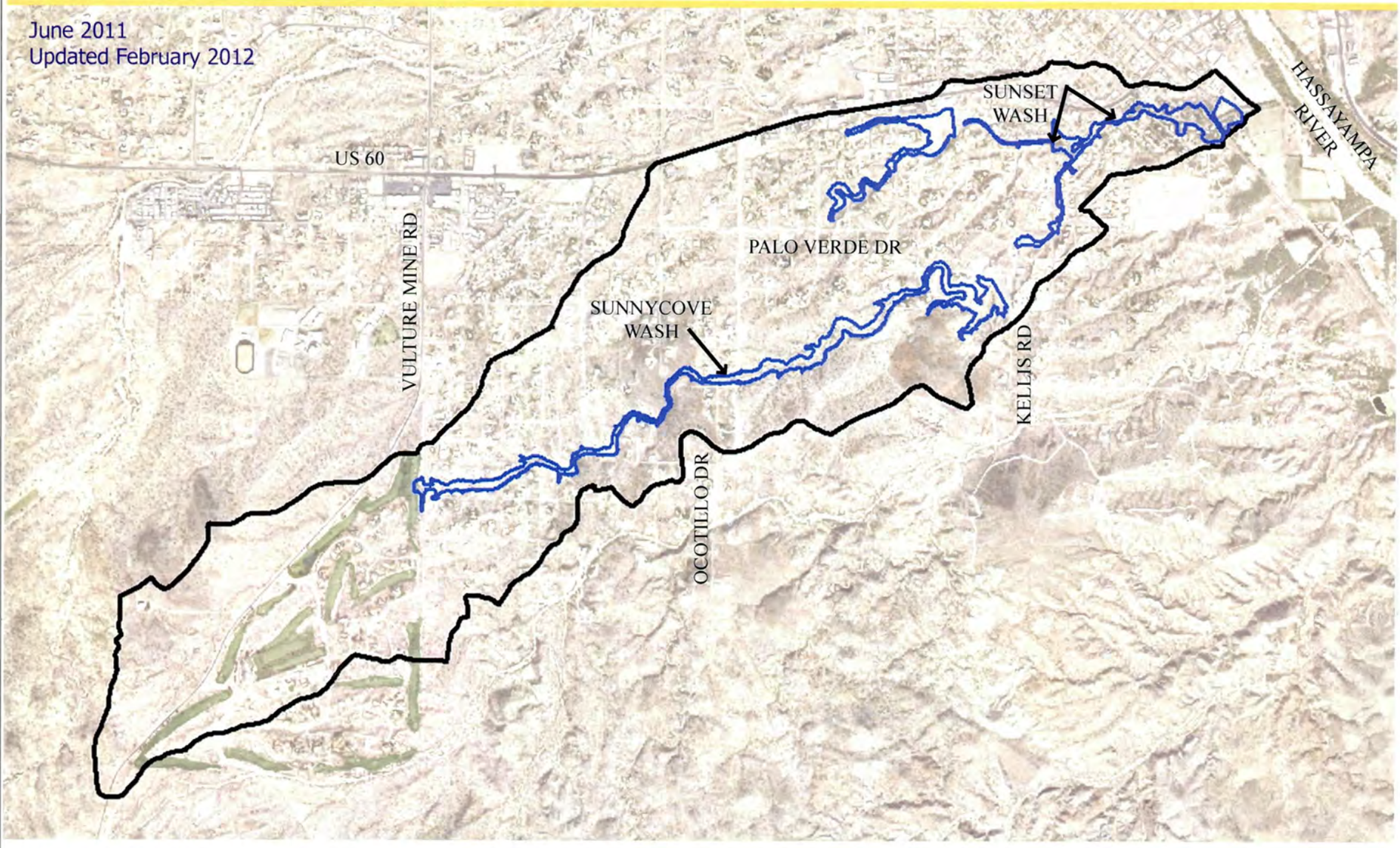
Wickenburg Area Drainage Master Study/Plan

FCD 2009C030 - PHASE 1 TECHNICAL DATA NOTEBOOK

June 2011
Updated February 2012



Prepared for:

Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009
(602) 506.1501

Prepared by:

Hoskin • Ryan Consultants, Inc.
creative engineering solutions

WICKENBURG
AREA DRAINAGE MASTER STUDY/PLAN
(FCD 2009C030)

PHASE 1 TECHNICAL DATA NOTEBOOK

June 6, 2011

Updated: February 6, 2012

Prepared for:
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2801 West Durango Street
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Prepared by:
Hoskin-Ryan Consultants, Inc.
6245 N. 24th Parkway, Suite 100
Phoenix, AZ 85016
(602) 252-8384

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 19690
PAUL W.R. HOSKIN
Date Signed 2/6/12
ARIZONA, U.S.A.

EXPIRES 3/31/2012

in association with :

Coe & Van Loo Consultants, Inc.
4550 N. 12th Street
Phoenix, AZ 85014
(602) 264-6831

Dewberry & Davis, LLC
7204 N. 16th Street, Suite 108
Phoenix, AZ 85020
(602) 943-1585

WICKENBURG AREA DRAINAGE MASTER STUDY/PLAN
(FCD 2009C030)

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Note: Erosion and sediment transport analysis is not covered by the scope of this study,

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Wickenburg ADMS/P Phase 1 Field Reconnaissance Report is included as Appendix G.

WICKENBURG AREA DRAINAGE MASTER STUDY/PLAN
(FCD 2009C030)

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100-Year Floodplain Maps, Sheets 1-5

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 19690
PAUL W.R. HOSKIN
Date Signed 2/6/12
ARIZONA, U.S.A.

EXPIRES 3/31/2012

1 Introduction

Hoskin•Ryan Consultants, Inc. (HRC), has been contracted by the Flood Control District of Maricopa County (District) to prepare the Wickenburg Area Drainage Master Study/Plan (ADMS/P). The ADMS/P lies within the watershed encompassing and surrounding the Town of Wickenburg (Town) in the north part of Maricopa County (Figure 1). The ADMS portion of the project identifies and quantifies known and potential flood hazards in the Wickenburg area, and where future flood control measures should be focused. If deemed necessary, the ADMP portion of the project will be initiated to identify alternatives and propose solutions to remediate flood hazards.

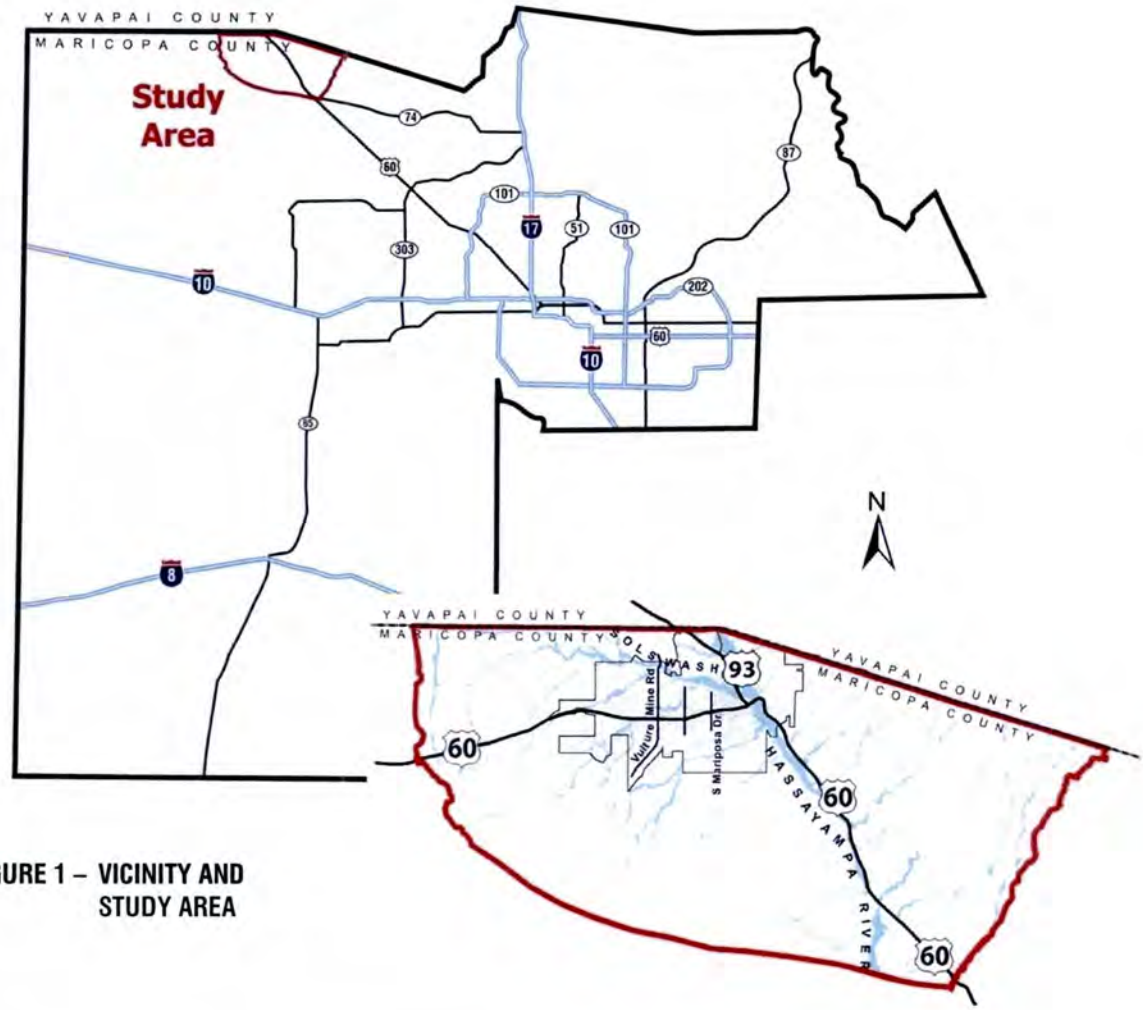

FIGURE 1 – VICINITY AND STUDY AREA

The study is an update of the Wickenburg Area Drainage Master Study (WADMS), completed in 1992. Since the WADMS, there have been advancements in the technology used to identify flood hazards, precipitation data has changed, and more recent and accurate digital topography is available. Growth, development, and other factors have resulted in changes to drainage patterns in some areas, causing potential changes to the flood hazards.

The ADMS/P will be completed in three phases (Figure 2). The first phase (Figure 3) identifies the current floodplain and flood hazards for Sunset Wash and Sunnycove Wash. The second phase addresses the floodplains that occur within, or in close proximity to, the Town limits. The third phase delineates floodplains for selected washes outside of the Town's jurisdictional limits. The ADMP (Phase 4) may recommend structural facilities, such as channels and basins, or non-structural methods such as development codes, for selected areas.

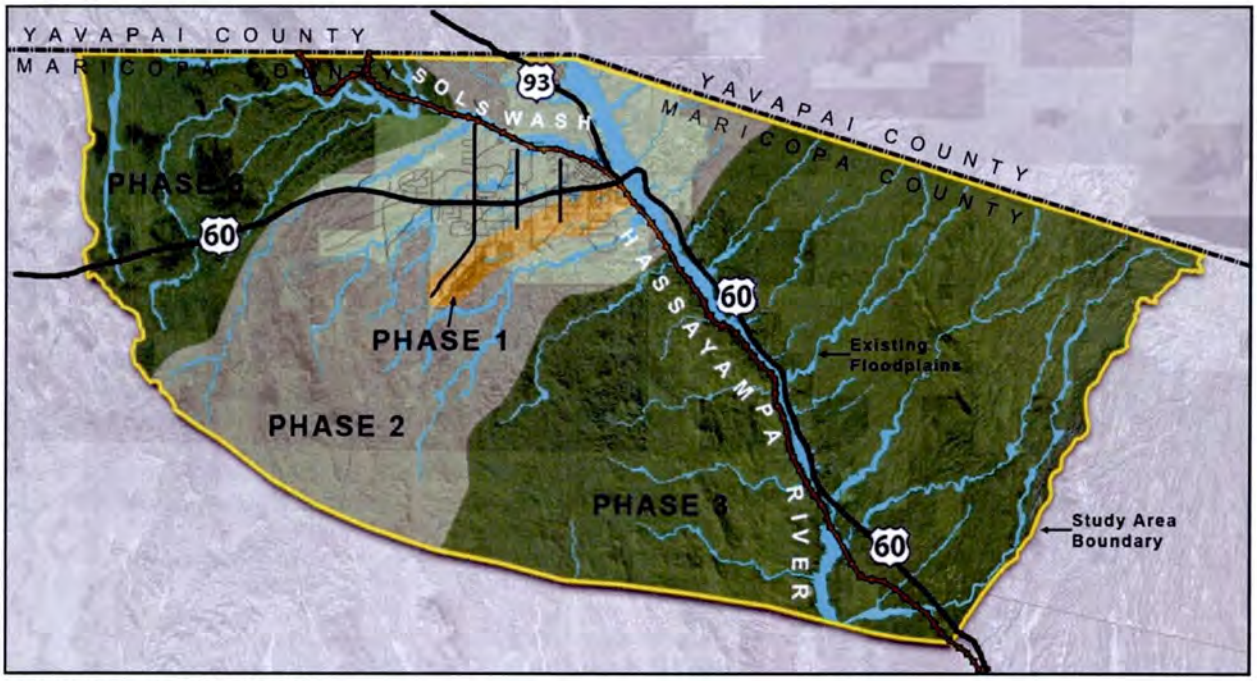

FIGURE 2 – STUDY PHASES

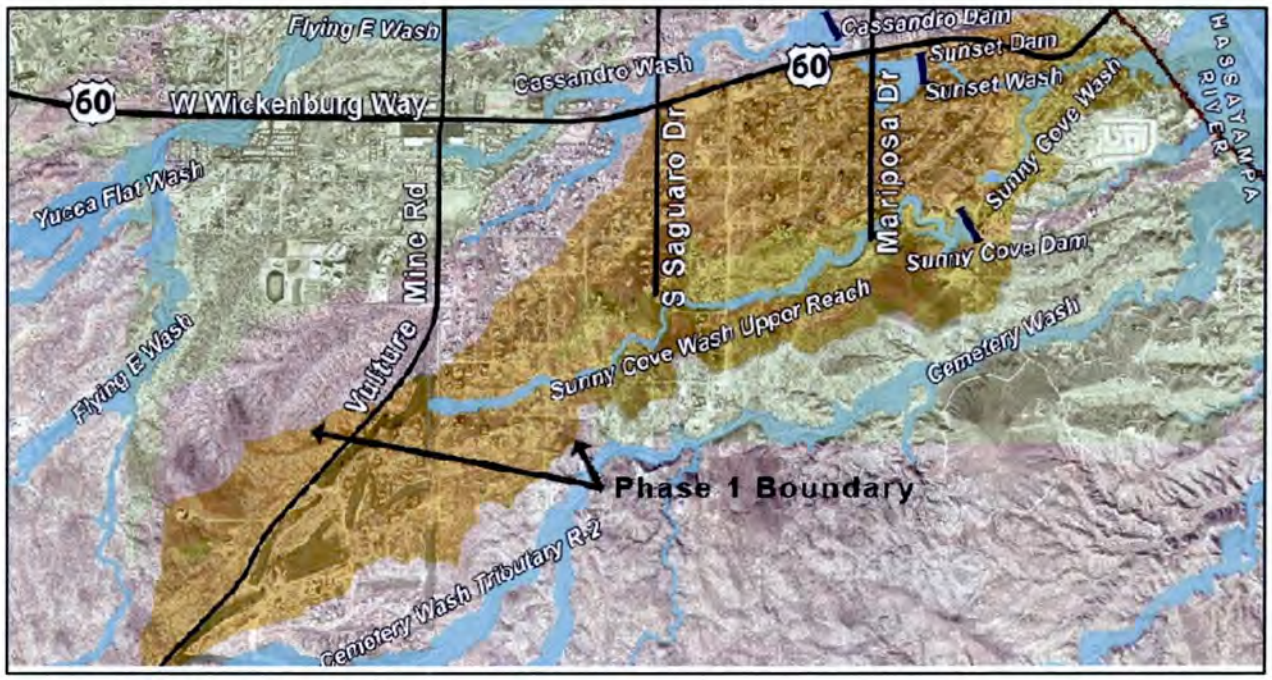

FIGURE 3 – PHASE 1 WATERSHED

Phase 1 is documented in this Technical Data Notebook (TDN). Letter of Map Revision (LOMR) submittals for Phases 2 and 3 are documented separately. The purpose of this TDN is a technical submission of new hydrologic and hydraulic analysis to FEMA supporting a LOMR request. The new hydrologic and hydraulic analysis are based on recent NOAA rainfall data and topographic mapping.

1.1 Authority for Study

The study is a joint effort between the District and the Town. The District's contract number is FCD 2009C030. The official Notice to Proceed date is July 12, 2010. The District Project Manager is Gregory L. Jones, PE, AICP.

1.2 Location of Study

The Phase 1 study area encompasses approximately 2.5 square miles of the Town of Wickenburg and its surrounding area, within Maricopa County. The watershed area is located within Township 7 North, Range 5 West, of the Gila River Base and Meridian.

Sunnycove Wash is a tributary to Sunset Wash which outlets to the Hassayampa River near the intersection of U.S. Highway 60 (US 60) and U.S. Highway 93 (US 93). Both Sunset Wash and Sunnycove Wash empty into earthen dams upstream of their confluence. The current FEMA Zone AE floodplain delineation extends from their confluence with the Hassayampa River westward for a distance of approximately one (1) mile along Sunset Wash, 0.4 miles along Sunnycove Wash downstream of the dam, and two (2) miles along Sunnycove Wash upstream of the dam.

1.3 Methodology Summary

Hydrologic Modeling

Hydrology for the approximately 2.5 square mile watershed contributing to the Sunnycove Wash and Sunset Wash floodplains was developed using the U.S. Army Corps of Engineers *HEC-1, Version 4.1, Flood Hydrograph Package* (Ref. 36). Hydrologic models prepared as part of the ADMS/P include the following:

- 500-year; 6-hour Existing Condition
- 100-year; 6-hour and 24-hour Existing Condition
- 50-year; 6-hour Existing Condition
- 10-year; 6-hour Existing Condition

The models were developed following the procedures recommended in the District's *Drainage Design Manual for Maricopa County, Volume I, Hydrology* (Ref. 19). The Phase 1 watershed was divided into watersheds contributing to Sunset Wash and Sunnycove Wash. Each watershed was then divided into sub-basins based on topographic mapping and field observations.

The District's *Drainage Design Management System Version 4.6.0* software (DDMSW), dated August 2010 (Ref. 17), was used to generate the sub-basin HEC-1 data.

Sub-basin parameters were gathered from a combination of field observation and existing land use and soils maps. Soil losses were estimated using the Green & Ampt method and excess rainfall runoff generated for the sub-basins using the Phoenix Mountain S-graph. Recent changes in development within the watershed areas are reflected in this study. *NOAA Atlas 14, Precipitation-Frequency Atlas of the United States, Volume 1, Arizona* (Ref. 32) was used as the point precipitation rainfall data source for the project.

Refer to Section 4 of this report for a detailed description of the hydrologic modeling methods.

Hydraulic Modeling

The effective Zone "AE" floodplains were previously delineated in the WADMS using the HEC-2 hydraulic model (the effective model). However, HEC-RAS version 4.0 (Ref. 38) was used to analyze the 100-year floodplains for this study.

HEC-RAS Cross-Section geometry was obtained from the 2004 two-foot contour interval topographic mapping provided by the District (Ref. 50). Elevations for the study are on the NAVD88 vertical datum. Cross-sections were created at the same locations as the effective model, and supplemented with Cross-Sections at additional locations, including locations where there is new culvert crossing data. Supplemental ground survey was conducted at drainage structures.

Encroachment Method #4 was used for the first iteration of floodway modeling, then Method #1 was used, and then encroachment limits were modified as necessary to optimize the floodway WSE.

Refer to Section 5 of this report for a detailed description of the hydraulic modeling methods.

1.4 Acknowledgements

This study is performed under the authority of the District, in cooperation with the Town. The HRC consultant team comprises firms of various disciplines required to complete all aspects of the project. HRC is the Prime Consultant responsible for all aspects of the study. Dewberry, and Coe and Van Loo Consultants, Inc., are assisting with data collection, hydrology, hydraulics, and floodplain delineation. Environmental Planning Group is assisting with data collection and existing conditions analysis. Bender Consulting Services is assisting with Public Involvement. Geological Consultants, Inc., is providing soils and bedrock analysis, and Alpha Geotechnical is providing soils sampling and testing.

1.5 Summary of Study Results

The HEC-1 output for each hydrologic model is included in appendix D.6. The USGS data for Arizona and the regional regression equations were used to verify the peak discharges. Refer to Section 4.5 for the hydrologic results.

The 100-year, 6-hour storm is used for the floodplain and floodway delineations because it produces higher peak discharges than the 100-year, 24-hour storm. Two additional washes upstream of Sunset Dam were delineated as part of this study (an extension to Sunset Wash and Sunset Wash Tributary 1). These two additional washes currently don't have floodplain delineations. Refer to the Floodplain Work Maps located at the back of this report for the wash locations.

The current FEMA flood Zones AE behind the Sunnycove Dam and Zone A behind the Sunset Dam have been revised to Zone AH. For the rest of the floodplain delineations, the flood Zone AE is still applicable with the exception of a small Zone X area within Sunset Wash.

2 Study Documentation Abstract and FEMA Forms

2.1: Study Documentation Abstract for FEMA Submittals		Initial Study		Restudy	X	CLOMR		LOMR	X	Other	

2.1.1	Date Study Accepted	
2.1.2	Study Contractor	Hoskin-Ryan Consultants, Inc.
	Contact(s)	Paul W.R. Hoskin, PE / Douglas Both, CFM / Peng Zhang, PE, CFM
	Address	6245 N. 24th Parkway, Suite 100 Phoenix, AZ 85016
	Phone	(602) 252-8384
	Internal Ref. No.	HRC 10-003-01
	Subcontractors w/ Phone	Coe & Van Loo Consultants, Inc. – (602) 264-6831 Dewberry & Davis, LLC – (602) 943-1585
2.1.3	FEMA Technical Review Contractor	
	Contact(s)	
	Address	
	Phone	
	Internal Ref. No.	
2.1.4	FEMA Regional Reviewer	
	Phone	
2.1.5	State Technical Reviewer	
	Phone	
2.1.6	Local Technical Reviewer	Greg Jones, PE, AICP – Flood Control District of Maricopa County Kathryn Gross, CFM, MA – Flood Control District of Maricopa County
	Phone	Greg Jones (602) 506-5537 Kathryn Gross (602) 506-4837
	Internal Ref. No.	FCD 2009C030
2.1.7	Reach Description	Sunset Wash between headwaters and confluence with Hassayampa River. Sunset Wash Tributary 1 between headwaters and Sunset Dam. Sunnycove Wash between headwaters and confluence with the Sunset Wash. FIRM 04013C0235G and 04013C0253H
2.1.8	USGS Quad Sheet(s) with original photo date & latest photo revision date	7.5-Minute Topographic Quadrangle Map Series: Vulture Peak, Arizona, provisional editing 1990. Wickenburg, Arizona, 1964, photo inspected 1978.
2.1.9	Unique Conditions and Problems	The Sunset and Sunnycove Dams lie within the watershed and attenuate flows downstream.
2.1.10	Coordination of Discharges (Agency, Date, Comments)	Peak flows to be generated as part of the study. Review and approval of peak flows to be completed by the Flood Control District of Maricopa County.

Study Documentation Abstract for Local Government and ADWR Submittals		
2.1: General Information		
2.1.1	Community	Wickenburg, Town of
2.1.2	Community Number	040056
2.1.3	County	Maricopa County
2.1.4	State	Arizona
2.1.5	Date Study Accepted	
2.1.6	Study Contractor	Hoskin-Ryan Consultants, Inc.
	Contact(s)	Paul W.R. Hoskin, PE / Douglas Both, CFM / Peng Zhang, PE, CFM
	Address	6245 N. 24th Parkway, Suite 100 Phoenix, AZ 85016
	Phone	(602) 252-8384
	Internal Ref. No.	HRC 10-003-01
2.1.7	State Technical Reviewer	
	Phone	
2.1.8	Local Technical Reviewer	Greg Jones, PE, AICP – Flood Control District of Maricopa County Kathryn Gross, CFM, MA – Flood Control District of Maricopa County
	Phone	Greg Jones (602) 506-5537 Kathryn Gross (602) 506-4837
	Internal Ref. No.	FCD 2009C030
2.1.9	River or Stream Name	Sunset Wash, Sunset Wash Tributary 1 and Sunnycove Wash
2.1.10	Reach Description	Sunset Wash between headwaters and confluence with Hassayampa River. Sunset Wash Tributary 1 between headwaters and Sunset Dam. Sunnycove Wash between headwaters and confluence with Sunset Wash.
2.1.11	Study Type (riverine, alluvial, fan, etc.)	Riverine
Section 2.2: Mapping Information		
2.2.1	USGS Quad Sheet(s) with original photo date & latest photo revision date	7.5-Minute Topographic Quadrangle Map Series: Vulture Peak, Arizona, provisional editing 1990. Wickenburg, Arizona, 1964, photo inspected 1978.
2.2.2	Mapping for Hydrologic Study, Type/Source, Scale, Date	2-foot contour interval topographic mapping, covering the study area, from the Flood Control District of Maricopa County, dated 7/7/2004
2.2.3	Mapping for Hydraulic Study, Type/Source, Scale, Date, Subcontractor, Date of Aerial Mapping	2-foot contour interval topographic mapping, covering the study area, from the Flood Control District of Maricopa County, dated 7/7/2004
Section 2.3: Hydrology		
2.3.1	Model or Method Used (incl. vendor and version)	*HEC-1 Flood Hydrograph Package, Version 4.1*, U.S. Army Corps of Engineers, Hydrologic Engineering Center, June 1998
		Drainage Design Management System, Version 4.6.0, KVL Consultants, Inc., for Flood Control District of Maricopa County, 8/12/2010
2.3.2	Storm Duration	6-hour and 24-hour
2.3.3	Hydrograph Type	Flood Control District of Maricopa County 6-hour distribution for 6-hour modeling; SCS Type II distribution for 24-hour modeling
2.3.4	Frequencies Determined	10-year,6-hour, 50-year, 6-hour, 100-year, 6- and 24-hour and 500-year, 6-hour

2.3.5	List of Gages Used in Frequency Analysis or Calibration	There are no flow rate gages within the study area.
2.3.6	Rainfall Amounts and Reference	Isopluvials for Maricopa County, Arizona, from the Flood Control District of Maricopa County's *Drainage Design Manual for Maricopa County, Arizona, Volume I-Hydrology*, June 14, 2010 2-year, 6-hour Precipitation = 1.42 inches 2-year, 24-hour Precipitation = 1.93 inches 100-year, 6-hour Precipitation = 3.32 inches 100-year, 24-hour Precipitation = 4.42 inches 500-year, 6-hour precipitation = 4.20 inches 500-year, 24-hour precipitation = 5.54 inches
2.3.7	Unique Conditions and Problems	
2.3.8	Coordination of Discharges (agency, date, comments)	Peak flows generated as part of the study. Review and approval of peak flows to be completed by the Flood Control District of Maricopa County.
Section 2.4: Hydraulics		
2.4.1	Model or Method Used (incl. vendor and version)	*HEC-RAS River Analysis System, Version 4.0*, U.S. Army Corps of Engineers, Hydrologic Engineering Center, March 2008.
		HEC-GeoRAS, Version 4.2.93, U.S. Army Corps of Engineers, September 2009.
2.4.2	Regime	Subcritical
2.4.3	Frequencies for which Profiles Were Computed	10-year,6-hour, 50-year, 6-hour, 100-year, 6 and 500-year, 6-hour
2.4.4	Method of Floodway Calculation	HEC-RAS Floodway Modeling Method 1
2.4.5	Unique Conditions and Problems	
Section 2.5: Additional Information		
Item		Description / Discussion

U.S. DEPARTMENT OF HOMELAND SECURITY - FEDERAL EMERGENCY MANAGEMENT AGENCY

OVERVIEW & CONCURRENCE FORM

O.M.B No. 1660-0016
Expires: 12/31/2010

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, U.S. Department of Homeland Security, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (1660-0016). 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 DHS-FEMA

This request is for a (check one):

☐ CLOMR: A letter from DHS-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 DHS-FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See 44 CFR Ch. 1, Parts 60, 65 & 72)

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
Ex: 480301	City of Katy	TX	480301	0005D	02/08/83
480287	Harris County	TX	48201C	0220G	09/28/90
056 040056	TOWN OF WICKENBURG	AZ	04013C	0235G	09/30/05
56 040056	TOWN OF WICKENBURG	AZ	04013C	0253H	09/30/05

2. a. Flooding Source: SUNSET WASH, SUNSET WASH TRIBUTARY 1 AND SUNNYCOVE WASH

   b. Types of Flooding: ☒ Riverine ☐ Coastal ☐ Shallow Flooding (e.g., Zones AO and AH) ☐ Alluvial fan ☐ Lakes ☐ Other (Attach Description)

3. Project Name/Identifier: WICKENBURG AREA DRAINAGE STUDY / PLANNING

4. FEMA zone designations affected: A, AE (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 ☐ Base Map Changes
   ☐ Coastal Analysis ☒ Hydraulic Analysis ☒ Hydrologic Analysis ☐ Corrections
   ☐ Weir-Dam Changes ☐ Levee Certification ☐ Alluvial Fan Analysis ☐ Natural Changes
   ☒ New Topographic Data ☐ 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 structures (check all that apply)

   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, Attach Explanation

Please see the DHS-FEMA Web site at http://www.fema.gov/plan/prevent/fhm/frm_fees.shtm **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	Company: FLOOD CONTROL DISTRICT, MARICOPA COUNTY	
Mailing Address: 2801 W. DURANGO STREET PHOENIX, AZ 85009	Daytime Telephone No.: (602) 506-4837	Fax No.: (602)506-8561
	E-Mail Address: kag@mail.maricopa.gov	
Signature of Requester (required): Kathryn Gross	Date: 6/9/11	

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: RICHARD DESTEFANO BUILDING INSPECTOR	Community Name: TOWN OF WICKENBURG	
Mailing Address: 155 N. TEGNER ST., STE A. WICKENBURG, AZ. 85390	Daytime Telephone No.: 928-668-0513	Fax No.: 602-506-1580
	E-Mail Address: rdestefano@ci.wickenburg.az.us	
Community Official's Signature (required):	Date: 6-13-11	

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 data, hydrologic and hydraulic analysis, and any other supporting data. All documents submitted in support of this request are correct to the best of my knowledge. All analyses have been performed correctly and in accordance with sound engineering practices. All project works are designed in accordance with sound engineering practices to provide protection from the 1% annual chance flood. If "as-built" conditions data/plan provided, then the structure(s) has been built according to the plans being certified, is in place, and is fully functioning. 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: PAUL W.R. HOSKIN, P.E	License No.: AZ 19690	Expiration Date: 2/31/2012
Company Name: HOSKIN RYAN CONSULTANTS, INC	Telephone No.: (602) 252-8384	Fax No.: (602) 252-8385
Signature:		Date: 6/6/11

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)

U.S. DEPARTMENT OF HOMELAND SECURITY - FEDERAL EMERGENCY MANAGEMENT AGENCY

OVERVIEW & CONCURRENCE FORM

O.M.B No. 1660-0016
Expires: 12/31/2010

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, U.S. Department of Homeland Security, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (1660-0016). 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 DHS-FEMA

This request is for a (check one):

☐ CLOMR: A letter from DHS-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 DHS-FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See 44 CFR Ch. 1, Parts 60, 65 & 72)

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
Ex: 480301	City of Katy	TX	480301	0005D	02/08/83
480287	Harris County	TX	48201C	0220G	09/28/90
040037	MARICOPA COUNTY	AZ	04013C	0235G	09/30/05
37 040037	MARICOPA COUNTY	AZ	04013C	0253H	09/30/05

2. a. Flooding Source: SUNSET WASH, SUNSET WASH TRIBUTARY 1 AND SUNNYCOVE WASH

   b. Types of Flooding: ☒ Riverine ☐ Coastal ☐ Shallow Flooding (e.g., Zones AO and AH) ☐ Alluvial fan ☐ Lakes ☐ Other (Attach Description)

3. Project Name/Identifier: WICKENBURG AREA DRAINAGE STUDY / PLANNING

4. FEMA zone designations affected: A, AE (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 ☐ Base Map Changes
   ☐ Coastal Analysis ☒ Hydraulic Analysis ☒ Hydrologic Analysis ☐ Corrections
   ☐ Weir-Dam Changes ☐ Levee Certification ☐ Alluvial Fan Analysis ☐ Natural Changes
   ☒ New Topographic Data ☐ 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 structures (check all that apply)

   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, Attach Explanation

Please see the DHS-FEMA Web site at http://www.fema.gov/plan/prevent/fhm/frm_fees.shtm **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	Company: FLOOD CONTROL DISTRICT, MARICOPA COUNTY	
Mailing Address: 2801 W. DURANGO STREET PHOENIX, AZ 85009	Daytime Telephone No.: (602) 506-4837	Fax No.: (602)506-8561
	E-Mail Address: kag@mail.maricopa.gov	
Signature of Requester (required):	Date: 6/9/11	

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.	Community Name: MARICOPA COUNTY	
Mailing Address: 2801 W. DURANGO STREET PHOENIX, AZ 85009	Daytime Telephone No.: (602) 506-1501	Fax No.: (602) 506-4601
	E-Mail Address: tsp@mail.maricopa.gov	
Community Official's Signature (required):	Date: 6/20/11	

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 data, hydrologic and hydraulic analysis, and any other supporting data. All documents submitted in support of this request are correct to the best of my knowledge. All analyses have been performed correctly and in accordance with sound engineering practices. All project works are designed in accordance with sound engineering practices to provide protection from the 1% annual chance flood. If "as-built" conditions data/plan provided, then the structure(s) has been built according to the plans being certified, is in place, and is fully functioning. 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: PAUL W.R. HOSKIN, P.E	License No.: AZ 19690	Expiration Date: 2/31/2012
Company Name: HOSKIN RYAN CONSULTANTS, INC	Telephone No.: (602) 252-8384	Fax No.: (602) 252-8385
Signature:		Date: 6/6/11

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
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☐ 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)

U.S. DEPARTMENT OF HOMELAND SECURITY - FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 1660-0016
Expires: 12/31/2010

PAPERWORK REDUCTION ACT

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Flooding Source: SUNSET WASH
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 B) ☐ 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.)	Effective/FIS (cfs)	Revised (cfs)
AT HASSAYAMPA RIVER	0.591	600	1,146
DOWNSTREAM OF SUNSET DAM	0.029	32	56
UPSTREAM OF SUNSET DAM	0.601	740	927

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

☐ Statistical Analysis of Gage Records ☒ Precipitation/Runoff Model HEC-1
☐ 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.

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.

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.) Effective	Proposed/Revised
Downstream Limit	HASSAYAMPA RIVER	RS 0.178	2039.00 (NAVD88)	2035.89 (NAVD88)
Upstream Limit	EAST OF LOS ALTOS DR.	RS 1.902	N/A	2185.25 (NAVD88)

2. Hydraulic Method/Model Used

HEC-RAS VERSION 4.0

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

DHS-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 may help 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/plan/prevent/fhm/frm_soft.shtm. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS. Review of your submittal and resolution of valid modeling discrepancies may result in reduced review time.

4. Models Submitted	Natural Run		Floodway Run		Datum
Duplicate Effective Model*	File Name:	Plan Name:	File Name:	Plan Name:	____
Corrected Effective Model*	File Name:	Plan Name:	File Name:	Plan Name:	____
Existing or Pre-Project Conditions Model	File Name:	Plan Name:	File Name:	Plan Name:	____
Revised or Post-Project Conditions Model	File Name: WKB1.prj	Plan Name: WKB1.p01	File Name: N/A	Plan Name: N/A	NAVD88
Other - (attach description)	File Name:	Plan Name:	File Name:	Plan Name:	____

* For details, refer to the corresponding section of the instructions.

☒ Digital Models Submitted? (Required)

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.).

☒ Digital Mapping (GIS/CADD) Data Submitted

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.

☒ Annotated FIRM and/or FBFM (Required)

D. COMMON REGULATORY REQUIREMENTS*

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

   a. 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 or without BFEs established and would result in increases above 1.00 foot.

   b. 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.

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/CLOMR requests, does this request have the potential to impact an endangered species? ☐ Yes ☒ No

   If Yes, please submit documentation to the community to show that you have complied with Sections 9 and 10 of the Endangered Species Act (ESA). Section 9 of the ESA prohibits anyone from "taking" or harming an endangered species. If an action might harm an endangered species, a permit is required from U.S. Fish and Wildlife Service or National Marine Fisheries Service under Section 10 of the ESA.

   For actions authorized, funded, or being carried out by Federal or State agencies, please submit documentation from the agency showing its compliance with Section 7(a)(2) of the ESA.

* Not inclusive of all applicable regulatory requirements. For details, see 44 CFR parts 60 and 65.

U.S. DEPARTMENT OF HOMELAND SECURITY - FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 1660-0016
Expires: 12/31/2010

PAPERWORK REDUCTION ACT

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Flooding Source: SUNSET WASH TRIBUTARY 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 B) ☐ 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.)	Effective/FIS (cfs)	Revised (cfs)
UPSTREAM OF SUNSET DAM	0.270	N/A	412

Methodology for New Hydrologic Analysis (check all that apply)

☐ Statistical Analysis of Gage Records ☒ Precipitation/Runoff Model HEC-1
☐ 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.

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.

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.) Effective	Proposed/Revised
Downstream Limit	SUNSET DAM	RS 0.009	N/A	2123.83 (NAVD88)
Upstream Limit	EAST OF LOS ALTOS DR.	RS 0.256	N/A	2155.21 (NAVD88)

Hydraulic Method/Model Used

HEC-RAS VERSION 4.0

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

DHS-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 may help 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/plan/prevent/fhm/frm_soft.shtm. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS. Review of your submittal and resolution of valid modeling discrepancies may result in reduced review time.

4.

Models Submitted	Natural Run		Floodway Run		Datum
Duplicate Effective Model*	File Name:	Plan Name:	File Name:	Plan Name:	____
Corrected Effective Model*	File Name:	Plan Name:	File Name:	Plan Name:	____
Existing or Pre-Project Conditions Model	File Name:	Plan Name:	File Name:	Plan Name:	____
Revised or Post-Project Conditions Model	File Name: WKB1.prj	Plan Name: WKB1.p01	File Name: N/A	Plan Name: N/A	NAVD88
Other - (attach description)	File Name:	Plan Name:	File Name:	Plan Name:	____

* For details, refer to the corresponding section of the instructions.

☒ Digital Models Submitted? (Required)

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.).

☒ Digital Mapping (GIS/CADD) Data Submitted

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.

☒ Annotated FIRM and/or FBFM (Required)

D. COMMON REGULATORY REQUIREMENTS*

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

   a. 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 or without BFEs established and would result in increases above 1.00 foot.

   b. 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.

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/CLOMR requests, does this request have the potential to impact an endangered species? ☐ Yes ☒ No

   If Yes, please submit documentation to the community to show that you have complied with Sections 9 and 10 of the Endangered Species Act (ESA). Section 9 of the ESA prohibits anyone from "taking" or harming an endangered species. If an action might harm an endangered species, a permit is required from U.S. Fish and Wildlife Service or National Marine Fisheries Service under Section 10 of the ESA.

   For actions authorized, funded, or being carried out by Federal or State agencies, please submit documentation from the agency showing its compliance with Section 7(a)(2) of the ESA.

* Not inclusive of all applicable regulatory requirements. For details, see 44 CFR parts 60 and 65.

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Flooding Source: SUNNYCOVE WASH
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 B) ☐ 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.)	Effective/FIS (cfs)	Revised (cfs)
AT SUNSET WASH	0.114	145	326
UPSTREAM OF SUNNYCOVE DAM	1.393	1,232	1,542
STEINWAY DRIVE	0.562	737	1,006

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

☐ Statistical Analysis of Gage Records ☒ Precipitation/Runoff Model HEC-1
☐ 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.

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.

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.) Effective	Proposed/Revised
Downstream Limit	SUNSET WASH	RS 0.022	2081.14 (NAVD88)	2081.12 (NAVD88)
Upstream Limit	STEINWAY DRIVE	RS 3.132	2332.12 (NAVD88)	2330.23 (NAVD88)

Hydraulic Method/Model Used

HEC-RAS VERSION 4.0

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

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4. Models Submitted	Natural Run		Floodway Run		Datum
Duplicate Effective Model*	File Name:	Plan Name:	File Name:	Plan Name:	____
Corrected Effective Model*	File Name:	Plan Name:	File Name:	Plan Name:	____
Existing or Pre-Project Conditions Model	File Name:	Plan Name:	File Name:	Plan Name:	____
Revised or Post-Project Conditions Model	File Name: WKB1.prj	Plan Name: WKB1.p01	File Name: N/A	Plan Name: N/A	NAVD88
Other - (attach description)	File Name:	Plan Name:	File Name:	Plan Name:	____

* For details, refer to the corresponding section of the instructions.

☒ Digital Models Submitted? (Required)

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.).

☒ Digital Mapping (GIS/CADD) Data Submitted

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.

☒ Annotated FIRM and/or FBFM (Required)

D. COMMON REGULATORY REQUIREMENTS*

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

   a. 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 or without BFEs established and would result in increases above 1.00 foot.

   b. 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.

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/CLOMR requests, does this request have the potential to impact an endangered species? ☐ Yes ☒ No

   If Yes, please submit documentation to the community to show that you have complied with Sections 9 and 10 of the Endangered Species Act (ESA). Section 9 of the ESA prohibits anyone from "taking" or harming an endangered species. If an action might harm an endangered species, a permit is required from U.S. Fish and Wildlife Service or National Marine Fisheries Service under Section 10 of the ESA.

   For actions authorized, funded, or being carried out by Federal or State agencies, please submit documentation from the agency showing its compliance with Section 7(a)(2) of the ESA.

* Not inclusive of all applicable regulatory requirements. For details, see 44 CFR parts 60 and 65.

U.S. DEPARTMENT OF HOMELAND SECURITY - FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

O.M.B No. 1660-0016
Expires: 12/31/2010

PAPERWORK REDUCTION ACT

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Flooding Source: SUNSET WASH TRIBUTARY 1
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/Basin .....complete Section D
Levee/Floodwall .....complete Section E
Sediment Transport.....complete Section F (if required)

Description Of Structure

1. **Name of Structure: (3) - 32" X 24" CMP (SST_120)**

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

   Location of Structure: PRIVATE DRIVEWAY (RS 0.213)

   Downstream Limit/Cross Section: RS 0.209

   Upstream Limit/Cross Section: RS 0.218

2. **Name of Structure: (3) - 32" X 24" CMP (SST_130)**

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

   Location of Structure: PRIVATE DRIVEWAY (RS 0.155)

   Downstream Limit/Cross Section: RS 0.152

   Upstream Limit/Cross Section: RS 0.159

3. **Name of Structure: (3) - 32" X 24" CMP (SST_140)**

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

   Location of Structure: PRIVATE DRIVEWAY (RS 0.135)

   Downstream Limit/Cross Section: RS 0.132

   Upstream Limit/Cross Section: RS 0.138

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

U.S. DEPARTMENT OF HOMELAND SECURITY - FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

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Flooding Source: SUNSET WASH TRIBUTARY 1
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/Basin .....complete Section D
Levee/Floodwall .....complete Section E
Sediment Transport.....complete Section F (if required)

Description Of Structure

1. Name of Structure: (3) - 32" X 24" CMP (SST_150)

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

Location of Structure: PRIVATE DRIVEWAY (RS 0.119)

Downstream Limit/Cross Section: RS 0.116

Upstream Limit/Cross Section: RS 0.122

2. Name of Structure: (3) - 36" X 24" CMP (SST_160)

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

Location of Structure: MARIPOSA DRIVE (RS 0.082)

Downstream Limit/Cross Section: RS 0.076

Upstream Limit/Cross Section: RS 0.090

3. Name of Structure:

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

Location of Structure:

Downstream Limit/Cross Section:

Upstream Limit/Cross Section:

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

B. CHANNELIZATION

Flooding Source:

me of Structure:

1. Accessory Structures

The channelization includes (check one):

- ☐ Levees [Attach Section E (Levee/Floodwall)]
- ☐ Superelevated sections
- ☐ Debris basin/detention basin [Attach Section D (Dam/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 -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: SUNSET WASH TRIBUTARY 1

Name of Structure: (3) - 32" X 24" CMP (SST_120)

1. This revision reflects (check one):

☒ Bridge/culvert not modeled in the FIS
☐ Modified bridge/culvert previously modeled in the FIS
☐ Revised 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): HEC-RAS
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.

B. CHANNELIZATION

Flooding Source:

Name of Structure:

1. Accessory Structures

The channelization includes (check one):

- ☐ Levees [Attach Section E (Levee/Floodwall)]
- ☐ Superelevated sections
- ☐ Debris basin/detention basin [Attach Section D (Dam/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 -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: SUNSET WASH TRIBUTARY 1

Name of Structure: (3) - 32" X 24" CMP (SST_130)

1. This revision reflects (check one):

☒ Bridge/culvert not modeled in the FIS
☐ Modified bridge/culvert previously modeled in the FIS
☐ Revised 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): HEC-RAS
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.

B. CHANNELIZATION

Flooding Source:

Name of Structure:

1. Accessory Structures

The channelization includes (check one):

- ☐ Levees [Attach Section E (Levee/Floodwall)]
- ☐ Superelevated sections
- ☐ Debris basin/detention basin [Attach Section D (Dam/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 -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: SUNSET WASH TRIBUTARY 1

Name of Structure: (3) - 32" X 24" CMP (SST_140)

1. This revision reflects (check one):

☒ Bridge/culvert not modeled in the FIS
☐ Modified bridge/culvert previously modeled in the FIS
☐ Revised 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): HEC-RAS
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.

B. CHANNELIZATION

Flooding Source:

Name of Structure:

1. Accessory Structures

The channelization includes (check one):

- ☐ Levees [Attach Section E (Levee/Floodwall)]
- ☐ Superelevated sections
- ☐ Debris basin/detention basin [Attach Section D (Dam/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 -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: SUNSET WASH TRIBUTARY 1

Name of Structure: (3) - 32" X 24" CMP (SST_150)

1. This revision reflects (check one):

☒ Bridge/culvert not modeled in the FIS
☐ Modified bridge/culvert previously modeled in the FIS
☐ Revised 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): HEC-RAS
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.

B. CHANNELIZATION

Flooding Source:

me of Structure:

1. Accessory Structures

The channelization includes (check one):

- ☐ Levees [Attach Section E (Levee/Floodwall)]
- ☐ Superelevated sections
- ☐ Debris basin/detention basin [Attach Section D (Dam/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 -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: SUNSET WASH TRIBUTARY 1

Name of Structure: (3) - 36" X 24" CMP (SST_160)

1. This revision reflects (check one):

☒ Bridge/culvert not modeled in the FIS
☐ Modified bridge/culvert previously modeled in the FIS
☐ Revised 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): HEC-RAS
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.

U.S. DEPARTMENT OF HOMELAND SECURITY - FEDERAL EMERGENCY MANAGEMENT AGENCY

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Flooding Source: SUNSET WASH
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/Basin .....complete Section D
Levee/Floodwall .....complete Section E
Sediment Transport.....complete Section F (if required)

Description Of Structure

1. **Name of Structure: SUNSET DAM**

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

   Location of Structure: LATITUDE: 33.9650685; LONGITUDE:112.7423764

   Downstream Limit/Cross Section: N/A

   Upstream Limit/Cross Section: N/A

2. **Name of Structure: (3) - 36" CMP (SST_170)**

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

   Location of Structure: MARIPOSA DRIVE (RS 1.456)

   Downstream Limit/Cross Section: RS 1.447

   Upstream Limit/Cross Section: RS 1.466

3. **Name of Structure: (3) - 20" X 16" CMP (SST_200)**

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

   Location of Structure: LINCOLN STREET (RS 0.732)

   Downstream Limit/Cross Section: RS 0.726

   Upstream Limit/Cross Section: RS 0.737

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

U.S. DEPARTMENT OF HOMELAND SECURITY - FEDERAL EMERGENCY MANAGEMENT AGENCY

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Flooding Source: SUNSET WASH
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/Basin .....complete Section D
Levee/Floodwall .....complete Section E
Sediment Transport.....complete Section F (if required)

Description Of Structure

1. **Name of Structure: (3) - 20" X 16" CMP (SST_300)**

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

   Location of Structure: JACKSON STREET (RS 0.663)

   Downstream Limit/Cross Section: RS 0.658

   Upstream Limit/Cross Section: RS 0.668

2. **Name of Structure: (1) - 10' X 3' CBC (SST_400)**

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

   Location of Structure: MESQUITE STREET (RS 0.542)

   Downstream Limit/Cross Section: RS 0.537

   Upstream Limit/Cross Section: RS 0.547

3. **Name of Structure: BRIDGE (SST_500)**

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

   Location of Structure: BNSF RAILROAD CROSSING (RS 0.264)

   Downstream Limit/Cross Section: RS 0.260

   Upstream Limit/Cross Section: RS 0.269

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

B. CHANNELIZATION

Flooding Source:

Name of Structure:

1. Accessory Structures

The channelization includes (check one):

- ☐ Levees [Attach Section E (Levee/Floodwall)]
- ☐ Superelevated sections
- ☐ Debris basin/detention basin [Attach Section D (Dam/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 -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: SUNSET WASH

Name of Structure: (3) - 36" CMP (SST_170)

1. This revision reflects (check one):

☒ Bridge/culvert not modeled in the FIS
☐ Modified bridge/culvert previously modeled in the FIS
☐ Revised 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): HEC-RAS
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.

B. CHANNELIZATION

Flooding Source:

Name of Structure:

1. Accessory Structures

The channelization includes (check one):

- ☐ Levees [Attach Section E (Levee/Floodwall)]
- ☐ Superelevated sections
- ☐ Debris basin/detention basin [Attach Section D (Dam/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 -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: SUNSET WASH

Name of Structure: (3) - 20" X 16" CMP (SST_200)

1. This revision reflects (check one):

- ☐ Bridge/culvert not modeled in the FIS
- ☐ Modified bridge/culvert previously modeled in the FIS
- ☒ Revised 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): HEC-RAS
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.

B. CHANNELIZATION

Flooding Source:

Name of Structure:

1. Accessory Structures

The channelization includes (check one):

- ☐ Levees [Attach Section E (Levee/Floodwall)]
- ☐ Superelevated sections
- ☐ Debris basin/detention basin [Attach Section D (Dam/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 -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: SUNSET WASH

Name of Structure: (3) - 20" X 16" CMP (SST_300)

1. This revision reflects (check one):

☐ Bridge/culvert not modeled in the FIS
☐ Modified bridge/culvert previously modeled in the FIS
☒ Revised 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): HEC-RAS
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.

B. CHANNELIZATION

Flooding Source:

Name of Structure:

1. Accessory Structures

The channelization includes (check one):

☐ Levees [Attach Section E (Levee/Floodwall)]
☐ Superelevated sections
☐ Debris basin/detention basin [Attach Section D (Dam/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 -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: SUNSET WASH

Name of Structure: (1) - 10' X 3' CBC (SST_400)

1. This revision reflects (check one):

☐ Bridge/culvert not modeled in the FIS
☐ Modified bridge/culvert previously modeled in the FIS
☒ Revised 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): HEC-RAS
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.

B. CHANNELIZATION

Flooding Source:

me of Structure:

1. Accessory Structures

The channelization includes (check one):

- ☐ Levees [Attach Section E (Levee/Floodwall)]
- ☐ Superelevated sections
- ☐ Debris basin/detention basin [Attach Section D (Dam/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 -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: SUNSET WASH

Name of Structure: BRIDGE (SST_500)

1. This revision reflects (check one):

- ☐ Bridge/culvert not modeled in the FIS
- ☐ Modified bridge/culvert previously modeled in the FIS
- ☒ Revised 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): HEC-RAS
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.

D. DAM/BASIN

Flooding Source: SUNSET WASH

Name of Structure: SUNSET DAM

1. This request is for (check one): ☒ Existing dam ☐ New dam ☐ Modification of existing dam

2. The dam was designed by (check one): ☒ Federal agency ☐ State agency ☐ Local government agency ☐ Private organization

   Name of the agency or organization: NRCS

3. The Dam was permitted as (check one):

   a. ☐ Federal Dam ☐ State Dam

   Provide the permit or identification number (ID) for the dam and the appropriate permitting agency or organization

   Permit or ID number Permitting Agency or Organization

   b. ☒ Local Government Dam ☐ Private Dam

   Provided related drawings, specification and supporting design information.

4. Does the project involve revised hydrology? ☒ Yes ☐ No

   If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2).

   Was the dam/basin designed using critical duration storm?

   ☒ Yes, provide supporting documentation with your completed Form 2.

   ☐ No, provide a written explanation and justification for not using the critical duration storm.

5. Does the submittal include debris/sediment yield analysis? ☐ Yes ☒ No

   If yes, then fill out Section F (Sediment Transport).
   If No, then attach your explanation for why debris/sediment analysis was not considered.

6. Does the Base Flood Elevation behind the dam or downstream of the dam change?

   ☒ Yes ☐ No If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2) and complete the table below.

Stillwater Elevation Behind the Dam

FREQUENCY (% annual chance)	FIS	REVISED
10-year (10%)	2125.92	2126.62
50-year (2%)	2128.35	2129.73
100-year (1%)	2129.12	2130.99
500-year (0.2%)	N/A	2133.49
Normal Pool Elevation	N/A	N/A

NOTE: ELEVATIONS ARE ON THE NAVD 88 VERTICAL DATUM

7. Please attach a copy of the formal Operation and Maintenance Plan

U.S. DEPARTMENT OF HOMELAND SECURITY - FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

O.M.B No. 1660-0016
Expires: 12/31/2010

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, U.S. Department of Homeland Security, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (1660-0016). 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: SUNNYCOVE WASH
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/Basin .....complete Section D
Levee/Floodwall .....complete Section E
Sediment Transport.....complete Section F (if required)

Description Of Structure

1. **Name of Structure: SUNNYCOVE DAM**

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

   Location of Structure: LATITUDE: 33.9571309; LONGITUDE:112.7396911

   Downstream Limit/Cross Section: N/A

   Upstream Limit/Cross Section: N/A

2. **Name of Structure: (5) - 54" RCP (SUN_100)**

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

   Location of Structure: STEINWAY DRIVE (RS 3.100)

   Downstream Limit/Cross Section: RS 3.091

   Upstream Limit/Cross Section: RS 3.105

3. **Name of Structure: (3) - 48" CMP (SUN_200)**

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

   Location of Structure: MARIPOSA DRIVE (RS 1.137)

   Downstream Limit/Cross Section: RS 1.127

   Upstream Limit/Cross Section: RS 1.156

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

U.S. DEPARTMENT OF HOMELAND SECURITY - FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

O.M.B No. 1660-0016
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Flooding Source: SUNNYCOVE WASH
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/Basin .....complete Section D
Levee/Floodwall .....complete Section E
Sediment Transport.....complete Section F (if required)

Description Of Structure

1. **Name of Structure: (1) - 24" CMP (SUN_500)**

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

Location of Structure: KELLIS ROAD (RS 0.269)

Downstream Limit/Cross Section: RS 0.263

Upstream Limit/Cross Section: RS 0.279

2. **Name of Structure: (2) - 24" CMP (SUN_510)**

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

Location of Structure: COTTONWOOD ROAD (RS 0.233)

Downstream Limit/Cross Section: RS 0.226

Upstream Limit/Cross Section: RS 0.239

3. **Name of Structure:**

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

Location of Structure:

Downstream Limit/Cross Section:

Upstream Limit/Cross Section:

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

B. CHANNELIZATION

Flooding Source:

Name of Structure:

1. Accessory Structures

The channelization includes (check one):

☐ Levees [Attach Section E (Levee/Floodwall)]
☐ Superelevated sections
☐ Debris basin/detention basin [Attach Section D (Dam/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 -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: SUNNYCOVE WASH

Name of Structure: (5) - 54" RCP (SUN_100)

1. This revision reflects (check one):

☒ Bridge/culvert not modeled in the FIS
☐ Modified bridge/culvert previously modeled in the FIS
☐ Revised 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): HEC-RAS
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.

B. CHANNELIZATION

Flooding Source:

Name of Structure:

1. Accessory Structures

The channelization includes (check one):

- ☐ Levees [Attach Section E (Levee/Floodwall)]
- ☐ Superelevated sections
- ☐ Debris basin/detention basin [Attach Section D (Dam/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 -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: SUNNYCOVE WASH

Name of Structure: (3) - 48" CMP (SUN_200)

1. This revision reflects (check one):

☐ Bridge/culvert not modeled in the FIS
☐ Modified bridge/culvert previously modeled in the FIS
☒ Revised 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): HEC-RAS
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.

B. CHANNELIZATION

Flooding Source:

Name of Structure:

1. Accessory Structures

The channelization includes (check one):

- ☐ Levees [Attach Section E (Levee/Floodwall)]
- ☐ Superelevated sections
- ☐ Debris basin/detention basin [Attach Section D (Dam/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 -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: SUNNYCOVE WASH

Name of Structure: (1) - 24" CMP (SUN_500)

1. This revision reflects (check one):

☒ Bridge/culvert not modeled in the FIS
☐ Modified bridge/culvert previously modeled in the FIS
☐ Revised 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): HEC-RAS
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.

B. CHANNELIZATION

Flooding Source:

Name of Structure:

1. Accessory Structures

The channelization includes (check one):

- ☐ Levees [Attach Section E (Levee/Floodwall)]
- ☐ Superelevated sections
- ☐ Debris basin/detention basin [Attach Section D (Dam/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 -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: SUNNYCOVE WASH

Name of Structure: (2) - 24" CMP (SUN_510)

1. This revision reflects (check one):

☒ Bridge/culvert not modeled in the FIS
☐ Modified bridge/culvert previously modeled in the FIS
☐ Revised 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): HEC-RAS
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.

D. DAM/BASIN

Flooding Source: SUNNYCOVE WASH

Name of Structure: SUNNYCOVE DAM

1. This request is for (check one): ☒ Existing dam ☐ New dam ☐ Modification of existing dam

2. The dam was designed by (check one): ☒ Federal agency ☐ State agency ☐ Local government agency ☐ Private organization

   Name of the agency or organization: NRCS

3. The Dam was permitted as (check one):

   a. ☐ Federal Dam ☐ State Dam

   Provide the permit or identification number (ID) for the dam and the appropriate permitting agency or organization

   Permit or ID number Permitting Agency or Organization

   b. ☒ Local Government Dam ☐ Private Dam

   Provided related drawings, specification and supporting design information.

4. Does the project involve revised hydrology? ☒ Yes ☐ No

   If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2).

   Was the dam/basin designed using critical duration storm?

   ☒ Yes, provide supporting documentation with your completed Form 2.

   ☐ No, provide a written explanation and justification for not using the critical duration storm.

5. Does the submittal include debris/sediment yield analysis? ☐ Yes ☒ No

   If yes, then fill out Section F (Sediment Transport).
   If No, then attach your explanation for why debris/sediment analysis was not considered.

6. Does the Base Flood Elevation behind the dam or downstream of the dam change?

   ☒ Yes ☐ No If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2) and complete the table below.

Stillwater Elevation Behind the Dam

FREQUENCY (% annual chance)	FIS	REVISED
10-year (10%)	2159.41	2159.32
50-year (2%)	2163.70	2164.56
100-year (1%)	2164.97	2166.61
500-year (0.2%)	N/A	2170.79
Normal Pool Elevation	N/A	N/A

NOTE: ELEVATIONS ARE ON THE NAVD 88 VERTICAL DATUM

7. Please attach a copy of the formal Operation and Maintenance Plan

E. LEVEE/FLOODWALL

1. System Elements

a. This Levee/Floodwall analysis is based on (check one):

☐ upgrading of an existing levee/floodwall system
☐ a newly constructed levee/floodwall system
☐ reanalysis of an existing levee/floodwall system

b. Levee elements and locations are (check one):

☐ earthen embankment, dike, berm, etc.	Station	to
☐ structural floodwall	Station	to
☐ Other (describe):	Station	to

c. Structural Type (check one):

☐ monolithic cast-in place reinforced concrete
☐ reinforced concrete masonry block
☐ sheet piling
☐ Other (describe):

d. Has this levee/floodwall system been certified by a Federal agency to provide protection from the base flood?

☐ Yes ☐ No

If Yes, by which agency?

e. Attach certified drawings containing the following information (indicate drawing sheet numbers):

1. Plan of the levee embankment and floodwall structures. Sheet Numbers:
2. A profile of the levee/floodwall system showing the Base Flood Elevation (BFE), levee and/or wall crest and foundation, and closure locations for the total levee system. Sheet Numbers:
3. A profile of the BFE, closure opening outlet and inlet invert elevations, type and size of opening, and kind of closure. Sheet Numbers:
4. A layout detail for the embankment protection measures. Sheet Numbers:
5. Location, layout, and size and shape of the levee embankment features, foundation treatment, floodwall structure, closure structures, and pump stations. Sheet Numbers:

2. Freeboard

a. The minimum freeboard provided above the BFE is:

Riverine

3.0 feet or more at the downstream end and throughout	☐ Yes	☐ No
3.5 feet or more at the upstream end	☐ Yes	☐ No
4.0 feet within 100 feet upstream of all structures and/or constrictions	☐ Yes	☐ No

Coastal

1.0 foot above the height of the one percent wave associated with the 1%-annual-chance stillwater surge elevation or maximum wave runup (whichever is greater).	☐ Yes	☐ No
2.0 feet above the 1%-annual-chance stillwater surge elevation	☐ Yes	☐ No

2. Freeboard (continued)

Please note, occasionally exceptions are made to the minimum freeboard requirement. If an exception is requested, attach documentation addressing Paragraph 65.10(b)(1)(ii) of the NFIP Regulations.

If No is answered to any of the above, please attach an explanation.

b. Is there an indication from historical records that ice-jamming can affect the BFE? ☐ Yes ☐ No

If Yes, provide ice-jam analysis profile and evidence that the minimum freeboard discussed above still exists.

3. Closures

a. Openings through the levee system (check one): ☐ exists ☐ does not exist

If opening exists, list all closures:

Channel Station	Left or Right Bank	Opening Type	Highest Elevation for Opening Invert	Type of Closure Device

(Extend table on an added sheet as needed and reference)

Note: Geotechnical and geologic data

In addition to the required detailed analysis reports, data obtained during field and laboratory investigations and used in the design analysis for the following system features should be submitted in a tabulated summary form. (Reference U.S. Army Corps of Engineers [USACE] EM-1110-2-1906 Form 2086.)

4. Embankment Protection

a. The maximum levee slope landside is:

b. The maximum levee slope floodside is:

c. The range of velocities along the levee during the base flood is: (min.) to (max.)

d. Embankment material is protected by (describe what kind):

e. Riprap Design Parameters (check one): ☐ Velocity ☐ Tractive stress
Attach references

Reach	Sideslope	Flow Depth	Velocity	Curve or Straight	Stone Riprap			Depth of Toedown
					D_{100}	D_{50}	Thickness	
Sta to								
Sta to								
Sta to								
Sta to								
Sta to								
Sta to								

(Extend table on an added sheet as needed and reference each entry)

4. Embankment Protection (continued)

f. Is a bedding/filter analysis and design attached? ☐ Yes ☐ No

g. Describe the analysis used for other kinds of protection used (include copies of the design analysis):

Attach engineering analysis to support construction plans.

5. Embankment And Foundation Stability

a. Identify locations and describe the basis for selection of critical location for analysis:

☐ Overall height: Sta. ; height ft.

☐ Limiting foundation soil strength:

Sta. , depth to

strength ϕ = degrees, c = psf

slope: SS = (h) to (v)

(Repeat as needed on an added sheet for additional locations)

b. Specify the embankment stability analysis methodology used (e.g., circular arc, sliding block, infinite slope, etc.):

c. Summary of stability analysis results:

Case	Loading Conditions	Critical Safety Factor	Criteria (Min.)
I	End of construction		1.3
II	Sudden drawdown		1.0
III	Critical flood stage		1.4
IV	Steady seepage at flood stage		1.4
VI	Earthquake (Case I)		1.0

(Reference: USACE EM-1110-2-1913 Table 6-1)

d. Was a seepage analysis for the embankment performed? ☐ Yes ☐ No

If Yes, describe methodology used:

e. Was a seepage analysis for the foundation performed? ☐ Yes ☐ No

f. Were uplift pressures at the embankment landside toe checked? ☐ Yes ☐ No

g. Were seepage exit gradients checked for piping potential? ☐ Yes ☐ No

h. The duration of the base flood hydrograph against the embankment is hours.

Attach engineering analysis to support construction plans.

E. LEVEE/FLOODWALL (CONTINUED)

Floodwall And Foundation Stability

a. Describe analysis submittal based on Code (check one):

☐ UBC (1988) or ☐ Other (specify):

b. Stability analysis submitted provides for:

☐ Overturning ☐ Sliding If not, explain:

c. Loading included in the analyses were:

☐ Lateral earth @ P_A = psf; P_p = psf

☐ Surcharge-Slope @ , ☐ surface psf

☐ Wind @ P_w = psf

☐ Seepage (Uplift); ☐ Earthquake @ P_{eq} = %g

☐ 1%-annual-chance significant wave height: ft.

☐ 1%-annual-chance significant wave period: sec.

d. Summary of Stability Analysis Results: Factors of Safety.

Itemize for each range in site layout dimension and loading condition limitation for each respective reach.

Loading Condition	Criteria (Min)		Sta	To	Sta	To
	Overturn	Sliding	Overturn	Sliding	Overturn	Sliding
Dead & Wind	1.5	1.5				
Dead & Soil	1.5	1.5				
Dead, Soil, Flood, & Impact	1.5	1.5				
Dead, Soil, & Seismic	1.3	1.3				

(Ref: FEMA 114 Sept 1986; USACE EM 1110-2-2502)

(Note: Extend table on an added sheet as needed and reference)

e. Foundation bearing strength for each soil type:

Bearing Pressure	Sustained Load (psf)	Short Term Load (psf)
Computed design maximum		
Maximum allowable		

f. Foundation scour protection ☐ is, ☐ is not provided. If provided, attach explanation and supporting documentation:

Attach engineering analysis to support construction plans.

7. Settlement

a. Has anticipated potential settlement been determined and incorporated into the specified construction elevations to maintain the established freeboard margin? ☐ Yes ☐ No

b. The computed range of settlement is ft. to ft.

c. Settlement of the levee crest is determined to be primarily from :

☐ Foundation consolidation
☐ Embankment compression
☐ Other (Describe):

d. Differential settlement of floodwalls ☐ has ☐ has not been accommodated in the structural design and construction.

Attach engineering analysis to support construction plans.

8. Interior Drainage

a. Specify size of each interior watershed:

Draining to pressure conduit: acres
Draining to ponding area: acres

b. Relationships Established

Ponding elevation vs. storage	☐ Yes	☐ No
Ponding elevation vs. gravity flow	☐ Yes	☐ No
Differential head vs. gravity flow	☐ Yes	☐ No

c. The river flow duration curve is enclosed: ☐ Yes ☐ No

d. Specify the discharge capacity of the head pressure conduit: cfs

e. Which flooding conditions were analyzed?

• Gravity flow (Interior Watershed)	☐ Yes	☐ No
• Common storm (River Watershed)	☐ Yes	☐ No
• Historical ponding probability	☐ Yes	☐ No
• Coastal wave overtopping	☐ Yes	☐ No

If No for any of the above, attach explanation.

f. Interior drainage has been analyzed based on joint probability of interior and exterior flooding and the capacities of pumping and outlet facilities to provide the established level of flood protection. ☐ Yes ☐ No

If No, attach explanation.

g. The rate of seepage through the levee system for the base flood is cfs

h. The length of levee system used to drive this seepage rate in item g: ft.

8. Interior Drainage (continued)

i. Will pumping plants be used for interior drainage? ☐ Yes ☐ No

If Yes, include the number of pumping plants:
For each pumping plant, list:

	Plant #1	Plant #2
The number of pumps		
The ponding storage capacity		
The maximum pumping rate		
The maximum pumping head		
The pumping starting elevation		
The pumping stopping elevation		
Is the discharge facility protected?		
Is there a flood warning plan?		
How much time is available between warning and flooding?		

Will the operation be automatic? ☐ Yes ☐ No

If the pumps are electric, are there backup power sources? ☐ Yes ☐ No

(Reference: USACE EM-1110-2-3101, 3102, 3103, 3104, and 3105)

Include a copy of supporting documentation of data and analysis. Provide a map showing the flooded area and maximum ponding elevations for all erior watersheds that result in flooding.

9. Other Design Criteria

a. The following items have been addressed as stated:

Liquefaction ☐ is ☐ is not a problem
Hydrocompaction ☐ is ☐ is not a problem
Heave differential movement due to soils of high shrink/swell ☐ is ☐ is not a problem

b. For each of these problems, state the basic facts and corrective action taken:

Attach supporting documentation

c. If the levee/floodwall is new or enlarged, will the structure adversely impact flood levels and/or flow velocities floodside of the structure?
☐ Yes ☐ No

Attach supporting documentation

d. 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:

Name of Structure:

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 acre-feet

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

Sediment transport rate (percent concentration by volume)

Method used to estimate sediment transport:

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:

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.

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.

- ***Form 2, Section A.5: Impacts of Sediment Transport on Hydrology***

  Erosion and sediment transport analysis is not covered by the scope of this study.

- ***Form 2, Section B.1: Effective Model Water Surface Elevations for Sunset Wash***
  To compare the downstream water surface elevations between the Effective Model and the Proposed Model, the Effective Model water surface elevation was interpolated at the proposed River Station (RS) 0.178. Since RS 0.718 is within RS 0.216 and RS 50.94, the water surface at RS 0.178 is interpolated between the bounding cross-section.

Original FIS (HEC-2) Model						Revised Conditions (HEC-RAS) Model	
River Station RS	Downstream Reach Length (ft)	Downstream Distance to RS 0.178 (ft)	WSE (ft) NAVD29	Datum Conversion Factor (ft)	WSE (ft) NAVD88	River Station RS	WSE (ft)
0.216	1141	55	2037.47	2.185	2039.66		
					2039.00	0.178	2035.89
50.94	0		2023.82	2.185	2026.01		

- ***Form 2, Section D.1***

  Refer to Appendix B.6 for the sample letter sent to property owners who will be affected by this study.

- ***Form 3, Section C.3***

  The structures along Sunset Wash, Sunset Wash Tributary 1 and Sunnycove Wash have been field surveyed by Hoskin Ryan Consultants, Inc.. The survey report signed by a land surveyor provides dimension, shape, material and other information regarding to these structures. Refer to Appendix C for a copy of the survey report.

- ***Form 3, Section D.4***

  Attached are the Dam Safety Inspection Report Letters for Sunset Dam and Sunnycove Dam documenting that there are no safety deficiencies.

JANICE K. BREWER
Governor

HERBERT R. GUENTHER
Director

ARIZONA DEPARTMENT OF WATER RESOURCES

3550 North Central Avenue, Second Floor
PHOENIX, ARIZONA 85012-2105

(602) 771-8500

July 12
~~June 18~~, 2010

Mr. Tom Renckly, P.E.
Structures Management Branch Manager
Flood Control District Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

RE: Sunnycove Dam (07.48)
April 5, 2010 Dam Safety Inspection Report
Finding of No Safety Deficiency

Dear Mr. Renckly:

Enclosed for your information and action is a copy of the Arizona Department of Water Resources (Department) report of the most recent inspection conducted by Nicole Spence-Gibson on April 5, 2010 on the above listed dam. Along with the enclosed invoice, please remit payment in the amount of $180.00 to:

Peggy Beckett
Arizona Department of Water Resources
Surface Water Division
3550 North Central Avenue
Phoenix, Arizona 85012

In compliance with Arizona Revised Statutes (A.R.S.) § 41-1009, this letter notifies you that the inspection found no safety deficiencies that must be corrected. The dam safety inspection report identifies maintenance and repair action items that need to be addressed at the dam before the next scheduled inspection. Please provide the Department a schedule of when you intend to do this work and also notify us in writing when you complete the items.

The Department has reviewed the size and hazard potential classifications for the dam. The classifications have not changed from small size and high hazard potential.

It is Department policy to review the License of Approval of each operating dam within state jurisdiction following its dam safety inspection. Based on the findings of the

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inspection and a review of our files, the License, issued July 23, 1986, requires no changes and remains in full force and effect.

The next inspection by the Department is tentatively scheduled for April 2011. We will contact you in advance to arrange a mutually convenient inspection date and time. Please notify the Department promptly of any unusual or alarming condition, which may occur at the dam.

If you or anyone connected this dam have any questions regarding this letter, please contact Nicole Spence-Gibson at (602) 771-8658.

Sincerely,

Michael Johnson, Ph.D., P.E.
Assistant Director & Chief Engineer
Surface Water Division

Enclosures:
1. Inspection Report & Photos
2. Invoice
3. Notification of Inspection and Due Process Rights

Printed on recycled paper. Each ton of recycled paper saves 7,000 gallons of water.

TRR
MOF

JANICE K. BREWER
Governor

HERBERT R. GUENTHER
Director

ARIZONA DEPARTMENT OF WATER RESOURCES

3550 North Central Avenue, Second Floor
PHOENIX, ARIZONA 85012-2105
(602) 771-8500

May 12, 2010

Mr. Tom Renckly, P.E.
Structures Management Branch Manager
Flood Control District Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

RE: Sunset Dam (07.49)
April 5, 2010 Dam Safety Inspection Report
Finding of No Safety Deficiency

Dear Mr. Renckly:

Enclosed for your information and action is a copy of the Arizona Department of Water Resources (Department) report of the most recent inspection conducted by Nicole Spence-Gibson on April 5, 2010 on the above listed dam. Along with the enclosed invoice, please remit payment in the amount of $140.00 to:

Peggy Beckett
Arizona Department of Water Resources
Surface Water Division
3550 North Central Avenue
Phoenix, Arizona 85012

In compliance with Arizona Revised Statutes (A.R.S.) § 41-1009, this letter notifies you that the inspection found no safety deficiencies that must be corrected. The dam safety inspection report identifies maintenance and repair action items that need to be addressed at the dam before the next scheduled inspection. Please provide the Department a schedule of when you intend to do this work and also notify us in writing when you complete the items.

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It is Department policy to review the License of Approval of each operating dam within state jurisdiction following its dam safety inspection. Based on the findings of the

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If you or anyone connected this dam have any questions regarding this letter, please contact Nicole Spence-Gibson at (602) 771-8658.

Sincerely,

Michael Johnson, Ph.D., P.E.
Assistant Director & Chief Engineer
Surface Water Division

Enclosures:
1. Inspection Report & Photos
2. Invoice
3. Notification of Inspection and Due Process Rights

Printed on recycled paper. Each ton of recycled paper saves 7,000 gallons of water.

- ***Form 3, Section D.7***

  Attached is the Operation and Maintenance Plan for Sunset Dam and Sunnycove Dam.

OPERATION AND MAINTENANCE AGREEMENT
FOR
STRUCTURAL MEASURES

THIS AGREEMENT made on October 27, 1975 is between the Soil Conservation Service, United States Department of Agriculture, hereinafter referred to as the Service, and the following organization hereinafter referred to as the Sponsor:

Flood Control District of Maricopa County

The Sponsor and the Service agree to carry out the plan on the attached 4 pages for the operation and maintenance of structural measures in the

Wickenburg

Watershed Project, State of Arizona. The measures covered by this agreement are identified as:

Sunset Floodwater Retarding Dam
Sunnyrove Floodwater Retarding Dam
Buried Outlet Pipeline

Name of Sponsor: Flood Control District of Maricopa County

By: [signature] Title: Chairman, Board of Directors

This action was authorized at an official meeting of the Sponsor named immediately above on October 27, 1975 at Phoenix, Ariz.

Attest: [signature] Title: Clerk of the Board

Soil Conservation Service
United States Department of Agriculture

By: [signature]

Title: State Conservationist

OPERATION AND MAINTENANCE PLAN

I. OPERATIONS

The principal spillway at both structures are ungated and will allow the floodwaters above the sediment pool elevations to discharge into the outlet pipeline. However, the sediment pools are intended to be dry and routine operation will require opening the gated sediment pool drains after the water surface in the flood pool recedes to the elevation of the low-stage orifice in the principal spillway riser (the gated sediment pool drain may be opened at any time if the low-stage orifice becomes plugged). Routine operation also requires that the gated sediment pool drains be cleaned of sediment and debris and closed after the sediment pools have drained.

Any future development proposals to tie local storm drains into the outlet pipeline must be evaluated prior to approval.

II. MAINTENANCE

Proper functioning of the structural works will require regular periodic maintenance. All structures are to be maintained by making prompt repairs to structures or structural features damaged by floods. The following items of maintenance are anticipated and should be made a part of a regular inspection and maintenance program:

1. Sunset FRS

   a. Trash and obstructions must be removed from the principal spillway trash racks and low-stage orifice.

   b. It is anticipated that some continual riprap maintenance may be necessary in the emergency spillway SAF basin and outlet channel.

   c. It is intended that the soft plug section of the chain link fence below the SAF basin should collapse whenever the emergency spillway operates. This section of fence will need to be erected again or replaced if damaged.

2. Sunnycove FRS

   a. Trash and obstructions must be removed from the principal spillway trash racks and low-stage orifice.

   b. Some erosion is expected in the emergency spillway outlet channel downstream of the control section whenever it operates. It should be inspected annually and after every operation of the emergency spillway. Any damage near the vicinity of the control section should be evaluated to determine if repair action should be initiated.

II. MAINTENANCE (Continued)

3. Outlet Pipeline

a. Most of the floodwater sediment entering the reservoir will be trapped and allowed to accumulate in the sediment pools (assumed trap efficiency - 100 percent at Sunset, 95 percent Sunnycove). It is intended that the sediment that is not trapped in the reservoirs will accumulate in the sediment traps located in the outlet pipelines. Some sediment is expected to enter the outlet pipeline whenever the principal spillways function and whenever the sediment pools are drained. The sediment traps in the outlet pipeline should be inspected annually and all accumulated sediment removed after every discharge.

b. It is anticipated that some continual riprap maintenance may be necessary adjacent to the pipeline outlet structure. The sediment trap at the end of the outlet pipeline should be inspected after each local storm event to assure that debris and sediments from local runoff are not allowed to accumulate in the outlet structure.

III. ESTABLISHMENT PERIOD

1. During an Establishment Period, as herein defined, the Service will bear such part of the cost of any needed major repairs to structural measures, including associated vegetative work, as is proportionate to the original construction costs borne by the Service in the construction of the structural measures except that the Service will not bear any of the cost for:

a. Repairs to channels or portions thereof which do not have permanent linings such as concrete, riprap, or grouted rock.

b. Repairs determined by the Service to have been occasioned by improper operation or maintenance, or both.

c. Repairs applicable to municipal or industrial water supply or to any other purpose for which construction costs are not authorized to be paid for in whole or in part with funds appropriated to the Service.

d. Repairs that are mutually determined by the Sponsor and the Service as being items of normal maintenance rather than major repair and are not therefore in keeping with the spirit and intent of the Establishment Period provisions.

III. ESTABLISHMENT PERIOD (Continued)

2. The Establishment Period for structural measures (exclusive of any associated vegetative work) is a period of three years ending at midnight on the third anniversary of the date on which the structural measure is accepted.

3. The Establishment Period for vegetative work associated with a structural measure is a period from date of acceptance of the initial vegetative work to midnight of the date on which the Service writes the Sponsor advising that an adequate vegetative cover has been obtained.

4. As used in the two preceding paragraphs, and elsewhere in the Plan, the following words have the meanings described below:

   ACCEPTED, ACCEPTANCE: The date structural or vegetative measures are accepted from the contractor when a contract is involved, or the date structural or vegetative measures are completed to the satisfaction of the Service when force account operations are involved.

5. Major repair may involve such things as (1) repairing separated joints, cracks or breaks in the principal spillway, (2) correcting seepage, (3) replacing significant backfill around structures resulting from major erosion damage, (4) major revegetation due to failure to obtain an adequate vegetative cover, and (5) restoring areas with significant erosion caused by unusual flow (volume, recurrence or extended period of time) in emergency spillways.

6. No action with respect to needed repairs during the Establishment Period will be taken by the Sponsor or the Service which would lessen or adversely affect any legal liability of any contractor or his surety for payment of the cost of the repairs.

IV. INSPECTIONS AND REPORTS

1. During the Establishment Period the Sponsor and the Service will jointly inspect the structural measures at least annually and after unusually severe floods or the occurrence of any other unusual condition that might adversely affect the structural measures. It is desirable tthe annual inspections be performed during the month shown below. Any supplemental inspections then determined necessary will be scheduled and agreed to at that time.

October
Month

IV. INSPECTIONS AND REPORTS (Continued)

2. After the Establishment Period the structural measures will be inspected annually by the Sponsor, preferably during the month shown below, and after unusually severe floods or the occurrence of any other unusual condition that might adversely affect the structural measures.

October
(Month)

3. After the Establishment Period the Service may inspect the structural measures at any reasonable time.

4. A written report will be made of each inspection. The report of joint inspections will be prepared by the S ponsor with the assistance of the Service. A copy of each report will be provided by the party preparing the report to the other party within ten days of the date on which the inspection was made.

V. RECORDS

The Sponsor will maintain in a centralized location a record of all inspections performed both individually and jointly by the Sponsor and the Service, and of all significant actions taken by the Sponsor with respect to operation and maintenance. The Service may inspect these records at any reasonable time.

VI. GENERAL

1. The Sponsor will:

   a. Prohibit the installation of any structures or facilities that will interfere with the operation or maintenance of the structural measures.

   b. Obtain prior Service approval of the plans and specifications for any alteration or improvement to the structural measures.

   c. Obtain prior Service approval of any agreement to be entered into with other parties for the operation or maintenance of all or any part of the structural measures, and provide the Service with a copy of the agreement after it has been signed by the Sponsor and the other party.

2. Service personnel will be provided the right of free access to the structural measures at any reasonable time for the purpose of carrying out the terms of this Plan.

IV. GENERAL (Continued)

3. The responsibilities of the Sponsor under this Plan are effective simultaneously with the acceptance of the works of improvement in whole or in part.

VII. SPECIAL PROVISIONS

1. The Sponsor will:

Hold and save the United States free from any and all claims and damages arising from the construction, maintenance and operation of any road in, on, or across works of improvement constructed with Federal assistance pursuant to Public Law 83-566, or the failure to fully close and relocate any such road in accordance with State law.

3 Survey and Mapping Information

A separate *Survey Report* prepared by Hoskin-Ryan Consultants (Ref. 27) is included as Appendix C. Information in this section is a summary of the detailed information found in the survey report.

3.1 Field Survey Information

3.1.1 Structures

Field survey of major existing roadway culvert structures was conducted in December 2010, to supplement the topographic mapping. All structures surveyed were documented in a manner consistent with the requirements in the *FEMA Guidelines and Specifications for Flood Hazard Mapping Partners* (Ref. 14), and are documented in Appendix C. Control Points were provided by the National Geodetic Survey, via the Maricopa County Department of Transportation (MCDOT) website.

3.1.2 Railroad

A field survey of drainage structures crossing the Burling Northern Santa Fe (BNSF) Railroad was conducted in March 2011. Survey included top of rail, culvert and trestle dimensions and flow line elevations. Refer to Appendix C for survey field notes.

3.1.3 Sunset and Sunnycove Dams

Recent surveys conducted by the District of the impoundment areas behind the Sunset and Sunnycove Dams were provided for use in this study (Ref. 49). The impoundment volumes provided were checked against those computed using the 2004 topographic mapping. Since both maps are consistent, the 2004 topographic mapping was selected for calculation of the impoundment volumes behind the dams.

3.1.4 Finished Floor Elevations

Finished floor elevation surveys were performed for 31 homes adjacent to, or within, the delineated floodplains of Sunset and Sunnycove Washes. The intent of the surveys was primarily as justification for refinement of the floodplain delineation boundary. Results of the survey are documented in the Survey Report included as Appendix C.

3.2 Mapping

Topographic mapping data from the Wickenburg Mapping Project (FCD 03-66), dated July 7th, 2004 (Ref. 50), was provided by the District and used to create 2-foot contour interval mapping. The vertical datum of the topographic data is NAVD88 and its geographic coordinate system is State Plane Arizona Central (NAD83).

4 Hydrology

4.1 Method Description

Hydrologic analyses were performed using the US Army Corps of Engineer's computer program HEC-1, Version 4.1, Flood Hydrograph Package in accordance with procedures and parameters recommended in the District's *Drainage Design Manual for Maricopa County, Volume I, Hydrology* (Ref. 19). Hydrologic Models for Phase 1 are as follows:

- 500-year; 6-hour Existing Condition
- 100-year; 6-hour and 24-hour Existing Condition
- 50-year; 6-hour Existing Condition
- 10-year; 6-hour Existing Condition

Each model uses the Green and Ampt methodology to estimate rainfall losses, and the Phoenix Mountain S-graph for the unit hydrograph. Flow is routed using the Normal Depth routing option and ponding and storage is modeled for the two dams using level pool reservoir routing. The watershed sub-basins and the flow routing schematic for the runoff model are shown on Exhibit 2.

The study identified the 100-year, 6-hour and 24-hour peak discharges from which it was determined that that the 6-hour produces the highest discharge. The peak discharge from the 500-year storm event was also produced for the study.

4.2 Parameter Estimation

4.2.1 Drainage Area Boundaries

The watershed basin and sub-basin boundaries are shown on Exhibits 1 and 2, along with a schematic of the HEC-1 sub-basins and routings. Both Sunset and Sunnycove Washes are partially impounded by dams and they were therefore divided into upper and lower reaches. Sunnycove Wash drains to Sunset Wash, downstream

of both dams, and they have a combined watershed area of 2.5 square miles at the confluence with the Hassayampa River.

Using ArcGIS, a terrain model was created from the 2004 topographic mapping, which was then used to delineate the watershed basin and sub-basin boundaries. Adjustments were made to the sub-basin delineations, as necessary, based on aerial photography and field observations. Concentration points occur at the natural confluence of tributaries, at split flow locations, and where manmade drainage facilities or structures affect flow characteristics. Concentration points were also located at existing developments prone to flooding.

4.2.2 Watershed Work Maps

The work maps for this study include land use, soils, and routing on GIS layers and mapping provided by the District. The parameters used in the models, and the basin and routing information, are depicted in Exhibits 1 through 4. The Sunnycove Wash watershed is divided into six sub-basins and the Sunset Wash watershed into three sub-basins.

All sub-basins are named after the main wash or a prominent feature in the area using five or six digit alphanumeric characters. The first two to three characters identify the wash and watershed that the sub-basin is located within (e.g. Basin SC1 is located within the Sunnycove watershed). The remaining characters are numeric values that start at the upstream end of the sub-basin and increase in the downstream direction.

Channel routes are identified by an "R" followed by the wash name initials and the downstream operation. Storage Routings are identified by the word "DAM"

followed by the wash name initials, and diversions are identified by the word "DIV" followed by the wash name initials.

4.2.3 Gage Data

There are impoundment and precipitation gages at Sunset Dam and at Sunnycove Dam, both maintained by the District. Each gage has 21 years of record and the data is available on the District's website. Since stream gages are not available in the study area, calibration of the hydrology models was not conducted for Phase 1.

4.2.4 Statistical Parameters

The HEC-1 models were used to evaluate the hydrologic response of the study area to a range of precipitation events. Since wash gage stations are not available within the Phase 1 study area, a statistical analysis is not included. The runoff models were compared with the results from USGS and regional regression equations (see Section 4.5.2 and Appendix D.7)

4.2.5 Precipitation and Inflow Hydrographs

4.2.5.1 Precipitation

The District has recently decided to use the Mean Partial Duration Time Series point precipitation values from NOAA Atlas 14 (Ref. 32). This results in a decrease in precipitation values for most of Maricopa County, however for the ADMS/P watershed, the precipitation values increase by approximately ten percent.

Isopluvial maps of rainfall intensities contained in the NOAA Atlas 14, Precipitation-Frequency Atlas of the United States, Volume 1, Arizona (Ref. 32) are used for this study. Rainfall data from the District's GIS shape files are embedded in the District's DDMSW program. DDMSW was used to develop hydrologic models for the 10, 50, and 100-year events. Precipitation for the 500-year event was read from the NOAA 14 table and graphs extracted from the NOAA website: (http://hdsc.nws.noaa.gov/hdsc/pfds/sa/az_pfds.html) based on the geographic coordinates of the centroid of Phase 1 study area. The point values area summarized in Table 1, and precipitation table and graphs are provided in Appendix D.1.

Table 1 – Phase 1 Point Precipitation Values

Frequency and Duration	Point Precipitation (inches)
2-Year, 6-Hour	1.42
2-Year, 24-Hour	1.93
100-Year, 6-Hour	3.32
100-Year, 24-Hour	4.42
500-Year, 6-Hour	4.20
500-Year, 24-Hour	5.54

4.2.5.2 Distribution Pattern

This study delivers HEC-1 modeling for the 6-hour storm distribution for the 10-, 50-, 100-, and 500-year storm events. In addition, the 24-hour storm distribution model was established for a comparison with the 6-hour storm distribution.

Typically, the 6-hour storm distribution is used for drainage areas of less than 20 square miles except for on-site storage facilities (Ref. 20). The 6-

hour distribution may also be used for drainage areas between 20 square miles and 100 square miles to estimate the peak flood discharges that could be realized on watersheds due to the occurrence of a local storm critically centered over part or the entire watershed.

The Maricopa County 6-hour local storm distributions consist of five dimensionless storm patterns as shown in Table 2.4 of the *Hydrology Manual* (Ref. 19). Pattern 1 has the greatest rainfall intensities that can be expected in the eye of a local storm. Given that Phase 1 is a small watershed of 2.5 square miles, Pattern 1 is appropriate and is therefore used for the ADMS/P hydrology.

The 24-hour storm SCS Type II distribution is used for flood studies in Maricopa County for watershed areas between 20 and 500 square miles. This distribution is listed in Table 5 of the District's *Hydrology Manual* (Ref. 19).

4.2.5.3 Depth-Area Reduction

Depth-Area reduction was applied using the JD record option of HEC-1 and is based on the curves presented in Tables 2.1 and 2.2 of the *Hydrology Manual* (Ref. 19). The DDMSW program has these curves embedded in it.

4.2.6 Physical Parameters

4.2.6.1 Soils and Land Use

Detailed digital soil survey data is from the Natural Resources Conservation Service (NRCS), as provided by the District. The soils maps and data for the Wickenburg ADMS/P are compiled from this source.

The existing 2010 land use dataset developed by MAG was refined for use in the hydrologic analysis. There are 38 different MAG land use categories that do not directly correlate to the 17 shown in Table 4.2 of the District's Hydrology Manual (Ref. 19). Since the DDMSW program utilizes MAG land use categories, and provides Green and Ampt parameters for each category, the MAG land use categories are used in this study instead of Table 4.2 of the District's Hydrology Manual (Ref. 19).

The soil texture and land use data provide information regarding rainfall infiltration, which is discussed in the next section.

4.2.6.2 Rainfall Losses – Green-Ampt Infiltration

The Green-Ampt infiltration equation was selected to calculate the rainfall losses. Two phases are involved by using the Green-Ampt method. The first phase is surface retention loss, which is represented by a parameter called initial abstraction (IA) in HEC-1. The initial abstraction is a function of land use. The DDMSW program provides initial abstraction for each category of land use.

The second phase simulates the infiltration of rainfall into soil. The Green-Ampt equation, which is represented as follows, takes into account the soil suction head, porosity, hydraulic conductivity and time.

$$f = XKSAT\left(1 + \frac{PSIF \cdot DTHETA}{F}\right)$$

$$f = \frac{dF}{dt}$$

where f = infiltration rate (inches/hour)

XKSAT=saturated hydraulic conductivity (inches/hour)

PSIF=wetting front capillary suction (inches)

DTHETA=soil moisture deficit, pre-condition

F=accumulated infiltration depth (inches)

The saturated hydraulic conductivity (XKSAT) for bare ground conditions varies with soil texture and is provided by the DDMSW program. The DDMSW program adjusts the XKSAT values for vegetation cover and land use for each sub-basin. The wetting front capillary suction (PSIF) is also a function of soil texture and decreases with XKSAT. The DDMSW program calculates the PSIF from XKSAT based on their relationship depicted in Figure 4.3 of the District's Hydrology Manual (Ref. 19).

The soil moisture deficit (DTHETA) is a function of land use and is computed by the DDMSW program. Observation of the aerial photographs shows that some land use types within the study area have different soil moisture deficits from their default values. When necessary, adjustments are made by adding new land use categories with reasonable DTHETA values. These new categories are provided in Appendix D.2.

For the impervious area of a sub-basin, no infiltration occurs. A default percentage of impervious area (RTIMP) for each land use type is provided in the DDMSW program. However, some land use types within the study area exhibit different impervious percentages from their default values. Adjustments were made by adding new land use categories with reasonable RTIMP values. These new categories could be found in Appendix D.2.

4.2.6.3 Unit Hydrograph

The four S-graphs appropriate for use within Maricopa County are Phoenix Mountain, Phoenix Valley, Desert/Rangeland, and Agricultural S-graphs. Given the terrain of the study area, the Phoenix Mountain S-graph was selected to generate the unit hydrographs within each sub-basin. The lag time is required to obtain the unit hydrograph from the S-graph.

Per the District's Hydrology Manual, lag time is computed using the following equation:

$$Lag = 24K_n\left(\frac{L \cdot Lca}{S^{0.5}}\right)^{0.38}$$

Lag = basin lag in hours

K_n = mean Manning's n for channels within the basin

L = length of the longest watercourse in miles

Lca = length along the watercourse to a point opposite the centroid in miles

S = watercourse slope in feet per mile

The DDMSW program calculates the Kn for the drainage basins based on the land use types within the sub-basin. The Kn values for the land use types added to the DDMSW program were estimated based on the aerial photographs and terrain mapping.

The longest watercourses for each sub-basin were traced using the terrain model produced from the 2004 mapping. Lca values for all sub-basins

were calculated by identifying their centroids. The watercourse slopes were calculated using ArcGIS tools.

4.2.7 Reach Routing

The Normal Depth Routing Method was used for routing hydrographs within Phase 1. It is the preferred method for most applications in Maricopa County and can be used for both natural and artificial channels, in both urbanized and non-urbanized watersheds. This method simulates attenuation due to overbank storage.

Longitudinal slopes and Manning's "n" values for the routing reaches were estimated based on the topographic mapping, aerial photographs, and field observations. Worksheets for "n" value calculations are located in the Field Reconnaissance Report, included as Appendix G (Ref. 26). These worksheets show tabulated reach routing parameters and Cross-Section sketches with "n" value estimations. The "n" values for the routing reaches do not vary between the different storm durations or development conditions models because the roughness for these well-defined channels does not change appreciably with varying depths of flow.

A spreadsheet was created to verify the NSTPS time step values calculated using the DDMSW program (Appendix D.3). The NSTPS values were calculated for the 100-year 6-hour event using the following equation:

$$NSTPS = \frac{Reach\ Length}{Celerity \times Time\ Step \times 60}$$

$NSTPS$ = time steps

$Reach\ Length$ = reach routing length

$Celerity = \partial Q / \partial A$, for a rectangular channel it is 5/3 of normal velocity. This ratio is also used to estimate the celerity in the spreadsheet.

$Time\ Step =$ 3 minutes for this study

4.2.8 Storage Routing

Typically, the capacity of existing roadway culverts in the area will be exceeded under 100-year or smaller flood events. Since these roadway crossings do not have much upstream storage capacity they do not have an effect on the peak flows downstream. Therefore, roadway crossings are not modeled in the HEC-1 model, and flow is assumed to continue downstream unimpeded.

Stage-storage-discharge relationships were developed the for Sunnycove and Sunset Dams. The stage-storage relationships provided for each dam were derived from the 2004 topographic mapping. Construction plans for each dam and outflow pipe are the basis for the stage-discharge relationship, prepared in the SITES (Ref. 46) model.

The HEC-1 models for entire Phase I watershed were built with JD records to reflect area-depth relationship. However, these models with the JD records do not calculate the water surface elevations for the storage routing. Therefore, in order to get the flood pool elevations, a separate HEC-1 model was built without the JD records, to just route the hydrograph through the dams and obtain the flood pool elevations. The hydrograph was retrieved through a DSS data file. All HEC-1 models are included in Appendix D.

The Principal Spillway of each dam has an un-gated orifice that allows the floodwaters above the sediment pool elevations to discharge into the outlet pipeline, and a gated orifice at the reservoir bottom to drain the sediment pool. At the commencement of a precipitation event, the sediment pools are anticipated to be dry. If at any time the un-gated orifice becomes clogged, the gated sediment pool drain may be opened.

4.2.8.1 Sunset Dam

Sunset Dam, located on Sunset Wash, was designed and constructed by NRCS to protect portions of the Town of Wickenburg from flooding. The construction of the dam was completed in April 1975.

The dam is an earth-fill structure with a crest length of 488 feet and a crest width of 14 feet. The embankment , with a height of 30.5-feet, has an upstream slope of 3:1 and a downstream slope of 2:1. The dam reservoir capacity is 80.53 acre-feet (2004 data) at the emergency spillway crest elevation of 2133.2 feet (NAVD88). The storage capacity includes an additional 10.81 acre-feet of sediment storage for the 100-year life of the structure (Ref. 29). The dam reservoir does not have a permanent pool and is designed to detain the 100-year runoff.

The Principal Spillway structure is an intake tower (two-way riser) attached with a perforated gate well. The flow into the intake tower is controlled by a 9-inch by 9-inch low stage orifice at elevation 2122.2 feet (NAVD88) and a high stage spillway weir at elevation 2133.2 feet. The 9-inch by 9-inch orifice was designed to drawdown the 100-year reservoir pool in

less than ten days to the sediment pool elevation of 2122.2 feet. The perforated gate well is a 60-inch CMP with its top flush with the sediment pool. A gated orifice of 18-inch diameter, at the reservoir bottom of 2113.5 feet, controls flow from the gate well into the intake tower. The gated orifice was designed to drain the sediment pool. The intake tower connects to a 30-inch outlet pipe. Discharge through the 30-inch pipe conduit enters a relief manhole immediately downstream toe of the dam and is then conveyed through a pipeline system jointly used by Sunnycove Dam to an outfall in the Hassayampa River, approximately 1.5 miles downstream. Flow in excess of the pipeline capacity leaves the relief manhole and travels as surface flow.

The emergency spillway is a 40-feet wide, uncontrolled reinforced concrete structure constructed on top of the dam embankment with a crest elevation of 2133.2 feet. It consists of an entrance control structure, a straight chute and a stilling basin with baffle blocks. The emergency spillway conveys the runoff to a discharge point just downstream of the dam. The emergency spillway has a discharge capacity of 3,400 cfs and can pass the PMF flow of 3,907 cfs with 0.3 feet of freeboard (Ref. 29).

4.2.8.2 Sunnycove Dam

Sunnycove Dam, located on Sunnycove Wash, was also designed and constructed by the NRCS to protect downstream portions of the Town of Wickenburg. The dam embankment has the following physical characteristics: earth-fill structure, crest length of 714 feet, crest width of 14 feet, upstream

slope of 3:1, downstream slope is 2:1 and a maximum height of 48.5 feet (Ref. 28).

The Principal Spillway structure is an intake tower (two-way riser) attached with a perforated gate well. The flow into the intake tower is controlled by a 8-inch by 8-inch low stage orifice at elevation 2150.2 feet (NAVD88) and a high stage spillway weir at elevation 2171.7 feet. The 8-inch by 8-inch orifice was designed to drawdown the 100-year reservoir pool in less than ten days to the sediment pool elevation of 2150.2 feet (Ref. 28). The perforated gate well is a 60-inch CMP with its top flush with the sediment pool at 2150.2 feet. A gated orifice of 18-inch diameter, at the reservoir bottom of 2130.2 feet, controls flow from the gate well into the intake tower. The gated orifice was designed to drain the sediment pool. The intake tower connects to a 30-inch outlet pipe. Discharge through the 30-inch pipe conduit enters the relief manhole immediately downstream toe of the dam and is then conveyed through the pipeline system jointly used by Sunset Dam to an outfall in the Hassayampa River, approximately 1.5 miles downstream. Flow in excess of the pipeline capacity leaves the relief manhole and travels as surface flow.

The emergency spillway is a 100-feet wide, uncontrolled earth-lined channel constructed though a narrow ridge located 200 feet north of the abutment. The emergency spillway conveys the runoff to a discharge point several hundred feet below the downstream toe of the dam. The emergency spillway has a discharge capacity of 6,300 cfs and can pass the PMF flow of 7188 cfs with 0.7 feet of freeboard (Ref. 28).

The dam reservoir capacity is 216.92 acre-feet at the emergency spillway crest elevation, calculated from the 2004 mapping data. In addition, it provides 19.28 acre-feet of sediment storage for the 100-year life of the structure. The dam reservoir does not have a permanent pool and is designed to detain the 100-year runoff. The Principal Spillway is designed to empty the accumulated 100-year runoff within ten days.

4.2.9 Flow Splits and Diversions

The Principal Spillways of Sunnycove and Sunset Dams are connected to a pipeline system that outlets to Sunset Wash at the railroad, just upstream of its confluence with the Hassayampa River. Information was collected from the Pipeline As-Built Plans (Refs. 40, 41, 42), on which the Pipeline Schematic Map is based. The elevations on the as-built plan were increased by a datum difference of +2.2 feet, to convert from the National Geodetic Vertical Datum of 1929 (NGVD29) to the North American Vertical Datum of 1988 (NAVD88).

As shown on the Pipeline Schematic Map, the Principal Spillways, i.e. two-way riser structures, are connected to the release manholes immediate downstream of the dams through 30-inch conduits. Pipelines collect flow from two release manholes and then combine at a joint manhole, ultimately releasing at the outlet manhole located within Sunset Wash east of the railroad.

The pipeline system is composed of pipes sizing from 15-inch to 30-inch in diameter. When the Principal Spillway outflow exceeds the capacity of the pipeline system, the excess flow is released at the manhole immediately downstream of each dam. The pipeline capacity was calculated assuming the upstream ends of hydraulic

grade lines are exactly at the crests of the two release manholes. It is estimated that the pipeline capacities are 17.1 cfs for Sunset Dam and 19.5 cfs for Sunnycove Dam. The calculations and the Pipeline Schematic Map are provided in Appendix D.5.

In the hydrology models, the flow conveyed by the pipeline system is diverted to the confluence at the Hassayampa River using Kinematic Wave routing. The remaining flow, i.e. the combination of the excess flow from the release manhole and the flow from the emergency spillway, is routed along the existing washes using Normal Depth Routing.

4.2.10 SITES Model

The District developed the riser hydraulics relationships using the SITES computer model, and provided the stage-discharge curves for this study for both Sunset and Sunnycove Dam (Appendix D.4).

The capacity of the Principal Spillway for each of Sunset and Sunnycove Dams is controlled by the orifice and weir flow when the water surface elevation starts to rise above the orifice and spillway crest. As the water surface elevation rises, the friction of the 30-inch conduit increases dramatically and controls the outlet flow. Detailed calculations are simulated by SITES models and results are provided by the District.

The SITES Water Resource Site Analysis program was developed by NRCS (Ref. 46) to analyze the hydrology and hydraulics for designs of NRCS dams and ponds. The program estimates watershed runoff using curve numbers and develops unit hydrograph based on the dimensionless curve documented in the National Engineering Handbook, Chapter 16 (Ref. 44). The program determines principal spillway rating curves by standard weir, orifice and pipe flow formulas documented in

the National Engineering Handbook, Section 5 (Ref. 45). The program can also develop emergency spillway rating curves using one of four encoded methods. The program was developed to analyze the stability and integrity of emergency spillways.

4.3 Problems Encountered During the Study

No special problem was encountered. No warning or error messages occur in the models.

4.4 Calibration

There are two impoundment gages but no stream gage within the study area, therefore, no calibrations are made.

4.5 Final Results

4.5.1 Hydrologic Analysis Results

Hydrologic models were prepared for the 10-year, 6-hour, 50-year, 6-hour, 100-year, 6- and 24-hour and 500-year, 6-hour storm events for the existing condition using the NOAA 14 precipitation results for each. As expected for a small watershed like the Phase 1 watershed, the 6-hour storm produces higher peak discharges than the 24-hour storm, and was therefore selected for the floodplain delineations. HEC-1 output for each model is included in Appendix D.6, and the peak flow rates used in the floodplain delineation are summarized in Tables 2 and 3. Refer to Exhibit 5 for the Flow Map.

In general, the flow obtained is higher than the WADMS. Selected concentration points are shown for comparison in Tables 2 and 3. The increase in flow can be attributed to: (1) increased precipitation of NOAA 14 in comparison with NOAA 2; and (2) increased development in the area. The development downstream of

the two dams results in an increase in impervious coverage from 6.1% (Basin SAD8) to 20.2% (average of Basin SN2, SN3 and SC6) in this study.

Table 2 – 100-Year Hydrologic Results Summary for Sunnycove Wash

HEC-1 I.D.	100-Year Peak Discharge (cfs)	Time to Peak Discharge (hr)	Contributing Drainage Area (sq. mi.)
SC1	1006	4.25	0.56
SC2	288	4.10	0.10
SC3	427	4.15	0.20
SC4	663	4.30	0.38
SC5	372	4.15	0.15
SC6	326	4.10	0.11
C1	1048	4.30	0.66
C2	1322	4.25	0.86
C3	1542	4.55	1.39
C4	326	4.10	0.11

Table 3 – 100-Year Hydrologic Results Summary for Sunset Wash

HEC-1 I.D.	100-Year Peak Discharge (cfs)	Time to Peak Discharge (hr)	Contributing Drainage Area (sq. mi.)
SN1	927	4.30	0.60
SN2	493	4.20	0.26
SN3	557	4.15	0.22
C5	493	4.20	0.26
C6	770	4.15	0.37
C7	1146	4.20	0.59

4.5.2 Verification of Results

Two methods were used to verify the peak discharges, comparison with USGS data for Arizona, and comparison with regional regression equations.

4.5.2.1 USGS Data for Arizona

The District has adopted a chart to describe the general relationship between peak discharges and watershed size for Maricopa County (Ref. 19). This relationship is based on Log-Pearson Type 3 (LP3) regression curve analysis using USGS streamflow and statistical data taken from 314 continuous or partial-record gage stations throughout Arizona, and is a

function of drainage area. The peak discharges from the HEC-1 output were plotted on the chart for comparison, as shown in Figure 4A, and lie within the 75th percentile confidence limits. Detailed results are included in Appendix D.7.

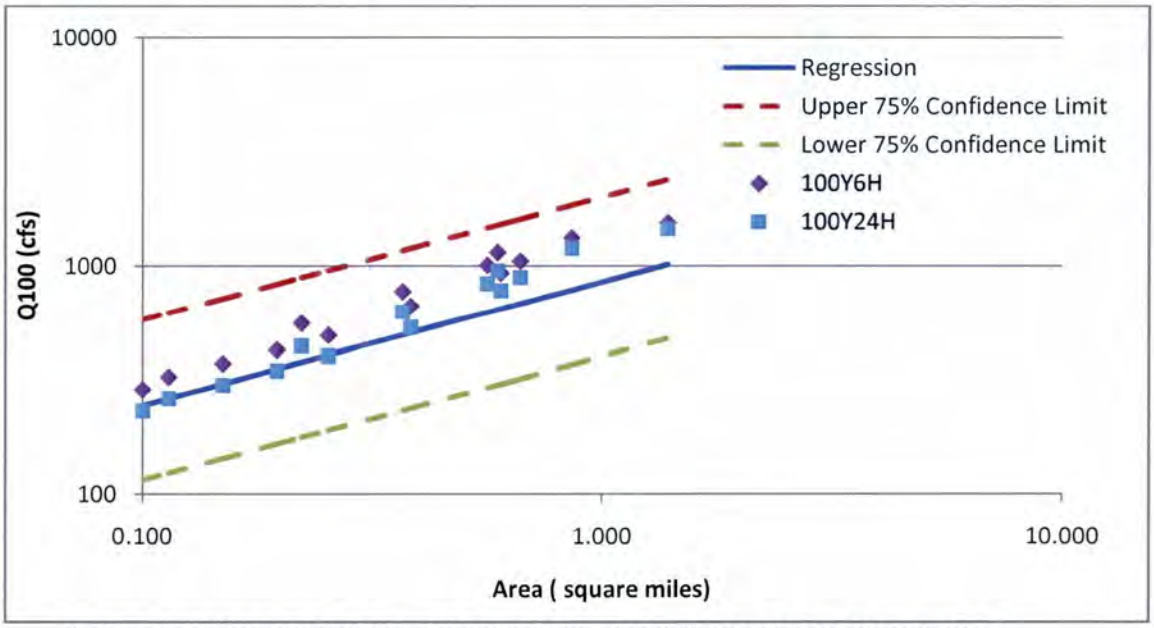


FIGURE 4A – COMPARISON OF 100-YR HEC-1 OUTPUT WITH USGS DATA FOR ARIZONA

4.5.2.2 Regional Regression Equations

The second method used to verify results was comparison with USGS Regional Regression Equations. The Region 12 regression equations are a function of drainage area and elevation. Based on the terrain model, the average elevation for the project area is 2227.8 feet (NAVD88). Figures 4B, 4C, and 4D show the comparison with the 10-Year, 50-Year, and 100-Year output, respectively. Based on the comparison, the HEC-1 output results are significantly higher than the regional regression results for the 10-year event, but are reasonable close for the 50-year and 100-year events. Detailed results are included in Appendix D.7.

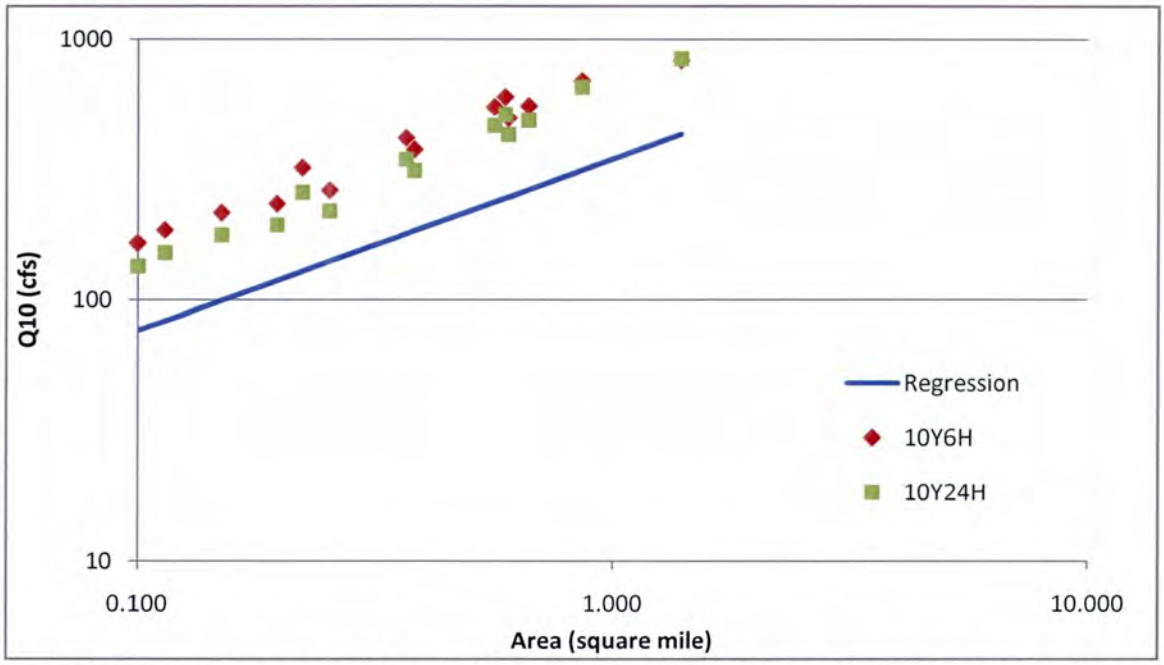


FIGURE 4B – COMPARISON OF 10-YR HEC-1 OUTPUT WITH USGS REGIONAL REGRESSION EQUATIONS

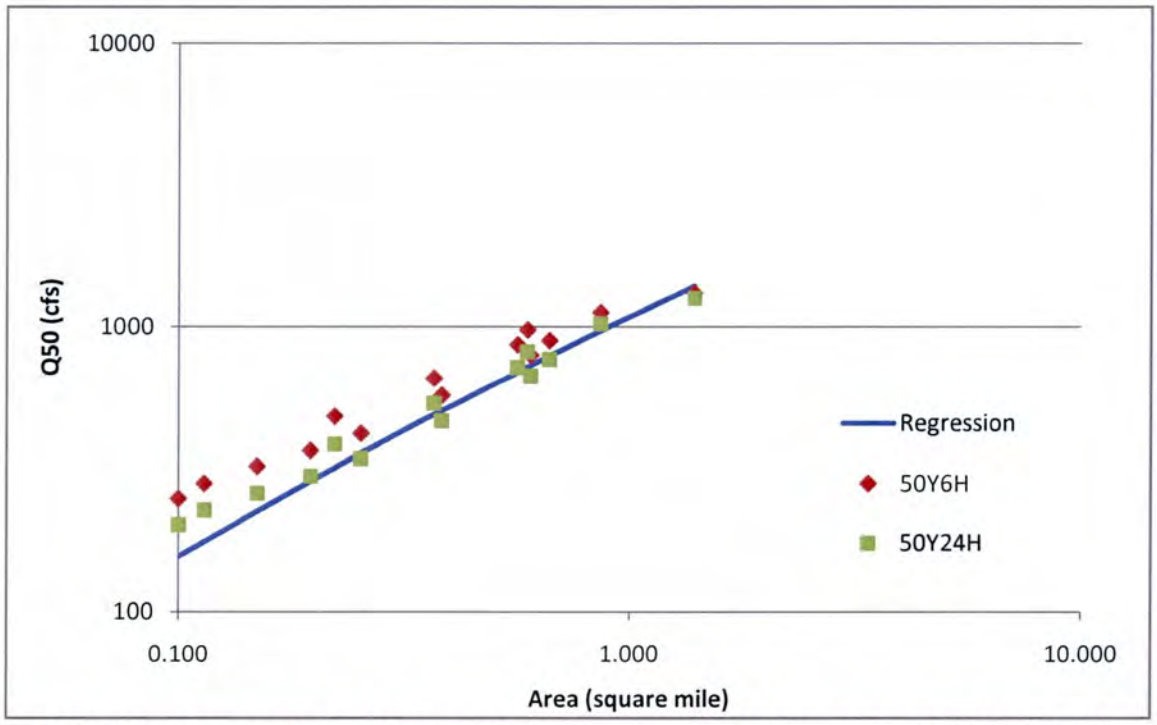


FIGURE 4C – COMPARISON OF 50-YR HEC-1 OUTPUT WITH USGS REGIONAL REGRESSION EQUATIONS

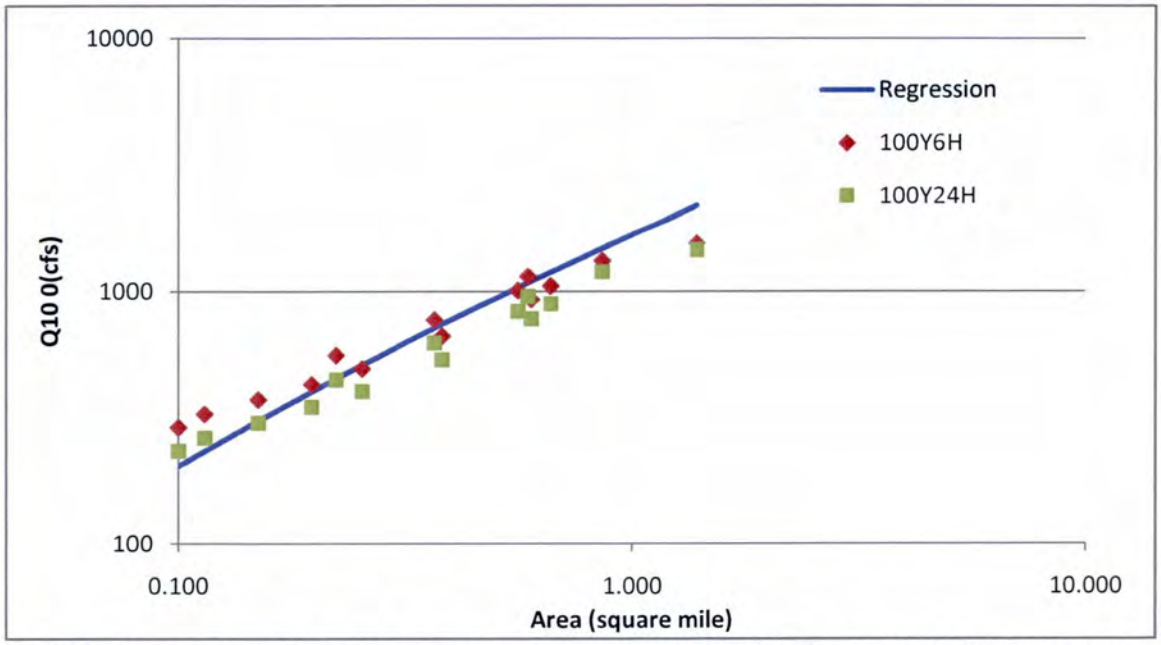


FIGURE 4D – COMPARISON OF 100-YR HEC-1 OUTPUT WITH USGS REGIONAL REGRESSION EQUATIONS

5 Hydraulics

5.1 Method Description

The effective Zone "AE" floodplain along the Phase 1 washes was previously delineated in the WADMS using HEC-2 hydraulic models. However, for this study the U.S. Army Corps of Engineers computer program, HEC-RAS version 4.0 (Ref. 38) is utilized to analyze the existing conditions 100-year floodplain along Sunset Wash, Sunset Wash Tributary 1, and Sunnycove Wash (Phase 1 Washes).

The downstream boundary condition for Sunnycove Wash - Reach 2 is based on the normal depth (S=0.020 ft/ft). Since the Sunnycove Wash - Reach 2 ends upstream of the Sunnycove FRS, the 100-year, 6-hour flood pool level of 2166.61-feet controls the floodplain delineation at Cross-Sections 0.937 to 0.642.

The downstream boundary condition for Sunnycove Wash - Reach 1 and Sunset - Reach 2 is the junction of the two washes (between Cross-Sections 0.022 and 0.828, respectively).

The downstream boundary condition for Sunset Wash - Reach 1 is based on the normal depth (S=0.0067 ft/ft). The first Cross-Section (RS 0.178) is located at Tegner Street, approximately 450-feet east of the BNSF railroad.

The downstream boundary condition for Sunset Wash - Reach 3 is based on the normal depth (S=0.02073 ft/ft). The downstream boundary condition for Sunset Wash - Tributary 1) is also based on the normal depth (S=0.00933 ft/ft). Since these two washes end upstream of the Sunset FRS, the 100-year, 6-hour flood pool level of 2130.99-feet controls the floodplain delineation at Cross-Sections 1.346, 0.009 and 0.076, respectively.

5.2 Work Study Maps

Work study maps are prepared for the Phase 1 washes at 1"=200' full-size scale, and are included in map pockets in the back of this report. Reduced-scale copies of the maps follow this section.

5.3 Parameter Estimation

5.3.1 Roughness Coefficients

Manning's roughness coefficients ('n'-values) are chosen based on values presented in the FCDMC *Drainage Design Manual for Maricopa County, Volume II – Hydraulics* (Ref 18) and the USGS *Selection of Manning's Roughness Coefficient for Natural and Constructed Vegetated and Non-Vegetated Channels* (Ref. 34). The range of 'n' values is summarized in Table 4. To give a representation of different segments of the study area, photographs and 'n'-value calculations are included in Appendix G.

Table 4 – HEC-RAS Manning's Roughness Coefficients

Location	Roughness Coefficient
Channel Banks	0.030-0.1
Channel Bottom	0.025-0.064
Concrete culverts	0.013
CMP Culverts	0.024

5.3.2 Expansion and Contraction Coefficients

Expansion and contraction coefficients are based on values presented in the FCDMC *Drainage Design Manual for Maricopa County, Volume II – Hydraulics* (Ref. 18). Contraction and expansion values of 0.3 and 0.1 are used for Cross-Sections without dramatic differences. For Cross-Sections before and after culverts (cross sections 2, 3 and 4), dramatic contraction and expansion cause a greater energy loss;

therefore, 0.5 and 0.3 are used for the expansion and contraction coefficients, respectively.

5.3.3 Entrance Loss Coefficients

Culvert entrance loss coefficients are based on values presented in the HEC-RAS *Hydraulic Reference Manual*, dated March 2008 (Ref. 39). The coefficients chosen are summarized in Table 5.

Table 5 – Entrance Loss Coefficients

Culvert ID	Wash Name	River Station	Road Crossing	Material	Shape	Entrance Type	Entrance Loss Coefficient
SUN_100	Sunnycove Wash - Reach 2	3.100	Steinway Drive	RCP	Circular	Headwall	0.5
SUN_200		1.137	Mariposa Drive	CMP	Circular	Headwall	0.5
SUN_500	Sunnycove Wash - Reach 1	0.269	Kellis Road	CMP	Circular	Projected from Fill	0.9
SUN_510		0.233	Cottonwood Road	CMP	Circular	Projected from Fill	0.9
SST_170	Sunset Wash - Reach 3	1.456	Mariposa Drive	CMP	Circular	Headwall	0.5
SST_200	Sunset Wash - Reach 1	0.732	Lincoln Street	CMP	Arch	Mitered to Slope	0.7
SST_300		0.663	Jackson Street	CMP	Arch	Mitered to Slope	0.7
SST_400		0.542	Mesquite Street	CBC	Box	Wingwalls flared (30-75 deg)	0.4
SST_500		0.264	BNSF Railroad	WOOD	Bridge	N/A	N/A
SST_120	Sunset Wash - Tributary 1	0.213	Private Driveway	CMP	Pipe Arch	Projected from Fill	0.7
SST_130		0.155	Private Driveway	CMP	Arch	Mitered to Slope	0.7
SST_140		0.135	Private Driveway	CMP	Arch	Mitered to Slope	0.7
SST_150		0.119	Private Driveway	CMP	Arch	Mitered to Slope	0.7
SST_160		0.082	Mariposa Drive	CMP	Arch	Headwall	0.7

5.4 Cross-Section Description

HEC-RAS geometry data is obtained from the two-foot contour interval topographic mapping provided by the District, dated 2004. Supplemental ground survey is provided by Hoskin-Ryan Consultants, Inc as documented in the Survey Report (Ref. 27). Elevations for the study are on the NAVD88 vertical datum.

Cross-Sections are located along the washes such that the distance between two consecutive sections is approximately 500-feet. Cross-Sections are placed perpendicular to the flow paths as much as possible. Additional Cross-Sections are provided upstream and downstream of culvert crossings, based on placement recommendations in the *HEC-RAS Hydraulic Reference Manual* (Ref. 39). HEC-RAS Cross-Section plots are located in Appendix E.5.4.

5.5 Modeling Considerations

5.5.1 Hydraulic Jump

No adjustments are made to the HEC-RAS model regarding hydraulic jump.

5.5.2 Culverts and Bridges

There are thirteen culverts and one bridge within Phase 1. The dimensions for these culverts are obtained from the field survey prepared by HRC. The box culverts are added to the HEC-RAS model. The majority of these culverts were not previously modeled in the WADMS. Refer to Table 6 for the box culvert summary. Also, refer Appendix G for the field survey information.

Table 6 – Culvert Summary

Culvert ID	Wash Name	River Station	Road Crossing	Material	Shape	Size	Length (ft)
SUN_100*	Sunnycove Wash - Reach 2	3.100	Steinway Drive	RCP	Circular	5 - 54"	50'
SUN_200		1.137	Mariposa Drive	CMP	Circular	3 - 48"	100'
SUN_500*	Sunnycove Wash - Reach 1	0.269	Kellis Road	CMP	Circular	1 - 24"	79'
SUN_510*		0.233	Cottonwood Road	CMP	Circular	2 - 24"	60'
SST_170*	Sunset Wash - Reach 3	1.456	Mariposa Drive	CMP	Circular	3 - 36"	82
SST_200*	Sunset Wash - Reach 1	0.732	Lincoln Street	CMP	Arch	3 - 20"x16"	47'
SST_300		0.663	Jackson Street	CMP	Arch	3 - 20"x16"	46'
SST_400		0.542	Mesquite Street	CBC	Box	1 - 10'x3'	47'
SST_500		0.264	BNSF Railroad	WOOD	Bridge	N/A	N/A
SST_120*	Sunset Wash - Tributary 1	0.213	Private Driveway	CMP	Pipe Arch	3 - 32"X24"	40'
SST_130*		0.155	Private Driveway	CMP	Arch	3 - 32"X24"	21'
SST_140*		0.135	Private Driveway	CMP	Arch	3 - 32"X24"	21'
SST_150*		0.119	Private Driveway	CMP	Arch	3 - 32"X24"	21'
SST_160*		0.082	Mariposa Drive	CMP	Arch	3 - 36"X24"	56'

Note: *Culverts not modeled in WADMS study.

5.5.3 Levees and Dikes

There are no levees or dikes modeled as part of this study.

5.5.4 Islands and Flow Splits

The landform within the study area is generally mountainous and some of the washes do not have the capacity to convey the 100-year, 6-hour flow within the top of banks. Also, street culvert crossings are not sized adequately to convey the 100-year, 6-hour storm event. As a result, there is the possibility for islands to be present and flow splits to occur.

There is a hill approximately eight feet high within properties adjacent to Sunset Wash between Cross-Sections 0.828 and 0.737. This hill is shown on Cross-Section 0.753 and on the Work Maps and Annotated Maps as an island.

There is a flow split in Sunset Wash at the Mesquite Road crossing (between Cross-Sections 0.570 and 0.537). At this location, the 1 - 10 feet x 3 feet concrete

box culvert (CBC) has a capacity of 185 cfs. The 100-year, 6-hour flow within Sunset Wash at this location is approximately 770 cfs. The flow in excess of the culvert capacity, overtops the road and splits to the south along Mesquite Street and to the east along the wash. A Manning's flow split calculation estimates that 186 cfs diverts to the south along Mesquite Street in the 100-year, 6-hour storm event. The diverted flow ultimately combines with the rest of the flow (in Sunset Wash) approximately 1,200-feet southeast of the culvert crossing. Refer to Appendix E.4 for the Structure Analysis and the Flow Split Calculations.

5.5.5 Ineffective Flow Areas

Ineffective flow is not modeled upstream and downstream of the culvert crossings since the 100-year flow overtops all the culvert crossings. Ineffective flow modeled upstream and downstream of the BNSF railroad crossing and at some other Cross-Sections is based upon recommended guidelines in the *HEC-RAS Hydraulic Reference Manual* (Ref. 39).

5.5.6 Supercritical Flow

There are no reaches of supercritical flow modeled as part of this study.

5.6 Floodway Modeling

The floodway modeling was performed on the previously studied washes in the WADMS; including Sunnycove Wash - Reach 2, Sunnycove Wash - Reach 1 and Sunset Wash - Reaches 1 and 2. No floodway modeling is performed on Sunset Wash - Reach 3 and on Sunset Wash Tributary 1.

For the first iteration of the floodway modeling, Encroachment Method #4 is used, then Encroachment Method #1, with floodway encroachment stations limited to the bank

stations. Encroachment limits were then modified as necessary to optimize the floodway WSE. Additional iterations are performed WSE as follows:

- Floodway WSE to be no greater than 1-foot above the floodplain WSE.
- Floodway WSE to have no negative surcharge.
- The floodway extends to be generally smooth and consistent within segments of the wash.

5.7 Problems Encountered During the Study

5.7.1 Special Problems and Solutions

There are two problem areas within the study area, described with solutions in detail below.

The first problem area is within Sunnycove Wash at the Kellis Road crossing (between Cross-Sections 0.279 and 0.216). The single 24-inch CMP culvert does not have capacity to convey the local runoff of 137 cfs. As a result, the runoff overtops the road with some of the flow splitting to the north along Kellis Road. The flow stays mainly within the road limits without affecting any properties. The flow merges back into the wash approximately 200-feet downstream of the culvert crossing.

To better represent the flow split, ineffective flow areas are included in the left over banks at RS 0.239 and RS 0.226. As a result, no flow split calculation is performed and the floodplain delineation represents the flow merging back into the main wash within a distance of 200-feet.

For the floodway delineation at RS 0.279, the left encroachment station is outside the floodplain limits because if the left encroachment station is adjusted to be

within the floodplain limits, the change in WSE becomes more than 1.00-foot. After many iterations, the encroachment station of 9968 (outside the floodplain limit station 9976.23) works best. This problem could be related to the flow split at the downstream culvert. Refer to the Modeling Warning and Error Messages (CHECK-RAS Structure, Item #6).in Appendix E.5.6 for an additional explanation of this problem.

The second problem area is within Sunset Wash between cross-sections 1.019 and 0.431. Within the given range, nine cross-sections were extended to contain the 500-year flow. Due to the cross-section orientation and the widening of the 500-year floodplain, it was impossible to extend four additional cross-sections (0.753, 0.737, 0.726 and 0.708). As a result, there cross-sections have extended water surface elevations. Refer to Appendix E.5 for the 500-year hydraulic calculations.

5.7.2 Modeling Warning and Error Messages

There are many modeling warning and error messages associated with HEC-RAS, including: Check-RAS NT, Check-RAS XS, Check-RAS Structures and Check-RAS Floodway. These warning and error messages do not affect the accuracy of the results. Refer to Appendix E.5.6 for the summary of the warning and error messages.

5.8 Calibration

No hydraulic modeling calibration was performed as part of this study.

5.9 Final Results

5.9.1 Hydraulic Analysis Results

The 100-year, 6-hour flows are modeled in the HEC-RAS computer program and used to delineate the floodplains. The resulting floodplain delineations are shown on the 100-Year Floodplain Work Maps (included in map pockets in the back of this report) and included at a reduced scale following this section.

The HEC-1 output is located in Appendix D.6. The 100-year, 6-hour HEC-1 flows used in the HEC-RAS model are summarized in Table 7. The flows used for Sunset Wash - Reach 3, Sunset Wash - Tributary 1 and portions of Sunnycove Wash - Reach 1 are pro-rated. Otherwise, flows are taken directly from selected concentration points in the HEC-1 model. Refer to Exhibit 6 for the pro-rated Sub-Basins and the flow summary table. The HEC-RAS results for the 100-year peak flows are summarized in Table 8. HEC-RAS output reports, tables, and Cross-Sections are included in Appendix E.5.

The 10-, 50-, 100- and the 500-year, 6-hour flow summary table used in the HEC-RAS model is included in Appendix E.5.3.

Table 7 – 100-Year Flows Used for HEC-RAS Modeling

Wash Name	HEC-1 I.D.	Peak Discharge (cfs)
Sunnycove Wash - Reach 2	SC1	1,006
	C1	1,048
	C2	1,322
	C3	1,542
Sunnycove Wash - Reach 1	SC6A	137*
	SC6	326
Sunset Wash - Reaches 1 & 2	SN2A	56*
	SN2	493
	C6	770
	C7	1,146-186=960**
	C7	1,146
Sunset Wash - Reach 3	SN1B	515*
Sunset Wash - Tributary 1	SN1A	412*

Note: *Pro-rated flow (Refer to Exhibit 6)
**Flow split (Refer to Appendix E.4)

Table 8 – HEC-RAS Results for 100-Year Event

Note: Elevations shown are on the NAVD88 Datum.

River Station (RS)	Peak Discharge (cfs)	Water Surface Elevation (ft)
Sunnycove Wash – Reach 2		
3.132	1006	2330.23
3.105	1006	2329.76
3.1	Culvert	
3.091	1006	2325.8
3.06	1006	2324.25
2.995	1006	2321
2.901	1048	2314.42
2.832	1048	2308.76
2.739	1048	2302.35
2.657	1048	2295.93
2.592	1322	2291.41
2.563	1322	2289.08
2.496	1322	2284.4
2.432	1322	2279.4
2.379	1322	2276.38
2.32	1322	2271.73
2.261	1322	2266.54
2.203	1322	2260.19
2.118	1322	2253.45
2.028	1322	2245.22
1.93	1322	2239.02
1.867	1322	2234.4
1.83	1542	2231.58
1.778	1542	2228.12
1.733	1542	2225.61
1.681	1542	2221.62
1.618	1542	2216.77
1.55	1542	2211.69
1.478	1542	2207.45
1.415	1542	2203.33
1.327	1542	2198.32
1.27	1542	2193
1.193	1542	2189.32
1.164	1542	2189.5
1.15	1542	2189.51
1.137	Culvert	
1.127	1542	2182.6
1.091	1542	2180.62
1.054	1542	2177.59

Table 8 (Continued) – HEC-RAS Results for 100-Year Event

Note: Elevations shown are on the NAVD88 Datum.

River Station (RS)	Peak Discharge (cfs)	Water Surface Elevation (ft)
Sunnycove Wash – Reach 2 (Continued)		
0.997	1542	2170.04
0.937	1542	2165.57
0.897	1542	2162.06
0.85	1542	2158.4
0.807	1542	2155.74
0.758	1542	2151.93
0.693	1542	2147.05
0.642	1542	2141.4
Sunnycove Wash - Reach 1		
0.4	137	2110.79
0.365	137	2107.72
0.34	137	2107.5
0.294	137	2105.57
0.279	137	2105.54
0.269	Culvert	
0.263	326	2103.15
0.245	326	2102.92
0.239	326	2102.85
0.233	Culvert	
0.226	326	2100.74
0.216	326	2098.92
0.194	326	2097.39
0.159	326	2094.3
0.089	326	2086.67
0.036	326	2081.54
0.022	326	2081.12
Sunset Wash – Reach 3		
1.902	515	2185.25
1.829	515	2179.12
1.777	515	2173.75
1.727	515	2168.87
1.694	515	2166.62
1.649	515	2162.06
1.616	515	2158.86
1.557	515	2154.08
1.502	515	2149.4
1.466	515	2149.48
1.456	Culvert	
1.447	515	2142.96

Table 8 (Continued) – HEC-RAS Results for 100-Year Event

Note: Elevations shown are on the NAVD88 Datum.

River Station (RS)	Peak Discharge (cfs)	Water Surface Elevation (ft)
Sunset Wash – Reach 3 (Continued)		
1.398	515	2137.34
1.346	515	2126.72
Sunset Wash - Reaches 1 & 2		
1.197	56	2110.86
1.17	56	2110.58
1.117	56	2103.65
1.019	56	2095.86
0.925	493	2087.17
0.88	493	2082.69
0.858	493	2081.93
0.828	493	2080.87
0.753	770	2077.10
0.737	770	2074.4
0.732	Culvert	
0.726	770	2074.28
0.708	770	2073.38
0.679	770	2072.03
0.668	770	2071.09
0.663	Culvert	
0.658	770	2069.42
0.647	770	2068.07
0.633	770	2067.51
0.607	770	2065.6
0.57	770	2063.99
0.547	770	2062.83
0.542	Culvert	
0.537	960	2061.53
0.524	960	2060.41
0.504	960	2058.92
0.461	960	2054.82
0.431	960	2052.35
0.36	1146	2047.80
0.289	1146	2044.17
0.269	1146	2043.73
0.264	Bridge	
0.26	1146	2041.36
0.232	1146	2038.78
0.197	1146	2037.13
0.178	1146	2035.89

Table 8 (Continued) – HEC-RAS Results for 100-Year Event

Note: Elevations shown are on the NAVD88 Datum.

River Station (RS)	Peak Discharge (cfs)	Water Surface Elevation (ft)
Sunset Wash - Tributary 1		
0.256	412	2155.21
0.218	412	2150.82
0.213	Culvert	
0.209	412	2150.45
0.177	412	2146.8
0.159	412	2144.44
0.155	Culvert	
0.152	412	2143.58
0.145	412	2142.95
0.138	412	2142.83
0.135	Culvert	
0.132	412	2141.94
0.126	412	2141.24
0.122	412	2141.26
0.119	Culvert	
0.116	412	2140.59
0.102	412	2139.11
0.090	412	2137.5
0.082	Culvert	
0.076	412	2130.38
0.009	412	2123.83

5.9.2 Verification of Results

The majority of the proposed floodplain delineations are similar to the effective FEMA delineation. However, variations are due to the increase in the 100-year flow rates, updated topography, revised 'n' values, land use changes and updated modeling techniques.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WICKENBURG AREA DRAINAGE MASTER STUDY / PLAN
PHASE 1 FLOODPLAIN WORK MAPS
SUNSET WASH, SUNSET WASH TRIBUTARY 1 AND SUNNYCOVE WASH FLOODPLAIN DELINEATION

FCD CONTRACT NO. 2009-C030

HYDROLOGY/HYDRAULICS

WICKENBURG ADMS
PHASE 1 TDN
PREPARED BY HOSKIN RYAN CONSULTANTS
REPORT DATED: APRIL 2011

HORIZONTAL CONTROL

BASED ON HARN ARIZONA STATE PLANE COORDINATE SYSTEM (AZSPC)

TOPOGRAPHY SOURCE

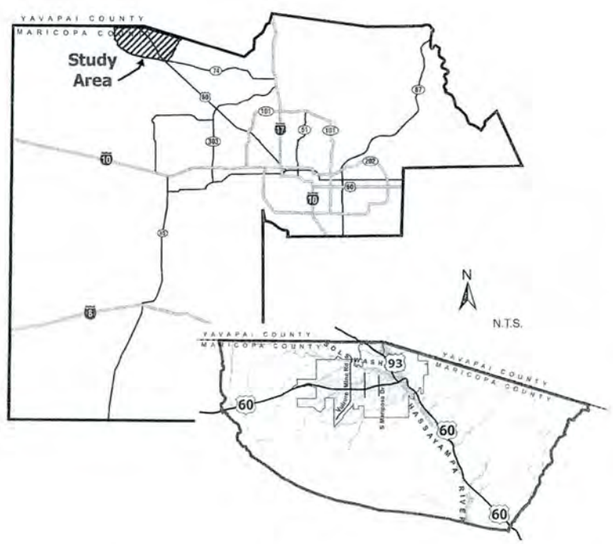
WICKENBURG MAPPING PROJECT
FCD CONTRACT NO. 03-66
2 FOOT CONTOUR INTERVAL
DATE FLOWN: JULY 2004
DATUM: NAD 1983, NAVD 1988

PROJECT BENCHMARK

NATIONAL GEODETIC SURVEY (NGS) HEIGHT MODERNIZATION POINTS LOCATED THROUGHOUT THE STUDY AREA

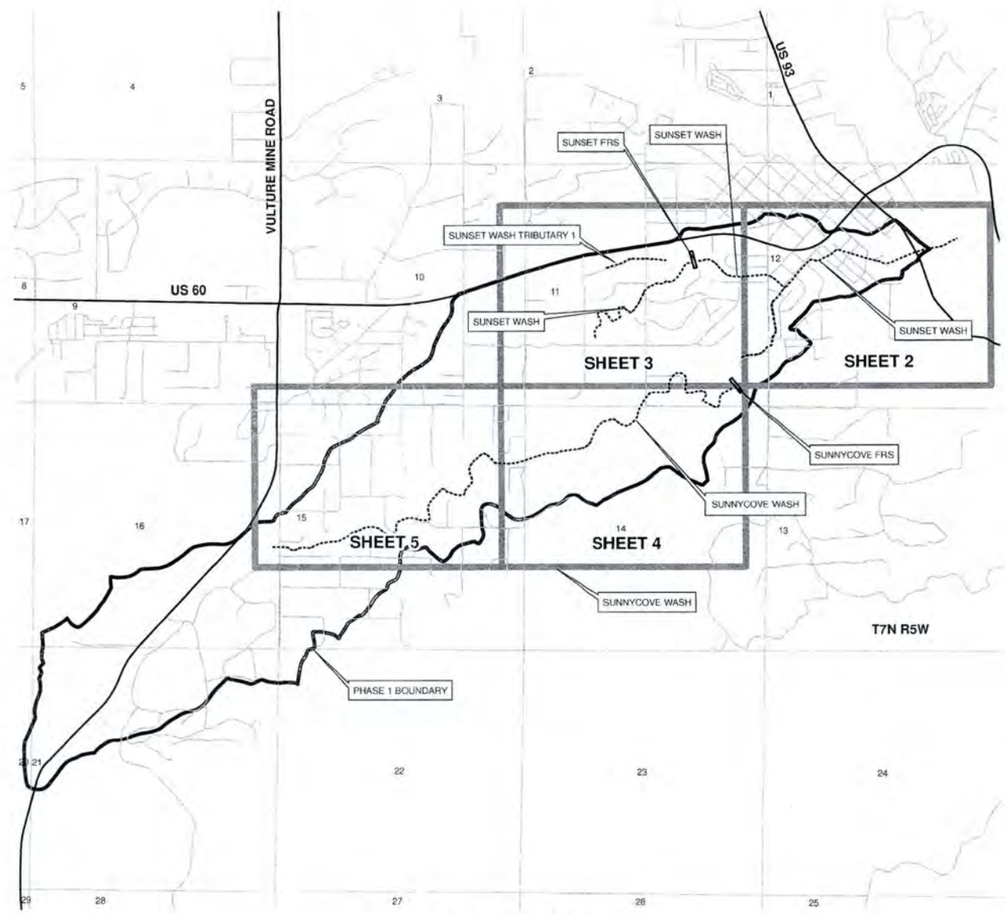
SUPPLEMENTAL SURVEY

HOSKIN RYAN CONSULTANTS
SURVEY REPORT DATED: APRIL 2011



LOCATION MAP

N.T.S.



VICINITY MAP

N.T.S.

RECOMMENDED BY _____ DATE
APPROVED BY _____ DATE
CHIEF ENGINEER AND GENERAL MANAGER

Hoskin•Ryan Consultants, Inc.
CREATIVE ENGINEERING SOLUTIONS
6245 N. 24th Parkway #100 Phoenix, AZ 85016
Office: (602) 252.8384 Fax: (602) 252.8385

WICKENBURG AREA DRAINAGE MASTER STUDY / PLAN PHASE 1

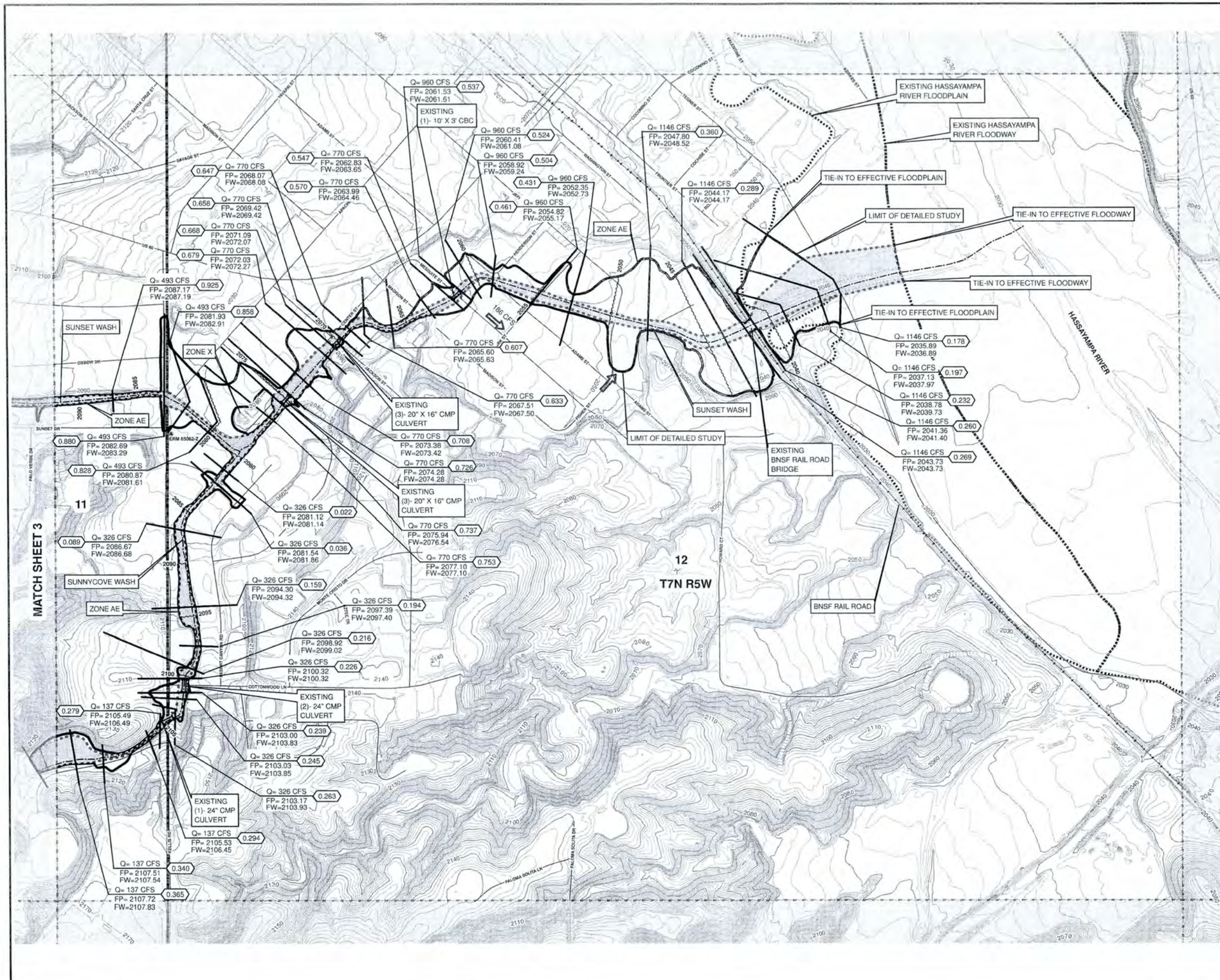
F.C.D. CONTRACT No. 2009-C030

100-YEAR FLOODPLAIN WORK MAPS

	BY	DATE
DESIGN	N.Z., P.Z.	2/2012
DESIGN CHK.	D.B.	2/2012
PLANS	N.Z., L.M.	2/2012
PLANS CHK.	D.B., P.W.R.H.	2/2012

EXPIRES 3/31/2012

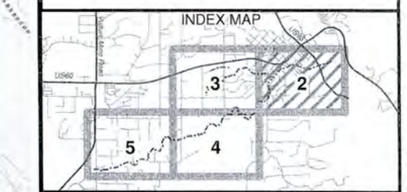
SHEET 1 OF 5



LEGEND

- CROSS-SECTION CUT LINE
- 2030 BASE FLOOD ELEVATIONS
- PROFILE BASE LINE
- 100-YEAR FLOODWAY BOUNDARY
- 100-YEAR FLOODPLAIN BOUNDARY
- 15 TOWNSHIP AND RANGE
- SECTION LINE AND ID
- STREETS
- RAILROAD
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EFFECTIVE FLOODPLAIN BOUNDARY
- ERM 65062-Z ELEV. REFERENCE MARK
- FLOW SPLIT DIRECTION
- EXISTING CULVERT
- 0.159 Q= 412 CFS FP= 2144.44 FW= 2145.44 — RIVER STATION, FLOW RATE, FLOODPLAIN ELEVATION AND FLOODWAY ELEVATION

INDEX MAP



DATUM CONVERSION:
SUNSET WASH:
NGVD 29 + 2.185 = NADV88
SUNNYCOVE WASH:
NGVD 29 + 2.188 = NAVD88

0 50 100 200 300 400 Feet
1 in = 200 ft.

TOPOGRAPHY SOURCE
WICKENBURG MAPPING PROJECT: FCD CONTRACT NO. 03-66
2 FOOT CONTOUR INTERVAL
DATE FLOWN: JULY 2004
DATUM: NAD 1983, NAVD 1988

ELEVATION REFERENCE MARKS

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

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
56062-Z		CALCULATED POSITION, NOTHING FOUND OR SET. NOTE- POSITION FALLS IN THE MIDDLE OF A PALM TREE.

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WICKENBURG AREA DRAINAGE MASTER STUDY / PLAN PHASE 1

F.C.D. CONTRACT No. 2009-C030

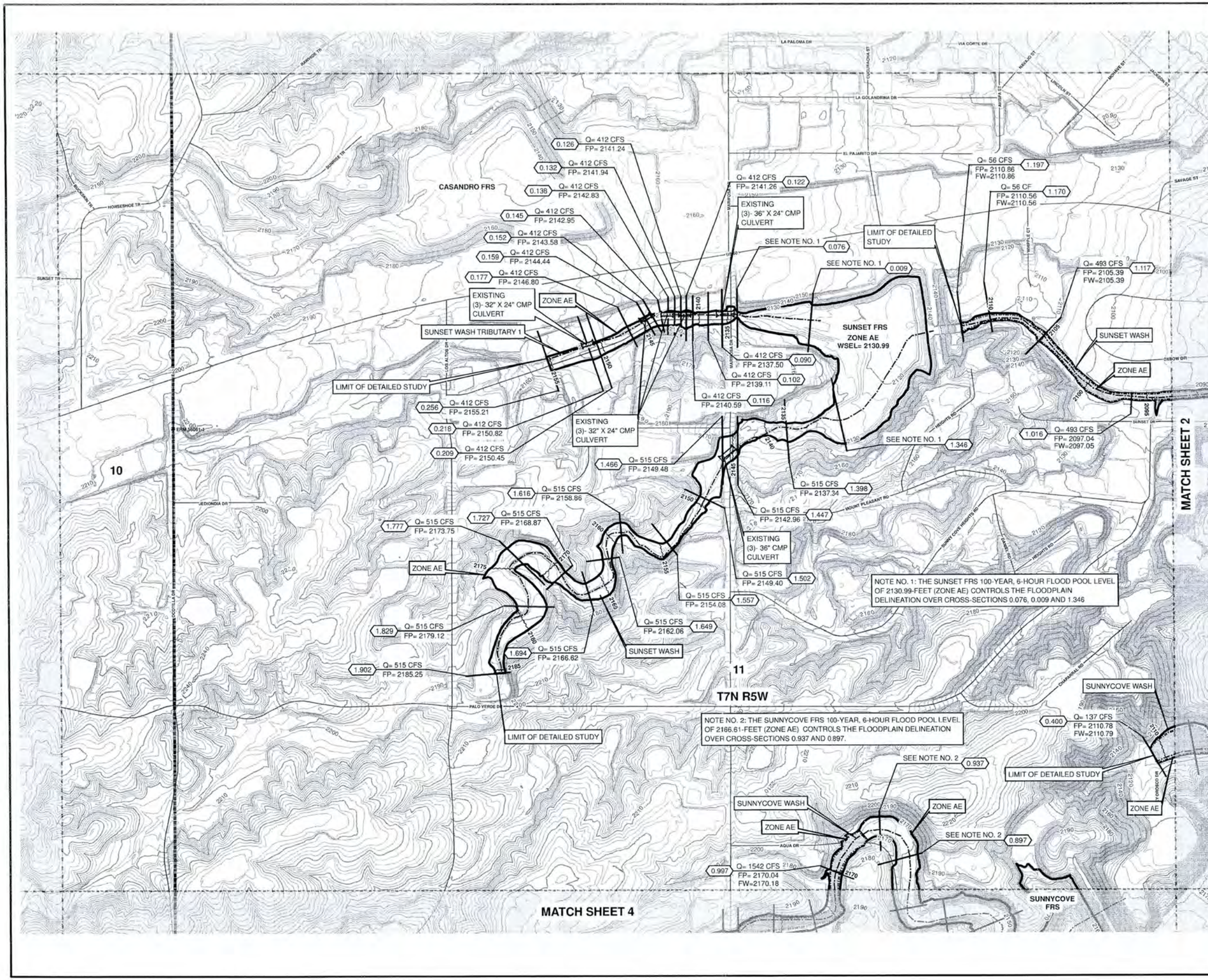
100-YEAR FLOODPLAIN WORK MAPS

REGISTERED PROFESSIONAL ENGINEER 19690 PAUL W. R. HOSKIN ARIZONA, U.S.A.

EXPIRES 3/31/2012

	BY	DATE
DESIGN	N.Z., P.Z.	2/2012
DESIGN CHK.	D.B.	2/2012
PLANS	N.Z., L.M.	2/2012
PLANS CHK.	D.B., P.W.R.H.	2/2012

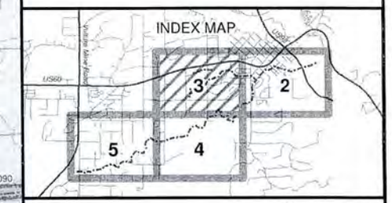
SHEET 2 OF 5



LEGEND

- CROSS-SECTION CUT LINE
- 2050 BASE FLOOD ELEVATIONS
- PROFILE BASE LINE
- 100-YEAR FLOODWAY BOUNDARY
- 100-YEAR FLOODPLAIN BOUNDARY
- TOWNSHIP AND RANGE
- 15 SECTION LINE AND ID
- STREETS
- RAILROAD
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- ERM 56062-Z ELEV. REFERENCE MARK
- FLOW SPLIT DIRECTION
- EXISTING CULVERT
- 0.159 Q= 412 CFS FP= 2144.44 FW= 2145.44 — RIVER STATION, FLOW RATE, FLOODPLAIN ELEVATION AND FLOODWAY ELEVATION

INDEX MAP



DATUM CONVERSION:
SUNSET WASH:
NGVD 29 + 2.185 = NADV88

SUNNYCOVE WASH:
NGVD 29 + 2.188 = NAVD88

0 50 100 200 300 400 Feet
1 in = 200 ft

TOPOGRAPHY SOURCE
WICKENBURG MAPPING PROJECT: FCD CONTRACT NO. 03-66
2 FOOT CONTOUR INTERVAL
DATE FLOWN: JULY 2004
DATUM: NAD 1983, NAVD 1988

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

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
56061-1	2188.671	FD 3" BC FL NO STAMPING

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WICKENBURG AREA DRAINAGE MASTER STUDY / PLAN PHASE 1

F.C.D. CONTRACT No. 2009-C030

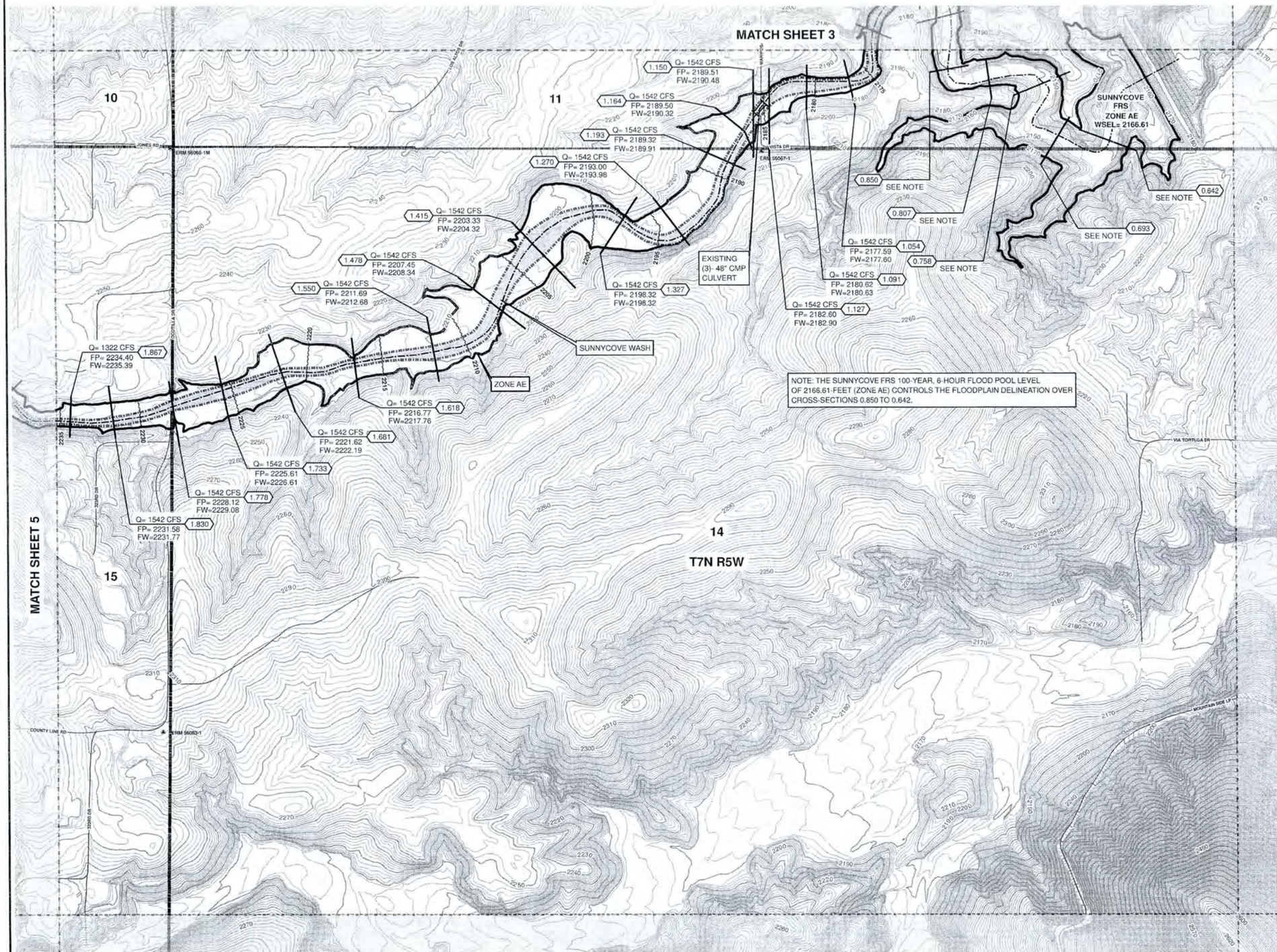
100-YEAR FLOODPLAIN WORK MAPS

	BY	DATE
DESIGN	N.Z., P.Z.	2/2012
DESIGN CHK.	D.B.	2/2012
PLANS	N.Z.	2/2012
PLANS CHK.	D.B., P.W.R.H.	2/2012

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 19690 PAUL W. R. HOSKIN DATE SIGNED 2/2/12 ARIZONA, U.S.A.

EXPIRES 3/31/2012

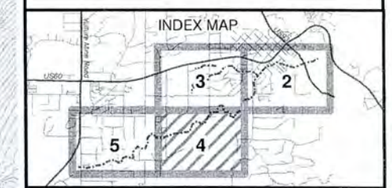
SHEET 3 OF 5



LEGEND

- CROSS-SECTION CUT LINE
- 2065 BASE FLOOD ELEVATIONS
- PROFILE BASE LINE
- 100-YEAR FLOODWAY BOUNDARY
- 100-YEAR FLOODPLAIN BOUNDARY
- TOWNSHIP AND RANGE
- 15 SECTION LINE AND ID
- STREETS
- RAILROAD
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- ERM 65062-Z ELEV. REFERENCE MARK
- FLOW SPLIT DIRECTION
- EXISTING CULVERT
- 0.159 Q= 412 CFS FP= 2144.44 FW= 2145.44 — RIVER STATION, FLOW RATE, FLOODPLAIN ELEVATION AND FLOODWAY ELEVATION

INDEX MAP



DATUM CONVERSION:

SUNNYCOVE WASH:
NGVD 29 + 2.188 = NAVD88

0 50 100 200 300 400 Feet
1 in = 200 ft

TOPOGRAPHY SOURCE

WICKENBURG MAPPING PROJECT: FCD CONTRACT NO. 03-66
2 FOOT CONTOUR INTERVAL
DATE FLOWN: JULY 2004
DATUM: NAD 1983, NAVD 1988

ELEVATION REFERENCE MARKS

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

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
56067-1	2200.09	FD 1" IP 0.3' UP W/ 2 1/2" GLO BC STAMPED "S11 S14 1948"
56068-1M	2238.314	FD 1/2" RB W/O ID FL, REPLACED WITH 1/2" ROUND SSTL METAL ROD 0.4' DN W/ 3" MARICOPA COUNTY BC STAMPED "T7N R5W S10 S11 S15 S14 2005 37174"
56083-1	2298.954	FD 1" IP 0.7' UP W/ 2 1/2" GLO BC STAMPED "1/4 S15 S14 1948"

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WICKENBURG AREA DRAINAGE MASTER STUDY / PLAN PHASE 1

F.C.D. CONTRACT No. 2009-C030

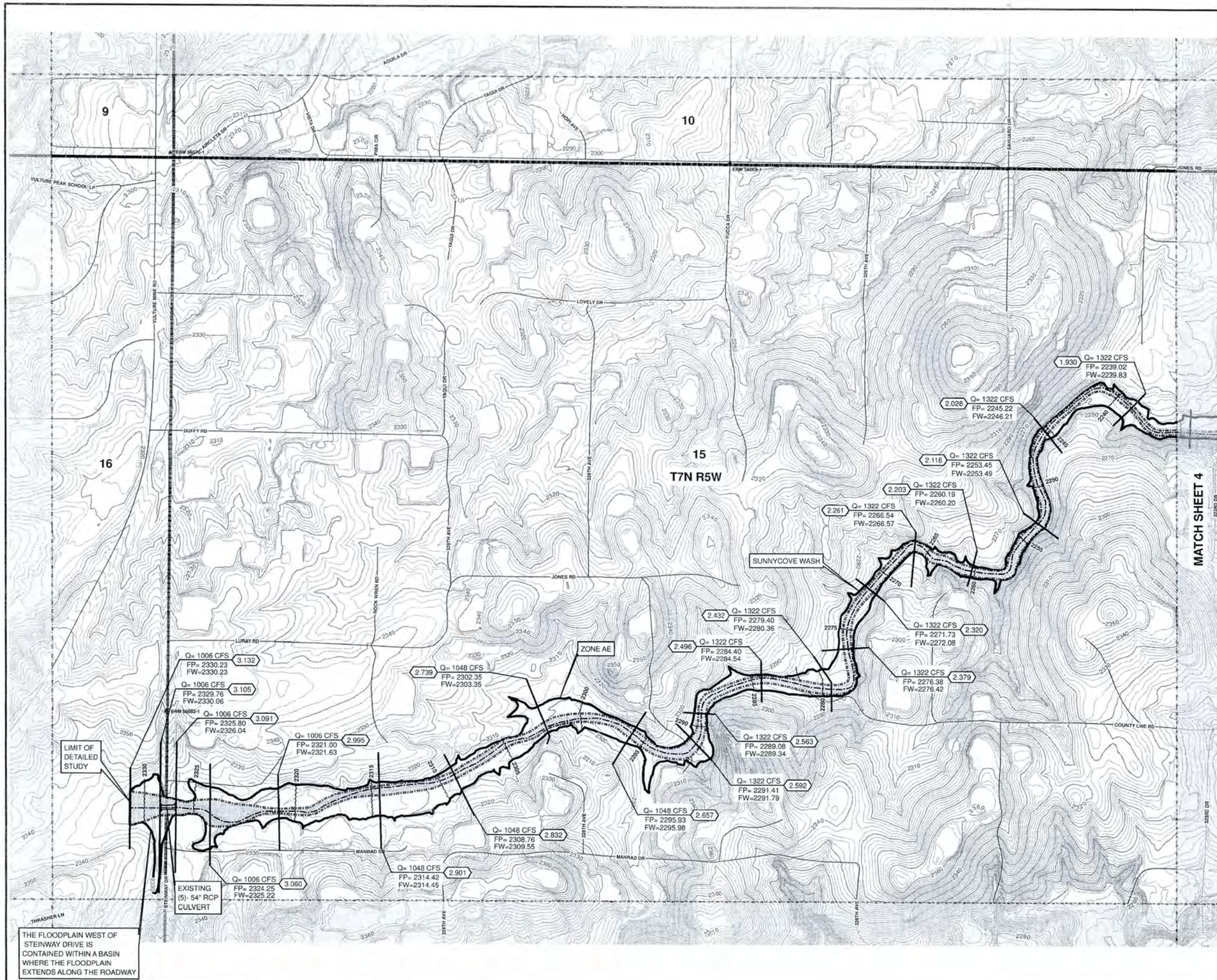
100-YEAR FLOODPLAIN WORK MAPS

	BY	DATE
DESIGN	N.Z., P.Z.	2/2012
DESIGN CHK.	D.B.	2/2012
PLANS	N.Z., L.M.	2/2012
PLANS CHK.	D.B., P.W.R.H.	2/2012

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26690 PAUL W. R. HOSKIN Date Signed 2/2/12 ARIZONA, U.S.A.

EXPIRES 3/31/2012

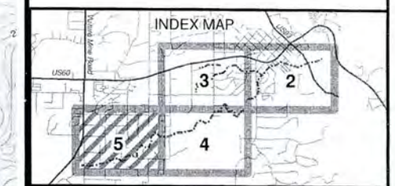
SHEET 4 OF 5



LEGEND

- CROSS-SECTION CUT LINE
- 2095 BASE FLOOD ELEVATIONS
- PROFILE BASE LINE
- 100-YEAR FLOODWAY BOUNDARY
- 100-YEAR FLOODPLAIN BOUNDARY
- TOWNSHIP AND RANGE
- 15 SECTION LINE AND ID
- STREETS
- RAILROAD
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- ERM 65062-Z ELEV. REFERENCE MARK
- FLOW SPLIT DIRECTION
- EXISTING CULVERT
- 0.159 Q= 412 CFS FP= 2144.44 FW= 2145.44 — RIVER STATION, FLOW RATE, FLOODPLAIN ELEVATION AND FLOODWAY ELEVATION

INDEX MAP



DATUM CONVERSION:

SUNNYCOVE WASH:
NGVD 29 + 2.188 = NAVD88

0 50 100 200 300 400 Feet
1 in = 200 ft

TOPOGRAPHY SOURCE

WICKENBURG MAPPING PROJECT; FCD CONTRACT NO. 03-66
2 FOOT CONTOUR INTERVAL
DATE FLOWN: JULY 2004
DATUM: NAD 1983, NAVD 1988

ELEVATION REFERENCE MARKS

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

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
56069-1	2282.912	FD 3" BC FL STAMPED "1999 1/4 S10 S15 LS 25074" NOTE- SET IN CONC
56070-1	2300.721	FD 2" IP 0.8' UP W/ 2 1/2" GLO BC STAMPED "T7NR5W S9 S10 S15 S16 1948"
56082-1	2349.169	FD 1" IP IN HH 0.45' DN W/ 3" MCDOT BC STAMPED "T5NR7W 1/4 16 LS 26411"

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WICKENBURG AREA DRAINAGE MASTER STUDY / PLAN PHASE 1

F.C.D. CONTRACT No. 2009-C030

100-YEAR FLOODPLAIN WORK MAPS

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26590 PAUL W. RYAN HOSKIN DATE SIGNED 2/6/12 ARIZONA, U.S.A.

EXPIRES 3/31/2012

	BY	DATE
DESIGN	N.Z., P.Z.	2/2012
DESIGN CHK.	D.B.	2/2012
PLANS	N.Z., L.M.	2/2012
PLANS CHK.	D.B., P.W.R.H.	2/2012

SHEET 5 OF 5

6 Erosion and Sediment Transport

Erosion and Sediment Transport are not covered under the Scope of this study.

7 Draft FIS Report Data

7.1 Summary of Discharges

The draft summary of discharges is provided in Table 9.

Table 9 – Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Year	50-Year	100-Year	500-Year
Sunnycove Wash					
At Sunset Wash	0.114	186	282	326	428
Upstream of Flood Control Dam	1.393	831	1316	1542	2102
At Steinway Drive Crossing	0.562	549	863	1006	1344
Sunset Wash					
At Hassayampa River	0.591	599	975	1146	1550
At confluence with Sunnycove Wash	0.369	419	660	770	1028
Downstream of Flood Control Dam	0.029	30	48	56	75
Upstream of Flood Control Dam	0.340	279	443	515	696
Sunset Wash Tributary 1					
Upstream of Flood Control Dam	0.270	220	350	412	551

7.2 Floodway Data

The floodway data results are summarized in Tables 10 and 11. There is no floodway delineation within the Sunnycove FRS 100-year, 6-hour flood pool level of 2166.61-feet. However, cross-sections 0.937 to 0.642, presented in the HEC-RAS model, are within the pool level extents. As a result, the cross-sections within the pool level extents are not included in the summary table.

