reach1	1804.030	.045	.025	.045	
Reach1	1781.875	.045	.025	.045	
Reach1	1645.995	.045	.025	.045	
Reach1	1515.506	.045	.025	.045	
Reach1	1502.91	Inl Struct			
Reach1	1495.849	.045	.025	.045	
Reach1	1479.893	.045	.025	.045	
Reach1	1344.964	.045	.025	.045	
Reach1	1266.459	.045	.025	.045	
Reach1	1197.553	Inl Struct			
Reach1	1189.172	.045	.025	.045	
Reach1	1165.285	.045	.025	.045	
Reach1	1028.773	.045	.025	.045	
Reach1	998.5162	.045	.025	.045	
Reach1	990.7514	Inl Struct			
Reach1	982.1498	.045	.025	.045	
Reach1	972.0575	.045	.025	.045	.018
Reach1	866.9367	.045	.025	.045	.018
Reach1	799.0856	.045	.025	.045	.018
Reach1	789.9481	Inl Struct			
Reach1	783.0189	.045	.025	.045	.018
Reach1	772.6547	.045	.025	.045	.018
Reach1	729.7908	.045	.025	.045	.018
Reach1	582.7006	.045	.025	.045	.018
Reach1	551.0980	Inl Struct			
Reach1	541.1541	.045	.025	.045	.018
Reach1	501.3466	.045	.025	.045	.018
Reach1	383.5453	.045	.025	.045	.018
Reach1	141.7450	.045	.025	.045	.018
Reach1	134.3734	.045	.025	.045	.018
Reach1	114.1627	.045	.025	.045	.018
Reach1	58.59812	.045	.025	.045	.018

SUMMARY OF REACH LENGTHS

River: SunValley

Reach	River Sta.	Left	Channel	Right
Reach1	15089.58	34.42	40.59	39.56
Reach1	15048.99	18.08	103.04	102.59
Reach1	14945.94	19.16	8.46	8.56
Reach1	14937.48	95.42	60.05	59.99
Reach1	14877.43	36.15	35.88	35.55
Reach1	14841.55	31.93	32.26	32.66
Reach1	14809.29	100.8	100.54	100.16
Reach1	14708.76	56.95	57.01	57.06
Reach1	14651.74	51.25	51.5	51.82
Reach1	14600.25	32.76	32.72	32.64
Reach1	14567.53	52.66	52.72	52.8
Reach1	14523.69	Inl Struct		
Reach1	14523.69	8.48	8.88	9.48
Reach1	14514.80	177.35	177.56	177.91
Reach1	14337.25	62.9	62.56	62.03
Reach1	14300	Inl Struct		
Reach1	14274.69	57.78	58.34	59.33
Reach1	14216.35	74.27	74.29	73.71
Reach1	14142.06	22.53	22.58	22.41
Reach1	14119.48	5.15	4.33	3.87
Reach1	14115.15	29.6	29.98	30.67
Reach1	14085.17	142.61	142.24	140.94
Reach1	13942.92	180.72	184.32	184.77
Reach1	13758.60	50.99	45.68	45.83
Reach1	13720.10	Inl Struct		
Reach1	13712.92	45.39	33.3	33.73
Reach1	13679.62	112.29	123.67	122.67
Reach1	13555.95	113.19	113.97	114.96
Reach1	13441.98	28.51	28.49	28.47
Reach1	13420.23	Inl Struct		
Reach1	13413.49	21.2	21.23	21.26
Reach1	13392.26	108.89	109.1	109.36
Reach1	13283.16	135.15	134.52	133.84
Reach1	13148.64	35.55	34.79	33.98
Reach1	13121.90	Inl Struct		
Reach1	13113.85	9.35	10.44	11.63
Reach1	13103.41	154.85	154.42	153.97
Reach1	12948.99	198.07	197.79	197.49
Reach1	12751.20	39.48	40.9	42.42
Reach1	12722.07	Inl Struct		
Reach1	12710.30	28.03	26.22	24.28
Reach1	12684.08	113.73	113.69	113.65
Reach1	12570.39	148.78	149.13	149.54
Reach1	12421.26	33.43	33.67	33.97
Reach1	12398.37	Inl Struct		

Reach1	12387.58	29.56	29.3	29.02
Reach1	12358.28	113.64	113.78	113.98
Reach1	12244.50	83.79	83.82	83.88
Reach1	12160.68	42.62	42.07	41.33
Reach1	12125.61	Inl Struct		
Reach1	12118.62	32.56	35.03	36.81
Reach1	12083.58	49.87	49.08	49.47
Reach1	12034.51	169.66	172.55	176.11
Reach1	11861.96	36.64	36.88	37.17
Reach1	11832.55	Inl Struct		
Reach1	11825.08	28.68	30.77	33.36
Reach1	11794.31	131.95	134.18	136.6
Reach1	11660.13	78.37	76.71	74.69
Reach1	11583.43	50.9	52.57	54.46
Reach1	11538.79	Inl Struct		
Reach1	11530.86	33.78	23.74	23.86
Reach1	11507.12	142.2	129.36	130.85
Reach1	11377.76	118.53	119.36	121.77
Reach1	11258.40	17.22	17.86	19.63
Reach1	11246.90	Inl Struct		
Reach1	11240.54	15.56	15.62	15.8
Reach1	11224.92	128.46	130.11	134.5
Reach1	11094.81	130.13	130.28	130.52
Reach1	10964.53	37.05	36.97	36.69
Reach1	10937.06	Inl Struct		
Reach1	10927.56	15.25	15.61	16.41
Reach1	10911.95	136.28	136.15	135.78
Reach1	10775.80	147.49	147.77	148.45
Reach1	10637.14	Inl Struct		
Reach1	10628.03	71.72	72.71	75.25
Reach1	10555.32	87.97	87.15	85.03
Reach1	10468.18	39.9	40.03	40.4
Reach1	10435.00	Inl Struct		
Reach1	10428.14	20.27	20.51	21.16
Reach1	10407.63	133.9	133.63	132.83
Reach1	10274.00	112.55	112.04	110.67
Reach1	10161.95	34.93	35.23	35.99
Reach1	10136.06	Inl Struct		
Reach1	10126.72	29.84	29.95	30.21
Reach1	10096.77	159.16	158.22	155.84
Reach1	9938.554	146.24	147.26	149.88
Reach1	9791.290	89.95	88.59	84.96
Reach1	9713.006	Inl Struct		
Reach1	9702.693	19.42	19.75	20.69
Reach1	9682.938	94.59	93.97	92.1
Reach1	9588.970	132.45	131.99	130.73
Reach1	9456.982	38.02	36.94	34.17
Reach1	9426.926	Inl Struct		
Reach1	9420.045	17.74	18.08	18.94
Reach1	9401.967	69.29	69.28	69.2
Reach1	9332.685	89.49	87.8	83.87
Reach1	9244.882	30.7	30.85	31.22
Reach1	9220.901	Inl Struct		
Reach1	9214.029	22.59	22.52	22.34
Reach1	9191.509	66.02	65.86	65.44
Reach1	9125.650	99.28	98.68	97.1
Reach1	9026.968	11.35	11.55	12.07
Reach1	9019.372	Inl Struct		
Reach1	9015.422	16.81	17.33	18.71
Reach1	8998.093	34.49	34.39	34.13
Reach1	8963.707	111.1	110.63	109.38
Reach1	8853.075	37.25	37.3	37.42
Reach1	8820.596	Inl Struct		
Reach1	8815.779	16.81	16.58	15.96
Reach1	8799.197	136.47	137.75	141.13
Reach1	8661.449	162.11	160.9	157.74
Reach1	8500.547	31.01	31.16	31.56
Reach1	8474.735	Inl Struct		
Reach1	8469.387	29.35	30.16	32.22
Reach1	8439.225	153.05	152.01	149.35
Reach1	8287.219	137.53	137.57	137.67
Reach1	8149.652	26.77	26.97	27.47
Reach1	8128.972	Inl Struct		
Reach1	8122.685	25.2	25.43	25.99
Reach1	8097.253	143.63	143.43	142.94
Reach1	7953.828	154.35	154.26	154.06
Reach1	7799.566	26.33	26.38	26.51
Reach1	7779.531	Inl Struct		
Reach1	7773.177	20.89	21.09	21.57
Reach1	7752.089	153.22	153.18	153.06
Reach1	7598.913	152.41	151.96	150.89
Reach1	7446.958	27.19	27.57	28.46
Reach1	7427.061	Inl Struct		
Reach1	7419.387	39.44	39.81	40.69
Reach1	7379.578	161.81	161.94	162.32
Reach1	7217.642	161.2	160.56	158.96
Reach1	7057.082	34.73	34.78	34.92
Reach1	7026.190	Inl Struct		
Reach1	7022.299	23.19	23.3	23.59
Reach1	6998.997	144.86	144.57	143.82
Reach1	6854.423	121.52	122.18	124.03
Reach1	6732.243	19.23	18.73	17.35
Reach1	6718.729	Inl Struct		
Reach1	6713.511	21.88	22.33	23.6
Reach1	6691.186	120.42	120.13	119.34

Reach1	6571.056	125.19	125.21	125.25
Reach1	6445.849	29.58	29.41	28.87
Reach1	6421.011	Inl Struct		
Reach1	6416.444	22.28	22.32	22.42
Reach1	6394.126	120.05	119.64	118.51
Reach1	6274.483	126.69	127.31	129.07
Reach1	6147.176	34.03	33.75	33
Reach1	6121.654	Inl Struct		
Reach1	6113.420	18.73	19	19.76
Reach1	6094.420	122.11	122.35	123.02
Reach1	5972.070	131.25	130.71	129.23
Reach1	5841.366	28.72	28.73	28.76
Reach1	5820.431	Inl Struct		
Reach1	5812.631	26.12	26.24	26.58
Reach1	5786.387	99.31	99.2	98.87
Reach1	5687.190	239.11	239.19	239.36
Reach1	5448.002	33.97	34.23	34.92
Reach1	5418.712	Inl Struct		
Reach1	5413.769	32.76	32.65	32.35
Reach1	5381.124	105.94	105.9	105.8
Reach1	5275.222	142.93	142.63	141.87
Reach1	5132.593	16.43	16.54	16.82
Reach1	5120.617	Inl Struct		
Reach1	5116.053	28.35	28.98	30.57
Reach1	5087.074	120.85	120.42	119.34
Reach1	4966.653	115.98	116.59	118.21
Reach1	4850.062	31.83	31.51	30.7
Reach1	4824.903	Inl Struct		
Reach1	4818.556	47.68	48.27	49.79
Reach1	4770.290	87.27	86.99	86.24
Reach1	4683.298	174.81	173.77	171.35
Reach1	4509.527	20.74	20.89	21.2
Reach1	4494.152	Inl Struct		
Reach1	4488.645	17.41	17.58	17.97
Reach1	4471.064	111.79	111.4	110.55
Reach1	4359.662	113.56	114.68	117.21
Reach1	4244.980	57.44	57.05	56.33
Reach1	4187.928	41.13	36.77	33.71
Reach1	4151.155	24.9	22.11	23.6
Reach1	4129.040	15.84	13.56	13.79
Reach1	4115.484	22.15	21.37	21.37
Reach1	4094.117	121.42	121.57	123.68
Reach1	3972.552	122	119.64	116.59
Reach1	3852.914	40.17	40.19	40.37
Reach1	3816.660	Inl Struct		
Reach1	3812.718	12.91	13.23	14.34
Reach1	3799.484	162.02	161.91	161.64
Reach1	3637.573	224.71	224.26	223.15
Reach1	3413.317	12.77	12.79	12.91
Reach1	3404.692	Inl Struct		
Reach1	3400.519	14.6	14.61	14.63
Reach1	3385.912	109.13	109.41	110.24
Reach1	3276.504	135.74	135.15	134.13
Reach1	3141.353	30.98	30.96	31.09
Reach1	3116.898	Inl Struct		
Reach1	3110.386	24.24	24.4	24.86
Reach1	3085.983	96.26	98.69	97.66
Reach1	2987.290	136.21	127.37	123.69
Reach1	2859.922	35.43	21.37	17.22
Reach1	2838.551	4.4	4.62	5.59
Reach1	2833.935	34.95	34.27	33.65
Reach1	2817	Culvert		
Reach1	2799.662	39.66	33.35	37.94
Reach1	2766.312	79.48	111.17	106.16
Reach1	2655.140	119.9	116.47	117.94
Reach1	2538.673	120.1	117.66	112.04
Reach1	2421.011	22.81	22.77	22.72
Reach1	2403.885	Inl Struct		
Reach1	2398.240	13.22	13.59	14.43
Reach1	2384.655	87.32	86.98	86.3
Reach1	2297.673	154.29	151.97	147.14
Reach1	2145.706	34.99	34.89	34.69
Reach1	2110.812	20.47	20.54	20.67
Reach1	2097.252	Inl Struct		
Reach1	2090.275	12.14	12.01	11.76
Reach1	2078.263	32.76	32.37	31.59
Reach1	2045.894	101.6	101.81	102.2
Reach1	1944.087	94.19	92.9	90.45
Reach1	1851.190	47.44	47.16	46.62
Reach1	1810.842	Inl Struct		
Reach1	1804.030	22.53	22.16	21.42
Reach1	1781.875	138.03	135.88	131.47
Reach1	1645.995	131.53	130.49	128.21
Reach1	1515.506	19.66	19.66	19.61
Reach1	1502.91	Inl Struct		
Reach1	1495.849	16.86	15.96	13.9
Reach1	1479.893	135.81	134.93	133.03
Reach1	1344.964	78.43	78.51	78.68
Reach1	1266.459	78.59	77.29	74.43999
Reach1	1197.553	Inl Struct		
Reach1	1189.172	23.62	23.89	24.5
Reach1	1165.285	137.96	136.51	133.48
Reach1	1028.773	30.78	30.26	29.2
Reach1	998.5162	16.47	16.36	16.15
Reach1	990.7514	Inl Struct		

Reach1	982.1498	10.77	10.09	8.59
Reach1	972.0575	104.64	105.12	106.02
Reach1	866.9367	68.75	67.85	65.97
Reach1	799.0856	15.77	16.07	16.69
Reach1	789.9481	Inl Struct		
Reach1	783.0189	10.26	10.36	10.58
Reach1	772.6547	42.92	42.86	42.75
Reach1	729.7908	147.69	147.09	145.8
Reach1	582.7006	43.17	41.54	38.04
Reach1	551.0980	Inl Struct		
Reach1	541.1541	39.48	39.81	40.48
Reach1	501.3466	115.27	117.8	123.19
Reach1	383.5453	241.51	241.8	243.35
Reach1	141.7450	7.3	7.37	7.96
Reach1	134.3734	20.74	20.21	20.83
Reach1	114.1627	34.28	55.56	42.21
Reach1	58.59812	5.22	58.6	106.5

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: SunValley

Reach	River Sta.	Contr.	Expan.
Reach1	15089.58	.1	.3
Reach1	15048.99	.1	.3
Reach1	14945.94	.1	.3
Reach1	14937.48	.1	.3
Reach1	14877.43	.1	.3
Reach1	14841.55	.1	.3
Reach1	14809.29	.1	.3
Reach1	14708.76	.1	.3
Reach1	14651.74	.1	.3
Reach1	14600.25	.1	.3
Reach1	14567.53	.1	.3
Reach1	14523.69	Inl Struct	
Reach1	14523.69	.1	.3
Reach1	14514.80	.1	.3
Reach1	14337.25	.1	.3
Reach1	14300	Inl Struct	
Reach1	14274.69	.1	.3
Reach1	14216.35	.1	.3
Reach1	14142.06	.1	.3
Reach1	14119.48	.1	.3
Reach1	14115.15	.1	.3
Reach1	14085.17	.1	.3
Reach1	13942.92	.1	.3
Reach1	13758.60	.1	.3
Reach1	13720.10	Inl Struct	
Reach1	13712.92	.1	.3
Reach1	13679.62	.1	.3
Reach1	13555.95	.1	.3
Reach1	13441.98	.1	.3
Reach1	13420.23	Inl Struct	
Reach1	13413.49	.1	.3
Reach1	13392.26	.1	.3
Reach1	13283.16	.1	.3
Reach1	13148.64	.1	.3
Reach1	13121.90	Inl Struct	
Reach1	13113.85	.1	.3
Reach1	13103.41	.1	.3
Reach1	12948.99	.1	.3
Reach1	12751.20	.1	.3
Reach1	12722.07	Inl Struct	
Reach1	12710.30	.1	.3
Reach1	12684.08	.1	.3
Reach1	12570.39	.1	.3
Reach1	12421.26	.1	.3
Reach1	12398.37	Inl Struct	
Reach1	12387.58	.1	.3
Reach1	12358.28	.1	.3
Reach1	12244.50	.1	.3
Reach1	12160.68	.1	.3
Reach1	12125.61	Inl Struct	
Reach1	12118.62	.1	.3
Reach1	12083.58	.1	.3
Reach1	12034.51	.1	.3
Reach1	11861.96	.1	.3
Reach1	11832.55	Inl Struct	
Reach1	11825.08	.1	.3
Reach1	11794.31	.1	.3
Reach1	11660.13	.1	.3
Reach1	11583.43	.1	.3
Reach1	11538.79	Inl Struct	
Reach1	11530.86	.1	.3
Reach1	11507.12	.1	.3
Reach1	11377.76	.1	.3
Reach1	11258.40	.1	.3
Reach1	11246.90	Inl Struct	
Reach1	11240.54	.1	.3
Reach1	11224.92	.1	.3
Reach1	11094.81	.1	.3

Reach1	10964.53	.1	.3
Reach1	10937.06	Inl Struct	
Reach1	10927.56	.1	.3
Reach1	10911.95	.1	.3
Reach1	10775.80	.1	.3
Reach1	10637.14	Inl Struct	
Reach1	10628.03	.1	.3
Reach1	10555.32	.1	.3
Reach1	10468.18	.1	.3
Reach1	10435.00	Inl Struct	
Reach1	10428.14	.1	.3
Reach1	10407.63	.1	.3
Reach1	10274.00	.1	.3
Reach1	10161.95	.1	.3
Reach1	10136.06	Inl Struct	
Reach1	10126.72	.1	.3
Reach1	10096.77	.1	.3
Reach1	9938.554	.1	.3
Reach1	9791.290	.1	.3
Reach1	9713.006	Inl Struct	
Reach1	9702.693	.1	.3
Reach1	9682.938	.1	.3
Reach1	9588.970	.1	.3
Reach1	9456.982	.1	.3
Reach1	9426.926	Inl Struct	
Reach1	9420.045	.1	.3
Reach1	9401.967	.1	.3
Reach1	9332.685	.1	.3
Reach1	9244.882	.1	.3
Reach1	9220.901	Inl Struct	
Reach1	9214.029	.1	.3
Reach1	9191.509	.1	.3
Reach1	9125.650	.1	.3
Reach1	9026.968	.1	.3
Reach1	9019.372	Inl Struct	
Reach1	9015.422	.1	.3
Reach1	8998.093	.1	.3
Reach1	8963.707	.1	.3
Reach1	8853.075	.1	.3
Reach1	8820.596	Inl Struct	
Reach1	8815.779	.1	.3
Reach1	8799.197	.1	.3
Reach1	8661.449	.1	.3
Reach1	8500.547	.1	.3
Reach1	8474.735	Inl Struct	
Reach1	8469.387	.1	.3
Reach1	8439.225	.1	.3
Reach1	8287.219	.1	.3
Reach1	8149.652	.1	.3
Reach1	8128.972	Inl Struct	
Reach1	8122.685	.1	.3
Reach1	8097.253	.1	.3
Reach1	7953.828	.1	.3
Reach1	7799.566	.1	.3
Reach1	7779.531	Inl Struct	
Reach1	7773.177	.1	.3
Reach1	7752.089	.1	.3
Reach1	7598.913	.1	.3
Reach1	7446.958	.1	.3
Reach1	7427.061	Inl Struct	
Reach1	7419.387	.1	.3
Reach1	7379.578	.1	.3
Reach1	7217.642	.1	.3
Reach1	7057.082	.1	.3
Reach1	7026.190	Inl Struct	
Reach1	7022.299	.1	.3
Reach1	6998.997	.1	.3
Reach1	6854.423	.1	.3
Reach1	6732.243	.1	.3
Reach1	6718.729	Inl Struct	
Reach1	6713.511	.1	.3
Reach1	6691.186	.1	.3
Reach1	6571.056	.1	.3
Reach1	6445.849	.1	.3
Reach1	6421.011	Inl Struct	
Reach1	6416.444	.1	.3
Reach1	6394.126	.1	.3
Reach1	6274.483	.1	.3
Reach1	6147.176	.1	.3
Reach1	6121.654	Inl Struct	
Reach1	6113.420	.1	.3
Reach1	6094.420	.1	.3
Reach1	5972.070	.1	.3
Reach1	5841.366	.1	.3
Reach1	5820.431	Inl Struct	
Reach1	5812.631	.1	.3
Reach1	5786.387	.1	.3
Reach1	5687.190	.1	.3
Reach1	5448.002	.1	.3
Reach1	5418.712	Inl Struct	
Reach1	5413.769	.1	.3
Reach1	5381.124	.1	.3
Reach1	5275.222	.1	.3
Reach1	5132.593	.1	.3
Reach1	5120.617	Inl Struct	

Reach1	5116.053		.1	.3
Reach1	5087.074		.1	.3
Reach1	4966.653		.1	.3
Reach1	4850.062		.1	.3
Reach1	4824.903	Inl Struct		
Reach1	4818.556		.1	.3
Reach1	4770.290		.1	.3
Reach1	4683.298		.1	.3
Reach1	4509.527		.1	.3
Reach1	4494.152	Inl Struct		
Reach1	4488.645		.1	.3
Reach1	4471.064		.1	.3
Reach1	4359.662		.1	.3
Reach1	4244.980		.1	.3
Reach1	4187.928		.1	.3
Reach1	4151.155		.1	.3
Reach1	4129.040		.1	.3
Reach1	4115.484		.1	.3
Reach1	4094.117		.1	.3
Reach1	3972.552		.1	.3
Reach1	3852.914		.1	.3
Reach1	3816.660	Inl Struct		
Reach1	3812.718		.1	.3
Reach1	3799.484		.1	.3
Reach1	3637.573		.1	.3
Reach1	3413.317		.1	.3
Reach1	3404.692	Inl Struct		
Reach1	3400.519		.1	.3
Reach1	3385.912		.1	.3
Reach1	3276.504		.1	.3
Reach1	3141.353		.1	.3
Reach1	3116.898	Inl Struct		
Reach1	3110.386		.1	.3
Reach1	3085.983		.1	.3
Reach1	2987.290		.1	.3
Reach1	2859.922		.1	.3
Reach1	2838.551		.1	.3
Reach1	2833.935		.3	.5
Reach1	2817	Culvert		
Reach1	2799.662		.3	.5
Reach1	2766.312		.1	.3
Reach1	2655.140		.1	.3
Reach1	2538.673		.1	.3
Reach1	2421.011		.1	.3
Reach1	2403.885	Inl Struct		
Reach1	2398.240		.1	.3
Reach1	2384.655		.1	.3
Reach1	2297.673		.1	.3
Reach1	2145.706		.1	.3
Reach1	2110.812		.1	.3
Reach1	2097.252	Inl Struct		
Reach1	2090.275		.1	.3
Reach1	2078.263		.1	.3
Reach1	2045.894		.1	.3
Reach1	1944.087		.1	.3
Reach1	1851.190		.1	.3
Reach1	1810.842	Inl Struct		
Reach1	1804.030		.1	.3
Reach1	1781.875		.1	.3
Reach1	1645.995		.1	.3
Reach1	1515.506		.1	.3
Reach1	1502.91	Inl Struct		
Reach1	1495.849		.1	.3
Reach1	1479.893		.1	.3
Reach1	1344.964		.1	.3
Reach1	1266.459		.1	.3
Reach1	1197.553	Inl Struct		
Reach1	1189.172		.1	.3
Reach1	1165.285		.1	.3
Reach1	1028.773		.1	.3
Reach1	998.5162		.1	.3
Reach1	990.7514	Inl Struct		
Reach1	982.1498		.1	.3
Reach1	972.0575		.1	.3
Reach1	866.9367		.1	.3
Reach1	799.0856		.1	.3
Reach1	789.9481	Inl Struct		
Reach1	783.0189		.1	.3
Reach1	772.6547		.1	.3
Reach1	729.7908		.1	.3
Reach1	582.7006		.1	.3
Reach1	551.0980	Inl Struct		
Reach1	541.1541		.1	.3
Reach1	501.3466		.1	.3
Reach1	383.5453		.1	.3
Reach1	141.7450		.1	.3
Reach1	134.3734		.1	.3
Reach1	114.1627		.1	.3
Reach1	58.59812		.1	.3

Profile Output Table - Standard Table 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl

			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)
Reach1	15089.58	FLO2DQ	261.00	1665.42	1667.36		1667.66	0.012489	4.40	59.32	67.37
	0.82										
Reach1	15048.99	FLO2DQ	261.00	1664.89	1666.86	1666.75	1667.11	0.014047	3.98	65.51	92.46
	0.83										
Reach1	14945.94	FLO2DQ	261.00	1663.65	1665.02	1665.02	1665.29	0.023589	4.18	62.51	121.37
	1.03										
Reach1	14937.48	FLO2DQ	261.00	1661.40	1663.34		1663.44	0.002582	2.56	102.13	78.96
	0.40										
Reach1	14877.43	FLO2DQ	624.00	1660.46	1662.97		1663.22	0.005251	4.03	154.95	103.06
	0.58										
Reach1	14841.55	FLO2DQ	624.00	1660.47	1662.63	1662.22	1663.00	0.006823	4.84	128.90	79.07
	0.67										
Reach1	14809.29	FLO2DQ	624.00	1660.09	1662.42	1661.94	1662.78	0.006191	4.84	128.89	73.52
	0.64										
Reach1	14708.76	FLO2DQ	624.00	1659.61	1661.47	1661.29	1661.98	0.010852	5.71	109.21	74.07
	0.83										
Reach1	14651.74	FLO2DQ	624.00	1659.12	1661.09		1661.41	0.007162	4.51	138.34	98.06
	0.67										
Reach1	14600.25	FLO2DQ	624.00	1658.58	1660.80		1661.07	0.005255	4.17	149.76	94.70
	0.58										
Reach1	14567.53	FLO2DQ	624.00	1658.54	1660.61	1660.04	1660.90	0.005083	4.36	143.24	82.50
	0.58										
Reach1	14523.69		Inl Struct								
Reach1	14523.69	FLO2DQ	624.00	1657.92	1660.48		1660.68	0.004618	3.60	173.51	85.09
	0.44										
Reach1	14514.80	FLO2DQ	1230.00	1656.42	1660.18		1660.61	0.006459	5.24	234.80	84.02
	0.55										
Reach1	14337.25	FLO2DQ	1230.00	1655.36	1659.32	1657.87	1659.63	0.004242	4.48	274.26	90.16
	0.45										
Reach1	14300		Inl Struct								
Reach1	14274.69	FLO2DQ	1230.00	1655.23	1659.14		1659.54	0.012083	5.07	242.45	146.11
	0.69										
Reach1	14216.35	FLO2DQ	1230.00	1654.53	1658.44		1658.89	0.009946	5.43	233.82	134.91
	0.66										
Reach1	14142.06	FLO2DQ	1393.00	1654.26	1657.41	1657.04	1658.02	0.013740	6.24	223.57	112.34
	0.77										
Reach1	14119.48	FLO2DQ	1393.00	1654.21	1656.61	1656.61	1657.58	0.024254	7.92	175.87	91.65
	1.01										
Reach1	14115.15	FLO2DQ	1393.00	1652.63	1656.52		1657.09	0.009615	6.06	229.94	89.28
	0.67										
Reach1	14085.17	FLO2DQ	1393.00	1652.31	1656.12		1656.76	0.011511	6.44	216.36	87.37
	0.72										
Reach1	13942.92	FLO2DQ	1393.00	1651.47	1654.76		1655.26	0.009162	5.67	245.82	101.71
	0.64										
Reach1	13758.60	FLO2DQ	1393.00	1650.15	1653.43	1652.54	1653.78	0.006438	4.77	291.91	121.19
	0.54										
Reach1	13720.10		Inl Struct								
Reach1	13712.92	FLO2DQ	1463.00	1647.44	1651.24		1651.56	0.004909	4.59	318.52	113.22
	0.48										
Reach1	13679.62	FLO2DQ	1463.00	1647.40	1651.01		1651.38	0.006051	4.86	301.04	114.89
	0.53										
Reach1	13555.95	FLO2DQ	1463.00	1646.91	1650.14		1650.55	0.007334	5.15	283.87	114.72
	0.58										
Reach1	13441.98	FLO2DQ	1459.00	1646.13	1649.27	1648.54	1649.68	0.007983	5.16	282.68	121.65
	0.60										
Reach1	13420.23		Inl Struct								
Reach1	13413.49	FLO2DQ	1459.00	1643.91	1646.80		1647.35	0.010259	5.94	245.60	103.23
	0.68										
Reach1	13392.26	FLO2DQ	1459.00	1642.81	1646.72		1647.13	0.006374	5.10	286.36	105.56
	0.55										
Reach1	13283.16	FLO2DQ	1459.00	1642.58	1646.09		1646.45	0.005775	4.80	304.25	114.50
	0.52										
Reach1	13148.64	FLO2DQ	1459.00	1641.92	1645.13	1644.39	1645.54	0.007971	5.17	281.94	120.76
	0.60										
Reach1	13121.90		Inl Struct								
Reach1	13113.85	FLO2DQ	1457.00	1638.72	1642.15		1642.57	0.006958	5.19	280.64	107.89
	0.57										
Reach1	13103.41	FLO2DQ	1457.00	1637.69	1642.18		1642.48	0.004157	4.41	330.36	109.76
	0.45										
Reach1	12948.99	FLO2DQ	1457.00	1637.65	1641.37		1641.73	0.005836	4.78	305.08	116.42
	0.52										
Reach1	12751.20	FLO2DQ	1457.00	1636.86	1640.01	1639.30	1640.36	0.008446	4.74	307.21	156.87
	0.60										
Reach1	12722.07		Inl Struct								
Reach1	12710.30	FLO2DQ	1548.00	1633.82	1636.87		1637.35	0.008309	5.56	278.56	110.53
	0.62										
Reach1	12684.08	FLO2DQ	1548.00	1632.23	1636.63		1637.12	0.008699	5.63	274.72	109.41
	0.63										
Reach1	12570.39	FLO2DQ	1548.00	1632.39	1635.95		1636.29	0.005188	4.67	331.52	119.73
	0.49										
Reach1	12421.26	FLO2DQ	1548.00	1632.05	1634.92	1634.17	1635.34	0.007905	5.20	297.50	125.61
	0.60										
Reach1	12398.37		Inl Struct								
Reach1	12387.58	FLO2DQ	1628.00	1628.34	1632.09		1632.46	0.004939	4.87	334.15	109.08
	0.49										
Reach1	12358.28	FLO2DQ	1628.00	1628.04	1631.79		1632.28	0.007684	5.58	291.81	108.35
	0.60										
Reach1	12244.50	FLO2DQ	1628.00	1627.33	1630.99		1631.42	0.007095	5.27	308.68	117.58
	0.57										
Reach1	12160.68	FLO2DQ	1628.00	1626.97	1630.35	1629.55	1630.80	0.007800	5.36	303.94	121.48
	0.60										
Reach1	12125.61		Inl Struct								