Table 10 – Floodway Data Summary for Sunnycove Wash

Cross-Section	Distance[1]	Floodway			Base Flood Water Surface Elevation			
		Width (feet)	Section Area (square feet)	Mean Velocity (feet per second)	Regulatory	Without Floodway	With Floodway	Increase
					(Feet NAVD88)			
Sunnycove Wash / Reach 2								
3.132	3.132	155	170.98	5.88	2330.23	2330.23	2330.23	0
3.105	3.105	89.51	489.46	2.06	2329.76	2329.76	2330.06	0.31
3.1	3.1	Culvert						
3.091	3.091	63.35	205.96	4.88	2325.8	2325.8	2326.04	0.24
3.06	3.06	127	221.41	4.54	2324.25	2324.25	2325.22	0.97
2.995	2.995	20.92	87.33	11.52	2321	2321	2321.63	0.62
2.901	2.901	45.47	122.96	8.52	2314.42	2314.42	2314.45	0.03
2.832	2.832	36.08	115.66	9.06	2308.76	2308.76	2309.55	0.79
2.739	2.739	35.71	115.43	9.08	2302.35	2302.35	2303.35	1
2.657	2.657	46.15	117.11	8.95	2295.93	2295.93	2295.98	0.05
2.592	2.592	58.16	167	7.92	2291.41	2291.41	2291.79	0.37
2.563	2.563	36.35	127.83	10.34	2289.08	2289.08	2289.34	0.26
2.496	2.496	31.28	121.37	10.89	2284.4	2284.4	2284.54	0.15
2.432	2.432	45	149.45	8.85	2279.4	2279.4	2280.36	0.96
2.379	2.379	33.45	128.42	10.29	2276.38	2276.38	2276.42	0.04
2.32	2.32	35.39	126.86	10.42	2271.73	2271.73	2272.08	0.35
2.261	2.261	48	143.53	9.21	2266.54	2266.54	2266.57	0.03
2.203	2.203	42.93	131.96	10.02	2260.19	2260.19	2260.2	0.01
2.118	2.118	46	137.52	9.61	2253.45	2253.45	2253.49	0.04
2.028	2.028	28.53	122.37	10.8	2245.22	2245.22	2246.21	0.99
1.93	1.93	23.93	120.29	10.99	2239.02	2239.02	2239.83	0.81
1.867	1.867	22.56	109.84	12.04	2234.4	2234.4	2235.39	0.99
1.83	1.83	40.33	143.71	10.73	2231.58	2231.58	2231.77	0.19
1.778	1.778	47.52	177.54	8.69	2228.12	2228.12	2229.08	0.97
1.733	1.733	58.98	186.9	8.25	2225.61	2225.61	2226.61	1
1.681	1.681	37.2	150.48	10.25	2221.62	2221.62	2222.19	0.56
1.618	1.618	31	136.52	11.3	2216.77	2216.77	2217.76	0.99
1.55	1.55	60	208.09	7.41	2211.69	2211.69	2212.68	0.99
1.478	1.478	63.9	194.36	7.93	2207.45	2207.45	2208.34	0.89
1.415	1.415	120	283.51	5.44	2203.33	2203.33	2204.32	0.98
1.327	1.327	34	142.21	10.84	2198.32	2198.32	2198.32	0
1.27	1.27	55.1	203.35	7.58	2193	2193	2193.98	0.98
1.193	1.193	45	169.54	9.1	2189.32	2189.32	2189.91	0.58
1.164	1.164	39.66	266.35	5.79	2189.5	2189.5	2190.32	0.83
1.15	1.15	85.28	681.03	2.26	2189.51	2189.51	2190.48	0.98

[1] Miles above confluence with Sunset Wash

Table 10 – Floodway Data Summary for Sunnycove Wash (Continued)

Cross-Section	Distance[1]	Floodway			Base Flood Water Surface Elevation			
		Width (feet)	Section Area (square feet)	Mean Velocity (feet per second)	Regulatory	Without Floodway	With Floodway	Increase
					(Feet NAVD88)			
Sunnycove Wash / Reach 2 (Continued)								
1.137	1.137	Culvert						
1.127	1.127	64.86	218.31	7.06	2182.6	2182.6	2182.9	0.3
1.091	1.091	64.9	193.62	7.96	2180.62	2180.62	2180.63	0
1.054	1.054	37	141.6	10.89	2177.59	2177.59	2177.6	0.01
0.997	0.997	50.3	154.39	9.99	2170.04	2170.04	2170.18	0.13
Sunnycove Wash - Reach 1								
0.4	0.4	77.84	36.17	3.79	2110.79	2110.79	2110.79	0
0.365	0.365	132.72	166.83	0.82	2107.72	2107.72	2107.81	0.09
0.34	0.34	28.6	40.88	3.35	2107.5	2107.5	2107.52	0.01
0.294	0.294	15.6	37.11	3.69	2105.57	2105.57	2106.46	0.89
0.279	0.279	56.3	119.92	1.14	2105.54	2105.54	2106.49	0.96
0.269	0.269	Culvert						
0.263	0.263	22.85	69.17	4.71	2103.15	2103.15	2103.97	0.82
0.245	0.245	34.33	102.91	3.17	2102.92	2102.92	2103.85	0.93
0.239	0.239	41.3	114.16	2.86	2102.85	2102.85	2103.81	0.96
0.233	0.233	Culvert						
0.226	0.226	54.42	56.84	5.74	2100.74	2100.74	2100.75	0.01
0.216	0.216	22.35	59.93	5.44	2098.92	2098.92	2099.02	0.1
0.194	0.194	19.52	40.25	8.1	2097.39	2097.39	2097.4	0
0.159	0.159	74.5	69.51	4.69	2094.3	2094.3	2094.32	0.02
0.089	0.089	41.71	52.5	6.21	2086.67	2086.67	2086.68	0
0.036	0.036	28.74	46.48	7.01	2081.54	2081.54	2081.86	0.31
0.022	0.022	30.22	69.58	4.69	2081.12	2081.12	2081.17	0.05

[1] Miles above confluence with the Sunset Wash

Table 11 – Floodway Data Summary for Sunset Wash

Cross-Section	Distance1	Floodway			Base Flood Water Surface Elevation			
		Width (feet)	Section Area (square feet)	Mean Velocity (feet per second)	Regulatory	Without Floodway	With Floodway	Increase
					(Feet NAVD88)			
Sunset Wash / Reaches 1 & 2								
1.197	1.197	38.52	129.81	0.43	2110.86	2110.86	2110.86	0
1.17	1.17	29.79	15.4	3.64	2110.56	2110.56	2110.56	0
1.117	1.117	48.34	75.14	6.56	2105.39	2105.39	2105.39	0
1.016	1.016	30.8	62.27	7.92	2097.04	2097.04	2097.05	0.01
0.925	0.925	24.96	57.06	8.64	2087.18	2087.18	2087.19	0.01
0.88	0.88	66.13	138.72	3.55	2082.69	2082.69	2083.29	0.6
0.858	0.858	35	103.93	4.74	2081.93	2081.93	2082.91	0.98
0.828	0.828	27.2	59.26	8.32	2080.87	2080.87	2081.61	0.73
0.753	0.753	23.23	75.52	10.2	2077.1	2077.1	2077.1	0
0.737	0.737	71.81	214.58	3.59	2075.94	2075.94	2076.54	0.59
0.732	0.732	Culvert						
0.726	0.726	76	140.68	5.47	2074.28	2074.28	2074.28	0
0.708	0.708	75	121.02	6.36	2073.38	2073.38	2073.42	0.04
0.679	0.679	55	123.95	6.21	2072.03	2072.03	2072.27	0.24
0.668	0.668	38.4	129.1	5.96	2071.09	2071.09	2072.07	0.98
0.663	0.663	Culvert						
0.658	0.658	54.52	105.91	7.27	2069.42	2069.42	2069.42	0
0.647	0.647	24	76.6	10.05	2068.07	2068.07	2068.08	0.01
0.633	0.633	39.39	122.12	6.31	2067.51	2067.51	2067.5	0
0.607	0.607	27.93	87.29	8.82	2065.6	2065.6	2065.63	0.04
0.57	0.57	40.36	128.89	5.97	2063.99	2063.99	2064.46	0.48
0.547	0.547	44.56	124.55	6.18	2062.83	2062.83	2063.65	0.82
0.542	0.542	Culvert						
0.537	0.537	40	107.86	8.9	2061.53	2061.53	2061.61	0.09
0.524	0.524	31.96	127.75	7.51	2060.41	2060.41	2061.08	0.67
0.504	0.504	26.43	91.6	10.48	2058.92	2058.92	2059.24	0.32
0.461	0.461	57.76	118.88	8.08	2054.82	2054.82	2055.17	0.35
0.431	0.431	33.5	101.55	9.45	2052.35	2052.35	2052.73	0.39
0.36	0.36	38.06	116.28	9.86	2047.8	2047.8	2048.52	0.72
0.289	0.289	60	146.26	7.84	2044.17	2044.17	2044.17	0
0.269	0.269	72.7	208.96	5.48	2043.73	2043.73	2043.73	0
0.264	0.264	BR U						
0.264	0.264	BR D						
0.26	0.26	60.95	137.86	8.31	2041.36	2041.36	2041.4	0.04
0.232	0.232	109.41	167.27	6.85	2038.78	2038.78	2039.73	0.95
0.197	0.197	171.06	242.47	4.73	2037.13	2037.13	2037.97	0.84
0.178	0.178	179.93	245.92	4.66	2035.89	2035.89	2036.89	1

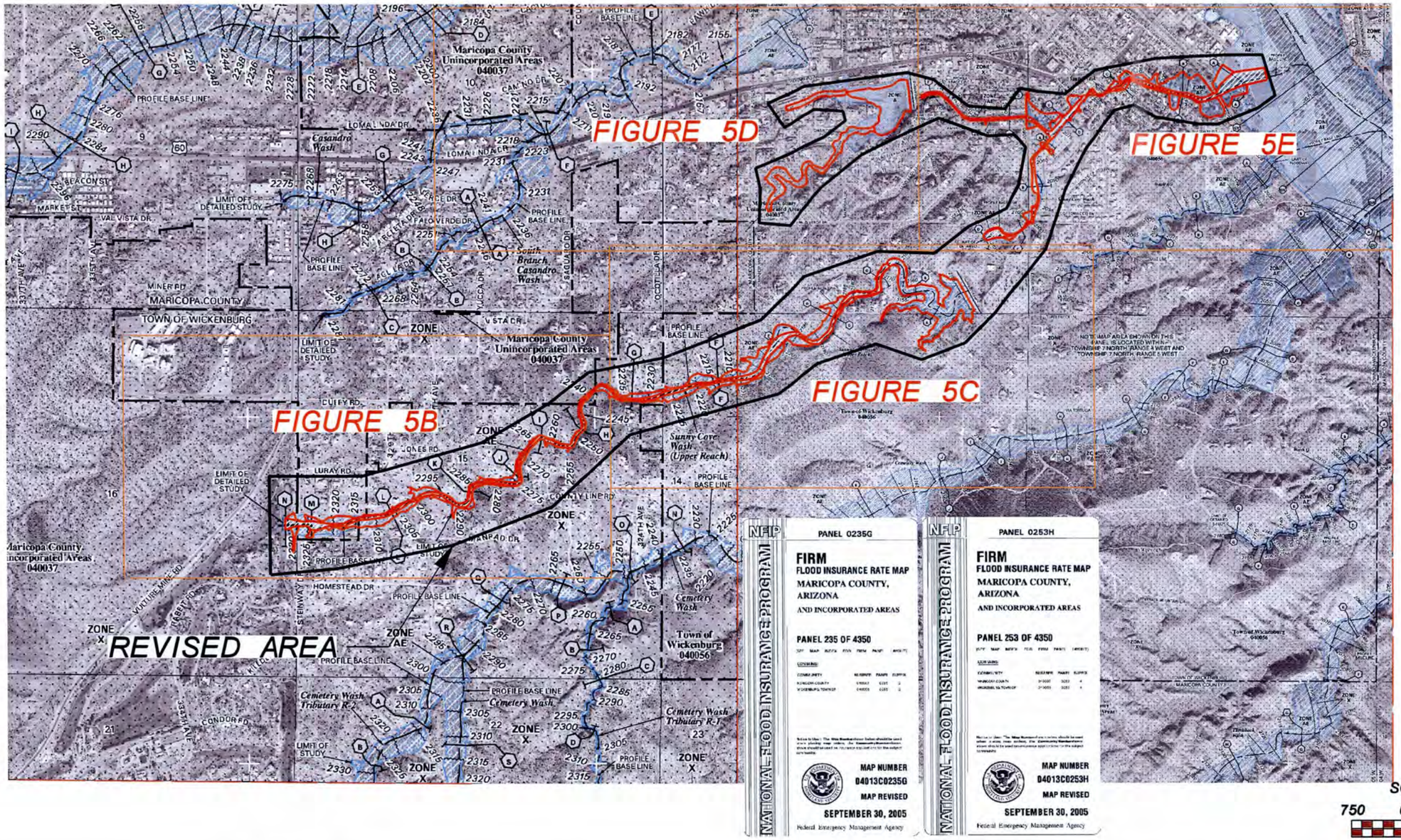
[1] Miles above confluence with the Hassayampa River

7.3 Annotated Flood Insurance Rate Map

Annotated Flood Insurance Rate Maps, covering Map Panels numbered 04013C0253H and 04013C0235G are shown in Figures 5A through 5E, following this section.

7.4 Flood Profiles

Flood profiles for the 10-, 50-, 100-, and 500-year floods are provided in Appendix E.5.5.



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LEGEND

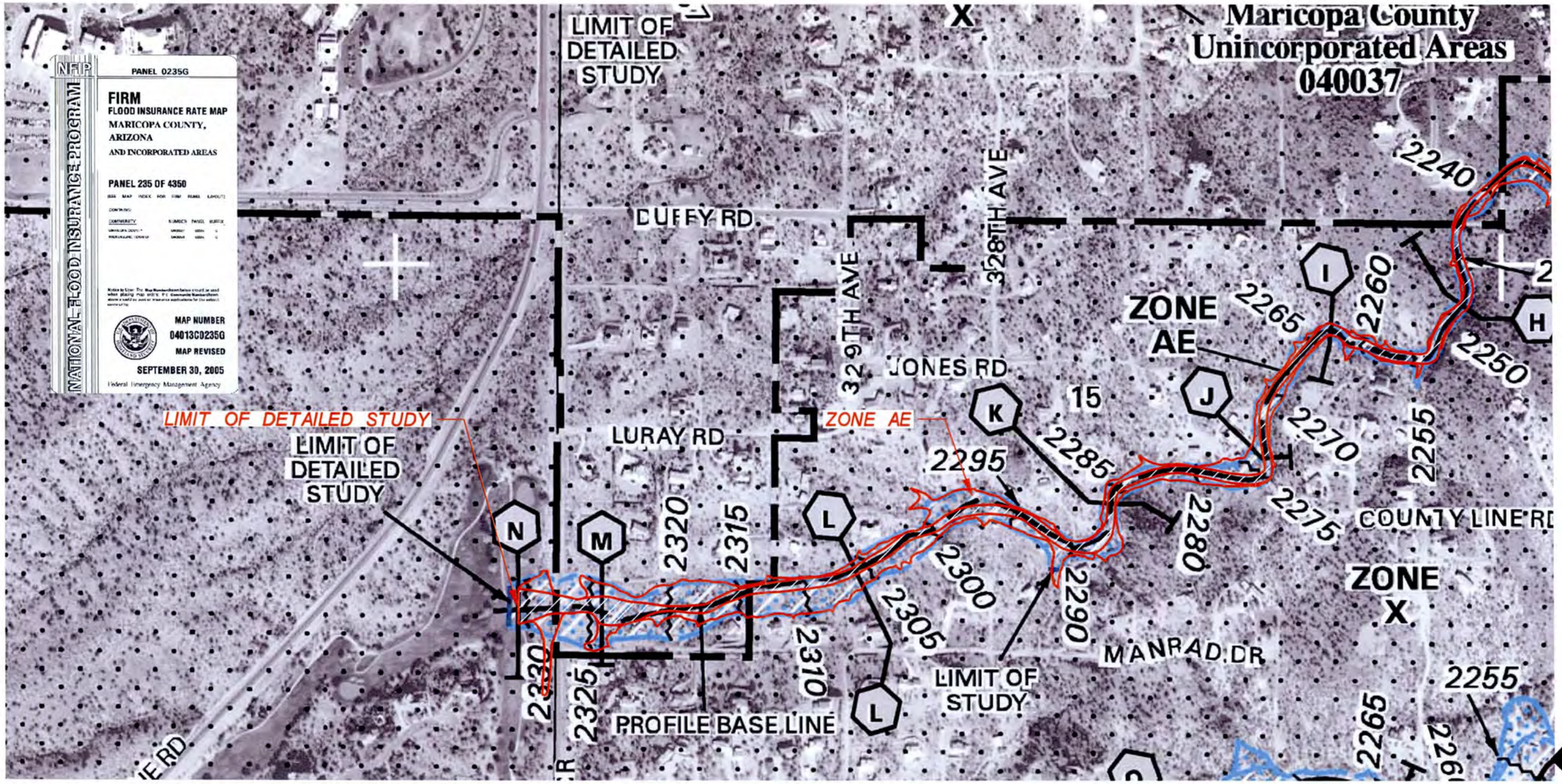
100-YEAR FLOODPLAIN

FLOODWAY

WICKENBURG ADMS/P PHASE I ANNOTATED FIRM MAP

FIGURE 5A

G:\Projects\10\10-003 Wickenburg ADMS\01-Phase 1\E-ANNOTATED FIRM.dgn
8/1/2011



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LEGEND

100-YEAR FLOODPLAIN

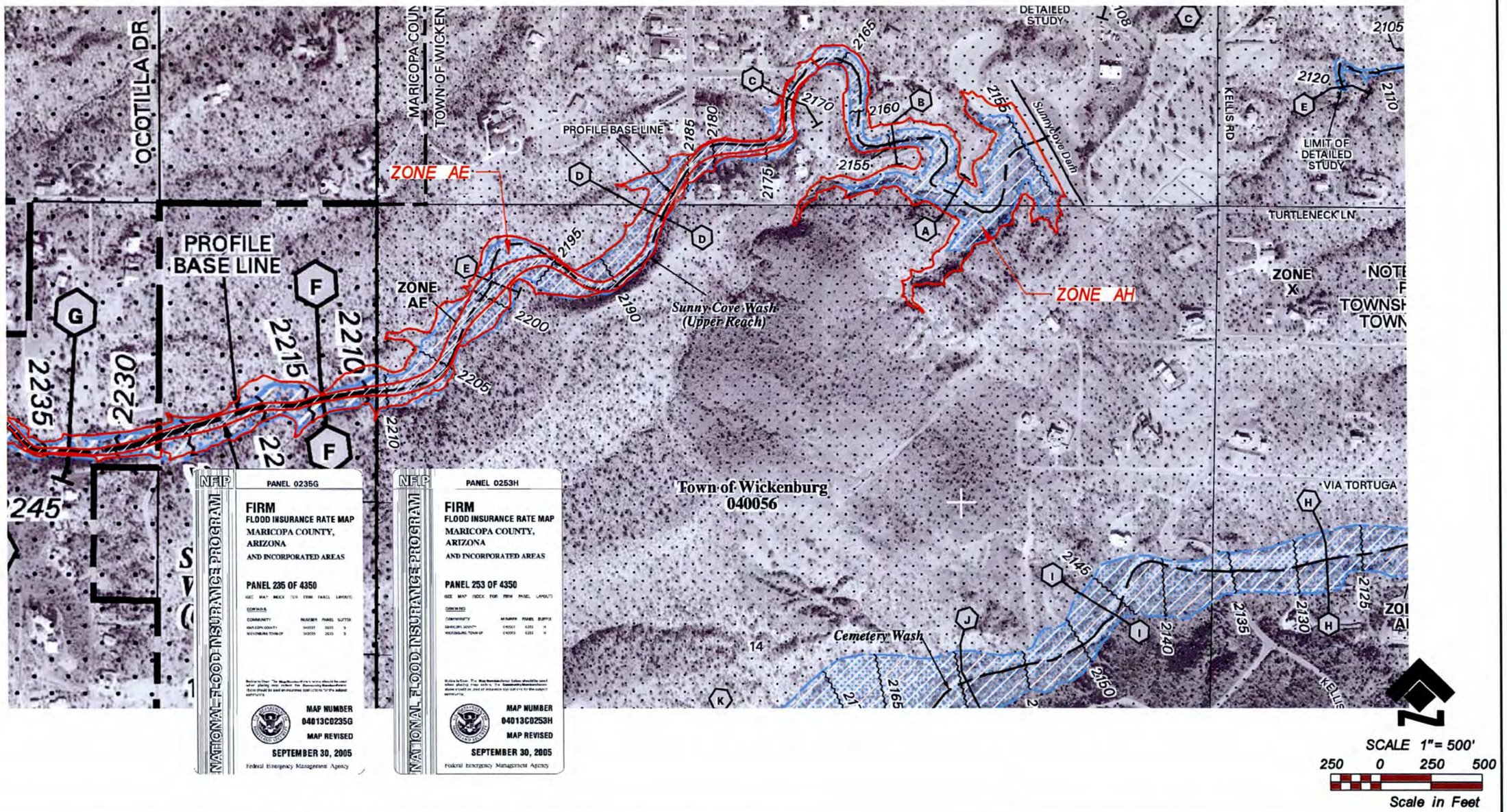
FLOODWAY

WICKENBURG ADMS/P
PHASE I
ANNOTATED FIRM MAP

FIGURE 5B

G:\Projects\10\10-003 Wickenburg ADMS\01-Phase 1\E-ANNOTATED FIRM.dgn
6/1/2011

MATCH FIGURE 5B



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LEGEND

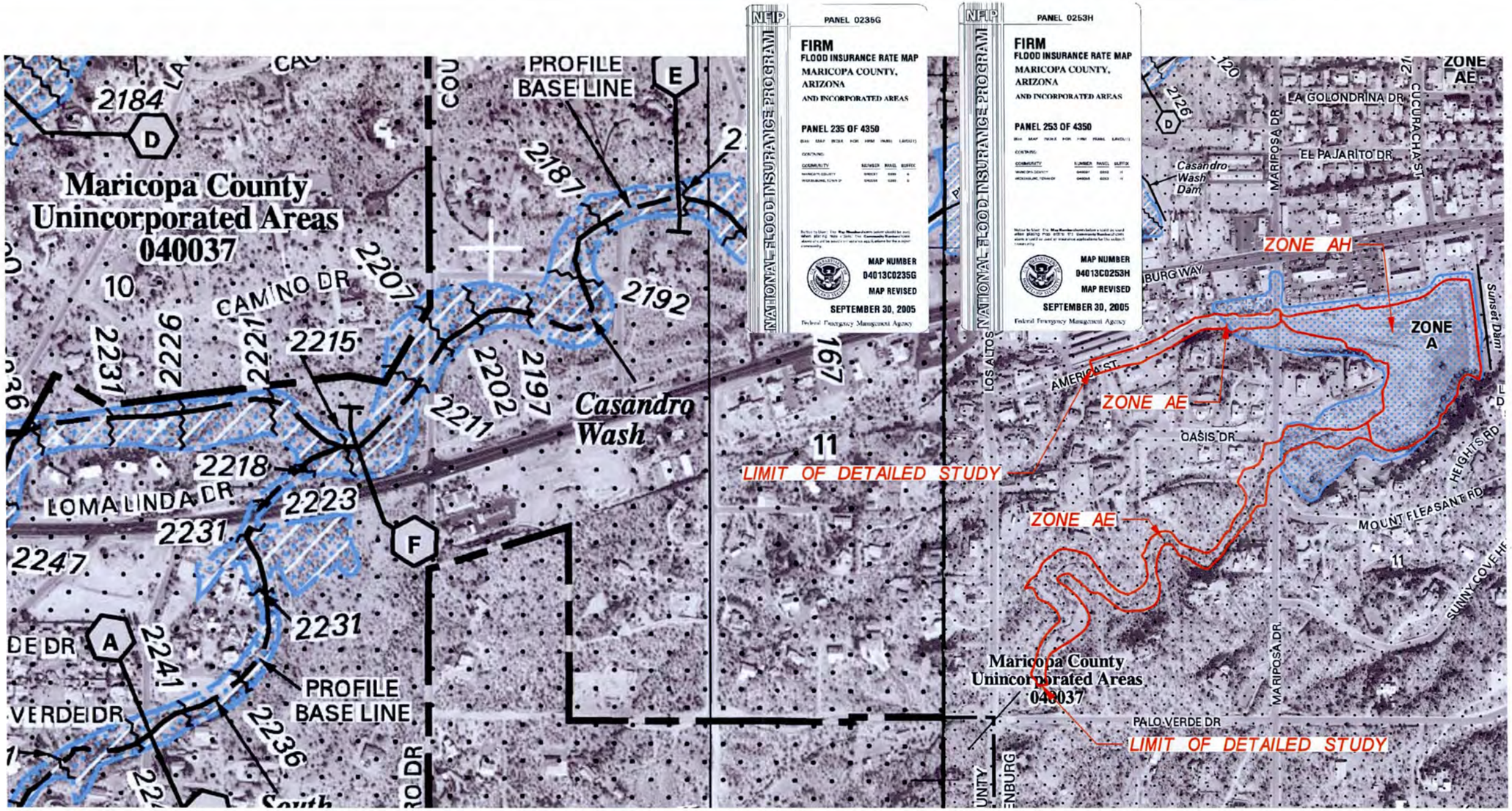
100-YEAR FLOODPLAIN

FLOODWAY

WICKENBURG ADMS/P PHASE I ANNOTATED FIRM MAP

FIGURE 5C

G:\Projects\10\10-003 Wickenburg ADMS\01-Phase 1\E-ANNOTATED FIRM.dgn
6/1/2011



SCALE 1"= 500'

250 0 250 500

Scale in Feet

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LEGEND

100-YEAR FLOODPLAIN

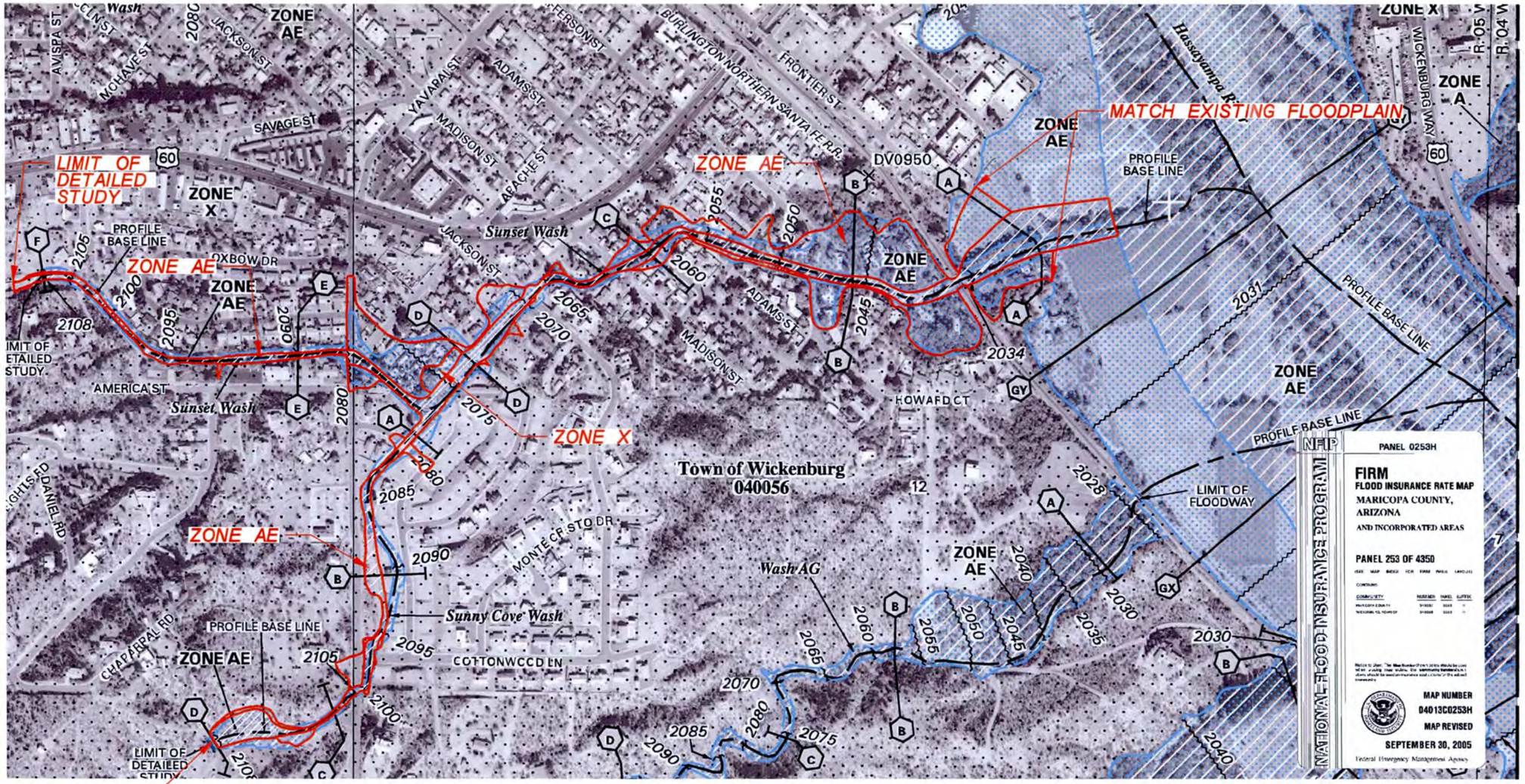
FLOODWAY

WICKENBURG ADMS/P
PHASE I
ANNOTATED FIRM MAP

FIGURE 5D

G:\Projects\10\10-003 Wickenburg ADMS\01-Phase 1\E-ANNOTATED FIRM.dgn
6/1/2011

MATCH FIGURE 5D



SCALE 1"= 500'

250 0 250 500

Scale in Feet

G:\Projects\10\10-003 Wickenburg ADMS\01-Phase 1\E-ANNOTATED FIRM.dgn
6/1/2011

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LEGEND

100-YEAR FLOODPLAIN

FLOODWAY

WICKENBURG ADMS/P PHASE I ANNOTATED FIRM MAP

FIGURE 5E

Appendix A: References

1. Arizona Department of Water Resources, *State Standard 1-97 Requirement for Flood Study Technical Documentation*, November 1997.

2. Arizona Department of Water Resources, *State Standard 2-96 Requirement for Floodplain and Floodway Delineation in Riverine Environments*, July 1996.

3. Arizona Department of Water Resources, *State Standard 5-96 State Standard for Watercourse System Sediment Balance*, September 1996.

4. Arizona Department of Water Resources, *State Standard 9-02 State Standard for Floodplain Hydraulic Modeling*, July 2002.

5. Arizona Water Commission, *Sunny Cove Flood Retarding – AZ Dam No. 7-48, Phase 1 Inspection Report National Dam Safety Program*, January 1979.

6. Arizona Water Commission, *Sunset Flood Retarding – AZ Dam No. 7-49, Phase 1 Inspection Report National Dam Safety Program*, January 1979.

7. Black and Veatch, *Wickenburg Area Drainage Master Study, Technical Documentation Report*, May 1994.

8. Cella Barr Associates, *Town of Wickenburg, Arizona, Flood Insurance Study*, December 1986.

9. Community Sciences Corporation, and Town of Wickenburg, *Town of Wickenburg General Plan*, adopted August 4, 2003.

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Appendix B: General Documentation and Correspondence

B.1 Special Problem Reports

Note: There are no Special Problem Reports.

B.2 Contact Reports

Note: There are no Contact Reports.

B.3 Meeting Minutes

Note: There are no Meeting Minutes.

B.4 General Correspondence

B.5 Contract Documents

B.6 Public Notification

B.7 FEMA Correspondense

B.4 GENERAL CORRESPONDENCE

{Date}

{Property Owner Name}
{Property Owner Mailing Address}

RE: Wickenburg Area Drainage Master Study (ADMS)- Phase 1 Sunset/Sunnycove Wash FDS

Parcel Number: XXX

Dear {Property Owner Name}

The District has identified the draft boundaries of the revised floodplain delineation for the Sunset and Sunnycove Washes, as part of the Wickenburg ADMS. The District is interested in obtaining detailed survey information for certain properties along the floodplain boundary in order to refine certain portions of the delineation.

You are receiving this letter because your property is one of the properties we would like to survey.

For this survey, the District's contractor will have a licensed professional land surveyor perform the necessary survey work. Should you agree to have your property surveyed, the surveyor will require access to your property for approximately one hour. They will not need to enter your home unless you have a basement or interior low floor such as a sunken living room. You do not need to be home unless you have access issues such as, locked gates, dogs on the property, etc.

If you agree to have your property surveyed please complete the enclosed form and send it to the District. You may also call in your request or email or fax the form to us as soon as possible. If you do not wish to have your property surveyed, no action is required. The District will not perform any survey work unless requested.

Survey work will occur between January 25, 2011 and February 11, 2011.

If you have any questions regarding the study and its impacts to your property please contact me at (602) 506-5537 or glj@mail.maricopa.gov.

Sincerely,

Greg Jones, P.E. A.I.C.P.
Regional Area Planning Manager

B.5 CONTRACT DOCUMENTS

EXHIBIT A

SCOPE OF WORK
Contract FCD 2009C030
Wickenburg Area Drainage Master Study/Plan (ADMS/P)

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1 GENERAL

1.1 PROJECT DESCRIPTION

This Scope of Work (SOW) is to contract for professional services necessary to produce the Wickenburg Area Drainage Master Study (ADMS) update. The CONSULTANT agrees to provide services to accomplish the work under the direction of a Registered Engineer with the State of Arizona in the appropriate discipline.

The ADMS, which will identify and quantify known and potential flooding hazards. The ADMS will characterize drainage, flooding sources and flooding hazards in the area including the identification of potential future flood hazards. The scope of work includes, but is not limited to, hydrology, hydraulics to determine effectiveness of existing drainage infrastructure, identification of drainage problems, structures surveys, and quantification of flood hazards via floodplain.

The ADMS consists largely of data collection, existing conditions analyses, floodplain delineation work, and identification/quantification of existing flooding problems. During the Study, the CONSULTANT shall review the existing hydrologic models, develop a comprehensive hydrologic model for the entire study area, identify drainage problems by reviewing past drainage complaints and analyzing the results of the hydrologic model, perform hydraulic analyses, develop floodplain delineations and submit to FEMA, and develop a list of flooding problems to be carried forward to a potential future Area Drainage Master Plan (ADMP). A Technical Data Notebook(s) and Executive Summary will be prepared at the completion. Additionally, the SOW includes a Pilot Study for a 20 square mile watershed, which includes a submittal to FEMA under a separate Technical Data Notebook. The Pilot Study will be completed at an accelerated schedule.

The following sections will be performed for the ADMS

- Section 1 GENERAL
- Section 2 PROJECT ADMINISTRATION AND COORDINATION
- Section 3 SURVEY
- Section 4 PUBLIC INVOLVEMENT
- Section 5 HYDROLOGY
- Section 6 HYDRAULICS
- Section 7 FLOODPLAIN DELINEATION
- Section 8 PLANNING STUDIES
- Section 9 DELIVERABLES

1.2 PURPOSE AND NEED

The purpose of the Wickenburg ADMS is to quantify the extent of drainage and flooding problems, sources, and hazards in the study area. The FEMA designated floodplains for various watercourses will incorporate existing drainage facilities and policies into the modeling process. However, the analysis will be based on the newer, more accurate 2-foot and 4-foot contour interval mapping. The ADMS will develop preliminary alternative solutions for the identified flooding problems.

Depending on the results of the delineations, flood hazard assessment, and available future funding, the District may undertake through a Change Order to complete an ADMP for prioritized portions of the study area within Maricopa County. Revised Statutes Title 48, Chapter 21, requires the Board of

Directors of the Flood Control District of Maricopa County (DISTRICT) to identify flood control problems and prepare plans which, when implemented, will eliminate or minimize flooding problems.

The major objectives of the project include:

- Development of a comprehensive hydrologic model in order to quantify the drainage and flooding hazards within the study area;
- Floodplain Delineations; and
- Identification of flood hazard areas and preliminary cost-effective alternative flood control solutions for those flooding problems.

Work for the ADMS will be performed in accordance with the following standards:

REFERENCES

- Section A DEFINITIONS
- Section B DATA DELIVERY STANDARDS
- Section C QUALITY ASSURANCE
- Section D CADD/DRAFTING STANDARDS
- Section E DESIGN REFERENCES, SPECIFICATIONS AND STANDARDS
- Section F DESIGN REFERENCES

1.3 PROJECT PHASING (This Section Not Used)

1.4 LOCATION

The study area and watersheds for the ADMS (shown on Figure 1) includes 145 mi^2 in Maricopa County and surrounding the Town of Wickenburg. Watershed areas included consist of the Sols Wash Tributaries, (155 $mi^{2)}$ West Tributaries (41mi^2) and East Tributaries (98mi^2). The watershed area for the Hassayampa River and Martinez Wash, which both extend into Yavapai County, are not included.

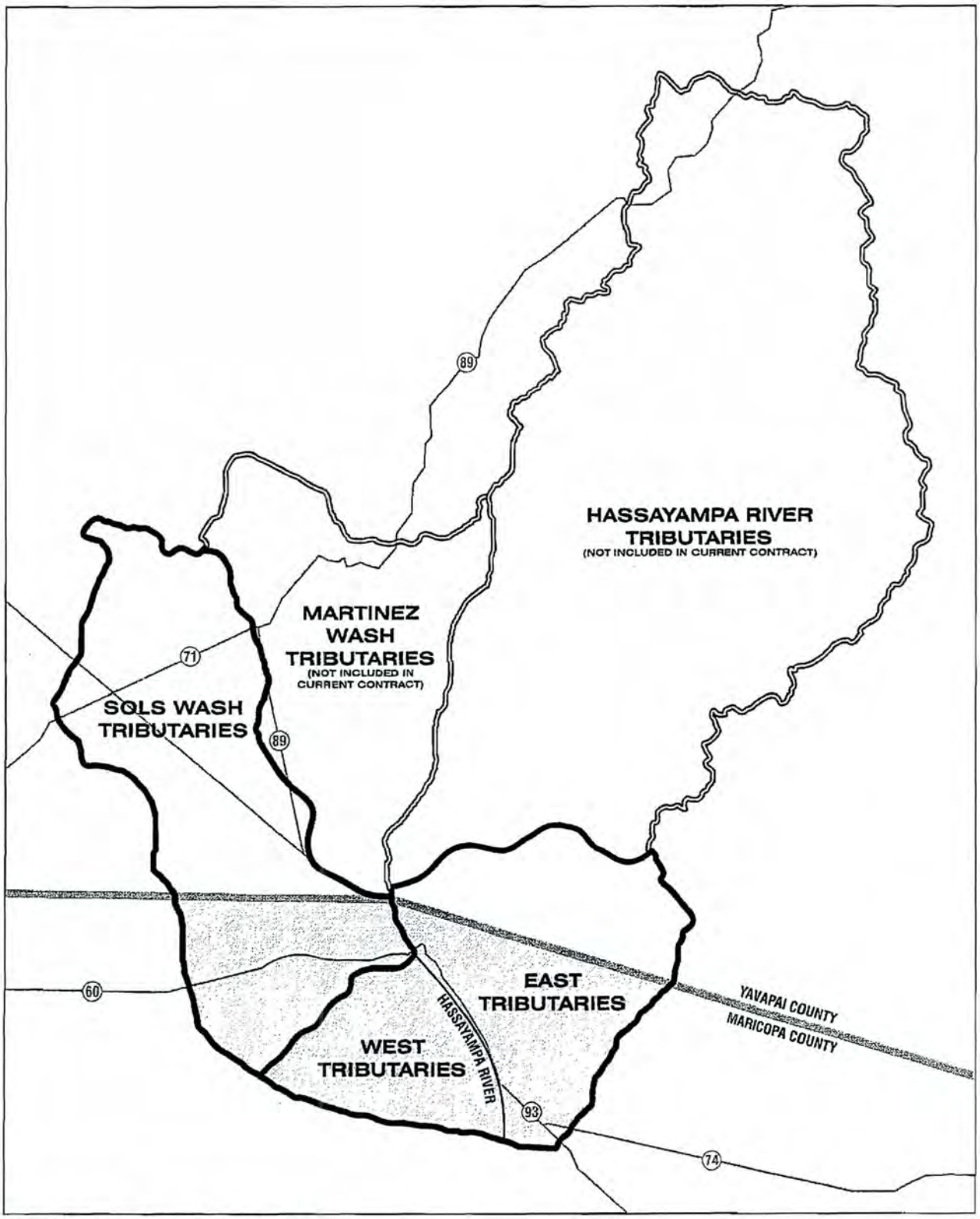

FIGURE 1: STUDY WATERSHEDS

WICKENBURG AREA DRAINAGE MASTER STUDY

Hoskin • Ryan Consultants, Inc.

FCD 2009C030

2 PROJECT ADMINISTRATION AND COORDINATION

2.1 PROJECT MANAGER

The CONSULTANT shall appoint a Project Manager who shall be knowledgeable and have responsible charge of the project. The Project Manager shall be the point of contact for the DISTRICT. The Project Manager shall be the same person listed in the CONSULTANT's Technical Proposal, unless otherwise approved by the DISTRICT.

The Project Manager is responsible for and shall perform the following tasks:

- Direct the work of the CONSULTANT's Project Team;
- Responsible for preparation, submittal, and revisions of contract documents, including invoices, monthly progress reports and schedule updates; and
- Keep the DISTRICT informed of all coordination with outside agencies and other affected parties.

The DISTRICT may request replacement of the Project Manager if it becomes apparent that this would be in the best interest of the project. The DISTRICT may terminate this agreement if the Project Manager is not available or if the CONSULTANT is unable to provide a replacement Project Manager acceptable to the DISTRICT.

2.2 PARTICIPANTS

The following project participants will be receiving copies of project submittals and will act as the agency point-of-contact:

Gregory L. Jones
Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009
Phone (602) 506-5537
Email: mailto:glj@mail.maricopa.gov

Rick Austin
Public Works
Town of Wickenburg
155 North Tegner, Ste A
Wickenburg AZ 85390
Phone (928) 2684-2761
Email: publicworks@ci.wickenburg.az.us

Charlie Cave
Yavapai County Flood Control District
500 S. Marina Street
Prescott, AZ 86303
Phone (928) 771-3197
Email: Charlie.Cave@co.yavapai.az.us

The CONSULTANT shall coordinate with the following organizations for information and input into the project:

- Flood Control District of Maricopa County (DISTRICT);
- Town of Wickenburg (Town);
- Wickenburg Chamber of Commerce;
- Arizona State Lands Department;
- Maricopa County Department of Transportation;
- Maricopa County Parks & Recreation;
- Maricopa County Planning and Development;
- Arizona Department of Transportation (ADOT);
- Arizona Game and Fish Department;
- Flood Control District of Yavapai County;
- Yavapai County, AZ;
- Nature Conservancy;
- BNSF Railroad;
- NRCS;
- USGS;
- Wickenburg Chamber of Commerce; and
- Bureau of Land Management (BLM).

2.3 PROGRESS REPORTS

The CONSULTANT will submit a monthly Progress Reports with each invoice. These reports shall discuss project activities for the same time period as included in the monthly invoices. The report shall be brief (no more than two [2] typed pages). At a minimum, the monthly report shall contain the following:

- A description of the significant work accomplished during the reporting month by task as identified in the contract fee proposal;
- A brief description of the work to be accomplished in the following month by task;
- A description of any problems encountered and actions to resolve the problems;
- The CONSULTANT shall provide a summary of the monthly and cumulative invoice amounts compared to the projected amounts as established at the project Kick-Off Meeting or as subsequently revised to reflect project change orders;
- For contracts or single work assignments greater than two hundred thousand dollars ($200,000), the CONSULTANT shall prepare and submit an Earned Value Analysis for all active tasks, a table showing the actual monthly invoice amounts to date and original project estimate cumulative monthly totals for the duration of the contract. A graph showing the Baseline Projected and Actual Expenditures and Earned Value will be included. The DISTRICT will furnish a spreadsheet template to the CONSULTANT for this purpose; and
- Updated Project Schedule.

The CONSULTANT shall call the DISTRICT's Project Manager once a week to provide a verbal progress report, unless directed otherwise by the DISTRICT's Project Manager. The CONSULTANT shall provide copies of minutes of meetings, and significant telephone conversations, and correspondence to the DISTRICT on a monthly basis. At the end of the project, copies of all minutes, conversations, correspondence, etc. shall be submitted in the Administration Report.

2.4 SCHEDULE

The CONSULTANT will submit a Project Schedule for the project at the Kick-Off Meeting. The level of detail provided by the schedule will, at a minimum, show major tasks, coordination meetings, all significant project and submittal milestones, and DISTRICT review periods. Additional detail for significant and critical sub-tasks may be required at the discretion of the DISTRICT's Project Manager.

The schedule shall be developed in a computerized format that contains the anticipated beginning and end dates for the tasks identified in the scope, the time duration of each task, a bar chart (Gantt Chart) showing the tasks and the overall duration of the project. The computer program MS Project or compatible is preferred. The CONSULTANT shall update this project schedule monthly.

The CONSULTANT shall allow a minimum of three (3) weeks for a review and comment period by the DISTRICT and other involved parties for all report submittals identified by milestone in the schedule.

The total contract time frame will not exceed **nine hundred ten (910) calendar days** not including optional tasks from the Notice to Proceed (NTP) date. Optional tasks are not included in the schedule. A schedule of major tasks with an estimated time of completion from the NTP is shown below.

NOTICE TO PROCEED

Kick Off Meeting ..... 2 Weeks
Final Submittal of Pilot Study to the District ..... 16 Weeks
Final Submittal of Hydrology and Geology Reports ..... 44 Weeks
Final Submittal of Hydraulics Reports ..... 96 Weeks
Final Submittal of TDN(s) ..... 104 Weeks
Final Submittal of Planning Studies ..... 120 Weeks
Final Submittal of Executive Summary Report ..... 127 Weeks
Lessons Learned Meeting ..... 129 Weeks
FINAL DELIVERABLES ..... 130 Weeks

2.5 PROCESS FLOW CHART

The CONSULTANT shall develop and implement a Process Flow Chart that fully coordinates the completion of all work tasks and deliverables in this Scope of Work with the tasks and deliverables specified to ensure they are carried out in a timely and effective manner.

This shall be updated monthly to show the current progress and provided at the Monthly Coordination Meeting.

2.6 INVOICES

The CONSULTANT will submit an estimate of the projected monthly billings at the Kick-Off Meeting. Thereafter, this estimate will be updated and submitted to the DISTRICT's Project Manager at least 10 days prior to the end of each quarter. This estimate will be based upon the percentage of work expected to be completed each month expressed as a percentage of the total contract amount and in dollars to be earned each month (earned value method).

Invoices shall be submitted monthly or at some other regular time interval approved by the DISTRICT. Invoices requesting progress payment, shall reflect the work accomplished during the invoice period. The invoices shall identify the project name, contract number, the DISTRICT's Project Control Number (PCN) and shall be completed as follows:

Payments shall be based upon the amount of work accomplished to date. Payments due shall be computed based on percent complete for each work task and subcontracted service identified in the contract fee proposal. The task percent complete multiplied by the budget amount for the task per the fee proposal shall be shown with a total due for all work tasks; the amounts previously billed; the amount due for the period; and the amount remaining for each task and the contract total.

Invoices shall be submitted to the DISTRICT's Accounts Payable for processing and payment. At the same time a copy of the invoice will be provided to the DISTRICT's Project Manager.

2.7 REQUIRED PROJECT MEETINGS

2.7.1 General Requirements

The Consultant is responsible for the minutes of any meetings and shall include copies of minutes of meetings, telephone conversations, and correspondence to the DISTRICT in the Project Administration Report.

The Meetings will generally held at the DISTRICT's office except that four(4) progress meeting will be held at the Town of Wickneburg as approved by the DISTRICT's Project Manager.

2.7.2 Kick-Off Meeting

The CONSULTANT shall meet with the DISTRICT within fourteen (14) days of the Notice to Proceed. At the meeting, the CONSULTANT will submit the project schedule which shall include dates of all proposed coordination meetings, dates of all required submittals for each of the tasks in the scope, significant project milestones, and DISTRICT review periods. The CONSULTANT will also submit a monthly estimation of the projected billings. The CONSULTANT shall bring the key project team members including the project checkers to the meeting to introduce them to the DISTRICT staff who will be working on the project. The DISTRICT will provide to the CONSULTANT such project information and data as the DISTRICT may have, including hydrology reports and models, aerial topographic mapping, utility record drawings, and other information and data as outlined in the Scope of Work.

2.7.3 Progress Meetings

The CONSULTANT shall participate in regular monthly coordination meetings (or more frequently as identified in the Scope of Work) with the DISTRICT's Project Manager. The CONSULTANT is responsible for taking and distributing the minutes of all meetings. Whenever possible, coordination and milestone/deliverable review meetings will be combined. During the Study a total of four (4) of these meetings will be held at the Town of Wickenburg.

2.7.4 Submittal Review Meetings (Replaced with Monthly Progress Meetings)

2.7.5 Stakeholder Coordination Meetings

Stakeholder Coordination shall be in accordance with Section 4.0 – Public Involvement.

2.7.6 FINAL Submittal Meeting

The FINAL Submittal Meeting shall be conducted in accordance with Section 5.7 – Hydrology.

2.7.7 Lessons Learned Meeting

Upon completion of the project, the CONSULTANT shall facilitate a half (½) day workshop to review any Scope of Work (SOW) items, task items, project assumptions, methodologies, project issues, etc., that can provide insight to the Project Team for future projects.

2.7.8 Other Meetings

Other meetings may be required as identified in the Scope of Work and other sections within these Guidelines.

2.8 RIGHT-OF-ENTRY

For survey, and geotechnical investigations, including sediment sampling, requiring Right-of-Entry (ROE) by the CONSULTANT, the CONSULTANT shall notify all property owners within the Project Area by mail and obtain any necessary ROE for the Project Area.

The DISTRICT will furnish the CONSULTANT with a draft notification letter. The CONSULTANT shall furnish the final notification letter and ROE form for prior written approval by the DISTRICT's Project Manager, as well as a list of all property owners notified.

2.9 OPTIONAL TASKS

2.9.A Optional Task 2A – Additional Meetings

The CONSULTANT shall conduct additional meetings with Stakeholders, working groups, public officials, governing bodies, or other project related meetings as requested by the DISTRICT. The specific need for this task will be determined by the DISTRICT during the contract period and may include additional contract time.

Optional Items are not authorized with the Notice to Proceed and may be authorized in writing by the DISTRICT based upon specific need as determined by the DISTRICT during the contract period and may include additional contract time. All invoices shall separately identify cost for the work under this task. This task shall not be included in the schedule until the task is authorized.

3 SURVEY

3.1 GENERAL

3.1.1 Supervisory Qualification Requirements

All survey work conducted by the CONSULTANT shall be supervised by and Arizona Registered Land Surveyor (RLS).

3.1.2 Right-of Entry Letter (See Task 2.8)

3.1.3 Assessor's Data

The DISTRICT will provide the CONSULTANT with Maricopa County Assessor's data to develop the list of property owners. The CONSULTANT shall review and modify the list in order to notify the current property owner prior to entering the property.

3.1.4 Property Owners List

The DISTRICT will provide a Database listing of all property owners within the study area. The CONSULTANT will identify affected property owners within the Project Area for further notification.

3.1.5 Transmittal of Notice

The DISTRICT will notify, by first-class mail, all the property owners within the study area of the Project Area. The CONSULTANT shall request rights-of-entry (ROE) for the DISTRICT, CONSULTANT and any Subconsultants. Laminated copies of the approved notification letter shall be carried by the CONSULTANT's personnel during field surveys. For public or other lands with restricted access, the CONSULTANT or his Subconsultants shall at all times carry copies of permits, licences, or letters of permission from the issuing authority when entering upon such lands.

3.2 SURVEY SERVICES

3.2.1 Survey Criteria

All survey work performed to obtain topographic mapping shall meet or exceed FEMA minimum criteria as defined in the FEMA Document unless stated otherwise. This includes, but is not limited to, field control surveys, verification of profiles, and for floodplain delineation projects, the establishment of permanent elevation reference marks (ERMs).

3.2.2 Structure Surveys

Field surveys of bridges, culverts, roadway improvements, railroads, embankments, levees, dam structures , and other structures shall be sufficient for the particular needs of the project, as specified in the Scope of Work. A total of seventy (70) structure surveys are included with the base contract. Photographs shall be taken and documented for the upstream and downstream ends of culverts and bridges. Additional surveys will be conducted as an Optional Task if authorized by the DISTRICT.

3.2.3 Structure Surveys Delivery Format

Structure survey information should be reduced and compiled into an 11" x 17" (maximum size) drawing for inclusion in the project survey report. For hydraulic modeling use, the information presented in the drawing should be in a format appropriate for use in the HEC-RAS model.

3.2.4 Coordinate System

All digital mapping data shall be submitted to the DISTRICT using the Arizona Coordinate System, 1983, Central Zone (international feet). The CONSULTANT shall reduce any terrestrial ground surveying measurements to said grid projection. The CONSULTANT shall provide the combined factor(s) used to reduce said ground measurements in the Project Survey Report.

3.2.5 Survey Control

Survey horizontal and vertical control for the Project shall be tied to uniform datum compatible with floodplain delineations within Maricopa County.

3.2.6 Geodetic Control Network

Where readily available, surveys will tie into the nearest primary and secondary control points from the MCDOT Geodetic Control Network. All ground control shall be positioned at a 5 cm (two-sigma) Federal Geodetic Control Subcommittee accuracy standard in both horizontal and vertical position

3.2.7 Horizontal Control

Unless otherwise specified in the Scope of Work, all horizontal control surveys shall be tied and delivered in NAD 83 (1992 epoch). Arizona coordinate system, 1983, central zone using the international feet as the units of measurement (ARS § 33-132). All horizontal control points and corresponding coordinates shall be listed in the Project Survey Report. Horizontal control points shall also be noted on the appropriate plan sheets, indicated by symbol at the true position and completely documented in the map sheet margin.

3.2.8 Vertical Control

Unless otherwise specified in the Scope of Work, all vertical surveys shall be based on NAVD 88, per the FEMA Document. The CONSULTANT shall utilize the published values for the Geoid Inclined Plane provided by Maricopa County Department of Transportation GDACS during the survey collection procedures on and as shown Attached (GEOID INCLINED PLANE PARAMETERS). A conversion factor, including documentation on how it was derived, shall be provided by the CONSULTANT to allow comparison of NAVD 88 elevations to NGVD 29 elevations and shall be included in the Project Survey Report. The conversion outlined in the FEMA Document shall be used. All vertical control points and corresponding coordinates shall be listed in the Project Survey Report. Vertical control points shall also be noted on the appropriate plan sheets.

3.2.9 Survey Meetings

The Survey Manager and Survey Technician for the project shall attend separate meetings with DISTRICT survey staff members to discuss the survey results and ensure that all work is performed in accordance with DISTRICT standards.

3.3 PROJECT SURVEY REPORT

The CONSULTANT shall prepare and deliver a Project Survey Report documenting surveys, aerial controls, and data collection for the Project. The Project Survey Report shall be 8½-inches by 11-inches in size and bound together. Any 11-inch by 17-inch maps included in the report shall be fan folded. Any larger maps shall be folded and contained in map pockets bound within the report. The Project Survey Report shall be sealed and signed by an Arizona Registered Land Surveyor in responsible charge of the survey aspects of the Project.

3.3.1 Contents of Project Survey Report

The Project Survey Report shall include a summary of the CONSULTANT responsibilities and survey activities; copies of all survey notebooks and office calculations; electronically collected survey data; details of benchmarks, aerial control, and other horizontal and vertical control points and the datum upon which each benchmark was originally established, horizontal and vertical order and class, benchmark type, ground grid conversion factor(s), and a detailed description of the point location for ready recovery in the field; quality control; GPS session information; and metadata for control stations, primary control targets, and blind aerial targets. The Project Survey Report shall include the following:

- A Table of Contents Sheet;
- A "SURVEYORS SUMMARY AND CERTIFICATION" which should include the following:
  - A background of GPS.
- Survey Summary which includes the following:
  - General discussion of the firm(s) responsibilities and overall approaches and procedures.
  - Specific static procedures.
  - Discussion of the procedures, equipment, control found and set, software utilized to process.
  - Discussion of procedures.

3.3.2 Format For Electronically Collected Data

All survey data collected electronically shall be submitted as an ASCII text file readable in MS Word and WordPerfect.

3.4 OPTIONAL TASKS

3.4.A Optional Task 3A – Additional Surveys

The CONSULTANT shall survey up to an additional thirty (30) structures (as defined above) and / or elevation certificates (if required) if authorized by the DISTRICT. Areas of braided and split flow identified in the field by the Project Hydrologists will be identified. Where the topographic maps do not provide sufficient detail to determine flow splits, additional field cross-sections shall be surveyed. The number and location of these is estimated at no more than five (5) locations.

Optional Items are not authorized with the Notice to Proceed and may be authorized in writing by the DISTRICT based upon specific need as determined by the DISTRICT during the contract period and may include additional contract time. All invoices shall separately identify cost for the work under this task. This task shall not be included in the schedule until the task is authorized.

4 PUBLIC INVOLVEMENT

4.1 GENERAL

The Public Information Office of the DISTRICT has prepared a separate set of guidelines for CONSULTANTs conducting public involvement and public information activities for the DISTRICT. A copy of these guidelines is available from the Public Information Office and should be used as a reference by the CONSULTANT when preparing public information related materials.

It is the intention of the guidelines to increase quality, efficiency, and consistency in public involvement work and products at the DISTRICT. These guidelines should assist in creating a consistent message for uniform and quality materials. These guidelines cover:

District Key Messages and Values
Creating a Public Involvement Plan
District Turnaround Times
Quality Control and Review
Materials Content Guidelines
Writing Guidelines
Design & Printing Guidelines
Logo Guidelines
Website Guidelines
Powerpoint Guidelines
Public Meeting Guidelines
Deliverables
Public Information Office Staff.

The DISTRICT and the CONSULTANT will plan and conduct public involvement and information as required for a particular project and as identified in the Scope of Work, in accordance with the DISTRICT Public Involvement and Information Guidelines. The number of public involvement activities will be as identified in the Scope of Work.

4.2 PUBLIC INVOLVEMENT PLAN

The Consultant shall provide a Public Involvement Plan in conjunction with the Stakeholder Involvement Plan (See Section 4.7) immediately upon the NTP.

4.3 PUBLIC INFORMATION MEDIA

The CONSULTANT shall prepare material announcing the beginning of the study, the study schedule, and introducing the public to the DISTRICT and the study process as follows:

- Create draft brochure (final and printing to be done by the DISTRICT);
- Create draft cover letter for mailing brochure to residents, businesses and Stakeholders;
- DISTRICT will mail brochure to affected and identified properties located within the study area boundaries; and
- Place brochures in key area locations in study area – schools, libraries, etc.

4.4 PROJECT WEBSITE

The CONSULTANT shall create and provide information to the DISTRICT and Town of Wickenburg for placement on their respective web sites. The CONSULTANT shall review Websites and recommend updates to the Websites on a regular basis. The CONSULTANT SHALL Provide suggested website wording and format about start of ADMS to Town of Wickenburg for their placement on their website along with brochure.

4.5 ADDITIONAL PUBLIC OUTREACH

The CONSULTANT shall create and provide a media backgrounder and a press release regarding start of the ADMS. The DISTRICT shall contact local media (e.g. radio, newspaper) and arrange an informal meeting (e.g., Brown Bag lunch meeting) and review project and provide media backgrounder and press release as approved by the DISTRICT's Project Manager.

4.6 PUBLIC MEETINGS

4.6.1 General

The DISTRICT is responsible for placing the legal advertising at the beginning of the study. After the advertisement is run, the DISTRICT will supply the CONSULTANT with a copy of the original affidavit of publication from each of the newspapers for each day that the advertisement ran to be included in the final reports.

CONSULTANT will be responsible for identify potential locations for each public meeting. The DISTRICT will secure the location. The CONSTULTANT shall be responsible for coordinating the setting up and taking down of each meeting, besides participating in the meetings.

The following shall occur for each public meeting:

- Assist DISTRICT in creating an agenda;
- The CONSULTANT shall create a draft flyer/brochure announcing public meeting to everyone located within the study boundaries;
- The DISTRICT shall final and mail the flyer/brochure;
- The DISTRICT will place a legal advertisement regarding the public meeting;
- The DISTRICT will place at least 2 display advertisements in area newspapers (one week apart) advertising the public meeting;
- The CONSULTANT shall create a draft invitation and to be send to identified stakeholders, elected officials in that area (mayor and city council), and city staff (city manager, engineer, and PIO) to the public meeting;
- The DISTRICT shall final and send the invitations to the stakeholders, elected officials in that area (mayor and city council), and city staff (city manager, engineer, and PIO) to the public meeting;
- As directed by the DISTRICT's Project Manager, the CONSULTANT shall create a poster(s) to be placed in visible public places announcing the study and any upcoming public meetings;
- The CONSULTANT shall produce handouts (e.g., fact sheets), comment sheets, and graphic display boards for meeting as required for each public meeting;
- The CONSULTANT shall provide information about the public meeting to be posted on the DISTRICT and Town of Wickenburg websites by the TOWN and the DISTRICT;
- The CONSULTANT shall work with Town of Wickenburg, Chamber of Commerce and other stakeholders to utilize their newsletters. bulletins, websites, etc. to advertise the public meetings;
- The CONSULTANT shall assist in any coordination of local presentations to stakeholder organizations or other entities (e.g., civic organizations, Homeowner Associations, Chamber of Commerce); DISTRICT will do the presenting; and
- The DISTRICT shall send out press releases about the public meeting. The CONSULTANT shall follow DISTRICT Public Involvement Guidelines for holding a public meeting.

4.6.2 Required Public Meetings

Public meetings shall be held at the following stages:

- Brown Bag Lunch Meeting – Start of ADMS, prior to Public Meeting 1;
- Public Meeting 1 – Start of ADMS and Sunny Cove Wash Study;
- Public Meeting 2 – Completion of Sunny Cove Wash TDN;
- Public Meeting 3 – Intermediate Floodplain Delineation; and
- Public Meeting 4 – Completion of TDN for ADMS.

4.6.3 Post Public Meeting Tasks

CONSULTANT shall make electronic copies of the exhibit boards and handouts available to the DISTRICT and Town of Wickenburg to post on their websites.

CONSULTANT shall document each outreach event (e.g., mailing, public meeting, stakeholder meeting) in a Community Outreach Activity Log. To include the following:

- Mailing List;
- Material provided;
- Delivery method; and
- Location, time and duration of meeting(s).

4.7 STAKEHOLDER INVOLVEMENT

Agencies, private enterprises, or individuals who have an interest in the outcome of the project will be considered stakeholders.

The CONSULTANT shall prepare a Stakeholder Involvement Plan in conjunction with the Public Involvement Plan (See Section 4.2) immediately upon NTP. The Plan will include a preliminary list of stakeholders for use in developing a stakeholder database, preliminary agendas for the initial stakeholder working group meeting, a preliminary stakeholder's matrix of opportunities and issues, and a preliminary stakeholder involvement schedule. Stakeholders will be split into two groups: those to be actively involved and be part of a Stakeholder Work Group, and those that wish to be passively involved by just being kept informed. After review by the DISTRICT's Project Manager, the CONSULTANT will finalize the plan and keep it updated during the Study.

The CONSULTANT and the DISTRICT's Project Manager shall meet with officials from the Town of Wickenburg, Stakeholders and other interested parties as may be appropriate and as identified in the Section 2 of this Scope of Work. The purpose of such meetings is to identify local flooding problems and obtain information on current and planned public works projects, infrastructure modifications, storm drainage systems, development, corporate limits, and expectations for "kinder and gentler" elements, operation and maintenance needs, and other items of interest that will facilitate the completion of a successful project. In addition, project partner expectations and requirements for the project will be identified and incorporated into the project whenever possible.

Meetings with other agencies shall generally be held at their offices, depending on the issues and number of stakeholders involved. A total of three (3) meetings are included under this task. The DISTRICT shall be kept informed of all such meetings and shall attend the meetings when needed. The DISTRICT shall be copied on all meeting minutes.

The CONSULTANT shall identify the Stakeholders and contact personnel affected or bordering the study area. A total of three (3) Stakeholder Working Group meetings shall be held during the study. After the DISTRICT has approved the list of Stakeholders, the CONSULTANT shall participate and help schedule a Stakeholder Working Group Kick-off Meeting. The meeting agenda will include:

- An overview of the ADMS Purpose and Goals;
- ADMS Schedule and Milestones;
- Identification of Stakeholder Opportunities and Constraints; and
- Development of Future Meeting Dates (if necessary).

The CONSULTANT shall also utilize those meetings as an opportunity to engage stakeholders and, if deemed appropriate and approved by the DISTRICT, additional agency or non-agency stakeholders may be added to the Stakeholder Working Group as a result of the public meetings.

The CONSULTANT shall schedule and coordinate two (2) additional Stakeholder Working Group meetings throughout the Study.

The CONSULTANT shall coordinate with the stakeholders throughout the project to exchange information, address opportunities and issues and ensure that stakeholder concerns and input are considered as part of the potential ADMP alternatives formulation.

In addition to the working group meetings and public information activities, the Stakeholders shall be invited to the Monthly Coordination meetings, as appropriate.

The CONSULTANT shall keep Stakeholders informed throughout the study via electronic updates, and e-newsletter articles for their publications

The CONSULTANT shall keep a written summary of all meetings and outreach-related activities with the stakeholders and will include them as part of the project record (e.g., Community Outreach Activity Log).

5 HYDROLOGY

The CONSULTANT shall perform complete and detailed hydrologic analysis and geologic analysis of the project area in order to fulfill the specific requirements identified in the Scope of Work for the Study. **Hydrology for the Sunny Cove Wash area (Pilot Study area) will be completed in accordance with this Section but will precede the completion of work for other watershed areas.**

5.1 PROCEDURES

The CONSULTANT shall follow the procedures outlined in the Drainage Design Manual for Maricopa County, Volume I Hydrology, latest revision, for all hydrologic modeling and calculations and the Scope of Work, General Requirements and Procedures.

5.2 RETURN FREQUENCY

Hydrologic modeling shall be completed for the specific frequency and duration required as follows for the ADMS tasks:

- 500-year; either 6-hour or 24-hour Existing Condition;
- 250-year; either 6-hour or 24-hour Existing Condition (Sunset Dam, Sunny Cove Dam and Cassandro Wash Dam Only);
- 100-year 24-hour Existing Condition;
- 100-year 6-hour Existing Condition;
- 50-year; either 6-hour or 24-hour Existing Condition;
- 10-year; either 6-hour or 24-hour Existing Condition;
- 100-year 24-hour Future Condition; and
- 100-year 6-hour Future Condition.

After completing the initial hydrologic modeling a selection will be made between the 6-hour or 24-hour HEC-1 model which generates the higher peak flow for each storm event. Based on the results, the 10, 50, 250 (dam watersheds only), and 500 (all watersheds) events shall be computed using the controlling duration identified in the 100-year model.

5.3 EXISTING STUDIES AND FIELD RECONNAISSANCE

The CONSULTANT shall research and consider all existing hydrologic studies of the area and shall become familiar with the general hydrology and geology of the area. A field reconnaissance shall be performed to determine the following, and the results shall be documented in the Data Collection Report:

- Verify sub-basin delineations boundaries;
- Verify flow patterns;
- Verify bedrock and soil unit mapping obtained from existing data;
- Determine the actual current land use for parcels;
- Identify flow diversion locations caused by natural obstructions, drainage structures, storm drains, site grading, etc.;
- Field cross-sections at hydraulic flow splits locations will be performed in accordance with Optional Task 3A; and
- Existing stormwater retention areas.

5.4 BASE MAPS

The CONSULTANT shall develop the Hydrologic and Geologic base maps using the topographic mapping prepared by the CONSULTANT/subconsultant or supplied by the DISTRICT. For those areas not covered by the mapping, U.S. Geological Survey (USGS) topographical quadrangle maps will be used. An overall Watershed Drainage Basin map with sheet index will be prepared at an appropriate scale as approved by the DISTRICT's Project Manager.

5.5 COMPUTER MODELING

The CONSULTANT may recommend Other Models / Methods for used based on the watershed subject to the DISTRICT Project Manager's approval.

The CONSULTANT shall use the U.S. Army Corps of Engineers computer program HEC-1, Version 4.1, to develop a hydrologic model for the area. All modeling shall be in accordance with the latest version of the DISTRICT's Drainage Design Manual, Hydrology.

The DISTRICT's computer program DDMSW, latest version, shall be used to develop HEC-1 input data. The specific hydrologic techniques to be used are:

- Rainfall Excess: The Green and Ampt methodology will be utilized for estimation of rainfall losses;
- Unit Hydrograph: The Clark and S-Graph method should be used. The choices in methodology will be to the discretion of the CONSULTANT, with approval from the DISTRICT;
- The Times of concentration and Lag times shall be adjusted for the appropriate return frequency using the Drainage Design Manual, Volume I;
- Channel Routing: The choice of methodology will be at the discretion of the CONSULTANT, with approval from the DISTRICT. Average cross sections will be developed utilizing available mapping and field reconnaissance data. Sufficient field cross sections will be taken to ensure that routing reaches are reasonable and representative of field conditions. The HEC-1 routing parameters for the reaches modeled using HEC-RAS will be adjusted after the HEC-RAS cross sections are available. The resulting velocities and depths, for all reaches, must be assessed for realistic values;
- Reservoir Routing: Detailed analysis of structures and ponding areas will be accomplished for the dams. The Modified Puls reservoir routing option of HEC-1 will be used for the reservoir routing analysis;
    - Reservoir Routing for Cassandro Dam will use the Cassandro Dam 2009 Field Survey DTM.
    - Reservoir Routing for Sunset and Sunny Cove Dams will use the Wickenburg 2004 DTM.
- Channel Transmission Losses: Attempts should be made to estimate infiltration losses through channel bottoms based on existing field data or literature. If sufficient data is not available, the final report must acknowledge so and explain how the peaks and volumes of flow are affected by not including the transmission losses; and
- The DISTRICT will provide appropriate references to facilitate parameter estimation.

Output of the computer model should be reviewed to see if the peak flows, routing velocities and volumes are realistic. An adjustment to input for obtaining the most realistic results is normal to the scope.

The CONSULTANT shall attempt to recover historic stream gage data and use it to compare with the results obtained by the hydrologic model. Major differences must be discussed in the final report. The peak discharges and unit discharges for the sub-basins should be graphically presented and compared to regional discharge curves. Major differences must be discussed in the final report.

5.6 WATERSHED AND SUB-BASIN DELINEATION

Separate hydrology models will be provided for each Watershed defined as follows and as shown in Figure 1:

- Sols Wash;
- West Tributaries; and
- East Tributaries.

A Pilot Test area within the watershed will be selected and hydrologic analyses performed and submitted to the DISTRICT for review prior to initiating sub-basin delineation and parameter estimation on the remainder of the watershed.

Using appropriate hydrologic judgment, sub-basins are to be identified that provide reasonable depiction of the watershed condition. The sub-basins must be as homogeneous as possible, using watershed area, watershed type (mountainous and flat lands or urban and undeveloped areas), and time of concentration as criteria. Sub-basin breakdowns will be done in sufficient detail to provide peak discharges at structures, major road crossings, confluences, and at boundary lines. An appropriate time step and number of ordinates is to be selected that allows for complete calculation of the flood hydrograph without sacrificing resolution of the flood peak. All calculations or assumptions used in developing sub-basin and routing parameters shall be documented and made a part of the appendix for the hydrology report. Field surveys may need to be taken for HEC-1 modeling purposes.

Modifications to the HEC-1 models, including the Pilot Test, area may be required to represent the conditions of the "levee in place" and "levee removed" for all de-certified levees or embankments. Floodplains will be delineated only for the "worst case" floodplain condition which may be the ponding which results from a HEC-1 stage-storage routing on the upstream side of culverts and the full unattenuated discharge at the downstream side of the embankments.

5.7 MEETINGS

Five (5) meetings and two field trip meetings shall be held with DISTRICT staff at the following milestones. These meetings will be combined with monthly progress meetings and meetings required by other tasks as much as possible.

- **Field Trip 1** – Performed at the start of the project to scope out the critical points of the watershed and problem areas, including the Sunny Cove Wash (Pilot Test) area.
- **Meeting Number 1 (Combined with Monthly Progress Meeting)** – Held as soon as basic data is gathered and the sub-basins have been delineated. Sample HEC-1 parameter estimations and results from the Pilot Test area should also be presented and discussed at this meeting. A copy of the draft maps of the sub-basins and soil and bedrock maps must be delivered to the DISTRICT prior to this meeting.
- **Meeting Number 2 (Combined with Monthly Progress Meeting)** – After all the parameters have been estimated. A draft copy of the parameters must be delivered to the DISTRICT at least one week prior to this meeting.

- **Meeting Number 3 (Combined with Monthly Progress Meeting)** – After the preliminary HEC-1 results have been obtained and a draft report has been prepared. A copy of the draft report and the copy of the HEC-1 on a floppy disc, compatible with the DISTRICT's computer, must be delivered two weeks prior to the meeting.
- **Meeting Number 4 (Combined with Monthly Progress Meeting)** – To discuss comments on the Hydrology & Geology Report by the DISTRICT.
- **Field Trip 2** – To discuss comments by the DISTRICT in the field. This field trip may be scheduled for the same day as Meeting Number 4 to discuss the results obtained.
- **Meeting Number 5 (Combined with Monthly Progress Meeting)** – FINAL Submittal meeting for all TDNs and Deliverables.

5.8 REVIEW AND APPROVAL

It is required that the CONSULTANT obtains approval from the DISTRICT at each of the following steps:

- Pilot Test Area at the start of the project;
- Soil and bedrock maps, watershed boundary maps, and land use maps (shape files are acceptable for review purposes);
- HEC-1 parameter estimation;
- HEC-1 flow schematic and input parameters; and
- HEC-1 results.

All hydrology models and digital supporting data including GIS shape files shall be submitted to the DISTRICT for review and approval.

The DISTRICT must approve any changes made by the CONSULTANT to any models. Additionally, the CONSULTANT shall fully document the changes so the DISTRICT can verify the changes.

All changes to any hydrology models prepared by the CONSULTANT must be provided to the DISTRICT in a timely manner for review and approval.

5.9 HYDROLOGY & GEOLOGY REPORT

A Hydrology & Geology Report shall be prepared to document the results of the Study. Available geology and soils data report will supplement the compilation of the geology and soils map. Bedrock and overburden soil matrices shall summarize the bedrock and soil physical and hydrologic properties.

5.9.1 Technical Data Notebook

The Hydrology & Geology Report will be included as Section 3 of the Technical Data Notebook, and will be prepared in accordance with ADWR State Standards Attachment 1-97 (SSA 1-97). The report will be organized as specified by the DISTRICT, following SSA 1-97 format. The report shall be submitted in draft form for review and comment and the final report shall be submitted upon incorporation of review comments. This report supports the Technical Data Notebook for FEMA submittals. It includes existing condition hydrology models for the return frequencies listed in Section 5.2.

5.9.2 Sunset/Sunny Cove Watershed Hydrology & Geology Report

A separate hydrologic analysis and Hydrology and Geology Report will be provided for the Sunset/Sunny Cove Watershed on an accelerated schedule at the beginning of the contract. Results from the Structures Assessment shall be referenced.

5.9.3 ADMS Hydrology & Geology Report

An ADMS Hydrology & Geology Report shall also be prepared in which all models developed under the current scope of work are presented.

Tables and Figures to be prepared for the Hydrology & Geology Report shall include:

- **Schematic Map** – Topographic base map(s) showing the sub-basins, schematic map for the HEC-1 overlain on an Area Photo, routing reaches, order of combining the hydrographs, major man-made structures such as pipe or culverts, and references (i.e. street names, Township, Range, Section, etc.) at a scale of 1 inch = 2000 feet;
- **Routing Map** – Topographic base map showing the Tc flow path or lag flow paths, and routing reaches at the same scale as the base map. Pertinent hydraulic data for each routing reach such as cross section locations, photographs, "n" value selection, velocity calculations, pipe or culvert dimensions and slopes shall be included on the map;
- **Soils and Bedrock Maps** – Soils and bedrock map(s) at the same scale as the base map;
- **Land Use Map** – Land Use Map(s) at the same scale as above;
- **Flow Map** – Base topographic map showing the results of the study (i.e. peak flows, peak volumes, etc) at major concentration points. The level of detail of this map is to be determined by each individual scope); and
- **Tables** – Pertinent data on all the structures in the watershed (such as spillway elevation, rating curves, etc.).

One set of study maps (i.e. Schematic maps, Routing maps, Soils maps and Bedrock maps, Land Use maps and the Flow map) to be folded and delivered in a binder.

5.10 OPTIONAL TASKS

5.10.A Optional Task 5A – Grid-Based Model

The CONSULTANT shall propose a computer program or use FLO-2D at large grid scale subject to the DISTRICT's Project Manager approval for a 20-square mile test tributary using the 50', 100', and 150' grid cell sizes. 100-year -24-hour existing condition event with a single storm model. Results from this modeling effort will be used as a comparison to the HEC-1 results. Deliverables will include final GIS shape files outputs from the FLO-2D program, hydrograph, and a table or shape file with a comparison of discharges and volumes at specific locations in common to both models. Results will be summarized in a Pilot Study Report. Results will be cross-referenced with the Hydrologic Model defined in this Section.

Optional Items are not authorized with the Notice to Proceed and may be authorized in writing by the DISTRICT based upon specific need as determined by the DISTRICT during the contract period and may include additional contract time. All invoices shall separately identify cost for the work under this task. This task shall not be included in the schedule until the task is authorized.

6 HYDRAULICS

If the hydraulics will be part of a package submitted to FEMA, the DISTRICT's Floodplain Delineation guidelines shall be used.

6.1 STANDARDS

The CONSULTANT shall follow the procedures outlined in the Drainage Design Manual for Maricopa County, Volume II Hydraulics latest revision and the DDMSW River Mechanics Manual (FCDMC, 2009), for all hydraulics calculations, except as amended or modified herein or in the scope of work.

6.2 OPEN CHANNEL HYDRAULICS FOR WATERCOURSES

HEC-RAS Version 4.0 or HEC-GeoRAS Version 4.2.93 shall be used by the CONSULTANT and approved by the DISTRICT to perform water surface profile calculations, unless the DISTRICT agrees in writing to another method. A hard copy and CD with input and output files shall be submitted for DISTRICT review. The HEC-RAS files shall be prepared in a format suitable for submittal to FEMA.

The modeling of tributary (side) drainage for floodplain delineation shall be addressed per FEMA criteria.

The modeling of tributary (side) drainage for design purposes shall be the more restrictive of either the:

- 100-year frequency peak in the main channel, with 10-year frequency peak tributary drainage or;
- The 10-year frequency peak in the main channel, with the 100-year frequency peak tributary drainage.

Locations of cross sections used in the water-surface profile calculations shall be provided on a scaled map and also in a tabular format. The cross section labels on the maps shall reflect cross sections in the models.

All hydraulic design shall be in accordance with the Maricopa County Drainage Policy and Standards Manual and the Maricopa County Drainage Design Manual, Hydraulics.

At the commencement of the study, an "Effective" HEC-RAS model shall be developed to model and compare results and parameters from the current study. New topographic mapping shall be used with current discharge rates and Manning's 'n' values to compare results to currently mapped conditions.

6.3 MULTIPLE PROFILES

Hydraulic analysis shall be performed for the 10, 50, 100 and 500-year flood frequencies. Flood profiles shall be presented in graphical form in accordance with FEMA format and will be provided in the final TDN(s).

6.4 SEDIMENT SAMPLING

The CONSULTANT shall obtain and test samples of the existing channel bed and banks at selected locations of most likely channel degradation and scour identified from the geological and soils mapping throughout the candidate study reaches and the upstream sediment source areas. Thirty (30) channel/bank sites will be selected from those areas deemed to be the more susceptible to channel degradation and scour where soil samples (shovels up to 2 feet deep) will be obtained and sieve analyses will be performed. Representative samples will be obtained from both the channel and channel banks.

The sampling procedures shall be consistent with procedures described in the Bureau of Reclamation's, Computing Degradation and Local Scour, January 1984, or the U.S. Army Corps of Engineers', Sedimentation Investigations of Rivers and Reservoirs, 31 October 1995. The pebble-count results shall be combined with the sieve analysis results to develop a gradation curve per the 1984 Bureau of Reclamation method. Gradations of the sediment samples shall be plotted for both the channel bed and banks. Changes in the gradations throughout the study reach shall be documented. Test data, gradation plots, plots of the longitudinal change in size, and any other supporting data shall be included in the Technical Data Notebook.

6.5 QUALITATIVE ANALYSIS FOR LATERAL MIGRATION

A qualitative analysis for lateral migration shall be conducted for each of the washes within the entire study area.

The purpose of a qualitative lateral migration analysis is to roughly define areas subject to lateral migration and to delineate the approximate limits of erosion hazard setback based on both geomorphic and engineering principles. The qualitative lateral erosion analysis will be based on the assessment and interpretation of geologic maps, soil maps, USGS maps, and field visits.

The qualitative geomorphic analysis shall include a study of published soil maps, the most recent topography, and field visits to the selected study reaches of the Wickenburg ADMS. Geomorphic/geologic principles shall be used to identify bedrock outcrops, armored channel beds, cut banks, and existing man-made bank protection structures. The locations of such features will be plotted in a GIS shape file. Up to four sets of historical aerial photos for the stream reaches to be evaluated for lateral migration potential shall be collected from the DISTRICT and other sources for channel lateral migration comparison. When the aerial photos are not rectified, they should be semi-rectified based on Arizona State Plane HARN NAD 1983 Central coordinate system using ArcGIS software. The historical aerials will be used to identify the types of channel changes that have occurred, the locations of channel movement, and the maximum long-term channel movement during the period of record. A brief description and map of the representative locations of areas of likely Lateral Migration shall be submitted to and approved by the DISTRICT.

A GIS shape file shall be prepared and delivered.

The CONSULTANT shall include a section within the ADMS Hydrology & Geology Report describing the methodology and results of the lateral migration analyses.

6.6 TOTAL SCOUR SPREADSHEET

The CONSULTANT shall prepare a spreadsheet documenting the results of each scour type from the Total Scour Calculations for typical reaches of the area studied for the floodplain delineations.

6.7 OPTIONAL TASKS

6.7.A Optional Task 6A – Sols Wash HEC-RAS, Sediment Transport and River Mechanics

The CONSULTANT shall perform a HEC-RAS analysis, sediment transport analysis and scour analysis for the Sols Wash only from its confluence with the Hassayampa River, upstream a distance of approximately eight (8) river miles. The HEC-RAS models shall be performed in accordance with Section 6.2.

6.7.A.1 General

The CONSULTANT shall recommend areas that require additional analysis to determine if the area(s) has erosion/lateral migration hazards. This shall be done in accordance with this section.

Scour analysis shall be performed using an analytical approach based on flow characteristics associated with 100-year frequency peak flow, the depth of the thalweg, and the channel bed materials. For long-term scour component, a dominant discharge such as a 10-year flood should be used. The total scour depth should be measured from channel thalweg.

Scour calculations are to be tabulated at all critical locations and presented with a map showing the locations. All of the following shall be considered in determining the total amount of scour:

6.7.A.2 Quantitative Analysis for Lateral Migration

The quantitative analysis for lateral migration will be based on (1) the analysis of historical aerial photographs; (2) Level I and Level II analyses from current Arizona State Standard Lateral Migration Setback Allowance for Riverine Floodplains in Arizona, ADWR, 1996; and (2) bank stability analysis based on hydraulic and geotechnical engineering principles.

The sediment sampling will be based on the procedures outlined in Section 6.6.A.6. Fine-grained samples will be sieved to determine the size distribution. The sediment distribution for coarse-grained samples will be estimated using a pebble-count procedure. The gradations of the sediment samples shall be plotted.

Check bank lateral stability for Sols Wash based on current Arizona State Standard Lateral Migration Setback Allowance for Riverine Floodplains in Arizona, ADWR, 1996. The allowable velocity analysis method documented in the current Arizona State Standard Lateral Migration Setback Allowance for Riverine Floodplains in Arizona shall be used. A sediment-laden condition shall be used for the Level II analysis. The representative bank locations shall be selected by the CONSULTANT to depict the range of bank conditions observed in the study reach. A brief description and map of the representative locations shall be submitted to and approved by the DISTRICT prior to application of the Level II methodology by the CONSULTANT. Reach-average hydraulic data obtained from the most recent HEC-2 or HEC-RAS model available for the study reach at the time of the analysis will be used in the Level II analysis.

Hydraulic and geotechnical engineering principles shall be used to provide more details about the bank stability and lateral erosion. The methodology can be from one of the following technical documents:

(1) Riverbank Stability Analysis. I: Theory and II: Applications by Osman, et al. (J. of Hydraulic Engineering, ASCE, 114(2), 1988);
(2) Sediment and Erosion Design Guide by Mussetter, et al. (Albuquerque Metropolitan Arroyo Flood Control Authority, 1994); and
(3) Bank and Near-bank Processes in an Incised Channel by Simon et al. (Geomorphology, Elsevier, 35, 2000).

The recommended methodology shall be submitted for approval by the DISTRICT prior to the work. A software (Bank Stability and Toe Erosion Model) developed by National Sedimentation Laboratory) may be used. A brief description and map of the representative locations shall be submitted to and approved by the DISTRICT prior to application of the engineering methodology by the CONSULTANT.

6.7.A.3 Total Scour

The total scour analysis for the existing conditions shall be in accordance with the DDMSW River Mechanics Manual (FCDMC, 2009) and shall include the estimation of long-term scour, general scour; bend scour, bed-form scour, low-flow incisement and local scour. A safety factor of 1.3 shall be used. The total scour depth should be measured from channel thalweg. The total scour analysis for existing conditions will be performed for eight (8) miles of channel. The soil samples for this task will be based on Section 6.4.

6.7.A.4 Sediment Yield

The 100-year storm event sediment yield and annual sediment yield shall be estimated based on the procedures documented in the DDMSW River Mechanics Manual (FCDMC, 2009). The soil samples for this task will be based on Section 6.4.

The sediment yield consists of two parts and is defined as the sum of the wash load and the total bed material load delivered to a point of interest. The wash load is calculated with the MUSLE method, and the total bed material load is calculated with the Zeller-Fullerton equation, which is based on the assumption that the reach is at an equilibrium condition. The sediment yield can be calculated for a particular frequency (return period) or on an annual basis. In both cases (annual and return period), the sediment delivery ratio shall be applied to the wash load estimate. In addition, to convert the wash load from tons to volume, the relevant equation from the DDMSW River Mechanics Manual shall be used.

For the total bed material load, the result from the Zeller-Fullerton equation is converted to a total bed load volume for the total storm duration based on the assumption that the sediment discharge hydrograph follows the same shape of the water flow hydrograph. Please refer to the DDMSW River Mechanics Manual for more detailed information. The latest version of the DDMSW software may be used to calculate the sediment yield.

6.7.A.5 Sediment Transport

Existing condition FLUVIAL-12, HEC-6, HEC-6T models, or other models approved by the DISTRICT, for the 100-year flood, and for the historical flood series, shall be developed for Sols Wash. The model for the Sols Wash will extend from its confluence with the Hassayampa River, upstream a distance of approximately eight (8) river miles.

6.7.A.6 Sediment Sampling and Testing

The CONSULTANT shall obtain and test samples of the existing channel bed and banks throughout the study reach and the upstream sediment source area. The number of soil samples (shovels up to 2 feet deep) and sieve analyses shall be forty-six (46). The sampling procedures shall be consistent with procedures described in the Bureau of Reclamation's, Computing Degradation and Local Scour, January 1984, or the U.S. Army Corps of Engineers', Sedimentation Investigations of Rivers and Reservoirs, 31 October 1995. The pebble-count results shall be combined with the sieve analysis results to develop a gradation curve per the 1984 Bureau of Reclamation method. Gradations of the sediment samples shall be plotted for both the channel bed and banks. Changes in the gradations throughout the study reach shall be documented. Test data, gradation plots, plots of the longitudinal change in size, and any other supporting data shall be included in the Technical Data Notebook.

Optional Items are not authorized with the Notice to Proceed and may be authorized in writing by the DISTRICT based upon specific need as determined by the DISTRICT during the contract period and may include additional contract time. All invoices shall separately identify cost for the work under this task. This task shall not be included in the schedule until the task is authorized.

6.7.B Optional Task 6B – Additional 12 Miles of Sediment Transport and River Mechanics

The CONSULTANT shall provide sediment transport and river mechanics for an additional Twelve (12) river miles in general accordance with Optional Task 6.7.A.

Optional Items are not authorized with the Notice to Proceed and may be authorized in writing by the DISTRICT based upon specific need as determined by the DISTRICT during the contract period and may include additional contract time. All invoices shall separately identify cost for the work under this task. This task shall not be included in the schedule until the task is authorized.

6.7.C Optional Task 6C – Additional Sediment Samples

The CONSULTANT shall provide an additional fifty (50) sediment samples throughout the watershed area.

Optional Items are not authorized with the Notice to Proceed and may be authorized in writing by the DISTRICT based upon specific need as determined by the DISTRICT during the contract period and may include additional contract time. All invoices shall separately identify cost for the work under this task. This task shall not be included in the schedule until the task is authorized.

7 FLOODPLAIN DELINEATION

7.1 GENERAL

The CONSULTANT shall delineate and/or re-delineate approximately 100 river miles of detailed delineations in accordance with this scope of work. Delineations do not include the Hassayampa River, Sols Wash or Hospital Wash. An additional 80 river miles may be provided under an optional task if authorized by the DISTRICT. The CONSULTANT shall meet with the DISTRICT and make recommendations for the areas to be delineated. The DISTRICT's Project Manager shall approve all locations to be delineated.

7.2 COORDINATION

The CONSULTANT shall meet with officials from the local communities in accordance with Section 4 of the Scope of Work. The purpose of these meetings is to identify local flooding problems and obtain information on current and planned public works projects, channel modifications, storm drainage systems, development, and corporate limits.

Public involvement will be conducted in accordance with Section 4 of the Scope of Work.

7.3 DATA COLLECTION

See Section 8.1 for Data Collection

7.4 FIELD RECONNAISSANCE

The CONSULTANT will conduct field reconnaissance covering the full study reach. This will include observation of channel and floodplain conditions for estimation of Manning's "n" values, photographic documentation of floodplain characteristics, and determination of channel bank stations, observation of possible overflow areas, inspection of levees or other flood control structures, and measurement of bridge dimensions.

Manning's "n" values are to be determined using the methodology in the USGS report, Estimated Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona, April 1991. Copies of the report are available through the DISTRICT.

The field reconnaissance results will be incorporated in the TDN as Appendix E, and a draft copy will be submitted to the DISTRICT for review and approval prior to beginning the HEC-RAS modeling. The field reconnaissance section will present the determination of channel and overbank "n" values using captioned color photographs or color photocopies. The section will also discuss floodplain conditions affecting the delineation, describe structures and obstructions, and provide color photos or photocopies of major hydraulic structures. The location of photos and direction of view, structures, and "n" values will be displayed on reduced scale mapping.

Manning's 'n' evaluations shall be performed for all study watercourses to determine if the water surface elevations are sensitive to minor changes to "n" values. Results shall be documented in the Field Reconnaissance Report. Following completion of the initial HEC-RAS modeling, a sensitivity analysis will be conducted for all watercourses. If significant changes are noted, the CONSULTANT and the DISTRICT will determine the most appropriate "n" values to use in the delineation study. An "Effective" model will be prepared using the new topography and current discharge values for later comparison.

7.5 CROSS-SECTIONS

The location and alignment of modeling cross-sections and channel centerlines will be submitted for the DISTRICT's review and approval prior to digitizing the cross-section data. FEMA mapped cross-section locations and those digitized from work maps will be presented initially, where available. Where possible, the cross-section locations (cross-section digital file) from the effective floodplain delineation study will be used.

Identification of cross-sections will be in river miles, increasing upstream. Cross-sections will be spaced approximately every 500 feet, unless geographic or structural constraints dictate otherwise, and will extend the full width of the area inundated by 100-year floodwaters. Cross-section IDs may change from the current FEMA IDs if the thalweg or river baseline has changed.

Cross-section stationing will be from left to right looking downstream with the thalweg as station 10,000.

Cross-section orientation may need to be altered after running the HEC-RAS model to ensure that they are perpendicular to the flow, per FEMA criteria.

Textual descriptions regarding cross-section locations with respect to physical features within each study area will be required within the Hydraulic model. These descriptions should also reference flow-splits and other hydrologically pertinent study results, including results from previous related studies.

The cross-section plots will show water surface profiles, ineffective flow areas, "n" values, encroachments, channel stationing, and other pertinent information. All plots are to be accompanied by a legend.

7.6 FLOODPLAIN DELINEATION

The CONSULTANT will conduct the study using the guidelines established in FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners, April 2003, FIA Document 12, Appeals, Revisions, and Amendments to Flood Insurance Maps, December 1993, Arizona Department of Water Resources' State Standard for Floodplain Hydraulic Modeling (SS9-02), and the project Scope of Work.

7.6.1 Modeling

Floodplain delineations will be accomplished using the U.S. Army Corps of Engineers' most recent version of the HEC-RAS computer model. Evaluations will be made with the assumption that all levees do not meet FEMA certification standards. Therefore delineation downstream of culverts will be made using the downstream concentration point discharge below any culvert. For situations where a levee embankment may be found parallel to the flow direction there may be the need to evaluate the levee "in place" and "not in place" for determining the worst case water surface elevation.

The models for each study area will need to include textual descriptions regarding the name of the CONSULTANT and their location, DISTRICT contract number, DISTRICT Project Manager, study-related topographic mapping, and other items determined pertinent to obtain full study documentation.

The CONSULTANT is to make refinements to the HEC-RAS model based on review of the model results by the DISTRICT, ADWR, FEMA, and the FEMA Flood Map Production Coordination Contractor. The CONSULTANT shall also review the HEC-RAS model results for reasonableness. The use of FEMA's Check-RAS computer program will be part of the review process. Work normal to the scope shall include all adjustments to the input parameters required for obtaining the most realistic results.

Bridges and culverts must be modeled in compliance with HEC-RAS modeling requirements for the selected routine. Where multiple bridges occur, each bridge will be modeled separately. The HEC-RAS modeling results for bridges, culverts, and other hydraulic structures may need to be checked using an independent method as determined by the DISTRICT to analyze these structures.

For floodplains identified as ponding areas, it is preferable to analyze these areas by using storage routing techniques as provided in the HEC-1 computer model (see Section 5), unless it can be demonstrated that movement of flood-flows is riverine in nature. If appropriate, the CONSULTANT shall identify a floodway for the purpose of allowing the pond to seek a constant stage throughout the area extent of the ponding, versus the creation of two independent ponds.

7.6.2 Delineation

The delineation study shall be based on the results of the hydrologic study as summarized in Section 5 of this document, or existing hydrology data supplied by the DISTRICT at the beginning of the project.

The delineation work shall meet requirements for floodplain and floodway delineations as prescribed by the FEMA and the ADWR. The delineation work may also require review and acceptance by other cities, towns, or local agencies as identified in the contract Scope of Work.

Flood zones must be determined according to FEMA criteria and clearly labeled on the final work-study drawings.

Floodways are to be determined using equal conveyance encroachment to start with, but only Encroachment Method 1 will be used in the final analysis. The floodway encroachment should produce a rise in the water surface elevation that is as near the one-foot maximum as possible.

7.6.3 Sunset/Sunset Cove Watershed (Pilot Study)

Floodplain/Floodway Analysis for the Sunset/Sunny Cove Watershed will be performed separately and on an accelerated schedule at the beginning of the contract.

7.7 WORK-STUDY MAPS

The CONSULTANT shall provide permanent work-study drawings. Unless specified otherwise, the drawings shall be 24" x 36" in size, with a scale of 1-inch = 200-feet and a contour interval of 2-foot for all mapping with the exception of section line roads which will have a contour interval of 1 foot and/or spot elevations. A cover sheet will be provided with the project title, date of topographic mapping, and a location map showing geographic range covered by each specific mapping sheet.

Each drawing shall include contours, spot elevations, the floodplain and floodway delineations, and a minimum of a north arrow, scale, section corners and quarter corners, current and proposed streets and highway names, NAD83 Central Zone State Plane Coordinate System grid marks, major drainage features, corporate boundaries, cross section lines, channel station center line, index map, and description and elevation of elevation reference marks (ERMs). The DISTRICT will supply a template of map and drawing formats.

The final drawings shall be sealed by each qualified registrant according to the work performed. The work of each SUBCONSULTANT and/or sub-contractor shall be performed in accordance with the Scope of Work and these Guidelines. The CONSULTANT shall check all work prior to each submittal to the DISTRICT. All drawings shall be initialed and dated by the person who performed the work and the checker.

7.8 MEETINGS

The following meetings shall be held with DISTRICT staff to review the results of the hydraulic modeling:

- **Meeting Number 1 (Combined with Monthly Progress Meeting)** – To review Manning's 'n' value selection. Values chosen by the CONSULTANT should be presented and discussed at this meeting;
- **Meeting Number 2 (Combined with Monthly Progress Meeting)** – To review the selected HEC-RAS cross-section location and alignment. The location and alignment of modeling cross-sections and channel centerline will be submitted for the DISTRICT's review and approval prior to digitizing the cross-section data;
- **Meeting Number 3 (Combined with Monthly Progress Meeting)** – To review draft floodplain delineations. Draft delineations are to be submitted to the DISTRICT prior to the meeting;
- **Meeting Number 4(Combined with Monthly Progress Meeting)** – Meeting with the Town of Wickenburg to review study results; and
- **Meeting Number 5 (Combined with Monthly Progress Meeting)** – Final Submittal Review.

7.9 REVIEW AND APPROVAL

The CONSULTANT must obtain DISTRICT approval at each of the following steps:

- Field Reconnaissance Report and estimation of Manning's "n" values;
- Proposed location and alignment of the cross sections and channel centerline;
- Floodplain (natural) delineation;
- Floodway delineation using equal conveyance Encroachment Method 4, following approval of floodplain delineation;
- Floodway delineation using Encroachment Method 1;
- Finalized reporting in Technical Data Notebook; and
- Final FEMA submittal package (with all documentation).

7.10 TECHNICAL DATA NOTEBOOK

Technical Data Notebook(s) (TDN) shall be prepared in accordance with the ADWR State Standards Attachment 1-97 (SSA1-97) to present the findings of the floodplain/floodway delineations. TDN(s) will be separated into geographic or watershed based documents. The format of the TDN(s) shall follow "ADWR/FEMA Submittals" as outlined in SSA1-97 unless otherwise specified in the Scope of Work. Pertinent information from other sections of these guidelines shall also be documented as necessary to fully complete the TDN(s) for a FEMA submittal and review. The TDN(s) shall include profile plots and complete printouts of the HEC-RAS and HEC-1 models.

A separate TDN will be prepared for Sunset/Sunny Cove Wash Watershed (Pilot Study) and submitted to FEMA on an accelerated schedule.

7.11 EXECUTIVE SUMMARY

An Executive Summary Report shall be prepared to document the results and drawings from all of the TDNs.

7.12 HIS DATA

Delivery of digital study data for population of the DISTRICT's Hydrologic Information System (HIS) database shall comply with the DISTRICT's HIS Data Delivery Specifications as required under Reference B, Data Delivery Standards. The CONSULTANT shall have the option of delivering the digital data in one of two formats:

- OPTION 1 – Digital data shall be delivered in a Geographical Information System (GIS) format per DISTRICT specifications; or, using shape file format instead of coverages; or
- OPTION 2 – Digital data shall be delivered in a CADD standard ASCII DXF format from either AutoCAD or MicroStation per DISTRICT specifications.

All required HIS submittals must be reviewed and accepted prior to finalizing the TDN(s) for submittal to FEMA.

7.13 THIS SECTION NOT USED

7.14 SUBMITTALS

The CONSULTANT will submit the following items to the DISTRICT for review by Federal Emergency Management Agency (FEMA) and any other appropriate governmental agency. All of the following products, unless otherwise specified, are considered deliverables for the FEMA submittal:

- Original Affidavits of Publication;
- Two (2) complete sets of blackline topographic base maps with the floodplain/floodway delineations shown. All drawings shall be signed and sealed by persons of appropriate professional registration(s). Each registrant shall provide a specific statement as to what service they performed;
- Two (2) copies of the TDN(s), including complete HEC-1 and HEC-RAS digital input/output files on diskettes or CDs. The TDN(s) shall be prepared in accordance with ADWR State Standards Attachment 1-97 (SSA1-97) using the ADWR/FEMA Submittals outline, unless otherwise specified by the DISTRICT;
- Final Submittal - The following products are considered deliverables for the final submittal to the DISTRICT after FEMA approval is issued;
- One (1) complete set final sealed work maps and cover sheet in pdf format and four (4) complete sets of sealed blackline topographic base maps with the floodplain/floodway delineations shown. All drawings shall be signed and sealed by persons of appropriate professional registration(s). Each registrant will provide a specific statement as to what service they performed; and
- Four (4) complete copies of the TDN(s) including HEC-1 and HEC-RAS input/output files on diskettes. The TDN(s) shall be prepared in accordance with ADWR State Standards Attachment 1-97 (SSA1-97) using the ADWR/FEMA Submittals outline, unless otherwise specified by the DISTRICT. This submittal of the TDN(s) shall include any correspondence and/or meeting minutes with the reviewing agencies, and shall reflect any revisions required by those reviewing agencies. Revisions may include, but are not limited to, modifications to the delineation maps, the HEC-1 model, the HEC-RAS model, and/or the final TDN(s).

7.15 FEMA COMMENTS

The CONSULTANT shall review FEMA comments. After review of FEMA comments with DISTRICT staff, CONSULTANT shall prepare a response and revised submittal or addendum to TDN(s). CONSULTANT shall provide response to DISTRICT for DISTRICT re-submittal.

7.16 OPTIONAL TASKS

7.16.A Optional Task 7A – HAZUS (This Section Not Used)

7.16.B Optional Task 7B – Additional Watercourse Delineation

The CONSULTANT shall provide floodplain and floodway delineations for an additional eighty (40) river miles, per Sections 6 and 7 of the Scope of Work.

Optional Items are not authorized with the Notice to Proceed and may be authorized in writing by the DISTRICT based upon specific need as determined by the DISTRICT during the contract period and may include additional contract time. All invoices shall separately identify cost for the work under this task. This task shall not be included in the schedule until the task is authorized.

7.16.C Optional Task 7C – Sols Wash Floodplain (This Section Not Used)

7.16.D Optional Task 7D – Additional FEMA Review Time

The CONSULTANT shall notify the DISTRICT if additional FEMA review time is required. This Optional Task is to be used for additional FEMA review time that may be required beyond the original contracted time for Task 7.15.

Optional Items are not authorized with the Notice to Proceed and may be authorized in writing by the DISTRICT based upon specific need as determined by the DISTRICT during the contract period and may include additional contract time. All invoices shall separately identify cost for the work under this task. This task shall not be included in the schedule until the task is authorized.

8 PLANNING STUDIES

As part of the Study tasks, the CONSULTANT shall research the following items, which will contribute to the project data/materials required for each task:

- Data collection;
- Analysis of existing facilities;
- Identification of past drainage and flooding problems;
- Collection of existing flood photos;
- Completion of existing conditions analysis;
- Identification of flood hazard limits;
- Evaluate impacts on the watershed due to development; and
- Identification of drainage problems.

The CONSULTANT shall develop a Flood and Community Context Inventory Report for submittal to the DISTRICT at the completion of the Study.

8.1 DATA COLLECTION

The CONSULTANT shall collect and review pertinent data from the DISTRICT, MCDOT, partner Towns and Cities, and other sources. Data to be collected and reviewed will include the following available data:

- Existing topographic mapping;
- Utility quarter-section maps;
- As-built plans for existing roadways, railroads, structures, dams; etc.;
- FEMA Flood Hazard Boundary Maps;
- FEMA-approved floodplain delineation studies;
- Letters of Map Amendment and/or Revisions;
- Drainage reports;
- Biologic Reports;
- Archaeological Reports; and
- Environmental Reports.

Additional data collected under this task will include, but is not limited to:

- Site plans;
- Future drainage improvement plans;
- Land-use plans;
- Development plans;
- Highway widening and concept studies;
- Major utility corridors;
- Landfill closure plans; and
- Historic flood data, such as precipitation data, newspaper articles, and historic flooding photos.

Interviews should be arranged with appropriate agencies or associations for information on drainage problems in the area.

The CONSULTANT shall develop a comprehensive list of flooding and drainage problems affecting the project area. An essential part of the Study is to document the need and necessity of proceeding with an ADMP, which will require a Change Order.

The CONSULTANT shall develop a comprehensive list of possible existing and proposed development projects affecting the study area.

The CONSULTANT will provide a map, which indicates the location of flooding, or problem areas identified by the flood data obtained.

8.1.1 Planning/Regulatory Coordination

The CONSULTANT shall complete an inventory and determine the status and relevance of any planning studies conducted by Maricopa County, partner Towns and Cities, and any other agencies working within the project area.

The CONSULTANT shall identify significant conditional development approvals by the Maricopa County Board of Supervisors, partner Towns and/or Cities' Councils, and any other agencies.

The CONSULTANT shall meet with planning staff from identified agencies to determine current policy thinking concerning land use, development standards, flood control, and environmental protection for the project area.

The CONSULTANT shall assess and document opportunities and obstacles created by adopted codes, ordinances, and development conditions.

The CONSULTANT shall identify planning issues resulting from policies and/or regulations pertinent to the project.

8.1.2 Site Visits

Refer to Task 5.3 for team and DISTRICT one (1) day site visit for an overview of the watershed.

The DISTRICT will conduct at least one (1) additional all-day site visit during the Study to familiarize the CONSULTANT and the DISTRICT with the project area, and to determine any initial conflicts or opportunities.

8.2 EXISTING CONDITIONS ANALYSIS

The CONSULTANT shall research and become familiar with all existing hydrologic and hydraulic studies and models affecting the project area.

The DISTRICT shall prepare a GIS map layer and accompanying database that includes all land ownership in the area. The land ownership base map will indicate whether property is publicly or privately held and ownership information.

8.2.1 Flood and Community Context Inventory Report

The CONSULTANT will compile the data in a Flood and Community Context Inventory Report. The Flood and Community Context Inventory Report will contain a description of information collected for this project, and include the following, as applicable:

- Executive Summary;
- Project Description;
- Scope of Project;
- Data Collection Results;
  - Current Conditions.
  - Areas of Past and Potential Flooding.
  - Existing and Future Development Plans.
  - Current and Future Transportation Plans.
  - Existing and Future Drainage Facilities.
  - Existing Biological, Archaeological and Environmental Resources.
- Land;
  - Parcel Ownership.
- Rights-of-Entry Requirements;
- Existing Hydrology/Hydraulics/FLO-2D Models;
  - Summary of Models/Conditions.
  - Concerns.
- Major Utilities;
- Existing Facilities Exhibit; and
- References/Figures.

The CONSULTANT shall submit a DRAFT of this report to the DISTRICT, followed by a FINAL once all Flood and Community Context Inventory Report tasks are complete.

8.2.2 Existing Facilities Exhibit

The CONSULTANT shall prepare an Existing Facilities Exhibit containing an inventory of all man-made or relevant drainage facilities within the project area, including stock ponds. The inventory shall note the condition, size and/or capacity, level of protection, and ownership of these structures. These facilities will become part of the base map for the alternatives analysis. The CONSULTANT shall make maximum use of these facilities, where feasible, as part of the alternative plans. Existing major natural washes and existing and planned man-made drainage facilities in the watershed should be shown on the Existing Facilities Exhibit.

8.3 FLOOD HAZARD ASSESSMENT

The following GIS map and Layers shall be developed following completion of the hydrology models:

- Flow Characteristics Map;
  - Riverine.
  - Alluvial flow.
  - Distributary Flow.
  - Ponding.
  - Debris Flow.
- Flow magnitude and Extent Map;
- Geologic and Soil Unit Map; and
- Flood hazards Delineations Map.

This data set shall be interpreted to determine the suitability/compatibility with flood protection structure types and methods in meeting the goals and objectives established for the appropriate level of stormwater management. This analysis shall serve as the initial building block for the development of the alternatives for the potential ADMP. Results of the Flood Hazard Assessment will be documented in the Flood and Community Context Inventory Report.

9 DELIVERABLES

All reports or documents shall be submitted to the DISTRICT for review in draft form. Upon receipt of review comments, the CONSULTANT shall incorporate appropriate revisions and complete the report. The CONSULTANT shall incorporate a two-week DISTRICT review time in the project schedule.

9.1 DOCUMENTS

The CONSULTANT shall provide the following documentation for this Project:

Project Administration Report: The Project Administration Report will be submitted at the end of the project and will include copies all minutes, conversations, correspondence, etc. Public Meeting Announcements, Sign-in sheets and formal letters.

Project Schedule: The Project Schedule will be submitted at the kick-off meeting and will be updated as necessary.

Process Flow Chart: The Process Flow Chart will coordinate all work tasks and deliverables.

Stakeholder/Public Involvement Plan: An outline of the proposed methods of informing the public/stakeholders of the project issues and results.

Project Survey Report: The Survey Report will document the survey controls, benchmarks, structure surveys, and quality control cross-section checks.

Geotechnical Report: The Geotechnical Report will document the results of the Geotechnical Investigation and all test results.

Technical Data Notebooks: A compilation of documents and reports organized in accordance with ADWR standards.

ADMS Hydrology and Geology Report: The Hydrology and Geology Report will be part of Section 3 of the TDN.

Data Collection Report: The Data Collection Report will be part of the TDN.

Field Reconnaissance Report: Report to document the Manning's 'n' value evaluation and special field conditions and photographs.

Pilot Study Report: Report for an approximate $20mi^2$ watershed area which encompasses the Sunny Cove Wash

Flood and Community Context Inventory Report: The Context Identification Report will be a compilation of land-use and planning information including a summary of prior hydrology and floodplain reports.

Executive Summary Report: A summary of the study area, watershed and floodplain maps and study description.

9.2 FORMAT

The CONSULTANT shall prepare and deliver to the DISTRICT for review five (5) hard copies of all draft submittals and two (2) CDs with the reports in an editable Word document and with the digital hydraulic and hydrology models that have been used.

Upon completion of the project, five (5) hardcopies of the Final Summary Report and Exhibit, each with a labeled CD insert, will be delivered to the DISTRICT.

The CONSULTANT shall deliver a separate CD containing electronic copies of the report and all exhibits in PDF format.

The CONSULTANT shall deliver a CD containing the models and documents/graphics/drawings in the original format in which the documents were developed.

REFERENCE A – DEFINITIONS

A.1 DEFINITIONS

When the following terms are used in the contract documents, the meaning will be as follows:

ADWR – Arizona Department of Water Resources

AGENT - The DISTRICT's authorized representative shall be the Planning and Project Management Division Manager or his duly authorized representative, hereinafter called the "Agent". For purposes of this contract, the Agent's duly authorized representative shall be the Project Manager and he/she shall be the sole contact for administering this contract.

Agreement – The term "Agreement" is also referred to and may be designated as "Contract."

Amendment – A written alteration to the executed contract, within the general scope of work, which authorizes and directs any of the following: an addition, deletion, or revision to the scope of work; or an adjustment in the contract performance period or contract value; or any combination thereof. The term "Amendment" is also referred to and may be designated as "Change Order." (Exhibit 1)

A.R.S. – Arizona Revised Statutes, as amended, through the most recently completed legislative session.

Certificate of Performance – CONSULTANT certification required prior to final contract payment by the DISTRICT, certifying that all lawful claims for labor, rental of equipment, material used and any other claims in connection with the contract have been paid by the CONSULTANT. (Exhibit 2)

Change Order – The term "Change Order" is also referred to and may be designated as "Amendment." (Exhibit 1)

CLOMR – Conditional Letter of Map Revision issued by FEMA.

CONSULTANT – The individual, partnership, firm, corporation, joint venture, or other business entity with which the DISTRICT has entered into a contract to provide professional services. The term "CONSULTANT" means and includes the CONSULTANT and all of its representatives and subCONSULTANTs.

Contract – The fully executed contract for CONSULTANT services entered into between the DISTRICT and the CONSULTANT for completion of the scope of work. The contract is a mutually binding legal relationship, which includes all attachments, exhibits, supplements, and amendments to the contract and represents the entire and integrated agreement between the DISTRICT and the CONSULTANT. It supersedes all prior discussions, negotiations, representations, or agreements pertaining to the scope of work, whether written or oral. The term "Contract" is also referred to and may be designated as "Agreement."

Contract Adjustment – See Amendment or Change Order.

Contract Fee - The total compensation to be paid by the DISTRICT to the CONSULTANT for the acceptable completion of the scope of work. The contract fee can only be changed by a written amendment to the contract. The term "Contract Fee" is also referred to and may be designated as "Contract Value."

Contract Value – The term "Contract Value" is also referred to and may be designated as "Contract Fee."

Cost Estimate – The CONSULTANT's best professional estimate of the value of the construction project and/or associated services based on current costs. The cost information for construction projects in the cost estimate shall be adjusted to reflect costs effective the date that the bids are opened.

County – Maricopa County, Arizona.

Day – A calendar day of 24 hours, measured from midnight to the following midnight.

Design Specification – Category of specifications, which sets out in detail, the materials used for contract work and the mode and manner in which contract work is to be performed.

DISTRICT – The Flood Control DISTRICT of Maricopa County, Arizona, a political taxing subdivision of the state of Arizona organized under Section 48, Chapter 21, of the Arizona Revised Statutes, having all the powers, privileges and immunities granted generally to municipal corporations.

Errors and Omissions – Wrongful acts of the CONSULTANT arising out of performing, or failing to perform, professional services.

FEMA – Federal Emergency Management Agency.

Forbearance – Formal action by the DISTRICT to reserve and maintain all contractual rights and remedies while allowing the CONSULTANT to complete the contract requirements beyond the contract completion date when the CONSULTANT has been delayed through no fault of the DISTRICT or other Agencies identified by the Scope of Work.

LOMR – Letter of Map Revision issued by FEMA.

Maricopa County Procurement Code – Code adopted by the Maricopa County Board of Supervisors and the District's Board of Directors, which applies to all expenditures of public monies, except contracts between the County or DISTRICT and other political subdivisions or other governments. The Code defines the responsibilities and authorities granted to County and DISTRICT representatives for solicitation, negotiation, and award of contracts, or other purchasing agreements.

Milestone – A principal event specified in the contract documents relating to an intermediate schedule completion date or time prior to the final contract completion date.

Notice to Proceed (NTP) – The formal notification issued by the DISTRICT to the CONSULTANT authorizing the CONSULTANT to proceed with the work and establishing the date of commencement of the performance period.

Performance Period – The period of time provided in the contract for the completion of the scope of work by the CONSULTANT. The performance period is initiated by the Notice to Proceed. The performance period may only be revised by an amendment to the contract.

Progress Payments – Monetary payment made to the CONSULTANT as contract work progresses and determined on the basis of percentage of completion accomplished.

Project – The total work identified by the Scope of Work, to be completed pursuant to the contract requirements.

Project Manager – CONSULTANT's representative and the primary contact with the DISTRICT and/or the DISTRICT's representative and the primary contact with the CONSULTANT. The Project Manager is knowledgeable and responsible for all aspects and phases of the project.

Small Business Enterprise Program – The Maricopa County Small Business Enterprise (SBE) Program is incorporated by reference. It is Maricopa County's policy to provide small businesses the opportunity to participate in the County's solicitation process and to be considered to fulfill the requirement for various commodities and services. No specific SBE participation percentage goal or dollar amount has been established for this contract.

Schedule – A timeline of the scope of work that, at a minimum, contains those elements of the DISTRICT scheduling template which are applicable to the project, i.e., contract start and completion dates, coordination meetings, dates of required submittals, and significant project milestones.

Scope of Work (SOW) – Contract document detailing the specific work requirements in addition to the CONSULTANT Guidelines.

Seal – The placement of a permanently legible imprint of the registrant's seal and signature in accordance with Arizona Board of Technical Registration R4-30-304. The seal shall bear the name of the registrant and shall state the profession in which the registrant is permitted to practice; whom shall be qualified and regularly and customarily engage in the technical discipline of the scoped items of work.

Specification – A description of the technical requirements for a material, product, or service that includes the criteria for determining whether these requirements are met.

Stamp – The term "Stamp" is also referred to and may be designated as "Seal".

Standard – A document that establishes engineering and technical limitations and applications of materials, processes, methods, designs, and engineering practices.

Study – An investigation that results in the acquisition of knowledge through the analysis of a proposed project or issue. At the completion of the study, the CONSULTANT provides the DISTRICT with a written report of the information attained during the study period.

Subconsultant – An individual or a business entity, which has a direct contract with the CONSULTANT to perform a portion of the Scope of Work. The term "subconsultant" means and includes the subconsultant and the subconsultant's authorized representatives.

Technical Data Notebook – The organization of technical documentation for flood studies according to the State Standard SSA1-97.

Termination – Right reserved by the DISTRICT to bring an end to a contract for either the convenience of the DISTRICT, or due to the unexcused failure of the CONSULTANT to perform.

Written or In Writing – Any worded or numbered expression which can be read, reproduced, and later communicated, and includes electronically transmitted and stored information.

REFERENCE B – DATA DELIVERY STANDARDS

CONSULTANT can select a GIS FORMAT or a CAD FORMAT for data deliveries.

GIS FORMAT

CONSULTANTs who choose to follow the GIS standards by delivering the data in Arc/Info format should follow the specs book titled: "Data Delivery Specifications: The Hydrologic Information System (HIS) REV. 3.1 June 1, 1998" Flood Control District of Maricopa County, latest edition.

Data deliveries should include the following data:

Name	Page No.	Description
NDXPRJ	LP-40	Shows the map sheet boundaries of the project
PRJ	LP-60	Defines the boundary of the project
CARTO	LP-110	Planimetric features captured but not used by HIS (Fences, tree lines, etc)
CORNERS	LP-210	Section corners as defined by the PLSS (Public Land Survey System)
CTRL	LP-215	Other control points that are not corners
AGRCLTR	LP-305	Dairy and Agricultural Areas
STRCT	LP-360	Structures like building footprints (if any)
DQ.TBL	LP-410	Data Quality of Data: Scale, date, Vertical Datum, Projection
PRJDAT.TBL	LP-430	Contractor name, Project Name, Project ID
FPBL	LP-520	Floodway center line
FPCTLFCD	LP-523	Elevation Reference Marks
FPSRFFCD	LP-535	Surface Water Elevation
FPXFCD	LP-540	Cross sections used in HEC-RAS
FPZNFCD	LP-550	Floodplain Zones
FPZNHZ	LP-560	Floodplain Hazard Zones
SPWBLN	LP-588	Spillway Baseline route System
SPWXSEC	LP-590	Spillway Cross section
SPWZN	LP-591	Spillway Zone
CNL	LP-610	Canals (If any)
FLTY	LP-620	FCD Project in the area (if any)
RR	LP-650	Railroads in the area (if any)
STRTCLN	LP-655	Street Centerlines
STRTDTL	LP-660	Edge of Pavement (if any)
UTLTY	LP-670	Utilities, Power poles, etc (if any)
ELV	LP-710	Contours and spot elevations
BRIDGE	LP-608	Bridges, including any headwalls or wing walls
CULVERT	LP-612	Culverts, including any headwalls or wing walls
VEG	LP-775	Areas of similar vegetative mix
DRNBSN	LP-920	Drainage basins
DRNPTH	LP-930	Drainage Path
LAKE	LP-950	Lakes that are in the area (if any)
RIVER	LP-960	Washes or streams in the area (if any)

This is a comprehensive listing of possible features. If there are no features collected under one of the categories mentioned, then the theme does not need to be delivered.

HIS data submittals will be subject to a quality control (QC) check by DISTRICT staff. The DISTRICT makes use of a checklist and a computer program to document and automate the QC process. A hardcopy of the checklist shall be delivered to the CONSULTANT at the Kick-off meeting. The CONSULTANT shall use the checklist to review each HIS data submittal for compliance and deliver a completed copy of the checklist to the DISTRICT along with the data submittal.

The computerized application that automates the QC process is available upon request at no charge to the CONSULTANT. The CONSULTANT is recommended to make use of the computer application to review the data prior to submittal of HIS.

All required HIS submittals must be reviewed and accepted prior to finalizing the TDN(s) for submittal to FEMA.

CADD FORMAT

CONSULTANTs should follow the CADD standards and should deliver digital data in ASCII DXF format from either AutoCAD Version 13 or newer or Microstation Version 7.01 or newer per the following specs book: "Data Delivery Specifications: Computer Aided Drafting & Design REV 1.0 January 2000" Flood Control DISTRICT of Maricopa County, latest edition. The CAD Drafting standards in which all plans shall be prepared can be found at the Website of the Flood Control DISTRICT of Maricopa County at http://www.fcd.maricopa.gov/Resources/CAD/default.asp

1.1.1 Data Deliveries For Survey Data:

Name	Page No.	Description
CORNERS	CP-100 thru CP-104	Section corners as defined by the PLSS (Public Land Survey System)
MISC CTRL	CP-105 thru CP-108	Other control points that are not corners
ERM	CP-109 thru CP-111	Elevation Reference Marks

1.1.2 Data Deliveries For Hydrology/Hydraulics

Name	Page No.	Description
BRIDGES	CP-300	Bridges, including any headwalls or wingwalls
CARTO	CP-301 thru	Planimetric features captured but not used by HIS (fences,

Name	Page No.	Description
	CP-302	tree lines, etc.)
CULVERTS	CP-303	Culverts, including any headwalls or wingwalls
DATA QUALITY	CP-304	Data quality, scale, date, vertical datum and projection
BASINS	CP-305 thru CP-306	Drainage basins
FLOW PATH	CP-307 thru CP-308	Drainage flow paths
BASELINE	CP-309 thru CP-310	Floodway baseline (reach)
SURFACE WATER	CP-311	Surface water elevation
FX SECTIONS	CP-312 thru CP-313	Cross sections associated with the HEC-RAS model
FP ZONES	CP-314 thru CP-316	Floodplain zones
HAZARD ZONES	CP-317 thru CP-318	Floodplain hazard zones
HEC-RAS	CP-319	HEC-RAS output report
LANDFORM	CP-320 thru CP-321	Land forms as per Piedmont Flood Hazard Assessment Manual
LANDSTBL	CP-322 thru CP-323	Land stability as per Piedmont Flood Hazard Assessment Manual
INDEX	CP-324	Shows the map sheet boundaries of the project
BOUNDARY	CP-325	Defines the boundary of the project
PROJECT IDENT	CP-326	Contractor name, project name, project ID
SOILS	CP-327 thru CP-337	Soils data
SPW BASELINE BLN	CP-338 thru CP-339	Spillway baseline (reach)
SPWX-SECTION	CP-340 thru CP-341	Cross sections associated with the HEC-RAS model
SPW ZONES	CP-342	Spillway inundation zones

1.1.3 Data Deliveries For Planning

Name	Page No.	Description
CARTO	CP-400 thru CP-401	Planimetric features captured but not used by HIS
DEVELOPMEN	CP-402 thru	Sites where new construction is occurring

Name	Page No.	Description
T SITES	CP-403	
DATA QUALITY	CP-405 thru CP-406	Data quality, scale, date, vertical datum and projection
LAND USE CUR	CP-405 thru CP-406	Present land use
LAND USE FUT	CP-407 thru CP-408	Future land use
INDEX SHEET	CP-409	Map sheet index
BOUNDARY	CP-410	Project Boundary
PROJ IDENT	CP-411	Contractor name, project name, project ID
ANIMAL SP STATUS	CP-412 thru CP-415	Special status species (animal) habitat
PLANT SP STATUS	CP-416 thru CP-419	Special status species (plant) habitat
VEGETATION	CP-420 thru CP-422	Areas of similar vegetative mix

This is a comprehensive listing of possible features. If there are no features collected under one of the categories mentioned, then the feature does not need to be delivered.

REFERENCE C – CADD/DRAFTING STANDARDS

CONSULTANTs shall follow the CADD/DRAFTING Standards as specified in the latest edition of the DISTRICT's Drafting Guides.

REFERENCE D – QUALITY ASSURANCE

The CONSULTANT shall independently check all design drawings and calculations. Each drawing and every calculation sheet shall be initialed and dated by both the designer and checker for each and every submittal of design drawings and calculations. The CONSULTANT shall verify the completeness of the check before submitting drawings or calculations to the DISTRICT. Submittals received which have not been initialed and dated, or that appear to have not been checked, will be returned. Re-submittal shall be made within two (2) working days, and no formal contract time extension will be considered for the re-submittal.

Upon review of any plan submittal by the DISTRICT, if more than five significant comments are identified on five or more sheets, the CONSULTANT shall be asked to retrieve the plans for rechecking. The CONSULTANT shall recheck the plans, make appropriate corrections and resubmit the plans within 72 hours after being returned to the CONSULTANT. No additional contract time or fee will be provided for the rechecking.

All calculations submitted to the DISTRICT shall be complete in detail and shall be checked. All engineering assumptions made during the design other than standard engineering judgments shall be documented with appropriate references on the calculation sheets.

The person checking the calculations shall not be the originator and shall possess equal or better qualifications than the originator.

Calculations can be either hand calculations or computer generated calculations. Computer generated calculations can be used for either the design or the check, but cannot be used for both the design and the check. All hand calculations and computer-generated calculations shall be sealed by a registered engineer prior to submittal to the DISTRICT. HEC-1 and HEC-RAS modeling are excepted from the hand calculation requirement.

The work of any subCONSULTANTs utilized by the prime CONSULTANT for this contract (i.e., civil design, and structural design) shall be reviewed by the prime CONSULTANT for compliance with the Scope of Work and project specifications prior to submittal for review by the DISTRICT.

The CONSULTANT shall submit a copy of its QA/QC procedures with the technical proposal. The procedure should outline the CONSULTANT's method of checking plans and calculations, including the use of check prints. Check prints should be kept on file during the term of the contract for review by the DISTRICT.

All final contract documents including all final reports, specifications, engineer's estimates, and plans shall be sealed by a Professional Engineer registered in the State of Arizona. And, in addition, all interim submittals with the exception of the plans shall be sealed and shall be stamped preliminary.

REFERENCE E – DESIGN REFERENCES, SPECIFICATIONS, AND STANDARDS

E.1 STANDARD DETAILS AND SPECIFICATIONS

"Uniform Standard Specifications for Public Works Construction," and "Uniform Standard Details for Public Works Construction," 1998 Arizona, and all revisions through 2002, Maricopa Association of Governments (MAG).

"Flood Control District of Maricopa County Engineering Division 2002 Computer Aided Drafting Guidelines."

"Maricopa County Supplement to the MAG Standard Details," by Maricopa County Highway Department (now referred to as MCDOT), shall be utilized as part of the design criteria.

Use standard MAG details on plans unless otherwise requested by the DISTRICT. Arizona Department of Transportation (ADOT) standard details may be used, as approved and when appropriate, then modified to be referenced to MAG specifications.

E.2 DESIGN MANUALS, POLICIES, GUIDES, AND PROCEDURES

"Drainage Design Manual for Maricopa County, Arizona, Volume I Hydrology," FCDMC, latest revision.

"Drainage Design Manual for Maricopa County Arizona, Volume II Hydraulics," FCDMC, latest revision.

Chapter 11 Sedimentation, "Drainage Design Manual for Maricopa County Arizona, Volume II Hydraulics," FCDMC, 2009 draft.

"Drainage Design Manual for Maricopa County, Arizona, Volume III Erosion Control," FCDMC, latest revision.

"River Mechanics Manual for DDMSW (draft)," FCDMC, September 2009.

"Urban Highways, Channel Lining Design Guidelines," ADOT, February 1989.

"Design Manual for Engineering Analysis of Fluvial Systems," Simons, Li & Assoc. (SLA), prepared for Arizona Department of Water Resources, 1985.

"Computing Degradation and Local Scour," Pemberton, E.L. and Lara, J.M., U. S. Bureau of Reclamation, Sedimentation Section, 1984.

Structural design shall be in accordance with current AASHTO Specifications. Street and maintenance road crossings shall be designed to accommodate HS20-44 loading. Calculations shall be based on service loads and the working stress method.

"Pipe Selection Guidelines and Procedures," ADOT, February 1, 1996 with March 21, 1996 revisions.

"A Policy on Geometric Design of Highways and Streets," 4th Edition, AASHTO, 2001, commonly referred to as the "Green Book," and "Maricopa County Department of Transportation Roadway Design Manual" latest edition and revisions shall be used, unless otherwise requested by the DISTRICT.

"Roadside Design Guide," AASHTO, 2002, to be used to establish clear distances and other related safety issues.

E.3 SCENERY RESOURCES AND MULTI-USE ASSESSMENT GUIDELINES

The CONSULTANT shall utilize the references listed below as a frame of reference and guide for designing and implementing the Scenery Resources and Multi-Use Assessment:

"Policy for the Aesthetic Treatment and Landscaping of Flood Control Projects," FCDMC, 1992.

"Revised Cost Ceiling Tables for Landscaping and Project Aesthetic Features," FCDMC, April 26, 2001.

"Beauty and the Beast, A Feature Article for the AFMA Newsletter, Vol 17, Number 2," Dennis Holcomb, FCDMC, October 2000.

"Issues and Concerns Pertaining to the Incorporation of Aesthetic Features in Flood Protection Facilities," FCDMC, April 28, 2002.

"A Framework for Assessing the Relative Ability of Alternative Flood Protection Methods to Complement and Achieve Compatibility with the Visual Character of Landscape Settings in Maricopa County."

"Identification of General Landscape Setting Categories and Appropriate Landscape Treatment Themes & Prescriptions for District Flood Protection Facilities based upon MAG 2000 Land Use Categories," FCDMC, April 29, 2002.

"Aesthetic and Multi-Use Design Guidelines for Flood Control Basins and Channels," FCDMC, April 23, 2002.

"Landscape Character Types and Sub-Types in the National Forests of Arizona and New Mexico," USDA-FS, undated.

"National Forest Landscape Management, Vol. 2, Ch. 1, The Visual Management System, Ag Handbook 462," USDA-FS, 1974.

"National Forest Landscape Management, Vol. 1, Ag Handbook 434," USDA-FS, 1973.

"Landscape Aesthetics, A Handbook for Scenery Management, Ag Handbook 701," USDA-FS, 1995.

"National Forest Landscape Management, Vol. 2, Ch. 4, Roads, Ag Handbook 483," 1977.

"National Forest Landscape Management, Vol. 2 Ch. 2, Utilities, Ag Handbook 478," USDA-FS, 1975.

"Landscape Architecture Technical Information Series, Vol. 1, No. 3, Creating Land for Tomorrow," ASLA, 1978

"Forest landscape Description and Inventories – a basis for land planning and design, USDA Forest Research Paper PSW-49," USDA-FS, 1968.

"Application Procedures for Designation of Parkways, Historic, and Scenic Roads in Arizona," ADOT, 1993.

"Landscape Inventory and Analysis for Maricopa County," FCDMC, 2009.

"Aesthetic and Multiple-Use Guidelines for Flood Control Basins and Channels," FCDMC, April 23, 2002.

"Existing Facilities Landscape Aesthetics and Multi-Use Opportunities Assessment, North Valley Structures Analysis," FCDMC, February 5, 2001.

"Existing Facilities Landscape Aesthetics and Multi-Use Opportunities Assessment, West Valley Structures Analysis," FCDMC, June 1, 2001

"Maricopa County Regional Trail System Plan," Maricopa County Trail Commission, August 16, 2004.

"Desert Spaces, An Open Space Plan for the Maricopa County," Maricopa Association of Governments,undated.

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

January 24, 2011

BRIGHT CLARA PAULICK TR
PO BOX 1206
WICKENBURG, AZ 85358

To Whom It May Concern:

The Flood Control District of Maricopa County (District) invites all interested persons to attend a public meeting presenting the Phase 1 results of the updated Wickenburg Area Drainage Master Study (ADMS). This phase of the study performed floodplain/floodway delineations which updated the floodplain/floodway boundaries in all of the drainage area contributing to the Sunset and Sunnycove washes within the Town of Wickenburg. Based on property ownership records, your property is near or within this recently updated floodplain/floodway.

The public meeting will be held on Thursday February 3, 2011 from 5:30 p.m. to 7:30 p.m. (6:00 presentation) at the Wickenburg Community Center. You will have an opportunity to review the updated floodplain/floodway boundaries and speak with project team members from the District and its consultants.

The updated delineations include both the establishment of 1.1 linear miles of new Zone AE floodplains with Base Flood Elevations; and the modification of 3.1 linear miles of floodplain and floodway widths and Base Flood Elevations (increases and decreases) for areas with previously delineated Zone AE floodplains and floodways.

The floodplain reaches impacted are:

- Sunset Wash: modified floodplain/floodway from the Hassayampa River to Sunset Dam
- Sunset Wash: new Zone AE floodplain (no floodway) from the Sunset Dam impoundment area to 430 feet downstream of Los Altos Drive
- Sunset Wash Tributary 1: new Zone AE floodplain (no floodway) from the Sunset Dam impoundment area to 400 feet downstream of Los Altos Drive

- Sunnycove Wash: modified floodplain/floodway from the Hassayampa River to 160 feet north of Steinway Drive

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 may use the data as the "best available information" for floodplain management. Persons with buildings on their property in the updated Sunset/Sunnycove Wash floodplains and floodways 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 have flood insurance to financially protect themselves from losses incurred by flood damage to buildings on their property.

If you have any questions about the updated floodplain/floodway boundaries, please contact Kathryn Gross, Senior Hydrologist, at (602) 506-4837 or kag@mail.maricopa.gov; or Greg Jones, Regional Area Planning Manager, at (602) 506-5537 or glj@mail.maricopa.gov.

Sincerely,

Kathryn Gross, M.A., CFM
Senior Hydrologist

APN	OwnerAddre	OwnerCity	OwnerState	OwnerZip	PropertyAd	PropertyCi	PropertyZi	TaxAddress	TaxAddre_1	TaxCity	TaxState	TaxZip
50549108A	300 W TURTLEBACK LN	WICKENBURG	AZ	85390	50 N LINCOLN ST	WICKENBURG	85390	300 W TURTLEBACK LN		WICKENBURG	AZ	85390-4322
50551137	2500 LOU MENK DR PO BOX 961089	FORT WORTH	TX	76161-0089				PO BOX 960189		FORT WORTH	TX	76161
50538018B	580 S MARIPOSA ST	WICKENBURG	AZ	85390	580 S MARIPOSA DR	WICKENBURG	85390	580 S MARIPOSA DR		WICKENBURG	AZ	85390-1366
50542101D	32908 MANRAD DR	WICKENBURG	AZ	85390	32908 W MANRAD DR		85390	32908 MANRAD DR		WICKENBURG	AZ	85390-2153
50551107	PO BOX 893	WICKENBURG	AZ	85358	249 W SYLVAN RD		85390	PO BOX 893		WICKENBURG	AZ	85358-0893
50549078	400 S CATALINA AVE	REDONDO BEACH	CA	90277				400 S CATALINA AVE		REDONDO BEACH	CA	90277-3721
50534043	PO BOX 20911	WICKENBURG	AZ	85358				PO BOX 20911		WICKENBURG	AZ	85358-5911
50549089	PO BOX 2399	WICKENBURG	AZ	85358	21 N LINCOLN ST	WICKENBURG	85390	PO BOX 2399		WICKENBURG	AZ	85358-2399
50552030	1 SANTA FE PLAZA 5200 E SHEILA ST	LOS ANGELES	CA	90040				PO BOX 960189		FORT WORTH	TX	76161
50528001F	790 JAVELINA DR	WICKENBURG	AZ	85390	790 JAVELINA DR	WICKENBURG	85390	790 JAVELINA DR		WICKENBURG	AZ	85390-2371
50538018K	815 OASIS DR	WICKENBURG	AZ	85390				815 OASIS DR		WICKENBURG	AZ	85390-1383
50542101A	51205 N 330TH AVE	WICKENBURG	AZ	85390				1490 MANRAD DR		WICKENBURG	AZ	85390
50528013B	515 W WICKENBURG WAY	WICKENBURG	AZ	85390	625 W AQUA DR	WICKENBURG	85390	515 W WICKENBURG WAY		WICKENBURG	AZ	85390-5200
50538019H	4040 W AUGUST AVE	PHOENIX	AZ	85021				5318 W WALTANN LN		GLENDALE	AZ	85306-2525
50530033	P O BOX 2518	WICKENBURG	AZ	85358	23 S OXBOW DR		85390	PO BOX 2518		WICKENBURG	AZ	85358-2518
50528014D	745 W AGUA DR	WICKENBURG	AZ	85390	745 W AGUA DR	WICKENBURG	85390	745 W AGUA DR		WICKENBURG	AZ	85390-1315
50530073C	440 AMERICA ST	WICKENBURG	AZ	85390-0000				440 AMERICA ST		WICKENBURG	AZ	85390-1302
50528001E	780 JAVELINA DR	WICKENBURG	AZ	85390	780 JAVELINA DR	WICKENBURG	85390	780 JAVELINA DR		WICKENBURG	AZ	85390-2371
50538018G	56558 RANCHO CASITAS RD	WICKENBURG	AZ	85390				56558 RANCHO CASITAS RD		WICKENBURG	AZ	85390-2485
50549070	P O BOX 1595	WICKENBURG	AZ	85358	331 W CENTER ST	WICKENBURG	85390	P O BOX 1595		WICKENBURG	AZ	85358-1595
50549106	11 N LINCOLN	WICKENBURG	AZ	85390	11 LINCOLN ST		85390	11 N LINCOLN ST		WICKENBURG	AZ	85390
50534020	840 W AMERICA ST	WICKENBURG	AZ	85390	840 W AMERICA ST	WICKENBURG	85390	840 AMERICA ST		WICKENBURG	AZ	85390-1306
50542106	PO BOX 1206	WICKENBURG	AZ	85358	51555 N 327TH AVE	WICKENBURG	85390	PO BOX 1206		WICKENBURG	AZ	85358-1206
50528008B	660 S KELLIS RD	WICKENBURG	AZ	85390				660 S KELLIS RD		WICKENBURG	AZ	85390-1347
50528007C	BOX 143	WICKENBURG	AZ	85358				PO BOX 143		WICKENBURG	AZ	85358-0143
50538050D	P O BOX 2147	WICKENBURG	AZ	85358	870 S MARIPOSA DR			PO BOX 1488		WICKENBURG	AZ	85358-1488
50528001A	825 S MARIPOSA DR	WICKENBURG	AZ	85390	825 S MARIPOSA DR	WICKENBURG	85390	825 S MARIPOSA DR		WICKENBURG	AZ	85390-1370
50549111	PO BOX 375	WICKENBURG	AZ	85358	543 W APACHE ST		85390	543 W APACHE ST		WICKENBURG	AZ	85390-1312
50542083D	51309 N STEINWAY DR	WICKENBURG	AZ	85390	51309 N 331ST AVE	WICKENBURG	85390	1325 STEINWAY DR		WICKENBURG	AZ	85390-3184
50549115B	P O BOX 894	WICKENBURG	AZ	85358	57 N GRANT ST	WICKENBURG	85390	PO BOX 894		WICKENBURG	AZ	85358-0894
50551072A	869 PHILLIPS ST	VISTA	CA	92083-7108				869 PHILLIPS ST		VISTA	CA	92083-7108
50538019F	P O BOX 2246	WICKENBURG	AZ	85358				PO BOX 2246		WICKENBURG	AZ	85358-2246
50544001C	1551 S VULTURE MINE RD	WICKENBURG	AZ	85390				1551 S VULTURE MINE RD		WICKENBURG	AZ	85390-2118
50533029F	603 W WHIPPLE CT	WICKENBURG	AZ	85390	603 WHIPPLE CT	WICKENBURG	85390	603 W WHIPPLE CT		WICKENBURG	AZ	85390-2370
50542082E	3137 E ROCK WREN RD	PHOENIX	AZ	85048	1340 ROCK WREN RD	WICKENBURG	85390	PO BOX 20009		WICKENBURG	AZ	85358-5009
50549072A	138 S JACKSON ST	WICKENBURG	AZ	85390	138 S JACKSON ST	WICKENBURG	85390	BAC HOME LOANS SERVICING LP	2380 PERFORMANCE DR RGV D7 450	RICHARDSON	TX	75082-4333
50549072B	139 S JACKSON ST	WICKENBURG	AZ	85390	138 S JACKSON ST	WICKENBURG	85390	139 S JACKSON ST		WICKENBURG	AZ	85390-2349
50551101	139 PARK ST	WICKENBURG	AZ	85390	139 N PARK ST		85390	139 PARK ST		WICKENBURG	AZ	85390-2302
50551094F	176 S MESQUITE ST	WICKENBURG	AZ	85390	176 S MESQUITE ST	WICKENBURG	85390	176 S MESQUITE ST		WICKENBURG	AZ	85390-1373
50542063A	1470 W JONES RD	WICKENBURG	AZ	85390				1470 W JONES RD		WICKENBURG	AZ	85390-1639
50542005A	15651 N 27TH ST #126	PHOENIX	AZ	85032-0000	1210 S 325TH AVE	WICKENBURG	85390	5580 W ROSE GARDEN LN		GLENDALE	AZ	85308-6241
50542101C	PO BOX 20422	WICKENBURG	AZ	85358				PO BOX 20422		WICKENBURG	AZ	85358-5422
50527060	590 LOST CANYON RD	WICKENBURG	AZ	85390	590 W DESERT CANYON D	WICKENBURG	85390	590 LOST CANYON RD		WICKENBURG	AZ	85390
50542046	BOX 931	WICKENBURG	AZ	85358	860 S OCOTILLO DR	WICKENBURG	85390	HENRY LAWRENCE/BETTY JOHNSON	BOX 931	WICKENBURG	AZ	85358-0931
50529029D	PO BOX 2046	WICKENBURG	AZ	85358				PO BOX 2046		WICKENBURG	AZ	85358-2046
50542075F	1070 S OCOTILLO DR	WICKENBURG	AZ	85390	51814 N OCOTILLO DR		85390	1070 S OCOTILLO DR		WICKENBURG	AZ	85390-1620
50542078A	1205 S 325TH AVE	WICKENBURG	AZ	85390	1205 S 325TH AVE	WICKENBURG	85390	1205 S 325TH AVE		WICKENBURG	AZ	85390
50534022	PO BOX 1360	WICKENBURG	AZ	85358	850 W AMERICA ST		85390	PO BOX 1360		WICKENBURG	AZ	85358-1360
50542032A	PO BOX 1896	WICKENBURG	AZ	85358	32742 W MANRAD DR		85390	PO BOX 1896		WICKENBURG	AZ	85358-1896
50551120	311 SYLVAN RD	WICKENBURG	AZ	85390	311 SYLVAN RD	WICKENBURG	85390	311 SYLVAN RD		WICKENBURG	AZ	85390-2315
50551122A	P O BOX 896	WICKENBURG	AZ	85358	311 SYLVAN RD	WICKENBURG	85390	311 SYLVAN RD		WICKENBURG	AZ	85390-2315
50534061D	955 W WICKENBURG WAY	WICKENBURG	AZ	85358	955 W WICKENBURG WY	WICKENBURG	85390	955 W WICKENBURG WAY		WICKENBURG	AZ	85390-2283
50551055	101 S MESQUITE ST	WICKENBURG	AZ	85390	101 S MESQUITE ST	WICKENBURG	85390	101 S MESQUITE ST		WICKENBURG	AZ	85390-1374

50528014F	PO BOX 21	CAMP VERDE	AZ	86322	705 W AGUA DR	WICKENBURG	85390	PO BOX 21	CAMP VERDE	AZ	86322-0021
50549122	8 MOUNTAIN VILLA D3	CHAMPION	PA	15622	426 S KELLIS RD	WICKENBURG	85390	8 MOUNTAIN VILLA D3	CHAMPION	PA	15622-2118
50527057	620 W DESERT CANYON RD	WICKENBURG	AZ	85390	620 DESERT CANYON RD	WICKENBURG	85390	620 DESERT CANYON RD	WICKENBURG	AZ	85390-3391
50549081	50847 N STEINWAY DR	WICKENBURG	AZ	85390	401 S APACHE RD		85390	50847 N STEINWAY DR	WICKENBURG	AZ	85390-2152
50551053	P O BOX 546	JACKSON	WY	83001	40 S MESQUITE ST		85390	PO BOX 546	JACKSON	WY	83001-0546
50527054A	650 DESERT CANYON RD	WICKENBURG	AZ	85390	650 N DESERT CANYON RE	WICKENBURG	85390	650 DESERT CANYON RD	WICKENBURG	AZ	85390-3391
50551106	2084 MEADOW BROOK RD	ALTADENA	CA	91001	229 W SYLVAN RD		85390	2084 MEADOWBROOK RD	ALTADENA	CA	91001-3452
50530085U	597 WHIPPLE CT	WICKENBURG	AZ	85390	597 WHIPPLE CT	WICKENBURG	85390	597 WHIPPLE CT	WICKENBURG	AZ	85390-2337
50527078	4000 HORIZON WY	IRVING	TX	75063	515 W DESERT CANYON RI	WICKENBURG	85390	4000 HORIZON WY	IRVING	TX	75063-2260
50527107	635 DESERT CANYON RD	WICKENBURG	AZ	85390	635 N DESERT CANYON RE	WICKENBURG	85390	635 DESERT CANYON RD	WICKENBURG	AZ	85390-3372
50528012	2801W DURANGO ST	PHOENIX	AZ	85009				2801 W DURANGO ST	PHOENIX	AZ	85009-6356
50527004Q	365 W COTTONWOOD ST	WICKENBURG	AZ	85390	365 COTTONWOOD LN	WICKENBURG	85390	365 W COTTONWOOD	WICKENBURG	AZ	85390-4318
50549086	65 N LINCOLN ST	WICKENBURG	AZ	85390-1352	64 LINCOLN ST		85390	65 N LINCOLN ST	WICKENBURG	AZ	85390-1352
50551104A	580 E EL PATIO	CAMPBELL	CA	95008	293 S JEFFERSON ST		85390	580 E EL PATIO	CAMPBELL	CA	95008-2114
50549105A	P O BOX 1394	WICKENBURG	AZ	85358	575 W APACHE ST	WICKENBURG	85390	P O BOX 1394	WICKENBURG	AZ	85358-1394
50542072G	PO BOX 772857	STEAMBOAT SPRINGS	CO	80477-2857				PO BOX 772857	STEAMBOAT SPR	CO	80477-2857
50542009A	6040 E MAIN ST UNIT A100 125	MESA	AZ	85205-8928	32848 W MANRAD DR	WICKENBURG	85390	6040 E MAIN ST UNIT A100125	MESA	AZ	85205-8928
50549118B	500 W WICKENBURG WAY	WICKENBURG	AZ	85390	500 W WICKENBURG WY	WICKENBURG	85390	500 W WICKENBURG WAY	WICKENBURG	AZ	85390-2356
50527064	550 S DESERT CANYON RD	WICKENBERG	AZ	85390	550 DESERT CANYON RD	WICKENBURG	85390	550 DESERT CANYON RD	WICKENBURG	AZ	85390-2593
50542008G	32817 W LURAY RD	WICKENBURG	AZ	85390							
50527112A	395 COTTONWOOD LN	WICKENBURG	AZ	85390	395 COTTONWOOD LN	WICKENBURG	85390	395 COTTONWOOD LN	WICKENBURG	AZ	85390-3393
50542099A	10790 MNT ANTERO WY	PARKER	CO	80138				10790 MNT ANTERO WY	PARKER	CO	80138-8307
50542072B	1910 MANRAD DR	WICKENBURG	AZ	85390	1910 MANRAD DR	WICKENBURG	85390	1910 MANRAD DR	WICKENBURG	AZ	85390-3179
50527059	PO BOX 20573	WICKENBURG	AZ	85358	600 W DESERT CANYON D	WICKENBURG	85390	PO BOX 20573	WICKENBURG	AZ	85358-5573
50528010C	725 W PALO VERDE DR	WICKENBURG	AZ	85390	435 S PALO VERDE RD	WICKENBURG	85390	725 W PALO VERDE DR	WICKENBURG	AZ	85390-1396
50542050C	PO BOX 1476	WICKENBURG	AZ	85358	32716 W MANRAD DR		85390	PO BOX 1476	WICKENBURG	AZ	85358-1476
50549114	PO BOX 20788	WICKENBURG	AZ	85358	72 N GRANT ST		85390	PO BOX 20788	WICKENBURG	AZ	85358-5788
50530034	481 S OXBOW	WICKENBURG	AZ	85390	21 S OXBOW DR		85390	481 S OXBOW DR	WICKENBURG	AZ	85390-1390
50527058	P O BOX 2080	WICKENBURG	AZ	85390	610 W DESERT CANYON D	WICKENBURG	85390	PO BOX 2080	WICKENBURG	AZ	85358-2080
50527066	305 W LOST CANYON RD	WICKENBURG	AZ	85390	305 LOST CANYON DR	WICKENBURG	85390	305 W LOST CANYON RD	WICKENBURG	AZ	85390-3351
50527056	PO BOX 152	WICKENBURG	AZ	85358	630 W DESERT CANYON D	WICKENBURG	85390	PO BOX 152	WICKENBURG	AZ	85358-0152
50542030	1590 W JONES RD	WICKENBURG	AZ	85390	1590 W COUNTY LINE RD	WICKENBURG	85390	1590 W JONES RD	WICKENBURG	AZ	85390-3126
50534037	P O BOX 3223	WICKENBURG	AZ	85358	885 W AMERICA ST	WICKENBURG 85390		PO BOX 1859	WICKENBURG	AZ	85358-1859
50527079	525 W DESERT CANYON RD	WICKENBURG	AZ	85390	525 W DESERT CANYON RI	WICKENBURG	85390	525 DESERT CANYON RD	WICKENBURG	AZ	85390-3360
50549107A	36 N LINCOLN	WICKENBURG	AZ	85390-1351	36 N LINCOLN ST	WICKENBURG	85390	36 N LINCOLN ST	WICKENBURG	AZ	85390-1351
50551129	BOX 20878	WICKENBURG	AZ	85358	185 FISHER ST	WICKENBURG	85390	BOX 20878	WICKENBURG	AZ	85358-5878
50527055	640 S DESERT CANYON RD	WICKENBURG	AZ	85390	640 DESERT CANYON DR	WICKENBURG	85390	640 DESERT CANYON RD	WICKENBURG	AZ	85390-3391
50552016D	322 SYLVAN RD	WICKENBURG	AZ	85390	322 SYLVAN RD	WICKENBURG	85390	322 SYLVAN RD	WICKENBURG	AZ	85390-2314
50551105	545 N JACKSON	WICKENBURG	AZ	85390	209 SYLVAN RD	WICKENBURG	85390	545 N JACKSON ST	WICKENBURG	AZ	85390-1256
50549113	83 N GRANT ST	WICKENBURG	AZ	85390	82 N GRANT ST		85390	83 N GRANT ST	WICKENBURG	AZ	85390-1330
50551126D	141 S FISHER ST	WICKENBURG	AZ	85390	141 S FISHER ST		85390	141 S FISHER ST	WICKENBURG	AZ	85390-1326
50538032	PO BOX 21536	WICKENBURG	AZ	85358	890 W PALO VERDE DR			PO BOX 21536	WICKENBURG	AZ	85358-6536
50530073D	336 AMERICA ST	WICKENBURG	AZ	85390	336 N AMERICA ST	WICKENBURG	85390	336 AMERICA ST	WICKENBURG	AZ	85390-2332
50530032	501 S OXBOW DR	WICKENBURG	AZ	85390	501 OXBOW DR		85390	501 S OXBOW DR	WICKENBURG	AZ	85390-1392
50527113	7890 E MCCLAIN DR #4	SCOTTSDALE	AZ	85260				14400 N 76TH PL	SCOTTSDALE	AZ	85260-2962
50527075	3045 CANTEL CT	WICKENBURG	AZ	85390	510 N DESERT CANYON RE	WICKENBURG	85390	3045 CANTEL CT	WICKENBURG	AZ	85390-4002
50527115B	987 W BLUE FOX RD	GREEN VALLEY	AZ	85614				987 W BLUE FOX RD	GREEN VALLEY	AZ	85614-5866
50534021	1905 DUFF RD	WICKENBURG	AZ	85390	850 W AMERICA ST	WICKENBURG 85390		1905 DUFF RD	WICKENBURG	AZ	85390-3118
50551102	550 N COUNTRY CLUB DR	WICKENBURG	AZ	85390	159 PARK ST	WICKENBURG	85390	550 N COUNTRY CLUB DR	WICKENBURG	AZ	85390-3625
50530039A	114 CARL SANDBURD DR	CENTRALIA	WA	98531-9043	13 S OXBOW DR		85390	114 CARL SANDBURG DR	CENTRALIA	WA	98531-9043
50551128	145 FISHER ST	WICKENBURG	AZ	85390	145 S FISHER ST		85390	145 FISHER ST	WICKENBURG	AZ	85390-1326
50542072D	2901 W DURANGO	PHOENIX	AZ	85009	33052 W MANRAD DR	WICKENBURG	85390	2901 W DURANGO	PHOENIX	AZ	85009-6357
50551113B	1126 SW 333RD ST	FEDERAL WAY	WA	98023	6 SYLVAN LN	WICKENBURG	85390	1126 SW 333RD ST	FEDERAL WAY	WA	98023-5319
50527108	645 S DESERT CANYON DR	WICKENBURG	AZ	85390	645 N DESERT CANYON RE	WICKENBURG	85390	18439 N 43RD DR	GLENDALE	AZ	85308-1610

50542091C	51235 329TH AVE	WICKENBURG	AZ	85390	51235 N 329TH AVE	WICKENBURG		85390	51235 N 329TH AVE		WICKENBURG	AZ	85390-2155
50551054C	PO BOX 132	CONGRESS	AZ	85332					PO BOX 784		WICKENBURG	AZ	85358-0784
50527076	500 DESERT CANYON RD	WICKENBURG	AZ	85390	500 DESERT CANYON RD	WICKENBURG		85390	500 DESERT CANYON RD		WICKENBURG	AZ	85390-2593
50549077D	160 S JACKSON	WICKENBURG	AZ	85390									
50542060	6437 E EXETER BLVD	SCOTTSDALE	AZ	85251	1010 CACTI VERDE	WICKENBURG		85390	6437 E EXETER BLVD		SCOTTSDALE	AZ	85251-3101
50527073	2624 VALENTINE AVE	KINGMAN	AZ	86401	530 DESERT CANYON RD	WICKENBURG		85390	2624 VALENTINE AVE		KINGMAN	AZ	86401-4700
50542072E	33052 MANRAD RD	WICKENBURG	AZ	85390					1940 MANRAD DR		WICKENBURG	AZ	85390-3179
50542025A	51409 N 328TH AVE	WICKENBURG	AZ	85390	51409 N 328TH AVE			85390	51409 N 328TH AVE		WICKENBURG	AZ	85390-3106
50530035	PO OBX 21417	WICKENBURG	AZ	85358	19 S OXBOW DR			85390	PO BOX OBX		WICKENBURG	AZ	85358
50549069	134 S MADISON	WICKENBURG	AZ	85390	134 S MADISON ST	WICKENBURG		85390	134 S MADISON		WICKENBURG	AZ	85390-1359
50534061C	PO BOX 201	WICKENBURG	AZ	85358	975 W WICKENBURG WY				PO BOX 201		WICKENBURG	AZ	85358-0201
50542024B	PO BOX 20695	WICKENBURG	AZ	85358	1090 S 324TH AVE	WICKENBURG		85390	PO BOX 20695		WICKENBURG	AZ	85358-5695
50551125A	315 SYLVAN RD	WICKENBURG	AZ	85390	315 W SYLVAN LN			85390	315 SYLVAN RD		WICKENBURG	AZ	85390-2315
50534032A	BOX 658	WICKENBURG	AZ	85358	890 AMERICA ST		85390		BOX 658		WICKENBURG	AZ	85358-0658
50530041	431 S OXBOW ST	WICKENBURG	AZ	85390	7 S OXBOW DR			85390	431 S OXBOW DR		WICKENBURG	AZ	85390-1390
50534018	51 S MARIPOSA DR	WICKENBURG	AZ	85390	51 N MARIPOSA DR		85390		51 S MARIPOSA DR		WICKENBURG	AZ	85390-2342
50549109	23616 N 185TH AVE	SURPRISE	AZ	85387	59 LINCOLN ST			85390	23616 N 185TH AVE		SURPRISE	AZ	85387-9609
50542044B	PO BOX 1736	WICKENBURG	AZ	85358	51230 N 328TH AVE			85390	PO BOX 1736		WICKENBURG	AZ	85358-1736
50538031	880 W PALO VERDE DR	WICKENBURG	AZ	85390	880 W PALO VERDE DR				880 W PALO VERDE DR		WICKENBURG	AZ	85390-1397
50527072	540 DESERT CANYON	WICKENBURG	AZ	85390	540 DESERT CANYON RD	WICKENBURG		85390	540 DESERT CANYON RD		WICKENBURG	AZ	85390-2593
50530042	421 S OXBOW	WICKENBURG	AZ	85390	5 S OXBOW DR			85390	421 S OXBOW DR		WICKENBURG	AZ	85390-1390
50551114D	8 SYLVAN LN	WICKENBURG	AZ	85390	8 SYLVAN LN	WICKENBURG		85390	8 SYLVAN LN		WICKENBURG	AZ	85390-2312
50527065A	34030 POWELL HILL	SHEDD	OR	97377-9757					PO BOX 29		SHEDD	OR	97377-0029
50551037A	P O BOX 1117	WICKENBURG	AZ	85358	16 S HENDERSON ST			85390	P O BOX 1117		WICKENBURG	AZ	85358-1117
50551036A	PO BOX 1117	WICKENBURG	AZ	85358					PO BOX 1117		WICKENBURG	AZ	85358-1117
50551094E	166 S MESQUITE ST	WICKENBURG	AZ	85390	166 S MESQUITE ST	WICKENBURG		85390	166 S MESQUITE ST		WICKENBURG	AZ	85390-1373
50542062	1050 S SAGUARO DR	WICKENBURG	AZ	85901-1339					1050 S SAGUARO DR		WICKENBURG	AZ	85390-1339
50549079	46 N JACKSON ST	WICKENBURG	AZ	85390	46 N JACKSON ST	WICKENBURG		85390	46 N JACKSON ST		WICKENBURG	AZ	85390-2369
50527053A	P O BOX 21	WICKENBURG	AZ	85358					PO BOX 21		WICKENBURG	AZ	85358-0021
50551116	16 SYLVAN LN	WICKENBURG	AZ	85390	12 W SYLVAN LN			85390	16 SYLVAN LN		WICKENBURG	AZ	85390-2312
50527077	505 DESERT CANYON RD	WICKENBERG	AZ	85390	505 DESERT CANYON RD	WICKENBURG		85390	505 DESERT CANYON RD		WICKENBERG	AZ	85390-3360
50538050C	840 S MARIPOSA DR	WICKENBURG	AZ	85390	840 S MARIPOSA DR	WICKENBURG		85390	840 S MARIPOSA DR		WICKENBURG	AZ	85390-1368
50527061	PO BOX 3614	WICKENBURG	AZ	85390	580 DESERT CANYON RD	WICKENBURG		85390	PO BOX 3614		WICKENBURG	AZ	85358-3614
50528003C	635 PALO VERDE DR	WICKENBURG	AZ	85390-1394	635 S PALO VERDE DR	WICKENBURG		85390	635 W PALO VERDE DR		WICKENBURG	AZ	85390-1394
50534024	715 KELLIS RD	WICKENBURG	AZ	85390	870 AMERICA ST	WICKENBURG	85390		715 KELLIS RD		WICKENBURG	AZ	85390
50534019	PO BOX 20344	WICKENBURG	AZ	85358	830 W AMERICA ST	WICKENBURG	85390		PO BOX 20344		WICKENBURG	AZ	85358-5344
50530036A	17 S OXBOW	WICKENBURG	AZ	85358	461 S OXBOW DR	WICKENBURG		85390	461 S OXBOW DR		WICKENBURG	AZ	85390-1390
50552027A	501 S TEGNER ST	WICKENBURG	AZ	85390					501 S TEGNER ST		WICKENBURG	AZ	85390-2323
50552029	501 S TEGNER ST	WICKENBURG	AZ	85390					501 S TEGNER ST		WICKENBURG	AZ	85390-2323
50527071	310 LOST CANYON RD	WICKENBURG	AZ	85390	310 LOST CANYON RD	WICKENBURG		85390	310 LOST CANYON RD		WICKENBURG	AZ	85390-3351
50527115A	695 S KELLIS RD	WICKENBURG	AZ	85390	350 W COTTONWOOD LN			85390	695 S KELLIS RD		WICKENBURG	AZ	85390-1349
50533029K	600 WHIPPLE CT	WICKENBURG	AZ	85390	600 W WHIPPLE ST			85390	600 WHIPPLE CT		WICKENBURG	AZ	85390-2370
50551108	269 SYLVAN RD	WICKENBURG	AZ	85390	269 W SYLVAN RD	WICKENBURG		85390	269 SYLVAN RD		WICKENBURG	AZ	85390-2316
50527074	860 S LOS ALTOS DR	WICKENBURG	AZ	85390	520 N DESERT CANYON RI	WICKENBURG		85390	860 S LOS ALTOS DR		WICKENBURG	AZ	85390-1357
50549121A	85 GRAND ST	WICKENBURG	AZ	85390					85 GRAND ST		WICKENBURG	AZ	85390
50538050A	1025 LOS ALTOS DR	WICKENBURG	AZ	85390					1025 LOS ALTOS DR		WICKENBURG	AZ	85390-2365
50551111A	296 S JEFFERSON ST	WICKENBURG	AZ	85390	296 S JEFFERSON ST	WICKENBURG		85390	296 S JEFFERSON ST		WICKENBURG	AZ	85390-1345
50551118A	90 W COOL WATER LN	WICKENBURG	AZ	85390	18 SYLVAN LN	WICKENBURG		85390	16 SYLVAN LN		WICKENBURG	AZ	85390-2312
50551119A	9 SYLVAN LN	WICKENBURG	AZ	85390	9 SYLVAN LN	WICKENBURG		85390	9 SYLVAN LN		WICKENBURG	AZ	85390-2313
50534055B	1012 BETHANY RD	BURBANK	CA	91504	815 W OASIS DR	WICKENBURG	85390		WARME RAINER H/INGRID TR	1012 BETHANY RD	BURBANK	CA	91504-3013
50528014H	PO BOX 2019	WICKENBURG	AZ	85358-2019	770 JAVELINA DR	WICKENBURG		85390	PO BOX 2019		WICKENBURG	AZ	85358-2019
50528011C	155 N TEGNER ST STE A	WICKENBURG	AZ	85390					155 N TEGNER ST STE A		WICKENBURG	AZ	85390-3427
50542095	PO BOX 207	MT VERNON	OR	97865	1535 W COUNTY LINE RD	WICKENBURG		85390	PO BOX 21377		WICKENBURG	AZ	85358-6377
50530043	PO BOX 161	WICKENBURG	AZ	85358	411 S OXBOW DR	WICKENBURG		85390	PO BOX 161		WICKENBURG	AZ	85358-0161

50530040	441 S OXBOW	WICKENBURG	AZ	85390	9 S OXBOW DR			85390	441 S OXBOW DR	WICKENBURG	AZ	85390-1390
50542091B	51323 N 329TH AVE	WICKENBURG	AZ	85390	51323 N 329TH AVE	WICKENBURG		85390	51323 N 329TH AVE	WICKENBURG	AZ	85390-3153
50528013D	PO BOX 2764	WICKENBURG	AZ	85358	611 W AGUA DR	WICKENBURG		85390	PO BOX 2764	WICKENBURG	AZ	85358-2764
50528013E	51020 HIGHWAY 60/89 STE B	WICKENBURG	AZ	85390	615 W AGUA DR	WICKENBURG		85390	51020 HIGHWAY 60/89 STE B	WICKENBURG	AZ	85390-3507
50534023	PO BOX 1193	WICKENBURG	AZ	85358-1193	860 W AMERICA ST	WICKENBURG	85390		PO BOX 1193	WICKENBURG	AZ	85358-1193
50551057	123 S MESQUITE ST	WICKENBURG	AZ	85390	123 S MESQUITE ST	WICKENBURG		85390	123 S MESQUITE ST	WICKENBURG	AZ	85390-1374

AFFIDAVIT OF PUBLICATION
FLOODPLAIN/FLOODWAY REVISION

01

Arizona Business Gazette
The business resource

PO BOX 194
Phoenix, Arizona 85001-0194
(602) 444-7315 FAX (602) 444-7364

Announcement of Floodplain/Floodway Revision for Sunset Wash, Sunset Wash Tributary 1, and Sunnycove Wash in the Town of Wickenburg, Arizona

The Flood Control District of Maricopa County (District), in cooperation with The Town of Wickenburg, in accordance with the National Flood Insurance Program regulation 65.7(b)(1), hereby gives notice of the District's intent to revise the floodplain/floodway generally located within Township 7 North, Range 5 West, Sections 11, 12, and 15.

Specifically, the floodplain/floodway was revised along the following reaches:

Sunset Wash from the confluence with the Hassayampa River to Sunset Dam. Revision results in increases and decreases to widths and depths of both the Zone AE floodplain and floodway.

Sunset Dam impoundment from Sunset Dam to Mariposa Drive. The delineation was revised from Zone A to Zone AH for the dam impoundment.

Sunnycove Wash from the confluence with Sunset Wash to Sunnycove Dam and from 150 feet downstream of Agua Drive to 160 feet north of Steinway Drive. Revision results in increases and decreases to widths and depths of both the Zone AE floodplain and floodway.

Sunnycove Wash revision with floodway removal from Sunnycove Dam to 150 feet downstream of Agua Drive. The Zone AE floodplain and floodway has been revised to Zone AH for the dam impoundment area.

Additional floodplain was established along Sunset Wash and Sunset Wash Tributary 1 along the following reaches:

Sunset Wash from Sunset Dam to 430 feet downstream of Los Altos Drive. Revision establishes Zone AE floodplain with Base Flood Elevations (BFE) with no floodway.

Sunset Wash Tributary 1 from Sunset Dam to 400 feet downstream of Los Altos Drive. Revision establishes Zone AE floodplain with Base Flood Elevations (BFE) with no floodway.

Maps and detailed analysis of the revised floodplain and floodway can be reviewed at the Flood Control District of Maricopa County, 2801 W. Durango St., Phoenix, AZ 85009. Interested persons may contact Ms. Kathryn Gross at 602-506-4837 or by email at kag@mail.maricopa.gov for additional information.

Published: April 21, 2011

STATE OF ARIZONA
COUNTY OF MARICOPA } SS.

Mark Gilmore, being first duly sworn, upon oath deposes and says: That he is the Legal Ad Rep of the Arizona Business Gazette, a newspaper of general circulation in the county of Maricopa, State of Arizona, published weekly at Phoenix, Arizona, and that the copy hereto attached is a true copy of the advertisement published in the said paper on the dates indicated.

4/21/2011

Sworn to before me this
21ST day of
APRIL 2011

MELISSA HOEKSTRA
Notary Public - Arizona
Maricopa County
My Comm. Expires Aug 1, 2014

Notary Public

ANNOUNCEMENT OF FLOODPLAIN/FLOODWAY REVISION FOR SUNSET WASH, SUNSET WASH TRIBUTARY 1 AND SUNNYCOVE WASH IN THE TOWN OF WICKENBURG, ARIZONA

STATE OF ARIZONA

County of Maricopa

Kevin Cloe, being duly sworn, upon oath, deposes and says: That he is the Publisher of

The Wickenburg Sun

A newspaper of general circulation in the County of Maricopa State of Arizona, published in Wickenburg, Arizona, and that the copy hereto attached is a true copy of the advertisement as published weekly in The Wickenburg Sun on the Dates following:

April 20, 2011

KEVIN CLOE
PUBLISHER

Notary Public State of Arizona
Maricopa County
Tamara Thomas
My Commission Expires
02/02/2012

Sworn to before me this **20th** day of **April,** A.D. **2011.**

Tamara Thomas

Notary Public My commission expires February 2, 2012

Announcement of Floodplain/Floodway Revision for Sunset Wash, Sunset Wash Tributary 1, and Sunnycove Wash in the Town of Wickenburg, Arizona

The Flood Control District of Maricopa County (District), in cooperation with the Town of Wickenburg, in accordance with the National Flood Insurance Program regulation 65.7(b)(1), hereby gives notice of the District's intent to revise the floodplain/floodway generally located within Township 7 North, Range 5 West, Sections 11, 12, and 15.

Specifically, the floodplain/floodway was revised along the following reaches:

Sunset Wash from the confluence with the Hassayampa River to Sunset Dam. Revision results in increases and decreases to widths and depths of both the Zone AE floodplain and floodway.

Sunset Dam impoundment from Sunset Dam to Mariposa Drive. The delineation was revised from Zone A to Zone AH for the dam impoundment.

Sunnycove Wash from the confluence with Sunset Wash to Sunnycove Dam and from 150 feet downstream of Agua Drive to 160 feet north of Steinway Drive. Revision results in increases and decreases to widths and depths of both the Zone AE floodplain and floodway.

Sunnycove Wash revision with floodway removal from Sunnycove Dam to 150 feet downstream of Agua Drive. The Zone AE floodplain and floodway has been revised to Zone AH for the dam impoundment area.

Additional floodplain was established along Sunset Wash and Sunset Wash Tributary 1 along the following reaches:

Sunset Wash from Sunset Dam to 430 feet downstream of Los Altos Drive. Revision establishes Zone AE floodplain with Base Flood Elevations (BFE) with no floodway.

Sunset Wash Tributary 1 from Sunset Dam to 400 feet downstream of Los Altos Drive. Revision establishes Zone AE floodplain with Base Flood Elevations (BFE) with no floodway.

Maps and detailed analysis of the revised floodplain and floodway can be reviewed at the Flood Control District of Maricopa County, 2801 W. Durango St., Phoenix, AZ 85009. Interested persons may contact Ms. Kathryn Gross at 602-506-4837 or by email at kag@mail.maricopa.gov for additional information.

Published in The Wickenburg Sun on April 20, 2011.

B.7 FEMA CORRESPONDENSE

Federal Emergency Management Agency

Washington, D.C. 20472

April 10, 2012

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Kelly Blunt
Mayor, Town of Wickenburg
155 North Tegner Street, Suite A
Wickenburg, AZ 85390

IN REPLY REFER TO:

Case No.:	11-09-3181P
Community Name:	Town of Wickenburg, AZ
Community No.:	040056
Effective Date of This Revision:	August 24, 2012

Dear Mayor Blunt:

The Flood Insurance Study report and Flood Insurance Rate Map for your community have been revised by this Letter of Map Revision (LOMR). Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals issued in your community.

Additional documents are enclosed which provide information regarding this LOMR. Please see the List of Enclosures below to determine which documents are included. Other attachments specific to this request may be included as referenced in the Determination Document. If you have any questions regarding floodplain management regulations for your community or the National Flood Insurance Program (NFIP) in general, please contact the Consultation Coordination Officer for your community. If you have any technical questions regarding this LOMR, please contact the Director, Mitigation Division of the Department of Homeland Security's Federal Emergency Management Agency (FEMA) in Oakland, California, at (510) 627-7175, or the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Sincerely,

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

For: Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

List of Enclosures:

- Letter of Map Revision Determination Document
- Annotated Flood Insurance Rate Map
- Annotated Flood Insurance Study Report

cc: (see attached list)

Courtesy Copy List - Town of Wickenburg, AZ

The Honorable Max W. Wilson
Chairman, Maricopa County Board of Supervisors

Mr. Richard Destefano
Building Inspector
Town of Wickenburg

Mr. Tim Murphy, P.E.
Mitigation Planning & Technical Programs Manager
Floodplain Management and Services Division
Flood Control District of Maricopa County

Ms. Kelli Sertich, AICP, CFM
FMS Division Manger
Flood Control District of Maricopa County

Mr. Kevin Lavalle
GIS Analyst
Flood Control District of Maricopa County

Ms. Kathryn Gross, CFM
Chief Hydrologist
Flood Control District of Maricopa County

Mr. Brian Cosson, CFM
NFIP State Manager
Arizona Department of Water Resources

Mr. Paul W.R. Hoskin, P.E.
Principal/Water Resources Director
Hoskin Ryan Consultants, Incorporation

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	Town of Wickenburg Maricopa County Arizona	NO PROJECT	FLOODWAY HYDRAULIC ANALYSIS HYDROLOGIC ANALYSIS NEW TOPOGRAPHIC DATA
	COMMUNITY NO.: 040056		
IDENTIFIER	Wickenburg Area Drainage Study/Planning	APPROXIMATE LATITUDE & LONGITUDE: 33.962, -112.738 SOURCE: USGS QUADRANGLE DATUM: NAD 83	

ANNOTATED MAPPING ENCLOSURES	ANNOTATED STUDY ENCLOSURES
TYPE: FIRM* NO.: 04013C0235G DATE: September 30, 2005 TYPE: FIRM* NO.: 04013C0253H DATE: September 30, 2005	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: September 30, 2005 PROFILES: 984P - 988P, 988P(a), AND 988P(b) FLOODWAY DATA TABLE: 5 SUMMARY OF DISCHARGES TABLE: 3 STILLWATER ELEVATION TABLE: 6

Enclosures reflect changes to flooding sources affected by this revision.
* FIRM - Flood Insurance Rate Map. ** FBFM - Flood Boundary and Floodway Map; *** FHBM - Flood Hazard Boundary Map

FLOODING SOURCE(S) & REVISED REACH(ES) See Page 2 for Additional Flooding Sources

Sunset Wash - from the confluence with Hassayampa River to just downstream of the Flood Control Dam

Sunset Wash Tributary - from the confluence with Sunset Wash (Upper Reach) to approximately 920 feet upstream of Mariposa Drive

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Sunset Wash	Zone AE	Zone AE	YES	YES
	BFEs*	BFEs	YES	YES
	Floodway	Floodway	YES	YES
Sunset Wash Tributary	Zone A	Zone AE	NONE	YES

* BFEs - Base Flood Elevations

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

125360 PT202.BKR.11093181P.H17 102-I-A-C

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

OTHER FLOODING SOURCES AFFECTED BY THIS REVISION

FLOODING SOURCE(S) & REVISED REACH(ES)

Sunset Wash Tributary - from the confluence with Sunset Wash (Upper Reach) to approximately 920 feet upstream of Mariposa Drive
Sunny Cove Wash - from the confluence with Sunset Wash to approximately 680 feet upstream of Kellis Road
Sunset Wash (Upper Reach) - from the Flood Control Dam to approximately 2,320 feet upstream of Mariposa Drive
Sunny Cove Wash (Upper Reach) - from the Flood Control Dam to approximately 180 feet upstream of Steinway Drive

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Sunset Wash Tributary	Zone X (shaded)	Zone AE	YES	YES
	No BFEs*	BFEs	YES	NONE
Sunny Cove Wash	Zone AE	Zone AE	YES	YES
	Floodway	Floodway	YES	YES
	BFEs	BFEs	YES	YES
Sunset Wash (Upper Reach)	Zone A	Zone AE	YES	YES
	Zone X (shaded)	Zone AE	YES	NONE
	No BFEs	BFEs	YES	NONE
Sunny Cove Wash (Upper Reach)	Zone AE	Zone AE	YES	YES
	Floodway	Floodway	YES	YES
	BFEs	BFEs	YES	YES

* BFEs - Base Flood Elevations

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

125360 PT202.BKR.11093181P.H17 102-I-A-C

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

OTHER COMMUNITIES AFFECTED BY THIS REVISION

CID Number: 040037 **Name:** Maricopa County, Arizona

AFFECTED MAP PANELS	AFFECTED PORTIONS OF THE FLOOD INSURANCE STUDY REPORT
TYPE: FIRM* NO.: 04013C0235G DATE: September 30, 2005 TYPE: FIRM* NO.: 04013C0253H DATE: September 30, 2005	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: September 30, 2005 PROFILES: 984P - 988P, 988P(a), AND 988P(b) FLOODWAY DATA TABLE: 5 SUMMARY OF DISCHARGES TABLE: 3 STILLWATER ELEVATION TABLE: 6

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

125360 PT202.BKR.11093181P H17 102-I-A-C

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

We provide the floodway designation to your community as a tool to regulate floodplain development. Therefore, the floodway revision we have described in this letter, while acceptable to us, must also be acceptable to your community and adopted by appropriate community action, as specified in Paragraph 60.3(d) of the NFIP regulations.

COMMUNITY REMINDERS

We based this determination on the base (1-percent-annual-chance) flood discharges computed in the submitted hydrologic analysis. Future development of projects upstream could cause increased discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on discharges and could, therefore, indicate that greater flood hazards exist in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

125360 PT202.BKR.11093181P.H17 102-I-A-C

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Sally M. Ziolkowski
Director, Mitigation Division
Federal Emergency Management Agency, Region IX
1111 Broadway Street, Suite 1200
Oakland, CA 94607-4052
(510) 627-7175

STATUS OF THE COMMUNITY NFIP MAPS

We are processing a revised FIRM and FIS report for Maricopa County in our countywide format; therefore, we will not physically revise and republish the FIRM and FIS report for your community to incorporate the modifications made by this LOMR at this time. Preliminary copies of the countywide FIRM and FIS report, which present information from the effective FIRMs and FIS reports for your community and other incorporated communities in Maricopa County, were submitted to your community for review on December 2, 2010.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

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Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

A notice of changes will be published in the *Federal Register*. This information also will be published in your local newspaper on or about the dates listed below and through FEMA's Flood Hazard Mapping website at https://www.floodmaps.fema.gov/fhm/Scripts/bfe_main.asp.

LOCAL NEWSPAPER Name: *Arizona Business Gazette*
Dates: April 19, 2012, and April 26, 2012

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised flood hazard determination information presented in this LOMR may be changed.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

125360 PT202.BKR.11093181P.H17 102-I-A-C

Federal Emergency Management Agency

Washington, D.C. 20472

April 10, 2012

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Max W. Wilson
Chairman, Maricopa County
Board of Supervisors
301 West Jefferson, 10th Floor
Phoenix, AZ 85003

IN REPLY REFER TO:

Case No.:	11-09-3181P
Community Name:	Maricopa County, AZ
Community No.:	040037
Effective Date of This Revision:	August 24, 2012

Dear Mr. Wilson:

The Flood Insurance Study report and Flood Insurance Rate Map for your community have been revised by this Letter of Map Revision (LOMR). Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals issued in your community.

Additional documents are enclosed which provide information regarding this LOMR. Please see the List of Enclosures below to determine which documents are included. Other attachments specific to this request may be included as referenced in the Determination Document. If you have any questions regarding floodplain management regulations for your community or the National Flood Insurance Program (NFIP) in general, please contact the Consultation Coordination Officer for your community. If you have any technical questions regarding this LOMR, please contact the Director, Mitigation Division of the Department of Homeland Security's Federal Emergency Management Agency (FEMA) in Oakland, California, at (510) 627-7175, or the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Sincerely,

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

For: Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

List of Enclosures:

- Letter of Map Revision Determination Document
- Annotated Flood Insurance Rate Map
- Annotated Flood Insurance Study Report

cc: (see attached list)

Courtesy Copy List - Maricopa County, AZ

The Honorable Kelly Blunt
Mayor, Town of Wickenburg

Mr. Timothy S. Phillips, P.E.
Chief Engineer and General Manager
Flood Control District of Maricopa County

Mr. Tim Murphy, P.E.
Mitigation Planning & Technical Programs Manager
Floodplain Management and Services Division
Flood Control District of Maricopa County

Ms. Kelli Sertich, AICP, CFM
FMS Division Manger
Flood Control District of Maricopa County

Ms. Kathryn Gross, CFM
Chief Hydrologist
Flood Control District of Maricopa County

Mr. Kevin Lavalle
GIS Analyst
Flood Control District of Maricopa County

Mr. Brian Cosson, CFM
NFIP State Manager
Arizona Department of Water Resources

Mr. Paul W.R. Hoskin, P.E.
Principal/Water Resources Director
Hoskin Ryan Consultants, Incorporation

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	Maricopa County Arizona (Unincorporated Areas)	NO PROJECT	FLOODWAY HYDRAULIC ANALYSIS HYDROLOGIC ANALYSIS NEW TOPOGRAPHIC DATA
	COMMUNITY NO.: 040037		
IDENTIFIER	Wickenburg Area Drainage Study/Planning	APPROXIMATE LATITUDE & LONGITUDE: 33.962, -112.738 SOURCE: USGS QUADRANGLE DATUM: NAD 83	

ANNOTATED MAPPING ENCLOSURES	ANNOTATED STUDY ENCLOSURES
TYPE: FIRM* NO.: 04013C0235G DATE: September 30, 2005 TYPE: FIRM* NO.: 04013C0253H DATE: September 30, 2005	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: September 30, 2005 PROFILES: 984P - 988P, 988P(a), AND 988P(b) FLOODWAY DATA TABLE: 5 SUMMARY OF DISCHARGES TABLE: 3 STILLWATER ELEVATION TABLE: 6

Enclosures reflect changes to flooding sources affected by this revision.
* FIRM - Flood Insurance Rate Map; ** FBFM - Flood Boundary and Floodway Map; *** FHBM - Flood Hazard Boundary Map

FLOODING SOURCE(S) & REVISED REACH(ES)

Sunny Cove Wash (Upper Reach) - from the Flood Control Dam to approximately 180 feet upstream of Steinway Drive

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Sunny Cove Wash (Upper Reach)	Zone AE	Zone AE	YES	YES
	BFEs*	BFEs	YES	NONE
	Floodway	Floodway	YES	YES

* BFEs - Base Flood Elevations

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

125360 PT202.BKR.11093181P.H17 102-I-A-C

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

OTHER COMMUNITIES AFFECTED BY THIS REVISION

CID Number: 040056 **Name:** Town of Wickenburg, Arizona

AFFECTED MAP PANELS	AFFECTED PORTIONS OF THE FLOOD INSURANCE STUDY REPORT
TYPE: FIRM* NO.: 04013C0235G DATE: September 30, 2005 TYPE: FIRM* NO.: 04013C0253H DATE: September 30, 2005	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: September 30, 2005 PROFILES: 984P - 988P, 988P(a), AND 988P(b) FLOODWAY DATA TABLE: 5 SUMMARY OF DISCHARGES TABLE: 3 STILLWATER ELEVATION TABLE: 6

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

125360 PT202.BKR.11093181P.H17 102-I-A-C

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

We provide the floodway designation to your community as a tool to regulate floodplain development. Therefore, the floodway revision we have described in this letter, while acceptable to us, must also be acceptable to your community and adopted by appropriate community action, as specified in Paragraph 60.3(d) of the NFIP regulations.

COMMUNITY REMINDERS

We based this determination on the base (1-percent-annual-chance) flood discharges computed in the submitted hydrologic model. Future development of projects upstream could cause increased discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on discharges and could, therefore, indicate that greater flood hazards exist in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Sally M. Ziolkowski
Director, Mitigation Division
Federal Emergency Management Agency, Region IX
1111 Broadway Street, Suite 1200
Oakland, CA 94607-4052
(510) 627-7175

STATUS OF THE COMMUNITY NFIP MAPS

We are processing a revised FIRM and FIS report for Maricopa County in our countywide format; therefore, we will not physically revise and republish the FIRM and FIS report for your community to incorporate the modifications made by this LOMR at this time. Preliminary copies of the countywide FIRM and FIS report, which present information from the effective FIRMs and FIS reports for your community and other incorporated communities in Maricopa County, were submitted to your community for review on December 2, 2010.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

A notice of changes will be published in the *Federal Register*. This information also will be published in your local newspaper on or about the dates listed below and through FEMA's Flood Hazard Mapping website at https://www.floodmaps.fema.gov/fhm/Scripts/bfe_main.asp.

LOCAL NEWSPAPER Name: *Arizona Business Gazette*
Dates: April 19, 2012, and April 26, 2012

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised flood hazard determination information presented in this LOMR may be changed.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Siamak Esfandiary, Ph.D., P.E., Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

125360 PT202.BKR.11093181P.H17 102-I-A-C

Flood Control District
of Maricopa County

Board of Directors
Fulton Brock, District 1
Don Stapely, District 2
Andrew Kunasek, District 3
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February 8, 2012

LOMR Manager
LOMC Clearinghouse
7390 Coca Cola Drive, Suite 204
Hanover, MD 21076

Subject: Wickenburg Area Drainage Master Plan: Phase 1 Floodplain Delineation Study TDN, Sunset and Sunnycove Washes (FCD Contract FCD2009C030) by Hoskin Ryan Consultants, Inc.

Case No.: 11-09-3181P

Communities: Town of Wickenburg, Community No. 040056
Unincorporated Maricopa County, Community No. 040037

Flooding Sources: Sunset Wash, Sunset Wash Tributary 1 and Sunnycove Wash

FIRM panels affected: 04013C0235G 04013C253H

LOMR Manager:

We have received your comments dated November 18, 2011 and are providing the following responses. A CD with supporting documentation is also included with our response.

Item 1: Our review revealed that the water surface elevation (WSEL) profiles that correspond to floods having a 10-percent, and 1-percent (base flood) chance of being equaled or exceeded in any given year cross each other at Cross-section .737 on Sunset Wash. Please revise the existing conditions HEC-RAS hydraulic model to properly reflect the WSELs for each flood event.

District Response: Regarding the cross-over in water surface elevations for cross-section .737 on Sunset Wash, we have eliminated the cross-over of profiles for this location. It appears it was a combination of how the ineffective flow areas were set and the use of an internal cross-section for the culvert analysis. Once these items were adjusted the water surface elevations fell into place.

Item 2: Our review revealed that the WSEL profiles that correspond to floods having a 2-percent, and .2-percent chance of being equaled or exceeded in any given year cross each other at Cross Sections 0.282 through

1.019 on sunset Wash and Cross Sections 0.022, 0.239, and 0.245 on Sunnycove Wash. Please revise the existing conditions HEC-RAS hydraulic model to properly reflect the WSELs for each flood event.

District Response:

1. Regarding the profile issues along Sunset Wash between .828 and 1.019 (item 2), modifications were made that have removed the concerns.
    - The first modification was re-evaluating the discharges being used in the area. Discharges that were initially being introduced at cross-section .925 were shifted upstream and started in cross-section 1.117 this provides a better representation of the possible discharges being contributed by the watershed for this reach.
    - Multiple attempts were made to try and bring the 500 year elevation up for cross-sections 1.019 and .925. The challenge faced in this area is that the overbank area is depressed in relation to the main channel. The main channel in the area is not overtopped for the one hundred year event but the channel will be overtopped during the 500 year event. Due to the depressed area located in the left overbank the 500 year flows have a larger area to expand in which results in water surface elevations that are lower than the 100-year elevation contained in the main channel. This was remedied by removing cross-section 1.019 and relocating that cross-section just downstream at 1.016. Levee stations were then used to control flows between the main channel and overbank area so that the 500 year event water surface elevations would at least be at the 100 year elevation or above.
2. Regarding the profile issues along Sunnycove Wash at .222, .239, and .245, modifications have been made that eliminate the profiles crossing. Part of the problem was again an internal cross-section for the culvert located at .233 and then the ineffective flow area in the left overbank of .239 was adjusted as well. Once these modifications were made the water surface elevations fell into place.

Item 3: If the submitted topographic work maps entitled, "100-year Floodplain Work Maps" prepared by Hoskin-Ryan Consultants, Inc dated November 2011, change as a result of the revisions to the hydraulic model requested in Items1 and 2, please revise the workmaps to show the appropriate changes.

District Response: Some revisions were necessary from updating the modeling. Revised work maps are included with this submittal. Also included is a CD containing the revised RAS model and revised floodplain limits in shape file format.

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

Enclosure

Copy to:

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

Robert Bezek
Federal Emergency Management Agency
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Hoskin Ryan Consultants, Inc
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NATIONAL FLOOD INSURANCE PROGRAM

FEMA PRODUCTION AND TECHNICAL SERVICES CONTRACTOR

November 18, 2011

Ms. Kathryn Gross, CFM
Chief Hydrologist
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009

IN REPLY REFER TO:
Case No.: 11-09-3181P
Communities: Town of Wickenburg and Maricopa County, AZ
Community Nos.: 040056 and 040037

316-AD

Dear Ms. Gross:

This responds to your submittal dated November 16, 2011, concerning a June 6, 2011 request, 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:	Wickenburg Area Drainage Study/Planning
Flooding Source:	Sunny Cove Wash, Sunny Cove Wash Upper Reach, Sunset Wash, Sunset Wash Upper Reach, Sunset Wash Tributary 1
FIRM Panel(s) Affected:	04013C0310 L and 04013C0328 L

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 available on the FEMA website at http://www.fema.gov/plan/prevent/fhm/frm_fees.shtm 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, Mr. James Lindsay, by e-mail at JGLindsay@mbaker.com or by telephone at 720-514-1122, 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. Richard Destefano
Building Inspector
Town of Wickenburg

Mr. Timothy S. Phillips, P.E.
Chief Engineer & General Manager
Flood Control District of Maricopa County

Mr. Paul W.R. Hoskin, P.E.
Principal/Water Resources Director
Hoskin Ryan Consultants, Incorporation

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.: 11-09-3181P

Requester: Ms. Kathryn Gross, CFM

Communities: Town of Wickenburg and
Maricopa County, AZ

Community Nos.: 040056 and 040037

The issues listed below must be addressed before we can continue the review of your request.

1. Our review revealed that the water-surface elevation (WSEL) profiles that correspond to floods having a 10-percent, and 1-percent (base flood) chance of being equaled or exceeded in any given year cross each other at Cross Section .737 on Sunset Wash. Please revise the existing conditions HEC-RAS hydraulic model to properly reflect the WSELs for each flood event.

2. Our review revealed that the WSEL profiles that correspond to floods having a 2-percent, and 0.2-percent chance of being equaled or exceeded in any given year cross each other at Cross Sections 0.828 through 1.019 on Sunset Wash and Cross Sections 0.022, 0.239, and 0.245 on Sunny Cove Wash. Please revise the existing conditions HEC-RAS hydraulic model to properly reflect the WSELs for each flood event.

3. If the submitted topographic work maps entitled, "100-Year Floodplain Work Maps," prepared by Hoskin Ryan Consultants, Inc., dated November 2011, change as a result of the revisions to the hydraulic model requested in Items 1 and 2, please revise the work maps to show the appropriate changes.

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 Stapely, District 2
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Max Wilson, District 4
Mary Rose Wilcox, District 5

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October 5, 2011

LOMR Manager
LOMC Clearinghouse
7390 Coca Cola Drive, Suite 204
Hanover, MD 21076

Subject: Wickenburg Area Drainage Master Plan: Phase 1 Floodplain Delineation Study TDN, Sunset and Sunnycove Washes (FCD Contract FCD2009C030) by Hoskin Ryan Consultants, Inc.

Case No.: 11-09-3181P

Communities: Town of Wickenburg, Community No. 040056
Unincorporated Maricopa County, Community No. 040037

Flooding Sources: Sunset Wash, Sunset Wash Tributary 1 and Sunnycove Wash

FIRM panels affected: 04013C0235G 04013C253H

LOMR Manager:

We have received your comments dated August 10, 2011 and are providing the following responses. A CD with supporting documentation is also included with our response.

Question 1: Submit Duplicate Effective model…to ensure the revised data will be integrated into the effective data to provide a continuous FIS model U/S and D/S of the revised reach.

District Response: A duplicate effective model has been included on the CD. It is located in the "comment 1 duplicate effective" folder. It contains a zip file which contains (1) the effective HEC-2 models for Sunset and Sunnycove wash (Wash AD is all of sunset and the lower reach of Sunnycove and Wash AE is the upper reach of Sunnycove), (2) the duplicate effective RAS models, and (3) an excel spreadsheet of various cross-section locations for the effective, duplicate effective, and revised water surface elevations for floodplain and floodway. There are a few idiosyncrasies that resulted due to how the effective natural run was performed (used effective flow area stationing) that is not picked up by RAS when it imports. Overall it looks reasonable.

Question 2: Review revealed a possible split flow between XS .547 and .431 on Sunset Wash. Please revise the model to incorporate a split flow analysis for this area or provide an explanation as to why the area should not be modeled as a split flow.

District Response: At Mesquite Rd all of the flow cannot be contained as the overflow crosses over the top of the culvert and some flow continues down Mesquite Rd. A HEC-RAS analysis has been performed for the area. As seen in Cross Sections 1055 to 247, the majority of the flow is within the Madison, Mesquite, and Fisher Street Roadway Rights-of-Way. Beyond the roadway locations, flow depths are less than half a foot with most locations reflecting higher grades where structures are located. Cross Section 6 is already within the floodplain along the main wash. Therefore, the majority of the flow is within the properties which are already included in the Sunset Wash floodplain. As a result, we believe that no additional floodplain delineation is necessary in this location. The supporting documentation for this is included in the folder "comment 2 split flow at Mesquite" on the CD. Please refer to Exhibit 4 for the Split Flow Map as well as the RAS model "SunsetWashFlowSplit_HEC-RAS".

Question 3: Blocked obstruction used in the overbanks of Sunset Wash Reach #1. If these do not represent structures in the floodplain, please remove the obstructions and consider revising the ground geometry or using the ineffective flow option, as appropriate.

District Response: The obstructions modeled in Sunset Wash Reach #1 represent structures located in the overbanks. No modifications to the model are necessary.

Question 4: The submitted existing condition RAS output shows negative surcharges at XS .642 and .693 on Sunnycove Wash. Revise so no negative surcharges exist or explain why this is not necessary.

District Response: These cross-sections fall within the flood pool of Sunnycove Dam. They are not used as part of the floodplain/floodway delineation. These cross-sections were used to start up the RAS model. The floodplain delineation limits in this area are set by the stage/storage relationship included in the hydrology models.

Question 5: It appears as though the structures at 0.269, 1.137, and 1.456 have a relatively large skew angle compared to the normal direction of flow of the flooding source. Please adjust the bridge dimensions to define an equivalent cross section perpendicular to the flow of the flooding source, skew the bridge in the bridge/culvert editor of HEC-RAS, or explain why making this adjustment is not necessary.

District Response: The bridge/culvert dimensions do not need to be adjusted in the HEC-RAS model because all three culverts are oriented parallel to the main flow path. Since all three culverts don't have the capacity to convey the flow, shallow flooding occurs in the overbank areas, downstream of the culverts. As a result, we believe that no modifications are necessary. Please refer to Exhibits 1, 2 and 3 for the culvert orientations with this submittal (located in folder "comment 5 culverts" on the CD), as well as Appendix C which contains the survey report and includes data for these structures.

Question 6: The Special Flood Hazard Area (SFHA), the area that would be inundated by the base (1-percentannual-chance) flood, designated Zone AH is subject to shallow flooding, usually in the form of a pond, with average depths between 1 foot and 3 feet. Please provide calculations for the SFHAs designated Zone AH on the submitted topographic work map entitled, "100 Year Floodplain Work Maps," prepared by Hoskin Ryan Consultants, Inc., dated June 2011, or revise the designation to Zone AE.

District Response: The limits of the Zone AH map the ponded water surface elevation behind the dams. The limits were determined by stage/storage relationships used in the hydrologic modeling. The District typically prefers to model level pool water surfaces with hydrologic storage relationships as well as identify their location using Zone AH to easily identify where the ponding water surface ties into the hydraulic model water surface. However, per conversations with the PTS reviewer we are fine having it be reflected as Zone AE on the FIRM panel.

Question 7: The geometry of Cross Section 0.263 on Sunny Cove Wash in the existing conditions HEC-RAS hydraulic analysis does not appear to match the ground geometry shown on the above-referenced topographic work map. Please provide an explanation for this discrepancy, or make the appropriate changes.

District Response: All the cross sections were cut from the Digital Terrain Model (DTM) data in which the contours unfortunately do not reflect the finer details, especially near culvert/bridge locations. For this reason, field surveys for all the culverts/bridges were conducted. Cross Section 0.263 is located immediately downstream of the culvert crossing Kellis Road within Sunnycove Wash Reach 1. Refer to Exhibit 1 (included in "comment 5 culverts" folder on the CD) for the cross section location. As a result, this cross section was modified to incorporate the culvert crossing invert of 2100.24. The structure survey data is located on page 82 of the Phase 1 Survey Report located in Appendix C of the Technical Data Notebook.

Question 8: The base floodplain top widths shown in the existing condition RAS analysis at XS .524 and .178 on Sunset Wash and .263 on Sunnycove do not match the floodplain top widths shown on the workmap. Please provide an explanation for the discrepancies.

District Response: In general, for all floodplains and floodways, the limits are based on the reported water surface stations and encroachment stations provided in the RAS output.

- Sunnycove .263 – the top width for .263 is shorter than what is shown on the map. For this cross-section, the hydraulic model did not show flows in the left overbank; however, we anticipate that flows overtopping the street at cross-section .279 due to the culvert will be able to flow down the street. Cross-section .245 downstream also reflects flow on the road. To be consistent, the two floodplains were connected, disregarding the left water surface station shown in cross-section .263.
- Sunset .524 – Top width 126 feet in the model. For this cross-section, the majority of the right overbank is composed of an obstruction representing a house. To be conservative, the floodplain limits were drawn on the other side of the obstruction so that the presence of the structure does not underestimate the floodplain width.

- Sunset .178 – Top width 388 feet in the model. Floodplain limits are determined by the water surface stations. The floodplain limits were also extended to tie into the Hassayampa River floodplain. The difference in top width is related to high ground within the cross-section that we are including in the floodplain as well as trying to find a logical tie-in to the Hassayampa River.

Question 9: The floodway top width shown in the existing conditions HEC-RAS hydraulic analysis at Cross Section 0.753 on Sunset Wash does not match the approximate base floodplain top width shown on the above-referenced topographic work map. Please provide an explanation for this discrepancy, or make the appropriate changes.

District response: The floodway and floodplain limits for this cross-section were determined based on the water surface stations and floodway encroachment stations. The apparent discrepancy for the floodway results from the floodway encroachment stopping at the bank stations and the water surface elevation within the eastern channel (which represents the floodway area) is below the bank stations resulting in a difference between the encroachment width of 74 feet versus the floodway top width of 23 feet. The apparent discrepancy regarding the floodplain top width is the same. The wetted areas (3 separate areas) within the floodplain stations match the top width reported as 158.3 ft. The dry areas (2 separate areas) within the floodplain stations represent 110.35 ft and when added together total 268.65 ft which matches the entire distance represented by the two water surface stations on the map. No revisions are necessary.

Question 10: From our technical review, it appears as though the base floodplain delineation is not mapped correctly on Sunny Cove Wash at Cross Sections 0.022, 0.159 and 0.194 on the above-referenced topographic work map. Please provide an explanation for these discrepancies, or make the appropriate revisions.

District Response: For the above mentioned cross-sections, the floodplain limits were determined using the water surface stations identified in RAS. The floodplain water surface elevation is essentially coincident with the contour data shown on the hard copy floodplain workmaps. Digital contour files and floodplain limits were submitted with the TDN package to help aid in the review. They are included on the CD "FCD03-66 Contours from Wickenburg Mapping and Phase 1 Floodplains". Cross-sections were cut from the DTM data associated with the mapping product. Verify .159 and .194 to match WSEL stations. No revisions are necessary.

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

Enclosure

Copy to:

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

Robert Bezek
Federal Emergency Management Agency
Region IX
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Wickenburg, AZ 85390

Paul Hoskin, P.E.
Hoskin Ryan Consultants, Inc
6245 N. 24th Parkway, Suite 100
Phoenix, AZ 85016

NATIONAL FLOOD INSURANCE PROGRAM

FEMA PRODUCTION AND TECHNICAL SERVICES CONTRACTOR

August 10, 2011

Mr. Paul W.R. Hoskin, P.E.
Principal/Water Resources Director
Hoskin Ryan Consultants, Incorporation
6245 North 24th Parkway, Suite 100
Phoenix, AZ 85016

IN REPLY REFER TO:
Case No.: 11-09-3181P
Communities: Town of Wickenburg and Maricopa County, AZ
Community Nos.: 040056 and 040037

316-AD

Dear Mr. Hoskin:

This responds to your request dated June 6, 2011, 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:	Wickenburg Area Drainage Study/Planning
Flooding Source:	Sunny Cove Wash, Sunny Cove Wash Upper Reach, Sunset Wash, Sunset Wash Upper Reach, Sunset Wash Tributary 1
FIRM Panel(s) Affected:	04013C0310 L and 04013C0328 L

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 available on the FEMA website at http://www.fema.gov/plan/prevent/fhm/frm_fees.shtm 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, Mr. James Lindsay, by e-mail at JGLindsay@mbaker.com or by telephone at 720-514-1122, 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. Richard Destefano
Building Inspector
Town of Wickenburg

Mr. Timothy S. Phillips, P.E.
Chief Engineer & General Manager
Flood Control District of Maricopa County

Ms. Kathryn Gross, CFM
Chief Hydrologist
Flood Control District of Maricopa County

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.: 11-09-3181P

Requester: Mr. Paul W.R. Hoskin, P.E.

Communities: Town of Wickenburg and
Maricopa County, AZ

Community Nos.: 040056 and 040037

The issues listed below must be addressed before we can continue the review of your request.

1. As required on page 10 of the instructions for the MT-2 application/certification forms (copy enclosed), please provide a copy of the duplicate effective model for the revised flooding sources. This is required to ensure that the effective model's input data has been transferred correctly to the requester's equipment and to ensure that the revised data will be integrated into the effective data to provide a continuous Flood Insurance Study model upstream and downstream of the revised reach.

2. Our detailed review revealed a possible split flow between Cross Sections 0.547 and 0.431on Sunset Wash. Please revise the model to incorporate a split flow analysis for this area or provide an explanation why this area should not be modeled as a split flow.

3. The blocked obstruction option was used in the overbanks of Sunset Wash Reach #1. If these areas do not represent structures in the floodplain, please remove the obstructions and consider revising the ground geometry or using the ineffective flow option, as appropriate.

4. The submitted existing conditions HEC-RAS hydraulic analysis output shows negative surcharges at Cross Sections 0.642 and 0.693 on Sunny Cove Wash. Please revise the floodway analysis to eliminate all negative surcharges, or explain why this is not necessary.

5. It appears as though the structures at 0.269, 1.137, and 1.456 have a relatively large skew angle compared to the normal direction of flow of the flooding source. Please adjust the bridge dimensions to define an equivalent cross section perpendicular to the flow of the flooding source, skew the bridge in the bridge/culvert editor of HEC-RAS, or explain why making this adjustment is not necessary.

6. The Special Flood Hazard Area (SFHA), the area that would be inundated by the base (1-percent-annual-chance) flood, designated Zone AH is subject to shallow flooding, usually in the form of a pond, with average depths between 1 foot and 3 feet. Please provide calculations for the SFHAs designated Zone AH on the submitted topographic work map entitled, "100 Year Floodplain Work Maps," prepared by Hoskin Ryan Consultants, Inc., dated June 2011, or revise the designation to Zone AE.

7. The geometry of Cross Section 0.263 on Sunny Cove Wash in the existing conditions HEC-RAS hydraulic analysis does not appear to match the ground geometry shown on the above-referenced topographic work map. Please provide an explanation for this discrepancy, or make the appropriate changes.

8. The base floodplain top widths shown in the existing conditions HEC-RAS hydraulic analysis at Cross Sections 0.524 and 0.178 on Sunset Wash and Cross Section 0.263 on Sunny Cove Wash do not match the approximate base floodplain top widths shown on the above-referenced topographic work map. Please provide an explanation for these discrepancies, or make the appropriate changes.

9. The floodway top width shown in the existing conditions HEC-RAS hydraulic analysis at Cross Section 0.753 on Sunset Wash does not match the approximate base floodplain top width shown on the above-referenced topographic work map. Please provide an explanation for this discrepancy, or make the appropriate changes.

10. From our technical review, it appears as though the base floodplain delineation is not mapped correctly on Sunny Cove Wash at Cross Sections 0.022, 0.159 and 0.194 on the above-referenced topographic work map. Please provide an explanation for these discrepancies, or make the appropriate revisions.

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.

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of Maricopa County

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June 23, 2011

LOMR Manager
LOMC Clearinghouse
7390 Coca Cola Drive, Suite 204
Hanover, MD 21076

Subject: Wickenburg Area Drainage Master Plan: Phase 1 Floodplain Delineation Study TDN, Sunset and Sunnycove Washes (FCD Contract FCD2009C030) by Hoskin Ryan Consultants, Inc.

Communities: Town of Wickenburg, Community No. 040056
Unincorporated Maricopa County, Community No. 040037

Flooding Sources: Sunset Wash, Sunset Wash Tributary 1 and Sunnycove Wash

FIRM panels affected: 04013C0235G 04013C253H

LOMR Manager:

Enclosed is the technical supporting data for the Wickenburg Area Drainage Master Plan: Phase 1 Floodplain Delineation Study TDN, Sunset and Sunnycove Washes. This study includes new hydrology and the re-delineation of 3.1 linear miles of Zone AE floodplain and floodway along Sunset and Sunncove Washes and 1.1 linear miles of new Zone AE floodplains without floodways along Sunset Wash and Sunset Wash Tributary 1 within the Town of Wickenburg. The study area is located in the northwest portion of Maricopa County.

The results are presented in one Technical Data Notebook. Hydrologic and hydraulic information is located in Section 4 and 5. The FEMA forms are located in Section 2. A full-size set of floodplain delineation work maps are located at the back of the Notebook. Annotated FIRM panels are located in Section 7. Digital versions of the hydrologic and hydraulic analysis are included on the CD in the front pocket of the Notebook.

The digital floodplain limits and topographic contours are included on a CD "FCD03-66 Contours from Wickenburg Mapping and Phase 1 Floodplains". The CD is located in the front pocket of the Notebook as well.

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

Enclosure

Copy to: Beth Norton
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June 23, 2011

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Unincorporated Maricopa County, Community No. 040037

Flooding Sources: Sunset Wash, Sunset Wash Tributary 1 and Sunnycove Wash

FIRM panels affected: 04013C0235G 04013C253H

LOMR Manager:

Enclosed is the technical supporting data for the Wickenburg Area Drainage Master Plan: Phase 1 Floodplain Delineation Study TDN, Sunset and Sunnycove Washes. This study includes new hydrology and the re-delineation of 3.1 linear miles of Zone AE floodplain and floodway along Sunset and Sunncove Washes and 1.1 linear miles of new Zone AE floodplains without floodways along Sunset Wash and Sunset Wash Tributary 1 within the Town of Wickenburg. The study area is located in the northwest portion of Maricopa County.

The results are presented in one Technical Data Notebook. Hydrologic and hydraulic information is located in Section 4 and 5. The FEMA forms are located in Section 2. A full-size set of floodplain delineation work maps are located at the back of the Notebook. Annotated FIRM panels are located in Section 7. Digital versions of the hydrologic and hydraulic analysis are included on the CD in the front pocket of the Notebook.

The digital floodplain limits and topographic contours are included on a CD "FCD03-66 Contours from Wickenburg Mapping and Phase 1 Floodplains". The CD is located in the front pocket of the Notebook as well.

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

Enclosure

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Appendix C: Survey Field Notes

The *Wickenburg Area Drainage Master Study/Plan Phase 1 Survey Report*, prepared by Hoskin-Ryan Consultants, Inc. is included as Appendix C.

Office

Project

25 September 2010

INPUT	OUTPUT
State Plane, NAD83	State Plane, NAD83
0202 - Arizona Central, Int. Feet	0202 - Arizona Central, Int. Feet
Vertical - NGVD29 (Vertcon94), U.S. Feet	Vertical - NAVD88, U.S. Feet

Sunset

1/2

Northing/Y:	1079600	**Northing/Y:**	1079600.000
Easting/X:	449500	**Easting/X:**	449500.000
Elevation/Z:	2130	**Elevation/Z:**	2132.185
Convergence:	-0 27 41.77019	**Convergence:**	-0 27 41.77019
Scale Factor:	0.999971842	**Scale Factor:**	0.999971842
Combined Factor:	0.999874605	**Combined Factor:**	0.999874500

Grid Shift (Int. ft.): X/Easting = 0.0, Y/Northing = 0.0

Sunny Cove

2/2

Northing/Y:	1076670	**Northing/Y:**	1076670.000
Easting/X:	450250	**Easting/X:**	450250.000
Elevation/Z:	2160	**Elevation/Z:**	2162.188
Convergence:	-0 27 36.29383	**Convergence:**	-0 27 36.29383
Scale Factor:	0.999971412	**Scale Factor:**	0.999971412
Combined Factor:	0.999872743	**Combined Factor:**	0.999872639

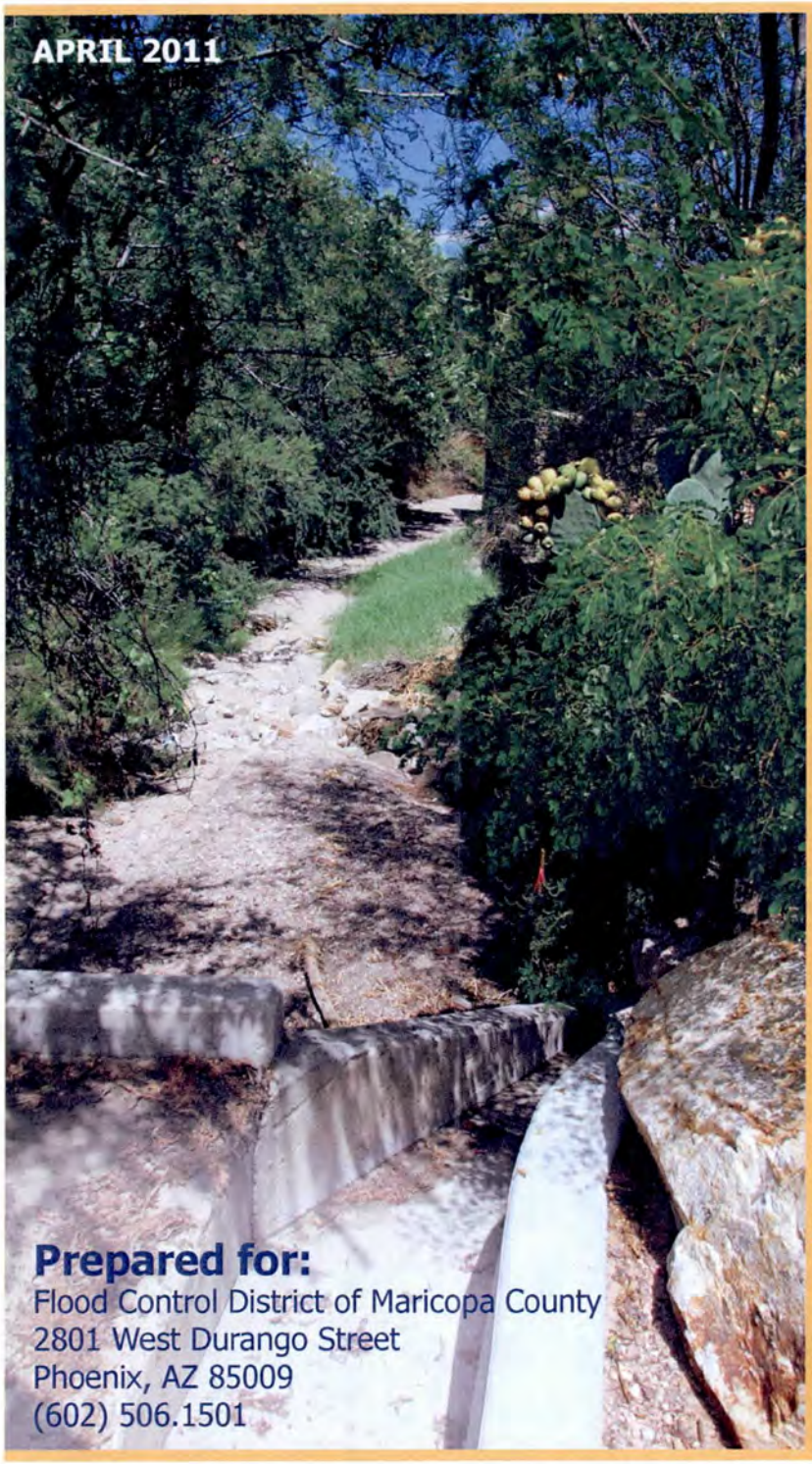
Grid Shift (Int. ft.): X/Easting = 0.0, Y/Northing = 0.0

Remark:

Wickenburg Area Drainage Master Study/Plan

FCD 2009C030 - PHASE 1 SURVEY REPORT

APRIL 2011



Prepared for:

Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009
(602) 506.1501

Prepared by:

Hoskin • Ryan Consultants, Inc.
creative engineering solutions

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B - Structure Field Sketches
C - Finish Floor Survey Field Notes

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
27238
DAVID P.
FORNEY
DATE SIGNED: 4-25-11
ARIZONA, U.S.A.

EXPIRES 6-30-14

1 INTRODUCTION

Hoskin-Ryan Consultants, Inc., (HRC) has been contracted by the Flood Control District of Maricopa County (District) to prepare the Wickenburg Area Drainage Master Study/Plan (ADMS/P). The ADMS/P lies within the watershed encompassing and surrounding the Town of Wickenburg in the north part of Maricopa County (Figure 1). The ADMS portion of the project identifies and quantifies known and potential flood hazards in the Wickenburg area, and where future flood control measures should be focused. If deemed necessary, the ADMP portion of the project will be initiated to identify alternatives and propose solutions to remediate flood hazards. This study is a joint effort between the District and the Town of Wickenburg (Town).

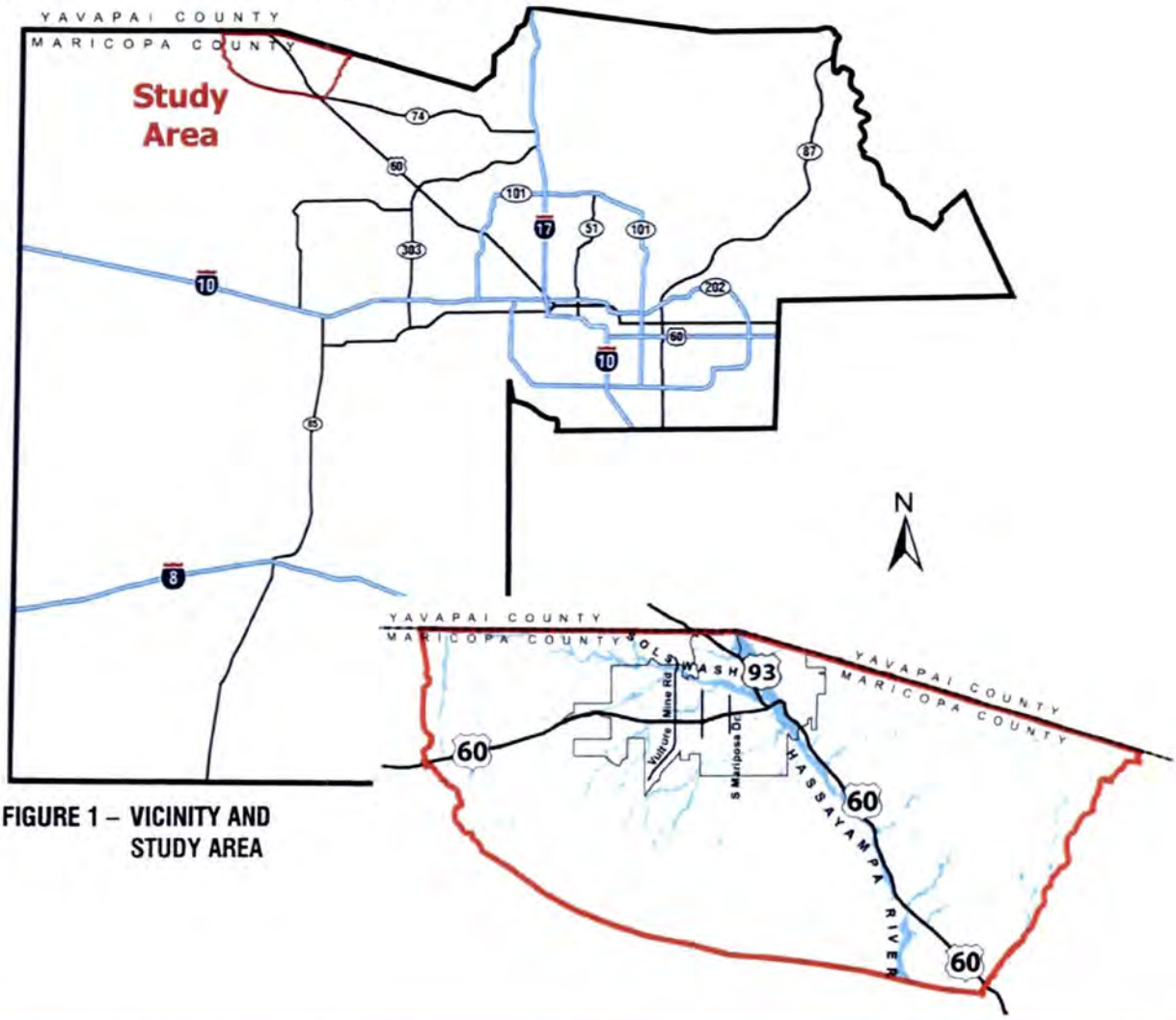


FIGURE 1 – VICINITY AND STUDY AREA

The study is an update of the Wickenburg Area Drainage Master Study (WADMS), completed in 1992. Since the WADMS, there have been advancements in the technology used to identify flood hazards, precipitation data has changed, and more recent and accurate digital topography is available. Growth, development, and other factors have resulted in changes to drainage patterns in some areas, causing potential changes to the flood hazards.

The ADMS will be completed in three phases (Figure 2). The first phase (Figure 3) identifies the current floodplain and flood hazards for Sunset Wash and Sunny Cove Wash. The second phase addresses the floodplains that occur within, or in close proximity to, the Town limits. The third phase delineates floodplains for selected washes outside of the Town's jurisdictional limits.

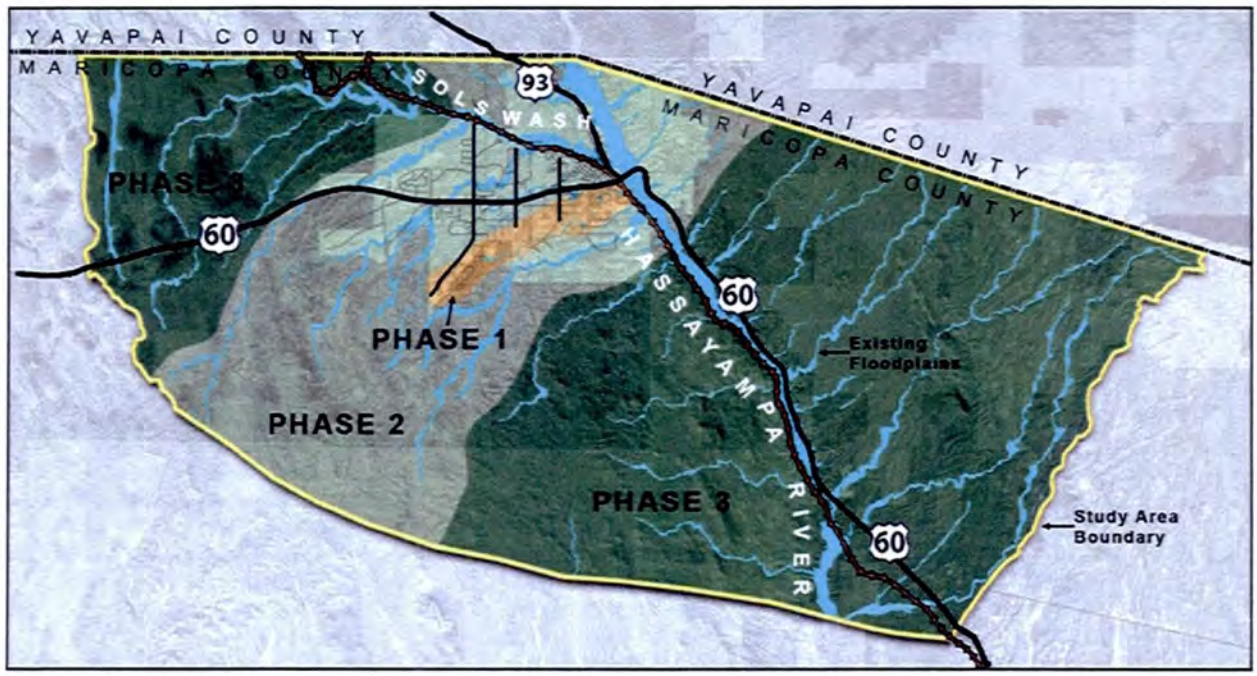


FIGURE 2 – STUDY PHASES

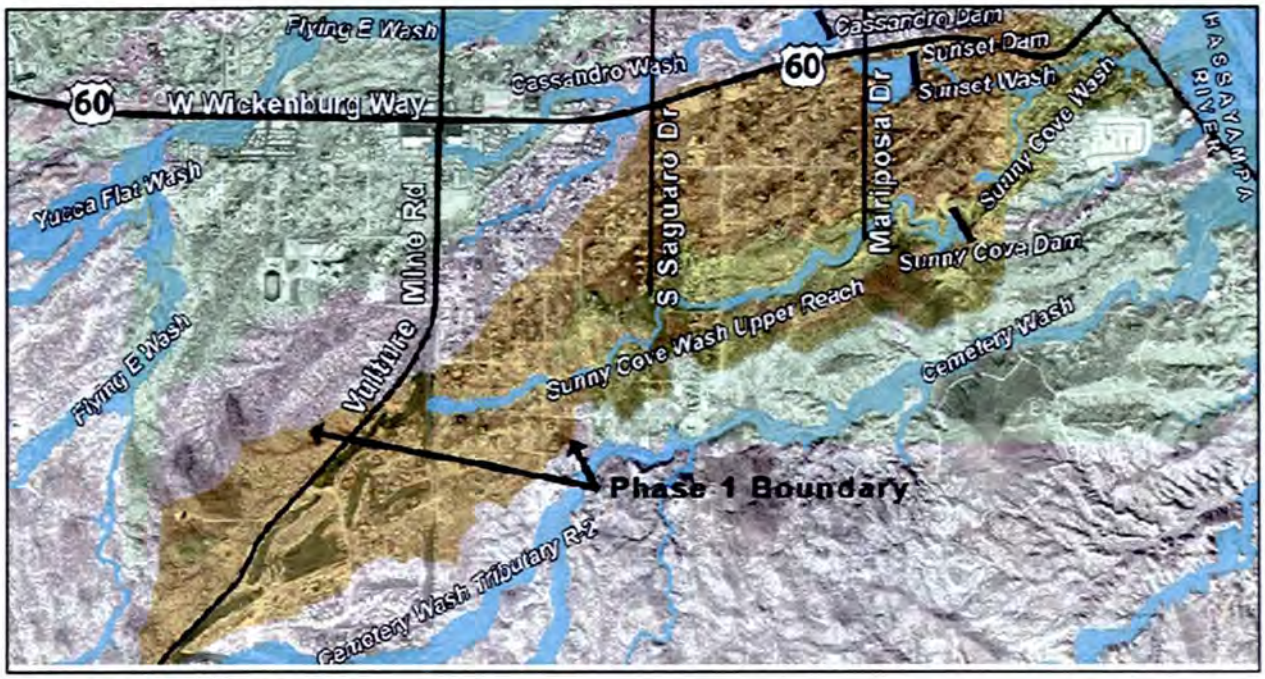


FIGURE 3 – PHASE 1 WATERSHED

Completion of the ADMS will allow the District and the Town to identify flood risk areas, permitting future development to occur in an informed manner. The ADMP (Phase 4) may recommend structural facilities, such as channels and basins, or non-structural methods such as development codes, for selected areas.

1.1 Purpose of Report

The purpose of the Survey Report is to outline the procedures and processes used to collect surveyed data for the Wickenburg ADMS/P. Surveyed data collected for this project includes local ground control, structures (including bridges, culverts, dams and roadways) and finish floor elevations. Finish floor elevation data is provided where structures either are within proposed floodplains or closely abound proposed floodplains

1.2 Surveyors Summary and Certification

I David P. Forney, as a duly appointed Registered Land Surveyor in the State of Arizona, RLS 27238, do hereby attest that the survey control network and data collected within said network has been executed under my direct supervision and that the information contained herein does not represent a Boundary, Property or Right-of-Way survey.

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
27238
DAVID P.
FORNEY
DATE SIGNED: 4-28-11
ARIZONA, U.S.A.
EXPIRES 6-30-14

1.3 Background of Global Positioning System

The Global Positioning System (GPS) is a worldwide radio navigation system consisting of three (3) parts. These three (3) parts are the Space (Satellite Constellation), Ground (Ground Control Stations), and the User (Receivers), produced by the United States Department of Defense and maintained by the United States Air Force. Currently, the GPS constellation consists of 27 (24+3 constellation) satellites. These satellites orbit the earth along their ephemerides at an interval of 12 hours. The satellites transmit a code with the precise position of the satellite and a precise time stamp of the transmission provided by an onboard atomic clock. The precise ephemeris information is uploaded to the satellites by the control segment which monitors the positions of the satellites and makes any adjustments in the signals.

The user segment (receivers) "receive" the signal transmitted from the satellites and using the

onboard software can triangulate a position with the signal from a minimum of 4 satellites. These receivers do not send any signals to the satellites; it is a one-way system. The use of a one-way system ensures an unlimited amount of users. Precise geo-referenced location (5mm+/-) can be obtained through static collection and post-processing.

1.4 General Responsibilities and Procedures

The scope of work includes the collection of survey information required by FEMA, cross sections of waterways and detailed structure surveys. These items are spread across an area of approximately 80 square miles in Phase 1 & 2 and could grow to encompass as much as 155 square miles. This survey encompassed parts of T7N: R6W, R5W, R4W & T8N, R5W.

Such a large area requires the use of GPS Surveying for data collection. The GPS Control Network is based on National Geodetic Survey (NGS) Height Modernization points located throughout the study area. These NGS points are Maricopa County Department of Transportation monuments located by adjusted GPS observation. These monuments consist of sleeved Stainless Steel rods driven to refusal and topped with Aluminum Caps in a well. All the recovered monuments were found in good condition.

2 General Survey Procedures

2.1 Survey Setup and Execution

GPS was used to recover monuments that are part of the National Height Modernization Survey. The positions have been adjusted to the North American Datum 1983 (NAD83) National Spatial Reference System (NSRS) Epoch 2007 (NSRS2007).

According to the NGS website (REF. 1) "NGS has adopted a realization of NAD 83 called NAD 83(NSRS2007) for the distribution of coordinates at ~70,000 passive geodetic control monuments. This realization approximates (but is not, and can never be, equivalent to) the more rigorously defined NAD 83(CORS96) realization in which Continuously Operating Reference Station (CORS) coordinates are distributed. NAD 83(NSRS2007) was created by adjusting GPS data collected during various campaign-style geodetic surveys performed between the mid-1980´s and 2005. For this adjustment NAD 83(CORS96) positional coordinates for ~700 CORS were held fixed (predominantly at the 2002.0 epoch for the stable North American plate, but also at the 2007.0 epoch in Alaska and western CONUS) to obtain consistent positional coordinates for the ~70,000 passive marks. Derived NAD 83(NSRS2007) positional coordinates should be consistent with corresponding NAD 83(CORS96) positional coordinates to within the accuracy of the GPS data used in the adjustment and the accuracy of the corrections applied to these data for systematic errors, such as refraction. In particular, there were no corrections made to the observations for vertical crustal motion when converting from the epoch of the GPS survey into the epoch of the adjustment while the NAD 83(CORS96) coordinates do reflect motion in all three directions at CORS sites. For this reason alone, there can never be total equivalency between NAD 83 (NSRS2007) and NAD 83(CORS96) ".

Per the NGS Datasheets (Ref. 2) "The orthometric height was determined by GPS observations

and a high-resolution GEOID model using precise GPS observation and processing techniques." The monument positions were observed using Trimble 5800 receivers and TSC2 data collectors. A minimum 1800 epoch (~30 minute) static observation was performed at each control point. These observation files were uploaded to the NGS Online User Positioning System (OPUS) for confirmation of the published data, as well as post processed using Trimble Business Center software version 1.2 as a secondary check of the published data for results see Tables 1 & 2.

TABLE 1: NGS COORDINATES COMPARISON GEODETIC COORDINATES

NGS to OPUS and Trimble Business Center Point(TBC) Comparison Geodetic Values NAD83(2007)						
Station	Latitude	diff	Longitude	diff	El Height(M)	diff
4LH2/AJ3888	33°51'56.29378"		112°37'55.13396"		573.401	
OPUS	33°51'56.29364"	-0.00014"	112°37'55.13437"	0.00041"	573.374	-0.027
TBC	33°51'56.29378"	0.00000"	112°37'55.13443"	0.00047"	573.375	-0.026
4MK6/AJ3623	33°53'21.54287"		112°49'13.17594"		780.021	
OPUS	33°53'21.54319"	0.00032"	112°49'13.17692"	0.00098"	780.014	-0.007
TBC	33°53'21.54324"	0.00037"	112°49'13.17630"	0.00036"	779.977	-0.044
4MM1/AJ3624	33°54'18.91030"		112°55'46.97044"		801.330	
OPUS	33°54'18.91054"	0.00024"	112°55'46.97137"	0.00093"	801.366	0.036
TBC	33°54'18.91086"	0.00056"	112°55'46.97144"	.001"	801.344	0.014
4NJ1/AJ3899	33°56'33.35521"		112°46'18.53398"		694.622	
OPUS	33°56'33.35582"	0.00610"	112°46'18.53549"	0.00151"	694.606	-0.016
TBC	33°56'33.35584"	0.00063"	112°46'18.53491"	0.00093"	694.585	-0.037
4NL1/AJ3628	33°56'57.19438"		112°52'15.37075"		786.053	
OPUS	33°56'57.19458"	0.00020"	112°52'15.37168"	0.00093"	786.026	-0.027
TBC	33°56'57.19460"	0.00022"	112°52'15.37173"	0.00098"	786.000	-0.053
4OI2/AJ3900	33°58'47.97679"		112°42'12.33193"		667.126	
OPUS	33°58'47.97717"	0.00038"	112°42'12.33253"	0.00060"	667.066	-0.06
TBC	33°58'47.97708"	0.00029"	112°42'12.33248"	0.00055"	667.093	-0.033
4OK6/AJ3633	33°59'31.89948"		112°49'10.89224"		678.641	
OPUS	33°59'31.89953"	0.00005"	112°49'10.89272"	0.00048"	678.718	0.077
TBC	33°59'31.89971"	0.00023"	112°49'10.89250"	0.00026"	678.642	0.001
4OM2/AJ3634	33°59'10.85953"		112°55'50.40357"		722.801	
OPUS	33°59'10.85978"	0.00025"	112°55'50.40418"	0.00061"	722.835	0.034
TBC	33°59'10.86012"	0.00059"	112°55'50.40436"	0.00079"	722.809	0.008

TABLE 2: NGS COORDINATES COMPARISON STATE PLANE COORDINATES

NGS to OPUS and Trimble Business Center Point(TBC) Comparison AZSPC NAD83(2007) IFEET						
Station Name	Northing	diff to NGS	Easting	diff to NGS	Elevation	diff to NGS
4LH2/AJ3888	1,043,247.63		482,867.04		1978.80	
OPUS	1,043,247.62	-0.01	482,867.01	-0.03	1978.94	0.14
TBC	1,043,247.64	0.01	482,866.99	-0.05	1978.71	-0.09
4MK6/AJ3623	1,052,314.87		425,769.29		2656.90	
OPUS	1,052,314.90	0.03	425,769.21	-0.08	2656.89	-0.01
TBC	1,052,314.90	0.02	425,769.26	-0.03	2656.79	-0.11
4MM1/AJ3624	1,058,423.36		392,629.81		2726.80	
OPUS	1,058,423.38	0.02	392,629.74	-0.08	2726.92	0.12
TBC	1,058,423.43	0.06	392,629.72	-0.09	2726.87	0.07
4NJ1/AJ3899	1,071,577.50		440,652.87		2376.30	
OPUS	1,071,577.56	0.06	440,652.75	-0.12	2376.24	-0.06
TBC	1,071,577.56	0.06	440,652.79	-0.08	2376.18	-0.12
4NL1/AJ3628	1,074,252.30		410,613.03		2676.30	
OPUS	1,074,252.32	0.02	410,612.95	-0.08	2676.14	-0.16
TBC	1,074,252.33	0.03	410,612.96	-0.07	2676.05	-0.25
4OI2/AJ3900	1,085,019.28		461,498.75		2285.60	
OPUS	1,085,019.32	0.04	461,498.70	-0.05	2285.17	-0.43
TBC	1,085,019.29	0.01	461,498.72	-0.03	2285.27	-0.33
4OK6/AJ3633	1,089,749.63		426,291.27		2323.60	
OPUS	1,089,749.63	0.00	426,291.23	-0.04	2323.71	0.11
TBC	1,089,749.65	0.02	426,291.25	-0.02	2323.46	-0.14
4OM2/AJ3634	1,087,937.46		392,632.13		2468.80	
OPUS	1,087,937.49	0.03	392,632.08	-0.05	2468.72	-0.08
TBC	1,087,937.53	0.07	392,632.05	-0.08	2468.67	-0.13

As the scope of this survey is not geodetic in nature, all control point positions were held using the NGS Datasheets coordinates see Table 1. The GPS control network was calibrated using these positions (Figure 5). The data was collected on the Arizona State Plane Coordinate System (AZSPC) Central Zone using the NAD83 (NSRS2007) reference frame the Arizona Revised Statutes (ARS) prescribed unit of measure, International Feet, and realized to the North American Vertical Datum 1988 (NAVD88) using GEOID 2009 with an inclined reference plane. All data was output to files for use on Geographic Information Systems (GIS) platforms, thus the data was output at AZSPC83 (NSRS2007) Grid coordinates elevated to NAVD88 (GEOID09).

TABLE 3: NGS DATASHEET COORDINATES

Station Name/ PID	Stab	Accuracy Estimates (95% confidence in CM)			NAD83(2007) Lat (N)	Lon(W)	Orthometric Height (FT) (NAVD88)	State Plane Coordinates NAD83(2007) IFT Northing	Easting	Combined Factor
4LH2/AJ3888	A	N=0.96	E=0.84	Ellip=1.31	33 51 56.29378	112 37 55.13396	1978.8	1,043,247.63	482,867.04	0.99986398
4MK6/AJ3623	A	N=0.67	E=0.57	Ellip=1.00	33 53 21.54287	112 49 13.17594	2656.9	1,052,314.87	425,769.29	0.99986366
4MM1/AJ3624	A	N=0.59	E=0.53	Ellip=0.94	33 54 18.91030	112 55 46.97044	2726.8	1,058,423.36	392,629.81	0.99988239
4NJ1/AJ3899	A	N=0.73	E=0.63	Ellip=1.04	33 56 33.35521	112 46 18.53398	2376.3	1,071,577.50	440,652.87	0.99986798
4NL1/AJ3628	A	N=0.57	E=0.51	Ellip=0.94	33 56 57.19438	112 52 15.37075	2676.3	1,074,252.30	410,613.03	0.99987250
4OI2/AJ3900	A	N=0.67	E=0.59	Ellip=1.02	33 58 47.97679	112 42 12.33193	2285.6	1,085,019.28	461,498.75	0.99986041
4OK6/AJ3633	A	N=0.59	E=0.55	Ellip=0.96	33 59 31.89948	112 49 10.89224	2323.6	1,089,749.63	426,291.27	0.99987925
4OM2/AJ3634	A	N=0.45	E=0.41	Ellip=0.94	33 59 10.85953	112 55 50.40357	2468.8	1,087,937.46	392,632.13	0.99989470

FIGURE 4: CALIBRATION PARAMETERS

Horizontal Calibration Parameters

Translation north:	0.000 ft
Translation east:	0.000 ft
Rotation:	0°00'00"
Origin northing:	1070076.294 ft
Origin easting:	430148.875 ft
Scale factor:	1.0000000000

Vertical Calibration Parameters

Vertical shift at origin:	0.055 ft
Slope north:	3.024 ppm
Slope east:	1.035 ppm
Origin northing:	1043247.635 ft
Origin easting:	482866.999 ft

Residual Differences Between GPS And Known Coordinates

Summary

	Maximum residual	Root Mean Square residual	Point
Horizontal	0.034 ft	0.019 ft	4NJ1GPS
Vertical	-0.088 ft	0.059 ft	4NL1GPS
Three-dimensional	0.092 ft	0.062 ft	4NL1GPS

After the recovery, confirmation and calibration, numerous Geodetic Densification and Cadastral Survey (GDACS) control points were checked throughout the Phases 1 & 2 areas. This presents some difficulties as the GDACS points were collected before the advent of NSRS2007 or GEOID09 which are the standard Horizontal and Vertical Datums for the NGS control points used. In Figure 4 the height differentials between GEOID03 and GEOID09 are shown throughout Arizona. In the area of the this survey these differences are ~ -(0.05-0.15)m. The Real Time Kinematic (RTK) observations confirm this. Because of the uncertainty of the GEOID differencing, the GDACS control points were also observed statically using 900 epoch observations and OPUS- Rapid Static (OPUS-RS) for post-processing and confirmation as shown in Table 4.

FIGURE 5: GEOID HEIGHT DIFFERENCE ARIZONA

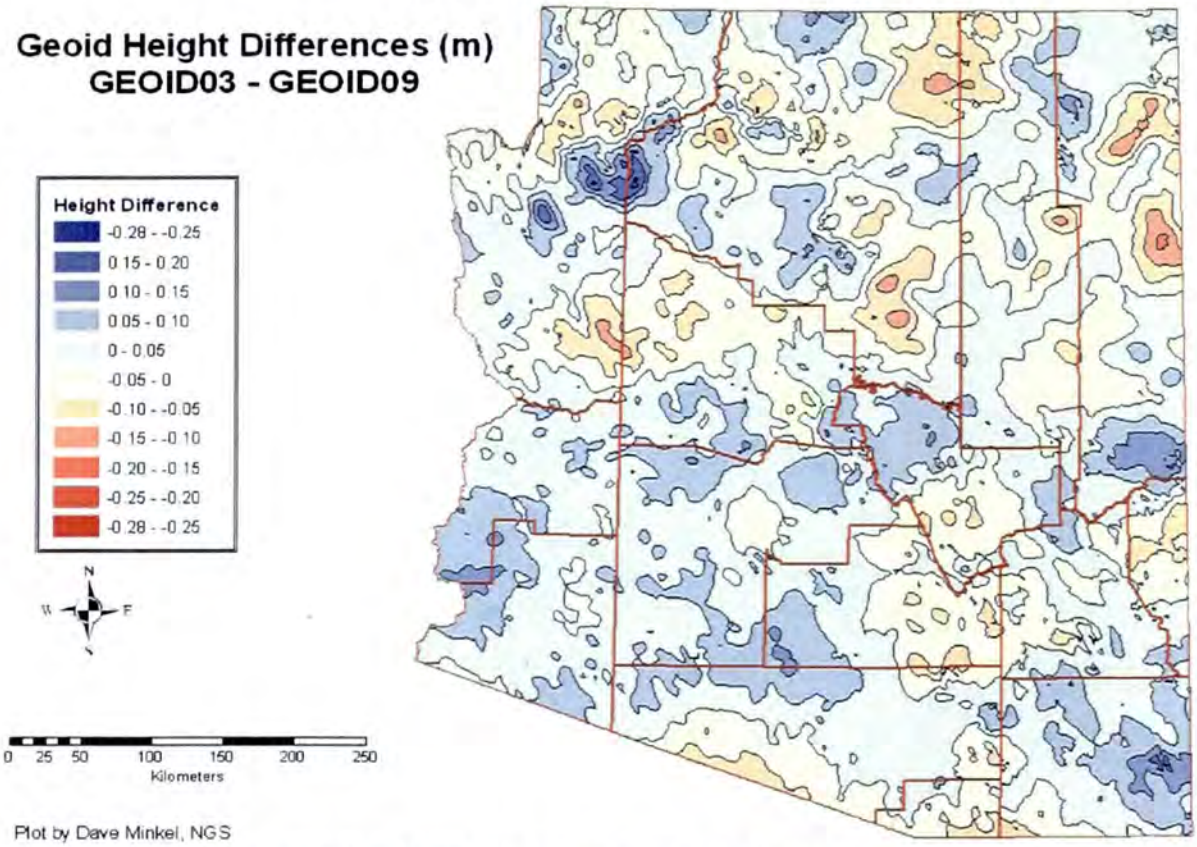


Image taken from: Meyer, Thomas H. and Baron, Robert, "Improving Surveying Accuracy and Efficiency in Connecticut: An Accuracy Assessment of GEOID03 and GEOID09" (2010). Department of Natural Resources and the Environment Articles. Paper 12. http://digitalcommons.uconn.edu/nrme_articles/12

TABLE 4: GDACS COMPARISON

GDACS(NAD83 1992)(GEOID99) to OPUS-RS and RTK Comparison AZSPC NAD83(2007)(GEOID09) IFEET						
Station Name	Northing	diff to GDACS	Easting	diff to NGS	Elevation	diff to GDACS
56005-2M	1,092,382.59		443,432.80		2276.98	
OPUS	1,092,382.74	0.14	443,432.72	-0.09	2276.90	-0.08
RTK	1,092,382.70	0.10	443,432.63	-0.17	2276.86	-0.12
56040-1M	1,084,376.67		451,309.55		2,081.10	
RTK	1,084,376.75	0.08	451,309.50	-0.05	2,080.95	-0.15
56016-1	1,089,758.98		440,769.66		2243.42	
OPUS	1,089,759.11	0.13	440,769.58	-0.08	2243.35	-0.08
RTK	1,089,759.02	0.04	440,769.51	-0.15	2243.31	-0.12
56070-1	1,076,557.69		440,734.40		2,300.72	
RTK	1,076,557.79	0.10	440,734.23	-0.16	2,300.64	-0.08
56092-1	1,071,278.46		440,685.22		2,366.20	
RTK	1,071,278.59	0.13	440,685.07	-0.15	2,366.21	0.00
56059-Z1	1,079,240.32		435,478.84		2,330.97	
OPUS	1,079,240.44	0.11	435,478.73	-0.11	2,330.80	-0.16
RTK	1,079,240.43	0.11	435,478.70	-0.14	2,330.87	-0.10

After mapping checks were performed, field crews surveyed structures and cross sections at street and wash intersections. There were estimated to be 70 structures throughout Phases 1-3. Initially HRC has completed surveys of 17 road structures. These surveys were completed in accordance with FEMA standards as outlined in Guidelines and Specifications for Flood Hazard Mapping Partners Appendix N: Data Capture Guidelines, May 2005 (REF. 3). The process of surveying structures consists of setting or observing at least two (2) baseline local control points for each structure; From which all measurements for the structure are then made by Total Station and coded per the FEMA standards for importation to a GIS file. Along with the electronic data, field sketches were produced showing the size, width, depth & skew from the control line of the structure. Other information included on the field sketches includes Latitude, Longitude and Elevation of the control points, along with crew information and time and date of survey.

2.1.1 Equipment Used

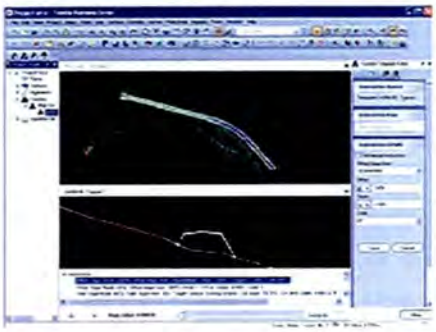
- Trimble R8 Dual Channel GPS Receivers
- Trimble TSC2 Data Collectors v12.42 software
- Topcon GTS8000 Robotic Total Stations
- Fixed Height Tripods

2.2.2 Software Used

- Trimble Business Center v1.2 (TBC V1.2)
- Trimble Convert to Rinex
- AutoCAD Civil 3D 2008 w/ Carlson Survey 2011
- ArcGIS v10
- NGS Online User Positioning Service (OPUS)

TSC2

TBC V1.2



GTS8000

R8

2.2 Static Observation Procedures

The static observations consisted of placing a Trimble R8 rover over the monument using a 2-Meter fixed height tri-pod and collecting data for a minimum of 1,800 epochs (~30 Minutes) or 900 epochs (~15 minutes) for GDACS checks. This data was stored in the rover memory and extracted as a .DAT file. The .DAT file was then converted to a Rinex v1.1 file using Trimble "Convert to Rinex"

software. This Rinex file was then uploaded to the NGS OPUS-RS program, the results of which were compared to the NGS Datasheets for the monuments. As a secondary check, the static observations were post-processed through Trimble Business Center V1.2 and compared to confirm the NGS Datasheet coordinates.

2.3 Data Collection Procedures

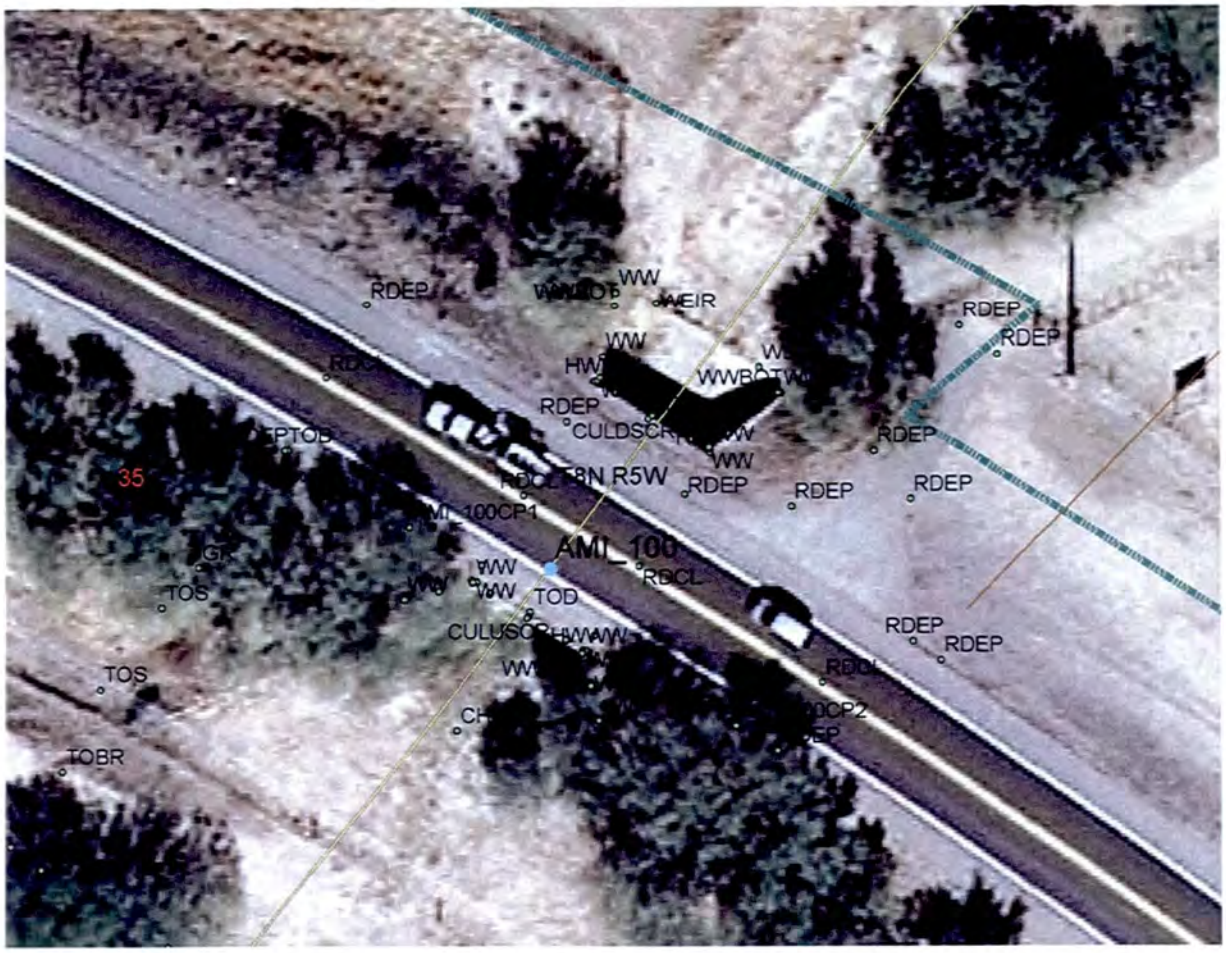
The Data collection was performed using three (3) techniques: GPS, total station (TS), and manual measurement. The GPS portion of the procedure was utilized to establish local control monuments for the individual structure surveys. The GPS base station was setup near NGS station 4NL1. The survey crew then located existing monumentation such as street centerline monuments or property corners, when available, or set temporary local control monumentation (PK nail, 60D nail or Hub and Tack) near the identified structure. Once these monuments were identified or established the survey crew performed a 3 minute RTK observation on a minimum of two (2) monuments to establish a base line for the structure.

After completing the GPS control procedure, the crews setup the total station on one of the collected local control monuments, back sighting the other to orient to the local baseline. Then collected and checked into any other local control monumentation, which may have been set for alternate observation positions. After all the checks were completed, the survey crew collected the cross-sectional information required per the FEMA standards, coding the observations for GIS importation.

The manual measurements were completed for items such as pipe diameters or box culvert barrel dimensions and deck thickness. All measurements were sketched on to the field notes per FEMA guidelines. All of the electronic data was exported to a delimited text file and imported to an Excel

spreadsheet to be formatted to allow seamless importation into ArcGIS. The data was then visually checked against the aerial mapping provided by the District as seen in Figure 6.

FIGURE 6: GIS VISUAL INSPECTION



Finish floor elevation surveys were completed for buildings within or close to floodplain areas. The procedure for FEMA elevation certification, as outlined in FEMA form 81-31 (REF. 4), was implemented for this task. The procedure was performed using a 3 wire level and consisted of observations across the front of the building, at the front (typically street side) building corners and various offsets dictated by conditions, and at a door threshold for the finish floor elevation. The notes provided were inserted into the floodplain map.

TABLE 5: FINISH FLOOR ELEVATION SURVEY RESULTS

Lot ID	Property Information					FFE
	APN	Owner's Name	Address	City	Zip Code	(ft)
1	50527054A	EDGERTON SUSAN	650 S DESERT CANYON RD	WICKENBURG	85390	2096.96
2	50527055	JOHNSON ROBERT H/GAIL RAU	640 S DESERT CANYON DR	WICKENBURG	85390	2097.01
3	50549105A	GOHEEN LINDA J	575 W APACHE ST	WICKENBURG	85390	2082.06
4	50549121A	SWEENEY BRADLEY V/VICKI L	85 GRAND ST	WICKENBURG	85391	2082.02
5	50549112B	KILLORAN PATRICK/SALLY	83 N GRANT ST	WICKENBURG	85392	2081.82
	50549112B	KILLORAN PATRICK/SALLY	83 N GRANT ST	WICKENBURG	85392	2080.44
6	50549109	PARKER THOMAS	59 LINCOLN ST	WICKENBURG	85393	2080.61
7	50549111	BURGESS STEVEN C/DEBORAH A	543 W APACHE ST	WICKENBURG	85390	2078.66
8	50549079	RUSSELL PAULINE	46 N JACKSON ST	WICKENBURG	85394	2073.15
9	50549072B	CAMPBELL SEAN C/GENETA D	138 S JACKSON ST	WICKENBURG	85390	2070.06
	50549072B	CAMPBELL SEAN C/GENETA D	138 S JACKSON ST	WICKENBURG	85390	2068.88
10	50549070	BJERREGAARD RUSSELL L/KATHLEEN M	331 W CENTER ST	WICKENBURG	85397	2066.94
11	50551072A	BYRNE MICHAEL D	36 S MESQUITE DR	WICKENBURG	85398	2063.56
12	50551094E	ROUBAL BART C	166 S MESQUITE ST	WICKENBURG	85390	2062.72
13	50551053	ECHEVERRIA SOPHIE B TR	43 S MESQUITE ST	WICKENBURG	85390	2061.99
14	5055154C	MCMILLIN ERIN M	40-1/2 S MESQUITE ST	WICKENBURG	85390	2059.92
15	50551055	DOUGLASS KAREN	101 S MESQUITE ST	WICKENBURG	85390	2060.1
	50551055	DOUGLASS KAREN	101 S MESQUITE ST	WICKENBURG	85390	2059.86
16	50551037A	ROOT BILLIE M	16 S HENDERSON ST	WICKENBURG	85390	2057.42
17	50551101	CARRASCO JOSE A/VICKIE L	139 N PARK ST	WICKENBURG	85390	2054.38
18	50551102	LUPKE SCOTT T/SORRELLS STACY	159 PARK ST	WICKENBURG	85390	2054.04
19	50551105	KERKES MITCHELL/ ILA TR	209 SYLVAN RD	WICKENBURG	85390	2056.18
20	50551106	ELLIOTT PAULA TR	229 W SYLVAN RD	WICKENBURG	85390	2053.48
21	50551107	ALLEN LOIS R TR	249 W SYLVAN RD	WICKENBURG	85390	2052.52
22	50551108	SMITH MICHAEL	269 W SYLVAN RD	WICKENBURG	85390	2051.45
23	50551122A	DOOM DANIEL L/PATRICIA A ETAL	311 SYLVAN RD	WICKENBURG	85390	2047.37
24	50552029	SIMPSON FAM TRUST/SIMPSON LIV TRUST/SIMPSON	501 S TEGNER ST	WICKENBURG	85391	2040.00
25	50534024	SWHU SHUMWAY CONTRACTING LC	870 AMERICA ST	WICKENBURG	85390	2049.78
26	50534023	WORTH ANNA MARY	860 AMERICA ST	WICKENBURG	85390	2048.26
27	50534022	CRISSMAN SAMUEL E / BRENDA L	850 AMERICA ST	WICKENBURG	85390	2047.31
28	50534037	INTERNATIONAL CH FOURSQUARE GOSPEL	885 W AMERICA ST	WICKENBURG	85390	2152.00
29	50534039	INTERNTL CHURCH OF THE FOUR SQ GOSPEL	885 W AMERICA ST	WICKENBURG	85390	2150.07