Reach1	12118.62	FLO2DQ	1709.00	1624.18	1627.97		1628.36	0.005720	5.04	339.42
118.01	0.52									
Reach1	12083.58	FLO2DQ	1709.00	1623.88	1627.67		1628.13	0.007834	5.44	314.11
122.94	0.60									
Reach1	12034.51	FLO2DQ	1709.00	1623.23	1627.17		1627.70	0.009430	5.84	292.58
118.09	0.65									
Reach1	11861.96	FLO2DQ	1709.00	1622.44	1625.80	1624.94	1626.24	0.007262	5.30	322.65
124.23	0.58									
Reach1	11832.55		Inl Struct							
Reach1	11825.08	FLO2DQ	1710.00	1619.92	1623.56		1623.98	0.005741	5.16	331.57
111.26	0.53									
Reach1	11794.31	FLO2DQ	1710.00	1619.67	1623.24		1623.76	0.008368	5.79	295.41
110.49	0.62									
Reach1	11660.13	FLO2DQ	1710.00	1618.82	1622.13		1622.62	0.008403	5.64	302.95
118.40	0.62									
Reach1	11583.43	FLO2DQ	1710.00	1618.29	1621.54	1620.73	1621.99	0.007684	5.41	316.36
123.33	0.59									
Reach1	11538.79		Inl Struct							
Reach1	11530.86	FLO2DQ	1719.00	1613.55	1618.35		1618.86	0.005578	6.62	318.22
105.12	0.55									
Reach1	11507.12	FLO2DQ	1719.00	1613.30	1618.10		1618.74	0.002594	7.34	326.04
104.13	0.62									
Reach1	11377.76	FLO2DQ	1719.00	1612.92	1617.29		1618.26	0.004992	8.95	270.20
112.11	0.80									
Reach1	11258.40	FLO2DQ	1718.00	1612.31	1616.53	1616.53	1617.63	0.005211	9.44	264.99
121.09	0.90									
Reach1	11246.90		Inl Struct							
Reach1	11240.54	FLO2DQ	1718.00	1608.86	1614.04		1614.95	0.003167	8.64	293.13
106.48	0.74									
Reach1	11224.92	FLO2DQ	1718.00	1608.95	1614.03		1614.88	0.003597	8.28	291.73
106.60	0.71									
Reach1	11094.81	FLO2DQ	1718.00	1608.91	1613.54		1614.38	0.004062	8.25	290.88
110.66	0.72									
Reach1	10964.53	FLO2DQ	1718.00	1608.37	1612.60	1612.60	1613.72	0.006026	9.58	258.46
117.79	0.89									
Reach1	10937.06		Inl Struct							
Reach1	10927.56	FLO2DQ	1717.00	1605.71	1610.45		1611.34	0.003388	8.83	296.97
107.44	0.76									
Reach1	10911.95	FLO2DQ	1717.00	1605.60	1609.89		1611.23	0.005065	10.41	244.83
102.76	0.93									
Reach1	10775.80	FLO2DQ	1717.00	1605.12	1609.28	1609.28	1610.49	0.005212	9.87	250.54
106.83	0.92									
Reach1	10637.14		Inl Struct							
Reach1	10628.03	FLO2DQ	1716.00	1603.01	1607.27	1607.27	1608.47	0.006135	9.91	247.56
104.31	0.91									
Reach1	10555.32	FLO2DQ	1716.00	1602.63	1607.06		1607.89	0.003407	8.31	300.95
112.23	0.74									
Reach1	10468.18	FLO2DQ	1716.00	1602.32	1606.31	1606.31	1607.48	0.005682	9.83	255.17
118.04	0.93									
Reach1	10435.00		Inl Struct							
Reach1	10428.14	FLO2DQ	1716.00	1598.89	1603.74		1604.90	0.004859	9.62	250.35
100.15	0.84									
Reach1	10407.63	FLO2DQ	1716.00	1599.05	1603.86		1604.72	0.003485	8.21	285.01
102.66	0.69									
Reach1	10274.00	FLO2DQ	1716.00	1598.75	1603.59		1604.23	0.002865	7.39	332.41
115.17	0.62									
Reach1	10161.95	FLO2DQ	1716.00	1598.33	1602.59	1602.59	1603.74	0.006328	9.63	249.49
111.71	0.90									
Reach1	10136.06		Inl Struct							
Reach1	10126.72	FLO2DQ	1713.00	1595.85	1601.14		1601.73	0.002116	7.15	351.61
107.53	0.58									
Reach1	10096.77	FLO2DQ	1713.00	1595.71	1600.85		1601.64	0.002706	8.01	307.93
103.90	0.65									
Reach1	9938.554	FLO2DQ	1713.00	1595.65	1600.53		1601.17	0.002733	7.38	330.96
114.23	0.62									
Reach1	9791.290	FLO2DQ	1713.00	1594.99	1599.39	1599.39	1600.60	0.004590	9.53	245.34
108.86	0.88									
Reach1	9713.006		Inl Struct							
Reach1	9702.693	FLO2DQ	1721.00	1592.03	1596.64		1597.60	0.005014	9.13	268.11
104.64	0.80									
Reach1	9682.938	FLO2DQ	1721.00	1591.83	1596.59		1597.49	0.004458	8.58	276.33
102.26	0.75									
Reach1	9588.970	FLO2DQ	1719.00	1591.46	1596.47		1597.05	0.002810	7.08	343.26
111.58	0.59									
Reach1	9456.982	FLO2DQ	1719.00	1591.25	1595.35	1595.35	1596.50	0.005318	9.64	256.85
115.61	0.90									
Reach1	9426.926		Inl Struct							
Reach1	9420.045	FLO2DQ	1718.00	1588.58	1593.15		1594.26	0.004763	9.57	258.37
103.89	0.83									
Reach1	9401.967	FLO2DQ	1718.00	1588.62	1593.21		1594.12	0.004075	8.80	279.64
104.68	0.76									
Reach1	9332.685	FLO2DQ	1718.00	1588.41	1593.13		1593.80	0.002986	7.62	325.60
112.88	0.65									
Reach1	9244.882	FLO2DQ	1718.00	1588.39	1592.31	1592.31	1593.39	0.007444	9.53	254.87
118.01	0.92									
Reach1	9220.901		Inl Struct							
Reach1	9214.029	FLO2DQ	1718.00	1585.32	1589.85	1589.85	1591.05	0.006296	9.89	245.94
106.87	0.89									
Reach1	9191.509	FLO2DQ	1718.00	1584.75	1589.37		1590.34	0.005441	9.01	267.83
106.02	0.80									
Reach1	9125.650	FLO2DQ	1718.00	1584.70	1589.08		1590.02	0.004180	8.90	284.43
111.44	0.80									
Reach1	9026.968	FLO2DQ	1707.00	1584.48	1588.44	1588.44	1589.48	0.007199	9.43	259.08
120.10	0.90									
Reach1	9019.372		Inl Struct							

Reach1	9015.422	FLO2DQ	1707.00	1581.84	1586.25		1587.47	0.006390	9.93	242.45
103.80	0.90									
Reach1	8998.093	FLO2DQ	1707.00	1581.77	1586.58		1587.20	0.002892	7.41	330.63
107.87	0.62									
Reach1	8963.707	FLO2DQ	1707.00	1581.77	1586.47		1587.11	0.002562	7.47	336.27
111.19	0.64									
Reach1	8853.075	FLO2DQ	1707.00	1581.46	1585.55	1585.55	1586.68	0.005190	9.64	262.09
118.05	0.90									
Reach1	8820.596		Inl Struct							
Reach1	8815.779	FLO2DQ	1718.00	1579.34	1584.08		1584.97	0.003207	8.67	298.35
109.20	0.75									
Reach1	8799.197	FLO2DQ	1718.00	1579.48	1584.22		1584.84	0.002440	7.63	346.66
112.53	0.64									
Reach1	8661.449	FLO2DQ	1718.00	1579.33	1583.85		1584.49	0.002623	7.52	337.64
113.61	0.65									
Reach1	8500.547	FLO2DQ	1715.00	1578.79	1582.72	1582.72	1583.84	0.006791	9.69	254.43
114.32	0.92									
Reach1	8474.735		Inl Struct							
Reach1	8469.387	FLO2DQ	1715.00	1576.45	1580.93		1582.04	0.004992	9.50	258.30
102.15	0.83									
Reach1	8439.225	FLO2DQ	1715.00	1576.31	1581.14		1581.78	0.003081	7.54	331.17
114.32	0.64									
Reach1	8287.219	FLO2DQ	1715.00	1575.84	1580.72		1581.34	0.002635	7.41	342.65
116.55	0.62									
Reach1	8149.652	FLO2DQ	1715.00	1575.57	1579.67	1579.67	1580.81	0.005201	9.68	261.75
115.50	0.90									
Reach1	8128.972		Inl Struct							
Reach1	8122.685	FLO2DQ	1711.00	1572.64	1577.80	1577.80	1579.04	0.004861	9.88	247.59
103.82	0.85									
Reach1	8097.253	FLO2DQ	1711.00	1572.87	1578.04		1578.65	0.002040	7.20	345.53
107.65	0.58									
Reach1	7953.828	FLO2DQ	1711.00	1572.75	1577.71		1578.32	0.002568	7.28	342.58
113.69	0.61									
Reach1	7799.566	FLO2DQ	1711.00	1572.54	1576.61	1576.61	1577.72	0.005918	9.72	259.76
115.42	0.92									
Reach1	7779.531		Inl Struct							
Reach1	7773.177	FLO2DQ	1707.00	1570.51	1574.94	1574.94	1576.11	0.005450	10.02	251.94
106.60	0.90									
Reach1	7752.089	FLO2DQ	1707.00	1570.28	1574.77		1575.80	0.004045	9.47	273.88
107.04	0.83									
Reach1	7598.913	FLO2DQ	1707.00	1569.85	1574.42		1575.14	0.003344	7.92	314.99
118.17	0.69									
Reach1	7446.958	FLO2DQ	1707.00	1569.77	1573.43	1573.43	1574.46	0.005824	9.55	270.08
127.35	0.94									
Reach1	7427.061		Inl Struct							
Reach1	7419.387	FLO2DQ	1702.00	1565.87	1571.36		1571.89	0.001947	6.84	362.16
112.65	0.55									
Reach1	7379.578	FLO2DQ	1702.00	1566.52	1571.16		1571.79	0.002885	7.43	329.93
116.41	0.64									
Reach1	7217.642	FLO2DQ	1702.00	1566.09	1570.78		1571.35	0.002242	7.12	353.89
117.33	0.61									
Reach1	7057.082	FLO2DQ	1702.00	1565.81	1569.65	1569.65	1570.78	0.005502	9.78	260.76
117.35	0.94									
Reach1	7026.190		Inl Struct							
Reach1	7022.299	FLO2DQ	1694.00	1562.87	1567.78	1567.78	1569.02	0.004308	9.77	249.51
107.12	0.86									
Reach1	6998.997	FLO2DQ	1694.00	1562.84	1567.09		1568.15	0.004669	9.20	255.94
103.46	0.84									
Reach1	6854.423	FLO2DQ	1694.00	1562.38	1566.50		1567.48	0.004269	9.28	279.60
112.50	0.85									
Reach1	6732.243	FLO2DQ	1694.00	1561.61	1565.75	1565.75	1566.89	0.005067	9.81	262.97
116.69	0.91									
Reach1	6718.729		Inl Struct							
Reach1	6713.511	FLO2DQ	1691.00	1559.27	1564.52		1565.14	0.001950	7.40	356.04
112.08	0.59									
Reach1	6691.186	FLO2DQ	1691.00	1559.39	1564.37		1565.08	0.002411	7.74	323.19
109.47	0.65									
Reach1	6571.056	FLO2DQ	1691.00	1558.97	1564.16		1564.78	0.002128	7.33	347.64
115.19	0.61									
Reach1	6445.849	FLO2DQ	1691.00	1558.93	1563.21	1563.21	1564.36	0.004864	9.71	263.02
117.80	0.90									
Reach1	6421.011		Inl Struct							
Reach1	6416.444	FLO2DQ	1687.00	1556.38	1561.44	1561.44	1562.67	0.004174	9.90	258.55
111.16	0.84									
Reach1	6394.126	FLO2DQ	1687.00	1556.29	1561.09		1561.89	0.002917	8.18	304.19
110.64	0.71									
Reach1	6274.483	FLO2DQ	1687.00	1555.80	1560.89		1561.54	0.002229	7.48	343.19
117.06	0.63									
Reach1	6147.176	FLO2DQ	1687.00	1555.74	1559.98	1559.98	1561.09	0.005090	9.57	261.89
120.30	0.91									
Reach1	6121.654		Inl Struct							
Reach1	6113.420	FLO2DQ	1684.00	1553.20	1557.80		1558.63	0.003008	8.21	294.22
107.70	0.72									
Reach1	6094.420	FLO2DQ	1684.00	1553.17	1557.34		1558.53	0.004778	9.70	249.69
106.28	0.89									
Reach1	5972.070	FLO2DQ	1684.00	1552.54	1557.04		1557.93	0.003466	8.60	292.87
116.33	0.77									
Reach1	5841.366	FLO2DQ	1684.00	1552.63	1556.29	1556.29	1557.35	0.005639	9.64	267.17
124.02	0.95									
Reach1	5820.431		Inl Struct							
Reach1	5812.631	FLO2DQ	1684.00	1548.62	1553.00	1553.00	1554.22	0.004946	10.18	253.97
105.25	0.91									
Reach1	5786.387	FLO2DQ	1684.00	1548.05	1552.91		1553.82	0.003226	8.75	292.35
108.24	0.75									

Reach1	5687.190	FLO2DQ	1684.00	1547.64	1552.78		1553.47	0.002474	7.68	330.67
115.02	0.66									
Reach1	5448.002	FLO2DQ	1684.00	1547.74	1551.52	1551.52	1552.61	0.005489	9.70	264.14
120.36	0.94									
Reach1	5418.712		Inl Struct							
Reach1	5413.769	FLO2DQ	1681.00	1544.71	1549.08	1549.08	1550.30	0.004946	10.19	254.92
106.49	0.91									
Reach1	5381.124	FLO2DQ	1681.00	1544.20	1548.98		1549.83	0.003069	8.31	294.13
107.87	0.73									
Reach1	5275.222	FLO2DQ	1681.00	1544.13	1548.65		1549.49	0.003342	8.48	298.56
111.57	0.75									
Reach1	5132.593	FLO2DQ	1681.00	1543.65	1547.74	1547.74	1548.87	0.005266	9.72	256.85
115.55	0.92									
Reach1	5120.617		Inl Struct							
Reach1	5116.053	FLO2DQ	1680.00	1541.69	1546.17	1546.17	1547.38	0.004732	10.11	254.69
105.93	0.90									
Reach1	5087.074	FLO2DQ	1680.00	1540.90	1545.31		1546.42	0.004251	9.48	258.34
101.97	0.85									
Reach1	4966.653	FLO2DQ	1680.00	1540.49	1545.08		1545.87	0.003191	8.31	307.78
116.19	0.74									
Reach1	4850.062	FLO2DQ	1680.00	1540.37	1544.28	1544.28	1545.38	0.005302	9.63	262.79
119.72	0.93									
Reach1	4824.903		Inl Struct							
Reach1	4818.556	FLO2DQ	1697.00	1537.70	1541.67	1541.67	1542.85	0.005625	10.21	254.30
106.19	0.96									
Reach1	4770.290	FLO2DQ	1758.00	1536.81	1541.49		1542.51	0.003810	9.18	281.94
106.99	0.81									
Reach1	4683.298	FLO2DQ	1758.00	1536.17	1541.39		1542.15	0.002698	8.10	330.24
115.61	0.69									
Reach1	4509.527	FLO2DQ	1758.00	1536.42	1540.38	1540.38	1541.49	0.005258	9.98	280.27
123.86	0.93									
Reach1	4494.152		Inl Struct							
Reach1	4488.645	FLO2DQ	1796.00	1534.05	1538.49	1538.49	1539.70	0.004919	10.14	272.46
112.53	0.91									
Reach1	4471.064	FLO2DQ	1796.00	1533.36	1537.69		1538.83	0.004399	9.77	275.37
105.78	0.87									
Reach1	4359.662	FLO2DQ	1796.00	1532.70	1537.52		1538.32	0.002856	8.32	327.57
115.38	0.71									
Reach1	4244.980	FLO2DQ	1796.00	1532.65	1536.71	1536.71	1537.87	0.004938	9.83	274.42
120.05	0.91									
Reach1	4187.928	FLO2DQ	1796.00	1532.62	1536.90		1537.38	0.002339	6.94	402.50
191.33	0.63									
Reach1	4151.155	FLO2DQ	1796.00	1532.51	1536.95		1537.25	0.001382	5.46	452.44
173.94	0.49									
Reach1	4129.040	FLO2DQ	1796.00	1532.53	1536.89		1537.22	0.001342	5.38	438.05
155.38	0.48									
Reach1	4115.484	FLO2DQ	1796.00	1532.43	1536.92		1537.18	0.001045	4.96	488.53
157.60	0.43									
Reach1	4094.117	FLO2DQ	2268.00	1532.30	1536.69		1537.13	0.001928	6.65	467.75
157.84	0.58									
Reach1	3972.552	FLO2DQ	2268.00	1531.36	1535.94		1536.78	0.003894	9.36	395.75
132.76	0.82									
Reach1	3852.914	FLO2DQ	2268.00	1530.84	1534.94	1534.94	1536.18	0.005987	10.77	331.23
130.00	1.00									
Reach1	3816.660		Inl Struct							
Reach1	3812.718	FLO2DQ	2268.00	1529.29	1534.49		1535.11	0.002458	8.09	460.50
134.41	0.66									
Reach1	3799.484	FLO2DQ	2268.00	1530.22	1534.45		1535.08	0.002957	8.35	443.49
134.98	0.72									
Reach1	3637.573	FLO2DQ	2268.00	1529.48	1534.09		1534.61	0.002408	7.60	481.16
138.76	0.65									
Reach1	3413.317	FLO2DQ	2268.00	1528.36	1532.58	1532.58	1533.79	0.005693	10.54	339.33
136.27	0.97									
Reach1	3404.692		Inl Struct							
Reach1	3400.519	FLO2DQ	2268.00	1526.46	1531.15	1531.15	1532.42	0.005196	10.61	332.94
127.42	0.94									
Reach1	3385.912	FLO2DQ	2268.00	1526.09	1531.20		1531.92	0.002709	8.69	434.97
129.55	0.70									
Reach1	3276.504	FLO2DQ	2268.00	1525.91	1530.79		1531.60	0.003012	8.72	411.74
134.11	0.73									
Reach1	3141.353	FLO2DQ	2268.00	1525.63	1529.82	1529.82	1531.04	0.005389	10.55	341.77
135.86	0.95									
Reach1	3116.898		Inl Struct							
Reach1	3110.386	FLO2DQ	2268.00	1523.35	1528.16		1529.05	0.003312	9.22	397.51
128.76	0.77									
Reach1	3085.983	FLO2DQ	2268.00	1522.96	1528.20		1528.93	0.002537	8.51	436.93
131.76	0.68									
Reach1	2987.290	FLO2DQ	2268.00	1522.47	1527.84		1528.67	0.002656	8.66	415.35
132.55	0.69									
Reach1	2859.922	FLO2DQ	2268.00	1522.51	1527.75		1528.28	0.001912	7.32	511.62
153.36	0.59									
Reach1	2838.551	FLO2DQ	2268.00	1522.40	1527.82		1528.20	0.001384	6.43	650.21
229.54	0.51									
Reach1	2833.935	FLO2DQ	2268.00	1520.61	1527.14	1527.14	1528.13	0.003681	9.33	426.44
216.35	0.80									
Reach1	2817		Culvert							
Reach1	2799.662	FLO2DQ	2268.00	1520.28	1526.85	1526.85	1527.85	0.003786	9.47	423.68
204.98	0.81									
Reach1	2766.312	FLO2DQ	2268.00	1520.69	1526.00		1526.40	0.001551	6.44	594.75
190.71	0.53									
Reach1	2655.140	FLO2DQ	2268.00	1520.86	1525.14		1526.10	0.004449	9.83	373.49
135.55	0.88									
Reach1	2538.673	FLO2DQ	2268.00	1520.36	1524.80		1525.59	0.003341	8.79	410.29
135.93	0.76									

Reach1	2421.011	FLO2DQ	2268.00	1519.79	1523.89	1523.89	1525.06	0.005714	10.56	346.23
140.29	0.97									
Reach1	2403.885		Inl Struct							
Reach1	2398.240	FLO2DQ	2268.00	1517.64	1521.65	1521.65	1522.91	0.006518	11.45	330.26
125.94	1.05									
Reach1	2384.655	FLO2DQ	2268.00	1517.42	1521.73		1522.53	0.004021	9.48	400.19
128.79	0.83									
Reach1	2297.673	FLO2DQ	2268.00	1516.46	1521.39		1522.21	0.003084	8.79	409.13
133.73	0.74									
Reach1	2145.706	FLO2DQ	2268.00	1516.13	1520.94		1521.74	0.003107	8.66	417.64
141.70	0.74									
Reach1	2110.812	FLO2DQ	2268.00	1516.10	1520.38	1520.38	1521.56	0.005520	10.57	347.47
139.56	0.96									
Reach1	2097.252		Inl Struct							
Reach1	2090.275	FLO2DQ	2268.00	1513.29	1518.21		1519.16	0.003609	9.23	377.79
128.79	0.79									
Reach1	2078.263	FLO2DQ	2268.00	1513.01	1518.30		1519.06	0.002839	8.61	421.59
130.32	0.70									
Reach1	2045.894	FLO2DQ	2268.00	1513.21	1518.10		1518.96	0.003106	8.82	397.90
130.35	0.74									
Reach1	1944.087	FLO2DQ	2268.00	1512.76	1517.77		1518.64	0.003188	8.98	405.53
137.91	0.75									
Reach1	1851.190	FLO2DQ	2268.00	1512.57	1517.03	1517.03	1518.24	0.005088	10.41	345.05
138.41	0.93									
Reach1	1810.842		Inl Struct							
Reach1	1804.030	FLO2DQ	2268.00	1509.50	1514.62		1515.65	0.003702	9.51	367.69
128.21	0.81									
Reach1	1781.875	FLO2DQ	2268.00	1509.51	1514.78		1515.48	0.002436	8.07	437.49
131.03	0.66									
Reach1	1645.995	FLO2DQ	2268.00	1509.27	1514.50		1515.16	0.002220	7.91	461.48
141.06	0.64									
Reach1	1515.506	FLO2DQ	2268.00	1509.16	1513.50	1513.50	1514.70	0.005298	10.41	347.77
142.40	0.94									
Reach1	1502.91		Inl Struct							
Reach1	1495.849	FLO2DQ	2268.00	1506.34	1511.43		1512.27	0.003257	9.12	405.22
129.14	0.75									
Reach1	1479.893	FLO2DQ	2268.00	1506.43	1511.43		1512.21	0.002800	8.57	416.68
128.37	0.71									
Reach1	1344.964	FLO2DQ	2268.00	1505.87	1510.95		1511.81	0.003051	8.87	406.82
135.40	0.74									
Reach1	1266.459	FLO2DQ	2268.00	1505.52	1510.23	1510.23	1511.47	0.005057	10.54	341.49
133.36	0.92									
Reach1	1197.553		Inl Struct							
Reach1	1189.172	FLO2DQ	2268.00	1503.71	1508.10		1509.27	0.004929	10.42	345.33
126.75	0.92									
Reach1	1165.285	FLO2DQ	2268.00	1503.16	1508.28		1509.06	0.002785	8.63	419.73
130.80	0.71									
Reach1	1028.773	FLO2DQ	2268.00	1502.94	1507.99		1508.67	0.002500	8.13	465.24
154.50	0.67									
Reach1	998.5162	FLO2DQ	2268.00	1503.30	1507.42	1507.42	1508.52	0.005464	10.31	365.67
155.16	0.95									
Reach1	990.7514		Inl Struct							
Reach1	982.1498	FLO2DQ	2268.00	1499.31	1503.60		1504.59	0.004594	9.96	367.13
128.89	0.89									
Reach1	972.0575	FLO2DQ	2268.00	1499.04	1503.75		1504.47	0.002903	8.48	428.24
133.75	0.72									
Reach1	866.9367	FLO2DQ	2268.00	1498.37	1502.79	1502.79	1504.03	0.005038	10.51	342.43
135.67	0.93									
Reach1	799.0856	FLO2DQ	2268.00	1498.30	1502.23	1502.23	1503.41	0.006069	10.64	342.79
139.41	1.00									
Reach1	789.9481		Inl Struct							
Reach1	783.0189	FLO2DQ	2268.00	1495.94	1500.27	1500.14	1501.41	0.005197	10.68	348.80
126.50	0.94									
Reach1	772.6547	FLO2DQ	2268.00	1495.81	1500.38		1501.29	0.003706	9.32	385.38
129.67	0.80									
Reach1	729.7908	FLO2DQ	2268.00	1495.34	1500.29		1501.13	0.003038	8.80	399.92
131.83	0.74									
Reach1	582.7006	FLO2DQ	2268.00	1494.73	1499.27	1499.27	1500.52	0.005239	10.67	341.79
135.56	0.95									
Reach1	551.0980		Inl Struct							
Reach1	541.1541	FLO2DQ	2268.00	1492.98	1498.59		1499.21	0.001929	7.77	475.55
134.62	0.60									
Reach1	501.3466	FLO2DQ	2268.00	1492.75	1498.38		1499.11	0.002251	8.32	444.62
132.24	0.65									
Reach1	383.5453	FLO2DQ	2268.00	1493.14	1498.23		1498.82	0.001916	7.48	477.59
134.33	0.59									
Reach1	141.7450	FLO2DQ	2268.00	1492.41	1496.71	1496.71	1498.04	0.006120	11.34	323.67
121.05	1.02									
Reach1	134.3734	FLO2DQ	2268.00	1490.97	1496.26		1496.84	0.001805	6.95	444.31
117.97	0.57									
Reach1	114.1627	FLO2DQ	2268.00	1489.77	1496.14		1496.80	0.001667	7.29	441.32
118.31	0.56									
Reach1	58.59812	FLO2DQ	2268.00	1490.86	1495.32	1495.32	1496.60	0.006474	9.52	279.48
114.19	1.00									

COE & VAN LOO CONSULTANTS, INC.