2.4 Collected Field Data Examples

2.4.1 Example of Structure Collection File

```
2374,447288.70,1079552.07,2165.83,SST_100EMR
2375,447288.45,1079552.82,2165.85,SST_100HW
2376,447288.14,1079534.84,2165.58,SST_100EUS
2377,447288.11,1079527.05,2165.54,SST_100EUS
2378,447287.93,1079519.09,2165.61,SST_100EUS
2379,447287.94,1079505.61,2165.83,SST_100HW
2380,447287.94,1079519.78,2162.41,SST_100INVUS
2381,447287.88,1079527.45,2162.31,SST_100INVUS
2382,447288.01,1079535.21,2162.40,SST_100INVUS
2383,447250.58,1079517.14,2163.49,SST_100TOS
2384,447256.19,1079507.72,2163.73,SST_100CH
2385,447257.04,1079504.55,2164.08,SST_100CH
2386,447259.06,1079498.33,2164.48,SST_100TOS
2387,447261.22,1079485.81,2168.14,SST_100TOB
2388,447244.77,1079478.60,2168.35,SST_100TOB
2389,447239.69,1079486.96,2164.35,SST_100TOS
2390,447236.79,1079490.37,2164.63,SST_100CH
2391,447235.93,1079491.78,2164.08,SST_100CH
2392,447229.31,1079505.40,2164.52,SST_100TOS
2393,447287.96,1079544.90,2165.68,SST_100TOB
2394,447277.06,1079548.62,2166.89,SST_100TOB
2395,447253.01,1079553.61,2180.41,SST_100TOB
2396,447231.60,1079536.80,2180.32,SST_100TOB
2397,447212.57,1079524.83,2180.71,SST_100TOB
2398,447311.71,1079528.25,2165.33,SST_100TR
2399,447312.35,1079556.43,2165.61,SST_100TR
2400,447311.96,1079582.95,2166.46,SST_100TR
2401,447311.62,1079609.95,2168.32,SST_100TR
2402,447311.08,1079504.13,2165.99,SST_100TR
2403,447310.23,1079477.99,2167.35,SST_100TR
2404,447310.05,1079453.06,2169.15,SST_100TR
2405,447333.42,1079511.53,2165.49,SST_100HW
2406,447333.73,1079560.93,2165.11,SST_100HW
2407,447333.96,1079543.03,2161.94,SST_100INVDS
2408,447334.11,1079534.99,2161.82,SST_100INVDS
2409,447333.93,1079527.03,2161.88,SST_100INVDS
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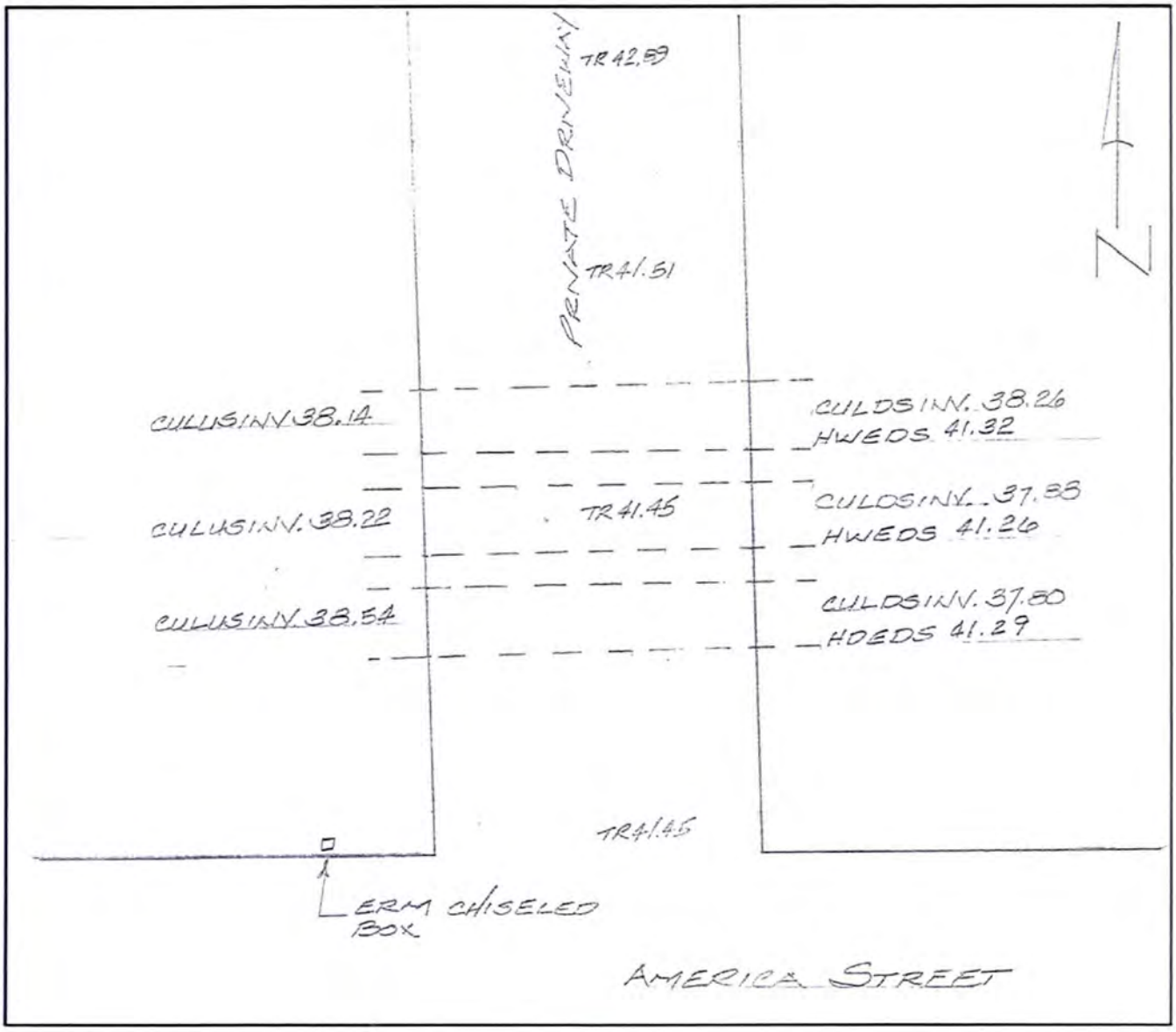
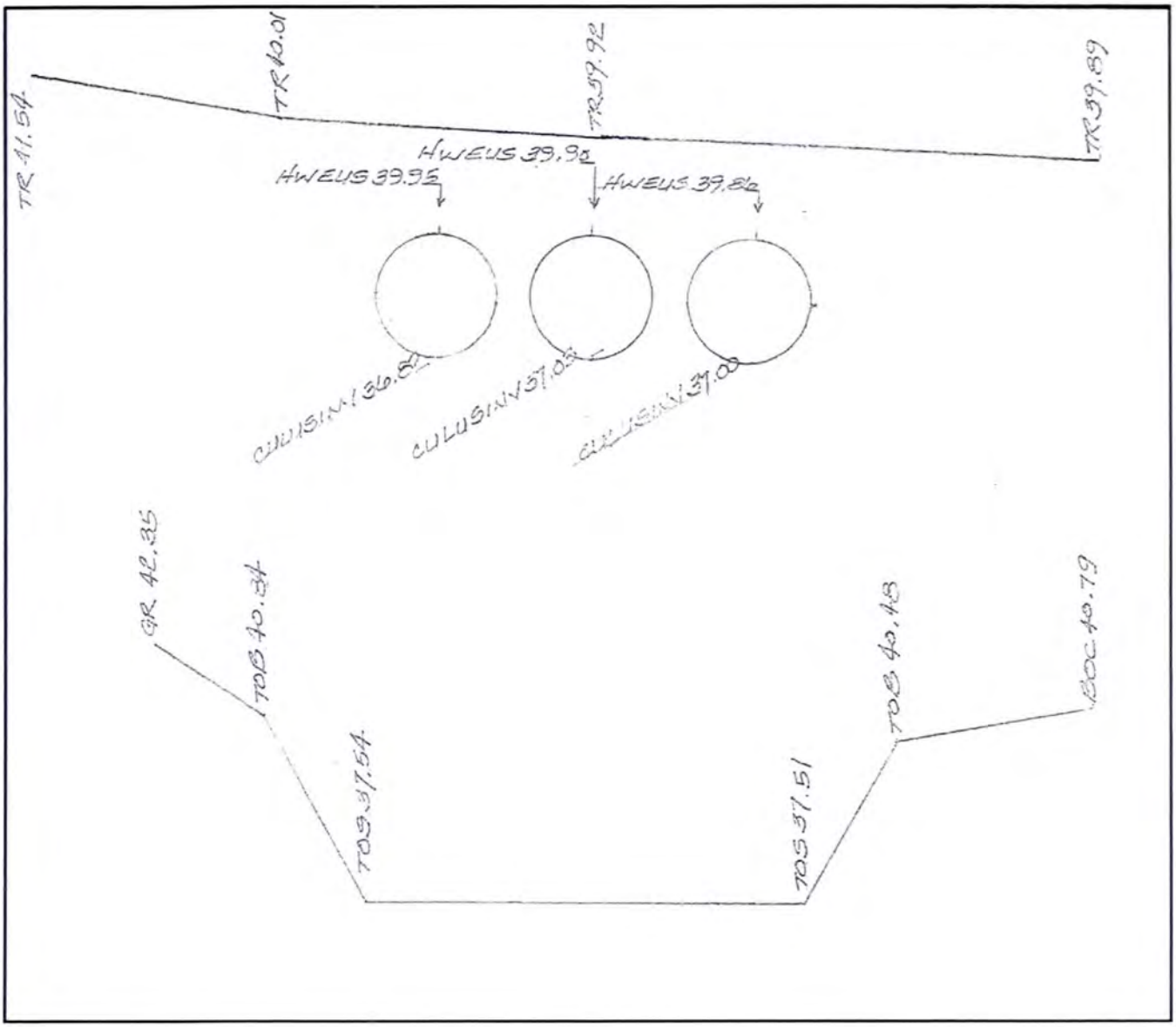
2.4.2 Example Field Sketch

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TR 40.01
TR 39.92
TR 39.89
HWEUS 39.95
HWEUS 39.92
HWEUS 39.86
CULUSINV 36.51
CULUSINV 37.05
CULUSINV 37.00
GR 42.35
TOB 40.34
TOS 37.54
TOS 37.51
TOB 40.48
EOC 40.79

2.4.3 Finish Floor Elevations

1-25-11
PERHAM
ZEPPALA

FLOOD CERT

101 S. MESQUITE #11
TBM GPS PT# 2024
ELEV= 2061.21

ELEV	DESCR.
59.55	L. COR CONC.
59.58	10' L OF L. COR CONC.
59.50	N/G @ R. COR
59.60	N/G 9' R. OF R COR
59.47	WEEP HOLE IN P/W
59.57	T.P.
60.10	F.F.
59.86	F.F. GUEST HOUSE
58.70	WEEP HOLE BK YARD
59.42	KOOL DECK
59.07	WEEP HOLE CTR E. WALL
59.13	" " SE COR

166 MESQUITE #9
TBM 2061.21

62.00	N/G 6' L. OF L. COR
61.96	" @ L. COR.
62.72	F.F.
62.40	N/G @ R. COR
62.40	" 5' R. OF R. COR

40½ S. MESQUITE
TBM 2061.21

61.80	T.P.
59.92	FF
59.65	N/G @ ENT
59.80	N/G 20' R OF R COR
T.P	60.00
60.00	N/G @ L COR
60.20	N/G 10' L OF L COR

2.4.4 GIS Example Results:

3 References

1. National Geodetic Survey, Website FAQ
http://www.ngs.noaa.gov/NationalReadjustment/adjustment_faq.html#5

2. National Geodetic Survey, Benchmark Datasheet
http://www.ngs.noaa.gov/cgi-bin/datasheet.prl?Explain=DATASHEET

3. FEMA Guidelines and Specifications for Flood Hazard Mapping Partners Appendix N: Data Capture Guidelines, May 2005

APPENDIX A: Structure Survey Results

PT_NUMBER	X	Y	Z	STRUCTURE	CODE
2374	447288.7	1079552	2165.83	SST_100	EMR
2375	447288.5	1079553	2165.85	SST_100	HW
2376	447288.1	1079535	2165.58	SST_100	EUS
2377	447288.1	1079527	2165.54	SST_100	EUS
2378	447287.9	1079519	2165.61	SST_100	EUS
2379	447287.9	1079506	2165.83	SST_100	HW
2380	447287.9	1079520	2162.41	SST_100	INVUS
2381	447287.9	1079527	2162.31	SST_100	INVUS
2382	447288	1079535	2162.4	SST_100	INVUS
2383	447250.6	1079517	2163.49	SST_100	TOS
2384	447256.2	1079508	2163.73	SST_100	CH
2385	447257	1079505	2164.08	SST_100	CH
2386	447259.1	1079498	2164.48	SST_100	TOS
2387	447261.2	1079486	2168.14	SST_100	TOB
2388	447244.8	1079479	2168.35	SST_100	TOB
2389	447239.7	1079487	2164.35	SST_100	TOS
2390	447236.8	1079490	2164.63	SST_100	CH
2391	447235.9	1079492	2164.08	SST_100	CH
2392	447229.3	1079505	2164.52	SST_100	TOS
2393	447288	1079545	2165.68	SST_100	TOB
2394	447277.1	1079549	2166.89	SST_100	TOB
2395	447253	1079554	2180.41	SST_100	TOB
2396	447231.6	1079537	2180.32	SST_100	TOB
2397	447212.6	1079525	2180.71	SST_100	TOB
2398	447311.7	1079528	2165.33	SST_100	TR
2399	447312.4	1079556	2165.61	SST_100	TR
2400	447312	1079583	2166.46	SST_100	TR
2401	447311.6	1079610	2168.32	SST_100	TR
2402	447311.1	1079504	2165.99	SST_100	TR
2403	447310.2	1079478	2167.35	SST_100	TR
2404	447310.1	1079453	2169.15	SST_100	TR
2405	447333.4	1079512	2165.49	SST_100	HW
2406	447333.7	1079561	2165.11	SST_100	HW
2407	447334	1079543	2161.94	SST_100	INVDS
2408	447334.1	1079535	2161.82	SST_100	INVDS
2409	447333.9	1079527	2161.88	SST_100	INVDS
2008	447330.5	1079478	2167	SST_100	SST_100CP1
2009	447313.4	1079295	2182.38	SST_100	SST_100CP2
2010	447425.1	1079302	2177.57	SST_100	SST_100CP3
2410	447661.2	1079493	2160.61	SST_110	SST_110 ERM

2411	447653.7	1079496	2158.86	SST_110	WW
2412	447660.6	1079493	2160.57	SST_110	WW
2413	447671.8	1079459	2160.6	SST_110	WW
2414	447659.5	1079484	2154.17	SST_110	CULUS#1INV
2415	447661.4	1079479	2154.09	SST_110	CULUS#2INV
2416	447662.5	1079474	2153.89	SST_110	CULUS#3INV
2417	447664.2	1079469	2153.99	SST_110	CULUS#4INV
2418	447665.8	1079471	2156.8	SST_110	CULUS#5INV
2419	447667.2	1079466	2156.68	SST_110	CULUS#6INV
2420	447670	1079464	2160.59	SST_110	HWEUS
2421	447668.4	1079469	2160.63	SST_110	HWEUS
2422	447666.2	1079476	2160.51	SST_110	HWEUS
2423	447664.2	1079482	2160.5	SST_110	HWEUS
2424	447651.2	1079497	2159.59	SST_110	TOB
2425	447648.4	1079483	2155.65	SST_110	TOS
2426	447648.3	1079482	2155.05	SST_110	CH
2427	447649.1	1079473	2155.63	SST_110	TOS
2428	447645.7	1079445	2166	SST_110	TOB
2429	447670.7	1079461	2158.45	SST_110	TOB
2430	447667	1079476	2159.22	SST_110	TR
2431	447661.9	1079500	2160.52	SST_110	TR
2432	447661.8	1079524	2160.92	SST_110	TR
2433	447661.9	1079547	2161.64	SST_110	TR
2434	447673.8	1079453	2159.46	SST_110	TR
2435	447681.9	1079429	2160.45	SST_110	TR
2436	447688.8	1079411	2162.02	SST_110	TR
2437	447715.9	1079448	2152.76	SST_110	CULDS#1INV
2438	447716.8	1079446	2152.87	SST_110	CULDS#1INV
2439	447718.4	1079441	2152.86	SST_110	CULDS#3INV
2440	447719.7	1079436	2153.22	SST_110	CULDS#4INV
2441	447708.2	1079444	2155.38	SST_110	CULDS#5INV
2442	447710.2	1079440	2155.39	SST_110	CULDS#5INV
2012	447691.2	1079474	2158.24	SST_110	SST_110CP1
2013	447710.9	1079385	2161.38	SST_110	SST_110CP2
2444	448000.6	1079510	2150	SST_120	SST_120ERM
2445	447988.9	1079530	2149.13	SST_120	CULUS#1INV
2446	447989.8	1079527	2148.81	SST_120	CULUS#2INV
2447	447990.9	1079523	2149.09	SST_120	CULUS#3INV
2448	448003.1	1079554	2149.53	SST_120	CULUS#4INV
2449	448004.1	1079553	2152.74	SST_120	HC BEG
2450	448003	1079557	2152.79	SST_120	HC
2451	447999.4	1079556	2152.71	SST_120	HC

2452	448000.5	1079552	2152.71	SST_120	HC CLO
2453	447990.9	1079530	2152.02	SST_120	HWEUS
2454	447991.4	1079527	2151.86	SST_120	HWEUS
2455	447992.7	1079523	2151.9	SST_120	HWEUS
2456	447966.6	1079529	2153.16	SST_120	TOB
2457	447967.1	1079526	2151	SST_120	TOS
2458	447971.7	1079513	2150.6	SST_120	TOS
2459	447973.2	1079508	2152.69	SST_120	TOB
2460	447990.2	1079542	2153.11	SST_120	TR
2461	447994.8	1079528	2152.02	SST_120	TR
2462	447996.5	1079523	2151.66	SST_120	TR
2463	448001	1079511	2149.98	SST_120	TR
2464	448027	1079542	2148.56	SST_120	CULDS#1INV
2465	448027.9	1079539	2148.37	SST_120	CULDS#2INV
2466	448028.9	1079536	2148.78	SST_120	CULDS#3INV
2467	448026.8	1079546	2148.61	SST_120	CULDS#4INV
2468	448018.5	1079551	2153.17	SST_120	REP
2469	448024.7	1079532	2151.71	SST_120	REP
2470	447996.4	1079523	2151.67	SST_120	REP
2471	447990.2	1079542	2153.02	SST_120	REP
2014	448001.2	1079481	2150.2	SST_120	SST_120CP1
2015	448081.3	1079508	2149.04	SST_120	SST_120CP2
2473	448280.4	1079643	2143.78	SST_130	SST_130ERM
2474	448280.3	1079643	2143.81	SST_130	TOB
2475	448266	1079639	2143.94	SST_130	TOB
2476	448261.2	1079644	2140.61	SST_130	TOS
2477	448259	1079649	2140.66	SST_130	TOS
2478	448255.6	1079651	2144.46	SST_130	TOB
2479	448267.8	1079664	2143.98	SST_130	TOB
2480	448272.8	1079660	2140.01	SST_130	CULUS#1INV
2481	448276	1079655	2140.21	SST_130	CULUS#2INV
2482	448279.2	1079649	2140.39	SST_130	CULUS#3INV
2483	448281.3	1079650	2143.29	SST_130	HWEUS
2484	448278.1	1079656	2143.32	SST_130	HWEUS
2485	448274.9	1079661	2143.33	SST_130	HWEUS
2486	448273.5	1079664	2143.32	SST_130	REP
2487	448283.7	1079645	2143.3	SST_130	REP
2488	448297.5	1079653	2143	SST_130	REP
2489	448287.4	1079672	2143.11	SST_130	REP
2490	448291.1	1079671	2139.86	SST_130	CULDS#1INV
2491	448294.3	1079665	2139.75	SST_130	CULDS#2INV
2492	448297.7	1079659	2139.73	SST_130	CULDS#3INV

2016	448366.5	1079636	2142.34	SST_130	SST_130CP1
2017	448662.9	1079657	2136.36	SST_130	SST_130CP2
3222	448377.6	1079664	2142.07	SST_140	SST_140 ERM
3223	448360.8	1079664	2142.3	SST_140	BOC
3224	448360.5	1079668	2142	SST_140	TOB
3225	448360.5	1079673	2138.93	SST_140	TOS
3226	448359.8	1079680	2139.04	SST_140	TOS
3227	448360.3	1079684	2142.63	SST_140	TOB
3228	448359.2	1079687	2144.28	SST_140	GR
3229	448377.3	1079686	2142.37	SST_140	TOB
3230	448376.4	1079685	2138.99	SST_140	TOS
3231	448377	1079667	2138.65	SST_140	TOS
3232	448377	1079664	2142.05	SST_140	BOC
3233	448379.5	1079682	2138.27	SST_140	CULUS1INV
3234	448379.8	1079676	2138.34	SST_140	CULUS2INV
3235	448379.8	1079669	2138.66	SST_140	CULUS3INV
3236	448381.8	1079669	2141.52	SST_140	HWEUS
3237	448381.4	1079676	2141.58	SST_140	HWEUS
3238	448381.5	1079682	2141.64	SST_140	HWEUS
3239	448382.1	1079664	2141.58	SST_140	RD
3240	448381.8	1079676	2141.57	SST_140	RD
3241	448381.5	1079685	2141.67	SST_140	RD
3242	448385.9	1079694	2143.01	SST_140	RD
3243	448399	1079691	2142.76	SST_140	RD1
3244	448397.4	1079685	2141.5	SST_140	RD1
3245	448397.6	1079676	2141.45	SST_140	RD1
3246	448398	1079664	2141.39	SST_140	RD1
3247	448398	1079683	2141.45	SST_140	HWEDS
3248	448398.1	1079676	2141.38	SST_140	HWEDS
3249	448397.9	1079669	2141.41	SST_140	HWEDS
3250	448400.7	1079683	2138.39	SST_140	CULDS1INV
3251	448400.8	1079676	2138.01	SST_140	CULDS2INV
3252	448401.2	1079670	2137.92	SST_140	CULDS3INV
3253	448462.4	1079664	2140.67	SST_150	SST_150 ERM
3254	448445.5	1079664	2140.92	SST_150	BOC
3255	448444.3	1079668	2140.61	SST_150	TOB
3256	448443.4	1079673	2137.64	SST_150	TOS
3257	448443.9	1079678	2137.66	SST_150	TOS
3258	448444.1	1079683	2140.96	SST_150	TOB
3259	448444.5	1079688	2142.47	SST_150	GR
3260	448461.9	1079686	2140.42	SST_150	TOB
3261	448461.3	1079685	2137.54	SST_150	TOS

3262	448461.3	1079667	2137.39	SST_150	TOS
3263	448461.3	1079664	2140.51	SST_150	BOC
3264	448464.1	1079683	2136.94	SST_150	CULUS1INV
3265	448464.1	1079676	2137.16	SST_150	CULUS2INV
3266	448464.1	1079669	2137.13	SST_150	CULUS3INV
3267	448466.8	1079669	2139.99	SST_150	HWEUS
3268	448466.6	1079676	2140.02	SST_150	HWEUS
3269	448466.8	1079683	2140.07	SST_150	HWEUS
3270	448466.8	1079695	2141.66	SST_150	RD
3271	448467.2	1079685	2140.14	SST_150	RD
3272	448467.2	1079676	2140.05	SST_150	RD
3273	448467.2	1079664	2140.02	SST_150	RD
3274	448483.1	1079664	2139.73	SST_150	RD1
3275	448483.1	1079676	2139.72	SST_150	RD1
3276	448483.1	1079685	2139.76	SST_150	RD1
3277	448483.8	1079695	2141.62	SST_150	RD1
3278	448483.5	1079682	2139.76	SST_150	HWEDS
3279	448483.5	1079676	2139.7	SST_150	HWEDS
3280	448483.5	1079669	2139.74	SST_150	HWEDS
3281	448485.3	1079669	2136.84	SST_150	CULDS3INV
3282	448485.1	1079676	2136.68	SST_150	CULDS2INV
3283	448485.1	1079682	2136.71	SST_150	CULDS1INV
3284	448600.8	1079664	2138.22	SST_160	BOC
3285	448598.1	1079669	2137.84	SST_160	TOB
3286	448597.7	1079675	2134.76	SST_160	TOS
3287	448598.2	1079679	2134.86	SST_160	TOS
3288	448598.3	1079684	2137.88	SST_160	TOB
3289	448597.7	1079697	2143.09	SST_160	GR
3290	448636.1	1079689	2137.33	SST_160	HW
3291	448635.8	1079665	2137.33	SST_160	HW
3292	448628.4	1079665	2137.33	SST_160	HW
3293	448629	1079665	2137.32	SST_160	GDR
3294	448636	1079665	2137.34	SST_160	GDR
3295	448636.4	1079689	2137.31	SST_160	GDR
3296	448636	1079683	2137.3	SST_160	HWEUS
3297	448635.8	1079676	2137.29	SST_160	HWEUS
3298	448635.9	1079668	2137.3	SST_160	HWEUS
3299	448635.8	1079684	2133.71	SST_160	CULUS1INV
3300	448635.8	1079675	2133.79	SST_160	CULUS2INV
3301	448635.6	1079668	2133.78	SST_160	CULUS3INV
3302	448670.2	1079708	2136.92	SST_160	TR
3303	448669.6	1079684	2136.16	SST_160	TR

3304	448669.3	1079660	2136.15	SST_160	TR
3305	448668.9	1079636	2136.58	SST_160	TR
3306	448691.5	1079659	2135.73	SST_160	HW
3307	448691.4	1079698	2135.98	SST_160	HW
3308	448696.5	1079701	2135.94	SST_160	HW
3309	448695.9	1079701	2135.95	SST_160	GDR
3310	448691.3	1079698	2136.01	SST_160	GDR
3311	448691.5	1079659	2135.77	SST_160	GDR
3312	448691.4	1079667	2135.68	SST_160	HWEDS
3313	448691.4	1079675	2135.69	SST_160	HWEDS
3314	448691.5	1079683	2135.74	SST_160	HWEDS
3315	448692	1079683	2132.82	SST_160	CULDS1INV
3316	448691.9	1079675	2132.57	SST_160	CULDS2INV
3317	448691.9	1079667	2132.62	SST_160	CULDS3INV
2114	448674	1078889	2152.88	SST_170	SST_170
2115	448659.9	1079131	2153.27	SST_170	SST_170
2116	448641.6	1079095	2150.65	SST_170	SST_170
2117	448680.9	1078989	0	SST_170	SST_170
2118	448659.9	1079131	2153.27	SST_170	SST_170
2119	448632.5	1078989	2148.11	SST_170	ERM SST_170
2120	448632.4	1078990	2148.13	SST_170	HWUS
2121	448632	1078962	2148	SST_170	HWUS
2122	448632	1078983	2142.89	SST_170	CUL1USINV
2123	448632	1078976	2142.95	SST_170	CUL2USINV
2124	448631.8	1078969	2142.94	SST_170	CUL3USINV
2125	448632.1	1078969	2148.05	SST_170	HWE3US
2126	448632.2	1078976	2148.1	SST_170	HWE2US
2127	448632.9	1078990	2146.54	SST_170	SPILLWAY
2128	448637.1	1078991	2148.09	SST_170	SPILLWAY
2129	448641.1	1078990	2148.18	SST_170	SPILLWAY
2130	448641.5	1078996	2148.19	SST_170	SPILLWAY
2131	448634.9	1078996	2147.73	SST_170	SPILLWAY
2132	448626	1078991	2145.93	SST_170	SPILLWAY
2133	448624.5	1078988	2144.83	SST_170	SPILLWAY
2134	448632.1	1078987	2144.01	SST_170	SPILLWAY
2135	448594.7	1078994	2148.2	SST_170	GRD
2136	448603.4	1078984	2147.86	SST_170	TOB
2137	448612	1078975	2145.6	SST_170	GRD
2138	448620	1078965	2144.16	SST_170	TOS
2139	448623.1	1078960	2143.97	SST_170	CLCH
2140	448626.9	1078955	2144.23	SST_170	TOS
2141	448635.7	1078947	2149.9	SST_170	TOB

2142	448639.9	1078940	2150.28	SST_170	GRD
2143	448677.7	1079080	2149.69	SST_170	TOC
2144	448677.6	1079054	2148.98	SST_170	TOC
2145	448677.4	1079028	2148.76	SST_170	TOC
2146	448677.3	1079002	2148.58	SST_170	TOC
2147	448677.2	1078998	2148.52	SST_170	TOC
2148	448677.1	1078994	2148.07	SST_170	TOC
2149	448677.2	1078990	2148.08	SST_170	TOC
2150	448677.2	1078986	2148.6	SST_170	TOC
2151	448677.1	1078976	2148.88	SST_170	TOC
2152	448677	1078950	2150.01	SST_170	TOC
2153	448676.8	1078924	2151.41	SST_170	TOC
2154	448659.3	1078925	2150.9	SST_170	TR
2155	448659.8	1078952	2149.58	SST_170	TR
2156	448660.1	1078978	2148.67	SST_170	TR
2157	448660.8	1079003	2148.3	SST_170	TR
2158	448661.1	1079029	2148.37	SST_170	TR
2159	448661.6	1079055	2148.8	SST_170	TR
2160	448662.1	1079080	2149.6	SST_170	TR
2161	448641.6	1079081	2149.93	SST_170	TOC
2162	448641.5	1079056	2149.14	SST_170	TOC
2163	448641.3	1079031	2147.83	SST_170	TOC
2164	448641.3	1079003	2148.54	SST_170	TOC
2165	448641.4	1078999	2148.52	SST_170	TOC
2166	448641.2	1078995	2148	SST_170	TOC
2167	448641.1	1078991	2148.09	SST_170	TOC
2168	448641.2	1078986	2148.6	SST_170	TOC
2169	448641.4	1078979	2148.82	SST_170	TOC
2170	448641	1078951	2149.64	SST_170	TOC
2171	448640.9	1078926	2151.11	SST_170	TOC
2172	448681.2	1078989	2148.18	SST_170	SPILLWAY
2173	448693.6	1078992	2147	SST_170	SPILLWAY
2174	448691.9	1079001	2146.3	SST_170	SPILLWAY
2175	448684.8	1078996	2147.81	SST_170	SPILLWAY
2176	448681.3	1078996	2148.21	SST_170	SPILLWAY
2177	448688.9	1079020	2147.07	SST_170	HW
2178	448689.3	1079047	2146.85	SST_170	HW
2179	448690	1079041	2145.51	SST_170	CUL1DSINV
2180	448690.1	1079034	2145.73	SST_170	CUL2DSINV
2181	448690.1	1079026	2145.89	SST_170	CUL3DSINV
2019	451845.2	1079311	2073.36	SST_200	SST_200CP1
2020	451893.2	1079267	2074.06	SST_200	SST_200CP2

5000	452086.3	1079553	2069.14	SST_300	ERM SST300
5001	452044	1079546	2069.6	SST_300	RDCL
5002	452056.3	1079535	2069.67	SST_300	BOCEUS
5003	452066.1	1079526	2068.76	SST_300	TOBL
5004	452067.5	1079525	2067.9	SST_300	GR
5005	452067.9	1079525	2066.4	SST_300	TOSL
5006	452070.3	1079522	2066.25	SST_300	CHCL
5007	452071.4	1079520	2066.38	SST_300	TOSR
5008	452072.2	1079519	2068.06	SST_300	GR
5009	452092.6	1079507	2078.57	SST_300	TOBR
5010	452105.5	1079495	2078.8	SST_300	GR
5011	452109.3	1079536	2069.98	SST_300	BOCEUS
5012	452099.7	1079545	2069.23	SST_300	BOCEUS
5013	452096.3	1079548	2068.57	SST_300	BOCEUS
5014	452095	1079549	2068.46	SST_300	BOCEUS PC
5015	452093.7	1079550	2068.52	SST_300	BOCEUS
5016	452090.1	1079552	2069.03	SST_300	BOCEUS
5017	452082.4	1079554	2069.21	SST_300	BOCEUS POC
5018	452067	1079548	2069.39	SST_300	BOCEUS PT
5019	452071.8	1079545	2069.22	SST_300	TOB
5020	452082.4	1079550	2069.03	SST_300	TOB
5021	452087.9	1079550	2068.95	SST_300	TOB
5022	452092.5	1079546	2068.32	SST_300	TOB
5023	452097.7	1079542	2069.14	SST_300	TOB
5024	452097.2	1079536	2069.54	SST_300	TOB
5025	452093	1079534	2069.18	SST_300	TOB
5026	452087.8	1079529	2069.32	SST_300	TOB
5027	452085.4	1079532	2066.13	SST_300	TOS
5028	452094.1	1079538	2065.77	SST_300	TOS
5029	452086.9	1079543	2065.75	SST_300	TOS
5030	452084	1079547	2065.54	SST_300	TOS
5031	452076	1079543	2066.07	SST_300	TOS
5032	452087.1	1079546	2065.33	SST_300	INVUS1
5033	452090.5	1079543	2065.41	SST_300	INVUS2
5034	452093.7	1079540	2065.3	SST_300	INVUS3
5035	452093.9	1079540	2066.72	SST_300	CULUSCR3
5036	452090.7	1079543	2066.77	SST_300	CULUSCR2
5037	452087.1	1079547	2066.71	SST_300	CULUSCR1
5038	452061.5	1079535	2073.23	SST_300	RAIL
5039	452073.2	1079546	2073.38	SST_300	RAIL PC
5040	452079.9	1079549	2073.24	SST_300	RAIL POC
5041	452087.7	1079550	2073.13	SST_300	RAIL PT

5042	452098	1079541	2073.35	SST_300	RAIL
5043	452103.4	1079535	2074.02	SST_300	RAIL
5044	452103.5	1079536	2069.98	SST_300	RAILBOT
5045	452098.1	1079542	2069.22	SST_300	RAILBOT
5046	452087.8	1079550	2069.01	SST_300	RAILBOT
5047	452079.9	1079549	2069.12	SST_300	RAILBOT
5048	452073.1	1079546	2069.24	SST_300	RAILBOT
5049	452061.5	1079535	2069.1	SST_300	RAILBOT
5050	452105.6	1079561	2068.52	SST_300	RDCL
5051	452129.6	1079540	2070.93	SST_300	RDCL
5052	452130.5	1079560	2069.02	SST_300	BOCEDS
5053	452127.2	1079563	2068.84	SST_300	BOCEDS
5054	452124.2	1079566	2069.01	SST_300	BOCEDS
5055	452120.6	1079569	2068.74	SST_300	BOCEDS
5056	452117.4	1079572	2068.02	SST_300	BOCEDS
5057	452116.3	1079573	2067.94	SST_300	BOCEDS PC
5058	452112.5	1079577	2068.45	SST_300	BOCEDS
5059	452109.5	1079585	2068.43	SST_300	BOCEDS POC
5060	452114.8	1079601	2068.49	SST_300	BOCEDS PT
5061	452131.1	1079619	2068.39	SST_300	BOCEDS
5062	452117.8	1079581	2065	SST_300	INVDS1
5063	452120.9	1079578	2064.94	SST_300	INVDS2
5064	452124.3	1079575	2065.14	SST_300	INVDS3
5065	452124.1	1079575	2066.54	SST_300	CULDSCR3
5066	452120.8	1079578	2066.32	SST_300	CULDSCR2
5067	452117.7	1079581	2066.37	SST_300	CULDSCR1
2021	452133.5	1079535	2071.14	SST_300	SST_300CP1
2022	452088.4	1079575	2069.08	SST_300	SST_300CP2
5068	452641.9	1079771	2062.36	SST_400	ERM SST400
5069	452683.6	1079787	2061.57	SST_400	TEMP
5070	452612.1	1079777	2062.06	SST_400	GR
5071	452619	1079770	2062.29	SST_400	TOBL
5072	452623	1079766	2060.4	SST_400	GR
5073	452626.3	1079762	2059.36	SST_400	GR
5074	452627.2	1079761	2058.52	SST_400	TOSL
5075	452628.3	1079759	2058.69	SST_400	GR
5076	452630	1079757	2058.18	SST_400	CHCL
5077	452632.1	1079754	2058.04	SST_400	TOSR
5078	452635	1079753	2059.53	SST_400	GR
5079	452638.2	1079751	2060.06	SST_400	GR
5080	452640.2	1079749	2061.12	SST_400	TOBR
5081	452644.4	1079744	2062.03	SST_400	GR

5082	452636	1079771	2060.11	SST_400	WW
5083	452641.6	1079771	2061.8	SST_400	WW
5084	452641.7	1079771	2062.34	SST_400	WALL
5085	452650.5	1079763	2062.29	SST_400	WALL
5086	452650.6	1079763	2061.81	SST_400	WW
5087	452650.2	1079758	2060.14	SST_400	WW
5088	452641.6	1079771	2058.17	SST_400	WWBOT
5089	452641.6	1079771	2058.17	SST_400	WALLBOT
5090	452650.4	1079763	2058.2	SST_400	WALLBOT
5091	452650.4	1079763	2058.2	SST_400	WWBOT
5092	452651.1	1079764	2061.77	SST_400	CUL
5093	452642.3	1079771	2061.81	SST_400	CUL
5094	452645.9	1079767	2058.07	SST_400	CULUSINV
5095	452646	1079767	2061.07	SST_400	CULUSCR1
5096	452633.7	1079774	2061.52	SST_400	TOB
5097	452639.9	1079767	2058.13	SST_400	TOS
5098	452645.3	1079762	2058.05	SST_400	TOS
5099	452651.7	1079756	2061.49	SST_400	TOB
5100	452648.7	1079780	2058.49	SST_400	CBINV
5101	452667.2	1079802	2057.98	SST_400	CBINV
5102	452679.8	1079800	2061.54	SST_400	CUL
5103	452688.4	1079792	2061.57	SST_400	CUL
5104	452693.8	1079793	2059.54	SST_400	WW
5105	452689	1079792	2061.5	SST_400	WW
5106	452688.9	1079792	2062.04	SST_400	WALL
5107	452680.2	1079800	2062.03	SST_400	WALL
5108	452684.6	1079789	2061.35	SST_400	WALLBOT
5109	452688.2	1079791	2060.19	SST_400	WALLBOT
5110	452693.7	1079793	2059.15	SST_400	WALLBOT
5111	452685.8	1079788	2061.17	SST_400	WALLBOT
5112	452689.3	1079790	2060.14	SST_400	WALLBOT
5113	452695.8	1079792	2059.11	SST_400	WALLBOT
5114	452696.1	1079791	2060.5	SST_400	WALL
5115	452692.7	1079790	2061.04	SST_400	WALL
5116	452690.8	1079790	2061.79	SST_400	WALL
5117	452688.9	1079789	2062	SST_400	WALL
5118	452686.3	1079787	2061.93	SST_400	WALL
5119	452665.8	1079763	2062.09	SST_400	BOCEUS
5120	452660.2	1079768	2062.2	SST_400	BOCEUS
5121	452658.5	1079769	2061.75	SST_400	BOCEUS
5122	452649.6	1079777	2061.76	SST_400	BOCEUS
5123	452648.4	1079778	2062.25	SST_400	BOCEUS

5124	452639.7	1079786	2062.29	SST_400	BOCEUS
5125	452660	1079810	2062.06	SST_400	BOCEDS
5126	452673.6	1079798	2061.98	SST_400	BOCEDS
5127	452675.6	1079797	2061.56	SST_400	BOCEDS
5128	452684.5	1079789	2061.53	SST_400	BOCEDS
5129	452686.8	1079787	2062.01	SST_400	BOCEDS
5130	452697.4	1079777	2061.71	SST_400	BOCEDS
5131	452684.6	1079796	2055.85	SST_400	CHCL
5132	452684.6	1079796	2057.75	SST_400	CULDSINV
5133	452684.6	1079796	2057.75	SST_400	CULDSCR1
5134	452685.5	1079748	2061.32	SST_400	CS101011
5135	452700.6	1079794	2063.07	SST_400	WALL
5136	452717.2	1079812	2063.09	SST_400	WALL
5137	452718.6	1079810	2063.14	SST_400	WALL
5138	452718.7	1079810	2065.08	SST_400	WALL
5139	452734.9	1079828	2065.15	SST_400	WALL
5140	452737.1	1079826	2065.14	SST_400	WALL
5141	452737.1	1079826	2065.15	SST_400	BC
5142	452757	1079848	2064.83	SST_400	BC
5143	452755.5	1079847	2060.02	SST_400	BF
5144	452755.1	1079846	2054.98	SST_400	TOSR
5145	452748.2	1079851	2055.21	SST_400	TOSL
5146	452717.8	1079829	2054.55	SST_400	TOS
5147	452721.2	1079825	2055.47	SST_400	TOS
5148	452693.2	1079794	2055.7	SST_400	WWBOT
5149	452681.3	1079804	2055.73	SST_400	WWBOT
5150	452681.9	1079806	2057.56	SST_400	INV12INCSP
5151	452681.9	1079806	2055.49	SST_400	INV24INCP
5152	452697.3	1079793	2058.82	SST_400	WALLBOT
5153	452696.5	1079792	2058.83	SST_400	WALLBOT
5154	452696.4	1079793	2060.36	SST_400	WALL
5155	452697.5	1079793	2060.56	SST_400	WALL
5156	452711	1079780	2060.97	SST_400	WALL
5157	452713.4	1079778	2060.3	SST_400	WALL
5158	452725.3	1079767	2060.35	SST_400	WALL
5159	452725.1	1079767	2059.63	SST_400	WALLBOT
5160	452726.2	1079768	2059.59	SST_400	WALLBOT
5161	452713.9	1079779	2060.55	SST_400	WALL
5162	452714.4	1079779	2060.59	SST_400	WALL
5163	452714.7	1079779	2060.25	SST_400	WALL
5164	452726.4	1079768	2060.23	SST_400	WALL
5165	452704.5	1079750	2061.11	SST_400	RDCL

5166	452686.8	1079765	2061.46	SST_400	RDCL
5167	452671.4	1079779	2061.7	SST_400	RDCL
5168	452662.5	1079787	2061.71	SST_400	RDCL
5169	452648.4	1079800	2061.89	SST_400	RDCL
5170	452632.2	1079814	2062.13	SST_400	RDCL
2023	452617.8	1079809	2062	SST_400	SST_400CP1
2024	452685.4	1079748	2061.34	SST_400	SST_400CP2
2100	440689	1073486	2329.39	SUN_100	ERM
2101	440679.9	1073494	2327.02	SUN_100	WW
2102	440688.3	1073486	2329.35	SUN_100	WW
2103	440688.2	1073483	2329.38	SUN_100	HWEUS
2104	440688.1	1073476	2329.36	SUN_100	HWEUS
2105	440687.7	1073469	2329.32	SUN_100	HWEUS
2106	440687.7	1073461	2329.32	SUN_100	HWEUS
2107	440687.5	1073453	2329.33	SUN_100	HWEUS
2108	440687.4	1073450	2329.32	SUN_100	HWW
2109	440682.7	1073437	2327.18	SUN_100	HWW
2110	440682.6	1073438	2322.89	SUN_100	TOS
2111	440673.6	1073426	2323.49	SUN_100	TOS
2112	440669.3	1073411	2323.57	SUN_100	TOS
2113	440670.7	1073390	2324.5	SUN_100	TOS
2114	440669.8	1073365	2324.3	SUN_100	TOS
2115	440671.1	1073341	2324.6	SUN_100	TOS
2116	440664.6	1073341	2324.65	SUN_100	TOS
2117	440662.7	1073363	2324.52	SUN_100	TOS
2118	440661.3	1073389	2324.43	SUN_100	TOS
2119	440656.8	1073411	2324.36	SUN_100	TOS
2120	440658.8	1073466	2324.05	SUN_100	TOS
2121	440670.8	1073483	2323.4	SUN_100	TOS
2122	440683.4	1073490	2322.91	SUN_100	TOS
2123	440691.5	1073479	2323.53	SUN_100	INVUS
2124	440691.3	1073471	2323.56	SUN_100	INVUS
2125	440691.1	1073464	2323.56	SUN_100	INVUS
2126	440691	1073457	2323.51	SUN_100	INVUS
2127	440690.8	1073449	2323.53	SUN_100	INVUS
2128	440692.7	1073482	2329.39	SUN_100	TOB
2129	440692.3	1073499	2329.73	SUN_100	TOB
2130	440691.8	1073514	2329.88	SUN_100	TOB
2131	440668.7	1073516	2328.12	SUN_100	TOB
2132	440653.6	1073517	2328.61	SUN_100	TOB
2133	440646.4	1073513	2328.83	SUN_100	TOB
2134	440639.1	1073507	2329.75	SUN_100	TOB

2135	440637.1	1073494	2329.59	SUN_100	TOB
2136	440635.3	1073461	2328.91	SUN_100	TOB
2137	440639.5	1073416	2329.27	SUN_100	TOB
2138	440643.9	1073403	2329.26	SUN_100	TOB
2139	440644.1	1073380	2329.45	SUN_100	TOB
2140	440645.7	1073355	2329.67	SUN_100	TOB
2141	440645.7	1073326	2331.7	SUN_100	TOB
2142	440690.1	1073323	2329.77	SUN_100	TOB
2143	440689.8	1073349	2329.56	SUN_100	TOB
2144	440690.6	1073372	2329.36	SUN_100	TOB
2145	440692.4	1073402	2329.51	SUN_100	TOB
2146	440691.9	1073445	2329.12	SUN_100	TOB
2147	440714.5	1073464	2329.43	SUN_100	TR
2148	440714.2	1073439	2329.25	SUN_100	TR
2149	440713.8	1073413	2329.28	SUN_100	TR
2150	440713.5	1073387	2329.47	SUN_100	TR
2151	440714.9	1073490	2329.71	SUN_100	TR
2152	440715.3	1073516	2330.14	SUN_100	TR
2153	440715.5	1073542	2330.71	SUN_100	TR
2154	440755.4	1073487	2325.48	SUN_100	WW
2155	440741.4	1073482	2329.32	SUN_100	WW
2156	440740.5	1073445	2329.32	SUN_100	WW
2157	440755.1	1073439	2325.4	SUN_100	WW
2158	440755.2	1073440	2322.64	SUN_100	CONC
2159	440740.9	1073445	2322.66	SUN_100	CONC
2160	440741.8	1073482	2322.64	SUN_100	CONC
2161	440755.6	1073487	2322.71	SUN_100	CONC
2162	440741.5	1073479	2323.28	SUN_100	INVDS
2163	440741.5	1073471	2323.38	SUN_100	INVDS
2164	440741.2	1073464	2323.24	SUN_100	INVDS
2165	440741	1073456	2323.28	SUN_100	INVDS
2166	440740.8	1073449	2323.3	SUN_100	INVDS
2000	440727.4	1073386	2329.02	SUN_100	SUN_100CP1
2001	440727.5	1073501	2329.44	SUN_100	SUN_100CP2
2167	448616.4	1076652	2186.91	SUN_200	ERM
2168	448616.1	1076652	2186.9	SUN_200	HWUS
2169	448616	1076644	2186.88	SUN_200	EUS
2170	448615.9	1076634	2186.88	SUN_200	EUS
2171	448615.8	1076624	2186.91	SUN_200	EUS
2172	448615.6	1076616	2186.86	SUN_200	HWUS
2173	448615.9	1076625	2181.21	SUN_200	INVUS
2174	448615.7	1076635	2181.29	SUN_200	INVUS

2175	448615.8	1076645	2181.22	SUN_200	INVUS
2176	448625.6	1076597	2188.95	SUN_200	TOB
2177	448615.4	1076605	2183.99	SUN_200	TOS
2178	448610.3	1076611	2183.4	SUN_200	CH
2179	448608.6	1076612	2182.59	SUN_200	CH
2180	448602.2	1076623	2182.55	SUN_200	CH
2181	448628.1	1076653	2187.38	SUN_200	TCS
2182	448625.7	1076653	2187.14	SUN_200	TCS
2183	448616.8	1076651	2185.59	SUN_200	TCS
2184	448610	1076651	2182.8	SUN_200	TCS
2185	448613.1	1076654	2184.33	SUN_200	TCS
2186	448615.9	1076656	2185.28	SUN_200	TCS
2187	448618.9	1076657	2185.96	SUN_200	TCS
2188	448625.6	1076659	2187.12	SUN_200	TCS
2189	448628.1	1076660	2187.28	SUN_200	TCS
2190	448628.4	1076659	2186.97	SUN_200	FCS
2191	448625.6	1076658	2186.67	SUN_200	FCS
2192	448618.7	1076657	2185.66	SUN_200	FCS
2193	448615.8	1076656	2184.93	SUN_200	FCS
2194	448613.4	1076654	2184.07	SUN_200	FCS
2195	448610.3	1076650	2182.73	SUN_200	FCS
2196	448615.6	1076648	2182.82	SUN_200	FCS
2197	448616	1076652	2183.96	SUN_200	FCS
2198	448616.9	1076653	2185.1	SUN_200	FCS
2199	448628.3	1076655	2186.97	SUN_200	FCS
2200	448668.9	1076697	2187.28	SUN_200	TCS
2201	448669.1	1076691	2187.1	SUN_200	TCS
2202	448668.9	1076692	2186.87	SUN_200	FCS
2203	448668.9	1076694	2186.85	SUN_200	FCS
2204	448647.3	1076676	2187.1	SUN_200	TR
2205	448647.7	1076700	2187.65	SUN_200	TR
2206	448647.4	1076725	2189.03	SUN_200	TR
2207	448647.4	1076750	2190.97	SUN_200	TR
2208	448645.9	1076650	2187.29	SUN_200	TR
2209	448645.3	1076625	2187.87	SUN_200	TR
2210	448644.9	1076600	2188.74	SUN_200	TR
2211	448628.1	1076600	2189	SUN_200	BC
2212	448628.3	1076624	2188.06	SUN_200	BC
2213	448628.4	1076651	2187.45	SUN_200	BC
2214	448628.5	1076655	2186.98	SUN_200	BC
2215	448628.4	1076659	2186.95	SUN_200	BC
2216	448628.5	1076663	2187.38	SUN_200	BC

2217	448628.5	1076682	2187.62	SUN_200	BC
2218	448628.8	1076709	2188.44	SUN_200	BC
2219	448628.9	1076750	2191.33	SUN_200	BC
2220	448613.3	1076676	2183.24	SUN_200	TOS
2221	448614	1076713	2183.87	SUN_200	TOS
2222	448723.8	1076794	2189	SUN_200	SET NAIL
2223	448600	1076624	2183.43	SUN_200	CH
2224	448570.8	1076647	2184.39	SUN_200	CH
2225	448544.7	1076666	2184.42	SUN_200	TOS
2226	448521.2	1076679	2193.92	SUN_200	TOB
2227	448492.8	1076655	2191.88	SUN_200	TOB
2228	448516.7	1076631	2184.66	SUN_200	TOS
2229	448542.7	1076594	2185.07	SUN_200	CH
2230	448563.9	1076566	2185.12	SUN_200	CH
2231	448566.3	1076565	2183.57	SUN_200	CH
2232	448580.6	1076558	2183.58	SUN_200	CH
2233	448583.6	1076556	2184.92	SUN_200	CH
2234	448606.4	1076540	2185.14	SUN_200	TOS
2235	448622.3	1076534	2192.32	SUN_200	TOB
2236	448676.3	1076699	2186	SUN_200	TCS
2237	448677	1076693	2185.05	SUN_200	TCS
2238	448680.7	1076695	2183.59	SUN_200	TCS
2239	448683.6	1076697	2182.54	SUN_200	TCS
2240	448683.1	1076698	2182	SUN_200	FCS
2241	448680.6	1076696	2183.06	SUN_200	FCS
2242	448677.2	1076694	2184.39	SUN_200	FCS
2243	448676.3	1076696	2184.24	SUN_200	FCS
2244	448677.1	1076697	2183.36	SUN_200	FCS
2245	448677	1076699	2182.27	SUN_200	FCS
2246	448676.9	1076698	2186.52	SUN_200	HWDS
2247	448677	1076733	2186.41	SUN_200	HWDS
2248	448676.7	1076724	2179.67	SUN_200	INVDS
2249	448676.8	1076715	2180.03	SUN_200	INVDS
2250	448676.8	1076705	2180.31	SUN_200	INVDS
2002	448630.8	1076605	2188.54	SUN_200	sun_200cp1
2003	448665.1	1076751	2191.33	SUN_200	sun_200cp2
2251	448619	1077072	2191.44	SUN_300	ERM
2252	448618.8	1077072	2191.44	SUN_300	HW
2253	448618.2	1077065	2191.41	SUN_300	HW
2254	448618.1	1077068	2187.58	SUN_300	INVUS
2255	448613.1	1077075	2190.89	SUN_300	TCS
2256	448618.4	1077077	2192.43	SUN_300	TCS

2257	448630.1	1077085	2196.07	SUN_300	TCS
2258	448630.1	1077078	2195.87	SUN_300	TCS
2259	448623.2	1077075	2193.91	SUN_300	TCS
2260	448619	1077072	2191.67	SUN_300	TCS
2261	448618.3	1077071	2189.56	SUN_300	FCS
2262	448618.5	1077073	2191.11	SUN_300	FCS
2263	448630.3	1077080	2195.6	SUN_300	FCS
2264	448630.5	1077083	2195.59	SUN_300	FCS
2265	448621.4	1077078	2192.94	SUN_300	FCS
2266	448613.9	1077073	2190.35	SUN_300	FCS
2267	448569.1	1077058	2195.2	SUN_300	TOB
2268	448574.1	1077048	2190.43	SUN_300	TOS
2269	448576.9	1077042	2190.28	SUN_300	CH
2270	448577.4	1077041	2190	SUN_300	CH
2271	448578	1077040	2189.99	SUN_300	CH
2272	448578.9	1077039	2190.35	SUN_300	CH
2273	448579.7	1077037	2190.57	SUN_300	TOS
2274	448584.9	1077022	2199.41	SUN_300	TOB
2275	448608.2	1077035	2198.62	SUN_300	TOB
2276	448603.5	1077050	2189.84	SUN_300	TOS
2277	448603.3	1077051	2189.68	SUN_300	CH
2278	448602.9	1077052	2189.28	SUN_300	CH
2279	448602.5	1077052	2189.2	SUN_300	CH
2280	448602.1	1077053	2189.62	SUN_300	CH
2281	448598.5	1077063	2189.93	SUN_300	TOS
2282	448593.5	1077076	2195.29	SUN_300	TOB
2283	448611.9	1077073	2189.77	SUN_300	TOS
2284	448617.7	1077065	2188.49	SUN_300	TOS
2285	448625.2	1077091	2196.12	SUN_300	TOB
2286	448626.4	1077066	2196.43	SUN_300	TOB
2287	448623.5	1077042	2197.6	SUN_300	TOB
2288	448618.4	1077069	2191.44	SUN_300	EUS
2289	448630.6	1077068	2196.35	SUN_300	BC
2290	448630.6	1077090	2196.23	SUN_300	BC
2291	448630.8	1077118	2197.66	SUN_300	BC
2292	448631.1	1077145	2200	SUN_300	BC
2293	448630.7	1077088	2196.18	SUN_300	BC
2294	448630.6	1077083	2195.59	SUN_300	BC
2295	448630.6	1077080	2195.6	SUN_300	BC
2296	448630.6	1077075	2196.11	SUN_300	BC
2297	448630.3	1077043	2197.41	SUN_300	BC
2298	448630.3	1077017	2199.53	SUN_300	BC

2299	448630.2	1076993	2201.28	SUN_300	BC
2300	448647.1	1076993	2201.05	SUN_300	TR
2301	448647.6	1077016	2199.32	SUN_300	TR
2302	448647.1	1077043	2197.41	SUN_300	TR
2303	448647.7	1077068	2196.21	SUN_300	TR
2304	448649.3	1077093	2196.27	SUN_300	TR
2305	448649.1	1077120	2197.59	SUN_300	TR
2306	448649	1077143	2199.65	SUN_300	TR
2307	448671.3	1077077	2195.94	SUN_300	TCS
2308	448673.9	1077079	2195.24	SUN_300	TCS
2309	448681.1	1077077	2191.51	SUN_300	TCS
2310	448682.2	1077083	2191.5	SUN_300	TCS
2311	448671.1	1077084	2196.01	SUN_300	TCS
2312	448671.2	1077083	2195.87	SUN_300	FCS
2313	448682.4	1077082	2191.25	SUN_300	FCS
2314	448681.2	1077077	2191.21	SUN_300	FCS
2315	448674.1	1077079	2194.7	SUN_300	FCS
2316	448670.9	1077078	2195.71	SUN_300	FCS
2317	448685.1	1077059	2183.83	SUN_300	INVDS
2318	448685.5	1077064	2187.6	SUN_300	HW
2319	448684.4	1077056	2187.47	SUN_300	HW
2004	448666.6	1077036	2198.22	SUN_300	SUN_300CP1
2005	448649.2	1077136	2198.99	SUN_300	SUN_300CP2
2320	448630.2	1078425	2161.48	SUN_400	ERM
2321	448630.1	1078425	2161.46	SUN_400	HW
2322	448629.9	1078421	2161.47	SUN_400	EUS
2323	448629.8	1078421	2153.97	SUN_400	INVUS
2324	448629.6	1078417	2161.44	SUN_400	HW
2325	448634.2	1078399	2165.08	SUN_400	TOB
2326	448623.3	1078417	2155.57	SUN_400	TOS
2327	448622.2	1078421	2155.39	SUN_400	TOS
2328	448634.3	1078369	2163.8	SUN_400	TOB
2329	448621	1078385	2157.18	SUN_400	TOS
2330	448612.8	1078393	2156.3	SUN_400	CH
2331	448611.6	1078394	2155.84	SUN_400	CH
2332	448610.5	1078394	2155.87	SUN_400	CH
2333	448609.3	1078395	2156.56	SUN_400	CH
2334	448600.4	1078401	2156.63	SUN_400	CH
2335	448595.1	1078408	2156.25	SUN_400	TOS
2336	448636.7	1078424	2166.06	SUN_400	TOB
2337	448633.7	1078438	2166.95	SUN_400	TOB
2338	448608.6	1078459	2179.68	SUN_400	TOB

2339	448558.2	1078445	2185.65	SUN_400	TOB
2340	448638.2	1078421	2166.1	SUN_400	BC
2341	448637.9	1078397	2165.05	SUN_400	BC
2342	448637.8	1078373	2164.09	SUN_400	BC
2343	448637.8	1078348	2163.16	SUN_400	BC
2344	448637.7	1078333	2162.91	SUN_400	BC
2345	448637.5	1078328	2162.43	SUN_400	BC
2346	448637.4	1078325	2162.51	SUN_400	BC
2347	448637.5	1078320	2163	SUN_400	BC
2348	448636.9	1078323	2162.85	SUN_400	TCS
2349	448629.6	1078326	2161.91	SUN_400	TCS
2350	448624.3	1078327	2160.94	SUN_400	TCS
2351	448620.3	1078330	2159.91	SUN_400	TCS
2352	448621.4	1078331	2159.49	SUN_400	FCS
2353	448625.5	1078328	2160.6	SUN_400	FCS
2354	448637.3	1078325	2162.5	SUN_400	FCS
2355	448637.2	1078328	2162.47	SUN_400	FCS
2356	448631.2	1078330	2161.62	SUN_400	FCS
2357	448625.3	1078333	2159.62	SUN_400	FCS
2358	448626.2	1078334	2159.99	SUN_400	TCS
2359	448630.6	1078331	2161.71	SUN_400	TCS
2360	448636.9	1078331	2162.84	SUN_400	TCS
2361	448655.9	1078347	2162.93	SUN_400	TR
2362	448656.2	1078372	2163.69	SUN_400	TR
2363	448656.1	1078397	2164.84	SUN_400	TR
2364	448655.8	1078421	2165.99	SUN_400	TR
2365	448656.5	1078448	2167.2	SUN_400	TR
2366	448656.5	1078473	2168.35	SUN_400	TR
2367	448657.2	1078499	2169.27	SUN_400	TR
2368	448638.7	1078489	2169.28	SUN_400	BC
2369	448638.5	1078468	2168.43	SUN_400	BC
2370	448638.5	1078445	2167.29	SUN_400	BC
2371	448686	1078405	2161.39	SUN_400	HW
2372	448685.9	1078401	2153.41	SUN_400	INVDS
2373	448686	1078397	2161.4	SUN_400	HW
2006	448725.6	1078360	2158.83	SUN_400	SUN_400CP1
2007	448635.3	1078364	2163.81	SUN_400	SUN_400CP2
6182	451376	1077917	2102.48	SUN_500	SUN_500ERM
6183	451357.7	1077907	2101.9	SUN_500	GR
6184	451364.6	1077904	2101.94	SUN_500	TOBL
6185	451371.5	1077899	2099.79	SUN_500	TOSL
6186	451375	1077898	2099.94	SUN_500	GR

6187	451378.3	1077897	2099.68	SUN_500	CHCL
6188	451382.4	1077895	2100.03	SUN_500	TOSR
6189	451397.4	1077894	2109.07	SUN_500	TOBR
6190	451376.5	1077907	2099.08	SUN_500	CSPUSINV1 20IN
6191	451382.4	1077907	2099.17	SUN_500	CSPUSINV2 20IN
6192	451382.7	1077967	2098.4	SUN_500	CSPDSINV2
6193	451377	1077968	2098.39	SUN_500	CSPDSINV1
6194	451404.8	1077957	2103.07	SUN_500	BOCEDS
6195	451380.9	1077957	2102.45	SUN_500	BOCEDS
6196	451349.5	1077957	2101.89	SUN_500	BOCEDS
6197	451349.7	1077940	2101.87	SUN_500	RDCL
6198	451379	1077938	2102.39	SUN_500	RDCL
6199	451404.8	1077938	2103.04	SUN_500	RDCL
6200	451405.7	1077917	2103.14	SUN_500	BOCEUS
6201	451378.6	1077917	2102.53	SUN_500	BOCEUS
6202	451349.5	1077917	2101.96	SUN_500	BOCEUS
6203	451289	1077763	2108.57	SUN_500	ERM SUN_500
6204	451241.5	1077779	2109.41	SUN_500	GR
6205	451243.3	1077771	2108.99	SUN_500	TOBL
6206	451250.4	1077751	2103.23	SUN_500	TOSL
6207	451252	1077747	2102.65	SUN_500	GR
6208	451252.5	1077746	2102.47	SUN_500	CHCL
6209	451253.3	1077743	2102.85	SUN_500	GR
6210	451258	1077730	2103.5	SUN_500	GR
6211	451261.3	1077720	2105.39	SUN_500	TOSR
6212	451266.5	1077706	2114	SUN_500	TOBR
6213	451266.2	1077691	2114.8	SUN_500	GR
6214	451287.3	1077724	2112.28	SUN_500	BOCEUS
6215	451288.8	1077763	2108.61	SUN_500	BOCEUS
6216	451290	1077804	2105.4	SUN_500	BOCEUS
6217	451308.8	1077806	2104.72	SUN_500	RDCL
6218	451307.1	1077768	2107.51	SUN_500	RDCL
6219	451305.4	1077722	2111.73	SUN_500	RDCL
6220	451323.4	1077721	2111.96	SUN_500	BOCEDS
6221	451325.1	1077762	2108.09	SUN_500	BOCEDS
6222	451326.3	1077797	2105.34	SUN_500	BOCEDS
6223	451269.7	1077750	2101.58	SUN_500	CSPUSINV 24IN
6224	451334.4	1077795	2100.37	SUN_500	CSPDSINV
2055	451308.2	1077792	2105.61	SUN_500	SUN_500CP1
2056	451294.6	1077958	2102.68	SUN_500	SUN_500CP2
6182	451376	1077917	4214.32	SUN_510	ERM SUN_510
6183	451357.7	1077907	4213.74	SUN_510	GR

6184	451364.6	1077904	4213.78	SUN_510	TOBL
6185	451371.5	1077899	4211.62	SUN_510	TOSL
6186	451375	1077898	4211.78	SUN_510	GR
6187	451378.3	1077897	4211.52	SUN_510	CHCL
6188	451382.4	1077895	4211.87	SUN_510	TOSR
6189	451397.4	1077894	4220.91	SUN_510	TOBR
6190	451376.4	1077907	4210.92	SUN_510	CSPUSINV1 20IN
6191	451382.3	1077907	4211.01	SUN_510	CSPUSINV2 20IN
6192	451382.7	1077967	4210.23	SUN_510	CSPDSINV2
6193	451376.9	1077968	4210.22	SUN_510	CSPDSINV1
6194	451404.7	1077957	4214.91	SUN_510	BOCEDS
6195	451380.9	1077957	4214.29	SUN_510	BOCEDS
6196	451349.5	1077957	4213.73	SUN_510	BOCEDS
6197	451349.7	1077940	4213.71	SUN_510	RDCL
6198	451379	1077938	4214.22	SUN_510	RDCL
6199	451404.8	1077938	4214.87	SUN_510	RDCL
6200	451405.7	1077917	4214.97	SUN_510	BOCEUS
6201	451378.6	1077917	4214.37	SUN_510	BOCEUS
6202	451349.5	1077917	4213.79	SUN_510	BOCEUS
415	454013.53	1079601.49	2040.11	SST_500	SST_400 CP1
416	454118.44	1079674.71	2038.80	SST_500	SST_400 CP2
417	454018.34	1079660.15	2050.22	SST_500	SST_400 ERM
418	453992.80	1079704.21	2052.44	SST_500	TOB
419	453994.63	1079705.53	2053.37	SST_500	RAIL
420	453998.78	1079708.25	2053.36	SST_500	RAIL
421	454000.62	1079709.69	2052.51	SST_500	TOB
422	454029.67	1079671.05	2050.82	SST_500	TOB
423	454016.28	1079666.36	2050.86	SST_500	TOB
424	454038.45	1079632.80	2051.36	SST_500	GR
425	454041.82	1079635.59	2052.49	SST_500	RAIL
426	454045.92	1079638.36	2052.49	SST_500	RAIL
427	454049.41	1079640.95	2051.39	SST_500	GR
428	454070.56	1079609.66	2050.10	SST_500	TOB
429	454059.32	1079601.91	2050.33	SST_500	TOB
430	454094.19	1079553.15	2050.68	SST_500	TOB
431	454096.69	1079554.38	2051.39	SST_500	RAIL
432	454100.68	1079557.33	2051.35	SST_500	RAIL
433	454103.19	1079558.59	2050.20	SST_500	TOB
434	454059.05	1079601.73	2050.94	SST_500	TWHDWL
435	454057.45	1079603.08	2049.51	SST_500	BWHDWL
436	454057.03	1079601.30	2049.26	SST_500	BOTGDR
437	454056.65	1079600.90	2052.51	SST_500	GDR

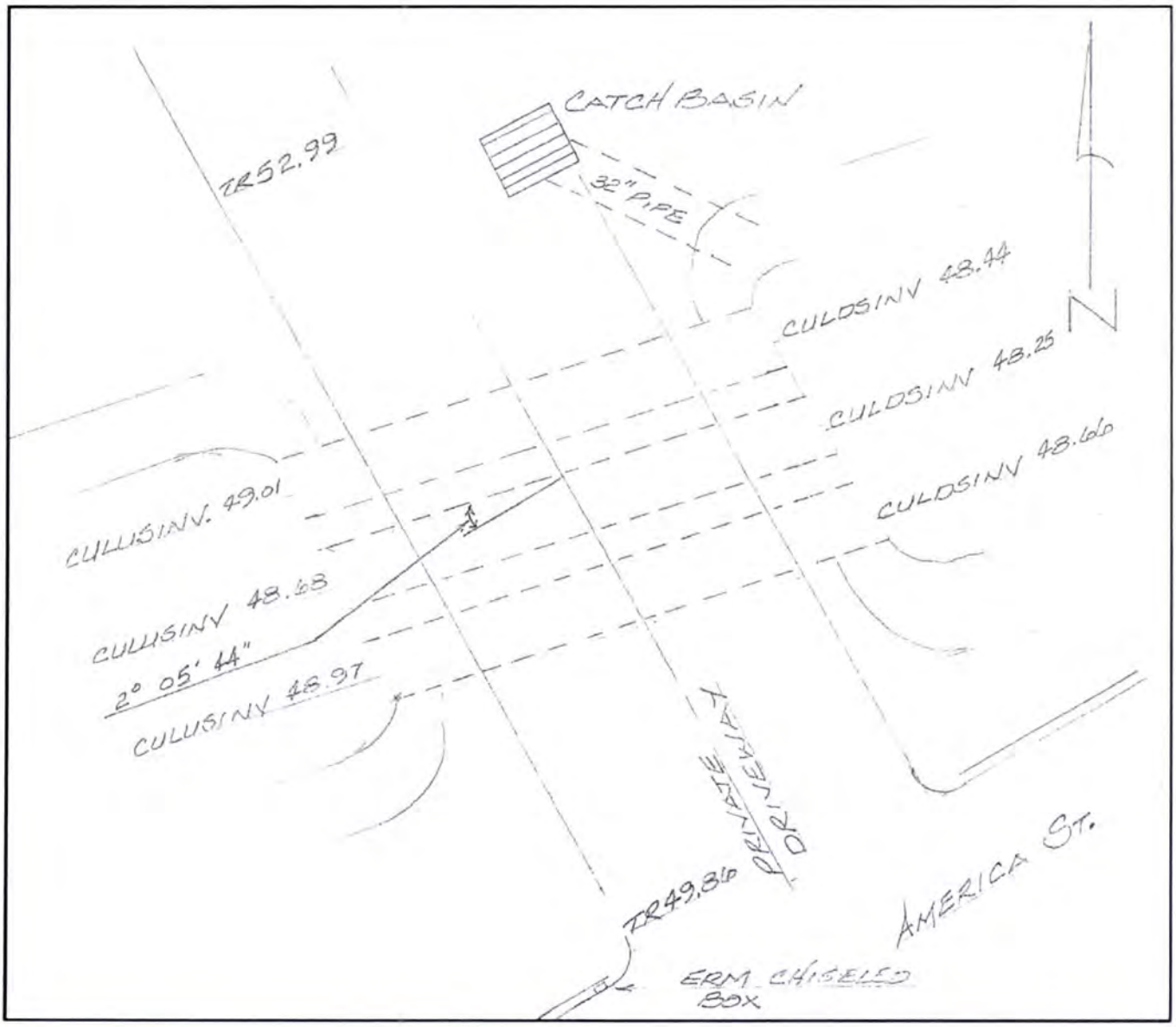
438	454016.24	1079660.45	2053.42	SST_500	GDR
439	454017.47	1079659.82	2050.10	SST_500	BOTGDR
440	454017.04	1079663.20	2049.71	SST_500	BWHDWL
441	454017.20	1079663.21	2051.80	SST_500	TWHDWL
442	454029.97	1079670.95	2051.71	SST_500	TWHDWL
443	454030.12	1079671.03	2050.56	SST_500	BWHDWL
444	454031.74	1079670.92	2050.17	SST_500	BOTGDR
445	454031.72	1079671.08	2053.26	SST_500	GDR
446	454071.81	1079611.56	2052.39	SST_500	GDR
447	454071.76	1079611.44	2049.15	SST_500	BOTGDR
448	454070.97	1079610.21	2049.50	SST_500	BWHDWL
449	454070.89	1079610.17	2050.73	SST_500	TWHDWL
450	454052.15	1079607.45	2048.27	SST_500	BOTDECK
451	454044.35	1079619.13	2048.52	SST_500	BOTDECK
452	454036.52	1079630.99	2048.70	SST_500	BOTDECK
453	454028.64	1079642.75	2048.88	SST_500	BOTDECK
454	454020.81	1079653.97	2048.97	SST_500	BOTDECK
455	454036.57	1079664.71	2048.99	SST_500	BOTDECK
456	454044.31	1079653.30	2048.85	SST_500	BOTDECK
457	454052.28	1079641.70	2048.75	SST_500	BOTDECK
458	454060.13	1079629.96	2048.54	SST_500	BOTDECK
459	454067.90	1079618.43	2048.30	SST_500	BOTDECK
460	454075.31	1079615.42	2047.00	SST_500	DSRIGHTABUTMENT
461	454075.31	1079615.49	2044.75	SST_500	GRD
462	454052.43	1079599.51	2046.95	SST_500	USRIGHTABUTMENT
463	454052.40	1079599.66	2045.96	SST_500	GRD
464	454013.54	1079657.67	2045.29	SST_500	GRD
465	454013.21	1079657.64	2047.91	SST_500	USLEFTABUTMENT
466	454036.22	1079673.33	2047.88	SST_500	DSLEFTABUTMENT
467	454036.22	1079673.31	2045.58	SST_500	GDR
468	454022.25	1079645.94	2040.55	SST_500	TOS
469	454028.01	1079636.16	2039.71	SST_500	CH
470	454030.05	1079631.73	2038.81	SST_500	CH
471	454033.25	1079626.99	2039.13	SST_500	CHCL
472	454037.07	1079621.23	2038.98	SST_500	CH
473	454042.57	1079613.62	2039.97	SST_500	TOS
474	454049.85	1079614.92	2039.42	SST_500	PIER
475	454061.42	1079622.92	2039.12	SST_500	PIER
476	454054.11	1079634.81	2039.43	SST_500	PIER
477	454041.91	1079626.66	2039.12	SST_500	PIER
478	454034.01	1079638.08	2039.10	SST_500	PIER
479	454045.98	1079646.36	2039.18	SST_500	PIER

480	454038.63	1079657.40	2039.78	SST_500	PIER
481	454026.37	1079649.11	2039.97	SST_500	PIER
482	454019.10	1079659.36	2043.22	SST_500	PIER
483	454030.10	1079668.49	2044.98	SST_500	PIER
484	454068.27	1079611.42	2044.24	SST_500	PIER
485	454057.98	1079604.44	2045.08	SST_500	PIER
486	454080.90	1079653.33	2038.58	SST_500	CHCL
487	454044.39	1079636.21	2038.79	SST_500	CHCL
488	453968.21	1079641.07	2041.45	SST_500	GDR
489	453977.43	1079628.99	2040.57	SST_500	TOB
490	453987.89	1079615.20	2039.46	SST_500	TOS
491	453990.31	1079610.44	2039.31	SST_500	CHCL
492	453993.42	1079605.59	2039.73	SST_500	TOS
493	454002.82	1079590.21	2041.18	SST_500	TOB
494	454010.58	1079574.61	2041.39	SST_500	GDR
495	454020.61	1079653.97	2043.03	SST_500	FL
496	454028.72	1079642.98	2040.03	SST_500	FL
497	454036.63	1079631.34	2038.99	SST_500	FL
498	454044.77	1079619.39	2039.40	SST_500	FL
499	454052.13	1079607.44	2043.63	SST_500	FL
500	454059.86	1079629.89	2039.30	SST_500	FL
501	454052.34	1079641.57	2038.73	SST_500	FL
502	454044.67	1079653.44	2039.75	SST_500	FL

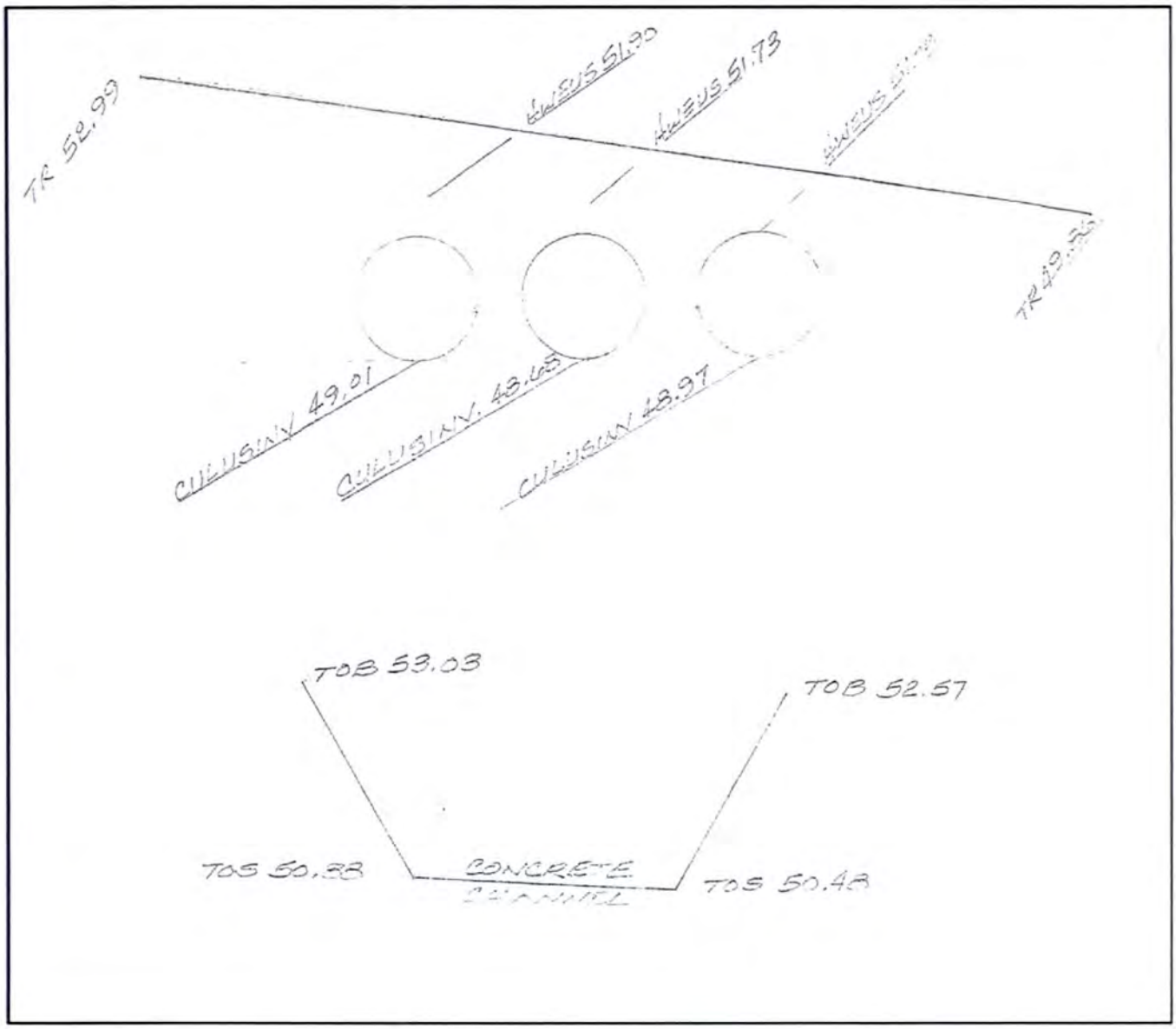
APPENDIX B: Structure Field Sketches

Wash Name:	Sunset Wash Tributary			ID:	SST_120
Location:	America Street and Private Driveway			RS:	0.213
Benchmark ID:		Elev:	2149.87	PC:	IM:
GPS Lat:		GPS Long:		Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	3	TYPE	CMP	LENGTH	40.0'	SIZE	H:	24"	W:	32"	SKEW	2° R
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:	No headwall on either side of culvert												



Wash Name:	Sunset Wash Tributary	ID:	SST_120
Location:	America Street and Private Driveway	RS:	0.213
GPS Lat:	GPS Long:		



Wash Name:	Sunset Wash Tributary	ID:	SST_120
Location:	America Street and Private Driveway	RS:	0.213
GPS Lat:	GPS Lat:	GPS Lat:	

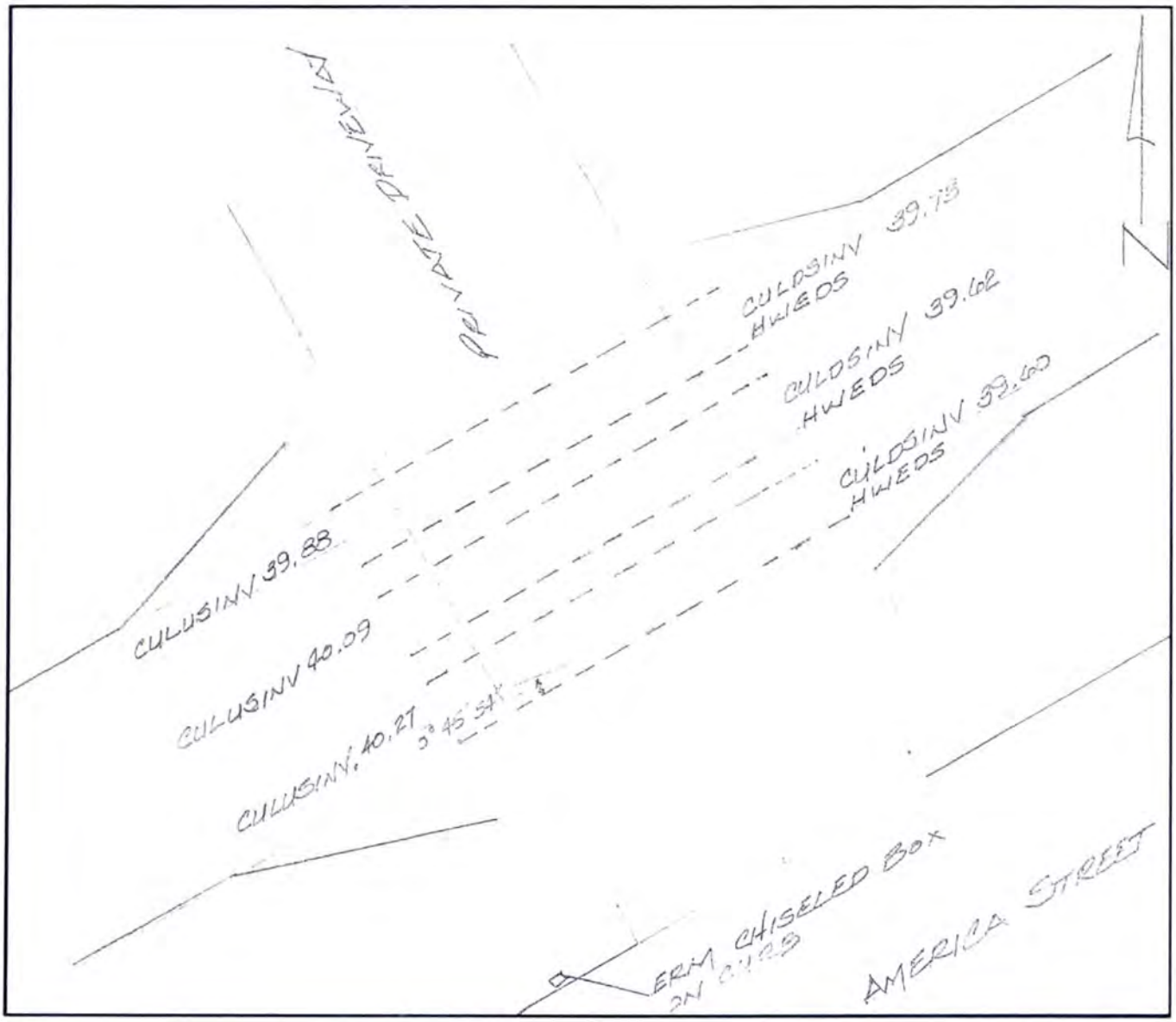
View to East, Upstream of Culvert

View to West, Downstream of Culvert

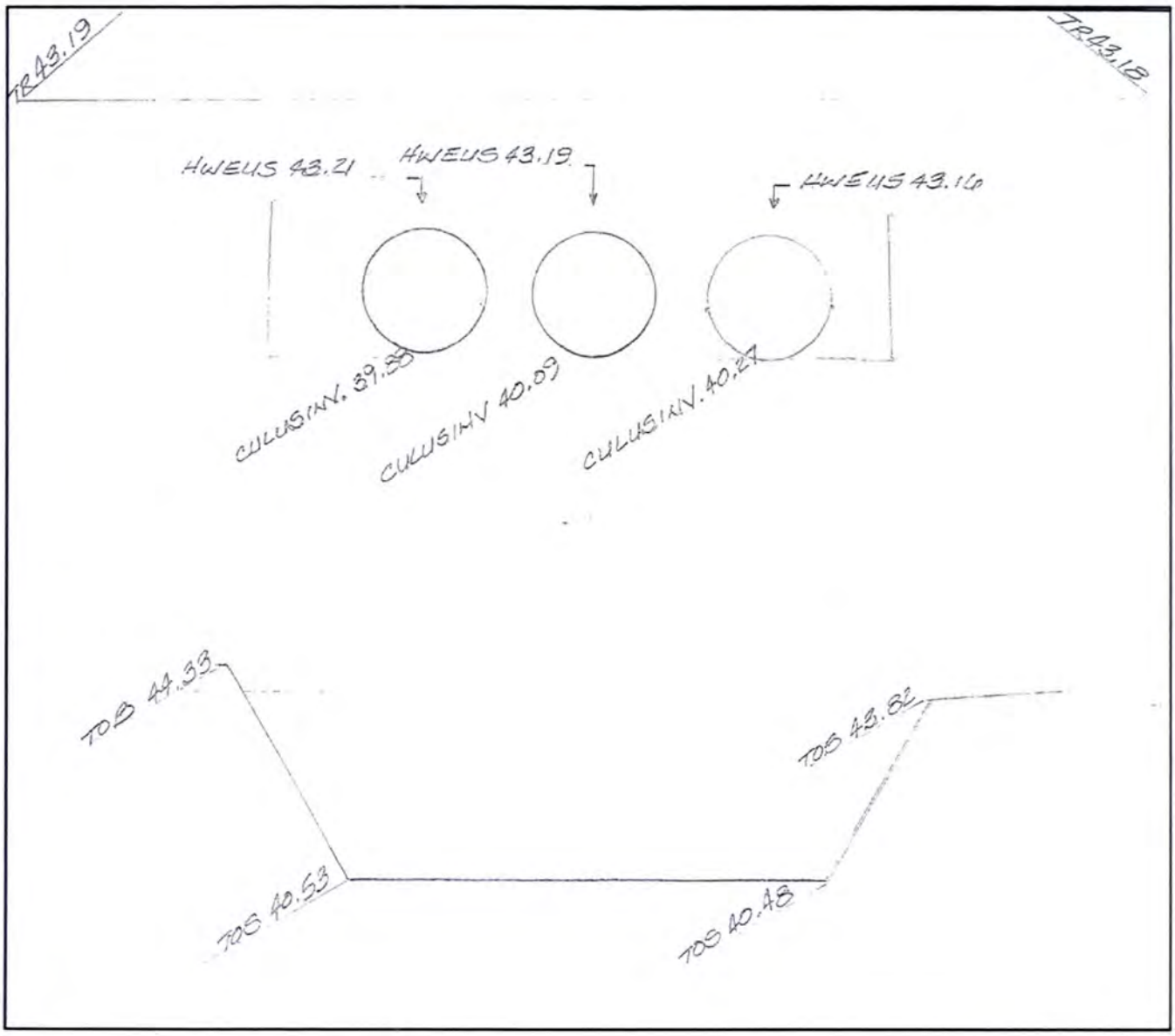
View to North, from Culvert Crossing

Wash Name:	Sunset Wash Tributary			ID:	SST_130
Location:	America Street and Private Driveway			RS:	0.155
Benchmark ID:		Elev:	2143.66	PC:	IM:
GPS Lat:		GPS Long:		Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	3	TYPE	CMP	LENGTH	21.0'	SIZE	H:	24"	W:	32"	SKEW	1° R
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:	No headwall on either side of culvert												



Wash Name:	Sunset Wash Tributary	ID:	SST_130
Location:	America Street and Private Driveway	RS:	0.155
GPS Lat:	GPS Long:		



Wash Name:	Sunset Wash Tributary	ID:	SST_130
Location:	America Street and Private Driveway	RS:	0.155
GPS Lat:	GPS Long:		

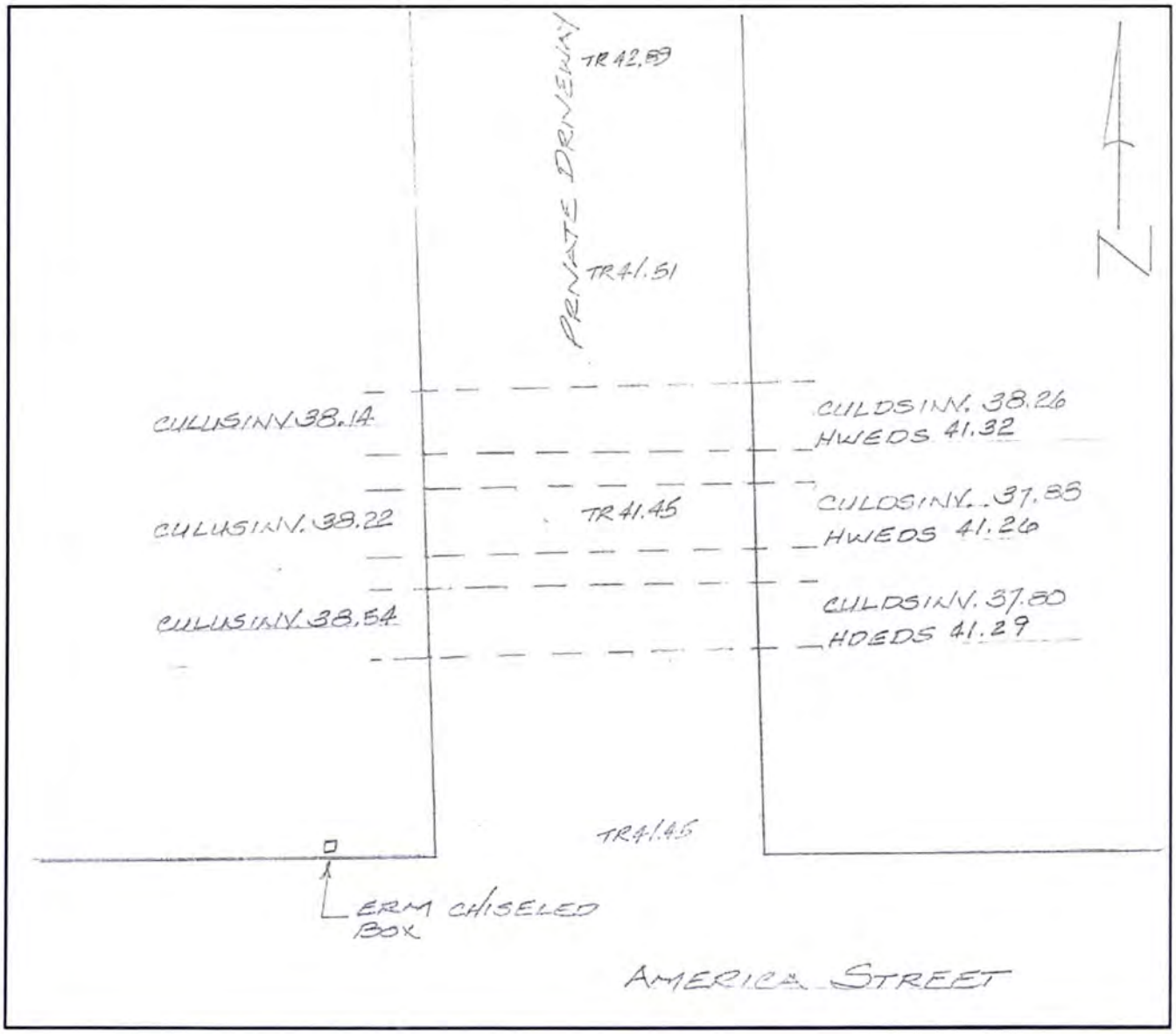
View to East, Upstream of Culvert

View to West, Downstream of Culvert

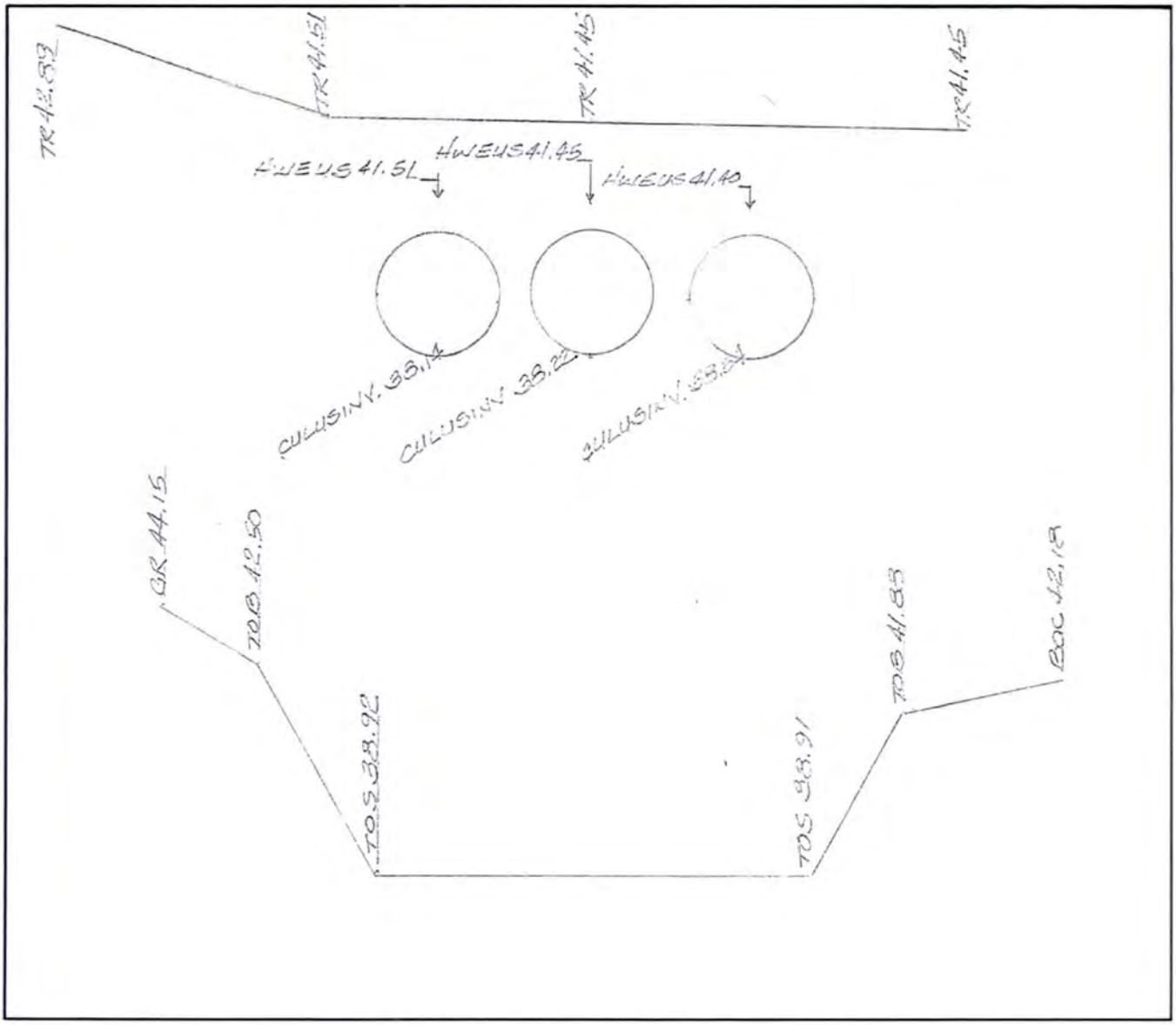
View to North, from Culvert Crossing

Wash Name:	Sunset Wash Tributary	ID:	SST_140
Location:	America Street and Private Driveway	RS:	0.135
Benchmark ID:	Elev:	PC:	IM:
GPS Lat:	GPS Long:	Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	3	TYPE	CMP	LENGTH	21.0'	SIZE	H:	24"	W:	32"	SKEW	2° R
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:	No headwall on either side of culvert												



Wash Name:	Sunset Wash Tributary	ID:	SST_140
Location:	America Street and Private Driveway	RS:	0.135
GPS Lat:	GPS Long:		



Wash Name:	Sunset Wash Tributary	ID:	SST_140
Location:	America Street and Private Driveway	RS:	0.135
GPS Lat:	GPS Long:		

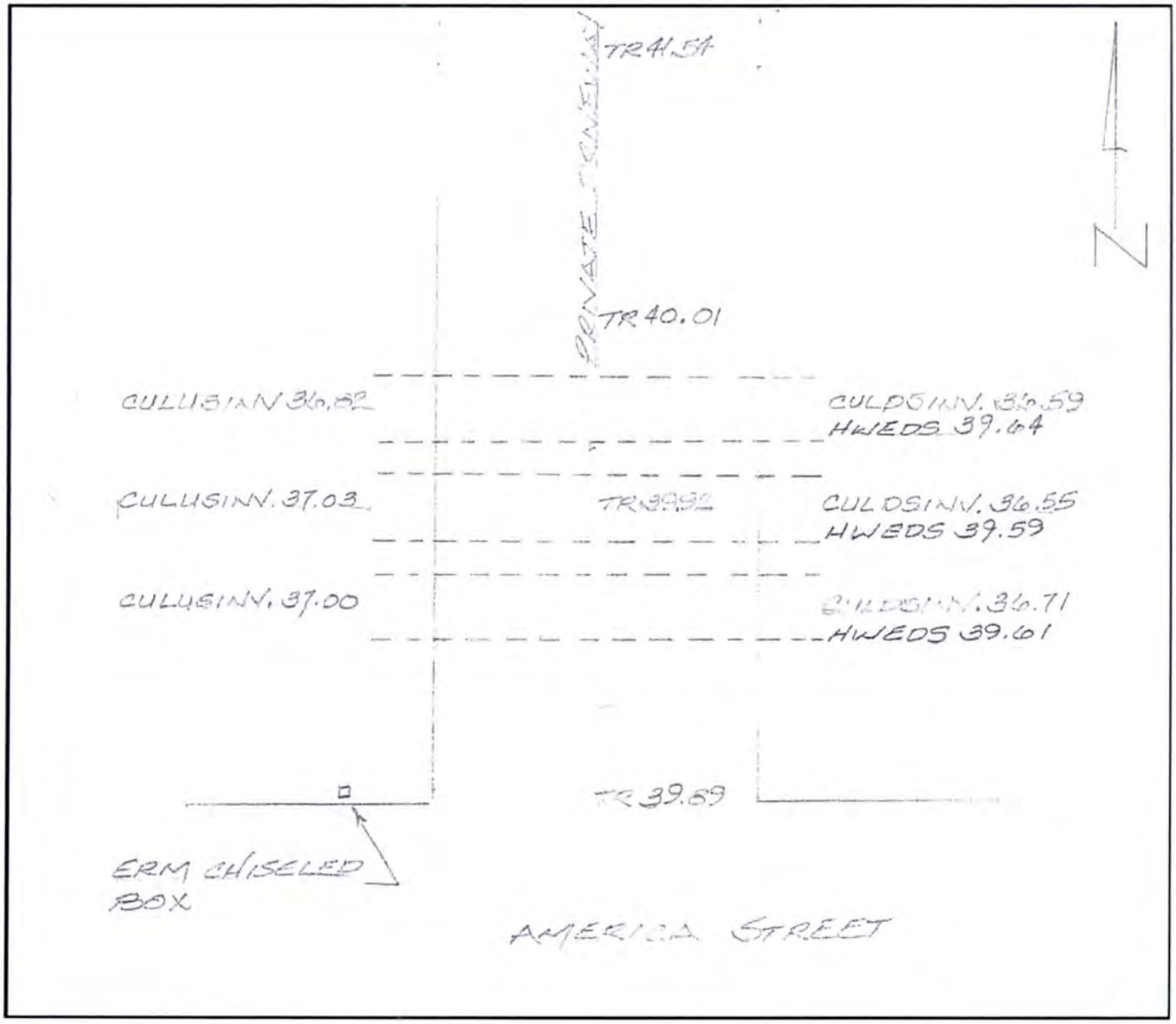
View to East, Upstream of Culvert

View to West, Downstream of Culvert

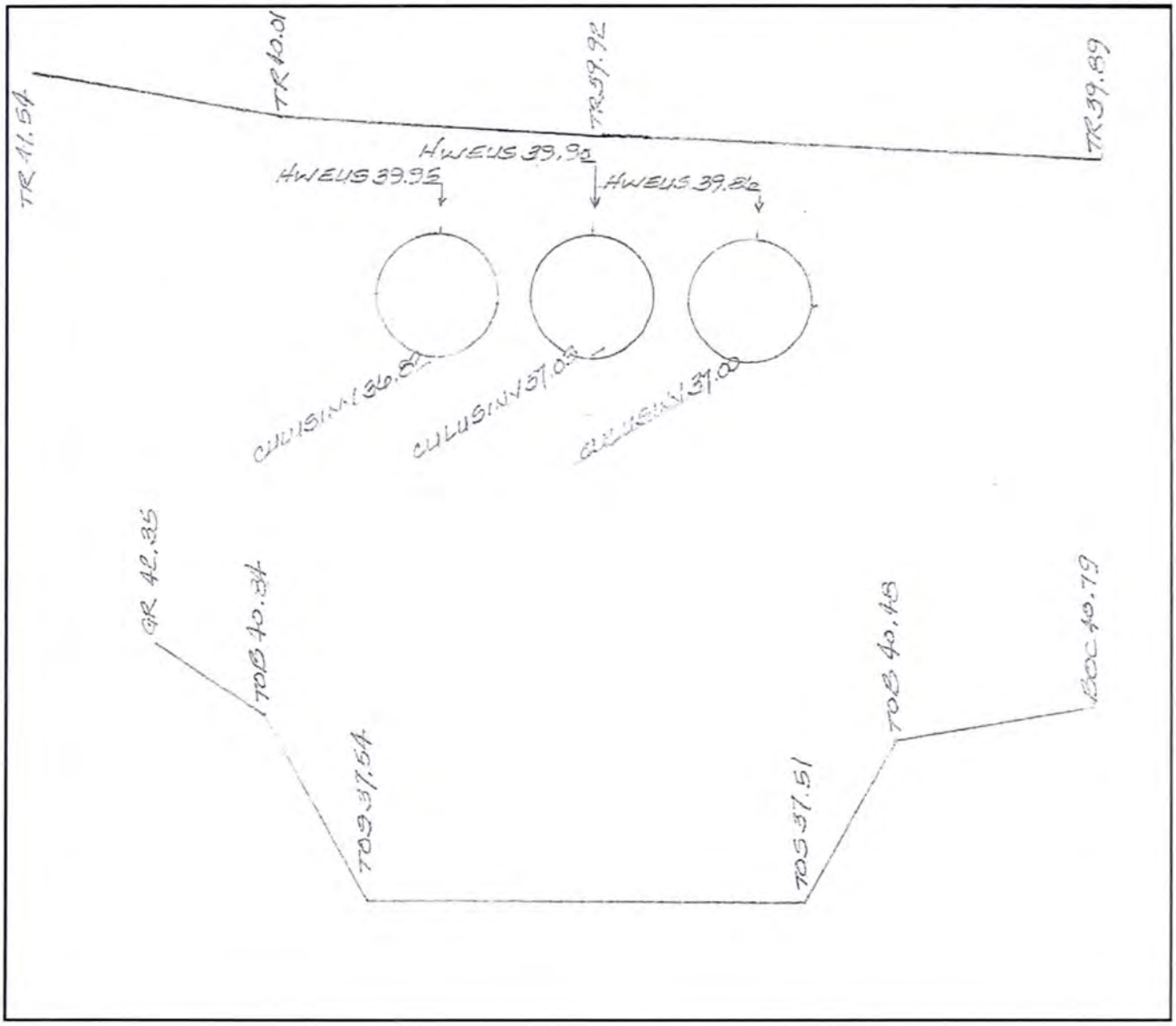
View to North, from Culvert Crossing

Wash Name:	Sunset Wash Tributary			ID:	SST_150
Location:	America Street and Private Driveway			RS:	0.119
Benchmark ID:		Elev:	2145.55	PC:	IM:
GPS Lat:		GPS Long:		Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	3	TYPE	CMP	LENGTH	21.0'	SIZE	H:	24"	W:	32"	SKEW	0°
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:	No headwall on either side of culvert												



Wash Name:	Sunset Wash Tributary	ID:	SST_150
Location:	America Street and Private Driveway	RS:	0.119
GPS Lat:	GPS Long:		



Wash Name:	Sunset Wash Tributary	ID:	SST_150
Location:	America Street and Private Driveway	RS:	0.119
GPS Lat:	GPS Long:		

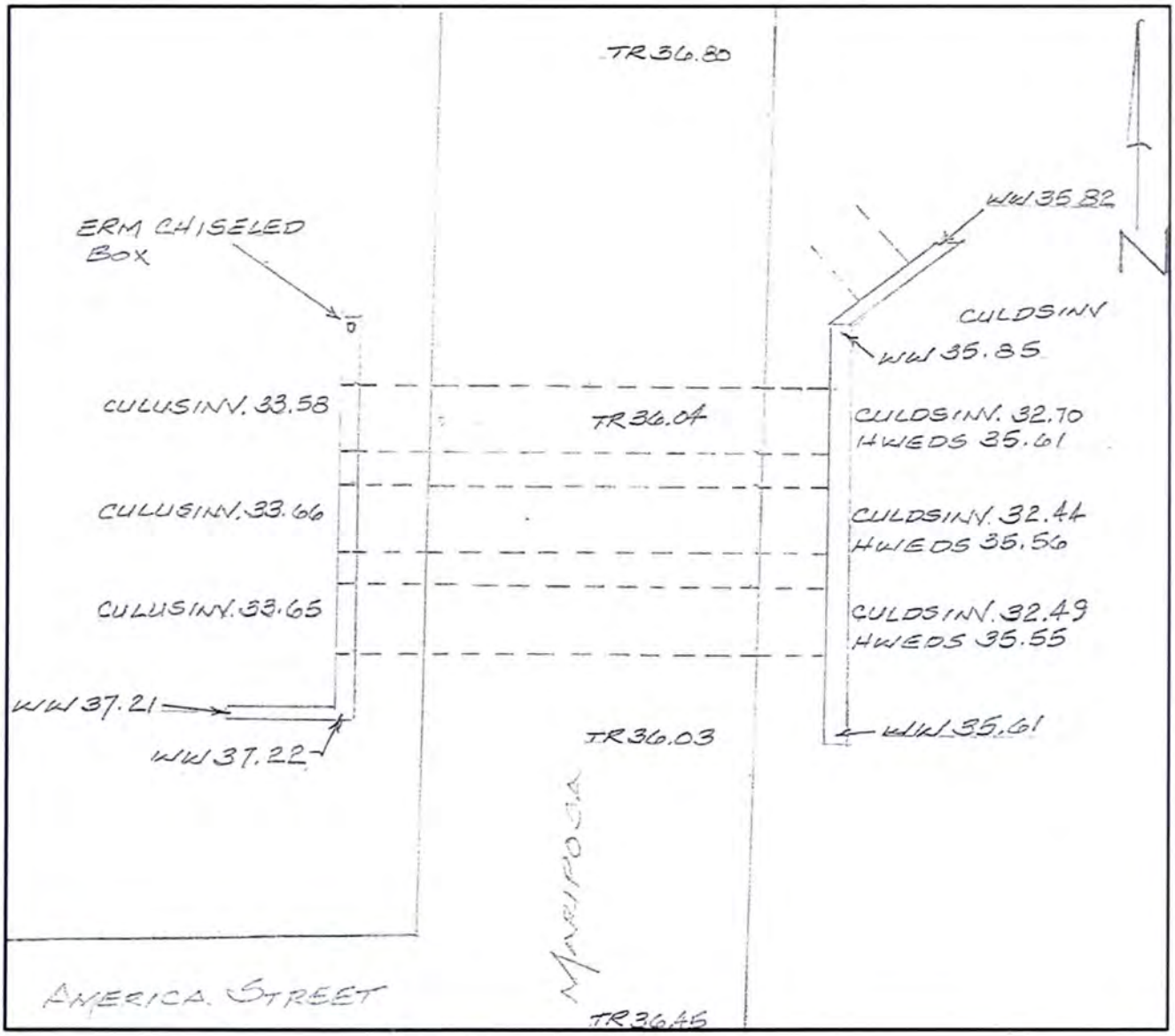
View to East, Upstream of Culvert

View to West, Downstream of Culvert

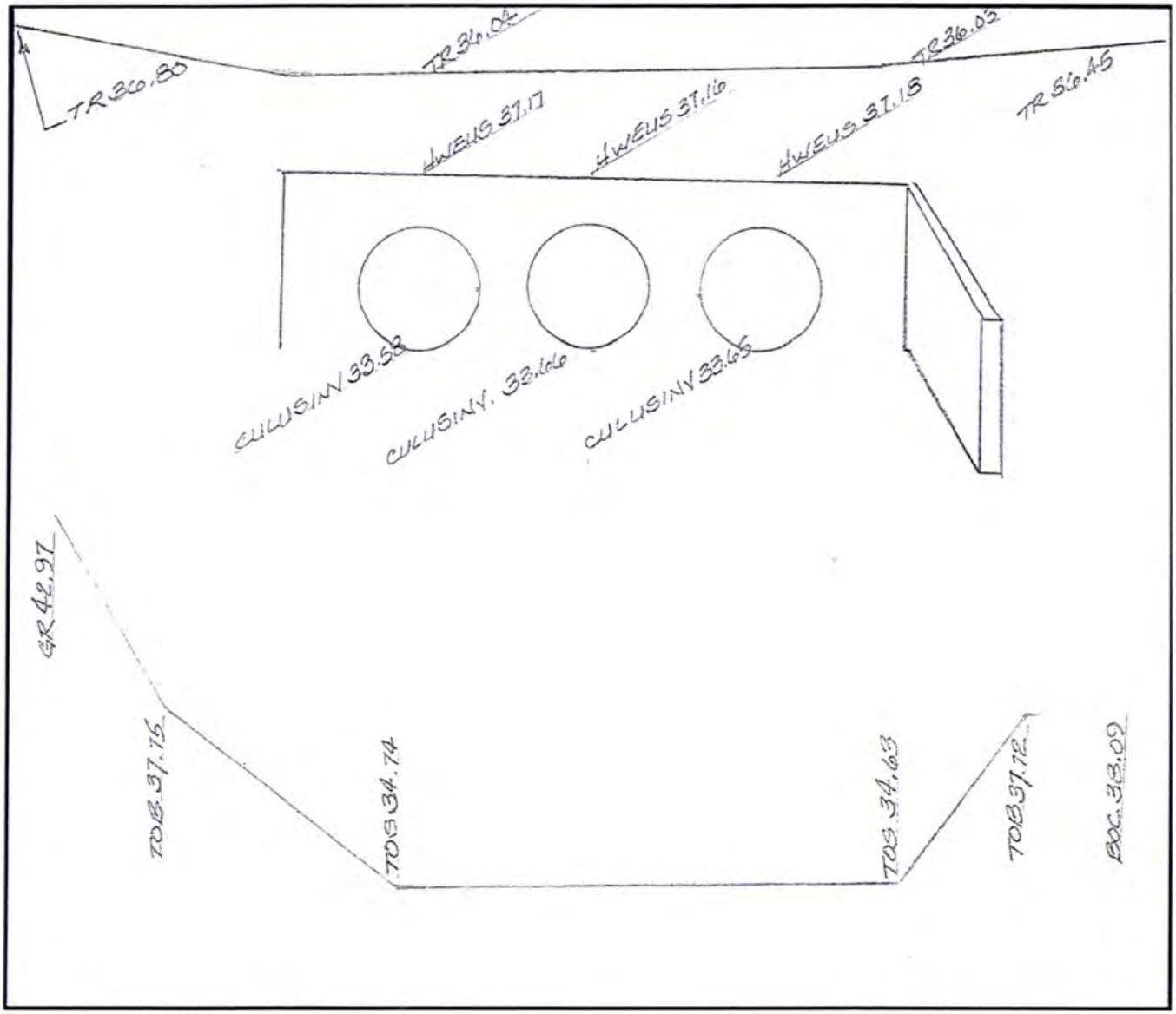
View to North, from Culvert Crossing

Wash Name:	Sunset Wash Tributary			ID:	SST_160
Location:	Mariposa Drive and America Street			RS:	0.082
Benchmark ID:		Elev:	2137.18	PC:	IM:
GPS Lat:		GPS Long:		Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	3	TYPE	CMP	LENGTH	56.0'	SIZE	H:	24"	W:	36"	SKEW	0°
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:	No headwall on either side of culvert												



Wash Name:	Sunset Wash Tributary	ID:	SST_160
Location:	Mariposa Drive and America Street	RS:	0.082
GPS Lat:	GPS Long:		



Wash Name:	Sunset Wash Tributary	ID:	SST_160
Location:	Mariposa Drive and America Street	RS:	0.082
GPS Lat:	GPS Long:		

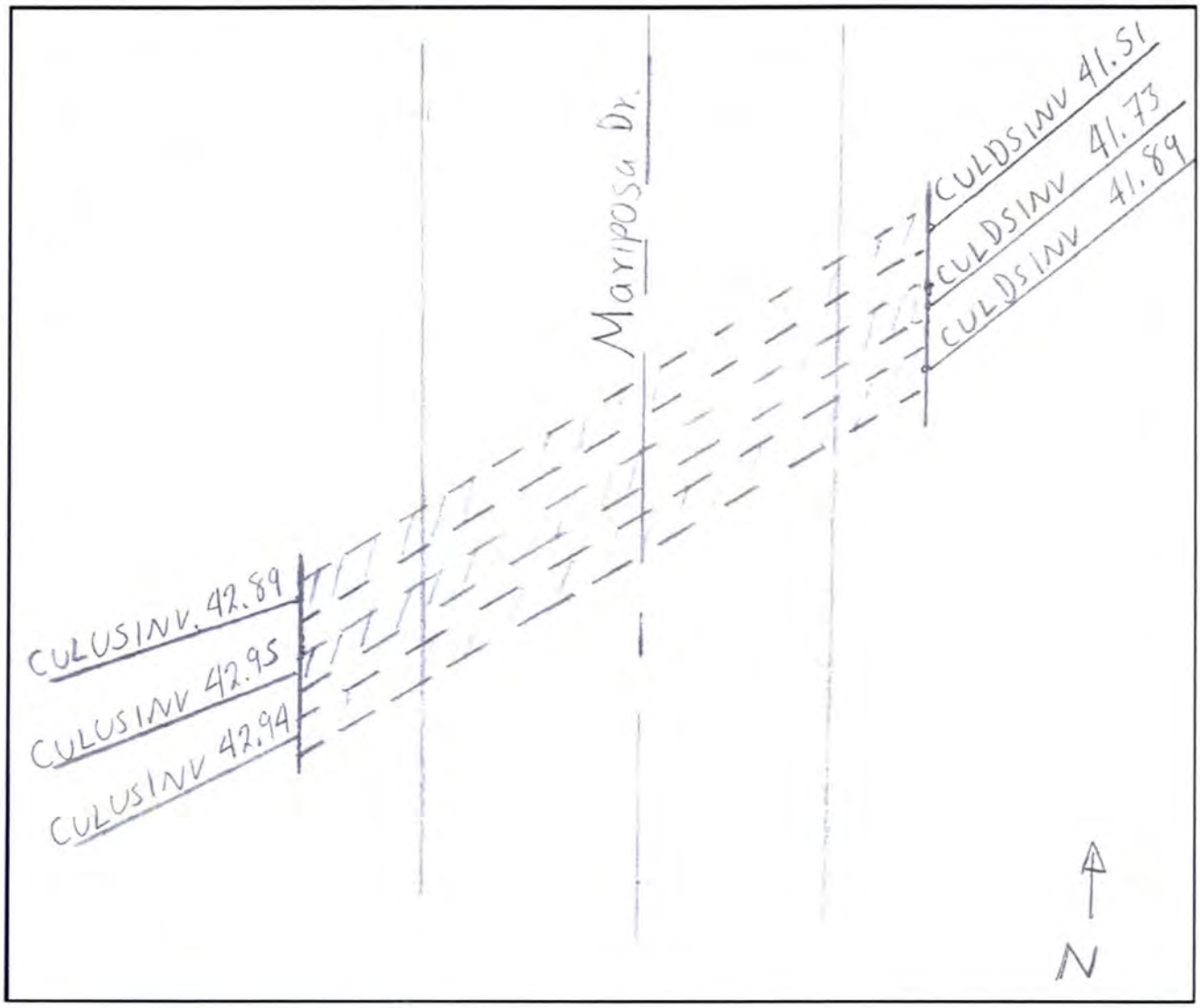
View to East, Upstream of Culvert

View to West, Downstream of Culvert

View to North, from Culvert Crossing

Wash Name:	Sunset Wash	ID:	SST_170
Location:	Mariposa Drive	RS:	1.456
Benchmark ID:	Elev:	PC:	IM:
GPS Lat:	GPS Long:	Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	3	TYPE	CMP	LENGTH	82.0'	SIZE	H:	36"	W:	36"	SKEW	0°
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:													

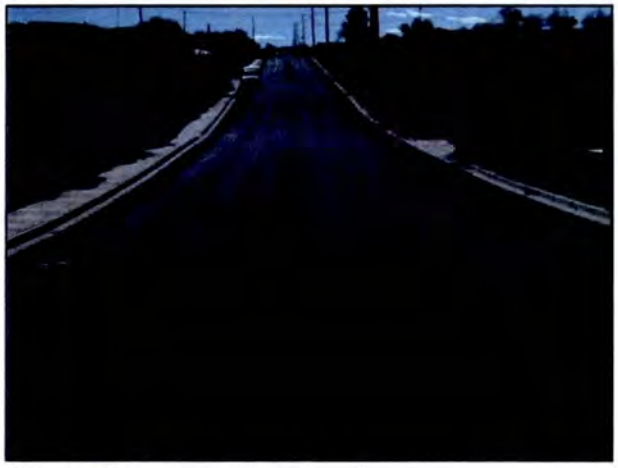


Wash Name:	Sunset Wash	ID:	SST_170
Location:	Mariposa Drive	RS:	1.456
GPS Lat:	GPS Long:		

View to East, Upstream of Culvert

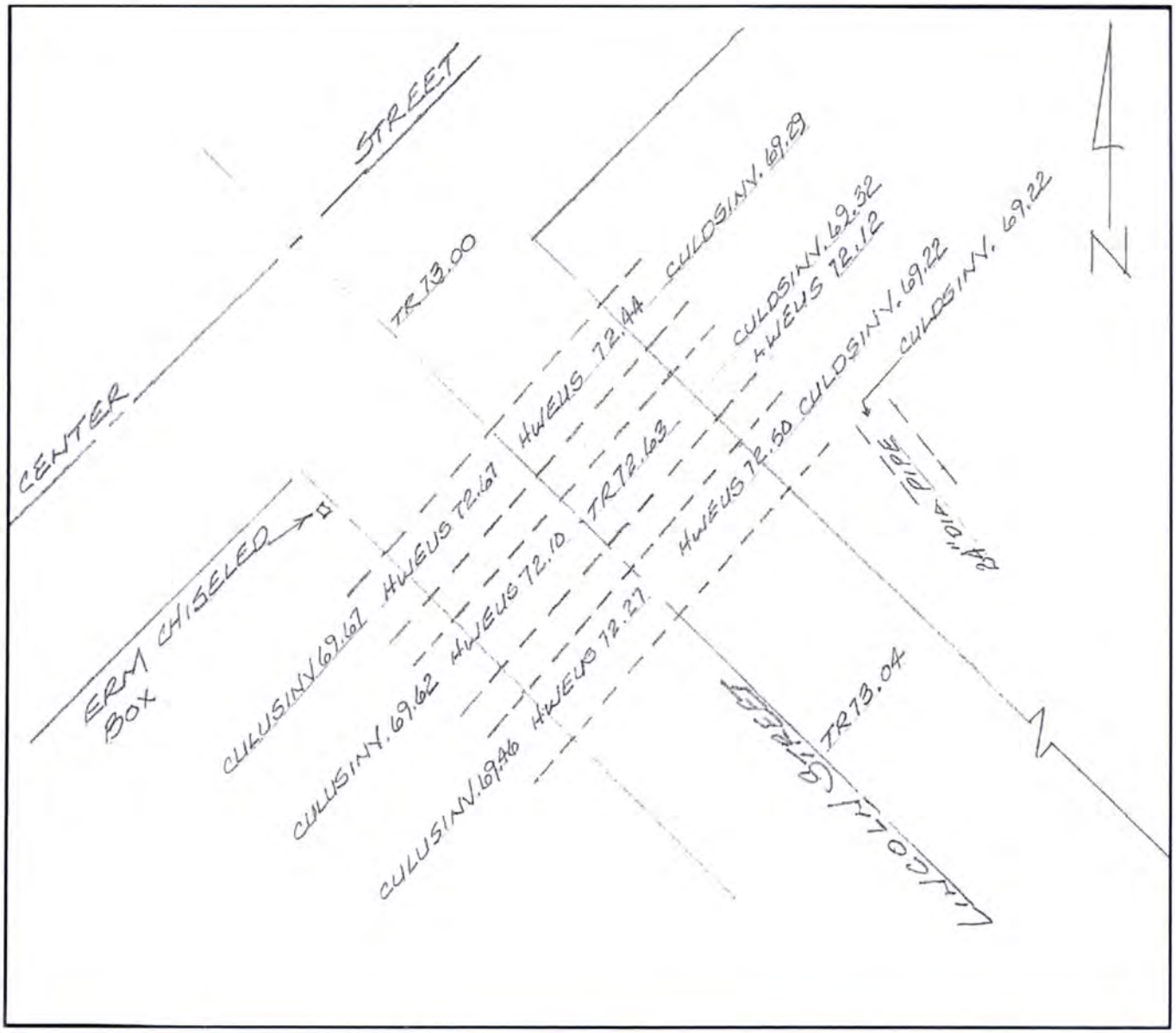
View to West, Downstream of Culvert

View to North, from Culvert Crossing

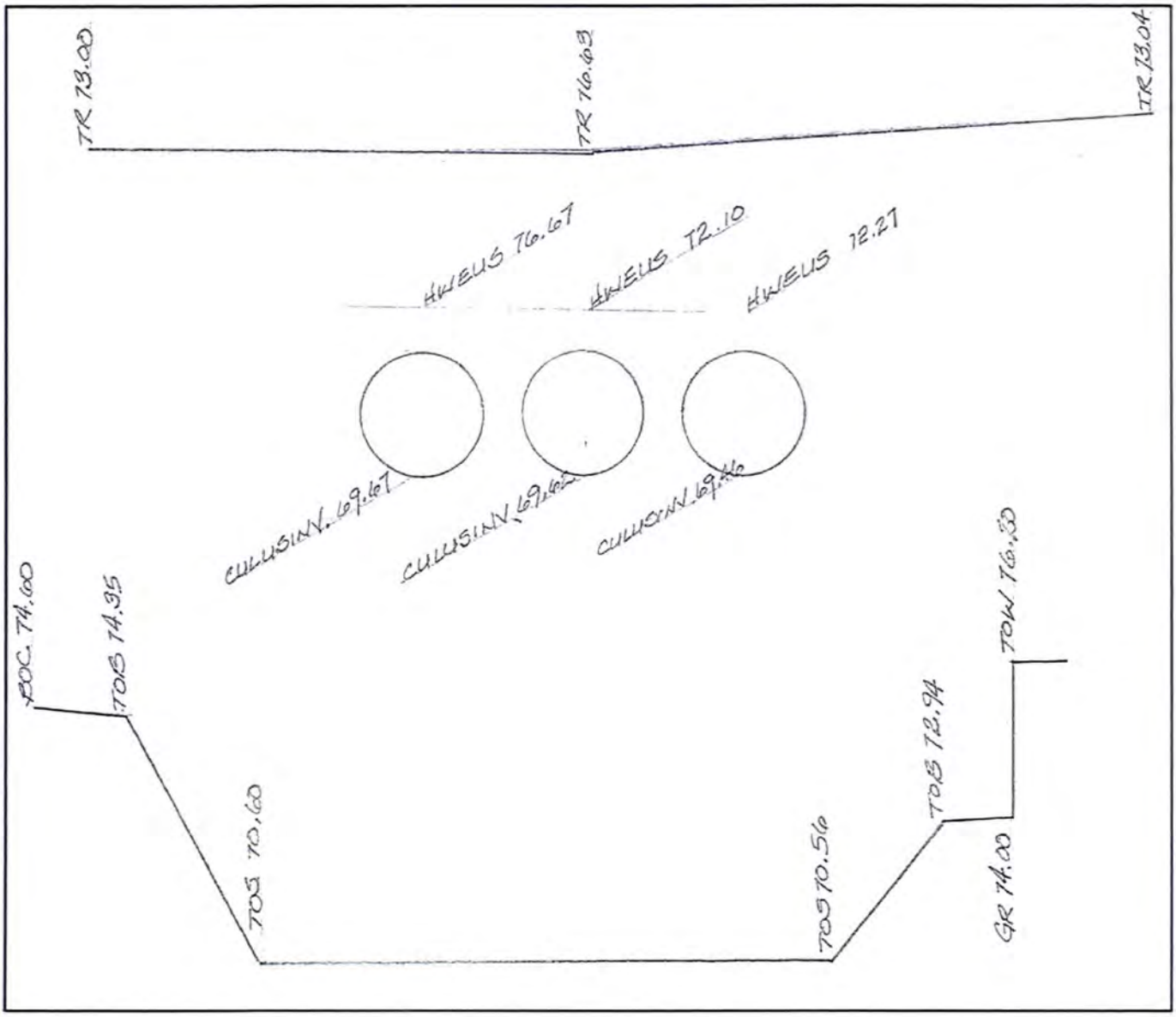

View to South, from Culvert Crossing

Wash Name:	Sunset Wash					ID:	SST_200
Location:	Lincoln Street					RS:	0.732
Benchmark ID:		Elev:	2073.60	PC:		IM:	
GPS Lat:			GPS Long:			Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	3	TYPE	CMP	LENGTH	47.0'	SIZE	H:	16"	W:	20"	SKEW	2° L
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:	No headwall on either side of culvert												



Wash Name:	Sunset Wash	ID:	SST_200
Location:	Lincoln Street	RS:	0.732
GPS Lat:	GPS Long:		



Wash Name:	Sunset Wash	ID:	SST_200
Location:	Lincoln Street	RS:	0.732
GPS Lat:	GPS Long:		

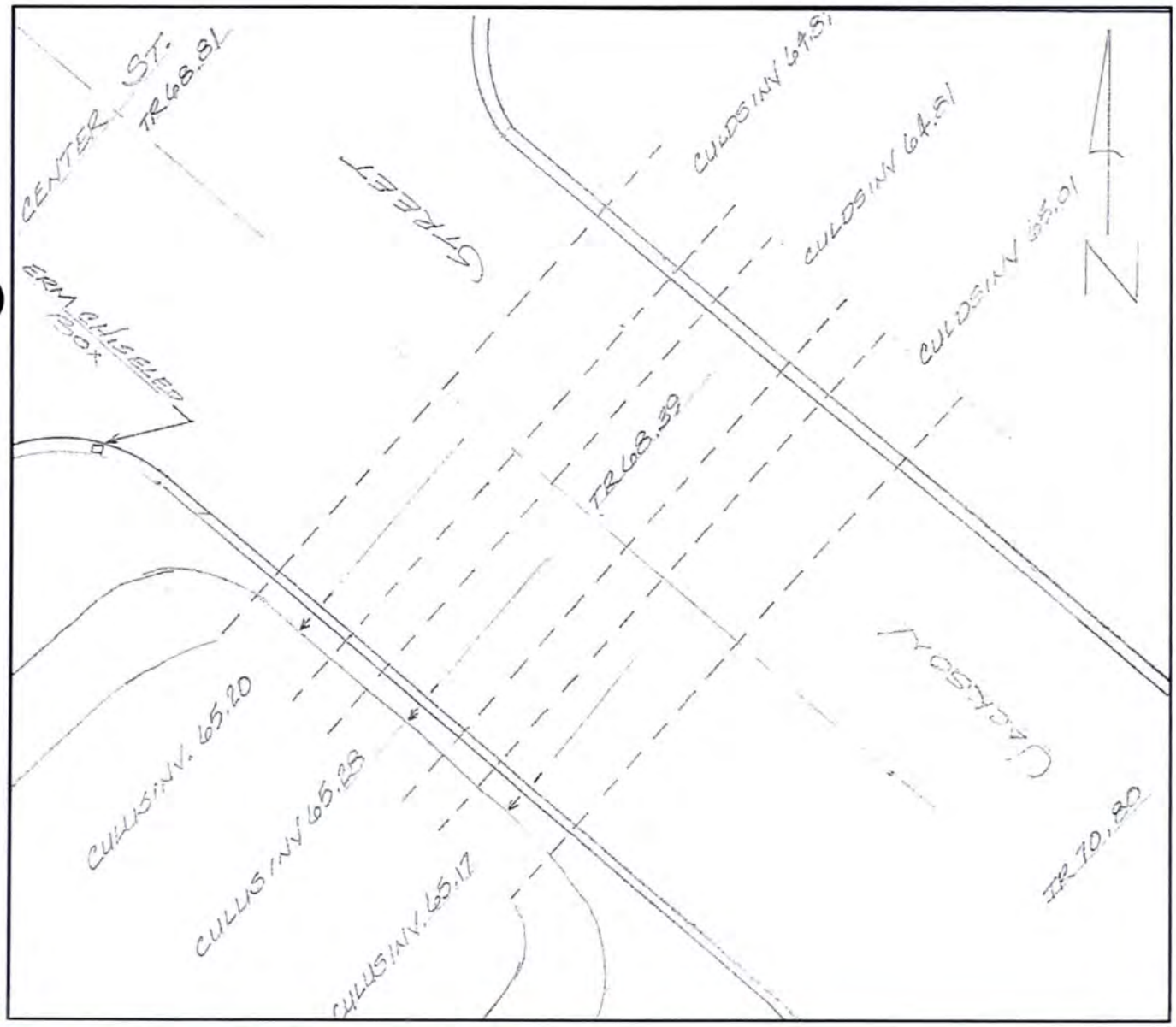
View to Northeast, Upstream of Culvert

View to Southwest, Downstream of Culvert

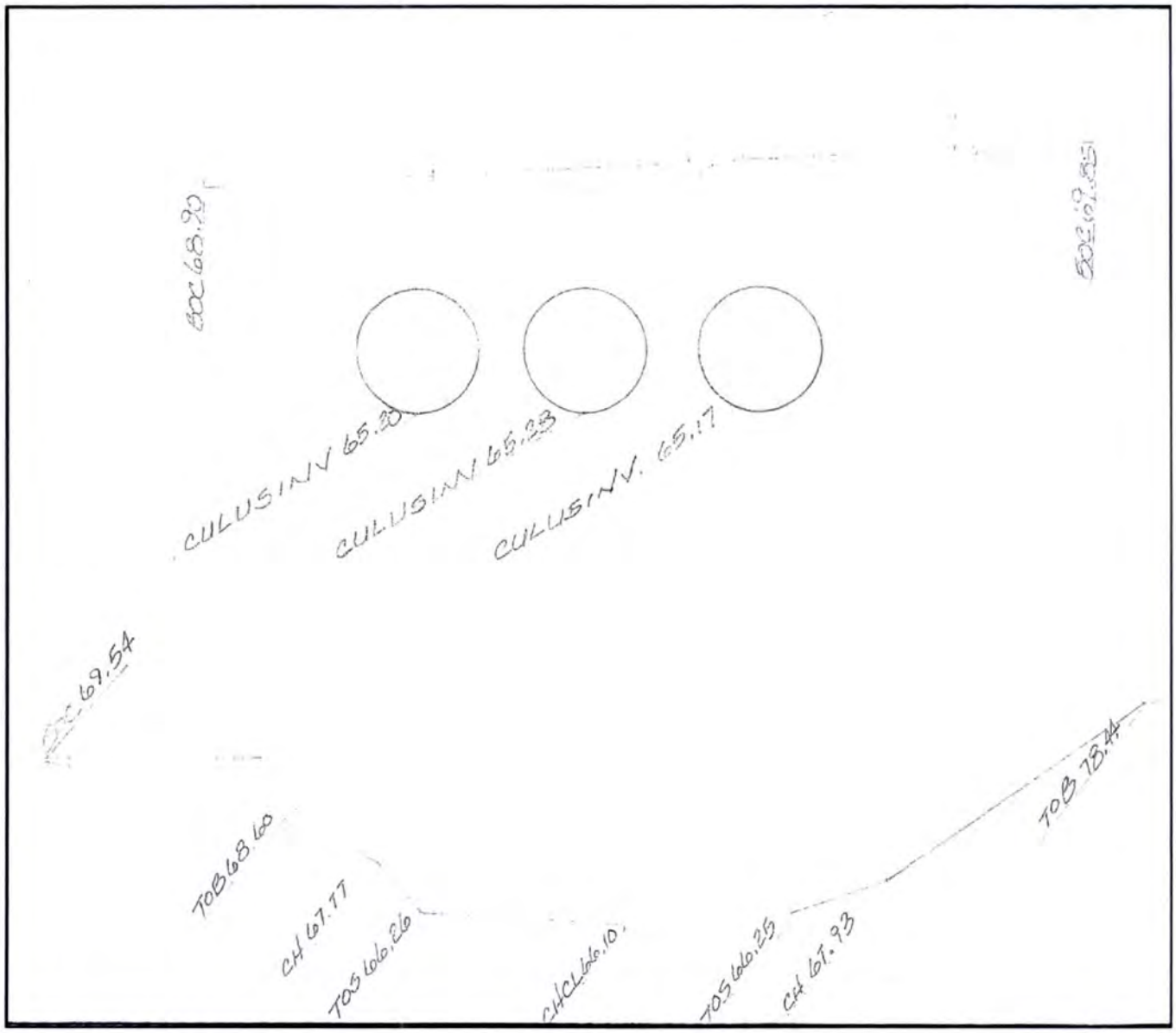
View to Northwest, from Culvert Crossing

Wash Name:	Sunset Wash					ID:	SST_300
Location:	Jackson Street					RS:	0.663
Benchmark ID:		Elev:	2069.01	PC:		IM:	
GPS Lat:			GPS Long:			Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	3	TYPE	CMP	LENGTH	46.0'	SIZE	H:	16"	W:	20"	SKEW	0°
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:	No headwall on either side of culvert												



Wash Name:	Sunset Wash	ID:	SST_300
Location:	Jackson Street	RS:	0.663
GPS Lat:	GPS Long:		



Wash Name:	Sunset Wash	ID:	SST_300
Location:	Jackson Street	RS:	0.663
GPS Lat:	GPS Long:		

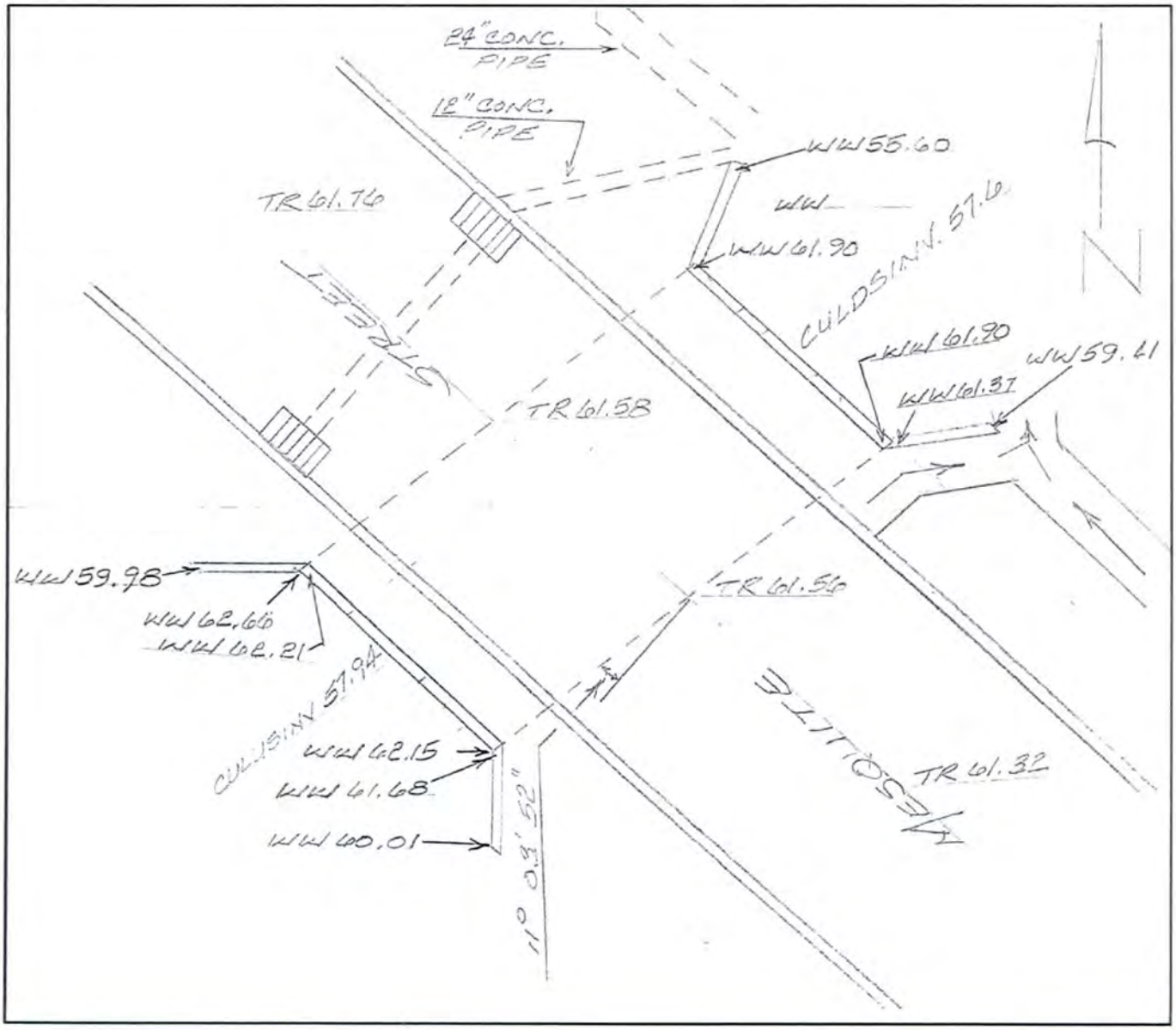
View to Northeast, Upstream of Culvert

View to Northeast, Upstream of Culvert

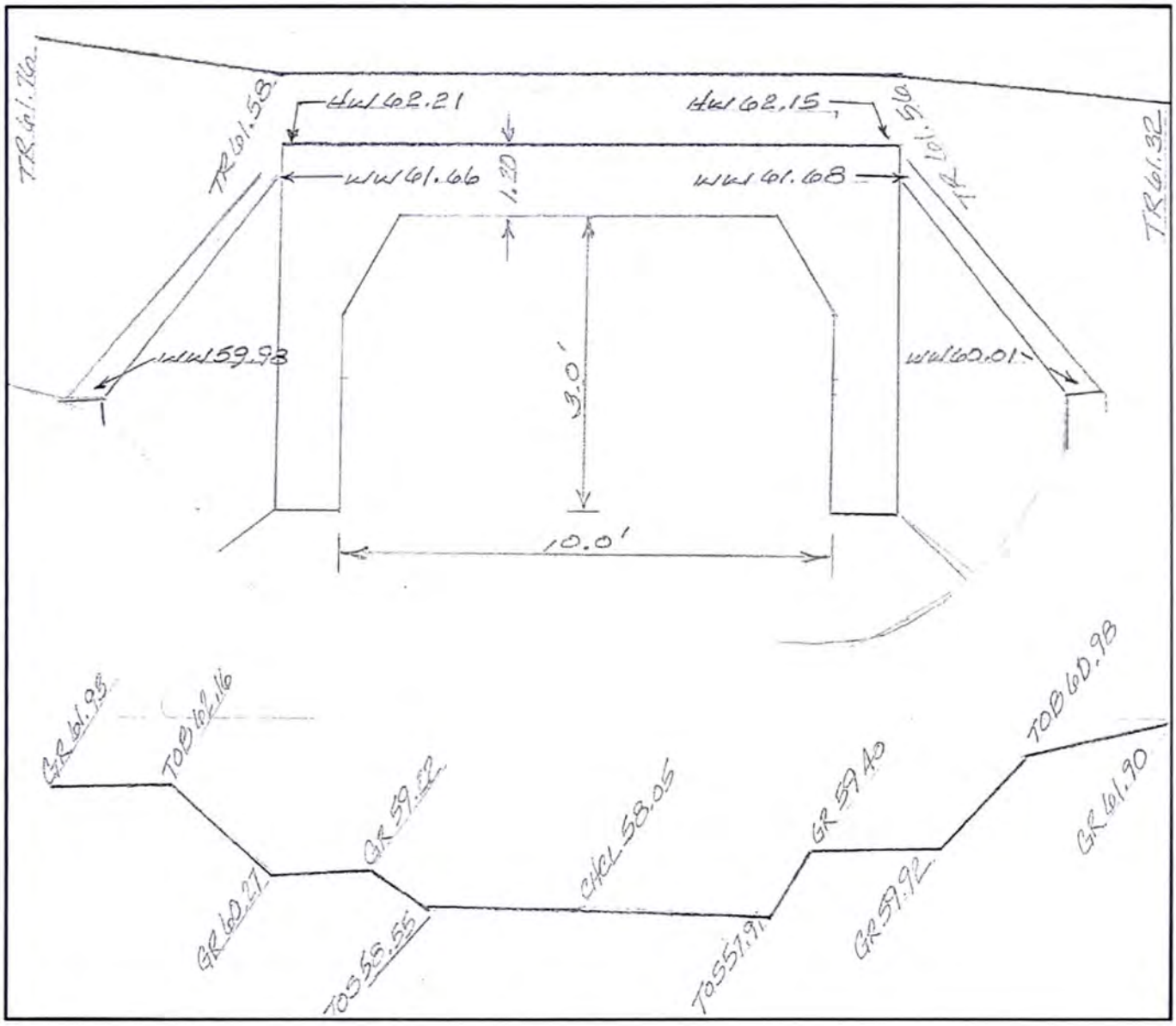
View to Northeast, Downstream of Culvert

Wash Name:	Sunset Wash			ID:	SST_400
Location:	Mesquite Drive			RS:	0.542
Benchmark ID:		Elev:	2062.23	PC:	IM:
GPS Lat:		GPS Long:		Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	1	TYPE	CBC	LENGTH	47'	SIZE	H:	3'	W:	10'	SKEW	11° R
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:													



Wash Name:	Sunset Wash	ID:	SST_400
Location:	Mesquite Drive	RS:	0.542
GPS Lat:	GPS Long:		



Wash Name:	Sunset Wash	ID:	SST_400
Location:	Mesquite Drive	RS:	0.542
GPS Lat:	GPS Long:		

View to Northeast, Upstream of Culvert

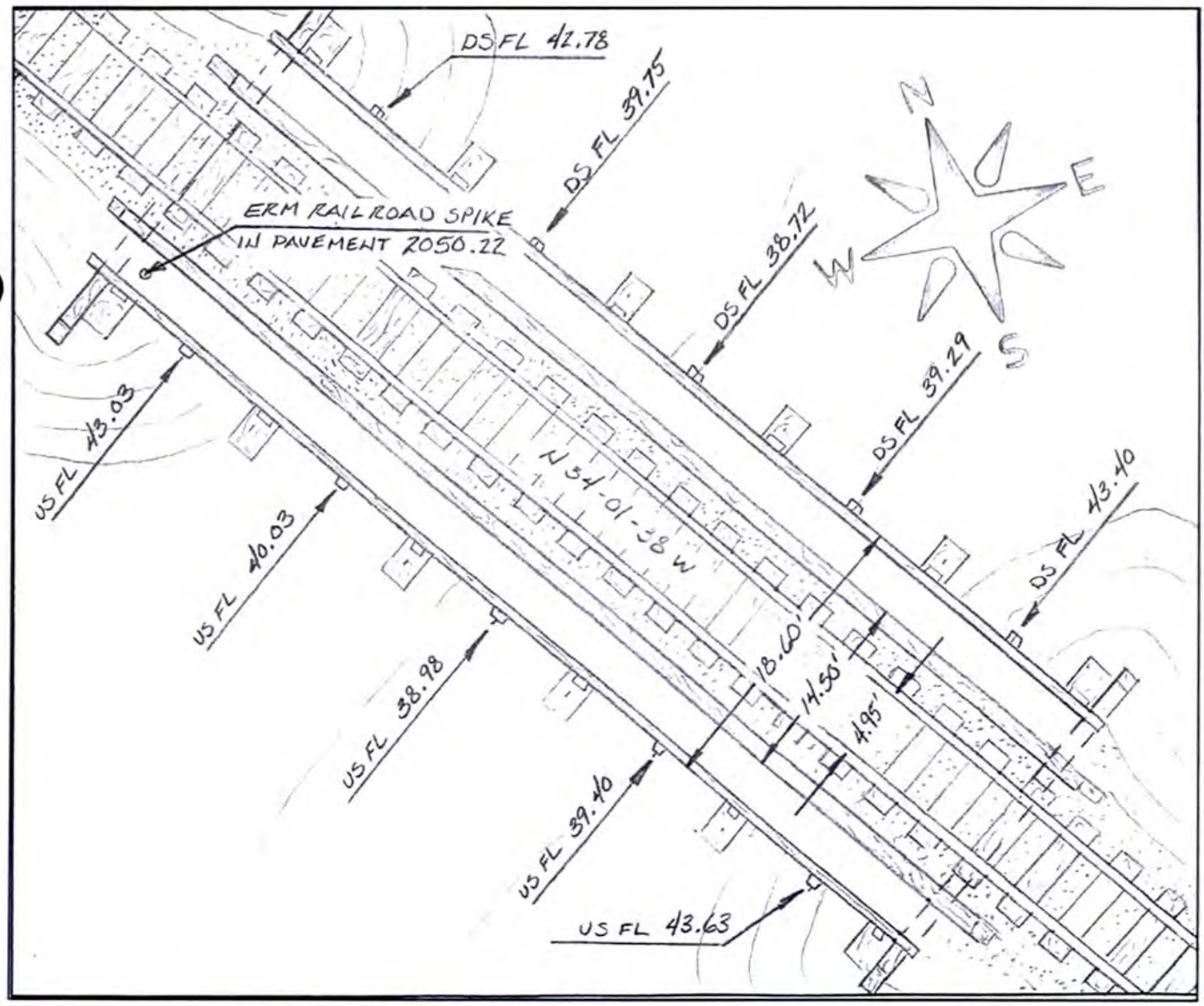
View to Southwest, Downstream of Culvert

View to West, Downstream of Culvert

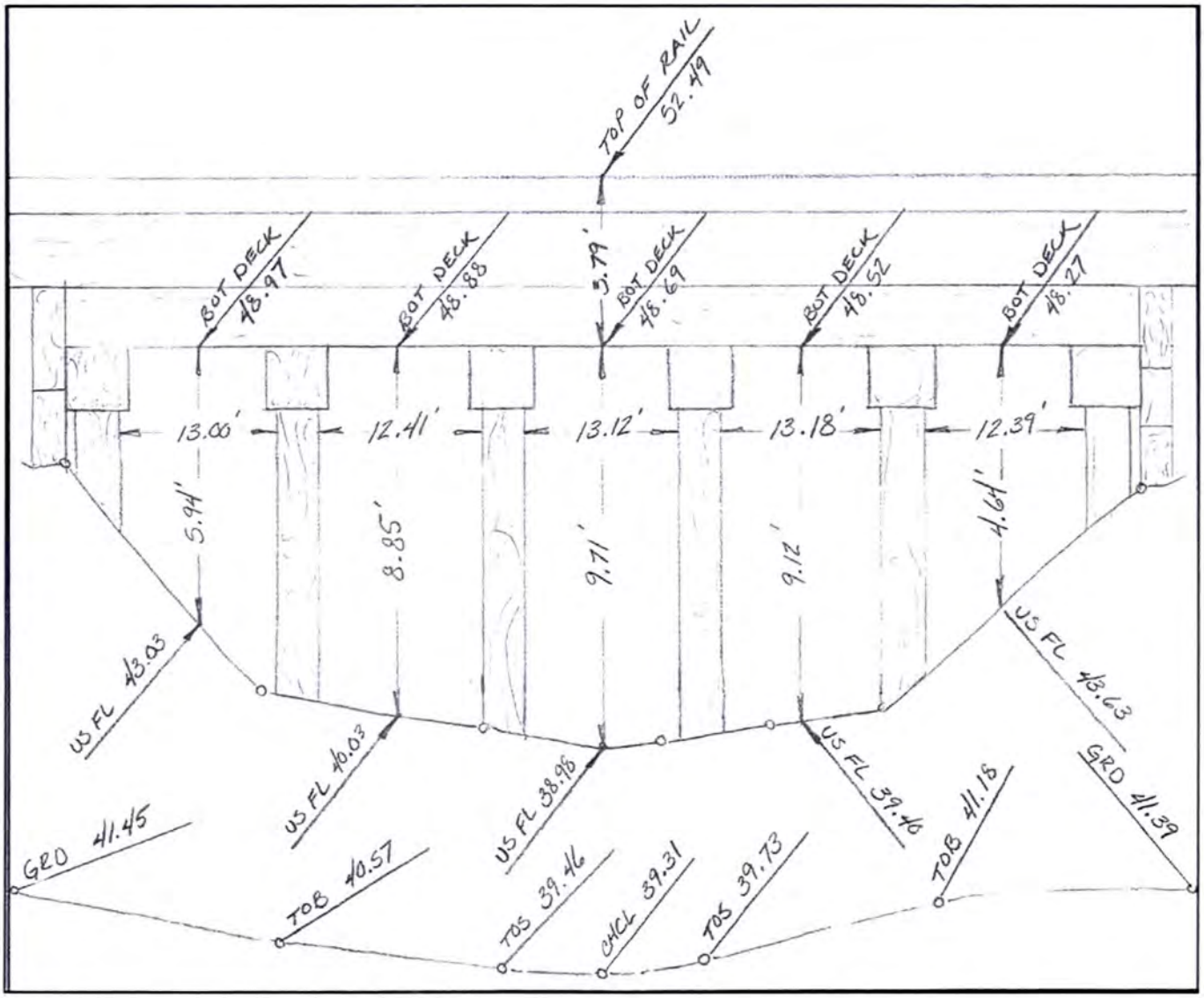
View to Southeast, from Culvert Crossing

Wash Name:	Sunset Wash	ID:	SST_500
Location:	BNSF Railroad Crossing	RS:	0.264
Benchmark ID:	Elev:	PC:	IM:
GPS Lat:	GPS Long:	Photo ID:	

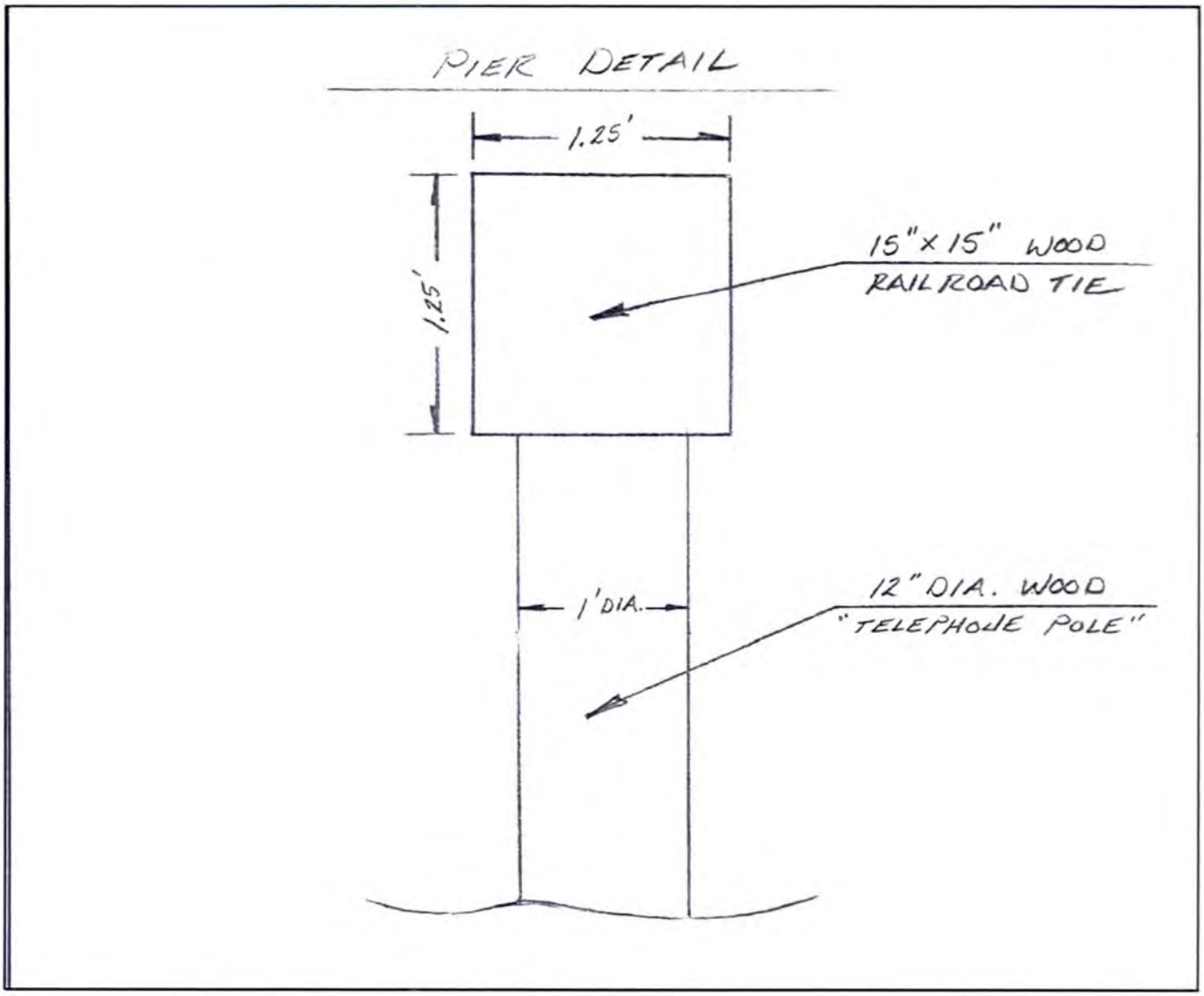
BRIDGE	RAIL	DECK	Wood	WIDTH	18.60'	PIER(S)	4	@	13'±	SKEW
CULVERT	NUM#	TYPE		LENGTH		SIZE	H:		W:	SKEW
DAM	TOP WIDTH			SIDESLOPE	US:		DS:		RISER	
ADDITIONAL COMMENTS:	Located at BNSF mile post 140.2									



Wash Name:	Sunset Wash	ID:	SST_500
Location:	BNSF Railroad Crossing	RS:	0.264
GPS Lat:	GPS Long:		



Wash Name:	Sunset Wash	ID:	SST_500
Location:	BNSF Railroad Crossing	RS:	0.264
GPS Lat:	GPS Long:		



Wash Name:	Sunset Wash	ID:	SST_500
Location:	BNSF Railroad Crossing	RS:	0.264
GPS Lat:	GPS Long:		

View to East, Upstream of Culvert

View to West, Downstream of Culvert

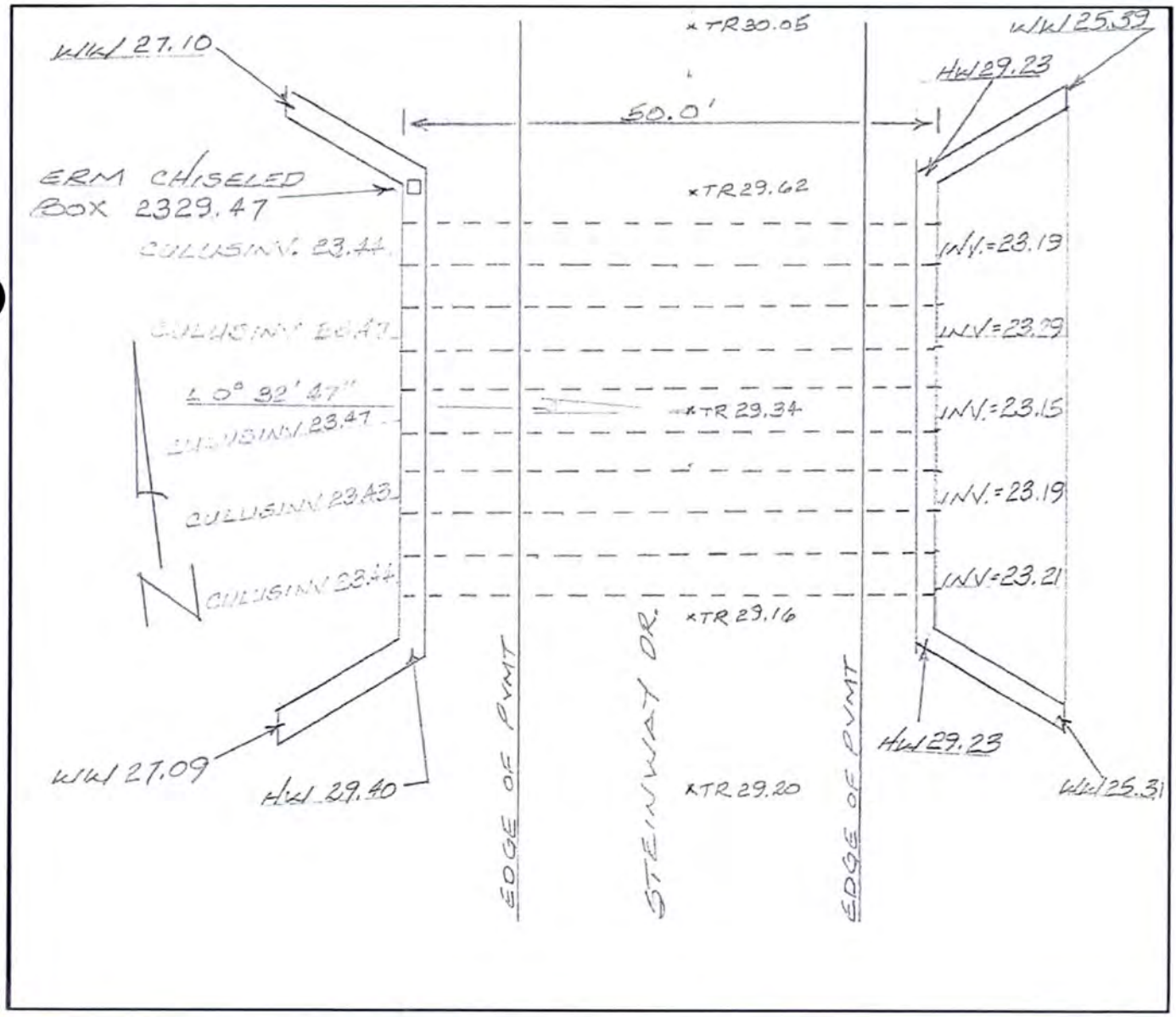
View to Northeast, Downstream of Culvert

View to Southwest, Downstream of Culvert

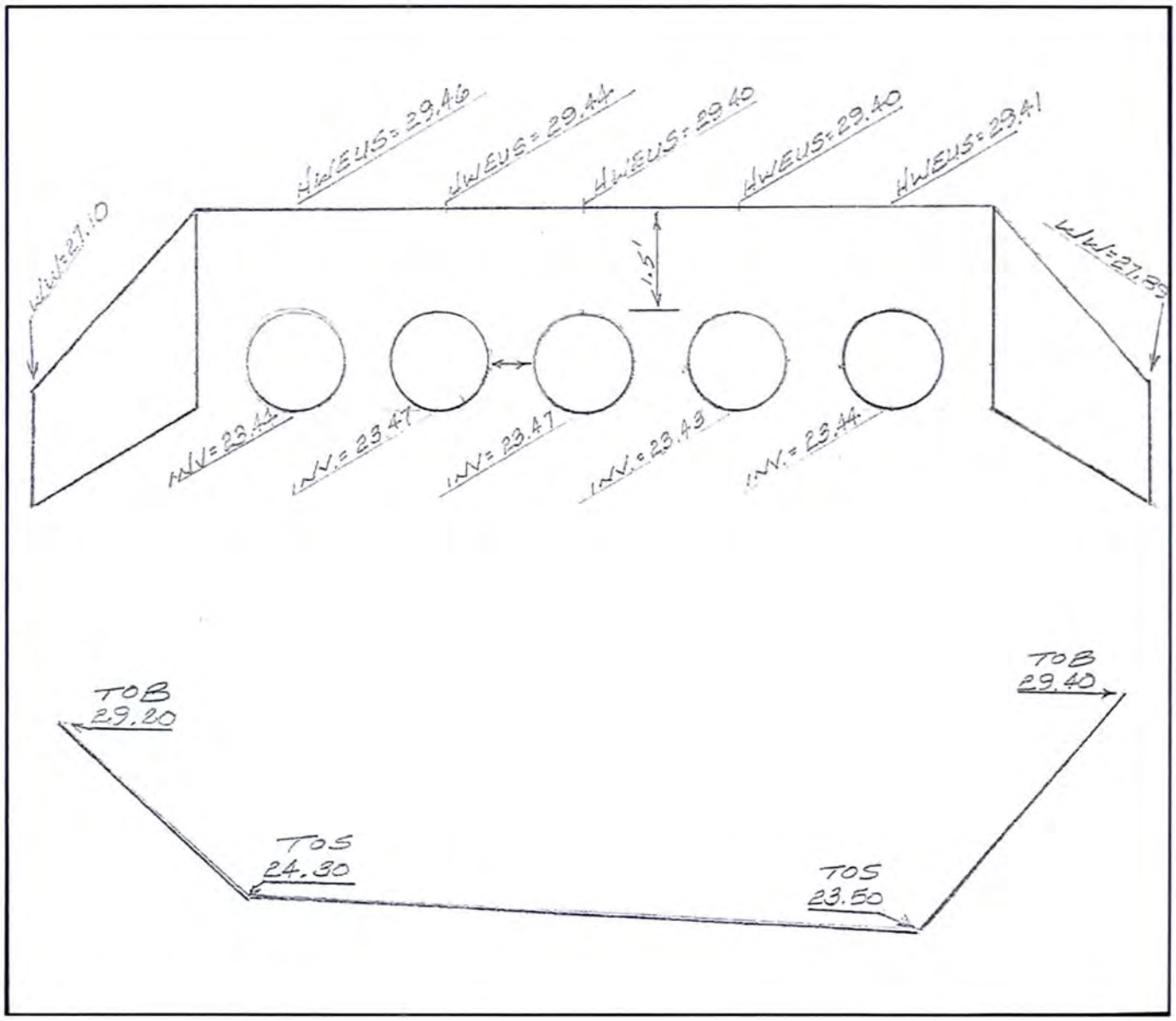
View to North, On Railroad Tracks

Wash Name:	Sunnycove Wash Upper Reach			ID:	SUN_100
Location:	Steinway Drive			RS:	3.100
Benchmark ID:		Elev:	2329.47	PC:	IM:
GPS Lat:		GPS Long:		Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW
CULVERT	NUM#	5	TYPE	RCP	LENGTH	50.0'	SIZE	H:	54"	W:	54"	SKEW
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER		
ADDITIONAL COMMENTS:												



Wash Name:	Sunnycove Wash Upper Reach	ID:	SUN_100
Location:	Steinway Drive	RS:	3.100
GPS Lat:	GPS Long:		



Wash Name:	Sunnycove Wash Upper Reach	ID:	SUN_100
Location:	Steinway Drive	RS:	3.100
GPS Lat:	GPS Long:		

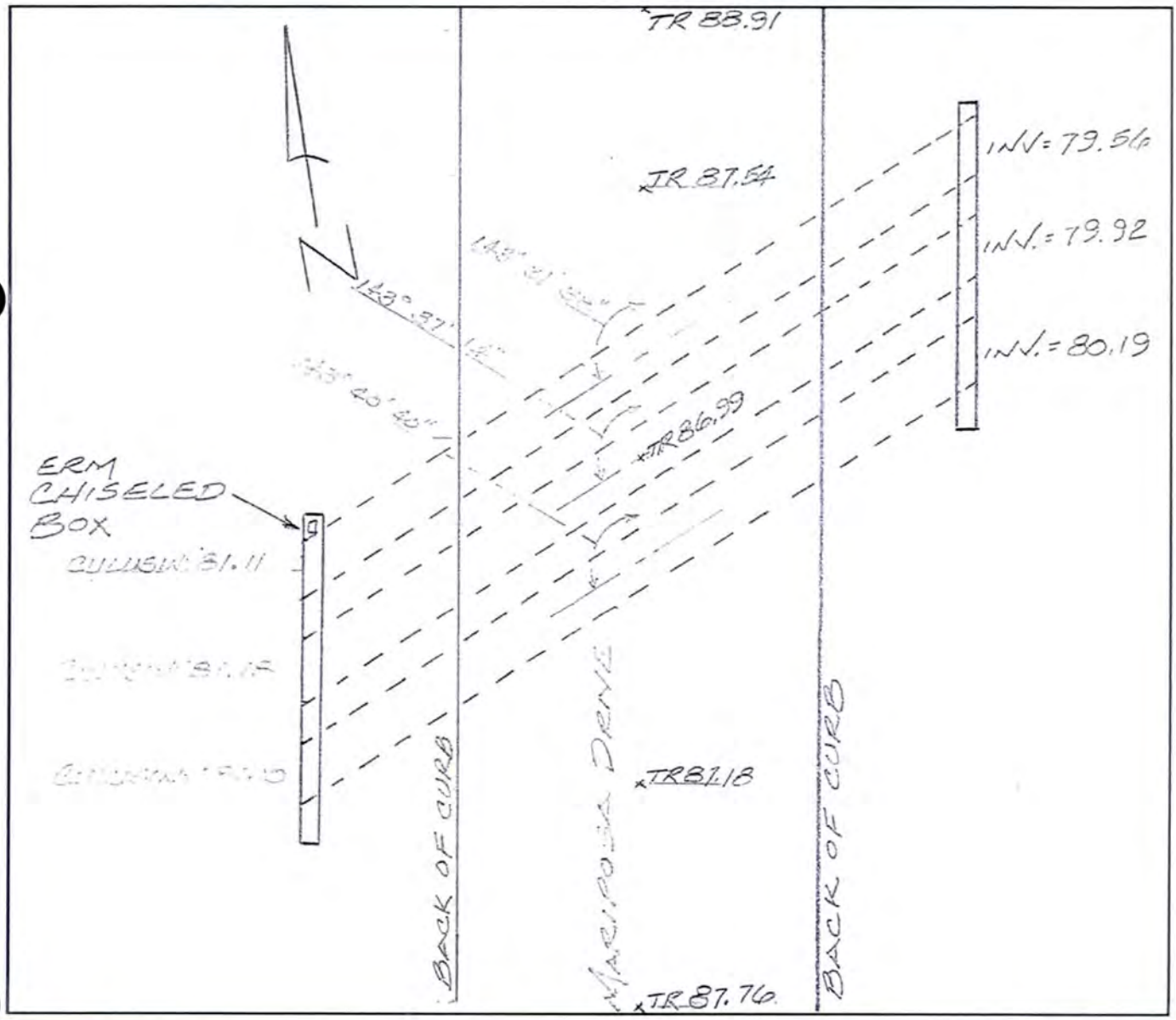
View to East, Upstream of Culvert

View to West, Downstream of Culvert

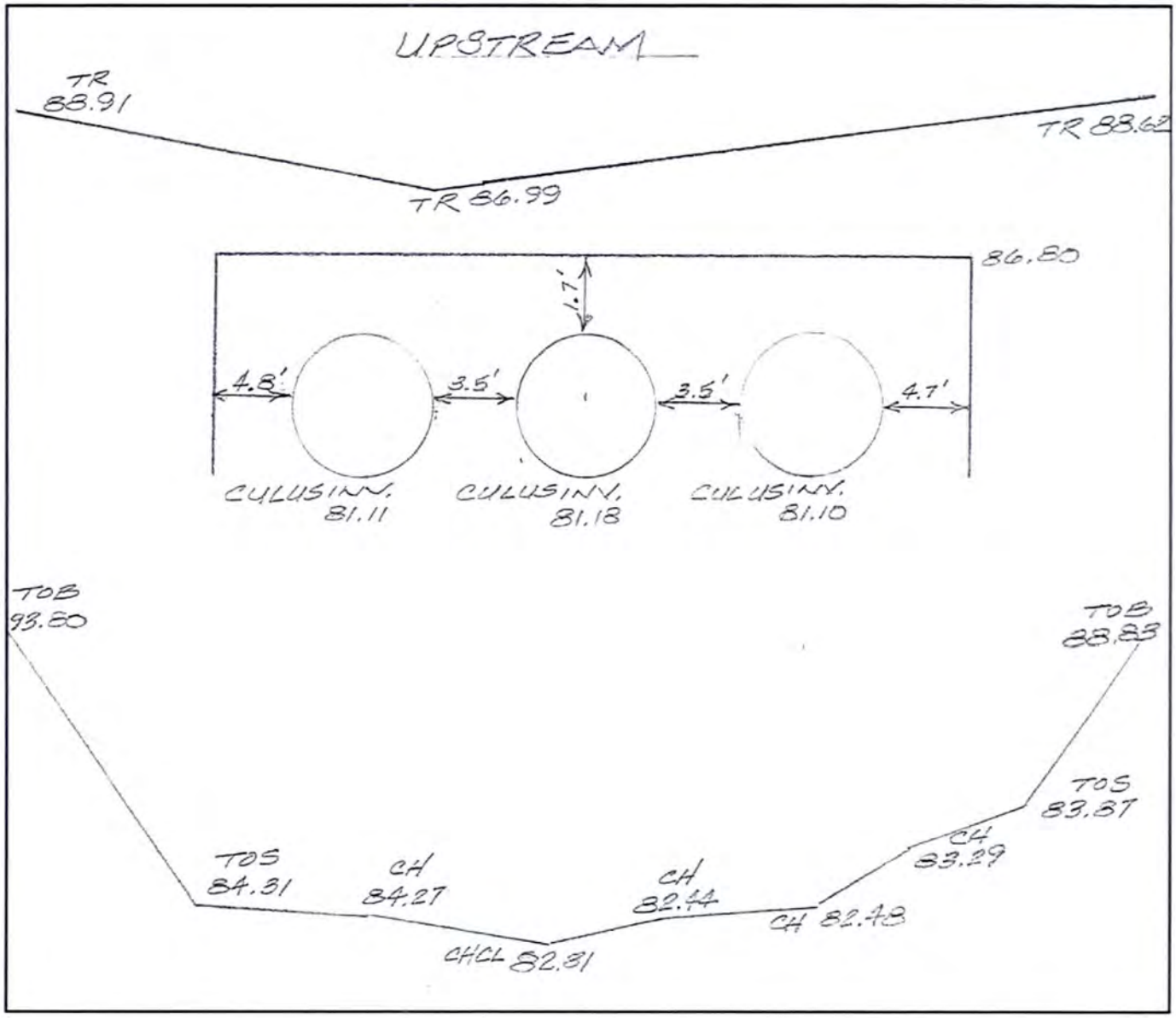
View to North, from Culvert Crossing

Wash Name:	Sunnycove Wash Upper Reach			ID:	SUN_200
Location:	Mariposa Drive			RS:	1.137
Benchmark ID:		Elev:	2186.79	PC:	IM:
GPS Lat:		GPS Long:		Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	3	TYPE	CMP	LENGTH	100.0'	SIZE	H:	48"	W:	48"	SKEW	53° L
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:													



Wash Name:	Sunnycove Wash Upper Reach	ID:	SUN_200
Location:	Mariposa Drive	RS:	1.137
GPS Lat:	GPS Long:		



Wash Name:	Sunnycove Wash Upper Reach	ID:	SUN_200
Location:	Mariposa Drive	RS:	1.137
GPS Lat:	GPS Long:		

View to East, Upstream of Culvert

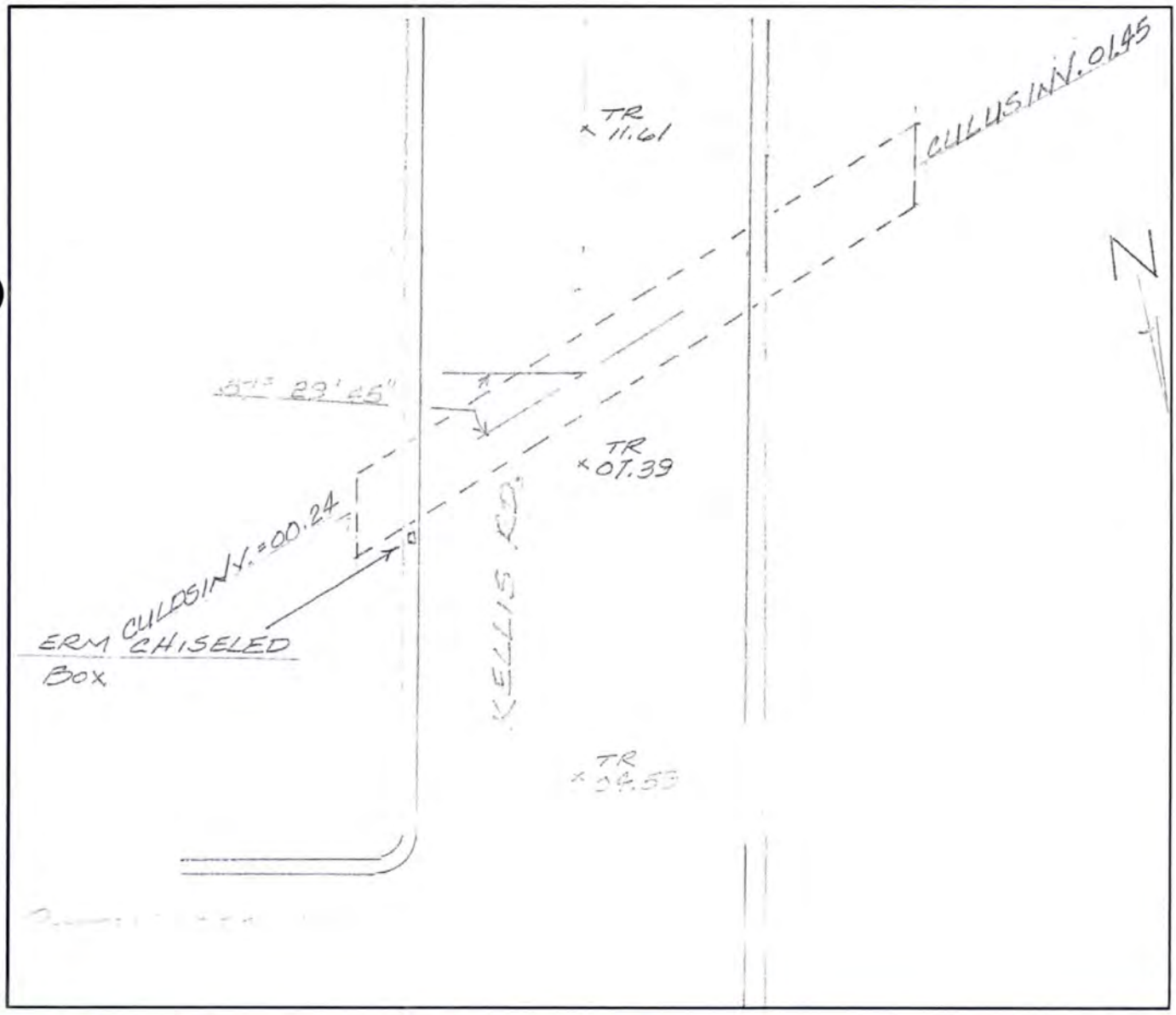
View to West, Downstream of Culvert

View to North, from Culvert Crossing

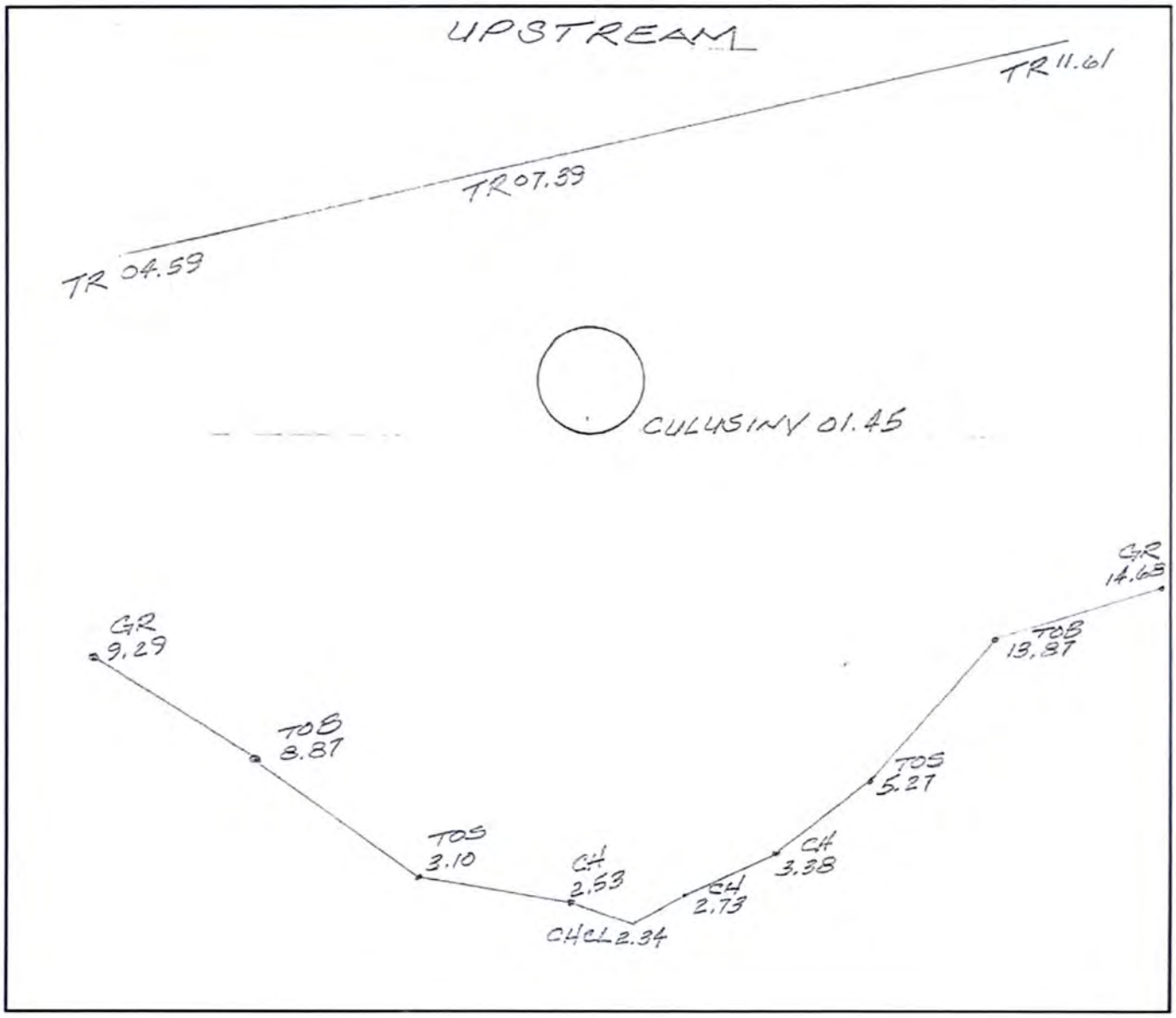
View to South, from Culvert Crossing

Wash Name:	Sunnycove Wash			ID:	SUN_500
Location:	Kellis Road			RS:	0.269
Benchmark ID:		Elev:	2108.45	PC:	IM:
GPS Lat:		GPS Long:		Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	1	TYPE	CMP	LENGTH	79.0'	SIZE	H:	24"	W:	24"	SKEW	37° L
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:			No headwall on either side of culvert										



Wash Name:	Sunnycove Wash	ID:	SUN_500
Location:	Kellis Road	RS:	0.269
GPS Lat:	GPS Long:		



Wash Name:	Sunnycove Wash	ID:	SUN_500
Location:	Kellis Road	RS:	0.269
GPS Lat:	GPS Long:		

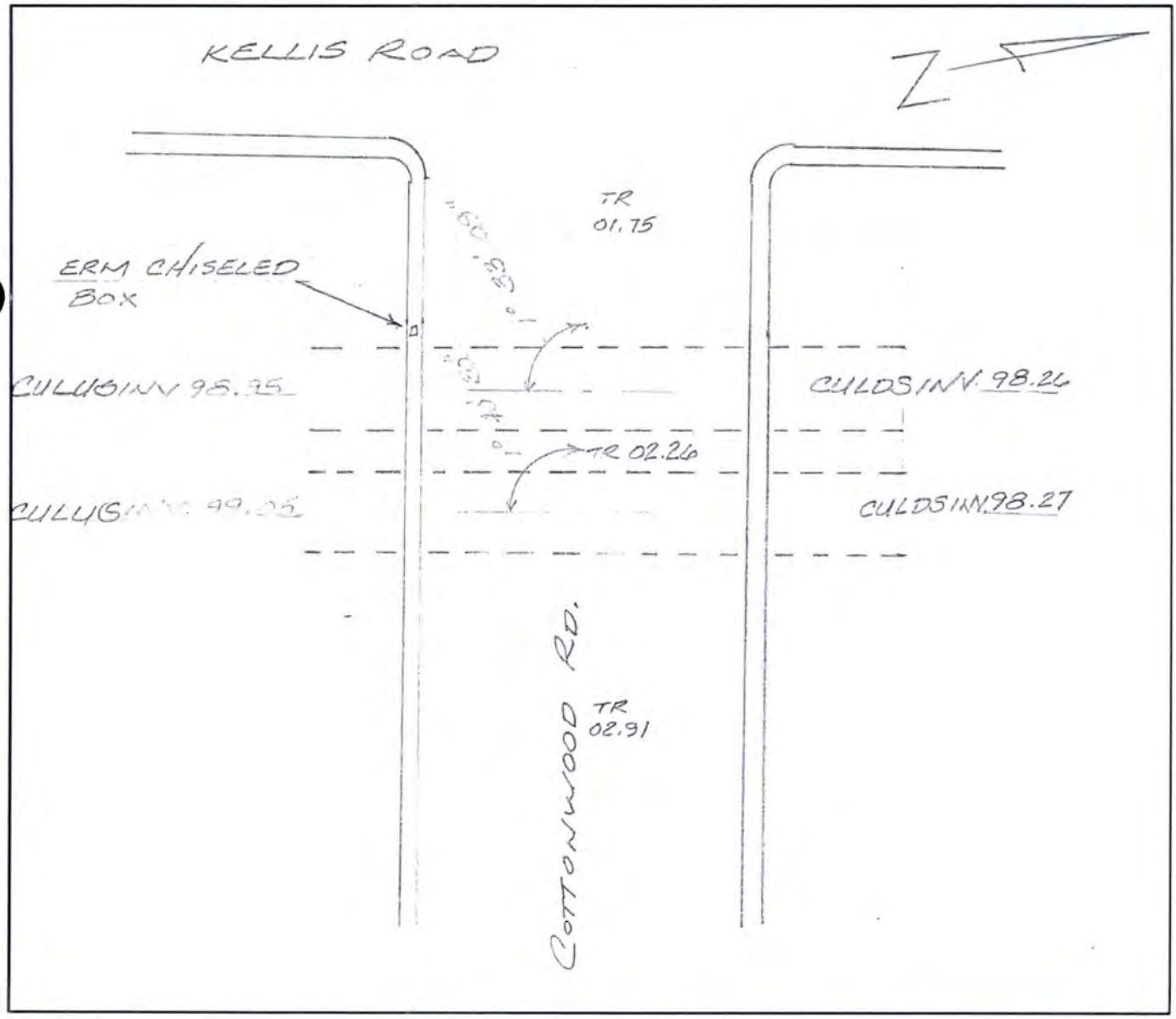
View to East, Upstream of Culvert

View to East, Downstream of Culvert

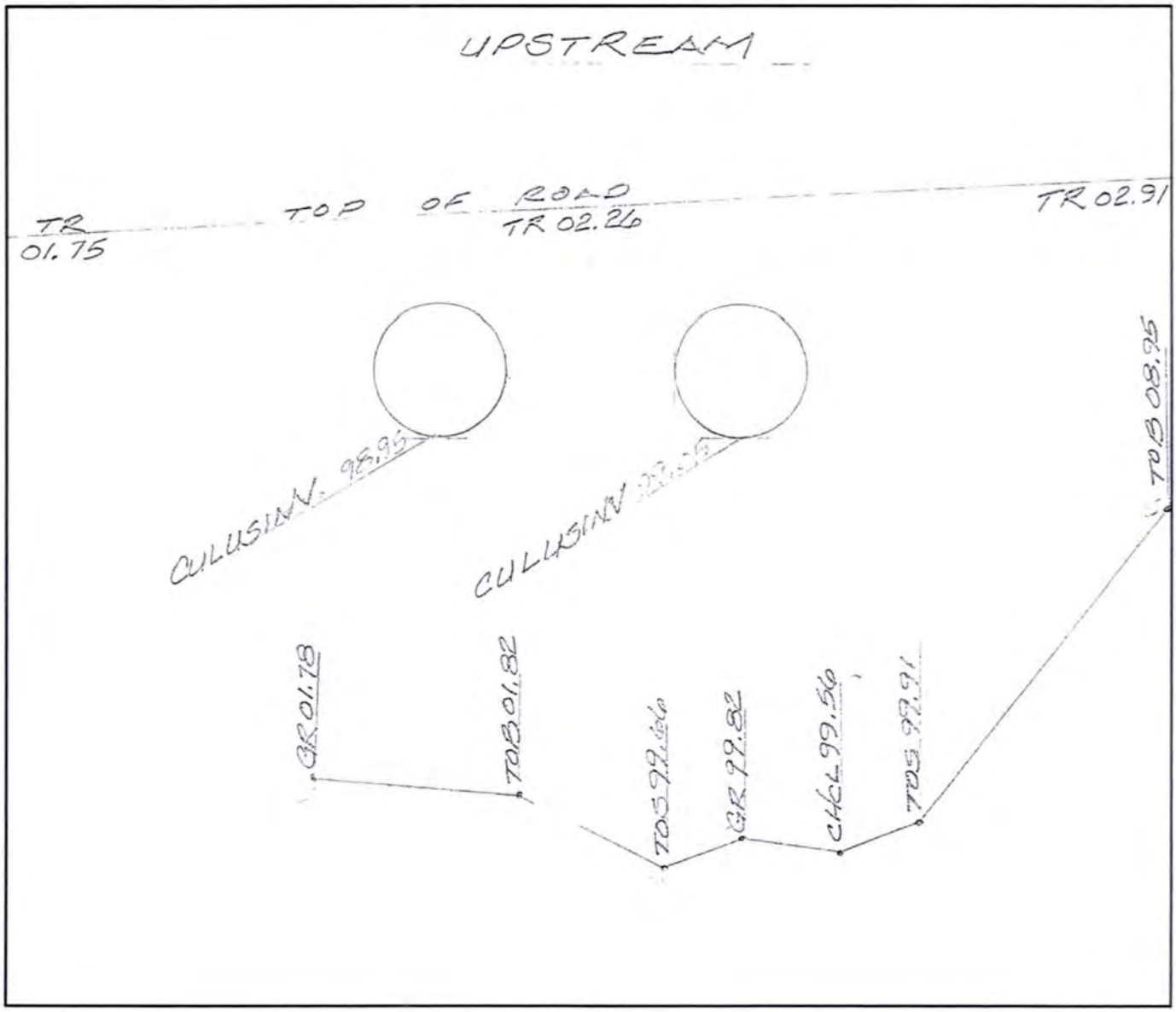
View to North, from Culvert Crossing

Wash Name:	Sunnycove Wash			ID:	SUN_510
Location:	Cottonwood Road			RS:	0.233
Benchmark ID:		Elev:	2102.36	PC:	IM:
GPS Lat:		GPS Long:		Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	2	TYPE	CMP	LENGTH	60.0'	SIZE	H:	24"	W:	24"	SKEW	2° L
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:	No headwall on either side of culvert												



Wash Name:	Sunnycove Wash	ID:	SUN_510
Location:	Cottonwood Road	RS:	0.233
GPS Lat:	GPS Long:		



Wash Name:	Sunnycove Wash	ID:	SUN_510
Location:	Cottonwood Road	RS:	0.233
GPS Lat:	GPS Long:		

View to North, Upstream of Culvert

View to South, Downstream of Culvert

View to West, from Culvert Crossing

APPENDIX C: Finish Floor Survey Field Notes

1-25-11
PERHAM
ZEPPOLA

FLOOD CERT

101 S. MESQUITE #11
TBM GPS PT# 2024
ELEV= 2061.21

ELEV	DESCR.
59.55	L. COR CONC.
59.58	10' L OF L. COR CONC.
59.50	N/G @ R. COR
59.60	N/G 9' R. OF R COR
59.47	WEEP HOLE IN P/W
59.57	T.P.
60.10	F.F.
59.86	F.F. GUEST HOUSE
58.70	WEEP HOLE BK YARD
59.42	POOL DECK
59.07	WEEP HOLE CTR E WALL
59.13	" " SE COR

166 MESQUITE #9
TBM 2061.21

62.00	N/G 6' L. OF L. COR
61.96	" @ L. COR.
62.72	F.F.
62.40	N/G @ R. COR
62.40	" 5' R. OF R. COR

40½ S. MESQUITE
TBM 2061.21

61.80	T.P.
59.92	FF
59.65	N/G @ ENT
59.80	N/G 20' R OF R COR
TP	60.00
60.00	N/G @ L COR
60.20	N/G 10' L OF L COR

36 S MESQUITE
TBM 2061.21

63.56 F.F.
63.40 N/G 5' R. OF R. COR
63.20 N/G @ R. COR.
62.90 N/G @ L. COR
62.60 N/G 15' L OF L. COR.

INT. PARK ST & SYLVAN RD.
FD MK W/TAG LS# 24513
3 MIN OBSERVATION
GPS ELE 2052.90

209 SYLVAN RD
TBM 2052.90

56.18 FF
54.70 15' R OF R COR
54.70 N/G @ R COR
54.20 N/G @ L COR
53.60 N/G 15' L OF L. COR

229 SYLVAN RD.

53.40 10' R. OF R COR
53.20 N/G @ R COR
53.48 F.F.
52.40 N/G @ L COR
52.40 N/G 10' L. OF L. COR

TC 50.63

249 SYLVAN RD
52.30 N/G 10 R OF R COR
52.10 N/G @ R COR
52.36 CARPORT R
52.48 " L

249 SYLVAN CONT.

52.52 FF
51.40 N/G L. COR.
51.20 N/G 8' L. OF L. COR.

49.45 T.P.

269 SYLVAN

51.30 N/G 12' R OF R COR
51.30 N/G @ R COR
51.45 FF
50.90 N/G @ L COR
50.00 N/G 10' L OF L COR

52.91 ✓ TBM
46.20 T.P.
45.75 T.P

311 SYLVAN

46.50 N/G 10' R OF R. COR
46.90 N/G @ R COR
47.37 FF
46.80 N/G @ L COR
46.80 N/G L OF L. COR.
47.05 CARPORT BK
46.99 " FRT
47.12 " R.
46.98 " L

159 PARK
TBM 2052.90

52.70 N/G 4' R OF R.COR
52.90 N/G @ R COR
54.04 FF
53.90 N/G @ L COR
53.90 N/G 8' L OF L COR

139	PARK		
53.90	N/G 12' R OF R COR		
53.80	N/G R COR		
54.93	FF		
N/A	N/G L COR		
	N/G L OF L COR		
53.88	CARPORT	BK	
53.80	"	FRT	
167	HENDERSON		
TBM	2061.21		
64.47	N/G 8' R OF R COR		
64.70	N/G @ R COR		
65.73	FF		
64.30	N/G L COR		
64.20	N/G 6' L. OF L COR		
64.89	CONC R SIDE		
65.00	CONC, R COR		

43 MESQUITE
TBM 2061.21

60.60 N/G 5' R OF R COR
60.70 N/G @ R COR
61.39 FF
60.80 N/G @ L COR
61.10 N/G 10' L OF L COR

TBM 2150.07
870 AMERICA ROAD

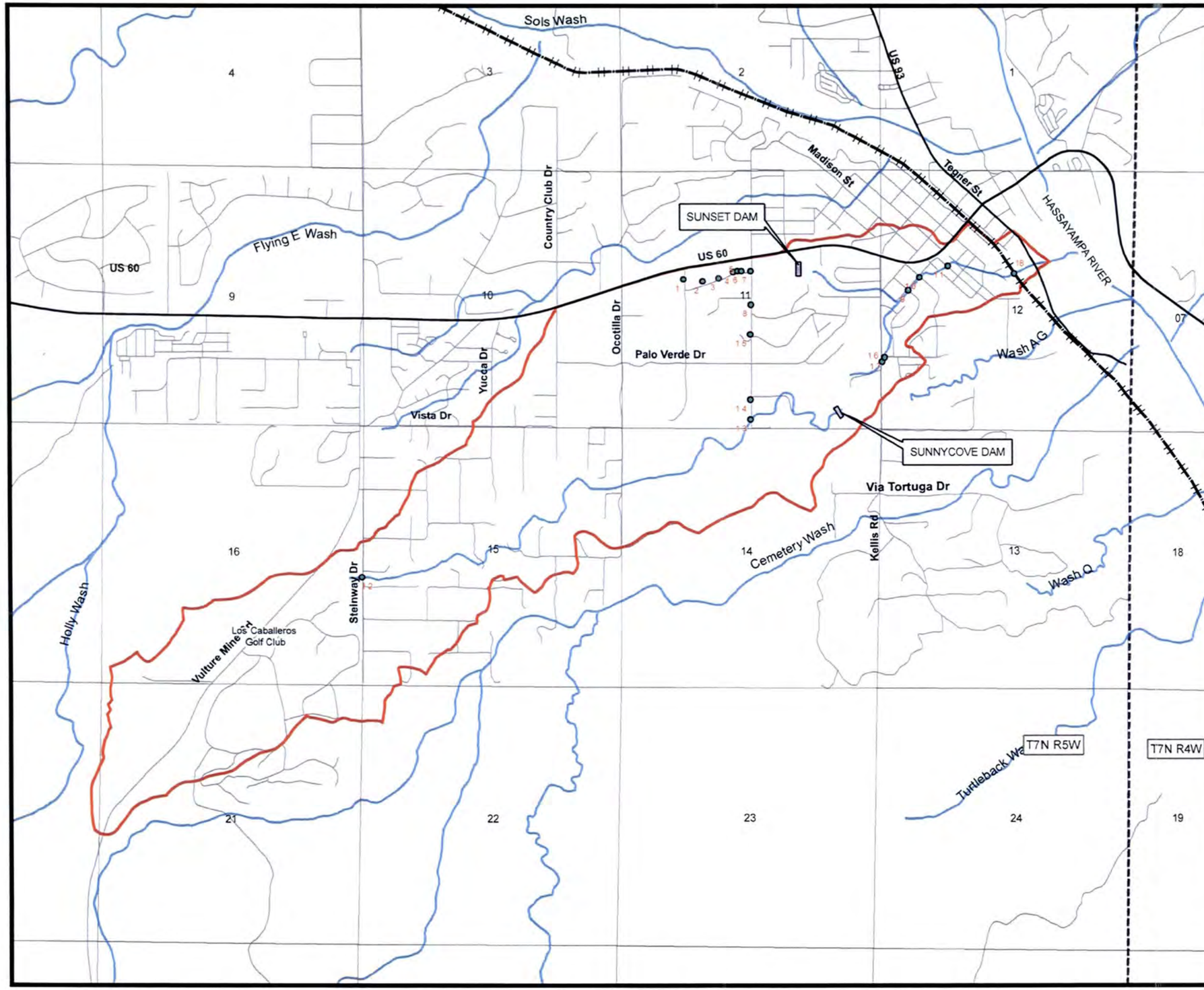
FF = 49.78

860 AMERICA ROAD

FF = 43.26

850 AMERICA ROAD

FF = 4731



Legend

- Phase I Watershed Boundary
- Wash Flowline
- Railroad
- Dam
- Township and Range
- Sections
- Phase 1 Structures

PHASE 1
SURVEYED STRUCTURES

1 - SST_100
2 - SST_110
3 - SST_120
4 - SST_130
5 - SST_140
6 - SST_150
7 - SST_160
8 - SST_170
9 - SST_200
10 - SST_300
11 - SST_400
12 - SUN_100
13 - SUN_200
14 - SUN_300
15 - SUN_400
16 - SUN_500
17 - SUN_510
18 - SST_500

N

0 500 1,000 2,000 Feet
1 in = 2,000 ft

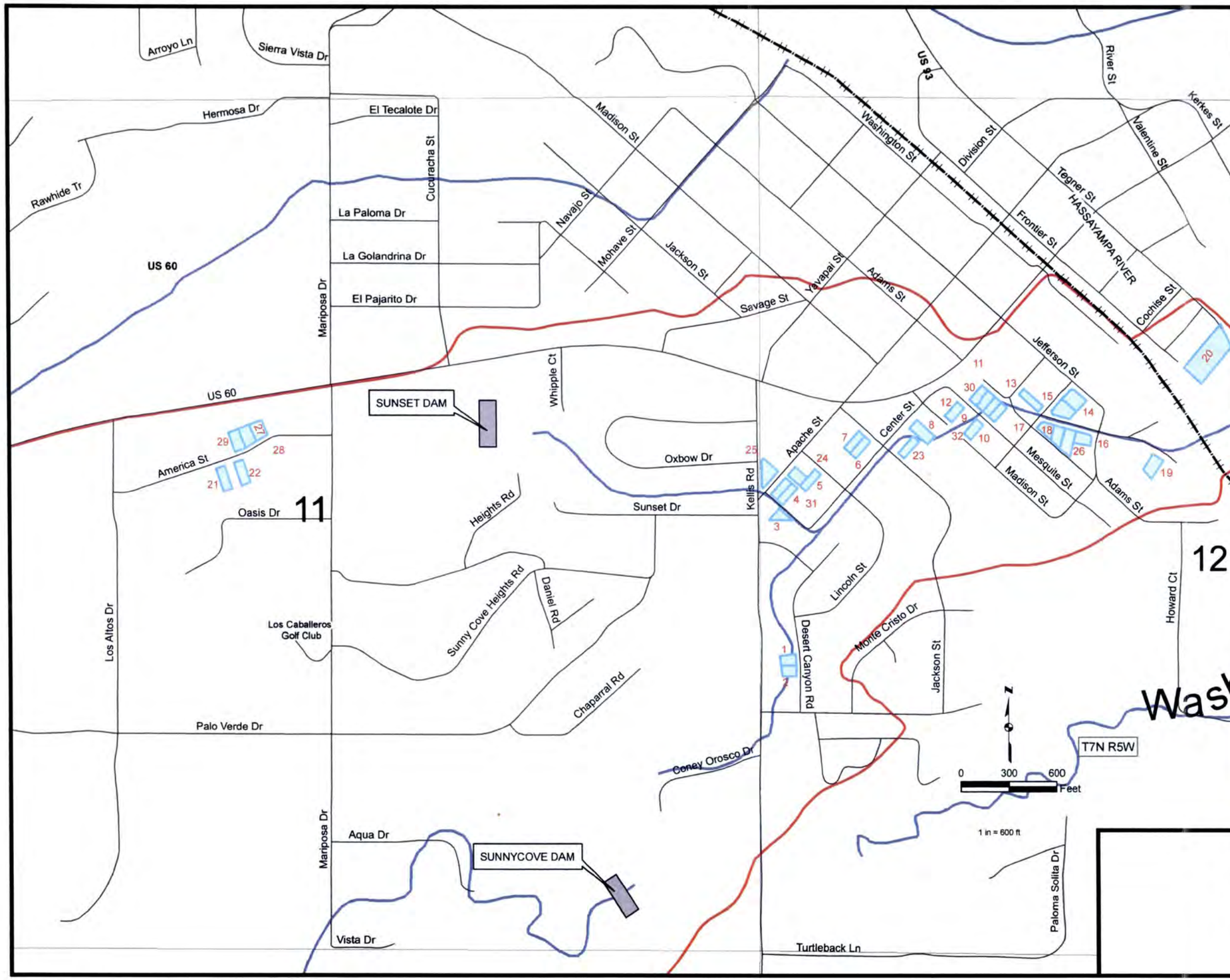
Hoskin • Ryan Consultants, Inc.
6245 N. 24th Parkway #100 Phoenix, AZ 85016
Office: (602) 252.8384 Fax: (602) 252.8385

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

WICKENBURG
AREA DRAINAGE MASTER STUDY / PLAN

F.C.D. Contract No. 2009-C030

FIGURE 7: SURVEYED STRUCTURE
LOCATION MAP



Legend

- Phase I Watershed Boundary
- Wash Flowline
- Railroad
- Dam
- Township and Range
- Sections
- Phase 1 FFE Lot

PHASE 1
SURVEYED STRUCTURES
1-640 S DESERT CANYON RD
2-650 DESERT CANYON RD
3-85 GRAND ST
4-83 N GRANT ST
5-23616 N 185TH AVE
6-46 N JACKSON ST
7-46 N JACKSON ST
8-P O BOX 1595
9-869 PHILLIPS ST
10-166 S MESQUITE ST
11-P O BOX 546
12-101 S MESQUITE ST
13-P O BOX 1117
14-139 PARK ST
15-159 PARK ST
16-269 SYLVAN RD
17-2084 MEADOW BROOK RD
18-545 N JACKSON
19-P O BOX 896
20-501 S TEGNER ST
21-P O BOX 3223
22-BOX 1859
23-139 S JACKSON ST
24-PO BOX 375
25-P O BOX 1394
26-PO BOX 893
27-PO BOX 1360
28-PO BOX 1193
29-715 KELLIS RD
30-PO BOX 132
31-83 N GRANT ST
32-101 S MESQUITE ST

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FLOOD CONTROL DISTRICT
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WICKENBURG
AREA DRAINAGE MASTER STUDY / PLAN

F.C.D. Contract No. 2009-C030

FIGURE 8: FINISH FLOOR ELEVATION CHECK
LOCATION MAP

Appendix D: Hydrologic Analysis Supporting Documentation

D.1 Precipitation Data

D.2 Physical Parameter Calculations

D.3 Hydrograph Routing Data

D.4 Reservoir Routing Data

D.5 Flow Splits and Diversions Data

D.6 Hydrologic Calculations

D.7 Verification

D.1 PRECIPITATION DATA

ID	Method	Duration	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
DEFAULT	NOAA14	5 MIN	0.318	0.432	0.516	0.630	0.715	0.801
	NOAA14	10 MIN	0.484	0.657	0.786	0.959	1.088	1.220
	NOAA14	15 MIN	0.601	0.815	0.974	1.189	1.349	1.512
	NOAA14	30 MIN	0.809	1.098	1.312	1.601	1.817	2.036
	NOAA14	1 HOUR	1.001	1.358	1.624	1.981	2.249	2.520
	NOAA14	2 HOUR	1.118	1.500	1.791	2.184	2.485	2.802
	NOAA14	3 HOUR	1.179	1.555	1.854	2.274	2.609	2.958
	NOAA14	6 HOUR	1.417	1.825	2.146	2.598	2.949	3.319
	NOAA14	12 HOUR	1.664	2.119	2.478	2.969	3.354	3.746
	NOAA14	24 HOUR	1.932	2.464	2.890	3.481	3.940	4.422

The 6-hour duration NOAA 14 precipitation for the 2-, 5-, 10-, 25-, 50- and 100-year events.
Extracted from DDMSW version 4.6.0.

ID	Method	Duration	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
DEFAULT	NOAA14	5 MIN	0.318	0.432	0.516	0.630	0.715	0.801
	NOAA14	10 MIN	0.484	0.657	0.786	0.959	1.088	1.220
	NOAA14	15 MIN	0.601	0.815	0.974	1.189	1.349	1.512
	NOAA14	30 MIN	0.809	1.098	1.312	1.601	1.817	2.036
	NOAA14	1 HOUR	1.001	1.358	1.624	1.981	2.249	2.520
	NOAA14	2 HOUR	1.118	1.500	1.791	2.184	2.485	2.802
	NOAA14	3 HOUR	1.179	1.555	1.854	2.274	2.609	2.958
	NOAA14	6 HOUR	1.417	1.825	2.146	2.598	2.949	3.319
	NOAA14	12 HOUR	1.664	2.119	2.478	2.969	3.354	3.746
	NOAA14	24 HOUR	1.932	2.464	2.890	3.481	3.940	4.422

The 24-hour duration NOAA 14 precipitation for the 2-, 5-, 10-, 25-, 50- and 100-year events.
Extracted from DDMSW version 4.6.0.

Centroid of Phase I study area

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Arizona 33.953072 N 112.758409 W 237 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 1, Version 4
G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006

Extracted: Sun Jan 16 2011

Confidence Limits | Seasonality | Related Info | GIS data | Maps | Docs | Return to State Map

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.24	0.37	0.46	0.62	0.76	0.86	0.92	1.11	1.31	1.52	1.59	1.86	2.11	2.32	2.88	3.34	3.93	4.39
2	0.32	0.48	0.60	0.80	0.99	1.11	1.17	1.41	1.65	1.92	2.02	2.35	2.66	2.94	3.65	4.24	4.99	5.59
5	0.43	0.65	0.81	1.09	1.35	1.49	1.54	1.81	2.10	2.45	2.60	3.01	3.40	3.75	4.63	5.39	6.37	7.14
10	0.51	0.78	0.97	1.30	1.61	1.78	1.84	2.13	2.45	2.87	3.05	3.52	3.98	4.38	5.34	6.24	7.40	8.27
25	0.63	0.95	1.18	1.59	1.97	2.17	2.25	2.58	2.94	3.45	3.67	4.23	4.76	5.22	6.25	7.35	8.73	9.71
50	0.71	1.08	1.34	1.80	2.23	2.47	2.59	2.92	3.32	3.91	4.16	4.79	5.38	5.88	6.92	8.16	9.72	10.77
100	0.80	1.21	1.50	2.02	2.50	2.78	2.93	3.29	3.70	4.38	4.66	5.36	6.00	6.54	7.58	8.96	10.70	11.80
200	0.88	1.35	1.67	2.25	2.78	3.10	3.30	3.67	4.10	4.87	5.17	5.95	6.64	7.22	8.21	9.75	11.66	12.81
500	1.00	1.52	1.89	2.54	3.14	3.52	3.81	4.20	4.63	5.54	5.87	6.75	7.50	8.12	9.03	10.76	12.90	14.10
1000	1.09	1.65	2.05	2.76	3.42	3.85	4.22	4.61	5.05	6.07	6.41	7.38	8.17	8.82	9.63	11.52	13.83	15.05

* These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

The 250-year precipitations were interpolated as 3.76 inches for 6-hour duration and 4.98 inches for 24-hour duration.

50	0.97	1.48	1.84	2.48	3.07	3.23	3.39	3.70	4.09	4.54	4.77	5.28	5.95	6.48	7.56	8.98	10.71	11.82
100	1.10	1.68	2.08	2.80	3.46	3.62	3.81	4.14	4.58	5.10	5.36	5.92	6.63	7.22	8.29	9.87	11.80	12.98
200	1.23	1.87	2.32	3.12	3.86	4.02	4.28	4.62	5.06	5.67	5.95	6.58	7.34	7.97	8.99	10.75	12.89	14.12
500	1.38	2.10	2.61	3.51	4.35	4.60	4.91	5.30	5.74	6.49	6.82	7.49	8.31	8.98	9.90	11.90	14.31	15.59
1000	1.51	2.29	2.84	3.83	4.74	5.06	5.44	5.86	6.29	7.12	7.50	8.20	9.08	9.78	10.58	12.77	15.36	16.69

* The **upper** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **greater** than.
** These precipitation frequency estimates are based on a partial duration series. **ARI** is the Average Recurrence Interval.

Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

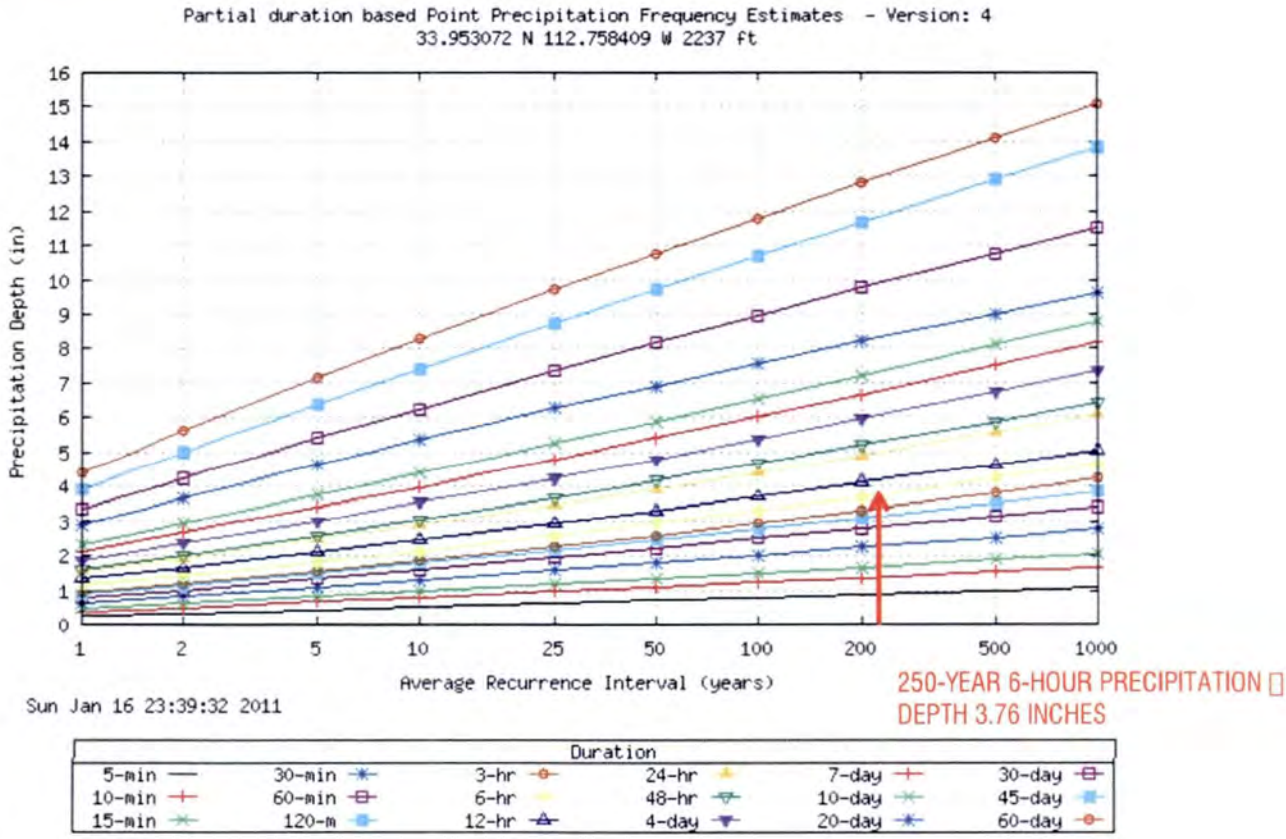
*** Lower bound of the 90% confidence interval**
Precipitation Frequency Estimates (inches)

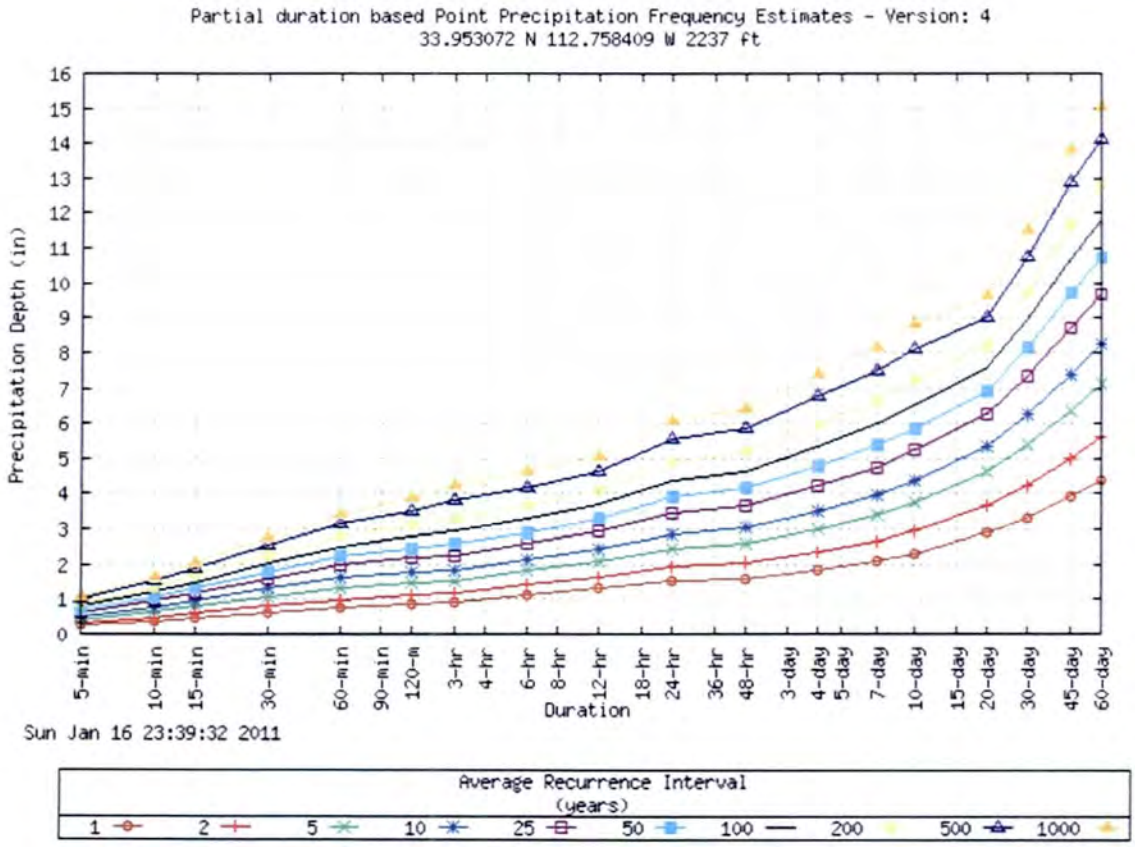
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.19	0.29	0.36	0.48	0.59	0.69	0.76	0.92	1.10	1.34	1.39	1.69	1.91	2.10	2.63	3.03	3.56	4.00
2	0.25	0.37	0.46	0.62	0.77	0.89	0.96	1.16	1.38	1.69	1.76	2.13	2.41	2.65	3.33	3.85	4.53	5.08
5	0.33	0.51	0.63	0.84	1.04	1.18	1.26	1.48	1.75	2.15	2.26	2.72	3.07	3.39	4.21	4.88	5.77	6.48
10	0.39	0.60	0.74	1.00	1.24	1.39	1.49	1.73	2.03	2.50	2.64	3.18	3.58	3.95	4.86	5.65	6.69	7.50
25	0.47	0.72	0.89	1.20	1.49	1.68	1.80	2.07	2.40	2.97	3.17	3.81	4.27	4.70	5.67	6.64	7.87	8.78
50	0.53	0.81	1.00	1.35	1.67	1.89	2.03	2.32	2.69	3.32	3.55	4.29	4.81	5.27	6.26	7.36	8.74	9.72
100	0.59	0.90	1.11	1.50	1.85	2.10	2.26	2.56	2.96	3.67	3.95	4.78	5.33	5.83	6.83	8.06	9.58	10.63
200	0.64	0.98	1.21	1.63	2.02	2.31	2.50	2.81	3.22	4.03	4.32	5.27	5.86	6.41	7.38	8.74	10.40	11.49
500	0.71	1.08	1.34	1.81	2.23	2.55	2.80	3.12	3.56	4.49	4.82	5.92	6.57	7.15	8.08	9.59	11.44	12.56
1000	0.76	1.16	1.43	1.93	2.39	2.73	3.03	3.35	3.79	4.83	5.18	6.43	7.10	7.71	8.56	10.21	12.20	13.33

* The **lower** bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are **less** than.

** These precipitation frequency estimates are based on a partial duration maxima series. **ARI** is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

Text version of tables





Related Information

Maps & Aerials

Click here to see topographic maps and aerial photographs available for this location from Microsoft Research Maps

Watershed/Streamflow Information

Click here to see watershed and streamflow information available for this location from the U.S. Environmental Protection Agency's site

Climate Data Sources

National Climatic Data Center (NCDC) database

Locate NCDC climate stations within:

+/-30 minutes or +/-1 degree of this location. Digital ASCII data can be obtained directly from **NCDC**.

Note: Precipitation frequency results are based on analysis of precipitation data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to the matching documentation available at the PF Document page

Natural Resources Conservation Service's (NRCS) SNOTEL dataset

At present, there are more than 700 SNOTEL sites typically located in the mountainous regions of the Western U.S. that report daily and/or hourly precipitation, air temperture, snow water equivalent and snow depth data.

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910
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Disclaimer

D.2 PHYSICAL PARAMETER CALCULATIONS

Sub-basin Parameters

Number of pages: 1

Flood Control District of Maricopa County
Drainage Design Management System
SUB BASINS
Project Reference: WICKENBURG EX 6HR

1/25/2011

Area ID	Sub Basin Parameters								Rainfall Losses				
	Area (sq mi)	Length (mi)	Slope (ft/mi)	S-Graph	Lca (mi)	Lag (min)	Velocity (f/s)	Kn	IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)
Major Basin ID: 01													
SN1	0.601	2.38	101.3	MOUNTAIN	1.14	29.80	7.04	0.034	0.19	0.39	6.00	0.19	18
SN2	0.255	1.58	126.5	Mountain	0.80	21.40	6.53	0.034	0.20	0.40	6.00	0.18	7
SN3	0.223	1.27	96.3	Mountain	0.51	14.40	7.79	0.028	0.22	0.35	5.20	0.29	39
SC1	0.562	1.67	104.0	Mountain	0.73	24.40	6.01	0.038	0.18	0.34	6.60	0.16	9
SC2	0.100	0.63	129.1	Mountain	0.28	10.30	5.35	0.035	0.20	0.37	6.60	0.15	8
SC3	0.197	1.15	108.7	Mountain	0.56	18.00	5.62	0.036	0.19	0.37	6.40	0.16	7
SC4	0.384	2.00	107.3	Mountain	1.06	29.20	6.03	0.037	0.20	0.35	7.00	0.12	22
SC5	0.150	0.90	198.4	Mountain	0.49	15.50	5.13	0.040	0.21	0.38	6.40	0.15	30
SC6	0.114	0.66	187.1	Mountain	0.33	10.50	5.56	0.035	0.25	0.38	6.40	0.16	13

* Non default value

Sub-basin Land Use

Flood Control District of Maricopa County
Drainage Design Management System
LAND USE
Project Reference: WICKENBURG EX 6HR

1/25/2011

Sub Basin	Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kn
Major Basin ID: 01								
SC1	111	0.051	9.1	0.20	5	30.0	DRY	0.035
	511	0.068	12.1	0.20	20	40.0	DRY	0.035
	551	0.003	0.5	0.10	20	25.0	DRY	0.030
	720	0.101	17.9	0.10	5	90.0	NORMAL	0.030
	731	0.062	11.0	0.20	0	30.0	DRY	0.050
	910	0.009	1.7	0.20	0	30.0	DRY	0.030
	940	0.269	47.8	0.20	0	25.0	DRY	0.040
		0.563	**100.1**					
SC2	111	0.079	78.6	0.20	5	30.0	DRY	0.035
	731	0.001	1.4	0.20	0	30.0	DRY	0.050
	910	0.011	10.6	0.20	0	30.0	DRY	0.030
	940	0.009	9.4	0.20	0	25.0	DRY	0.040
		0.101	**100.0**					
SC3	111	0.123	62.7	0.20	5	30.0	DRY	0.035
	551	0.001	0.7	0.10	20	25.0	DRY	0.030
	720	0.014	7.2	0.10	5	90.0	NORMAL	0.030
	731	0.012	5.9	0.20	0	30.0	DRY	0.050
	910	0.010	5.0	0.20	0	30.0	DRY	0.030
	940	0.037	18.6	0.20	0	25.0	DRY	0.040
		0.197	**100.1**					
SC4	111	0.181	47.3	0.20	5	30.0	DRY	0.035
	552	0.001	0.2	0.30	10	30.0	DRY	0.040
	910	0.014	3.6	0.20	0	30.0	DRY	0.030
	940	0.188	48.9	0.20	0	25.0	DRY	0.040
		0.384	**100.0**					
SC5	111	0.006	4.1	0.20	5	30.0	DRY	0.035
	552	0.012	7.7	0.30	10	30.0	DRY	0.040
	940	0.132	88.1	0.20	0	25.0	DRY	0.040
		0.150	**99.9**					
SC6	111	0.036	32.0	0.20	5	30.0	DRY	0.035
	131	0.006	4.9	0.30	20	35.0	DRY	0.030
	151	0.017	15.3	0.25	30	30.0	DRY	0.025
	533	0.002	1.7	0.10	80	75.0	DRY	0.020
	552	0.046	40.6	0.30	10	30.0	DRY	0.040
	910	0.005	4.7	0.20	0	30.0	DRY	0.030
	940	0.001	0.8	0.20	0	25.0	DRY	0.040
		0.114	**100.0**					
SN1	111	0.405	67.4	0.20	5	30.0	DRY	0.035
	131	0.016	2.6	0.30	20	35.0	DRY	0.030
	172	0.001	0.2	0.10	80	50.0	DRY	0.020
	173	0.007	1.1	0.25	10	50.0	DRY	0.035
	210	0.032	5.3	0.10	80	65.0	NORMAL	0.020
	311	0.002	0.4	0.10	80	50.0	DRY	0.020
	410	0.001	0.1	0.10	80	75.0	NORMAL	0.020
	531	0.001	0.1	0.10	80	75.0	DRY	0.020
	532	0.012	2.0	0.15	40	40.0	DRY	0.025
	533	0.009	1.4	0.10	80	75.0	DRY	0.020
	551	0.002	0.3	0.10	20	25.0	DRY	0.030
	731	0.018	2.9	0.20	0	30.0	DRY	0.050
	910	0.037	6.2	0.20	0	30.0	DRY	0.030
	920	0.000	0.1	0.20	50	30.0	DRY	0.020
	930	0.011	1.8	0.20	0	25.0	DRY	0.025
	940	0.048	8.0	0.20	0	25.0	DRY	0.040
		0.601	**99.9**					
SN2	111	0.196	76.8	0.20	5	30.0	DRY	0.035
	131	0.007	2.7	0.30	20	35.0	DRY	0.030

* Non default value

Sub Basin	Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kn
Major Basin ID: 01								
SN2	151	0.008	3.3	0.25	30	30.0	DRY	0.025
	210	0.001	0.4	0.10	80	65.0	NORMAL	0.020
	410	0.000	0.2	0.10	80	75.0	NORMAL	0.020
	533	0.002	0.7	0.10	80	75.0	DRY	0.020
	552	0.001	0.4	0.30	10	30.0	DRY	0.040
	711	0.002	0.6	0.25	5	90.0	NORMAL	0.035
	731	0.000		0.20	0	30.0	DRY	0.050
	910	0.023	8.9	0.20	0	30.0	DRY	0.030
	920	0.001	0.2	0.20	50	30.0	DRY	0.020
	940	0.015	6.0	0.20	0	25.0	DRY	0.040
		0.255	**100.2**					
SN3	111	0.003	1.5	0.20	5	30.0	DRY	0.035
	131	0.022	9.9	0.30	20	35.0	DRY	0.030
	151	0.098	44.1	0.25	30	30.0	DRY	0.025
	171	0.004	1.8	0.25	45	50.0	DRY	0.025
	172	0.009	4.2	0.10	80	50.0	DRY	0.020
	210	0.026	11.7	0.10	80	65.0	NORMAL	0.020
	311	0.007	3.2	0.10	80	50.0	DRY	0.020
	410	0.005	2.0	0.10	80	75.0	NORMAL	0.020
	512	0.003	1.4	0.10	80	30.0	DRY	0.020
	521	0.004	1.6	0.29	45	50.0	NORMAL	0.025
	531	0.003	1.5	0.10	80	75.0	DRY	0.020
	533	0.007	3.1	0.10	80	75.0	DRY	0.020
	541	0.001	0.4	0.10	80	50.0	DRY	0.020
	550	0.000	0.1	0.10	80	75.0	NORMAL	0.020
	711	0.003	1.5	0.25	5	90.0	NORMAL	0.035
	750	0.007	3.2	0.50	0	85.0	NORMAL	0.100
	910	0.006	2.5	0.20	0	30.0	DRY	0.030
	920	0.002	0.7	0.20	50	30.0	DRY	0.020
	940	0.013	5.7	0.20	0	25.0	DRY	0.040
		0.223	**100.1**					

New Categories Added to Default Land Use Table of DDMSW

New categories were added to the default land use table of the DDMSW program in order to adjust parameters in line with observations from the aerial photographs as follows:

- Add six new categories to the Residential group: Category 111 for Rural Residential, Category 131 for Large Lot Residential, Category 151 for Small Lot Residential, Categories 171, 172 and 173 for Medium Density Residential. The Medium Density Residential varies dramatically in impervious coverage; therefore, Categories 171, 172 and 173 were created for the Medium Density Residential. IA, RTIMP, vegetation cover, Dtheta and Kn for these categories were adjusted by examining the aerial photographs.
- Add Category 311 to the Industrial group. Based on observations of the aerial photographs, the vegetation cover of Category 311 was set as 50% in comparison with 75% for the existing Category 310.
- Add Category 511 and 512 to the Tourist group. Category 511 was setup specifically for the golf resort, Caballeros Inn and Ranch. Category 512 was created for hotels and motels in this area.
- Add seven new categories to the Institutional group. Category 521 was created for schools. The impervious coverage was found to vary dramatically for medical institutions and nursing homes, therefore, Categories 531 and 532 were created to reflect impervious coverage. Category 533 was created for the religious institutions. Category 541 was created specifically for the cemetery located at Madison Street and

Yavapai Street. Categories 551 and 552 were added for public facilities with different IA and RTIMP.

- Add six new categories to the Open Space group. Category 711 was created for parks with dense vegetation cover. Category 731 was added for passive open space, including the reservoir area upstream of dams. Categories 910, 920, and 930 were created for planned, but currently undeveloped residential, commercial and employment generating parcels. Category 940 was added for vacant land as shown in the existing land use database.

Flood Control District of Maricopa County
Drainage Design Management System
Agency: FCDMC - LAND USE DEFAULTS
Project Reference: WICKENBURG EX 6HR

Code	Description	Initial Abstraction IA	Percent Impervious RTIMP	Vegetation Cover	Moisture Deficit DTHETA	Hydraulic Efficiency Kn
Agriculture						
750	Agriculture	0.50	-	85.0	ORMAL	0.100
Commercial						
200	General Commercial (Commercial where no detail available)	0.10	80	60.0	ORMAL	0.020
220	Neighborhood Commercial (50,000 to 100,000 sq. ft.)	0.10	80	65.0	ORMAL	0.020
230	Community Commercial (100,000 to 500,000 sq. ft.)	0.10	80	75.0	ORMAL	0.020
240	Regional Commercial (500,000 to 1,000,000 sq. ft.)	0.10	80	65.0	ORMAL	0.020
250	Super-Regional Commercial (>= 1,000,000 sq. ft.)	0.10	80	70.0	ORMAL	0.020
210	Specialty Commercial (<=50,000 sq. ft.)	0.10	80	65.0	ORMAL	0.020
Industrial						
300	General Industrial (Industrial where no detail available)	0.15	55	60.0	ORMAL	0.020
310	Warehouse/Distribution Centers	0.10	80	75.0	ORMAL	0.020
311	Warehouse/Distribution Centers	0.10	80	50.0	DRY	0.020
320	Industrial	0.15	55	60.0	ORMAL	0.020
Institutional						
521	Educational	0.29	45	50.0	ORMAL	0.025
531	Medical/Nursing Home	0.10	80	75.0	DRY	0.020
532	Medical/Nursing Home	0.15	40	40.0	DRY	0.025
533	Religious Institutions	0.10	80	75.0	DRY	0.020
520	Educational (Schools and universities)	0.29	45	80.0	ORMAL	0.020
530	Institutional (Includes hospitals and churches)	0.10	80	75.0	ORMAL	0.020
550	Public Facilities (comm centers, libraries, sub-stations)	0.10	80	75.0	ORMAL	0.020
551	Public Facilities (comm centers, libraries, sub-stations)	0.10	20	25.0	DRY	0.030
552	Public Facilities (comm centers, libraries, sub-stations)	0.30	10	30.0	DRY	0.040
Office						
400	Office General (Office where no detail available)	0.10	80	75.0	ORMAL	0.020
420	Office Mid Rise (5-12 stories)	0.10	80	75.0	ORMAL	0.020
430	Office High Rise (13 stories or more)	0.10	80	75.0	ORMAL	0.020
810	Business Park (enclosed industrial, office or retail)	0.10	80	75.0	ORMAL	0.020
410	Office Low Rise (1-4 stories)	0.10	80	75.0	ORMAL	0.020
Open Space						
711	Active Open Space	0.25	5	90.0	ORMAL	0.035
910	Developing Residential - Vacant	0.20	-	30.0	DRY	0.030
920	Developing Commercial - Vacant	0.20	50	30.0	DRY	0.020
930	Developing Employment Generating - Vacant	0.20	-	25.0	DRY	0.025
540	Cemeteries	0.10	5	90.0	ORMAL	0.020
541	Cemeteries	0.10	80	50.0	DRY	0.020
700	General Open Space (Open space where no detail available)	0.10	5	90.0	ORMAL	0.030
710	Active Open Space (Includes parks)	0.10	5	90.0	ORMAL	0.030
730	Passive Open Space (Includes mountain preserves and washes)	0.10	-	90.0	ORMAL	0.050
731	Passive Open Space (Includes mountain preserves and washes)	0.20	-	30.0	DRY	0.050
740	Water	0.00	-	0.0	WET	0.030
900	Vacant (Existing land use database only)	0.35	-	25.0	DRY	0.025
940	Vacant (Existing land use database only)	0.20	-	25.0	DRY	0.040
720	Golf courses	0.10	5	90.0	ORMAL	0.030
Other						
560	Special Events (stadiums, sports complexes and fairgrounds)	0.10	80	75.0	ORMAL	0.020
Other Employment						
570	Other Employment - low (Proving grounds and land fills)	0.10	80	75.0	ORMAL	0.020
580	Other Employment - medium	0.10	80	75.0	ORMAL	0.020
590	Other Employment - high	0.10	80	75.0	ORMAL	0.020
Residential						
120	Estate Residential (1/5 du per acre to 1 du per acre)	0.30	5	30.0	ORMAL	0.020

Code	Description	Initial Abstraction IA	Percent Impervious RTIMP	Vegetation Cover	Moisture Deficit DTHETA	Hydraulic Efficiency Kn
140	Medium Lot Residential - Single Family (2-4 du per acre)	0.25	30	50.0	ORMAL	0.020
150	Small Lot Residential - Single Family (4-6 du per acre)	0.25	30	50.0	ORMAL	0.020
151	Small Lot Residential - Single Family (4-6 du per acre)	0.25	30	30.0	DRY	0.025
170	Medium Density Residential - Muli Family (5-10 du per acre)	0.25	45	50.0	ORMAL	0.020
171	Medium Density Residential - Muli Family (5-10 du per acre)	0.25	45	50.0	DRY	0.025
172	Medium Density Residential - Muli Family (5-10 du per acre)	0.10	80	50.0	DRY	0.020
173	Medium Density Residential - Muli Family (5-10 du per acre)	0.25	10	50.0	DRY	0.035
180	High Density Residential - Multi Family (10-15 du per acre)	0.25	45	50.0	ORMAL	0.020
190	Very High Density Residential - Multi Family (>15 du per ac)	0.25	45	50.0	ORMAL	0.020
110	Rural Residential (<= 1/5 du per acre)	0.30	5	30.0	ORMAL	0.020
111	Rural Residential (<= 1/5 du per acre)	0.20	5	30.0	DRY	0.035
130	Large Lot Residential - Single Family (1-2 du per acre)	0.30	15	50.0	ORMAL	0.020
131	Large Lot Residential - Single Family (1-2 du per acre)	0.30	20	35.0	DRY	0.030
160	Very Small Lot Residential - Single Family (>6 du per acre)	0.25	40	50.0	ORMAL	0.020
Tourist						
510	Tourist and Visitor Accommodations (Hotels, motels, resorts)	0.10	80	75.0	ORMAL	0.020
511	Golf Course Resort	0.20	20	40.0	DRY	0.035
512	Hotels and Motels	0.10	80	30.0	DRY	0.020
Transportation						
600	General Transportation (where no detail available)	0.10	80	75.0	ORMAL	0.020
610	Transportation (railways, transit centers, freeways)	0.10	80	75.0	ORMAL	0.020
620	Airports (Includes public use airports)	0.15	55	60.0	ORMAL	0.020
630	General Transportation	0.10	80	75.0	ORMAL	0.020

Flood Control District of Maricopa County
Drainage Design Management System
SOILS
Project Reference: WICKENBURG EX 6HR

1/25/2011

Area ID	Book Number	Map Unit	Soil ID	Area (sq mi)	Area (%)	XKSAT	Rock Percent (%)	Effective Rock (%)
Major Basin ID: 01								
SC1	645	24	64524	0.032	5.70	0.02	-	100
	645	38	64538	0.395	70.30	0.13	-	100
	645	73	64573	0.092	16.40	0.09	30.00	100
	645	94	64594	0.040	7.20	0.33	-	100
	645	97	64597	0.003	0.50	0.07	-	100
SC2	645	38	64538	0.086	85.50	0.13	-	100
	645	73	64573	0.015	14.50	0.09	30.00	100
SC3	645	38	64538	0.177	89.90	0.13	-	100
	645	73	64573	0.020	10.10	0.09	30.00	100
SC4	645	38	64538	0.129	33.50	0.13	-	100
	645	73	64573	0.255	66.50	0.09	30.00	100
SC5	645	38	64538	0.074	49.30	0.13	-	100
	645	73	64573	0.007	4.90	0.09	30.00	100
	645	105	645105	0.069	45.80	0.14	60.00	100
SC6	645	38	64538	0.114	100.00	0.13	-	100
SN1	645	7	6457	0.020	3.40	0.62	-	100
	645	38	64538	0.333	55.30	0.13	-	100
	645	73	64573	0.142	23.70	0.09	30.00	100
	645	94	64594	0.106	17.60	0.33	-	100
SN2	645	7	6457	0.009	3.60	0.62	-	100
	645	38	64538	0.217	85.00	0.13	-	100
	645	94	64594	0.029	11.30	0.33	-	100
SN3	645	7	6457	0.029	12.90	0.62	-	100
	645	38	64538	0.117	52.50	0.13	-	100
	645	54	64554	0.077	34.40	0.29	-	100
	645	94	64594	0.000	0.10	0.33	-	100

D.3 HYDROGRAPH ROUTING DATA

Pipeline Kinematic Routing

Flood Control District of Maricopa County
Drainage Design Management System
HEC-1 ROUTING DATA
Project Reference: WICKENBURG EX 6HR

1/25/2011

Route ID	Shape	Length (ft)	Slope (ft/ft)	Manning's N	Diameter (in)	Height (ft)	Width (ft)	Side Slope (h/v)
KINEMATIC WAVE								
Major Basin 01								
RSCC7	PIPE	5,691.00	0.0163	0.013	18	-	-	-
RSNC7	PIPE	5,047.00	0.0143	0.013	18	-	-	-

Route ID	LOB N	Chan N	ROB N	Length (ft)	Slope (ft/ft)	Max Elev (ft)		1.	2.	3.	4.	5.	6.	7.	8.
NORMAL DEPTH															
Major Basin 01															
RC2DAM	0.062	0.035	0.062	10,737.00	0.0145	2,206.00	X:	900.00	926.00	986.00	990.00	1,010.00	1,014.00	1,074.00	1,100.00
							Y:	2,206.00	2,205.00	2,202.00	2,200.00	2,200.00	2,202.00	2,205.00	2,206.00
RC6C7	0.069	0.036	0.069	3,551.80	0.0122	2,057.00	X:	900.00	950.00	963.00	993.00	1,008.00	1,038.00	1,050.00	1,100.00
							Y:	2,057.00	2,056.00	2,056.00	2,050.00	2,050.00	2,056.00	2,056.00	2,057.00
RSC1C1	0.057	0.033	0.057	2,545.60	0.0150	2,316.00	X:	900.00	950.00	990.00	993.00	1,008.00	1,011.00	1,051.00	1,100.00
							Y:	2,316.00	2,315.00	2,311.00	2,310.00	2,310.00	2,311.00	2,315.00	2,316.00
RSCC4	0.055	0.035	0.055	2,688.70	0.0347	2,106.00	X:	900.00	960.00	990.00	998.00	1,002.00	1,010.00	1,012.00	1,013.00
							Y:	2,106.00	2,105.00	2,102.00	2,100.00	2,100.00	2,102.00	2,108.00	2,108.00
RSNC5	0.064	0.035	0.064	2,142.50	0.0169	2,097.00	X:	900.00	950.00	977.00	995.00	1,005.00	1,023.00	1,050.00	1,100.00
							Y:	2,097.00	2,096.00	2,096.00	2,090.00	2,090.00	2,096.00	2,096.00	2,097.00

RSC1C1 is from the Location #13 of the Field Reconnaissance Notes. The typical cross-section is characterized by a trapezoidal channel of 15' bottom width, 1' deep with 3:1 side slope, and the overbank area slopes 10:1.

RC2DAM is from the Location #11 of the Field Reconnaissance Notes. The typical cross-section is characterized by a trapezoidal channel of 20' bottom width, 2' deep with 2:1 side slope, and the overbank area slopes 20:1.

RSCC4 is from the Location #8 of the Field Reconnaissance Notes. The typical cross-section is characterized by a trapezoidal channel of 4' bottom width, 2' deep with 4:1 side slope, and the overbank area slopes 10:1 on one side, wall on another side.

RSNC5 is from the Location #7 of the Field Reconnaissance Notes. The typical cross-section is characterized by a trapezoidal channel of 10' bottom width, 6' deep with 3:1 side slope.

RC6C7 is from the Location #2 of the Field Reconnaissance Notes. The typical cross-section is characterized by a trapezoidal channel of 15' bottom width, 6' deep with 5:1 side slope.

Wickenburg ADMS

Normal Steps Verification (100-year 6-hour event)

Time step= 3 min

RSC1C1

HEC-1 Record

RS	***2*** FLOW							
RC	0.057	0.033	0.057	2546	0.015	2316		
RX	900	950	990	993	1008	1011	1051	1100
RY	2316	2315	2311	2310	2310	2311	2315	2316

Normal Depth Calculation

Q=	1006 cfs	*from HEC-1 output*
Normal V=	5.78 fps	
Celerity=	9.63 fps	
Travel Time=	264 s	
Steps=	***1.5***	*Round to 2*

Match the HEC-1 card

RC2DAM

HEC-1 Record

RS	***7*** FLOW							
RC	0.062	0.035	0.062	10737	0.0145	2206		
RX	900	926	986	990	1010	1014	1074	1100
RY	2206	2205	2202	2200	2200	2202	2205	2206

Normal Depth Calculation

Q=	1322 cfs	*from HEC-1 output*
Normal V=	4.90 fps	
Celerity=	8.17 fps	
Travel Time=	1315 s	
Steps=	***7.3***	*Round to 7*

Match the HEC-1 card

RSCC4

HEC-1 Record

RS	***1*** FLOW							
RC	0.055	0.035	0.055	2689	0.0347	2106		
RX	900	960	990	998	1002	1010	1012	1013
RY	2106	2105	2102	2100	2100	2102	2108	2108

Normal Depth Calculation

Q=	0	cfs	*from HEC-1 output*
Normal V=	N/A	fps	
Celerity=	N/A	fps	
Travel Time=	N/A	s	
Steps=	***N/A***		*Assume 1*

Match the HEC-1 card

RSNC5

HEC-1 Record

RS	***1***	FLOW						
RC	0.064	0.035	0.064	2143	0.0169	2097		
RX	900	950	977	995	1005	1023	1050	1100
RY	2097	2096	2096	2090	2090	2096	2096	2097

Normal Depth Calculation

Q=	0	cfs	*from HEC-1 output*
Normal V=	N/A	fps	
Celerity=	N/A	fps	
Travel Time=	N/A	s	
Steps=	***N/A***		*Assume 1*

Match the HEC-1 card

RC6C7

HEC-1 Record

RS	***2***	FLOW						
RC	0.069	0.036	0.069	3552	0.0122	2057		
RX	900	950	963	993	1008	1038	1050	1100
RY	2057	2056	2056	2050	2050	2056	2056	2057

Normal Depth Calculation

Q=	770	cfs	*from HEC-1 output*
Normal V=	7.52	fps	
Celerity=	12.53	fps	
Travel Time=	283	s	
Steps=	***1.6***		*Round to 2*

Match the HEC-1 card

D.4 RESERVOIR ROUTING DATA

SITES - SUNNYCOVE

NGVD 29

```
                                                                                Sites
1*******************************************************************************
SITES XEQ 01/13/2011   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
     VER 2005.1.3                (USER MANUAL - DATED OCTOBER 2007)
     TIME 08:49:32

************************* 80-80 LIST OF INPUT DATA ***************************

SITES     01/01/2005Sunny     SunnyCove FRS                 1.35      I8
SAVMOV    0    101
SAVMOV    101  1                                                       1
STRUCTURE Sunny      Sunnycove
                     2140      2                   0
                     2150      4                   0
                     2160      8                   0
                     2170      15                  0
                     2173      17                  1597
                     2178      22                  7612
ENDTABLE
WSDATA    5C 1       80        1.35      .70
STORM                          24
POOLDATA  ELEV                 2148      2148                          TC
PSINLET   ELEV       0.7       15        2169.5    .67       .67
PSDATA    1          291       30                  .013      2127
GRAPHICS  I
GO,STORM  QLR        TYPE2     4.2                           2169.5
SAVMOV    2    101   1                   Sunny
ENDJOB
*******************************************************************************


1SITES ----------------------------------------------------------------------
 XEQ 01/13/2011                SunnyCove FRS                      WSID= Sunny
 VER 2005.1.3                     Sunnycove                         SUBW= 1
 TIME 08:49:32            SITE = Sunny              PASS=    1     PART=   1

 ****************************     BASIC DATA     ********************************
 CLIMATE AREA - NOT DEFINED                          DESIGN CLASS  C

 STORM DISTRIBUTION.....24 HOUR TYPE II RAINFALL DISTRIBUTION

 PRECIP. - STORM RF      DURATION      RF TABLE
              4.20         24.00          TYPE2

 WSDATA -       CN         DA-SM          TC/L           -/H           QRF
             80.00          1.35          0.70          0.00          0.00

 SITEDATA- PERM POOL     CREST PS       FP SED       VALLEY FL        378?
              0.00       2148.00      2148.00          0.00           NO

           BASEFLOW     INITIAL EL    EXTRA VOL     SITE TYPE
              0.00          0.00         0.00       SIMULATION

 PSDATA -  NO. COND       COND L        DIA/W           -/H
              1.00       291.00        30.00          0.00

              PS N          KE        WEIR L        TW EL
             0.013        0.70        15.00       2127.00

            2ND STG      ORF H         ORF L     START AUX.
            2169.50       0.67          0.67      2169.50

 ASCRESTS -   AUX.1       AUX.2         AUX.3         AUX.4         AUX.5
               0.00        0.00          0.00          0.00          0.00

 AUX.DATA -  REF.NO.   RETARD. Ci   TIE STATION   INLET LENGTH
                 0        0.00          0.00             0

 AUX.DATA - INLET N    SIDE SLOPE     EXIT N      EXIT SLOPE     ACTUAL AUX?
              0.000        0.00        0.000         0.000           NO

 BTM WIDTH -    BW1         BW2           BW3           BW4           BW5
               0.00        0.00          0.00          0.00          0.00


1SITES ----------------------------------------------------------------------
 XEQ 01/13/2011                SunnyCove FRS                      WSID= Sunny
 VER 2005.1.3                     Sunnycove                         SUBW= 1
 TIME 08:49:32            SITE = Sunny              PASS=    1     PART=   2

 ***** WARNING - ELEVATION OF FULL PIPE FLOW (2171.33) EQUALS OR EXCEEDS
                 GIVEN CREST ELEVATION ON STRUCTURE TABLE (2170.00).
                 PS RATING NOT COMPUTED, PASS STOPPED.

 CREST PS       2148.00 FT      22.4 ACFT      3.60 AC       0.0 CFS

 SED ACCUM      2148.00 FT      22.4 ACFT      3.60 AC       0.0 CFS

 2ND STAGE      2169.50 FT     197.6 ACFT     14.65 AC       9.9 CFS

 AUX. CREST     2170.00 FT     205.0 ACFT     15.00 AC      28.2 CFS

      PS STORAGE     182.6 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

 START ELEV     2169.50 FT     197.6 ACFT     14.65 AC       9.9 CFS

 STORM HYD      D=  24.00 HR    P=  4.20 IN     Q=  2.21 IN      DA=   1.35 SM
               TC=   0.70 HR   CN=  80.00     VOL=    159.0 ACFT

      PEAK =       1358.7 CFS, AT   12.4 HRS.

 ***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
                 ARRAY LIMIT(2140.00).
```

```
***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2140.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2140.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2140.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2140.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2140.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2140.00).

*******************************************************************************
RATING TABLE DEVELOPED, SITE = Sunny:
 WITH PS AND AUX. GIVEN - NO ASDATA RECORD GIVEN.

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2148.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2148.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2148.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2148.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2148.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2148.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2148.00).