2579F08B

FINAL DRAINAGE REPORT
FOR
SUN CITY FESTIVAL
THE FOOTHILLS AT FESTIVAL RANCH PHASE 2
TOWN OF BUCKEYE, ARIZONA

January 5, 2006
1st Revision: March 31, 2006
2nd Revision: May 30, 2008

Prepared for:

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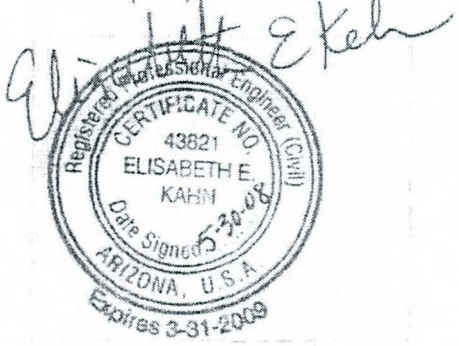

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Approved 7-18-08
Town of Buckeye Engineer Date

The Town approves this report for concept only and accepts no liability for errors or omissions

CVL Job Number: 68-0035-04-10

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3.0 MANAGEMENT OF OFF-SITE RUNOFF

3.1 Off-site Hydrology

Existing hydrology prepared by Kimley Horn & Associates shows the existing flow from the site is 790 cfs. CVL has prepared a post conditions HEC-1 analysis that includes the Sun City Festival Phase 1. The post development flows exiting the site are 728 cfs. Therefore, the site meets pre vs. post flow conditions. See Appendix A.

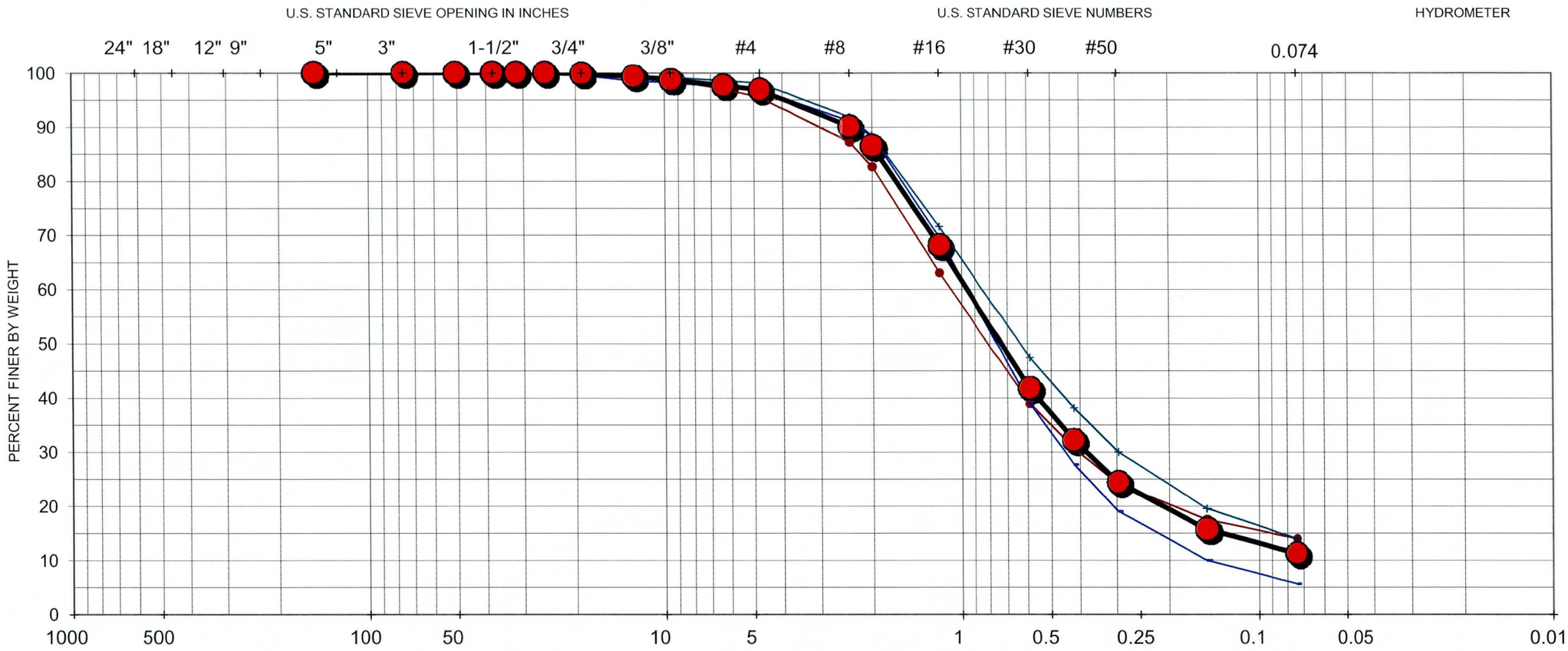
3.2 Off-site Runoff Management Plan

Channel 1 has been designed to convey off-site and on-site flow through the site. This flow is conveyed in a grass lined channel and will ultimately outfall to Wagner Wash. Refer to Appendix B for the HEC-RAS analysis of this channel. Water surface elevations have been calculated along the entire length of the channel. Finish floor elevations have been designed to be protected from the 100-year off-site flow. Drop structures have been provided at culverts to control erosive velocities.

Off-site flow from the south is constricted by a 57" x 38" pipe that conveys approximately 155 cfs under Sun Valley Parkway to Channel #1. Interceptor channels on the south side of Sun Valley Parkway direct flow not being conveyed through the pipe to the west. Flow that is routed west is conveyed in an existing channel along the south side of Sun Valley Parkway. This flow is ultimately received by Wagner Wash.

Appendix F

Erosion/Sediment Transport



BOULDERS				GRAVEL					SAND					SILT	
MEDIUM	SMALL	LARGE	SMALL	VERY COARSE	COARSE	MEDIUM	FINE	VERY FINE	VERY COARSE	COARSE	MEDIUM	FINE	VERY FINE	COARSE	MEDIUM

CAP 5 CAP 6 CAP 8 Average + Log Scale + Sizes Labels

WHITE TANK MOUNTAINS FANS 1 AND 2
FLOODPLAIN DELINEATION

JE Fuller Hydrology and Geomorphology Inc.
Tempe Arizona

Sediment Yield (MUSLE) for Fan 2 Ys = Rw * K * LS * C * P

Rw, Storm Energy Runoff Factor; Rw = a(V*q)^b

Drainage Area =	1.74	sq. mi.
Area Contributing Sediment =	1.74	sq. mi.

Recurrence Interval	Ratios	Volume, V (ac-ft)	Flow Peak (cfs)	a	b	Rw
Q-2	0.1	14	142	95	0.56	6563
Q-5	0.25	34	354	95	0.56	18314
Q-10	0.35	48	496	95	0.56	26697
Q-25	0.55	75	779	95	0.56	44290
Q-50	0.75	102	1062	95	0.56	62686
Q-100	1	136	1416	95	0.56	86517

K, Soil Erodibility Factor: Table 14, Camp, 1986

Soil Map Unit	K	% of Basin
3	0.16	3.7%
48	0.08	25.1%
100	0.02	49.8%
49	0.08	19.0%
115	0.27	2.5%
Weighted K Factor:	0.06	

C, Cover and Management Factor; Figures 5-7, SCS Ag. Handbook #537

Cover Type	% of Basin	Canopy Factor	Mulch Factor	Root Factor	Composite C Factor	Weighted C Factor
	100	0.90	0.90	0.40	0.32	0.32
					Composite Weighted C Factor=	0.324

LS, Topographic Factor; LS = ((L/72.6)^n)*(0.065+0.0454*S+0.0065*S^2)

Slope Lengths:	200	ft	(Basin Average)
Slope Angles:	25.3	%	(Basin Average)
n =	0.5		
Eq'n B.4 ADWR Manual, Appendix B			
LS =	8.92		

P, Erosion Control Factor

No Practice, Natural or Regulated	
Weighted P for Contributing Watershed	1

Weighted Average Annual Sediment Yield:

Recurrence Interval	Rw	K	LS	C	P	Ys (tons)	Unit Ys (AF/sq.mi)
Q-2	6563	0.06	8.92	0.32	1.00	1088	0.26
Q-50	18314	0.06	8.92	0.32	1.00	3036	0.73
Q-10	26697	0.06	8.92	0.32	1.00	4426	1.06
Q-25	44290	0.06	8.92	0.32	1.00	7343	1.76
Q-50	62686	0.06	8.92	0.32	1.00	10393	2.49
Q-100	86517	0.06	8.92	0.32	1.00	14344	3.44
Weighted Average Annual Sediment Yield:						2061	0.49

Sediment Delivery Ratio	0.53
Total Wash Load Sediment Yield Volume	4.5 (ac. ft)

Sediment Yield (MUSLE) for Fan 1

Ys = Rw * K * LS * C * P

Rw, Storm Energy Runoff Factor; Rw = a(V*q)^b

Drainage Area =	0.43 sq. mi.
Area Contributing Sediment =	0.43 sq. mi.

Recurrence Interval	Ratios	Volume, V (ac-ft)	Flow Peak (cfs)	a	b	Rw
Q-2	0.1	4	66	95	0.56	2099
Q-5	0.25	10	166	95	0.56	5858
Q-10	0.35	13	232	95	0.56	8540
Q-25	0.55	21	364	95	0.56	14167
Q-50	0.75	29	497	95	0.56	20052
Q-100	1	38	662	95	0.56	27675

K, Soil Erodibility Factor: Table 14, Camp, 1986

Soil Map Unit	K	% of Basin
48	0.08	0.0827
100	0.02	0.5626
110	0.20	0.2591
49	0.08	0.0956
Weighted K Factor:	0.08	

C, Cover and Management Factor; Figures 5-7, SCS Ag. Handbook #537

Cover Type	% of Basin	Canopy Factor	Mulch Factor	Root Factor	Composite C Factor	Weighted C Factor
	100	0.90	0.90	0.40	0.32	0.32
					Composite Weighted C Factor=	0.324

LS, Topographic Factor; LS = ((L/72.6)^n)*(0.065+0.0454*S+0.0065*S^2)

Slope Lengths:	200	ft	(Basin Average)
Slope Angles:	32.5	%	(Basin Average)
n =	0.5		
Eq'n B.4 ADWR Manual, Appendix B			
LS =	13.95		

P, Erosion Control Factor

No Practice, Natural or Regulated	
Weighted P for Contributing Watershed	1

Weighted Average Annual Sediment Yield:

Recurrence Interval	Rw	K	LS	C	P	Ys (tons)	Unit Ys (AF/sq.mi)
Q-2	2099	0.08	13.95	0.32	1.00	732	0.71
Q-5	5858	0.08	13.95	0.32	1.00	2043	1.98
Q-10	8540	0.08	13.95	0.32	1.00	2979	2.89
Q-25	14167	0.08	13.95	0.32	1.00	4941	4.80
Q-50	20052	0.08	13.95	0.32	1.00	6994	6.79
Q-100	27675	0.08	13.95	0.32	1.00	9653	9.37
Weighted Average Annual Sediment Yield:						1387	1.35

Sediment Delivery Ratio	0.53	
Total Wash Load Sediment Yield Volume	3.1	(ac. ft)

Sediment Yield Calculations for 6-hr storm event									
	Subbasin S110					S900			
Time t	Discharge Q (cfs)	Flow Volume, Vw=Q*t (ft^3)	Sediment Load Qs (cfs)	Sediment Volume (Qs/Q)*Vw (ft^3)		Discharge Q (cfs)	Flow Volume, Vw=Q*t (cfs)	Sediment Load Qs (cfs)	Sediment Volume (Qs/Q)*Vw (ft^3)
1/1/1999 12:00	0					0			
1/1/1999 12:05	0.03	4.5	0.0	0.0		0.04	6	0.0	0.0
1/1/1999 12:10	0.11	21	0.0	0.0		0.08	18	0.0	0.0
1/1/1999 12:15	0.28	58.5	0.0	0.0		0.19	40.5	0.0	0.0
1/1/1999 12:20	0.51	118.5	0.0	0.0		0.37	84	0.0	0.0
1/1/1999 12:25	0.81	198	0.0	0.0		0.62	148.5	0.0	0.0
1/1/1999 12:30	0.99	270	0.0	0.0		0.9	228	0.0	0.0
1/1/1999 12:35	1.15	321	0.0	0.0		1.23	319.5	0.0	0.0
1/1/1999 12:40	1.28	364.5	0.0	0.0		1.68	436.5	0.0	0.0
1/1/1999 12:45	1.4	402	0.0	0.0		2.02	555	0.0	0.0
1/1/1999 12:50	1.49	433.5	0.0	0.0		2.28	645	0.0	0.0
1/1/1999 12:55	1.58	460.5	0.0	0.0		2.51	718.5	0.0	0.0
1/1/1999 13:00	1.63	481.5	0.0	0.0		2.73	786	0.0	0.8
1/1/1999 13:05	1.65	492	0.0	0.0		2.93	849	0.0	0.6
1/1/1999 13:10	1.66	496.5	0.0	0.0		3.14	910.5	0.0	0.9
1/1/1999 13:15	1.67	499.5	0.0	0.0		3.3	966	0.0	0.7
1/1/1999 13:20	1.68	502.5	0.0	0.0		3.42	1008	0.0	0.8
1/1/1999 13:25	1.69	505.5	0.0	0.0		3.51	1039.5	0.0	0.9
1/1/1999 13:30	1.72	511.5	0.0	0.0		3.6	1066.5	0.0	1.0
1/1/1999 13:35	1.75	520.5	0.0	0.0		3.69	1093.5	0.0	1.1
1/1/1999 13:40	1.77	528	0.0	0.0		3.77	1119	0.0	1.2
1/1/1999 13:45	1.78	532.5	0.0	0.0		3.83	1140	0.0	1.3
1/1/1999 13:50	1.77	532.5	0.0	0.0		3.89	1158	0.0	1.4
1/1/1999 13:55	1.75	528	0.0	0.0		3.95	1176	0.0	1.5
1/1/1999 14:00	1.74	523.5	0.0	0.0		4	1192.5	0.0	1.5
1/1/1999 14:05	1.73	520.5	0.0	0.0		4.02	1203	0.0	1.6
1/1/1999 14:10	1.72	517.5	0.0	0.0		4.03	1207.5	0.0	1.6
1/1/1999 14:15	1.71	514.5	0.0	0.0		4.05	1212	0.0	0.7
1/1/1999 14:20	1.73	516	0.0	0.0		4.09	1221	0.0	0.7
1/1/1999 14:25	1.78	526.5	0.0	0.0		4.14	1234.5	0.0	0.8
1/1/1999 14:30	1.88	549	0.0	0.0		4.22	1254	0.0	0.8
1/1/1999 14:35	2.02	585	0.0	0.0		4.32	1281	0.0	0.9
1/1/1999 14:40	2.19	631.5	0.0	0.0		4.44	1314	0.0	1.0
1/1/1999 14:45	2.28	670.5	0.0	0.0		4.59	1354.5	0.0	1.2
1/1/1999 14:50	2.37	697.5	0.0	0.0		4.79	1407	0.0	1.4
1/1/1999 14:55	2.48	727.5	0.0	0.0		5.05	1476	0.0	1.7
1/1/1999 15:00	2.67	772.5	0.0	0.0		5.32	1555.5	0.0	2.2
1/1/1999 15:05	2.9	835.5	0.0	0.0		5.65	1645.5	0.0	0.7
1/1/1999 15:10	3.19	913.5	0.0	0.0		6.04	1753.5	0.0	0.9
1/1/1999 15:15	3.39	987	0.0	0.0		6.53	1885.5	0.0	1.3
1/1/1999 15:20	3.76	1072.5	0.0	0.0		7.39	2088	0.0	2.2
1/1/1999 15:25	4.53	1243.5	0.0	0.0		8.42	2371.5	0.0	3.8
1/1/1999 15:30	5.88	1561.5	0.0	0.0		9.87	2743.5	0.0	4.2
1/1/1999 15:35	11.5	2607	0.0	3.5		18.53	4260	0.0	10.0
1/1/1999 15:40	25.92	5613	0.1	13.3		28.72	7087.5	0.1	19.6
1/1/1999 15:45	53.01	11839.5	0.2	45.6		52.13	12127.5	0.2	46.0
1/1/1999 15:50	108.68	24253.5	0.6	128.4		103.87	23400	0.4	93.3
1/1/1999 15:55	211.95	48094.5	1.6	366.3		171.46	41299.5	0.9	221.9
1/1/1999 16:00	356.62	85285.5	3.3	798.6		276.47	67189.5	1.6	385.9
1/1/1999 16:05	509.89	129976.5	5.5	1413.0		396.95	101013	2.3	575.4
1/1/1999 16:10	658.24	175219.5	8.1	2155.1		567.13	144612	3.8	961.9
1/1/1999 16:15	662.13	198055.5	8.3	2484.2		701.33	190269	5.2	1408.2
1/1/1999 16:20	593.15	188292	7.1	2262.3		802.9	225634.5	5.8	1624.2
1/1/1999 16:25	447.24	156058.5	4.3	1492.3		906.63	256429.5	7.6	2139.3
1/1/1999 16:30	368.7	122391	3.6	1193.9		935.61	276336	7.7	2261.0
1/1/1999 16:35	296.12	99723	2.5	841.7		890.66	273940.5	7.0	2154.3
1/1/1999 16:40	231.53	79147.5	1.7	565.8		763.55	248131.5	5.7	1845.4
1/1/1999 16:45	181.09	61893	1.2	409.5		670.8	215152.5	4.6	1475.4
1/1/1999 16:50	144.29	48807	0.8	284.9		607.41	191731.5	4.0	1270.3
1/1/1999 16:55	111.46	38362.5	0.6	194.1		532.85	171039	3.1	1001.5
1/1/1999 17:00	89.01	30070.5	0.4	142.4		470.55	150510	3.0	948.3
1/1/1999 17:05	70.35	23904	0.3	96.1		415	132832.5	2.5	811.0
1/1/1999 17:10	54.92	18790.5	0.2	67.1		359.31	116146.5	2.0	652.4
1/1/1999 17:15	43.75	14800.5	0.1	45.3		312.77	100812	1.8	579.7
1/1/1999 17:20	33.91	11649	0.1	23.9		275.57	88251	1.6	501.4

Sediment Yield Calculations for 6-hr storm event									
	Subbasin S110					S900			
Time t	Discharge Q (cfs)	Flow Volume, Vw=Q*t (ft^3)	Sediment Load Qs (cfs)	Sediment Volume (Qs/Q)*Vw (ft^3)		Discharge Q (cfs)	Flow Volume, Vw=Q*t (cfs)	Sediment Load Qs (cfs)	Sediment Volume (Qs/Q)*Vw (ft^3)
1/1/1999 17:25	26.28	9028.5	0.1	22.3		243.52	77863.5	1.4	441.6
1/1/1999 17:30	19.9	6927	0.0	6.8		212.74	68439	1.2	370.7
1/1/1999 17:35	18.39	5743.5	0.0	4.3		182.59	59299.5	1.0	330.4
1/1/1999 17:40	16.88	5290.5	0.0	3.0		158.66	51187.5	0.8	255.7
1/1/1999 17:45	12.35	4384.5	0.0	3.3		140.76	44913	0.8	242.9
1/1/1999 17:50	7.63	2997	0.0	0.0		123.29	39607.5	0.6	185.6
1/1/1999 17:55	2.87	1575	0.0	0.0		107.92	34681.5	0.5	157.1
1/1/1999 18:00	2.59	819	0.0	0.0		94.9	30423	0.4	137.2
1/1/1999 18:05	2.26	727.5	0.0	0.0		83.44	26751	0.4	121.8
1/1/1999 18:10	1.86	618	0.0	0.0		72.97	23461.5	0.3	95.8
1/1/1999 18:15	1.64	525	0.0	0.0		61.89	20229	0.3	84.9
1/1/1999 18:20	1.37	451.5	0.0	0.0		57.4	17893.5	0.2	73.8
1/1/1999 18:25	1.02	358.5	0.0	0.0		49.85	16087.5	0.2	66.5
1/1/1999 18:30	0.81	274.5	0.0	0.0		40.76	13591.5	0.1	47.7
1/1/1999 18:35	0.63	216	0.0	0.0		32.81	11035.5	0.1	34.4
1/1/1999 18:40	0.49	168	0.0	0.0		28.41	9183	0.1	24.5
1/1/1999 18:45	0.38	130.5	0.0	0.0		26.83	8286	0.1	18.3
1/1/1999 18:50	0.3	102	0.0	0.0		24.88	7756.5	0.1	22.4
1/1/1999 18:55	0.22	78	0.0	0.0		24.2	7362	0.1	23.4
1/1/1999 19:00	0.17	58.5	0.0	0.0		23.63	7174.5	0.1	21.0
1/1/1999 19:05	0.13	45	0.0	0.0		21.84	6820.5	0.0	15.4
1/1/1999 19:10	0.1	34.5	0.0	0.0		19.98	6273	0.0	15.5
1/1/1999 19:15	0.08	27	0.0	0.0		17.88	5679	0.0	14.7
1/1/1999 19:20	0.06	21	0.0	0.0		13.23	4666.5	0.0	11.2
1/1/1999 19:25	0.04	15	0.0	0.0		8.24	3220.5	0.0	4.8
1/1/1999 19:30	0.03	10.5	0.0	0.0		3.49	1759.5	0.0	1.4
1/1/1999 19:35	0.02	7.5	0.0	0.0		2.66	922.5	0.0	0.9
1/1/1999 19:40	0.02	6	0.0	0.0		1.75	661.5	0.0	0.0
1/1/1999 19:45	0.01	4.5	0.0	0.0		0.88	394.5	0.0	0.0
1/1/1999 19:50	0.01	3	0.0	0.0		0.72	240	0.0	0.0
1/1/1999 19:55	0	1.5	0.0	0.0		0.55	190.5	0.0	0.0
1/1/1999 20:00	0	0	0.0	0.0		0.38	139.5	0.0	0.0
1/1/1999 20:05	0		0.0	0.0		0.32	105	0.0	0.0
1/1/1999 20:10	0		0.0	0.0		0.27	88.5	0.0	0.0
1/1/1999 20:15	0		0.0	0.0		0.22	73.5	0.0	0.0
1/1/1999 20:20	0		0.0	0.0		0.19	61.5	0.0	0.0
1/1/1999 20:25	0		0.0	0.0		0.16	52.5	0.0	0.0
1/1/1999 20:30	0		0.0	0.0		0.14	45	0.0	0.0
1/1/1999 20:35	0		0.0	0.0		0.11	37.5	0.0	0.0
1/1/1999 20:40	0		0.0	0.0		0.1	31.5	0.0	0.0
1/1/1999 20:45	0		0.0	0.0		0.09	28.5	0.0	0.0
1/1/1999 20:50	0		0.0	0.0		0.08	25.5	0.0	0.0
1/1/1999 20:55	0		0.0	0.0		0.07	22.5	0.0	0.0
1/1/1999 21:00	0		0.0	0.0		0.06	19.5	0.0	0.0
1/1/1999 21:05	0		0.0	0.0		0.05	16.5	0.0	0.0
1/1/1999 21:10	0		0.0	0.0		0.04	13.5	0.0	0.0
1/1/1999 21:15	0		0.0	0.0		0.03	10.5	0.0	0.0
1/1/1999 21:20	0		0.0	0.0		0.02	7.5	0.0	0.0
1/1/1999 21:25	0		0.0	0.0		0.01	4.5	0.0	0.0
1/1/1999 21:30	0					0			
	Total (ac-ft)	37.6		0.35			84.7		0.55

Concentration	0.007358953

Total Volume (ac ft)	122.3

Sediment Yield Calculations for 24-hr storm event									
	Subbasin S110					S900			
Time t	Discharge Q (cfs)	Flow Volume, Vw=Q*t (ft^3)	Sediment Load Qs (cfs)	Sediment Volume (Qs/Q)*Vw (ft^3)		Discharge Q (cfs)	Flow Volume, Vw=Q*t (cfs)	Sediment Load Qs (cfs)	Sediment Volume (Qs/Q)*Vw (ft^3)
1/1/1999 12:00	0					0			
1/1/1999 12:05	0.01	1.5	0.0	0.0		0.01	1.5	0.0	0.0
1/1/1999 12:10	0.04	7.5	0.0	0.0		0.02	4.5	0.0	0.0
1/1/1999 12:15	0.09	19.5	0.0	0.0		0.06	12	0.0	0.0
1/1/1999 12:20	0.17	39	0.0	0.0		0.12	27	0.0	0.0
1/1/1999 12:25	0.28	67.5	0.0	0.0		0.21	49.5	0.0	0.0
1/1/1999 12:30	0.37	97.5	0.0	0.0		0.31	78	0.0	0.0
1/1/1999 12:35	0.45	123	0.0	0.0		0.45	114	0.0	0.0
1/1/1999 12:40	0.54	148.5	0.0	0.0		0.63	162	0.0	0.0
1/1/1999 12:45	0.6	171	0.0	0.0		0.78	211.5	0.0	0.0
1/1/1999 12:50	0.65	187.5	0.0	0.0		0.92	255	0.0	0.0
1/1/1999 12:55	0.69	201	0.0	0.0		1.06	297	0.0	0.0
1/1/1999 13:00	0.72	211.5	0.0	0.0		1.18	336	0.0	0.0
1/1/1999 13:05	0.74	219	0.0	0.0		1.28	369	0.0	0.0
1/1/1999 13:10	0.76	225	0.0	0.0		1.37	397.5	0.0	0.0
1/1/1999 13:15	0.78	231	0.0	0.0		1.45	423	0.0	0.0
1/1/1999 13:20	0.79	235.5	0.0	0.0		1.51	444	0.0	0.0
1/1/1999 13:25	0.8	238.5	0.0	0.0		1.57	462	0.0	0.0
1/1/1999 13:30	0.8	240	0.0	0.0		1.62	478.5	0.0	0.0
1/1/1999 13:35	0.81	241.5	0.0	0.0		1.67	493.5	0.0	0.0
1/1/1999 13:40	0.81	243	0.0	0.0		1.71	507	0.0	0.0
1/1/1999 13:45	0.82	244.5	0.0	0.0		1.74	517.5	0.0	0.0
1/1/1999 13:50	0.82	246	0.0	0.0		1.77	526.5	0.0	0.0
1/1/1999 13:55	0.82	246	0.0	0.0		1.8	535.5	0.0	0.0
1/1/1999 14:00	0.82	246	0.0	0.0		1.82	543	0.0	0.0
1/1/1999 14:05	0.82	246	0.0	0.0		1.84	549	0.0	0.0
1/1/1999 14:10	0.82	246	0.0	0.0		1.86	555	0.0	0.0
1/1/1999 14:15	0.82	246	0.0	0.0		1.87	559.5	0.0	0.0
1/1/1999 14:20	0.82	246	0.0	0.0		1.89	564	0.0	0.0
1/1/1999 14:25	0.82	246	0.0	0.0		1.9	568.5	0.0	0.0
1/1/1999 14:30	0.82	246	0.0	0.0		1.91	571.5	0.0	0.0
1/1/1999 14:35	0.82	246	0.0	0.0		1.92	574.5	0.0	0.0
1/1/1999 14:40	0.82	246	0.0	0.0		1.92	576	0.0	0.0
1/1/1999 14:45	0.82	246	0.0	0.0		1.93	577.5	0.0	0.0
1/1/1999 14:50	0.82	246	0.0	0.0		1.93	579	0.0	0.0
1/1/1999 14:55	0.82	246	0.0	0.0		1.94	580.5	0.0	0.0
1/1/1999 15:00	0.82	246	0.0	0.0		1.94	582	0.0	0.0
1/1/1999 15:05	0.82	246	0.0	0.0		1.95	583.5	0.0	0.0
1/1/1999 15:10	0.82	246	0.0	0.0		1.95	585	0.0	0.0
1/1/1999 15:15	0.82	246	0.0	0.0		1.95	585	0.0	0.0
1/1/1999 15:20	0.82	246	0.0	0.0		1.96	586.5	0.0	0.0
1/1/1999 15:25	0.82	246	0.0	0.0		1.96	588	0.0	0.0
1/1/1999 15:30	0.82	246	0.0	0.0		1.96	588	0.0	0.0
1/1/1999 15:35	0.82	246	0.0	0.0		1.96	588	0.0	0.0
1/1/1999 15:40	0.82	246	0.0	0.0		1.97	589.5	0.0	0.0
1/1/1999 15:45	0.82	246	0.0	0.0		1.97	591	0.0	0.0
1/1/1999 15:50	0.83	247.5	0.0	0.0		1.97	591	0.0	0.0
1/1/1999 15:55	0.84	250.5	0.0	0.0		1.98	592.5	0.0	0.0
1/1/1999 16:00	0.87	256.5	0.0	0.0		2	597	0.0	0.0
1/1/1999 16:05	0.91	267	0.0	0.0		2.02	603	0.0	0.0
1/1/1999 16:10	0.95	279	0.0	0.0		2.06	612	0.0	0.0
1/1/1999 16:15	0.98	289.5	0.0	0.0		2.11	625.5	0.0	0.0
1/1/1999 16:20	1.01	298.5	0.0	0.0		2.16	640.5	0.0	0.0
1/1/1999 16:25	1.03	306	0.0	0.0		2.23	658.5	0.0	0.0
1/1/1999 16:30	1.04	310.5	0.0	0.0		2.29	678	0.0	0.0
1/1/1999 16:35	1.06	315	0.0	0.0		2.33	693	0.0	0.0
1/1/1999 16:40	1.07	319.5	0.0	0.0		2.36	703.5	0.0	0.0
1/1/1999 16:45	1.07	321	0.0	0.0		2.4	714	0.0	0.0
1/1/1999 16:50	1.08	322.5	0.0	0.0		2.43	724.5	0.0	0.0
1/1/1999 16:55	1.08	324	0.0	0.0		2.45	732	0.0	0.0

Sediment Yield Calculations for 24-hr storm event									
	Subbasin S110					S900			
Time t	Discharge Q (cfs)	Flow Volume, Vw=Q*t (ft^3)	Sediment Load Qs (cfs)	Sediment Volume (Qs/Q)*Vw (ft^3)		Discharge Q (cfs)	Flow Volume, Vw=Q*t (cfs)	Sediment Load Qs (cfs)	Sediment Volume (Qs/Q)*Vw (ft^3)
1/1/1999 17:00	1.09	325.5	0.0	0.0		2.48	739.5	0.0	0.0
1/1/1999 17:05	1.09	327	0.0	0.0		2.49	745.5	0.0	0.0
1/1/1999 17:10	1.09	327	0.0	0.0		2.51	750	0.0	0.0
1/1/1999 17:15	1.09	327	0.0	0.0		2.53	756	0.0	0.0
1/1/1999 17:20	1.09	327	0.0	0.0		2.54	760.5	0.0	0.0
1/1/1999 17:25	1.09	327	0.0	0.0		2.55	763.5	0.0	0.0
1/1/1999 17:30	1.1	328.5	0.0	0.0		2.56	766.5	0.0	0.0
1/1/1999 17:35	1.1	330	0.0	0.0		2.57	769.5	0.0	0.0
1/1/1999 17:40	1.1	330	0.0	0.0		2.57	771	0.0	0.0
1/1/1999 17:45	1.1	330	0.0	0.0		2.58	772.5	0.0	0.7
1/1/1999 17:50	1.1	330	0.0	0.0		2.59	775.5	0.0	0.7
1/1/1999 17:55	1.1	330	0.0	0.0		2.59	777	0.0	0.7
1/1/1999 18:00	1.1	330	0.0	0.0		2.6	778.5	0.0	0.7
1/1/1999 18:05	1.1	330	0.0	0.0		2.61	781.5	0.0	0.7
1/1/1999 18:10	1.12	333	0.0	0.0		2.62	784.5	0.0	0.7
1/1/1999 18:15	1.14	339	0.0	0.0		2.64	789	0.0	0.7
1/1/1999 18:20	1.18	348	0.0	0.0		2.67	796.5	0.0	0.8
1/1/1999 18:25	1.23	361.5	0.0	0.0		2.71	807	0.0	0.8
1/1/1999 18:30	1.26	373.5	0.0	0.0		2.75	819	0.0	0.9
1/1/1999 18:35	1.28	381	0.0	0.0		2.81	834	0.0	0.9
1/1/1999 18:40	1.3	387	0.0	0.0		2.88	853.5	0.0	1.0
1/1/1999 18:45	1.32	393	0.0	0.0		2.94	873	0.0	0.7
1/1/1999 18:50	1.33	397.5	0.0	0.0		2.98	888	0.0	0.7
1/1/1999 18:55	1.34	400.5	0.0	0.0		3.02	900	0.0	0.7
1/1/1999 19:00	1.35	403.5	0.0	0.0		3.05	910.5	0.0	0.8
1/1/1999 19:05	1.35	405	0.0	0.0		3.08	919.5	0.0	0.8
1/1/1999 19:10	1.36	406.5	0.0	0.0		3.11	928.5	0.0	0.8
1/1/1999 19:15	1.36	408	0.0	0.0		3.13	936	0.0	0.9
1/1/1999 19:20	1.36	408	0.0	0.0		3.15	942	0.0	0.9
1/1/1999 19:25	1.37	409.5	0.0	0.0		3.17	948	0.0	0.9
1/1/1999 19:30	1.37	411	0.0	0.0		3.18	952.5	0.0	0.9
1/1/1999 19:35	1.37	411	0.0	0.0		3.19	955.5	0.0	0.9
1/1/1999 19:40	1.37	411	0.0	0.0		3.21	960	0.0	1.0
1/1/1999 19:45	1.37	411	0.0	0.0		3.22	964.5	0.0	1.0
1/1/1999 19:50	1.37	411	0.0	0.0		3.22	966	0.0	1.0
1/1/1999 19:55	1.37	411	0.0	0.0		3.23	967.5	0.0	1.0
1/1/1999 20:00	1.37	411	0.0	0.0		3.24	970.5	0.0	1.0
1/1/1999 20:05	1.38	412.5	0.0	0.0		3.25	973.5	0.0	1.0
1/1/1999 20:10	1.39	415.5	0.0	0.0		3.26	976.5	0.0	1.0
1/1/1999 20:15	1.42	421.5	0.0	0.0		3.28	981	0.0	1.1
1/1/1999 20:20	1.46	432	0.0	0.0		3.32	990	0.0	0.7
1/1/1999 20:25	1.52	447	0.0	0.0		3.37	1003.5	0.0	0.7
1/1/1999 20:30	1.58	465	0.0	0.0		3.43	1020	0.0	0.8
1/1/1999 20:35	1.64	483	0.0	0.0		3.52	1042.5	0.0	0.9
1/1/1999 20:40	1.71	502.5	0.0	0.0		3.63	1072.5	0.0	1.0
1/1/1999 20:45	1.75	519	0.0	0.0		3.73	1104	0.0	1.1
1/1/1999 20:50	1.79	531	0.0	0.0		3.82	1132.5	0.0	1.3
1/1/1999 20:55	1.82	541.5	0.0	0.0		3.93	1162.5	0.0	1.4
1/1/1999 21:00	1.84	549	0.0	0.0		4.02	1192.5	0.0	1.6
1/1/1999 21:05	1.86	555	0.0	0.0		4.1	1218	0.0	0.7
1/1/1999 21:10	1.89	562.5	0.0	0.0		4.17	1240.5	0.0	0.8
1/1/1999 21:15	1.93	573	0.0	0.0		4.24	1261.5	0.0	0.8
1/1/1999 21:20	1.98	586.5	0.0	0.0		4.32	1284	0.0	0.9
1/1/1999 21:25	2.03	601.5	0.0	0.0		4.4	1308	0.0	1.0
1/1/1999 21:30	2.07	615	0.0	0.0		4.49	1333.5	0.0	1.1
1/1/1999 21:35	2.1	625.5	0.0	0.0		4.58	1360.5	0.0	1.2
1/1/1999 21:40	2.14	636	0.0	0.0		4.68	1389	0.0	1.3
1/1/1999 21:45	2.18	648	0.0	0.0		4.78	1419	0.0	1.4
1/1/1999 21:50	2.23	661.5	0.0	0.0		4.87	1447.5	0.0	1.5
1/1/1999 21:55	2.29	678	0.0	0.0		4.96	1474.5	0.0	1.6

Sediment Yield Calculations for 24-hr storm event									
	Subbasin S110					S900			
Time t	Discharge Q (cfs)	Flow Volume, Vw=Q*t (ft^3)	Sediment Load Qs (cfs)	Sediment Volume (Qs/Q)*Vw (ft^3)		Discharge Q (cfs)	Flow Volume, Vw=Q*t (cfs)	Sediment Load Qs (cfs)	Sediment Volume (Qs/Q)*Vw (ft^3)
1/1/1999 22:00	2.33	693	0.0	0.0		5.06	1503	0.0	1.8
1/1/1999 22:05	2.36	703.5	0.0	0.0		5.16	1533	0.0	2.0
1/1/1999 22:10	2.4	714	0.0	0.0		5.28	1566	0.0	2.2
1/1/1999 22:15	2.45	727.5	0.0	0.0		5.38	1599	0.0	2.3
1/1/1999 22:20	2.51	744	0.0	0.0		5.49	1630.5	0.0	2.5
1/1/1999 22:25	2.6	766.5	0.0	0.0		5.6	1663.5	0.0	2.8
1/1/1999 22:30	2.69	793.5	0.0	0.0		5.74	1701	0.0	0.8
1/1/1999 22:35	2.81	825	0.0	0.0		5.91	1747.5	0.0	0.9
1/1/1999 22:40	2.98	868.5	0.0	0.0		6.12	1804.5	0.0	1.0
1/1/1999 22:45	3.14	918	0.0	0.0		6.36	1872	0.0	1.2
1/1/1999 22:50	3.33	970.5	0.0	0.0		6.64	1950	0.0	1.4
1/1/1999 22:55	3.57	1035	0.0	0.0		6.98	2043	0.0	1.8
1/1/1999 23:00	3.78	1102.5	0.0	0.0		7.33	2146.5	0.0	2.2
1/1/1999 23:05	4	1167	0.0	0.0		7.72	2257.5	0.0	2.7
1/1/1999 23:10	4.28	1242	0.0	0.0		8.19	2386.5	0.0	3.5
1/1/1999 23:15	4.51	1318.5	0.0	0.0		8.65	2526	0.0	4.5
1/1/1999 23:20	4.77	1392	0.0	0.0		9.13	2667	0.0	5.6
1/1/1999 23:25	5.09	1479	0.0	0.0		9.69	2823	0.0	5.4
1/1/1999 23:30	5.39	1572	0.0	0.0		10.24	2989.5	0.0	5.2
1/1/1999 23:35	10.29	2352	0.0	2.2		16.93	4075.5	0.0	10.9
1/1/1999 23:40	24.36	5197.5	0.0	10.0		24.05	6147	0.1	19.1
1/1/1999 23:45	52.53	11533.5	0.2	43.1		42.54	9988.5	0.1	35.1
1/1/1999 23:50	103.99	23478	0.5	122.6		89.1	19746	0.4	89.7
1/1/1999 23:55	193.69	44652	1.3	304.2		147.83	35539.5	0.8	186.4
1/2/1999 0:00	305.76	74917.5	2.5	604.4		246.19	59103	1.3	320.3
1/2/1999 0:05	421.85	109141.5	4.3	1113.9		358.64	90724.5	2.0	506.5
1/2/1999 0:10	531.6	143017.5	5.6	1497.4		521	131946	3.3	843.4
1/2/1999 0:15	528.83	159064.5	5.4	1636.8		643.33	174649.5	4.4	1205.8
1/2/1999 0:20	469.09	149688	4.9	1575.0		735.49	206823	5.5	1557.8
1/2/1999 0:25	350.3	122908.5	3.3	1163.8		833.38	235330.5	6.8	1917.0
1/2/1999 0:30	286.85	95572.5	2.4	784.0		853.27	252997.5	5.8	1725.5
1/2/1999 0:35	230.06	77536.5	1.8	592.0		795.91	247377	6.4	1974.3
1/2/1999 0:40	181.43	61723.5	1.2	411.0		652.39	217245	4.7	1571.2
1/2/1999 0:45	142.56	48598.5	0.8	272.6		554.49	181032	3.7	1209.9
1/2/1999 0:50	114.24	38520	0.6	211.5		497.57	157809	3.2	1023.5
1/2/1999 0:55	88.92	30474	0.4	143.8		440.87	140766	2.6	832.6
1/2/1999 1:00	71.73	24097.5	0.2	64.6		391.45	124848	2.1	679.1
1/2/1999 1:05	57.15	19332	0.2	65.5		344.02	110320.5	2.0	629.7
1/2/1999 1:10	45.23	15357	0.2	52.5		297.53	96232.5	1.7	551.8
1/2/1999 1:15	36.57	12270	0.1	32.3		258.99	83478	1.4	454.7
1/2/1999 1:20	29.04	9841.5	0.1	25.6		229.39	73257	1.3	400.7
1/2/1999 1:25	23.17	7831.5	0.0	12.7		204.66	65107.5	1.1	363.0
1/2/1999 1:30	17.94	6166.5	0.0	4.3		179.52	57627	0.9	303.5
1/2/1999 1:35	16.56	5175	0.0	10.3		153.53	49957.5	0.8	270.1
1/2/1999 1:40	15.18	4761	0.0	7.1		133.28	43021.5	0.7	214.1
1/2/1999 1:45	11.58	4014	0.0	5.5		119.23	37876.5	0.6	175.6
1/2/1999 1:50	7.78	2904	0.0	0.0		105.31	33681	0.4	140.7
1/2/1999 1:55	3.96	1761	0.0	0.0		92.73	29706	0.4	124.1
1/2/1999 2:00	3.7	1149	0.0	0.0		81.96	26203.5	0.4	112.4
1/2/1999 2:05	3.44	1071	0.0	0.0		72.12	23112	0.3	101.6
1/2/1999 2:10	3.16	990	0.0	0.0		63.3	20313	0.3	81.8
1/2/1999 2:15	3.03	928.5	0.0	0.0		53.86	17574	0.2	74.2
1/2/1999 2:20	2.92	892.5	0.0	0.0		51.31	15775.5	0.2	63.8
1/2/1999 2:25	2.79	856.5	0.0	0.0		45.1	14461.5	0.2	61.7
1/2/1999 2:30	2.68	820.5	0.0	0.0		37.16	12339	0.1	42.7
1/2/1999 2:35	2.58	789	0.0	0.0		29.61	10015.5	0.1	30.7
1/2/1999 2:40	2.47	757.5	0.0	0.0		26.29	8385	0.1	17.3
1/2/1999 2:45	2.38	727.5	0.0	0.0		26.06	7852.5	0.1	15.8
1/2/1999 2:50	2.29	700.5	0.0	0.0		25.21	7690.5	0.1	23.3
1/2/1999 2:55	2.2	673.5	0.0	0.0		25.13	7551	0.1	22.6

Sediment Yield Calculations for 24-hr storm event									
	Subbasin S110					S900			
Time t	Discharge Q (cfs)	Flow Volume, Vw=Q*t (ft^3)	Sediment Load Qs (cfs)	Sediment Volume (Qs/Q)*Vw (ft^3)		Discharge Q (cfs)	Flow Volume, Vw=Q*t (cfs)	Sediment Load Qs (cfs)	Sediment Volume (Qs/Q)*Vw (ft^3)
1/2/1999 3:00	2.14	651	0.0	0.0		24.8	7489.5	0.1	21.4
1/2/1999 3:05	2.09	634.5	0.0	0.0		23.42	7233	0.1	20.6
1/2/1999 3:10	2.05	621	0.0	0.0		21.94	6804	0.1	15.6
1/2/1999 3:15	2.02	610.5	0.0	0.0		20.22	6324	0.1	16.2
1/2/1999 3:20	1.99	601.5	0.0	0.0		15.55	5365.5	0.0	13.6
1/2/1999 3:25	1.96	592.5	0.0	0.0		10.54	3913.5	0.0	7.5
1/2/1999 3:30	1.92	582	0.0	0.0		5.84	2457	0.0	1.2
1/2/1999 3:35	1.87	568.5	0.0	0.0		5.57	1711.5	0.0	2.8
1/2/1999 3:40	1.81	552	0.0	0.0		5.27	1626	0.0	2.2
1/2/1999 3:45	1.78	538.5	0.0	0.0		4.97	1536	0.0	1.7
1/2/1999 3:50	1.75	529.5	0.0	0.0		4.84	1471.5	0.0	1.5
1/2/1999 3:55	1.72	520.5	0.0	0.0		4.7	1431	0.0	1.3
1/2/1999 4:00	1.71	514.5	0.0	0.0		4.59	1393.5	0.0	1.2
1/2/1999 4:05	1.69	510	0.0	0.0		4.5	1363.5	0.0	1.1
1/2/1999 4:10	1.68	505.5	0.0	0.0		4.42	1338	0.0	1.0
1/2/1999 4:15	1.67	502.5	0.0	0.0		4.35	1315.5	0.0	0.9
1/2/1999 4:20	1.67	501	0.0	0.0		4.29	1296	0.0	0.9
1/2/1999 4:25	1.66	499.5	0.0	0.0		4.24	1279.5	0.0	0.8
1/2/1999 4:30	1.66	498	0.0	0.0		4.2	1266	0.0	0.8
1/2/1999 4:35	1.65	496.5	0.0	0.0		4.15	1252.5	0.0	0.8
1/2/1999 4:40	1.63	492	0.0	0.0		4.12	1240.5	0.0	0.7
1/2/1999 4:45	1.6	484.5	0.0	0.0		4.07	1228.5	0.0	0.7
1/2/1999 4:50	1.57	475.5	0.0	0.0		4.02	1213.5	0.0	1.6
1/2/1999 4:55	1.52	463.5	0.0	0.0		3.96	1197	0.0	1.5
1/2/1999 5:00	1.49	451.5	0.0	0.0		3.89	1177.5	0.0	1.4
1/2/1999 5:05	1.46	442.5	0.0	0.0		3.83	1158	0.0	1.3
1/2/1999 5:10	1.44	435	0.0	0.0		3.74	1135.5	0.0	1.2
1/2/1999 5:15	1.43	430.5	0.0	0.0		3.68	1113	0.0	1.1
1/2/1999 5:20	1.41	426	0.0	0.0		3.63	1096.5	0.0	1.0
1/2/1999 5:25	1.4	421.5	0.0	0.0		3.58	1081.5	0.0	1.0
1/2/1999 5:30	1.4	420	0.0	0.0		3.54	1068	0.0	0.9
1/2/1999 5:35	1.39	418.5	0.0	0.0		3.51	1057.5	0.0	0.9
1/2/1999 5:40	1.39	417	0.0	0.0		3.47	1047	0.0	0.8
1/2/1999 5:45	1.38	415.5	0.0	0.0		3.45	1038	0.0	0.8
1/2/1999 5:50	1.38	414	0.0	0.0		3.42	1030.5	0.0	0.8
1/2/1999 5:55	1.36	411	0.0	0.0		3.39	1021.5	0.0	0.8
1/2/1999 6:00	1.33	403.5	0.0	0.0		3.36	1012.5	0.0	0.7
1/2/1999 6:05	1.29	393	0.0	0.0		3.31	1000.5	0.0	0.7
1/2/1999 6:10	1.24	379.5	0.0	0.0		3.26	985.5	0.0	1.1
1/2/1999 6:15	1.21	367.5	0.0	0.0		3.21	970.5	0.0	1.0
1/2/1999 6:20	1.19	360	0.0	0.0		3.14	952.5	0.0	0.9
1/2/1999 6:25	1.17	354	0.0	0.0		3.06	930	0.0	0.8
1/2/1999 6:30	1.15	348	0.0	0.0		3	909	0.0	0.7
1/2/1999 6:35	1.14	343.5	0.0	0.0		2.95	892.5	0.0	0.7
1/2/1999 6:40	1.13	340.5	0.0	0.0		2.91	879	0.0	1.1
1/2/1999 6:45	1.12	337.5	0.0	0.0		2.87	867	0.0	1.0
1/2/1999 6:50	1.12	336	0.0	0.0		2.84	856.5	0.0	1.0
1/2/1999 6:55	1.11	334.5	0.0	0.0		2.81	847.5	0.0	0.9
1/2/1999 7:00	1.11	333	0.0	0.0		2.79	840	0.0	0.9
1/2/1999 7:05	1.11	333	0.0	0.0		2.76	832.5	0.0	0.9
1/2/1999 7:10	1.1	331.5	0.0	0.0		2.75	826.5	0.0	0.9
1/2/1999 7:15	1.1	330	0.0	0.0		2.73	822	0.0	0.8
1/2/1999 7:20	1.1	330	0.0	0.0		2.72	817.5	0.0	0.8
1/2/1999 7:25	1.1	330	0.0	0.0		2.7	813	0.0	0.8
1/2/1999 7:30	1.1	330	0.0	0.0		2.69	808.5	0.0	0.8
1/2/1999 7:35	1.1	330	0.0	0.0		2.68	805.5	0.0	0.8
1/2/1999 7:40	1.1	330	0.0	0.0		2.67	802.5	0.0	0.8
1/2/1999 7:45	1.1	330	0.0	0.0		2.67	801	0.0	0.8
1/2/1999 7:50	1.09	328.5	0.0	0.0		2.65	798	0.0	0.7
1/2/1999 7:55	1.08	325.5	0.0	0.0		2.64	793.5	0.0	0.7

Sediment Yield Calculations for 24-hr storm event									
	Subbasin S110					S900			
Time t	Discharge Q (cfs)	Flow Volume, Vw=Q*t (ft^3)	Sediment Load Qs (cfs)	Sediment Volume (Qs/Q)*Vw (ft^3)		Discharge Q (cfs)	Flow Volume, Vw=Q*t (cfs)	Sediment Load Qs (cfs)	Sediment Volume (Qs/Q)*Vw (ft^3)
1/2/1999 8:00	1.05	319.5	0.0	0.0		2.62	789	0.0	0.7
1/2/1999 8:05	1.01	309	0.0	0.0		2.59	781.5	0.0	0.7
1/2/1999 8:10	0.97	297	0.0	0.0		2.55	771	0.0	0.0
1/2/1999 8:15	0.94	286.5	0.0	0.0		2.5	757.5	0.0	0.0
1/2/1999 8:20	0.91	277.5	0.0	0.0		2.44	741	0.0	0.0
1/2/1999 8:25	0.89	270	0.0	0.0		2.37	721.5	0.0	0.0
1/2/1999 8:30	0.88	265.5	0.0	0.0		2.31	702	0.0	0.0
1/2/1999 8:35	0.87	262.5	0.0	0.0		2.27	687	0.0	0.0
1/2/1999 8:40	0.86	259.5	0.0	0.0		2.23	675	0.0	0.0
1/2/1999 8:45	0.85	256.5	0.0	0.0		2.2	664.5	0.0	0.0
1/2/1999 8:50	0.84	253.5	0.0	0.0		2.17	655.5	0.0	0.0
1/2/1999 8:55	0.84	252	0.0	0.0		2.14	646.5	0.0	0.0
1/2/1999 9:00	0.83	250.5	0.0	0.0		2.12	639	0.0	0.0
1/2/1999 9:05	0.83	249	0.0	0.0		2.1	633	0.0	0.0
1/2/1999 9:10	0.83	249	0.0	0.0		2.08	627	0.0	0.0
1/2/1999 9:15	0.83	249	0.0	0.0		2.06	621	0.0	0.0
1/2/1999 9:20	0.83	249	0.0	0.0		2.05	616.5	0.0	0.0
1/2/1999 9:25	0.83	249	0.0	0.0		2.04	613.5	0.0	0.0
1/2/1999 9:30	0.82	247.5	0.0	0.0		2.03	610.5	0.0	0.0
1/2/1999 9:35	0.82	246	0.0	0.0		2.02	607.5	0.0	0.0
1/2/1999 9:40	0.82	246	0.0	0.0		2.01	604.5	0.0	0.0
1/2/1999 9:45	0.82	246	0.0	0.0		2.01	603	0.0	0.0
1/2/1999 9:50	0.82	246	0.0	0.0		2	601.5	0.0	0.0
1/2/1999 9:55	0.82	246	0.0	0.0		2	600	0.0	0.0
1/2/1999 10:00	0.82	246	0.0	0.0		1.99	598.5	0.0	0.0
1/2/1999 10:05	0.82	246	0.0	0.0		1.99	597	0.0	0.0
1/2/1999 10:10	0.82	246	0.0	0.0		1.99	597	0.0	0.0
1/2/1999 10:15	0.82	246	0.0	0.0		1.98	595.5	0.0	0.0
1/2/1999 10:20	0.82	246	0.0	0.0		1.98	594	0.0	0.0
1/2/1999 10:25	0.82	246	0.0	0.0		1.98	594	0.0	0.0
1/2/1999 10:30	0.82	246	0.0	0.0		1.98	594	0.0	0.0
1/2/1999 10:35	0.82	246	0.0	0.0		1.98	594	0.0	0.0
1/2/1999 10:40	0.82	246	0.0	0.0		1.98	594	0.0	0.0
1/2/1999 10:45	0.82	246	0.0	0.0		1.97	592.5	0.0	0.0
1/2/1999 10:50	0.82	246	0.0	0.0		1.97	591	0.0	0.0
1/2/1999 10:55	0.82	246	0.0	0.0		1.97	591	0.0	0.0
1/2/1999 11:00	0.82	246	0.0	0.0		1.97	591	0.0	0.0
1/2/1999 11:05	0.82	246	0.0	0.0		1.97	591	0.0	0.0
1/2/1999 11:10	0.82	246	0.0	0.0		1.97	591	0.0	0.0
1/2/1999 11:15	0.82	246	0.0	0.0		1.97	591	0.0	0.0
1/2/1999 11:20	0.82	246	0.0	0.0		1.97	591	0.0	0.0
1/2/1999 11:25	0.82	246	0.0	0.0		1.97	591	0.0	0.0
1/2/1999 11:30	0.82	246	0.0	0.0		1.97	591	0.0	0.0
1/2/1999 11:35	0.82	246	0.0	0.0		1.97	591	0.0	0.0
1/2/1999 11:40	0.82	246	0.0	0.0		1.97	591	0.0	0.0
1/2/1999 11:45	0.82	246	0.0	0.0		1.97	591	0.0	0.0
1/2/1999 11:50	0.82	246	0.0	0.0		1.96	589.5	0.0	0.0
1/2/1999 11:55	0.8	243	0.0	0.0		1.95	586.5	0.0	0.0
1/2/1999 12:00	0.78	237	0.0	0.0		1.94	583.5	0.0	0.0
1/2/1999 12:05	0.73	226.5	0.0	0.0		1.9	576	0.0	0.0
1/2/1999 12:10	0.65	207	0.0	0.0		1.85	562.5	0.0	0.0
1/2/1999 12:15	0.57	183	0.0	0.0		1.77	543	0.0	0.0
1/2/1999 12:20	0.47	156	0.0	0.0		1.66	514.5	0.0	0.0
1/2/1999 12:25	0.35	123	0.0	0.0		1.51	475.5	0.0	0.0
1/2/1999 12:30	0.28	94.5	0.0	0.0		1.36	430.5	0.0	0.0
1/2/1999 12:35	0.22	75	0.0	0.0		1.22	387	0.0	0.0
1/2/1999 12:40	0.17	58.5	0.0	0.0		1.04	339	0.0	0.0
1/2/1999 12:45	0.13	45	0.0	0.0		0.89	289.5	0.0	0.0
1/2/1999 12:50	0.1	34.5	0.0	0.0		0.78	250.5	0.0	0.0
1/2/1999 12:55	0.08	27	0.0	0.0		0.68	219	0.0	0.0