RATING TABLE NUMBER  2
       ELEV.     Q-TOTAL     Q-PS      Q-AUX.     VOLUME      AREA
       FEET       CFS        CFS        CFS       AC-FT      ACRE
  1  2148.00      0.00       0.00       0.00      22.40      3.60
  2  2148.13      0.10       0.10       0.00      22.87      3.63
  3  2148.26      0.28       0.28       0.00      23.34      3.65
                                                TRANSITION TO ORIFICE FLOW, ELEV = 2148.39 FT
  4  2148.39      0.51       0.51       0.00      23.82      3.68
  5  2155.43      5.75       5.75       0.00      57.60      6.17
  6  2162.46      8.12       8.12       0.00     111.83      9.72
  7  2169.50      9.94       9.94       0.00     197.59     14.65
  8  2170.11     32.17      32.17       0.00     206.64     15.07
  9  2170.72     72.71      72.71       0.00     215.94     15.48
                                                FULL CONDUIT FLOW, ELEV = 2171.33 FT
 10  2171.33    125.16     125.16       0.00     225.49     15.88
 11  2173.55    128.33     128.33       0.00     262.52     17.55
 12  2175.78    131.36     131.36       0.00     304.03     19.78
 13  2178.00    134.32     134.32       0.00     350.49     22.00
 14     0.00      0.00       0.00       0.00       0.00      2.00
 15     0.00      0.00       0.00       0.00       0.00      2.00
 16     0.00      0.00       0.00       0.00       0.00      2.00
 17     0.00      0.00       0.00       0.00       0.00      2.00
 18     0.00      0.00       0.00       0.00       0.00      2.00
 19     0.00      0.00       0.00       0.00       0.00      2.00
 20     0.00      0.00       0.00       0.00       0.00      2.00
                                                FULL CONDUIT FLOW, ELEV = 2171.33 FT

ROUTING OF STORM HYDROGRAPH STARTS AT ELEVATION  2169.50

ROUTED        BTM WIDTH  MAX ELEV   VOL-MAX  AREA-MAX   AUX.-HP   VOL-AUX.
RESULTS          FT         FT       ACFT       AC         FT       ACFT
STORM HYD        0.0     2174.65     282.4      18.7      0.00       0.0

***** MESSAGE - ROUTING ONLY: NO AUXILIARY SPILLWAY ANALYSIS

          PEAK - CFS        Q-PS     Q-AUX.    Q-TOT.
          DISCHARGE  =     129.8       0.0     129.8
-------------------------------------------------------------------------------

 Inflow Hyd 1 PSH-Peak =        129.78 CFS  at   14.20 hrs.,  Location Point
HYDOUT   1     Sunny

1SITES....JOB NO.  1 COMPLETE.
-------------------------------------------------------------------------------
```

0 SUBWATERSHED(S) ANALYZED.

1 STRUCTURE(S) ANALYZED.

1 HYDROGRAPHS ROUTED AT LOWEST SITE.

0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

****

SITES.....COMPUTATIONS COMPLETE

1 SUMMARY TABLE 1 SITES VERSION 2005.1.3
DATED 01/01/2005

WATERSHED ID	RUN DATE	RUN TIME
Sunny	01/13/2011	08:49:32

>>>	SITE ID	SUBWS ID	SUBWS DA (SQ MI)	CURVE NO.	TC (HRS)	TOTAL DA (SQ MI)	TYPE DESIGN	STRUC CLASS	<<<
	Sunny	1	1.35	80.	0.70	1.35	TR60	C	

PASS NO.	DIA./ WIDTH (IN/FT)	AUX.CREST ELEV (FT)	BTM. WIDTH (FT)	MAX. HP (FT)	MAX. ELEV (FT)	EMB. VOL. (CY)	INTEGR.* DIST. (FT)	EXIT* VEL. (FT/SEC)	TYPE HYD
1	30.0	2170.0	0.0	4.7	2174.6	0.	0.	0.0	STORM HYD

* INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED HYDROGRAPH SHOWN UNDER TYPE HYD.

SITES.....SUMMARY TABLE 1 COMPLETED.

NRCS SITES VERSION 2005.1.3 ,01/01/2005
Sunny FILES

INPUT = h:\kenr\projects\wickenburg\Sunnycove\Sites.D2C
OUTPUT = h:\kenr\projects\wickenburg\Sunnycove\Sites.OUT
DATED 01/13/2011 08:49:32

FILE GEN. = h:\kenr\projects\wickenburg\Sunnycove\Sites.DEC DATED 01/13/2011 08:49:32

GRAPHICS FILES GENERATED

OPTION "L" = h:\kenr\projects\wickenburg\Sunnycove\Sites.DRG DATED 01/13/2011 08:49:32

OPTION "P" = h:\kenr\projects\wickenburg\Sunnycove\Sites.DHY DATED 01/13/2011 08:49:32

OPTION "E" = h:\kenr\projects\wickenburg\Sunnycove\Sites.DEM DATED 01/13/2011 08:49:32

SITES - SUNSET

NGVD 29

```
                                                                                Sites
1*********************************************************************************
SITES XEQ 01/04/2011   WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
     VER 2005.1.3              (USER MANUAL - DATED OCTOBER 2007)
     TIME 10:00:41

************************* 80-80 LIST OF INPUT DATA ****************************

SITES     01/01/2005Sunset    Sunset                        0.6       I8
SAVMOV    0    101                                                     1
SAVMOV    101  1
*         Sunset FRS
STRUCTURE Sunse      Sunset FRS
                     2115      0                  0
                     2120      2.5                0
                     2125      5                  0
                     2130      9                  0
                     2131      10                 0
                     2132      11                 116
                     2135      12.5               928
                     2140      15                 3132
                     2141      16                 3668
ENDTABLE
WSDATA    5S Su      82        0.6       .3
STORM                          24
POOLDATA  ELEV                 2120      2120                          TC
PSINLET   ELEV       .7        15        2131      .75       .75
PSDATA    1          184       30                  0.013     2107
GRAPHICS  I
GO,STORM  QLR        TYPE2     4.2                           2131
SAVMOV    2    101   1                   Sunse
ENDJOB
*********************************************************************************

1SITES XEQ 01/04/2011 ------------- COMMENT PAGE -------------------------------
      VER 2005.1.3                    Sunset                      WSID = Sunset


 Sunset FRS

1SITES ----------------------------------------------------------------------------
 XEQ 01/04/2011                     Sunset                          WSID= Sunset
 VER 2005.1.3                       Sunset FRS                        SUBW= Su
 TIME 10:00:41             SITE = Sunse              PASS=    1     PART=   1

 ****************************     BASIC DATA     *********************************
 CLIMATE AREA - NOT DEFINED                        DESIGN CLASS  S = USER DEFINED

 STORM DISTRIBUTION.....24 HOUR TYPE II RAINFALL DISTRIBUTION

 PRECIP. - STORM RF      DURATION      RF TABLE
             4.20         24.00          TYPE2

 WSDATA -      CN         DA-SM          TC/L          -/H           QRF
             82.00         0.60          0.30         0.00          0.00

 SITEDATA- PERM POOL     CREST PS      FP SED       VALLEY FL        378?
             0.00        2120.00      2120.00         0.00           NO

           BASEFLOW     INITIAL EL    EXTRA VOL    SITE TYPE
             0.00          0.00         0.00       SIMULATION

 PSDATA -  NO. COND       COND L        DIA/W          -/H
             1.00        184.00        30.00         0.00

             PS N          KE          WEIR L       TW EL
            0.013         0.70         15.00      2107.00

           2ND STG      ORF H         ORF L      START AUX.
          2131.00        0.75         0.75       2131.00

 ASCRESTS -   AUX.1      AUX.2         AUX.3        AUX.4         AUX.5
              0.00        0.00         0.00         0.00          0.00

 AUX.DATA -  REF.NO.   RETARD. Ci   TIE STATION   INLET LENGTH
                0         0.00         0.00           0

 AUX.DATA - INLET N    SIDE SLOPE     EXIT N      EXIT SLOPE     ACTUAL AUX?
             0.000        0.00        0.000        0.000           NO

 BTM WIDTH -    BW1        BW2          BW3          BW4           BW5
               0.00       0.00         0.00         0.00          0.00

1SITES ----------------------------------------------------------------------------
 XEQ 01/04/2011                     Sunset                          WSID= Sunset
 VER 2005.1.3                       Sunset FRS                        SUBW= Su
 TIME 10:00:41             SITE = Sunse              PASS=    1     PART=   2

 ***** WARNING - ELEVATION OF FULL PIPE FLOW (2132.65) EQUALS OR EXCEEDS
                 GIVEN CREST ELEVATION ON STRUCTURE TABLE (2131.00).
                 PS RATING NOT COMPUTED, PASS STOPPED.

 CREST PS       2120.00 FT      6.2 ACFT      2.50 AC       0.0 CFS

 SED ACCUM      2120.00 FT      6.2 ACFT      2.50 AC       0.0 CFS

 2ND STAGE      2131.00 FT     69.5 ACFT     10.00 AC       8.8 CFS

 AUX. CREST     2131.00 FT     69.5 ACFT     10.00 AC       8.8 CFS

      PS STORAGE      63.2 ACFT,  BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.
```

```
START ELEV     2131.00 FT      69.5 ACFT     10.00 AC       8.8 CFS

STORM HYD     D=  24.00 HR    P=  4.20 IN     Q=  2.37 IN      DA=   0.60 SM
             TC=   0.30 HR   CN=  82.00     VOL=     76.0 ACFT

     PEAK =      1051.2 CFS, AT   12.1 HRS.

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2115.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2115.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2115.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
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***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2115.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2115.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2115.00).

*******************************************************************************
RATING TABLE DEVELOPED, SITE = Sunse:
 WITH PS AND AUX. GIVEN - NO ASDATA RECORD GIVEN.

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2120.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2120.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2120.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
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***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2120.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2120.00).

***** MESSAGE - INPUT(   0.00) TO INTERPOLATION ROUTINE IS BELOW
               ARRAY LIMIT(2120.00).

Sunset
 RATING TABLE NUMBER  2
        ELEV.     Q-TOTAL     Q-PS     Q-AUX.    VOLUME     AREA
        FEET       CFS        CFS       CFS      AC-FT     ACRE
   1  2120.00      0.00       0.00      0.00      6.25      2.50
   2  2120.15      0.13       0.13      0.00      6.62      2.57
   3  2120.29      0.37       0.37      0.00      7.00      2.65
                                                TRANSITION TO ORIFICE FLOW, ELEV = 2120.44 FT
   4  2120.44      0.67       0.67      0.00      7.39      2.72
   5  2123.96      5.12       5.12      0.00     20.06      4.48
   6  2127.48      7.21       7.21      0.00     39.85      6.98
   7  2131.00      8.82       8.82      0.00     69.50     10.00
   8  2131.55     28.04      28.04      0.00     75.16     10.55
   9  2132.10     62.99      62.99      0.00     81.11     11.05
                                                FULL CONDUIT FLOW, ELEV = 2132.65 FT
  10  2132.65    108.18     108.18      0.00     87.27     11.33
  11  2135.43    113.93     113.93      0.00    120.73     12.72
  12  2138.22    119.37     119.37      0.00    158.05     14.11
  13  2141.00    124.58     124.58      0.00    199.50     16.00
  14     0.00      0.00       0.00      0.00      0.00      0.00
  15     0.00      0.00       0.00      0.00      0.00      0.00
  16     0.00      0.00       0.00      0.00      0.00      0.00
  17     0.00      0.00       0.00      0.00      0.00      0.00
  18     0.00      0.00       0.00      0.00      0.00      0.00
  19     0.00      0.00       0.00      0.00      0.00      0.00
  20     0.00      0.00       0.00      0.00      0.00      0.00
                                                FULL CONDUIT FLOW, ELEV = 2132.65 FT

ROUTING OF STORM HYDROGRAPH STARTS AT ELEVATION  2131.00

ROUTED        BTM WIDTH  MAX ELEV   VOL-MAX  AREA-MAX   AUX.-HP   VOL-AUX.
RESULTS          FT         FT       ACFT      AC         FT       ACFT
STORM HYD         0.0    2134.17     105.0     12.1      0.00        0.0

***** MESSAGE - ROUTING ONLY: NO AUXILIARY SPILLWAY ANALYSIS

          PEAK - CFS        Q-PS     Q-AUX.    Q-TOT.
          DISCHARGE  =     111.2       0.0     111.2
```

```
Inflow Hyd 1 PSH-Peak =        111.23 CFS  at   12.86 hrs.,  Location Point
HYDOUT   1     Sunse

1SITES....JOB NO.  1 COMPLETE.

Sunset        Sunset

      0 SUBWATERSHED(S) ANALYZED.

      1 STRUCTURE(S) ANALYZED.

      1 HYDROGRAPHS ROUTED AT LOWEST SITE.

      0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

*******************************************************************************


SITES.....COMPUTATIONS COMPLETE

1                              SUMMARY TABLE  1          SITES VERSION 2005.1.3
                              ----------------                DATED 01/01/2005

WATERSHED ID                          RUN DATE                          RUN TIME
------------                          --------                          --------
Sunset                               01/04/2011                         10:00:41

>>>   SITE    SUBWS    SUBWS DA   CURVE    TC   TOTAL DA   TYPE    STRUC    <<<
       ID      ID      (SQ MI)    NO.    (HRS)  (SQ MI)  DESIGN   CLASS
      -----   ----    --------   -----   ----   -------  -----   -----
      Sunse    Su         0.60     82.   0.30      0.60    TR60     S

PASS  DIA./  AUX.CREST  BTM.   MAX.    MAX.    EMB.  INTEGR.*  EXIT*    TYPE
 NO.  WIDTH    ELEV    WIDTH   HP     ELEV    VOL.   DIST.     VEL.     HYD
     (IN/FT)   (FT)     (FT)  (FT)    (FT)    (CY)   (FT)   (FT/SEC)
----  -----  -------  ------  ----  -------  -------  -----  ------  ---------
   1   30.0   2131.0     0.0   3.2   2134.2       0.     0.     0.0  STORM HYD

*  INTEGRITY DIST. AND EXIT VEL. VALUES ARE BASED ON THE ROUTED
   HYDROGRAPH SHOWN UNDER TYPE HYD.


SITES.......SUMMARY TABLE 1 COMPLETED.

                    NRCS  SITES    VERSION 2005.1.3  ,01/01/2005
                            Sunset   FILES

INPUT  = H:\kenr\projects\wickenburg\Sunset\Sites.D2C
OUTPUT = H:\kenr\projects\wickenburg\Sunset\Sites.OUT
         DATED 01/04/2011 10:00:41

        FILE GEN.    = H:\kenr\projects\wickenburg\Sunset\Sites.DEC DATED 01/04/2011 10:00:41

                         GRAPHICS FILES GENERATED

OPTION "L"  = H:\kenr\projects\wickenburg\Sunset\Sites.DRG DATED 01/04/2011 10:00:41

OPTION "P"  = H:\kenr\projects\wickenburg\Sunset\Sites.DHY DATED 01/04/2011 10:00:41

OPTION "E"  = H:\kenr\projects\wickenburg\Sunset\Sites.DEM DATED 01/04/2011 10:00:41
```

Dam Storage Routing

Flood Control District of Maricopa County
Drainage Design Management System
HEC-1 STORAGE FACILITIES
Project Reference: WICKENBURG EX 6HR

1/25/2011

Storage Basin ID: **DAMSC**

			1	2	3	4	5	6	7	8	9	10
Elevation Top of Dam:	-NA-	**Volume (ac-ft)**	19.28	26.94	36.47	47.89	61.20	76.51	93.90	113.47	135.29	159.65
Length of Dam:	-NA-	**Discharge (cfs)**		2	3	5	6	7	7	8	9	9
Discharge Coefficient:	-NA-	**Elevation (ft)**	2,150.2	2,152.2	2,154.2	2,156.2	2,158.2	2,160.2	2,162.2	2,164.2	2,166.2	2,168.2
Weir Coefficient:	-NA-											

	11	12	13	14.	15	16	17	18	19	20
Volume (ac-ft)	186.80	216.92	225.15	233.39	241.63	250.19	286.77	326.84	368.00	-
Discharge (cfs)	10	28	162	393	674	979	2,635	4,906	7,746	-
Elevation (ft)	2,170.2	2,172.2	2,172.7	2,173.2	2,173.7	2,174.2	2,176.2	2,178.2	2,180.2	-

	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
Peak Volume (ac-ft)			~~63.99~~		113.47	~~159.65~~
Peak Stage (ft)			~~2,158.49~~		~~2,164.28~~	~~2,168.20~~

DDMSW incorrectly interpolated. The peak stage is 2166.61 ft for the 100-year 6-hour event. See next page.

Storage Basin ID: **DAMSN**

			1	2	3	4	5	6	7	8	9	10
Elevation Top of Dam:	-NA-	**Volume (ac-ft)**	10.81	19.04	29.27	35.33	41.59	48.64	55.86	63.77	71.84	80.53
Length of Dam:	-NA-	**Discharge (cfs)**		3	5	6	6	7	7	8	8	9
Discharge Coefficient:	-NA-	**Elevation (ft)**	2,122.2	2,124.2	2,126.2	2,127.2	2,128.2	2,129.2	2,130.2	2,131.2	2,132.2	2,133.2
Weir Coefficient:	-NA-											

	11	12	13	14.	15	16	17	18	19	20
Volume (ac-ft)	89.37	98.87	108.56	119.00	129.68	141.27	153.09	165.82	178.79	192.72
Discharge (cfs)	173	437	714	1,041	1,412	1,822	2,267	2,746	3,255	3,793
Elevation (ft)	2,134.2	2,135.2	2,136.2	2,137.2	2,138.2	2,139.2	2,140.2	2,141.2	2,142.2	2,143.2

	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
Peak Volume (ac-ft)			~~28.08~~		~~50.08~~	~~65.38~~
Peak Stage (ft)			~~2,126.12~~		~~2,129.48~~	~~2,131.40~~

DDMSW incorrectly interpolated. The peak stage is 2130.99 ft for the 100-year 6-hour event. See next page.

Math Functions

File Edit Display Help

Selected Data Set: /WK/DAMSC/STAGE/19NOV1910/3MIN//

Arithmetic | General | Time Functions | Hydrologic | Smoothing | Statistics

Type: Basic

Number of Valid Values:	2000		
Number of Missing Values:	0		
Last Valid Value:	2160.7483	at	23NOV1910, 15:57
Minimum Value:	2130.0	at	19NOV1910, 12:00
Mean Value:	2162.4595		
Maximum Value:	2166.611	at	19NOV1910, 19:36
Accumulated Amount:	4324919.0		
Standard Deviation:	6.566256		
Skew Coefficent:	-4.117852		
Data Type:	INST-VAL		
Units:	FEET		

Sunnycove Dam Flood Pool Elevation = 2166.61 feet for the 100-year 6-hour event

Compute

Compute Complete

Math Functions

File Edit Display Help

Selected Data Set: /WK/DAMSN/STAGE/19NOV1910/3MIN//

Arithmetic | General | Time Functions | Hydrologic | Smoothing | Statistics

Type: Basic

Number of Valid Values:	2000		
Number of Missing Values:	0		
Last Valid Value:	2124.2615	at	23NOV1910, 15:57
Minimum Value:	2113.5	at	19NOV1910, 12:00
Mean Value:	2126.9053		
Maximum Value:	2130.986	at	19NOV1910, 18:24
Accumulated Amount:	4253810.5		
Standard Deviation:	3.2657328		
Skew Coefficent:	-2.1069474		
Data Type:	INST-VAL		
Units:	FEET		

Sunset Dam Flood Pool Elevation = 2130.99 feet for the 100-year 6-hour event

Compute

Compute Complete

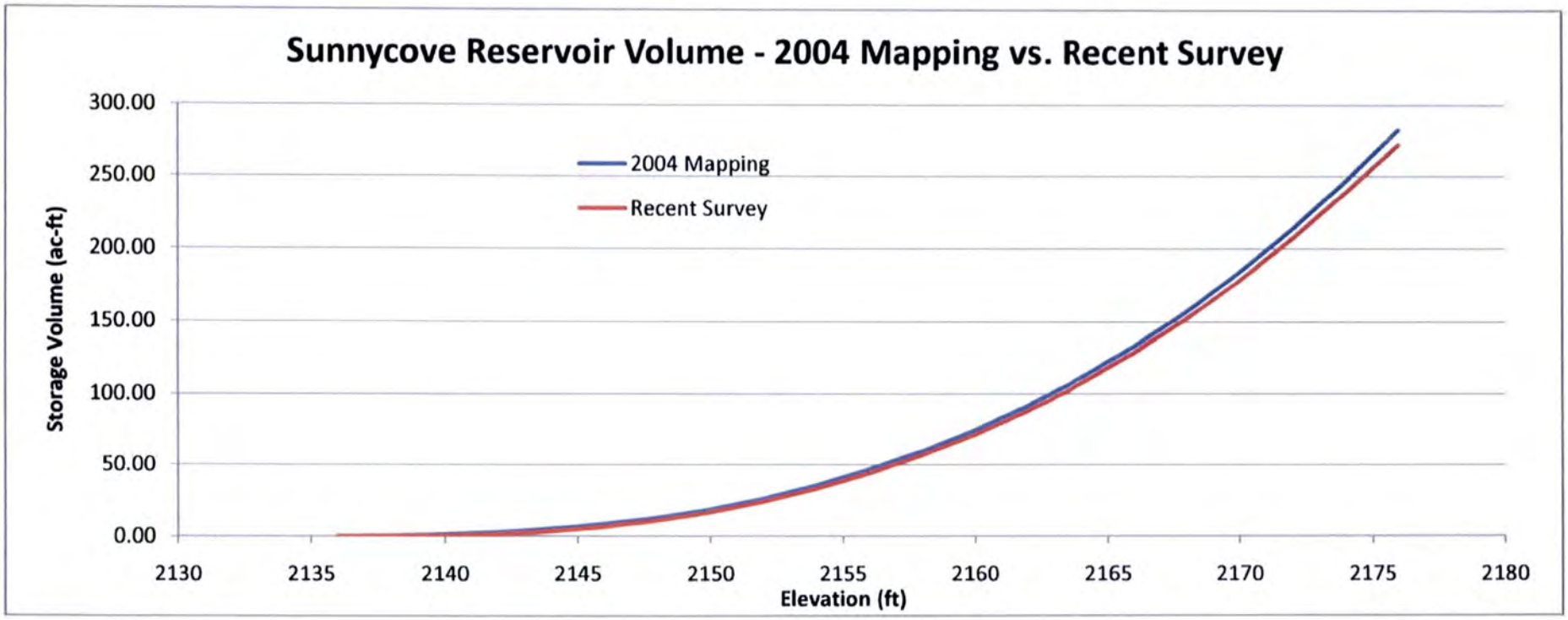
Sunnycove Reservoir Volumes Measured from the 2004 Aerial Mapping and Recent FCD Survey

Sunnycove Dam Volume
Volume in blue is interpolated.

Elevation (ft)	2004 Wickenburg 2-foot mapping			
	Accu Volume (cubic ft)	Sarea (aq ft)	Accu Volume (ac-ft)	Surface Area (Ac)
2136	2058.102276	4180.265991	0.05	0.10
2137			0.22	
2138	17435.16572	12672.01078	0.40	0.29
2139			0.84	
2140	56176.74263	25763.12036	1.29	0.59
2141			2.07	
2142	124053.9239	43915.96676	2.85	1.01
2143			4.04	
2144	228036.8922	61815.45146	5.24	1.42
2145			6.85	
2146	368624.4665	83130.68102	8.46	1.91
2147			10.65	
2148	558936.3553	111254.2617	12.83	2.55
2149			15.68	
2150	807490.8262	146104.5036	18.54	3.35
2151			22.27	
2152	1132822.595	188706.1604	26.01	4.33
2153			30.67	
2154	1539581.336	231235.9384	35.34	5.31
2155			40.96	
2156	2028780.384	275712.8449	46.57	6.33
2157			53.13	
2158	2600114.73	319919.411	59.69	7.34
2159			67.24	
2160	3258066.646	367855.7983	74.79	8.44
2161			83.38	
2162	4005847.193	416962.6602	91.96	9.57
2163			101.64	
2164	4848936.66	468783.9499	111.32	10.76
2165			122.10	
2166	5788534.949	522435.9806	132.89	11.99
2167			144.92	
2168	6837325.128	586012.2661	156.96	13.45
2169			170.39	
2170	8007327.548	651214.7945	183.82	14.95
2171			198.72	
2172	9305506.221	722941.9183	213.63	16.60
2173			230.10	
2174	10740445.36	795627.7625	246.57	18.27
2175			264.69	
2176	12318960.01	874815.0889	282.80	20.08
2177			302.65	
2178	14048092.55	957847.2774	322.50	21.99
2179			344.21	
2180	15939070.44	1043986.579	365.91	23.97

Elevation (ft)	FCD Survey	
	Volume (CY)	Volume (ac-ft)
2136	0	0
2137		0.00
2138	0	0
2139		0.12
2140	384	0.24
2141		0.75
2142	2025	1.26
2143		2.30
2144	5397	3.35
2145		4.88
2146	10353	6.42
2147		8.56
2148	17252	10.69
2149		13.60
2150	26639	16.51
2151		20.16
2152	38425	23.82
2153		28.35
2154	53047	32.88
2155		38.35
2156	70701	43.82
2157		50.24
2158	91397	56.65
2159		64.05
2160	115257	71.44
2161		79.85
2162	142385	88.26
2163		97.79
2164	173148	107.32
2165		117.95
2166	207423	128.57
2167		140.36
2168	245479	152.16
2169		165.21
2170	287594	178.26
2171		192.70
2172	334188	207.14
2173		222.92
2174	385099	238.70
2175		255.43
2176	439086	272.16

The volume obtained from the 2004 aerial mapping was used for the dam storage routing.



Sunset Dam Volume

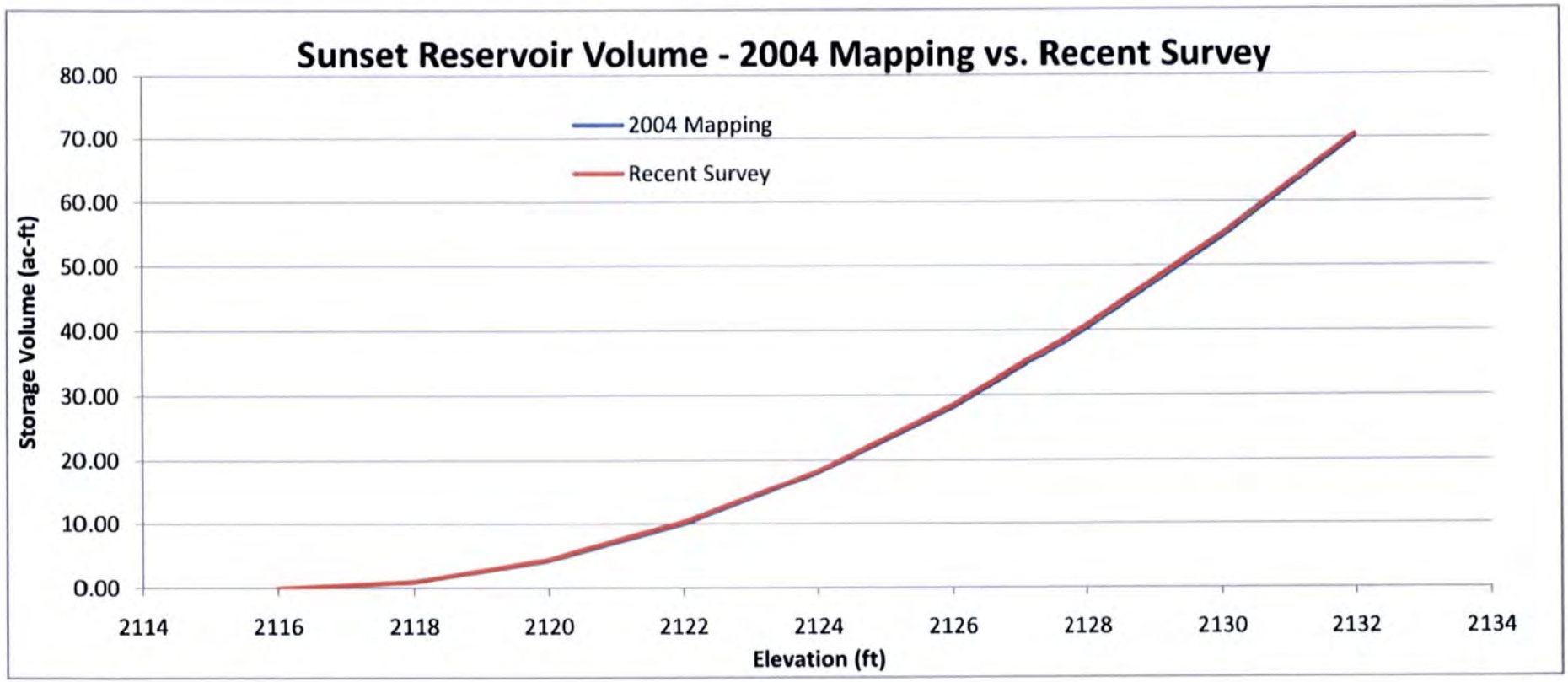
Volume in blue is interpolated

Sunset Reservoir Volumes Measured from the 2004 Aerial Mapping and Recent FCD Survey

Elevation (ft)	2004 Wickenburg 2-foot mapping			
	Accumulated Volume (cubic ft)	Sarea (sq ft)	Accu Volume (ac-ft)	Surface Area (Ac)
2116	438.878065	905.577567	0.01	0.02
2117			0.50	
2118	42928.43424	45917.12896	0.99	1.05
2119			2.64	
2120	186757.3189	99008.57242	4.29	2.27
2121			7.15	
2122	435801.7965	151568.9365	10.00	3.48
2123			14.02	
2124	785804.7639	198952.9121	18.04	4.57
2125			23.05	
2126	1222304.908	241191.8293	28.06	5.54
2127			34.12	
2128	1750125.494	289449.2403	40.18	6.64
2129			47.23	
2130	2364350.658	330594.8089	54.28	7.59
2131			62.19	
2132	3053748.162	365854.0966	70.10	8.40
2133			78.79	
2134	3810443.778	401884.2194	87.48	9.23
2135			96.97	
2136	4637625.759	437208.2764	106.47	10.04
2137			116.91	
2138	5547944.641	487075.6351	127.36	11.18
2139			138.95	
2140	6557776.361	540813.7622	150.55	12.42
2141			163.28	
2142	7666906.15	590523.7792	176.01	13.56
2143			189.93	
2144	8879928.44	650009.7082	203.86	14.92
2145			219.19	
2146	10216268.96	705293.346	234.53	16.19

Elevation (ft)	FCD Survey	
	Volume (CY)	Volume (ac-ft)
2116	10	0.01
2117		0.52
2118	1661	1.03
2119		2.76
2120	7230	4.48
2121		7.41
2122	16668	10.33
2123		14.33
2124	29559	18.32
2125		23.39
2126	45915	28.46
2127		34.56
2128	65598	40.66
2129		47.72
2130	88378	54.78
2131		62.65
2132	113781	70.53

Two results are almost identical. The volume obtained from the 2004 aerial mapping was selected for the dam storage routing.



D.5 FLOW SPLITS AND DIVERSIONS DATA

Dam Stage-Discharge Curve from SITES models - Provided by FCDMC

The Values below Reflect '88 Vertical Datum and PS Rating determined using SITES (NRCS)

Sunnycove										
SE	2150.2	2152.2	2154.2	2156.2	2158.2	2160.2	2162.2	2164.2	2166.2	2168.2
SE	2170.2	2172.2	2172.7	2173.2	2173.7	2174.2	2176.2	2178.2	2180.2	
SQ	0	1.7	3.2	4.7	5.9	6.6	7.3	8	8.5	9
SQ	9.6	28	162	393	674	979	2635	4906	7746	

The Values below Reflect '88 Vertical Datum and PS Rating determined using SITES (NRCS)

Sunset										
SE	2122.2	2124.2	2126.2	2127.2	2128.2	2129.2	2130.2	2131.2	2132.2	2133.2
SE	2134.2	2135.2	2136.2	2137.2	2138.2	2139.2	2140.2	2141.2	2142.2	2143.2
SQ	0	2.6	5.1	5.7	6.3	6.9	7.4	7.9	8.4	8.8
SQ	173	437	714	1041	1412	1822	2267	2746	3255	3793

Wickenburg ADMS Dam Diversions - Pipeline System Capacity

Dam Pipeline Capacity

Note: Only pipe friction was considered to determine the pipe capacity. Headloss at inlet, outlet and transition were not considered.

Hazen-Williams Equation was used to calculate the headloss

$$H_f = 4.72 Q^{1.85} C^{-1.85} D^{-4.87} L$$

$$Q = 0.432\ CD^{2.63} \left(\frac{H_f}{L} \right)^{0.54}$$

Hf is friction headloss in ft
Q is discharge in cfs
C is roughness coefficiet, 130 for concrete pipe
D is the pipe diameter in ft
L is the pipe length in ft

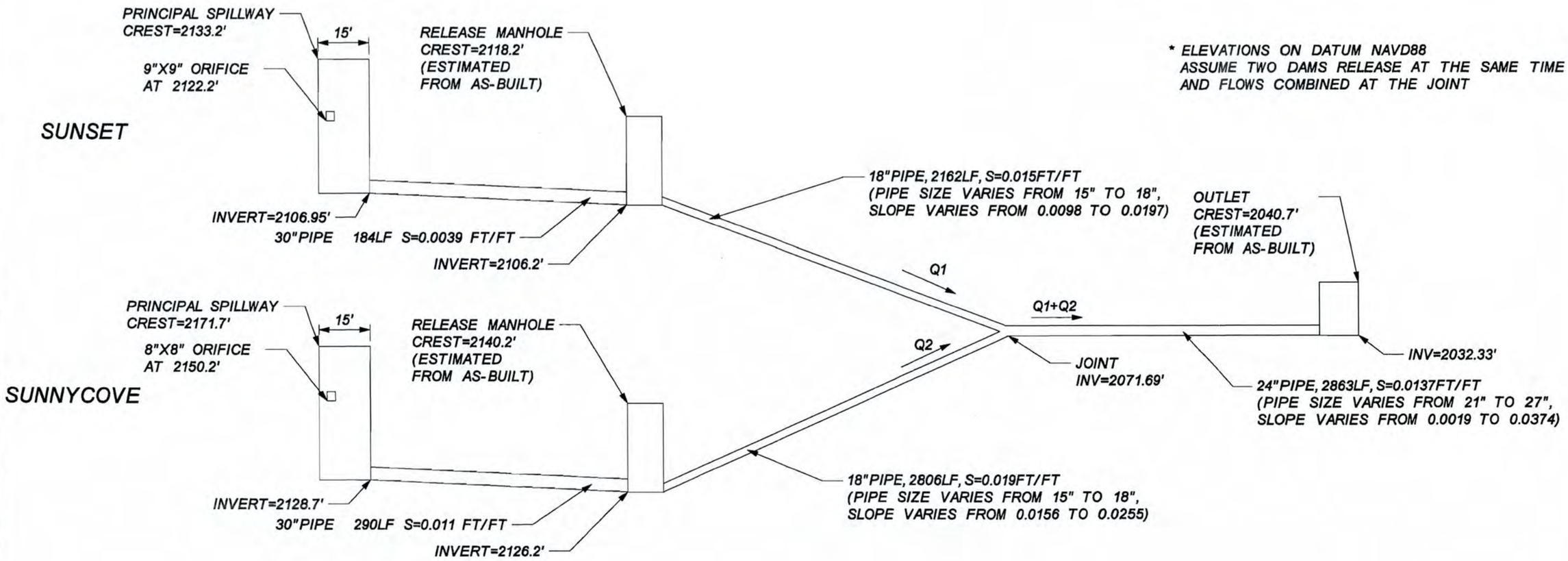
Pipeline Capacity

General Info		
Sunset release manhole crest, H1=	2118.2 ft	
Sunny Cove release manhole crest, H2=	2140.2 ft	
Downstream manhole crest, H3=	2040.7 ft	
Pipeline from Sunset to the joint		
Pipe diameter=	1.5 ft	
Pipe length=	2162 ft	
Pipe slope=	0.015 ft/ft	
Flow rate, Q1=	17.1 cfs	*Variant*
Friction headloss, Hf1=	33.17 ft	
Pipeline from Sunny Cove to the joint		
Pipe diameter=	1.5 ft	
Pipe length=	2806 ft	
Pipe slope=	0.019 ft/ft	
Flow rate, Q2=	19.5 cfs	*Variant*
Friction headloss, Hf2=	55.16 ft	
Pipeline from the joint to the outlet		
Pipe diameter=	2 ft	
Pipe length=	2863 ft	
Pipe slope=	0.0137 ft/ft	
Flow rate, Q1+Q2=	36.6 cfs	
Friction headloss, Hf3=	44.34 ft	
Headloss		
Water head for Sunset, H1-H3=	77.5 ft	
Friction headloss for Sunset, Hf1+Hf3=	77.5 ft	*=H1-H3*
Water head for Sunny Cove, H2-H3=	99.5 ft	
Friction headloss for Sunny Cove, Hf2+Hf3=	99.5 ft	*=H2-H3*

The pipeline system capacities are 17.1 cfs for Sunset Dam and 19.5 cfs for Sunnycove Dam. The excess flow will be released by the manholes immediate downstream of two dams.

Pipeline Capa Calculation with Formulas

	A	B	C	D	E	F
1	**Wickenburg ADMS**					
2	***Dam Pipeline Capacity***					
3						
26	*Note: Only pipe friction was considered to determine the pipe capacity. Headloss at inlet, outlet and transition were not considered.*					
28	Hazen-Williams Equation was used to calculate the headloss					
29–30	$H_f = 4.72 Q^{1.85} C^{-1.85} D^{-4.87} L$					
31–34	$Q = 0.432\, CD^{2.63} \left(\frac{H_f}{L}\right)^{0.54}$					
35	Hf is friction headloss in ft					
36	Q is discharge in cfs					
37	C is roughness coefficiet, 130 for concrete pipe					
38	D is the pipe diameter in ft					
39	L is the pipe length in ft					
40						
41						
42	***Pipeline Capacity***					
43	***General Info***					
44	Sunset release manhole crest, H1=	2118.2	ft			
45	Sunny Cove release manhole crest, H2=	2140.2	ft			
46	Downstream manhole crest, H3=	2040.7	ft			
47	***Pipeline from Sunset to the joint***					
48	Pipe diameter=	1.5	ft			
49	Pipe length=	2162	ft			
50	Pipe slope=	0.015	ft/ft			
51	Flow rate, Q1=	17.0831882065063	cfs	*Variant*		
52	Friction headloss, Hf1=	=4.72*(B51^1.85)/(130^1.85)/(B48^4.87)*B49	ft			
53	***Pipeline from Sunny Cove to the joint***					
54	Pipe diameter=	1.5	ft			
55	Pipe length=	2806	ft			
56	Pipe slope=	0.019	ft/ft			
57	Flow rate, Q2=	19.5338329852203	cfs	*Variant*		
58	Friction headloss, Hf2=	=4.72*(B57^1.85)/(130^1.85)/(B54^4.87)*B55	ft			
59	***Pipeline from the joint to the outlet***					
60	Pipe diameter=	2	ft			
61	Pipe length=	2863	ft			
62	Pipe slope=	0.0137	ft/ft			
63	Flow rate, Q1+Q2=	=B51+B57	cfs			
64	Friction headloss, Hf3=	=4.72*(B63^1.85)/(130^1.85)/(B60^4.87)*B61	ft			
65	***Headloss***					
66	Water head for Sunset, H1-H3=	=B44-B46	ft			
67	Friction headloss for Sunset, Hf1+Hf3=	=B52+B64	ft	*=H1-H3*		
68	Water head for Sunny Cove, H2-H3=	=B45-B46	ft			
69	Friction headloss for Sunny Cove, Hf2+Hf3=	=B58+B64	ft	*=H2-H3*		



Hoskin • Ryan Consultants
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Office: (602) 252-8384 Fax: (602) 252-8385 www.hoskinryan.com

LEGEND

WICKENBURG ADMS/P
PHASE I
PIPELINE SCHEMATIC MAP

G:\Projects\10\10-003 Wickenburg ADMS\01-Phase 1\Hydro\Principal Spillway.dgn
4/25/2011

D.6 HYDROLOGIC CALCULATIONS

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN  1998               *
*            VERSION 4.1               *
*                                      *
*  RUN DATE   12APR11  TIME  16:05:34  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    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        Flood Control District of Maricopa County
  2           ID    Project Name: Wickenburg Area Drainage Master Study/Plan
  3           ID    Contract FCD 2009C030
  4           ID    Hoskin Ryan Consultants, Inc.
  5           ID
  6           ID    Phase I Hydrology Model
  7           ID    Phase I study area includes tributary watersheds of Sunset and
  8           ID    Sunnycove Washes. Sunnycove tributary sub basins include: SC1, SC2
  9           ID    SC3, SC4, SC5 and SC6.  Sunnset tributary sub basins include: SN1,
 10           ID    SN2 and SN3.
 11           ID    Total drainage area is 2.59 square miles.
 12           ID    Two flood retarding structures were constructed within Phase I
 13           ID    study area, Sunset and Sunnycove Dams.  A pipeline system was
 14           ID    constructed and connected to the primary spillways to release
 15           ID    Dam Reservoirs to Hassayampa River.
 16           ID    The compacity of the pipeline system is 19.5 cfs for Sunnycove Dam
 17           ID    and 17.1 cfs for Sunset Dam.  Excess flow will be released at the
 18           ID    release manholes immediate downstream of two dams or through the
 19           ID    emergency spillways.
 20           ID
 21           ID    10 Year 6 Hour Existing Condition
 22           ID        Model prepared with DDMSW version 4.6.0
 23           ID    Rainfall: NOAA 14
 24           ID    Area-Depth: the default reduction factor in DDMSW was selected
 25           ID    Rainfall Loss: Green-Ampt Equation
 26           ID        Unit Hydrograph: S-Graph (Mountain)
 27           ID    Soil: Latest soil map from NRCS was used, file provided by FCDMC
 28           ID    Land Use: MAG 2009 land use file was used, provided by FCDMC
 29           ID    Channel Routing: Cross-section geometries and Manning's n were
 30           ID    based on field observation.
 31           ID    Storage Routing: Dam storage volumes were based on 2004 Wickenburg
 32           ID    Aerial Mapping.
 33           ID
 34           ID    File Name: 10Y6H.DAT
 35           ID        Date: 01/17/2011
 36           ID
 37           IT       3 19NOV10    1200    2000
 38           IN      15
 39           IO       5
              *DIAGRAM
              *
 40           JD   2.146  0.0001
 41           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
 42           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
 43           PC   0.962   0.972   0.983   0.991   1.000
 44           JD   2.133  0.5000
 45           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
 46           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
 47           PC   0.962   0.972   0.983   0.991   1.000
 48           JD   2.092     2.8
 49           PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.068   0.077
 50           PC   0.088   0.101   0.121   0.164   0.253   0.451   0.694   0.836   0.900   0.938
 51           PC   0.950   0.963   0.975   0.988   1.000
              *
```

1 HEC-1 INPUT PAGE 2

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 52           KK     SC1   BASIN
 53           BA   0.562
 54           LG    0.18    0.34    6.60    0.16       9
 55           UI       0      78      96     259     414     528     621     843     714     504
 56           UI     442     390     345     301     253     204     184     168     136     110
 57           UI      97      85      74      59      59      38      38      38      34      15
 58           UI      15      15      15      15      15      15      15      15       0       0
 59           UI       0       0       0       0       0       0       0       0       0       0
              *
```

```
 60          KK  RSC1C1   ROUTE
 61          RS       2    FLOW
 62          RC   0.057   0.033   0.057    2546  0.0150 2316.00
 63          RX  900.00  950.00  990.00  993.00 1008.00 1011.00 1051.00 1100.00
 64          RY  2316.0 2315.00 2311.00 2310.00 2310.00 2311.00 2315.00 2316.00
             *

 65          KK     SC2   BASIN
 66          BA   0.100
 67          LG    0.20    0.37    6.60    0.15       8
 68          UI       0      46     173     306     236     162     116      79      55      38
 69          UI      26      17      13       6       6       6       0       0       0       0
 70          UI       0       0       0       0       0       0       0       0       0       0
 71          UI       0       0       0       0       0       0       0       0       0       0
 72          UI       0       0       0       0       0       0       0       0       0       0
             *

 73          KK      C1 COMBINE
 74          KM    Total tributary area of 0.6627 square miles for Sub Basin SC1 and SC2.
 75          HC       2  0.6627
             *

 76          KK     SC3   BASIN
 77          BA   0.197
 78          LG    0.19    0.37    6.40    0.16       7
 79          UI       0      37      85     186     261     350     352     228     194     163
 80          UI     135     103      87      73      55      45      39      28      25      18
 81          UI      18      13       7       7       7       7       7       7       0       0
 82          UI       0       0       0       0       0       0       0       0       0       0
 83          UI       0       0       0       0       0       0       0       0       0       0
             *

 84          KK      C2 COMBINE
 85          KM    Total tributary area of 0.8597 square miles for Sub Basin SC1, SC2 and SC3.
 86          HC       2  0.8597
             *

 87          KK  RC2DAM   ROUTE
 88          RS       7    FLOW
 89          RC   0.062   0.035   0.062   10737  0.0145 2206.00
 90          RX  900.00  926.00  986.00  990.00 1010.00 1014.00 1074.00 1100.00
 91          RY  2206.0 2205.00 2202.00 2200.00 2200.00 2202.00 2205.00 2206.00
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 92          KK     SC4   BASIN
 93          BA   0.384
 94          LG    0.20    0.35    7.00    0.12      22
 95          UI       0      44      44     107     183     259     307     348     441     498
 96          UI     325     274     250     224     203     181     160     136     114     106
 97          UI      98      85      73      57      55      48      45      34      34      30
 98          UI      22      22      22      22      12       8       8       8       8       8
 99          UI       8       8       8       8       8       0       0       0       0       0
             *

100          KK     SC5   BASIN
101          BA   0.150
102          LG    0.21    0.38    6.40    0.15      30
103          UI       0      33      97     196     266     338     208     170     139     109
104          UI      82      70      50      39      32      25      18      16      13       6
105          UI       6       6       6       6       0       0       0       0       0       0
106          UI       0       0       0       0       0       0       0       0       0       0
107          UI       0       0       0       0       0       0       0       0       0       0
             *

108          KK      C3 COMBINE
109          KM    Total tributary area of 1.3934 square miles for Sub Basin SC1, SC2, SC3,
110          KM    SC4 and SC5.
111          HC       3  1.3934
             *

112          KK   DAMSC STORAGE
113          KM   According to the as-built plan, the emergency spillway crest elevation is
114          KM   2172.20 feet (NAVD88).
115          KM   The stage-discharge rating curve is based on SITES model results, provided
116          KM   by FCDMC.
117          KM   The dam storage routing is for FEMA floodplain delineation purposes, not
118          KM   applicable for NRCS dam safety standards.
119          KO       3
120          RS       1    STOR
121          SV       0   19.28   26.94   36.47   47.89   61.20   76.51   93.90  113.47  135.29
122          SV  159.65  186.80  216.92  225.15  233.39  241.63  250.19  286.77  326.84  368.00
123          SQ       0       0     1.7     3.2     4.7     5.9     6.6     7.3     8.0     8.5
124          SQ     9.0     9.6    28.0     162     393     674     979    2635    4906    7746
125          SE    2130 2150.20 2152.20 2154.20 2156.20 2158.20 2160.20 2162.20 2164.20 2166.20
126          SE  2168.2 2170.20 2172.20 2172.70 2173.20 2173.70 2174.20 2176.20 2178.20 2180.20
             *

127          KK   DIVSC  DIVERT
128          KM   The downstream pipeline has a maximum capacity of 19.5 cfs.
129          DT    DTSC     0.0    19.5
130          DI     0.0    19.5  4000.0
131          DQ     0.0    19.5    19.5
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

132          KK   RSCC4   ROUTE
133          RS       1    FLOW
134          RC   0.055   0.035   0.055    2689  0.0347 2106.00
```

```
135          RX  900.00  960.00  990.00  998.00 1002.00 1010.00 1012.00 1013.00
136          RY  2106.0 2105.00 2102.00 2100.00 2100.00 2102.00 2108.00 2108.00
             *

137          KK     SC6   BASIN
138          BA   0.114
139          LG    0.25    0.38    6.40    0.16      13
140          UI       0      50     189     331     281     186     135      91      66      44
141          UI      31      21      18       7       7       7       7       0       0       0
142          UI       0       0       0       0       0       0       0       0       0       0
143          UI       0       0       0       0       0       0       0       0       0       0
144          UI       0       0       0       0       0       0       0       0       0       0
             *

145          KK      C4 COMBINE
146          KM   Given that no surface flow released from Sunnycove Dam during the 10-,
147          KM   50-, 100- and 250-year 6-hour events, the total tributary area for C4
148          KM   only includes Sub Basin SC6, i.e. 0.114 square miles.
149          KM   Given that the surface flow released from Sunnycove Dam during the
150          KM   500-year 6-hour event lags behind the local flow from Sub Basin SC6
151          KM   and is not additive to the dominating local peak flow, the total
152          KM   tributary area for C4 only includes Sub Basin SC6, i.e. 0.114 square
153          KM   miles.
154          HC       2   0.114
             *

155          KK     SN1   BASIN
156          BA   0.601
157          LG    0.19    0.39    6.00    0.19      18
158          UI       0      68      68     159     272     387     462     527     645     797
159          UI     524     432     391     353     321     285     257     221     185     166
160          UI     156     142     113      98      87      77      74      59      52      52
161          UI      39      33      33      33      33      13      13      13      13      13
162          UI      13      13      13      13      13      13       0       0       0       0
             *

163          KK   DAMSN STORAGE
164          KM   According to the as-built plan, the emergency spillway crest elevation is
165          KM   2133.20 feet (NAVD88).
166          KM   The stage-discharge rating curve is based on SITES model results, provided
167          KM   by FCDMC.
168          KM   The dam storage routing is for FEMA floodplain delineation purposes, not
169          KM   applicable for NRCS dam safety standards.
170          KO       3
171          RS       1    STOR
172          SV       0   10.81   19.04   29.27   35.33   41.59   48.64   55.86   63.77   80.53
173          SV   89.37   98.87  108.56  119.00  129.68  141.27  153.09  165.82  178.79  192.72
174          SQ       0       0    2.60    5.10    5.70    6.30    6.90    7.40    7.90    8.80
175          SQ     173     437     714    1041    1412    1822    2267    2746    3255    3793
176          SE  2113.5 2122.20 2124.20 2126.20 2127.20 2128.20 2129.20 2130.20 2131.20 2133.20
177          SE  2134.2 2135.20 2136.20 2137.20 2138.20 2139.20 2140.20 2141.20 2142.20 2143.20
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

178          KK   DIVSN  DIVERT
179          KM   The downstream pipeline has a maximum capacity of 17.1 cfs.
180          DT    DTSN     0.0    17.1
181          DI     0.0    17.1  1500.0
182          DQ     0.0    17.1    17.1
             *

183          KK   RSNC5   ROUTE
184          RS       1    FLOW
185          RC   0.064   0.035   0.064    2143  0.0169 2097.00
186          RX  900.00  950.00  977.00  995.00 1005.00 1023.00 1050.00 1100.00
187          RY  2097.0 2096.00 2096.00 2090.00 2090.00 2096.00 2096.00 2097.00
             *

188          KK     SN2   BASIN
189          BA   0.255
190          LG    0.20    0.40    6.00    0.18       7
191          UI       0      40      67     157     248     303     401     391     259     224
192          UI     194     167     140     112      96      87      68      53      47      43
193          UI      31      31      20      20      20      12       8       8       8       8
194          UI       8       8       8       0       0       0       0       0       0       0
195          UI       0       0       0       0       0       0       0       0       0       0
             *

196          KK      C5 COMBINE
197          KM   Given that no surface flow released from Sunset Dam during the 10-, 50-,
198          KM   100- and 250-year 6-hour events, the total tributary area for C5 only
199          KM   includes Sub Basin SN2, i.e. 0.255 square miles.
200          KM   Given that the surface flow released from Sunset Dam during the 500-year
201          KM   6-hour event lags behind the local flow from Sub Basin SN2 and is not
202          KM   additive to the dominating local peak flow, the total tributary area
203          KM   for C5 only includes Sub Basin SN2, i.e. 0.255 square miles.
204          HC       2   0.255
             *

205          KK      C6 COMBINE
206          KM   Given that no surface flow released from Sunnycove/Sunset Dams during
207          KM   the 10-, 50-, 100- and 250-year events, the total tributary area for C6
208          KM   only includes Sub Basin SC6 and SN2, i.e. 0.369 square miles.
209          KM   Given that the surface flow released from Sunnycove/Sunset Dams during
210          KM   the 500-year 6-hour event lags behind the local flows from Sub Basin SC6
211          KM   and SN2 and is not additive to the dominating local peak flow, the total
212          KM   tributary area for C6 only includes Sub Basin SC6 and SN2, i.e. 0.369
213          KM   square miles.
214          HC       2   0.369
             *

215          KK   RC6C7   ROUTE
216          RS       2    FLOW
```

```
                                                                10Y6H
 217          RC   0.069   0.036   0.069    3552  0.0122 2057.00
 218          RX  900.00  950.00  963.00  993.00 1008.00 1038.00 1050.00 1100.00
 219          RY  2057.0 2056.00 2056.00 2050.00 2050.00 2056.00 2056.00 2057.00
              *
1                                          HEC-1 INPUT                                                          PAGE  6

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 220          KK    RTSCRETRIEVE
 221          DR    DTSC
              *

 222          KK   RSCC7   ROUTE
 223          KM   Kinematic wave was selected for the routing through the pipeline, no attenuat
 224          RK    5691  0.0163   0.013            CIRC   1.500
              *

 225          KK    RTSNRETRIEVE
 226          DR    DTSN
              *

 227          KK   RSNC7   ROUTE
 228          KM   Kinematic wave was selected for the routing through the pipeline, no attenuat
 229          RK    5047  0.0143   0.013            CIRC   1.500
              *

 230          KK     SN3   BASIN
 231          BA   0.223
 232          LG    0.22    0.35    5.20    0.29      39
 233          UI       0      52     174     338     476     469     303     247     195     142
 234          UI     117      87      64      52      40      28      26      16      10      10
 235          UI      10      10      10       0       0       0       0       0       0       0
 236          UI       0       0       0       0       0       0       0       0       0       0
 237          UI       0       0       0       0       0       0       0       0       0       0
              *

 238          KK      C7 COMBINE
 239          KM   Given that no surface flow released from Sunnycove/Sunset Dams during
 240          KM   the 10-, 50-, 100- and 250-year 6-hour events, the total tributary area
 241          KM   for C7 only includes Sub Basin SC6, SN2 and SN3, i.e. 0.5913 square miles.
 242          KM   Given that the surface flow released from Sunnycove/Sunset Dams during
 243          KM   the 500-year 6-hour event lags behind the local flows from Sub Basin SC6,
 244          KM   SN2 and SN3 and is not additive to  the dominating local peak flow, the
 245          KM   total tributary area for C7 only includes Sub Basin SC6, SN2 and SN3,
 246          KM   i.e. 0.5913 square miles.
 247          HC       4  0.5913
              *
 248          ZZ
1
          SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   52        SC1
              V
              V
   60     RSC1C1
              .
              .
   65         .          SC2
              .            .
              .            .
   73        C1............
              .
              .
   76         .          SC3
              .            .
              .            .
   84        C2............
              V
              V
   87     RC2DAM
              .
              .
   92         .          SC4
              .            .
              .            .
  100         .            .          SC5
              .            .            .
              .            .            .
  108        C3........................
              V
              V
  112      DAMSC
              .
              .
  129         .------->    DTSC
  127      DIVSC
              V
              V
  132      RSCC4
              .
              .
  137         .          SC6
              .            .
              .            .
  145        C4............
              .
              .
  155         .          SN1
              .            V
              .            V
  163         .        DAMSN
```

```
                .          .
                .          .
  180           .          .-------->   DTSN
  178           .       DIVSN
                .          V
                .          V
  183           .       RSNC5
                .          .
                .          .
  188           .          .         SN2
                .          .           .
                .          .           .
  196           .        C5............
                .          .
                .          .
  205         C6............
               V
               V
  215       RC6C7
                .
                .
  221           .          .<-------    DTSC
  220           .       RTSC
                .          V
                .          V
  222           .       RSCC7
                .          .
                .          .
  226           .          .          .<-------    DTSN
  225           .          .       RTSN
                .          .          V
                .          .          V
  227           .          .      RSNC7
                .          .          .
                .          .          .
  230           .          .          .        SN3
                .          .          .          .
                .          .          .          .
  238         C7.................................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN   1998               *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   12APR11  TIME  16:05:34  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

Flood Control District of Maricopa County
Project Name: Wickenburg Area Drainage Master Study/Plan
Contract FCD 2009C030
Hoskin Ryan Consultants, Inc.

Phase I Hydrology Model
Phase I study area includes tributary watersheds of Sunset and Sunnycove Washes. Sunnycove tributary sub basins include: SC1, SC2 SC3, SC4, SC5 and SC6. Sunnset tributary sub basins include: SN1, SN2 and SN3.
Total drainage area is 2.59 square miles.
Two flood retarding structures were constructed within Phase I study area, Sunset and Sunnycove Dams. A pipeline system was constructed and connected to the primary spillways to release Dam Reservoirs to Hassayampa River.
The compacity of the pipeline system is 19.5 cfs for Sunnycove Dam and 17.1 cfs for Sunset Dam. Excess flow will be released at the release manholes immediate downstream of two dams or through the emergency spillways.

10 Year 6 Hour Existing Condition
Model prepared with DDMSW version 4.6.0
Rainfall: NOAA 14
Area-Depth: the default reduction factor in DDMSW was selected
Rainfall Loss: Green-Ampt Equation
Unit Hydrograph: S-Graph (Mountain)
Soil: Latest soil map from NRCS was used, file provided by FCDMC
Land Use: MAG 2009 land use file was used, provided by FCDMC
Channel Routing: Cross-section geometries and Manning's n were based on field observation.
Storage Routing: Dam storage volumes were based on 2004 Wickenburg Aerial Mapping.

File Name: 10Y6H.DAT
Date: 01/17/2011

```
 39 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT        HYDROGRAPH TIME DATA
                     NMIN          3  MINUTES IN COMPUTATION INTERVAL
                    IDATE     19NOV10  STARTING DATE
                    ITIME       1200  STARTING TIME
                       NQ       2000  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE     23NOV10  ENDING DATE
                   NDTIME        1557  ENDING TIME
                    ICENT          19  CENTURY MARK
```

```
              COMPUTATION INTERVAL     .05 HOURS
                  TOTAL TIME BASE   99.95 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

 40 JD         INDEX STORM NO. 1
                    STRM        2.15  PRECIPITATION DEPTH
                    TRDA         .00  TRANSPOSITION DRAINAGE AREA

 41 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       .02       .02       .02       .02       .02
                     .03       .03       .03       .03       .03       .09       .09       .09       .09       .09
                     .02       .02       .02       .02       .02       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00

 44 JD         INDEX STORM NO. 2
                    STRM        2.13  PRECIPITATION DEPTH
                    TRDA         .50  TRANSPOSITION DRAINAGE AREA

 45 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       .02       .02       .02       .02       .02
                     .03       .03       .03       .03       .03       .09       .09       .09       .09       .09
                     .02       .02       .02       .02       .02       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00

 48 JD         INDEX STORM NO. 3
                    STRM        2.09  PRECIPITATION DEPTH
                    TRDA        2.80  TRANSPOSITION DRAINAGE AREA

 49 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
                     .01       .01       .01       .01       .01       .02       .02       .02       .02       .02
                     .04       .04       .04       .04       .04       .05       .05       .05       .05       .05
                     .03       .03       .03       .03       .03       .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

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
112 KK    *     DAMSC  *      STORAGE
          *            *
          **************

119 KO         OUTPUT CONTROL VARIABLES
                    IPRNT           3  PRINT CONTROL
                    IPLOT           0  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE

            HYDROGRAPH ROUTING DATA

120 RS         STORAGE ROUTING
                    NSTPS           1  NUMBER OF SUBREACHES
                     ITYP        STOR  TYPE OF INITIAL CONDITION
                   RSVRIC         .00  INITIAL CONDITION
                        X         .00  WORKING R AND D COEFFICIENT

121 SV          STORAGE           .0      19.3      26.9      36.5      47.9      61.2      76.5      93.9     113.5     135.3
                                159.6     186.8     216.9     225.1     233.4     241.6     250.2     286.8     326.8     368.0

123 SQ          DISCHARGE          0.        0.        2.        3.        5.        6.        7.        7.        8.        9.
                                   9.       10.       28.      162.      393.      674.      979.     2635.     4906.     7746.

125 SE          ELEVATION       2130.00   2150.20   2152.20   2154.20   2156.20   2158.20   2160.20   2162.20   2164.20   2166.20
                                2168.20   2170.20   2172.20   2172.70   2173.20   2173.70   2174.20   2176.20   2178.20   2180.20
                                                                   ***

    ***            ***            ***            ***            ***

                     HYDROGRAPH AT STATION    DAMSC
                   TRANSPOSITION AREA        .0 SQ MI
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```
 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR      99.95-HR
+  (CFS)       (HR)
                          (CFS)
+      7.      7.40                 7.           6.           6.           5.
                        (INCHES)  .044         .173         .463         .567
                         (AC-FT)    3.           13.          34.          42.

 PEAK STORAGE  TIME                        MAXIMUM AVERAGE STORAGE
                                   6-HR        24-HR        72-HR      99.95-HR
+ (AC-FT)      (HR)
     79.       7.55                78.          74.          62.          55.

 PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                   6-HR        24-HR        72-HR      99.95-HR
+  (FEET)      (HR)
  2160.48      7.50             2160.38      2159.83      2158.26      2156.40

                          CUMULATIVE AREA =    1.39 SQ MI

      ***                 ***        ***          ***          ***

                          HYDROGRAPH AT STATION    DAMSC
                         TRANSPOSITION AREA       .5 SQ MI

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR      99.95-HR
+  (CFS)       (HR)
                          (CFS)
+      7.      7.40                 7.           6.           6.           5.
                        (INCHES)  .044         .172         .459         .561
                         (AC-FT)    3.           13.          34.          42.

 PEAK STORAGE  TIME                        MAXIMUM AVERAGE STORAGE
                                   6-HR        24-HR        72-HR      99.95-HR
+ (AC-FT)      (HR)
     78.       7.55                77.          73.          62.          54.

 PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                   6-HR        24-HR        72-HR      99.95-HR
+  (FEET)      (HR)
  2160.38      7.55             2160.29      2159.73      2158.16      2156.31

                          CUMULATIVE AREA =    1.39 SQ MI

      ***                 ***        ***          ***          ***

                          HYDROGRAPH AT STATION    DAMSC
                         TRANSPOSITION AREA      2.8 SQ MI

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR      99.95-HR
+  (CFS)       (HR)
                          (CFS)
+      6.      7.50                 6.           6.           5.           4.
                        (INCHES)  .040         .153         .382         .457
                         (AC-FT)    3.           11.          28.          34.

 PEAK STORAGE  TIME                        MAXIMUM AVERAGE STORAGE
                                   6-HR        24-HR        72-HR      99.95-HR
+ (AC-FT)      (HR)
     64.       7.70                63.          59.          50.          44.

 PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                   6-HR        24-HR        72-HR      99.95-HR
+  (FEET)      (HR)
  2158.57      7.70             2158.48      2157.93      2156.44      2154.74

                          CUMULATIVE AREA =    1.39 SQ MI

      ***                 ***        ***          ***          ***


                          INTERPOLATED HYDROGRAPH AT    DAMSC

 PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                   6-HR        24-HR        72-HR      99.95-HR
+  (CFS)       (HR)
                          (CFS)
+      6.      7.50                 6.           6.           5.           4.
                        (INCHES)  .042         .160         .413         .499
                         (AC-FT)    3.           12.          31.          37.

                          CUMULATIVE AREA =    1.39 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
 163 KK     *     DAMSN  *      STORAGE
            *            *
            **************

 170 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          3  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

                 HYDROGRAPH ROUTING DATA
```

```
171 RS        STORAGE ROUTING
                   NSTPS          1  NUMBER OF SUBREACHES
                    ITYP       STOR  TYPE OF INITIAL CONDITION
                   RSVRIC        .00  INITIAL CONDITION
                        X        .00  WORKING R AND D COEFFICIENT

172 SV          STORAGE          .0      10.8      19.0      29.3      35.3      41.6      48.6      55.9      63.8      80.5
                                89.4      98.9     108.6     119.0     129.7     141.3     153.1     165.8     178.8     192.7

174 SQ          DISCHARGE        0.        0.        3.        5.        6.        6.        7.        7.        8.        9.
                                173.      437.      714.     1041.     1412.     1822.     2267.     2746.     3255.     3793.

176 SE          ELEVATION     2113.50   2122.20   2124.20   2126.20   2127.20   2128.20   2129.20   2130.20   2131.20   2133.20
                              2134.20   2135.20   2136.20   2137.20   2138.20   2139.20   2140.20   2141.20   2142.20   2143.20
                                                                        ***

     ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION    DAMSN
                      TRANSPOSITION AREA        .0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      99.95-HR
+   (CFS)       (HR)
                          (CFS)
+      5.       6.25                 5.           5.           3.           3.
                          (INCHES)  .083         .296         .592         .649
                           (AC-FT)   3.           9.          19.          21.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR        72-HR      99.95-HR
+  (AC-FT)      (HR)
      33.       6.30                32.          28.          22.          19.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR        72-HR      99.95-HR
+   (FEET)      (HR)
  2126.78       6.30             2126.63      2126.02      2124.70      2123.83

                        CUMULATIVE AREA =      .60 SQ MI

     ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION    DAMSN
                      TRANSPOSITION AREA        .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      99.95-HR
+   (CFS)       (HR)
                          (CFS)
+      5.       6.25                 5.           5.           3.           2.
                          (INCHES)  .082         .293         .585         .640
                           (AC-FT)   3.           9.          19.          21.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR        72-HR      99.95-HR
+  (AC-FT)      (HR)
      32.       6.30                32.          28.          22.          19.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR        72-HR      99.95-HR
+   (FEET)      (HR)
  2126.73       6.30             2126.58      2125.97      2124.67      2123.80

                        CUMULATIVE AREA =      .60 SQ MI

     ***            ***            ***            ***            ***

                        HYDROGRAPH AT STATION    DAMSN
                      TRANSPOSITION AREA       2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      99.95-HR
+   (CFS)       (HR)
                          (CFS)
+      4.       6.50                 4.           4.           2.           2.
                          (INCHES)  .065         .220         .422         .459
                           (AC-FT)   2.           7.          14.          15.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR        72-HR      99.95-HR
+  (AC-FT)      (HR)
      26.       6.50                25.          23.          18.          16.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR        72-HR      99.95-HR
+   (FEET)      (HR)
  2125.59       6.50             2125.46      2124.97      2123.96      2123.24

                        CUMULATIVE AREA =      .60 SQ MI

     ***            ***            ***            ***            ***


                      INTERPOLATED HYDROGRAPH AT    DAMSN

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      99.95-HR
+   (CFS)       (HR)
                          (CFS)
+      5.       6.35                 5.           5.           3.           2.
```

10Y6H

(INCHES)	.081	.286	.567	.621
(AC-FT)	3.	9.	18.	20.

CUMULATIVE AREA = .60 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	SC1	549.	4.25	59.	15.	5.	.56		
ROUTED TO	RSC1C1	527.	4.35	59.	15.	5.	.56		
HYDROGRAPH AT	SC2	166.	4.10	10.	3.	1.	.10		
2 COMBINED AT	C1	554.	4.30	68.	17.	6.	.66		
HYDROGRAPH AT	SC3	235.	4.15	20.	5.	2.	.20		
2 COMBINED AT	C2	690.	4.25	85.	21.	7.	.86		
ROUTED TO	RC2DAM	616.	4.60	85.	21.	7.	.86		
HYDROGRAPH AT	SC4	378.	4.30	50.	13.	4.	.38		
HYDROGRAPH AT	SC5	217.	4.15	20.	5.	2.	.15		
3 COMBINED AT	C3	831.	4.45	143.	36.	12.	1.39		
ROUTED TO	DAMSC	6.	7.50	6.	6.	5.	1.39		
DIVERSION TO	DTSC	6.	7.50	6.	6.	5.	1.39		
HYDROGRAPH AT	DIVSC	0.	.00	0.	0.	0.	1.39		
ROUTED TO	RSCC4	0.	.00	0.	0.	0.	1.39		
HYDROGRAPH AT	SC6	186.	4.10	12.	3.	1.	.11		
2 COMBINED AT	C4	186.	4.10	12.	3.	1.	.11		
HYDROGRAPH AT	SN1	499.	4.30	66.	16.	5.	.60		
ROUTED TO	DAMSN	5.	6.35	5.	5.	3.	.60		
DIVERSION TO	DTSN	5.	6.35	5.	5.	3.	.60		
HYDROGRAPH AT	DIVSN	0.	.00	0.	0.	0.	.60		
ROUTED TO	RSNC5	0.	.00	0.	0.	0.	.60		
HYDROGRAPH AT	SN2	264.	4.20	25.	6.	2.	.25		
2 COMBINED AT	C5	264.	4.20	25.	6.	2.	.25		
2 COMBINED AT	C6	419.	4.15	37.	9.	3.	.37		
ROUTED TO	RC6C7	361.	4.30	37.	9.	3.	.37		
HYDROGRAPH AT	RTSC	6.	7.50	6.	6.	5.	1.39		
ROUTED TO	RSCC7	6.	7.60	6.	6.	5.	1.39		
HYDROGRAPH AT	RTSN	5.	6.35	5.	5.	3.	.60		
ROUTED TO	RSNC7	5.	6.40	5.	5.	3.	.60		
HYDROGRAPH AT	SN3	322.	4.15	30.	8.	3.	.22		
4 COMBINED AT	C7	599.	4.20	72.	26.	14.	.59		

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	DT (MIN)	INTERPOLATED TO COMPUTATION INTERVAL PEAK (CFS)	INTERPOLATED TO COMPUTATION INTERVAL TIME TO PEAK (MIN)	INTERPOLATED TO COMPUTATION INTERVAL VOLUME (IN)
FOR STORM = 1	STORM AREA (SQ MI) =			.00					
RSCC7	MANE	3.00	6.70	460.22	.57	3.00	6.70	459.00	.57

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4212E+02 EXCESS= .0000E+00 OUTFLOW= .4207E+02 BASIN STORAGE= .3657E-01 PERCENT ERROR= .0

FOR STORM = 2	STORM AREA (SQ MI) =			.50					
RSCC7	MANE	3.00	6.66	460.70	.56	3.00	6.66	459.00	.56

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4172E+02 EXCESS= .0000E+00 OUTFLOW= .4169E+02 BASIN STORAGE= .3610E-01 PERCENT ERROR= .0

FOR STORM = 3	STORM AREA (SQ MI) =			2.80					
RSCC7	MANE	3.00	6.03	469.07	.46	3.00	6.03	468.00	.46

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3397E+02 EXCESS= .0000E+00 OUTFLOW= .3394E+02 BASIN STORAGE= .2767E-01 PERCENT ERROR= .0

FOR STORM = 1	STORM AREA (SQ MI) =			.00					
RSNC7	MANE	3.00	5.45	384.19	.65	3.00	5.45	384.00	.65

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2079E+02 EXCESS= .0000E+00 OUTFLOW= .2078E+02 BASIN STORAGE= .9133E-02 PERCENT ERROR= .0

FOR STORM = 2	STORM AREA (SQ MI) =			.50					
RSNC7	MANE	3.00	5.42	384.58	.64	3.00	5.42	384.00	.64

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2052E+02 EXCESS= .0000E+00 OUTFLOW= .2051E+02 BASIN STORAGE= .9008E-02 PERCENT ERROR= .0

FOR STORM = 3	STORM AREA (SQ MI) =			2.80					
RSNC7	MANE	3.00	4.34	399.39	.46	3.00	4.34	399.00	.46

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1471E+02 EXCESS= .0000E+00 OUTFLOW= .1471E+02 BASIN STORAGE= .6572E-02 PERCENT ERROR= .0

*** NORMAL END OF HEC-1 ***

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN  1998                *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   12APR11  TIME  16:04:45  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    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

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID        Flood Control District of Maricopa County
  2           ID    Project Name: Wickenburg Area Drainage Master Study/Plan
  3           ID    Contract FCD 2009C030
  4           ID    Hoskin Ryan Consultants, Inc.
  5           ID
  6           ID    Phase I Hydrology Model
  7           ID    Phase I study area includes tributary watersheds of Sunset and
  8           ID    Sunnycove Washes. Sunnycove tributary sub basins include: SC1, SC2
  9           ID    SC3, SC4, SC5 and SC6.  Sunnset tributary sub basins include: SN1,
 10           ID    SN2 and SN3.
 11           ID    Total drainage area is 2.59 square miles.
 12           ID    Two flood retarding structures were constructed within Phase I
 13           ID    study area, Sunset and Sunnycove Dams.  A pipeline system was
 14           ID    constructed and connected to the primary spillways to release
 15           ID    Dam Reservoirs to Hassayampa River.
 16           ID    The compacity of the pipeline system is 19.5 cfs for Sunnycove Dam
 17           ID    and 17.1 cfs for Sunset Dam.  Excess flow will be released at the
 18           ID    release manholes immediate downstream of two dams or through the
 19           ID    emergency spillways.
 20           ID
 21           ID    50 Year 6 Hour Existing Condition
 22           ID        Model prepared with DDMSW version 4.6.0
 23           ID    Rainfall: NOAA 14
 24           ID    Area-Depth: the default reduction factor in DDMSW was selected
 25           ID    Rainfall Loss: Green-Ampt Equation
 26           ID        Unit Hydrograph: S-Graph (Mountain)
 27           ID    Soil: Latest soil map from NRCS was used, file provided by FCDMC
 28           ID    Land Use: MAG 2009 land use file was used, provided by FCDMC
 29           ID    Channel Routing: Cross-section geometries and Manning's n were
 30           ID    based on field observation.
 31           ID    Storage Routing: Dam storage volumes were based on 2004 Wickenburg
 32           ID    Aerial Mapping.
 33           ID
 34           ID    File Name: 50Y6H.DAT
 35           ID        Date: 01/17/2011
 36           ID
 37           IT       3 19NOV10    1200    2000
 38           IN      15
 39           IO       5
              *DIAGRAM
              *
 40           JD   2.949  0.0001
 41           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
 42           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
 43           PC   0.962   0.972   0.983   0.991   1.000
 44           JD   2.931  0.5000
 45           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
 46           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
 47           PC   0.962   0.972   0.983   0.991   1.000
 48           JD   2.875     2.8
 49           PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.068   0.077
 50           PC   0.088   0.101   0.121   0.164   0.253   0.451   0.694   0.836   0.900   0.938
 51           PC   0.950   0.963   0.975   0.988   1.000
              *
```

1 HEC-1 INPUT PAGE 2

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 52           KK     SC1   BASIN
 53           BA   0.562
 54           LG    0.18    0.34    6.60    0.16       9
 55           UI       0      78      96     259     414     528     621     843     714     504
 56           UI     442     390     345     301     253     204     184     168     136     110
 57           UI      97      85      74      59      59      38      38      38      34      15
 58           UI      15      15      15      15      15      15      15      15       0       0
 59           UI       0       0       0       0       0       0       0       0       0       0
              *
```

```
 60          KK  RSC1C1   ROUTE
 61          RS       2    FLOW
 62          RC   0.057   0.033   0.057    2546  0.0150 2316.00
 63          RX  900.00  950.00  990.00  993.00 1008.00 1011.00 1051.00 1100.00
 64          RY  2316.0 2315.00 2311.00 2310.00 2310.00 2311.00 2315.00 2316.00
             *

 65          KK     SC2   BASIN
 66          BA   0.100
 67          LG    0.20    0.37    6.60    0.15       8
 68          UI       0      46     173     306     236     162     116      79      55      38
 69          UI      26      17      13       6       6       6       0       0       0       0
 70          UI       0       0       0       0       0       0       0       0       0       0
 71          UI       0       0       0       0       0       0       0       0       0       0
 72          UI       0       0       0       0       0       0       0       0       0       0
             *

 73          KK      C1 COMBINE
 74          KM    Total tributary area of 0.6627 square miles for Sub Basin SC1 and SC2.
 75          HC       2  0.6627
             *

 76          KK     SC3   BASIN
 77          BA   0.197
 78          LG    0.19    0.37    6.40    0.16       7
 79          UI       0      37      85     186     261     350     352     228     194     163
 80          UI     135     103      87      73      55      45      39      28      25      18
 81          UI      18      13       7       7       7       7       7       7       0       0
 82          UI       0       0       0       0       0       0       0       0       0       0
 83          UI       0       0       0       0       0       0       0       0       0       0
             *

 84          KK      C2 COMBINE
 85          KM    Total tributary area of 0.8597 square miles for Sub Basin SC1, SC2 and SC3.
 86          HC       2  0.8597
             *

 87          KK  RC2DAM   ROUTE
 88          RS       7    FLOW
 89          RC   0.062   0.035   0.062   10737  0.0145 2206.00
 90          RX  900.00  926.00  986.00  990.00 1010.00 1014.00 1074.00 1100.00
 91          RY  2206.0 2205.00 2202.00 2200.00 2200.00 2202.00 2205.00 2206.00
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 92          KK     SC4   BASIN
 93          BA   0.384
 94          LG    0.20    0.35    7.00    0.12      22
 95          UI       0      44      44     107     183     259     307     348     441     498
 96          UI     325     274     250     224     203     181     160     136     114     106
 97          UI      98      85      73      57      55      48      45      34      34      30
 98          UI      22      22      22      22      12       8       8       8       8       8
 99          UI       8       8       8       8       8       0       0       0       0       0
             *

100          KK     SC5   BASIN
101          BA   0.150
102          LG    0.21    0.38    6.40    0.15      30
103          UI       0      33      97     196     266     338     208     170     139     109
104          UI      82      70      50      39      32      25      18      16      13       6
105          UI       6       6       6       6       0       0       0       0       0       0
106          UI       0       0       0       0       0       0       0       0       0       0
107          UI       0       0       0       0       0       0       0       0       0       0
             *

108          KK      C3 COMBINE
109          KM    Total tributary area of 1.3934 square miles for Sub Basin SC1, SC2, SC3,
110          KM    SC4 and SC5.
111          HC       3  1.3934
             *

112          KK   DAMSC STORAGE
113          KM   According to the as-built plan, the emergency spillway crest elevation is
114          KM   2172.20 feet (NAVD88).
115          KM   The stage-discharge rating curve is based on SITES model results, provided
116          KM   by FCDMC.
117          KM   The dam storage routing is for FEMA floodplain delineation purposes, not
118          KM   applicable for NRCS dam safety standards.
119          KO       3
120          RS       1    STOR
121          SV       0   19.28   26.94   36.47   47.89   61.20   76.51   93.90  113.47  135.29
122          SV  159.65  186.80  216.92  225.15  233.39  241.63  250.19  286.77  326.84  368.00
123          SQ       0       0     1.7     3.2     4.7     5.9     6.6     7.3     8.0     8.5
124          SQ     9.0     9.6    28.0     162     393     674     979    2635    4906    7746
125          SE    2130 2150.20 2152.20 2154.20 2156.20 2158.20 2160.20 2162.20 2164.20 2166.20
126          SE  2168.2 2170.20 2172.20 2172.70 2173.20 2173.70 2174.20 2176.20 2178.20 2180.20
             *

127          KK   DIVSC  DIVERT
128          KM   The downstream pipeline has a maximum capacity of 19.5 cfs.
129          DT    DTSC     0.0    19.5
130          DI     0.0    19.5  4000.0
131          DQ     0.0    19.5    19.5
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

132          KK   RSCC4   ROUTE
133          RS       1    FLOW
134          RC   0.055   0.035   0.055    2689  0.0347 2106.00
```

```
135          RX  900.00  960.00  990.00  998.00 1002.00 1010.00 1012.00 1013.00
136          RY 2106.0 2105.00 2102.00 2100.00 2100.00 2102.00 2108.00 2108.00
             *

137          KK     SC6   BASIN
138          BA   0.114
139          LG    0.25    0.38    6.40    0.16      13
140          UI       0      50     189     331     281     186     135      91      66      44
141          UI      31      21      18       7       7       7       7       0       0       0
142          UI       0       0       0       0       0       0       0       0       0       0
143          UI       0       0       0       0       0       0       0       0       0       0
144          UI       0       0       0       0       0       0       0       0       0       0
             *

145          KK      C4 COMBINE
146          KM   Given that no surface flow released from Sunnycove Dam during the 10-,
147          KM   50-, 100- and 250-year 6-hour events, the total tributary area for C4
148          KM   only includes Sub Basin SC6, i.e. 0.114 square miles.
149          KM   Given that the surface flow released from Sunnycove Dam during the
150          KM   500-year 6-hour event lags behind the local flow from Sub Basin SC6
151          KM   and is not additive to the dominating local peak flow, the total
152          KM   tributary area for C4 only includes Sub Basin SC6, i.e. 0.114 square
153          KM   miles.
154          HC       2   0.114
             *

155          KK     SN1   BASIN
156          BA   0.601
157          LG    0.19    0.39    6.00    0.19      18
158          UI       0      68      68     159     272     387     462     527     645     797
159          UI     524     432     391     353     321     285     257     221     185     166
160          UI     156     142     113      98      87      77      74      59      52      52
161          UI      39      33      33      33      33      13      13      13      13      13
162          UI      13      13      13      13      13      13       0       0       0       0
             *

163          KK   DAMSN STORAGE
164          KM   According to the as-built plan, the emergency spillway crest elevation is
165          KM   2133.20 feet (NAVD88).
166          KM   The stage-discharge rating curve is based on SITES model results, provided
167          KM   by FCDMC.
168          KM   The dam storage routing is for FEMA floodplain delineation purposes, not
169          KM   applicable for NRCS dam safety standards.
170          KO       3
171          RS       1    STOR
172          SV       0   10.81   19.04   29.27   35.33   41.59   48.64   55.86   63.77   80.53
173          SV   89.37   98.87  108.56  119.00  129.68  141.27  153.09  165.82  178.79  192.72
174          SQ       0       0    2.60    5.10    5.70    6.30    6.90    7.40    7.90    8.80
175          SQ     173     437     714    1041    1412    1822    2267    2746    3255    3793
176          SE  2113.5 2122.20 2124.20 2126.20 2127.20 2128.20 2129.20 2130.20 2131.20 2133.20
177          SE  2134.2 2135.20 2136.20 2137.20 2138.20 2139.20 2140.20 2141.20 2142.20 2143.20
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

178          KK   DIVSN  DIVERT
179          KM   The downstream pipeline has a maximum capacity of 17.1 cfs.
180          DT    DTSN     0.0    17.1
181          DI     0.0    17.1  1500.0
182          DQ     0.0    17.1    17.1
             *

183          KK   RSNC5   ROUTE
184          RS       1    FLOW
185          RC   0.064   0.035   0.064    2143  0.0169 2097.00
186          RX  900.00  950.00  977.00  995.00 1005.00 1023.00 1050.00 1100.00
187          RY  2097.0 2096.00 2096.00 2090.00 2090.00 2096.00 2096.00 2097.00
             *

188          KK     SN2   BASIN
189          BA   0.255
190          LG    0.20    0.40    6.00    0.18       7
191          UI       0      40      67     157     248     303     401     391     259     224
192          UI     194     167     140     112      96      87      68      53      47      43
193          UI      31      31      20      20      20      12       8       8       8       8
194          UI       8       8       8       0       0       0       0       0       0       0
195          UI       0       0       0       0       0       0       0       0       0       0
             *

196          KK      C5 COMBINE
197          KM   Given that no surface flow released from Sunset Dam during the 10-, 50-,
198          KM   100- and 250-year 6-hour events, the total tributary area for C5 only
199          KM   includes Sub Basin SN2, i.e. 0.255 square miles.
200          KM   Given that the surface flow released from Sunset Dam during the 500-year
201          KM   6-hour event lags behind the local flow from Sub Basin SN2 and is not
202          KM   additive to the dominating local peak flow, the total tributary area
203          KM   for C5 only includes Sub Basin SN2, i.e. 0.255 square miles.
204          HC       2   0.255
             *

205          KK      C6 COMBINE
206          KM   Given that no surface flow released from Sunnycove/Sunset Dams during
207          KM   the 10-, 50-, 100- and 250-year events, the total tributary area for C6
208          KM   only includes Sub Basin SC6 and SN2, i.e. 0.369 square miles.
209          KM   Given that the surface flow released from Sunnycove/Sunset Dams during
210          KM   the 500-year 6-hour event lags behind the local flows from Sub Basin SC6
211          KM   and SN2 and is not additive to the dominating local peak flow, the total
212          KM   tributary area for C6 only includes Sub Basin SC6 and SN2, i.e. 0.369
213          KM   square miles.
214          HC       2   0.369
             *

215          KK   RC6C7   ROUTE
216          RS       2    FLOW
```

```
217          RC   0.069   0.036   0.069    3552  0.0122 2057.00
218          RX  900.00  950.00  963.00  993.00 1008.00 1038.00 1050.00 1100.00
219          RY  2057.0 2056.00 2056.00 2050.00 2050.00 2056.00 2056.00 2057.00
             *
1                                        HEC-1 INPUT                                                          PAGE  6

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

220          KK    RTSCRETRIEVE
221          DR    DTSC
             *

222          KK   RSCC7   ROUTE
223          KM   Kinematic wave was selected for the routing through the pipeline, no attenuat
224          RK    5691  0.0163   0.013            CIRC   1.500
             *

225          KK    RTSNRETRIEVE
226          DR    DTSN
             *

227          KK   RSNC7   ROUTE
228          KM   Kinematic wave was selected for the routing through the pipeline, no attenuat
229          RK    5047  0.0143   0.013            CIRC   1.500
             *

230          KK     SN3   BASIN
231          BA   0.223
232          LG    0.22    0.35    5.20    0.29      39
233          UI       0      52     174     338     476     469     303     247     195     142
234          UI     117      87      64      52      40      28      26      16      10      10
235          UI      10      10      10       0       0       0       0       0       0       0
236          UI       0       0       0       0       0       0       0       0       0       0
237          UI       0       0       0       0       0       0       0       0       0       0
             *

238          KK       C7 COMBINE
239          KM   Given that no surface flow released from Sunnycove/Sunset Dams during
240          KM   the 10-, 50-, 100- and 250-year 6-hour events, the total tributary area
241          KM   for C7 only includes Sub Basin SC6, SN2 and SN3, i.e. 0.5913 square miles.
242          KM   Given that the surface flow released from Sunnycove/Sunset Dams during
243          KM   the 500-year 6-hour event lags behind the local flows from Sub Basin SC6,
244          KM   SN2 and SN3 and is not additive to  the dominating local peak flow, the
245          KM   total tributary area for C7 only includes Sub Basin SC6, SN2 and SN3,
246          KM   i.e. 0.5913 square miles.
247          HC       4  0.5913
             *
248          ZZ
1
        SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE   (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.   (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

  52       SC1
            V
            V
  60    RSC1C1
            .
            .
  65        .         SC2
            .           .
            .           .
  73       C1...........
            .
            .
  76        .         SC3
            .           .
            .           .
  84       C2...........
            V
            V
  87    RC2DAM
            .
            .
  92        .         SC4
            .           .
            .           .
 100        .           .         SC5
            .           .           .
            .           .           .
 108       C3........................
            V
            V
 112     DAMSC
            .
            .
 129        .------->    DTSC
 127     DIVSC
            V
            V
 132     RSCC4
            .
            .
 137        .         SC6
            .           .
            .           .
 145       C4...........
            .
            .
 155        .         SN1
            .           V
            .           V
 163        .       DAMSN
```

```
                .          .
180             .          .------->    DTSN
178             .       DIVSN
                .          V
                .          V
183             .       RSNC5
                .          .
                .          .
188             .          .        SN2
                .          .          .
                .          .          .
196             .        C5............
                .          .
                .          .
205           C6............
               V
               V
215         RC6C7
                .
                .
221             .          .<-------    DTSC
220             .      RTSC
                .          V
                .          V
222             .      RSCC7
                .          .
                .          .
226             .          .          .<-------    DTSN
225             .          .       RTSN
                .          .          V
                .          .          V
227             .          .      RSNC7
                .          .          .
                .          .          .
230             .          .          .        SN3
                .          .          .          .
                .          .          .          .
238           C7.................................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   12APR11  TIME  16:04:45  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

Flood Control District of Maricopa County
Project Name: Wickenburg Area Drainage Master Study/Plan
Contract FCD 2009C030
Hoskin Ryan Consultants, Inc.

Phase I Hydrology Model
Phase I study area includes tributary watersheds of Sunset and Sunnycove Washes. Sunnycove tributary sub basins include: SC1, SC2 SC3, SC4, SC5 and SC6. Sunnset tributary sub basins include: SN1, SN2 and SN3.
Total drainage area is 2.59 square miles.
Two flood retarding structures were constructed within Phase I study area, Sunset and Sunnycove Dams. A pipeline system was constructed and connected to the primary spillways to release Dam Reservoirs to Hassayampa River.
The compacity of the pipeline system is 19.5 cfs for Sunnycove Dam and 17.1 cfs for Sunset Dam. Excess flow will be released at the release manholes immediate downstream of two dams or through the emergency spillways.

50 Year 6 Hour Existing Condition
Model prepared with DDMSW version 4.6.0
Rainfall: NOAA 14
Area-Depth: the default reduction factor in DDMSW was selected
Rainfall Loss: Green-Ampt Equation
Unit Hydrograph: S-Graph (Mountain)
Soil: Latest soil map from NRCS was used, file provided by FCDMC
Land Use: MAG 2009 land use file was used, provided by FCDMC
Channel Routing: Cross-section geometries and Manning's n were based on field observation.
Storage Routing: Dam storage volumes were based on 2004 Wickenburg Aerial Mapping.

File Name: 50Y6H.DAT
Date: 01/17/2011

```
39 IO        OUTPUT CONTROL VARIABLES
                   IPRNT          5  PRINT CONTROL
                   IPLOT          0  PLOT CONTROL
                   QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT        HYDROGRAPH TIME DATA
                    NMIN          3  MINUTES IN COMPUTATION INTERVAL
                   IDATE     19NOV10  STARTING DATE
                   ITIME        1200  STARTING TIME
                      NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                  NDDATE     23NOV10  ENDING DATE
                  NDTIME        1557  ENDING TIME
                   ICENT          19  CENTURY MARK
```

```
                COMPUTATION INTERVAL     .05 HOURS
                     TOTAL TIME BASE   99.95 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

 40 JD           INDEX STORM NO. 1
                       STRM        2.95  PRECIPITATION DEPTH
                       TRDA         .00  TRANSPOSITION DRAINAGE AREA

 41 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       .02       .02       .02       .02       .02
                     .03       .03       .03       .03       .03       .09       .09       .09       .09       .09
                     .02       .02       .02       .02       .02       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00

 44 JD           INDEX STORM NO. 2
                       STRM        2.93  PRECIPITATION DEPTH
                       TRDA         .50  TRANSPOSITION DRAINAGE AREA

 45 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       .02       .02       .02       .02       .02
                     .03       .03       .03       .03       .03       .09       .09       .09       .09       .09
                     .02       .02       .02       .02       .02       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00

 48 JD           INDEX STORM NO. 3
                       STRM        2.88  PRECIPITATION DEPTH
                       TRDA        2.80  TRANSPOSITION DRAINAGE AREA

 49 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
                     .01       .01       .01       .01       .01       .02       .02       .02       .02       .02
                     .04       .04       .04       .04       .04       .05       .05       .05       .05       .05
                     .03       .03       .03       .03       .03       .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

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
 112 KK   *     DAMSC  *      STORAGE
          *            *
          **************

 119 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          3  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

               HYDROGRAPH ROUTING DATA

 120 RS          STORAGE ROUTING
                      NSTPS          1  NUMBER OF SUBREACHES
                       ITYP       STOR  TYPE OF INITIAL CONDITION
                     RSVRIC        .00  INITIAL CONDITION
                          X        .00 WORKING R AND D COEFFICIENT

 121 SV            STORAGE          .0      19.3      26.9      36.5      47.9      61.2      76.5      93.9     113.5     135.3
                                 159.6     186.8     216.9     225.1     233.4     241.6     250.2     286.8     326.8     368.0

 123 SQ          DISCHARGE          0.        0.        2.        3.        5.        6.        7.        7.        8.        9.
                                    9.       10.       28.      162.      393.      674.      979.     2635.     4906.     7746.

 125 SE          ELEVATION       2130.00   2150.20   2152.20   2154.20   2156.20   2158.20   2160.20   2162.20   2164.20   2166.20
                                 2168.20   2170.20   2172.20   2172.70   2173.20   2173.70   2174.20   2176.20   2178.20   2180.20
                                                                   ***

    ***            ***            ***            ***            ***

                     HYDROGRAPH AT STATION    DAMSC
                   TRANSPOSITION AREA        .0 SQ MI
```

```
 PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR      99.95-HR
   (CFS)       (HR)
                                  (CFS)
+      8.      7.25                   8.           8.           8.           7.
                                (INCHES)         .055         .218         .618         .792
                                 (AC-FT)           4.          16.          46.          59.

 PEAK STORAGE  TIME                                MAXIMUM AVERAGE STORAGE
                                        6-HR        24-HR        72-HR      99.95-HR
+  (AC-FT)     (HR)
     128.      7.50                  127.         122.         106.          95.

 PEAK STAGE    TIME                                MAXIMUM AVERAGE STAGE
                                        6-HR        24-HR        72-HR      99.95-HR
+   (FEET)     (HR)
   2165.54     7.50                2165.45      2164.94      2163.44      2161.37

                                CUMULATIVE AREA =    1.39 SQ MI

      ***                   ***          ***          ***          ***

                              HYDROGRAPH AT STATION    DAMSC
                             TRANSPOSITION AREA       .5 SQ MI

 PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR      99.95-HR
+   (CFS)      (HR)
                                  (CFS)
+      8.      7.25                   8.           8.           8.           7.
                                (INCHES)         .055         .218         .615         .788
                                 (AC-FT)           4.          16.          46.          59.

 PEAK STORAGE  TIME                                MAXIMUM AVERAGE STORAGE
                                        6-HR        24-HR        72-HR      99.95-HR
+  (AC-FT)     (HR)
     127.      7.50                  126.         120.         105.          94.

 PEAK STAGE    TIME                                MAXIMUM AVERAGE STAGE
                                        6-HR        24-HR        72-HR      99.95-HR
+   (FEET)     (HR)
   2165.44     7.50                2165.35      2164.84      2163.33      2161.27

                                CUMULATIVE AREA =    1.39 SQ MI

      ***                   ***          ***          ***          ***

                              HYDROGRAPH AT STATION    DAMSC
                             TRANSPOSITION AREA      2.8 SQ MI

 PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR      99.95-HR
+   (CFS)      (HR)
                                  (CFS)
+      8.      7.55                   8.           8.           7.           7.
                                (INCHES)         .053         .205         .573         .731
                                 (AC-FT)           4.          15.          43.          54.

 PEAK STORAGE  TIME                                MAXIMUM AVERAGE STORAGE
                                        6-HR        24-HR        72-HR      99.95-HR
+  (AC-FT)     (HR)
     111.      7.65                  110.         105.          91.          81.

 PEAK STAGE    TIME                                MAXIMUM AVERAGE STAGE
                                        6-HR        24-HR        72-HR      99.95-HR
+   (FEET)     (HR)
   2163.93     7.70                2163.84      2163.31      2161.78      2159.78

                                CUMULATIVE AREA =    1.39 SQ MI

      ***                   ***          ***          ***          ***

                              INTERPOLATED HYDROGRAPH AT    DAMSC

 PEAK FLOW     TIME                                MAXIMUM AVERAGE FLOW
                                        6-HR        24-HR        72-HR      99.95-HR
+   (CFS)      (HR)
                                  (CFS)
+      8.      7.55                   8.           8.           7.           7.
                                (INCHES)         .054         .210         .590         .754
                                 (AC-FT)           4.          16.          44.          56.

                                CUMULATIVE AREA =    1.39 SQ MI

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

            **************
            *            *
 163 KK     *    DAMSN   *      STORAGE
            *            *
            **************

 170 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          3  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

                HYDROGRAPH ROUTING DATA
```

```
171 RS        STORAGE ROUTING
                   NSTPS        1  NUMBER OF SUBREACHES
                    ITYP     STOR  TYPE OF INITIAL CONDITION
                   RSVRIC      .00  INITIAL CONDITION
                        X      .00 WORKING R AND D COEFFICIENT

172 SV          STORAGE        .0      10.8      19.0      29.3      35.3      41.6      48.6      55.9      63.8      80.5
                              89.4      98.9     108.6     119.0     129.7     141.3     153.1     165.8     178.8     192.7

174 SQ          DISCHARGE      0.        0.        3.        5.        6.        6.        7.        7.        8.        9.
                             173.      437.      714.     1041.     1412.     1822.     2267.     2746.     3255.     3793.

176 SE          ELEVATION   2113.50   2122.20   2124.20   2126.20   2127.20   2128.20   2129.20   2130.20   2131.20   2133.20
                            2134.20   2135.20   2136.20   2137.20   2138.20   2139.20   2140.20   2141.20   2142.20   2143.20
                                                                      ***

     ***            ***            ***            ***            ***

                      HYDROGRAPH AT STATION    DAMSN
                    TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      99.95-HR
+   (CFS)       (HR)
                                   (CFS)
+      7.       6.25                 7.           7.           6.           5.
                                (INCHES)         .111         .421        1.037        1.195
                                 (AC-FT)           4.          14.          33.          38.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR        72-HR      99.95-HR
+  (AC-FT)      (HR)
     54.        6.35                53.          48.          36.          31.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR        72-HR      99.95-HR
+   (FEET)      (HR)
  2129.91       6.35             2129.75      2129.07      2127.27      2126.00

                      CUMULATIVE AREA =      .60 SQ MI

     ***            ***            ***            ***            ***

                      HYDROGRAPH AT STATION    DAMSN
                    TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      99.95-HR
+   (CFS)       (HR)
                                   (CFS)
+      7.       6.25                 7.           7.           6.           5.
                                (INCHES)         .110         .419        1.029        1.184
                                 (AC-FT)           4.          13.          33.          38.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR        72-HR      99.95-HR
+  (AC-FT)      (HR)
     53.        6.35                52.          47.          36.          31.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR        72-HR      99.95-HR
+   (FEET)      (HR)
  2129.84       6.35             2129.68      2129.01      2127.21      2125.95

                      CUMULATIVE AREA =      .60 SQ MI

     ***            ***            ***            ***            ***

                      HYDROGRAPH AT STATION    DAMSN
                    TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      99.95-HR
+   (CFS)       (HR)
                                   (CFS)
+      7.       6.45                 7.           6.           5.           4.
                                (INCHES)         .102         .382         .887         .999
                                 (AC-FT)           3.          12.          28.          32.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR        72-HR      99.95-HR
+  (AC-FT)      (HR)
     46.        6.50                45.          40.          30.          26.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR        72-HR      99.95-HR
+   (FEET)      (HR)
  2128.79       6.50             2128.64      2127.98      2126.29      2125.16

                      CUMULATIVE AREA =      .60 SQ MI

     ***            ***            ***            ***            ***


                    INTERPOLATED HYDROGRAPH AT    DAMSN

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR        72-HR      99.95-HR
+   (CFS)       (HR)
                                   (CFS)
+      7.       6.35                 7.           7.           5.           5.
```

50Y6H

(INCHES)	.110	.415	1.014	1.164
(AC-FT)	4.	13.	32.	37.

CUMULATIVE AREA = .60 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	SC1	863.	4.25	99.	25.	8.	.56		
ROUTED TO	RSC1C1	834.	4.35	99.	25.	8.	.56		
HYDROGRAPH AT	SC2	250.	4.10	18.	4.	1.	.10		
2 COMBINED AT	C1	893.	4.30	115.	29.	10.	.66		
HYDROGRAPH AT	SC3	367.	4.15	34.	9.	3.	.20		
2 COMBINED AT	C2	1124.	4.25	144.	36.	12.	.86		
ROUTED TO	RC2DAM	993.	4.65	144.	36.	12.	.86		
HYDROGRAPH AT	SC4	574.	4.30	78.	20.	7.	.38		
HYDROGRAPH AT	SC5	324.	4.15	31.	8.	3.	.15		
3 COMBINED AT	C3	1316.	4.45	239.	60.	20.	1.39		
ROUTED TO	DAMSC	8.	7.55	8.	8.	7.	1.39		
DIVERSION TO	DTSC	8.	7.55	8.	8.	7.	1.39		
HYDROGRAPH AT	DIVSC	0.	.00	0.	0.	0.	1.39		
ROUTED TO	RSCC4	0.	.00	0.	0.	0.	1.39		
HYDROGRAPH AT	SC6	282.	4.10	20.	5.	2.	.11		
2 COMBINED AT	C4	282.	4.10	20.	5.	2.	.11		
HYDROGRAPH AT	SN1	793.	4.30	108.	27.	9.	.60		
ROUTED TO	DAMSN	7.	6.35	7.	7.	5.	.60		
DIVERSION TO	DTSN	7.	6.35	7.	7.	5.	.60		
HYDROGRAPH AT	DIVSN	0.	.00	0.	0.	0.	.60		
ROUTED TO	RSNC5	0.	.00	0.	0.	0.	.60		
HYDROGRAPH AT	SN2	421.	4.20	43.	11.	4.	.25		
2 COMBINED AT	C5	421.	4.20	43.	11.	4.	.25		
2 COMBINED AT	C6	660.	4.15	63.	16.	5.	.37		
ROUTED TO	RC6C7	597.	4.25	63.	16.	5.	.37		
HYDROGRAPH AT	RTSC	8.	7.55	8.	8.	7.	1.39		
ROUTED TO	RSCC7	8.	7.65	8.	8.	7.	1.39		
HYDROGRAPH AT	RTSN	7.	6.35	7.	7.	5.	.60		
ROUTED TO	RSNC7	7.	6.45	7.	7.	5.	.60		
HYDROGRAPH AT	SN3	483.	4.15	46.	12.	4.	.22		
4 COMBINED AT	C7	975.	4.20	116.	40.	22.	.59		

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
FOR STORM = 1	STORM AREA (SQ MI) =			.00					
RSCC7	MANE	3.00	8.34	458.43	.79	3.00	8.34	459.00	.79

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5885E+02 EXCESS= .0000E+00 OUTFLOW= .5879E+02 BASIN STORAGE= .5916E-01 PERCENT ERROR= .0

FOR STORM = 2	STORM AREA (SQ MI) =			.50					
RSCC7	MANE	3.00	8.31	458.64	.79	3.00	8.31	459.00	.79

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5858E+02 EXCESS= .0000E+00 OUTFLOW= .5852E+02 BASIN STORAGE= .5888E-01 PERCENT ERROR= .0

FOR STORM = 3	STORM AREA (SQ MI) =			2.80					
RSCC7	MANE	3.00	7.91	468.24	.73	3.00	7.91	468.00	.73

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5434E+02 EXCESS= .0000E+00 OUTFLOW= .5430E+02 BASIN STORAGE= .5402E-01 PERCENT ERROR= .0

FOR STORM = 1	STORM AREA (SQ MI) =			.00					
RSNC7	MANE	3.00	7.25	388.00	1.19	3.00	7.25	387.00	1.19

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3830E+02 EXCESS= .0000E+00 OUTFLOW= .3827E+02 BASIN STORAGE= .2102E-01 PERCENT ERROR= .0

FOR STORM = 2	STORM AREA (SQ MI) =			.50					
RSNC7	MANE	3.00	7.22	388.19	1.18	3.00	7.22	387.00	1.18

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3794E+02 EXCESS= .0000E+00 OUTFLOW= .3791E+02 BASIN STORAGE= .2068E-01 PERCENT ERROR= .0

FOR STORM = 3	STORM AREA (SQ MI) =			2.80					
RSNC7	MANE	3.00	6.65	397.85	1.00	3.00	6.65	396.00	1.00

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3203E+02 EXCESS= .0000E+00 OUTFLOW= .3201E+02 BASIN STORAGE= .1577E-01 PERCENT ERROR= .0

*** NORMAL END OF HEC-1 ***

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN   1998               *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   13APR11  TIME  09:19:22   *
*                                       *
*****************************************
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```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
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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
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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        Flood Control District of Maricopa County
    2           ID    Project Name: Wickenburg Area Drainage Master Study/Plan
    3           ID    Contract FCD 2009C030
    4           ID    Hoskin Ryan Consultants, Inc.
    5           ID
    6           ID    Phase I Hydrology Model
    7           ID    Phase I study area includes tributary watersheds of Sunset and
    8           ID    Sunnycove Washes. Sunnycove tributary sub basins include: SC1, SC2
    9           ID    SC3, SC4, SC5 and SC6.  Sunnset tributary sub basins include: SN1,
   10           ID    SN2 and SN3.
   11           ID    Total drainage area is 2.59 square miles.
   12           ID    Two flood retarding structures were constructed within Phase I
   13           ID    study area, Sunset and Sunnycove Dams.  A pipeline system was
   14           ID    constructed and connected to the primary spillways to release
   15           ID    Dam Reservoirs to Hassayampa River.
   16           ID    The compacity of the pipeline system is 19.5 cfs for Sunnycove Dam
   17           ID    and 17.1 cfs for Sunset Dam.  Excess flow will be released at the
   18           ID    release manholes immediate downstream of the dams or through the
   19           ID    emergency spillways.
   20           ID
   21           ID    100 Year 6 Hour Existing Condition
   22           ID        Model prepared with DDMSW version 4.6.0
   23           ID    Rainfall: NOAA 14
   24           ID    Area-Depth: the default reduction factor in DDMSW was selected
   25           ID    Rainfall Loss: Green-Ampt Equation
   26           ID        Unit Hydrograph: S-Graph (Mountain)
   27           ID    Soil: Latest soil map from NRCS was used, file provided by FCDMC
   28           ID    Land Use: MAG 2009 land use file was used, provided by FCDMC
   29           ID    Channel Routing: Cross-section geometries and Manning's n were
   30           ID    based on field observation.
   31           ID    Storage Routing: Dam storage volumes were based on 2004 Wickenburg
   32           ID    Aerial Mapping.
   33           ID
   34           ID    File Name: 100Y6H.DAT
   35           ID        Date: 01/17/2011
   36           ID
   37           IT       3 19NOV10    1200    2000
   38           IN      15
   39           IO       5
                *DIAGRAM
                *
   40           JD   3.319  0.0001
   41           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
   42           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
   43           PC   0.962   0.972   0.983   0.991   1.000
   44           JD   3.299  0.5000
   45           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
   46           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
   47           PC   0.962   0.972   0.983   0.991   1.000
   48           JD   3.236     2.8
   49           PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.068   0.077
   50           PC   0.088   0.101   0.121   0.164   0.253   0.451   0.694   0.836   0.900   0.938
   51           PC   0.950   0.963   0.975   0.988   1.000
                *
1                                    HEC-1 INPUT                                    PAGE  2

  LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   52           KK     SC1   BASIN
   53           BA   0.562
   54           LG    0.18    0.34    6.60    0.16       9
   55           UI       0      78      96     259     414     528     621     843     714     504
   56           UI     442     390     345     301     253     204     184     168     136     110
   57           UI      97      85      74      59      59      38      38      38      34      15
   58           UI      15      15      15      15      15      15      15      15       0       0
   59           UI       0       0       0       0       0       0       0       0       0       0
                *
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```
 60          KK  RSC1C1   ROUTE
 61          RS       2    FLOW
 62          RC   0.057   0.033   0.057    2546  0.0150 2316.00
 63          RX  900.00  950.00  990.00  993.00 1008.00 1011.00 1051.00 1100.00
 64          RY  2316.0 2315.00 2311.00 2310.00 2310.00 2311.00 2315.00 2316.00
             *

 65          KK     SC2   BASIN
 66          BA   0.100
 67          LG    0.20    0.37    6.60    0.15       8
 68          UI       0      46     173     306     236     162     116      79      55      38
 69          UI      26      17      13       6       6       6       0       0       0       0
 70          UI       0       0       0       0       0       0       0       0       0       0
 71          UI       0       0       0       0       0       0       0       0       0       0
 72          UI       0       0       0       0       0       0       0       0       0       0
             *

 73          KK      C1 COMBINE
 74          KM    Total tributary area of 0.6627 square miles for Sub Basin SC1 and SC2.
 75          HC       2  0.6627
             *

 76          KK     SC3   BASIN
 77          BA   0.197
 78          LG    0.19    0.37    6.40    0.16       7
 79          UI       0      37      85     186     261     350     352     228     194     163
 80          UI     135     103      87      73      55      45      39      28      25      18
 81          UI      18      13       7       7       7       7       7       7       0       0
 82          UI       0       0       0       0       0       0       0       0       0       0
 83          UI       0       0       0       0       0       0       0       0       0       0
             *

 84          KK      C2 COMBINE
 85          KM    Total tributary area of 0.8597 square miles for Sub Basin SC1, SC2 and SC3.
 86          HC       2  0.8597
             *

 87          KK  RC2DAM   ROUTE
 88          RS       7    FLOW
 89          RC   0.062   0.035   0.062   10737  0.0145 2206.00
 90          RX  900.00  926.00  986.00  990.00 1010.00 1014.00 1074.00 1100.00
 91          RY  2206.0 2205.00 2202.00 2200.00 2200.00 2202.00 2205.00 2206.00
             *
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 92          KK     SC4   BASIN
 93          BA   0.384
 94          LG    0.20    0.35    7.00    0.12      22
 95          UI       0      44      44     107     183     259     307     348     441     498
 96          UI     325     274     250     224     203     181     160     136     114     106
 97          UI      98      85      73      57      55      48      45      34      34      30
 98          UI      22      22      22      22      12       8       8       8       8       8
 99          UI       8       8       8       8       8       0       0       0       0       0
             *

100          KK     SC5   BASIN
101          BA   0.150
102          LG    0.21    0.38    6.40    0.15      30
103          UI       0      33      97     196     266     338     208     170     139     109
104          UI      82      70      50      39      32      25      18      16      13       6
105          UI       6       6       6       6       0       0       0       0       0       0
106          UI       0       0       0       0       0       0       0       0       0       0
107          UI       0       0       0       0       0       0       0       0       0       0
             *

108          KK      C3 COMBINE
109          KM    Total tributary area of 1.3934 square miles for Sub Basin SC1, SC2, SC3,
110          KM    SC4 and SC5.
111          ZW   A=WK B=C3 C=FLOW
112          HC       3  1.3934
             *

113          KK   DAMSC STORAGE
114          KM   According to the as-built plan, the emergency spillway crest elevation is
115          KM   2172.20 feet (NAVD88).
116          KM   The stage-discharge rating curve is based on SITES model results, provided
117          KM   by FCDMC.
118          KM   The dam storage routing is for FEMA floodplain delineation purposes, not
119          KM   applicable for NRCS dam safety standards.
120          KO       3
121          RS       1    STOR
122          SV       0   19.28   26.94   36.47   47.89   61.20   76.51   93.90  113.47  135.29
123          SV  159.65  186.80  216.92  225.15  233.39  241.63  250.19  286.77  326.84  368.00
124          SQ       0       0     1.7     3.2     4.7     5.9     6.6     7.3     8.0     8.5
125          SQ     9.0     9.6    28.0     162     393     674     979    2635    4906    7746
126          SE    2130 2150.20 2152.20 2154.20 2156.20 2158.20 2160.20 2162.20 2164.20 2166.20
127          SE  2168.2 2170.20 2172.20 2172.70 2173.20 2173.70 2174.20 2176.20 2178.20 2180.20
             *

128          KK   DIVSC  DIVERT
129          KM   The downstream pipeline has a maximum capacity of 19.5 cfs.
130          DT    DTSC     0.0    19.5
131          DI     0.0    19.5  4000.0
132          DQ     0.0    19.5    19.5
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

133          KK   RSCC4   ROUTE
134          RS       1    FLOW
```

```
135          RC   0.055   0.035   0.055    2689  0.0347 2106.00
136          RX  900.00  960.00  990.00  998.00 1002.00 1010.00 1012.00 1013.00
137          RY  2106.0 2105.00 2102.00 2100.00 2100.00 2102.00 2108.00 2108.00
             *

138          KK     SC6   BASIN
139          BA   0.114
140          LG    0.25    0.38    6.40    0.16      13
141          UI       0      50     189     331     281     186     135      91      66      44
142          UI      31      21      18       7       7       7       7       0       0       0
143          UI       0       0       0       0       0       0       0       0       0       0
144          UI       0       0       0       0       0       0       0       0       0       0
145          UI       0       0       0       0       0       0       0       0       0       0
             *

146          KK      C4 COMBINE
147          KM   Given that no surface flow released from Sunnycove Dam during the 10-,
148          KM   50-, 100- and 250-year 6-hour events, the total tributary area for C4
149          KM   only includes Sub Basin SC6, i.e. 0.114 square miles.
150          KM   Given that the surface flow released from Sunnycove Dam during the
151          KM   500-year 6-hour event lags behind the local flow from Sub Basin SC6
152          KM   and is not additive to the dominating local peak flow, the total
153          KM   tributary area for C4 only includes Sub Basin SC6, i.e. 0.114 square
154          KM   miles.
155          HC       2   0.114
             *

156          KK     SN1   BASIN
157          ZW   A=WK B=SN1 C=FLOW
158          BA   0.601
159          LG    0.19    0.39    6.00    0.19      18
160          UI       0      68      68     159     272     387     462     527     645     797
161          UI     524     432     391     353     321     285     257     221     185     166
162          UI     156     142     113      98      87      77      74      59      52      52
163          UI      39      33      33      33      33      13      13      13      13      13
164          UI      13      13      13      13      13      13       0       0       0       0
             *

165          KK   DAMSN STORAGE
166          KM   According to the as-built plan, the emergency spillway crest elevation is
167          KM   2133.20 feet (NAVD88).
168          KM   The stage-discharge rating curve is based on SITES model results, provided
169          KM   by FCDMC.
170          KM   The dam storage routing is for FEMA floodplain delineation purposes, not
171          KM   applicable for NRCS dam safety standards.
172          KO       3
173          RS       1    STOR
174          SV       0   10.81   19.04   29.27   35.33   41.59   48.64   55.86   63.77   80.53
175          SV   89.37   98.87  108.56  119.00  129.68  141.27  153.09  165.82  178.79  192.72
176          SQ       0       0    2.60    5.10    5.70    6.30    6.90    7.40    7.90    8.80
177          SQ     173     437     714    1041    1412    1822    2267    2746    3255    3793
178          SE  2113.5 2122.20 2124.20 2126.20 2127.20 2128.20 2129.20 2130.20 2131.20 2133.20
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

179          SE  2134.2 2135.20 2136.20 2137.20 2138.20 2139.20 2140.20 2141.20 2142.20 2143.20
             *

180          KK   DIVSN  DIVERT
181          KM   The downstream pipeline has a maximum capacity of 17.1 cfs.
182          DT    DTSN     0.0    17.1
183          DI     0.0    17.1  1500.0
184          DQ     0.0    17.1    17.1
             *

185          KK   RSNC5   ROUTE
186          RS       1    FLOW
187          RC   0.064   0.035   0.064    2143  0.0169 2097.00
188          RX  900.00  950.00  977.00  995.00 1005.00 1023.00 1050.00 1100.00
189          RY  2097.0 2096.00 2096.00 2090.00 2090.00 2096.00 2096.00 2097.00
             *

190          KK     SN2   BASIN
191          BA   0.255
192          LG    0.20    0.40    6.00    0.18       7
193          UI       0      40      67     157     248     303     401     391     259     224
194          UI     194     167     140     112      96      87      68      53      47      43
195          UI      31      31      20      20      20      12       8       8       8       8
196          UI       8       8       8       0       0       0       0       0       0       0
197          UI       0       0       0       0       0       0       0       0       0       0
             *

198          KK      C5 COMBINE
199          KM   Given that no surface flow released from Sunset Dam during the 10-, 50-,
200          KM   100- and 250-year 6-hour events, the total tributary area for C5 only
201          KM   includes Sub Basin SN2, i.e. 0.255 square miles.
202          KM   Given that the surface flow released from Sunset Dam during the 500-year
203          KM   6-hour event lags behind the local flow from Sub Basin SN2 and is not
204          KM   additive to the dominating local peak flow, the total tributary area
205          KM   for C5 only includes Sub Basin SN2, i.e. 0.255 square miles.
206          HC       2   0.255
             *

207          KK      C6 COMBINE
208          KM   Given that no surface flow released from Sunnycove/Sunset Dams during
209          KM   the 10-, 50-, 100- and 250-year events, the total tributary area for C6
210          KM   only includes Sub Basin SC6 and SN2, i.e. 0.369 square miles.
211          KM   Given that the surface flow released from Sunnycove/Sunset Dams during
212          KM   the 500-year 6-hour event lags behind the local flows from Sub Basin SC6
213          KM   and SN2 and is not additive to the dominating local peak flow, the total
214          KM   tributary area for C6 only includes Sub Basin SC6 and SN2, i.e. 0.369
215          KM   square miles.
216          HC       2   0.369
             *
```

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 217          KK   RC6C7   ROUTE
 218          RS       2    FLOW
 219          RC   0.069   0.036   0.069    3552  0.0122 2057.00
 220          RX  900.00  950.00  963.00  993.00 1008.00 1038.00 1050.00 1100.00
 221          RY  2057.0 2056.00 2056.00 2050.00 2050.00 2056.00 2056.00 2057.00
              *

 222          KK    RTSCRETRIEVE
 223          DR    DTSC
              *

 224          KK   RSCC7   ROUTE
 225          KM   Kinematic wave was selected for the routing through the pipeline, no attenuat
 226          RK    5691  0.0163   0.013            CIRC   1.500
              *

 227          KK    RTSNRETRIEVE
 228          DR    DTSN
              *

 229          KK   RSNC7   ROUTE
 230          KM   Kinematic wave was selected for the routing through the pipeline, no attenuat
 231          RK    5047  0.0143   0.013            CIRC   1.500
              *

 232          KK     SN3   BASIN
 233          BA   0.223
 234          LG    0.22    0.35    5.20    0.29      39
 235          UI       0      52     174     338     476     469     303     247     195     142
 236          UI     117      87      64      52      40      28      26      16      10      10
 237          UI      10      10      10       0       0       0       0       0       0       0
 238          UI       0       0       0       0       0       0       0       0       0       0
 239          UI       0       0       0       0       0       0       0       0       0       0
              *

 240          KK      C7 COMBINE
 241          KM   Given that no surface flow released from Sunnycove/Sunset Dams during
 242          KM   the 10-, 50-, 100- and 250-year 6-hour events, the total tributary area
 243          KM   for C7 only includes Sub Basin SC6, SN2 and SN3, i.e. 0.5913 square miles.
 244          KM   Given that the surface flow released from Sunnycove/Sunset Dams during
 245          KM   the 500-year 6-hour event lags behind the local flows from Sub Basin SC6,
 246          KM   SN2 and SN3 and is not additive to  the dominating local peak flow, the
 247          KM   total tributary area for C7 only includes Sub Basin SC6, SN2 and SN3,
 248          KM   i.e. 0.5913 square miles.
 249          HC       4  0.5913
              *
 250          ZZ
```

1

```
              SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   52        SC1
              V
              V
   60     RSC1C1
              .
              .
   65         .         SC2
              .           .
              .           .
   73        C1...........
              .
              .
   76         .         SC3
              .           .
              .           .
   84        C2...........
              V
              V
   87     RC2DAM
              .
              .
   92         .         SC4
              .           .
              .           .
  100         .           .         SC5
              .           .           .
              .           .           .
  108        C3......................
              V
              V
  113      DAMSC
              .
              .
  130         .------->    DTSC
  128      DIVSC
              V
              V
  133      RSCC4
              .
              .
  138         .         SC6
              .           .
              .           .
  146        C4...........
              .
              .
  156         .         SN1
              .           V
```

```
                 .          V
165              .       DAMSN
                 .          .
                 .          .
182              .          .-------->    DTSN
180              .       DIVSN
                 .          V
                 .          V
185              .       RSNC5
                 .          .
                 .          .
190              .          .         SN2
                 .          .          .
                 .          .          .
198              .         C5............
                 .          .
                 .          .
207            C6............
                V
                V
217         RC6C7
                 .
                 .
223              .          .<--------    DTSC
222              .       RTSC
                 .          V
                 .          V
224              .       RSCC7
                 .          .
                 .          .
228              .          .          .<--------    DTSN
227              .          .       RTSN
                 .          .          V
                 .          .          V
229              .          .      RSNC7
                 .          .          .
                 .          .          .
232              .          .          .         SN3
                 .          .          .          .
                 .          .          .          .
240            C7.................................
```

```
(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN  1998               *
*            VERSION 4.1               *
*                                      *
*  RUN DATE   13APR11  TIME  09:19:22  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*          (916) 756-1104              *
*                                      *
****************************************
```

Flood Control District of Maricopa County
Project Name: Wickenburg Area Drainage Master Study/Plan
Contract FCD 2009C030
Hoskin Ryan Consultants, Inc.

Phase I Hydrology Model
Phase I study area includes tributary watersheds of Sunset and Sunnycove Washes. Sunnycove tributary sub basins include: SC1, SC2 SC3, SC4, SC5 and SC6. Sunnset tributary sub basins include: SN1, SN2 and SN3.
Total drainage area is 2.59 square miles.
Two flood retarding structures were constructed within Phase I study area, Sunset and Sunnycove Dams. A pipeline system was constructed and connected to the primary spillways to release Dam Reservoirs to Hassayampa River.
The compacity of the pipeline system is 19.5 cfs for Sunnycove Dam and 17.1 cfs for Sunset Dam. Excess flow will be released at the release manholes immediate downstream of the dams or through the emergency spillways.

100 Year 6 Hour Existing Condition
Model prepared with DDMSW version 4.6.0
Rainfall: NOAA 14
Area-Depth: the default reduction factor in DDMSW was selected
Rainfall Loss: Green-Ampt Equation
Unit Hydrograph: S-Graph (Mountain)
Soil: Latest soil map from NRCS was used, file provided by FCDMC
Land Use: MAG 2009 land use file was used, provided by FCDMC
Channel Routing: Cross-section geometries and Manning's n were based on field observation.
Storage Routing: Dam storage volumes were based on 2004 Wickenburg Aerial Mapping.

File Name: 100Y6H.DAT
Date: 01/17/2011

```
39 IO        OUTPUT CONTROL VARIABLES
                   IPRNT          5  PRINT CONTROL
                   IPLOT          0  PLOT CONTROL
                   QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT        HYDROGRAPH TIME DATA
                    NMIN          3  MINUTES IN COMPUTATION INTERVAL
                   IDATE     19NOV10  STARTING DATE
                   ITIME        1200  STARTING TIME
                      NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                  NDDATE     23NOV10  ENDING DATE
                  NDTIME        1557  ENDING TIME
```

```
                ICENT          19  CENTURY MARK

          COMPUTATION INTERVAL     .05 HOURS
              TOTAL TIME BASE   99.95 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

 40 JD      INDEX STORM NO. 1
                STRM        3.32  PRECIPITATION DEPTH
                TRDA         .00  TRANSPOSITION DRAINAGE AREA

 41 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       .02       .02       .02       .02       .02
                .03       .03       .03       .03       .03       .09       .09       .09       .09       .09
                .02       .02       .02       .02       .02       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00

 44 JD      INDEX STORM NO. 2
                STRM        3.30  PRECIPITATION DEPTH
                TRDA         .50  TRANSPOSITION DRAINAGE AREA

 45 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       .02       .02       .02       .02       .02
                .03       .03       .03       .03       .03       .09       .09       .09       .09       .09
                .02       .02       .02       .02       .02       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                .00       .00       .00       .00       .00       .00       .00       .00       .00       .00

 48 JD      INDEX STORM NO. 3
                STRM        3.24  PRECIPITATION DEPTH
                TRDA        2.80  TRANSPOSITION DRAINAGE AREA

 49 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
                .01       .01       .01       .01       .01       .02       .02       .02       .02       .02
                .04       .04       .04       .04       .04       .05       .05       .05       .05       .05
                .03       .03       .03       .03       .03       .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
   -----DSS---ZOPEN:  New File Opened,  File: DAMROUTING.DSS
                      Unit:  71;  DSS Version: 6-JG
-----DSS---ZWRITE Unit  71; Vers.    1:  /WK/C3/FLOW/19NOV1910/3MIN//
-----DSS---ZWRITE Unit  71; Vers.    1:  /WK/C3/FLOW/20NOV1910/3MIN//
-----DSS---ZWRITE Unit  71; Vers.    1:  /WK/C3/FLOW/21NOV1910/3MIN//
-----DSS---ZWRITE Unit  71; Vers.    1:  /WK/C3/FLOW/22NOV1910/3MIN//
-----DSS---ZWRITE Unit  71; Vers.    1:  /WK/C3/FLOW/23NOV1910/3MIN//


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


          **************
          *            *
 113 KK   *     DAMSC  *      STORAGE
          *            *
          **************

 120 KO      OUTPUT CONTROL VARIABLES
                IPRNT           3  PRINT CONTROL
                IPLOT           0  PLOT CONTROL
                QSCAL          0.  HYDROGRAPH PLOT SCALE

           HYDROGRAPH ROUTING DATA

 121 RS      STORAGE ROUTING
                NSTPS           1  NUMBER OF SUBREACHES
                 ITYP        STOR  TYPE OF INITIAL CONDITION
                RSVRIC        .00  INITIAL CONDITION
                    X         .00 WORKING R AND D COEFFICIENT

 122 SV       STORAGE          .0      19.3      26.9      36.5      47.9      61.2      76.5      93.9     113.5     135.3
                             159.6     186.8     216.9     225.1     233.4     241.6     250.2     286.8     326.8     368.0

 124 SQ      DISCHARGE         0.        0.        2.        3.        5.        6.        7.        7.        8.        9.
                               9.       10.       28.      162.      393.      674.      979.     2635.     4906.     7746.

 126 SE      ELEVATION     2130.00   2150.20   2152.20   2154.20   2156.20   2158.20   2160.20   2162.20   2164.20   2166.20
```

```
2168.20   2170.20   2172.20   2172.70   2173.20   2173.70   2174.20   2176.20   2178.20   2180.20
                                  ***
   ***          ***          ***          ***          ***

                HYDROGRAPH AT STATION    DAMSC
              TRANSPOSITION AREA        .0 SQ MI

 PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                              6-HR        24-HR        72-HR      99.95-HR
+  (CFS)       (HR)
                  (CFS)
+     9.        7.45            9.           9.           8.           8.
                (INCHES)      .059         .232         .666         .859
                (AC-FT)         4.           17.          49.          64.

 PEAK STORAGE  TIME                    MAXIMUM AVERAGE STORAGE
                              6-HR        24-HR        72-HR      99.95-HR
+ (AC-FT)      (HR)
    151.       7.50           150.         144.         128.         115.

 PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                              6-HR        24-HR        72-HR      99.95-HR
+  (FEET)      (HR)
  2167.48      7.50         2167.39      2166.91      2165.46      2163.35

                CUMULATIVE AREA =     1.39 SQ MI

   ***          ***          ***          ***          ***

                HYDROGRAPH AT STATION    DAMSC
              TRANSPOSITION AREA        .5 SQ MI

 PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                              6-HR        24-HR        72-HR      99.95-HR
+  (CFS)       (HR)
                  (CFS)
+     9.        7.45            9.           9.           8.           8.
                (INCHES)      .059         .231         .663         .856
                (AC-FT)         4.           17.          49.          64.

 PEAK STORAGE  TIME                    MAXIMUM AVERAGE STORAGE
                              6-HR        24-HR        72-HR      99.95-HR
+ (AC-FT)      (HR)
    150.       7.50           149.         143.         127.         114.

 PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                              6-HR        24-HR        72-HR      99.95-HR
+  (FEET)      (HR)
  2167.38      7.50         2167.29      2166.81      2165.36      2163.24

                CUMULATIVE AREA =     1.39 SQ MI

   ***          ***          ***          ***          ***

                HYDROGRAPH AT STATION    DAMSC
              TRANSPOSITION AREA       2.8 SQ MI

 PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                              6-HR        24-HR        72-HR      99.95-HR
+  (CFS)       (HR)
                  (CFS)
+     8.        7.55            8.           8.           8.           7.
                (INCHES)      .056         .222         .631         .811
                (AC-FT)         4.           16.          47.          60.

 PEAK STORAGE  TIME                    MAXIMUM AVERAGE STORAGE
                              6-HR        24-HR        72-HR      99.95-HR
+ (AC-FT)      (HR)
    134.       7.70           133.         127.         112.         100.

 PEAK STAGE    TIME                    MAXIMUM AVERAGE STAGE
                              6-HR        24-HR        72-HR      99.95-HR
+  (FEET)      (HR)
  2166.08      7.65         2165.98      2165.47      2163.98      2161.92

                CUMULATIVE AREA =     1.39 SQ MI

   ***          ***          ***          ***          ***


                INTERPOLATED HYDROGRAPH AT    DAMSC

 PEAK FLOW     TIME                    MAXIMUM AVERAGE FLOW
                              6-HR        24-HR        72-HR      99.95-HR
+  (CFS)       (HR)
                  (CFS)
+     9.        7.50            9.           8.           8.           7.
                (INCHES)      .057         .226         .644         .829
                (AC-FT)         4.           17.          48.          62.

                CUMULATIVE AREA =     1.39 SQ MI

-----DSS---ZWRITE Unit  71; Vers.    1:  /WK/SN1/FLOW/19NOV1910/3MIN//
-----DSS---ZWRITE Unit  71; Vers.    1:  /WK/SN1/FLOW/20NOV1910/3MIN//
-----DSS---ZWRITE Unit  71; Vers.    1:  /WK/SN1/FLOW/21NOV1910/3MIN//
-----DSS---ZWRITE Unit  71; Vers.    1:  /WK/SN1/FLOW/22NOV1910/3MIN//
-----DSS---ZWRITE Unit  71; Vers.    1:  /WK/SN1/FLOW/23NOV1910/3MIN//

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***
```

```
              **************
              *            *
165 KK        *    DAMSN   *      STORAGE
              *            *
              **************

172 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          3  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

              HYDROGRAPH ROUTING DATA

173 RS          STORAGE ROUTING
                      NSTPS          1  NUMBER OF SUBREACHES
                       ITYP       STOR  TYPE OF INITIAL CONDITION
                     RSVRIC        .00  INITIAL CONDITION
                          X        .00  WORKING R AND D COEFFICIENT

174 SV            STORAGE          .0      10.8      19.0      29.3      35.3      41.6      48.6      55.9      63.8      80.5
                                  89.4      98.9     108.6     119.0     129.7     141.3     153.1     165.8     178.8     192.7

176 SQ            DISCHARGE        0.        0.        3.        5.        6.        6.        7.        7.        8.        9.
                                  173.      437.      714.     1041.     1412.     1822.     2267.     2746.     3255.     3793.

178 SE            ELEVATION     2113.50   2122.20   2124.20   2126.20   2127.20   2128.20   2129.20   2130.20   2131.20   2133.20
                                2134.20   2135.20   2136.20   2137.20   2138.20   2139.20   2140.20   2141.20   2142.20   2143.20
                                                                   ***

      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION    DAMSN
                      TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR       72-HR     99.95-HR
+   (CFS)       (HR)
                          (CFS)
+      8.       6.35                8.          7.          6.          5.
                        (INCHES)   .121        .461       1.189       1.408
                         (AC-FT)     4.         15.         38.         45.

  PEAK STORAGE  TIME                         MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR       72-HR     99.95-HR
+  (AC-FT)      (HR)
      63.       6.35                62.         57.         44.         37.

  PEAK STAGE    TIME                         MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR       72-HR     99.95-HR
+   (FEET)      (HR)
   2131.16      6.35             2130.99     2130.32     2128.46     2127.06

                      CUMULATIVE AREA =      .60 SQ MI

      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION    DAMSN
                      TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR       72-HR     99.95-HR
+   (CFS)       (HR)
                          (CFS)
+      8.       6.35                8.          7.          6.          5.
                        (INCHES)   .120        .459       1.182       1.397
                         (AC-FT)     4.         15.         38.         45.

  PEAK STORAGE  TIME                         MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR       72-HR     99.95-HR
+  (AC-FT)      (HR)
      63.       6.35                62.         56.         44.         37.

  PEAK STAGE    TIME                         MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR       72-HR     99.95-HR
+   (FEET)      (HR)
   2131.09      6.35             2130.93     2130.25     2128.39     2127.00

                      CUMULATIVE AREA =      .60 SQ MI

      ***             ***             ***             ***             ***

                        HYDROGRAPH AT STATION    DAMSN
                      TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR       72-HR     99.95-HR
+   (CFS)       (HR)
                          (CFS)
+      7.       6.45                7.          7.          6.          5.
                        (INCHES)   .112        .427       1.061       1.228
                         (AC-FT)     4.         14.         34.         39.

  PEAK STORAGE  TIME                         MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR       72-HR     99.95-HR
+  (AC-FT)      (HR)
      55.       6.55                54.         49.         37.         32.

  PEAK STAGE    TIME                         MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR       72-HR     99.95-HR
+   (FEET)      (HR)
   2130.09      6.55             2129.93     2129.25     2127.45     2126.17
```

CUMULATIVE AREA = .60 SQ MI

*** *** *** *** ***

INTERPOLATED HYDROGRAPH AT DAMSN

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	99.95-HR
8.	6.30	(CFS)	8.	7.	6.	5.
		(INCHES)	.119	.456	1.169	1.379
		(AC-FT)	4.	15.	37.	44.

CUMULATIVE AREA = .60 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	SC1	1006.	4.25	117.	29.	10.	.56		
ROUTED TO	RSC1C1	974.	4.35	117.	29.	10.	.56		
HYDROGRAPH AT	SC2	288.	4.10	21.	5.	2.	.10		
2 COMBINED AT	C1	1048.	4.30	136.	34.	11.	.66		
HYDROGRAPH AT	SC3	427.	4.15	40.	10.	3.	.20		
2 COMBINED AT	C2	1322.	4.25	172.	43.	14.	.86		
ROUTED TO	RC2DAM	1168.	4.65	172.	43.	14.	.86		
HYDROGRAPH AT	SC4	663.	4.30	91.	23.	8.	.38		
HYDROGRAPH AT	SC5	372.	4.15	36.	9.	3.	.15		
3 COMBINED AT	C3	1542.	4.55	286.	72.	24.	1.39		
ROUTED TO	DAMSC	9.	7.50	9.	8.	8.	1.39		
DIVERSION TO	DTSC	9.	7.50	9.	8.	8.	1.39		
HYDROGRAPH AT	DIVSC	0.	.00	0.	0.	0.	1.39		
ROUTED TO	RSCC4	0.	.00	0.	0.	0.	1.39		
HYDROGRAPH AT	SC6	326.	4.10	24.	6.	2.	.11		
2 COMBINED AT	C4	326.	4.10	24.	6.	2.	.11		
HYDROGRAPH AT	SN1	927.	4.30	128.	32.	11.	.60		
ROUTED TO	DAMSN	8.	6.30	8.	7.	6.	.60		
DIVERSION TO	DTSN	8.	6.30	8.	7.	6.	.60		
HYDROGRAPH AT	DIVSN	0.	.00	0.	0.	0.	.60		
ROUTED TO	RSNC5	0.	.00	0.	0.	0.	.60		
HYDROGRAPH AT	SN2	493.	4.20	51.	13.	4.	.25		
2 COMBINED AT	C5	493.	4.20	51.	13.	4.	.25		
2 COMBINED AT	C6	770.	4.15	75.	19.	6.	.37		
ROUTED TO	RC6C7	704.	4.25	75.	19.	6.	.37		
HYDROGRAPH AT	RTSC	9.	7.50	9.	8.	8.	1.39		

```
          ROUTED TO
                        RSCC7        9.    7.60         9.         8.         8.      1.39
          HYDROGRAPH AT
+                       RTSN         8.    6.30         8.         7.         6.       .60
          ROUTED TO
+                       RSNC7        8.    6.40         8.         7.         6.       .60
          HYDROGRAPH AT
+                        SN3       557.    4.15        54.        14.         5.       .22
          4 COMBINED AT
+                         C7      1146.    4.20       136.        46.        25.       .59
1
                                   SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                       (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                          INTERPOLATED TO
                                                                       COMPUTATION INTERVAL
          ISTAQ    ELEMENT      DT        PEAK    TIME TO      VOLUME      DT       PEAK    TIME TO      VOLUME
                                                     PEAK                                     PEAK
                              (MIN)      (CFS)     (MIN)      (IN)     (MIN)     (CFS)     (MIN)       (IN)
          FOR STORM = 1  STORM AREA (SQ MI) =        .00
             RSCC7  MANE        3.00      8.82    459.77       .86      3.00      8.82    459.00        .86

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6386E+02 EXCESS= .0000E+00 OUTFLOW= .6379E+02 BASIN STORAGE= .6465E-01 PERCENT ERROR=    .0

          FOR STORM = 2  STORM AREA (SQ MI) =        .50
             RSCC7  MANE        3.00      8.79    458.22       .86      3.00      8.79    459.00        .85

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6361E+02 EXCESS= .0000E+00 OUTFLOW= .6354E+02 BASIN STORAGE= .6822E-01 PERCENT ERROR=    .0

          FOR STORM = 3  STORM AREA (SQ MI) =       2.80
             RSCC7  MANE        3.00      8.47    467.44       .81      3.00      8.47    468.00        .81

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6025E+02 EXCESS= .0000E+00 OUTFLOW= .6020E+02 BASIN STORAGE= .6072E-01 PERCENT ERROR=    .0

          FOR STORM = 1  STORM AREA (SQ MI) =        .00
             RSNC7  MANE        2.97      7.88    388.59      1.41      3.00      7.88    387.00       1.41

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4513E+02 EXCESS= .0000E+00 OUTFLOW= .4509E+02 BASIN STORAGE= .2857E-01 PERCENT ERROR=    .0

          FOR STORM = 2  STORM AREA (SQ MI) =        .50
             RSNC7  MANE        2.97      7.85    388.75      1.40      3.00      7.85    387.00       1.40

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4478E+02 EXCESS= .0000E+00 OUTFLOW= .4475E+02 BASIN STORAGE= .2820E-01 PERCENT ERROR=    .0

          FOR STORM = 3  STORM AREA (SQ MI) =       2.80
             RSNC7  MANE        2.99      7.35    398.16      1.23      3.00      7.35    399.00       1.23

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3935E+02 EXCESS= .0000E+00 OUTFLOW= .3933E+02 BASIN STORAGE= .2209E-01 PERCENT ERROR=    .0


*** NORMAL END OF HEC-1 ***


  -----DSS---ZCLOSE Unit:  71,   File: DAMROUTING.DSS
            Pointer Utilization:    .25
            Number of Records:     10
            File Size:     32.2  Kbytes
            Percent Inactive:     .0
```

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN  1998               *
*            VERSION 4.1               *
*                                      *
*  RUN DATE   12APR11  TIME  16:06:26  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    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        Flood Control District of Maricopa County
  2           ID    Project Name: Wickenburg Area Drainage Master Study/Plan
  3           ID    Contract FCD 2009C030
  4           ID    Hoskin Ryan Consultants, Inc.
  5           ID
  6           ID    Phase I Hydrology Model
  7           ID    Phase I study area includes tributary watersheds of Sunset and
  8           ID    Sunnycove Washes. Sunnycove tributary sub basins include: SC1, SC2
  9           ID    SC3, SC4, SC5 and SC6.  Sunnset tributary sub basins include: SN1,
 10           ID    SN2 and SN3.
 11           ID    Total drainage area is 2.59 square miles.
 12           ID    Two flood retarding structures were constructed within Phase I
 13           ID    study area, Sunset and Sunnycove Dams.  A pipeline system was
 14           ID    constructed and connected to the primary spillways to release
 15           ID    Dam Reservoirs to Hassayampa River.
 16           ID    The compacity of the pipeline system is 19.5 cfs for Sunnycove Dam
 17           ID    and 17.1 cfs for Sunset Dam.  Excess flow will be released at the
 18           ID    release manholes immediate downstream of two dams or through the
 19           ID    emergency spillways.
 20           ID
 21           ID    100 Year 24 Hour Existing Condition
 22           ID        Model prepared with DDMSW version 4.6.0
 23           ID    Rainfall: NOAA 14
 24           ID    Area-Depth: the default reduction factor in DDMSW was selected
 25           ID    Rainfall Loss: Green-Ampt Equation
 26           ID        Unit Hydrograph: S-Graph (Mountain)
 27           ID    Soil: Latest soil map from NRCS was used, file provided by FCDMC
 28           ID    Land Use: MAG 2009 land use file was used, provided by FCDMC
 29           ID    Channel Routing: Cross-section geometries and Manning's n were
 30           ID    based on field observation.
 31           ID    Storage Routing: Dam storage volumes were based on 2004 Wickenburg
 32           ID    Aerial Mapping.
 33           ID
 34           ID    File Name: 100Y24H.DAT
 35           ID        Date: 01/17/2011
 36           ID
 37           IT       3 19NOV10    1200    2000
 38           IN      15
 39           IO       5
              *DIAGRAM
              *
 40           JD   4.422  0.0001
 41           PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
 42           PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
 43           PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
 44           PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
 45           PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
 46           PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
 47           PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
 48           PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
 49           PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
 50           PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
 51           JD   4.289     5.0
 52           JD   4.201    10.0
              *
```

1 HEC-1 INPUT PAGE 2

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 53           KK     SC1   BASIN
 54           BA   0.562
 55           LG    0.18    0.34    6.60    0.16       9
 56           UI       0      78      96     259     414     528     621     843     714     504
 57           UI     442     390     345     301     253     204     184     168     136     110
 58           UI      97      85      74      59      59      38      38      38      34      15
 59           UI      15      15      15      15      15      15      15      15       0       0
 60           UI       0       0       0       0       0       0       0       0       0       0
```

```
              *
   61         KK  RSC1C1   ROUTE
   62         RS       2    FLOW
   63         RC   0.057   0.033   0.057    2546  0.0150 2316.00
   64         RX  900.00  950.00  990.00  993.00 1008.00 1011.00 1051.00 1100.00
   65         RY  2316.0 2315.00 2311.00 2310.00 2310.00 2311.00 2315.00 2316.00
              *
   66         KK     SC2   BASIN
   67         BA   0.100
   68         LG    0.20    0.37    6.60    0.15       8
   69         UI       0      46     173     306     236     162     116      79      55      38
   70         UI      26      17      13       6       6       6       0       0       0       0
   71         UI       0       0       0       0       0       0       0       0       0       0
   72         UI       0       0       0       0       0       0       0       0       0       0
   73         UI       0       0       0       0       0       0       0       0       0       0
              *
   74         KK      C1 COMBINE
   75         KM    Total tributary area of 0.6627 square miles for Sub Basin SC1 and SC2.
   76         HC       2  0.6627
              *
   77         KK     SC3   BASIN
   78         BA   0.197
   79         LG    0.19    0.37    6.40    0.16       7
   80         UI       0      37      85     186     261     350     352     228     194     163
   81         UI     135     103      87      73      55      45      39      28      25      18
   82         UI      18      13       7       7       7       7       7       7       0       0
   83         UI       0       0       0       0       0       0       0       0       0       0
   84         UI       0       0       0       0       0       0       0       0       0       0
              *
   85         KK      C2 COMBINE
   86         KM    Total tributary area of 0.8597 square miles for Sub Basin SC1, SC2 and SC3.
   87         HC       2  0.8597
              *
   88         KK  RC2DAM   ROUTE
   89         RS       7    FLOW
   90         RC   0.062   0.035   0.062   10737  0.0145 2206.00
   91         RX  900.00  926.00  986.00  990.00 1010.00 1014.00 1074.00 1100.00
   92         RY  2206.0 2205.00 2202.00 2200.00 2200.00 2202.00 2205.00 2206.00
              *
1                                          HEC-1 INPUT                                          PAGE  3

 LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   93         KK     SC4   BASIN
   94         BA   0.384
   95         LG    0.20    0.35    7.00    0.12      22
   96         UI       0      44      44     107     183     259     307     348     441     498
   97         UI     325     274     250     224     203     181     160     136     114     106
   98         UI      98      85      73      57      55      48      45      34      34      30
   99         UI      22      22      22      22      12       8       8       8       8       8
  100         UI       8       8       8       8       8       0       0       0       0       0
              *
  101         KK     SC5   BASIN
  102         BA   0.150
  103         LG    0.21    0.38    6.40    0.15      30
  104         UI       0      33      97     196     266     338     208     170     139     109
  105         UI      82      70      50      39      32      25      18      16      13       6
  106         UI       6       6       6       6       0       0       0       0       0       0
  107         UI       0       0       0       0       0       0       0       0       0       0
  108         UI       0       0       0       0       0       0       0       0       0       0
              *
  109         KK      C3 COMBINE
  110         KM    Total tributary area of 1.3934 square miles for Sub Basin SC1, SC2, SC3,
  111         KM    SC4 and SC5.
  112         HC       3  1.3934
              *
  113         KK   DAMSC STORAGE
  114         KM   According to the as-built plan, the emergency spillway crest elevation is
  115         KM   2172.20 feet (NAVD88).
  116         KM   The stage-discharge rating curve is based on SITES model results, provided
  117         KM   by FCDMC.
  118         KM   The dam storage routing is for FEMA floodplain delineation purposes, not
  119         KM   applicable for NRCS dam safety standards.
  120         KO       3
  121         RS       1    STOR
  122         SV       0   19.28   26.94   36.47   47.89   61.20   76.51   93.90  113.47  135.29
  123         SV  159.65  186.80  216.92  225.15  233.39  241.63  250.19  286.77  326.84  368.00
  124         SQ       0       0     1.7     3.2     4.7     5.9     6.6     7.3     8.0     8.5
  125         SQ     9.0     9.6    28.0     162     393     674     979    2635    4906    7746
  126         SE    2130 2150.20 2152.20 2154.20 2156.20 2158.20 2160.20 2162.20 2164.20 2166.20
  127         SE  2168.2 2170.20 2172.20 2172.70 2173.20 2173.70 2174.20 2176.20 2178.20 2180.20
              *
  128         KK   DIVSC  DIVERT
  129         KM   The downstream pipeline has a maximum capacity of 19.5 cfs.
  130         DT    DTSC     0.0    19.5
  131         DI     0.0    19.5  4000.0
  132         DQ     0.0    19.5    19.5
              *
1                                          HEC-1 INPUT                                          PAGE  4

 LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  133         KK   RSCC4   ROUTE
  134         RS       1    FLOW
```

```
                                                  100Y24H
135          RC   0.055   0.035   0.055    2689  0.0347 2106.00
136          RX  900.00  960.00  990.00  998.00 1002.00 1010.00 1012.00 1013.00
137          RY  2106.0 2105.00 2102.00 2100.00 2100.00 2102.00 2108.00 2108.00
             *

138          KK     SC6   BASIN
139          BA   0.114
140          LG    0.25    0.38    6.40    0.16      13
141          UI       0      50     189     331     281     186     135      91      66      44
142          UI      31      21      18       7       7       7       7       0       0       0
143          UI       0       0       0       0       0       0       0       0       0       0
144          UI       0       0       0       0       0       0       0       0       0       0
145          UI       0       0       0       0       0       0       0       0       0       0
             *

146          KK      C4 COMBINE
147          KM   Given that no surface flow released from Sunnycove Dam during the 10-, 50-,
148          KM   100-, 250- and 500-year 24-hour events, the total tributary area for C4 only
149          KM   includes Sub Basin SC6, i.e. 0.114 square miles.
150          HC       2   0.114
             *

151          KK     SN1   BASIN
152          BA   0.601
153          LG    0.19    0.39    6.00    0.19      18
154          UI       0      68      68     159     272     387     462     527     645     797
155          UI     524     432     391     353     321     285     257     221     185     166
156          UI     156     142     113      98      87      77      74      59      52      52
157          UI      39      33      33      33      33      13      13      13      13      13
158          UI      13      13      13      13      13      13       0       0       0       0
             *

159          KK   DAMSN STORAGE
160          KM   According to the as-built plan, the emergency spillway crest elevation is
161          KM   2133.20 feet (NAVD88).
162          KM   The stage-discharge rating curve is based on SITES model results, provided
163          KM   by FCDMC.
164          KM   The dam storage routing is for FEMA floodplain delineation purposes, not
165          KM   applicable for NRCS dam safety standards.
166          KO       3
167          RS       1    STOR
168          SV       0   10.81   19.04   29.27   35.33   41.59   48.64   55.86   63.77   80.53
169          SV   89.37   98.87  108.56  119.00  129.68  141.27  153.09  165.82  178.79  192.72
170          SQ       0       0    2.60    5.10    5.70    6.30    6.90    7.40    7.90    8.80
171          SQ     173     437     714    1041    1412    1822    2267    2746    3255    3793
172          SE  2113.5 2122.20 2124.20 2126.20 2127.20 2128.20 2129.20 2130.20 2131.20 2133.20
173          SE  2134.2 2135.20 2136.20 2137.20 2138.20 2139.20 2140.20 2141.20 2142.20 2143.20
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1 HEC-1 INPUT PAGE 5

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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

174          KK   DIVSN  DIVERT
175          KM   The downstream pipeline has a maximum capacity of 17.1 cfs.
176          DT    DTSN     0.0    17.1
177          DI     0.0    17.1  1500.0
178          DQ     0.0    17.1    17.1
             *

179          KK   RSNC5   ROUTE
180          RS       1    FLOW
181          RC   0.064   0.035   0.064    2143  0.0169 2097.00
182          RX  900.00  950.00  977.00  995.00 1005.00 1023.00 1050.00 1100.00
183          RY  2097.0 2096.00 2096.00 2090.00 2090.00 2096.00 2096.00 2097.00
             *

184          KK     SN2   BASIN
185          BA   0.255
186          LG    0.20    0.40    6.00    0.18       7
187          UI       0      40      67     157     248     303     401     391     259     224
188          UI     194     167     140     112      96      87      68      53      47      43
189          UI      31      31      20      20      20      12       8       8       8       8
190          UI       8       8       8       0       0       0       0       0       0       0
191          UI       0       0       0       0       0       0       0       0       0       0
             *

192          KK      C5 COMBINE
193          KM   Given that no surface flow released from Sunset Dam during the 10-, 50-,
194          KM   100- 250- and 500-year 24-hour events, the total tributary area for C5 only
195          KM   includes Sub Basin SN2, i.e. 0.255 square miles.
196          HC       2   0.255
             *

197          KK      C6 COMBINE
198          KM   Given that no surface flow released from Sunnycove/Sunset Dams during the 10-
199          KM   50-, 100-, 250- and 500-year 24-hour events, the total tributary area for C6
200          KM   only includes Sub Basin SC6 and SN2, i.e. 0.369 square miles.
201          HC       2   0.369
             *

202          KK   RC6C7   ROUTE
203          RS       2    FLOW
204          RC   0.069   0.036   0.069    3552  0.0122 2057.00
205          RX  900.00  950.00  963.00  993.00 1008.00 1038.00 1050.00 1100.00
206          RY  2057.0 2056.00 2056.00 2050.00 2050.00 2056.00 2056.00 2057.00
             *

207          KK    RTSCRETRIEVE
208          DR    DTSC
             *
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1 HEC-1 INPUT PAGE 6

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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
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209          KK   RSCC7   ROUTE
210          KM   Kinematic wave was selected for the routing through the pipeline, no attenuat
211          RK    5691  0.0163   0.013            CIRC   1.500
             *

212          KK    RTSNRETRIEVE
213          DR    DTSN
             *

214          KK   RSNC7   ROUTE
215          KM   Kinematic wave was selected for the routing through the pipeline, no attenuat
216          RK    5047  0.0143   0.013            CIRC   1.500
             *

217          KK     SN3   BASIN
218          BA   0.223
219          LG    0.22     0.35     5.20     0.29      39
220          UI       0       52      174      338     476      469      303      247      195      142
221          UI     117       87       64       52      40       28       26       16       10       10
222          UI      10       10       10        0       0        0        0        0        0        0
223          UI       0        0        0        0       0        0        0        0        0        0
224          UI       0        0        0        0       0        0        0        0        0        0
             *

225          KK      C7 COMBINE
226          KM   Given that no surface flow released from Sunnycove/Sunset Dams during the 10-
227          KM   50-, 100-, 250- and 500-year 24-hour events, the total tributary area for C7
228          KM   only includes Sub Basin SC6, SN2 and SN3, i.e. 0.5913 square miles.
229          HC       4  0.5913
             *
230          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   53        SC1
              V
              V
   61     RSC1C1
              .
              .
   66         .         SC2
              .           .
              .           .
   74        C1............
              .
              .
   77         .         SC3
              .           .
              .           .
   85        C2............
              V
              V
   88     RC2DAM
              .
              .
   93         .         SC4
              .           .
              .           .
  101         .           .         SC5
              .           .           .
              .           .           .
  109        C3........................
              V
              V
  113      DAMSC
              .
              .
  130         .------->    DTSC
  128      DIVSC
              V
              V
  133      RSCC4
              .
              .
  138         .         SC6
              .           .
              .           .
  146        C4............
              .
              .
  151         .         SN1
              .           V
              .           V
  159         .       DAMSN
              .           .
              .           .
  176         .           .------->    DTSN
  174         .       DIVSN
              .           V
              .           V
  179         .       RSNC5
              .           .
              .           .
  184         .           .         SN2
              .           .           .
              .           .           .
  192         .         C5............
              .           .
              .           .
  197        C6............
              V
              V
```

```
202        RC6C7
             .
             .
208          .          .<-------    DTSC
207          .       RTSC
             .          V
             .          V
209          .       RSCC7
             .          .
             .          .
213          .          .          .<-------    DTSN
212          .          .       RTSN
             .          .          V
             .          .          V
214          .          .       RSNC7
             .          .          .
             .          .          .
217          .          .          .         SN3
             .          .          .           .
             .          .          .           .
225          C7.......................................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            JUN   1998                *
*          VERSION 4.1                 *
*                                      *
*  RUN DATE   12APR11  TIME  16:06:26  *
*                                      *
****************************************
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```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

Flood Control District of Maricopa County
Project Name: Wickenburg Area Drainage Master Study/Plan
Contract FCD 2009C030
Hoskin Ryan Consultants, Inc.

Phase I Hydrology Model
Phase I study area includes tributary watersheds of Sunset and Sunnycove Washes. Sunnycove tributary sub basins include: SC1, SC2 SC3, SC4, SC5 and SC6. Sunnset tributary sub basins include: SN1, SN2 and SN3.
Total drainage area is 2.59 square miles.
Two flood retarding structures were constructed within Phase I study area, Sunset and Sunnycove Dams. A pipeline system was constructed and connected to the primary spillways to release Dam Reservoirs to Hassayampa River.
The compacity of the pipeline system is 19.5 cfs for Sunnycove Dam and 17.1 cfs for Sunset Dam. Excess flow will be released at the release manholes immediate downstream of two dams or through the emergency spillways.

100 Year 24 Hour Existing Condition
Model prepared with DDMSW version 4.6.0
Rainfall: NOAA 14
Area-Depth: the default reduction factor in DDMSW was selected
Rainfall Loss: Green-Ampt Equation
Unit Hydrograph: S-Graph (Mountain)
Soil: Latest soil map from NRCS was used, file provided by FCDMC
Land Use: MAG 2009 land use file was used, provided by FCDMC
Channel Routing: Cross-section geometries and Manning's n were based on field observation.
Storage Routing: Dam storage volumes were based on 2004 Wickenburg Aerial Mapping.

File Name: 100Y24H.DAT
Date: 01/17/2011

```
39 IO        OUTPUT CONTROL VARIABLES
                  IPRNT          5  PRINT CONTROL
                  IPLOT          0  PLOT CONTROL
                  QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT        HYDROGRAPH TIME DATA
                   NMIN          3  MINUTES IN COMPUTATION INTERVAL
                  IDATE     19NOV10  STARTING DATE
                  ITIME       1200  STARTING TIME
                     NQ       2000  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE     23NOV10  ENDING DATE
                 NDTIME       1557  ENDING TIME
                  ICENT         19  CENTURY MARK

            COMPUTATION INTERVAL     .05 HOURS
                 TOTAL TIME BASE   99.95 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

40 JD        INDEX STORM NO. 1
                  STRM       4.42  PRECIPITATION DEPTH
                  TRDA        .00  TRANSPOSITION DRAINAGE AREA

41 PI          PRECIPITATION PATTERN
                 .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
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51 JD INDEX STORM NO. 2

STRM 4.29 PRECIPITATION DEPTH
TRDA 5.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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52 JD INDEX STORM NO. 3

STRM 4.20 PRECIPITATION DEPTH
TRDA 10.00 TRANSPOSITION DRAINAGE AREA

0 PI PRECIPITATION PATTERN

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.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	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
113 KK    *   DAMSC    *    STORAGE
          *            *
          **************

120 KO       OUTPUT CONTROL VARIABLES
                  IPRNT          3  PRINT CONTROL
                  IPLOT          0  PLOT CONTROL
                  QSCAL         0.  HYDROGRAPH PLOT SCALE

             HYDROGRAPH ROUTING DATA

121 RS       STORAGE ROUTING
                  NSTPS          1  NUMBER OF SUBREACHES
                  ITYP        STOR  TYPE OF INITIAL CONDITION
                  RSVRIC       .00  INITIAL CONDITION
                  X            .00  WORKING R AND D COEFFICIENT
```

122 SV	STORAGE	.0	19.3	26.9	36.5	47.9	61.2	76.5	93.9	113.5	135.3
		159.6	186.8	216.9	225.1	233.4	241.6	250.2	286.8	326.8	368.0
124 SQ	DISCHARGE	0.	0.	2.	3.	5.	6.	7.	7.	8.	9.
		9.	10.	28.	162.	393.	674.	979.	2635.	4906.	7746.
126 SE	ELEVATION	2130.00	2150.20	2152.20	2154.20	2156.20	2158.20	2160.20	2162.20	2164.20	2166.20
		2168.20	2170.20	2172.20	2172.70	2173.20	2173.70	2174.20	2176.20	2178.20	2180.20

```
                                                      ***

     ***           ***           ***           ***           ***

                  HYDROGRAPH AT STATION     DAMSC
                  TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW      TIME                     MAXIMUM AVERAGE FLOW
                                 6-HR        24-HR       72-HR      99.95-HR
+   (CFS)        (HR)
                          (CFS)
+      9.       19.65                9.          9.          8.          7.
                        (INCHES)  .057        .228        .654        .781
                        (AC-FT)     4.         17.         49.         58.

  PEAK STORAGE   TIME                     MAXIMUM AVERAGE STORAGE
                                 6-HR        24-HR       72-HR      99.95-HR
+  (AC-FT)       (HR)
      140.      20.15          140.        137.        122.        103.

  PEAK STAGE     TIME                     MAXIMUM AVERAGE STAGE
                                 6-HR        24-HR       72-HR      99.95-HR
+   (FEET)       (HR)
```

```
  2166.57     20.15                2166.56     2166.31     2164.95     2160.75

                        CUMULATIVE AREA =    1.39 SQ MI

      ***               ***          ***          ***          ***

                         HYDROGRAPH AT STATION    DAMSC
                       TRANSPOSITION AREA      5.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR       72-HR     99.95-HR
+   (CFS)       (HR)
                          (CFS)
+      8.       19.65                 8.          8.          8.          7.
                        (INCHES)     .056        .224        .642        .766
                         (AC-FT)      4.          17.         48.         57.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR       72-HR     99.95-HR
+  (AC-FT)      (HR)
    134.       20.10                134.        131.        116.         98.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR       72-HR     99.95-HR
+   (FEET)      (HR)
  2166.08      20.15              2166.06     2165.80     2164.43     2160.27

                        CUMULATIVE AREA =    1.39 SQ MI

      ***               ***          ***          ***          ***

                         HYDROGRAPH AT STATION    DAMSC
                       TRANSPOSITION AREA     10.0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR       72-HR     99.95-HR
+   (CFS)       (HR)
                          (CFS)
+      8.       19.90                 8.          8.          8.          7.
                        (INCHES)     .056        .222        .634        .755
                         (AC-FT)      4.          16.         47.         56.

 PEAK STORAGE   TIME                          MAXIMUM AVERAGE STORAGE
                                     6-HR        24-HR       72-HR     99.95-HR
+  (AC-FT)      (HR)
    130.       20.05                130.        127.        113.         95.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                     6-HR        24-HR       72-HR     99.95-HR
+   (FEET)      (HR)
  2165.73      20.05              2165.72     2165.45     2164.08     2159.95

                        CUMULATIVE AREA =    1.39 SQ MI

      ***               ***          ***          ***          ***


                       INTERPOLATED HYDROGRAPH AT     DAMSC

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                     6-HR        24-HR       72-HR     99.95-HR
+   (CFS)       (HR)
                          (CFS)
+      8.       19.65                 8.          8.          8.          7.
                        (INCHES)     .057        .225        .644        .767
                         (AC-FT)      4.          17.         48.         57.

                        CUMULATIVE AREA =    1.39 SQ MI


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
159 KK    *     DAMSN  *      STORAGE
          *            *
          **************

166 KO          OUTPUT CONTROL VARIABLES
                     IPRNT          3  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

              HYDROGRAPH ROUTING DATA

167 RS          STORAGE ROUTING
                     NSTPS          1  NUMBER OF SUBREACHES
                      ITYP       STOR  TYPE OF INITIAL CONDITION
                    RSVRIC        .00  INITIAL CONDITION
                         X        .00  WORKING R AND D COEFFICIENT

168 SV            STORAGE          .0      10.8      19.0      29.3      35.3      41.6      48.6      55.9      63.8      80.5
                                  89.4      98.9     108.6     119.0     129.7     141.3     153.1     165.8     178.8     192.7

170 SQ          DISCHARGE          0.        0.        3.        5.        6.        6.        7.        7.        8.        9.
                                  173.      437.      714.     1041.     1412.     1822.     2267.     2746.     3255.     3793.

172 SE          ELEVATION       2113.50   2122.20   2124.20   2126.20   2127.20   2128.20   2129.20   2130.20   2131.20   2133.20
                                2134.20   2135.20   2136.20   2137.20   2138.20   2139.20   2140.20   2141.20   2142.20   2143.20
```

*** *** *** *** ***

HYDROGRAPH AT STATION DAMSN
TRANSPOSITION AREA .0 SQ MI

PEAK FLOW (CFS)	TIME (HR)		6-HR	MAXIMUM AVERAGE FLOW 24-HR	72-HR	99.95-HR
+ 8.	15.75	(CFS)	8.	7.	6.	5.
		(INCHES)	.117	.454	1.175	1.328
		(AC-FT)	4.	15.	38.	43.

PEAK STORAGE (AC-FT)	TIME (HR)		6-HR	MAXIMUM AVERAGE STORAGE 24-HR	72-HR	99.95-HR
+ 58.	16.30		58.	55.	43.	35.

PEAK STAGE (FEET)	TIME (HR)		6-HR	MAXIMUM AVERAGE STAGE 24-HR	72-HR	99.95-HR
+ 2130.52	16.15		2130.50	2130.08	2128.32	2126.24

CUMULATIVE AREA = .60 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION DAMSN
TRANSPOSITION AREA 5.0 SQ MI

PEAK FLOW (CFS)	TIME (HR)		6-HR	MAXIMUM AVERAGE FLOW 24-HR	72-HR	99.95-HR
+ 7.	15.70	(CFS)	7.	7.	6.	5.
		(INCHES)	.114	.445	1.138	1.280
		(AC-FT)	4.	14.	36.	41.

PEAK STORAGE (AC-FT)	TIME (HR)		6-HR	MAXIMUM AVERAGE STORAGE 24-HR	72-HR	99.95-HR
+ 56.	16.10		56.	53.	41.	33.

PEAK STAGE (FEET)	TIME (HR)		6-HR	MAXIMUM AVERAGE STAGE 24-HR	72-HR	99.95-HR
+ 2130.22	16.05		2130.20	2129.77	2128.02	2125.98

CUMULATIVE AREA = .60 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION DAMSN
TRANSPOSITION AREA 10.0 SQ MI

PEAK FLOW (CFS)	TIME (HR)		6-HR	MAXIMUM AVERAGE FLOW 24-HR	72-HR	99.95-HR
+ 7.	15.80	(CFS)	7.	7.	6.	5.
		(INCHES)	.113	.438	1.114	1.248
		(AC-FT)	4.	14.	36.	40.

PEAK STORAGE (AC-FT)	TIME (HR)		6-HR	MAXIMUM AVERAGE STORAGE 24-HR	72-HR	99.95-HR
+ 54.	16.05		54.	51.	40.	32.

PEAK STAGE (FEET)	TIME (HR)		6-HR	MAXIMUM AVERAGE STAGE 24-HR	72-HR	99.95-HR
+ 2130.01	16.05		2129.99	2129.57	2127.82	2125.81

CUMULATIVE AREA = .60 SQ MI

*** *** *** *** ***

INTERPOLATED HYDROGRAPH AT DAMSN

PEAK FLOW (CFS)	TIME (HR)		6-HR	MAXIMUM AVERAGE FLOW 24-HR	72-HR	99.95-HR
+ 7.	15.70	(CFS)	7.	7.	6.	5.
		(INCHES)	.115	.446	1.145	1.289
		(AC-FT)	4.	14.	37.	41.