Sediment Yield Calculations for 24-hr storm event									
	Subbasin S110					S900			
Time t	Discharge Q (cfs)	Flow Volume, Vw=Q*t (ft^3)	Sediment Load Qs (cfs)	Sediment Volume (Qs/Q)*Vw (ft^3)		Discharge Q (cfs)	Flow Volume, Vw=Q*t (cfs)	Sediment Load Qs (cfs)	Sediment Volume (Qs/Q)*Vw (ft^3)
1/2/1999 13:00	0.06	21	0.0	0.0		0.6	192	0.0	0.0
1/2/1999 13:05	0.05	16.5	0.0	0.0		0.52	168	0.0	0.0
1/2/1999 13:10	0.04	13.5	0.0	0.0		0.45	145.5	0.0	0.0
1/2/1999 13:15	0.03	10.5	0.0	0.0		0.39	126	0.0	0.0
1/2/1999 13:20	0.02	7.5	0.0	0.0		0.34	109.5	0.0	0.0
1/2/1999 13:25	0.02	6	0.0	0.0		0.3	96	0.0	0.0
1/2/1999 13:30	0.01	4.5	0.0	0.0		0.26	84	0.0	0.0
1/2/1999 13:35	0.01	3	0.0	0.0		0.22	72	0.0	0.0
1/2/1999 13:40	0.01	3	0.0	0.0		0.19	61.5	0.0	0.0
1/2/1999 13:45	0	1.5	0.0	0.0		0.17	54	0.0	0.0
1/2/1999 13:50	0	0	0.0	0.0		0.15	48	0.0	0.0
1/2/1999 13:55	0	0	0.0	0.0		0.13	42	0.0	0.0
1/2/1999 14:00	0	0	0.0	0.0		0.11	36	0.0	0.0
1/2/1999 14:05	0	0	0.0	0.0		0.09	30	0.0	0.0
1/2/1999 14:10	0	0	0.0	0.0		0.08	25.5	0.0	0.0
1/2/1999 14:15	0	0	0.0	0.0		0.07	22.5	0.0	0.0
1/2/1999 14:20	0	0	0.0	0.0		0.06	19.5	0.0	0.0
1/2/1999 14:25	0	0	0.0	0.0		0.05	16.5	0.0	0.0
1/2/1999 14:30	0	0	0.0	0.0		0.04	13.5	0.0	0.0
1/2/1999 14:35	0	0	0.0	0.0		0.04	12	0.0	0.0
1/2/1999 14:40	0	0	0.0	0.0		0.03	10.5	0.0	0.0
1/2/1999 14:45	0	0	0.0	0.0		0.03	9	0.0	0.0
1/2/1999 14:50	0	0	0.0	0.0		0.02	7.5	0.0	0.0
1/2/1999 14:55	0	0	0.0	0.0		0.02	6	0.0	0.0
1/2/1999 15:00	0	0	0.0	0.0		0.02	6	0.0	0.0
1/2/1999 15:05	0	0	0.0	0.0		0.01	4.5	0.0	0.0
1/2/1999 15:10	0	0	0.0	0.0		0.01	3	0.0	0.0
1/2/1999 15:15	0	0	0.0	0.0		0.01	3	0.0	0.0
1/2/1999 15:20	0	0	0.0	0.0		0	1.5	0.0	0.0
1/2/1999 15:25	0	0	0.0	0.0		0	0	0.0	0.0
1/2/1999 15:30	0	0	0.0	0.0		0	0	0.0	0.0
1/2/1999 15:35									
	Total (ac-ft)	32.6		0.25			78.2		0.46

Concentration	0.006407942

Total Volume (ac ft)	110.8

Reach Breaks (D/S Station #)	Existing Channel Bottom Elevations (ft)	Cross-Section ID	Discharge (cfs)	Mannings n	Existing Slope (ft/ft)	Reach Segment Length (ft)	Flow Width (ft)	Wetted Area (sq ft)	Top Width (ft)	Velocity (ft/s)	Hydraulic Depth (ft)	Average Velocity (ft/s)	Average Depth (ft)	Average Width (ft)	D50 (mm)	G	Existing Sediment Transport Capacity (cfs)	Sediment Inflow #1 (cfs)	Sediment Inflow #2 (cfs)	Total Sediment Inflow (cfs)	Long-term Flow Width (ft)	Long-term Wetted Area (sq ft)	Long-term Top Width (ft)	Long-term Velocity (ft/s)	Long-term Hydraulic Depth	Long-term Average Velocity (ft/s)	Long-term Average Depth (ft)	Long-term Average Width (ft)	Equilibrium Sediment Transport Capacity (cfs)	Equilibrium Slope (ft/ft)	Existing Slope (ft/ft)	Slope Difference	U/S Deposition Depth (ft)
	1660.50	XS_37873	218.3755	0.035	0.001782	0	54.4	109.6	93.6	2.0	1.2				0.7	4				0	37.6	49.0	76.5	4.5	0.6									
	1660.41	XS_37872	298.48	0.035	0.001782	50	56.9	121.2	75.1	2.5	1.6				0.7	4				0	46.0	56.5	68.4	5.3	0.8									
	1659.85	XS_37871	319.158	0.035	0.0112	50	46.5	69.8	68.0	4.6	1.0				0.7	4				0	43.8	58.1	66.3	5.5	0.9									
	1659.78	XS_37870	354.2525	0.035	0.00148	50	60.8	144.4	78.3	2.5	1.8				0.7	4				0	49.2	63.1	69.8	5.6	0.9									
	1659.51	XS_37869	395.703	0.035	0.00536	50	60.1	102.6	74.2	3.9	1.4				0.7	4				0	55.4	67.3	69.5	5.9	1.0									
	1658.80	XS_37650	429.0405	0.035	0.01416	50	53.5	84.4	83.7	5.1	1.0				0.7	4				0	51.3	75.4	81.6	5.7	0.9									
	1658.55	XS_37649	429.926	0.035	0.00504	50	65.7	115.1	83.4	3.7	1.4				0.7	4				0	59.5	74.6	79.3	5.8	0.9									
14523.69	1658.20	XS_37648	430.3775	0.035	0.00694	50	62.4	102.3	78.9	4.2	1.3	3.5	1.3	57.5	0.7	4	0.4910843	3.16758		3.1675784	58.0	73.1	75.3	5.9	1.0	5.5	0.9	50.1	3.252997	0.019945	0.00657	-0.013375	4.7
	1655.81	XS_37647	430.3775	0.035	0.001	50	54.9	182.9	78.5	2.4	2.3				0.7	4				0	44.9	99.1	70.1	4.3	1.4									
	1656.07	XS_37646	430.1255	0.035	0.001	50	65.0	184.1	80.0	2.3	2.3				0.7	4				0	58.0	99.9	71.6	4.3	1.4									
	1655.71	XS_37645	433.0095	0.035	0.00708	50	55.6	97.9	70.9	4.4	1.4				0.7	4				0	55.9	100.1	71.1	4.3	1.4									
	1655.28	XS_37644	436.24	0.035	0.00868	50	52.3	92.5	71.0	4.7	1.3				0.7	4				0	53.5	101.1	72.1	4.3	1.4									
	1655.43	XS_37643	459.893	0.035	0.001	50	65.8	236.7	135.9	1.9	1.7				0.7	4				0	45.2	117.4	97.1	3.9	1.2									
	1654.52	XS_37642	480.5535	0.035	0.01806	50	31.3	84.3	84.3	5.7	1.0				0.7	4				0	39.4	122.4	100.7	3.9	1.2									
	1654.56	XS_37641	487.235	0.035	0.001	50	69.8	238.4	126.9	2.0	1.9				0.7	4				0	51.2	123.5	100.9	3.9	1.2									
14119.48	1654.17	XS_37640	487.592	0.035	0.00776	50	57.3	111.7	88.8	4.4	1.3	3.5	1.6	56.5	0.7	4	0.4204219	0.33184	0.49108	0.822928447	58.4	118.1	90.3	4.1	1.3	4.2	1.3	50.8	0.860447	0.0066	0.0041	-0.0025	1
	1652.32	XS_37639	488.8485	0.045	0.00572	50	48.0	137.0	79.9	3.6	1.7				0.7	4				0	49.0	144.6	80.5	3.4	1.8									
	1652.04	XS_37638	489.328	0.045	0.00572	50	57.4	138.7	82.5	3.5	1.7				0.7	4				0	58.3	146.5	83.2	3.3	1.8									
	1651.74	XS_37637	489.4785	0.045	0.006	50	61.2	140.3	88.0	3.5	1.6				0.7	4				0	62.5	150.5	89.0	3.3	1.7									
	1651.37	XS_37636	489.6955	0.045	0.00734	50	61.5	134.8	92.6	3.6	1.5				0.7	4				0	64.2	154.1	94.4	3.2	1.6									
	1651.12	XS_37635	489.923	0.045	0.0049	50	72.3	155.2	97.1	3.2	1.6				0.7	4				0	72.4	155.9	97.2	3.1	1.6									
	1650.71	XS_37634	490.812	0.045	0.0082	50	69.6	134.9	100.5	3.6	1.3				0.7	4				0	73.2	159.6	102.8	3.1	1.6									
	1650.24	XS_37633	492.954	0.045	0.00954	50	69.7	131.0	103.9	3.8	1.3				0.7	4				0	74.6	162.3	106.6	3.0	1.5									
13720.1	1650.19	XS_37632	511.9485	0.045	0.001	50	103.0	298.6	142.2	1.7	2.1	3.3	1.6	67.8	0.7	4	0.638103	0.14127	0.42042	0.561689609	88.1	178.7	128.3	2.9	1.4	3.2	1.6	67.8	0.518069	0.00483	0.00533	0.0005	0
	1647.38	XS_37631	511.9485	0.045	0.001	50	77.5	270.0	110.1	1.9	2.5				0.7	4				0	64.3	151.0	99.8	3.4	1.5									
	1647.36	XS_37630	511.4935	0.045	0.001	50	84.1	268.4	108.6	1.9	2.5				0.7	4				0	73.3	150.3	98.8	3.4	1.5									
	1647.18	XS_37629	511.1715	0.045	0.00356	50	79.4	180.8	105.0	2.8	1.7				0.7	4				0	76.1	152.6	102.6	3.4	1.5									
	1646.60	XS_37628	510.881	0.045	0.01156	50	63.2	126.0	103.4	4.1	1.2				0.7	4				0	68.1	154.5	106.1	3.3	1.5									
	1646.31	XS_37627	510.664	0.045	0.00584	50	72.6	157.4	108.1	3.2	1.5				0.7	4				0	72.3	155.5	107.9	3.3	1.4									
13420.23	1646.01	XS_37626	510.5485	0.045	0.00602	50	75.6	158.2	112.0	3.2	1.4	2.9	1.8	75.4	0.7	4	0.3634763	0	0.6381	0.638102952	75.5	157.7	111.9	3.2	1.4	3.3	1.5	71.6	0.705582	0.00607	0.00457	-0.0015	0.5
	1642.98	XS_37625	510.4995	0.045	0.00234	50	70.9	201.3	100.4	2.5	2.0				0.7	4				0	68.7	180.4	98.9	2.8	1.8									
	1642.87	XS_37624	510.398	0.045	0.00234	50	78.0	206.0	106.7	2.5	1.9				0.7	4				0	75.7	184.5	104.8	2.8	1.8									
	1642.60	XS_37623	510.3315	0.045	0.00526	50	73.2	160.3	104.7	3.2	1.5				0.7	4				0	76.4	185.7	106.6	2.7	1.7									
	1642.40	XS_37622	510.1775	0.045	0.00412	50	79.3	175.3	108.9	2.9	1.6				0.7	4				0	80.8	188.0	109.8	2.7	1.7									
	1641.93	XS_37621	510.041	0.045	0.00936	50	64.3	135.9	107.0	3.8	1.3				0.7	4				0	72.7	188.8	111.1	2.7	1.7									
13121.9	1641.84	XS_37620	510.048	0.045	0.00172	50	89.9	238.7	122.6	2.1	1.9	2.8	1.7	75.9	0.7	4	0.3560417	0	0.36348	0.363476325	84.9	193.8	118.8	2.6	1.6	2.7	1.7	76.5	0.306096	0.0033	0.0038	0.0005	0
	1638.39	XS_37619	510.048	0.045	0.00214	50	74.3	208.7	102.9	2.4	2.0				0.7	4				0	68.9	160.8	98.8	3.2	1.6									
	1638.28	XS_37618	510.027	0.045	0.00214	50	81.2	209.6	104.2	2.4	2.0				0.7	4				0	76.6	161.7	100.3	3.2	1.6									
	1637.76	XS_37617	510.09	0.045	0.01032	50	65.0	128.2	99.4	4.0	1.3				0.7	4				0	70.3	163.0	102.3	3.1	1.6									
	1637.52	XS_37616	510.2545	0.045	0.00486	50	64.7	165.4	106.6	3.1	1.6				0.7	4				0	64.8	165.8	106.7	3.1	1.6									
	1637.69	XS_37615	511.7385	0.045	0.001	50	91.1	277.9	118.6	1.8	2.3				0.7	4				0	80.4	168.9	111.3	3.0	1.5									
	1637.26	XS_37614	512.953	0.045	0.00866	50	72.8	142.2	111.9	3.6	1.3				0.7	4				0	77.5	170.8	114.0	3.0	1.5									
	1636.81	XS_37613	518.7315	0.045	0.00888	50	68.4	142.9	113.5	3.6	1.3				0.7	4				0	73.6	173.0	115.8	3.0	1.5									
12722.07	1636.66	XS_37612	539.182	0.045	0.00306	50	85.9	214.8	133.6	2.5	1.6	2.9	1.7	75.4	0.7	4	0.4193189	0.16898	0.35604	0.525018935	81.5	185.7	130.6	2.9	1.4	3.1	1.5	74.2	0.499903	0.00482	0.00432	-0.0005	0.2
	1632.29	XS_37611	541.842	0.045	0.001	50	64.0	279.5	109.5	1.9	2.6				0.7	4				0	52.2	177.3	101.7	3.1	1.7									
	1632.86	XS_37610	547.3055	0.045	0.001	50	88.0	283.3	112.1	1.9	2.5				0.7	4				0	79.4	179.7	104.2	3.0	1.7									
	1632.42	XS_37609	547.9075	0.045	0.00872	50	71.6	144.7	106.3	3.8	1.4				0.7	4				0	77.0	183.1	109.3	3.0	1.7									
	1632.56	XS_37608	548.0335	0.045	0.001	50	98.0	289.7	118.6	1.9	2.4				0.7	4				0	90.4	184.4	111.2	3.0	1.7									
	1632.25	XS_37607	548.2505	0.045	0.00628	50	87.0	163.0	112.0	3.4	1.5				0.7	4				0	89.5	186.2	114.0	2.9	1.6									
12398.37	1632.10	XS_37606	548.527	0.045	0.00296	50	98.3	208.9	118.3	2.6	1.8	2.6	2.0	84.5	0.7	4	0.256082	0.0542	0.41932	0.473519858	96.6	188.1	116.9	2.9	1.6	3.0	1.7	80.9	0.480841	0.00413	0.00063	-0.0035	1.1
	1628.19	XS_37605	548.527	0.045	0.00656	50	76.1	151.0	95.5	3.6	1.6				0.7	4				0	78.4	175.7	97.2	3.1	1.8									
	1627.86	XS_37604	548.2225	0.045	0.00656	50	68.0	153.7	99.9	3.6	1.5				0.7	4				0	71.3	178.9	101.7	3.1	1.8									
	1627.69	XS_37603	547.897	0.045	0.00342	50	76.2	191.7	106.5	2.9	1.8				0.7	4				0	75.0	181.6	105.7	3.0	1.7									
	1627.27	XS_37602	552.9195	0.045	0.00852	50	65.1	146.3	106.0	3.8	1.4				0.7	4				0	70.9	184.8	109.1	3.0	1.7									
	1626.91	XS_37601	556.493	0.045	0.0072	50	66.1	156.0	108.7	3.6	1.4				0.7	4				0	70.8	187.2	111.5	3.0	1.7									
12125.61	1626.83	XS_37600	588.133	0.045	0.00164	50	92.7	263.3	122.1	2.2	2.2	3.3	1.6	74.0	0.7	4	0.6556292	0.22971	0.25608	0.485796781	86.2	196.6	116.2	3.0	1.7	3.0	1.7	75.4	0.470143	0.00406	0.00456	0.0005	0
	1623.96	XS_37599	598.0625	0.045	0.0138	50	61.9	130.5	101.6	4.6	1.3				0.7	4				0	69.3	176.7	107.4	3.4	1.6									
	1623.27	XS_37598	598.0625	0.045	0.0138	50	53.4	133.1	106.7	4.5	1.2				0.7	4				0	61.3	178.6	110.1	3.3	1.6									
	1623.06	XS_37597	598.0485	0.045	0.00406	50	73.2	194.7	110.3	3.1	1.8				0.7	4				0	71.0	177.8	109.0	3.4	1.6									
	1622.72	XS_37596	598.0485	0.045	0.00676	50	69.8	167.1	110.4	3.6	1.5				0.7	4				0	71.6	179.3	111.4	3.3	1.6									
	1622.49	XS_37595	597.996	0.045	0.00462	50	80.3	190.8	115.7	3.1	1.6				0.7	4				0	79.1	181.7	115.2	3.3	1.6									
11832.55	1622.48	XS_37594	597.947	0.045	0.001	50	104.3	312.3	125.8	1.9	2.5	3.5	1.7	73.8	0.7	4	0.8321559	0.05692	0.65563	0.712550381	95.1	181.9	115.6	3.3	1.6	3.3	1.6	74.6	0.7213	0.00541	0.00491	-0.0005	0.2
	1619.57	XS_37593	598.5	0.032	0.0065	50	65.6	132.1	99.3	4.5	1.3				0.7	4				0	67.9	146.9	100.5	4.1	1.5									
	1619.25	XS_37370	602.35	0.032	0.0065	50	67.6	131.0	96.4	4.6	1.4				0.7	4				0	69.8	145.8	97.9	4.1	1.5									
	1618.89	XS_37369	602.35	0.032	0.00716	50	71.0	129.0	99.7	4.7	1.3				0.7	4				0	73.8	148.0	101.5	4.1	1.5									
	1618.52	XS_37368	602.0385	0.032	0.00752	50	74.2	131.1	107.8	4.6	1.2				0.7	4				0	77.7	152.5	109.5	3.9	1.4									
11538.79	1618.29	XS_37367	601.867	0.032	0.00454	50	82.6	155.4	113.0	3.9	1.4	4.5	1.3	72.2	0.7	4	1.4140897	0.02274	0.83216	0.854891923	82.5	154.3	112.9	3.9	1.4	4.0	1.4	74.3	0.916429	0.00464	0.00514	0.0005	0
	1614.56	XS_37366	601.7235	0.032	0.0263	50	39.0	71.3	60.2	8.4	1.2				0.7	4				0	45.1	107.0	71.5	5.6	1.5									
	1613.25	XS_37365	601.51	0.032	0.0263	50	33.6	75.0	68.1	8.0	1.1				0.7	4				0	42.4	116.3	88.1	5.2	1.3									
	1613.05	XS_37364	601.363	0.032	0.0039	50	46.6	155.8	101.5	3.9	1.5				0.7	4				0	40.0	117.7	90.7	5.1	1.3									
	1612.92	XS_37363	601.314	0.032	0.00268	50	50.5	177.6	106.1	3.4	1.7				0.7	4				0	41.0	122.2	99.6	4.9	1.2									
	1612.72	XS_37362	601.307	0.032	0.00388	50	50.6	159.9	107.8	3.8	1.5				0.7	4				0	43.9	123.7	102.9	4.9	1.2									

Reach Breaks (D/S Station #)	Existing Channel Bottom Elevations (ft)	Cross-Section ID	Discharge (cfs)	Mannings n	Existing Slope (ft/ft)	Reach Segment Length (ft)	Flow Width (ft)	Wetted Area (sq ft)	Top Width (ft)	Velocity (ft/s)	Hydraulic Depth (ft)	Average Velocity (ft/s)	Average Depth (ft)	Average Width (ft)	D50 (mm)	G	Existing Sediment Transport Capacity (cfs)	Sediment Inflow #1 (cfs)	Sediment Inflow #2 (cfs)	Total Sediment Inflow (cfs)	Long-term Flow Width (ft)	Long-term Wetted Area (sq ft)	Long-term Top Width (ft)	Long-term Velocity (ft/s)	Long-term Hydraulic Depth	Long-term Average Velocity (ft/s)	Long-term Average Depth (ft)	Long-term Average Width (ft)	Equilibrium Sediment Transport Capacity (cfs)	Equilibrium Slope (ft/ft)	Existing Slope (ft/ft)	Slope Difference	U/S Deposition Depth (ft)
11246.9	1612.44	XS_37135	601.2825	0.032	0.00564	50	44.9	144.4	110.5	4.2	1.3	5.3	1.4	44.2	0.7	4	1.7701256	0	1.41409	1.414089655	41.4	126.4	108.4	4.8	1.2	5.1	1.3	42.3	1.467455	0.00857	0.00707	-0.0015	0.5
	1608.85	XS_37134	601.2825	0.032	0.001	50	51.9	235.7	102.5	2.6	2.3				0.7	4				0	33.5	107.3	88.0	5.6	1.2								
	1609.07	XS_37133	601.4575	0.032	0.001	50	55.4	237.0	104.1	2.5	2.3				0.7	4				0	36.2	105.3	84.1	5.7	1.3								
	1608.92	XS_37132	601.4575	0.032	0.00306	50	48.1	167.2	100.7	3.6	1.7				0.7	4				0	37.7	107.5	88.6	5.6	1.2								
	1608.84	XS_37131	601.076	0.032	0.00152	50	54.6	213.3	109.5	2.8	1.9				0.7	4				0	37.9	110.8	95.5	5.4	1.2								
	1608.64	XS_36900	600.992	0.032	0.00404	50	47.1	157.9	107.7	3.8	1.5				0.7	4				0	38.6	112.5	99.4	5.3	1.1								
10937.06	1608.42	XS_36899	600.9815	0.032	0.00442	50	47.0	154.3	108.7	3.9	1.4	3.2	1.8	50.7	0.7	4	0.2155829	0	1.77013	1.770125628	39.3	113.7	102.1	5.3	1.1	5.5	1.2	37.2	1.864396	0.011231	0.00145	-0.009781	2.9
	1605.71	XS_36898	600.9675	0.032	0.00412	50	39.7	136.0	75.1	4.4	1.8				0.7	4				0	45.5	182.8	84.1	3.3	2.2								
	1605.50	XS_36897	600.859	0.032	0.00412	50	45.8	150.3	96.7	4.0	1.6				0.7	4				0	52.5	197.1	101.8	3.0	1.9								
	1605.48	XS_36896	600.7295	0.032	0.001	50	61.9	239.9	107.5	2.5	2.2				0.7	4				0	57.0	199.1	104.4	3.0	1.9								
	1605.10	XS_36660	600.607	0.032	0.00756	50	43.5	126.1	98.4	4.8	1.3				0.7	4				0	55.2	199.8	105.4	3.0	1.9								
	1604.82	XS_36659	600.4985	0.032	0.0055	50	45.2	140.5	101.5	4.3	1.4				0.7	4				0	54.4	200.5	106.4	3.0	1.9								
10637.14	1604.72	XS_36658	600.474	0.032	0.00206	50	52.5	191.7	105.7	3.1	1.8	3.8	1.7	48.1	0.7	4	0.4660466	0	0.21558	0.215582858	53.7	200.6	106.5	3.0	1.9	3.1	1.9	53.0	0.182256	0.00179	0.00329	0.0015	0
	1602.94	XS_36657	600.4425	0.032	0.00588	50	43.9	133.5	94.0	4.5	1.4				0.7	4				0	47.7	156.7	96.8	3.8	1.6								
	1602.64	XS_36656	600.369	0.032	0.00588	50	47.3	136.3	99.0	4.4	1.4				0.7	4				0	51.4	160.0	102.1	3.8	1.6								
	1602.38	XS_36416	600.5965	0.032	0.00528	50	47.5	143.0	102.9	4.2	1.4				0.7	4				0	50.8	162.3	105.7	3.7	1.5								
10435	1602.32	XS_36415	600.5965	0.032	0.0012	50	64.0	236.4	118.9	2.5	2.0	3.9	1.5	50.7	0.7	4	0.5403876	0.00071	0.46605	0.466757115	53.9	166.4	112.6	3.6	1.5	3.7	1.5	50.9	0.43885	0.00359	0.00309	-0.0005	0.1
	1599.06	XS_36414	600.523	0.032	0.0031	50	46.7	160.1	91.4	3.8	1.8				0.7	4				0	45.2	149.6	90.1	4.0	1.7								
	1598.91	XS_36169	600.355	0.032	0.0031	50	47.3	163.2	95.9	3.7	1.7				0.7	4				0	45.6	152.2	94.1	3.9	1.6								
	1598.82	XS_36168	600.0925	0.032	0.00182	50	54.4	197.4	103.7	3.0	1.9				0.7	4				0	48.3	155.5	99.4	3.9	1.6								
	1598.72	XS_36167	599.914	0.032	0.00198	50	55.5	195.0	107.1	3.1	1.8				0.7	4				0	50.0	158.0	103.4	3.8	1.5								
	1598.54	XS_36166	599.767	0.032	0.0035	50	49.8	163.5	106.0	3.7	1.5				0.7	4				0	49.1	159.0	105.2	3.8	1.5								
10136.06	1598.37	XS_35911	599.6445	0.032	0.00344	50	48.4	165.7	108.1	3.6	1.5	3.5	1.7	50.4	0.7	4	0.3112869	0	0.54039	0.540387637	47.5	160.4	107.5	3.7	1.5	3.9	1.6	47.6	0.475068	0.00381	0.00231	-0.0015	0.5
	1595.73	XS_35910	599.3295	0.032	0.0026	50	47.6	167.9	90.5	3.6	1.9				0.7	4				0	46.9	162.8	89.7	3.7	1.8								
	1595.60	XS_35909	597.7125	0.032	0.0026	50	48.0	172.3	97.0	3.5	1.8				0.7	4				0	47.3	167.3	96.5	3.6	1.7								
	1595.63	XS_35908	596.701	0.032	0.001	50	57.5	236.8	105.1	2.5	2.3				0.7	4				0	48.9	169.1	99.5	3.5	1.7								
	1595.60	XS_35907	596.5855	0.032	0.001	50	59.4	242.7	111.9	2.5	2.2				0.7	4				0	50.2	172.7	104.9	3.5	1.6								
	1595.58	XS_35906	595.63	0.032	0.001	50	61.7	242.5	111.9	2.5	2.2				0.7	4				0	52.5	172.9	105.5	3.4	1.6								
	1595.34	XS_35905	595.63	0.032	0.00474	50	46.7	146.7	102.5	4.1	1.4				0.7	4				0	50.9	172.2	104.4	3.5	1.6								
	1595.00	XS_35640	595.3815	0.032	0.00676	50	38.0	119.0	79.1	5.0	1.5				0.7	4				0	46.7	172.4	104.7	3.5	1.6								
9713.01	1594.79	XS_35639	602.224	0.032	0.00418	50	47.2	165.9	124.8	3.6	1.3	3.4	1.8	50.8	0.7	4	0.2801544	0.01496	0.31129	0.32624804	51.4	190.6	132.4	3.2	1.4	3.5	1.7	49.4	0.306835	0.00285	0.00235	-0.0005	0.2
	1591.88	XS_35638	602.224	0.032	0.00442	50	44.0	143.8	90.7	4.2	1.6				0.7	4				0	47.0	163.8	92.7	3.7	1.8								
	1591.66	XS_35637	601.825	0.032	0.00442	50	45.4	146.4	95.1	4.1	1.5				0.7	4				0	48.5	166.6	97.0	3.6	1.7								
	1591.46	XS_35363	601.559	0.032	0.00406	50	47.7	152.9	99.5	3.9	1.5				0.7	4				0	50.3	169.4	101.3	3.6	1.7								
	1591.44	XS_35362	601.3735	0.032	0.001	50	60.4	241.2	108.7	2.5	2.2				0.7	4				0	51.3	170.6	103.0	3.5	1.7								
	1591.29	XS_35361	601.2405	0.032	0.00304	50	51.8	170.3	105.1	3.5	1.6				0.7	4				0	52.0	171.9	105.2	3.5	1.6								
9426.93	1591.14	XS_35360	601.1985	0.032	0.00292	50	52.3	174.4	108.2	3.4	1.6	3.6	1.7	50.3	0.7	4	0.3727508	0	0.28015	0.280154361	52.2	173.8	108.1	3.5	1.6	3.6	1.7	50.2	0.34535	0.00295	0.00245	-0.0005	0.2
	1588.57	XS_35359	601.1355	0.032	0.00424	50	45.9	149.9	97.8	4.0	1.5				0.7	4				0	47.3	158.9	98.5	3.8	1.6								
	1588.36	XS_35358	599.5465	0.032	0.00424	50	49.4	151.7	101.5	4.0	1.5				0.7	4				0	50.9	160.8	102.3	3.7	1.6								
	1588.55	XS_35073	598.2585	0.032	0.001	50	65.7	244.8	113.7	2.4	2.2				0.7	4				0	54.6	163.0	106.0	3.7	1.5								
9220.9	1588.37	XS_35072	598.0555	0.032	0.0037	50	53.8	164.3	112.4	3.6	1.5	3.5	1.7	53.7	0.7	4	0.3515233	0	0.37275	0.3727508	54.3	166.9	112.7	3.6	1.5	3.7	1.6	51.8	0.42972	0.00353	0.00103	-0.0025	0.5
	1584.75	XS_35071	597.961	0.032	0.001	50	55.7	236.5	104.3	2.5	2.3				0.7	4				0	45.6	158.8	98.2	3.8	1.6								
	1584.80	XS_35070	597.695	0.032	0.001	50	61.2	240.9	109.5	2.5	2.2				0.7	4				0	50.7	162.1	103.5	3.7	1.6								
	1584.51	XS_35069	597.569	0.032	0.00568	50	45.5	138.2	100.5	4.3	1.4				0.7	4				0	49.7	163.3	105.4	3.7	1.5								
9019.37	1584.56	XS_35068	597.5445	0.032	0.001	50	63.8	247.1	116.7	2.4	2.1	2.9	2.0	56.5	0.7	4	0.1623117	0	0.35152	0.351523277	52.6	165.9	109.6	3.6	1.5	3.7	1.6	49.7	0.404956	0.00347	0.00097	-0.0025	0.5
	1581.87	XS_35067	597.5235	0.032	0.0013	50	59.4	214.7	100.0	2.8	2.1				0.7	4				0	57.0	194.8	98.4	3.1	2.0								
	1581.80	XS_35066	597.4675	0.032	0.0013	50	63.7	219.4	105.6	2.7	2.1				0.7	4				0	61.2	199.1	104.0	3.0	1.9								
	1581.53	XS_35065	601.2895	0.032	0.00548	50	47.1	139.9	100.0	4.3	1.4				0.7	4				0	57.3	205.7	112.0	2.9	1.8								
8820.6	1581.41	XS_34770	601.2895	0.032	0.00226	50	56.6	190.7	111.6	3.2	1.7	3.2	1.8	56.7	0.7	4	0.2544867	0.02172	0.16231	0.184032697	58.8	206.6	113.0	2.9	1.8	3.0	1.9	58.6	0.180503	0.00176	0.00226	0.0005	0
	1579.50	XS_34769	601.174	0.032	0.001	50	64.8	237.2	104.5	2.5	2.3				0.7	4				0	57.3	175.0	99.0	3.4	1.8								
	1579.65	XS_34768	601.286	0.032	0.001	50	68.5	239.5	107.0	2.5	2.2				0.7	4				0	61.1	176.5	101.0	3.4	1.7								
	1579.40	XS_34767	601.286	0.032	0.005	50	52.8	143.3	99.3	4.2	1.4				0.7	4				0	58.3	178.1	103.4	3.4	1.7								
	1579.19	XS_34766	601.286	0.032	0.00412	50	54.5	152.3	99.9	3.9	1.5				0.7	4				0	58.3	177.3	102.1	3.4	1.7								
	1578.95	XS_34765	601.02	0.032	0.00476	50	51.4	147.8	103.3	4.1	1.4				0.7	4				0	56.5	180.1	106.3	3.3	1.7								
	1578.82	XS_34764	600.915	0.032	0.00276	50	53.9	177.2	108.0	3.4	1.6				0.7	4				0	54.5	181.5	108.4	3.3	1.7								
8474.74	1578.78	XS_34763	600.285	0.032	0.001	50	66.1	247.0	115.9	2.4	2.1	3.3	1.8	58.8	0.7	4	0.2858122	0	0.25449	0.254486686	57.7	182.7	110.5	3.3	1.7	3.4	1.7	57.7	0.310576	0.00256	0.00206	-0.0005	0.2
	1576.26	XS_34762	600.033	0.032	0.00416	50	47.2	148.7	95.0	4.0	1.6				0.7	4				0	52.4	184.8	98.8	3.2	1.9								
	1576.06	XS_34456	599.536	0.032	0.00416	50	46.4	149.7	96.7	4.0	1.5				0.7	4				0	51.7	185.2	99.7	3.2	1.9								
	1576.04	XS_34455	599.186	0.032	0.001	50	61.9	237.8	105.6	2.5	2.3				0.7	4				0	55.7	186.8	101.9	3.2	1.8								
	1575.84	XS_34454	599.0425	0.032	0.00404	50	49.0	155.0	103.3	3.9	1.5				0.7	4				0	54.3	189.9	106.2	3.2	1.8								
	1575.77	XS_34453	598.8815	0.032	0.00148	50	59.3	213.8	108.8	2.8	2.0				0.7	4				0	56.2	190.3	106.9	3.1	1.8								
	1575.63	XS_34452	598.7555	0.032	0.00274	50	52.7	177.1	107.8	3.4	1.6				0.7	4				0	54.9	191.9	109.1	3.1	1.8								
8128.97	1575.34	XS_34451	598.738	0.032	0.00576	50	46.3	140.3	105.2	4.3	1.3	3.6	1.7	51.8	0.7	4	0.3557465	0	0.28581	0.285812154	55.1	194.0	112.1	3.1	1.7	3.2	1.8	54.3	0.223589	0.00213	0.00263	0.0005	0
	1572.68	XS_34450	598.633	0.032	0.001	50	56.1	234.3	101.8	2.6	2.3				0.7	4				0	47.4	164.7	96.1	3.6	1.7								
	1572.84	XS_34449	598.465	0.032	0.001	50	58.6	235.5	103.1	2.5	2.3				0.7	4				0	49.7	164.9	96.4	3.6	1.7								
	1572.61	XS_34448	598.206	0.032	0.00462	50	45.1	146.0	98.4	4.1	1.5				0.7	4				0	48.5	167.5	100.1	3.6	1.7								
	1572.68	XS_34447	598.206	0.032	0.001	50	59.8	239.6	107.8	2.5	2.2				0.7	4				0	50.7	169.0	102.6	3.5	1.6								
	1572.65	XS_34446	597.6845	0.032	0.001	50	61.1	242.3	111.1	2.5	2.2				0.7	4				0	51.6	170.3	104.7	3.5	1.6								
	1572.53	XS_34129	597.4885	0.032	0.00236	50	52.0	185.3	108.3	3.2	1.7				0.7	4				0	49.9	171.6	106.8	3.5	1.6								
7779.53	1572.51	XS_34128	597.373	0.032	0.001	50	65.6	246.2	115.4	2.4	2.1	2.8	2.0	56.9	0.7	4	0.1377892	0	0.35575	0.355746468	55.8	173.8	110.0	3.4	1.6	3.5	1.7	50.5	0.344601	0.00299	0.00049	-0.0025	0.9
	1570.15	XS_34127	597.205	0.032	0.00138	50	54.1	213.0	102.6	2.8	2.1				0.7	4				0	51.6	192.9	100.6	3.1	1.9								
	1570.08	XS_34126	596.568	0.032	0.00138	50	56.5	214.3	104.4	2.8	2.1				0.7	4				0	54.0	194.4	102.7	3.1	1.9								
	1570.03	XS_34125	595.987	0.032	0.001	50	62.4	242.0	111.2	2.5	2.2				0.7	4				0	57.0	198.2	108.1	3.0	1.8								

Reach Breaks (D/S Station #)	Existing Channel Bottom Elevations (ft)	Cross-Section ID	Discharge (cfs)	Mannings n	Existing Slope (ft/ft)	Reach Segment Length (ft)	Flow Width (ft)	Wetted Area (sq ft)	Top Width (ft)	Velocity (ft/s)	Hydraulic Depth (ft)	Average Velocity (ft/s)	Average Depth (ft)	Average Width (ft)	D50 (mm)	G	Existing Sediment Transport Capacity (cfs)	Sediment Inflow #1 (cfs)	Sediment Inflow #2 (cfs)	Total Sediment Inflow (cfs)	Long-term Flow Width (ft)	Long-term Wetted Area (sq ft)	Long-term Top Width (ft)	Long-term Velocity (ft/s)	Long-term Hydraulic Depth	Long-term Average Velocity (ft/s)	Long-term Average Depth (ft)	Long-term Average Width (ft)	Equilibrium Sediment Transport Capacity (cfs)	Equilibrium Slope (ft/ft)	Existing Slope (ft/ft)	Slope Difference	U/S Deposition Depth (ft)
	1569.76	XS_34124	595.581	0.032	0.00542	50	46.3	143.6	107.3	4.1	1.3				0.7	4				0	55.4	200.7	111.5	3.0	1.8									
	1569.80	XS_34123	595.553	0.032	0.001	50	65.0	244.9	114.8	2.4	2.1				0.7	4				0	59.5	200.9	111.8	3.0	1.8									
	1569.83	XS_34122	595.602	0.032	0.001	50	68.9	246.8	117.0	2.4	2.1				0.7	4				0	63.3	202.5	114.1	2.9	1.8									
7427.06	1569.32	XS_34121	595.602	0.032	0.01028	50	45.5	121.2	113.6	4.9	1.1	3.1	1.9	57.0	0.7	4	0.2217107	0	0.13779	0.137789163	61.2	208.0	121.9	2.9	1.7	3.0	1.8	57.4	0.181973	0.00187	0.00237	0.0005	0
	1566.51	XS_34120	595.3395	0.032	0.0046	50	49.3	144.9	97.2	4.1	1.5				0.7	4				0	55.9	189.3	102.5	3.1	1.8									
	1566.28	XS_34119	594.475	0.032	0.0046	50	52.0	145.5	98.3	4.1	1.5				0.7	4				0	58.5	188.5	101.8	3.2	1.9									
	1566.14	XS_33792	593.831	0.032	0.00288	50	53.7	169.7	101.9	3.5	1.7				0.7	4				0	56.5	189.6	103.4	3.1	1.8									
	1566.09	XS_33791	593.4285	0.032	0.00102	50	64.6	238.2	109.2	2.5	2.2				0.7	4				0	58.9	191.3	105.9	3.1	1.8									
	1565.99	XS_33790	593.2605	0.032	0.002	50	59.9	194.3	109.0	3.1	1.8				0.7	4				0	59.8	193.4	108.9	3.1	1.8									
	1565.94	XS_33789	593.096	0.032	0.001	50	66.9	244.6	115.1	2.4	2.1				0.7	4				0	60.6	195.4	111.8	3.0	1.7									
	1565.87	XS_33788	593.0365	0.032	0.00142	50	63.2	219.2	113.9	2.7	1.9				0.7	4				0	60.0	195.6	112.0	3.0	1.7									
7026.19	1565.50	XS_33787	593.0365	0.032	0.00744	50	52.4	131.2	109.3	4.5	1.2	3.4	1.7	57.7	0.7	4	0.3091601	0	0.22171	0.22171068	64.0	198.3	115.8	3.0	1.7	3.1	1.8	59.3	0.216028	0.00203	0.00253	0.0005	0
	1562.79	XS_33786	592.851	0.032	0.00508	50	45.1	138.9	94.8	4.3	1.5				0.7	4				0	51.4	179.9	98.4	3.3	1.8									
	1562.54	XS_33785	592.494	0.032	0.00508	50	48.1	142.1	100.4	4.2	1.4				0.7	4				0	54.9	185.1	105.9	3.2	1.7									
	1562.40	XS_33784	592.193	0.032	0.00278	50	55.0	172.8	104.2	3.4	1.7				0.7	4				0	56.7	184.5	105.0	3.2	1.8									
	1562.34	XS_33448	591.9235	0.032	0.00108	50	62.7	235.0	110.5	2.5	2.1				0.7	4				0	56.4	185.8	107.0	3.2	1.7									
6718.73	1562.35	XS_33447	591.7415	0.032	0.001	50	64.9	243.4	114.0	2.4	2.1	3.4	1.8	55.2	0.7	4	0.2947109	0	0.30916	0.309160105	57.8	187.7	109.9	3.2	1.7	3.2	1.8	55.4	0.241937	0.00226	0.00176	-0.0005	0.1
	1561.45	XS_33446	591.598	0.032	0.04328	50	24.2	47.9	32.9	12.3	1.5				0.7	4				0	49.8	168.9	113.1	3.5	1.5									
	1559.29	XS_33445	591.3565	0.032	0.04328	50	25.3	49.1	34.9	12.0	1.4				0.7	4				0	46.8	160.3	99.1	3.7	1.6									
	1559.11	XS_33444	591.0975	0.032	0.00368	50	46.7	156.9	101.1	3.8	1.6				0.7	4				0	47.5	161.8	101.4	3.7	1.6									
	1558.99	XS_33443	590.7615	0.032	0.00238	50	49.9	181.2	104.5	3.3	1.7				0.7	4				0	47.2	162.9	103.2	3.6	1.6									
	1558.80	XS_33442	590.506	0.032	0.00368	50	45.3	159.9	106.2	3.7	1.5				0.7	4				0	46.1	164.9	106.6	3.6	1.5									
	1558.85	XS_33441	590.3485	0.032	0.001	50	59.6	243.2	114.0	2.4	2.1				0.7	4				0	49.0	166.3	109.0	3.5	1.5									
6421.01	1558.71	XS_33440	590.275	0.032	0.00276	50	50.5	180.0	115.1	3.3	1.6	5.8	1.6	43.1	0.7	4	2.5402004	0	0.29471	0.294710909	48.8	169.6	114.4	3.5	1.5	3.6	1.5	47.9	0.349602	0.00334	0.00784	0.0045	0
	1556.40	XS_33439	590.149	0.032	0.00472	50	46.6	144.6	99.6	4.1	1.5				0.7	4				0	37.4	97.2	89.7	6.1	1.1									
	1556.16	XS_33438	589.827	0.032	0.00472	50	45.1	146.0	102.0	4.0	1.4				0.7	4				0	36.0	99.7	95.6	5.9	1.0									
	1555.81	XS_33092	589.813	0.032	0.00712	50	41.3	128.9	101.9	4.6	1.3				0.7	4				0	35.3	99.8	95.9	5.9	1.0									
	1555.78	XS_33091	589.813	0.032	0.001	50	58.7	244.1	115.1	2.4	2.1				0.7	4				0	35.8	102.4	102.0	5.8	1.0									
	1555.87	XS_33090	589.568	0.032	0.001	50	60.5	246.4	118.0	2.4	2.1				0.7	4				0	36.9	103.0	103.8	5.7	1.0									
6121.65	1555.58	XS_33089	589.5505	0.032	0.00574	50	48.2	142.8	112.1	4.1	1.3	3.6	1.6	50.1	0.7	4	0.3713985	0	2.5402	2.540200442	39.9	104.6	108.0	5.6	1.0	5.8	1.0	36.9	2.507808	0.015408	0.00272	-0.012688	3.8
	1553.13	XS_33088	589.5505	0.032	0.00598	50	43.5	133.8	98.2	4.4	1.4				0.7	4				0	49.1	167.8	100.7	3.5	1.7									
	1552.83	XS_33087	589.449	0.032	0.00598	50	46.0	135.1	100.8	4.4	1.3				0.7	4				0	51.7	169.4	103.2	3.5	1.6									
	1552.55	XS_33086	589.344	0.032	0.00566	50	44.8	141.1	107.7	4.2	1.3				0.7	4				0	50.4	173.6	109.8	3.4	1.6									
	1552.41	XS_33085	589.316	0.032	0.00272	50	55.6	178.9	112.6	3.3	1.6				0.7	4				0	55.0	175.2	112.3	3.4	1.6									
	1552.50	XS_33084	589.316	0.032	0.001	50	65.7	248.4	120.8	2.4	2.1				0.7	4				0	55.8	177.5	116.2	3.3	1.5									
5820.43	1552.41	XS_32733	589.2705	0.032	0.0018	50	67.7	210.7	124.4	2.8	1.7	3.6	1.6	53.9	0.7	4	0.3854647	0	0.3714	0.371398546	63.1	181.3	122.6	3.2	1.5	3.4	1.6	54.2	0.308502	0.00291	0.00241	-0.0005	0.2
	1547.85	XS_32732	589.2705	0.032	0.001	50	53.2	236.8	106.7	2.5	2.2				0.7	4				0	43.0	159.9	101.9	3.7	1.6									
	1547.93	XS_32731	588.9835	0.032	0.001	50	56.8	238.0	108.2	2.5	2.2				0.7	4				0	46.5	160.6	103.1	3.7	1.6									
	1547.62	XS_32730	588.728	0.032	0.00602	50	41.0	136.2	103.4	4.3	1.3				0.7	4				0	45.4	161.8	105.1	3.6	1.5									
	1547.65	XS_32729	588.7105	0.032	0.001	50	58.6	241.8	112.8	2.4	2.1				0.7	4				0	47.8	163.4	107.8	3.6	1.5									
	1547.67	XS_32728	588.7105	0.032	0.001	50	62.2	241.5	112.4	2.4	2.1				0.7	4				0	51.5	163.1	107.3	3.6	1.5									
	1547.56	XS_32727	588.392	0.032	0.00222	50	56.8	189.6	111.9	3.1	1.7				0.7	4				0	52.9	164.7	110.1	3.6	1.5									
	1547.67	XS_32726	588.3465	0.032	0.001	50	67.4	246.8	119.1	2.4	2.1				0.7	4				0	56.1	166.8	113.8	3.5	1.5									
5418.71	1547.46	XS_32725	588.329	0.032	0.00412	50	57.4	159.5	115.5	3.7	1.4	2.9	1.9	56.7	0.7	4	0.15998	0	0.38546	0.385464682	58.9	168.3	116.2	3.5	1.4	3.6	1.5	50.2	0.376696	0.00347	0.00097	-0.0025	1
	1544.07	XS_32724	588.329	0.032	0.001	50	55.2	235.3	105.3	2.5	2.2				0.7	4				0	50.8	198.6	102.6	3.0	1.9									
	1544.07	XS_32723	588.2765	0.032	0.001	50	57.2	236.9	107.2	2.5	2.2				0.7	4				0	52.8	200.1	104.6	2.9	1.9									
	1544.11	XS_32722	588.2765	0.032	0.001	50	60.2	238.0	108.3	2.5	2.2				0.7	4				0	55.7	201.1	105.9	2.9	1.9									
	1543.79	XS_32721	588.1575	0.032	0.00642	50	43.4	132.8	101.8	4.4	1.3				0.7	4				0	54.2	201.9	107.0	2.9	1.9									
5120.62	1543.77	XS_32371	588.1645	0.032	0.001	50	59.1	240.4	111.2	2.4	2.2	2.9	2.0	55.0	0.7	4	0.1413054	0	0.15998	0.159979998	54.4	202.7	108.2	2.9	1.9	2.9	1.9	53.6	0.153868	0.0017	0.0012	-0.0005	0.1
	1542.94	XS_32370	588.1645	0.032	0.04536	50	37.9	59.9	60.4	9.8	1.0				0.7	4				0	57.6	185.8	107.2	3.2	1.7									
	1540.68	XS_32369	588.6825	0.032	0.04536	50	24.5	45.3	29.6	13.0	1.5				0.7	4				0	48.8	180.5	99.3	3.3	1.8									
	1540.44	XS_32368	589.33	0.032	0.00468	50	44.2	143.4	97.0	4.1	1.5				0.7	4				0	50.1	182.4	101.7	3.2	1.8									
	1540.49	XS_32367	590.9505	0.032	0.001	50	60.3	241.4	111.6	2.4	2.2				0.7	4				0	53.3	186.7	107.5	3.2	1.7									
	1540.41	XS_32366	592.4275	0.032	0.0015	50	58.3	215.1	113.1	2.8	1.9				0.7	4				0	54.8	189.3	111.0	3.1	1.7									
4824.9	1540.32	XS_32365	593.9325	0.032	0.00182	50	57.7	205.1	115.6	2.9	1.8	5.8	1.6	47.2	0.7	4	2.7843564	0.03345	0.14131	0.174759781	55.8	192.0	114.7	3.1	1.7	3.2	1.7	53.4	0.222897	0.00224	0.00874	0.0065	0
	1537.67	XS_32364	603.547	0.032	0.01792	50	39.8	94.8	91.3	6.4	1.0				0.7	4				0	41.0	100.0	92.7	6.0	1.1									
	1536.78	XS_32014	615.2615	0.032	0.01792	50	33.1	87.8	73.0	7.0	1.2				0.7	4				0	34.2	93.1	75.3	6.6	1.2									
	1536.33	XS_32013	621.4075	0.032	0.00894	50	37.4	121.1	95.4	5.1	1.3				0.7	4				0	33.4	101.0	90.9	6.2	1.1									
	1536.17	XS_32012	622.993	0.032	0.00318	50	45.8	171.9	105.1	3.6	1.6				0.7	4				0	33.7	103.9	97.3	6.0	1.1									
	1536.26	XS_32011	623.539	0.032	0.001	50	59.2	251.5	114.2	2.5	2.2				0.7	4				0	35.6	101.1	90.7	6.2	1.1									
	1536.40	XS_32010	625.0475	0.032	0.001	50	63.8	256.6	119.6	2.4	2.1				0.7	4				0	39.4	106.5	103.0	5.9	1.0									
4494.15	1536.40	XS_32009	628.712	0.032	0.001	50	67.5	259.8	122.5	2.4	2.1	4.2	1.7	49.5	0.7	4	0.709496	0.20172	2.78436	2.986077483	42.5	107.6	104.9	5.8	1.0	6.1	1.1	37.1	2.981666	0.015328	0.00364	-0.011688	4.1
	1533.27	XS_32008	633.808	0.032	0.00894	50	42.6	119.2	89.4	5.3	1.3				0.7	4				0	43.5	124.1	90.4	5.1	1.4									
	1532.82	XS_32007	644.0385	0.032	0.00894	50	40.3	121.0	90.5	5.3	1.3				0.7	4				0	41.2	125.9	91.3	5.1	1.4									
	1532.70	XS_32006	666.918	0.032	0.00244	50	53.9	194.1	105.7	3.4	1.8				0.7	4				0	44.0	130.8	95.5	5.1	1.4									
	1532.62	XS_32005	691.362	0.032	0.00162	50	59.5	230.3	112.9	3.0	2.0				0.7	4				0	45.7	138.8	104.9	5.0	1.3									
	1532.61	XS_31657	722.162	0.032	0.001	50	66.8	279.1	119.1	2.6	2.3				0.7	4				0	48.2	144.5	108.8	5.0	1.3									
	1532.71	XS_31656	750.869	0.032	0.001	50	77.8	317.5	155.1	2.4	2.0				0.7	4				0	52.5	151.1	114.7	5.0	1.3									
	1532.60	XS_31655	793.877	0.032	0.0021	50	81.6	275.4	174.6	2.9	1.6				0.7	4				0	64.2	180.5	164.7	4.4	1.1									
	1532.40	XS_31654	793.877	0.032	0.00402	50	71.3	210.3	144.5	3.8	1.5				0.7	4				0	63.6	169.3	139.9	4.7	1.2									
	1532.27	XS_32000	793.6845	0.032	0.00266	50	72.8	217.9	116.2	3.6	1.9				0.7	4				0	63.5	155.9	114.1	5.1	1.4									
3816.66	1530.90	XS_3817	794	0.032	0.005692	240	62.0	180.6	128.3	4.4	1.4	3.7	1.7	62.9	0.7	4	0.4941855	0.95867	0.7095	1.668166441	58.7	162.9	127.2	4.9	1.3	4.9	1.3	52.5		0.00793	0.00343	-0.0045	3.1
	1529.48	XS_3638	794	0.032	0.004978	179	79.1	183.4	121.0	4.3	1.5				0.7	4				0	85.7	234.7	124.2	3.4	1.9									