CUMULATIVE AREA = .60 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	SC1	834.	12.25	99.	27.	9.	.56		

ROUTED TO	RSC1C1	804.	12.35	99.	27.	9.	.56
+ HYDROGRAPH AT	SC2	233.	12.10	18.	5.	2.	.10
+ 2 COMBINED AT	C1	891.	12.30	117.	31.	10.	.66
+ HYDROGRAPH AT	SC3	347.	12.15	34.	9.	3.	.20
+ 2 COMBINED AT	C2	1192.	12.25	150.	40.	13.	.86
+ ROUTED TO	RC2DAM	1041.	12.60	150.	40.	13.	.86
+ HYDROGRAPH AT	SC4	535.	12.30	79.	23.	8.	.38
+ HYDROGRAPH AT	SC5	300.	12.15	32.	9.	3.	.15
+ 3 COMBINED AT	C3	1454.	12.45	260.	72.	24.	1.39
+ ROUTED TO	DAMSC	8.	19.65	8.	8.	8.	1.39
+ DIVERSION TO	DTSC	8.	19.65	8.	8.	8.	1.39
+ HYDROGRAPH AT	DIVSC	0.	.00	0.	0.	0.	1.39
+ ROUTED TO	RSCC4	0.	.00	0.	0.	0.	1.39
+ HYDROGRAPH AT	SC6	263.	12.10	21.	6.	2.	.11
+ 2 COMBINED AT	C4	263.	12.10	21.	6.	2.	.11
+ HYDROGRAPH AT	SN1	777.	12.30	111.	31.	10.	.60
+ ROUTED TO	DAMSN	7.	15.70	7.	7.	6.	.60
+ DIVERSION TO	DTSN	7.	15.70	7.	7.	6.	.60
+ HYDROGRAPH AT	DIVSN	0.	.00	0.	0.	0.	.60
+ ROUTED TO	RSNC5	0.	.00	0.	0.	0.	.60
+ HYDROGRAPH AT	SN2	401.	12.20	42.	11.	4.	.25
+ 2 COMBINED AT	C5	401.	12.20	42.	11.	4.	.25
+ 2 COMBINED AT	C6	624.	12.15	63.	17.	6.	.37
+ ROUTED TO	RC6C7	568.	12.25	63.	17.	6.	.37
+ HYDROGRAPH AT	RTSC	8.	19.65	8.	8.	8.	1.39
+ ROUTED TO	RSCC7	8.	19.75	8.	8.	8.	1.39
+ HYDROGRAPH AT	RTSN	7.	15.70	7.	7.	6.	.60
+ ROUTED TO	RSNC7	7.	16.20	7.	7.	6.	.60
+ HYDROGRAPH AT	SN3	445.	12.15	48.	15.	5.	.22
+ 4 COMBINED AT	C7	953.	12.20	121.	43.	24.	.59

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
FOR STORM = 1	STORM AREA (SQ MI) =			.00					
RSCC7	MANE	3.00	8.59	1218.55	.78	3.00	8.59	1221.00	.78

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5804E+02 EXCESS= .0000E+00 OUTFLOW= .5798E+02 BASIN STORAGE= .6799E-01 PERCENT ERROR= .0

```
FOR STORM = 2  STORM AREA (SQ MI) =        5.00
   RSCC7  MANE          3.00      8.47   1215.41       .76      3.00      8.47   1215.00          .76

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5689E+02 EXCESS= .0000E+00 OUTFLOW= .5682E+02 BASIN STORAGE= .6335E-01 PERCENT ERROR=    .0

FOR STORM = 3  STORM AREA (SQ MI) =       10.00
   RSCC7  MANE          3.00      8.38   1213.30       .75      3.00      8.38   1215.00          .75

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5611E+02 EXCESS= .0000E+00 OUTFLOW= .5605E+02 BASIN STORAGE= .6593E-01 PERCENT ERROR=    .0

FOR STORM = 1  STORM AREA (SQ MI) =         .00
   RSNC7  MANE          3.00      7.56    987.61      1.33      3.00      7.56    987.00         1.33

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4255E+02 EXCESS= .0000E+00 OUTFLOW= .4253E+02 BASIN STORAGE= .3191E-01 PERCENT ERROR=    .0

FOR STORM = 2  STORM AREA (SQ MI) =        5.00
   RSNC7  MANE          2.90      7.41    979.89      1.28      3.00      7.41    981.00         1.28

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4102E+02 EXCESS= .0000E+00 OUTFLOW= .4099E+02 BASIN STORAGE= .2997E-01 PERCENT ERROR=    .0

FOR STORM = 3  STORM AREA (SQ MI) =       10.00
   RSNC7  MANE          2.92      7.31    977.08      1.25      3.00      7.31    975.00         1.25

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4000E+02 EXCESS= .0000E+00 OUTFLOW= .3997E+02 BASIN STORAGE= .2877E-01 PERCENT ERROR=    .0


*** NORMAL END OF HEC-1 ***
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1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN   1998               *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   12APR11  TIME  16:07:13  *
*                                      *
****************************************
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****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
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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
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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

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID        Flood Control District of Maricopa County
  2           ID     Project Name: Wickenburg Area Drainage Master Study/Plan
  3           ID     Contract FCD 2009C030
  4           ID     Hoskin Ryan Consultants, Inc.
  5           ID
  6           ID     Phase I Hydrology Model
  7           ID     Phase I study area includes tributary watersheds of Sunset and
  8           ID     Sunnycove Washes. Sunnycove tributary sub basins include: SC1, SC2
  9           ID     SC3, SC4, SC5 and SC6.  Sunnset tributary sub basins include: SN1,
 10           ID     SN2 and SN3.
 11           ID     Total drainage area is 2.59 square miles.
 12           ID     Two flood retarding structures were constructed within Phase I
 13           ID     study area, Sunset and Sunnycove Dams.  A pipeline system was
 14           ID     constructed and connected to the primary spillways to release
 15           ID     Dam Reservoirs to Hassayampa River.
 16           ID     The compacity of the pipeline system is 19.5 cfs for Sunnycove Dam
 17           ID     and 17.1 cfs for Sunset Dam.  Excess flow will be released at the
 18           ID     release manholes immediate downstream of two dams or through the
 19           ID     emergency spillways.
 20           ID
 21           ID     500 Year 6 Hour Existing Condition
 22           ID        Model prepared with DDMSW version 4.6.0
 23           ID     Rainfall: NOAA 14
 24           ID     Area-Depth: the default reduction factor in DDMSW was selected
 25           ID     Rainfall Loss: Green-Ampt Equation
 26           ID        Unit Hydrograph: S-Graph (Mountain)
 27           ID     Soil: Latest soil map from NRCS was used, file provided by FCDMC
 28           ID     Land Use: MAG 2009 land use file was used, provided by FCDMC
 29           ID     Channel Routing: Cross-section geometries and Manning's n were
 30           ID     based on field observation.
 31           ID     Storage Routing: Dam storage volumes were based on 2004 Wickenburg
 32           ID     Aerial Mapping.
 33           ID
 34           ID     File Name: 500Y6H.DAT
 35           ID        Date: 01/17/2011
 36           ID
 37           IT       3 19NOV10    1200    2000
 38           IN      15
 39           IO       5
              *DIAGRAM
              *
 40           JD   4.200  0.0001
 41           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
 42           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
 43           PC   0.962   0.972   0.983   0.991   1.000
 44           JD   4.175  0.5000
 45           PC   0.000   0.008   0.016   0.025   0.033   0.041   0.050   0.058   0.066   0.074
 46           PC   0.087   0.099   0.118   0.138   0.216   0.377   0.834   0.911   0.931   0.950
 47           PC   0.962   0.972   0.983   0.991   1.000
 48           JD   4.095     2.8
 49           PC   0.000   0.009   0.016   0.025   0.034   0.042   0.051   0.059   0.068   0.077
 50           PC   0.088   0.101   0.121   0.164   0.253   0.451   0.694   0.836   0.900   0.938
 51           PC   0.950   0.963   0.975   0.988   1.000
              *
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1 HEC-1 INPUT PAGE 2

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 52           KK     SC1   BASIN
 53           BA   0.562
 54           LG    0.18    0.34    6.60    0.16       9
 55           UI       0      78      96     259     414     528     621     843     714     504
 56           UI     442     390     345     301     253     204     184     168     136     110
 57           UI      97      85      74      59      59      38      38      38      34      15
 58           UI      15      15      15      15      15      15      15      15       0       0
 59           UI       0       0       0       0       0       0       0       0       0       0
              *
```

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 60          KK  RSC1C1   ROUTE
 61          RS       2    FLOW
 62          RC   0.057   0.033   0.057    2546  0.0150 2316.00
 63          RX  900.00  950.00  990.00  993.00 1008.00 1011.00 1051.00 1100.00
 64          RY  2316.0 2315.00 2311.00 2310.00 2310.00 2311.00 2315.00 2316.00
             *

 65          KK     SC2   BASIN
 66          BA   0.100
 67          LG    0.20    0.37    6.60    0.15       8
 68          UI       0      46     173     306     236     162     116      79      55      38
 69          UI      26      17      13       6       6       6       0       0       0       0
 70          UI       0       0       0       0       0       0       0       0       0       0
 71          UI       0       0       0       0       0       0       0       0       0       0
 72          UI       0       0       0       0       0       0       0       0       0       0
             *

 73          KK      C1 COMBINE
 74          KM    Total tributary area of 0.6627 square miles for Sub Basin SC1 and SC2.
 75          HC       2  0.6627
             *

 76          KK     SC3   BASIN
 77          BA   0.197
 78          LG    0.19    0.37    6.40    0.16       7
 79          UI       0      37      85     186     261     350     352     228     194     163
 80          UI     135     103      87      73      55      45      39      28      25      18
 81          UI      18      13       7       7       7       7       7       7       0       0
 82          UI       0       0       0       0       0       0       0       0       0       0
 83          UI       0       0       0       0       0       0       0       0       0       0
             *

 84          KK      C2 COMBINE
 85          KM    Total tributary area of 0.8597 square miles for Sub Basin SC1, SC2 and SC3.
 86          HC       2  0.8597
             *

 87          KK  RC2DAM   ROUTE
 88          RS       7    FLOW
 89          RC   0.062   0.035   0.062   10737  0.0145 2206.00
 90          RX  900.00  926.00  986.00  990.00 1010.00 1014.00 1074.00 1100.00
 91          RY  2206.0 2205.00 2202.00 2200.00 2200.00 2202.00 2205.00 2206.00
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 92          KK     SC4   BASIN
 93          BA   0.384
 94          LG    0.20    0.35    7.00    0.12      22
 95          UI       0      44      44     107     183     259     307     348     441     498
 96          UI     325     274     250     224     203     181     160     136     114     106
 97          UI      98      85      73      57      55      48      45      34      34      30
 98          UI      22      22      22      22      12       8       8       8       8       8
 99          UI       8       8       8       8       8       0       0       0       0       0
             *

100          KK     SC5   BASIN
101          BA   0.150
102          LG    0.21    0.38    6.40    0.15      30
103          UI       0      33      97     196     266     338     208     170     139     109
104          UI      82      70      50      39      32      25      18      16      13       6
105          UI       6       6       6       6       0       0       0       0       0       0
106          UI       0       0       0       0       0       0       0       0       0       0
107          UI       0       0       0       0       0       0       0       0       0       0
             *

108          KK      C3 COMBINE
109          KM    Total tributary area of 1.3934 square miles for Sub Basin SC1, SC2, SC3,
110          KM    SC4 and SC5.
111          HC       3  1.3934
             *

112          KK   DAMSC STORAGE
113          KM   According to the as-built plan, the emergency spillway crest elevation is
114          KM   2172.20 feet (NAVD88).
115          KM   The stage-discharge rating curve is based on SITES model results, provided
116          KM   by FCDMC.
117          KM   The dam storage routing is for FEMA floodplain delineation purposes, not
118          KM   applicable for NRCS dam safety standards.
119          KO       3
120          RS       1    STOR
121          SV       0   19.28   26.94   36.47   47.89   61.20   76.51   93.90  113.47  135.29
122          SV  159.65  186.80  216.92  225.15  233.39  241.63  250.19  286.77  326.84  368.00
123          SQ       0       0     1.7     3.2     4.7     5.9     6.6     7.3     8.0     8.5
124          SQ     9.0     9.6    28.0     162     393     674     979    2635    4906    7746
125          SE    2130 2150.20 2152.20 2154.20 2156.20 2158.20 2160.20 2162.20 2164.20 2166.20
126          SE  2168.2 2170.20 2172.20 2172.70 2173.20 2173.70 2174.20 2176.20 2178.20 2180.20
             *

127          KK   DIVSC  DIVERT
128          KM   The downstream pipeline has a maximum capacity of 19.5 cfs.
129          DT    DTSC     0.0    19.5
130          DI     0.0    19.5  4000.0
131          DQ     0.0    19.5    19.5
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

132          KK   RSCC4   ROUTE
133          RS       1    FLOW
134          RC   0.055   0.035   0.055    2689  0.0347 2106.00
```

```
135          RX  900.00  960.00  990.00  998.00 1002.00 1010.00 1012.00 1013.00
136          RY  2106.0 2105.00 2102.00 2100.00 2100.00 2102.00 2108.00 2108.00
             *

137          KK     SC6   BASIN
138          BA   0.114
139          LG    0.25    0.38    6.40    0.16      13
140          UI       0      50     189     331     281     186     135      91      66      44
141          UI      31      21      18       7       7       7       7       0       0       0
142          UI       0       0       0       0       0       0       0       0       0       0
143          UI       0       0       0       0       0       0       0       0       0       0
144          UI       0       0       0       0       0       0       0       0       0       0
             *

145          KK      C4 COMBINE
146          KM   Given that no surface flow released from Sunnycove Dam during the 10-,
147          KM   50-, 100- and 250-year 6-hour events, the total tributary area for C4
148          KM   only includes Sub Basin SC6, i.e. 0.114 square miles.
149          KM   Given that the surface flow released from Sunnycove Dam during the
150          KM   500-year 6-hour event lags behind the local flow from Sub Basin SC6
151          KM   and is not additive to the dominating local peak flow, the total
152          KM   tributary area for C4 only includes Sub Basin SC6, i.e. 0.114 square
153          KM   miles.
154          HC       2   0.114
             *

155          KK     SN1   BASIN
156          BA   0.601
157          LG    0.19    0.39    6.00    0.19      18
158          UI       0      68      68     159     272     387     462     527     645     797
159          UI     524     432     391     353     321     285     257     221     185     166
160          UI     156     142     113      98      87      77      74      59      52      52
161          UI      39      33      33      33      33      13      13      13      13      13
162          UI      13      13      13      13      13      13       0       0       0       0
             *

163          KK   DAMSN STORAGE
164          KM   According to the as-built plan, the emergency spillway crest elevation is
165          KM   2133.20 feet (NAVD88).
166          KM   The stage-discharge rating curve is based on SITES model results, provided
167          KM   by FCDMC.
168          KM   The dam storage routing is for FEMA floodplain delineation purposes, not
169          KM   applicable for NRCS dam safety standards.
170          KO       3
171          RS       1    STOR
172          SV       0   10.81   19.04   29.27   35.33   41.59   48.64   55.86   63.77   80.53
173          SV   89.37   98.87  108.56  119.00  129.68  141.27  153.09  165.82  178.79  192.72
174          SQ       0       0    2.60    5.10    5.70    6.30    6.90    7.40    7.90    8.80
175          SQ     173     437     714    1041    1412    1822    2267    2746    3255    3793
176          SE  2113.5 2122.20 2124.20 2126.20 2127.20 2128.20 2129.20 2130.20 2131.20 2133.20
177          SE  2134.2 2135.20 2136.20 2137.20 2138.20 2139.20 2140.20 2141.20 2142.20 2143.20
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

178          KK   DIVSN  DIVERT
179          KM   The downstream pipeline has a maximum capacity of 17.1 cfs.
180          DT    DTSN     0.0    17.1
181          DI     0.0    10.0    17.1    20.0  1500.0
182          DQ     0.0    10.0    17.1    17.1    17.1
             *

183          KK   RSNC5   ROUTE
184          RS       1    FLOW
185          RC   0.064   0.035   0.064    2143  0.0169 2097.00
186          RX  900.00  950.00  977.00  995.00 1005.00 1023.00 1050.00 1100.00
187          RY  2097.0 2096.00 2096.00 2090.00 2090.00 2096.00 2096.00 2097.00
             *

188          KK     SN2   BASIN
189          BA   0.255
190          LG    0.20    0.40    6.00    0.18       7
191          UI       0      40      67     157     248     303     401     391     259     224
192          UI     194     167     140     112      96      87      68      53      47      43
193          UI      31      31      20      20      20      12       8       8       8       8
194          UI       8       8       8       0       0       0       0       0       0       0
195          UI       0       0       0       0       0       0       0       0       0       0
             *

196          KK      C5 COMBINE
197          KM   Given that no surface flow released from Sunset Dam during the 10-, 50-,
198          KM   100- and 250-year 6-hour events, the total tributary area for C5 only
199          KM   includes Sub Basin SN2, i.e. 0.255 square miles.
200          KM   Given that the surface flow released from Sunset Dam during the 500-year
201          KM   6-hour event lags behind the local flow from Sub Basin SN2 and is not
202          KM   additive to the dominating local peak flow, the total tributary area
203          KM   for C5 only includes Sub Basin SN2, i.e. 0.255 square miles.
204          HC       2   0.255
             *

205          KK      C6 COMBINE
206          KM   Given that no surface flow released from Sunnycove/Sunset Dams during
207          KM   the 10-, 50-, 100- and 250-year events, the total tributary area for C6
208          KM   only includes Sub Basin SC6 and SN2, i.e. 0.369 square miles.
209          KM   Given that the surface flow released from Sunnycove/Sunset Dams during
210          KM   the 500-year 6-hour event lags behind the local flows from Sub Basin SC6
211          KM   and SN2 and is not additive to the dominating local peak flow, the total
212          KM   tributary area for C6 only includes Sub Basin SC6 and SN2, i.e. 0.369
213          KM   square miles.
214          HC       2   0.369
             *

215          KK   RC6C7   ROUTE
216          RS       2    FLOW
```

```
 217          RC   0.069   0.036   0.069    3552  0.0122 2057.00
 218          RX  900.00  950.00  963.00  993.00 1008.00 1038.00 1050.00 1100.00
 219          RY  2057.0 2056.00 2056.00 2050.00 2050.00 2056.00 2056.00 2057.00
              *
1                                   HEC-1 INPUT                                                    PAGE  6

LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 220          KK    RTSCRETRIEVE
 221          DR    DTSC
              *

 222          KK   RSCC7   ROUTE
 223          KM   Kinematic wave was selected for the routing through the pipeline, no attenuat
 224          RK    5691  0.0163   0.013            CIRC   1.500
              *

 225          KK    RTSNRETRIEVE
 226          DR    DTSN
              *

 227          KK   RSNC7   ROUTE
 228          KM   Kinematic wave was selected for the routing through the pipeline, no attenuat
 229          RK    5047  0.0143   0.013            CIRC   1.500
              *

 230          KK     SN3   BASIN
 231          BA   0.223
 232          LG    0.22    0.35    5.20    0.29      39
 233          UI       0      52     174     338     476     469     303     247     195     142
 234          UI     117      87      64      52      40      28      26      16      10      10
 235          UI      10      10      10       0       0       0       0       0       0       0
 236          UI       0       0       0       0       0       0       0       0       0       0
 237          UI       0       0       0       0       0       0       0       0       0       0
              *

 238          KK       C7 COMBINE
 239          KM   Given that no surface flow released from Sunnycove/Sunset Dams during
 240          KM   the 10-, 50-, 100- and 250-year 6-hour events, the total tributary area
 241          KM   for C7 only includes Sub Basin SC6, SN2 and SN3, i.e. 0.5913 square miles.
 242          KM   Given that the surface flow released from Sunnycove/Sunset Dams during
 243          KM   the 500-year 6-hour event lags behind the local flows from Sub Basin SC6,
 244          KM   SN2 and SN3 and is not additive to  the dominating local peak flow, the
 245          KM   total tributary area for C7 only includes Sub Basin SC6, SN2 and SN3,
 246          KM   i.e. 0.5913 square miles.
 247          HC       4  0.5913
              *
 248          ZZ
1
          SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   52        SC1
              V
              V
   60     RSC1C1
              .
              .
   65         .         SC2
              .           .
              .           .
   73        C1...........
              .
              .
   76         .         SC3
              .           .
              .           .
   84        C2...........
              V
              V
   87     RC2DAM
              .
              .
   92         .         SC4
              .           .
              .           .
  100         .           .         SC5
              .           .           .
              .           .           .
  108        C3......................
              V
              V
  112      DAMSC
              .
              .
  129         .------->    DTSC
  127      DIVSC
              V
              V
  132      RSCC4
              .
              .
  137         .         SC6
              .           .
              .           .
  145        C4...........
              .
              .
  155         .         SN1
              .           V
              .           V
  163         .       DAMSN
```

```
                .          .
 180            .          .-------->   DTSN
 178            .       DIVSN
                .          V
                .          V
 183            .       RSNC5
                .          .
                .          .
 188            .          .        SN2
                .          .          .
                .          .          .
 196            .         C5...........
                .          .
                .          .
 205          C6...........
               V
               V
 215        RC6C7
                .
                .
 221            .          .<-------   DTSC
 220            .      RTSC
                .          V
                .          V
 222            .      RSCC7
                .          .
                .          .
 226            .          .          .<-------    DTSN
 225            .          .       RTSN
                .          .          V
                .          .          V
 227            .          .      RSNC7
                .          .          .
                .          .          .
 230            .          .          .         SN3
                .          .          .           .
                .          .          .           .
 238          C7.................................
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN   1998               *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   12APR11  TIME  16:07:13  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

Flood Control District of Maricopa County
Project Name: Wickenburg Area Drainage Master Study/Plan
Contract FCD 2009C030
Hoskin Ryan Consultants, Inc.

Phase I Hydrology Model
Phase I study area includes tributary watersheds of Sunset and Sunnycove Washes. Sunnycove tributary sub basins include: SC1, SC2 SC3, SC4, SC5 and SC6. Sunnset tributary sub basins include: SN1, SN2 and SN3.
Total drainage area is 2.59 square miles.
Two flood retarding structures were constructed within Phase I study area, Sunset and Sunnycove Dams. A pipeline system was constructed and connected to the primary spillways to release Dam Reservoirs to Hassayampa River.
The compacity of the pipeline system is 19.5 cfs for Sunnycove Dam and 17.1 cfs for Sunset Dam. Excess flow will be released at the release manholes immediate downstream of two dams or through the emergency spillways.

500 Year 6 Hour Existing Condition
Model prepared with DDMSW version 4.6.0
Rainfall: NOAA 14
Area-Depth: the default reduction factor in DDMSW was selected
Rainfall Loss: Green-Ampt Equation
Unit Hydrograph: S-Graph (Mountain)
Soil: Latest soil map from NRCS was used, file provided by FCDMC
Land Use: MAG 2009 land use file was used, provided by FCDMC
Channel Routing: Cross-section geometries and Manning's n were based on field observation.
Storage Routing: Dam storage volumes were based on 2004 Wickenburg Aerial Mapping.

File Name: 500Y6H.DAT
Date: 01/17/2011

```
 39 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT        HYDROGRAPH TIME DATA
                     NMIN          3  MINUTES IN COMPUTATION INTERVAL
                    IDATE     19NOV10  STARTING DATE
                    ITIME       1200  STARTING TIME
                       NQ       2000  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE     23NOV10  ENDING DATE
                   NDTIME       1557  ENDING TIME
                    ICENT         19  CENTURY MARK
```

```
              COMPUTATION INTERVAL     .05 HOURS
                  TOTAL TIME BASE   99.95 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

 40 JD         INDEX STORM NO. 1
                    STRM        4.20  PRECIPITATION DEPTH
                    TRDA         .00  TRANSPOSITION DRAINAGE AREA

 41 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       .02       .02       .02       .02       .02
                     .03       .03       .03       .03       .03       .09       .09       .09       .09       .09
                     .02       .02       .02       .02       .02       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00

 44 JD         INDEX STORM NO. 2
                    STRM        4.18  PRECIPITATION DEPTH
                    TRDA         .50  TRANSPOSITION DRAINAGE AREA

 45 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       .02       .02       .02       .02       .02
                     .03       .03       .03       .03       .03       .09       .09       .09       .09       .09
                     .02       .02       .02       .02       .02       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                     .00       .00       .00       .00       .00       .00       .00       .00       .00       .00

 48 JD         INDEX STORM NO. 3
                    STRM        4.09  PRECIPITATION DEPTH
                    TRDA        2.80  TRANSPOSITION DRAINAGE AREA

 49 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
                     .01       .01       .01       .01       .01       .02       .02       .02       .02       .02
                     .04       .04       .04       .04       .04       .05       .05       .05       .05       .05
                     .03       .03       .03       .03       .03       .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

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
 112 KK   *    DAMSC   *      STORAGE
          *            *
          **************

 119 KO         OUTPUT CONTROL VARIABLES
                     IPRNT          3  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

            HYDROGRAPH ROUTING DATA

 120 RS         STORAGE ROUTING
                     NSTPS          1  NUMBER OF SUBREACHES
                      ITYP       STOR  TYPE OF INITIAL CONDITION
                    RSVRIC        .00  INITIAL CONDITION
                         X        .00  WORKING R AND D COEFFICIENT

 121 SV          STORAGE          .0      19.3      26.9      36.5      47.9      61.2      76.5      93.9     113.5     135.3
                                159.6     186.8     216.9     225.1     233.4     241.6     250.2     286.8     326.8     368.0

 123 SQ         DISCHARGE         0.        0.        2.        3.        5.        6.        7.        7.        8.        9.
                                  9.       10.       28.      162.      393.      674.      979.     2635.     4906.     7746.

 125 SE         ELEVATION      2130.00   2150.20   2152.20   2154.20   2156.20   2158.20   2160.20   2162.20   2164.20   2166.20
                               2168.20   2170.20   2172.20   2172.70   2173.20   2173.70   2174.20   2176.20   2178.20   2180.20
                                                                   ***

    ***           ***            ***            ***            ***

                     HYDROGRAPH AT STATION    DAMSC
                   TRANSPOSITION AREA        .0 SQ MI
```

PEAK FLOW (CFS)	TIME (HR)		6-HR	MAXIMUM AVERAGE FLOW 24-HR	72-HR	99.95-HR
+ 21.	6.75	(CFS)	20.	14.	11.	10.
		(INCHES)	.130	.369	.855	1.080
		(AC-FT)	10.	27.	64.	80.

PEAK STORAGE (AC-FT)	TIME (HR)	6-HR	MAXIMUM AVERAGE STORAGE 24-HR	72-HR	99.95-HR
+ 206.	6.75	203.	193.	174.	158.

PEAK STAGE (FEET)	TIME (HR)	6-HR	MAXIMUM AVERAGE STAGE 24-HR	72-HR	99.95-HR
+ 2171.45	6.75	2171.28	2170.62	2169.20	2167.01

CUMULATIVE AREA = 1.39 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION DAMSC
TRANSPOSITION AREA .5 SQ MI

PEAK FLOW (CFS)	TIME (HR)		6-HR	MAXIMUM AVERAGE FLOW 24-HR	72-HR	99.95-HR
+ 20.	6.75	(CFS)	19.	13.	11.	10.
		(INCHES)	.125	.356	.842	1.066
		(AC-FT)	9.	26.	63.	79.

PEAK STORAGE (AC-FT)	TIME (HR)	6-HR	MAXIMUM AVERAGE STORAGE 24-HR	72-HR	99.95-HR
+ 204.	6.75	202.	192.	173.	157.

PEAK STAGE (FEET)	TIME (HR)	6-HR	MAXIMUM AVERAGE STAGE 24-HR	72-HR	99.95-HR
+ 2171.35	6.75	2171.19	2170.55	2169.15	2166.96

CUMULATIVE AREA = 1.39 SQ MI

*** *** *** *** ***

HYDROGRAPH AT STATION DAMSC
TRANSPOSITION AREA 2.8 SQ MI

PEAK FLOW (CFS)	TIME (HR)		6-HR	MAXIMUM AVERAGE FLOW 24-HR	72-HR	99.95-HR
+ 11.	7.55	(CFS)	11.	10.	9.	9.
		(INCHES)	.071	.260	.737	.957
		(AC-FT)	5.	19.	55.	71.

PEAK STORAGE (AC-FT)	TIME (HR)	6-HR	MAXIMUM AVERAGE STORAGE 24-HR	72-HR	99.95-HR
+ 190.	7.55	189.	182.	164.	149.

PEAK STAGE (FEET)	TIME (HR)	6-HR	MAXIMUM AVERAGE STAGE 24-HR	72-HR	99.95-HR
+ 2170.40	7.55	2170.32	2169.84	2168.49	2166.33

CUMULATIVE AREA = 1.39 SQ MI

*** *** *** *** ***

INTERPOLATED HYDROGRAPH AT DAMSC

PEAK FLOW (CFS)	TIME (HR)		6-HR	MAXIMUM AVERAGE FLOW 24-HR	72-HR	99.95-HR
+ 15.	7.15	(CFS)	14.	11.	10.	9.
		(INCHES)	.093	.299	.779	1.001
		(AC-FT)	7.	22.	58.	74.

CUMULATIVE AREA = 1.39 SQ MI

*** ***

```
              **************
              *            *
163 KK        *    DAMSN   *      STORAGE
              *            *
              **************

170 KO          OUTPUT CONTROL VARIABLES
                     IPRNT          3  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE

                HYDROGRAPH ROUTING DATA
```

```
171 RS        STORAGE ROUTING
                   NSTPS          1  NUMBER OF SUBREACHES
                    ITYP       STOR  TYPE OF INITIAL CONDITION
                  RSVRIC        .00  INITIAL CONDITION
                       X        .00  WORKING R AND D COEFFICIENT

172 SV          STORAGE          .0      10.8      19.0      29.3      35.3      41.6      48.6      55.9      63.8      80.5
                                89.4      98.9     108.6     119.0     129.7     141.3     153.1     165.8     178.8     192.7

174 SQ          DISCHARGE        0.        0.        3.        5.        6.        6.        7.        7.        8.        9.
                               173.      437.      714.     1041.     1412.     1822.     2267.     2746.     3255.     3793.

176 SE          ELEVATION     2113.50   2122.20   2124.20   2126.20   2127.20   2128.20   2129.20   2130.20   2131.20   2133.20
                              2134.20   2135.20   2136.20   2137.20   2138.20   2139.20   2140.20   2141.20   2142.20   2143.20
                                                                        ***

     ***            ***            ***            ***            ***

                      HYDROGRAPH AT STATION    DAMSN
                   TRANSPOSITION AREA       .0 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR     99.95-HR
+   (CFS)       (HR)
                              (CFS)
+     69.       5.65            21.        12.         9.          7.
                          (INCHES)       .328       .715       1.587       1.918
                            (AC-FT)        11.        23.         51.         61.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR       24-HR       72-HR     99.95-HR
+  (AC-FT)      (HR)
      84.       5.65            80.        74.        59.         50.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR       24-HR       72-HR     99.95-HR
+   (FEET)      (HR)
  2133.57       5.65         2133.19    2132.42    2130.50     2128.97

                          CUMULATIVE AREA =     .60 SQ MI

     ***            ***            ***            ***            ***

                      HYDROGRAPH AT STATION    DAMSN
                   TRANSPOSITION AREA       .5 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR     99.95-HR
+   (CFS)       (HR)
                              (CFS)
+     63.       5.65            20.        11.         8.          7.
                          (INCHES)       .307       .693       1.565       1.897
                            (AC-FT)        10.        22.         50.         61.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR       24-HR       72-HR     99.95-HR
+  (AC-FT)      (HR)
      83.       5.65            80.        74.        59.         50.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR       24-HR       72-HR     99.95-HR
+   (FEET)      (HR)
  2133.53       5.65         2133.18    2132.42    2130.50     2128.96

                          CUMULATIVE AREA =     .60 SQ MI

     ***            ***            ***            ***            ***

                      HYDROGRAPH AT STATION    DAMSN
                   TRANSPOSITION AREA      2.8 SQ MI

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR     99.95-HR
+   (CFS)       (HR)
                              (CFS)
+      9.       6.55             9.         8.         7.          7.
                          (INCHES)       .134       .515       1.372       1.694
                            (AC-FT)         4.        17.         44.         54.

  PEAK STORAGE  TIME                          MAXIMUM AVERAGE STORAGE
                                      6-HR       24-HR       72-HR     99.95-HR
+  (AC-FT)      (HR)
      79.       6.55            78.        72.        57.         49.

  PEAK STAGE    TIME                          MAXIMUM AVERAGE STAGE
                                      6-HR       24-HR       72-HR     99.95-HR
+   (FEET)      (HR)
  2133.02       6.55         2132.85    2132.15    2130.26     2128.74

                          CUMULATIVE AREA =     .60 SQ MI

     ***            ***            ***            ***            ***


                   INTERPOLATED HYDROGRAPH AT    DAMSN

  PEAK FLOW     TIME                          MAXIMUM AVERAGE FLOW
                                      6-HR       24-HR       72-HR     99.95-HR
+   (CFS)       (HR)
                              (CFS)
+     57.       5.65            19.        11.         8.          7.
```

500Y6H

(INCHES)	.288	.674	1.545	1.875
(AC-FT)	9.	22.	50.	60.

CUMULATIVE AREA = .60 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	SC1	1344.	4.25	163.	41.	14.	.56		
ROUTED TO	RSC1C1	1305.	4.30	163.	41.	14.	.56		
HYDROGRAPH AT	SC2	378.	4.10	29.	7.	2.	.10		
2 COMBINED AT	C1	1414.	4.30	189.	47.	16.	.66		
HYDROGRAPH AT	SC3	568.	4.15	56.	14.	5.	.20		
2 COMBINED AT	C2	1790.	4.25	242.	60.	20.	.86		
ROUTED TO	RC2DAM	1587.	4.60	241.	60.	20.	.86		
HYDROGRAPH AT	SC4	876.	4.30	123.	31.	10.	.38		
HYDROGRAPH AT	SC5	486.	4.15	49.	12.	4.	.15		
3 COMBINED AT	C3	2102.	4.55	399.	101.	33.	1.39		
ROUTED TO	DAMSC	15.	7.15	14.	11.	10.	1.39		
DIVERSION TO	DTSC	15.	7.50	14.	11.	10.	1.39		
HYDROGRAPH AT	DIVSC	0.	6.75	0.	0.	0.	1.39		
ROUTED TO	RSCC4	0.	7.05	0.	0.	0.	1.39		
HYDROGRAPH AT	SC6	428.	4.10	33.	8.	3.	.11		
2 COMBINED AT	C4	428.	4.10	33.	8.	3.	.11		
HYDROGRAPH AT	SN1	1247.	4.30	176.	44.	15.	.60		
ROUTED TO	DAMSN	57.	5.65	19.	11.	8.	.60		
DIVERSION TO	DTSN	16.	6.35	11.	9.	8.	.60		
HYDROGRAPH AT	DIVSN	41.	5.65	7.	2.	1.	.60		
ROUTED TO	RSNC5	40.	5.80	7.	2.	1.	.60		
HYDROGRAPH AT	SN2	662.	4.20	71.	18.	6.	.25		
2 COMBINED AT	C5	662.	4.20	79.	20.	7.	.25		
2 COMBINED AT	C6	1028.	4.15	112.	28.	9.	.37		
ROUTED TO	RC6C7	952.	4.25	112.	28.	9.	.37		
HYDROGRAPH AT	RTSC	15.	7.50	14.	11.	10.	1.39		
ROUTED TO	RSCC7	15.	7.60	14.	11.	10.	1.39		
HYDROGRAPH AT	RTSN	16.	6.35	11.	9.	8.	.60		
ROUTED TO	RSNC7	16.	7.10	11.	9.	8.	.60		
HYDROGRAPH AT	SN3	733.	4.15	72.	18.	6.	.22		
4 COMBINED AT	C7	1550.	4.20	200.	65.	33.	.59		

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)	INTERPOLATED TO COMPUTATION INTERVAL DT (MIN)	PEAK (CFS)	TIME TO PEAK (MIN)	VOLUME (IN)
FOR STORM = 1	STORM AREA (SQ MI) =			.00					
RSCC7	MANE	2.67	19.50	359.87	1.08	3.00	19.50	360.00	1.08
CONTINUITY SUMMARY (AC-FT) - INFLOW= .7999E+02 EXCESS= .0000E+00 OUTFLOW= .7991E+02 BASIN STORAGE= .7354E-01 PERCENT ERROR= .0									
FOR STORM = 2	STORM AREA (SQ MI) =			.50					
RSCC7	MANE	2.53	19.50	375.96	1.06	3.00	19.50	378.00	1.06
CONTINUITY SUMMARY (AC-FT) - INFLOW= .7915E+02 EXCESS= .0000E+00 OUTFLOW= .7908E+02 BASIN STORAGE= .7344E-01 PERCENT ERROR= .0									
FOR STORM = 3	STORM AREA (SQ MI) =			2.80					
RSCC7	MANE	2.86	11.45	461.02	.96	3.00	11.45	459.00	.96
CONTINUITY SUMMARY (AC-FT) - INFLOW= .7109E+02 EXCESS= .0000E+00 OUTFLOW= .7100E+02 BASIN STORAGE= .7227E-01 PERCENT ERROR= .0									
FOR STORM = 1	STORM AREA (SQ MI) =			.00					
RSNC7	MANE	2.54	17.10	317.84	1.77	3.00	17.10	318.00	1.77
CONTINUITY SUMMARY (AC-FT) - INFLOW= .5679E+02 EXCESS= .0000E+00 OUTFLOW= .5673E+02 BASIN STORAGE= .4324E-01 PERCENT ERROR= .0									
FOR STORM = 2	STORM AREA (SQ MI) =			.50					
RSNC7	MANE	2.43	17.10	427.28	1.77	3.00	17.10	426.00	1.77
CONTINUITY SUMMARY (AC-FT) - INFLOW= .5673E+02 EXCESS= .0000E+00 OUTFLOW= .5668E+02 BASIN STORAGE= .4321E-01 PERCENT ERROR= .0									
FOR STORM = 3	STORM AREA (SQ MI) =			2.80					
RSNC7	MANE	2.84	8.72	400.83	1.69	3.00	8.72	399.00	1.69
CONTINUITY SUMMARY (AC-FT) - INFLOW= .5431E+02 EXCESS= .0000E+00 OUTFLOW= .5428E+02 BASIN STORAGE= .4135E-01 PERCENT ERROR= .0									

*** NORMAL END OF HEC-1 ***

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN  1998                *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   13APR11  TIME  09:20:02  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    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        Flood Control District of Maricopa County
  2           ID    Project Name: Wickenburg Area Drainage Master Study/Plan
  3           ID    Contract FCD 2009C030
  4           ID    Hoskin Ryan Consultants, Inc.
  5           ID
  6           ID    Phase I Hydrology Model
  7           ID    This model is setup to route inflows recorded in the DSS file
  8           ID    through two dams.
  9           ID    The inflows recorded in the DSS file is for the 100-year 6-hour event.
 10           ID    Storage Routing: Dam storage volumes were based on 2004 Wickenburg
 11           ID    Aerial Mapping.
 12           ID
 13           ID    File Name: DAMROUTING.DAT
 14           ID        Date: 4/13/2011
 15           ID
 16           IT       3 19NOV10    1200    2000
 17           IN      15
 18           IO       5
              *DIAGRAM
              *

 19           KK   C3
 20           ZR  =QI A=WK B=C3 C=FLOW
              *

 21           KK   DAMSC STORAGE
 22           KM   According to the as-built plan, the emergency spillway crest elevation is
 23           KM   2172.20 feet (NAVD88).
 24           KM   The stage-discharge rating curve is based on SITES model results, provided
 25           KM   by FCDMC.
 26           KM   The dam storage routing is for FEMA floodplain delineation purposes, not
 27           KM   applicable for NRCS dam safety standards.
 28           ZW   A=WK B=DAMSC C=STAGE
 29           RS       1    STOR
 30           SV       0   19.28   26.94   36.47   47.89   61.20   76.51   93.90  113.47  135.29
 31           SV  159.65  186.80  216.92  225.15  233.39  241.63  250.19  286.77  326.84  368.00
 32           SQ       0       0     1.7     3.2     4.7     5.9     6.6     7.3     8.0     8.5
 33           SQ     9.0     9.6    28.0     162     393     674     979    2635    4906    7746
 34           SE    2130 2150.20 2152.20 2154.20 2156.20 2158.20 2160.20 2162.20 2164.20 2166.20
 35           SE  2168.2 2170.20 2172.20 2172.70 2173.20 2173.70 2174.20 2176.20 2178.20 2180.20
              *

 36           KK   SN1
 37           ZR  =QI A=WK B=SN1 C=FLOW
              *

 38           KK   DAMSN STORAGE
 39           KM   According to the as-built plan, the emergency spillway crest elevation is
 40           KM   2133.20 feet (NAVD88).
 41           KM   The stage-discharge rating curve is based on SITES model results, provided
 42           KM   by FCDMC.
 43           KM   The dam storage routing is for FEMA floodplain delineation purposes, not
 44           KM   applicable for NRCS dam safety standards.
 45           ZW   A=WK B=DAMSN C=STAGE
 46           RS       1    STOR
```

1 HEC-1 INPUT PAGE 2

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 47           SV       0   10.81   19.04   29.27   35.33   41.59   48.64   55.86   63.77   80.53
 48           SV   89.37   98.87  108.56  119.00  129.68  141.27  153.09  165.82  178.79  192.72
 49           SQ       0       0    2.60    5.10    5.70    6.30    6.90    7.40    7.90    8.80
 50           SQ     173     437     714    1041    1412    1822    2267    2746    3255    3793
 51           SE  2113.5 2122.20 2124.20 2126.20 2127.20 2128.20 2129.20 2130.20 2131.20 2133.20
 52           SE  2134.2 2135.20 2136.20 2137.20 2138.20 2139.20 2140.20 2141.20 2142.20 2143.20
              *
 53           ZZ
```

```
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

*** HEC1 ERROR 4 *** NO HYDROGRAPHS AVAILABLE TO ROUTE
                 V
                 V
   21       DAMSC
                 V
                 V
   38       DAMSN

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

         1 ERRORS IN STREAM SYSTEM
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*              JUN   1998              *
*            VERSION 4.1               *
*                                      *
*  RUN DATE   13APR11  TIME  09:20:02  *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*           (916) 756-1104             *
*                                      *
****************************************
```

Flood Control District of Maricopa County
Project Name: Wickenburg Area Drainage Master Study/Plan
Contract FCD 2009C030
Hoskin Ryan Consultants, Inc.

Phase I Hydrology Model
This model is setup to route inflows recorded in the DSS file
through two dams.
The inflows recorded in the DSS file is for the 100-year 6-hour event.
Storage Routing: Dam storage volumes were based on 2004 Wickenburg
Aerial Mapping.

File Name: DAMROUTING.DAT
Date: 4/13/2011

```
  18 IO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE

     IT          HYDROGRAPH TIME DATA
                        NMIN          3  MINUTES IN COMPUTATION INTERVAL
                       IDATE     19NOV10  STARTING DATE
                       ITIME        1200  STARTING TIME
                          NQ        2000  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     23NOV10  ENDING DATE
                      NDTIME        1557  ENDING TIME
                       ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .05 HOURS
                       TOTAL TIME BASE   99.95 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
   -----DSS---ZOPEN:  Existing File Opened,  File: DAMROUTING.DSS
                      Unit:  71;  DSS Version: 6-JG
        ----- Entering ZRRTSX for unit 71 -----
Pathname: /WK/C3/FLOW//3MIN//
        Time Window set.  Interval:     3  Number of data values:      1
        Starting date and time:  Nov 19, 1910  1200  (   3975  720)
        Ending   date and time:  Nov 19, 1910  1200  (   3975  720)
        Input time offset:       0
        After ZRDINF, Record found: T
        Pathname: /WK/C3/FLOW/19NOV1910/3MIN//
        Number of actual data:  480  Header length:   0
        Compression:   0  Quality:   0
-----DSS--- ZREAD Unit  71; Vers.    1:  /WK/C3/FLOW/19NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:    1   NVALS:    1    JULS:    3975  ISTIME:   720
        NLDATA:  480   JULSD:    3975
        JULS: 19NOV10       JULSD: 19NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:  240  NDATA:  480  NREAD:    1  ILIM:    1
      ----- Exiting ZRRTS, Number of data values:      1,  Status:  0
        Offset:       0,  Units: CFS     ,  Type:INST-VAL
        ----- Entering ZRRTSX for unit 71 -----
Pathname: /WK/C3/FLOW//3MIN//
        Time Window set.  Interval:     3  Number of data values:    744
        Starting date and time:  Nov 19, 1910  1200  (   3975  720)
        Ending   date and time:  Nov 21, 1910  0109  (   3977   69)
        Input time offset:       0
        After ZRDINF, Record found: T
        Pathname: /WK/C3/FLOW/19NOV1910/3MIN//
        Number of actual data:  480  Header length:   0
        Compression:   0  Quality:   0
-----DSS--- ZREAD Unit  71; Vers.    1:  /WK/C3/FLOW/19NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:    1   NVALS:  744    JULS:    3975  ISTIME:   720
```

```
        NLDATA:  480   JULSD:    3975
        JULS: 19NOV10        JULSD: 19NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:  240  NDATA:  480  NREAD:  241  ILIM:  241
        After ZRDINF, Record found: T
        Pathname: /WK/C3/FLOW/20NOV1910/3MIN//
        Number of actual data:  480  Header length:   0
        Compression:   0  Quality:   0
-----DSS--- ZREAD Unit  71; Vers.    1:  /WK/C3/FLOW/20NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:  242   NVALS:  744    JULS:    3975  ISTIME:   720
        NLDATA:  480   JULSD:    3976
        JULS: 19NOV10        JULSD: 20NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:    1  NDATA:  480  NREAD:  480  ILIM:  721
        After ZRDINF, Record found: T
        Pathname: /WK/C3/FLOW/21NOV1910/3MIN//
        Number of actual data:  480  Header length:   0
        Compression:   0  Quality:   0
-----DSS--- ZREAD Unit  71; Vers.    1:  /WK/C3/FLOW/21NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:  722   NVALS:  744    JULS:    3975  ISTIME:   720
        NLDATA:  480   JULSD:    3977
        JULS: 19NOV10        JULSD: 21NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:    1  NDATA:  480  NREAD:   23  ILIM:  744
      ----- Exiting ZRRTS, Number of data values:    744,  Status:  0
        Offset:        0,  Units: CFS      ,  Type:INST-VAL
        ----- Entering ZRRTSX for unit 71 -----
Pathname: /WK/C3/FLOW//3MIN//
        Time Window set.  Interval:      3  Number of data values:      1
        Starting date and time:  Nov 21, 1910  0109  (   3977   69)
        Ending   date and time:  Nov 21, 1910  0109  (   3977   69)
        Input time offset:       0
        After ZRDINF, Record found: T
        Pathname: /WK/C3/FLOW/21NOV1910/3MIN//
        Number of actual data:  480  Header length:   0
        Compression:   0  Quality:   0
-----DSS--- ZREAD Unit  71; Vers.    1:  /WK/C3/FLOW/21NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:    1   NVALS:    1    JULS:    3977  ISTIME:    69
        NLDATA:  480   JULSD:    3977
        JULS: 21NOV10        JULSD: 21NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:   23  NDATA:  480  NREAD:    1  ILIM:    1
      ----- Exiting ZRRTS, Number of data values:      1,  Status:  0
        Offset:        0,  Units: CFS      ,  Type:INST-VAL
        ----- Entering ZRRTSX for unit 71 -----
Pathname: /WK/C3/FLOW//3MIN//
        Time Window set.  Interval:      3  Number of data values:    744
        Starting date and time:  Nov 21, 1910  0109  (   3977   69)
        Ending   date and time:  Nov 22, 1910  1418  (   3978  858)
        Input time offset:       0
        After ZRDINF, Record found: T
        Pathname: /WK/C3/FLOW/21NOV1910/3MIN//
        Number of actual data:  480  Header length:   0
        Compression:   0  Quality:   0
-----DSS--- ZREAD Unit  71; Vers.    1:  /WK/C3/FLOW/21NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:    1   NVALS:  744    JULS:    3977  ISTIME:    69
        NLDATA:  480   JULSD:    3977
        JULS: 21NOV10        JULSD: 21NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:   23  NDATA:  480  NREAD:  458  ILIM:  458
        After ZRDINF, Record found: T
        Pathname: /WK/C3/FLOW/22NOV1910/3MIN//
        Number of actual data:  480  Header length:   0
        Compression:   0  Quality:   0
-----DSS--- ZREAD Unit  71; Vers.    1:  /WK/C3/FLOW/22NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:  459   NVALS:  744    JULS:    3977  ISTIME:    69
        NLDATA:  480   JULSD:    3978
        JULS: 21NOV10        JULSD: 22NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:    1  NDATA:  480  NREAD:  286  ILIM:  744
      ----- Exiting ZRRTS, Number of data values:    744,  Status:  0
        Offset:        0,  Units: CFS      ,  Type:INST-VAL
        ----- Entering ZRRTSX for unit 71 -----
Pathname: /WK/C3/FLOW//3MIN//
        Time Window set.  Interval:      3  Number of data values:      1
        Starting date and time:  Nov 22, 1910  1418  (   3978  858)
        Ending   date and time:  Nov 22, 1910  1418  (   3978  858)
        Input time offset:       0
        After ZRDINF, Record found: T
        Pathname: /WK/C3/FLOW/22NOV1910/3MIN//
        Number of actual data:  480  Header length:   0
        Compression:   0  Quality:   0
-----DSS--- ZREAD Unit  71; Vers.    1:  /WK/C3/FLOW/22NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:    1   NVALS:    1    JULS:    3978  ISTIME:   858
        NLDATA:  480   JULSD:    3978
        JULS: 22NOV10        JULSD: 22NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:  286  NDATA:  480  NREAD:    1  ILIM:    1
      ----- Exiting ZRRTS, Number of data values:      1,  Status:  0
        Offset:        0,  Units: CFS      ,  Type:INST-VAL
        ----- Entering ZRRTSX for unit 71 -----
Pathname: /WK/C3/FLOW//3MIN//
        Time Window set.  Interval:      3  Number of data values:    744
        Starting date and time:  Nov 22, 1910  1418  (   3978  858)
        Ending   date and time:  Nov 24, 1910  0327  (   3980  207)
        Input time offset:       0
        After ZRDINF, Record found: T
        Pathname: /WK/C3/FLOW/22NOV1910/3MIN//
        Number of actual data:  480  Header length:   0
        Compression:   0  Quality:   0
```

```
-----DSS--- ZREAD Unit  71; Vers.    1:  /WK/C3/FLOW/22NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:    1   NVALS:  744    JULS:    3978  ISTIME:   858
        NLDATA:  480   JULSD:    3978
        JULS: 22NOV10       JULSD: 22NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:  286  NDATA:  480  NREAD:  195  ILIM:  195
        After ZRDINF, Record found: T
        Pathname: /WK/C3/FLOW/23NOV1910/3MIN//
        Number of actual data:  480  Header length:   0
        Compression:   0  Quality:   0
-----DSS--- ZREAD Unit  71; Vers.    1:  /WK/C3/FLOW/23NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:  196   NVALS:  744    JULS:    3978  ISTIME:   858
        NLDATA:  480   JULSD:    3979
        JULS: 22NOV10       JULSD: 23NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:    1  NDATA:  480  NREAD:  480  ILIM:  675
        After ZRDINF, Record found: F
        Pathname: /WK/C3/FLOW/24NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:  676   NVALS:  744    JULS:    3978  ISTIME:   858
        NLDATA:  480   JULSD:    3980
        JULS: 22NOV10       JULSD: 24NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:    1  NDATA:  480  NREAD:   69  ILIM:  744
-----DSS*** ZRRTS:  CAUTION - Data block not found in file.  Unit:  71
Pathname: /WK/C3/FLOW/24NOV1910/3MIN//
      ----- Exiting ZRRTS, Number of data values:    744,  Status:  3
        Offset:       0,  Units: CFS      ,  Type:INST-VAL
-----DSS---ZWRITE Unit  71; Vers.    1:  /WK/DAMSC/STAGE/19NOV1910/3MIN//
-----DSS---ZWRITE Unit  71; Vers.    1:  /WK/DAMSC/STAGE/20NOV1910/3MIN//
-----DSS---ZWRITE Unit  71; Vers.    1:  /WK/DAMSC/STAGE/21NOV1910/3MIN//
-----DSS---ZWRITE Unit  71; Vers.    1:  /WK/DAMSC/STAGE/22NOV1910/3MIN//
-----DSS---ZWRITE Unit  71; Vers.    1:  /WK/DAMSC/STAGE/23NOV1910/3MIN//
      ----- Entering ZRRTSX for unit 71 -----
Pathname: /WK/SN1/FLOW//3MIN//
        Time Window set.  Interval:     3  Number of data values:      1
        Starting date and time:  Nov 19, 1910  1200  (   3975  720)
        Ending   date and time:  Nov 19, 1910  1200  (   3975  720)
        Input time offset:       0
        After ZRDINF, Record found: T
        Pathname: /WK/SN1/FLOW/19NOV1910/3MIN//
        Number of actual data:  480  Header length:   0
        Compression:   0  Quality:   0
-----DSS--- ZREAD Unit  71; Vers.    1:  /WK/SN1/FLOW/19NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:    1   NVALS:    1    JULS:    3975  ISTIME:   720
        NLDATA:  480   JULSD:    3975
        JULS: 19NOV10       JULSD: 19NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:  240  NDATA:  480  NREAD:    1  ILIM:    1
      ----- Exiting ZRRTS, Number of data values:      1,  Status:  0
        Offset:       0,  Units: CFS      ,  Type:INST-VAL
      ----- Entering ZRRTSX for unit 71 -----
Pathname: /WK/SN1/FLOW//3MIN//
        Time Window set.  Interval:     3  Number of data values:    744
        Starting date and time:  Nov 19, 1910  1200  (   3975  720)
        Ending   date and time:  Nov 21, 1910  0109  (   3977   69)
        Input time offset:       0
        After ZRDINF, Record found: T
        Pathname: /WK/SN1/FLOW/19NOV1910/3MIN//
        Number of actual data:  480  Header length:   0
        Compression:   0  Quality:   0
-----DSS--- ZREAD Unit  71; Vers.    1:  /WK/SN1/FLOW/19NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:    1   NVALS:  744    JULS:    3975  ISTIME:   720
        NLDATA:  480   JULSD:    3975
        JULS: 19NOV10       JULSD: 19NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:  240  NDATA:  480  NREAD:  241  ILIM:  241
        After ZRDINF, Record found: T
        Pathname: /WK/SN1/FLOW/20NOV1910/3MIN//
        Number of actual data:  480  Header length:   0
        Compression:   0  Quality:   0
-----DSS--- ZREAD Unit  71; Vers.    1:  /WK/SN1/FLOW/20NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:  242   NVALS:  744    JULS:    3975  ISTIME:   720
        NLDATA:  480   JULSD:    3976
        JULS: 19NOV10       JULSD: 20NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:    1  NDATA:  480  NREAD:  480  ILIM:  721
        After ZRDINF, Record found: T
        Pathname: /WK/SN1/FLOW/21NOV1910/3MIN//
        Number of actual data:  480  Header length:   0
        Compression:   0  Quality:   0
-----DSS--- ZREAD Unit  71; Vers.    1:  /WK/SN1/FLOW/21NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:  722   NVALS:  744    JULS:    3975  ISTIME:   720
        NLDATA:  480   JULSD:    3977
        JULS: 19NOV10       JULSD: 21NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:    1  NDATA:  480  NREAD:   23  ILIM:  744
      ----- Exiting ZRRTS, Number of data values:    744,  Status:  0
        Offset:       0,  Units: CFS      ,  Type:INST-VAL
      ----- Entering ZRRTSX for unit 71 -----
Pathname: /WK/SN1/FLOW//3MIN//
        Time Window set.  Interval:     3  Number of data values:      1
        Starting date and time:  Nov 21, 1910  0109  (   3977   69)
        Ending   date and time:  Nov 21, 1910  0109  (   3977   69)
        Input time offset:       0
        After ZRDINF, Record found: T
        Pathname: /WK/SN1/FLOW/21NOV1910/3MIN//
        Number of actual data:  480  Header length:   0
        Compression:   0  Quality:   0
-----DSS--- ZREAD Unit  71; Vers.    1:  /WK/SN1/FLOW/21NOV1910/3MIN//
```

```
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:    1   NVALS:    1    JULS:    3977  ISTIME:    69
        NLDATA:  480   JULSD:    3977
        JULS: 21NOV10        JULSD: 21NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:   23  NDATA:  480  NREAD:    1  ILIM:    1
      ----- Exiting ZRRTS, Number of data values:     1,  Status:  0
        Offset:        0,  Units: CFS     ,  Type:INST-VAL
        ----- Entering ZRRTSX for unit 71 -----
Pathname: /WK/SN1/FLOW//3MIN//
        Time Window set.  Interval:     3  Number of data values:    744
        Starting date and time:  Nov 21, 1910  0109  (   3977   69)
        Ending   date and time:  Nov 22, 1910  1418  (   3978  858)
        Input time offset:       0
        After ZRDINF, Record found: T
        Pathname: /WK/SN1/FLOW/21NOV1910/3MIN//
        Number of actual data:  480  Header length:   0
        Compression:   0  Quality:   0
-----DSS--- ZREAD Unit  71; Vers.    1:  /WK/SN1/FLOW/21NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:    1   NVALS:  744    JULS:    3977  ISTIME:    69
        NLDATA:  480   JULSD:    3977
        JULS: 21NOV10        JULSD: 21NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:   23  NDATA:  480  NREAD:  458  ILIM:  458
        After ZRDINF, Record found: T
        Pathname: /WK/SN1/FLOW/22NOV1910/3MIN//
        Number of actual data:  480  Header length:   0
        Compression:   0  Quality:   0
-----DSS--- ZREAD Unit  71; Vers.    1:  /WK/SN1/FLOW/22NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:  459   NVALS:  744    JULS:    3977  ISTIME:    69
        NLDATA:  480   JULSD:    3978
        JULS: 21NOV10        JULSD: 22NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:    1  NDATA:  480  NREAD:  286  ILIM:  744
      ----- Exiting ZRRTS, Number of data values:   744,  Status:  0
        Offset:        0,  Units: CFS     ,  Type:INST-VAL
        ----- Entering ZRRTSX for unit 71 -----
Pathname: /WK/SN1/FLOW//3MIN//
        Time Window set.  Interval:     3  Number of data values:      1
        Starting date and time:  Nov 22, 1910  1418  (   3978  858)
        Ending   date and time:  Nov 22, 1910  1418  (   3978  858)
        Input time offset:       0
        After ZRDINF, Record found: T
        Pathname: /WK/SN1/FLOW/22NOV1910/3MIN//
        Number of actual data:  480  Header length:   0
        Compression:   0  Quality:   0
-----DSS--- ZREAD Unit  71; Vers.    1:  /WK/SN1/FLOW/22NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:    1   NVALS:    1    JULS:    3978  ISTIME:   858
        NLDATA:  480   JULSD:    3978
        JULS: 22NOV10        JULSD: 22NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:  286  NDATA:  480  NREAD:    1  ILIM:    1
      ----- Exiting ZRRTS, Number of data values:     1,  Status:  0
        Offset:        0,  Units: CFS     ,  Type:INST-VAL
        ----- Entering ZRRTSX for unit 71 -----
Pathname: /WK/SN1/FLOW//3MIN//
        Time Window set.  Interval:     3  Number of data values:    744
        Starting date and time:  Nov 22, 1910  1418  (   3978  858)
        Ending   date and time:  Nov 24, 1910  0327  (   3980  207)
        Input time offset:       0
        After ZRDINF, Record found: T
        Pathname: /WK/SN1/FLOW/22NOV1910/3MIN//
        Number of actual data:  480  Header length:   0
        Compression:   0  Quality:   0
-----DSS--- ZREAD Unit  71; Vers.    1:  /WK/SN1/FLOW/22NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:    1   NVALS:  744    JULS:    3978  ISTIME:   858
        NLDATA:  480   JULSD:    3978
        JULS: 22NOV10        JULSD: 22NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:  286  NDATA:  480  NREAD:  195  ILIM:  195
        After ZRDINF, Record found: T
        Pathname: /WK/SN1/FLOW/23NOV1910/3MIN//
        Number of actual data:  480  Header length:   0
        Compression:   0  Quality:   0
-----DSS--- ZREAD Unit  71; Vers.    1:  /WK/SN1/FLOW/23NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:  196   NVALS:  744    JULS:    3978  ISTIME:   858
        NLDATA:  480   JULSD:    3979
        JULS: 22NOV10        JULSD: 23NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:    1  NDATA:  480  NREAD:  480  ILIM:  675
        After ZRDINF, Record found: F
        Pathname: /WK/SN1/FLOW/24NOV1910/3MIN//
      ----DSS---Debug:  Enter ZRRTSB;  Unit:  71
        NSTART:  676   NVALS:  744    JULS:    3978  ISTIME:   858
        NLDATA:  480   JULSD:    3980
        JULS: 22NOV10        JULSD: 24NOV10
        Quality Read: F,  Quality Requested: F
        ---ZRRTSB Calculations:  NPOS:    1  NDATA:  480  NREAD:   69  ILIM:  744
-----DSS*** ZRRTS:  CAUTION - Data block not found in file.  Unit:  71
Pathname: /WK/SN1/FLOW/24NOV1910/3MIN//
      ----- Exiting ZRRTS, Number of data values:   744,  Status:  3
        Offset:        0,  Units: CFS     ,  Type:INST-VAL
-----DSS---ZWRITE Unit  71; Vers.    1:  /WK/DAMSN/STAGE/19NOV1910/3MIN//
-----DSS---ZWRITE Unit  71; Vers.    1:  /WK/DAMSN/STAGE/20NOV1910/3MIN//
-----DSS---ZWRITE Unit  71; Vers.    1:  /WK/DAMSN/STAGE/21NOV1910/3MIN//
-----DSS---ZWRITE Unit  71; Vers.    1:  /WK/DAMSN/STAGE/22NOV1910/3MIN//
-----DSS---ZWRITE Unit  71; Vers.    1:  /WK/DAMSN/STAGE/23NOV1910/3MIN//
1
```

DAMROUTING

	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	C3	1542.	4.55	286.	72.	24.	.00		
+	ROUTED TO	DAMSC	9.	7.55	9.	8.	8.	.00	2166.61	7.60
+	HYDROGRAPH AT	SN1	927.	4.30	128.	32.	11.	.00		
+	ROUTED TO	DAMSN	8.	6.30	8.	7.	6.	.00	2130.99	6.40

*** NORMAL END OF HEC-1 ***

```
-----DSS---ZCLOSE Unit:  71,   File: DAMROUTING.DSS
          Pointer Utilization:   .25
          Number of Records:     20
          File Size:     61.6  Kbytes
          Percent Inactive:    .0
```

D.7 VERIFICATION

USGS Regression

$Q_{100} = 850\ A^{0.54}$

Comparison of HEC-1 Outputs with USGS Regression

From Figure 8.3 of the Hydrology Manual, it could be found that the upper and lower 75% confidential limits are calculated using following equations.

$Q_{Upper\ 75} = 2000\ A^{0.54}$ $\qquad$ $Q_{Lower\ 75} = 400\ A^{0.54}$

ID	Area (square miles)	Regression	Upper 75% confidential limit	Lower 75% confidential limit	100Y6H	Within Range	100Y24H	Within Range
SC2	0.100	245	577	115	288	YES	233	YES
SC6/C4	0.114	263	619	124	326	YES	263	YES
SC5	0.150	305	718	144	372	YES	300	YES
SC3	0.197	354	832	166	427	YES	347	YES
SN3	0.223	378	889	178	557	YES	445	YES
SN2/C5	0.255	406	956	191	493	YES	401	YES
C6	0.369	496	1167	233	770	YES	624	YES
SC4	0.384	507	1193	239	663	YES	535	YES
SC1	0.562	623	1465	293	1006	YES	834	YES
C7	0.5913	640	1506	301	1146	YES	953	YES
SN1	0.601	646	1519	304	927	YES	777	YES
C1	0.6627	681	1602	320	1048	YES	891	YES
C2	0.8597	783	1843	369	1322	YES	1192	YES
C3	1.3934	1017	2392	478	1542	YES	1454	YES

Regional Regression

Comparison of HEC-1 Outputs with Regional Regression

$$Q_{10} = 479\,A^{0.661}\,ELEV^{-0.398}$$ std error= 52 percent

$$Q_{50} = 10^{7.36-4.17A^{-0.08}-0.440\lg ELEV}$$ std error= 37 percent

$$Q_{100} = 10^{6.55-3.17A^{-0.11}-0.454\lg ELEV}$$ std error= 39 percent

Average elevation for Phase I is 2227.8 feet (NAVD88). ELEV=2227.8/1000=2.2278

ID	Area (square miles)	Q10				Q50				Q100			
		Regression	10Y6H	10Y24H	Max Error, percentage	Regression	50Y6H	50Y24H	Max Error, percentage	Regression	100Y6H	100Y24H	Max Error, percentage
SC2	0.100	76	166	135	118%	156	250	202	60%	203	288	233	42%
SC6/C4	0.114	83	186	152	124%	176	282	228	60%	233	326	263	40%
SC5	0.150	99	217	178	118%	226	324	262	44%	307	372	300	21%
SC3	0.197	119	235	195	97%	287	367	300	28%	400	427	347	13%
SN3	0.223	129	322	259	149%	320	483	387	51%	450	557	445	24%
SN2/C5	0.255	141	264	220	87%	359	421	345	17%	510	493	401	21%
C6	0.369	180	419	347	133%	491	660	538	35%	716	770	624	13%
SC4	0.384	185	378	313	104%	507	574	466	13%	742	663	535	28%
SC1	0.562	238	549	468	131%	692	863	721	25%	1034	1006	834	19%
C7	0.5913	246	599	513	143%	721	975	816	35%	1080	1146	953	12%
SN1	0.601	249	499	431	101%	730	793	669	9%	1095	927	777	29%
C1	0.6627	265	554	489	109%	790	893	766	13%	1189	1048	891	25%
C2	0.8597	315	690	653	119%	969	1124	1025	16%	1475	1322	1192	19%
C3	1.3934	434	831	842	94%	1400	1316	1263	10%	2166	1542	1454	33%

Appendix E: Hydraulic Analysis Supporting Documentation

E.1 Roughness Coefficient Estimation

E.2 Cross-Section Plots

Note: HEC-RAS cross-section plots are located in Appendix E.5.

E.3 Expansion and Contraction Coefficients

E.4 Analysis of Structures

E.5 Hydraulic Calculations

E.5.1 Schematic

E.5.2 Report

E.5.3 Summary Tables

E.5.4 Cross-Sections

E.5.5 Flood Profiles

E.5.6 Modeling Warning and Error Messages

E.1 ROUGHNESS COEFFICIENT ESTIMATION

Note: Photographs supporting the 'n'-value calculations are included in Appendix G.

WICKENBURG AREA DRAINAGE MASTER STUDY/PLAN
Manning's "n"-Value Summary

River/Reach Name	River Station (RS)	LOB	Channel	ROB
Sunnycove Wash / Reach 2	3.132	0.035	0.03	0.035
	3.105	0.045	0.035	0.045
	3.1	Culvert		
	3.091	0.045	0.033	0.045
	3.06	0.057	0.033	0.057
	2.995	0.058	0.033	0.06
	2.901	0.057	0.033	0.057
	2.832	0.057	0.033	0.057
	2.739	0.06	0.033	0.057
	2.657	0.06	0.035	0.057
	2.592	0.06	0.035	0.057
	2.563	0.057	0.035	0.057
	2.496	0.057	0.033	0.057
	2.432	0.057	0.033	0.057
	2.379	0.057	0.033	0.057
	2.32	0.057	0.033	0.057
	2.261	0.057	0.033	0.057
	2.203	0.057	0.033	0.057
	2.118	0.057	0.033	0.057
	2.028	0.057	0.033	0.057
	1.93	0.06	0.033	0.057
	1.867	0.062	0.033	0.057
	1.83	0.062	0.033	0.057
	1.778	0.057	0.033	0.057
	1.733	0.057	0.033	0.057
	1.681	0.057	0.033	0.057
	1.618	0.06	0.033	0.06
	1.55	0.06	0.033	0.06
	1.478	0.062	0.033	0.062
	1.415	0.062	0.035	0.062
	1.327	0.062	0.035	0.062
	1.27	0.062	0.035	0.062
	1.193	0.062	0.033	0.062
	1.164	0.062	0.033	0.062
	1.15	0.062	0.035	0.062
	1.137	Culvert		
	1.127	0.062	0.035	0.062
	1.091	0.062	0.035	0.062
	1.054	0.062	0.035	0.062
	0.997	0.06	0.032	0.06

WICKENBURG AREA DRAINAGE MASTER STUDY/PLAN
Manning's "n"-Value Summary

River/Reach Name	River Station (RS)	LOB	Channel	ROB
Sunnycove Wash / Reach 2	0.937	0.06	0.032	0.06
	0.897	0.059	0.03	0.059
	0.85	0.059	0.03	0.059
	0.807	0.059	0.03	0.059
	0.758	0.059	0.03	0.059
	0.693	0.059	0.03	0.059
	0.642	0.059	0.03	0.059
Sunnycove Wash / Reach 1	0.4	0.049	0.039	0.035
	0.365	0.049	0.039	0.035
	0.34	0.049	0.039	0.035
	0.294	0.049	0.039	0.035
	0.279	0.049	0.039	0.035
	0.269	Culvert		
	0.263	0.049	0.035	0.055
	0.245	0.049	0.035	0.055
	0.239	0.049	0.035	0.055
	0.233	Culvert		
	0.226	0.055	0.035	0.055
	0.216	0.055	0.035	0.055
	0.194	0.055	0.035	0.055
	0.159	0.055	0.035	0.055
	0.089	0.055	0.035	0.055
	0.036	0.055	0.035	0.055
	0.022	0.064	0.035	0.064
Sunset Wash / Reach 3	1.902	0.057	0.033	0.057
	1.829	0.057	0.033	0.057
	1.777	0.057	0.033	0.057
	1.727	0.057	0.033	0.057
	1.694	0.057	0.033	0.057
	1.649	0.057	0.033	0.057
	1.616	0.057	0.033	0.057
	1.557	0.057	0.033	0.057
	1.502	0.057	0.033	0.057
	1.466	0.057	0.033	0.057
	1.456	Culvert		
	1.447	0.057	0.033	0.057
	1.398	0.062	0.033	0.057
	1.346	0.057	0.033	0.057
Sunset Wash / Reach 2	1.197	0.064	0.04	0.064
	1.17	0.064	0.04	0.064

WICKENBURG AREA DRAINAGE MASTER STUDY/PLAN
Manning's "n"-Value Summary

River/Reach Name	River Station (RS)	LOB	Channel	ROB
Sunset Wash / Reach 2	1.117	0.064	0.04	0.064
	1.019	0.064	0.04	0.064
	0.925	0.064	0.04	0.064
	0.88	0.064	0.025	0.064
	0.858	0.03	0.025	0.03
	0.828	0.052	0.025	0.064
Sunset Wash / Reach 1	0.753	0.1	0.031	0.074
	0.737	0.041	0.031	0.074
	0.732	Culvert		
	0.726	0.041	0.031	0.074
	0.708	0.041	0.031	0.074
	0.679	0.041	0.031	0.074
	0.668	0.041	0.031	0.074
	0.663	Culvert		
	0.658	0.041	0.031	0.074
	0.647	0.041	0.031	0.074
	0.633	0.064	0.039	0.064
	0.607	0.064	0.039	0.064
	0.57	0.064	0.039	0.064
	0.547	0.064	0.039	0.064
	0.542	Culvert		
	0.537	0.064	0.039	0.064
	0.524	0.064	0.039	0.064
	0.504	0.064	0.029	0.064
	0.461	0.056	0.029	0.056
	0.431	0.064	0.025	0.064
	0.36	0.064	0.025	0.064
	0.289	0.1	0.025	0.1
	0.269	0.1	0.036	0.1
	0.264	Bridge		
	0.26	0.069	0.036	0.069
	0.232	0.035	0.036	0.069
	0.197	0.035	0.036	0.069
	0.178	0.035	0.036	0.069
Sunset Wash / Tributary 1	0.256	0.064	0.03	0.057
	0.218	0.064	0.03	0.064
	0.213	Culvert		
	0.209	0.064	0.03	0.064
	0.177	0.064	0.03	0.057
	0.159	0.064	0.03	0.057

WICKENBURG AREA DRAINAGE MASTER STUDY/PLAN
Manning's "n"-Value Summary

River/Reach Name	River Station (RS)	LOB	Channel	ROB
Sunset Wash / Tributary 1	0.155	Culvert		
	0.152	0.064	0.03	0.057
	0.145	0.064	0.03	0.057
	0.138	0.064	0.03	0.057
	0.135	Culvert		
	0.132	0.064	0.03	0.057
	0.126	0.064	0.03	0.057
	0.122	0.064	0.03	0.057
	0.119	Culvert		
	0.116	0.064	0.03	0.057
	0.102	0.064	0.03	0.057
	0.09	0.064	0.03	0.057
	0.082	Culvert		
	0.076	0.057	0.03	0.057
	0.009	0.057	0.03	0.057

WICKENBURG AREA DRAINAGE MASTER STUDY/PLAN
PHASE 1 WASHES
Manning's "n"-Value Calculation

Location #	Wash Name	LOB							Channel							ROB						
		Base Value[1]	Adjustments for Roughness Factors [2]				Degree of [3]	Calculated [4]	Base Value[1]	Adjustments for Roughness Factors [2]				Degree of [3]	Calculated [4]	Base Value[1]	Adjustments for Roughness Factors [2]				Degree of [3]	Calculated [4]
		n_0	n_1	n_2	n_3	n_4	Meandering, m	n-Value	n_0	n_1	n_2	n_3	n_4	Meandering, m	n-Value	n_0	n_1	n_2	n_3	n_4	Meandering, m	n-Value
1	Sunset Wash - Reaches 1 & 2	0.025	0.000	0.000	0.005	0.005	1.0	**0.035**	0.025	0.000	0.000	0.001	0.008	1.0	**0.034**	0.025	0.000	0.000	0.005	0.005	1.0	**0.035**
2		0.025	0.000	0.000	0.005	0.005	1.0	**0.035**	0.025	0.000	0.000	0.001	0.010	1.0	**0.036**	0.025	0.002	0.002	0.020	0.020	1.0	**0.069**
3		0.025	0.002	0.002	0.010	0.025	1.0	**0.064**	0.020	0.000	0.000	0.005	0.000	1.0	**0.025**	0.025	0.002	0.002	0.010	0.025	1.0	**0.064**
4		0.025	0.000	0.002	0.010	0.010	1.0	**0.047**	0.025	0.000	0.000	0.002	0.005	1.0	**0.032**	0.025	0.000	0.002	0.010	0.010	1.0	**0.047**
5		0.025	0.002	0.002	0.010	0.025	1.0	**0.064**	0.028	0.000	0.000	0.001	0.010	1.0	**0.039**	0.025	0.002	0.002	0.010	0.025	1.0	**0.064**
6		0.020	0.000	0.001	0.015	0.005	1.0	**0.041**	0.028	0.000	0.000	0.001	0.002	1.0	**0.031**	0.025	0.002	0.002	0.020	0.025	1.0	**0.074**
7		0.025	0.002	0.002	0.010	0.025	1.0	**0.064**	0.020	0.000	0.000	0.000	0.015	1.0	**0.035**	0.025	0.002	0.002	0.010	0.025	1.0	**0.064**
8	SunnyCove Wash- Reach 1	0.025	0.001	0.000	0.004	0.025	1.0	**0.055**	0.025	0.008	0.000	0.000	0.002	1.0	**0.035**	0.025	0.001	0.000	0.004	0.025	1.0	**0.055**
9		0.025	0.000	0.000	0.004	0.020	1.0	**0.049**	0.025	0.000	0.000	0.004	0.010	1.0	**0.039**	0.020	0.000	0.003	0.002	0.010	1.0	**0.035**
10	SunnyCove Wash - Reach 2	0.030	0.000	0.002	0.002	0.025	1.0	**0.059**	0.025	0.000	0.003	0.000	0.002	1.0	**0.030**	0.030	0.000	0.002	0.002	0.025	1.0	**0.059**
11		0.030	0.000	0.002	0.005	0.025	1.0	**0.062**	0.026	0.002	0.005	0.000	0.002	1.0	**0.035**	0.030	0.000	0.002	0.005	0.025	1.0	**0.062**
12		0.030	0.000	0.002	0.010	0.015	1.0	**0.057**	0.026	0.000	0.003	0.000	0.002	1.0	**0.031**	0.030	0.000	0.002	0.010	0.015	1.0	**0.057**
13		0.030	0.000	0.002	0.005	0.020	1.0	**0.057**	0.026	0.000	0.005	0.000	0.002	1.0	**0.033**	0.030	0.000	0.002	0.005	0.020	1.0	**0.057**

Reference: Phillips, J.V., and Tadayon, S., 2006, *Selection of Manning's Roughness Coefficient for Natural and Constructed Vegetated and Non-Vegetated Channels, and Vegetation Maintenance Plan Guidelines for Vegetated Channels in Central Arizona: U.S. Geological Survey, Scientific Investigations Report 2006-5108, 41 p.*

Notes:

1. n_0 = Base value of n for a straight, uniform channels (Tables 1 and 2)
2. Adjustments for roughness factors other than meanders (Table 3), where:
   n_1 = Degree of Irregularity
   n_2 = Variation in channel cross section
   n_3 = Effect of obstructions
   n_4 = Amount of Vegetation
3. m = Degree of meandering (Table 3)
4. n- value $= (n_0 + n_1 + n_2 + n_3 + n_4)*m$

E.3 EXPANSION AND CONTRACTION COEFFICIENTS

WICKENBURG AREA DRAINAGE MASTER
Contraction / Expansion Coefficients

River/Reach Name	River Station (RS)	Contraction	Expansion
Sunnycove Wash / Reach 2	3.132	0.3	0.5
	3.105	0.3	0.5
	3.1	Culvert	
	3.091	0.3	0.5
	3.06	0.1	0.3
	2.995	0.1	0.3
	2.901	0.1	0.3
	2.832	0.1	0.3
	2.739	0.1	0.3
	2.657	0.1	0.3
	2.592	0.1	0.3
	2.563	0.1	0.3
	2.496	0.1	0.3
	2.432	0.1	0.3
	2.379	0.1	0.3
	2.32	0.1	0.3
	2.261	0.1	0.3
	2.203	0.1	0.3
	2.118	0.1	0.3
	2.028	0.1	0.3
	1.93	0.1	0.3
	1.867	0.1	0.3
	1.83	0.1	0.3
	1.778	0.1	0.3
	1.733	0.1	0.3
	1.681	0.1	0.3
	1.618	0.1	0.3
	1.55	0.1	0.3
	1.478	0.1	0.3
	1.415	0.1	0.3
	1.327	0.1	0.3
	1.27	0.1	0.3
	1.193	0.1	0.3
	1.164	0.3	0.5
	1.15	0.3	0.5
	1.137	Culvert	
	1.127	0.3	0.5
	1.091	0.1	0.3
	1.054	0.1	0.3
	0.997	0.1	0.3

WICKENBURG AREA DRAINAGE MASTER
Contraction / Expansion Coefficients

River/Reach Name	River Station (RS)	Contraction	Expansion
Sunnycove Wash / Reach 2	0.937	0.1	0.3
	0.897	0.1	0.3
	0.85	0.1	0.3
	0.807	0.1	0.3
	0.758	0.1	0.3
	0.693	0.1	0.3
	0.642	0.1	0.3
Sunnycove Wash / Reach 1	0.4	0.1	0.3
	0.365	0.1	0.3
	0.34	0.1	0.3
	0.294	0.3	0.5
	0.279	0.3	0.5
	0.269	Culvert	
	0.263	0.3	0.5
	0.245	0.3	0.5
	0.239	0.3	0.5
	0.233	Culvert	
	0.226	0.3	0.5
	0.216	0.1	0.3
	0.194	0.1	0.3
	0.159	0.1	0.3
	0.089	0.1	0.3
	0.036	0.1	0.3
	0.022	0.1	0.3
Sunset Wash / Reach 3	1.902	0.1	0.3
	1.829	0.1	0.3
	1.777	0.1	0.3
	1.727	0.1	0.3
	1.694	0.1	0.3
	1.649	0.1	0.3
	1.616	0.1	0.3
	1.557	0.1	0.3
	1.502	0.3	0.5
	1.466	0.3	0.5
	1.456	Culvert	
	1.447	0.3	0.5
	1.398	0.1	0.3
	1.346	0.1	0.3
Sunset Wash / Reach 2	1.197	0.1	0.3
	1.17	0.1	0.3

WICKENBURG AREA DRAINAGE MASTER
Contraction / Expansion Coefficients

River/Reach Name	River Station (RS)	Contraction	Expansion
Sunset Wash / Reach 2	1.117	0.1	0.3
	1.019	0.1	0.3
	0.925	0.1	0.3
	0.88	0.1	0.3
	0.858	0.1	0.3
	0.828	0.1	0.3
Sunset Wash / Reach 1	0.753	0.3	0.5
	0.737	0.3	0.5
	0.732	Culvert	
	0.726	0.3	0.5
	0.708	0.1	0.3
	0.679	0.3	0.5
	0.668	0.3	0.5
	0.663	Culvert	
	0.658	0.3	0.5
	0.647	0.1	0.3
	0.633	0.1	0.3
	0.607	0.1	0.3
	0.57	0.3	0.5
	0.547	0.3	0.5
	0.542	Culvert	
	0.537	0.3	0.5
	0.524	0.1	0.3
	0.504	0.1	0.3
	0.461	0.1	0.3
	0.431	0.1	0.3
	0.36	0.1	0.3
	0.289	0.3	0.5
	0.269	0.3	0.5
	0.264	Bridge	
	0.26	0.3	0.5
	0.232	0.1	0.3
	0.197	0.1	0.3
	0.178	0.1	0.3
Sunset Wash / Tributary 1	0.256	0.3	0.5
	0.218	0.3	0.5
	0.213	Culvert	
	0.209	0.3	0.5
	0.177	0.3	0.5
	0.159	0.3	0.5

WICKENBURG AREA DRAINAGE MASTER
Contraction / Expansion Coefficients

River/Reach Name	River Station (RS)	Contraction	Expansion
Sunset Wash / Tributary 1	0.155	Culvert	
	0.152	0.3	0.5
	0.145	0.3	0.5
	0.138	0.3	0.5
	0.135	Culvert	
	0.132	0.3	0.5
	0.126	0.3	0.5
	0.122	0.3	0.5
	0.119	Culvert	
	0.116	0.3	0.5
	0.102	0.3	0.5
	0.09	0.3	0.5
	0.082	Culvert	
	0.076	0.3	0.5
	0.009	0.1	0.3

E.4 ANALYSIS OF STRUCTURES

WICKENBURG AREA DRAINAGE MASTER STUDY/PLAN
Sunset Wash Flow Split at Mesquite Drive Crossing

Rating Table					Comparison to the HEC-1 ID: C6 Flow
WSE	Culvert Capacity	Weir Flow		Total Flow	
		To South	To East		
(ft)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
2061.59	185	0	0	185	
2062.34	215	52	40	307	
2062.56	227	89	104	420	419(1)
2062.88	243	156	255	654	660(2)
2063.01	249	186	339	774	770(3)
2063.25	260	248	520	1028	1028(4)

Notes:
(1) 10-Year, 6-Hour Flow
(2) 50-Year, 6-Hour Flow
(3) 100-Year, 6-Hour Flow
(4) 500-Year, 6-Hour Flow

BOX CULVERT SST_400 CAPACITY ANALYSIS BEFORE OVERTOPING
COMPUTATION OF CULVERT PERFORMANCE CURVE

December 14, 2010

==========

PROGRAM INPUT DATA

DESCRIPTION	VALUE
Culvert Span (ft)	10
Culvert Rise (ft)	3
FHWA Chart Number	8
FHWA Scale Number (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.013
Entrance Loss Coefficient of Culvert Opening	0.4
Culvert Length (ft)	46
Invert Elevation at Downstream end of Culvert (ft)	2057.6
Invert Elevation at Upstream end of Culvert (ft)	2057.94
Culvert Slope (ft/ft)	0.0074
Starting Flow Rate (cfs)	185
Incremental Flow Rate (cfs)	0
Ending Flow Rate (cfs)	185
Starting Tailwater Depth (ft)	3
Incremental Tailwater Depth (ft)	1
Ending Tailwater Depth (ft)	3

==========

COMPUTATION RESULTS

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
185.0	3.0	3.65	3.60	1.64	2.20	1.64	11.3

==========

HYDROCALC Hydraulics for Windows, Version 2.0.1 Freeware, Copyright(c) 1996-2010
Dodson & Associates, Inc., 5629 FM 1960 West, Suite 314, Houston, TX 77069
Email:software@dodson-hydro.com, All Rights Reserved.

Water Surface Elevation = 2057.94 + 3.65 = **2061.59'**

Lowest Road Elevation = 2061.61'

BOX CULVERT SST_400 CAPACITY ANALYSIS DURING OVERTOPPING
COMPUTATION OF CULVERT PERFORMANCE CURVE

December 14, 2010

==========

PROGRAM INPUT DATA

DESCRIPTION	VALUE
Culvert Span (ft)	10
Culvert Rise (ft)	3
FHWA Chart Number	8
FHWA Scale Number (Type of Culvert Entrance)	1
Manning's Roughness Coefficient (n-value)	0.013
Entrance Loss Coefficient of Culvert Opening	0.4
Culvert Length (ft)	46
Invert Elevation at Downstream end of Culvert (ft)	2057.6
Invert Elevation at Upstream end of Culvert (ft)	2057.94
Culvert Slope (ft/ft)	0.0074
Starting Flow Rate (cfs)	249
Incremental Flow Rate (cfs)	0
Ending Flow Rate (cfs)	249
Starting Tailwater Depth (ft)	3
Incremental Tailwater Depth (ft)	1
Ending Tailwater Depth (ft)	3

==========

COMPUTATION RESULTS

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
249.0	3.0	5.07	4.36	2	2.68	2	12.46

==========

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Dodson & Associates, Inc., 5629 FM 1960 West, Suite 314, Houston, TX 77069
Email:software@dodson-hydro.com, All Rights Reserved.

Water Surface Elevation = 2057.94 + 5.07 = **2063.01'**

Sunset Wash Flow Split to East at RS 0.547

****
UNEVEN WEIR FLOW PROGRAM
FORTRAN VERSION 1.0
****
PROJECT: Wickenburg ADMS
ENGINEER: NZ

DATE: 1/17/2011
TIME: 16:10. 5

INPUT PARAMETERS

STARTING WSEL: 2061.74
MAXIMUM WSEL: 2063.50
STEP SIZE: 0.10
BREADTH OF WEIR: 32.00

****
INPUT ELEVATION/STATION TABLE.
PROJECT: Wickenburg ADMS
DATE: 1/17/2011
TIME: 16:10. 5
****

POINT	ELEVATION	STATION
1	2063.94	0.00
2	2063.91	1.11
3	2063.65	11.12
4	2063.65	11.15
5	2063.50	21.29
6	2063.50	21.37
7	2063.12	46.69
8	2063.12	46.75
9	2062.95	65.26
10	2062.95	65.79
11	2062.72	91.31
12	2062.72	121.44
13	2062.45	144.63
14	2062.45	145.18
15	2062.44	145.68
16	2062.44	146.38
17	2062.19	167.99
18	2062.18	168.97
19	2062.18	212.94
20	2062.13	223.64
21	2062.12	224.12
22	2062.05	243.13
23	2062.04	243.36
24	2061.78	263.45
25	2061.78	263.80
26	2061.74	265.37

Sunset Wash Flow Split to East at RS 0.547

```
*****************************************
  WEIR COEFFICIENT TABLE
  PROJECT:  Wickenburg ADMS
  DATE:  1/17/2011
  TIME:  16:10. 5
*****************************************
```

INPUT COEFFICENT VALUES.

POINT	HEAD	COEFFICIENT
1	0.00	3.0000
2	4.00	3.0000

```
*****************************************
  UNEVEN WEIR FLOW PROGRAM
  FORTRAN VERSION 1.0
  PROJECT:  Wickenburg ADMS
  DATE:  1/17/2011
  TIME:  16:10. 5
*****************************************
```

ELEVATION	DISCHARGE (CFS)
2061.74	0.00
2061.84	0.20
2061.94	1.38
2062.04	4.04
2062.14	9.07
2062.24	20.08
2062.34	39.54
2062.44	65.33
2062.54	97.04
2062.64	134.48
2062.74	177.87
2062.84	230.35
2062.94	290.99
2062.95	297.84
2062.96	304.69
2062.97	311.53
2062.98	318.38
2062.99	325.23

ELEVATION	DISCHARGE (CFS)
2063.00	332.08
2063.01	338.93
2063.02	345.77
2063.03	352.62
2063.04	359.47
2063.14	435.67
2063.24	519.35
2063.34	610.17
2063.44	707.96

-100-yr

```
*******************************************
  UNEVEN WEIR FLOW PROGRAM
  FORTRAN VERSION 1.0
*******************************************
  PROJECT:  Wickenburg ADMS
  ENGINEER:  NZ

  DATE:  1/17/2011
  TIME:  15: 6.57


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


  STARTING WSEL:     2061.61
  MAXIMUM WSEL:      2063.50
  STEP SIZE:         0.10
  BREADTH OF WEIR:   30.00


*******************************************
  INPUT ELEVATION/STATION TABLE.
  PROJECT:  Wickenburg ADMS
  DATE:  1/17/2011
  TIME:  15: 6.57
*******************************************


  POINT   ELEVATION   STATION
  -----   ---------   -------
    1     2061.74     265.37
    2     2061.75     267.08
    3     2061.61     280.44
    4     2061.85     289.92
    5     2061.89     294.25
    6     2062.04     299.32
    7     2062.19     308.73
    8     2062.19     308.86
    9     2062.20     309.95
   10     2062.05     310.05
   11     2062.05     316.05
```

Sunset Wash Flow Split to South at RS 0.547

****
WEIR COEFFICIENT TABLE
PROJECT: Wickenburg ADMS
DATE: 1/17/2011
TIME: 15: 6.57
****

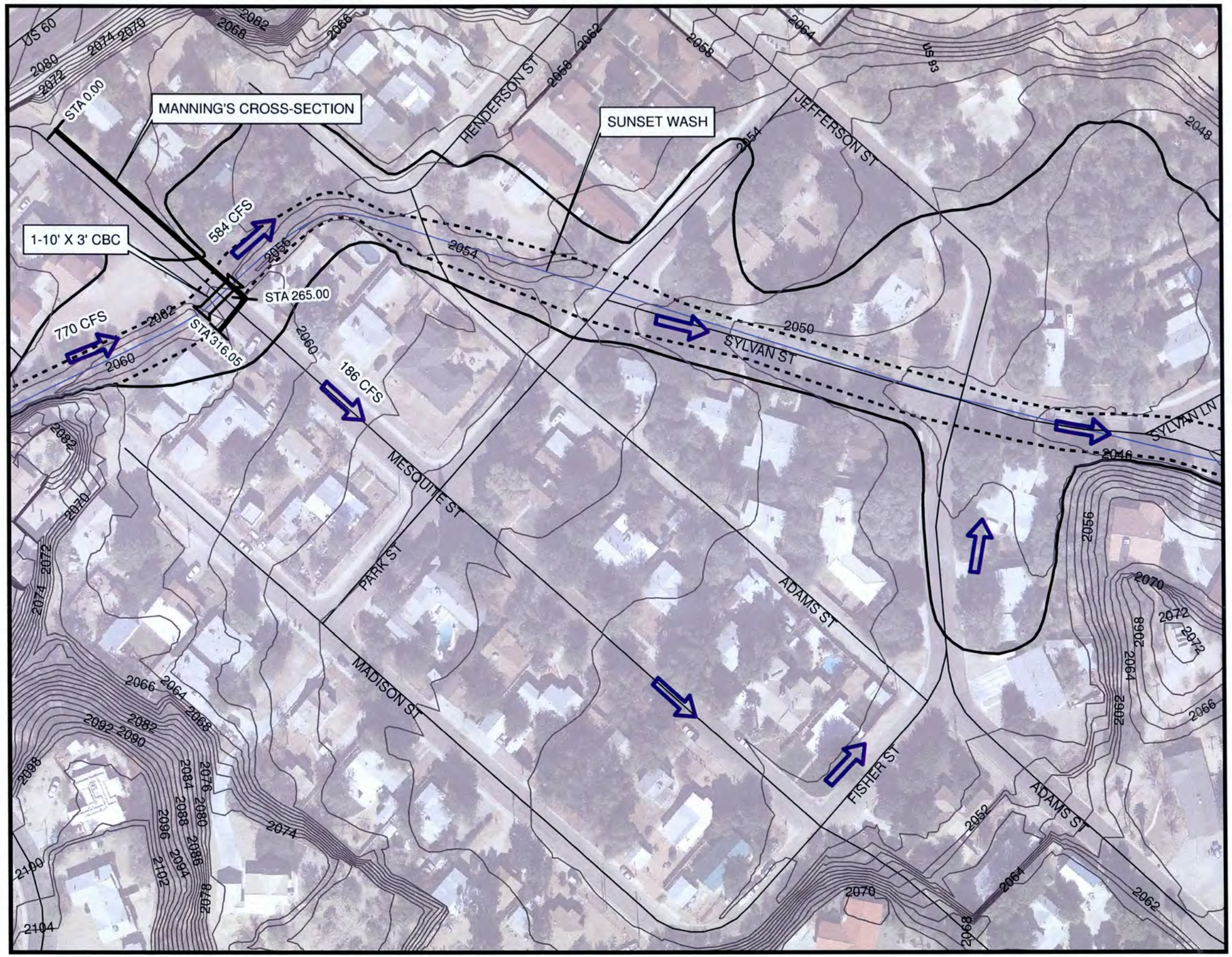
INPUT COEFFICENT VALUES.

POINT	HEAD	COEFFICIENT
1	0.00	3.0000
2	4.00	3.0000

****
UNEVEN WEIR FLOW PROGRAM
FORTRAN VERSION 1.0
PROJECT: Wickenburg ADMS
DATE: 1/17/2011
TIME: 15: 6.57
****

ELEVATION	DISCHARGE (CFS)
2061.61	0.00
2061.71	0.51
2061.81	2.89
2061.91	7.24
2062.01	13.57
2062.11	22.03
2062.21	33.24
2062.31	46.91
2062.41	62.51
2062.51	79.75
2062.61	98.48
2062.71	118.58
2062.81	139.96
2062.91	162.53
2062.92	164.90
2062.93	167.27
2062.94	169.65
2062.95	172.02
2062.96	174.39

ELEVATION	DISCHARGE (CFS)
2062.97	176.76
2062.98	179.13
2062.99	181.51
2063.00	183.88
2063.01	186.25 - 100-YR
2063.11	211.04
2063.21	236.87
2063.31	263.70
2063.41	291.49



Legend

- FLOODPLAIN BOUNDARY
- FLOODWAY BOUNDARY
- FLOW PATH
- WASH FLOW LINE
- EXISTING CULVERT

N

0 50 100 Feet

1 in = 100 ft

Hoskin • Ryan Consultants, Inc.
6245 N. 24th Parkway #100 Phoenix, AZ 85016
Office: (602) 252.8384 Fax: (602) 252.8385

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

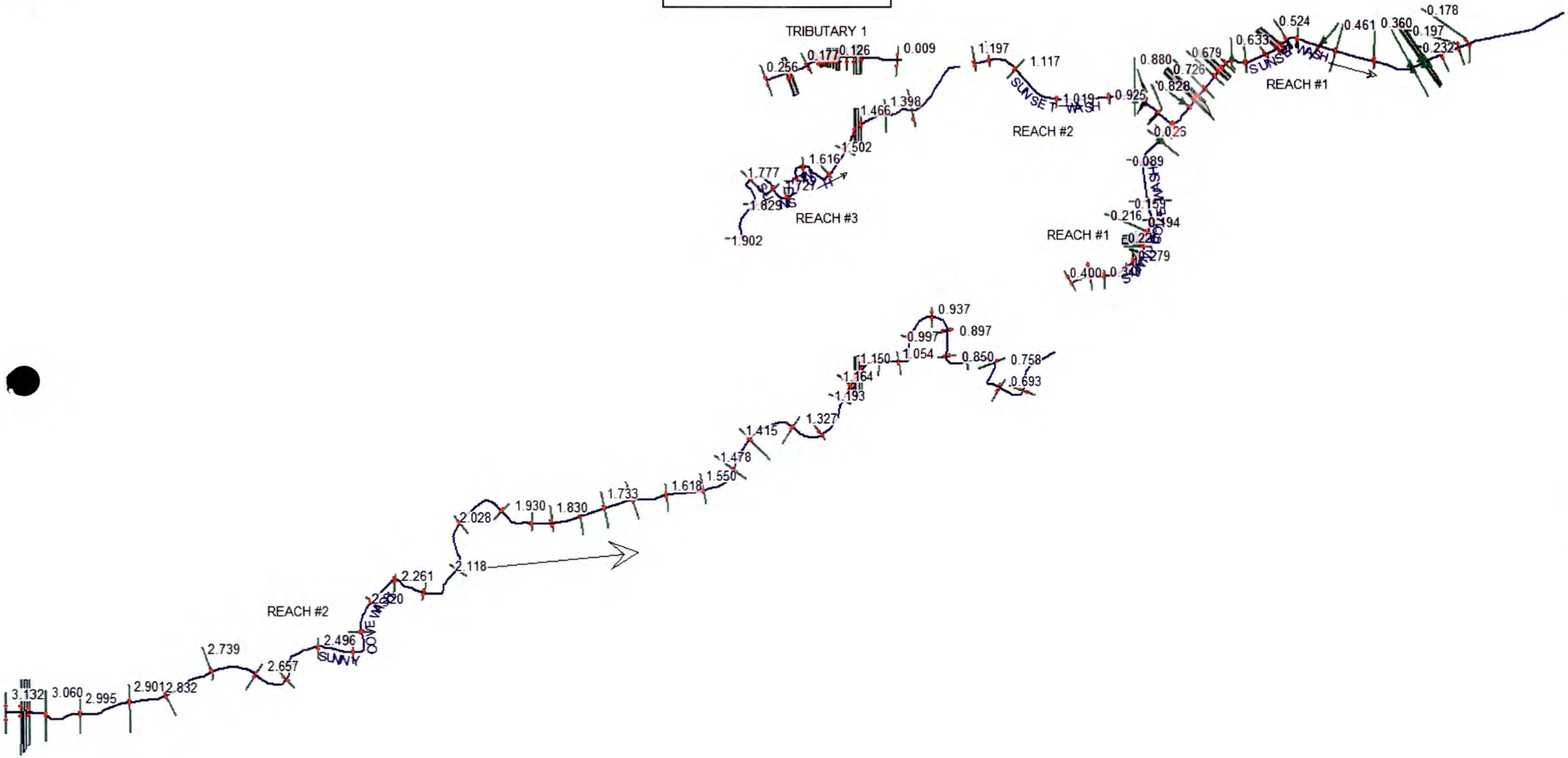
WICKENBURG
AREA DRAINAGE MASTER STUDY / PLAN

F.C.D. Contract No. 2009-C030

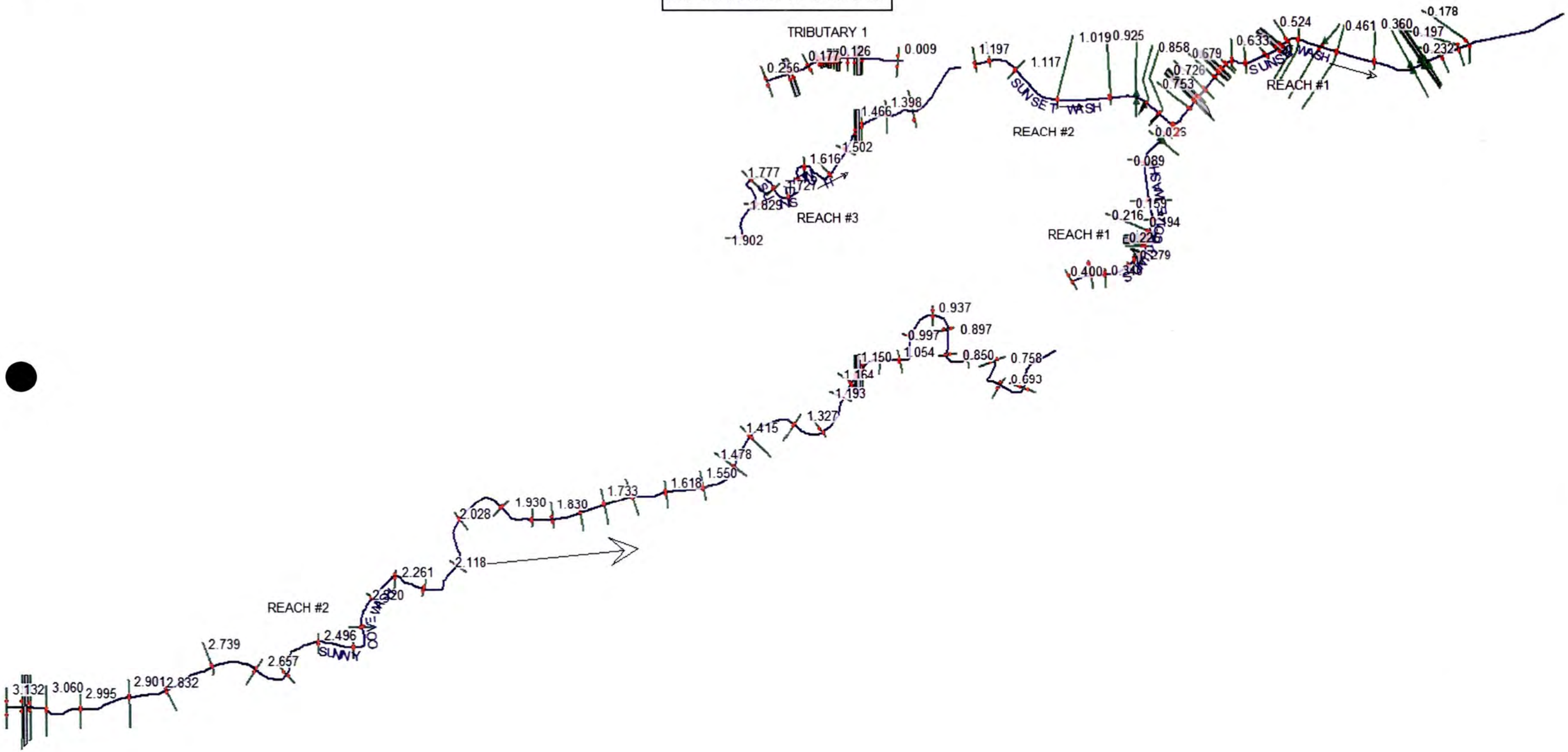
FLOW SPLIT MAP

E.5.1 SCHEMATIC

100-YEAR HEC-RAS MODEL



500-YEAR HEC-RAS MODEL



E.5.2 REPORT

10-YEAR, 50-YEAR AND 100-YEAR REPORT


```
                    HEC-RAS Version 4.1.0 Jan 2010
                     U.S. Army Corps 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: Wickenburg_Phase1
Project File : WKB1.prj
Run Date and Time: 2/6/2012 12:53:38 PM

Project in English units

Project Description:
Wickenburg Area Drainage Master Study/Plan (ADMS/P)
Phase 1 Hydraulic Model
for Sunset Wash, Sunset Wash Tributary 1 and Sunnycove Wash

Prepared
by:
Hoskin Ryan Consultants, Inc.
6245 N. 24th Parkway, Suite 100
Phoenix,
AZ 85016

Prepared for:
Flood Control District of Maricopa County
(FCDMC)
2801 W. Durango Street
Phoenix, AZ 85009

FCDMC Contract No.
2009-C030

FCDMC Project Manager: Gregory L. Jones

Topographic Mapping:
prepared during the Wickenburg Mapping Project (FCDMC 03-66), dated July 7th,
2004. Provided by the FCDMC and used to create the 2-foot contour interval
mapping.

Vertical Datum: NAVD88

Geographic Coordinate System is State
Plane Arizona Central (NAD83)

*******************************************************************************

PLAN DATA

Plan Title: Wickenburg_Phase1
Plan File : g:\Projects\10\10-003 Wickenburg ADMS\01-Phase 1\Hydro\HEC-RAS\WKB1.p01

          Geometry Title: Wickenburg_Phase1
          Geometry File : g:\Projects\10\10-003 Wickenburg ADMS\01-Phase 1\Hydro\HEC-RAS\WKB1.g01

          Flow Title    : 100-year, 6-hour
          Flow File     : g:\Projects\10\10-003 Wickenburg ADMS\01-Phase 1\Hydro\HEC-RAS\WKB1.f01

Plan Summary Information:
Number of:  Cross Sections =  121    Multiple Openings  =    0
            Culverts       =   13    Inline Structures  =    0
            Bridges        =    1    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

Encroachment Data
   Equal Conveyance = True
   Left Offset      =        0
   Right Offset     =        0

River = SUNNYCOVE WASH   Reach = REACH #2
RS      Profile           Method  Value1  Value2
```

```
3.132   FLOODWAY                1    9925   10080
3.105   FLOODWAY                1 9945.6710035.18
3.091   FLOODWAY                1 9964.2410027.59
3.060   FLOODWAY                1    9930   10057
2.995   FLOODWAY                1  9987.110008.02
2.901   FLOODWAY                1 9989.53   10035
2.832   FLOODWAY                1 9985.1910021.27
2.739   FLOODWAY                1  9972.110007.81
2.657   FLOODWAY                1 9979.7610025.91
2.592   FLOODWAY                1 9965.7910023.95
2.563   FLOODWAY                1 9985.0410021.39
2.496   FLOODWAY                1 9992.6310023.91
2.432   FLOODWAY                1    9980   10025
2.379   FLOODWAY                1    998010013.45
2.320   FLOODWAY                1 9986.6410022.03
2.261   FLOODWAY                1    9987   10035
2.203   FLOODWAY                1 9981.77 10024.7
2.118   FLOODWAY                1    9988   10034
2.028   FLOODWAY                1 9986.97 10015.5
1.930   FLOODWAY                1 9986.97 10010.9
1.867   FLOODWAY                1  9988.210010.76
1.830   FLOODWAY                1 9981.1110021.44
1.778   FLOODWAY                1 9972.48   10020
1.733   FLOODWAY                1 9981.02   10040
1.681   FLOODWAY                1  9984.8   10022
1.618   FLOODWAY                1 9985.0610016.06
1.550   FLOODWAY                1    9975   10035
1.478   FLOODWAY                1    9947 10010.9
1.415   FLOODWAY                1    9955   10075
1.327   FLOODWAY                1    9987   10021
1.270   FLOODWAY                1  9962.9   10018
1.193   FLOODWAY                1    9982   10027
1.164   FLOODWAY                1 9991.3910031.05
1.150   FLOODWAY                1    996010045.28
1.127   FLOODWAY                1 9979.14   10044
1.091   FLOODWAY                1  9983.1   10048
1.054   FLOODWAY                1    9983   10020
0.997   FLOODWAY                1 9970.0910020.39
0.937   FLOODWAY                1  9951.410015.72
0.897   FLOODWAY                1 9972.3310044.07
0.850   FLOODWAY                1 9969.37 10018.4
0.807   FLOODWAY                1 9943.3510005.81
0.758   FLOODWAY                1 9949.6410020.64
0.693   FLOODWAY                1  9979.4 10041.6
0.642   FLOODWAY                1 9965.5810042.49

River = SUNNYCOVE WASH    Reach = REACH #1
RS      Profile            Method  Value1  Value2
0.400   FLOODWAY                1 9931.3410009.25
0.365   FLOODWAY                1 9883.37 10017.3
0.340   FLOODWAY                1 9984.5610013.16
0.294   FLOODWAY                1 9993.7210009.06
0.279   FLOODWAY                1    996810024.15
0.263   FLOODWAY                1    998110003.46
0.245   FLOODWAY                1    997410013.03
0.239   FLOODWAY                1    9975 10016.3
0.226   FLOODWAY                1 9974.43 10019.2
0.216   FLOODWAY                1 9986.7610009.11
0.194   FLOODWAY                1 9990.5310010.05
0.159   FLOODWAY                1    9940 10014.5
0.089   FLOODWAY                1  9971.510013.21
0.036   FLOODWAY                1 9991.8210020.56
0.022   FLOODWAY                1 9992.2910024.37

River = SUNSET WASH       Reach = REACH #2
RS      Profile            Method  Value1  Value2
1.197   FLOODWAY                1 9988.3110026.83
1.170   FLOODWAY                1    9976 10005.8
1.117   FLOODWAY                1  9986.110034.83
1.016   FLOODWAY                1 9985.2710016.07
0.925   FLOODWAY                1 9984.6310009.59
0.880   FLOODWAY                1    998110047.13
0.858   FLOODWAY                1    9988   10023
0.828   FLOODWAY                1    9988 10015.2

River = SUNSET WASH       Reach = REACH #1
RS      Profile            Method  Value1  Value2
0.753   FLOODWAY                1 9985.57 10008.8
0.737   FLOODWAY                1 9946.1210017.93
0.726   FLOODWAY                1    9954   10030
0.708   FLOODWAY                1    9955   10030
0.679   FLOODWAY                1    9955   10010
0.668   FLOODWAY                1    9971 10009.4
0.658   FLOODWAY                1    995310007.52
0.647   FLOODWAY                1 9981.8310005.83
0.633   FLOODWAY                1 9974.7110014.28
0.607   FLOODWAY                1 9984.5410012.47
0.570   FLOODWAY                1 9982.3710022.73
0.547   FLOODWAY                1 9982.6510027.21
0.537   FLOODWAY                1 9974.7910014.79
0.524   FLOODWAY                1 9978.1510010.11
0.504   FLOODWAY                1 9989.57   10016
0.461   FLOODWAY                1 9979.1610036.92
0.431   FLOODWAY                1 9990.1610023.66
0.360   FLOODWAY                1 9978.9810017.04
0.289   FLOODWAY                1    9970   10030
0.269   FLOODWAY                1 9963.6510036.35
0.260   FLOODWAY                1    9968   10032
```

```
0.232   FLOODWAY                1    986010027.78
0.197   FLOODWAY                1    978010023.12
0.178   FLOODWAY                1 9771.8410033.48
```

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FLOW DATA

Flow Title: 100-year, 6-hour
Flow File : g:\Projects\10\10-003 Wickenburg ADMS\01-Phase 1\Hydro\HEC-RAS\WKB1.f01

Flow Data (cfs)

River	Reach	RS	FLOODPLAIN	FLOODWAY	50-YEAR	10-YEAR
SUNNYCOVE WASH	REACH #1	0.400	137	137	119	78
SUNNYCOVE WASH	REACH #1	0.263	326	326	282	186
SUNNYCOVE WASH	REACH #2	3.132	1006	1006	863	549
SUNNYCOVE WASH	REACH #2	2.901	1048	1048	893	554
SUNNYCOVE WASH	REACH #2	2.592	1322	1322	1124	690
SUNNYCOVE WASH	REACH #2	1.830	1542	1542	1316	831
SUNSET WASH	REACH #2	1.197	56	56	48	30
SUNSET WASH	REACH #2	1.117	493	493	421	264
SUNSET WASH	REACH #2	1.016	493	493	421	264
SUNSET WASH	REACH #2	0.925	493	493	421	264
SUNSET WASH	REACH #1	0.753	770	770	660	419
SUNSET WASH	REACH #1	0.537	960	960	819	470
SUNSET WASH	REACH #1	0.360	1146	1146	975	599
SUNSET WASH	REACH #3	1.902	515	515	443	279
SUNSET WASH	TRIBUTARY 1	0.256	412	412	350	220

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
SUNNYCOVE WASH	REACH #2	FLOODPLAIN		Normal S = 0.02
SUNSET WASH	REACH #1	FLOODPLAIN		Normal S = 0.0067
SUNSET WASH	REACH #3	FLOODPLAIN		Normal S = 0.02073
SUNSET WASH	TRIBUTARY 1	FLOODPLAIN		Normal S = 0.00933

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.400

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2111.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.		0.039	
W.S. Elev (ft)	2110.78	Reach Len. (ft)	229.53	185.77	170.71
Crit W.S. (ft)	2110.78	Flow Area (sq ft)		35.56	
E.G. Slope (ft/ft)	0.029057	Area (sq ft)		35.56	0.00
Q Total (cfs)	137.00	Flow (cfs)		137.00	
Top Width (ft)	77.70	Top Width (ft)		77.70	
Vel Total (ft/s)	3.85	Avg. Vel. (ft/s)		3.85	
Max Chl Dpth (ft)	1.11	Hydr. Depth (ft)		0.46	
Conv. Total (cfs)	803.7	Conv. (cfs)		803.7	
Length Wtd. (ft)	186.17	Wetted Per. (ft)		77.84	
Min Ch El (ft)	2109.67	Shear (lb/sq ft)		0.83	
Alpha	1.00	Stream Power (lb/ft s)		3.19	
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	0.09	1.04	0.04
C & E Loss (ft)	0.07	Cum SA (acres)	0.97	1.85	0.75

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

E.G. Elev (ft)	2111.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.22	Wt. n-Val.		0.039	
W.S. Elev (ft)	2110.79	Reach Len. (ft)	229.53	185.77	170.71
Crit W.S. (ft)	2110.79	Flow Area (sq ft)		36.17	
E.G. Slope (ft/ft)	0.027532	Area (sq ft)		36.17	
Q Total (cfs)	137.00	Flow (cfs)		137.00	
Top Width (ft)	77.84	Top Width (ft)		77.84	
Vel Total (ft/s)	3.79	Avg. Vel. (ft/s)		3.79	
Max Chl Dpth (ft)	1.12	Hydr. Depth (ft)		0.46	
Conv. Total (cfs)	825.7	Conv. (cfs)		825.7	
Length Wtd. (ft)	185.77	Wetted Per. (ft)		77.99	
Min Ch El (ft)	2109.67	Shear (lb/sq ft)		0.80	
Alpha	1.00	Stream Power (lb/ft s)		3.02	
Frctn Loss (ft)	0.20	Cum Volume (acre-ft)	0.02	1.18	0.00
C & E Loss (ft)	0.06	Cum SA (acres)	0.32	1.85	0.03

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2110.95	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.22	Wt. n-Val.		0.039		
W.S. Elev (ft)	2110.73	Reach Len. (ft)	229.53	185.77	170.71	
Crit W.S. (ft)	2110.73	Flow Area (sq ft)		31.63		
E.G. Slope (ft/ft)	0.031716	Area (sq ft)		31.63		
Q Total (cfs)	119.00	Flow (cfs)		119.00		
Top Width (ft)	76.46	Top Width (ft)		76.46		
Vel Total (ft/s)	3.76	Avg. Vel. (ft/s)		3.76		
Max Chl Dpth (ft)	1.06	Hydr. Depth (ft)		0.41		
Conv. Total (cfs)	668.2	Conv. (cfs)		668.2		
Length Wtd. (ft)	186.10	Wetted Per. (ft)		76.60		
Min Ch El (ft)	2109.67	Shear (lb/sq ft)		0.82		
Alpha	1.00	Stream Power (lb/ft s)		3.08		
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	0.07	0.95	0.03	
C & E Loss (ft)	0.06	Cum SA (acres)	0.93	1.84	0.66	

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2110.79	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.19	Wt. n-Val.		0.039		
W.S. Elev (ft)	2110.60	Reach Len. (ft)	229.53	185.77	170.71	
Crit W.S. (ft)	2110.60	Flow Area (sq ft)		22.28		
E.G. Slope (ft/ft)	0.032494	Area (sq ft)		22.28		
Q Total (cfs)	78.00	Flow (cfs)		78.00		
Top Width (ft)	61.07	Top Width (ft)		61.07		
Vel Total (ft/s)	3.50	Avg. Vel. (ft/s)		3.50		
Max Chl Dpth (ft)	0.93	Hydr. Depth (ft)		0.36		
Conv. Total (cfs)	432.7	Conv. (cfs)		432.7		
Length Wtd. (ft)	185.88	Wetted Per. (ft)		61.19		
Min Ch El (ft)	2109.67	Shear (lb/sq ft)		0.74		
Alpha	1.00	Stream Power (lb/ft s)		2.59		
Frctn Loss (ft)	0.33	Cum Volume (acre-ft)	0.03	0.70	0.01	
C & E Loss (ft)	0.05	Cum SA (acres)	0.58	1.77	0.48	

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: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.365

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2107.73	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.01	Wt. n-Val.	0.049	0.039	0.035	
W.S. Elev (ft)	2107.72	Reach Len. (ft)	179.96	133.12	128.74	
Crit W.S. (ft)		Flow Area (sq ft)	6.10	154.71	0.09	
E.G. Slope (ft/ft)	0.000425	Area (sq ft)	6.10	154.71	0.09	
Q Total (cfs)	137.00	Flow (cfs)	2.50	134.49	0.01	
Top Width (ft)	145.34	Top Width (ft)	11.41	132.72	1.21	
Vel Total (ft/s)	0.85	Avg. Vel. (ft/s)	0.41	0.87	0.16	
Max Chl Dpth (ft)	2.32	Hydr. Depth (ft)	0.53	1.17	0.08	
Conv. Total (cfs)	6643.3	Conv. (cfs)	121.0	6521.6	0.7	
Length Wtd. (ft)	136.09	Wetted Per. (ft)	11.52	132.94	1.22	
Min Ch El (ft)	2105.40	Shear (lb/sq ft)	0.01	0.03	0.00	
Alpha	1.03	Stream Power (lb/ft s)	0.01	0.03	0.00	

* Frctn Loss (ft)	* 0.12	* Cum Volume (acre-ft)	* 0.07	* 0.64	* 0.04	*
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 0.94	* 1.40	* 0.75	*

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #FLOODWAY

* E.G. Elev (ft)	* 2107.84	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.01	* Wt. n-Val.	*	* 0.039	* 0.035	*
* W.S. Elev (ft)	* 2107.83	* Reach Len. (ft)	* 179.96	* 133.12	* 128.74	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	*	* 168.58	* 0.22	*
* E.G. Slope (ft/ft)	*0.000333	* Area (sq ft)	*	* 168.58	* 0.22	*
* Q Total (cfs)	* 137.00	* Flow (cfs)	*	* 136.95	* 0.05	*
* Top Width (ft)	* 133.93	* Top Width (ft)	*	* 132.72	* 1.21	*
* Vel Total (ft/s)	* 0.81	* Avg. Vel. (ft/s)	*	* 0.81	* 0.23	*
* Max Chl Dpth (ft)	* 2.43	* Hydr. Depth (ft)	*	* 1.27	* 0.18	*
* Conv. Total (cfs)	* 7505.0	* Conv. (cfs)	*	* 7502.2	* 2.8	*
* Length Wtd. (ft)	* 133.12	* Wetted Per. (ft)	*	* 133.54	* 1.33	*
* Min Ch El (ft)	* 2105.40	* Shear (lb/sq ft)	*	* 0.03	* 0.00	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 0.02	* 0.00	*
* Frctn Loss (ft)	* 0.11	* Cum Volume (acre-ft)	* 0.02	* 0.75	* 0.00	*
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 0.32	* 1.40	* 0.02	*

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #50-YEAR

* E.G. Elev (ft)	* 2107.62	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.01	* Wt. n-Val.	* 0.049	* 0.039	* 0.035	*
* W.S. Elev (ft)	* 2107.61	* Reach Len. (ft)	* 179.96	* 133.12	* 128.74	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 4.88	* 140.29	* 0.01	*
* E.G. Slope (ft/ft)	*0.000447	* Area (sq ft)	* 4.88	* 140.29	* 0.01	*
* Q Total (cfs)	* 119.00	* Flow (cfs)	* 1.80	* 117.20	* 0.00	*
* Top Width (ft)	* 144.16	* Top Width (ft)	* 11.08	* 132.72	* 0.36	*
* Vel Total (ft/s)	* 0.82	* Avg. Vel. (ft/s)	* 0.37	* 0.84	* 0.07	*
* Max Chl Dpth (ft)	* 2.21	* Hydr. Depth (ft)	* 0.44	* 1.06	* 0.02	*
* Conv. Total (cfs)	* 5625.5	* Conv. (cfs)	* 85.1	* 5540.4	* 0.0	*
* Length Wtd. (ft)	* 135.93	* Wetted Per. (ft)	* 11.17	* 132.94	* 0.37	*
* Min Ch El (ft)	* 2105.40	* Shear (lb/sq ft)	* 0.01	* 0.03	* 0.00	*
* Alpha	* 1.03	* Stream Power (lb/ft s)	* 0.00	* 0.02	* 0.00	*
* Frctn Loss (ft)	* 0.13	* Cum Volume (acre-ft)	* 0.06	* 0.58	* 0.03	*
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 0.90	* 1.40	* 0.66	*

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YEAR

* E.G. Elev (ft)	* 2107.33	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.01	* Wt. n-Val.	* 0.049	* 0.039	*	*
* W.S. Elev (ft)	* 2107.32	* Reach Len. (ft)	* 179.96	* 133.12	* 128.74	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 1.73	* 101.17	*	*
* E.G. Slope (ft/ft)	*0.000575	* Area (sq ft)	* 1.73	* 101.17	*	*
* Q Total (cfs)	* 78.00	* Flow (cfs)	* 0.39	* 77.61	*	*
* Top Width (ft)	* 141.37	* Top Width (ft)	* 10.17	* 131.20	*	*
* Vel Total (ft/s)	* 0.76	* Avg. Vel. (ft/s)	* 0.22	* 0.77	*	*
* Max Chl Dpth (ft)	* 1.92	* Hydr. Depth (ft)	* 0.17	* 0.77	*	*
* Conv. Total (cfs)	* 3254.2	* Conv. (cfs)	* 16.1	* 3238.1	*	*
* Length Wtd. (ft)	* 134.82	* Wetted Per. (ft)	* 10.22	* 131.41	*	*
* Min Ch El (ft)	* 2105.40	* Shear (lb/sq ft)	* 0.01	* 0.03	*	*
* Alpha	* 1.02	* Stream Power (lb/ft s)	* 0.00	* 0.02	*	*
* Frctn Loss (ft)	* 0.17	* Cum Volume (acre-ft)	* 0.03	* 0.43	* 0.01	*
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 0.55	* 1.36	* 0.48	*

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.340

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	* 2107.60	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.10	* Wt. n-Val.	* 0.049	* 0.039	* 0.035	*
* W.S. Elev (ft)	* 2107.51	* Reach Len. (ft)	* 231.01	* 240.22	* 244.75	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 11.12	* 40.61	* 10.14	*
* E.G. Slope (ft/ft)	*0.003154	* Area (sq ft)	* 11.12	* 40.61	* 10.14	*
* Q Total (cfs)	* 137.00	* Flow (cfs)	* 15.97	* 109.65	* 11.38	*
* Top Width (ft)	* 74.19	* Top Width (ft)	* 14.23	* 28.60	* 31.36	*
* Vel Total (ft/s)	* 2.21	* Avg. Vel. (ft/s)	* 1.44	* 2.70	* 1.12	*
* Max Chl Dpth (ft)	* 1.82	* Hydr. Depth (ft)	* 0.78	* 1.42	* 0.32	*
* Conv. Total (cfs)	* 2439.4	* Conv. (cfs)	* 284.3	* 1952.4	* 202.6	*
* Length Wtd. (ft)	* 239.87	* Wetted Per. (ft)	* 14.35	* 28.65	* 31.39	*
* Min Ch El (ft)	* 2105.69	* Shear (lb/sq ft)	* 0.15	* 0.28	* 0.06	*
* Alpha	* 1.26	* Stream Power (lb/ft s)	* 0.22	* 0.75	* 0.07	*
* Frctn Loss (ft)	* 1.46	* Cum Volume (acre-ft)	* 0.03	* 0.34	* 0.03	*
* C & E Loss (ft)	* 0.05	* Cum SA (acres)	* 0.89	* 1.16	* 0.70	*

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

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2107.71	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.		0.039	
W.S. Elev (ft)	2107.54	Reach Len. (ft)	231.01	240.22	244.75
Crit W.S. (ft)		Flow Area (sq ft)		41.57	
E.G. Slope (ft/ft)	0.005011	Area (sq ft)		41.57	
Q Total (cfs)	137.00	Flow (cfs)		137.00	
Top Width (ft)	28.60	Top Width (ft)		28.60	
Vel Total (ft/s)	3.30	Avg. Vel. (ft/s)		3.30	
Max Chl Dpth (ft)	1.85	Hydr. Depth (ft)		1.45	
Conv. Total (cfs)	1935.4	Conv. (cfs)		1935.4	
Length Wtd. (ft)	240.22	Wetted Per. (ft)		30.77	
Min Ch El (ft)	2105.69	Shear (lb/sq ft)		0.42	
Alpha	1.00	Stream Power (lb/ft s)		1.39	
Frctn Loss (ft)	1.04	Cum Volume (acre-ft)	0.02	0.43	0.00
C & E Loss (ft)	0.00	Cum SA (acres)	0.32	1.16	0.02

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

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2107.48	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.	0.049	0.039	0.035
W.S. Elev (ft)	2107.39	Reach Len. (ft)	231.01	240.22	244.75
Crit W.S. (ft)		Flow Area (sq ft)	9.43	37.18	6.47
E.G. Slope (ft/ft)	0.003520	Area (sq ft)	9.43	37.18	6.47
Q Total (cfs)	119.00	Flow (cfs)	13.04	100.00	5.97
Top Width (ft)	71.62	Top Width (ft)	13.90	28.60	29.11
Vel Total (ft/s)	2.24	Avg. Vel. (ft/s)	1.38	2.69	0.92
Max Chl Dpth (ft)	1.70	Hydr. Depth (ft)	0.68	1.30	0.22
Conv. Total (cfs)	2005.8	Conv. (cfs)	219.7	1685.5	100.6
Length Wtd. (ft)	239.83	Wetted Per. (ft)	14.00	28.65	29.14
Min Ch El (ft)	2105.69	Shear (lb/sq ft)	0.15	0.29	0.05
Alpha	1.26	Stream Power (lb/ft s)	0.20	0.77	0.05
Frctn Loss (ft)	1.52	Cum Volume (acre-ft)	0.03	0.31	0.02
C & E Loss (ft)	0.04	Cum SA (acres)	0.84	1.15	0.62

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

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2107.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.	0.049	0.039	0.035
W.S. Elev (ft)	2107.06	Reach Len. (ft)	231.01	240.22	244.75
Crit W.S. (ft)		Flow Area (sq ft)	4.98	27.73	1.62
E.G. Slope (ft/ft)	0.004680	Area (sq ft)	4.98	27.73	1.62
Q Total (cfs)	78.00	Flow (cfs)	5.45	70.71	1.85
Top Width (ft)	48.13	Top Width (ft)	13.00	28.60	6.53
Vel Total (ft/s)	2.27	Avg. Vel. (ft/s)	1.09	2.55	1.14
Max Chl Dpth (ft)	1.36	Hydr. Depth (ft)	0.38	0.97	0.25
Conv. Total (cfs)	1140.2	Conv. (cfs)	79.6	1033.6	27.0
Length Wtd. (ft)	239.95	Wetted Per. (ft)	13.03	28.65	6.55
Min Ch El (ft)	2105.69	Shear (lb/sq ft)	0.11	0.28	0.07
Alpha	1.16	Stream Power (lb/ft s)	0.12	0.72	0.08
Frctn Loss (ft)	1.65	Cum Volume (acre-ft)	0.01	0.24	0.00
C & E Loss (ft)	0.02	Cum SA (acres)	0.50	1.11	0.47

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

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.294

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2106.10	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.56	Wt. n-Val.		0.039	
W.S. Elev (ft)	2105.53	Reach Len. (ft)	97.97	80.84	54.11
Crit W.S. (ft)	2105.36	Flow Area (sq ft)		22.72	
E.G. Slope (ft/ft)	0.016316	Area (sq ft)		22.72	
Q Total (cfs)	137.00	Flow (cfs)		137.00	
Top Width (ft)	15.34	Top Width (ft)		15.34	
Vel Total (ft/s)	6.03	Avg. Vel. (ft/s)		6.03	
Max Chl Dpth (ft)	2.96	Hydr. Depth (ft)		1.48	

* Conv. Total (cfs)	* 1072.6	* Conv. (cfs)	*		*	1072.6	*		*
* Length Wtd. (ft)	* 80.97	* Wetted Per. (ft)	*		*	16.47	*		*
* Min Ch El (ft)	* 2102.57	* Shear (lb/sq ft)	*		*	1.41	*		*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*		*	8.47	*		*
* Frctn Loss (ft)	* 0.29	* Cum Volume (acre-ft)	*	0.00	*	0.16	*	0.00	*
* C & E Loss (ft)	* 0.25	* Cum SA (acres)	*	0.85	*	1.04	*	0.61	*

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #FLOODWAY

* E.G. Elev (ft)	* 2106.67	* Element	*	Left OB	*	Channel	*	Right OB	*
* Vel Head (ft)	* 0.22	* Wt. n-Val.	*		*	0.039	*		*
* W.S. Elev (ft)	* 2106.45	* Reach Len. (ft)	*	97.97	*	80.84	*	54.11	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	*		*	36.80	*		*
* E.G. Slope (ft/ft)	*0.003765	* Area (sq ft)	*		*	36.80	*		*
* Q Total (cfs)	* 137.00	* Flow (cfs)	*		*	137.00	*		*
* Top Width (ft)	* 15.34	* Top Width (ft)	*		*	15.34	*		*
* Vel Total (ft/s)	* 3.72	* Avg. Vel. (ft/s)	*		*	3.72	*		*
* Max Chl Dpth (ft)	* 3.88	* Hydr. Depth (ft)	*		*	2.40	*		*
* Conv. Total (cfs)	* 2232.8	* Conv. (cfs)	*		*	2232.8	*		*
* Length Wtd. (ft)	* 81.30	* Wetted Per. (ft)	*		*	18.31	*		*
* Min Ch El (ft)	* 2102.57	* Shear (lb/sq ft)	*		*	0.47	*		*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*		*	1.76	*		*
* Frctn Loss (ft)	* 0.06	* Cum Volume (acre-ft)	*	0.02	*	0.21	*	0.00	*
* C & E Loss (ft)	* 0.10	* Cum SA (acres)	*	0.32	*	1.04	*	0.02	*

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #50-YEAR

* E.G. Elev (ft)	* 2105.92	* Element	*	Left OB	*	Channel	*	Right OB	*
* Vel Head (ft)	* 0.49	* Wt. n-Val.	*		*	0.039	*		*
* W.S. Elev (ft)	* 2105.44	* Reach Len. (ft)	*	97.97	*	80.84	*	54.11	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	*		*	21.28	*		*
* E.G. Slope (ft/ft)	*0.014658	* Area (sq ft)	*		*	21.28	*		*
* Q Total (cfs)	* 119.00	* Flow (cfs)	*		*	119.00	*		*
* Top Width (ft)	* 14.84	* Top Width (ft)	*		*	14.84	*		*
* Vel Total (ft/s)	* 5.59	* Avg. Vel. (ft/s)	*		*	5.59	*		*
* Max Chl Dpth (ft)	* 2.87	* Hydr. Depth (ft)	*		*	1.43	*		*
* Conv. Total (cfs)	* 982.9	* Conv. (cfs)	*		*	982.9	*		*
* Length Wtd. (ft)	* 80.94	* Wetted Per. (ft)	*		*	15.94	*		*
* Min Ch El (ft)	* 2102.57	* Shear (lb/sq ft)	*		*	1.22	*		*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*		*	6.83	*		*
* Frctn Loss (ft)	* 0.27	* Cum Volume (acre-ft)	*	0.00	*	0.15	*	0.00	*
* C & E Loss (ft)	* 0.21	* Cum SA (acres)	*	0.81	*	1.03	*	0.54	*

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YEAR

* E.G. Elev (ft)	* 2105.47	* Element	*	Left OB	*	Channel	*	Right OB	*
* Vel Head (ft)	* 0.32	* Wt. n-Val.	*		*	0.039	*		*
* W.S. Elev (ft)	* 2105.15	* Reach Len. (ft)	*	97.97	*	80.84	*	54.11	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	*		*	17.18	*		*
* E.G. Slope (ft/ft)	*0.011147	* Area (sq ft)	*		*	17.18	*		*
* Q Total (cfs)	* 78.00	* Flow (cfs)	*		*	78.00	*		*
* Top Width (ft)	* 13.34	* Top Width (ft)	*		*	13.34	*		*
* Vel Total (ft/s)	* 4.54	* Avg. Vel. (ft/s)	*		*	4.54	*		*
* Max Chl Dpth (ft)	* 2.58	* Hydr. Depth (ft)	*		*	1.29	*		*
* Conv. Total (cfs)	* 738.8	* Conv. (cfs)	*		*	738.8	*		*
* Length Wtd. (ft)	* 80.86	* Wetted Per. (ft)	*		*	14.32	*		*
* Min Ch El (ft)	* 2102.57	* Shear (lb/sq ft)	*		*	0.83	*		*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*		*	3.79	*		*
* Frctn Loss (ft)	* 0.23	* Cum Volume (acre-ft)	*	0.00	*	0.11	*		*
* C & E Loss (ft)	* 0.14	* Cum SA (acres)	*	0.47	*	1.00	*	0.45	*

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.279

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	* 2105.56	* Element	*	Left OB	*	Channel	*	Right OB	*
* Vel Head (ft)	* 0.07	* Wt. n-Val.	*	0.049	*	0.039	*	0.035	*
* W.S. Elev (ft)	* 2105.49	* Reach Len. (ft)	*	77.42	*	82.51	*	83.60	*
* Crit W.S. (ft)	* 2104.37	* Flow Area (sq ft)	*	3.85	*	62.79	*	0.44	*
* E.G. Slope (ft/ft)	*0.001498	* Area (sq ft)	*	3.85	*	62.79	*	0.44	*
* Q Total (cfs)	* 137.00	* Flow (cfs)	*	2.40	*	134.35	*	0.26	*
* Top Width (ft)	* 47.45	* Top Width (ft)	*	9.91	*	35.51	*	2.03	*
* Vel Total (ft/s)	* 2.04	* Avg. Vel. (ft/s)	*	0.62	*	2.14	*	0.58	*
* Max Chl Dpth (ft)	* 3.05	* Hydr. Depth (ft)	*	0.39	*	1.77	*	0.22	*
* Conv. Total (cfs)	* 3540.2	* Conv. (cfs)	*	62.0	*	3471.6	*	6.6	*
* Length Wtd. (ft)	* 82.51	* Wetted Per. (ft)	*	9.94	*	35.92	*	2.07	*
* Min Ch El (ft)	* 2102.44	* Shear (lb/sq ft)	*	0.04	*	0.16	*	0.02	*

Alpha	1.08	Stream Power (lb/ft s)	0.02	0.35	0.01
Frctn Loss (ft)		Cum Volume (acre-ft)		0.08	
C & E Loss (ft)		Cum SA (acres)	0.84	0.99	0.61

CROSS SECTION OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2106.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.049	0.039	0.035
W.S. Elev (ft)	2106.49	Reach Len. (ft)	77.42	82.51	83.60
Crit W.S. (ft)	2104.37	Flow Area (sq ft)	18.89	98.13	2.46
E.G. Slope (ft/ft)	0.000296	Area (sq ft)	18.89	98.13	2.46
Q Total (cfs)	137.00	Flow (cfs)	9.85	125.61	1.55
Top Width (ft)	56.15	Top Width (ft)	18.61	35.51	2.03
Vel Total (ft/s)	1.15	Avg. Vel. (ft/s)	0.52	1.28	0.63
Max Chl Dpth (ft)	4.05	Hydr. Depth (ft)	1.01	2.76	1.21
Conv. Total (cfs)	7968.9	Conv. (cfs)	572.8	7306.1	90.0
Length Wtd. (ft)	82.51	Wetted Per. (ft)	18.88	35.92	3.07
Min Ch El (ft)	2102.44	Shear (lb/sq ft)	0.02	0.05	0.01
Alpha	1.16	Stream Power (lb/ft s)	0.01	0.06	0.01
Frctn Loss (ft)		Cum Volume (acre-ft)		0.08	
C & E Loss (ft)		Cum SA (acres)	0.30	0.99	0.02

CROSS SECTION OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2105.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.	0.049	0.039	0.035
W.S. Elev (ft)	2105.38	Reach Len. (ft)	77.42	82.51	83.60
Crit W.S. (ft)	2104.26	Flow Area (sq ft)	2.81	58.81	0.24
E.G. Slope (ft/ft)	0.001422	Area (sq ft)	2.81	58.81	0.24
Q Total (cfs)	119.00	Flow (cfs)	1.51	117.38	0.11
Top Width (ft)	45.71	Top Width (ft)	8.70	35.51	1.50
Vel Total (ft/s)	1.92	Avg. Vel. (ft/s)	0.54	2.00	0.46
Max Chl Dpth (ft)	2.94	Hydr. Depth (ft)	0.32	1.66	0.16
Conv. Total (cfs)	3155.6	Conv. (cfs)	40.0	3112.7	3.0
Length Wtd. (ft)	82.51	Wetted Per. (ft)	8.72	35.92	1.53
Min Ch El (ft)	2102.44	Shear (lb/sq ft)	0.03	0.15	0.01
Alpha	1.06	Stream Power (lb/ft s)	0.02	0.29	0.01
Frctn Loss (ft)		Cum Volume (acre-ft)		0.08	
C & E Loss (ft)		Cum SA (acres)	0.80	0.98	0.54

CROSS SECTION OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2105.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.049	0.039	
W.S. Elev (ft)	2105.05	Reach Len. (ft)	77.42	82.51	83.60
Crit W.S. (ft)	2103.99	Flow Area (sq ft)	0.64	47.09	
E.G. Slope (ft/ft)	0.001308	Area (sq ft)	0.64	47.09	
Q Total (cfs)	78.00	Flow (cfs)	0.20	77.80	
Top Width (ft)	39.71	Top Width (ft)	4.25	35.46	
Vel Total (ft/s)	1.63	Avg. Vel. (ft/s)	0.31	1.65	
Max Chl Dpth (ft)	2.61	Hydr. Depth (ft)	0.15	1.33	
Conv. Total (cfs)	2156.8	Conv. (cfs)	5.5	2151.3	
Length Wtd. (ft)	82.51	Wetted Per. (ft)	4.26	35.86	
Min Ch El (ft)	2102.44	Shear (lb/sq ft)	0.01	0.11	
Alpha	1.02	Stream Power (lb/ft s)	0.00	0.18	
Frctn Loss (ft)		Cum Volume (acre-ft)		0.05	
C & E Loss (ft)		Cum SA (acres)	0.46	0.95	0.45

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.263

CROSS SECTION OUTPUT Profile #FLOODPLAIN

			Left OB	Channel	Right OB
E.G. Elev (ft)	2103.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.60	Wt. n-Val.	0.049	0.035	
W.S. Elev (ft)	2103.17	Reach Len. (ft)	45.34	99.22	161.90
Crit W.S. (ft)	2102.66	Flow Area (sq ft)	4.90	51.09	
E.G. Slope (ft/ft)	0.008091	Area (sq ft)	4.90	51.09	
Q Total (cfs)	326.00	Flow (cfs)	4.97	321.03	
Top Width (ft)	43.80	Top Width (ft)	21.63	22.17	
Vel Total (ft/s)	5.82	Avg. Vel. (ft/s)	1.01	6.28	
Max Chl Dpth (ft)	3.07	Hydr. Depth (ft)	0.23	2.30	
Conv. Total (cfs)	3624.2	Conv. (cfs)	55.3	3568.9	
Length Wtd. (ft)	93.59	Wetted Per. (ft)	21.66	24.20	
Min Ch El (ft)	2100.10	Shear (lb/sq ft)	0.11	1.07	
Alpha	1.15	Stream Power (lb/ft s)	0.12	6.70	
Frctn Loss (ft)	0.37	Cum Volume (acre-ft)	0.10	0.37	0.01
C & E Loss (ft)	0.23	Cum SA (acres)	0.81	0.93	0.61

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2104.29	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.36	Wt. n-Val.	0.049	0.035	
W.S. Elev (ft)	2103.93	Reach Len. (ft)	45.34	99.22	161.90
Crit W.S. (ft)		Flow Area (sq ft)	0.23	68.05	
E.G. Slope (ft/ft)	0.003342	Area (sq ft)	0.23	68.05	

Q Total (cfs)	326.00	Flow (cfs)	0.14	325.86		
Top Width (ft)	22.46	Top Width (ft)	0.29	22.17		
Vel Total (ft/s)	4.77	Avg. Vel. (ft/s)	0.62	4.79		
Max Chl Dpth (ft)	3.83	Hydr. Depth (ft)	0.78	3.07		
Conv. Total (cfs)	5639.0	Conv. (cfs)	2.4	5636.6		
Length Wtd. (ft)	99.67	Wetted Per. (ft)	1.08	24.97		
Min Ch El (ft)	2100.10	Shear (lb/sq ft)	0.04	0.57		
Alpha	1.01	Stream Power (lb/ft s)	0.03	2.72		
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)	0.02	0.39	0.01	
C & E Loss (ft)	0.11	Cum SA (acres)	0.28	0.93	0.02	

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2103.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.50	Wt. n-Val.	0.049	0.035	
W.S. Elev (ft)	2103.08	Reach Len. (ft)	45.34	99.22	161.90
Crit W.S. (ft)		Flow Area (sq ft)	3.17	49.17	
E.G. Slope (ft/ft)	0.006842	Area (sq ft)	3.17	49.17	
Q Total (cfs)	282.00	Flow (cfs)	2.52	279.48	
Top Width (ft)	39.64	Top Width (ft)	17.73	21.91	
Vel Total (ft/s)	5.39	Avg. Vel. (ft/s)	0.80	5.68	
Max Chl Dpth (ft)	2.98	Hydr. Depth (ft)	0.18	2.24	
Conv. Total (cfs)	3409.2	Conv. (cfs)	30.5	3378.7	
Length Wtd. (ft)	94.94	Wetted Per. (ft)	17.76	23.88	
Min Ch El (ft)	2100.10	Shear (lb/sq ft)	0.08	0.88	
Alpha	1.10	Stream Power (lb/ft s)	0.06	5.00	
Frctn Loss (ft)	0.36	Cum Volume (acre-ft)	0.08	0.34	0.01
C & E Loss (ft)	0.18	Cum SA (acres)	0.77	0.93	0.53

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2103.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.	0.049	0.035	
W.S. Elev (ft)	2102.82	Reach Len. (ft)	45.34	99.22	161.90
Crit W.S. (ft)		Flow Area (sq ft)	0.28	43.70	
E.G. Slope (ft/ft)	0.004216	Area (sq ft)	0.28	43.70	
Q Total (cfs)	186.00	Flow (cfs)	0.07	185.93	
Top Width (ft)	26.80	Top Width (ft)	5.82	20.98	
Vel Total (ft/s)	4.23	Avg. Vel. (ft/s)	0.26	4.26	
Max Chl Dpth (ft)	2.72	Hydr. Depth (ft)	0.05	2.08	
Conv. Total (cfs)	2864.5	Conv. (cfs)	1.1	2863.4	
Length Wtd. (ft)	96.41	Wetted Per. (ft)	5.82	22.79	
Min Ch El (ft)	2100.10	Shear (lb/sq ft)	0.01	0.50	
Alpha	1.01	Stream Power (lb/ft s)	0.00	2.15	
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	0.05	0.28	0.01
C & E Loss (ft)	0.09	Cum SA (acres)	0.45	0.90	0.45

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.245

CROSS SECTION OUTPUT Profile #FLOODPLAIN

			Left OB	Channel	Right OB
E.G. Elev (ft)	2103.17	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.	0.049	0.035	0.055
W.S. Elev (ft)	2103.03	Reach Len. (ft)	26.92	29.17	30.85
Crit W.S. (ft)		Flow Area (sq ft)	66.61	74.62	3.11
E.G. Slope (ft/ft)	0.002339	Area (sq ft)	66.61	74.62	3.11
Q Total (cfs)	326.00	Flow (cfs)	67.22	255.34	3.44
Top Width (ft)	154.57	Top Width (ft)	116.67	34.33	3.58
Vel Total (ft/s)	2.26	Avg. Vel. (ft/s)	1.01	3.42	1.11
Max Chl Dpth (ft)	3.05	Hydr. Depth (ft)	0.57	2.17	0.87
Conv. Total (cfs)	6741.3	Conv. (cfs)	1390.0	5280.2	71.2
Length Wtd. (ft)	28.58	Wetted Per. (ft)	116.70	34.68	3.98
Min Ch El (ft)	2099.97	Shear (lb/sq ft)	0.08	0.31	0.11
Alpha	1.84	Stream Power (lb/ft s)	0.08	1.08	0.13
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	0.06	0.23	0.00
C & E Loss (ft)	0.02	Cum SA (acres)	0.74	0.87	0.60

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2103.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.049	0.035	0.055
W.S. Elev (ft)	2103.85	Reach Len. (ft)	26.92	29.17	30.85
Crit W.S. (ft)		Flow Area (sq ft)	2.49	102.84	6.05
E.G. Slope (ft/ft)	0.001238	Area (sq ft)	2.49	102.84	6.05
Q Total (cfs)	326.00	Flow (cfs)	2.19	317.10	6.71

Top Width (ft)	39.03	Top Width (ft)	1.12	34.33	3.58
Vel Total (ft/s)	2.93	Avg. Vel. (ft/s)	0.88	3.08	1.11
Max Chl Dpth (ft)	3.88	Hydr. Depth (ft)	2.22	3.00	1.69
Conv. Total (cfs)	9265.1	Conv. (cfs)	62.3	9012.1	190.7
Length Wtd. (ft)	28.93	Wetted Per. (ft)	3.32	34.68	4.80
Min Ch El (ft)	2099.97	Shear (lb/sq ft)	0.06	0.23	0.10
Alpha	1.08	Stream Power (lb/ft s)	0.05	0.71	0.11
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	0.02	0.20	0.00
C & E Loss (ft)	0.02	Cum SA (acres)	0.28	0.87	0.01

CROSS SECTION OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2103.04	Element			
Vel Head (ft)	0.14	Wt. n-Val.	0.049	0.035	0.055
W.S. Elev (ft)	2102.90	Reach Len. (ft)	26.92	29.17	30.85
Crit W.S. (ft)		Flow Area (sq ft)	51.88	70.24	2.67
E.G. Slope (ft/ft)	0.002395	Area (sq ft)	51.88	70.24	2.67
Q Total (cfs)	282.00	Flow (cfs)	45.54	233.62	2.84
Top Width (ft)	151.70	Top Width (ft)	114.05	34.33	3.31
Vel Total (ft/s)	2.26	Avg. Vel. (ft/s)	0.88	3.33	1.07
Max Chl Dpth (ft)	2.93	Hydr. Depth (ft)	0.45	2.05	0.80
Conv. Total (cfs)	5761.9	Conv. (cfs)	930.4	4773.4	58.1
Length Wtd. (ft)	28.65	Wetted Per. (ft)	114.08	34.68	3.68
Min Ch El (ft)	2099.97	Shear (lb/sq ft)	0.07	0.30	0.11
Alpha	1.82	Stream Power (lb/ft s)	0.06	1.01	0.12
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	0.05	0.20	0.00
C & E Loss (ft)	0.03	Cum SA (acres)	0.71	0.87	0.53

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2102.76	Element			
Vel Head (ft)	0.09	Wt. n-Val.	0.049	0.035	0.055
W.S. Elev (ft)	2102.67	Reach Len. (ft)	26.92	29.17	30.85
Crit W.S. (ft)		Flow Area (sq ft)	28.55	62.44	1.97
E.G. Slope (ft/ft)	0.001730	Area (sq ft)	28.55	62.44	1.97
Q Total (cfs)	186.00	Flow (cfs)	21.21	163.18	1.61
Top Width (ft)	113.69	Top Width (ft)	76.52	34.33	2.85
Vel Total (ft/s)	2.00	Avg. Vel. (ft/s)	0.74	2.61	0.82
Max Chl Dpth (ft)	2.70	Hydr. Depth (ft)	0.37	1.82	0.69
Conv. Total (cfs)	4472.4	Conv. (cfs)	510.1	3923.5	38.7
Length Wtd. (ft)	28.76	Wetted Per. (ft)	76.54	34.68	3.16
Min Ch El (ft)	2099.97	Shear (lb/sq ft)	0.04	0.19	0.07
Alpha	1.51	Stream Power (lb/ft s)	0.03	0.51	0.05
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	0.03	0.16	0.00
C & E Loss (ft)	0.02	Cum SA (acres)	0.41	0.83	0.45

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.239

CROSS SECTION OUTPUT Profile #FLOODPLAIN

			Left OB	Channel	Right OB
E.G. Elev (ft)	2103.10	Element			
Vel Head (ft)	0.10	Wt. n-Val.	0.049	0.035	0.055
W.S. Elev (ft)	2103.00	Reach Len. (ft)	67.37	67.73	75.52
Crit W.S. (ft)	2101.87	Flow Area (sq ft)	92.73	69.33	4.08
E.G. Slope (ft/ft)	0.001141	Area (sq ft)	127.65	69.33	4.08
Q Total (cfs)	326.00	Flow (cfs)	109.53	213.39	3.08
Top Width (ft)	183.98	Top Width (ft)	158.20	20.58	5.20
Vel Total (ft/s)	1.96	Avg. Vel. (ft/s)	1.18	3.08	0.75
Max Chl Dpth (ft)	4.00	Hydr. Depth (ft)	1.24	3.37	0.79
Conv. Total (cfs)	9650.6	Conv. (cfs)	3242.3	6317.1	91.2
Length Wtd. (ft)	67.73	Wetted Per. (ft)	74.89	22.05	5.43
Min Ch El (ft)	2099.00	Shear (lb/sq ft)	0.09	0.22	0.05
Alpha	1.73	Stream Power (lb/ft s)	0.10	0.69	0.04
Frctn Loss (ft)		Cum Volume (acre-ft)		0.18	
C & E Loss (ft)		Cum SA (acres)	0.66	0.85	0.60

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2103.94	Element			
Vel Head (ft)	0.11	Wt. n-Val.	0.049	0.035	
W.S. Elev (ft)	2103.83	Reach Len. (ft)	67.37	67.73	75.52
Crit W.S. (ft)	2101.79	Flow Area (sq ft)	49.37	86.48	
E.G. Slope (ft/ft)	0.000877	Area (sq ft)	49.37	86.48	
Q Total (cfs)	326.00	Flow (cfs)	73.61	252.39	
Top Width (ft)	41.30	Top Width (ft)	20.72	20.58	
Vel Total (ft/s)	2.40	Avg. Vel. (ft/s)	1.49	2.92	
Max Chl Dpth (ft)	4.83	Hydr. Depth (ft)	2.38	4.20	
Conv. Total (cfs)	11007.4	Conv. (cfs)	2485.5	8521.8	
Length Wtd. (ft)	67.73	Wetted Per. (ft)	23.08	24.45	
Min Ch El (ft)	2099.00	Shear (lb/sq ft)	0.12	0.19	

* Alpha	* 1.23	* Stream Power (lb/ft s)	* 0.17	* 0.57	*	*
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	*	* 0.13	*	*
* C & E Loss (ft)	*	* Cum SA (acres)	* 0.27	* 0.85	* 0.01	*

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #50-YEAR

* E.G. Elev (ft)	* 2102.97	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.09	* Wt. n-Val.	* 0.049	* 0.035	* 0.055 *
* W.S. Elev (ft)	* 2102.88	* Reach Len. (ft)	* 67.37	* 67.73	* 75.52 *
* Crit W.S. (ft)	* 2101.64	* Flow Area (sq ft)	* 83.68	* 66.84	* 3.48 *
* E.G. Slope (ft/ft)	*0.001039	* Area (sq ft)	* 108.84	* 66.84	* 3.48 *
* Q Total (cfs)	* 282.00	* Flow (cfs)	* 88.06	* 191.57	* 2.37 *
* Top Width (ft)	* 178.52	* Top Width (ft)	* 153.15	* 20.58	* 4.80 *
* Vel Total (ft/s)	* 1.83	* Avg. Vel. (ft/s)	* 1.05	* 2.87	* 0.68 *
* Max Chl Dpth (ft)	* 3.88	* Hydr. Depth (ft)	* 1.12	* 3.25	* 0.72 *
* Conv. Total (cfs)	* 8749.9	* Conv. (cfs)	* 2732.3	* 5943.9	* 73.7 *
* Length Wtd. (ft)	* 67.73	* Wetted Per. (ft)	* 74.89	* 22.05	* 5.01 *
* Min Ch El (ft)	* 2099.00	* Shear (lb/sq ft)	* 0.07	* 0.20	* 0.05 *
* Alpha	* 1.77	* Stream Power (lb/ft s)	* 0.08	* 0.56	* 0.03 *
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	*	* 0.16	* *
* C & E Loss (ft)	*	* Cum SA (acres)	* 0.62	* 0.85	* 0.53 *

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10-YEAR

* E.G. Elev (ft)	* 2102.72	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.06	* Wt. n-Val.	* 0.049	* 0.035	* 0.055 *
* W.S. Elev (ft)	* 2102.66	* Reach Len. (ft)	* 67.37	* 67.73	* 75.52 *
* Crit W.S. (ft)	* 2100.92	* Flow Area (sq ft)	* 67.19	* 62.31	* 2.50 *
* E.G. Slope (ft/ft)	*0.000662	* Area (sq ft)	* 79.10	* 62.31	* 2.50 *
* Q Total (cfs)	* 186.00	* Flow (cfs)	* 48.76	* 136.02	* 1.22 *
* Top Width (ft)	* 134.57	* Top Width (ft)	* 109.92	* 20.58	* 4.07 *
* Vel Total (ft/s)	* 1.41	* Avg. Vel. (ft/s)	* 0.73	* 2.18	* 0.49 *
* Max Chl Dpth (ft)	* 3.66	* Hydr. Depth (ft)	* 0.90	* 3.03	* 0.61 *
* Conv. Total (cfs)	* 7230.2	* Conv. (cfs)	* 1895.3	* 5287.5	* 47.5 *
* Length Wtd. (ft)	* 67.73	* Wetted Per. (ft)	* 74.89	* 22.05	* 4.25 *
* Min Ch El (ft)	* 2099.00	* Shear (lb/sq ft)	* 0.04	* 0.12	* 0.02 *
* Alpha	* 1.83	* Stream Power (lb/ft s)	* 0.03	* 0.25	* 0.01 *
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	*	* 0.11	* *
* C & E Loss (ft)	*	* Cum SA (acres)	* 0.35	* 0.82	* 0.44 *

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.226

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	* 2100.90	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.58	* Wt. n-Val.	*	* 0.035	* *
* W.S. Elev (ft)	* 2100.32	* Reach Len. (ft)	* 76.04	* 55.89	* 33.05 *
* Crit W.S. (ft)	* 2100.32	* Flow Area (sq ft)	*	* 53.21	* *
* E.G. Slope (ft/ft)	*0.016664	* Area (sq ft)	*	* 53.21	* *
* Q Total (cfs)	* 326.00	* Flow (cfs)	*	* 326.00	* *
* Top Width (ft)	* 44.72	* Top Width (ft)	*	* 44.72	* *
* Vel Total (ft/s)	* 6.13	* Avg. Vel. (ft/s)	*	* 6.13	* *
* Max Chl Dpth (ft)	* 2.06	* Hydr. Depth (ft)	*	* 1.19	* *
* Conv. Total (cfs)	* 2525.4	* Conv. (cfs)	*	* 2525.4	* *
* Length Wtd. (ft)	* 55.25	* Wetted Per. (ft)	*	* 45.02	* *
* Min Ch El (ft)	* 2098.25	* Shear (lb/sq ft)	*	* 1.23	* *
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 7.53	* *
* Frctn Loss (ft)	* 0.37	* Cum Volume (acre-ft)	* 0.46	* 1.74	* 0.51 *
* C & E Loss (ft)	* 0.14	* Cum SA (acres)	* 0.53	* 0.80	* 0.59 *

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m), between the current and previous cross section. This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #FLOODWAY

* E.G. Elev (ft)	* 2100.90	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.58	* Wt. n-Val.	*	* 0.035	* *
* W.S. Elev (ft)	* 2100.32	* Reach Len. (ft)	* 76.04	* 55.89	* 33.05 *
* Crit W.S. (ft)	* 2100.32	* Flow Area (sq ft)	*	* 53.31	* *
* E.G. Slope (ft/ft)	*0.016582	* Area (sq ft)	*	* 53.31	* *
* Q Total (cfs)	* 326.00	* Flow (cfs)	*	* 326.00	* *
* Top Width (ft)	* 44.77	* Top Width (ft)	*	* 44.77	* *
* Vel Total (ft/s)	* 6.12	* Avg. Vel. (ft/s)	*	* 6.12	* *

Max Chl Dpth (ft)	2.07	Hydr. Depth (ft)			1.19		
Conv. Total (cfs)	2531.6	Conv. (cfs)			2531.6		
Length Wtd. (ft)	55.89	Wetted Per. (ft)			45.06		
Min Ch El (ft)	2098.25	Shear (lb/sq ft)			1.22		
Alpha	1.00	Stream Power (lb/ft s)			7.49		
Frctn Loss (ft)	0.51	Cum Volume (acre-ft)		0.13	1.78		0.01
C & E Loss (ft)	0.06	Cum SA (acres)		0.26	0.80		0.01

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2100.73	Element		Left OB	Channel		Right OB
Vel Head (ft)	0.56	Wt. n-Val.			0.035		
W.S. Elev (ft)	2100.17	Reach Len. (ft)		76.04	55.89		33.05
Crit W.S. (ft)	2100.17	Flow Area (sq ft)			47.03		
E.G. Slope (ft/ft)	0.017360	Area (sq ft)			47.03		
Q Total (cfs)	282.00	Flow (cfs)			282.00		
Top Width (ft)	42.10	Top Width (ft)			42.10		
Vel Total (ft/s)	6.00	Avg. Vel. (ft/s)			6.00		
Max Chl Dpth (ft)	1.92	Hydr. Depth (ft)			1.12		
Conv. Total (cfs)	2140.3	Conv. (cfs)			2140.3		
Length Wtd. (ft)	55.33	Wetted Per. (ft)			42.38		
Min Ch El (ft)	2098.25	Shear (lb/sq ft)			1.20		
Alpha	1.00	Stream Power (lb/ft s)			7.21		
Frctn Loss (ft)	0.39	Cum Volume (acre-ft)		0.25	1.56		0.43
C & E Loss (ft)	0.13	Cum SA (acres)		0.50	0.80		0.52

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2100.30	Element		Left OB	Channel		Right OB
Vel Head (ft)	0.48	Wt. n-Val.			0.035		
W.S. Elev (ft)	2099.82	Reach Len. (ft)		76.04	55.89		33.05
Crit W.S. (ft)	2099.82	Flow Area (sq ft)			33.44		
E.G. Slope (ft/ft)	0.018684	Area (sq ft)			33.44		
Q Total (cfs)	186.00	Flow (cfs)			186.00		
Top Width (ft)	35.38	Top Width (ft)			35.38		
Vel Total (ft/s)	5.56	Avg. Vel. (ft/s)			5.56		
Max Chl Dpth (ft)	1.57	Hydr. Depth (ft)			0.94		
Conv. Total (cfs)	1360.7	Conv. (cfs)			1360.7		
Length Wtd. (ft)	55.55	Wetted Per. (ft)			35.62		
Min Ch El (ft)	2098.25	Shear (lb/sq ft)			1.09		
Alpha	1.00	Stream Power (lb/ft s)			6.09		
Frctn Loss (ft)	0.46	Cum Volume (acre-ft)		0.09	1.15		0.28
C & E Loss (ft)	0.11	Cum SA (acres)		0.27	0.77		0.44

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.216

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2099.23	Element		Left OB	Channel		Right OB
Vel Head (ft)	0.31	Wt. n-Val.		0.055	0.035		0.055
W.S. Elev (ft)	2098.92	Reach Len. (ft)		109.25	113.57		127.29

Crit W.S. (ft)		Flow Area (sq ft)	9.18	57.75	17.76
E.G. Slope (ft/ft)	0.003617	Area (sq ft)	9.18	57.75	17.76
Q Total (cfs)	326.00	Flow (cfs)	16.37	277.01	32.61
Top Width (ft)	44.61	Top Width (ft)	7.64	22.35	14.62
Vel Total (ft/s)	3.85	Avg. Vel. (ft/s)	1.78	4.80	1.84
Max Chl Dpth (ft)	3.03	Hydr. Depth (ft)	1.20	2.58	1.22
Conv. Total (cfs)	5420.6	Conv. (cfs)	272.3	4606.1	542.2
Length Wtd. (ft)	114.15	Wetted Per. (ft)	7.98	22.43	14.79
Min Ch El (ft)	2095.89	Shear (lb/sq ft)	0.26	0.58	0.27
Alpha	1.35	Stream Power (lb/ft s)	0.46	2.79	0.50
Frctn Loss (ft)	0.75	Cum Volume (acre-ft)	0.45	1.67	0.50
C & E Loss (ft)	0.07	Cum SA (acres)	0.53	0.76	0.59

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2099.48	Element			
Vel Head (ft)	0.46	Wt. n-Val.		0.035	
W.S. Elev (ft)	2099.02	Reach Len. (ft)	109.25	113.57	127.29
Crit W.S. (ft)		Flow Area (sq ft)		59.93	
E.G. Slope (ft/ft)	0.005687	Area (sq ft)		59.93	
Q Total (cfs)	326.00	Flow (cfs)		326.00	
Top Width (ft)	22.35	Top Width (ft)		22.35	
Vel Total (ft/s)	5.44	Avg. Vel. (ft/s)		5.44	
Max Chl Dpth (ft)	3.13	Hydr. Depth (ft)		2.68	
Conv. Total (cfs)	4322.9	Conv. (cfs)		4322.9	
Length Wtd. (ft)	113.57	Wetted Per. (ft)		27.06	
Min Ch El (ft)	2095.89	Shear (lb/sq ft)		0.79	
Alpha	1.00	Stream Power (lb/ft s)		4.28	
Frctn Loss (ft)	1.01	Cum Volume (acre-ft)	0.13	1.71	0.01
C & E Loss (ft)	0.06	Cum SA (acres)	0.26	0.76	0.01

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2098.98	Element			
Vel Head (ft)	0.30	Wt. n-Val.	0.055	0.035	0.055
W.S. Elev (ft)	2098.69	Reach Len. (ft)	109.25	113.57	127.29
Crit W.S. (ft)		Flow Area (sq ft)	7.48	52.53	14.48
E.G. Slope (ft/ft)	0.003844	Area (sq ft)	7.48	52.53	14.48
Q Total (cfs)	282.00	Flow (cfs)	12.85	243.89	25.26
Top Width (ft)	42.74	Top Width (ft)	6.90	22.35	13.48
Vel Total (ft/s)	3.79	Avg. Vel. (ft/s)	1.72	4.64	1.74
Max Chl Dpth (ft)	2.80	Hydr. Depth (ft)	1.08	2.35	1.07
Conv. Total (cfs)	4548.4	Conv. (cfs)	207.2	3933.7	407.4
Length Wtd. (ft)	114.09	Wetted Per. (ft)	7.21	22.43	13.63
Min Ch El (ft)	2095.89	Shear (lb/sq ft)	0.25	0.56	0.25
Alpha	1.33	Stream Power (lb/ft s)	0.43	2.61	0.44
Frctn Loss (ft)	0.79	Cum Volume (acre-ft)	0.24	1.50	0.42
C & E Loss (ft)	0.06	Cum SA (acres)	0.50	0.76	0.52

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2098.37	Element			
Vel Head (ft)	0.26	Wt. n-Val.	0.055	0.035	0.055
W.S. Elev (ft)	2098.11	Reach Len. (ft)	109.25	113.57	127.29
Crit W.S. (ft)		Flow Area (sq ft)	4.05	39.74	7.57
E.G. Slope (ft/ft)	0.004663	Area (sq ft)	4.05	39.74	7.57
Q Total (cfs)	186.00	Flow (cfs)	6.22	168.68	11.09
Top Width (ft)	38.05	Top Width (ft)	5.10	22.35	10.60
Vel Total (ft/s)	3.62	Avg. Vel. (ft/s)	1.54	4.25	1.47
Max Chl Dpth (ft)	2.22	Hydr. Depth (ft)	0.79	1.78	0.71
Conv. Total (cfs)	2723.9	Conv. (cfs)	91.1	2470.3	162.5
Length Wtd. (ft)	113.91	Wetted Per. (ft)	5.31	22.43	10.69
Min Ch El (ft)	2095.89	Shear (lb/sq ft)	0.22	0.52	0.21
Alpha	1.26	Stream Power (lb/ft s)	0.34	2.19	0.30
Frctn Loss (ft)	0.90	Cum Volume (acre-ft)	0.09	1.10	0.27
C & E Loss (ft)	0.05	Cum SA (acres)	0.27	0.73	0.44

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.194

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2098.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.02	Wt. n-Val.	0.055	0.035	0.055
W.S. Elev (ft)	2097.39	Reach Len. (ft)	183.85	186.13	187.15
Crit W.S. (ft)	2097.39	Flow Area (sq ft)	0.01	40.21	0.17
E.G. Slope (ft/ft)	0.015263	Area (sq ft)	0.01	40.21	0.17
Q Total (cfs)	326.00	Flow (cfs)	0.01	325.83	0.16
Top Width (ft)	20.83	Top Width (ft)	0.23	19.52	1.08
Vel Total (ft/s)	8.07	Avg. Vel. (ft/s)	0.47	8.10	0.95
Max Chl Dpth (ft)	3.88	Hydr. Depth (ft)	0.06	2.06	0.16
Conv. Total (cfs)	2638.7	Conv. (cfs)	0.1	2637.4	1.3
Length Wtd. (ft)	186.01	Wetted Per. (ft)	0.26	20.94	1.12
Min Ch El (ft)	2093.51	Shear (lb/sq ft)	0.05	1.83	0.14
Alpha	1.01	Stream Power (lb/ft s)	0.02	14.82	0.14
Frctn Loss (ft)	2.48	Cum Volume (acre-ft)	0.44	1.54	0.47
C & E Loss (ft)	0.16	Cum SA (acres)	0.52	0.70	0.56

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2098.42	Element		Left OB	Channel	Right OB
Vel Head (ft)	1.02	Wt. n-Val.			0.035	
W.S. Elev (ft)	2097.40	Reach Len. (ft)		183.85	186.13	187.15
Crit W.S. (ft)	2097.40	Flow Area (sq ft)			40.25	
E.G. Slope (ft/ft)	0.015656	Area (sq ft)			40.25	
Q Total (cfs)	326.00	Flow (cfs)			326.00	
Top Width (ft)	19.52	Top Width (ft)			19.52	
Vel Total (ft/s)	8.10	Avg. Vel. (ft/s)			8.10	
Max Chl Dpth (ft)	3.89	Hydr. Depth (ft)			2.06	
Conv. Total (cfs)	2605.4	Conv. (cfs)			2605.4	
Length Wtd. (ft)	186.01	Wetted Per. (ft)			21.38	
Min Ch El (ft)	2093.51	Shear (lb/sq ft)			1.84	
Alpha	1.00	Stream Power (lb/ft s)			14.90	
Frctn Loss (ft)	2.45	Cum Volume (acre-ft)		0.13	1.58	0.01
C & E Loss (ft)	0.16	Cum SA (acres)		0.26	0.70	0.01

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2098.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.94	Wt. n-Val.		0.035	0.055
W.S. Elev (ft)	2097.19	Reach Len. (ft)	183.85	186.13	187.15
Crit W.S. (ft)	2097.19	Flow Area (sq ft)		36.28	0.02
E.G. Slope (ft/ft)	0.015928	Area (sq ft)		36.28	0.02
Q Total (cfs)	282.00	Flow (cfs)		281.99	0.01
Top Width (ft)	19.74	Top Width (ft)		19.36	0.38
Vel Total (ft/s)	7.77	Avg. Vel. (ft/s)		7.77	0.49
Max Chl Dpth (ft)	3.68	Hydr. Depth (ft)		1.87	0.06
Conv. Total (cfs)	2234.4	Conv. (cfs)		2234.4	0.1
Length Wtd. (ft)	186.04	Wetted Per. (ft)		20.76	0.40
Min Ch El (ft)	2093.51	Shear (lb/sq ft)		1.74	0.05
Alpha	1.00	Stream Power (lb/ft s)		13.50	0.03
Frctn Loss (ft)	2.56	Cum Volume (acre-ft)	0.23	1.38	0.40
C & E Loss (ft)	0.14	Cum SA (acres)	0.49	0.70	0.50

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2097.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.76	Wt. n-Val.		0.035	
W.S. Elev (ft)	2096.67	Reach Len. (ft)	183.85	186.13	187.15
Crit W.S. (ft)	2096.64	Flow Area (sq ft)		26.67	
E.G. Slope (ft/ft)	0.016150	Area (sq ft)		26.67	

Q Total (cfs)	186.00	Flow (cfs)			186.00		
Top Width (ft)	16.92	Top Width (ft)			16.92		
Vel Total (ft/s)	6.98	Avg. Vel. (ft/s)			6.98		
Max Chl Dpth (ft)	3.16	Hydr. Depth (ft)			1.58		
Conv. Total (cfs)	1463.6	Conv. (cfs)			1463.6		
Length Wtd. (ft)	186.13	Wetted Per. (ft)			18.14		
Min Ch El (ft)	2093.51	Shear (lb/sq ft)			1.48		
Alpha	1.00	Stream Power (lb/ft s)			10.34		
Frctn Loss (ft)	3.05	Cum Volume (acre-ft)		0.08	1.02		0.26
C & E Loss (ft)	0.08	Cum SA (acres)		0.26	0.68		0.42

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

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.159

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2094.80	Element		Left OB		Channel		Right OB
Vel Head (ft)	0.49	Wt. n-Val.		0.055		0.035		0.055
W.S. Elev (ft)	2094.30	Reach Len. (ft)		372.88		368.68		360.58
Crit W.S. (ft)	2094.30	Flow Area (sq ft)		19.30		49.34		0.19
E.G. Slope (ft/ft)	0.011721	Area (sq ft)		19.30		49.34		0.19
Q Total (cfs)	326.00	Flow (cfs)		33.45		292.43		0.12
Top Width (ft)	77.37	Top Width (ft)		42.24		33.36		1.78
Vel Total (ft/s)	4.74	Avg. Vel. (ft/s)		1.73		5.93		0.66
Max Chl Dpth (ft)	2.62	Hydr. Depth (ft)		0.46		1.48		0.11
Conv. Total (cfs)	3011.2	Conv. (cfs)		309.0		2701.1		1.1
Length Wtd. (ft)	368.90	Wetted Per. (ft)		42.29		33.70		1.79
Min Ch El (ft)	2091.68	Shear (lb/sq ft)		0.33		1.07		0.08
Alpha	1.42	Stream Power (lb/ft s)		0.58		6.35		0.05
Frctn Loss (ft)	5.01	Cum Volume (acre-ft)		0.40		1.35		0.47
C & E Loss (ft)	0.01	Cum SA (acres)		0.43		0.59		0.56

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.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2094.80	Element		Left OB		Channel		Right OB
Vel Head (ft)	0.48	Wt. n-Val.		0.055		0.035		0.055
W.S. Elev (ft)	2094.32	Reach Len. (ft)		372.88		368.68		360.58
Crit W.S. (ft)	2094.32	Flow Area (sq ft)		19.49		49.86		0.16
E.G. Slope (ft/ft)	0.011253	Area (sq ft)		19.49		49.86		0.16
Q Total (cfs)	326.00	Flow (cfs)		34.28		291.59		0.13
Top Width (ft)	74.50	Top Width (ft)		40.26		33.36		0.88
Vel Total (ft/s)	4.69	Avg. Vel. (ft/s)		1.76		5.85		0.82
Max Chl Dpth (ft)	2.64	Hydr. Depth (ft)		0.48		1.49		0.18
Conv. Total (cfs)	3073.2	Conv. (cfs)		323.2		2748.8		1.2
Length Wtd. (ft)	368.90	Wetted Per. (ft)		40.54		33.70		1.01
Min Ch El (ft)	2091.68	Shear (lb/sq ft)		0.34		1.04		0.11
Alpha	1.41	Stream Power (lb/ft s)		0.59		6.08		0.09
Frctn Loss (ft)	4.96	Cum Volume (acre-ft)		0.09		1.39		0.01
C & E Loss (ft)	0.01	Cum SA (acres)		0.17		0.59		0.01

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 cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant
method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2094.66	Element		Left OB		Channel		Right OB
Vel Head (ft)	0.47	Wt. n-Val.		0.055		0.035		0.055
W.S. Elev (ft)	2094.19	Reach Len. (ft)		372.88		368.68		360.58
Crit W.S. (ft)	2094.19	Flow Area (sq ft)		14.68		45.68		0.04
E.G. Slope (ft/ft)	0.012016	Area (sq ft)		14.68		45.68		0.04
Q Total (cfs)	282.00	Flow (cfs)		21.56		260.42		0.02
Top Width (ft)	76.23	Top Width (ft)		42.00		33.36		0.86
Vel Total (ft/s)	4.67	Avg. Vel. (ft/s)		1.47		5.70		0.41
Max Chl Dpth (ft)	2.51	Hydr. Depth (ft)		0.35		1.37		0.05
Conv. Total (cfs)	2572.6	Conv. (cfs)		196.7		2375.7		0.2
Length Wtd. (ft)	368.84	Wetted Per. (ft)		42.04		33.70		0.87

* Min Ch El (ft)	* 2091.68	* Shear (lb/sq ft)	* 0.26	* 1.02	* 0.04	*
* Alpha	* 1.38	* Stream Power (lb/ft s)	* 0.38	* 5.80	* 0.02	*
* Frctn Loss (ft)	* 5.18	* Cum Volume (acre-ft)	* 0.20	* 1.21	* 0.40	*
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 0.40	* 0.59	* 0.49	*