Reach Breaks (D/S Station #)	Existing Channel Bottom Elevations (ft)	Cross-Section ID	Discharge (cfs)	Mannings n	Existing Slope (ft/ft)	Reach Segment Length (ft)	Flow Width (ft)	Wetted Area (sq ft)	Top Width (ft)	Velocity (ft/s)	Hydraulic Depth (ft)	Average Velocity (ft/s)	Average Depth (ft)	Average Width (ft)	D50 (mm)	G	Existing Sediment Transport Capacity (cfs)	Sediment Inflow #1 (cfs)	Sediment Inflow #2 (cfs)	Total Sediment Inflow (cfs)	Long-term Flow Width (ft)	Long-term Wetted Area (sq ft)	Long-term Top Width (ft)	Long-term Velocity (ft/s)	Long-term Hydraulic Depth	Long-term Average Velocity (ft/s)	Long-term Average Depth (ft)	Long-term Average Width (ft)	Equilibrium Sediment Transport Capacity (cfs)	Equilibrium Slope (ft/ft)	Existing Slope (ft/ft)	Slope Difference	U/S Deposition Depth (ft)
3404.69	1528.36	XS_3413	794	0.032	0.004978	225	61.0	186.4	125.6	4.3	1.5	4.3	1.5	70.1	0.7	4	1.1290925	0	0.49419	0.494185466	68.9	238.7	129.3	3.3	1.8	3.4	1.9	77.3		0.00227	0.00277	0.0005	0
	1526.09	XS_3386	794	0.032	0.001651	27	69.7	254.9	119.6	3.1	2.1				0.7	4				0	59.2	177.9	115.0	4.5	1.5								
	1525.91	XS_3277	794	0.032	0.001651	109	70.0	259.2	125.0	3.1	2.1				0.7	4				0	59.0	180.8	120.1	4.4	1.5								
3116.9	1525.63	XS_3141	794	0.032	0.002059	136	70.9	246.0	129.5	3.2	1.9	3.1	2.0	70.2	0.7	4	0.2651342	0	1.12909	1.129092504	61.7	183.8	125.2	4.3	1.5	4.4	1.5	60.0		0.00519	0.00169	-0.0035	1
	1523.35	XS_3110	794	0.032	0.007154	31	56.2	158.4	109.8	5.0	1.4				0.7	4				0	66.8	231.1	116.9	3.4	2.0								
2838.55	1522.47	XS_2987	794	0.032	0.007154	123	48.7	161.8	115.5	4.9	1.4	5.0	1.4	52.4	0.7	4	1.6006896	0	0.26513	0.265134248	59.5	234.3	120.8	3.4	1.9	3.4	2.0	63.2		0.00221	0.00571	0.0035	0
	1520.86	XS_2655	794	0.032	0.004573	332	66.8	186.6	118.3	4.3	1.6				0.7	4				0	62.7	162.1	116.4	4.9	1.4								
2403.890	1519.79	XS_2421	794	0.032	0.004573	234	65.3	195.1	132.1	4.1	1.5	4.2	1.5	66.1	0.7	4	0.9252407	0	1.60069	1.600689598	60.8	169.9	130.7	4.7	1.3	4.8	1.3	61.7		0.00714	0.00189	-0.00525	3
	1516.46	XS_2298	794	0.032	0.001925	123	67.2	247.2	124.7	3.2	2.0				0.7	4				0	58.7	187.4	121.1	4.2	1.5								
2097.250	1516.10	XS_2111	794	0.032	0.001925	187	70.8	254.7	134.4	3.1	1.9	3.2	1.9	69.0	0.7	4	0.2750948	0	0.92524	0.925240667	61.6	193.2	130.8	4.1	1.5	4.2	1.5	60.2		0.00466	0.00116	-0.0035	1.1
	1513.01	XS_2078	794	0.032	0.001866	33	63.3	245.3	119.5	3.2	2.1				0.7	4				0	60.8	225.6	118.3	3.5	1.9								
	1512.76	XS_1944	794	0.032	0.001866	134	65.5	253.5	129.6	3.1	2.0				0.7	4				0	62.8	233.3	128.4	3.4	1.8								
1810.840	1512.13	XS_1811	794	0.032	0.004737	133	56.5	195.8	137.0	4.1	1.4	3.5	1.8	61.8	0.7	4	0.3766969	0	0.27509	0.275094778	63.6	240.7	139.1	3.3	1.7	3.4	1.8	62.4		0.00243	0.00293	0.0005	0
	1509.51	XS_1782	794	0.032	0.001765	29	66.2	251.3	121.0	3.2	2.1				0.7	4				0	62.2	219.7	118.7	3.6	1.9								
	1509.27	XS_1646	794	0.032	0.001765	136	69.3	258.8	131.1	3.1	2.0				0.7	4				0	65.0	226.9	129.4	3.5	1.8								
1502.910	1509.16	XS_1516	794	0.032	0.001	130	76.7	315.8	140.7	2.5	2.2	2.9	2.1	70.7	0.7	4	0.1928812	0	0.3767	0.376696933	66.0	231.4	136.0	3.4	1.7	3.5	1.8	64.4		0.00269	0.00119	-0.0015	0.4
	1506.43	XS_1480	794	0.032	0.004148	36	60.6	189.8	114.6	4.2	1.7				0.7	4				0	72.1	283.2	120.4	2.8	2.4								
	1505.87	XS_1345	794	0.032	0.004148	135	56.6	194.9	122.4	4.1	1.6				0.7	4				0	69.2	290.9	128.8	2.7	2.3								
1197.550	1505.90	XS_1198	794	0.032	0.001	147	79.5	313.8	138.4	2.5	2.3	3.6	1.8	65.6	0.7	4	0.4616158	0	0.19288	0.19288119	77.9	298.6	137.6	2.7	2.2	2.7	2.3	73.1		0.00117	0.00167	0.0005	0
	1503.40	XS_1165	794	0.032	0.003382	33	60.4	203.0	116.3	3.9	1.7				0.7	4				0	61.5	210.9	116.9	3.8	1.8								
	1502.94	XS_1029	794	0.032	0.003382	136	64.7	219.6	141.7	3.6	1.5				0.7	4				0	66.0	228.0	142.1	3.5	1.6								
990.750	1503.30	XS_999	794	0.032	0.001	30	84.5	326.5	153.1	2.4	2.1	3.3	1.8	69.8	0.7	4	0.34956	0	0.46162	0.461615793	71.6	231.7	148.1	3.4	1.6	3.6	1.7	66.4		0.003	0.0005	-0.0025	0.5
	1499.04	XS_972	794	0.032	0.006381	27	63.8	166.4	114.2	4.8	1.5				0.7	4				0	73.5	233.9	120.3	3.4	1.9								
	1498.37	XS_867	794	0.032	0.006381	105	55.3	172.4	124.6	4.6	1.4				0.7	4				0	65.9	241.1	129.6	3.3	1.9								
789.950	1498.30	XS_799	794	0.032	0.001029	68	83.9	310.2	137.6	2.6	2.3	4.0	1.7	67.7	0.7	4	0.7549393	0	0.34956	0.349559997	76.0	244.2	133.9	3.3	1.8	3.3	1.9	71.8		0.0022	0.0037	0.0015	0
	1495.81	XS_773	794	0.032	0.005684	26	60.9	173.6	116.4	4.6	1.5				0.7	4				0	64.3	195.0	118.1	4.1	1.7								
	1494.73	XS_583	794	0.032	0.005684	190	54.3	178.7	124.6	4.4	1.4				0.7	4				0	57.9	200.5	126.2	4.0	1.6								
551.100	1494.77	XS_551	794	0.032	0.001	32	76.8	312.0	136.5	2.5	2.3	3.9	1.7	64.0	0.7	4	0.6181255	0	0.75494	0.754939345	62.6	203.0	130.5	3.9	1.6	4.0	1.6	61.6		0.00394	0.00419	0.00025	0
	1492.75	XS_501	794	0.032	0.001	50	66.7	298.1	121.9	2.7	2.4				0.7	4				0	55.3	203.1	114.9	3.9	1.8								
	1493.14	XS_384	794	0.032	0.001	117	80.8	299.2	123.0	2.7	2.4				0.7	4				0	70.1	204.2	116.6	3.9	1.8								
114.16	1489.77	XS_114	794	0.032	0.012481	270	36.6	121.4	85.4	6.5	1.4	4.0	2.1	61.3	0.7	4	0.6243565	0	0.61813	0.618125519	47.1	190.8	97.9	4.2	1.9	4.0	1.8	57.5		0.00332	0.00682	0.0035	0

Post Sedimentation Bed Elevations			
River Sta	Min Ch El	Eq. Slope	Eq Slope Elev
	(ft)	(ft/ft)	(ft)
14877.43	1660.5		1665.0
14841.55	1660.5		1664.3
14809.29	1660.1		1663.6
14708.76	1659.6		1661.6
14651.74	1659.1		1660.5
14600.25	1658.6		1659.4
14567.53	1658.5		1658.8
14523.69	1657.9	0.019945	1657.9
14514.8	1656.4		1656.8
14337.25	1655.4		1655.6
14300	1655.4		1655.4
14274.69	1655.2		1655.2
14216.35	1654.5		1654.8
14142.06	1654.3		1654.4
14119.48	1654.2	0.0066	1654.2
14115.15	1652.6		1652.1
14085.17	1652.3		1651.9
13942.92	1651.5		1651.2
13758.6	1650.2		1650.2
13720.1	1650.0	0.00533	1650.0
13712.92	1647.4		1647.9
13679.62	1647.4		1647.7
13555.95	1646.9		1646.9
13441.98	1646.1		1646.2
13420.23	1646.1	0.00607	1646.1
13413.49	1643.9		1643.1
13392.26	1642.8		1643.0
13283.16	1642.6		1642.6
13148.64	1641.9		1642.1
13121.9	1642.0	0.0038	1642.0
13113.85	1638.7		1638.4
13103.41	1637.7		1638.4
12948.99	1637.7		1637.6
12751.2	1636.9		1636.7
12722.07	1636.6	0.00482	1636.6
12710.3	1633.8		1633.2
12684.08	1632.2		1633.1
12570.39	1632.4		1632.6
12421.26	1632.1		1632.0
12398.37	1631.9	0.00413	1631.9
12387.58	1628.3		1628.1
12358.28	1628.0		1628.0
12244.5	1627.3		1627.5
12160.68	1627.0		1627.1
12125.61	1626.9	0.00456	1626.9
12118.62	1624.2		1623.9
12083.58	1623.9		1623.8
12034.51	1623.2		1623.5
11861.96	1622.4		1622.6
11832.55	1622.4	0.00541	1622.4
11825.08	1619.9		1619.4
11794.31	1619.7		1619.2
11660.13	1618.8		1618.6
11583.43	1618.3		1618.2
11538.79	1617.9	0.00514	1617.9
11530.86	1613.6		1614.5
11507.12	1613.3		1614.3
11377.76	1612.9		1613.2
11258.4	1612.3		1612.2
11246.9	1612.1	0.00857	1612.1
11240.54	1608.9		1611.2
11224.92	1609.0		1611.0
11094.81	1608.9		1609.6
10964.53	1608.4		1608.1
10937.06	1607.8	0.01123125	1607.8

Post Sedimentation Bed Elevations			
River Sta	Min Ch El	Eq. Slope	Eq Slope Elev
	(ft)	(ft/ft)	(ft)
10927.56	1605.7		1605.6
10911.95	1605.6		1605.6
10775.8	1605.1		1605.1
10637.14	1604.7	0.00329	1604.7
10628.03	1603.0		1602.9
10555.32	1602.6		1602.6
10468.18	1602.3		1602.3
10435	1602.2	0.00359	1602.2
10428.14	1598.9		1599.5
10407.63	1599.1		1599.4
10274	1598.8		1598.9
10161.95	1598.3		1598.5
10136.06	1598.4	0.00381	1598.4
10126.72	1595.9		1595.8
10096.77	1595.7		1595.7
9938.55	1595.7		1595.2
9791.29	1595.0		1594.8
9713.01	1594.6	0.00285	1594.6
9702.69	1592.0		1591.6
9682.94	1591.8		1591.5
9588.97	1591.5		1591.3
9456.98	1591.3		1590.9
9426.93	1590.8	0.00295	1590.8
9420.05	1588.6		1588.9
9401.97	1588.6		1588.8
9332.69	1588.4		1588.6
9244.88	1588.4		1588.3
9220.9	1588.2	0.00353	1588.2
9214.03	1585.3		1584.8
9191.51	1584.8		1584.8
9125.65	1584.7		1584.5
9026.97	1584.5		1584.2
9019.37	1584.2	0.00347	1584.2
9015.42	1581.8		1581.5
8998.09	1581.8		1581.5
8963.71	1581.8		1581.4
8853.08	1581.5		1581.2
8820.6	1581.1	0.00226	1581.1
8815.78	1579.3		1579.4
8799.2	1579.5		1579.3
8661.45	1579.3		1579.0
8500.55	1578.8		1578.6
8474.74	1578.5	0.00256	1578.5
8469.39	1576.5		1576.1
8439.23	1576.3		1576.0
8287.22	1575.8		1575.6
8149.65	1575.6		1575.3
8128.97	1575.2	0.00263	1575.2
8122.69	1572.6		1573.5
8097.25	1572.9		1573.4
7953.83	1572.8		1573.0
7799.57	1572.5		1572.6
7779.53	1572.5	0.00299	1572.5
7773.18	1570.5		1570.1
7752.09	1570.3		1570.0
7598.91	1569.9		1569.6
7446.96	1569.8		1569.3
7427.06	1569.2	0.00237	1569.2
7419.39	1565.9		1566.0
7379.58	1566.5		1565.9
7217.64	1566.1		1565.5
7057.08	1565.8		1565.1
7026.19	1565.1	0.00253	1565.1
7022.3	1562.9		1563.1
6999	1562.8		1563.0

Post Sedimentation Bed Elevations			
River Sta	Min Ch El	Eq. Slope	Eq Slope Elev
	(ft)	(ft/ft)	(ft)
6854.42	1562.4		1562.7
6732.24	1561.6		1562.4
6718.73	1560.9	0.00226	1562.4
6713.51	1559.3		1562.4
6691.19	1559.4		1562.2
6571.06	1559.0		1561.3
6445.85	1558.9		1560.3
6421.01	1558.7	0.00784	1560.1
6416.44	1556.4		1560.1
6394.13	1556.3		1559.8
6274.48	1555.8		1557.9
6147.18	1555.7		1556.0
6121.65	1555.6	0.0154075	1555.6
6113.42	1553.2		1553.3
6094.42	1553.2		1553.2
5972.07	1552.5		1552.8
5841.37	1552.6		1552.5
5820.43	1552.4	0.00291	1552.4
5812.63	1548.6		1548.8
5786.39	1548.1		1548.7
5687.19	1547.6		1548.4
5448	1547.7		1547.5
5418.71	1547.4	0.00347	1547.4
5413.77	1544.7		1544.4
5381.12	1544.2		1544.4
5275.22	1544.1		1544.2
5132.59	1543.7		1544.0
5120.62	1543.7	0.0017	1543.9
5116.05	1541.7		1543.9
5087.07	1540.9		1543.7
4966.65	1540.5		1542.6
4850.06	1540.4		1541.6
4824.9	1540.4	0.00874	1541.4
4818.56	1537.7		1541.4
4770.29	1536.8		1540.7
4683.3	1536.2		1539.3
4509.53	1536.4		1536.7
4494.15	1536.4	0.0153275	1536.4
4488.65	1534.1		1536.2
4471.06	1533.4		1536.1
4359.66	1532.7		1535.2
4244.98	1532.7		1534.3
4187.93	1532.6		1533.8
4151.16	1532.5		1533.6
4129.04	1532.5		1533.4
4115.48	1532.4		1533.3
4094.120	1532.3		1533.1
3972.550	1531.4		1532.1
3852.910	1530.8		1531.2
3816.660	1530.9	0.00793	1530.9
3812.720	1529.3		1529.3
3799.480	1530.2		1529.3
3637.570	1529.5		1528.8
3413.320	1528.4		1528.2
3404.690	1528.2	0.00277	1528.2
3400.520	1526.5		1526.9
3385.910	1526.1		1526.8
3276.500	1525.9		1526.2
3141.350	1525.6		1525.5
3116.900	1525.4	0.00519	1525.4
3110.390	1523.4		1524.3
3085.980	1523.0		1524.1
2987.290	1522.5		1523.6
2859.920	1522.5		1522.8
2838.550	1522.4	0.00571	1522.7

Post Sedimentation Bed Elevations			
River Sta	Min Ch El	Eq. Slope	Eq Slope Elev
	(ft)	(ft/ft)	(ft)
2833.940	1520.6		1522.7
2799.660	1520.3		1522.5
2766.310	1520.7		1522.2
2655.140	1520.9		1521.4
2538.670	1520.4		1520.6
2421.010	1519.8		1519.8
2403.890	1519.6	0.00714	1519.6
2398.240	1517.6		1517.7
2384.660	1517.4		1517.6
2297.670	1516.5		1517.2
2145.710	1516.1		1516.5
2110.810	1516.1		1516.3
2097.250	1516.3	0.00466	1516.3
2090.280	1513.3		1512.9
2078.260	1513.0		1512.9
2045.890	1513.2		1512.8
1944.090	1512.8		1512.5
1851.190	1512.6		1512.2
1810.840	1512.1	0.00293	1512.1
1804.030	1509.5		1510.0
1781.880	1509.5		1509.9
1646.000	1509.3		1509.5
1515.510	1509.2		1509.2
1502.910	1509.2	0.00269	1509.2
1495.850	1506.3		1506.4
1479.890	1506.4		1506.4
1344.960	1505.9		1506.1
1266.460	1505.5		1506.0
1197.550	1505.9	0.00167	1505.9
1189.170	1503.7		1503.8
1165.290	1503.2		1503.8
1028.770	1502.9		1503.3
998.520	1503.3		1503.3
990.750	1503.2	0.003	1503.2
982.150	1499.3		1498.7
972.060	1499.0		1498.7
866.940	1498.4		1498.3
799.090	1498.3		1498.1
789.950	1498.0	0.0037	1498.0
783.020	1495.9		1495.7
772.650	1495.8		1495.7
729.790	1499.8		1495.5
582.700	1494.7		1494.9
551.100	1494.8	0.00419	1494.8
541.150	1493.0		1493.8
501.350	1492.8		1493.5
383.550	1493.1		1492.7
141.750	1492.4		1491.0
134.370	1491.0		1491.0
114.160	1489.8	0.00682	1490.9
58.600	1490.9		1490.9

Appendix G
(Separate Volume)

Geomorphology Analyses Supporting Documentation

Appendix H

Operations and Maintenance

EXHIBIT A

HYDROLOGY EXHIBIT MAPS

PLATE 1
WATERSHED MAP

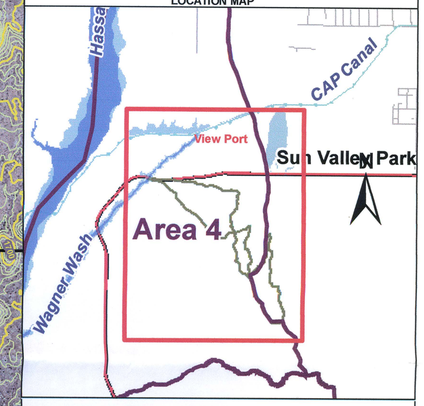
HYDROLOGY FOR FANS 1 & 2 APPROXIMATE FDS

- Fan Apices
- Lca Paths
- Lag Time Paths
- Subbasin Boundaries
- 10-ft Contours
- 50-ft Contours

S900
S110
S120
R3W
R4W
T4N
T3N

N E S W

LOCATION MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A
FLOODPLAIN DELINEATION STUDY OF

FAN 1 & FAN 2

WHITE TANK MOUNTAINS
JANUARY 2009

0 0.125 0.25 0.5 0.75 1 Miles

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.

PLATE 2
SOILS MAP

HYDROLOGY FOR
FANS 1 & 2
APPROXIMATE FDS

- Fan Apices
- Lca Paths
- Lag Time Paths
- Subbasin Boundaries

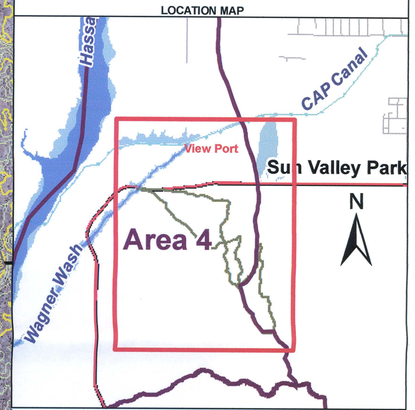
SOILS

XKSAT

- 0.03
- 0.06
- 0.13
- 0.16
- 0.34
- 0.37
- 0.39
- 0.4
- 0.58
- 10-ft Contours
- 50-ft Index Contours

S900
S110
S120
R3W
R4W
T4N
T3N

LOCATION MAP



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

APPROXIMATE ZONE A
FLOODPLAIN DELINEATION STUDY OF

FAN 1 & FAN 2

WHITE TANK MOUNTAINS
JANUARY 2009

0 0.125 0.25 0.5 0.75 1 Miles

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PLATE 3
LANDUSE MAP

HYDROLOGY FOR
FANS 1 & 2
APPROXIMATE FDS

- Fan Apices
- Lca Paths
- Lag Time Paths
- Subbasin Boundaries

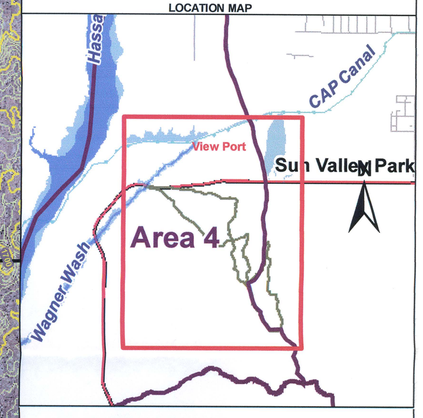
Land Use

- Mountain Terrain (NMT), > 10 % Slopes
- Natural Desert Range (NDR)
- 10-ft Contours
- 50-ft Index Contours

S900
S110
S120
R3W
R4W
T4N
T3N

N E S W

LOCATION MAP



FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

APPROXIMATE ZONE A
FLOODPLAIN DELINEATION STUDY OF

FAN 1 & FAN 2

WHITE TANK MOUNTAINS
JANUARY 2009

0 0.125 0.25 0.5 0.75 1 Miles

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC

EXHIBIT B

GEOMORPHOLOGY EXHIBIT MAPS

Geomorphology Exhibit Map
Stage I - Landform Map

Fans 1 & 2 Study Area
Alluvial Fan
Bedrock
Pediment
10-ft Contours
50-ft Index Contours

N
W
E
S

0 0.15 0.3 0.6 0.9 1.2
Miles

Base photo date: 2007

R4W
R3W
T4N
T3N

Fan 2 Hydrographic Apex

Geomorphology Exhibit Map
Stage II - Stability Map

Inactive

Active

0 0.125 0.25 0.5 0.75 1

Miles

Base photo date: 2007

R4W

R3W

T4N

T3N

Fan 2 Hydrographic Apex

Geomorphology Exibit Map
Stage III - Floodplain Map

- AAFF
- AFHH
- AFUFD
- AFZA
- X (shaded)
- X (unshaded)
- A

N
W E
S

0 0.125 0.25 0.5 0.75 1
Miles

Base photo date: 2007

R4W
R3W
T4N
T3N

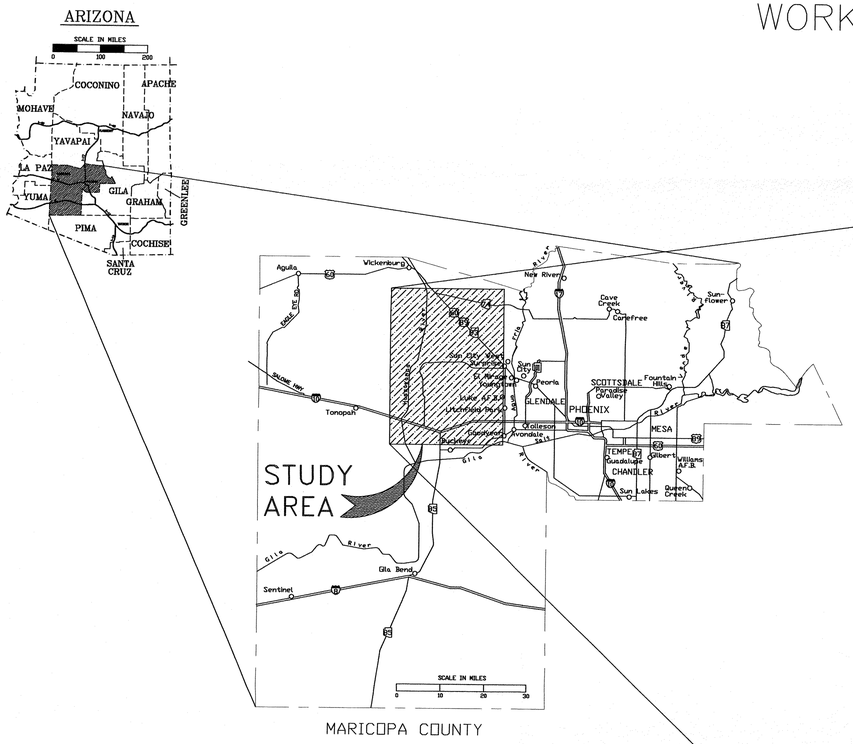
Fan 2 Hydrographic Apex

EXHIBIT C

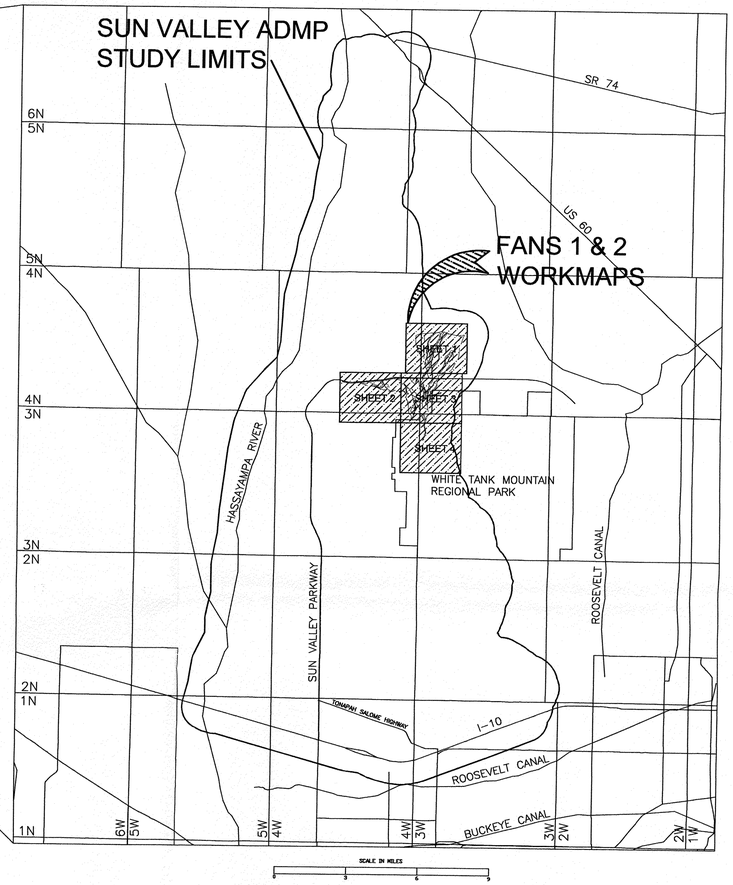
HYDRAULICS STUDY WORK MAPS

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE FLOODPLAIN DELINEATION STUDY OF THE WHITE TANK MOUNTAIN PIEDMONT FAN SITES 1 & 2 WORK ASSIGNMENT #2, FCD NO. 2007 C051



MARICOPA COUNTY



NOTES

1. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
2. ALL ELEVATIONS ARE BASED ON NORTH AMERICAN VERTICAL DATUM OF 1988.

STATEMENTS OF PROFESSIONAL REGISTRANT

THE FLOODPLAIN DELINEATIONS PRESENTED ON THE FOLLOWING SHEETS WERE PREPARED UNDER MY DIRECT SUPERVISION USING HYDROLOGY PREPARED UNDER THE SAME CONTRACT.

JE FULLER
HYDROLOGY & GEOMORPHOLOGY, INC.
8400 S. KYRENE ROAD, SUITE 201
TEMPE, ARIZONA 85284
PHONE: 480-752-2124
FAX: 480-839-2193

INDEX SHEET

JANUARY, 2009

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LEGEND

- 100-YR ADMINISTRATIVE FLOODWAY
- EFFECTIVE 100-YR FLOODPLAIN BOUNDARY
- EFFECTIVE 100-YR FLOODWAY
- SECTION BOUNDARY
- CROSS SECTION — 200, Q = 595 cfs
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- STATE PLANE COORDINATES — 1,046,800 N, 648,800 E

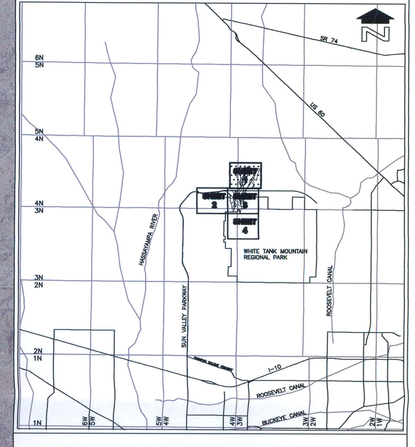
ZONE DESIGNATIONS

ZONE A	Approximate 100-year administrative floodway; riverine reaches upstream of hydrologic apex.
ZONE AFHH	Alluvial Fan High Hazard administrative floodway
ZONE AFUFD	Alluvial Fan Uncertain Flow Distribution Area administrative floodway
ZONE AAFF	Approximate Alluvial Fan Floodway administrative floodway
ZONE AFZA	Alluvial Fan Zone A floodplain
ZONE X (SHADED)	Areas flooded between 100- and 500-yr discharge, areas of 100-yr flooding depth less than 1 foot, or drainage area less than 1 square mile
ZONE X	Areas outside the 500-yr floodplain
ZONE D	*Area not studied*

NOTES

1. SECTION BOUNDARIES PROVIDED BY FCDMC
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. VERTICAL DATUM IS NAVD88.

SHEET INDEX MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF WHITE TANK FANS

1 & 2

FCD NO. 2007 CO51
WHITE TANK MOUNTAINS FANS 1&2
WORK ASSIGNMENT #2
JANUARY, 2009

SCALE IN FEET
500' 0' 500' 1000'
CONTOUR INTERVAL = 10 FEET

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC
8400 S. KYRENE ROAD, SUITE 201
TEMPE, ARIZONA 85284
PHONE: 480-753-6105
FAX: 480-839-2103

SHEET 1 OF 4

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"=500' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, DECEMBER 27, 2000. AERIAL UPDATE: NOVEMBER 2004.

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA

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LEGEND

- 100-YR ADMINISTRATIVE FLOODWAY
- EFFECTIVE 100-YR FLOODPLAIN BOUNDARY
- EFFECTIVE 100-YR FLOODWAY
- SECTION BOUNDARY
- CROSS SECTION — 200, Q = 595 cfs
- CORPORATE LIMITS — Corporate Limits
- COUNTY BOUNDARY — County Boundary
- STATE PLANE COORDINATES — 1,046,800 N, 648,600 E

ZONE DESIGNATIONS

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ZONE D	Area not studied

NOTES

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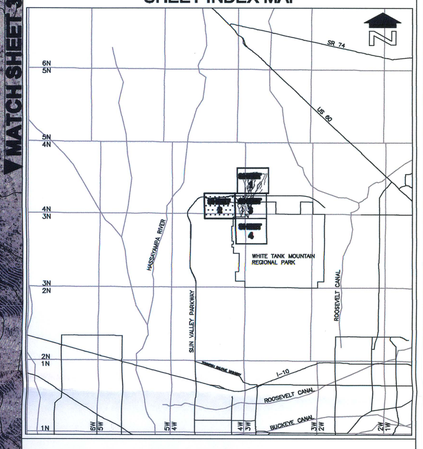
3. VERTICAL DATUM IS NAVD88.

SHEET INDEX MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF WHITE TANK FANS

1 & 2

FCD NO. 2007 CO51
WHITE TANK MOUNTAINS FANS 1&2
WORK ASSIGNMENT #2
JANUARY, 2009

SCALE IN FEET
500' 0' 500' 1000'
CONTOUR INTERVAL = 10 FEET

Registered Professional Engineer — CERTIFICATE # 26848 — JONATHAN FULLER — 1-30-09 — ARIZONA, U.S.A. — Expires 3/31/2011

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC
2400 E. ARIZONA BILTMO, SUITE 201, TEMPE, ARIZONA, 85016
PHONE: 480-753-5726 FAX: 480-839-2198

SHEET 2 OF 4

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"=600' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, DECEMBER 27, 2000. AERIAL UPDATE: NOVEMBER 2004.

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA

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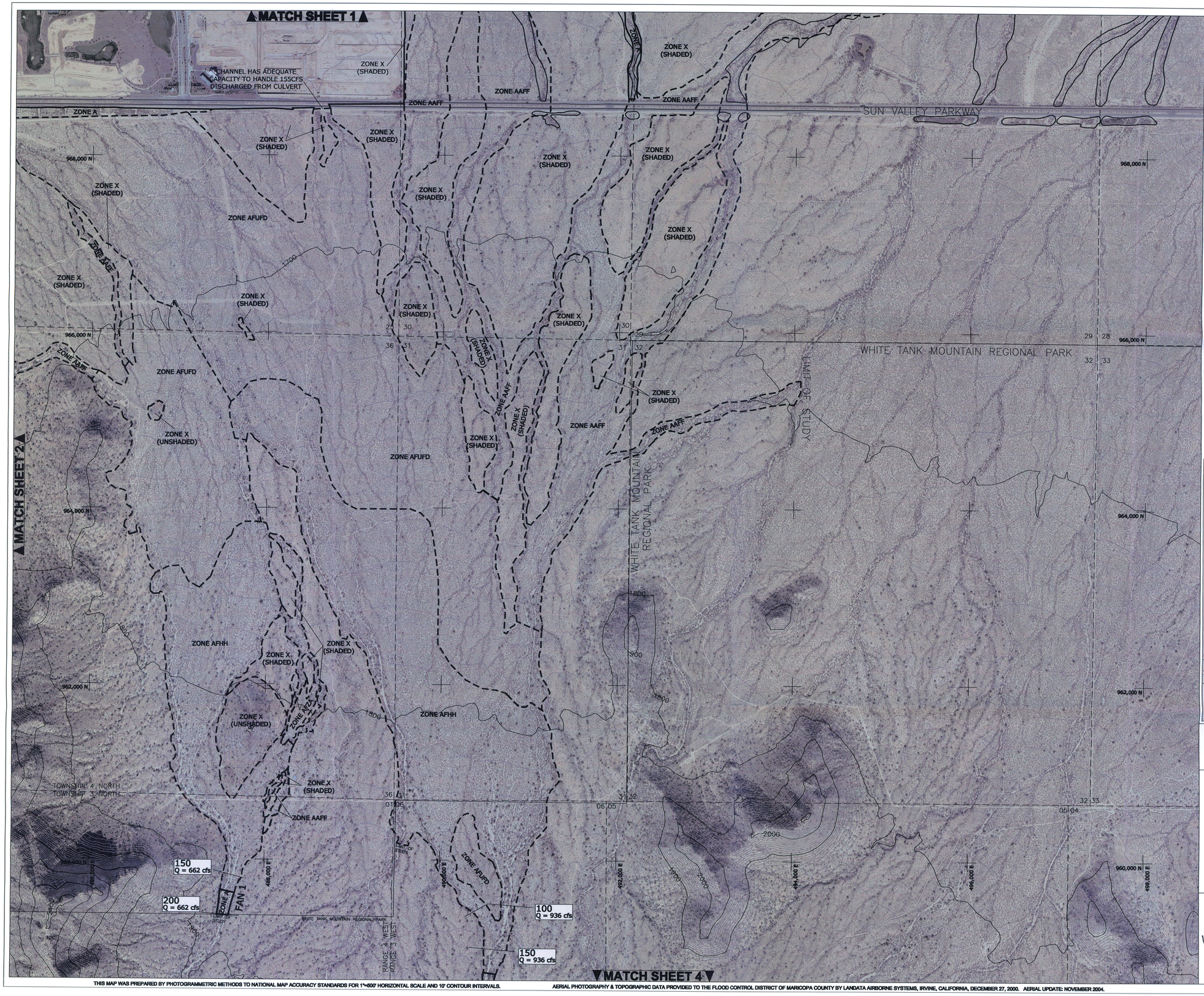

LEGEND

- 100-YR ADMINISTRATIVE FLOODWAY
- EFFECTIVE 100-YR FLOODPLAIN BOUNDARY
- EFFECTIVE 100-YR FLOODWAY
- SECTION BOUNDARY
- CROSS SECTION — 200 Q = 595 cfs
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- STATE PLANE COORDINATES — 1,046,800 N | 646,800 E

ZONE DESIGNATIONS

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ZONE X	Areas outside the 500-yr floodplain
ZONE D	Area not studied

NOTES

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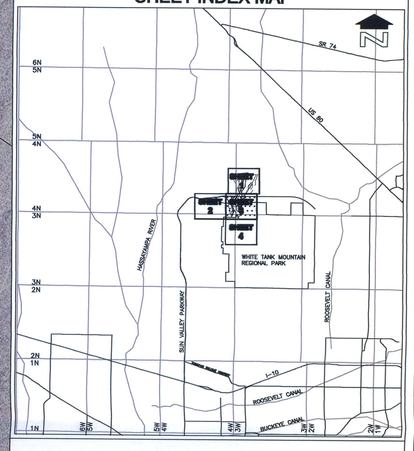
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. VERTICAL DATUM IS NAVD88.

SHEET INDEX MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF WHITE TANK FANS

1 & 2

FCD NO. 2007 CO51
WHITE TANK MOUNTAINS FANS 1&2
WORK ASSIGNMENT #2
JANUARY, 2009

SCALE IN FEET
500' 0' 500' 1000'
CONTOUR INTERVAL = 10 FEET

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
3430 E. SUNRISE ROAD, SUITE 201, TUCSON, ARIZONA, 85718
PHONE: 480-293-3124 FAX: 480-536-2103

SHEET 3 OF 4

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"=500' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, DECEMBER 27, 2000. AERIAL UPDATE: NOVEMBER 2004.

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA

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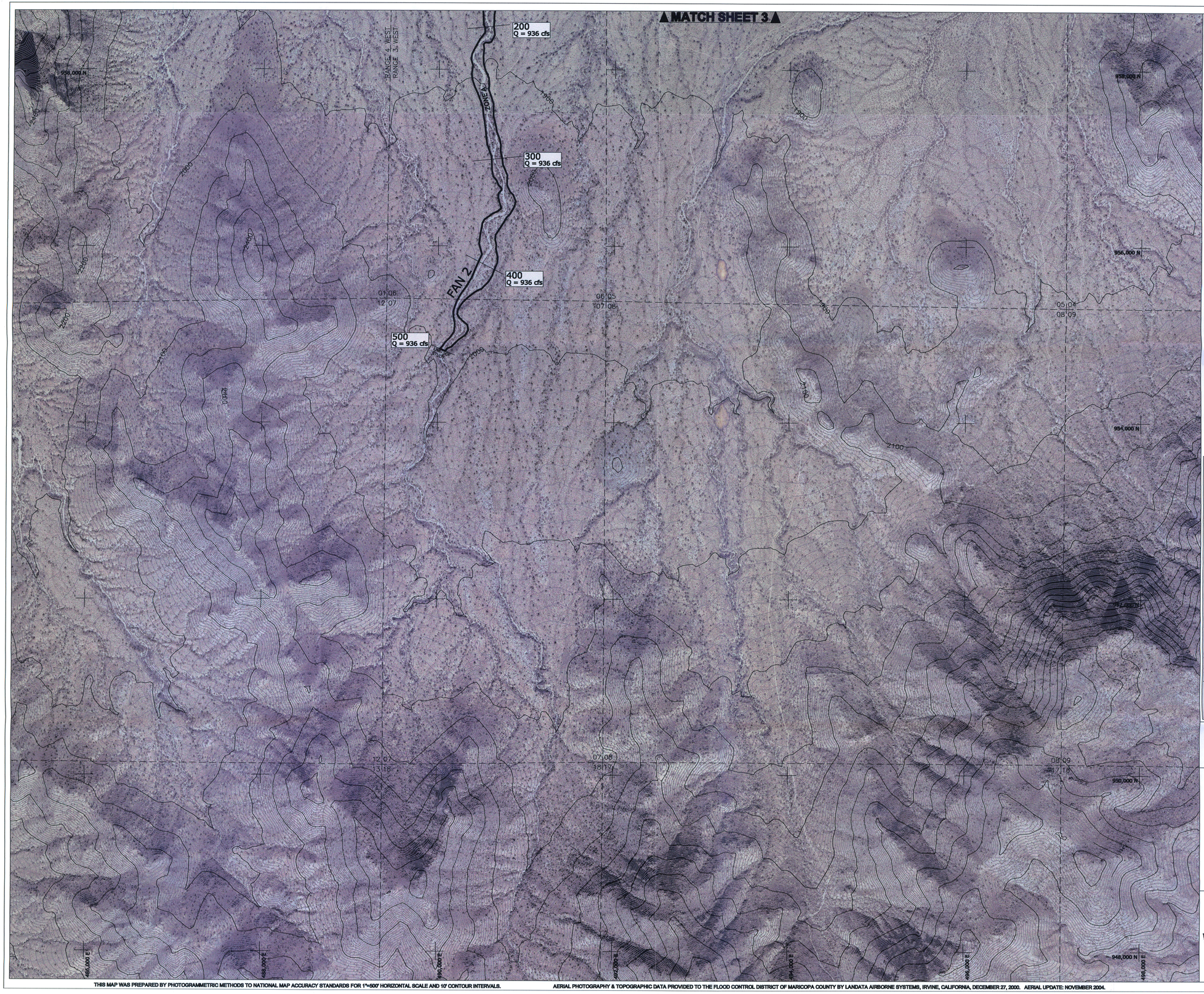

LEGEND

- 100-YR ADMINISTRATIVE FLOODWAY
- EFFECTIVE 100-YR FLOODPLAIN BOUNDARY
- EFFECTIVE 100-YR FLOODWAY
- SECTION BOUNDARY
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- STATE PLANE COORDINATES — 1,046,800 N / 648,800 E

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ZONE D	Area not studied

NOTES

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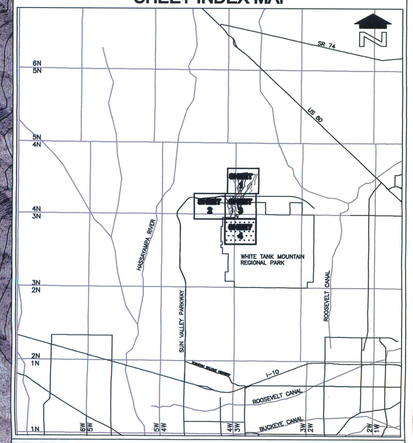
2. HORIZONTAL PROJECTION IS ARIZONA STATE PLANE, CENTRAL ZONE, NORTH AMERICAN DATUM OF 1983.
3. VERTICAL DATUM IS NAVD88.

SHEET INDEX MAP



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

APPROXIMATE ZONE A FLOODPLAIN DELINEATION STUDY OF WHITE TANK FANS

1 & 2

FCD NO. 2007 CO51
WHITE TANK MOUNTAINS FANS 1&2
WORK ASSIGNMENT #2
JANUARY, 2009

Registered Professional Engineer — CERTIFICATE NO. 26846 — JONATHAN FULLER — 7-30-09 — Date Signed — ARIZONA, U.S.A. — Expires 3/31/2011

SCALE IN FEET
500' 0' 500' 1000'
CONTOUR INTERVAL = 10 FEET

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC.
8400 S. KYRENE ROAD, SUITE 201
TEMPE, ARIZONA 85284
PHONE: 480-753-2124
FAX: 480-839-6168

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"=500' HORIZONTAL SCALE AND 10' CONTOUR INTERVALS.

AERIAL PHOTOGRAPHY & TOPOGRAPHIC DATA PROVIDED TO THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY BY LANDATA AIRBORNE SYSTEMS, IRVINE, CALIFORNIA, DECEMBER 27, 2000. AERIAL UPDATE: NOVEMBER 2004.

GROUND CONTROL SURVEY DATA PROVIDED BY RBF CONSULTING, PHOENIX, ARIZONA

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NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles, Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' National Geodetic Vertical Datum of 1929 (NGVD 29). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was *Arizona State Plane Zone 3176 (central Arizona)*. The **horizontal datum** was *NAD83, GRS80 spheroid*. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the *National Geodetic Vertical Datum of 1929*. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(310) 713-3191

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from multiple sources. Base map files were provided in digital format by Maricopa County. Orthophoto images were produced at a scale of 1:8000 using HARN for control. Aerial photography is dated December 2000 to December 2002.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

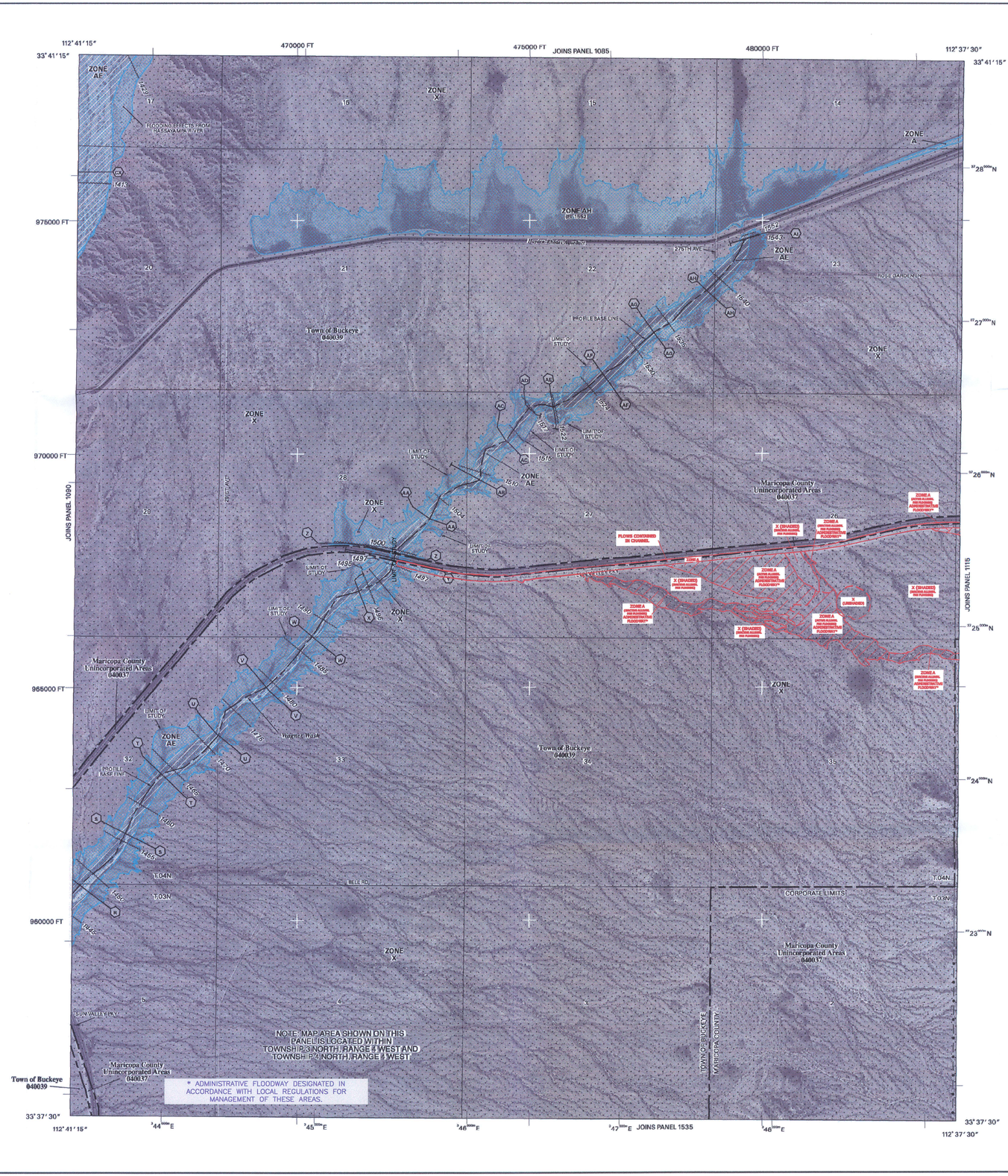
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMAMAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/.

LEGEND FOR ANNOTATION

100-YEAR FLOODPLAIN BOUNDARY

100-YEAR FLOODWAY BOUNDARY

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC. 2009



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones, and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the National Geodetic Vertical Datum of 1929

- (A)—(A) Cross section line
- (Z)—(Z) Transect line

112° 07' 08", 33° 25' 41" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere.

97°76'00"E — 1000-meter Universal Transverse Mercator grid tick values zone 12.

875000 FT — 5000-foot grid tick values: Arizona State Plane coordinate system, central zone (FIPSZONE 3176) NAD83 (Transverse Mercator)

X DV2313 — Bench mark (see explanation in Notes to Users section of this FIRM panel)

• M1.5 — River Mile

MAP REPOSITORY
Refer to Repositories Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
April 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
September 4, 1991, December 3, 1993, July 19, 2001

September 30, 2005 - to update corporate limits, to change Base Flood Elevations, to add Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to incorporate previously issued Letters of Map Amendment.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1095H

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1095 OF 4350
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BUCKEYE, TOWN OF	040039	1095	H
MARICOPA COUNTY	040037	1095	H

(ANNOTATED 2009)

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C1095H
MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency

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NOTES TO USERS

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Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was *Arizona State Plane Zone 3176 (central Arizona)*. The **horizontal datum** was *NAD83, GRS80 spheroid*. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the *National Geodetic Vertical Datum of 1929*. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(310) 713-3191

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from multiple sources. Base map files were provided in digital format by Maricopa County. Orthophoto images were produced at a scale of 1:6000 using HARN for control. Aerial photography is dated December 2000 to December 2002.

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Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

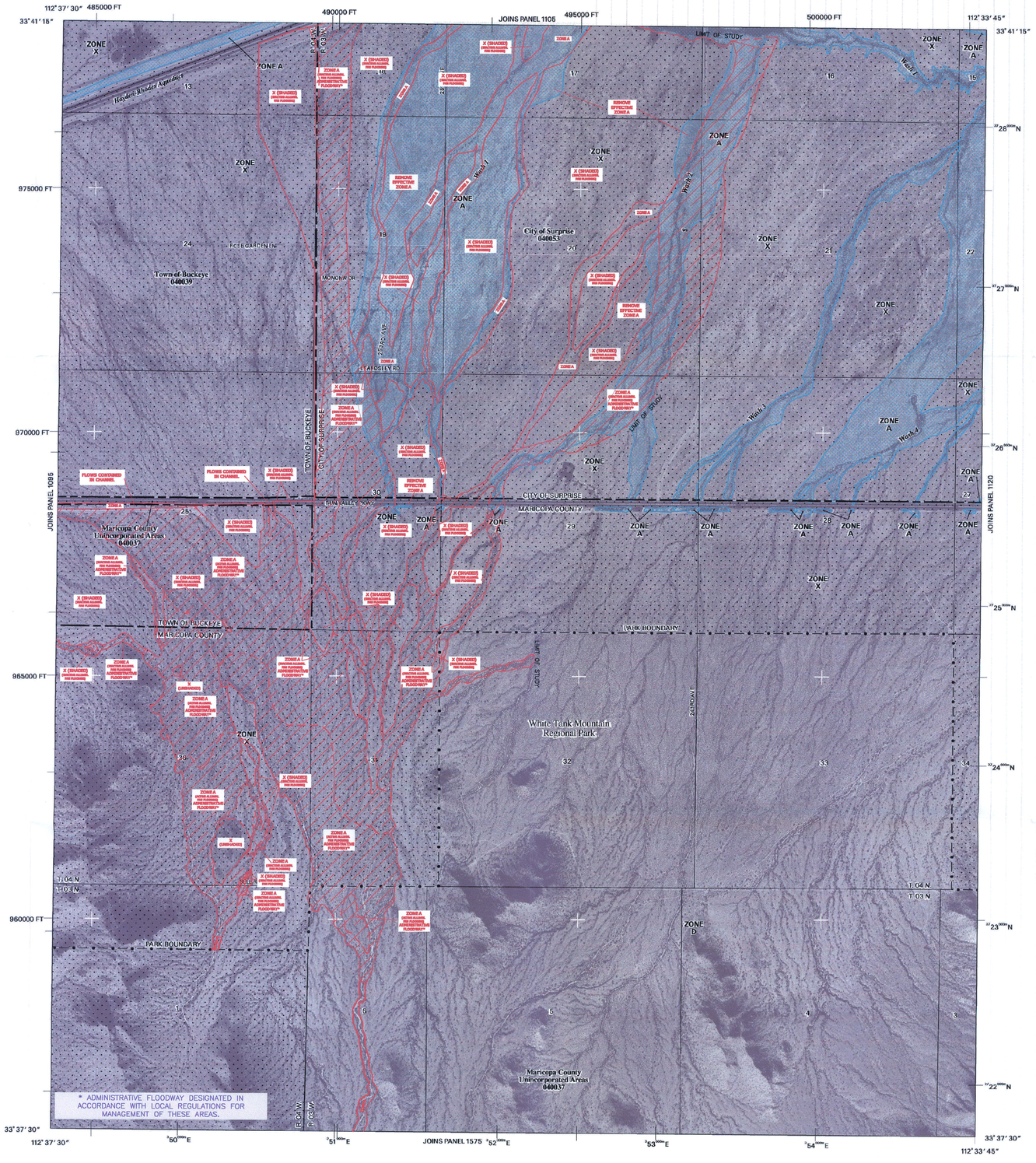
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMAMAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/.

LEGEND FOR ANNOTATION

100-YEAR FLOODPLAIN BOUNDARY

100-YEAR FLOODWAY BOUNDARY

JE FULLER HYDROLOGY & GEOMORPHOLOGY, INC. 2009



* ADMINISTRATIVE FLOODWAY DESIGNATED IN ACCORDANCE WITH LOCAL REGULATIONS FOR MANAGEMENT OF THESE AREAS.

LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- **ZONE A** No Base Flood Elevations determined.
- **ZONE AE** Base Flood Elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- **ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- **ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- **ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

- **ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.
- **ZONE D** Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones, and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the National Geodetic Vertical Datum of 1929

- (A)—(A) Cross section line
- (2)—(2) Transect line

112° 07′ 08″, 33° 25′ 41″ — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere.

4276000mE — 1000-meter Universal Transverse Mercator grid tick values zone 12

875000 FT — 5000-foot grid tick values: Arizona State Plane coordinate system, central zone (FIPSZONE 3176) NAD83 (Transverse Mercator)

×DV2313 — Bench mark (see explanation in Notes to Users section of this FIRM panel)

• MILE — River Mile

MAP REPOSITORY
Refer to Repositories Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
April 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
September 4, 1991, December 3, 1993, July 19, 2001

September 30, 2005 - to update corporate limits, to change Base Flood Elevations, to add Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to change zone designations, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to incorporate previously issued Letters of Map Amendment.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1115H

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 1115 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BUCKEYE, TOWN OF	040039	1115	H
MARICOPA COUNTY	040037	1115	H
SURPRISE, CITY OF	040053	1115	H

(ANNOTATED 2009)

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject communities.

MAP NUMBER
04013C1115H
MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency

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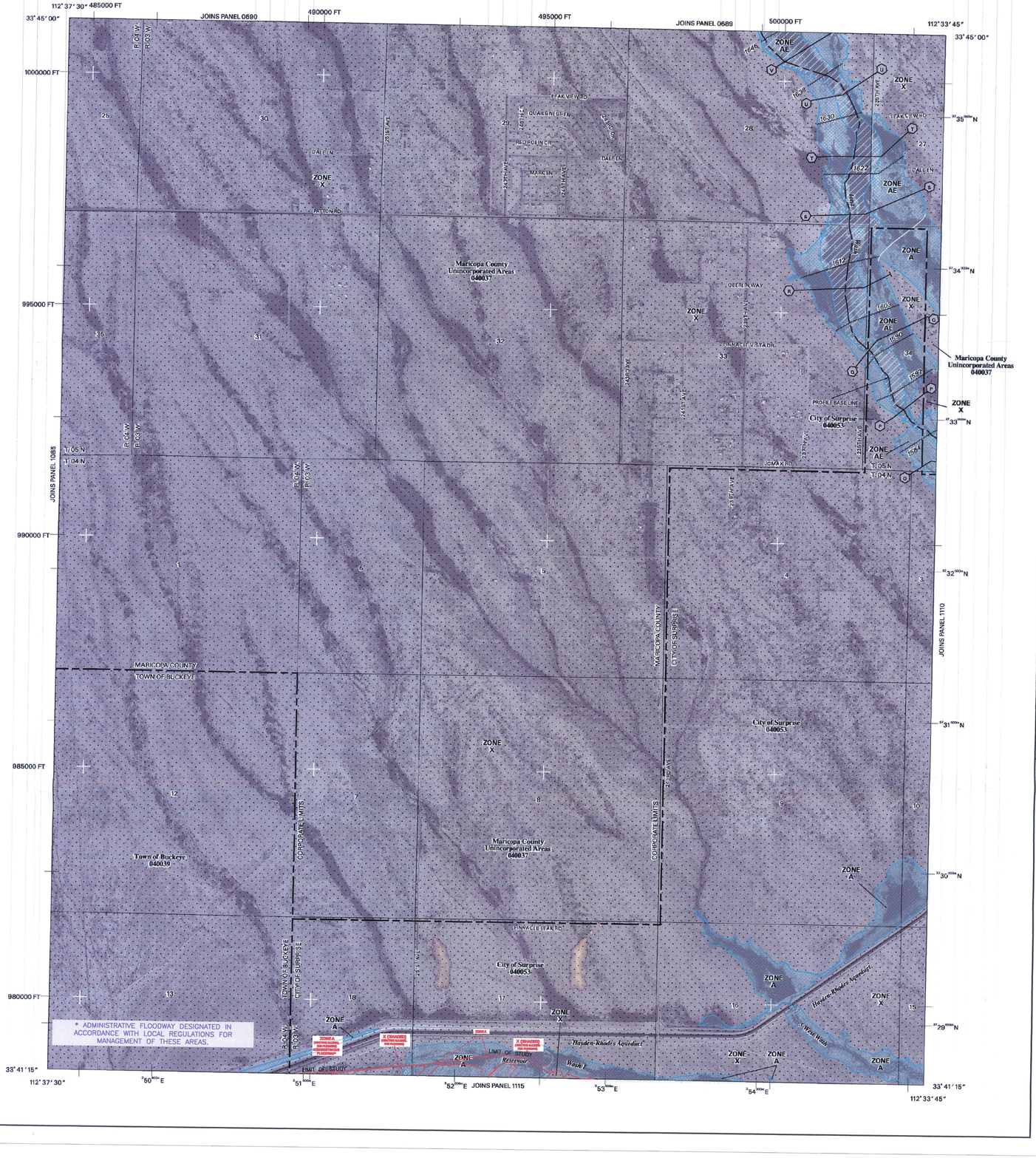

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- M1.5 River Mile

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NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1105H

FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 1105 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

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MAP NUMBER
04013C1105H
MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency

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