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 OUTPUT Profile #10-YEAR

* E.G. Elev (ft)	* 2094.29	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.49	* Wt. n-Val.	* 0.055	* 0.035	*	*
* W.S. Elev (ft)	* 2093.80	* Reach Len. (ft)	* 372.88	* 368.68	* 360.58	*
* Crit W.S. (ft)	* 2093.80	* Flow Area (sq ft)	* 0.99	* 32.85	*	*
* E.G. Slope (ft/ft)	*0.016666	* Area (sq ft)	* 0.99	* 32.85	*	*
* Q Total (cfs)	* 186.00	* Flow (cfs)	* 0.59	* 185.41	*	*
* Top Width (ft)	* 45.18	* Top Width (ft)	* 14.06	* 31.12	*	*
* Vel Total (ft/s)	* 5.50	* Avg. Vel. (ft/s)	* 0.59	* 5.64	*	*
* Max Chl Dpth (ft)	* 2.12	* Hydr. Depth (ft)	* 0.07	* 1.06	*	*
* Conv. Total (cfs)	* 1440.8	* Conv. (cfs)	* 4.6	* 1436.2	*	*
* Length Wtd. (ft)	* 368.69	* Wetted Per. (ft)	* 14.06	* 31.44	*	*
* Min Ch El (ft)	* 2091.68	* Shear (lb/sq ft)	* 0.07	* 1.09	*	*
* Alpha	* 1.05	* Stream Power (lb/ft s)	* 0.04	* 6.14	*	*
* Frctn Loss (ft)	* 5.90	* Cum Volume (acre-ft)	* 0.08	* 0.89	* 0.26	*
* C & E Loss (ft)	* 0.04	* Cum SA (acres)	* 0.23	* 0.58	* 0.42	*

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: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.089

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	* 2087.27	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.60	* Wt. n-Val.	* 0.055	* 0.035	* 0.055	*
* W.S. Elev (ft)	* 2086.67	* Reach Len. (ft)	* 293.21	* 281.13	* 263.99	*
* Crit W.S. (ft)	* 2086.67	* Flow Area (sq ft)	* 0.54	* 52.34	* 0.27	*
* E.G. Slope (ft/ft)	*0.015894	* Area (sq ft)	* 0.54	* 52.34	* 0.27	*
* Q Total (cfs)	* 326.00	* Flow (cfs)	* 0.82	* 324.87	* 0.31	*
* Top Width (ft)	* 44.78	* Top Width (ft)	* 1.75	* 41.71	* 1.33	*
* Vel Total (ft/s)	* 6.13	* Avg. Vel. (ft/s)	* 1.50	* 6.21	* 1.15	*
* Max Chl Dpth (ft)	* 1.71	* Hydr. Depth (ft)	* 0.31	* 1.25	* 0.21	*
* Conv. Total (cfs)	* 2585.8	* Conv. (cfs)	* 6.5	* 2576.8	* 2.5	*
* Length Wtd. (ft)	* 279.84	* Wetted Per. (ft)	* 1.86	* 41.91	* 1.39	*
* Min Ch El (ft)	* 2084.96	* Shear (lb/sq ft)	* 0.29	* 1.24	* 0.20	*
* Alpha	* 1.02	* Stream Power (lb/ft s)	* 0.44	* 7.69	* 0.22	*
* Frctn Loss (ft)	* 4.83	* Cum Volume (acre-ft)	* 0.31	* 0.92	* 0.47	*
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 0.24	* 0.27	* 0.54	*

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #FLOODWAY

* E.G. Elev (ft)	* 2087.28	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.60	* Wt. n-Val.	*	* 0.035	*	*
* W.S. Elev (ft)	* 2086.68	* Reach Len. (ft)	* 293.21	* 281.13	* 263.99	*
* Crit W.S. (ft)	* 2086.66	* Flow Area (sq ft)	*	* 52.50	*	*
* E.G. Slope (ft/ft)	*0.016368	* Area (sq ft)	*	* 52.50	*	*
* Q Total (cfs)	* 326.00	* Flow (cfs)	*	* 326.00	*	*
* Top Width (ft)	* 41.71	* Top Width (ft)	*	* 41.71	*	*
* Vel Total (ft/s)	* 6.21	* Avg. Vel. (ft/s)	*	* 6.21	*	*
* Max Chl Dpth (ft)	* 1.72	* Hydr. Depth (ft)	*	* 1.26	*	*
* Conv. Total (cfs)	* 2548.1	* Conv. (cfs)	*	* 2548.1	*	*
* Length Wtd. (ft)	* 280.98	* Wetted Per. (ft)	*	* 42.95	*	*
* Min Ch El (ft)	* 2084.96	* Shear (lb/sq ft)	*	* 1.25	*	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 7.76	*	*

* Frctn Loss (ft)	* 4.60	* Cum Volume (acre-ft)	* 0.00	* 0.96	* 0.01	*
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 0.00	* 0.27	* 0.00	*

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #50-YEAR

* E.G. Elev (ft)	* 2087.10	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.55	* Wt. n-Val.	* 0.055	* 0.035	* 0.055	*
* W.S. Elev (ft)	* 2086.55	* Reach Len. (ft)	* 293.21	* 281.13	* 263.99	*
* Crit W.S. (ft)	* 2086.55	* Flow Area (sq ft)	* 0.36	* 47.36	* 0.14	*
* E.G. Slope (ft/ft)	*0.016642	* Area (sq ft)	* 0.36	* 47.36	* 0.14	*
* Q Total (cfs)	* 282.00	* Flow (cfs)	* 0.48	* 281.40	* 0.13	*
* Top Width (ft)	* 44.07	* Top Width (ft)	* 1.41	* 41.71	* 0.94	*
* Vel Total (ft/s)	* 5.89	* Avg. Vel. (ft/s)	* 1.34	* 5.94	* 0.94	*
* Max Chl Dpth (ft)	* 1.59	* Hydr. Depth (ft)	* 0.25	* 1.14	* 0.15	*
* Conv. Total (cfs)	* 2186.0	* Conv. (cfs)	* 3.7	* 2181.3	* 1.0	*
* Length Wtd. (ft)	*	* Wetted Per. (ft)	* 1.50	* 41.91	* 0.99	*
* Min Ch El (ft)	* 2084.96	* Shear (lb/sq ft)	* 0.25	* 1.17	* 0.15	*
* Alpha	* 1.01	* Stream Power (lb/ft s)	* 0.33	* 6.98	* 0.14	*
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	* 0.14	* 0.81	* 0.40	*
* C & E Loss (ft)	*	* Cum SA (acres)	* 0.22	* 0.27	* 0.49	*

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #10-YEAR

* E.G. Elev (ft)	* 2086.70	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.37	* Wt. n-Val.	* 0.055	* 0.035	* 0.055	*
* W.S. Elev (ft)	* 2086.33	* Reach Len. (ft)	* 293.21	* 281.13	* 263.99	*
* Crit W.S. (ft)	* 2086.28	* Flow Area (sq ft)	* 0.11	* 37.83	* 0.01	*
* E.G. Slope (ft/ft)	*0.015363	* Area (sq ft)	* 0.11	* 37.83	* 0.01	*
* Q Total (cfs)	* 186.00	* Flow (cfs)	* 0.09	* 185.91	* 0.00	*
* Top Width (ft)	* 42.69	* Top Width (ft)	* 0.77	* 41.71	* 0.21	*
* Vel Total (ft/s)	* 4.90	* Avg. Vel. (ft/s)	* 0.86	* 4.91	* 0.33	*
* Max Chl Dpth (ft)	* 1.37	* Hydr. Depth (ft)	* 0.14	* 0.91	* 0.03	*
* Conv. Total (cfs)	* 1500.6	* Conv. (cfs)	* 0.7	* 1499.9	* 0.0	*
* Length Wtd. (ft)	* 279.72	* Wetted Per. (ft)	* 0.82	* 41.91	* 0.22	*
* Min Ch El (ft)	* 2084.96	* Shear (lb/sq ft)	* 0.12	* 0.87	* 0.03	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	* 0.11	* 4.25	* 0.01	*
* Frctn Loss (ft)	* 5.13	* Cum Volume (acre-ft)	* 0.08	* 0.59	* 0.26	*
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 0.17	* 0.27	* 0.42	*

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.036

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	* 2082.19	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.65	* Wt. n-Val.	* 0.055	* 0.035	* 0.055	*
* W.S. Elev (ft)	* 2081.54	* Reach Len. (ft)	* 73.64	* 74.31	* 75.38	*
* Crit W.S. (ft)	* 2081.54	* Flow Area (sq ft)	* 3.96	* 35.82	* 13.04	*
* E.G. Slope (ft/ft)	*0.018777	* Area (sq ft)	* 37.88	* 35.82	* 118.02	*
* Q Total (cfs)	* 326.00	* Flow (cfs)	* 16.51	* 248.46	* 61.04	*
* Top Width (ft)	* 220.14	* Top Width (ft)	* 54.87	* 27.51	* 137.76	*
* Vel Total (ft/s)	* 6.17	* Avg. Vel. (ft/s)	* 4.17	* 6.94	* 4.68	*
* Max Chl Dpth (ft)	* 1.44	* Hydr. Depth (ft)	* 1.19	* 1.30	* 1.42	*
* Conv. Total (cfs)	* 2379.0	* Conv. (cfs)	* 120.5	* 1813.1	* 445.4	*
* Length Wtd. (ft)	* 74.40	* Wetted Per. (ft)	* 3.32	* 27.51	* 9.17	*
* Min Ch El (ft)	* 2080.15	* Shear (lb/sq ft)	* 1.40	* 1.53	* 1.67	*
* Alpha	* 1.09	* Stream Power (lb/ft s)	* 5.83	* 10.59	* 7.80	*
* Frctn Loss (ft)	* 0.59	* Cum Volume (acre-ft)	* 0.18	* 0.63	* 0.11	*
* C & E Loss (ft)	* 0.09	* Cum SA (acres)	* 0.05	* 0.05	* 0.12	*

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: 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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2082.65	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.80	Wt. n-Val.		0.035	0.055
W.S. Elev (ft)	2081.86	Reach Len. (ft)	73.64	74.31	75.38
Crit W.S. (ft)	2081.86	Flow Area (sq ft)		44.37	2.10
E.G. Slope (ft/ft)	0.016409	Area (sq ft)		44.37	2.10
Q Total (cfs)	326.00	Flow (cfs)		320.19	5.81
Top Width (ft)	28.74	Top Width (ft)		27.51	1.23
Vel Total (ft/s)	7.01	Avg. Vel. (ft/s)		7.22	2.76
Max Chl Dpth (ft)	1.71	Hydr. Depth (ft)		1.61	1.71
Conv. Total (cfs)	2544.9	Conv. (cfs)		2499.6	45.4
Length Wtd. (ft)	74.32	Wetted Per. (ft)		29.04	2.94
Min Ch El (ft)	2080.15	Shear (lb/sq ft)		1.57	0.73
Alpha	1.04	Stream Power (lb/ft s)		11.30	2.02
Frctn Loss (ft)	0.57	Cum Volume (acre-ft)	0.00	0.64	0.00
C & E Loss (ft)	0.14	Cum SA (acres)	0.00	0.05	0.00

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2082.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.59	Wt. n-Val.	0.055	0.035	0.055
W.S. Elev (ft)	2081.42	Reach Len. (ft)	73.64	74.31	75.38
Crit W.S. (ft)	2081.42	Flow Area (sq ft)	3.54	32.35	11.88
E.G. Slope (ft/ft)	0.019646	Area (sq ft)	31.28	32.35	101.79
Q Total (cfs)	282.00	Flow (cfs)	14.02	214.49	53.49
Top Width (ft)	200.41	Top Width (ft)	49.78	27.51	123.13
Vel Total (ft/s)	5.90	Avg. Vel. (ft/s)	3.96	6.63	4.50
Max Chl Dpth (ft)	1.32	Hydr. Depth (ft)	1.07	1.18	1.30
Conv. Total (cfs)	2011.9	Conv. (cfs)	100.0	1530.3	381.6
Length Wtd. (ft)	74.40	Wetted Per. (ft)	3.32	27.51	9.17
Min Ch El (ft)	2080.15	Shear (lb/sq ft)	1.31	1.44	1.59
Alpha	1.09	Stream Power (lb/ft s)	5.18	9.56	7.15
Frctn Loss (ft)	0.67	Cum Volume (acre-ft)	0.03	0.56	0.09
C & E Loss (ft)	0.07	Cum SA (acres)	0.04	0.05	0.11

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: 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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2081.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.45	Wt. n-Val.	0.055	0.035	0.055
W.S. Elev (ft)	2081.12	Reach Len. (ft)	73.64	74.31	75.38
Crit W.S. (ft)	2081.12	Flow Area (sq ft)	2.56	24.18	9.16
E.G. Slope (ft/ft)	0.022241	Area (sq ft)	18.18	24.18	67.20
Q Total (cfs)	186.00	Flow (cfs)	8.66	140.46	36.87
Top Width (ft)	173.44	Top Width (ft)	38.63	27.51	107.30
Vel Total (ft/s)	5.18	Avg. Vel. (ft/s)	3.39	5.81	4.03
Max Chl Dpth (ft)	1.02	Hydr. Depth (ft)	0.77	0.88	1.00
Conv. Total (cfs)	1247.2	Conv. (cfs)	58.1	941.9	247.2
Length Wtd. (ft)	74.40	Wetted Per. (ft)	3.32	27.51	9.17
Min Ch El (ft)	2080.15	Shear (lb/sq ft)	1.07	1.22	1.39
Alpha	1.09	Stream Power (lb/ft s)	3.62	7.09	5.58
Frctn Loss (ft)	0.94	Cum Volume (acre-ft)	0.02	0.39	0.06
C & E Loss (ft)	0.04	Cum SA (acres)	0.03	0.05	0.09

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.022

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2081.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.35	Wt. n-Val.	0.064	0.035	0.064
W.S. Elev (ft)	2081.12	Reach Len. (ft)	330.00	330.00	330.00
Crit W.S. (ft)		Flow Area (sq ft)	0.95	68.11	2.51
E.G. Slope (ft/ft)	0.004325	Area (sq ft)	0.95	68.11	2.51
Q Total (cfs)	326.00	Flow (cfs)	0.84	322.76	2.39
Top Width (ft)	37.05	Top Width (ft)	1.86	30.22	4.97
Vel Total (ft/s)	4.56	Avg. Vel. (ft/s)	0.89	4.74	0.95
Max Chl Dpth (ft)	2.69	Hydr. Depth (ft)	0.51	2.25	0.50
Conv. Total (cfs)	4956.9	Conv. (cfs)	12.8	4907.8	36.4
Length Wtd. (ft)	330.00	Wetted Per. (ft)	2.12	30.80	5.07
Min Ch El (ft)	2078.43	Shear (lb/sq ft)	0.12	0.60	0.13
Alpha	1.07	Stream Power (lb/ft s)	0.11	2.83	0.13
Frctn Loss (ft)	2.63	Cum Volume (acre-ft)	0.15	0.54	0.01
C & E Loss (ft)	0.13	Cum SA (acres)			

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2081.49	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.35	Wt. n-Val.	0.064	0.035	
W.S. Elev (ft)	2081.14	Reach Len. (ft)	330.00	330.00	330.00
Crit W.S. (ft)		Flow Area (sq ft)	0.99	68.77	
E.G. Slope (ft/ft)	0.004438	Area (sq ft)	0.99	68.77	
Q Total (cfs)	326.00	Flow (cfs)	0.91	325.09	
Top Width (ft)	32.08	Top Width (ft)	1.86	30.22	
Vel Total (ft/s)	4.67	Avg. Vel. (ft/s)	0.92	4.73	
Max Chl Dpth (ft)	2.71	Hydr. Depth (ft)	0.53	2.28	
Conv. Total (cfs)	4893.5	Conv. (cfs)	13.7	4879.8	
Length Wtd. (ft)	330.00	Wetted Per. (ft)	2.14	31.83	
Min Ch El (ft)	2078.43	Shear (lb/sq ft)	0.13	0.60	
Alpha	1.02	Stream Power (lb/ft s)	0.12	2.83	
Frctn Loss (ft)	2.65	Cum Volume (acre-ft)	0.00	0.55	
C & E Loss (ft)	0.13	Cum SA (acres)			

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2081.17	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.35	Wt. n-Val.	0.064	0.035	0.064
W.S. Elev (ft)	2080.83	Reach Len. (ft)	330.00	330.00	330.00
Crit W.S. (ft)		Flow Area (sq ft)	0.48	59.31	1.27
E.G. Slope (ft/ft)	0.005182	Area (sq ft)	0.48	59.31	1.27
Q Total (cfs)	282.00	Flow (cfs)	0.38	280.57	1.05
Top Width (ft)	35.09	Top Width (ft)	1.33	30.22	3.54
Vel Total (ft/s)	4.62	Avg. Vel. (ft/s)	0.78	4.73	0.83
Max Chl Dpth (ft)	2.40	Hydr. Depth (ft)	0.36	1.96	0.36
Conv. Total (cfs)	3917.5	Conv. (cfs)	5.2	3897.7	14.6
Length Wtd. (ft)	330.00	Wetted Per. (ft)	1.51	30.80	3.61
Min Ch El (ft)	2078.43	Shear (lb/sq ft)	0.10	0.62	0.11
Alpha	1.04	Stream Power (lb/ft s)	0.08	2.95	0.09
Frctn Loss (ft)	2.83	Cum Volume (acre-ft)	0.00	0.48	0.00
C & E Loss (ft)	0.11	Cum SA (acres)			

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2080.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.33	Wt. n-Val.	0.064	0.035	0.064
W.S. Elev (ft)	2080.20	Reach Len. (ft)	330.00	330.00	330.00
Crit W.S. (ft)	2079.89	Flow Area (sq ft)	0.01	40.50	0.02
E.G. Slope (ft/ft)	0.008118	Area (sq ft)	0.01	40.50	0.02
Q Total (cfs)	186.00	Flow (cfs)	0.00	185.99	0.01
Top Width (ft)	30.87	Top Width (ft)	0.19	30.22	0.46
Vel Total (ft/s)	4.59	Avg. Vel. (ft/s)	0.27	4.59	0.27
Max Chl Dpth (ft)	1.77	Hydr. Depth (ft)	0.05	1.34	0.05
Conv. Total (cfs)	2064.3	Conv. (cfs)	0.0	2064.2	0.1
Length Wtd. (ft)	330.00	Wetted Per. (ft)	0.22	30.80	0.47
Min Ch El (ft)	2078.43	Shear (lb/sq ft)	0.02	0.67	0.02
Alpha	1.00	Stream Power (lb/ft s)	0.01	3.06	0.01
Frctn Loss (ft)	3.44	Cum Volume (acre-ft)	0.00	0.33	0.00
C & E Loss (ft)	0.09	Cum SA (acres)			

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

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

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 3.132

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2330.80	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.57	Wt. n-Val.	0.035	0.030	0.035
W.S. Elev (ft)	2330.23	Reach Len. (ft)	141.91	141.71	141.66
Crit W.S. (ft)	2330.23	Flow Area (sq ft)	5.36	162.13	3.25
E.G. Slope (ft/ft)	0.011460	Area (sq ft)	5.36	162.13	3.25
Q Total (cfs)	1006.00	Flow (cfs)	10.41	988.71	6.88
Top Width (ft)	160.85	Top Width (ft)	19.20	131.42	10.24
Vel Total (ft/s)	5.89	Avg. Vel. (ft/s)	1.94	6.10	2.11
Max Chl Dpth (ft)	1.52	Hydr. Depth (ft)	0.28	1.23	0.32
Conv. Total (cfs)	9397.3	Conv. (cfs)	97.3	9235.7	64.3
Length Wtd. (ft)	141.70	Wetted Per. (ft)	19.21	131.44	10.26
Min Ch El (ft)	2328.71	Shear (lb/sq ft)	0.20	0.88	0.23
Alpha	1.05	Stream Power (lb/ft s)	0.39	5.38	0.48
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	0.07	1.40	1.26
C & E Loss (ft)	0.28	Cum SA (acres)	10.87	11.10	12.13

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2330.80	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.56	Wt. n-Val.	0.035	0.030	0.035
W.S. Elev (ft)	2330.23	Reach Len. (ft)	141.91	141.71	141.66
Crit W.S. (ft)	2330.23	Flow Area (sq ft)	5.10	162.64	3.24
E.G. Slope (ft/ft)	0.011308	Area (sq ft)	5.10	162.64	3.24
Q Total (cfs)	1006.00	Flow (cfs)	11.38	987.29	7.34
Top Width (ft)	155.00	Top Width (ft)	14.53	131.42	9.05
Vel Total (ft/s)	5.88	Avg. Vel. (ft/s)	2.23	6.07	2.26
Max Chl Dpth (ft)	1.52	Hydr. Depth (ft)	0.35	1.24	0.36
Conv. Total (cfs)	9460.5	Conv. (cfs)	107.0	9284.5	69.0
Length Wtd. (ft)	141.71	Wetted Per. (ft)	14.67	131.44	9.15
Min Ch El (ft)	2328.71	Shear (lb/sq ft)	0.25	0.87	0.25
Alpha	1.05	Stream Power (lb/ft s)	0.55	5.30	0.57
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	0.01	1.27	0.01
C & E Loss (ft)	0.25	Cum SA (acres)	1.63	11.10	2.26

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: 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 OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2330.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.52	Wt. n-Val.	0.035	0.030	0.035
W.S. Elev (ft)	2330.11	Reach Len. (ft)	141.91	141.71	141.66
Crit W.S. (ft)	2330.11	Flow Area (sq ft)	3.28	146.15	2.12
E.G. Slope (ft/ft)	0.012068	Area (sq ft)	3.28	146.15	2.12
Q Total (cfs)	863.00	Flow (cfs)	5.54	853.48	3.99
Top Width (ft)	154.75	Top Width (ft)	15.02	131.42	8.31
Vel Total (ft/s)	5.69	Avg. Vel. (ft/s)	1.69	5.84	1.88
Max Chl Dpth (ft)	1.40	Hydr. Depth (ft)	0.22	1.11	0.26
Conv. Total (cfs)	7855.8	Conv. (cfs)	50.4	7769.1	36.3
Length Wtd. (ft)	141.70	Wetted Per. (ft)	15.03	131.44	8.33
Min Ch El (ft)	2328.71	Shear (lb/sq ft)	0.16	0.84	0.19
Alpha	1.04	Stream Power (lb/ft s)	0.28	4.89	0.36
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	0.05	1.27	1.14
C & E Loss (ft)	0.26	Cum SA (acres)	10.11	11.09	11.54

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

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2330.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.41	Wt. n-Val.	0.035	0.030	0.035
W.S. Elev (ft)	2329.81	Reach Len. (ft)	141.91	141.71	141.66
Crit W.S. (ft)	2329.81	Flow Area (sq ft)	0.39	107.04	0.36
E.G. Slope (ft/ft)	0.014064	Area (sq ft)	0.39	107.04	0.36
Q Total (cfs)	549.00	Flow (cfs)	0.35	548.26	0.39
Top Width (ft)	140.16	Top Width (ft)	5.19	131.42	3.54
Vel Total (ft/s)	5.09	Avg. Vel. (ft/s)	0.90	5.12	1.09
Max Chl Dpth (ft)	1.10	Hydr. Depth (ft)	0.08	0.81	0.10
Conv. Total (cfs)	4629.4	Conv. (cfs)	3.0	4623.1	3.3
Length Wtd. (ft)	141.70	Wetted Per. (ft)	5.20	131.44	3.55
Min Ch El (ft)	2328.71	Shear (lb/sq ft)	0.07	0.71	0.09
Alpha	1.01	Stream Power (lb/ft s)	0.06	3.66	0.10
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	0.02	0.90	0.69
C & E Loss (ft)	0.20	Cum SA (acres)	7.85	11.03	8.56

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.
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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: SUNNYCOVE WASH
REACH: REACH #2 RS: 3.105

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2329.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.045	0.035	0.045
W.S. Elev (ft)	2329.76	Reach Len. (ft)	75.04	75.06	75.03
Crit W.S. (ft)	2325.86	Flow Area (sq ft)	39.66	462.02	768.72
E.G. Slope (ft/ft)	0.000093	Area (sq ft)	39.66	462.02	768.72
Q Total (cfs)	1006.00	Flow (cfs)	9.11	551.47	445.42
Top Width (ft)	465.84	Top Width (ft)	64.37	89.51	311.96
Vel Total (ft/s)	0.79	Avg. Vel. (ft/s)	0.23	1.19	0.58
Max Chl Dpth (ft)	7.58	Hydr. Depth (ft)	0.62	5.16	2.46
Conv. Total (cfs)	104566.5	Conv. (cfs)	947.2	57320.9	46298.4
Length Wtd. (ft)	75.06	Wetted Per. (ft)	64.46	92.48	312.07
Min Ch El (ft)	2322.18	Shear (lb/sq ft)	0.00	0.03	0.01
Alpha	1.48	Stream Power (lb/ft s)	0.00	0.03	0.01
Frctn Loss (ft)		Cum Volume (acre-ft)		0.39	
C & E Loss (ft)		Cum SA (acres)	10.74	10.74	11.61

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2330.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.		0.035	
W.S. Elev (ft)	2330.06	Reach Len. (ft)	75.04	75.06	75.03
Crit W.S. (ft)	2325.86	Flow Area (sq ft)		489.46	
E.G. Slope (ft/ft)	0.000282	Area (sq ft)		489.46	
Q Total (cfs)	1006.00	Flow (cfs)		1006.00	
Top Width (ft)	89.51	Top Width (ft)		89.51	
Vel Total (ft/s)	2.06	Avg. Vel. (ft/s)		2.06	
Max Chl Dpth (ft)	7.88	Hydr. Depth (ft)		5.47	
Conv. Total (cfs)	59956.3	Conv. (cfs)		59956.3	
Length Wtd. (ft)	75.06	Wetted Per. (ft)		99.87	
Min Ch El (ft)	2322.18	Shear (lb/sq ft)		0.09	
Alpha	1.00	Stream Power (lb/ft s)		0.18	
Frctn Loss (ft)		Cum Volume (acre-ft)		0.21	
C & E Loss (ft)		Cum SA (acres)	1.61	10.74	2.24

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2329.55	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.045	0.035	0.045
W.S. Elev (ft)	2329.54	Reach Len. (ft)	75.04	75.06	75.03
Crit W.S. (ft)	2325.68	Flow Area (sq ft)	28.21	442.15	700.10
E.G. Slope (ft/ft)	0.000084	Area (sq ft)	28.21	442.15	700.10
Q Total (cfs)	863.00	Flow (cfs)	7.42	488.21	367.37
Top Width (ft)	434.75	Top Width (ft)	38.74	89.51	306.50
Vel Total (ft/s)	0.74	Avg. Vel. (ft/s)	0.26	1.10	0.52
Max Chl Dpth (ft)	7.36	Hydr. Depth (ft)	0.73	4.94	2.28
Conv. Total (cfs)	94168.2	Conv. (cfs)	809.8	53272.5	40085.9
Length Wtd. (ft)	75.06	Wetted Per. (ft)	38.82	92.48	306.61
Min Ch El (ft)	2322.18	Shear (lb/sq ft)	0.00	0.03	0.01
Alpha	1.49	Stream Power (lb/ft s)	0.00	0.03	0.01
Frctn Loss (ft)		Cum Volume (acre-ft)		0.31	
C & E Loss (ft)		Cum SA (acres)	10.02	10.73	11.02

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2328.62	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.045	0.035	0.045
W.S. Elev (ft)	2328.60	Reach Len. (ft)	75.04	75.06	75.03
Crit W.S. (ft)	2324.90	Flow Area (sq ft)	9.09	358.76	426.49
E.G. Slope (ft/ft)	0.000095	Area (sq ft)	9.09	358.76	426.49
Q Total (cfs)	549.00	Flow (cfs)	2.15	365.65	181.20
Top Width (ft)	383.97	Top Width (ft)	14.34	89.51	280.12
Vel Total (ft/s)	0.69	Avg. Vel. (ft/s)	0.24	1.02	0.42
Max Chl Dpth (ft)	6.42	Hydr. Depth (ft)	0.63	4.01	1.52
Conv. Total (cfs)	56459.0	Conv. (cfs)	221.2	37603.3	18634.5
Length Wtd. (ft)	75.06	Wetted Per. (ft)	14.38	92.48	280.21
Min Ch El (ft)	2322.18	Shear (lb/sq ft)	0.00	0.02	0.01
Alpha	1.57	Stream Power (lb/ft s)	0.00	0.02	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)		0.14	
C & E Loss (ft)		Cum SA (acres)	7.82	10.67	8.10

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 3.091

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2326.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.43	Wt. n-Val.	0.045	0.033	0.045
W.S. Elev (ft)	2325.80	Reach Len. (ft)	161.13	166.69	164.71
Crit W.S. (ft)		Flow Area (sq ft)	0.30	190.77	2.57
E.G. Slope (ft/ft)	0.003236	Area (sq ft)	0.30	190.77	2.57
Q Total (cfs)	1006.00	Flow (cfs)	0.19	1003.00	2.80
Top Width (ft)	70.54	Top Width (ft)	1.45	63.35	5.74
Vel Total (ft/s)	5.20	Avg. Vel. (ft/s)	0.64	5.26	1.09
Max Chl Dpth (ft)	3.81	Hydr. Depth (ft)	0.21	3.01	0.45
Conv. Total (cfs)	17684.1	Conv. (cfs)	3.4	17631.4	49.3
Length Wtd. (ft)	166.51	Wetted Per. (ft)	1.51	64.87	5.79
Min Ch El (ft)	2321.98	Shear (lb/sq ft)	0.04	0.59	0.09
Alpha	1.02	Stream Power (lb/ft s)	0.03	3.12	0.10
Frctn Loss (ft)	0.78	Cum Volume (acre-ft)	16.40	24.50	15.17
C & E Loss (ft)	0.18	Cum SA (acres)	10.68	10.61	11.33

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2326.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.37	Wt. n-Val.		0.033	
W.S. Elev (ft)	2326.04	Reach Len. (ft)	161.13	166.69	164.71
Crit W.S. (ft)		Flow Area (sq ft)		205.96	
E.G. Slope (ft/ft)	0.002603	Area (sq ft)		205.96	
Q Total (cfs)	1006.00	Flow (cfs)		1006.00	
Top Width (ft)	63.35	Top Width (ft)		63.35	
Vel Total (ft/s)	4.88	Avg. Vel. (ft/s)		4.88	
Max Chl Dpth (ft)	4.05	Hydr. Depth (ft)		3.25	
Conv. Total (cfs)	19717.7	Conv. (cfs)		19717.7	
Length Wtd. (ft)	166.44	Wetted Per. (ft)		66.43	
Min Ch El (ft)	2321.98	Shear (lb/sq ft)		0.50	
Alpha	1.00	Stream Power (lb/ft s)		2.46	
Frctn Loss (ft)	0.48	Cum Volume (acre-ft)	3.57	28.14	4.45
C & E Loss (ft)	0.08	Cum SA (acres)	1.61	10.61	2.24

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2325.95	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.37	Wt. n-Val.	0.045	0.033	0.045
W.S. Elev (ft)	2325.58	Reach Len. (ft)	161.13	166.69	164.71
Crit W.S. (ft)		Flow Area (sq ft)	0.07	177.19	1.44
E.G. Slope (ft/ft)	0.003056	Area (sq ft)	0.07	177.19	1.44
Q Total (cfs)	863.00	Flow (cfs)	0.03	861.78	1.19
Top Width (ft)	68.77	Top Width (ft)	0.70	63.35	4.72
Vel Total (ft/s)	4.83	Avg. Vel. (ft/s)	0.38	4.86	0.82
Max Chl Dpth (ft)	3.60	Hydr. Depth (ft)	0.10	2.80	0.31
Conv. Total (cfs)	15611.7	Conv. (cfs)	0.5	15589.7	21.5
Length Wtd. (ft)	166.56	Wetted Per. (ft)	0.73	64.87	4.76
Min Ch El (ft)	2321.98	Shear (lb/sq ft)	0.02	0.52	0.06
Alpha	1.01	Stream Power (lb/ft s)	0.01	2.53	0.05
Frctn Loss (ft)	0.79	Cum Volume (acre-ft)	14.15	22.54	12.86
C & E Loss (ft)	0.21	Cum SA (acres)	9.99	10.60	10.76

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2325.04	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.30	Wt. n-Val.		0.033	
W.S. Elev (ft)	2324.75	Reach Len. (ft)	161.13	166.69	164.71

* Crit W.S. (ft)	*	* Flow Area (sq ft)	*		*	125.92	*		*
* E.G. Slope (ft/ft)	*0.003493	* Area (sq ft)	*		*	125.92	*		*
* Q Total (cfs)	* 549.00	* Flow (cfs)	*		*	549.00	*		*
* Top Width (ft)	* 58.80	* Top Width (ft)	*		*	58.80	*		*
* Vel Total (ft/s)	* 4.36	* Avg. Vel. (ft/s)	*		*	4.36	*		*
* Max Chl Dpth (ft)	* 2.77	* Hydr. Depth (ft)	*		*	2.14	*		*
* Conv. Total (cfs)	* 9289.5	* Conv. (cfs)	*		*	9289.5	*		*
* Length Wtd. (ft)	* 166.63	* Wetted Per. (ft)	*		*	60.05	*		*
* Min Ch El (ft)	* 2321.98	* Shear (lb/sq ft)	*		*	0.46	*		*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*		*	1.99	*		*
* Frctn Loss (ft)	* 0.81	* Cum Volume (acre-ft)	*	8.78	*	17.28	*	7.18	*
* C & E Loss (ft)	* 0.13	* Cum SA (acres)	*	7.81	*	10.55	*	7.86	*

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 3.060

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	* 2325.27	* Element	*	Left OB	*	Channel	*	Right OB	*
* Vel Head (ft)	* 1.02	* Wt. n-Val.	*	0.057	*	0.033	*	0.057	*
* W.S. Elev (ft)	* 2324.25	* Reach Len. (ft)	*	323.55	*	342.36	*	325.27	*
* Crit W.S. (ft)	* 2324.25	* Flow Area (sq ft)	*	17.63	*	100.50	*	55.04	*
* E.G. Slope (ft/ft)	*0.007296	* Area (sq ft)	*	17.63	*	100.50	*	55.04	*
* Q Total (cfs)	* 1006.00	* Flow (cfs)	*	27.04	*	870.93	*	108.02	*
* Top Width (ft)	* 131.03	* Top Width (ft)	*	33.45	*	29.29	*	68.29	*
* Vel Total (ft/s)	* 5.81	* Avg. Vel. (ft/s)	*	1.53	*	8.67	*	1.96	*
* Max Chl Dpth (ft)	* 4.15	* Hydr. Depth (ft)	*	0.53	*	3.43	*	0.81	*
* Conv. Total (cfs)	* 11777.5	* Conv. (cfs)	*	316.6	*	10196.2	*	1264.7	*
* Length Wtd. (ft)	* 337.73	* Wetted Per. (ft)	*	33.74	*	29.71	*	69.08	*
* Min Ch El (ft)	* 2320.10	* Shear (lb/sq ft)	*	0.24	*	1.54	*	0.36	*
* Alpha	* 1.94	* Stream Power (lb/ft s)	*	0.37	*	13.35	*	0.71	*
* Frctn Loss (ft)	* 2.35	* Cum Volume (acre-ft)	*	16.36	*	23.94	*	15.06	*
* C & E Loss (ft)	* 0.08	* Cum SA (acres)	*	10.62	*	10.43	*	11.19	*

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

* E.G. Elev (ft)	* 2325.85	* Element	*	Left OB	*	Channel	*	Right OB	*
* Vel Head (ft)	* 0.63	* Wt. n-Val.	*	0.057	*	0.033	*	0.057	*
* W.S. Elev (ft)	* 2325.22	* Reach Len. (ft)	*	323.55	*	342.36	*	325.27	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	*	50.54	*	128.83	*	42.04	*
* E.G. Slope (ft/ft)	*0.003219	* Area (sq ft)	*	50.54	*	128.83	*	42.04	*
* Q Total (cfs)	* 1006.00	* Flow (cfs)	*	69.67	*	875.10	*	61.23	*
* Top Width (ft)	* 127.00	* Top Width (ft)	*	55.49	*	29.29	*	42.22	*
* Vel Total (ft/s)	* 4.54	* Avg. Vel. (ft/s)	*	1.38	*	6.79	*	1.46	*
* Max Chl Dpth (ft)	* 5.12	* Hydr. Depth (ft)	*	0.91	*	4.40	*	1.00	*
* Conv. Total (cfs)	* 17731.6	* Conv. (cfs)	*	1228.0	*	15424.3	*	1079.3	*
* Length Wtd. (ft)	* 341.19	* Wetted Per. (ft)	*	56.16	*	29.71	*	43.01	*
* Min Ch El (ft)	* 2320.10	* Shear (lb/sq ft)	*	0.18	*	0.87	*	0.20	*
* Alpha	* 1.96	* Stream Power (lb/ft s)	*	0.25	*	5.92	*	0.29	*
* Frctn Loss (ft)	* 2.02	* Cum Volume (acre-ft)	*	3.48	*	27.50	*	4.37	*
* C & E Loss (ft)	* 0.14	* Cum SA (acres)	*	1.51	*	10.43	*	2.16	*

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION OUTPUT Profile #50-YEAR

* E.G. Elev (ft)	* 2324.95	* Element	*	Left OB	*	Channel	*	Right OB	*
* Vel Head (ft)	* 1.05	* Wt. n-Val.	*	0.057	*	0.033	*	0.057	*
* W.S. Elev (ft)	* 2323.90	* Reach Len. (ft)	*	323.55	*	342.36	*	325.27	*
* Crit W.S. (ft)	* 2323.90	* Flow Area (sq ft)	*	8.93	*	90.16	*	34.78	*
* E.G. Slope (ft/ft)	*0.008377	* Area (sq ft)	*	8.93	*	90.16	*	34.78	*
* Q Total (cfs)	* 863.00	* Flow (cfs)	*	16.73	*	778.74	*	67.53	*
* Top Width (ft)	* 94.48	* Top Width (ft)	*	17.73	*	29.29	*	47.46	*
* Vel Total (ft/s)	* 6.45	* Avg. Vel. (ft/s)	*	1.87	*	8.64	*	1.94	*
* Max Chl Dpth (ft)	* 3.80	* Hydr. Depth (ft)	*	0.50	*	3.08	*	0.73	*
* Conv. Total (cfs)	* 9428.9	* Conv. (cfs)	*	182.8	*	8508.4	*	737.8	*
* Length Wtd. (ft)	* 338.36	* Wetted Per. (ft)	*	17.97	*	29.71	*	48.15	*
* Min Ch El (ft)	* 2320.10	* Shear (lb/sq ft)	*	0.26	*	1.59	*	0.38	*
* Alpha	* 1.63	* Stream Power (lb/ft s)	*	0.49	*	13.71	*	0.73	*
* Frctn Loss (ft)	* 2.48	* Cum Volume (acre-ft)	*	14.13	*	22.03	*	12.79	*
* C & E Loss (ft)	* 0.10	* Cum SA (acres)	*	9.95	*	10.42	*	10.66	*

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: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2324.10	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.74	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2323.35	Reach Len. (ft)	323.55	342.36	325.27
Crit W.S. (ft)	2323.13	Flow Area (sq ft)	3.34	74.09	13.93
E.G. Slope (ft/ft)	0.007302	Area (sq ft)	3.34	74.09	13.93
Q Total (cfs)	549.00	Flow (cfs)	5.32	524.29	19.39
Top Width (ft)	63.63	Top Width (ft)	5.38	29.29	28.96
Vel Total (ft/s)	6.01	Avg. Vel. (ft/s)	1.59	7.08	1.39
Max Chl Dpth (ft)	3.25	Hydr. Depth (ft)	0.62	2.53	0.48
Conv. Total (cfs)	6424.5	Conv. (cfs)	62.2	6135.3	227.0
Length Wtd. (ft)	340.32	Wetted Per. (ft)	5.52	29.71	29.42
Min Ch El (ft)	2320.10	Shear (lb/sq ft)	0.28	1.14	0.22
Alpha	1.33	Stream Power (lb/ft s)	0.44	8.04	0.30
Frctn Loss (ft)	3.16	Cum Volume (acre-ft)	8.77	16.89	7.16
C & E Loss (ft)	0.03	Cum SA (acres)	7.80	10.38	7.80

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

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.995

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2321.75	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.74	Wt. n-Val.	0.058	0.033	0.060
W.S. Elev (ft)	2321.00	Reach Len. (ft)	478.57	495.95	490.12
Crit W.S. (ft)	2321.00	Flow Area (sq ft)	132.49	74.30	20.43
E.G. Slope (ft/ft)	0.006668	Area (sq ft)	132.49	74.30	20.43
Q Total (cfs)	1006.00	Flow (cfs)	338.20	632.50	35.30
Top Width (ft)	144.25	Top Width (ft)	97.68	20.92	25.65
Vel Total (ft/s)	4.43	Avg. Vel. (ft/s)	2.55	8.51	1.73
Max Chl Dpth (ft)	3.93	Hydr. Depth (ft)	1.36	3.55	0.80
Conv. Total (cfs)	12320.0	Conv. (cfs)	4141.8	7745.9	432.3
Length Wtd. (ft)	492.09	Wetted Per. (ft)	98.29	21.09	25.87
Min Ch El (ft)	2317.07	Shear (lb/sq ft)	0.56	1.47	0.33
Alpha	2.44	Stream Power (lb/ft s)	1.43	12.48	0.57
Frctn Loss (ft)	3.04	Cum Volume (acre-ft)	15.81	23.25	14.78
C & E Loss (ft)	0.00	Cum SA (acres)	10.13	10.24	10.84

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2323.69	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.06	Wt. n-Val.		0.033	
W.S. Elev (ft)	2321.63	Reach Len. (ft)	478.57	495.95	490.12
Crit W.S. (ft)	2321.63	Flow Area (sq ft)		87.33	
E.G. Slope (ft/ft)	0.014376	Area (sq ft)		87.33	
Q Total (cfs)	1006.00	Flow (cfs)		1006.00	
Top Width (ft)	20.92	Top Width (ft)		20.92	
Vel Total (ft/s)	11.52	Avg. Vel. (ft/s)		11.52	
Max Chl Dpth (ft)	4.56	Hydr. Depth (ft)		4.17	
Conv. Total (cfs)	8390.3	Conv. (cfs)		8390.3	
Length Wtd. (ft)	495.76	Wetted Per. (ft)		28.02	
Min Ch El (ft)	2317.07	Shear (lb/sq ft)		2.80	
Alpha	1.00	Stream Power (lb/ft s)		32.22	
Frctn Loss (ft)	5.77	Cum Volume (acre-ft)	3.29	26.65	4.21
C & E Loss (ft)	0.19	Cum SA (acres)	1.30	10.24	2.00

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2321.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.70	Wt. n-Val.	0.058	0.033	0.060
W.S. Elev (ft)	2320.83	Reach Len. (ft)	478.57	495.95	490.12
Crit W.S. (ft)	2320.83	Flow Area (sq ft)	115.22	70.58	16.15
E.G. Slope (ft/ft)	0.006462	Area (sq ft)	115.22	70.58	16.15
Q Total (cfs)	863.00	Flow (cfs)	265.80	571.62	25.58
Top Width (ft)	140.06	Top Width (ft)	96.60	20.92	22.54
Vel Total (ft/s)	4.27	Avg. Vel. (ft/s)	2.31	8.10	1.58
Max Chl Dpth (ft)	3.76	Hydr. Depth (ft)	1.19	3.37	0.72
Conv. Total (cfs)	10735.5	Conv. (cfs)	3306.5	7110.7	318.2
Length Wtd. (ft)	492.48	Wetted Per. (ft)	97.19	21.09	22.76
Min Ch El (ft)	2317.07	Shear (lb/sq ft)	0.48	1.35	0.29
Alpha	2.47	Stream Power (lb/ft s)	1.10	10.93	0.45
Frctn Loss (ft)	2.93	Cum Volume (acre-ft)	13.67	21.40	12.60
C & E Loss (ft)	0.00	Cum SA (acres)	9.53	10.22	10.40

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2320.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.03	Wt. n-Val.	0.058	0.033	0.060
W.S. Elev (ft)	2319.88	Reach Len. (ft)	478.57	495.95	490.12
Crit W.S. (ft)	2319.88	Flow Area (sq ft)	35.65	50.70	4.26
E.G. Slope (ft/ft)	0.012178	Area (sq ft)	35.65	50.70	4.26
Q Total (cfs)	549.00	Flow (cfs)	87.82	452.07	9.11
Top Width (ft)	70.27	Top Width (ft)	43.34	20.92	6.00
Vel Total (ft/s)	6.06	Avg. Vel. (ft/s)	2.46	8.92	2.14
Max Chl Dpth (ft)	2.81	Hydr. Depth (ft)	0.82	2.42	0.71
Conv. Total (cfs)	4974.9	Conv. (cfs)	795.8	4096.6	82.5
Length Wtd. (ft)	494.35	Wetted Per. (ft)	43.84	21.09	6.17
Min Ch El (ft)	2317.07	Shear (lb/sq ft)	0.62	1.83	0.53
Alpha	1.81	Stream Power (lb/ft s)	1.52	16.30	1.12
Frctn Loss (ft)	4.76	Cum Volume (acre-ft)	8.63	16.40	7.09
C & E Loss (ft)	0.06	Cum SA (acres)	7.62	10.18	7.67

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: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNNYCOVE WASH
REACH: REACH #Z RS: 2.901

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2315.17	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.75	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2314.42	Reach Len. (ft)	350.30	361.80	393.51
Crit W.S. (ft)	2314.42	Flow Area (sq ft)	15.31	98.90	118.00
E.G. Slope (ft/ft)	0.005748	Area (sq ft)	15.31	98.90	118.00
Q Total (cfs)	1048.00	Flow (cfs)	27.34	785.20	235.46
Top Width (ft)	160.92	Top Width (ft)	17.60	27.10	116.23
Vel Total (ft/s)	4.51	Avg. Vel. (ft/s)	1.79	7.94	2.00
Max Chl Dpth (ft)	4.93	Hydr. Depth (ft)	0.87	3.65	1.02
Conv. Total (cfs)	13823.5	Conv. (cfs)	360.6	10357.1	3105.8
Length Wtd. (ft)	369.02	Wetted Per. (ft)	17.82	27.89	116.32
Min Ch El (ft)	2309.49	Shear (lb/sq ft)	0.31	1.27	0.36
Alpha	2.37	Stream Power (lb/ft s)	0.55	10.10	0.73
Frctn Loss (ft)	2.83	Cum Volume (acre-ft)	14.99	22.27	14.00
C & E Loss (ft)	0.01	Cum SA (acres)	9.50	9.96	10.05

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2315.86	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.41	Wt. n-Val.		0.033	0.057
W.S. Elev (ft)	2314.45	Reach Len. (ft)	350.30	361.80	393.51
Crit W.S. (ft)	2314.45	Flow Area (sq ft)		99.76	23.20
E.G. Slope (ft/ft)	0.009696	Area (sq ft)		99.76	23.20
Q Total (cfs)	1048.00	Flow (cfs)		980.30	67.70
Top Width (ft)	45.47	Top Width (ft)		27.10	18.37
Vel Total (ft/s)	8.52	Avg. Vel. (ft/s)		9.83	2.92
Max Chl Dpth (ft)	4.96	Hydr. Depth (ft)		3.68	1.26
Conv. Total (cfs)	10642.8	Conv. (cfs)		9955.3	687.6
Length Wtd. (ft)	362.82	Wetted Per. (ft)		30.23	19.14
Min Ch El (ft)	2309.49	Shear (lb/sq ft)		2.00	0.73
Alpha	1.25	Stream Power (lb/ft s)		19.63	2.14
Frctn Loss (ft)	3.63	Cum Volume (acre-ft)	3.29	25.58	4.08
C & E Loss (ft)	0.04	Cum SA (acres)	1.30	9.96	1.90

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 cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2314.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.70	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2314.24	Reach Len. (ft)	350.30	361.80	393.51
Crit W.S. (ft)	2314.24	Flow Area (sq ft)	12.27	94.01	97.10
E.G. Slope (ft/ft)	0.005499	Area (sq ft)	12.27	94.01	97.10
Q Total (cfs)	893.00	Flow (cfs)	19.78	705.73	167.49
Top Width (ft)	158.14	Top Width (ft)	15.91	27.10	115.13
Vel Total (ft/s)	4.39	Avg. Vel. (ft/s)	1.61	7.51	1.72
Max Chl Dpth (ft)	4.75	Hydr. Depth (ft)	0.77	3.47	0.84
Conv. Total (cfs)	12042.2	Conv. (cfs)	266.7	9516.8	2258.7
Length Wtd. (ft)	368.25	Wetted Per. (ft)	16.12	27.89	115.21
Min Ch El (ft)	2309.49	Shear (lb/sq ft)	0.26	1.16	0.29
Alpha	2.34	Stream Power (lb/ft s)	0.42	8.69	0.50
Frctn Loss (ft)	2.76	Cum Volume (acre-ft)	12.97	20.46	11.96
C & E Loss (ft)	0.00	Cum SA (acres)	8.91	9.95	9.62

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2314.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.82	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2313.40	Reach Len. (ft)	350.30	361.80	393.51
Crit W.S. (ft)	2313.40	Flow Area (sq ft)	2.89	71.23	19.02
E.G. Slope (ft/ft)	0.007812	Area (sq ft)	2.89	71.23	19.02
Q Total (cfs)	554.00	Flow (cfs)	3.86	529.70	20.45
Top Width (ft)	93.66	Top Width (ft)	6.40	27.10	60.16
Vel Total (ft/s)	5.95	Avg. Vel. (ft/s)	1.33	7.44	1.08
Max Chl Dpth (ft)	3.91	Hydr. Depth (ft)	0.45	2.63	0.32
Conv. Total (cfs)	6267.9	Conv. (cfs)	43.6	5992.9	231.3
Length Wtd. (ft)	365.17	Wetted Per. (ft)	6.58	27.89	60.19
Min Ch El (ft)	2309.49	Shear (lb/sq ft)	0.21	1.25	0.15
Alpha	1.50	Stream Power (lb/ft s)	0.29	9.26	0.17
Frctn Loss (ft)	3.31	Cum Volume (acre-ft)	8.42	15.71	6.96
C & E Loss (ft)	0.07	Cum SA (acres)	7.34	9.91	7.30

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: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.832

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2309.57	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.81	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2308.76	Reach Len. (ft)	496.90	493.39	489.66
Crit W.S. (ft)	2308.76	Flow Area (sq ft)	19.87	87.11	82.23
E.G. Slope (ft/ft)	0.010780	Area (sq ft)	19.87	87.11	82.23
Q Total (cfs)	1048.00	Flow (cfs)	46.92	732.13	268.95
Top Width (ft)	122.20	Top Width (ft)	24.31	36.08	61.82
Vel Total (ft/s)	5.54	Avg. Vel. (ft/s)	2.36	8.40	3.27
Max Chl Dpth (ft)	2.69	Hydr. Depth (ft)	0.82	2.41	1.33
Conv. Total (cfs)	10093.6	Conv. (cfs)	451.9	7051.4	2590.3
Length Wtd. (ft)	493.51	Wetted Per. (ft)	24.39	36.14	61.90
Min Ch El (ft)	2306.07	Shear (lb/sq ft)	0.55	1.62	0.89
Alpha	1.71	Stream Power (lb/ft s)	1.29	13.63	2.92
Frctn Loss (ft)	5.77	Cum Volume (acre-ft)	14.85	21.50	13.09
C & E Loss (ft)	0.03	Cum SA (acres)	9.33	9.70	9.24

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2310.82	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.27	Wt. n-Val.		0.033	
W.S. Elev (ft)	2309.55	Reach Len. (ft)	496.90	493.39	489.66
Crit W.S. (ft)	2309.30	Flow Area (sq ft)		115.66	
E.G. Slope (ft/ft)	0.010341	Area (sq ft)		115.66	
Q Total (cfs)	1048.00	Flow (cfs)		1048.00	
Top Width (ft)	36.08	Top Width (ft)		36.08	
Vel Total (ft/s)	9.06	Avg. Vel. (ft/s)		9.06	
Max Chl Dpth (ft)	3.48	Hydr. Depth (ft)		3.21	
Conv. Total (cfs)	10306.0	Conv. (cfs)		10306.0	
Length Wtd. (ft)	493.72	Wetted Per. (ft)		41.55	
Min Ch El (ft)	2306.07	Shear (lb/sq ft)		1.80	
Alpha	1.00	Stream Power (lb/ft s)		16.28	
Frctn Loss (ft)	5.86	Cum Volume (acre-ft)	3.29	24.69	3.97
C & E Loss (ft)	0.03	Cum SA (acres)	1.30	9.70	1.82

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

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2309.32	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.75	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2308.57	Reach Len. (ft)	496.90	493.39	489.66
Crit W.S. (ft)	2308.57	Flow Area (sq ft)	15.70	80.48	71.04
E.G. Slope (ft/ft)	0.010809	Area (sq ft)	15.70	80.48	71.04
Q Total (cfs)	893.00	Flow (cfs)	35.00	642.45	215.55
Top Width (ft)	116.96	Top Width (ft)	20.99	36.08	59.90
Vel Total (ft/s)	5.34	Avg. Vel. (ft/s)	2.23	7.98	3.03
Max Chl Dpth (ft)	2.50	Hydr. Depth (ft)	0.75	2.23	1.19
Conv. Total (cfs)	8589.4	Conv. (cfs)	336.7	6179.5	2073.2
Length Wtd. (ft)	493.50	Wetted Per. (ft)	21.06	36.14	59.97
Min Ch El (ft)	2306.07	Shear (lb/sq ft)	0.50	1.50	0.80
Alpha	1.69	Stream Power (lb/ft s)	1.12	11.99	2.43
Frctn Loss (ft)	5.74	Cum Volume (acre-ft)	12.86	19.74	11.20
C & E Loss (ft)	0.03	Cum SA (acres)	8.76	9.69	8.83

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2308.70	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.58	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2308.12	Reach Len. (ft)	496.90	493.39	489.66
Crit W.S. (ft)	2308.12	Flow Area (sq ft)	7.75	64.08	44.79
E.G. Slope (ft/ft)	0.010645	Area (sq ft)	7.75	64.08	44.79
Q Total (cfs)	554.00	Flow (cfs)	14.13	436.08	103.79
Top Width (ft)	105.85	Top Width (ft)	13.82	36.08	55.95

Vel Total (ft/s)	4.75	Avg. Vel. (ft/s)	1.82	6.81	2.32
Max Chl Dpth (ft)	2.05	Hydr. Depth (ft)	0.56	1.78	0.80
Conv. Total (cfs)	5369.6	Conv. (cfs)	137.0	4226.7	1005.9
Length Wtd. (ft)	493.47	Wetted Per. (ft)	13.88	36.14	56.00
Min Ch El (ft)	2306.07	Shear (lb/sq ft)	0.37	1.18	0.53
Alpha	1.66	Stream Power (lb/ft s)	0.68	8.02	1.23
Frctn Loss (ft)	5.47	Cum Volume (acre-ft)	8.37	15.15	6.67
C & E Loss (ft)	0.02	Cum SA (acres)	7.26	9.65	6.77

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.739

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2303.07	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.72	Wt. n-Val.	0.060	0.033	0.057
W.S. Elev (ft)	2302.35	Reach Len. (ft)	495.93	431.55	392.82
Crit W.S. (ft)	2302.35	Flow Area (sq ft)	126.06	54.80	29.32
E.G. Slope (ft/ft)	0.012740	Area (sq ft)	126.06	54.80	29.32
Q Total (cfs)	1048.00	Flow (cfs)	432.24	501.44	114.32
Top Width (ft)	134.42	Top Width (ft)	92.72	22.68	19.02
Vel Total (ft/s)	4.99	Avg. Vel. (ft/s)	3.43	9.15	3.90
Max Chl Dpth (ft)	2.51	Hydr. Depth (ft)	1.36	2.42	1.54
Conv. Total (cfs)	9285.0	Conv. (cfs)	3829.6	4442.6	1012.9
Length Wtd. (ft)		Wetted Per. (ft)	92.79	22.69	19.21
Min Ch El (ft)	2299.84	Shear (lb/sq ft)	1.08	1.92	1.21
Alpha	1.87	Stream Power (lb/ft s)	3.70	17.58	4.73
Frctn Loss (ft)		Cum Volume (acre-ft)	14.02	20.69	12.47
C & E Loss (ft)		Cum SA (acres)	8.66	9.37	8.79

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.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2304.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.59	Wt. n-Val.	0.060	0.033	
W.S. Elev (ft)	2303.35	Reach Len. (ft)	495.93	431.55	392.82
Crit W.S. (ft)	2303.35	Flow Area (sq ft)	37.92	77.51	
E.G. Slope (ft/ft)	0.013753	Area (sq ft)	37.92	77.51	
Q Total (cfs)	1048.00	Flow (cfs)	198.94	849.06	
Top Width (ft)	35.71	Top Width (ft)	13.03	22.68	
Vel Total (ft/s)	9.08	Avg. Vel. (ft/s)	5.25	10.95	
Max Chl Dpth (ft)	3.51	Hydr. Depth (ft)	2.91	3.42	
Conv. Total (cfs)	8936.5	Conv. (cfs)	1696.4	7240.1	
Length Wtd. (ft)	437.35	Wetted Per. (ft)	15.62	25.94	
Min Ch El (ft)	2299.84	Shear (lb/sq ft)	2.08	2.57	
Alpha	1.24	Stream Power (lb/ft s)	10.93	28.10	
Frctn Loss (ft)	6.08	Cum Volume (acre-ft)	3.08	23.60	3.97
C & E Loss (ft)	0.09	Cum SA (acres)	1.23	9.37	1.82

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 cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2302.85	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.66	Wt. n-Val.	0.060	0.033	0.057
W.S. Elev (ft)	2302.19	Reach Len. (ft)	495.93	431.55	392.82
Crit W.S. (ft)	2302.19	Flow Area (sq ft)	111.30	51.17	26.32
E.G. Slope (ft/ft)	0.012548	Area (sq ft)	111.30	51.17	26.32
Q Total (cfs)	893.00	Flow (cfs)	352.04	443.82	97.15
Top Width (ft)	132.38	Top Width (ft)	91.36	22.68	18.34
Vel Total (ft/s)	4.73	Avg. Vel. (ft/s)	3.16	8.67	3.69
Max Chl Dpth (ft)	2.35	Hydr. Depth (ft)	1.22	2.26	1.43
Conv. Total (cfs)	7972.0	Conv. (cfs)	3142.7	3962.1	867.2
Length Wtd. (ft)		Wetted Per. (ft)	91.42	22.69	18.52

* Min Ch El (ft)	* 2299.84	* Shear (lb/sq ft)	* 0.95	* 1.77	* 1.11 *
* Alpha	* 1.91	* Stream Power (lb/ft s)	* 3.02	* 15.32	* 4.11 *
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	* 12.14	* 18.99	* 10.66 *
* C & E Loss (ft)	*	* Cum SA (acres)	* 8.12	* 9.35	* 8.39 *

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.

CROSS SECTION OUTPUT Profile #10-YEAR

* E.G. Elev (ft)	* 2302.30	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.51	* Wt. n-Val.	* 0.060	* 0.033	* 0.057 *
* W.S. Elev (ft)	* 2301.79	* Reach Len. (ft)	* 495.93	* 431.55	* 392.82 *
* Crit W.S. (ft)	* 2301.79	* Flow Area (sq ft)	* 76.00	* 42.22	* 19.41 *
* E.G. Slope (ft/ft)	*0.011556	* Area (sq ft)	* 76.00	* 42.22	* 19.41 *
* Q Total (cfs)	* 554.00	* Flow (cfs)	* 184.91	* 309.23	* 59.86 *
* Top Width (ft)	* 126.31	* Top Width (ft)	* 86.94	* 22.68	* 16.69 *
* Vel Total (ft/s)	* 4.03	* Avg. Vel. (ft/s)	* 2.43	* 7.32	* 3.08 *
* Max Chl Dpth (ft)	* 1.95	* Hydr. Depth (ft)	* 0.87	* 1.86	* 1.16 *
* Conv. Total (cfs)	* 5153.6	* Conv. (cfs)	* 1720.1	* 2876.6	* 556.9 *
* Length Wtd. (ft)	*	* Wetted Per. (ft)	* 86.98	* 22.69	* 16.82 *
* Min Ch El (ft)	* 2299.84	* Shear (lb/sq ft)	* 0.63	* 1.34	* 0.83 *
* Alpha	* 2.03	* Stream Power (lb/ft s)	* 1.53	* 9.83	* 2.57 *
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	* 7.90	* 14.54	* 6.31 *
* C & E Loss (ft)	*	* Cum SA (acres)	* 6.69	* 9.31	* 6.37 *

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.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.657

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	* 2296.91	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.99	* Wt. n-Val.	* 0.060	* 0.035	* 0.057 *
* W.S. Elev (ft)	* 2295.93	* Reach Len. (ft)	* 289.00	* 346.56	* 404.01 *
* Crit W.S. (ft)	* 2295.93	* Flow Area (sq ft)	* 14.44	* 109.84	* 31.60 *
* E.G. Slope (ft/ft)	*0.011455	* Area (sq ft)	* 14.44	* 109.84	* 31.60 *
* Q Total (cfs)	* 1048.00	* Flow (cfs)	* 37.07	* 925.09	* 85.84 *
* Top Width (ft)	* 91.33	* Top Width (ft)	* 15.03	* 43.46	* 32.84 *
* Vel Total (ft/s)	* 6.72	* Avg. Vel. (ft/s)	* 2.57	* 8.42	* 2.72 *
* Max Chl Dpth (ft)	* 2.93	* Hydr. Depth (ft)	* 0.96	* 2.53	* 0.96 *
* Conv. Total (cfs)	* 9791.7	* Conv. (cfs)	* 346.4	* 8643.3	* 802.0 *
* Length Wtd. (ft)	* 357.23	* Wetted Per. (ft)	* 15.14	* 43.53	* 32.90 *
* Min Ch El (ft)	* 2293.00	* Shear (lb/sq ft)	* 0.68	* 1.80	* 0.69 *
* Alpha	* 1.40	* Stream Power (lb/ft s)	* 1.75	* 15.20	* 1.87 *
* Frctn Loss (ft)	* 2.95	* Cum Volume (acre-ft)	* 13.22	* 19.88	* 12.19 *
* C & E Loss (ft)	* 0.15	* Cum SA (acres)	* 8.05	* 9.04	* 8.55 *

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #FLOODWAY

* E.G. Elev (ft)	* 2297.27	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 1.30	* Wt. n-Val.	*	* 0.035	* 0.057 *
* W.S. Elev (ft)	* 2295.98	* Reach Len. (ft)	* 289.00	* 346.56	* 404.01 *
* Crit W.S. (ft)	* 2295.98	* Flow Area (sq ft)	*	* 112.11	* 5.00 *
* E.G. Slope (ft/ft)	*0.014054	* Area (sq ft)	*	* 112.11	* 5.00 *
* Q Total (cfs)	* 1048.00	* Flow (cfs)	*	* 1031.36	* 16.64 *
* Top Width (ft)	* 46.15	* Top Width (ft)	*	* 43.46	* 2.69 *
* Vel Total (ft/s)	* 8.95	* Avg. Vel. (ft/s)	*	* 9.20	* 3.33 *
* Max Chl Dpth (ft)	* 2.98	* Hydr. Depth (ft)	*	* 2.58	* 1.86 *
* Conv. Total (cfs)	* 8840.3	* Conv. (cfs)	*	* 8699.9	* 140.4 *
* Length Wtd. (ft)	* 346.96	* Wetted Per. (ft)	*	* 45.37	* 4.47 *
* Min Ch El (ft)	* 2293.00	* Shear (lb/sq ft)	*	* 2.17	* 0.98 *
* Alpha	* 1.04	* Stream Power (lb/ft s)	*	* 19.94	* 3.26 *
* Frctn Loss (ft)	* 3.80	* Cum Volume (acre-ft)	* 2.86	* 22.66	* 3.95 *
* C & E Loss (ft)	* 0.10	* Cum SA (acres)	* 1.15	* 9.04	* 1.81 *

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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 OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2296.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.91	Wt. n-Val.	0.060	0.035	0.057
W.S. Elev (ft)	2295.71	Reach Len. (ft)	289.00	346.56	404.01
Crit W.S. (ft)	2295.71	Flow Area (sq ft)	11.31	100.28	24.77
E.G. Slope (ft/ft)	0.011710	Area (sq ft)	11.31	100.28	24.77
Q Total (cfs)	893.00	Flow (cfs)	26.92	803.60	62.47
Top Width (ft)	86.13	Top Width (ft)	13.41	43.46	29.26
Vel Total (ft/s)	6.55	Avg. Vel. (ft/s)	2.38	8.01	2.52
Max Chl Dpth (ft)	2.71	Hydr. Depth (ft)	0.84	2.31	0.85
Conv. Total (cfs)	8252.4	Conv. (cfs)	248.8	7426.3	577.3
Length Wtd. (ft)	356.53	Wetted Per. (ft)	13.50	43.53	29.31
Min Ch El (ft)	2293.00	Shear (lb/sq ft)	0.61	1.68	0.62
Alpha	1.36	Stream Power (lb/ft s)	1.46	13.49	1.56
Frctn Loss (ft)	3.26	Cum Volume (acre-ft)	11.44	18.24	10.43
C & E Loss (ft)	0.13	Cum SA (acres)	7.52	9.03	8.18

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2295.85	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.72	Wt. n-Val.	0.060	0.035	0.057
W.S. Elev (ft)	2295.13	Reach Len. (ft)	289.00	346.56	404.01
Crit W.S. (ft)	2295.13	Flow Area (sq ft)	4.76	75.04	10.48
E.G. Slope (ft/ft)	0.013131	Area (sq ft)	4.76	75.04	10.48
Q Total (cfs)	554.00	Flow (cfs)	8.71	524.86	20.42
Top Width (ft)	72.48	Top Width (ft)	9.14	43.46	19.88
Vel Total (ft/s)	6.14	Avg. Vel. (ft/s)	1.83	6.99	1.95
Max Chl Dpth (ft)	2.13	Hydr. Depth (ft)	0.52	1.73	0.53
Conv. Total (cfs)	4834.5	Conv. (cfs)	76.0	4580.3	178.2
Length Wtd. (ft)	353.85	Wetted Per. (ft)	9.19	43.53	19.91
Min Ch El (ft)	2293.00	Shear (lb/sq ft)	0.42	1.41	0.43
Alpha	1.24	Stream Power (lb/ft s)	0.78	9.88	0.84
Frctn Loss (ft)	4.35	Cum Volume (acre-ft)	7.44	13.96	6.18
C & E Loss (ft)	0.07	Cum SA (acres)	6.14	8.98	6.20

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.592

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2291.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.48	Wt. n-Val.	0.060	0.035	0.057
W.S. Elev (ft)	2291.41	Reach Len. (ft)	119.02	151.06	183.93
Crit W.S. (ft)		Flow Area (sq ft)	4.52	145.30	129.78
E.G. Slope (ft/ft)	0.006591	Area (sq ft)	4.52	145.30	129.78
Q Total (cfs)	1322.00	Flow (cfs)	5.39	919.90	396.71
Top Width (ft)	142.08	Top Width (ft)	9.87	58.16	74.04
Vel Total (ft/s)	4.73	Avg. Vel. (ft/s)	1.19	6.33	3.06
Max Chl Dpth (ft)	3.45	Hydr. Depth (ft)	0.46	2.50	1.75
Conv. Total (cfs)	16283.2	Conv. (cfs)	66.3	11330.6	4886.3
Length Wtd. (ft)	154.80	Wetted Per. (ft)	9.92	58.37	74.77
Min Ch El (ft)	2287.96	Shear (lb/sq ft)	0.19	1.02	0.71
Alpha	1.37	Stream Power (lb/ft s)	0.22	6.48	2.18
Frctn Loss (ft)	1.32	Cum Volume (acre-ft)	13.16	18.86	11.44
C & E Loss (ft)	0.09	Cum SA (acres)	7.96	8.64	8.06

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the

need for additional cross sections.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2292.76	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.97	Wt. n-Val.		0.035	
W.S. Elev (ft)	2291.79	Reach Len. (ft)	119.02	151.06	183.93
Crit W.S. (ft)	2291.43	Flow Area (sq ft)		167.00	
E.G. Slope (ft/ft)	0.009156	Area (sq ft)		167.00	
Q Total (cfs)	1322.00	Flow (cfs)		1322.00	
Top Width (ft)	58.16	Top Width (ft)		58.16	
Vel Total (ft/s)	7.92	Avg. Vel. (ft/s)		7.92	
Max Chl Dpth (ft)	3.82	Hydr. Depth (ft)		2.87	
Conv. Total (cfs)	13816.0	Conv. (cfs)		13816.0	
Length Wtd. (ft)	151.06	Wetted Per. (ft)		61.39	
Min Ch El (ft)	2287.96	Shear (lb/sq ft)		1.55	
Alpha	1.00	Stream Power (lb/ft s)		12.31	
Frctn Loss (ft)	1.68	Cum Volume (acre-ft)	2.86	21.55	3.93
C & E Loss (ft)	0.07	Cum SA (acres)	1.15	8.64	1.79

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2291.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.48	Wt. n-Val.	0.060	0.035	0.057
W.S. Elev (ft)	2291.12	Reach Len. (ft)	119.02	151.06	183.93
Crit W.S. (ft)		Flow Area (sq ft)	2.22	128.11	107.97
E.G. Slope (ft/ft)	0.007676	Area (sq ft)	2.22	128.11	107.97
Q Total (cfs)	1124.00	Flow (cfs)	2.36	804.73	316.91
Top Width (ft)	138.05	Top Width (ft)	6.43	58.16	73.46
Vel Total (ft/s)	4.72	Avg. Vel. (ft/s)	1.06	6.28	2.94
Max Chl Dpth (ft)	3.16	Hydr. Depth (ft)	0.35	2.20	1.47
Conv. Total (cfs)	12829.3	Conv. (cfs)	26.9	9185.2	3617.2
Length Wtd. (ft)	154.62	Wetted Per. (ft)	6.46	58.37	74.12
Min Ch El (ft)	2287.96	Shear (lb/sq ft)	0.16	1.05	0.70
Alpha	1.38	Stream Power (lb/ft s)	0.17	6.61	2.05
Frctn Loss (ft)	1.47	Cum Volume (acre-ft)	11.39	17.33	9.81
C & E Loss (ft)	0.08	Cum SA (acres)	7.46	8.62	7.70

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2290.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.47	Wt. n-Val.	0.000	0.035	0.057
W.S. Elev (ft)	2290.45	Reach Len. (ft)	119.02	151.06	183.93
Crit W.S. (ft)	2290.30	Flow Area (sq ft)	0.00	89.30	59.40
E.G. Slope (ft/ft)	0.011668	Area (sq ft)	0.00	89.30	59.40
Q Total (cfs)	690.00	Flow (cfs)	0.00	543.75	146.25
Top Width (ft)	130.49	Top Width (ft)	0.18	58.16	72.15
Vel Total (ft/s)	4.64	Avg. Vel. (ft/s)	0.12	6.09	2.46
Max Chl Dpth (ft)	2.49	Hydr. Depth (ft)	0.01	1.54	0.82
Conv. Total (cfs)	6387.7	Conv. (cfs)	0.0	5033.8	1353.9
Length Wtd. (ft)	153.70	Wetted Per. (ft)	0.18	58.37	72.64
Min Ch El (ft)	2287.96	Shear (lb/sq ft)		1.11	0.60
Alpha	1.42	Stream Power (lb/ft s)		6.79	1.47
Frctn Loss (ft)	1.92	Cum Volume (acre-ft)	7.42	13.31	5.85
C & E Loss (ft)	0.05	Cum SA (acres)	6.11	8.58	5.77

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.563

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2290.48	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.40	Wt. n-Val.	0.057	0.035	0.057
W.S. Elev (ft)	2289.08	Reach Len. (ft)	403.13	354.16	306.31
Crit W.S. (ft)	2289.08	Flow Area (sq ft)	31.30	118.29	7.88
E.G. Slope (ft/ft)	0.011455	Area (sq ft)	31.30	118.29	7.88
Q Total (cfs)	1322.00	Flow (cfs)	118.67	1177.98	25.35
Top Width (ft)	61.59	Top Width (ft)	19.49	36.35	5.75
Vel Total (ft/s)	8.40	Avg. Vel. (ft/s)	3.79	9.96	3.22
Max Chl Dpth (ft)	3.33	Hydr. Depth (ft)	1.61	3.25	1.37
Conv. Total (cfs)	12351.8	Conv. (cfs)	1108.7	11006.2	236.9
Length Wtd. (ft)	354.17	Wetted Per. (ft)	19.76	36.46	6.37
Min Ch El (ft)	2285.75	Shear (lb/sq ft)	1.13	2.32	0.88
Alpha	1.27	Stream Power (lb/ft s)	4.30	23.10	2.85
Frctn Loss (ft)	3.49	Cum Volume (acre-ft)	13.11	18.40	11.15
C & E Loss (ft)	0.01	Cum SA (acres)	7.92	8.47	7.89

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*****************************************************************************************************

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 OUTPUT  Profile #FLOODWAY
*****************************************************************************************************
* E.G. Elev (ft)          * 2291.01  * Element                 *  Left OB *  Channel * Right OB *
* Vel Head (ft)           *    1.66  * Wt. n-Val.              *          *    0.035 *          *
* W.S. Elev (ft)          * 2289.34  * Reach Len. (ft)         *  403.13  *   354.16 *   306.31 *
* Crit W.S. (ft)          * 2289.29  * Flow Area (sq ft)       *          *   127.83 *          *
* E.G. Slope (ft/ft)      *0.013877  * Area (sq ft)            *          *   127.83 *          *
* Q Total (cfs)           * 1322.00  * Flow (cfs)              *          *  1322.00 *          *
* Top Width (ft)          *   36.35  * Top Width (ft)          *          *    36.35 *          *
* Vel Total (ft/s)        *   10.34  * Avg. Vel. (ft/s)        *          *    10.34 *          *
* Max Chl Dpth (ft)       *    3.59  * Hydr. Depth (ft)        *          *     3.52 *          *
* Conv. Total (cfs)       * 11222.5  * Conv. (cfs)             *          *  11222.5 *          *
* Length Wtd. (ft)        *  353.91  * Wetted Per. (ft)        *          *    42.99 *          *
* Min Ch El (ft)          * 2285.75  * Shear (lb/sq ft)        *          *     2.58 *          *
* Alpha                   *    1.00  * Stream Power (lb/ft s)  *          *    26.64 *          *
* Frctn Loss (ft)         *    4.50  * Cum Volume (acre-ft)    *    2.86  *    21.04 *     3.93 *
* C & E Loss (ft)         *    0.03  * Cum SA (acres)          *    1.15  *     8.47 *     1.79 *
*****************************************************************************************************

Warning: The cross section had to be extended vertically during the critical depth 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: The parabolic search method failed to converge on critical depth.  The program will try the cross section slice/secant

         method to find critical depth.

CROSS SECTION OUTPUT  Profile #50-YEAR
*****************************************************************************************************
* E.G. Elev (ft)          * 2290.04  * Element                 *  Left OB *  Channel * Right OB *
* Vel Head (ft)           *    1.29  * Wt. n-Val.              *   0.057  *    0.035 *    0.057 *
* W.S. Elev (ft)          * 2288.76  * Reach Len. (ft)         *  403.13  *   354.16 *   306.31 *
* Crit W.S. (ft)          * 2288.76  * Flow Area (sq ft)       *   25.28  *   106.42 *    6.12 *
* E.G. Slope (ft/ft)      *0.012060  * Area (sq ft)            *   25.28  *   106.42 *    6.12 *
* Q Total (cfs)           * 1124.00  * Flow (cfs)              *   92.14  *  1013.32 *   18.55 *
* Top Width (ft)          *   58.77  * Top Width (ft)          *   17.35  *    36.35 *    5.07 *
* Vel Total (ft/s)        *    8.16  * Avg. Vel. (ft/s)        *    3.64  *     9.52 *    3.03 *
* Max Chl Dpth (ft)       *    3.01  * Hydr. Depth (ft)        *    1.46  *     2.93 *    1.21 *
* Conv. Total (cfs)       * 10235.1  * Conv. (cfs)             *   839.0  *   9227.2 *   168.9 *
* Length Wtd. (ft)        *  354.37  * Wetted Per. (ft)        *   17.60  *    36.46 *    5.61 *
* Min Ch El (ft)          * 2285.75  * Shear (lb/sq ft)        *    1.08  *     2.20 *    0.82 *
* Alpha                   *    1.25  * Stream Power (lb/ft s)  *    3.94  *    20.92 *    2.49 *
* Frctn Loss (ft)         *    3.59  * Cum Volume (acre-ft)    *   11.36  *    16.93 *    9.57 *
* C & E Loss (ft)         *    0.01  * Cum SA (acres)          *    7.42  *     8.46 *    7.53 *
*****************************************************************************************************

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 OUTPUT  Profile #10-YEAR
*****************************************************************************************************
* E.G. Elev (ft)          * 2288.95  * Element                 *  Left OB *  Channel * Right OB *
* Vel Head (ft)           *    0.97  * Wt. n-Val.              *   0.057  *    0.035 *    0.057 *
* W.S. Elev (ft)          * 2287.98  * Reach Len. (ft)         *  403.13  *   354.16 *   306.31 *
* Crit W.S. (ft)          * 2287.98  * Flow Area (sq ft)       *   13.69  *    78.18 *    2.81 *
* E.G. Slope (ft/ft)      *0.013438  * Area (sq ft)            *   13.69  *    78.18 *    2.81 *
* Q Total (cfs)           *  690.00  * Flow (cfs)              *   43.25  *   639.80 *    6.95 *
* Top Width (ft)          *   52.41  * Top Width (ft)          *   12.63  *    36.35 *    3.44 *
* Vel Total (ft/s)        *    7.29  * Avg. Vel. (ft/s)        *    3.16  *     8.18 *    2.47 *
* Max Chl Dpth (ft)       *    2.23  * Hydr. Depth (ft)        *    1.08  *     2.15 *    0.82 *
* Conv. Total (cfs)       *  5952.2  * Conv. (cfs)             *   373.1  *   5519.1 *   60.0 *
* Length Wtd. (ft)        *  355.01  * Wetted Per. (ft)        *   12.81  *    36.46 *    3.81 *
* Min Ch El (ft)          * 2285.75  * Shear (lb/sq ft)        *    0.90  *     1.80 *    0.62 *
* Alpha                   *    1.18  * Stream Power (lb/ft s)  *    2.83  *    14.72 *    1.53 *
* Frctn Loss (ft)         *    4.11  * Cum Volume (acre-ft)    *    7.40  *    13.02 *    5.72 *
* C & E Loss (ft)         *    0.01  * Cum SA (acres)          *    6.09  *     8.42 *    5.61 *
*****************************************************************************************************

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.496

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2285.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.37	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2284.40	Reach Len. (ft)	321.65	335.45	333.37
Crit W.S. (ft)	2284.40	Flow Area (sq ft)	14.35	112.32	48.44
E.G. Slope (ft/ft)	0.008554	Area (sq ft)	14.35	112.32	48.44
Q Total (cfs)	1322.00	Flow (cfs)	46.55	1132.01	143.45
Top Width (ft)	73.65	Top Width (ft)	8.56	29.62	35.47
Vel Total (ft/s)	7.55	Avg. Vel. (ft/s)	3.24	10.08	2.96
Max Chl Dpth (ft)	4.14	Hydr. Depth (ft)	1.68	3.79	1.37
Conv. Total (cfs)	14293.7	Conv. (cfs)	503.3	12239.5	1551.0
Length Wtd. (ft)	330.94	Wetted Per. (ft)	9.19	29.83	35.58
Min Ch El (ft)	2280.26	Shear (lb/sq ft)	0.83	2.01	0.73
Alpha	1.55	Stream Power (lb/ft s)	2.70	20.26	2.15
Frctn Loss (ft)	2.70	Cum Volume (acre-ft)	12.90	17.47	10.95
C & E Loss (ft)	0.27	Cum SA (acres)	7.79	8.20	7.74

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2286.48	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.93	Wt. n-Val.		0.033	0.057
W.S. Elev (ft)	2284.54	Reach Len. (ft)	321.65	335.45	333.37
Crit W.S. (ft)	2284.54	Flow Area (sq ft)		116.64	4.73
E.G. Slope (ft/ft)	0.011673	Area (sq ft)		116.64	4.73
Q Total (cfs)	1322.00	Flow (cfs)		1308.07	13.93
Top Width (ft)	31.28	Top Width (ft)		29.62	1.66
Vel Total (ft/s)	10.89	Avg. Vel. (ft/s)		11.21	2.94
Max Chl Dpth (ft)	4.28	Hydr. Depth (ft)		3.94	2.85
Conv. Total (cfs)	12236.1	Conv. (cfs)		12107.2	129.0
Length Wtd. (ft)	334.21	Wetted Per. (ft)		33.33	4.43
Min Ch El (ft)	2280.26	Shear (lb/sq ft)		2.55	0.78
Alpha	1.05	Stream Power (lb/ft s)		28.60	2.29
Frctn Loss (ft)	3.95	Cum Volume (acre-ft)	2.86	20.04	3.91
C & E Loss (ft)	0.06	Cum SA (acres)	1.15	8.20	1.79

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 cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2285.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.26	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2284.09	Reach Len. (ft)	321.65	335.45	333.37
Crit W.S. (ft)	2284.09	Flow Area (sq ft)	11.79	103.05	37.90
E.G. Slope (ft/ft)	0.008637	Area (sq ft)	11.79	103.05	37.90
Q Total (cfs)	1124.00	Flow (cfs)	36.00	985.45	102.55
Top Width (ft)	69.39	Top Width (ft)	7.77	29.62	32.00
Vel Total (ft/s)	7.36	Avg. Vel. (ft/s)	3.05	9.56	2.71
Max Chl Dpth (ft)	3.83	Hydr. Depth (ft)	1.52	3.48	1.18
Conv. Total (cfs)	12094.6	Conv. (cfs)	387.4	10603.7	1103.5
Length Wtd. (ft)	331.03	Wetted Per. (ft)	8.34	29.83	32.11
Min Ch El (ft)	2280.26	Shear (lb/sq ft)	0.76	1.86	0.64
Alpha	1.50	Stream Power (lb/ft s)	2.33	17.81	1.72
Frctn Loss (ft)	2.84	Cum Volume (acre-ft)	11.18	16.07	9.41
C & E Loss (ft)	0.24	Cum SA (acres)	7.31	8.19	7.40

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2284.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.05	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2283.18	Reach Len. (ft)	321.65	335.45	333.37
Crit W.S. (ft)	2283.18	Flow Area (sq ft)	5.83	76.36	13.94
E.G. Slope (ft/ft)	0.010095	Area (sq ft)	5.83	76.36	13.94
Q Total (cfs)	690.00	Flow (cfs)	15.21	646.45	28.34
Top Width (ft)	55.42	Top Width (ft)	5.46	29.62	20.34
Vel Total (ft/s)	7.18	Avg. Vel. (ft/s)	2.61	8.47	2.03
Max Chl Dpth (ft)	2.92	Hydr. Depth (ft)	1.07	2.58	0.69
Conv. Total (cfs)	6867.5	Conv. (cfs)	151.4	6434.0	282.0
Length Wtd. (ft)	331.35	Wetted Per. (ft)	5.87	29.83	20.40
Min Ch El (ft)	2280.26	Shear (lb/sq ft)	0.63	1.61	0.43
Alpha	1.31	Stream Power (lb/ft s)	1.63	13.66	0.88
Frctn Loss (ft)	3.45	Cum Volume (acre-ft)	7.31	12.39	5.66
C & E Loss (ft)	0.19	Cum SA (acres)	6.01	8.15	5.53

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.432

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2279.88	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.48	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2279.40	Reach Len. (ft)	164.74	281.80	317.21
Crit W.S. (ft)		Flow Area (sq ft)	210.44	61.52	19.59
E.G. Slope (ft/ft)	0.007801	Area (sq ft)	210.44	61.52	19.59
Q Total (cfs)	1322.00	Flow (cfs)	787.33	482.45	52.21
Top Width (ft)	139.15	Top Width (ft)	101.42	22.19	15.53
Vel Total (ft/s)	4.53	Avg. Vel. (ft/s)	3.74	7.84	2.66
Max Chl Dpth (ft)	3.02	Hydr. Depth (ft)	2.07	2.77	1.26
Conv. Total (cfs)	14967.4	Conv. (cfs)	8914.0	5462.2	591.2
Length Wtd. (ft)	238.66	Wetted Per. (ft)	101.60	22.22	15.74
Min Ch El (ft)	2276.38	Shear (lb/sq ft)	1.01	1.35	0.61
Alpha	1.51	Stream Power (lb/ft s)	3.77	10.57	1.62
Frctn Loss (ft)	1.99	Cum Volume (acre-ft)	12.07	16.80	10.69
C & E Loss (ft)	0.09	Cum SA (acres)	7.39	8.01	7.55

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2282.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.72	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2280.36	Reach Len. (ft)	164.74	281.80	317.21
Crit W.S. (ft)	2280.36	Flow Area (sq ft)	40.74	82.79	25.91
E.G. Slope (ft/ft)	0.011973	Area (sq ft)	40.74	82.79	25.91
Q Total (cfs)	1322.00	Flow (cfs)	215.55	980.36	126.09
Top Width (ft)	45.00	Top Width (ft)	13.23	22.19	9.58
Vel Total (ft/s)	8.85	Avg. Vel. (ft/s)	5.29	11.84	4.87
Max Chl Dpth (ft)	3.98	Hydr. Depth (ft)	3.08	3.73	2.70
Conv. Total (cfs)	12081.7	Conv. (cfs)	1969.9	8959.5	1152.3
Length Wtd. (ft)	267.59	Wetted Per. (ft)	16.13	22.22	11.63
Min Ch El (ft)	2276.38	Shear (lb/sq ft)	1.89	2.79	1.67
Alpha	1.42	Stream Power (lb/ft s)	9.99	32.98	8.10
Frctn Loss (ft)	3.26	Cum Volume (acre-ft)	2.71	19.27	3.80
C & E Loss (ft)	0.02	Cum SA (acres)	1.10	8.01	1.74

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.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2279.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.46	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2279.12	Reach Len. (ft)	164.74	281.80	317.21
Crit W.S. (ft)		Flow Area (sq ft)	182.36	55.28	15.47
E.G. Slope (ft/ft)	0.008522	Area (sq ft)	182.36	55.28	15.47

Q Total (cfs)	1124.00	Flow (cfs)	662.24	421.90	39.85	
Top Width (ft)	134.19	Top Width (ft)	98.22	22.19	13.79	
Vel Total (ft/s)	4.44	Avg. Vel. (ft/s)	3.63	7.63	2.58	
Max Chl Dpth (ft)	2.74	Hydr. Depth (ft)	1.86	2.49	1.12	
Conv. Total (cfs)	12175.9	Conv. (cfs)	7173.9	4570.3	431.7	
Length Wtd. (ft)	239.80	Wetted Per. (ft)	98.38	22.22	13.97	
Min Ch El (ft)	2276.38	Shear (lb/sq ft)	0.99	1.32	0.59	
Alpha	1.51	Stream Power (lb/ft s)	3.58	10.10	1.52	
Frctn Loss (ft)	2.13	Cum Volume (acre-ft)	10.47	15.46	9.21	
C & E Loss (ft)	0.09	Cum SA (acres)	6.92	7.99	7.23	

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2278.87	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.41	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2278.46	Reach Len. (ft)	164.74	281.80	317.21
Crit W.S. (ft)		Flow Area (sq ft)	119.90	40.65	7.72
E.G. Slope (ft/ft)	0.010756	Area (sq ft)	119.90	40.65	7.72
Q Total (cfs)	690.00	Flow (cfs)	388.32	283.94	17.74
Top Width (ft)	123.24	Top Width (ft)	91.33	22.19	9.72
Vel Total (ft/s)	4.10	Avg. Vel. (ft/s)	3.24	6.99	2.30
Max Chl Dpth (ft)	2.08	Hydr. Depth (ft)	1.31	1.83	0.79
Conv. Total (cfs)	6653.1	Conv. (cfs)	3744.2	2737.8	171.0
Length Wtd. (ft)	243.20	Wetted Per. (ft)	91.46	22.22	9.86
Min Ch El (ft)	2276.38	Shear (lb/sq ft)	0.88	1.23	0.53
Alpha	1.55	Stream Power (lb/ft s)	2.85	8.58	1.21
Frctn Loss (ft)	2.61	Cum Volume (acre-ft)	6.85	11.94	5.58
C & E Loss (ft)	0.07	Cum SA (acres)	5.65	7.95	5.42

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.379

CROSS SECTION OUTPUT Profile #FLOODPLAIN

			Left OB	Channel	Right OB
E.G. Elev (ft)	2277.81	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.43	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2276.38	Reach Len. (ft)	331.81	311.94	290.99
Crit W.S. (ft)	2276.38	Flow Area (sq ft)	61.44	100.35	14.04
E.G. Slope (ft/ft)	0.008899	Area (sq ft)	61.44	100.35	14.04
Q Total (cfs)	1322.00	Flow (cfs)	216.25	1061.29	44.45
Top Width (ft)	70.16	Top Width (ft)	35.67	25.39	9.11
Vel Total (ft/s)	7.52	Avg. Vel. (ft/s)	3.52	10.58	3.17
Max Chl Dpth (ft)	4.05	Hydr. Depth (ft)	1.72	3.95	1.54
Conv. Total (cfs)	14013.8	Conv. (cfs)	2292.4	11250.2	471.2
Length Wtd. (ft)	313.07	Wetted Per. (ft)	35.88	25.54	9.61
Min Ch El (ft)	2272.33	Shear (lb/sq ft)	0.95	2.18	0.81
Alpha	1.63	Stream Power (lb/ft s)	3.35	23.08	2.57
Frctn Loss (ft)	3.00	Cum Volume (acre-ft)	11.55	16.27	10.57
C & E Loss (ft)	0.02	Cum SA (acres)	7.13	7.85	7.46

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 OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2278.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.92	Wt. n-Val.	0.057	0.033	
W.S. Elev (ft)	2276.42	Reach Len. (ft)	331.81	311.94	290.99
Crit W.S. (ft)	2276.42	Flow Area (sq ft)	27.08	101.35	
E.G. Slope (ft/ft)	0.012378	Area (sq ft)	27.08	101.35	
Q Total (cfs)	1322.00	Flow (cfs)	143.51	1178.49	
Top Width (ft)	33.45	Top Width (ft)	8.06	25.39	
Vel Total (ft/s)	10.29	Avg. Vel. (ft/s)	5.30	11.63	
Max Chl Dpth (ft)	4.09	Hydr. Depth (ft)	3.36	3.99	
Conv. Total (cfs)	11882.3	Conv. (cfs)	1289.9	10592.4	
Length Wtd. (ft)	312.90	Wetted Per. (ft)	10.96	28.66	
Min Ch El (ft)	2272.33	Shear (lb/sq ft)	1.91	2.73	
Alpha	1.17	Stream Power (lb/ft s)	10.12	31.78	
Frctn Loss (ft)	3.53	Cum Volume (acre-ft)	2.58	18.68	3.70
C & E Loss (ft)	0.04	Cum SA (acres)	1.06	7.85	1.71

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 cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant

method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2277.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.34	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2276.02	Reach Len. (ft)	331.81	311.94	290.99
Crit W.S. (ft)	2276.02	Flow Area (sq ft)	49.35	91.22	10.96
E.G. Slope (ft/ft)	0.009293	Area (sq ft)	49.35	91.22	10.96
Q Total (cfs)	1124.00	Flow (cfs)	166.27	925.10	32.63
Top Width (ft)	65.02	Top Width (ft)	31.58	25.39	8.05
Vel Total (ft/s)	7.42	Avg. Vel. (ft/s)	3.37	10.14	2.98
Max Chl Dpth (ft)	3.69	Hydr. Depth (ft)	1.56	3.59	1.36
Conv. Total (cfs)	11659.7	Conv. (cfs)	1724.8	9596.4	338.5
Length Wtd. (ft)	313.02	Wetted Per. (ft)	31.79	25.54	8.49
Min Ch El (ft)	2272.33	Shear (lb/sq ft)	0.90	2.07	0.75
Alpha	1.57	Stream Power (lb/ft s)	3.03	21.01	2.23
Frctn Loss (ft)	3.13	Cum Volume (acre-ft)	10.03	14.99	9.11
C & E Loss (ft)	0.03	Cum SA (acres)	6.67	7.84	7.15

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2276.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.10	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2275.09	Reach Len. (ft)	331.81	311.94	290.99
Crit W.S. (ft)	2275.09	Flow Area (sq ft)	24.95	67.58	4.74
E.G. Slope (ft/ft)	0.010731	Area (sq ft)	24.95	67.58	4.74
Q Total (cfs)	690.00	Flow (cfs)	75.58	602.94	11.48
Top Width (ft)	51.52	Top Width (ft)	20.83	25.39	5.30
Vel Total (ft/s)	7.09	Avg. Vel. (ft/s)	3.03	8.92	2.42
Max Chl Dpth (ft)	2.76	Hydr. Depth (ft)	1.20	2.66	0.90
Conv. Total (cfs)	6660.8	Conv. (cfs)	729.6	5820.4	110.8
Length Wtd. (ft)	312.92	Wetted Per. (ft)	20.99	25.54	5.59
Min Ch El (ft)	2272.33	Shear (lb/sq ft)	0.80	1.77	0.57
Alpha	1.40	Stream Power (lb/ft s)	2.41	15.81	1.38
Frctn Loss (ft)	3.50	Cum Volume (acre-ft)	6.57	11.59	5.53
C & E Loss (ft)	0.05	Cum SA (acres)	5.44	7.80	5.36

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.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.320

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2273.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.35	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2271.73	Reach Len. (ft)	329.37	310.98	280.86
Crit W.S. (ft)	2271.73	Flow Area (sq ft)	26.15	109.56	31.65
E.G. Slope (ft/ft)	0.010335	Area (sq ft)	26.15	109.56	31.65
Q Total (cfs)	1322.00	Flow (cfs)	103.25	1103.19	115.56
Top Width (ft)	66.86	Top Width (ft)	13.94	33.56	19.35
Vel Total (ft/s)	7.90	Avg. Vel. (ft/s)	3.95	10.07	3.65
Max Chl Dpth (ft)	3.50	Hydr. Depth (ft)	1.88	3.26	1.64
Conv. Total (cfs)	13003.8	Conv. (cfs)	1015.6	10851.5	1136.7
Length Wtd. (ft)	310.23	Wetted Per. (ft)	14.39	33.58	19.57
Min Ch El (ft)	2268.23	Shear (lb/sq ft)	1.17	2.11	1.04
Alpha	1.39	Stream Power (lb/ft s)	4.63	21.20	3.81
Frctn Loss (ft)	3.10	Cum Volume (acre-ft)	11.22	15.52	10.42
C & E Loss (ft)	0.03	Cum SA (acres)	6.94	7.64	7.36

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.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2273.86	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.78	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2272.08	Reach Len. (ft)	329.37	310.98	280.86
Crit W.S. (ft)	2272.08	Flow Area (sq ft)	0.40	121.28	5.18
E.G. Slope (ft/ft)	0.010338	Area (sq ft)	0.40	121.28	5.18
Q Total (cfs)	1322.00	Flow (cfs)	0.24	1307.04	14.72
Top Width (ft)	35.39	Top Width (ft)	0.11	33.56	1.72
Vel Total (ft/s)	10.42	Avg. Vel. (ft/s)	0.60	10.78	2.84
Max Chl Dpth (ft)	3.85	Hydr. Depth (ft)	3.65	3.61	3.01
Conv. Total (cfs)	13002.3	Conv. (cfs)	2.4	12855.2	144.8
Length Wtd. (ft)	310.63	Wetted Per. (ft)	3.76	33.58	4.67
Min Ch El (ft)	2268.23	Shear (lb/sq ft)	0.07	2.33	0.72
Alpha	1.06	Stream Power (lb/ft s)	0.04	25.12	2.03
Frctn Loss (ft)	3.05	Cum Volume (acre-ft)	2.48	17.88	3.68
C & E Loss (ft)	0.06	Cum SA (acres)	1.03	7.64	1.70

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 cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant
method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2272.66	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.25	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2271.42	Reach Len. (ft)	329.37	310.98	280.86
Crit W.S. (ft)	2271.42	Flow Area (sq ft)	21.96	99.04	25.82
E.G. Slope (ft/ft)	0.010768	Area (sq ft)	21.96	99.04	25.82
Q Total (cfs)	1124.00	Flow (cfs)	83.43	951.81	88.76
Top Width (ft)	64.21	Top Width (ft)	12.80	33.56	17.85
Vel Total (ft/s)	7.66	Avg. Vel. (ft/s)	3.80	9.61	3.44
Max Chl Dpth (ft)	3.19	Hydr. Depth (ft)	1.72	2.95	1.45
Conv. Total (cfs)	10831.5	Conv. (cfs)	803.9	9172.2	855.3
Length Wtd. (ft)	310.40	Wetted Per. (ft)	13.20	33.58	18.03
Min Ch El (ft)	2268.23	Shear (lb/sq ft)	1.12	1.98	0.96
Alpha	1.37	Stream Power (lb/ft s)	4.25	19.06	3.31
Frctn Loss (ft)	3.20	Cum Volume (acre-ft)	9.76	14.31	8.99
C & E Loss (ft)	0.02	Cum SA (acres)	6.50	7.63	7.06

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2271.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.94	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2270.67	Reach Len. (ft)	329.37	310.98	280.86
Crit W.S. (ft)	2270.67	Flow Area (sq ft)	13.39	73.88	13.80
E.G. Slope (ft/ft)	0.011652	Area (sq ft)	13.39	73.88	13.80
Q Total (cfs)	690.00	Flow (cfs)	44.69	607.48	37.83
Top Width (ft)	57.86	Top Width (ft)	10.07	33.56	14.24
Vel Total (ft/s)	6.83	Avg. Vel. (ft/s)	3.34	8.22	2.74
Max Chl Dpth (ft)	2.44	Hydr. Depth (ft)	1.33	2.20	0.97
Conv. Total (cfs)	6392.2	Conv. (cfs)	414.0	5627.7	350.5
Length Wtd. (ft)	310.84	Wetted Per. (ft)	10.37	33.58	14.34
Min Ch El (ft)	2268.23	Shear (lb/sq ft)	0.94	1.60	0.70
Alpha	1.30	Stream Power (lb/ft s)	3.14	13.16	1.92
Frctn Loss (ft)	3.65	Cum Volume (acre-ft)	6.43	11.08	5.47
C & E Loss (ft)	0.02	Cum SA (acres)	5.32	7.58	5.30

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.261

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2268.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.62	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2266.54	Reach Len. (ft)	300.38	305.66	292.49
Crit W.S. (ft)	2266.54	Flow Area (sq ft)	9.12	120.77	13.11
E.G. Slope (ft/ft)	0.009684	Area (sq ft)	9.12	120.77	13.11
Q Total (cfs)	1322.00	Flow (cfs)	29.74	1260.57	31.69
Top Width (ft)	52.56	Top Width (ft)	5.39	32.98	14.19
Vel Total (ft/s)	9.24	Avg. Vel. (ft/s)	3.26	10.44	2.42
Max Chl Dpth (ft)	4.30	Hydr. Depth (ft)	1.69	3.66	0.92
Conv. Total (cfs)	13434.2	Conv. (cfs)	302.2	12809.9	322.1
Length Wtd. (ft)	305.27	Wetted Per. (ft)	6.36	33.41	14.32
Min Ch El (ft)	2262.24	Shear (lb/sq ft)	0.87	2.19	0.55
Alpha	1.22	Stream Power (lb/ft s)	2.83	22.81	1.34
Frctn Loss (ft)	3.06	Cum Volume (acre-ft)	11.09	14.70	10.27
C & E Loss (ft)	0.07	Cum SA (acres)	6.87	7.40	7.26

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2268.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.58	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2266.57	Reach Len. (ft)	300.38	305.66	292.49
Crit W.S. (ft)	2266.57	Flow Area (sq ft)	8.97	121.85	12.71
E.G. Slope (ft/ft)	0.009351	Area (sq ft)	8.97	121.85	12.71
Q Total (cfs)	1322.00	Flow (cfs)	30.02	1257.07	34.90
Top Width (ft)	48.00	Top Width (ft)	4.42	32.98	10.60
Vel Total (ft/s)	9.21	Avg. Vel. (ft/s)	3.35	10.32	2.75
Max Chl Dpth (ft)	4.33	Hydr. Depth (ft)	2.03	3.69	1.20
Conv. Total (cfs)	13671.2	Conv. (cfs)	310.5	12999.8	360.9
Length Wtd. (ft)	305.43	Wetted Per. (ft)	5.86	33.41	11.18
Min Ch El (ft)	2262.24	Shear (lb/sq ft)	0.89	2.13	0.66
Alpha	1.20	Stream Power (lb/ft s)	2.99	21.97	1.82
Frctn Loss (ft)	3.33	Cum Volume (acre-ft)	2.44	17.01	3.63
C & E Loss (ft)	0.01	Cum SA (acres)	1.02	7.40	1.66

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 cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2267.66	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.46	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2266.20	Reach Len. (ft)	300.38	305.66	292.49
Crit W.S. (ft)	2266.20	Flow Area (sq ft)	7.37	109.52	8.79
E.G. Slope (ft/ft)	0.009891	Area (sq ft)	7.37	109.52	8.79
Q Total (cfs)	1124.00	Flow (cfs)	22.64	1082.28	19.08
Top Width (ft)	49.20	Top Width (ft)	4.84	32.98	11.38
Vel Total (ft/s)	8.94	Avg. Vel. (ft/s)	3.07	9.88	2.17
Max Chl Dpth (ft)	3.95	Hydr. Depth (ft)	1.52	3.32	0.77
Conv. Total (cfs)	11302.0	Conv. (cfs)	227.7	10882.6	191.8
Length Wtd. (ft)	305.35	Wetted Per. (ft)	5.72	33.41	11.48
Min Ch El (ft)	2262.24	Shear (lb/sq ft)	0.80	2.02	0.47
Alpha	1.18	Stream Power (lb/ft s)	2.44	20.00	1.03
Frctn Loss (ft)	3.18	Cum Volume (acre-ft)	9.65	13.57	8.88
C & E Loss (ft)	0.05	Cum SA (acres)	6.44	7.39	6.97

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2266.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.15	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2265.25	Reach Len. (ft)	300.38	305.66	292.49
Crit W.S. (ft)	2265.25	Flow Area (sq ft)	3.52	78.50	1.26
E.G. Slope (ft/ft)	0.011818	Area (sq ft)	3.52	78.50	1.26
Q Total (cfs)	690.00	Flow (cfs)	9.24	679.20	1.56
Top Width (ft)	40.69	Top Width (ft)	3.35	32.98	4.37
Vel Total (ft/s)	8.28	Avg. Vel. (ft/s)	2.62	8.65	1.23
Max Chl Dpth (ft)	3.01	Hydr. Depth (ft)	1.05	2.38	0.29
Conv. Total (cfs)	6347.1	Conv. (cfs)	85.0	6247.8	14.3
Length Wtd. (ft)	305.53	Wetted Per. (ft)	3.95	33.41	4.41
Min Ch El (ft)	2262.24	Shear (lb/sq ft)	0.66	1.73	0.21
Alpha	1.08	Stream Power (lb/ft s)	1.72	15.00	0.26
Frctn Loss (ft)	3.69	Cum Volume (acre-ft)	6.36	10.54	5.42
C & E Loss (ft)	0.06	Cum SA (acres)	5.27	7.35	5.24

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.203

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2261.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.40	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2260.19	Reach Len. (ft)	410.17	450.67	490.30
Crit W.S. (ft)	2260.19	Flow Area (sq ft)	9.63	131.52	7.90
E.G. Slope (ft/ft)	0.010397	Area (sq ft)	9.63	131.52	7.90
Q Total (cfs)	1322.00	Flow (cfs)	26.75	1271.30	23.95
Top Width (ft)	57.59	Top Width (ft)	8.75	42.93	5.91
Vel Total (ft/s)	8.87	Avg. Vel. (ft/s)	2.78	9.67	3.03
Max Chl Dpth (ft)	3.48	Hydr. Depth (ft)	1.10	3.06	1.34
Conv. Total (cfs)	12965.0	Conv. (cfs)	262.4	12467.8	234.9
Length Wtd. (ft)	450.51	Wetted Per. (ft)	9.02	43.06	6.49
Min Ch El (ft)	2256.71	Shear (lb/sq ft)	0.69	1.98	0.79
Alpha	1.15	Stream Power (lb/ft s)	1.92	19.17	2.40
Frctn Loss (ft)	4.69	Cum Volume (acre-ft)	11.02	13.81	10.20
C & E Loss (ft)	0.02	Cum SA (acres)	6.82	7.14	7.19

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2261.76	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.56	Wt. n-Val.		0.033	
W.S. Elev (ft)	2260.20	Reach Len. (ft)	410.17	450.67	490.30
Crit W.S. (ft)	2260.20	Flow Area (sq ft)		131.96	
E.G. Slope (ft/ft)	0.012836	Area (sq ft)		131.96	
Q Total (cfs)	1322.00	Flow (cfs)		1322.00	
Top Width (ft)	42.93	Top Width (ft)		42.93	
Vel Total (ft/s)	10.02	Avg. Vel. (ft/s)		10.02	
Max Chl Dpth (ft)	3.49	Hydr. Depth (ft)		3.07	
Conv. Total (cfs)	11668.6	Conv. (cfs)		11668.6	
Length Wtd. (ft)	450.56	Wetted Per. (ft)		47.95	
Min Ch El (ft)	2256.71	Shear (lb/sq ft)		2.21	
Alpha	1.00	Stream Power (lb/ft s)		22.09	
Frctn Loss (ft)	5.08	Cum Volume (acre-ft)	2.41	16.12	3.58
C & E Loss (ft)	0.00	Cum SA (acres)	1.00	7.14	1.63

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 OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2261.16	Element	Left OB	Channel	Right OB

Vel Head (ft)	1.28	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2259.88	Reach Len. (ft)	410.17	450.67	490.30
Crit W.S. (ft)	2259.88	Flow Area (sq ft)	7.07	117.93	6.14
E.G. Slope (ft/ft)	0.010959	Area (sq ft)	7.07	117.93	6.14
Q Total (cfs)	1124.00	Flow (cfs)	18.22	1088.22	17.57
Top Width (ft)	55.61	Top Width (ft)	7.46	42.93	5.21
Vel Total (ft/s)	8.57	Avg. Vel. (ft/s)	2.58	9.23	2.86
Max Chl Dpth (ft)	3.17	Hydr. Depth (ft)	0.95	2.75	1.18
Conv. Total (cfs)	10736.7	Conv. (cfs)	174.0	10394.9	167.8
Length Wtd. (ft)	450.55	Wetted Per. (ft)	7.70	43.06	5.72
Min Ch El (ft)	2256.71	Shear (lb/sq ft)	0.63	1.87	0.73
Alpha	1.13	Stream Power (lb/ft s)	1.62	17.29	2.10
Frctn Loss (ft)	4.92	Cum Volume (acre-ft)	9.60	12.77	8.83
C & E Loss (ft)	0.02	Cum SA (acres)	6.39	7.12	6.91

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2260.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.96	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2259.13	Reach Len. (ft)	410.17	450.67	490.30
Crit W.S. (ft)	2259.13	Flow Area (sq ft)	2.59	85.64	2.85
E.G. Slope (ft/ft)	0.012367	Area (sq ft)	2.59	85.64	2.85
Q Total (cfs)	690.00	Flow (cfs)	5.10	678.20	6.69
Top Width (ft)	50.96	Top Width (ft)	4.48	42.93	3.55
Vel Total (ft/s)	7.58	Avg. Vel. (ft/s)	1.97	7.92	2.35
Max Chl Dpth (ft)	2.41	Hydr. Depth (ft)	0.58	1.99	0.80
Conv. Total (cfs)	6204.5	Conv. (cfs)	45.9	6098.4	60.2
Length Wtd. (ft)	450.66	Wetted Per. (ft)	4.62	43.06	3.89
Min Ch El (ft)	2256.71	Shear (lb/sq ft)	0.43	1.54	0.56
Alpha	1.08	Stream Power (lb/ft s)	0.85	12.16	1.33
Frctn Loss (ft)	5.58	Cum Volume (acre-ft)	6.34	9.96	5.41
C & E Loss (ft)	0.01	Cum SA (acres)	5.24	7.08	5.21

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.118

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2255.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.60	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2253.45	Reach Len. (ft)	474.96	473.09	470.63
Crit W.S. (ft)	2253.45	Flow Area (sq ft)	5.18	127.37	3.20
E.G. Slope (ft/ft)	0.010402	Area (sq ft)	5.18	127.37	3.20
Q Total (cfs)	1322.00	Flow (cfs)	13.78	1301.64	6.58
Top Width (ft)	46.93	Top Width (ft)	4.69	37.77	4.47
Vel Total (ft/s)	9.74	Avg. Vel. (ft/s)	2.66	10.22	2.06
Max Chl Dpth (ft)	3.82	Hydr. Depth (ft)	1.11	3.37	0.72
Conv. Total (cfs)	12961.9	Conv. (cfs)	135.1	12762.3	64.5
Length Wtd. (ft)	472.71	Wetted Per. (ft)	5.18	38.37	4.70
Min Ch El (ft)	2249.63	Shear (lb/sq ft)	0.65	2.16	0.44
Alpha	1.09	Stream Power (lb/ft s)	1.73	22.03	0.91
Frctn Loss (ft)	5.40	Cum Volume (acre-ft)	10.95	12.48	10.14
C & E Loss (ft)	0.06	Cum SA (acres)	6.75	6.72	7.13

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2255.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.56	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2253.49	Reach Len. (ft)	474.96	473.09	470.63
Crit W.S. (ft)	2253.49	Flow Area (sq ft)	5.36	128.90	3.26
E.G. Slope (ft/ft)	0.009978	Area (sq ft)	5.36	128.90	3.26

Q Total (cfs)	1322.00	Flow (cfs)	14.39	1300.43	7.18
Top Width (ft)	46.00	Top Width (ft)	4.51	37.77	3.72
Vel Total (ft/s)	9.61	Avg. Vel. (ft/s)	2.69	10.09	2.20
Max Chl Dpth (ft)	3.86	Hydr. Depth (ft)	1.19	3.41	0.88
Conv. Total (cfs)	13234.9	Conv. (cfs)	144.1	13018.9	71.9
Length Wtd. (ft)	472.92	Wetted Per. (ft)	5.11	38.37	4.19
Min Ch El (ft)	2249.63	Shear (lb/sq ft)	0.65	2.09	0.48
Alpha	1.08	Stream Power (lb/ft s)	1.75	21.11	1.07
Frctn Loss (ft)	5.57	Cum Volume (acre-ft)	2.38	14.77	3.56
C & E Loss (ft)	0.06	Cum SA (acres)	0.98	6.72	1.61

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2254.56	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.45	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2253.11	Reach Len. (ft)	474.96	473.09	470.63
Crit W.S. (ft)	2253.11	Flow Area (sq ft)	3.69	114.34	1.84
E.G. Slope (ft/ft)	0.010875	Area (sq ft)	3.69	114.34	1.84
Q Total (cfs)	1124.00	Flow (cfs)	8.96	1111.82	3.23
Top Width (ft)	45.12	Top Width (ft)	3.96	37.77	3.39
Vel Total (ft/s)	9.38	Avg. Vel. (ft/s)	2.43	9.72	1.75
Max Chl Dpth (ft)	3.48	Hydr. Depth (ft)	0.93	3.03	0.54
Conv. Total (cfs)	10778.3	Conv. (cfs)	85.9	10661.5	30.9
Length Wtd. (ft)	472.72	Wetted Per. (ft)	4.37	38.37	3.56
Min Ch El (ft)	2249.63	Shear (lb/sq ft)	0.57	2.02	0.35
Alpha	1.06	Stream Power (lb/ft s)	1.39	19.67	0.61
Frctn Loss (ft)	5.54	Cum Volume (acre-ft)	9.55	11.57	8.78
C & E Loss (ft)	0.06	Cum SA (acres)	6.34	6.71	6.86

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 OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2253.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.08	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2252.26	Reach Len. (ft)	474.96	473.09	470.63
Crit W.S. (ft)	2252.26	Flow Area (sq ft)	1.11	82.45	0.09
E.G. Slope (ft/ft)	0.012389	Area (sq ft)	1.11	82.45	0.09
Q Total (cfs)	690.00	Flow (cfs)	1.92	688.02	0.06
Top Width (ft)	40.69	Top Width (ft)	2.17	37.77	0.75
Vel Total (ft/s)	8.25	Avg. Vel. (ft/s)	1.73	8.35	0.68
Max Chl Dpth (ft)	2.63	Hydr. Depth (ft)	0.51	2.18	0.12
Conv. Total (cfs)	6199.2	Conv. (cfs)	17.2	6181.4	0.6
Length Wtd. (ft)	472.74	Wetted Per. (ft)	2.39	38.37	0.79
Min Ch El (ft)	2249.63	Shear (lb/sq ft)	0.36	1.66	0.09
Alpha	1.02	Stream Power (lb/ft s)	0.62	13.87	0.06
Frctn Loss (ft)	6.07	Cum Volume (acre-ft)	6.32	9.09	5.39
C & E Loss (ft)	0.04	Cum SA (acres)	5.21	6.66	5.18

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.028

CROSS SECTION OUTPUT Profile #FLOODPLAIN

			Left OB	Channel	Right OB
E.G. Elev (ft)	2246.62	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.41	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2245.22	Reach Len. (ft)	543.25	516.73	445.55
Crit W.S. (ft)	2245.22	Flow Area (sq ft)	14.25	70.07	85.30

E.G. Slope (ft/ft)	0.012621	Area (sq ft)	14.25	70.07	85.30	
Q Total (cfs)	1322.00	Flow (cfs)	59.42	802.50	460.08	
Top Width (ft)	61.67	Top Width (ft)	7.50	20.55	33.62	
Vel Total (ft/s)	7.79	Avg. Vel. (ft/s)	4.17	11.45	5.39	
Max Chl Dpth (ft)	3.80	Hydr. Depth (ft)	1.90	3.41	2.54	
Conv. Total (cfs)	11767.4	Conv. (cfs)	528.9	7143.2	4095.2	
Length Wtd. (ft)	500.85	Wetted Per. (ft)	8.39	20.57	34.13	
Min Ch El (ft)	2241.42	Shear (lb/sq ft)	1.34	2.68	1.97	
Alpha	1.49	Stream Power (lb/ft s)	5.58	30.74	10.62	
Frctn Loss (ft)	4.48	Cum Volume (acre-ft)	10.85	11.40	9.66	
C & E Loss (ft)	0.10	Cum SA (acres)	6.69	6.40	6.92	

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2248.37	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.16	Wt. n-Val.		0.033	0.057
W.S. Elev (ft)	2246.21	Reach Len. (ft)	543.25	516.73	445.55
Crit W.S. (ft)	2246.21	Flow Area (sq ft)		90.41	31.96
E.G. Slope (ft/ft)	0.014138	Area (sq ft)		90.41	31.96
Q Total (cfs)	1322.00	Flow (cfs)		1130.69	191.31
Top Width (ft)	28.53	Top Width (ft)		20.55	7.98
Vel Total (ft/s)	10.80	Avg. Vel. (ft/s)		12.51	5.99
Max Chl Dpth (ft)	4.79	Hydr. Depth (ft)		4.40	4.00
Conv. Total (cfs)	11118.4	Conv. (cfs)		9509.5	1609.0
Length Wtd. (ft)	511.58	Wetted Per. (ft)		25.33	11.91
Min Ch El (ft)	2241.42	Shear (lb/sq ft)		3.15	2.37
Alpha	1.19	Stream Power (lb/ft s)		39.40	14.18
Frctn Loss (ft)	6.22	Cum Volume (acre-ft)	2.36	13.58	3.37
C & E Loss (ft)	0.08	Cum SA (acres)	0.95	6.40	1.54

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 cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2246.19	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.27	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2244.93	Reach Len. (ft)	543.25	516.73	445.55
Crit W.S. (ft)	2244.93	Flow Area (sq ft)	12.15	64.07	75.59
E.G. Slope (ft/ft)	0.012682	Area (sq ft)	12.15	64.07	75.59
Q Total (cfs)	1124.00	Flow (cfs)	48.14	693.03	382.84
Top Width (ft)	60.39	Top Width (ft)	6.93	20.55	32.92
Vel Total (ft/s)	7.40	Avg. Vel. (ft/s)	3.96	10.82	5.06
Max Chl Dpth (ft)	3.51	Hydr. Depth (ft)	1.75	3.12	2.30
Conv. Total (cfs)	9980.9	Conv. (cfs)	427.4	6153.9	3399.5
Length Wtd. (ft)	501.83	Wetted Per. (ft)	7.75	20.57	33.36
Min Ch El (ft)	2241.42	Shear (lb/sq ft)	1.24	2.47	1.79
Alpha	1.49	Stream Power (lb/ft s)	4.92	26.68	9.09
Frctn Loss (ft)	4.76	Cum Volume (acre-ft)	9.46	10.60	8.37
C & E Loss (ft)	0.05	Cum SA (acres)	6.28	6.39	6.67

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2245.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.95	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2244.17	Reach Len. (ft)	543.25	516.73	445.55
Crit W.S. (ft)	2244.17	Flow Area (sq ft)	7.50	48.62	51.53
E.G. Slope (ft/ft)	0.013319	Area (sq ft)	7.50	48.62	51.53
Q Total (cfs)	690.00	Flow (cfs)	25.92	448.37	215.71
Top Width (ft)	57.09	Top Width (ft)	5.45	20.55	31.09
Vel Total (ft/s)	6.41	Avg. Vel. (ft/s)	3.46	9.22	4.19
Max Chl Dpth (ft)	2.75	Hydr. Depth (ft)	1.38	2.37	1.66
Conv. Total (cfs)	5978.8	Conv. (cfs)	224.6	3885.1	1869.1
Length Wtd. (ft)	504.24	Wetted Per. (ft)	6.09	20.57	31.39

Min Ch El (ft)	2241.42	Shear (lb/sq ft)	1.02	1.97	1.36
Alpha	1.49	Stream Power (lb/ft s)	3.54	18.13	5.71
Frctn Loss (ft)	5.40	Cum Volume (acre-ft)	6.28	8.38	5.11
C & E Loss (ft)	0.01	Cum SA (acres)	5.17	6.35	5.01

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.930

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2240.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.07	Wt. n-Val.	0.060	0.033	0.057
W.S. Elev (ft)	2239.02	Reach Len. (ft)	314.10	334.19	353.01
Crit W.S. (ft)	2239.02	Flow Area (sq ft)	51.87	100.96	76.14
E.G. Slope (ft/ft)	0.006680	Area (sq ft)	51.87	100.96	76.14
Q Total (cfs)	1322.00	Flow (cfs)	148.31	966.46	207.23
Top Width (ft)	107.09	Top Width (ft)	30.57	23.93	52.59
Vel Total (ft/s)	5.77	Avg. Vel. (ft/s)	2.86	9.57	2.72
Max Chl Dpth (ft)	4.45	Hydr. Depth (ft)	1.70	4.22	1.45
Conv. Total (cfs)	16174.9	Conv. (cfs)	1814.6	11824.8	2535.5
Length Wtd. (ft)	332.37	Wetted Per. (ft)	30.89	24.07	52.73
Min Ch El (ft)	2234.57	Shear (lb/sq ft)	0.70	1.75	0.60
Alpha	2.07	Stream Power (lb/ft s)	2.00	16.75	1.64
Frctn Loss (ft)	2.47	Cum Volume (acre-ft)	10.43	10.39	8.84
C & E Loss (ft)	0.00	Cum SA (acres)	6.45	6.14	6.48

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2241.70	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.88	Wt. n-Val.		0.033	
W.S. Elev (ft)	2239.83	Reach Len. (ft)	314.10	334.19	353.01
Crit W.S. (ft)	2239.36	Flow Area (sq ft)		120.29	
E.G. Slope (ft/ft)	0.010576	Area (sq ft)		120.29	
Q Total (cfs)	1322.00	Flow (cfs)		1322.00	
Top Width (ft)	23.93	Top Width (ft)		23.93	
Vel Total (ft/s)	10.99	Avg. Vel. (ft/s)		10.99	
Max Chl Dpth (ft)	5.26	Hydr. Depth (ft)		5.03	
Conv. Total (cfs)	12855.1	Conv. (cfs)		12855.1	
Length Wtd. (ft)	334.06	Wetted Per. (ft)		32.90	
Min Ch El (ft)	2234.57	Shear (lb/sq ft)		2.41	
Alpha	1.00	Stream Power (lb/ft s)		26.53	
Frctn Loss (ft)	3.83	Cum Volume (acre-ft)	2.36	12.33	3.21
C & E Loss (ft)	0.06	Cum SA (acres)	0.95	6.14	1.50

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The cross section had to be extended vertically during the critical depth 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: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2239.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.10	Wt. n-Val.	0.060	0.033	0.057
W.S. Elev (ft)	2238.65	Reach Len. (ft)	314.10	334.19	353.01
Crit W.S. (ft)	2238.65	Flow Area (sq ft)	40.80	92.08	57.36
E.G. Slope (ft/ft)	0.007358	Area (sq ft)	40.80	92.08	57.36
Q Total (cfs)	1124.00	Flow (cfs)	107.97	870.02	146.01
Top Width (ft)	100.11	Top Width (ft)	29.07	23.93	47.11
Vel Total (ft/s)	5.91	Avg. Vel. (ft/s)	2.65	9.45	2.55
Max Chl Dpth (ft)	4.08	Hydr. Depth (ft)	1.40	3.85	1.22
Conv. Total (cfs)	13103.6	Conv. (cfs)	1258.7	10142.7	1702.1
Length Wtd. (ft)	332.51	Wetted Per. (ft)	29.35	24.07	47.23
Min Ch El (ft)	2234.57	Shear (lb/sq ft)	0.64	1.76	0.56
Alpha	2.02	Stream Power (lb/ft s)	1.69	16.60	1.42
Frctn Loss (ft)	2.54	Cum Volume (acre-ft)	9.13	9.67	7.69
C & E Loss (ft)	0.03	Cum SA (acres)	6.06	6.12	6.26

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2238.74	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.01	Wt. n-Val.	0.060	0.033	0.057	
W.S. Elev (ft)	2237.73	Reach Len. (ft)	314.10	334.19	353.01	
Crit W.S. (ft)	2237.73	Flow Area (sq ft)	17.52	70.02	22.99	
E.G. Slope (ft/ft)	0.008791	Area (sq ft)	17.52	70.02	22.99	
Q Total (cfs)	690.00	Flow (cfs)	37.55	602.37	50.09	
Top Width (ft)	70.71	Top Width (ft)	19.55	23.93	27.23	
Vel Total (ft/s)	6.24	Avg. Vel. (ft/s)	2.14	8.60	2.18	
Max Chl Dpth (ft)	3.15	Hydr. Depth (ft)	0.90	2.93	0.84	
Conv. Total (cfs)	7359.4	Conv. (cfs)	400.5	6424.7	534.2	
Length Wtd. (ft)	333.30	Wetted Per. (ft)	19.77	24.07	27.33	
Min Ch El (ft)	2234.57	Shear (lb/sq ft)	0.49	1.60	0.46	
Alpha	1.67	Stream Power (lb/ft s)	1.04	13.73	1.01	
Frctn Loss (ft)	2.68	Cum Volume (acre-ft)	6.12	7.68	4.73	
C & E Loss (ft)	0.07	Cum SA (acres)	5.01	6.08	4.71	

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.867

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2235.48	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.08	Wt. n-Val.	0.062	0.033	0.057	
W.S. Elev (ft)	2234.40	Reach Len. (ft)	187.09	193.59	197.38	
Crit W.S. (ft)	2234.40	Flow Area (sq ft)	120.19	82.70	26.01	
E.G. Slope (ft/ft)	0.008304	Area (sq ft)	120.19	82.70	26.01	
Q Total (cfs)	1322.00	Flow (cfs)	380.20	841.14	100.66	
Top Width (ft)	101.59	Top Width (ft)	68.65	21.17	11.77	
Vel Total (ft/s)	5.78	Avg. Vel. (ft/s)	3.16	10.17	3.87	
Max Chl Dpth (ft)	4.01	Hydr. Depth (ft)	1.75	3.91	2.21	
Conv. Total (cfs)	14507.5	Conv. (cfs)	4172.3	9230.6	1104.6	
Length Wtd. (ft)	192.35	Wetted Per. (ft)	68.95	21.19	12.51	
Min Ch El (ft)	2230.40	Shear (lb/sq ft)	0.90	2.02	1.08	
Alpha	2.09	Stream Power (lb/ft s)	2.86	20.58	4.17	
Frctn Loss (ft)	1.59	Cum Volume (acre-ft)	9.81	9.68	8.42	
C & E Loss (ft)	0.00	Cum SA (acres)	6.09	5.97	6.22	

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2237.82	Element	Left OB	Channel	Right OB	
Vel Head (ft)	2.43	Wt. n-Val.	0.062	0.033		
W.S. Elev (ft)	2235.39	Reach Len. (ft)	187.09	193.59	197.38	
Crit W.S. (ft)	2235.39	Flow Area (sq ft)	6.20	103.64		
E.G. Slope (ft/ft)	0.012476	Area (sq ft)	6.20	103.64		
Q Total (cfs)	1322.00	Flow (cfs)	17.38	1304.62		
Top Width (ft)	22.56	Top Width (ft)	1.39	21.17		
Vel Total (ft/s)	12.04	Avg. Vel. (ft/s)	2.80	12.59		
Max Chl Dpth (ft)	4.99	Hydr. Depth (ft)	4.46	4.90		
Conv. Total (cfs)	11835.7	Conv. (cfs)	155.6	11680.1		
Length Wtd. (ft)	193.55	Wetted Per. (ft)	5.80	26.17		
Min Ch El (ft)	2230.40	Shear (lb/sq ft)	0.83	3.08		
Alpha	1.08	Stream Power (lb/ft s)	2.34	38.82		
Frctn Loss (ft)	2.39	Cum Volume (acre-ft)	2.33	11.47	3.21	
C & E Loss (ft)	0.19	Cum SA (acres)	0.95	5.97	1.50	

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

Warning: The cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant

method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2235.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.98	Wt. n-Val.	0.062	0.033	0.057
W.S. Elev (ft)	2234.16	Reach Len. (ft)	187.09	193.59	197.38
Crit W.S. (ft)	2234.16	Flow Area (sq ft)	104.32	77.78	23.34
E.G. Slope (ft/ft)	0.007943	Area (sq ft)	104.32	77.78	23.34
Q Total (cfs)	1124.00	Flow (cfs)	296.07	742.72	85.21
Top Width (ft)	100.19	Top Width (ft)	67.86	21.17	11.16
Vel Total (ft/s)	5.47	Avg. Vel. (ft/s)	2.84	9.55	3.65
Max Chl Dpth (ft)	3.77	Hydr. Depth (ft)	1.54	3.67	2.09
Conv. Total (cfs)	12611.6	Conv. (cfs)	3322.0	8333.6	956.0
Length Wtd. (ft)	192.49	Wetted Per. (ft)	68.12	21.19	11.85
Min Ch El (ft)	2230.40	Shear (lb/sq ft)	0.76	1.82	0.98
Alpha	2.12	Stream Power (lb/ft s)	2.16	17.38	3.56
Frctn Loss (ft)	1.56	Cum Volume (acre-ft)	8.61	9.02	7.36
C & E Loss (ft)	0.00	Cum SA (acres)	5.71	5.95	6.02

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2234.30	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.78	Wt. n-Val.	0.062	0.033	0.057
W.S. Elev (ft)	2233.52	Reach Len. (ft)	187.09	193.59	197.38
Crit W.S. (ft)	2233.52	Flow Area (sq ft)	61.14	64.08	16.67
E.G. Slope (ft/ft)	0.007368	Area (sq ft)	61.14	64.08	16.67
Q Total (cfs)	690.00	Flow (cfs)	119.73	517.95	52.32
Top Width (ft)	96.29	Top Width (ft)	65.65	21.17	9.46
Vel Total (ft/s)	4.86	Avg. Vel. (ft/s)	1.96	8.08	3.14
Max Chl Dpth (ft)	3.13	Hydr. Depth (ft)	0.93	3.03	1.76
Conv. Total (cfs)	8038.6	Conv. (cfs)	1394.8	6034.2	609.5
Length Wtd. (ft)	193.00	Wetted Per. (ft)	65.82	21.19	10.03
Min Ch El (ft)	2230.40	Shear (lb/sq ft)	0.43	1.39	0.76
Alpha	2.13	Stream Power (lb/ft s)	0.84	11.24	2.40
Frctn Loss (ft)	1.51	Cum Volume (acre-ft)	5.84	7.16	4.57
C & E Loss (ft)	0.00	Cum SA (acres)	4.71	5.91	4.57

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.830

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2232.65	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.07	Wt. n-Val.	0.062	0.033	0.057
W.S. Elev (ft)	2231.58	Reach Len. (ft)	273.57	276.78	275.85
Crit W.S. (ft)	2231.58	Flow Area (sq ft)	92.41	136.03	17.79
E.G. Slope (ft/ft)	0.008232	Area (sq ft)	92.41	136.03	17.79
Q Total (cfs)	1542.00	Flow (cfs)	251.02	1245.42	45.56
Top Width (ft)	121.97	Top Width (ft)	66.02	40.33	15.62
Vel Total (ft/s)	6.26	Avg. Vel. (ft/s)	2.72	9.16	2.56
Max Chl Dpth (ft)	4.05	Hydr. Depth (ft)	1.40	3.37	1.14
Conv. Total (cfs)	16995.3	Conv. (cfs)	2766.7	13726.5	502.2
Length Wtd. (ft)	276.19	Wetted Per. (ft)	66.18	40.55	15.79
Min Ch El (ft)	2227.53	Shear (lb/sq ft)	0.72	1.72	0.58
Alpha	1.76	Stream Power (lb/ft s)	1.95	15.78	1.48
Frctn Loss (ft)	2.65	Cum Volume (acre-ft)	9.36	9.20	8.32
C & E Loss (ft)	0.02	Cum SA (acres)	5.80	5.83	6.16

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2233.55	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.79	Wt. n-Val.		0.033		
W.S. Elev (ft)	2231.77	Reach Len. (ft)	273.57	276.78	275.85	
Crit W.S. (ft)	2231.77	Flow Area (sq ft)		143.71		
E.G. Slope (ft/ft)	0.012218	Area (sq ft)		143.71		
Q Total (cfs)	1542.00	Flow (cfs)		1542.00		
Top Width (ft)	40.33	Top Width (ft)		40.33		
Vel Total (ft/s)	10.73	Avg. Vel. (ft/s)		10.73		
Max Chl Dpth (ft)	4.24	Hydr. Depth (ft)		3.56		
Conv. Total (cfs)	13950.4	Conv. (cfs)		13950.4		
Length Wtd. (ft)	276.73	Wetted Per. (ft)		45.40		
Min Ch El (ft)	2227.53	Shear (lb/sq ft)		2.41		
Alpha	1.00	Stream Power (lb/ft s)		25.90		
Frctn Loss (ft)	2.86	Cum Volume (acre-ft)	2.32	10.92	3.21	
C & E Loss (ft)	0.14	Cum SA (acres)	0.95	5.83	1.50	

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 OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2232.33	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.99	Wt. n-Val.	0.062	0.033	0.057	
W.S. Elev (ft)	2231.33	Reach Len. (ft)	273.57	276.78	275.85	
Crit W.S. (ft)	2231.33	Flow Area (sq ft)	76.50	126.24	14.20	
E.G. Slope (ft/ft)	0.008201	Area (sq ft)	76.50	126.24	14.20	
Q Total (cfs)	1316.00	Flow (cfs)	184.85	1097.48	33.66	
Top Width (ft)	119.27	Top Width (ft)	64.98	40.33	13.96	
Vel Total (ft/s)	6.07	Avg. Vel. (ft/s)	2.42	8.69	2.37	
Max Chl Dpth (ft)	3.80	Hydr. Depth (ft)	1.18	3.13	1.02	
Conv. Total (cfs)	14531.7	Conv. (cfs)	2041.2	12118.8	371.7	
Length Wtd. (ft)	276.24	Wetted Per. (ft)	65.11	40.55	14.10	
Min Ch El (ft)	2227.53	Shear (lb/sq ft)	0.60	1.59	0.52	
Alpha	1.74	Stream Power (lb/ft s)	1.45	13.86	1.22	
Frctn Loss (ft)	2.62	Cum Volume (acre-ft)	8.22	8.57	7.27	
C & E Loss (ft)	0.03	Cum SA (acres)	5.42	5.81	5.97	

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2231.52	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.81	Wt. n-Val.	0.062	0.033	0.057	
W.S. Elev (ft)	2230.72	Reach Len. (ft)	273.57	276.78	275.85	
Crit W.S. (ft)	2230.72	Flow Area (sq ft)	37.16	101.32	6.88	
E.G. Slope (ft/ft)	0.008209	Area (sq ft)	37.16	101.32	6.88	
Q Total (cfs)	831.00	Flow (cfs)	57.12	761.06	12.82	
Top Width (ft)	112.38	Top Width (ft)	62.34	40.33	9.72	
Vel Total (ft/s)	5.72	Avg. Vel. (ft/s)	1.54	7.51	1.86	
Max Chl Dpth (ft)	3.19	Hydr. Depth (ft)	0.60	2.51	0.71	
Conv. Total (cfs)	9171.9	Conv. (cfs)	630.4	8400.0	141.5	
Length Wtd. (ft)	276.40	Wetted Per. (ft)	62.40	40.55	9.82	
Min Ch El (ft)	2227.53	Shear (lb/sq ft)	0.31	1.28	0.36	
Alpha	1.59	Stream Power (lb/ft s)	0.47	9.62	0.67	
Frctn Loss (ft)	2.61	Cum Volume (acre-ft)	5.63	6.80	4.52	
C & E Loss (ft)	0.04	Cum SA (acres)	4.43	5.77	4.52	

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.778

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2229.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.00	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2228.12	Reach Len. (ft)	234.89	236.05	238.39
Crit W.S. (ft)	2228.05	Flow Area (sq ft)	62.80	106.21	81.80
E.G. Slope (ft/ft)	0.011361	Area (sq ft)	62.80	106.21	81.80
Q Total (cfs)	1542.00	Flow (cfs)	216.00	1014.12	311.88
Top Width (ft)	134.13	Top Width (ft)	45.52	37.85	50.77
Vel Total (ft/s)	6.15	Avg. Vel. (ft/s)	3.44	9.55	3.81
Max Chl Dpth (ft)	2.89	Hydr. Depth (ft)	1.38	2.81	1.61
Conv. Total (cfs)	14466.8	Conv. (cfs)	2026.5	9514.3	2926.0
Length Wtd. (ft)	236.76	Wetted Per. (ft)	45.59	37.85	50.89
Min Ch El (ft)	2225.23	Shear (lb/sq ft)	0.98	1.99	1.14
Alpha	1.71	Stream Power (lb/ft s)	3.36	19.00	4.35
Frctn Loss (ft)	2.61	Cum Volume (acre-ft)	8.87	8.43	8.01
C & E Loss (ft)	0.04	Cum SA (acres)	5.45	5.58	5.95

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

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2230.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.33	Wt. n-Val.		0.033	0.057
W.S. Elev (ft)	2229.08	Reach Len. (ft)	234.89	236.05	238.39
Crit W.S. (ft)		Flow Area (sq ft)		142.87	34.66
E.G. Slope (ft/ft)	0.008831	Area (sq ft)		142.87	34.66
Q Total (cfs)	1542.00	Flow (cfs)		1379.97	162.03
Top Width (ft)	47.52	Top Width (ft)		37.85	9.67
Vel Total (ft/s)	8.69	Avg. Vel. (ft/s)		9.66	4.67
Max Chl Dpth (ft)	3.85	Hydr. Depth (ft)		3.77	3.58
Conv. Total (cfs)	16408.9	Conv. (cfs)		14684.7	1724.2
Length Wtd. (ft)	236.46	Wetted Per. (ft)		41.43	13.15
Min Ch El (ft)	2225.23	Shear (lb/sq ft)		1.90	1.45
Alpha	1.14	Stream Power (lb/ft s)		18.36	6.79
Frctn Loss (ft)	2.30	Cum Volume (acre-ft)	2.32	10.01	3.10
C & E Loss (ft)	0.02	Cum SA (acres)	0.95	5.58	1.47

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

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2228.80	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.90	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2227.90	Reach Len. (ft)	234.89	236.05	238.39
Crit W.S. (ft)	2227.81	Flow Area (sq ft)	53.52	98.20	71.55
E.G. Slope (ft/ft)	0.011117	Area (sq ft)	53.52	98.20	71.55
Q Total (cfs)	1316.00	Flow (cfs)	172.52	880.26	263.22
Top Width (ft)	126.02	Top Width (ft)	42.08	37.85	46.09
Vel Total (ft/s)	5.89	Avg. Vel. (ft/s)	3.22	8.96	3.68
Max Chl Dpth (ft)	2.67	Hydr. Depth (ft)	1.27	2.59	1.55
Conv. Total (cfs)	12481.2	Conv. (cfs)	1636.2	8348.6	2496.4
Length Wtd. (ft)	236.73	Wetted Per. (ft)	42.15	37.85	46.20
Min Ch El (ft)	2225.23	Shear (lb/sq ft)	0.88	1.80	1.07
Alpha	1.66	Stream Power (lb/ft s)	2.84	16.14	3.95
Frctn Loss (ft)	2.56	Cum Volume (acre-ft)	7.81	7.85	7.00
C & E Loss (ft)	0.03	Cum SA (acres)	5.08	5.57	5.78

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

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2228.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.66	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2227.34	Reach Len. (ft)	234.89	236.05	238.39
Crit W.S. (ft)		Flow Area (sq ft)	32.25	76.72	48.82
E.G. Slope (ft/ft)	0.010975	Area (sq ft)	32.25	76.72	48.82
Q Total (cfs)	831.00	Flow (cfs)	86.90	579.58	164.52
Top Width (ft)	106.24	Top Width (ft)	32.87	37.85	35.53
Vel Total (ft/s)	5.27	Avg. Vel. (ft/s)	2.69	7.55	3.37
Max Chl Dpth (ft)	2.11	Hydr. Depth (ft)	0.98	2.03	1.37
Conv. Total (cfs)	7932.1	Conv. (cfs)	829.4	5532.3	1570.4
Length Wtd. (ft)	236.67	Wetted Per. (ft)	32.92	37.85	35.62
Min Ch El (ft)	2225.23	Shear (lb/sq ft)	0.67	1.39	0.94
Alpha	1.54	Stream Power (lb/ft s)	1.81	10.49	3.16
Frctn Loss (ft)	2.40	Cum Volume (acre-ft)	5.41	6.23	4.34
C & E Loss (ft)	0.02	Cum SA (acres)	4.13	5.52	4.38

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.733

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2226.47	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.85	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2225.61	Reach Len. (ft)	273.11	276.32	285.93
Crit W.S. (ft)	2225.61	Flow Area (sq ft)	8.89	80.26	192.88
E.G. Slope (ft/ft)	0.010691	Area (sq ft)	8.89	80.26	192.88
Q Total (cfs)	1542.00	Flow (cfs)	24.52	780.85	736.62
Top Width (ft)	148.12	Top Width (ft)	8.30	25.99	113.83
Vel Total (ft/s)	5.47	Avg. Vel. (ft/s)	2.76	9.73	3.82
Max Chl Dpth (ft)	3.77	Hydr. Depth (ft)	1.07	3.09	1.69
Conv. Total (cfs)	14913.6	Conv. (cfs)	237.2	7552.1	7124.3
Length Wtd. (ft)	279.85	Wetted Per. (ft)	8.58	26.56	114.37
Min Ch El (ft)	2221.84	Shear (lb/sq ft)	0.69	2.02	1.13
Alpha	1.84	Stream Power (lb/ft s)	1.91	19.62	4.30
Frctn Loss (ft)	2.39	Cum Volume (acre-ft)	8.68	7.92	7.26
C & E Loss (ft)	0.03	Cum SA (acres)	5.31	5.41	5.50

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2228.10	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.49	Wt. n-Val.		0.033	0.057
W.S. Elev (ft)	2226.61	Reach Len. (ft)	273.11	276.32	285.93
Crit W.S. (ft)	2226.61	Flow Area (sq ft)		106.30	80.59
E.G. Slope (ft/ft)	0.010786	Area (sq ft)		106.30	80.59
Q Total (cfs)	1542.00	Flow (cfs)		1162.98	379.02
Top Width (ft)	58.98	Top Width (ft)		25.99	32.99
Vel Total (ft/s)	8.25	Avg. Vel. (ft/s)		10.94	4.70
Max Chl Dpth (ft)	4.77	Hydr. Depth (ft)		4.09	2.44
Conv. Total (cfs)	14847.7	Conv. (cfs)		11198.2	3649.5
Length Wtd. (ft)	278.19	Wetted Per. (ft)		29.71	35.20
Min Ch El (ft)	2221.84	Shear (lb/sq ft)		2.41	1.54
Alpha	1.41	Stream Power (lb/ft s)		26.36	7.25
Frctn Loss (ft)	2.99	Cum Volume (acre-ft)	2.32	9.34	2.79
C & E Loss (ft)	0.06	Cum SA (acres)	0.95	5.41	1.36

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2226.21	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.79	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2225.42	Reach Len. (ft)	273.11	276.32	285.93
Crit W.S. (ft)	2225.42	Flow Area (sq ft)	7.36	75.27	171.10
E.G. Slope (ft/ft)	0.010522	Area (sq ft)	7.36	75.27	171.10
Q Total (cfs)	1316.00	Flow (cfs)	18.94	696.12	600.94
Top Width (ft)	146.71	Top Width (ft)	7.56	25.99	113.16
Vel Total (ft/s)	5.19	Avg. Vel. (ft/s)	2.57	9.25	3.51
Max Chl Dpth (ft)	3.58	Hydr. Depth (ft)	0.97	2.90	1.51
Conv. Total (cfs)	12829.2	Conv. (cfs)	184.6	6786.2	5858.4
Length Wtd. (ft)	279.76	Wetted Per. (ft)	7.81	26.56	113.67
Min Ch El (ft)	2221.84	Shear (lb/sq ft)	0.62	1.86	0.99
Alpha	1.89	Stream Power (lb/ft s)	1.59	17.21	3.47
Frctn Loss (ft)	2.59	Cum Volume (acre-ft)	7.65	7.38	6.34
C & E Loss (ft)	0.00	Cum SA (acres)	4.95	5.39	5.34

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2225.59	Element		Left OB	Channel	Right OB
Vel Head (ft)	0.61	Wt. n-Val.		0.057	0.033	0.057
W.S. Elev (ft)	2224.98	Reach Len. (ft)		273.11	276.32	285.93
Crit W.S. (ft)	2224.98	Flow Area (sq ft)		4.40	63.78	121.41
E.G. Slope (ft/ft)	0.009380	Area (sq ft)		4.40	63.78	121.41
Q Total (cfs)	831.00	Flow (cfs)		9.00	498.68	323.32
Top Width (ft)	143.46	Top Width (ft)		5.84	25.99	111.63
Vel Total (ft/s)	4.38	Avg. Vel. (ft/s)		2.05	7.82	2.66
Max Chl Dpth (ft)	3.14	Hydr. Depth (ft)		0.75	2.45	1.09
Conv. Total (cfs)	8580.1	Conv. (cfs)		92.9	5148.9	3338.3
Length Wtd. (ft)	279.22	Wetted Per. (ft)		6.03	26.56	112.08
Min Ch El (ft)	2221.84	Shear (lb/sq ft)		0.43	1.41	0.63
Alpha	2.06	Stream Power (lb/ft s)		0.87	10.99	1.69
Frctn Loss (ft)	2.58	Cum Volume (acre-ft)		5.31	5.85	3.88
C & E Loss (ft)	0.01	Cum SA (acres)		4.03	5.35	3.98

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.681

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2222.38	Element		Left OB	Channel	Right OB
Vel Head (ft)	0.75	Wt. n-Val.		0.057	0.033	0.057
W.S. Elev (ft)	2221.62	Reach Len. (ft)		336.96	333.04	319.82
Crit W.S. (ft)	2221.62	Flow Area (sq ft)		108.53	93.69	133.96
E.G. Slope (ft/ft)	0.006996	Area (sq ft)		108.53	93.69	133.96
Q Total (cfs)	1542.00	Flow (cfs)		220.89	841.55	479.56
Top Width (ft)	208.41	Top Width (ft)		120.18	25.42	62.80
Vel Total (ft/s)	4.59	Avg. Vel. (ft/s)		2.04	8.98	3.58
Max Chl Dpth (ft)	3.76	Hydr. Depth (ft)		0.90	3.69	2.13
Conv. Total (cfs)	18435.2	Conv. (cfs)		2640.9	10061.1	5733.3
Length Wtd. (ft)	328.94	Wetted Per. (ft)		120.34	25.44	63.68
Min Ch El (ft)	2217.86	Shear (lb/sq ft)		0.39	1.61	0.92
Alpha	2.31	Stream Power (lb/ft s)		0.80	14.45	3.29
Frctn Loss (ft)	2.76	Cum Volume (acre-ft)		8.31	7.37	6.18
C & E Loss (ft)	0.04	Cum SA (acres)		4.91	5.24	4.92

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2224.23	Element		Left OB	Channel	Right OB
Vel Head (ft)	2.05	Wt. n-Val.		0.057	0.033	0.057
W.S. Elev (ft)	2222.19	Reach Len. (ft)		336.96	333.04	319.82
Crit W.S. (ft)	2222.19	Flow Area (sq ft)		1.49	108.04	40.94
E.G. Slope (ft/ft)	0.010696	Area (sq ft)		1.49	108.04	40.94
Q Total (cfs)	1542.00	Flow (cfs)		1.99	1319.43	220.58
Top Width (ft)	37.20	Top Width (ft)		0.38	25.42	11.40
Vel Total (ft/s)	10.25	Avg. Vel. (ft/s)		1.33	12.21	5.39
Max Chl Dpth (ft)	4.33	Hydr. Depth (ft)		3.93	4.25	3.59
Conv. Total (cfs)	14910.1	Conv. (cfs)		19.2	12758.0	2132.9
Length Wtd. (ft)	331.75	Wetted Per. (ft)		4.29	25.44	14.49
Min Ch El (ft)	2217.86	Shear (lb/sq ft)		0.23	2.84	1.89
Alpha	1.25	Stream Power (lb/ft s)		0.31	34.63	10.16
Frctn Loss (ft)	3.77	Cum Volume (acre-ft)		2.31	8.66	2.39
C & E Loss (ft)	0.02	Cum SA (acres)		0.94	5.24	1.21

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 cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2222.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.83	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2221.29	Reach Len. (ft)	336.96	333.04	319.82
Crit W.S. (ft)	2221.29	Flow Area (sq ft)	70.65	85.14	113.00
E.G. Slope (ft/ft)	0.008221	Area (sq ft)	70.65	85.14	113.00
Q Total (cfs)	1316.00	Flow (cfs)	142.22	777.74	396.04
Top Width (ft)	183.24	Top Width (ft)	96.05	25.42	61.77
Vel Total (ft/s)	4.90	Avg. Vel. (ft/s)	2.01	9.13	3.50
Max Chl Dpth (ft)	3.43	Hydr. Depth (ft)	0.74	3.35	1.83
Conv. Total (cfs)	14514.1	Conv. (cfs)	1568.5	8577.6	4367.9
Length Wtd. (ft)	329.05	Wetted Per. (ft)	96.18	25.44	62.59
Min Ch El (ft)	2217.86	Shear (lb/sq ft)	0.38	1.72	0.93
Alpha	2.23	Stream Power (lb/ft s)	0.76	15.69	3.25
Frctn Loss (ft)	3.00	Cum Volume (acre-ft)	7.40	6.87	5.41
C & E Loss (ft)	0.02	Cum SA (acres)	4.63	5.23	4.77

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: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2221.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.75	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2220.61	Reach Len. (ft)	336.96	333.04	319.82
Crit W.S. (ft)	2220.61	Flow Area (sq ft)	28.12	67.94	72.08
E.G. Slope (ft/ft)	0.009092	Area (sq ft)	28.12	67.94	72.08
Q Total (cfs)	831.00	Flow (cfs)	65.98	561.47	203.55
Top Width (ft)	114.77	Top Width (ft)	30.57	25.42	58.78
Vel Total (ft/s)	4.94	Avg. Vel. (ft/s)	2.35	8.26	2.82
Max Chl Dpth (ft)	2.75	Hydr. Depth (ft)	0.92	2.67	1.23
Conv. Total (cfs)	8714.9	Conv. (cfs)	691.9	5888.3	2134.7
Length Wtd. (ft)	329.73	Wetted Per. (ft)	30.68	25.44	59.52
Min Ch El (ft)	2217.86	Shear (lb/sq ft)	0.52	1.52	0.69
Alpha	1.99	Stream Power (lb/ft s)	1.22	12.53	1.94
Frctn Loss (ft)	3.04	Cum Volume (acre-ft)	5.21	5.43	3.24
C & E Loss (ft)	0.00	Cum SA (acres)	3.92	5.19	3.42

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.618

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2217.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.15	Wt. n-Val.	0.060	0.033	0.060
W.S. Elev (ft)	2216.77	Reach Len. (ft)	355.44	357.61	360.99
Crit W.S. (ft)	2216.77	Flow Area (sq ft)	9.99	92.46	136.95
E.G. Slope (ft/ft)	0.010260	Area (sq ft)	9.99	92.46	136.95
Q Total (cfs)	1542.00	Flow (cfs)	27.07	964.63	550.31
Top Width (ft)	102.41	Top Width (ft)	8.55	26.47	67.38
Vel Total (ft/s)	6.44	Avg. Vel. (ft/s)	2.71	10.43	4.02
Max Chl Dpth (ft)	3.87	Hydr. Depth (ft)	1.17	3.49	2.03
Conv. Total (cfs)	15223.4	Conv. (cfs)	267.2	9523.3	5432.9
Length Wtd. (ft)	358.18	Wetted Per. (ft)	8.91	26.72	67.54
Min Ch El (ft)	2212.90	Shear (lb/sq ft)	0.72	2.22	1.30
Alpha	1.78	Stream Power (lb/ft s)	1.95	23.12	5.22
Frctn Loss (ft)	3.87	Cum Volume (acre-ft)	7.85	6.66	5.19
C & E Loss (ft)	0.10	Cum SA (acres)	4.41	5.05	4.44

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2220.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.25	Wt. n-Val.		0.033	0.060

W.S. Elev (ft)	2217.76	Reach Len. (ft)	355.44	357.61	360.99	
Crit W.S. (ft)	2217.76	Flow Area (sq ft)		118.64	17.87	
E.G. Slope (ft/ft)	0.012073	Area (sq ft)		118.64	17.87	
Q Total (cfs)	1542.00	Flow (cfs)		1461.84	80.16	
Top Width (ft)	31.00	Top Width (ft)		26.47	4.53	
Vel Total (ft/s)	11.30	Avg. Vel. (ft/s)		12.32	4.48	
Max Chl Dpth (ft)	4.86	Hydr. Depth (ft)		4.48	3.95	
Conv. Total (cfs)	14033.9	Conv. (cfs)		13304.4	729.5	
Length Wtd. (ft)	357.90	Wetted Per. (ft)		30.19	8.45	
Min Ch El (ft)	2212.90	Shear (lb/sq ft)		2.96	1.59	
Alpha	1.14	Stream Power (lb/ft s)		36.50	7.15	
Frctn Loss (ft)	3.84	Cum Volume (acre-ft)	2.31	7.79	2.17	
C & E Loss (ft)	0.27	Cum SA (acres)	0.94	5.05	1.15	

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2217.57	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.05	Wt. n-Val.	0.060	0.033	0.060
W.S. Elev (ft)	2216.52	Reach Len. (ft)	355.44	357.61	360.99
Crit W.S. (ft)	2216.52	Flow Area (sq ft)	8.01	85.95	120.50
E.G. Slope (ft/ft)	0.010143	Area (sq ft)	8.01	85.95	120.50
Q Total (cfs)	1316.00	Flow (cfs)	20.07	849.27	446.67
Top Width (ft)	100.48	Top Width (ft)	7.62	26.47	66.38
Vel Total (ft/s)	6.14	Avg. Vel. (ft/s)	2.51	9.88	3.71
Max Chl Dpth (ft)	3.62	Hydr. Depth (ft)	1.05	3.25	1.82
Conv. Total (cfs)	13066.8	Conv. (cfs)	199.2	8432.5	4435.0
Length Wtd. (ft)	358.14	Wetted Per. (ft)	7.95	26.72	66.51
Min Ch El (ft)	2212.90	Shear (lb/sq ft)	0.64	2.04	1.15
Alpha	1.80	Stream Power (lb/ft s)	1.60	20.12	4.25
Frctn Loss (ft)	3.82	Cum Volume (acre-ft)	7.10	6.22	4.55
C & E Loss (ft)	0.09	Cum SA (acres)	4.23	5.03	4.29

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2216.74	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.80	Wt. n-Val.	0.060	0.033	0.060
W.S. Elev (ft)	2215.94	Reach Len. (ft)	355.44	357.61	360.99
Crit W.S. (ft)	2215.94	Flow Area (sq ft)	4.23	70.66	82.83
E.G. Slope (ft/ft)	0.009329	Area (sq ft)	4.23	70.66	82.83
Q Total (cfs)	831.00	Flow (cfs)	8.32	587.59	235.10
Top Width (ft)	95.94	Top Width (ft)	5.44	26.47	64.03
Vel Total (ft/s)	5.27	Avg. Vel. (ft/s)	1.96	8.32	2.84
Max Chl Dpth (ft)	3.04	Hydr. Depth (ft)	0.78	2.67	1.29
Conv. Total (cfs)	8603.8	Conv. (cfs)	86.1	6083.6	2434.1
Length Wtd. (ft)	358.02	Wetted Per. (ft)	5.69	26.72	64.09
Min Ch El (ft)	2212.90	Shear (lb/sq ft)	0.43	1.54	0.75
Alpha	1.85	Stream Power (lb/ft s)	0.85	12.81	2.14
Frctn Loss (ft)	3.52	Cum Volume (acre-ft)	5.08	4.90	2.67
C & E Loss (ft)	0.06	Cum SA (acres)	3.78	4.99	2.97

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.550

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2212.49	Element	Left OB	Channel	Right OB

Vel Head (ft)	0.81	Wt. n-Val.	0.060	0.033	0.060
W.S. Elev (ft)	2211.69	Reach Len. (ft)	329.03	380.95	410.03
Crit W.S. (ft)	2211.69	Flow Area (sq ft)	140.45	63.76	101.87
E.G. Slope (ft/ft)	0.011378	Area (sq ft)	140.45	63.76	101.87
Q Total (cfs)	1542.00	Flow (cfs)	552.63	650.79	338.57
Top Width (ft)	169.64	Top Width (ft)	76.99	20.54	72.11
Vel Total (ft/s)	5.04	Avg. Vel. (ft/s)	3.93	10.21	3.32
Max Chl Dpth (ft)	3.25	Hydr. Depth (ft)	1.82	3.10	1.41
Conv. Total (cfs)	14456.2	Conv. (cfs)	5180.9	6101.1	3174.1
Length Wtd. (ft)		Wetted Per. (ft)	77.26	20.58	72.18
Min Ch El (ft)	2208.44	Shear (lb/sq ft)	1.29	2.20	1.00
Alpha	2.05	Stream Power (lb/ft s)	5.08	22.47	3.33
Frctn Loss (ft)		Cum Volume (acre-ft)	7.24	6.02	4.20
C & E Loss (ft)		Cum SA (acres)	4.06	4.85	3.86

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.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2214.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.35	Wt. n-Val.	0.060	0.033	0.060
W.S. Elev (ft)	2212.68	Reach Len. (ft)	329.03	380.95	410.03
Crit W.S. (ft)	2212.41	Flow Area (sq ft)	54.36	84.17	69.55
E.G. Slope (ft/ft)	0.009598	Area (sq ft)	54.36	84.17	69.55
Q Total (cfs)	1542.00	Flow (cfs)	247.74	949.75	344.51
Top Width (ft)	60.00	Top Width (ft)	18.53	20.54	20.93
Vel Total (ft/s)	7.41	Avg. Vel. (ft/s)	4.56	11.28	4.95
Max Chl Dpth (ft)	4.24	Hydr. Depth (ft)	2.93	4.10	3.32
Conv. Total (cfs)	15739.7	Conv. (cfs)	2528.8	9694.4	3516.5
Length Wtd. (ft)	369.92	Wetted Per. (ft)	21.12	20.58	23.84
Min Ch El (ft)	2208.44	Shear (lb/sq ft)	1.54	2.45	1.75
Alpha	1.59	Stream Power (lb/ft s)	7.03	27.66	8.66
Frctn Loss (ft)	4.26	Cum Volume (acre-ft)	2.09	6.96	1.81
C & E Loss (ft)	0.01	Cum SA (acres)	0.87	4.85	1.05

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

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2212.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.75	Wt. n-Val.	0.060	0.033	0.060
W.S. Elev (ft)	2211.50	Reach Len. (ft)	329.03	380.95	410.03
Crit W.S. (ft)	2211.50	Flow Area (sq ft)	125.87	59.84	88.39
E.G. Slope (ft/ft)	0.011243	Area (sq ft)	125.87	59.84	88.39
Q Total (cfs)	1316.00	Flow (cfs)	461.32	582.15	272.54
Top Width (ft)	166.04	Top Width (ft)	76.09	20.54	69.41
Vel Total (ft/s)	4.80	Avg. Vel. (ft/s)	3.66	9.73	3.08
Max Chl Dpth (ft)	3.05	Hydr. Depth (ft)	1.65	2.91	1.27
Conv. Total (cfs)	12411.0	Conv. (cfs)	4350.6	5490.1	2570.3
Length Wtd. (ft)		Wetted Per. (ft)	76.34	20.58	69.47
Min Ch El (ft)	2208.44	Shear (lb/sq ft)	1.16	2.04	0.89
Alpha	2.11	Stream Power (lb/ft s)	4.24	19.86	2.75
Frctn Loss (ft)		Cum Volume (acre-ft)	6.55	5.62	3.68
C & E Loss (ft)		Cum SA (acres)	3.88	4.84	3.73

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.

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2211.64	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.60	Wt. n-Val.	0.060	0.033	0.060
W.S. Elev (ft)	2211.04	Reach Len. (ft)	329.03	380.95	410.03
Crit W.S. (ft)	2211.04	Flow Area (sq ft)	91.57	50.45	58.61
E.G. Slope (ft/ft)	0.010364	Area (sq ft)	91.57	50.45	58.61
Q Total (cfs)	831.00	Flow (cfs)	265.75	420.50	144.75
Top Width (ft)	154.89	Top Width (ft)	73.94	20.54	60.41
Vel Total (ft/s)	4.14	Avg. Vel. (ft/s)	2.90	8.33	2.47
Max Chl Dpth (ft)	2.60	Hydr. Depth (ft)	1.24	2.46	0.97
Conv. Total (cfs)	8162.8	Conv. (cfs)	2610.4	4130.5	1421.9
Length Wtd. (ft)		Wetted Per. (ft)	74.14	20.58	60.46
Min Ch El (ft)	2208.44	Shear (lb/sq ft)	0.80	1.59	0.63
Alpha	2.27	Stream Power (lb/ft s)	2.32	13.22	1.55
Frctn Loss (ft)		Cum Volume (acre-ft)	4.69	4.41	2.09
C & E Loss (ft)		Cum SA (acres)	3.45	4.80	2.45

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.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.478

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2208.04	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.60	Wt. n-Val.	0.062	0.033	0.062
W.S. Elev (ft)	2207.45	Reach Len. (ft)	332.97	334.12	313.99
Crit W.S. (ft)	2207.21	Flow Area (sq ft)	262.71	61.71	5.74
E.G. Slope (ft/ft)	0.010344	Area (sq ft)	262.71	61.71	5.74
Q Total (cfs)	1542.00	Flow (cfs)	967.50	559.60	14.90
Top Width (ft)	167.87	Top Width (ft)	141.17	22.12	4.58
Vel Total (ft/s)	4.67	Avg. Vel. (ft/s)	3.68	9.07	2.60
Max Chl Dpth (ft)	3.32	Hydr. Depth (ft)	1.86	2.79	1.25
Conv. Total (cfs)	15161.5	Conv. (cfs)	9512.7	5502.2	146.5
Length Wtd. (ft)	328.88	Wetted Per. (ft)	141.46	22.15	5.22
Min Ch El (ft)	2204.39	Shear (lb/sq ft)	1.20	1.80	0.71
Alpha	1.76	Stream Power (lb/ft s)	4.42	16.31	1.84
Frctn Loss (ft)	4.06	Cum Volume (acre-ft)	5.71	5.47	3.69
C & E Loss (ft)	0.00	Cum SA (acres)	3.24	4.67	3.50

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

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2209.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.44	Wt. n-Val.	0.062	0.033	
W.S. Elev (ft)	2208.34	Reach Len. (ft)	332.97	334.12	313.99
Crit W.S. (ft)	2208.34	Flow Area (sq ft)	112.95	81.41	
E.G. Slope (ft/ft)	0.014072	Area (sq ft)	112.95	81.41	
Q Total (cfs)	1542.00	Flow (cfs)	600.31	941.69	
Top Width (ft)	63.90	Top Width (ft)	41.78	22.12	
Vel Total (ft/s)	7.93	Avg. Vel. (ft/s)	5.31	11.57	
Max Chl Dpth (ft)	3.95	Hydr. Depth (ft)	2.70	3.68	
Conv. Total (cfs)	12999.0	Conv. (cfs)	5060.6	7938.4	
Length Wtd. (ft)	331.55	Wetted Per. (ft)	44.19	25.55	
Min Ch El (ft)	2204.39	Shear (lb/sq ft)	2.25	2.80	
Alpha	1.47	Stream Power (lb/ft s)	11.93	32.38	
Frctn Loss (ft)	3.65	Cum Volume (acre-ft)	1.46	6.24	1.48
C & E Loss (ft)	0.20	Cum SA (acres)	0.64	4.67	0.95

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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 OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2207.80	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.55	Wt. n-Val.	0.062	0.033	0.062
W.S. Elev (ft)	2207.25	Reach Len. (ft)	332.97	334.12	313.99
Crit W.S. (ft)	2207.04	Flow Area (sq ft)	235.72	57.46	4.89
E.G. Slope (ft/ft)	0.010246	Area (sq ft)	235.72	57.46	4.89
Q Total (cfs)	1316.00	Flow (cfs)	809.50	494.51	11.99
Top Width (ft)	166.04	Top Width (ft)	139.69	22.12	4.23
Vel Total (ft/s)	4.41	Avg. Vel. (ft/s)	3.43	8.61	2.45
Max Chl Dpth (ft)	3.13	Hydr. Depth (ft)	1.69	2.60	1.16
Conv. Total (cfs)	13000.8	Conv. (cfs)	7997.1	4885.3	118.4
Length Wtd. (ft)	328.94	Wetted Per. (ft)	139.97	22.15	4.82
Min Ch El (ft)	2204.39	Shear (lb/sq ft)	1.08	1.66	0.65
Alpha	1.80	Stream Power (lb/ft s)	3.70	14.28	1.59
Frctn Loss (ft)	4.01	Cum Volume (acre-ft)	5.19	5.11	3.24
C & E Loss (ft)	0.00	Cum SA (acres)	3.07	4.65	3.39

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

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2207.21	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.43	Wt. n-Val.	0.062	0.033	0.062
W.S. Elev (ft)	2206.77	Reach Len. (ft)	332.97	334.12	313.99
Crit W.S. (ft)		Flow Area (sq ft)	169.83	46.89	3.08
E.G. Slope (ft/ft)	0.010125	Area (sq ft)	169.83	46.89	3.08
Q Total (cfs)	831.00	Flow (cfs)	474.32	350.25	6.43
Top Width (ft)	161.49	Top Width (ft)	136.01	22.12	3.36
Vel Total (ft/s)	3.78	Avg. Vel. (ft/s)	2.79	7.47	2.09
Max Chl Dpth (ft)	2.65	Hydr. Depth (ft)	1.25	2.12	0.92
Conv. Total (cfs)	8258.7	Conv. (cfs)	4713.9	3480.9	63.9
Length Wtd. (ft)	329.23	Wetted Per. (ft)	136.26	22.15	3.83
Min Ch El (ft)	2204.39	Shear (lb/sq ft)	0.79	1.34	0.51
Alpha	1.96	Stream Power (lb/ft s)	2.20	9.99	1.06
Frctn Loss (ft)	3.92	Cum Volume (acre-ft)	3.70	3.98	1.80
C & E Loss (ft)	0.00	Cum SA (acres)	2.66	4.61	2.15

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.415

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2203.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.64	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2203.33	Reach Len. (ft)	535.06	461.21	370.41
Crit W.S. (ft)	2203.33	Flow Area (sq ft)	60.07	74.17	186.90
E.G. Slope (ft/ft)	0.014970	Area (sq ft)	60.07	74.17	186.90
Q Total (cfs)	1542.00	Flow (cfs)	159.98	658.03	723.99
Top Width (ft)	224.91	Top Width (ft)	69.27	32.68	122.96
Vel Total (ft/s)	4.80	Avg. Vel. (ft/s)	2.66	8.87	3.87
Max Chl Dpth (ft)	3.13	Hydr. Depth (ft)	0.87	2.27	1.52
Conv. Total (cfs)	12602.9	Conv. (cfs)	1307.5	5378.1	5917.2
Length Wtd. (ft)	433.02	Wetted Per. (ft)	69.39	33.23	123.10
Min Ch El (ft)	2200.20	Shear (lb/sq ft)	0.81	2.09	1.42
Alpha	1.79	Stream Power (lb/ft s)	2.15	18.51	5.50
Frctn Loss (ft)	3.85	Cum Volume (acre-ft)	4.48	4.95	3.00
C & E Loss (ft)	0.03	Cum SA (acres)	2.43	4.46	3.04

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

E.G. Elev (ft)	2205.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.78	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2204.32	Reach Len. (ft)	535.06	461.21	370.41
Crit W.S. (ft)		Flow Area (sq ft)	76.94	106.34	100.23
E.G. Slope (ft/ft)	0.008862	Area (sq ft)	76.94	106.34	100.23
Q Total (cfs)	1542.00	Flow (cfs)	275.98	922.90	343.11
Top Width (ft)	120.00	Top Width (ft)	36.49	32.68	50.83
Vel Total (ft/s)	5.44	Avg. Vel. (ft/s)	3.59	8.68	3.42
Max Chl Dpth (ft)	4.12	Hydr. Depth (ft)	2.11	3.25	1.97
Conv. Total (cfs)	16380.5	Conv. (cfs)	2931.7	9803.9	3644.9
Length Wtd. (ft)	455.53	Wetted Per. (ft)	38.38	33.23	53.62
Min Ch El (ft)	2200.20	Shear (lb/sq ft)	1.11	1.77	1.03
Alpha	1.69	Stream Power (lb/ft s)	3.98	15.36	3.54
Frctn Loss (ft)	4.45	Cum Volume (acre-ft)	0.73	5.51	1.12
C & E Loss (ft)	0.14	Cum SA (acres)	0.34	4.46	0.76

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2203.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.59	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2203.19	Reach Len. (ft)	535.06	461.21	370.41
Crit W.S. (ft)	2203.19	Flow Area (sq ft)	50.14	69.47	169.29
E.G. Slope (ft/ft)	0.014732	Area (sq ft)	50.14	69.47	169.29
Q Total (cfs)	1316.00	Flow (cfs)	118.10	585.31	612.59
Top Width (ft)	223.30	Top Width (ft)	68.73	32.68	121.89
Vel Total (ft/s)	4.56	Avg. Vel. (ft/s)	2.36	8.43	3.62
Max Chl Dpth (ft)	2.99	Hydr. Depth (ft)	0.73	2.13	1.39
Conv. Total (cfs)	10842.3	Conv. (cfs)	973.0	4822.3	5047.1
Length Wtd. (ft)	434.44	Wetted Per. (ft)	68.83	33.23	122.02
Min Ch El (ft)	2200.20	Shear (lb/sq ft)	0.67	1.92	1.28
Alpha	1.84	Stream Power (lb/ft s)	1.58	16.20	4.62
Frctn Loss (ft)	3.72	Cum Volume (acre-ft)	4.09	4.62	2.62
C & E Loss (ft)	0.02	Cum SA (acres)	2.27	4.44	2.93

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2203.29	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.48	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2202.82	Reach Len. (ft)	535.06	461.21	370.41
Crit W.S. (ft)	2202.82	Flow Area (sq ft)	25.38	57.38	124.73
E.G. Slope (ft/ft)	0.014195	Area (sq ft)	25.38	57.38	124.73
Q Total (cfs)	831.00	Flow (cfs)	45.96	417.80	367.24
Top Width (ft)	210.71	Top Width (ft)	58.99	32.68	119.04
Vel Total (ft/s)	4.00	Avg. Vel. (ft/s)	1.81	7.28	2.94
Max Chl Dpth (ft)	2.62	Hydr. Depth (ft)	0.43	1.76	1.05
Conv. Total (cfs)	6974.7	Conv. (cfs)	385.7	3506.7	3082.3
Length Wtd. (ft)	440.66	Wetted Per. (ft)	59.05	33.23	119.14
Min Ch El (ft)	2200.20	Shear (lb/sq ft)	0.38	1.53	0.93
Alpha	1.91	Stream Power (lb/ft s)	0.69	11.14	2.73
Frctn Loss (ft)	4.54	Cum Volume (acre-ft)	2.96	3.58	1.34
C & E Loss (ft)	0.05	Cum SA (acres)	1.91	4.40	1.71

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: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.327

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2199.21	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.89	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2198.32	Reach Len. (ft)	224.89	303.29	348.39
Crit W.S. (ft)	2198.32	Flow Area (sq ft)	19.80	120.11	184.34
E.G. Slope (ft/ft)	0.005872	Area (sq ft)	19.80	120.11	184.34
Q Total (cfs)	1542.00	Flow (cfs)	56.81	1075.55	409.63
Top Width (ft)	173.42	Top Width (ft)	9.34	25.89	138.19
Vel Total (ft/s)	4.76	Avg. Vel. (ft/s)	2.87	8.95	2.22
Max Chl Dpth (ft)	5.04	Hydr. Depth (ft)	2.12	4.64	1.33
Conv. Total (cfs)	20122.3	Conv. (cfs)	741.4	14035.4	5345.5
Length Wtd. (ft)	305.92	Wetted Per. (ft)	10.13	26.30	138.50
Min Ch El (ft)	2193.28	Shear (lb/sq ft)	0.72	1.67	0.49
Alpha	2.54	Stream Power (lb/ft s)	2.06	14.99	1.08
Frctn Loss (ft)	2.72	Cum Volume (acre-ft)	3.99	3.92	1.42
C & E Loss (ft)	0.05	Cum SA (acres)	1.95	4.15	1.93

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2200.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.19	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2198.32	Reach Len. (ft)	224.89	303.29	348.39
Crit W.S. (ft)	2198.32	Flow Area (sq ft)	2.30	120.19	19.73
E.G. Slope (ft/ft)	0.010812	Area (sq ft)	2.30	120.19	19.73
Q Total (cfs)	1542.00	Flow (cfs)	3.77	1460.97	77.26
Top Width (ft)	34.00	Top Width (ft)	0.61	25.89	7.50
Vel Total (ft/s)	10.84	Avg. Vel. (ft/s)	1.64	12.16	3.92
Max Chl Dpth (ft)	5.04	Hydr. Depth (ft)	3.76	4.64	2.63
Conv. Total (cfs)	14829.5	Conv. (cfs)	36.2	14050.2	743.0
Length Wtd. (ft)	305.20	Wetted Per. (ft)	4.30	26.30	10.01
Min Ch El (ft)	2193.28	Shear (lb/sq ft)	0.36	3.08	1.33
Alpha	1.20	Stream Power (lb/ft s)	0.59	37.49	5.21
Frctn Loss (ft)	2.46	Cum Volume (acre-ft)	0.24	4.32	0.61
C & E Loss (ft)	0.37	Cum SA (acres)	0.11	4.15	0.52

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2198.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.84	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2198.10	Reach Len. (ft)	224.89	303.29	348.39
Crit W.S. (ft)	2198.10	Flow Area (sq ft)	17.81	114.48	154.31
E.G. Slope (ft/ft)	0.005602	Area (sq ft)	17.81	114.48	154.31
Q Total (cfs)	1316.00	Flow (cfs)	48.02	969.60	298.38
Top Width (ft)	172.41	Top Width (ft)	8.92	25.89	137.60
Vel Total (ft/s)	4.59	Avg. Vel. (ft/s)	2.70	8.47	1.93
Max Chl Dpth (ft)	4.82	Hydr. Depth (ft)	2.00	4.42	1.12
Conv. Total (cfs)	17582.9	Conv. (cfs)	641.6	12954.7	3986.6
Length Wtd. (ft)	305.08	Wetted Per. (ft)	9.66	26.30	137.87
Min Ch El (ft)	2193.28	Shear (lb/sq ft)	0.64	1.52	0.39
Alpha	2.56	Stream Power (lb/ft s)	1.74	12.89	0.76
Frctn Loss (ft)	2.52	Cum Volume (acre-ft)	3.68	3.65	1.24
C & E Loss (ft)	0.03	Cum SA (acres)	1.80	4.13	1.83

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2198.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.98	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2197.08	Reach Len. (ft)	224.89	303.29	348.39
Crit W.S. (ft)	2197.08	Flow Area (sq ft)	9.72	88.07	43.17
E.G. Slope (ft/ft)	0.007819	Area (sq ft)	9.72	88.07	43.17
Q Total (cfs)	831.00	Flow (cfs)	24.63	740.00	66.38
Top Width (ft)	102.60	Top Width (ft)	6.94	25.89	69.77
Vel Total (ft/s)	5.90	Avg. Vel. (ft/s)	2.53	8.40	1.54
Max Chl Dpth (ft)	3.80	Hydr. Depth (ft)	1.40	3.40	0.62
Conv. Total (cfs)	9397.7	Conv. (cfs)	278.5	8368.6	750.6
Length Wtd. (ft)	303.06	Wetted Per. (ft)	7.44	26.30	69.84
Min Ch El (ft)	2193.28	Shear (lb/sq ft)	0.64	1.63	0.30
Alpha	1.82	Stream Power (lb/ft s)	1.62	13.73	0.46
Frctn Loss (ft)	3.13	Cum Volume (acre-ft)	2.74	2.81	0.62
C & E Loss (ft)	0.03	Cum SA (acres)	1.51	4.09	0.91

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.270

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2194.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.42	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2193.00	Reach Len. (ft)	358.86	405.63	416.26
Crit W.S. (ft)	2193.00	Flow Area (sq ft)	42.53	135.93	14.06
E.G. Slope (ft/ft)	0.014948	Area (sq ft)	42.53	135.93	14.06
Q Total (cfs)	1542.00	Flow (cfs)	110.89	1369.58	61.53
Top Width (ft)	111.00	Top Width (ft)	54.34	50.03	6.64
Vel Total (ft/s)	8.01	Avg. Vel. (ft/s)	2.61	10.08	4.38
Max Chl Dpth (ft)	3.53	Hydr. Depth (ft)	0.78	2.72	2.12
Conv. Total (cfs)	12612.1	Conv. (cfs)	907.0	11201.9	503.2
Length Wtd. (ft)	394.39	Wetted Per. (ft)	54.84	50.26	7.71
Min Ch El (ft)	2189.52	Shear (lb/sq ft)	0.72	2.52	1.70
Alpha	1.43	Stream Power (lb/ft s)	1.89	25.43	7.45
Frctn Loss (ft)	3.39	Cum Volume (acre-ft)	3.83	3.03	0.63
C & E Loss (ft)	0.23	Cum SA (acres)	1.78	3.88	1.35

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: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

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

E.G. Elev (ft)	2194.94	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.96	Wt. n-Val.	0.062	0.035	0.062	
W.S. Elev (ft)	2193.98	Reach Len. (ft)	358.86	405.63	416.26	
Crit W.S. (ft)		Flow Area (sq ft)	0.17	185.12	18.06	
E.G. Slope (ft/ft)	0.006253	Area (sq ft)	0.17	185.12	18.06	
Q Total (cfs)	1542.00	Flow (cfs)	0.06	1482.08	59.86	
Top Width (ft)	55.10	Top Width (ft)	0.08	50.03	4.99	
Vel Total (ft/s)	7.58	Avg. Vel. (ft/s)	0.34	8.01	3.31	
Max Chl Dpth (ft)	4.51	Hydr. Depth (ft)	2.18	3.70	3.62	
Conv. Total (cfs)	19500.9	Conv. (cfs)	0.8	18743.1	757.0	
Length Wtd. (ft)	405.11	Wetted Per. (ft)	2.26	50.26	7.81	
Min Ch El (ft)	2189.52	Shear (lb/sq ft)	0.03	1.44	0.90	
Alpha	1.08	Stream Power (lb/ft s)	0.01	11.51	2.99	
Frctn Loss (ft)	3.06	Cum Volume (acre-ft)	0.24	3.25	0.46	
C & E Loss (ft)	0.09	Cum SA (acres)	0.11	3.88	0.47	

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2194.01	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.18	Wt. n-Val.	0.062	0.035	0.062	
W.S. Elev (ft)	2192.83	Reach Len. (ft)	358.86	405.63	416.26	
Crit W.S. (ft)	2192.83	Flow Area (sq ft)	34.86	127.72	12.99	
E.G. Slope (ft/ft)	0.013424	Area (sq ft)	34.86	127.72	12.99	
Q Total (cfs)	1316.00	Flow (cfs)	93.63	1169.92	52.45	
Top Width (ft)	97.72	Top Width (ft)	41.30	50.03	6.39	
Vel Total (ft/s)	7.50	Avg. Vel. (ft/s)	2.69	9.16	4.04	
Max Chl Dpth (ft)	3.36	Hydr. Depth (ft)	0.84	2.55	2.03	
Conv. Total (cfs)	11358.2	Conv. (cfs)	808.1	10097.4	452.7	
Length Wtd. (ft)	394.72	Wetted Per. (ft)	41.77	50.26	7.41	
Min Ch El (ft)	2189.52	Shear (lb/sq ft)	0.70	2.13	1.47	
Alpha	1.35	Stream Power (lb/ft s)	1.88	19.51	5.93	
Frctn Loss (ft)	3.16	Cum Volume (acre-ft)	3.54	2.80	0.57	
C & E Loss (ft)	0.18	Cum SA (acres)	1.67	3.87	1.25	

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: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2193.09	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.89	Wt. n-Val.	0.062	0.035	0.062	
W.S. Elev (ft)	2192.21	Reach Len. (ft)	358.86	405.63	416.26	
Crit W.S. (ft)	2192.21	Flow Area (sq ft)	15.93	96.56	9.30	
E.G. Slope (ft/ft)	0.014316	Area (sq ft)	15.93	96.56	9.30	
Q Total (cfs)	831.00	Flow (cfs)	38.32	758.06	34.63	
Top Width (ft)	77.38	Top Width (ft)	21.89	50.03	5.46	
Vel Total (ft/s)	6.82	Avg. Vel. (ft/s)	2.41	7.85	3.72	
Max Chl Dpth (ft)	2.74	Hydr. Depth (ft)	0.73	1.93	1.70	
Conv. Total (cfs)	6945.3	Conv. (cfs)	320.3	6335.7	289.4	
Length Wtd. (ft)	396.82	Wetted Per. (ft)	22.22	50.26	6.29	
Min Ch El (ft)	2189.52	Shear (lb/sq ft)	0.64	1.72	1.32	
Alpha	1.23	Stream Power (lb/ft s)	1.54	13.48	4.92	
Frctn Loss (ft)	3.49	Cum Volume (acre-ft)	2.68	2.17	0.41	
C & E Loss (ft)	0.11	Cum SA (acres)	1.43	3.83	0.61	

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: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.193

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2189.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.64	Wt. n-Val.	0.062	0.033	0.062
W.S. Elev (ft)	2189.32	Reach Len. (ft)	169.70	156.02	134.52
Crit W.S. (ft)		Flow Area (sq ft)	208.09	94.60	31.56
E.G. Slope (ft/ft)	0.005567	Area (sq ft)	208.09	94.60	31.56
Q Total (cfs)	1542.00	Flow (cfs)	663.03	795.84	83.13
Top Width (ft)	127.98	Top Width (ft)	86.99	23.71	17.28
Vel Total (ft/s)	4.61	Avg. Vel. (ft/s)	3.19	8.41	2.63
Max Chl Dpth (ft)	4.27	Hydr. Depth (ft)	2.39	3.99	1.83
Conv. Total (cfs)	20666.4	Conv. (cfs)	8886.1	10666.1	1114.2
Length Wtd. (ft)	160.85	Wetted Per. (ft)	87.49	23.87	17.65
Min Ch El (ft)	2185.05	Shear (lb/sq ft)	0.83	1.38	0.62
Alpha	1.94	Stream Power (lb/ft s)	2.63	11.59	1.64
Frctn Loss (ft)	0.20	Cum Volume (acre-ft)	2.80	1.96	0.41
C & E Loss (ft)	0.16	Cum SA (acres)	1.20	3.54	1.24

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2191.80	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.89	Wt. n-Val.	0.062	0.033	0.062
W.S. Elev (ft)	2189.91	Reach Len. (ft)	169.70	156.02	134.52
Crit W.S. (ft)	2189.89	Flow Area (sq ft)	21.77	108.47	39.30
E.G. Slope (ft/ft)	0.009299	Area (sq ft)	21.77	108.47	39.30
Q Total (cfs)	1542.00	Flow (cfs)	85.15	1291.98	164.87
Top Width (ft)	45.00	Top Width (ft)	6.70	23.71	14.59
Vel Total (ft/s)	9.10	Avg. Vel. (ft/s)	3.91	11.91	4.20
Max Chl Dpth (ft)	4.86	Hydr. Depth (ft)	3.25	4.57	2.69
Conv. Total (cfs)	15990.6	Conv. (cfs)	883.0	13397.9	1709.7
Length Wtd. (ft)	155.25	Wetted Per. (ft)	9.89	23.87	16.07
Min Ch El (ft)	2185.05	Shear (lb/sq ft)	1.28	2.64	1.42
Alpha	1.47	Stream Power (lb/ft s)	5.00	31.42	5.96
Frctn Loss (ft)	0.54	Cum Volume (acre-ft)	0.15	1.89	0.19
C & E Loss (ft)	0.41	Cum SA (acres)	0.08	3.54	0.37

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The cross section had to be extended vertically during the critical depth calculations.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant

method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2189.66	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.57	Wt. n-Val.	0.062	0.033	0.062
W.S. Elev (ft)	2189.09	Reach Len. (ft)	169.70	156.02	134.52
Crit W.S. (ft)		Flow Area (sq ft)	187.37	88.92	27.55
E.G. Slope (ft/ft)	0.005306	Area (sq ft)	187.37	88.92	27.55
Q Total (cfs)	1316.00	Flow (cfs)	547.68	700.77	67.55
Top Width (ft)	125.93	Top Width (ft)	86.01	23.71	16.20
Vel Total (ft/s)	4.33	Avg. Vel. (ft/s)	2.92	7.88	2.45
Max Chl Dpth (ft)	4.03	Hydr. Depth (ft)	2.18	3.75	1.70
Conv. Total (cfs)	18066.7	Conv. (cfs)	7518.9	9620.5	927.4
Length Wtd. (ft)	160.78	Wetted Per. (ft)	86.48	23.87	16.55
Min Ch El (ft)	2185.05	Shear (lb/sq ft)	0.72	1.23	0.55
Alpha	1.97	Stream Power (lb/ft s)	2.10	9.72	1.35
Frctn Loss (ft)	0.18	Cum Volume (acre-ft)	2.62	1.80	0.38
C & E Loss (ft)	0.15	Cum SA (acres)	1.14	3.52	1.14

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2188.83	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.52	Wt. n-Val.	0.062	0.033	0.062
W.S. Elev (ft)	2188.31	Reach Len. (ft)	169.70	156.02	134.52
Crit W.S. (ft)		Flow Area (sq ft)	121.96	70.55	16.40
E.G. Slope (ft/ft)	0.005948	Area (sq ft)	121.96	70.55	16.40
Q Total (cfs)	831.00	Flow (cfs)	290.75	504.56	35.69
Top Width (ft)	119.17	Top Width (ft)	82.89	23.71	12.57
Vel Total (ft/s)	3.98	Avg. Vel. (ft/s)	2.38	7.15	2.18
Max Chl Dpth (ft)	3.26	Hydr. Depth (ft)	1.47	2.98	1.30
Conv. Total (cfs)	10774.8	Conv. (cfs)	3769.8	6542.1	462.8
Length Wtd. (ft)	160.39	Wetted Per. (ft)	83.26	23.87	12.84
Min Ch El (ft)	2185.05	Shear (lb/sq ft)	0.54	1.10	0.47
Alpha	2.10	Stream Power (lb/ft s)	1.30	7.85	1.03
Frctn Loss (ft)	0.14	Cum Volume (acre-ft)	2.11	1.39	0.29
C & E Loss (ft)	0.14	Cum SA (acres)	1.00	3.48	0.52

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.164

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2189.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.062	0.033	0.062
W.S. Elev (ft)	2189.50	Reach Len. (ft)	132.32	71.08	40.42
Crit W.S. (ft)		Flow Area (sq ft)	476.46	233.54	73.17
E.G. Slope (ft/ft)	0.000540	Area (sq ft)	476.46	233.54	73.17
Q Total (cfs)	1542.00	Flow (cfs)	675.15	790.75	76.10
Top Width (ft)	184.77	Top Width (ft)	116.82	39.66	28.29
Vel Total (ft/s)	1.97	Avg. Vel. (ft/s)	1.42	3.39	1.04
Max Chl Dpth (ft)	6.66	Hydr. Depth (ft)	4.08	5.89	2.59
Conv. Total (cfs)	66372.3	Conv. (cfs)	29060.6	34036.3	3275.5
Length Wtd. (ft)	89.42	Wetted Per. (ft)	117.36	40.11	28.66
Min Ch El (ft)	2182.84	Shear (lb/sq ft)	0.14	0.20	0.09
Alpha	1.76	Stream Power (lb/ft s)	0.19	0.66	0.09
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	1.46	1.37	0.25
C & E Loss (ft)	0.03	Cum SA (acres)	0.80	3.43	1.17

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2190.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.52	Wt. n-Val.		0.033	
W.S. Elev (ft)	2190.32	Reach Len. (ft)	132.32	71.08	40.42
Crit W.S. (ft)		Flow Area (sq ft)		266.35	
E.G. Slope (ft/ft)	0.001802	Area (sq ft)		266.35	
Q Total (cfs)	1542.00	Flow (cfs)		1542.00	
Top Width (ft)	39.66	Top Width (ft)		39.66	
Vel Total (ft/s)	5.79	Avg. Vel. (ft/s)		5.79	
Max Chl Dpth (ft)	7.48	Hydr. Depth (ft)		6.72	
Conv. Total (cfs)	36326.7	Conv. (cfs)		36326.7	
Length Wtd. (ft)	68.73	Wetted Per. (ft)		50.53	
Min Ch El (ft)	2182.84	Shear (lb/sq ft)		0.59	
Alpha	1.00	Stream Power (lb/ft s)		3.43	
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	0.10	1.21	0.12
C & E Loss (ft)	0.20	Cum SA (acres)	0.07	3.43	0.35

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2189.33	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.	0.062	0.033	0.062
W.S. Elev (ft)	2189.25	Reach Len. (ft)	132.32	71.08	40.42
Crit W.S. (ft)		Flow Area (sq ft)	447.36	223.61	66.21
E.G. Slope (ft/ft)	0.000468	Area (sq ft)	447.36	223.61	66.21
Q Total (cfs)	1316.00	Flow (cfs)	570.03	684.53	61.44
Top Width (ft)	182.46	Top Width (ft)	115.52	39.66	27.29
Vel Total (ft/s)	1.79	Avg. Vel. (ft/s)	1.27	3.06	0.93
Max Chl Dpth (ft)	6.41	Hydr. Depth (ft)	3.87	5.64	2.43
Conv. Total (cfs)	60861.4	Conv. (cfs)	26362.1	31657.6	2841.7
Length Wtd. (ft)	89.39	Wetted Per. (ft)	116.03	40.11	27.62
Min Ch El (ft)	2182.84	Shear (lb/sq ft)	0.11	0.16	0.07
Alpha	1.76	Stream Power (lb/ft s)	0.14	0.50	0.06
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	1.39	1.24	0.23
C & E Loss (ft)	0.03	Cum SA (acres)	0.75	3.41	1.08

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2188.55	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.	0.062	0.033	0.062
W.S. Elev (ft)	2188.49	Reach Len. (ft)	132.32	71.08	40.42
Crit W.S. (ft)		Flow Area (sq ft)	362.03	193.79	46.82
E.G. Slope (ft/ft)	0.000331	Area (sq ft)	362.03	193.79	46.82
Q Total (cfs)	831.00	Flow (cfs)	345.66	453.90	31.44
Top Width (ft)	175.28	Top Width (ft)	111.35	39.66	24.27
Vel Total (ft/s)	1.38	Avg. Vel. (ft/s)	0.95	2.34	0.67
Max Chl Dpth (ft)	5.65	Hydr. Depth (ft)	3.25	4.89	1.93
Conv. Total (cfs)	45657.2	Conv. (cfs)	18991.4	24938.4	1727.3
Length Wtd. (ft)	89.21	Wetted Per. (ft)	111.80	40.11	24.51
Min Ch El (ft)	2182.84	Shear (lb/sq ft)	0.07	0.10	0.04
Alpha	1.78	Stream Power (lb/ft s)	0.06	0.23	0.03
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	1.17	0.92	0.19
C & E Loss (ft)	0.02	Cum SA (acres)	0.62	3.37	0.46

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.150

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2189.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2189.51	Reach Len. (ft)	98.63	122.07	115.27
Crit W.S. (ft)	2184.62	Flow Area (sq ft)	487.11	305.54	461.88
E.G. Slope (ft/ft)	0.000168	Area (sq ft)	487.11	305.54	461.88
Q Total (cfs)	1542.00	Flow (cfs)	487.17	654.40	400.44
Top Width (ft)	221.00	Top Width (ft)	82.80	39.67	98.53
Vel Total (ft/s)	1.23	Avg. Vel. (ft/s)	1.00	2.14	0.87
Max Chl Dpth (ft)	7.97	Hydr. Depth (ft)	5.88	7.70	4.69
Conv. Total (cfs)	119042.2	Conv. (cfs)	37609.1	50519.4	30913.7
Length Wtd. (ft)	122.07	Wetted Per. (ft)	84.24	39.75	98.97
Min Ch El (ft)	2181.54	Shear (lb/sq ft)	0.06	0.08	0.05
Alpha	1.63	Stream Power (lb/ft s)	0.06	0.17	0.04
Frctn Loss (ft)		Cum Volume (acre-ft)		0.93	
C & E Loss (ft)		Cum SA (acres)	0.50	3.36	1.11

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2190.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2190.48	Reach Len. (ft)	98.63	122.07	115.27
Crit W.S. (ft)	2184.95	Flow Area (sq ft)	68.32	344.28	268.44
E.G. Slope (ft/ft)	0.000310	Area (sq ft)	68.32	344.28	268.44
Q Total (cfs)	1542.00	Flow (cfs)	73.92	1084.43	383.65
Top Width (ft)	85.28	Top Width (ft)	9.22	39.67	36.39
Vel Total (ft/s)	2.26	Avg. Vel. (ft/s)	1.08	3.15	1.43
Max Chl Dpth (ft)	8.94	Hydr. Depth (ft)	7.41	8.68	7.38
Conv. Total (cfs)	87648.9	Conv. (cfs)	4201.6	61640.3	21807.0
Length Wtd. (ft)	122.07	Wetted Per. (ft)	16.62	39.75	43.02
Min Ch El (ft)	2181.54	Shear (lb/sq ft)	0.08	0.17	0.12
Alpha	1.47	Stream Power (lb/ft s)	0.09	0.53	0.17
Frctn Loss (ft)		Cum Volume (acre-ft)		0.72	
C & E Loss (ft)		Cum SA (acres)	0.06	3.36	0.33

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2189.28	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2189.25	Reach Len. (ft)	98.63	122.07	115.27
Crit W.S. (ft)	2184.41	Flow Area (sq ft)	466.36	295.54	437.24
E.G. Slope (ft/ft)	0.000139	Area (sq ft)	466.36	295.54	437.24
Q Total (cfs)	1316.00	Flow (cfs)	415.92	563.97	336.10
Top Width (ft)	218.69	Top Width (ft)	81.87	39.67	97.15
Vel Total (ft/s)	1.10	Avg. Vel. (ft/s)	0.89	1.91	0.77
Max Chl Dpth (ft)	7.71	Hydr. Depth (ft)	5.70	7.45	4.50
Conv. Total (cfs)	111527.1	Conv. (cfs)	35248.3	47795.2	28483.6
Length Wtd. (ft)	122.07	Wetted Per. (ft)	83.27	39.75	97.57
Min Ch El (ft)	2181.54	Shear (lb/sq ft)	0.05	0.06	0.04
Alpha	1.63	Stream Power (lb/ft s)	0.04	0.12	0.03
Frctn Loss (ft)		Cum Volume (acre-ft)		0.81	
C & E Loss (ft)		Cum SA (acres)	0.45	3.35	1.02

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2188.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2188.50	Reach Len. (ft)	98.63	122.07	115.27
Crit W.S. (ft)	2183.92	Flow Area (sq ft)	405.57	265.61	365.40
E.G. Slope (ft/ft)	0.000085	Area (sq ft)	405.57	265.61	365.40
Q Total (cfs)	831.00	Flow (cfs)	262.28	368.40	200.32
Top Width (ft)	212.28	Top Width (ft)	79.61	39.67	93.00
Vel Total (ft/s)	0.80	Avg. Vel. (ft/s)	0.65	1.39	0.55
Max Chl Dpth (ft)	6.96	Hydr. Depth (ft)	5.09	6.70	3.93
Conv. Total (cfs)	90231.2	Conv. (cfs)	28478.4	40001.9	21750.8
Length Wtd. (ft)	122.07	Wetted Per. (ft)	80.87	39.75	93.35
Min Ch El (ft)	2181.54	Shear (lb/sq ft)	0.03	0.04	0.02
Alpha	1.65	Stream Power (lb/ft s)	0.02	0.05	0.01
Frctn Loss (ft)		Cum Volume (acre-ft)		0.54	
C & E Loss (ft)		Cum SA (acres)	0.33	3.30	0.41

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.127

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2183.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.93	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2182.60	Reach Len. (ft)	179.80	191.64	190.11
Crit W.S. (ft)	2182.42	Flow Area (sq ft)	12.49	161.30	83.50
E.G. Slope (ft/ft)	0.006995	Area (sq ft)	12.49	161.30	83.50
Q Total (cfs)	1542.00	Flow (cfs)	28.09	1334.46	179.45
Top Width (ft)	125.62	Top Width (ft)	10.08	42.17	73.38

Vel Total (ft/s)	5.99	Avg. Vel. (ft/s)	2.25	8.27	2.15	
Max Chl Dpth (ft)	6.93	Hydr. Depth (ft)	1.24	3.82	1.14	
Conv. Total (cfs)	18437.3	Conv. (cfs)	335.9	15955.8	2145.6	
Length Wtd. (ft)	191.01	Wetted Per. (ft)	10.50	45.35	75.22	
Min Ch El (ft)	2175.67	Shear (lb/sq ft)	0.52	1.55	0.48	
Alpha	1.67	Stream Power (lb/ft s)	1.17	12.85	1.04	
Frctn Loss (ft)	1.29	Cum Volume (acre-ft)	0.56	9.22	1.01	
C & E Loss (ft)	0.16	Cum SA (acres)	0.40	3.25	0.88	

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2183.86	Element			
Vel Head (ft)	0.96	Wt. n-Val.		0.035	0.062
W.S. Elev (ft)	2182.90	Reach Len. (ft)	179.80	191.64	190.11
Crit W.S. (ft)		Flow Area (sq ft)		173.80	44.51
E.G. Slope (ft/ft)	0.006682	Area (sq ft)		173.80	44.51
Q Total (cfs)	1542.00	Flow (cfs)		1416.38	125.63
Top Width (ft)	64.86	Top Width (ft)		42.17	22.69
Vel Total (ft/s)	7.06	Avg. Vel. (ft/s)		8.15	2.82
Max Chl Dpth (ft)	7.23	Hydr. Depth (ft)		4.12	1.96
Conv. Total (cfs)	18864.5	Conv. (cfs)		17327.7	1536.9
Length Wtd. (ft)	191.29	Wetted Per. (ft)		48.30	25.73
Min Ch El (ft)	2175.67	Shear (lb/sq ft)		1.50	0.72
Alpha	1.24	Stream Power (lb/ft s)		12.23	2.04
Frctn Loss (ft)	1.32	Cum Volume (acre-ft)	0.13	9.33	0.40
C & E Loss (ft)	0.22	Cum SA (acres)	0.05	3.25	0.26

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2183.18	Element			
Vel Head (ft)	1.04	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2182.15	Reach Len. (ft)	179.80	191.64	190.11
Crit W.S. (ft)	2182.15	Flow Area (sq ft)	8.22	142.15	50.87
E.G. Slope (ft/ft)	0.008747	Area (sq ft)	8.22	142.15	50.87
Q Total (cfs)	1316.00	Flow (cfs)	17.27	1208.86	89.87
Top Width (ft)	121.80	Top Width (ft)	8.71	42.17	70.92
Vel Total (ft/s)	6.54	Avg. Vel. (ft/s)	2.10	8.50	1.77
Max Chl Dpth (ft)	6.48	Hydr. Depth (ft)	0.94	3.37	0.72
Conv. Total (cfs)	14070.9	Conv. (cfs)	184.7	12925.3	960.9
Length Wtd. (ft)	191.12	Wetted Per. (ft)	9.06	45.35	72.69
Min Ch El (ft)	2175.67	Shear (lb/sq ft)	0.50	1.71	0.38
Alpha	1.56	Stream Power (lb/ft s)	1.04	14.56	0.68
Frctn Loss (ft)	1.43	Cum Volume (acre-ft)	0.45	8.32	0.72
C & E Loss (ft)	0.10	Cum SA (acres)	0.35	3.23	0.80

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 OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2182.23	Element			
Vel Head (ft)	0.72	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2181.51	Reach Len. (ft)	179.80	191.64	190.11
Crit W.S. (ft)	2180.80	Flow Area (sq ft)	3.41	115.38	13.27
E.G. Slope (ft/ft)	0.007657	Area (sq ft)	3.41	115.38	13.27
Q Total (cfs)	831.00	Flow (cfs)	4.77	798.83	27.40
Top Width (ft)	64.60	Top Width (ft)	6.00	42.17	16.43
Vel Total (ft/s)	6.29	Avg. Vel. (ft/s)	1.40	6.92	2.06
Max Chl Dpth (ft)	5.84	Hydr. Depth (ft)	0.57	2.74	0.81
Conv. Total (cfs)	9496.5	Conv. (cfs)	54.5	9128.9	313.1
Length Wtd. (ft)	191.37	Wetted Per. (ft)	6.27	45.35	18.03
Min Ch El (ft)	2175.67	Shear (lb/sq ft)	0.26	1.22	0.35
Alpha	1.17	Stream Power (lb/ft s)	0.36	8.42	0.73
Frctn Loss (ft)	1.78	Cum Volume (acre-ft)	0.22	6.10	0.19
C & E Loss (ft)	0.27	Cum SA (acres)	0.24	3.19	0.26

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.091

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2182.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.46	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2180.62	Reach Len. (ft)	185.33	191.33	203.84
Crit W.S. (ft)	2180.62	Flow Area (sq ft)	27.62	120.99	74.59
E.G. Slope (ft/ft)	0.006486	Area (sq ft)	27.62	120.99	74.59
Q Total (cfs)	1542.00	Flow (cfs)	91.44	1280.54	170.03
Top Width (ft)	90.14	Top Width (ft)	11.30	21.80	57.04
Vel Total (ft/s)	6.91	Avg. Vel. (ft/s)	3.31	10.58	2.28
Max Chl Dpth (ft)	6.43	Hydr. Depth (ft)	2.45	5.55	1.31
Conv. Total (cfs)	19147.2	Conv. (cfs)	1135.4	15900.6	2111.2
Length Wtd. (ft)	192.01	Wetted Per. (ft)	12.30	22.21	58.11
Min Ch El (ft)	2174.19	Shear (lb/sq ft)	0.91	2.21	0.52
Alpha	1.97	Stream Power (lb/ft s)	3.01	23.34	1.18
Frctn Loss (ft)	1.58	Cum Volume (acre-ft)	0.47	8.60	0.66
C & E Loss (ft)	0.05	Cum SA (acres)	0.35	3.11	0.60

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2182.32	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.69	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2180.63	Reach Len. (ft)	185.33	191.33	203.84
Crit W.S. (ft)	2180.63	Flow Area (sq ft)	16.43	121.05	56.14
E.G. Slope (ft/ft)	0.007151	Area (sq ft)	16.43	121.05	56.14
Q Total (cfs)	1542.00	Flow (cfs)	55.71	1345.65	140.64
Top Width (ft)	64.90	Top Width (ft)	4.12	21.80	38.98
Vel Total (ft/s)	7.96	Avg. Vel. (ft/s)	3.39	11.12	2.51
Max Chl Dpth (ft)	6.44	Hydr. Depth (ft)	3.99	5.55	1.44
Conv. Total (cfs)	18235.4	Conv. (cfs)	658.8	15913.4	1663.1
Length Wtd. (ft)	191.87	Wetted Per. (ft)	7.59	22.21	40.85
Min Ch El (ft)	2174.19	Shear (lb/sq ft)	0.97	2.43	0.61
Alpha	1.72	Stream Power (lb/ft s)	3.28	27.04	1.54
Frctn Loss (ft)	1.69	Cum Volume (acre-ft)	0.09	8.68	0.18
C & E Loss (ft)	0.03	Cum SA (acres)	0.04	3.10	0.12

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 cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2181.64	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.38	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2180.26	Reach Len. (ft)	185.33	191.33	203.84
Crit W.S. (ft)	2180.26	Flow Area (sq ft)	23.70	113.13	54.28
E.G. Slope (ft/ft)	0.006434	Area (sq ft)	23.70	113.13	54.28
Q Total (cfs)	1316.00	Flow (cfs)	74.21	1140.29	101.50
Top Width (ft)	87.83	Top Width (ft)	10.47	21.80	55.56
Vel Total (ft/s)	6.89	Avg. Vel. (ft/s)	3.13	10.08	1.87
Max Chl Dpth (ft)	6.07	Hydr. Depth (ft)	2.26	5.19	0.98
Conv. Total (cfs)	16407.0	Conv. (cfs)	925.2	14216.3	1265.4
Length Wtd. (ft)	191.76	Wetted Per. (ft)	11.40	22.21	56.59
Min Ch El (ft)	2174.19	Shear (lb/sq ft)	0.84	2.05	0.39
Alpha	1.87	Stream Power (lb/ft s)	2.62	20.62	0.72
Frctn Loss (ft)	1.55	Cum Volume (acre-ft)	0.38	7.76	0.49
C & E Loss (ft)	0.03	Cum SA (acres)	0.31	3.09	0.52

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2180.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.61	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2178.57	Reach Len. (ft)	185.33	191.33	203.84

Crit W.S. (ft)	2178.57	Flow Area (sq ft)	9.26	76.24	4.61
E.G. Slope (ft/ft)	0.011599	Area (sq ft)	9.26	76.24	4.61
Q Total (cfs)	831.00	Flow (cfs)	28.35	793.14	9.51
Top Width (ft)	33.98	Top Width (ft)	6.59	21.80	5.59
Vel Total (ft/s)	9.22	Avg. Vel. (ft/s)	3.06	10.40	2.06
Max Chl Dpth (ft)	4.38	Hydr. Depth (ft)	1.41	3.50	0.82
Conv. Total (cfs)	7715.9	Conv. (cfs)	263.2	7364.4	88.3
Length Wtd. (ft)	191.30	Wetted Per. (ft)	7.16	22.21	6.44
Min Ch El (ft)	2174.19	Shear (lb/sq ft)	0.94	2.49	0.52
Alpha	1.22	Stream Power (lb/ft s)	2.87	25.85	1.07
Frctn Loss (ft)	2.39	Cum Volume (acre-ft)	0.19	5.68	0.15
C & E Loss (ft)	0.05	Cum SA (acres)	0.21	3.05	0.22

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.054

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2179.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.93	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2177.59	Reach Len. (ft)	239.07	304.60	349.02
Crit W.S. (ft)	2177.59	Flow Area (sq ft)	3.09	131.77	20.74
E.G. Slope (ft/ft)	0.010789	Area (sq ft)	3.09	131.77	20.74
Q Total (cfs)	1542.00	Flow (cfs)	5.86	1491.68	44.45
Top Width (ft)	60.62	Top Width (ft)	4.41	30.32	25.88
Vel Total (ft/s)	9.91	Avg. Vel. (ft/s)	1.90	11.32	2.14
Max Chl Dpth (ft)	5.69	Hydr. Depth (ft)	0.70	4.35	0.80
Conv. Total (cfs)	14845.6	Conv. (cfs)	56.4	14361.2	428.0
Length Wtd. (ft)	305.03	Wetted Per. (ft)	4.63	32.04	25.94
Min Ch El (ft)	2171.90	Shear (lb/sq ft)	0.45	2.77	0.54
Alpha	1.26	Stream Power (lb/ft s)	0.85	31.36	1.15
Frctn Loss (ft)	3.23	Cum Volume (acre-ft)	0.41	8.04	0.44
C & E Loss (ft)	0.17	Cum SA (acres)	0.32	2.99	0.40

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2179.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.02	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2177.60	Reach Len. (ft)	239.07	304.60	349.02
Crit W.S. (ft)	2177.60	Flow Area (sq ft)	2.14	132.03	7.43
E.G. Slope (ft/ft)	0.011074	Area (sq ft)	2.14	132.03	7.43
Q Total (cfs)	1542.00	Flow (cfs)	4.49	1516.25	21.27
Top Width (ft)	37.00	Top Width (ft)	1.95	30.32	4.73
Vel Total (ft/s)	10.89	Avg. Vel. (ft/s)	2.09	11.48	2.86
Max Chl Dpth (ft)	5.69	Hydr. Depth (ft)	1.10	4.35	1.57
Conv. Total (cfs)	14653.0	Conv. (cfs)	42.7	14408.2	202.1
Length Wtd. (ft)	304.81	Wetted Per. (ft)	2.84	32.04	6.14
Min Ch El (ft)	2171.90	Shear (lb/sq ft)	0.52	2.85	0.84
Alpha	1.09	Stream Power (lb/ft s)	1.09	32.72	2.40
Frctn Loss (ft)	3.49	Cum Volume (acre-ft)	0.05	8.12	0.03
C & E Loss (ft)	0.14	Cum SA (acres)	0.02	2.99	0.02

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 cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2178.96	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.70	Wt. n-Val.	0.062	0.035	0.062

W.S. Elev (ft)	2177.26	Reach Len. (ft)	239.07	304.60	349.02	
Crit W.S. (ft)	2177.26	Flow Area (sq ft)	1.81	121.84	13.28	
E.G. Slope (ft/ft)	0.010447	Area (sq ft)	1.81	121.84	13.28	
Q Total (cfs)	1316.00	Flow (cfs)	2.83	1288.11	25.05	
Top Width (ft)	53.30	Top Width (ft)	3.38	30.32	19.61	
Vel Total (ft/s)	9.61	Avg. Vel. (ft/s)	1.57	10.57	1.89	
Max Chl Dpth (ft)	5.36	Hydr. Depth (ft)	0.54	4.02	0.68	
Conv. Total (cfs)	12875.3	Conv. (cfs)	27.7	12602.5	245.1	
Length Wtd. (ft)	304.82	Wetted Per. (ft)	3.54	32.04	19.66	
Min Ch El (ft)	2171.90	Shear (lb/sq ft)	0.33	2.48	0.44	
Alpha	1.19	Stream Power (lb/ft s)	0.52	26.22	0.83	
Frctn Loss (ft)	3.25	Cum Volume (acre-ft)	0.32	7.24	0.33	
C & E Loss (ft)	0.13	Cum SA (acres)	0.28	2.98	0.34	

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2177.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.43	Wt. n-Val.		0.035	0.062
W.S. Elev (ft)	2176.09	Reach Len. (ft)	239.07	304.60	349.02
Crit W.S. (ft)	2176.09	Flow Area (sq ft)		86.44	0.39
E.G. Slope (ft/ft)	0.013487	Area (sq ft)		86.44	0.39
Q Total (cfs)	831.00	Flow (cfs)		830.74	0.27
Top Width (ft)	33.31	Top Width (ft)		30.06	3.26
Vel Total (ft/s)	9.57	Avg. Vel. (ft/s)		9.61	0.68
Max Chl Dpth (ft)	4.19	Hydr. Depth (ft)		2.88	0.12
Conv. Total (cfs)	7155.5	Conv. (cfs)		7153.2	2.3
Length Wtd. (ft)	304.46	Wetted Per. (ft)		31.76	3.27
Min Ch El (ft)	2171.90	Shear (lb/sq ft)		2.29	0.10
Alpha	1.01	Stream Power (lb/ft s)		22.02	0.07
Frctn Loss (ft)	3.78	Cum Volume (acre-ft)	0.17	5.32	0.14
C & E Loss (ft)	0.15	Cum SA (acres)	0.20	2.93	0.19

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNNYCOVE WASH
REACH: REACH #2 RS: 0.997

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2171.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.37	Wt. n-Val.	0.060	0.032	0.060
W.S. Elev (ft)	2170.04	Reach Len. (ft)	370.31	314.05	271.52
Crit W.S. (ft)	2170.04	Flow Area (sq ft)	14.37	147.77	18.64
E.G. Slope (ft/ft)	0.010387	Area (sq ft)	14.37	147.77	18.64
Q Total (cfs)	1542.00	Flow (cfs)	46.41	1433.34	62.25
Top Width (ft)	71.71	Top Width (ft)	9.49	50.30	11.92
Vel Total (ft/s)	8.53	Avg. Vel. (ft/s)	3.23	9.70	3.34
Max Chl Dpth (ft)	3.46	Hydr. Depth (ft)	1.51	2.94	1.56
Conv. Total (cfs)	15130.1	Conv. (cfs)	455.3	14063.9	610.8
Length Wtd. (ft)	314.00	Wetted Per. (ft)	9.92	50.36	12.25
Min Ch El (ft)	2166.58	Shear (lb/sq ft)	0.94	1.90	0.99
Alpha	1.21	Stream Power (lb/ft s)	3.03	18.46	3.29
Frctn Loss (ft)	3.34	Cum Volume (acre-ft)	0.36	7.07	0.28
C & E Loss (ft)	0.05	Cum SA (acres)	0.28	2.71	0.25

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2171.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.55	Wt. n-Val.		0.032	
W.S. Elev (ft)	2170.18	Reach Len. (ft)	370.31	314.05	271.52
Crit W.S. (ft)	2170.18	Flow Area (sq ft)		154.39	
E.G. Slope (ft/ft)	0.011837	Area (sq ft)		154.39	

Q Total (cfs)	1542.00	Flow (cfs)		1542.00		
Top Width (ft)	50.30	Top Width (ft)		50.30		
Vel Total (ft/s)	9.99	Avg. Vel. (ft/s)		9.99		
Max Chl Dpth (ft)	3.60	Hydr. Depth (ft)		3.07		
Conv. Total (cfs)	14173.2	Conv. (cfs)		14173.2		
Length Wtd. (ft)	314.05	Wetted Per. (ft)		55.54		
Min Ch El (ft)	2166.58	Shear (lb/sq ft)		2.05		
Alpha	1.00	Stream Power (lb/ft s)		20.52		
Frctn Loss (ft)	3.76	Cum Volume (acre-ft)	0.05	7.12		
C & E Loss (ft)	0.07	Cum SA (acres)	0.02	2.71		

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: Critical depth could not be determined within the specified number of iterations. The program used the iteration with the lowest energy.
Warning: The cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2171.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.25	Wt. n-Val.	0.060	0.032	0.060
W.S. Elev (ft)	2169.75	Reach Len. (ft)	370.31	314.05	271.52
Crit W.S. (ft)	2169.75	Flow Area (sq ft)	11.79	132.99	15.25
E.G. Slope (ft/ft)	0.010876	Area (sq ft)	11.79	132.99	15.25
Q Total (cfs)	1316.00	Flow (cfs)	37.87	1230.37	47.76
Top Width (ft)	69.55	Top Width (ft)	8.11	50.30	11.15
Vel Total (ft/s)	8.22	Avg. Vel. (ft/s)	3.21	9.25	3.13
Max Chl Dpth (ft)	3.17	Hydr. Depth (ft)	1.45	2.64	1.37
Conv. Total (cfs)	12618.9	Conv. (cfs)	363.1	11797.8	458.0
Length Wtd. (ft)	314.03	Wetted Per. (ft)	8.50	50.36	11.43
Min Ch El (ft)	2166.58	Shear (lb/sq ft)	0.94	1.79	0.91
Alpha	1.19	Stream Power (lb/ft s)	3.02	16.59	2.84
Frctn Loss (ft)	3.45	Cum Volume (acre-ft)	0.29	6.35	0.22
C & E Loss (ft)	0.05	Cum SA (acres)	0.25	2.69	0.22

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2170.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.92	Wt. n-Val.	0.060	0.032	0.060
W.S. Elev (ft)	2169.10	Reach Len. (ft)	370.31	314.05	271.52
Crit W.S. (ft)	2169.10	Flow Area (sq ft)	6.92	100.43	8.59
E.G. Slope (ft/ft)	0.011486	Area (sq ft)	6.92	100.43	8.59
Q Total (cfs)	831.00	Flow (cfs)	17.96	791.89	21.15
Top Width (ft)	66.68	Top Width (ft)	6.94	50.30	9.45
Vel Total (ft/s)	7.17	Avg. Vel. (ft/s)	2.59	7.88	2.46
Max Chl Dpth (ft)	2.52	Hydr. Depth (ft)	1.00	2.00	0.91
Conv. Total (cfs)	7753.8	Conv. (cfs)	167.6	7388.8	197.4
Length Wtd. (ft)	314.01	Wetted Per. (ft)	7.17	50.36	9.61
Min Ch El (ft)	2166.58	Shear (lb/sq ft)	0.69	1.43	0.64
Alpha	1.16	Stream Power (lb/ft s)	1.80	11.28	1.58
Frctn Loss (ft)	3.74	Cum Volume (acre-ft)	0.15	4.67	0.10
C & E Loss (ft)	0.03	Cum SA (acres)	0.18	2.65	0.14

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 0.937

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2166.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.21	Wt. n-Val.	0.060	0.032	0.060

W.S. Elev (ft)	2165.57	Reach Len. (ft)	293.29	212.90	164.16	
Crit W.S. (ft)	2165.57	Flow Area (sq ft)	10.76	163.43	13.52	
E.G. Slope (ft/ft)	0.010877	Area (sq ft)	10.76	163.43	13.52	
Q Total (cfs)	1542.00	Flow (cfs)	29.37	1471.07	41.56	
Top Width (ft)	84.06	Top Width (ft)	9.67	64.32	10.08	
Vel Total (ft/s)	8.21	Avg. Vel. (ft/s)	2.73	9.00	3.07	
Max Chl Dpth (ft)	3.59	Hydr. Depth (ft)	1.11	2.54	1.34	
Conv. Total (cfs)	14785.2	Conv. (cfs)	281.6	14105.1	398.5	
Length Wtd. (ft)	213.35	Wetted Per. (ft)	9.91	64.50	10.41	
Min Ch El (ft)	2161.98	Shear (lb/sq ft)	0.74	1.72	0.88	
Alpha	1.15	Stream Power (lb/ft s)	2.01	15.49	2.71	
Frctn Loss (ft)	2.20	Cum Volume (acre-ft)	0.25	5.94	0.18	
C & E Loss (ft)	0.01	Cum SA (acres)	0.20	2.30	0.18	

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 OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2166.95	Element			
Vel Head (ft)	1.32	Wt. n-Val.		0.032	
W.S. Elev (ft)	2165.64	Reach Len. (ft)	293.29	212.90	164.16
Crit W.S. (ft)	2165.64	Flow Area (sq ft)		167.53	
E.G. Slope (ft/ft)	0.012122	Area (sq ft)		167.53	
Q Total (cfs)	1542.00	Flow (cfs)		1542.00	
Top Width (ft)	64.32	Top Width (ft)		64.32	
Vel Total (ft/s)	9.20	Avg. Vel. (ft/s)		9.20	
Max Chl Dpth (ft)	3.66	Hydr. Depth (ft)		2.60	
Conv. Total (cfs)	14005.3	Conv. (cfs)		14005.3	
Length Wtd. (ft)	212.90	Wetted Per. (ft)		69.35	
Min Ch El (ft)	2161.98	Shear (lb/sq ft)		1.83	
Alpha	1.00	Stream Power (lb/ft s)		16.83	
Frctn Loss (ft)	2.41	Cum Volume (acre-ft)	0.05	5.96	
C & E Loss (ft)	0.03	Cum SA (acres)	0.02	2.30	

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 OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2166.42	Element			
Vel Head (ft)	1.09	Wt. n-Val.	0.060	0.032	0.060
W.S. Elev (ft)	2165.33	Reach Len. (ft)	293.29	212.90	164.16
Crit W.S. (ft)	2165.33	Flow Area (sq ft)	8.58	148.01	11.21
E.G. Slope (ft/ft)	0.011123	Area (sq ft)	8.58	148.01	11.21
Q Total (cfs)	1316.00	Flow (cfs)	22.16	1261.09	32.76
Top Width (ft)	82.01	Top Width (ft)	8.51	64.32	9.17
Vel Total (ft/s)	7.84	Avg. Vel. (ft/s)	2.58	8.52	2.92
Max Chl Dpth (ft)	3.35	Hydr. Depth (ft)	1.01	2.30	1.22
Conv. Total (cfs)	12478.2	Conv. (cfs)	210.1	11957.5	310.6
Length Wtd. (ft)	213.31	Wetted Per. (ft)	8.74	64.50	9.48
Min Ch El (ft)	2161.98	Shear (lb/sq ft)	0.68	1.59	0.82
Alpha	1.14	Stream Power (lb/ft s)	1.76	13.58	2.40
Frctn Loss (ft)	2.27	Cum Volume (acre-ft)	0.20	5.34	0.14
C & E Loss (ft)	0.00	Cum SA (acres)	0.18	2.28	0.16

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 OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2165.55	Element			
Vel Head (ft)	0.81	Wt. n-Val.	0.060	0.032	0.060
W.S. Elev (ft)	2164.74	Reach Len. (ft)	293.29	212.90	164.16
Crit W.S. (ft)	2164.74	Flow Area (sq ft)	4.26	109.65	6.41
E.G. Slope (ft/ft)	0.012334	Area (sq ft)	4.26	109.65	6.41
Q Total (cfs)	831.00	Flow (cfs)	9.15	805.47	16.38
Top Width (ft)	77.26	Top Width (ft)	6.01	64.32	6.93
Vel Total (ft/s)	6.91	Avg. Vel. (ft/s)	2.15	7.35	2.56
Max Chl Dpth (ft)	2.76	Hydr. Depth (ft)	0.71	1.70	0.93
Conv. Total (cfs)	7482.4	Conv. (cfs)	82.4	7252.5	147.5
Length Wtd. (ft)	213.16	Wetted Per. (ft)	6.16	64.50	7.16
Min Ch El (ft)	2161.98	Shear (lb/sq ft)	0.53	1.31	0.69
Alpha	1.10	Stream Power (lb/ft s)	1.14	9.62	1.76

* Frctn Loss (ft)	* 2.52	* Cum Volume (acre-ft)	* 0.10	* 3.91	* 0.06	*
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 0.12	* 2.24	* 0.09	*

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 0.897

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	* 2163.25	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 1.19	* Wt. n-Val.	* 0.059	* 0.030	* 0.059 *
* W.S. Elev (ft)	* 2162.06	* Reach Len. (ft)	* 248.07	* 246.71	* 237.21 *
* Crit W.S. (ft)	* 2162.06	* Flow Area (sq ft)	* 5.51	* 173.25	* 2.00 *
* E.G. Slope (ft/ft)	*0.009762	* Area (sq ft)	* 5.51	* 173.25	* 2.00 *
* Q Total (cfs)	* 1542.00	* Flow (cfs)	* 14.88	* 1524.23	* 2.89 *
* Top Width (ft)	* 80.22	* Top Width (ft)	* 4.02	* 71.74	* 4.45 *
* Vel Total (ft/s)	* 8.53	* Avg. Vel. (ft/s)	* 2.70	* 8.80	* 1.44 *
* Max Chl Dpth (ft)	* 2.74	* Hydr. Depth (ft)	* 1.37	* 2.42	* 0.45 *
* Conv. Total (cfs)	* 15606.8	* Conv. (cfs)	* 150.6	* 15426.9	* 29.2 *
* Length Wtd. (ft)	* 246.67	* Wetted Per. (ft)	* 4.87	* 71.88	* 4.54 *
* Min Ch El (ft)	* 2159.32	* Shear (lb/sq ft)	* 0.69	* 1.47	* 0.27 *
* Alpha	* 1.05	* Stream Power (lb/ft s)	* 1.86	* 12.92	* 0.39 *
* Frctn Loss (ft)	* 2.24	* Cum Volume (acre-ft)	* 0.20	* 5.12	* 0.15 *
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 0.15	* 1.96	* 0.16 *

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 OUTPUT Profile #FLOODWAY

* E.G. Elev (ft)	* 2163.29	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 1.23	* Wt. n-Val.	*	* 0.030	* *
* W.S. Elev (ft)	* 2162.06	* Reach Len. (ft)	* 248.07	* 246.71	* 237.21 *
* Crit W.S. (ft)	* 2162.06	* Flow Area (sq ft)	*	* 173.57	* *
* E.G. Slope (ft/ft)	*0.010606	* Area (sq ft)	*	* 173.57	* *
* Q Total (cfs)	* 1542.00	* Flow (cfs)	*	* 1542.00	* *
* Top Width (ft)	* 71.74	* Top Width (ft)	*	* 71.74	* *
* Vel Total (ft/s)	* 8.88	* Avg. Vel. (ft/s)	*	* 8.88	* *
* Max Chl Dpth (ft)	* 2.74	* Hydr. Depth (ft)	*	* 2.42	* *
* Conv. Total (cfs)	* 14973.1	* Conv. (cfs)	*	* 14973.1	* *
* Length Wtd. (ft)	* 246.72	* Wetted Per. (ft)	*	* 75.51	* *
* Min Ch El (ft)	* 2159.32	* Shear (lb/sq ft)	*	* 1.52	* *
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 13.52	* *
* Frctn Loss (ft)	* 2.51	* Cum Volume (acre-ft)	* 0.05	* 5.13	* *
* C & E Loss (ft)	* 0.04	* Cum SA (acres)	* 0.02	* 1.96	* *

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 OUTPUT Profile #50-YEAR

* E.G. Elev (ft)	* 2162.89	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 1.08	* Wt. n-Val.	* 0.059	* 0.030	* 0.059 *
* W.S. Elev (ft)	* 2161.82	* Reach Len. (ft)	* 248.07	* 246.71	* 237.21 *
* Crit W.S. (ft)	* 2161.82	* Flow Area (sq ft)	* 4.57	* 155.81	* 1.06 *
* E.G. Slope (ft/ft)	*0.010160	* Area (sq ft)	* 4.57	* 155.81	* 1.06 *
* Q Total (cfs)	* 1316.00	* Flow (cfs)	* 11.85	* 1302.90	* 1.25 *
* Top Width (ft)	* 78.69	* Top Width (ft)	* 3.67	* 71.74	* 3.28 *
* Vel Total (ft/s)	* 8.15	* Avg. Vel. (ft/s)	* 2.59	* 8.36	* 1.18 *
* Max Chl Dpth (ft)	* 2.49	* Hydr. Depth (ft)	* 1.25	* 2.17	* 0.32 *
* Conv. Total (cfs)	* 13055.9	* Conv. (cfs)	* 117.5	* 12925.9	* 12.4 *
* Length Wtd. (ft)	* 246.68	* Wetted Per. (ft)	* 4.43	* 71.88	* 3.34 *
* Min Ch El (ft)	* 2159.32	* Shear (lb/sq ft)	* 0.65	* 1.37	* 0.20 *
* Alpha	* 1.04	* Stream Power (lb/ft s)	* 1.70	* 11.50	* 0.24 *
* Frctn Loss (ft)	* 2.31	* Cum Volume (acre-ft)	* 0.16	* 4.59	* 0.11 *
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 0.13	* 1.95	* 0.13 *

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2162.04	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.80	Wt. n-Val.	0.059	0.030	0.059	
W.S. Elev (ft)	2161.24	Reach Len. (ft)	248.07	246.71	237.21	
Crit W.S. (ft)	2161.24	Flow Area (sq ft)	2.71	114.56	0.01	
E.G. Slope (ft/ft)	0.011348	Area (sq ft)	2.71	114.56	0.01	
Q Total (cfs)	831.00	Flow (cfs)	6.23	824.77	0.00	
Top Width (ft)	74.92	Top Width (ft)	2.82	71.74	0.36	
Vel Total (ft/s)	7.09	Avg. Vel. (ft/s)	2.30	7.20	0.28	
Max Chl Dpth (ft)	1.92	Hydr. Depth (ft)	0.96	1.60	0.04	
Conv. Total (cfs)	7800.9	Conv. (cfs)	58.5	7742.4	0.0	
Length Wtd. (ft)	246.70	Wetted Per. (ft)	3.41	71.88	0.36	
Min Ch El (ft)	2159.32	Shear (lb/sq ft)	0.56	1.13	0.02	
Alpha	1.03	Stream Power (lb/ft s)	1.29	8.13	0.01	
Frctn Loss (ft)	2.57	Cum Volume (acre-ft)	0.08	3.37	0.04	
C & E Loss (ft)	0.02	Cum SA (acres)	0.09	1.91	0.08	

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 0.850

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2159.81	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.40	Wt. n-Val.	0.059	0.030	0.059	
W.S. Elev (ft)	2158.40	Reach Len. (ft)	140.71	227.52	284.13	
Crit W.S. (ft)	2158.40	Flow Area (sq ft)	26.12	146.70	9.73	
E.G. Slope (ft/ft)	0.008449	Area (sq ft)	26.12	146.70	9.73	
Q Total (cfs)	1542.00	Flow (cfs)	78.38	1438.71	24.90	
Top Width (ft)	71.79	Top Width (ft)	17.48	46.29	8.02	
Vel Total (ft/s)	8.45	Avg. Vel. (ft/s)	3.00	9.81	2.56	
Max Chl Dpth (ft)	3.39	Hydr. Depth (ft)	1.49	3.17	1.21	
Conv. Total (cfs)	16775.7	Conv. (cfs)	852.7	15652.0	270.9	
Length Wtd. (ft)	224.95	Wetted Per. (ft)	17.69	46.40	8.36	
Min Ch El (ft)	2155.01	Shear (lb/sq ft)	0.78	1.67	0.61	
Alpha	1.27	Stream Power (lb/ft s)	2.34	16.35	1.57	
Frctn Loss (ft)	2.02	Cum Volume (acre-ft)	0.11	4.22	0.12	
C & E Loss (ft)	0.03	Cum SA (acres)	0.09	1.63	0.12	

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2160.05	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.62	Wt. n-Val.	0.059	0.030		
W.S. Elev (ft)	2158.44	Reach Len. (ft)	140.71	227.52	284.13	
Crit W.S. (ft)	2158.44	Flow Area (sq ft)	6.66	148.27		
E.G. Slope (ft/ft)	0.009755	Area (sq ft)	6.66	148.27		
Q Total (cfs)	1542.00	Flow (cfs)	19.94	1522.06		
Top Width (ft)	49.03	Top Width (ft)	2.74	46.29		
Vel Total (ft/s)	9.95	Avg. Vel. (ft/s)	3.00	10.27		
Max Chl Dpth (ft)	3.43	Hydr. Depth (ft)	2.43	3.20		
Conv. Total (cfs)	15612.4	Conv. (cfs)	201.9	15410.5		
Length Wtd. (ft)	226.75	Wetted Per. (ft)	5.04	48.78		
Min Ch El (ft)	2155.01	Shear (lb/sq ft)	0.80	1.85		
Alpha	1.05	Stream Power (lb/ft s)	2.41	19.00		
Frctn Loss (ft)	2.23	Cum Volume (acre-ft)	0.03	4.22		
C & E Loss (ft)	0.08	Cum SA (acres)	0.01	1.63		

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

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        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 OUTPUT  Profile #50-YEAR
*****************************************************************************************************
* E.G. Elev (ft)         * 2159.39  * Element                 *  Left OB *  Channel * Right OB *
* Vel Head (ft)          *    1.27  * Wt. n-Val.              *   0.059  *   0.030  *   0.059  *
* W.S. Elev (ft)         * 2158.11  * Reach Len. (ft)         *  140.71  *  227.52  *  284.13  *
* Crit W.S. (ft)         * 2158.11  * Flow Area (sq ft)       *   21.18  *  133.20  *    7.51  *
* E.G. Slope (ft/ft)     *0.008656  * Area (sq ft)            *   21.18  *  133.20  *    7.51  *
* Q Total (cfs)          * 1316.00  * Flow (cfs)              *   58.55  * 1239.71  *   17.74  *
* Top Width (ft)         *   69.79  * Top Width (ft)          *   16.36  *   46.29  *    7.14  *
* Vel Total (ft/s)       *    8.13  * Avg. Vel. (ft/s)        *    2.76  *    9.31  *    2.36  *
* Max Chl Dpth (ft)      *    3.10  * Hydr. Depth (ft)        *    1.29  *    2.88  *    1.05  *
* Conv. Total (cfs)      * 14145.0  * Conv. (cfs)             *   629.3  * 13325.1  *   190.7  *
* Length Wtd. (ft)       *  225.21  * Wetted Per. (ft)        *   16.53  *   46.40  *    7.43  *
* Min Ch El (ft)         * 2155.01  * Shear (lb/sq ft)        *    0.69  *    1.55  *    0.55  *
* Alpha                  *    1.24  * Stream Power (lb/ft s)   *    1.91  *   14.44  *    1.29  *
* Frctn Loss (ft)        *    2.10  * Cum Volume (acre-ft)    *    0.08  *    3.78  *    0.09  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)          *    0.08  *    1.61  *    0.11  *
*****************************************************************************************************

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 OUTPUT  Profile #10-YEAR
*****************************************************************************************************
* E.G. Elev (ft)         * 2158.37  * Element                 *  Left OB *  Channel * Right OB *
* Vel Head (ft)          *    0.98  * Wt. n-Val.              *   0.059  *   0.030  *   0.059  *
* W.S. Elev (ft)         * 2157.39  * Reach Len. (ft)         *  140.71  *  227.52  *  284.13  *
* Crit W.S. (ft)         * 2157.39  * Flow Area (sq ft)       *   10.34  *   99.63  *    3.16  *
* E.G. Slope (ft/ft)     *0.009577  * Area (sq ft)            *   10.34  *   99.63  *    3.16  *
* Q Total (cfs)          *  831.00  * Flow (cfs)              *   21.44  *  803.78  *    5.78  *
* Top Width (ft)         *   64.37  * Top Width (ft)          *   13.31  *   46.29  *    4.77  *
* Vel Total (ft/s)       *    7.35  * Avg. Vel. (ft/s)        *    2.07  *    8.07  *    1.83  *
* Max Chl Dpth (ft)      *    2.38  * Hydr. Depth (ft)        *    0.78  *    2.15  *    0.66  *
* Conv. Total (cfs)      *  8491.4  * Conv. (cfs)             *   219.1  *  8213.2  *    59.1  *
* Length Wtd. (ft)       *  225.97  * Wetted Per. (ft)        *   13.40  *   46.40  *    4.95  *
* Min Ch El (ft)         * 2155.01  * Shear (lb/sq ft)        *    0.46  *    1.28  *    0.38  *
* Alpha                  *    1.17  * Stream Power (lb/ft s)   *    0.96  *   10.36  *    0.70  *
* Frctn Loss (ft)        *    2.33  * Cum Volume (acre-ft)    *    0.04  *    2.76  *    0.04  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)          *    0.05  *    1.57  *    0.07  *
*****************************************************************************************************

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: SUNNYCOVE WASH
REACH: REACH #2          RS: 0.807


CROSS SECTION OUTPUT  Profile #FLOODPLAIN
*****************************************************************************************************
* E.G. Elev (ft)         * 2157.04  * Element                 *  Left OB *  Channel * Right OB *
* Vel Head (ft)          *    1.30  * Wt. n-Val.              *   0.059  *   0.030  *   0.059  *
* W.S. Elev (ft)         * 2155.74  * Reach Len. (ft)         *  334.50  *  259.69  *  209.40  *
* Crit W.S. (ft)         * 2155.74  * Flow Area (sq ft)       *   10.08  *  163.46  *    0.87  *
* E.G. Slope (ft/ft)     *0.009527  * Area (sq ft)            *   10.08  *  163.46  *    0.87  *
* Q Total (cfs)          * 1542.00  * Flow (cfs)              *   30.14  * 1510.57  *    1.29  *
* Top Width (ft)         *   69.50  * Top Width (ft)          *    6.96  *   61.21  *    1.33  *
* Vel Total (ft/s)       *    8.84  * Avg. Vel. (ft/s)        *    2.99  *    9.24  *    1.48  *
* Max Chl Dpth (ft)      *    3.49  * Hydr. Depth (ft)        *    1.45  *    2.67  *    0.65  *
* Conv. Total (cfs)      * 15797.8  * Conv. (cfs)             *   308.8  * 15475.7  *    13.2  *
* Length Wtd. (ft)       *  259.99  * Wetted Per. (ft)        *    7.52  *   61.85  *    1.85  *
* Min Ch El (ft)         * 2152.25  * Shear (lb/sq ft)        *    0.80  *    1.57  *    0.28  *
* Alpha                  *    1.07  * Stream Power (lb/ft s)   *    2.38  *   14.53  *    0.41  *
* Frctn Loss (ft)        *    2.51  * Cum Volume (acre-ft)    *    0.05  *    3.41  *    0.08  *
* C & E Loss (ft)        *    0.04  * Cum SA (acres)          *    0.05  *    1.35  *    0.09  *
*****************************************************************************************************

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
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defaulted to critical depth.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2157.10	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.35	Wt. n-Val.	0.059	0.030	
W.S. Elev (ft)	2155.75	Reach Len. (ft)	334.50	259.69	209.40
Crit W.S. (ft)	2155.75	Flow Area (sq ft)	3.28	164.30	
E.G. Slope (ft/ft)	0.009937	Area (sq ft)	3.28	164.30	
Q Total (cfs)	1542.00	Flow (cfs)	7.57	1534.43	
Top Width (ft)	62.46	Top Width (ft)	1.25	61.21	
Vel Total (ft/s)	9.20	Avg. Vel. (ft/s)	2.31	9.34	
Max Chl Dpth (ft)	3.50	Hydr. Depth (ft)	2.63	2.68	
Conv. Total (cfs)	15468.6	Conv. (cfs)	76.0	15392.6	
Length Wtd. (ft)	259.87	Wetted Per. (ft)	3.73	63.15	
Min Ch El (ft)	2152.25	Shear (lb/sq ft)	0.55	1.61	
Alpha	1.03	Stream Power (lb/ft s)	1.26	15.07	
Frctn Loss (ft)	2.65	Cum Volume (acre-ft)	0.01	3.40	
C & E Loss (ft)	0.03	Cum SA (acres)	0.00	1.35	

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 OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2156.65	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.19	Wt. n-Val.	0.059	0.030	0.059
W.S. Elev (ft)	2155.46	Reach Len. (ft)	334.50	259.69	209.40
Crit W.S. (ft)	2155.46	Flow Area (sq ft)	8.23	146.30	0.53
E.G. Slope (ft/ft)	0.010081	Area (sq ft)	8.23	146.30	0.53
Q Total (cfs)	1316.00	Flow (cfs)	23.63	1291.68	0.69
Top Width (ft)	68.56	Top Width (ft)	6.29	61.21	1.06
Vel Total (ft/s)	8.49	Avg. Vel. (ft/s)	2.87	8.83	1.29
Max Chl Dpth (ft)	3.21	Hydr. Depth (ft)	1.31	2.39	0.51
Conv. Total (cfs)	13106.8	Conv. (cfs)	235.4	12864.5	6.9
Length Wtd. (ft)	260.01	Wetted Per. (ft)	6.79	61.85	1.46
Min Ch El (ft)	2152.25	Shear (lb/sq ft)	0.76	1.49	0.23
Alpha	1.06	Stream Power (lb/ft s)	2.19	13.14	0.30
Frctn Loss (ft)	2.63	Cum Volume (acre-ft)	0.04	3.05	0.06
C & E Loss (ft)	0.04	Cum SA (acres)	0.04	1.33	0.08

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2155.72	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.88	Wt. n-Val.	0.059	0.030	0.059
W.S. Elev (ft)	2154.84	Reach Len. (ft)	334.50	259.69	209.40
Crit W.S. (ft)	2154.84	Flow Area (sq ft)	4.77	108.09	0.08
E.G. Slope (ft/ft)	0.011116	Area (sq ft)	4.77	108.09	0.08
Q Total (cfs)	831.00	Flow (cfs)	11.98	818.97	0.06
Top Width (ft)	66.41	Top Width (ft)	4.80	61.21	0.40
Vel Total (ft/s)	7.36	Avg. Vel. (ft/s)	2.51	7.58	0.71
Max Chl Dpth (ft)	2.58	Hydr. Depth (ft)	0.99	1.77	0.19
Conv. Total (cfs)	7881.8	Conv. (cfs)	113.6	7767.7	0.5
Length Wtd. (ft)	260.04	Wetted Per. (ft)	5.18	61.85	0.56
Min Ch El (ft)	2152.25	Shear (lb/sq ft)	0.64	1.21	0.10
Alpha	1.05	Stream Power (lb/ft s)	1.61	9.19	0.07
Frctn Loss (ft)	2.93	Cum Volume (acre-ft)	0.02	2.22	0.03
C & E Loss (ft)	0.02	Cum SA (acres)	0.02	1.29	0.05

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 0.758

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2153.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.18	Wt. n-Val.		0.030	0.059
W.S. Elev (ft)	2151.93	Reach Len. (ft)	321.53	343.19	425.28
Crit W.S. (ft)	2151.93	Flow Area (sq ft)		172.84	10.10
E.G. Slope (ft/ft)	0.009759	Area (sq ft)		172.84	10.10
Q Total (cfs)	1542.00	Flow (cfs)		1517.02	24.98
Top Width (ft)	80.95	Top Width (ft)		70.96	9.99
Vel Total (ft/s)	8.43	Avg. Vel. (ft/s)		8.78	2.47
Max Chl Dpth (ft)	3.27	Hydr. Depth (ft)		2.44	1.01
Conv. Total (cfs)	15609.6	Conv. (cfs)		15356.8	252.9
Length Wtd. (ft)	343.84	Wetted Per. (ft)		71.94	10.19
Min Ch El (ft)	2148.66	Shear (lb/sq ft)		1.46	0.60
Alpha	1.07	Stream Power (lb/ft s)		12.85	1.49
Frctn Loss (ft)	3.33	Cum Volume (acre-ft)	0.01	2.40	0.06
C & E Loss (ft)	0.02	Cum SA (acres)	0.03	0.95	0.07

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.
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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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2153.17	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.24	Wt. n-Val.		0.030	
W.S. Elev (ft)	2151.93	Reach Len. (ft)	321.53	343.19	425.28
Crit W.S. (ft)	2151.93	Flow Area (sq ft)		172.69	
E.G. Slope (ft/ft)	0.010487	Area (sq ft)		172.69	
Q Total (cfs)	1542.00	Flow (cfs)		1542.00	
Top Width (ft)	70.95	Top Width (ft)		70.95	
Vel Total (ft/s)	8.93	Avg. Vel. (ft/s)		8.93	
Max Chl Dpth (ft)	3.27	Hydr. Depth (ft)		2.43	
Conv. Total (cfs)	15057.5	Conv. (cfs)		15057.5	
Length Wtd. (ft)	343.19	Wetted Per. (ft)		73.93	
Min Ch El (ft)	2148.66	Shear (lb/sq ft)		1.53	
Alpha	1.00	Stream Power (lb/ft s)		13.66	
Frctn Loss (ft)	3.49	Cum Volume (acre-ft)		2.40	
C & E Loss (ft)	0.01	Cum SA (acres)		0.95	

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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 OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2152.76	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.07	Wt. n-Val.		0.030	0.059
W.S. Elev (ft)	2151.68	Reach Len. (ft)	321.53	343.19	425.28
Crit W.S. (ft)	2151.68	Flow Area (sq ft)		155.14	7.75
E.G. Slope (ft/ft)	0.010152	Area (sq ft)		155.14	7.75
Q Total (cfs)	1316.00	Flow (cfs)		1298.14	17.86
Top Width (ft)	79.33	Top Width (ft)		70.54	8.79
Vel Total (ft/s)	8.08	Avg. Vel. (ft/s)		8.37	2.30
Max Chl Dpth (ft)	3.02	Hydr. Depth (ft)		2.20	0.88
Conv. Total (cfs)	13060.9	Conv. (cfs)		12883.7	177.2
Length Wtd. (ft)	343.74	Wetted Per. (ft)		71.46	8.96
Min Ch El (ft)	2148.66	Shear (lb/sq ft)		1.38	0.55
Alpha	1.06	Stream Power (lb/ft s)		11.51	1.26
Frctn Loss (ft)	3.46	Cum Volume (acre-ft)	0.00	2.15	0.04
C & E Loss (ft)	0.02	Cum SA (acres)	0.02	0.94	0.06

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2151.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.82	Wt. n-Val.		0.030	0.059
W.S. Elev (ft)	2151.09	Reach Len. (ft)	321.53	343.19	425.28
Crit W.S. (ft)	2151.09	Flow Area (sq ft)		113.36	3.37
E.G. Slope (ft/ft)	0.011411	Area (sq ft)		113.36	3.37
Q Total (cfs)	831.00	Flow (cfs)		824.82	6.18
Top Width (ft)	75.41	Top Width (ft)		69.55	5.87
Vel Total (ft/s)	7.12	Avg. Vel. (ft/s)		7.28	1.83
Max Chl Dpth (ft)	2.43	Hydr. Depth (ft)		1.63	0.57
Conv. Total (cfs)	7779.2	Conv. (cfs)		7721.4	57.8
Length Wtd. (ft)	343.50	Wetted Per. (ft)		70.30	5.98

* Min Ch El (ft)	* 2148.66	* Shear (lb/sq ft)	*	*	1.15 *	0.40 *
* Alpha	* 1.04	* Stream Power (lb/ft s)	*	*	8.36 *	0.74 *
* Frctn Loss (ft)	* 3.82	* Cum Volume (acre-ft)	* 0.00	*	1.56 *	0.02 *
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 0.00	*	0.90 *	0.03 *

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 0.693

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	* 2148.39	* Element	* Left OB *	Channel *	Right OB *
* Vel Head (ft)	* 1.34	* Wt. n-Val.	* 0.059 *	0.030 *	*
* W.S. Elev (ft)	* 2147.05	* Reach Len. (ft)	* 186.51 *	270.51 *	384.68 *
* Crit W.S. (ft)	* 2147.05	* Flow Area (sq ft)	* 1.32 *	165.58 *	*
* E.G. Slope (ft/ft)	*0.009626	* Area (sq ft)	* 1.32 *	165.58 *	*
* Q Total (cfs)	* 1542.00	* Flow (cfs)	* 1.72 *	1540.28 *	*
* Top Width (ft)	* 65.22	* Top Width (ft)	* 3.34 *	61.88 *	*
* Vel Total (ft/s)	* 9.24	* Avg. Vel. (ft/s)	* 1.31 *	9.30 *	*
* Max Chl Dpth (ft)	* 3.67	* Hydr. Depth (ft)	* 0.40 *	2.68 *	*
* Conv. Total (cfs)	* 15716.5	* Conv. (cfs)	* 17.6 *	15699.0 *	*
* Length Wtd. (ft)	* 270.54	* Wetted Per. (ft)	* 3.43 *	62.52 *	*
* Min Ch El (ft)	* 2143.38	* Shear (lb/sq ft)	* 0.23 *	1.59 *	*
* Alpha	* 1.01	* Stream Power (lb/ft s)	* 0.30 *	14.81 *	*
* Frctn Loss (ft)	* 2.63	* Cum Volume (acre-ft)	* 0.01 *	1.07 *	0.01 *
* C & E Loss (ft)	* 0.06	* Cum SA (acres)	* 0.01 *	0.43 *	0.02 *

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 OUTPUT Profile #FLOODWAY

* E.G. Elev (ft)	* 2148.40	* Element	* Left OB *	Channel *	Right OB *
* Vel Head (ft)	* 1.35	* Wt. n-Val.	*	0.030 *	*
* W.S. Elev (ft)	* 2147.05	* Reach Len. (ft)	* 186.51 *	270.51 *	384.68 *
* Crit W.S. (ft)	* 2147.05	* Flow Area (sq ft)	*	165.26 *	*
* E.G. Slope (ft/ft)	*0.009867	* Area (sq ft)	*	165.26 *	*
* Q Total (cfs)	* 1542.00	* Flow (cfs)	*	1542.00 *	*
* Top Width (ft)	* 61.85	* Top Width (ft)	*	61.85 *	*
* Vel Total (ft/s)	* 9.33	* Avg. Vel. (ft/s)	*	9.33 *	*
* Max Chl Dpth (ft)	* 3.67	* Hydr. Depth (ft)	*	2.67 *	*
* Conv. Total (cfs)	* 15523.7	* Conv. (cfs)	*	15523.7 *	*
* Length Wtd. (ft)	* 270.51	* Wetted Per. (ft)	*	63.27 *	*
* Min Ch El (ft)	* 2143.38	* Shear (lb/sq ft)	*	1.61 *	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	15.01 *	*
* Frctn Loss (ft)	* 2.75	* Cum Volume (acre-ft)	*	1.06 *	*
* C & E Loss (ft)	* 0.05	* Cum SA (acres)	*	0.43 *	*

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 OUTPUT Profile #50-YEAR

* E.G. Elev (ft)	* 2147.99	* Element	* Left OB *	Channel *	Right OB *
* Vel Head (ft)	* 1.23	* Wt. n-Val.	* 0.059 *	0.030 *	*
* W.S. Elev (ft)	* 2146.75	* Reach Len. (ft)	* 186.51 *	270.51 *	384.68 *
* Crit W.S. (ft)	* 2146.75	* Flow Area (sq ft)	* 0.52 *	147.49 *	*
* E.G. Slope (ft/ft)	*0.009972	* Area (sq ft)	* 0.52 *	147.49 *	*
* Q Total (cfs)	* 1316.00	* Flow (cfs)	* 0.50 *	1315.50 *	*
* Top Width (ft)	* 62.38	* Top Width (ft)	* 2.09 *	60.29 *	*
* Vel Total (ft/s)	* 8.89	* Avg. Vel. (ft/s)	* 0.97 *	8.92 *	*
* Max Chl Dpth (ft)	* 3.37	* Hydr. Depth (ft)	* 0.25 *	2.45 *	*
* Conv. Total (cfs)	* 13178.2	* Conv. (cfs)	* 5.0 *	13173.2 *	*
* Length Wtd. (ft)	* 270.55	* Wetted Per. (ft)	* 2.14 *	60.90 *	*
* Min Ch El (ft)	* 2143.38	* Shear (lb/sq ft)	* 0.15 *	1.51 *	*
* Alpha	* 1.01	* Stream Power (lb/ft s)	* 0.15 *	13.45 *	*
* Frctn Loss (ft)	* 2.75	* Cum Volume (acre-ft)	* 0.00 *	0.96 *	0.01 *
* C & E Loss (ft)	* 0.06	* Cum SA (acres)	* 0.01 *	0.43 *	0.01 *

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2147.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.96	Wt. n-Val.		0.030	
W.S. Elev (ft)	2146.03	Reach Len. (ft)	186.51	270.51	384.68
Crit W.S. (ft)	2146.03	Flow Area (sq ft)		105.53	
E.G. Slope (ft/ft)	0.010857	Area (sq ft)		105.53	
Q Total (cfs)	831.00	Flow (cfs)		831.00	
Top Width (ft)	55.48	Top Width (ft)		55.48	
Vel Total (ft/s)	7.87	Avg. Vel. (ft/s)		7.87	
Max Chl Dpth (ft)	2.65	Hydr. Depth (ft)		1.90	
Conv. Total (cfs)	7975.2	Conv. (cfs)		7975.2	
Length Wtd. (ft)	270.52	Wetted Per. (ft)		55.99	
Min Ch El (ft)	2143.38	Shear (lb/sq ft)		1.28	
Alpha	1.00	Stream Power (lb/ft s)		10.06	
Frctn Loss (ft)	3.02	Cum Volume (acre-ft)	0.00	0.69	0.00
C & E Loss (ft)	0.06	Cum SA (acres)	0.00	0.41	0.00

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 0.642

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2142.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.14	Wt. n-Val.	0.059	0.030	0.059
W.S. Elev (ft)	2141.40	Reach Len. (ft)			
Crit W.S. (ft)	2141.40	Flow Area (sq ft)	1.17	179.10	2.07
E.G. Slope (ft/ft)	0.009823	Area (sq ft)	1.17	179.10	2.07
Q Total (cfs)	1542.00	Flow (cfs)	1.56	1537.09	3.35
Top Width (ft)	83.56	Top Width (ft)	2.86	76.91	3.80
Vel Total (ft/s)	8.46	Avg. Vel. (ft/s)	1.34	8.58	1.62
Max Chl Dpth (ft)	3.30	Hydr. Depth (ft)	0.41	2.33	0.54
Conv. Total (cfs)	15558.5	Conv. (cfs)	15.8	15509.0	33.8
Length Wtd. (ft)		Wetted Per. (ft)	2.97	77.48	3.95
Min Ch El (ft)	2138.10	Shear (lb/sq ft)	0.24	1.42	0.32
Alpha	1.03	Stream Power (lb/ft s)	0.32	12.17	0.52
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.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2142.55	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.17	Wt. n-Val.		0.030	
W.S. Elev (ft)	2141.38	Reach Len. (ft)			
Crit W.S. (ft)	2141.38	Flow Area (sq ft)		177.58	
E.G. Slope (ft/ft)	0.010498	Area (sq ft)		177.58	
Q Total (cfs)	1542.00	Flow (cfs)		1542.00	
Top Width (ft)	76.91	Top Width (ft)		76.91	
Vel Total (ft/s)	8.68	Avg. Vel. (ft/s)		8.68	
Max Chl Dpth (ft)	3.28	Hydr. Depth (ft)		2.31	
Conv. Total (cfs)	15049.5	Conv. (cfs)		15049.5	
Length Wtd. (ft)		Wetted Per. (ft)		79.34	
Min Ch El (ft)	2138.10	Shear (lb/sq ft)		1.47	
Alpha	1.00	Stream Power (lb/ft s)		12.74	
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.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2142.19	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.04	Wt. n-Val.	0.059	0.030	0.059

W.S. Elev (ft)	2141.15	Reach Len. (ft)				
Crit W.S. (ft)	2141.15	Flow Area (sq ft)	0.57	160.25	1.24	
E.G. Slope (ft/ft)	0.010394	Area (sq ft)	0.57	160.25	1.24	
Q Total (cfs)	1316.00	Flow (cfs)	0.62	1313.64	1.74	
Top Width (ft)	81.85	Top Width (ft)	2.00	76.91	2.94	
Vel Total (ft/s)	8.12	Avg. Vel. (ft/s)	1.09	8.20	1.41	
Max Chl Dpth (ft)	3.05	Hydr. Depth (ft)	0.29	2.08	0.42	
Conv. Total (cfs)	12908.0	Conv. (cfs)	6.1	12884.8	17.1	
Length Wtd. (ft)		Wetted Per. (ft)	2.08	77.48	3.06	
Min Ch El (ft)	2138.10	Shear (lb/sq ft)	0.18	1.34	0.26	
Alpha	1.02	Stream Power (lb/ft s)	0.19	11.00	0.37	
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.

CROSS SECTION OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2141.37	Element			
Vel Head (ft)	0.77	Wt. n-Val.	0.000	0.030	0.059
W.S. Elev (ft)	2140.61	Reach Len. (ft)			
Crit W.S. (ft)	2140.61	Flow Area (sq ft)	0.00	118.15	0.15
E.G. Slope (ft/ft)	0.011485	Area (sq ft)	0.00	118.15	0.15
Q Total (cfs)	831.00	Flow (cfs)	0.00	830.89	0.11
Top Width (ft)	78.03	Top Width (ft)	0.09	76.91	1.03
Vel Total (ft/s)	7.02	Avg. Vel. (ft/s)	0.14	7.03	0.73
Max Chl Dpth (ft)	2.50	Hydr. Depth (ft)	0.01	1.54	0.15
Conv. Total (cfs)	7754.2	Conv. (cfs)	0.0	7753.2	1.0
Length Wtd. (ft)		Wetted Per. (ft)	0.09	77.48	1.07
Min Ch El (ft)	2138.10	Shear (lb/sq ft)		1.09	0.10
Alpha	1.00	Stream Power (lb/ft s)		7.69	0.07
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.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #2 RS: 1.197

CROSS SECTION OUTPUT Profile #FLOODPLAIN

			Left OB	Channel	Right OB
E.G. Elev (ft)	2110.86	Element			
Vel Head (ft)	0.00	Wt. n-Val.	0.064	0.040	0.064
W.S. Elev (ft)	2110.86	Reach Len. (ft)	139.89	140.93	142.56
Crit W.S. (ft)		Flow Area (sq ft)	1.66	129.84	7.02
E.G. Slope (ft/ft)	0.000027	Area (sq ft)	1.66	129.84	7.02
Q Total (cfs)	56.00	Flow (cfs)	0.14	55.04	0.83
Top Width (ft)	47.95	Top Width (ft)	2.52	38.52	6.92
Vel Total (ft/s)	0.40	Avg. Vel. (ft/s)	0.08	0.42	0.12
Max Chl Dpth (ft)	3.74	Hydr. Depth (ft)	0.66	3.37	1.01
Conv. Total (cfs)	10847.1	Conv. (cfs)	26.9	10660.3	159.8
Length Wtd. (ft)	140.89	Wetted Per. (ft)	2.84	39.51	7.22
Min Ch El (ft)	2107.12	Shear (lb/sq ft)	0.00	0.01	0.00
Alpha	1.08	Stream Power (lb/ft s)	0.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	2.65	3.07	0.46
C & E Loss (ft)	0.03	Cum SA (acres)	2.45	1.22	0.79

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2110.86	Element			
Vel Head (ft)	0.00	Wt. n-Val.		0.040	
W.S. Elev (ft)	2110.86	Reach Len. (ft)	139.89	140.93	142.56
Crit W.S. (ft)		Flow Area (sq ft)		129.81	
E.G. Slope (ft/ft)	0.000031	Area (sq ft)		129.81	
Q Total (cfs)	56.00	Flow (cfs)		56.00	
Top Width (ft)	38.52	Top Width (ft)		38.52	
Vel Total (ft/s)	0.43	Avg. Vel. (ft/s)		0.43	
Max Chl Dpth (ft)	3.74	Hydr. Depth (ft)		3.37	
Conv. Total (cfs)	10086.4	Conv. (cfs)		10086.4	
Length Wtd. (ft)	140.88	Wetted Per. (ft)		42.91	
Min Ch El (ft)	2107.12	Shear (lb/sq ft)		0.01	
Alpha	1.00	Stream Power (lb/ft s)		0.00	
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	0.18	3.41	0.19
C & E Loss (ft)	0.03	Cum SA (acres)	0.22	1.20	0.22

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2110.78	Element			
Vel Head (ft)	0.00	Wt. n-Val.	0.064	0.040	0.064
W.S. Elev (ft)	2110.78	Reach Len. (ft)	139.89	140.93	142.56

Crit W.S. (ft)		Flow Area (sq ft)	1.46	126.73	6.47	
E.G. Slope (ft/ft)	0.000021	Area (sq ft)	1.46	126.73	6.47	
Q Total (cfs)	48.00	Flow (cfs)	0.11	47.23	0.66	
Top Width (ft)	47.52	Top Width (ft)	2.36	38.52	6.64	
Vel Total (ft/s)	0.36	Avg. Vel. (ft/s)	0.07	0.37	0.10	
Max Chl Dpth (ft)	3.66	Hydr. Depth (ft)	0.62	3.29	0.97	
Conv. Total (cfs)	10405.3	Conv. (cfs)	22.8	10239.0	143.5	
Length Wtd. (ft)	140.90	Wetted Per. (ft)	2.67	39.51	6.94	
Min Ch El (ft)	2107.12	Shear (lb/sq ft)	0.00	0.00	0.00	
Alpha	1.08	Stream Power (lb/ft s)	0.00	0.00	0.00	
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	1.93	2.79	0.36	
C & E Loss (ft)	0.02	Cum SA (acres)	2.19	1.21	0.65	

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2110.57	Element			
Vel Head (ft)	0.00	Wt. n-Val.	0.064	0.040	0.064
W.S. Elev (ft)	2110.56	Reach Len. (ft)	139.89	140.93	142.56
Crit W.S. (ft)		Flow Area (sq ft)	1.00	118.49	5.13
E.G. Slope (ft/ft)	0.000010	Area (sq ft)	1.00	118.49	5.13
Q Total (cfs)	30.00	Flow (cfs)	0.04	29.62	0.34
Top Width (ft)	46.38	Top Width (ft)	1.96	38.52	5.91
Vel Total (ft/s)	0.24	Avg. Vel. (ft/s)	0.04	0.25	0.07
Max Chl Dpth (ft)	3.44	Hydr. Depth (ft)	0.51	3.08	0.87
Conv. Total (cfs)	9271.7	Conv. (cfs)	13.7	9152.7	105.2
Length Wtd. (ft)	140.92	Wetted Per. (ft)	2.21	39.51	6.17
Min Ch El (ft)	2107.12	Shear (lb/sq ft)	0.00	0.00	0.00
Alpha	1.07	Stream Power (lb/ft s)	0.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.87	2.06	0.15
C & E Loss (ft)	0.02	Cum SA (acres)	0.99	1.18	0.34

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #2 RS: 1.170

CROSS SECTION OUTPUT Profile #FLOODPLAIN

			Left OB	Channel	Right OB
E.G. Elev (ft)	2110.82	Element			
Vel Head (ft)	0.26	Wt. n-Val.	0.064	0.040	0.064
W.S. Elev (ft)	2110.56	Reach Len. (ft)	299.79	277.90	234.94
Crit W.S. (ft)	2110.56	Flow Area (sq ft)	4.24	11.74	0.01
E.G. Slope (ft/ft)	0.022424	Area (sq ft)	4.24	11.74	0.01
Q Total (cfs)	56.00	Flow (cfs)	5.53	50.46	0.01
Top Width (ft)	35.77	Top Width (ft)	18.39	17.13	0.25
Vel Total (ft/s)	3.50	Avg. Vel. (ft/s)	1.31	4.30	0.45
Max Chl Dpth (ft)	0.94	Hydr. Depth (ft)	0.23	0.69	0.05
Conv. Total (cfs)	374.0	Conv. (cfs)	36.9	337.0	0.0
Length Wtd. (ft)	278.43	Wetted Per. (ft)	18.40	17.29	0.27
Min Ch El (ft)	2109.62	Shear (lb/sq ft)	0.32	0.95	0.07
Alpha	1.37	Stream Power (lb/ft s)	0.42	4.09	0.03
Frctn Loss (ft)	4.30	Cum Volume (acre-ft)	2.64	2.84	0.45
C & E Loss (ft)	0.06	Cum SA (acres)	2.41	1.13	0.78

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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 OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2110.82	Element			
Vel Head (ft)	0.26	Wt. n-Val.	0.064	0.040	0.064
W.S. Elev (ft)	2110.56	Reach Len. (ft)	299.79	277.90	234.94
Crit W.S. (ft)	2110.56	Flow Area (sq ft)	3.70	11.68	0.01
E.G. Slope (ft/ft)	0.022624	Area (sq ft)	3.70	11.68	0.01
Q Total (cfs)	56.00	Flow (cfs)	5.73	50.27	0.01
Top Width (ft)	29.79	Top Width (ft)	12.42	17.13	0.24
Vel Total (ft/s)	3.64	Avg. Vel. (ft/s)	1.55	4.30	0.44
Max Chl Dpth (ft)	0.94	Hydr. Depth (ft)	0.30	0.68	0.05
Conv. Total (cfs)	372.3	Conv. (cfs)	38.1	334.2	0.0
Length Wtd. (ft)	278.43	Wetted Per. (ft)	12.58	17.29	0.26
Min Ch El (ft)	2109.62	Shear (lb/sq ft)	0.42	0.95	0.06
Alpha	1.28	Stream Power (lb/ft s)	0.64	4.11	0.03
Frctn Loss (ft)	4.34	Cum Volume (acre-ft)	0.17	3.18	0.19
C & E Loss (ft)	0.06	Cum SA (acres)	0.20	1.11	0.22

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant

method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2110.75	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.	0.064	0.040	0.000
W.S. Elev (ft)	2110.50	Reach Len. (ft)	299.79	277.90	234.94
Crit W.S. (ft)	2110.50	Flow Area (sq ft)	3.24	10.76	0.00
E.G. Slope (ft/ft)	0.022922	Area (sq ft)	3.24	10.76	0.00
Q Total (cfs)	48.00	Flow (cfs)	3.87	44.13	0.00
Top Width (ft)	33.63	Top Width (ft)	16.39	17.13	0.11
Vel Total (ft/s)	3.43	Avg. Vel. (ft/s)	1.19	4.10	0.26
Max Chl Dpth (ft)	0.88	Hydr. Depth (ft)	0.20	0.63	0.02
Conv. Total (cfs)	317.0	Conv. (cfs)	25.5	291.5	0.0
Length Wtd. (ft)	278.18	Wetted Per. (ft)	16.39	17.29	0.12
Min Ch El (ft)	2109.62	Shear (lb/sq ft)	0.28	0.89	
Alpha	1.33	Stream Power (lb/ft s)	0.34	3.65	
Frctn Loss (ft)	4.13	Cum Volume (acre-ft)	1.92	2.56	0.35
C & E Loss (ft)	0.05	Cum SA (acres)	2.16	1.12	0.64

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2110.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.	0.064	0.040	
W.S. Elev (ft)	2110.33	Reach Len. (ft)	299.79	277.90	234.94
Crit W.S. (ft)	2110.33	Flow Area (sq ft)	1.03	7.85	
E.G. Slope (ft/ft)	0.027685	Area (sq ft)	1.03	7.85	
Q Total (cfs)	30.00	Flow (cfs)	0.93	29.07	
Top Width (ft)	25.89	Top Width (ft)	9.11	16.78	
Vel Total (ft/s)	3.38	Avg. Vel. (ft/s)	0.90	3.70	
Max Chl Dpth (ft)	0.71	Hydr. Depth (ft)	0.11	0.47	
Conv. Total (cfs)	180.3	Conv. (cfs)	5.6	174.7	
Length Wtd. (ft)	278.21	Wetted Per. (ft)	9.11	16.92	
Min Ch El (ft)	2109.62	Shear (lb/sq ft)	0.20	0.80	
Alpha	1.17	Stream Power (lb/ft s)	0.18	2.97	
Frctn Loss (ft)	3.82	Cum Volume (acre-ft)	0.87	1.85	0.14
C & E Loss (ft)	0.03	Cum SA (acres)	0.98	1.09	0.33

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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: SUNSET WASH
REACH: REACH #2 RS: 1.117

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2106.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.86	Wt. n-Val.	0.064	0.040	0.064
W.S. Elev (ft)	2105.39	Reach Len. (ft)	508.90	531.99	559.75
Crit W.S. (ft)	2105.20	Flow Area (sq ft)	10.79	56.95	7.70
E.G. Slope (ft/ft)	0.014878	Area (sq ft)	10.79	56.95	7.70
Q Total (cfs)	493.00	Flow (cfs)	34.84	444.36	13.80
Top Width (ft)	48.73	Top Width (ft)	8.49	25.20	15.04
Vel Total (ft/s)	6.54	Avg. Vel. (ft/s)	3.23	7.80	1.79
Max Chl Dpth (ft)	2.54	Hydr. Depth (ft)	1.27	2.26	0.51
Conv. Total (cfs)	4041.7	Conv. (cfs)	285.6	3643.0	113.1

Length Wtd. (ft)	531.53	Wetted Per. (ft)	8.86	25.21	15.28
Min Ch El (ft)	2102.85	Shear (lb/sq ft)	1.13	2.10	0.47
Alpha	1.30	Stream Power (lb/ft s)	3.65	16.37	0.84
Frctn Loss (ft)	8.02	Cum Volume (acre-ft)	2.59	2.62	0.43
C & E Loss (ft)	0.03	Cum SA (acres)	2.32	1.00	0.74

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

CROSS SECTION OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2106.26	Element			
Vel Head (ft)	0.87	Wt. n-Val.	0.064	0.040	0.064
W.S. Elev (ft)	2105.39	Reach Len. (ft)	508.90	531.99	559.75
Crit W.S. (ft)	2105.18	Flow Area (sq ft)	10.74	56.80	7.61
E.G. Slope (ft/ft)	0.015016	Area (sq ft)	10.74	56.80	7.61
Q Total (cfs)	493.00	Flow (cfs)	34.78	444.41	13.82
Top Width (ft)	48.34	Top Width (ft)	8.47	25.20	14.67
Vel Total (ft/s)	6.56	Avg. Vel. (ft/s)	3.24	7.82	1.82
Max Chl Dpth (ft)	2.54	Hydr. Depth (ft)	1.27	2.25	0.52
Conv. Total (cfs)	4023.2	Conv. (cfs)	283.8	3626.6	112.8
Length Wtd. (ft)	531.53	Wetted Per. (ft)	8.84	25.21	14.91
Min Ch El (ft)	2102.85	Shear (lb/sq ft)	1.14	2.11	0.48
Alpha	1.30	Stream Power (lb/ft s)	3.69	16.53	0.87
Frctn Loss (ft)	8.02	Cum Volume (acre-ft)	0.12	2.96	0.17
C & E Loss (ft)	0.03	Cum SA (acres)	0.13	0.98	0.18

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.

CROSS SECTION OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2105.96	Element			
Vel Head (ft)	0.74	Wt. n-Val.	0.064	0.040	0.064
W.S. Elev (ft)	2105.22	Reach Len. (ft)	508.90	531.99	559.75
Crit W.S. (ft)	2105.08	Flow Area (sq ft)	9.35	52.53	5.83
E.G. Slope (ft/ft)	0.014217	Area (sq ft)	9.35	52.53	5.83
Q Total (cfs)	421.00	Flow (cfs)	28.14	379.61	13.25
Top Width (ft)	40.71	Top Width (ft)	7.90	25.20	7.61
Vel Total (ft/s)	6.22	Avg. Vel. (ft/s)	3.01	7.23	2.27
Max Chl Dpth (ft)	2.37	Hydr. Depth (ft)	1.18	2.08	0.77
Conv. Total (cfs)	3530.8	Conv. (cfs)	236.0	3183.7	111.1
Length Wtd. (ft)	531.63	Wetted Per. (ft)	8.25	25.21	7.84
Min Ch El (ft)	2102.85	Shear (lb/sq ft)	1.01	1.85	0.66
Alpha	1.24	Stream Power (lb/ft s)	3.03	13.37	1.50
Frctn Loss (ft)	8.07	Cum Volume (acre-ft)	1.88	2.36	0.33
C & E Loss (ft)	0.03	Cum SA (acres)	2.08	0.99	0.62

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

CROSS SECTION OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2105.27	Element			
Vel Head (ft)	0.50	Wt. n-Val.	0.064	0.040	0.064
W.S. Elev (ft)	2104.77	Reach Len. (ft)	508.90	531.99	559.75
Crit W.S. (ft)		Flow Area (sq ft)	6.17	41.36	3.22
E.G. Slope (ft/ft)	0.012865	Area (sq ft)	6.17	41.36	3.22
Q Total (cfs)	264.00	Flow (cfs)	15.40	242.41	6.19
Top Width (ft)	36.59	Top Width (ft)	6.42	25.20	4.97
Vel Total (ft/s)	5.20	Avg. Vel. (ft/s)	2.49	5.86	1.93
Max Chl Dpth (ft)	1.92	Hydr. Depth (ft)	0.96	1.64	0.65
Conv. Total (cfs)	2327.5	Conv. (cfs)	135.7	2137.2	54.6
Length Wtd. (ft)	531.63	Wetted Per. (ft)	6.70	25.21	5.15
Min Ch El (ft)	2102.85	Shear (lb/sq ft)	0.74	1.32	0.50
Alpha	1.18	Stream Power (lb/ft s)	1.84	7.72	0.97
Frctn Loss (ft)	8.27	Cum Volume (acre-ft)	0.84	1.70	0.13
C & E Loss (ft)	0.04	Cum SA (acres)	0.92	0.96	0.32

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: SUNSET WASH
REACH: REACH #2 RS: 1.016

CROSS SECTION OUTPUT Profile #FLOODPLAIN

			Left OB	Channel	Right OB
E.G. Elev (ft)	2098.21	Element			
Vel Head (ft)	1.17	Wt. n-Val.	0.064	0.040	0.064
W.S. Elev (ft)	2097.04	Reach Len. (ft)	477.49	481.09	483.72
Crit W.S. (ft)	2097.04	Flow Area (sq ft)	4.90	53.46	3.66
E.G. Slope (ft/ft)	0.015313	Area (sq ft)	4.90	53.46	3.66
Q Total (cfs)	493.00	Flow (cfs)	11.56	473.01	8.43
Top Width (ft)	30.80	Top Width (ft)	6.42	19.50	4.89
Vel Total (ft/s)	7.95	Avg. Vel. (ft/s)	2.36	8.85	2.30
Max Chl Dpth (ft)	3.47	Hydr. Depth (ft)	0.76	2.74	0.75

Conv. Total (cfs)	3984.0	Conv. (cfs)	93.4	3822.5	68.1
Length Wtd. (ft)	481.07	Wetted Per. (ft)	6.59	20.02	5.11
Min Ch El (ft)	2093.57	Shear (lb/sq ft)	0.71	2.55	0.68
Alpha	1.19	Stream Power (lb/ft s)	1.68	22.58	1.58
Frctn Loss (ft)	8.23	Cum Volume (acre-ft)	2.49	1.95	0.36
C & E Loss (ft)	0.00	Cum SA (acres)	2.23	0.72	0.61

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 OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2098.21	Element			
Vel Head (ft)	1.16	Wt. n-Val.	0.064	0.040	0.064
W.S. Elev (ft)	2097.05	Reach Len. (ft)	477.49	481.09	483.72
Crit W.S. (ft)	2097.05	Flow Area (sq ft)	4.95	53.62	3.70
E.G. Slope (ft/ft)	0.015154	Area (sq ft)	4.95	53.62	3.70
Q Total (cfs)	493.00	Flow (cfs)	11.69	472.79	8.52
Top Width (ft)	30.80	Top Width (ft)	6.41	19.50	4.89
Vel Total (ft/s)	7.92	Avg. Vel. (ft/s)	2.36	8.82	2.30
Max Chl Dpth (ft)	3.48	Hydr. Depth (ft)	0.77	2.75	0.76
Conv. Total (cfs)	4004.9	Conv. (cfs)	95.0	3840.7	69.2
Length Wtd. (ft)	481.07	Wetted Per. (ft)	6.60	20.02	5.12
Min Ch El (ft)	2093.57	Shear (lb/sq ft)	0.71	2.53	0.68
Alpha	1.19	Stream Power (lb/ft s)	1.68	22.34	1.57
Frctn Loss (ft)	8.15	Cum Volume (acre-ft)	0.03	2.29	0.10
C & E Loss (ft)	0.00	Cum SA (acres)	0.04	0.70	0.06

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 cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2097.86	Element			
Vel Head (ft)	1.09	Wt. n-Val.	0.064	0.040	0.064
W.S. Elev (ft)	2096.77	Reach Len. (ft)	477.49	481.09	483.72
Crit W.S. (ft)	2096.77	Flow Area (sq ft)	3.31	48.15	2.45
E.G. Slope (ft/ft)	0.016224	Area (sq ft)	3.31	48.15	2.45
Q Total (cfs)	421.00	Flow (cfs)	7.05	408.88	5.08
Top Width (ft)	28.77	Top Width (ft)	5.27	19.50	4.00
Vel Total (ft/s)	7.81	Avg. Vel. (ft/s)	2.13	8.49	2.07
Max Chl Dpth (ft)	3.20	Hydr. Depth (ft)	0.63	2.47	0.61
Conv. Total (cfs)	3305.3	Conv. (cfs)	55.3	3210.1	39.9
Length Wtd. (ft)	481.08	Wetted Per. (ft)	5.42	20.02	4.18
Min Ch El (ft)	2093.57	Shear (lb/sq ft)	0.62	2.44	0.59
Alpha	1.15	Stream Power (lb/ft s)	1.32	20.68	1.23
Frctn Loss (ft)	8.68	Cum Volume (acre-ft)	1.80	1.75	0.28
C & E Loss (ft)	0.00	Cum SA (acres)	2.00	0.72	0.54

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 OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2096.96	Element			
Vel Head (ft)	0.86	Wt. n-Val.	0.064	0.040	0.064
W.S. Elev (ft)	2096.10	Reach Len. (ft)	477.49	481.09	483.72
Crit W.S. (ft)	2096.10	Flow Area (sq ft)	0.72	35.08	0.50
E.G. Slope (ft/ft)	0.019190	Area (sq ft)	0.72	35.08	0.50
Q Total (cfs)	264.00	Flow (cfs)	1.00	262.33	0.67
Top Width (ft)	23.77	Top Width (ft)	2.46	19.50	1.81
Vel Total (ft/s)	7.27	Avg. Vel. (ft/s)	1.39	7.48	1.33
Max Chl Dpth (ft)	2.53	Hydr. Depth (ft)	0.29	1.80	0.28
Conv. Total (cfs)	1905.7	Conv. (cfs)	7.2	1893.7	4.8
Length Wtd. (ft)	481.09	Wetted Per. (ft)	2.53	20.02	1.90
Min Ch El (ft)	2093.57	Shear (lb/sq ft)	0.34	2.10	0.32
Alpha	1.05	Stream Power (lb/ft s)	0.48	15.70	0.42
Frctn Loss (ft)	9.77	Cum Volume (acre-ft)	0.80	1.23	0.11
C & E Loss (ft)	0.00	Cum SA (acres)	0.87	0.68	0.27

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: SUNSET WASH
REACH: REACH #2 RS: 0.925

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2088.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.17	Wt. n-Val.	0.064	0.040	0.064
W.S. Elev (ft)	2087.18	Reach Len. (ft)	243.16	242.03	241.97
Crit W.S. (ft)	2087.18	Flow Area (sq ft)	0.04	56.84	0.02
E.G. Slope (ft/ft)	0.019242	Area (sq ft)	0.04	56.84	0.02
Q Total (cfs)	493.00	Flow (cfs)	0.02	492.97	0.01
Top Width (ft)	24.96	Top Width (ft)	0.51	24.26	0.19
Vel Total (ft/s)	8.66	Avg. Vel. (ft/s)	0.55	8.67	0.57
Max Chl Dpth (ft)	3.27	Hydr. Depth (ft)	0.07	2.34	0.11
Conv. Total (cfs)	3554.1	Conv. (cfs)	0.2	3553.8	0.1
Length Wtd. (ft)	242.05	Wetted Per. (ft)	0.53	26.03	0.30
Min Ch El (ft)	2083.91	Shear (lb/sq ft)	0.09	2.62	0.09
Alpha	1.00	Stream Power (lb/ft s)	0.05	22.75	0.05
Frctn Loss (ft)	1.77	Cum Volume (acre-ft)	2.47	1.34	0.34
C & E Loss (ft)	0.25	Cum SA (acres)	2.20	0.48	0.58

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2088.35	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.16	Wt. n-Val.	0.064	0.040	0.064
W.S. Elev (ft)	2087.19	Reach Len. (ft)	243.16	242.03	241.97
Crit W.S. (ft)	2087.19	Flow Area (sq ft)	0.04	57.00	0.02
E.G. Slope (ft/ft)	0.019069	Area (sq ft)	0.04	57.00	0.02
Q Total (cfs)	493.00	Flow (cfs)	0.02	492.96	0.01
Top Width (ft)	24.96	Top Width (ft)	0.51	24.26	0.19
Vel Total (ft/s)	8.64	Avg. Vel. (ft/s)	0.58	8.65	0.58
Max Chl Dpth (ft)	3.28	Hydr. Depth (ft)	0.08	2.35	0.12
Conv. Total (cfs)	3570.2	Conv. (cfs)	0.2	3569.9	0.1
Length Wtd. (ft)	242.03	Wetted Per. (ft)	0.54	26.03	0.30
Min Ch El (ft)	2083.91	Shear (lb/sq ft)	0.09	2.61	0.09
Alpha	1.00	Stream Power (lb/ft s)	0.05	22.54	0.05
Frctn Loss (ft)	0.83	Cum Volume (acre-ft)	0.00	1.68	0.08
C & E Loss (ft)	0.29	Cum SA (acres)	0.00	0.46	0.03

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2088.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.07	Wt. n-Val.		0.040	
W.S. Elev (ft)	2086.92	Reach Len. (ft)	243.16	242.03	241.97
Crit W.S. (ft)	2086.92	Flow Area (sq ft)		50.62	
E.G. Slope (ft/ft)	0.020203	Area (sq ft)		50.62	
Q Total (cfs)	421.00	Flow (cfs)		421.00	
Top Width (ft)	23.86	Top Width (ft)		23.86	
Vel Total (ft/s)	8.32	Avg. Vel. (ft/s)		8.32	
Max Chl Dpth (ft)	3.01	Hydr. Depth (ft)		2.12	
Conv. Total (cfs)	2961.9	Conv. (cfs)		2961.9	

* Length Wtd. (ft)	* 242.05	* Wetted Per. (ft)	*		*	25.61	*		*
* Min Ch El (ft)	* 2083.91	* Shear (lb/sq ft)	*		*	2.49	*		*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*		*	20.74	*		*
* Frctn Loss (ft)	* 1.70	* Cum Volume (acre-ft)	*	1.79	*	1.20	*	0.26	*
* C & E Loss (ft)	* 0.23	* Cum SA (acres)	*	1.97	*	0.48	*	0.52	*

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #10-YEAR

* E.G. Elev (ft)	* 2087.11	* Element	*	Left OB	*	Channel	*	Right OB	*
* Vel Head (ft)	* 0.86	* Wt. n-Val.	*		*	0.040	*		*
* W.S. Elev (ft)	* 2086.25	* Reach Len. (ft)	*	243.16	*	242.03	*	241.97	*
* Crit W.S. (ft)	* 2086.25	* Flow Area (sq ft)	*		*	35.53	*		*
* E.G. Slope (ft/ft)	*0.021524	* Area (sq ft)	*		*	35.53	*		*
* Q Total (cfs)	* 264.00	* Flow (cfs)	*		*	264.00	*		*
* Top Width (ft)	* 20.99	* Top Width (ft)	*		*	20.99	*		*
* Vel Total (ft/s)	* 7.43	* Avg. Vel. (ft/s)	*		*	7.43	*		*
* Max Chl Dpth (ft)	* 2.34	* Hydr. Depth (ft)	*		*	1.69	*		*
* Conv. Total (cfs)	* 1799.5	* Conv. (cfs)	*		*	1799.5	*		*
* Length Wtd. (ft)	* 242.04	* Wetted Per. (ft)	*		*	22.32	*		*
* Min Ch El (ft)	* 2083.91	* Shear (lb/sq ft)	*		*	2.14	*		*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*		*	15.89	*		*
* Frctn Loss (ft)	* 2.00	* Cum Volume (acre-ft)	*	0.80	*	0.84	*	0.11	*
* C & E Loss (ft)	* 0.19	* Cum SA (acres)	*	0.86	*	0.46	*	0.26	*

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNSET WASH
REACH: REACH #2 RS: 0.880

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	* 2083.04	* Element	*	Left OB	*	Channel	*	Right OB	*
* Vel Head (ft)	* 0.35	* Wt. n-Val.	*	0.064	*	0.025	*		*
* W.S. Elev (ft)	* 2082.69	* Reach Len. (ft)	*	109.90	*	115.17	*	96.20	*
* Crit W.S. (ft)	* 2082.38	* Flow Area (sq ft)	*	11.80	*	98.67	*		*
* E.G. Slope (ft/ft)	*0.003831	* Area (sq ft)	*	148.01	*	98.67	*	63.16	*
* Q Total (cfs)	* 493.00	* Flow (cfs)	*	17.39	*	475.61	*		*
* Top Width (ft)	* 541.44	* Top Width (ft)	*	352.87	*	65.77	*	122.80	*
* Vel Total (ft/s)	* 4.46	* Avg. Vel. (ft/s)	*	1.47	*	4.82	*		*
* Max Chl Dpth (ft)	* 1.73	* Hydr. Depth (ft)	*	1.04	*	1.50	*		*
* Conv. Total (cfs)	* 7965.0	* Conv. (cfs)	*	281.0	*	7684.0	*		*
* Length Wtd. (ft)	* 113.27	* Wetted Per. (ft)	*	11.36	*	65.78	*		*
* Min Ch El (ft)	* 2080.96	* Shear (lb/sq ft)	*	0.25	*	0.36	*		*
* Alpha	* 1.13	* Stream Power (lb/ft s)	*	0.37	*	1.73	*		*
* Frctn Loss (ft)	* 0.49	* Cum Volume (acre-ft)	*	2.05	*	0.91	*	0.16	*
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	*	1.21	*	0.23	*	0.24	*

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #FLOODWAY

* E.G. Elev (ft)	* 2083.49	* Element	*	Left OB	*	Channel	*	Right OB	*
* Vel Head (ft)	* 0.20	* Wt. n-Val.	*	0.064	*	0.025	*		*
* W.S. Elev (ft)	* 2083.29	* Reach Len. (ft)	*	109.90	*	115.17	*	96.20	*
* Crit W.S. (ft)	* 2082.39	* Flow Area (sq ft)	*	0.63	*	138.09	*		*
* E.G. Slope (ft/ft)	*0.001391	* Area (sq ft)	*	0.63	*	138.09	*		*
* Q Total (cfs)	* 493.00	* Flow (cfs)	*	0.24	*	492.76	*		*
* Top Width (ft)	* 66.13	* Top Width (ft)	*	0.36	*	65.77	*		*
* Vel Total (ft/s)	* 3.55	* Avg. Vel. (ft/s)	*	0.39	*	3.57	*		*
* Max Chl Dpth (ft)	* 2.33	* Hydr. Depth (ft)	*	1.75	*	2.10	*		*
* Conv. Total (cfs)	* 13217.0	* Conv. (cfs)	*	6.6	*	13210.5	*		*
* Length Wtd. (ft)	* 113.32	* Wetted Per. (ft)	*	2.11	*	67.62	*		*
* Min Ch El (ft)	* 2080.96	* Shear (lb/sq ft)	*	0.03	*	0.18	*		*
* Alpha	* 1.01	* Stream Power (lb/ft s)	*	0.01	*	0.63	*		*
* Frctn Loss (ft)	* 0.18	* Cum Volume (acre-ft)	*	0.00	*	1.13	*	0.08	*
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	*	0.00	*	0.21	*	0.03	*

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2082.88	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.29	Wt. n-Val.	0.064	0.025	
W.S. Elev (ft)	2082.59	Reach Len. (ft)	109.90	115.17	96.20
Crit W.S. (ft)	2082.26	Flow Area (sq ft)	10.66	92.03	
E.G. Slope (ft/ft)	0.003536	Area (sq ft)	113.14	92.03	51.17
Q Total (cfs)	421.00	Flow (cfs)	14.10	406.90	
Top Width (ft)	515.84	Top Width (ft)	339.15	65.77	110.92
Vel Total (ft/s)	4.10	Avg. Vel. (ft/s)	1.32	4.42	
Max Chl Dpth (ft)	1.63	Hydr. Depth (ft)	0.94	1.40	
Conv. Total (cfs)	7079.7	Conv. (cfs)	237.0	6842.7	
Length Wtd. (ft)	113.39	Wetted Per. (ft)	11.36	65.78	
Min Ch El (ft)	2080.96	Shear (lb/sq ft)	0.21	0.31	
Alpha	1.13	Stream Power (lb/ft s)	0.27	1.37	
Frctn Loss (ft)	0.53	Cum Volume (acre-ft)	1.47	0.80	0.12
C & E Loss (ft)	0.04	Cum SA (acres)	1.03	0.23	0.21

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2082.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.	0.064	0.025	
W.S. Elev (ft)	2082.19	Reach Len. (ft)	109.90	115.17	96.20
Crit W.S. (ft)	2081.98	Flow Area (sq ft)	6.14	65.88	
E.G. Slope (ft/ft)	0.004326	Area (sq ft)	39.76	65.88	19.43
Q Total (cfs)	264.00	Flow (cfs)	6.22	257.78	
Top Width (ft)	251.88	Top Width (ft)	130.65	65.77	55.46
Vel Total (ft/s)	3.67	Avg. Vel. (ft/s)	1.01	3.91	
Max Chl Dpth (ft)	1.23	Hydr. Depth (ft)	0.54	1.00	
Conv. Total (cfs)	4013.8	Conv. (cfs)	94.5	3919.2	
Length Wtd. (ft)	113.70	Wetted Per. (ft)	11.36	65.78	
Min Ch El (ft)	2080.96	Shear (lb/sq ft)	0.15	0.27	
Alpha	1.11	Stream Power (lb/ft s)	0.15	1.06	
Frctn Loss (ft)	0.66	Cum Volume (acre-ft)	0.69	0.56	0.05
C & E Loss (ft)	0.03	Cum SA (acres)	0.49	0.22	0.11

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #2 RS: 0.858

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2082.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.59	Wt. n-Val.	0.030	0.025	0.030
W.S. Elev (ft)	2081.93	Reach Len. (ft)	94.51	155.14	151.30
Crit W.S. (ft)	2081.93	Flow Area (sq ft)	18.24	57.02	19.56
E.G. Slope (ft/ft)	0.004998	Area (sq ft)	120.35	57.02	32.20
Q Total (cfs)	493.00	Flow (cfs)	25.54	380.64	86.82
Top Width (ft)	271.11	Top Width (ft)	206.54	28.17	36.40
Vel Total (ft/s)	5.20	Avg. Vel. (ft/s)	1.40	6.68	4.44
Max Chl Dpth (ft)	2.45	Hydr. Depth (ft)	0.24	2.02	1.59
Conv. Total (cfs)	6973.7	Conv. (cfs)	361.3	5384.3	1228.1
Length Wtd. (ft)	131.80	Wetted Per. (ft)	77.51	28.47	13.71
Min Ch El (ft)	2079.48	Shear (lb/sq ft)	0.07	0.62	0.45
Alpha	1.41	Stream Power (lb/ft s)	0.10	4.17	1.98
Frctn Loss (ft)	0.44	Cum Volume (acre-ft)	1.71	0.70	0.06
C & E Loss (ft)	0.15	Cum SA (acres)	0.50	0.11	0.06

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: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2083.28	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.37	Wt. n-Val.		0.025	0.030
W.S. Elev (ft)	2082.91	Reach Len. (ft)	94.51	155.14	151.30
Crit W.S. (ft)	2081.84	Flow Area (sq ft)		76.98	26.94

E.G. Slope (ft/ft)	0.001913	Area (sq ft)		76.98	26.94	
Q Total (cfs)	493.00	Flow (cfs)		396.98	96.02	
Top Width (ft)	35.00	Top Width (ft)		24.66	10.34	
Vel Total (ft/s)	4.74	Avg. Vel. (ft/s)		5.16	3.56	
Max Chl Dpth (ft)	3.43	Hydr. Depth (ft)		3.12	2.61	
Conv. Total (cfs)	11271.1	Conv. (cfs)		9075.9	2195.2	
Length Wtd. (ft)	154.77	Wetted Per. (ft)		27.56	12.77	
Min Ch El (ft)	2079.48	Shear (lb/sq ft)		0.33	0.25	
Alpha	1.06	Stream Power (lb/ft s)		1.72	0.90	
Frctn Loss (ft)	0.53	Cum Volume (acre-ft)		0.85	0.05	
C & E Loss (ft)	0.07	Cum SA (acres)		0.09	0.02	

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2082.32	Element			
Vel Head (ft)	0.66	Wt. n-Val.	0.030	0.025	0.030
W.S. Elev (ft)	2081.66	Reach Len. (ft)	94.51	155.14	151.30
Crit W.S. (ft)	2081.66	Flow Area (sq ft)	4.95	49.41	16.24
E.G. Slope (ft/ft)	0.006469	Area (sq ft)	74.39	49.41	23.03
Q Total (cfs)	421.00	Flow (cfs)	6.49	341.12	73.39
Top Width (ft)	198.83	Top Width (ft)	139.11	28.17	31.55
Vel Total (ft/s)	5.96	Avg. Vel. (ft/s)	1.31	6.90	4.52
Max Chl Dpth (ft)	2.18	Hydr. Depth (ft)	0.19	1.75	1.32
Conv. Total (cfs)	5234.4	Conv. (cfs)	80.7	4241.2	912.4
Length Wtd. (ft)	133.64	Wetted Per. (ft)	26.23	28.47	13.44
Min Ch El (ft)	2079.48	Shear (lb/sq ft)	0.08	0.70	0.49
Alpha	1.19	Stream Power (lb/ft s)	0.10	4.84	2.21
Frctn Loss (ft)	0.58	Cum Volume (acre-ft)	1.23	0.62	0.04
C & E Loss (ft)	0.17	Cum SA (acres)	0.42	0.10	0.05

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: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2081.73	Element			
Vel Head (ft)	0.56	Wt. n-Val.		0.025	0.030
W.S. Elev (ft)	2081.17	Reach Len. (ft)	94.51	155.14	151.30
Crit W.S. (ft)	2081.17	Flow Area (sq ft)		35.58	10.19
E.G. Slope (ft/ft)	0.008251	Area (sq ft)	22.22	35.58	10.61
Q Total (cfs)	264.00	Flow (cfs)		224.95	39.05
Top Width (ft)	115.87	Top Width (ft)	70.74	27.80	17.33
Vel Total (ft/s)	5.77	Avg. Vel. (ft/s)		6.32	3.83
Max Chl Dpth (ft)	1.69	Hydr. Depth (ft)		1.28	0.83
Conv. Total (cfs)	2906.4	Conv. (cfs)		2476.4	429.9
Length Wtd. (ft)	135.17	Wetted Per. (ft)		28.08	12.95
Min Ch El (ft)	2079.48	Shear (lb/sq ft)		0.65	0.41
Alpha	1.09	Stream Power (lb/ft s)		4.13	1.55
Frctn Loss (ft)	0.88	Cum Volume (acre-ft)	0.61	0.42	0.02
C & E Loss (ft)	0.13	Cum SA (acres)	0.24	0.10	0.03

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: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #2 RS: 0.828

CROSS SECTION OUTPUT Profile #FLOODPLAIN

			Left OB	Channel	Right OB
E.G. Elev (ft)	2080.95	Element			
Vel Head (ft)	0.08	Wt. n-Val.	0.052	0.025	
W.S. Elev (ft)	2080.87	Reach Len. (ft)	393.00	393.00	393.00

Crit W.S. (ft)		Flow Area (sq ft)	251.93	41.42		
E.G. Slope (ft/ft)	0.002423	Area (sq ft)	251.93	41.42		
Q Total (cfs)	493.00	Flow (cfs)	348.46	144.54		
Top Width (ft)	289.78	Top Width (ft)	258.29	31.50		
Vel Total (ft/s)	1.68	Avg. Vel. (ft/s)	1.38	3.49		
Max Chl Dpth (ft)	2.47	Hydr. Depth (ft)	0.98	1.32		
Conv. Total (cfs)	10016.3	Conv. (cfs)	7079.6	2936.7		
Length Wtd. (ft)	393.00	Wetted Per. (ft)	258.33	31.80		
Min Ch El (ft)	2078.40	Shear (lb/sq ft)	0.15	0.20		
Alpha	1.74	Stream Power (lb/ft s)	0.20	0.69		
Frctn Loss (ft)	2.08	Cum Volume (acre-ft)	1.31	0.53		
C & E Loss (ft)	0.15	Cum SA (acres)				

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2082.68	Element			
Vel Head (ft)	1.07	Wt. n-Val.		0.025	
W.S. Elev (ft)	2081.61	Reach Len. (ft)	393.00	393.00	393.00
Crit W.S. (ft)	2081.61	Flow Area (sq ft)		59.26	
E.G. Slope (ft/ft)	0.007931	Area (sq ft)		59.26	
Q Total (cfs)	493.00	Flow (cfs)		493.00	
Top Width (ft)	27.20	Top Width (ft)		27.20	
Vel Total (ft/s)	8.32	Avg. Vel. (ft/s)		8.32	
Max Chl Dpth (ft)	3.21	Hydr. Depth (ft)		2.18	
Conv. Total (cfs)	5535.9	Conv. (cfs)		5535.9	
Length Wtd. (ft)	393.00	Wetted Per. (ft)		30.07	
Min Ch El (ft)	2078.40	Shear (lb/sq ft)		0.98	
Alpha	1.00	Stream Power (lb/ft s)		8.12	
Frctn Loss (ft)	3.78	Cum Volume (acre-ft)		0.61	
C & E Loss (ft)	0.05	Cum SA (acres)			

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant
method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2080.78	Element			
Vel Head (ft)	0.09	Wt. n-Val.	0.052	0.025	
W.S. Elev (ft)	2080.69	Reach Len. (ft)	393.00	393.00	393.00
Crit W.S. (ft)		Flow Area (sq ft)	205.88	35.88	
E.G. Slope (ft/ft)	0.003118	Area (sq ft)	205.88	35.88	
Q Total (cfs)	421.00	Flow (cfs)	287.45	133.55	
Top Width (ft)	281.38	Top Width (ft)	251.47	29.91	
Vel Total (ft/s)	1.74	Avg. Vel. (ft/s)	1.40	3.72	
Max Chl Dpth (ft)	2.29	Hydr. Depth (ft)	0.82	1.20	
Conv. Total (cfs)	7540.1	Conv. (cfs)	5148.2	2391.8	
Length Wtd. (ft)	393.00	Wetted Per. (ft)	251.51	30.20	
Min Ch El (ft)	2078.40	Shear (lb/sq ft)	0.16	0.23	
Alpha	1.89	Stream Power (lb/ft s)	0.22	0.86	
Frctn Loss (ft)	2.41	Cum Volume (acre-ft)	0.93	0.47	
C & E Loss (ft)	0.14	Cum SA (acres)			

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2080.36	Element			
Vel Head (ft)	0.11	Wt. n-Val.	0.052	0.025	
W.S. Elev (ft)	2080.24	Reach Len. (ft)	393.00	393.00	393.00
Crit W.S. (ft)		Flow Area (sq ft)	104.36	23.26	
E.G. Slope (ft/ft)	0.005225	Area (sq ft)	104.36	23.26	
Q Total (cfs)	264.00	Flow (cfs)	171.44	92.56	
Top Width (ft)	174.44	Top Width (ft)	148.62	25.82	
Vel Total (ft/s)	2.07	Avg. Vel. (ft/s)	1.64	3.98	
Max Chl Dpth (ft)	1.84	Hydr. Depth (ft)	0.70	0.90	
Conv. Total (cfs)	3652.4	Conv. (cfs)	2371.9	1280.5	
Length Wtd. (ft)	393.00	Wetted Per. (ft)	148.65	26.08	
Min Ch El (ft)	2078.40	Shear (lb/sq ft)	0.23	0.29	
Alpha	1.71	Stream Power (lb/ft s)	0.38	1.16	
Frctn Loss (ft)	3.25	Cum Volume (acre-ft)	0.47	0.32	
C & E Loss (ft)	0.11	Cum SA (acres)			

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

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

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.753

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2078.71	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.62	Wt. n-Val.		0.031		
W.S. Elev (ft)	2077.10	Reach Len. (ft)	87.41	84.79	81.91	
Crit W.S. (ft)	2077.10	Flow Area (sq ft)		75.46		
E.G. Slope (ft/ft)	0.011041	Area (sq ft)	38.67	75.46		
Q Total (cfs)	770.00	Flow (cfs)		770.00		
Top Width (ft)	158.31	Top Width (ft)	135.07	23.23		
Vel Total (ft/s)	10.20	Avg. Vel. (ft/s)		10.20		
Max Chl Dpth (ft)	4.66	Hydr. Depth (ft)		3.25		
Conv. Total (cfs)	7328.1	Conv. (cfs)		7328.1		
Length Wtd. (ft)	84.93	Wetted Per. (ft)		26.16		
Min Ch El (ft)	2072.44	Shear (lb/sq ft)		1.99		
Alpha	1.00	Stream Power (lb/ft s)		20.29		
Frctn Loss (ft)	0.32	Cum Volume (acre-ft)	0.12	0.55	0.00	
C & E Loss (ft)	0.63	Cum SA (acres)	9.26	2.42	2.91	

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: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2078.71	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.61	Wt. n-Val.		0.031		
W.S. Elev (ft)	2077.10	Reach Len. (ft)	87.41	84.79	81.91	
Crit W.S. (ft)	2077.10	Flow Area (sq ft)		75.52		
E.G. Slope (ft/ft)	0.011013	Area (sq ft)		75.52		
Q Total (cfs)	770.00	Flow (cfs)		770.00		
Top Width (ft)	23.23	Top Width (ft)		23.23		
Vel Total (ft/s)	10.20	Avg. Vel. (ft/s)		10.20		
Max Chl Dpth (ft)	4.66	Hydr. Depth (ft)		3.25		
Conv. Total (cfs)	7337.5	Conv. (cfs)		7337.5		
Length Wtd. (ft)	84.94	Wetted Per. (ft)		26.17		
Min Ch El (ft)	2072.44	Shear (lb/sq ft)		1.98		
Alpha	1.00	Stream Power (lb/ft s)		20.23		
Frctn Loss (ft)	0.23	Cum Volume (acre-ft)	0.06	0.48	0.00	
C & E Loss (ft)	0.67	Cum SA (acres)	1.31	2.54	0.13	

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2078.23	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.49	Wt. n-Val.		0.031		
W.S. Elev (ft)	2076.74	Reach Len. (ft)	87.41	84.79	81.91	
Crit W.S. (ft)	2076.74	Flow Area (sq ft)		67.28		
E.G. Slope (ft/ft)	0.011138	Area (sq ft)	0.23	67.28		
Q Total (cfs)	660.00	Flow (cfs)		660.00		
Top Width (ft)	48.08	Top Width (ft)	25.85	22.23		
Vel Total (ft/s)	9.81	Avg. Vel. (ft/s)		9.81		
Max Chl Dpth (ft)	4.30	Hydr. Depth (ft)		3.03		
Conv. Total (cfs)	6253.8	Conv. (cfs)		6253.8		
Length Wtd. (ft)	84.92	Wetted Per. (ft)		24.92		
Min Ch El (ft)	2072.44	Shear (lb/sq ft)		1.88		
Alpha	1.00	Stream Power (lb/ft s)		18.42		
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	0.07	0.49	0.00	
C & E Loss (ft)	0.61	Cum SA (acres)	8.63	2.39	2.65	

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: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2077.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.20	Wt. n-Val.		0.031	
W.S. Elev (ft)	2075.80	Reach Len. (ft)	87.41	84.79	81.91
Crit W.S. (ft)	2075.80	Flow Area (sq ft)		47.62	
E.G. Slope (ft/ft)	0.011781	Area (sq ft)		47.62	
Q Total (cfs)	419.00	Flow (cfs)		419.00	
Top Width (ft)	19.61	Top Width (ft)		19.61	
Vel Total (ft/s)	8.80	Avg. Vel. (ft/s)		8.80	
Max Chl Dpth (ft)	3.36	Hydr. Depth (ft)		2.43	
Conv. Total (cfs)	3860.3	Conv. (cfs)		3860.3	
Length Wtd. (ft)	84.86	Wetted Per. (ft)		21.65	
Min Ch El (ft)	2072.44	Shear (lb/sq ft)		1.62	
Alpha	1.00	Stream Power (lb/ft s)		14.23	
Frctn Loss (ft)	0.17	Cum Volume (acre-ft)	0.03	0.36	0.00
C & E Loss (ft)	0.53	Cum SA (acres)	7.19	2.20	1.45

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.737

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2076.30	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.36	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2075.94	Reach Len. (ft)	57.97	58.68	59.01
Crit W.S. (ft)	2074.40	Flow Area (sq ft)	80.72	134.55	2.36
E.G. Slope (ft/ft)	0.001879	Area (sq ft)	80.72	134.55	2.36
Q Total (cfs)	770.00	Flow (cfs)	85.96	682.50	1.54
Top Width (ft)	227.70	Top Width (ft)	191.78	32.67	3.25
Vel Total (ft/s)	3.54	Avg. Vel. (ft/s)	1.06	5.07	0.65
Max Chl Dpth (ft)	5.83	Hydr. Depth (ft)	0.42	4.12	0.73
Conv. Total (cfs)	17764.3	Conv. (cfs)	1983.2	15745.7	35.4
Length Wtd. (ft)	58.68	Wetted Per. (ft)	191.85	35.27	3.63
Min Ch El (ft)	2070.11	Shear (lb/sq ft)	0.05	0.45	0.08
Alpha	1.83	Stream Power (lb/ft s)	0.05	2.27	0.05
Frctn Loss (ft)		Cum Volume (acre-ft)		0.35	
C & E Loss (ft)		Cum SA (acres)	8.93	2.37	2.91

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2076.80	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.27	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2076.54	Reach Len. (ft)	57.97	58.68	59.01
Crit W.S. (ft)	2074.40	Flow Area (sq ft)	56.41	153.88	4.28
E.G. Slope (ft/ft)	0.001170	Area (sq ft)	56.41	153.88	4.28
Q Total (cfs)	770.00	Flow (cfs)	93.41	673.62	2.96
Top Width (ft)	71.81	Top Width (ft)	35.89	32.67	3.25
Vel Total (ft/s)	3.59	Avg. Vel. (ft/s)	1.66	4.38	0.69
Max Chl Dpth (ft)	6.43	Hydr. Depth (ft)	1.57	4.71	1.32
Conv. Total (cfs)	22512.3	Conv. (cfs)	2731.1	19694.6	86.7
Length Wtd. (ft)	58.68	Wetted Per. (ft)	36.54	35.27	4.23
Min Ch El (ft)	2070.11	Shear (lb/sq ft)	0.11	0.32	0.07
Alpha	1.33	Stream Power (lb/ft s)	0.19	1.39	0.05
Frctn Loss (ft)		Cum Volume (acre-ft)		0.26	
C & E Loss (ft)		Cum SA (acres)	1.27	2.49	0.13

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2076.17	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2075.89	Reach Len. (ft)	57.97	58.68	59.01
Crit W.S. (ft)	2073.84	Flow Area (sq ft)	70.58	132.76	2.18
E.G. Slope (ft/ft)	0.001484	Area (sq ft)	70.58	132.76	2.18
Q Total (cfs)	660.00	Flow (cfs)	65.66	593.11	1.23
Top Width (ft)	214.09	Top Width (ft)	178.30	32.67	3.12
Vel Total (ft/s)	3.21	Avg. Vel. (ft/s)	0.93	4.47	0.57
Max Chl Dpth (ft)	5.78	Hydr. Depth (ft)	0.40	4.06	0.70
Conv. Total (cfs)	17135.5	Conv. (cfs)	1704.7	15398.8	32.0
Length Wtd. (ft)	58.68	Wetted Per. (ft)	178.37	35.27	3.49
Min Ch El (ft)	2070.11	Shear (lb/sq ft)	0.04	0.35	0.06
Alpha	1.75	Stream Power (lb/ft s)	0.03	1.56	0.03
Frctn Loss (ft)		Cum Volume (acre-ft)		0.30	
C & E Loss (ft)		Cum SA (acres)	8.42	2.34	2.65

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2075.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2075.64	Reach Len. (ft)	57.97	58.68	59.01
Crit W.S. (ft)	2072.96	Flow Area (sq ft)	34.87	124.68	1.48
E.G. Slope (ft/ft)	0.000811	Area (sq ft)	34.87	124.68	1.48
Q Total (cfs)	419.00	Flow (cfs)	23.49	394.96	0.55
Top Width (ft)	142.12	Top Width (ft)	106.92	32.67	2.53
Vel Total (ft/s)	2.60	Avg. Vel. (ft/s)	0.67	3.17	0.37
Max Chl Dpth (ft)	5.53	Hydr. Depth (ft)	0.33	3.82	0.59
Conv. Total (cfs)	14712.9	Conv. (cfs)	824.9	13868.8	19.2
Length Wtd. (ft)	58.68	Wetted Per. (ft)	106.96	35.27	2.86
Min Ch El (ft)	2070.11	Shear (lb/sq ft)	0.02	0.18	0.03
Alpha	1.40	Stream Power (lb/ft s)	0.01	0.57	0.01
Frctn Loss (ft)		Cum Volume (acre-ft)		0.19	
C & E Loss (ft)		Cum SA (acres)	7.08	2.15	1.44

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.726

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2074.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.62	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2074.28	Reach Len. (ft)	93.91	93.72	93.59
Crit W.S. (ft)		Flow Area (sq ft)	37.37	99.52	7.40
E.G. Slope (ft/ft)	0.005510	Area (sq ft)	37.37	99.52	7.40
Q Total (cfs)	770.00	Flow (cfs)	94.93	666.58	8.49
Top Width (ft)	87.48	Top Width (ft)	40.69	35.89	10.90
Vel Total (ft/s)	5.34	Avg. Vel. (ft/s)	2.54	6.70	1.15
Max Chl Dpth (ft)	5.00	Hydr. Depth (ft)	0.92	2.77	0.68
Conv. Total (cfs)	10372.9	Conv. (cfs)	1278.8	8979.7	114.3
Length Wtd. (ft)	93.74	Wetted Per. (ft)	40.73	38.54	10.97
Min Ch El (ft)	2069.28	Shear (lb/sq ft)	0.32	0.89	0.23
Alpha	1.39	Stream Power (lb/ft s)	0.80	5.95	0.27
Frctn Loss (ft)	0.65	Cum Volume (acre-ft)	0.52	0.85	0.02
C & E Loss (ft)	0.06	Cum SA (acres)	8.78	2.32	2.90

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2074.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.61	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2074.28	Reach Len. (ft)	93.91	93.72	93.59
Crit W.S. (ft)		Flow Area (sq ft)	34.32	99.40	6.96
E.G. Slope (ft/ft)	0.005499	Area (sq ft)	34.32	99.40	6.96
Q Total (cfs)	770.00	Flow (cfs)	96.93	664.52	8.56
Top Width (ft)	76.00	Top Width (ft)	31.27	35.89	8.84
Vel Total (ft/s)	5.47	Avg. Vel. (ft/s)	2.82	6.69	1.23
Max Chl Dpth (ft)	5.00	Hydr. Depth (ft)	1.10	2.77	0.79
Conv. Total (cfs)	10383.8	Conv. (cfs)	1307.1	8961.3	115.4
Length Wtd. (ft)	93.74	Wetted Per. (ft)	31.85	38.54	9.27
Min Ch El (ft)	2069.28	Shear (lb/sq ft)	0.37	0.89	0.26
Alpha	1.32	Stream Power (lb/ft s)	1.04	5.92	0.32
Frctn Loss (ft)	0.63	Cum Volume (acre-ft)	0.26	0.79	0.02
C & E Loss (ft)	0.05	Cum SA (acres)	1.23	2.44	0.12

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2074.65	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.57	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2074.08	Reach Len. (ft)	93.91	93.72	93.59
Crit W.S. (ft)		Flow Area (sq ft)	29.42	92.23	5.29
E.G. Slope (ft/ft)	0.005520	Area (sq ft)	29.42	92.23	5.29
Q Total (cfs)	660.00	Flow (cfs)	67.06	587.74	5.20
Top Width (ft)	83.48	Top Width (ft)	37.74	35.89	9.86
Vel Total (ft/s)	5.20	Avg. Vel. (ft/s)	2.28	6.37	0.98
Max Chl Dpth (ft)	4.80	Hydr. Depth (ft)	0.78	2.57	0.54
Conv. Total (cfs)	8883.0	Conv. (cfs)	902.6	7910.4	70.0
Length Wtd. (ft)	93.74	Wetted Per. (ft)	37.76	38.54	9.91
Min Ch El (ft)	2069.28	Shear (lb/sq ft)	0.27	0.82	0.18
Alpha	1.36	Stream Power (lb/ft s)	0.61	5.26	0.18
Frctn Loss (ft)	0.64	Cum Volume (acre-ft)	0.38	0.78	0.02
C & E Loss (ft)	0.05	Cum SA (acres)	8.28	2.29	2.64

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2074.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.37	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2073.68	Reach Len. (ft)	93.91	93.72	93.59
Crit W.S. (ft)	2072.56	Flow Area (sq ft)	15.71	78.03	1.79
E.G. Slope (ft/ft)	0.004334	Area (sq ft)	15.71	78.03	1.79
Q Total (cfs)	419.00	Flow (cfs)	24.01	394.10	0.89
Top Width (ft)	74.33	Top Width (ft)	30.62	35.89	7.83
Vel Total (ft/s)	4.39	Avg. Vel. (ft/s)	1.53	5.05	0.49
Max Chl Dpth (ft)	4.40	Hydr. Depth (ft)	0.51	2.17	0.23
Conv. Total (cfs)	6364.4	Conv. (cfs)	364.7	5986.2	13.5
Length Wtd. (ft)	93.73	Wetted Per. (ft)	30.63	38.54	7.84
Min Ch El (ft)	2069.28	Shear (lb/sq ft)	0.14	0.55	0.06
Alpha	1.25	Stream Power (lb/ft s)	0.21	2.77	0.03
Frctn Loss (ft)	0.61	Cum Volume (acre-ft)	0.18	0.58	0.01
C & E Loss (ft)	0.14	Cum SA (acres)	6.99	2.10	1.44

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.708

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2074.19	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.81	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2073.38	Reach Len. (ft)	154.20	154.96	155.66
Crit W.S. (ft)	2073.38	Flow Area (sq ft)	31.92	88.19	2.54
E.G. Slope (ft/ft)	0.008942	Area (sq ft)	31.92	88.19	2.54
Q Total (cfs)	770.00	Flow (cfs)	94.71	673.44	1.85
Top Width (ft)	89.46	Top Width (ft)	39.58	39.19	10.69
Vel Total (ft/s)	6.28	Avg. Vel. (ft/s)	2.97	7.64	0.73
Max Chl Dpth (ft)	4.01	Hydr. Depth (ft)	0.81	2.25	0.24
Conv. Total (cfs)	8142.9	Conv. (cfs)	1001.5	7121.8	19.6
Length Wtd. (ft)	154.77	Wetted Per. (ft)	39.62	40.33	10.70
Min Ch El (ft)	2069.37	Shear (lb/sq ft)	0.45	1.22	0.13
Alpha	1.32	Stream Power (lb/ft s)	1.33	9.32	0.10
Frctn Loss (ft)	1.07	Cum Volume (acre-ft)	0.44	0.65	0.01
C & E Loss (ft)	0.09	Cum SA (acres)	8.69	2.24	2.88

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2074.21	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.79	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2073.42	Reach Len. (ft)	154.20	154.96	155.66
Crit W.S. (ft)	2073.40	Flow Area (sq ft)	29.06	89.85	2.10
E.G. Slope (ft/ft)	0.008440	Area (sq ft)	29.06	89.85	2.10
Q Total (cfs)	770.00	Flow (cfs)	93.23	674.85	1.92
Top Width (ft)	75.00	Top Width (ft)	30.03	39.19	5.78
Vel Total (ft/s)	6.36	Avg. Vel. (ft/s)	3.21	7.51	0.91
Max Chl Dpth (ft)	4.05	Hydr. Depth (ft)	0.97	2.29	0.36
Conv. Total (cfs)	8381.7	Conv. (cfs)	1014.8	7346.0	20.9
Length Wtd. (ft)	154.82	Wetted Per. (ft)	30.73	40.33	6.06
Min Ch El (ft)	2069.37	Shear (lb/sq ft)	0.50	1.17	0.18
Alpha	1.25	Stream Power (lb/ft s)	1.60	8.82	0.17
Frctn Loss (ft)	1.13	Cum Volume (acre-ft)	0.19	0.59	0.01
C & E Loss (ft)	0.00	Cum SA (acres)	1.16	2.36	0.10

Warning: Critical depth could not be determined within the specified number of iterations. The program used the iteration with the lowest energy.
Warning: The cross section had to be extended vertically during the critical depth 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: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2073.96	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.73	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2073.23	Reach Len. (ft)	154.20	154.96	155.66
Crit W.S. (ft)	2073.23	Flow Area (sq ft)	26.10	82.33	1.09
E.G. Slope (ft/ft)	0.008668	Area (sq ft)	26.10	82.33	1.09
Q Total (cfs)	660.00	Flow (cfs)	68.28	591.19	0.53

Top Width (ft)	85.55	Top Width (ft)	38.20	39.19	8.17
Vel Total (ft/s)	6.03	Avg. Vel. (ft/s)	2.62	7.18	0.49
Max Chl Dpth (ft)	3.86	Hydr. Depth (ft)	0.68	2.10	0.13
Conv. Total (cfs)	7089.2	Conv. (cfs)	733.4	6350.1	5.7
Length Wtd. (ft)	154.80	Wetted Per. (ft)	38.23	40.33	8.17
Min Ch El (ft)	2069.37	Shear (lb/sq ft)	0.37	1.10	0.07
Alpha	1.29	Stream Power (lb/ft s)	0.97	7.93	0.04
Frctn Loss (ft)	1.20	Cum Volume (acre-ft)	0.32	0.59	0.01
C & E Loss (ft)	0.04	Cum SA (acres)	8.19	2.21	2.62

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2073.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.85	Wt. n-Val.	0.041	0.031	
W.S. Elev (ft)	2072.46	Reach Len. (ft)	154.20	154.96	155.66
Crit W.S. (ft)	2072.46	Flow Area (sq ft)	2.12	56.31	
E.G. Slope (ft/ft)	0.010627	Area (sq ft)	2.12	56.31	
Q Total (cfs)	419.00	Flow (cfs)	2.06	416.94	
Top Width (ft)	45.65	Top Width (ft)	16.02	29.63	
Vel Total (ft/s)	7.17	Avg. Vel. (ft/s)	0.97	7.40	
Max Chl Dpth (ft)	3.09	Hydr. Depth (ft)	0.13	1.90	
Conv. Total (cfs)	4064.6	Conv. (cfs)	19.9	4044.6	
Length Wtd. (ft)	154.88	Wetted Per. (ft)	16.02	30.69	
Min Ch El (ft)	2069.37	Shear (lb/sq ft)	0.09	1.22	
Alpha	1.06	Stream Power (lb/ft s)	0.09	9.01	
Frctn Loss (ft)	1.15	Cum Volume (acre-ft)	0.16	0.44	0.00
C & E Loss (ft)	0.12	Cum SA (acres)	6.94	2.03	1.43

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: SUNSET WASH
REACH: REACH #1 RS: 0.679

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2072.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.49	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2072.03	Reach Len. (ft)	56.17	56.16	56.18
Crit W.S. (ft)	2072.03	Flow Area (sq ft)	133.06	66.63	3.32
E.G. Slope (ft/ft)	0.005483	Area (sq ft)	133.06	66.63	3.32
Q Total (cfs)	770.00	Flow (cfs)	298.32	467.43	4.25
Top Width (ft)	200.54	Top Width (ft)	174.24	22.54	3.76
Vel Total (ft/s)	3.79	Avg. Vel. (ft/s)	2.24	7.02	1.28
Max Chl Dpth (ft)	4.28	Hydr. Depth (ft)	0.76	2.96	0.88
Conv. Total (cfs)	10398.7	Conv. (cfs)	4028.8	6312.6	57.4
Length Wtd. (ft)	56.16	Wetted Per. (ft)	174.26	23.98	4.15
Min Ch El (ft)	2067.75	Shear (lb/sq ft)	0.26	0.95	0.27
Alpha	2.21	Stream Power (lb/ft s)	0.59	6.67	0.35
Frctn Loss (ft)	0.31	Cum Volume (acre-ft)	0.15	0.38	0.00
C & E Loss (ft)	0.04	Cum SA (acres)	8.31	2.13	2.85

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: 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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2073.07	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.80	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2072.27	Reach Len. (ft)	56.17	56.16	56.18
Crit W.S. (ft)		Flow Area (sq ft)	48.53	72.12	3.30
E.G. Slope (ft/ft)	0.006423	Area (sq ft)	48.53	72.12	3.30
Q Total (cfs)	770.00	Flow (cfs)	187.57	577.24	5.19
Top Width (ft)	55.00	Top Width (ft)	30.24	22.54	2.22
Vel Total (ft/s)	6.21	Avg. Vel. (ft/s)	3.87	8.00	1.57
Max Chl Dpth (ft)	4.52	Hydr. Depth (ft)	1.60	3.20	1.49
Conv. Total (cfs)	9607.6	Conv. (cfs)	2340.4	7202.5	64.8
Length Wtd. (ft)	56.16	Wetted Per. (ft)	31.61	23.98	3.42
Min Ch El (ft)	2067.75	Shear (lb/sq ft)	0.62	1.21	0.39
Alpha	1.34	Stream Power (lb/ft s)	2.38	9.65	0.61

* Frctn Loss (ft)	* 0.26	* Cum Volume (acre-ft)	* 0.05	* 0.30	* 0.00	*
* C & E Loss (ft)	* 0.06	* Cum SA (acres)	* 1.05	* 2.25	* 0.09	*

CROSS SECTION OUTPUT Profile #50-YEAR

* E.G. Elev (ft)	* 2072.36	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.61	* Wt. n-Val.	* 0.041	* 0.031	* 0.074 *
* W.S. Elev (ft)	* 2071.75	* Reach Len. (ft)	* 56.17	* 56.16	* 56.18 *
* Crit W.S. (ft)	* 2071.75	* Flow Area (sq ft)	* 89.86	* 60.39	* 2.36 *
* E.G. Slope (ft/ft)	*0.006992	* Area (sq ft)	* 89.86	* 60.39	* 2.36 *
* Q Total (cfs)	* 660.00	* Flow (cfs)	* 208.98	* 447.97	* 3.04 *
* Top Width (ft)	* 159.35	* Top Width (ft)	* 133.64	* 22.54	* 3.17 *
* Vel Total (ft/s)	* 4.32	* Avg. Vel. (ft/s)	* 2.33	* 7.42	* 1.29 *
* Max Chl Dpth (ft)	* 4.00	* Hydr. Depth (ft)	* 0.67	* 2.68	* 0.74 *
* Conv. Total (cfs)	* 7893.3	* Conv. (cfs)	* 2499.4	* 5357.5	* 36.4 *
* Length Wtd. (ft)	* 56.16	* Wetted Per. (ft)	* 133.66	* 23.98	* 3.50 *
* Min Ch El (ft)	* 2067.75	* Shear (lb/sq ft)	* 0.29	* 1.10	* 0.29 *
* Alpha	* 2.09	* Stream Power (lb/ft s)	* 0.68	* 8.15	* 0.38 *
* Frctn Loss (ft)	* 0.35	* Cum Volume (acre-ft)	* 0.11	* 0.34	* 0.00 *
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 7.89	* 2.10	* 2.60 *

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: 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 OUTPUT Profile #10-YEAR

* E.G. Elev (ft)	* 2071.90	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.46	* Wt. n-Val.	* 0.041	* 0.031	* 0.074 *
* W.S. Elev (ft)	* 2071.45	* Reach Len. (ft)	* 56.17	* 56.16	* 56.18 *
* Crit W.S. (ft)	* 2071.45	* Flow Area (sq ft)	* 53.98	* 53.56	* 1.50 *
* E.G. Slope (ft/ft)	*0.005519	* Area (sq ft)	* 53.98	* 53.56	* 1.50 *
* Q Total (cfs)	* 419.00	* Flow (cfs)	* 91.60	* 325.92	* 1.47 *
* Top Width (ft)	* 132.94	* Top Width (ft)	* 107.88	* 22.54	* 2.52 *
* Vel Total (ft/s)	* 3.84	* Avg. Vel. (ft/s)	* 1.70	* 6.08	* 0.98 *
* Max Chl Dpth (ft)	* 3.70	* Hydr. Depth (ft)	* 0.50	* 2.38	* 0.59 *
* Conv. Total (cfs)	* 5639.9	* Conv. (cfs)	* 1233.0	* 4387.0	* 19.8 *
* Length Wtd. (ft)	* 56.16	* Wetted Per. (ft)	* 107.89	* 23.98	* 2.79 *
* Min Ch El (ft)	* 2067.75	* Shear (lb/sq ft)	* 0.17	* 0.77	* 0.18 *
* Alpha	* 1.99	* Stream Power (lb/ft s)	* 0.29	* 4.68	* 0.18 *
* Frctn Loss (ft)	* 0.31	* Cum Volume (acre-ft)	* 0.06	* 0.24	* 0.00 *
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 6.72	* 1.94	* 1.42 *

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: 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: SUNSET WASH
REACH: REACH #1 RS: 0.668

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	* 2071.71	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.62	* Wt. n-Val.	* 0.041	* 0.031	* 0.074 *
* W.S. Elev (ft)	* 2071.09	* Reach Len. (ft)	* 54.56	* 54.93	* 55.20 *
* Crit W.S. (ft)	* 2071.09	* Flow Area (sq ft)	* 98.17	* 69.07	* 1.89 *
* E.G. Slope (ft/ft)	*0.005737	* Area (sq ft)	* 98.17	* 69.07	* 1.89 *
* Q Total (cfs)	* 770.00	* Flow (cfs)	* 250.58	* 517.74	* 1.68 *
* Top Width (ft)	* 135.58	* Top Width (ft)	* 109.46	* 22.55	* 3.57 *
* Vel Total (ft/s)	* 4.55	* Avg. Vel. (ft/s)	* 2.55	* 7.50	* 0.89 *
* Max Chl Dpth (ft)	* 4.12	* Hydr. Depth (ft)	* 0.90	* 3.06	* 0.53 *
* Conv. Total (cfs)	* 10165.9	* Conv. (cfs)	* 3308.3	* 6835.5	* 22.1 *
* Length Wtd. (ft)	* 54.93	* Wetted Per. (ft)	* 109.49	* 23.28	* 4.27 *
* Min Ch El (ft)	* 2066.97	* Shear (lb/sq ft)	* 0.32	* 1.06	* 0.16 *
* Alpha	* 1.93	* Stream Power (lb/ft s)	* 0.82	* 7.96	* 0.14 *
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	*	* 0.29	*
* C & E Loss (ft)	*	* Cum SA (acres)	* 8.13	* 2.10	* 2.85 *

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION OUTPUT Profile #FLOODWAY

* E.G. Elev (ft)	* 2072.75	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.67	* Wt. n-Val.	* 0.041	* 0.031	* 0.074 *
* W.S. Elev (ft)	* 2072.07	* Reach Len. (ft)	* 54.56	* 54.93	* 55.20 *
* Crit W.S. (ft)	* 2071.20	* Flow Area (sq ft)	* 36.48	* 91.17	* 1.46 *
* E.G. Slope (ft/ft)	*0.003501	* Area (sq ft)	* 36.48	* 91.17	* 1.46 *
* Q Total (cfs)	* 770.00	* Flow (cfs)	* 126.67	* 642.28	* 1.05 *
* Top Width (ft)	* 38.40	* Top Width (ft)	* 15.28	* 22.55	* 0.57 *
* Vel Total (ft/s)	* 5.96	* Avg. Vel. (ft/s)	* 3.47	* 7.05	* 0.72 *
* Max Chl Dpth (ft)	* 5.10	* Hydr. Depth (ft)	* 2.39	* 4.04	* 2.55 *
* Conv. Total (cfs)	* 13013.9	* Conv. (cfs)	* 2140.8	* 10855.3	* 17.8 *
* Length Wtd. (ft)	* 54.93	* Wetted Per. (ft)	* 17.70	* 23.28	* 3.08 *
* Min Ch El (ft)	* 2066.97	* Shear (lb/sq ft)	* 0.45	* 0.86	* 0.10 *

Alpha	1.22	Stream Power (lb/ft s)	1.56	6.03	0.07	
Frctn Loss (ft)		Cum Volume (acre-ft)		0.19		
C & E Loss (ft)		Cum SA (acres)	1.03	2.22	0.09	

Warning: The cross section had to be extended vertically during the critical depth calculations.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2071.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.58	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2070.95	Reach Len. (ft)	54.56	54.93	55.20
Crit W.S. (ft)	2070.95	Flow Area (sq ft)	82.74	65.82	1.48
E.G. Slope (ft/ft)	0.005512	Area (sq ft)	82.74	65.82	1.48
Q Total (cfs)	660.00	Flow (cfs)	190.33	468.28	1.39
Top Width (ft)	129.44	Top Width (ft)	104.64	22.55	2.25
Vel Total (ft/s)	4.40	Avg. Vel. (ft/s)	2.30	7.11	0.94
Max Chl Dpth (ft)	3.98	Hydr. Depth (ft)	0.79	2.92	0.66
Conv. Total (cfs)	8889.6	Conv. (cfs)	2563.6	6307.3	18.7
Length Wtd. (ft)	54.93	Wetted Per. (ft)	104.67	23.28	2.94
Min Ch El (ft)	2066.97	Shear (lb/sq ft)	0.27	0.97	0.17
Alpha	1.93	Stream Power (lb/ft s)	0.63	6.92	0.16
Frctn Loss (ft)		Cum Volume (acre-ft)		0.25	
C & E Loss (ft)		Cum SA (acres)	7.74	2.07	2.60

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2071.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.53	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2070.51	Reach Len. (ft)	54.56	54.93	55.20
Crit W.S. (ft)	2070.51	Flow Area (sq ft)	40.31	56.04	0.81
E.G. Slope (ft/ft)	0.005403	Area (sq ft)	40.31	56.04	0.81
Q Total (cfs)	419.00	Flow (cfs)	63.74	354.55	0.71
Top Width (ft)	111.93	Top Width (ft)	88.11	22.55	1.27
Vel Total (ft/s)	4.31	Avg. Vel. (ft/s)	1.58	6.33	0.87
Max Chl Dpth (ft)	3.54	Hydr. Depth (ft)	0.46	2.49	0.64
Conv. Total (cfs)	5700.5	Conv. (cfs)	867.2	4823.6	9.6
Length Wtd. (ft)	54.93	Wetted Per. (ft)	88.13	23.28	1.80
Min Ch El (ft)	2066.97	Shear (lb/sq ft)	0.15	0.81	0.15
Alpha	1.84	Stream Power (lb/ft s)	0.24	5.14	0.13
Frctn Loss (ft)		Cum Volume (acre-ft)		0.17	
C & E Loss (ft)		Cum SA (acres)	6.59	1.91	1.42

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.658

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2070.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.07	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2069.42	Reach Len. (ft)	58.62	56.76	56.23
Crit W.S. (ft)	2069.42	Flow Area (sq ft)	22.44	83.38	0.24
E.G. Slope (ft/ft)	0.006967	Area (sq ft)	22.44	83.38	0.24
Q Total (cfs)	770.00	Flow (cfs)	53.42	716.48	0.10
Top Width (ft)	57.67	Top Width (ft)	32.08	23.70	1.89
Vel Total (ft/s)	7.26	Avg. Vel. (ft/s)	2.38	8.59	0.40
Max Chl Dpth (ft)	4.52	Hydr. Depth (ft)	0.70	3.52	0.13
Conv. Total (cfs)	9224.7	Conv. (cfs)	640.0	8583.6	1.2
Length Wtd. (ft)	56.82	Wetted Per. (ft)	32.16	26.49	2.04
Min Ch El (ft)	2064.90	Shear (lb/sq ft)	0.30	1.37	0.05
Alpha	1.31	Stream Power (lb/ft s)	0.72	11.76	0.02
Frctn Loss (ft)	0.49	Cum Volume (acre-ft)	0.20	1.60	0.07
C & E Loss (ft)	0.15	Cum SA (acres)	8.04	2.07	2.84

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 velocity head has changed by more than 0.5 ft (0.15 m). 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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2070.49	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.06	Wt. n-Val.	0.041	0.031	
W.S. Elev (ft)	2069.42	Reach Len. (ft)	58.62	56.76	56.23
Crit W.S. (ft)	2069.42	Flow Area (sq ft)	22.47	83.44	
E.G. Slope (ft/ft)	0.007097	Area (sq ft)	22.47	83.44	
Q Total (cfs)	770.00	Flow (cfs)	55.36	714.64	
Top Width (ft)	54.52	Top Width (ft)	30.82	23.70	
Vel Total (ft/s)	7.27	Avg. Vel. (ft/s)	2.46	8.56	
Max Chl Dpth (ft)	4.52	Hydr. Depth (ft)	0.73	3.52	
Conv. Total (cfs)	9140.1	Conv. (cfs)	657.2	8482.9	

* Length Wtd. (ft)	* 56.83	* Wetted Per. (ft)	* 30.99	* 27.02	*	*
* Min Ch El (ft)	* 2064.90	* Shear (lb/sq ft)	* 0.32	* 1.37	*	*
* Alpha	* 1.30	* Stream Power (lb/ft s)	* 0.79	* 11.72	*	*
* Frctn Loss (ft)	* 0.50	* Cum Volume (acre-ft)	* 0.02	* 1.62	*	*
* C & E Loss (ft)	* 0.15	* Cum SA (acres)	* 1.00	* 2.19	*	0.09 *

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The cross section had to be extended vertically during the critical depth calculations.
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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

* E.G. Elev (ft)	* 2070.16	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 1.10	* Wt. n-Val.	* 0.041	* 0.031	* 0.074 *
* W.S. Elev (ft)	* 2069.05	* Reach Len. (ft)	* 58.62	* 56.76	* 56.23 *
* Crit W.S. (ft)	* 2069.05	* Flow Area (sq ft)	* 11.58	* 74.66	* 0.02 *
* E.G. Slope (ft/ft)	*0.008000	* Area (sq ft)	* 11.58	* 74.66	* 0.02 *
* Q Total (cfs)	* 660.00	* Flow (cfs)	* 21.33	* 638.67	* 0.00 *
* Top Width (ft)	* 50.87	* Top Width (ft)	* 26.97	* 23.70	* 0.20 *
* Vel Total (ft/s)	* 7.65	* Avg. Vel. (ft/s)	* 1.84	* 8.55	* 0.28 *
* Max Chl Dpth (ft)	* 4.15	* Hydr. Depth (ft)	* 0.43	* 3.15	* 0.08 *
* Conv. Total (cfs)	* 7378.8	* Conv. (cfs)	* 238.4	* 7140.3	* 0.0 *
* Length Wtd. (ft)	* 56.79	* Wetted Per. (ft)	* 27.04	* 26.49	* 0.25 *
* Min Ch El (ft)	* 2064.90	* Shear (lb/sq ft)	* 0.21	* 1.41	* 0.03 *
* Alpha	* 1.21	* Stream Power (lb/ft s)	* 0.39	* 12.04	* 0.01 *
* Frctn Loss (ft)	* 0.54	* Cum Volume (acre-ft)	* 0.12	* 1.44	* 0.06 *
* C & E Loss (ft)	* 0.10	* Cum SA (acres)	* 7.65	* 2.04	* 2.60 *

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: 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 OUTPUT Profile #10-YEAR

* E.G. Elev (ft)	* 2069.08	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 1.13	* Wt. n-Val.	*	* 0.031	* *
* W.S. Elev (ft)	* 2067.95	* Reach Len. (ft)	* 58.62	* 56.76	* 56.23 *
* Crit W.S. (ft)	* 2067.95	* Flow Area (sq ft)	*	* 49.10	* *
* E.G. Slope (ft/ft)	*0.012466	* Area (sq ft)	*	* 49.10	* *
* Q Total (cfs)	* 419.00	* Flow (cfs)	*	* 419.00	* *
* Top Width (ft)	* 21.95	* Top Width (ft)	*	* 21.95	* *
* Vel Total (ft/s)	* 8.53	* Avg. Vel. (ft/s)	*	* 8.53	* *
* Max Chl Dpth (ft)	* 3.05	* Hydr. Depth (ft)	*	* 2.24	* *
* Conv. Total (cfs)	* 3752.7	* Conv. (cfs)	*	* 3752.7	* *
* Length Wtd. (ft)	* 56.76	* Wetted Per. (ft)	*	* 24.39	* *
* Min Ch El (ft)	* 2064.90	* Shear (lb/sq ft)	*	* 1.57	* *
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 13.37	* *
* Frctn Loss (ft)	* 0.70	* Cum Volume (acre-ft)	* 0.03	* 1.06	* 0.03 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 6.54	* 1.88	* 1.42 *

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: SUNSET WASH
REACH: REACH #1 RS: 0.647

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	* 2069.65	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 1.57	* Wt. n-Val.	* 0.041	* 0.031	* 0.074 *
* W.S. Elev (ft)	* 2068.07	* Reach Len. (ft)	* 91.04	* 75.10	* 49.83 *
* Crit W.S. (ft)	* 2068.07	* Flow Area (sq ft)	* 0.30	* 76.42	* 0.14 *
* E.G. Slope (ft/ft)	*0.010707	* Area (sq ft)	* 0.30	* 76.42	* 0.14 *
* Q Total (cfs)	* 770.00	* Flow (cfs)	* 0.42	* 769.49	* 0.10 *
* Top Width (ft)	* 25.82	* Top Width (ft)	* 1.28	* 24.00	* 0.53 *
* Vel Total (ft/s)	* 10.02	* Avg. Vel. (ft/s)	* 1.38	* 10.07	* 0.68 *
* Max Chl Dpth (ft)	* 3.84	* Hydr. Depth (ft)	* 0.24	* 3.18	* 0.26 *
* Conv. Total (cfs)	* 7441.4	* Conv. (cfs)	* 4.0	* 7436.5	* 0.9 *
* Length Wtd. (ft)	* 75.10	* Wetted Per. (ft)	* 1.37	* 26.42	* 0.75 *
* Min Ch El (ft)	* 2064.23	* Shear (lb/sq ft)	* 0.15	* 1.93	* 0.13 *
* Alpha	* 1.01	* Stream Power (lb/ft s)	* 0.20	* 19.47	* 0.09 *
* Frctn Loss (ft)	* 0.61	* Cum Volume (acre-ft)	* 0.18	* 1.49	* 0.07 *
* C & E Loss (ft)	* 0.29	* Cum SA (acres)	* 8.02	* 2.04	* 2.84 *

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*****************************************************************************************

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 velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
the
         need for additional cross sections.
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 OUTPUT  Profile #FLOODWAY
*****************************************************************************************
* E.G. Elev (ft)        * 2069.65  * Element                 *  Left OB  *  Channel  * Right OB *
* Vel Head (ft)         *    1.57  * Wt. n-Val.              *           *    0.031  *          *
* W.S. Elev (ft)        * 2068.08  * Reach Len. (ft)         *   91.04   *   75.10   *   49.83  *
* Crit W.S. (ft)        * 2068.08  * Flow Area (sq ft)       *           *   76.60   *          *
* E.G. Slope (ft/ft)    *0.011184  * Area (sq ft)            *           *   76.60   *          *
* Q Total (cfs)         *  770.00  * Flow (cfs)              *           *  770.00   *          *
* Top Width (ft)        *   24.00  * Top Width (ft)           *           *   24.00   *          *
* Vel Total (ft/s)      *   10.05  * Avg. Vel. (ft/s)         *           *   10.05   *          *
* Max Chl Dpth (ft)     *    3.85  * Hydr. Depth (ft)         *           *    3.19   *          *
* Conv. Total (cfs)     *  7281.0  * Conv. (cfs)              *           *  7281.0   *          *
* Length Wtd. (ft)      *   75.10  * Wetted Per. (ft)         *           *   27.43   *          *
* Min Ch El (ft)        * 2064.23  * Shear (lb/sq ft)         *           *    1.95   *          *
* Alpha                 *    1.00  * Stream Power (lb/ft s)   *           *   19.60   *          *
* Frctn Loss (ft)       *    0.63  * Cum Volume (acre-ft)     *           *    1.51   *          *
* C & E Loss (ft)       *    0.29  * Cum SA (acres)           *    0.98   *    2.16   *    0.09  *
*****************************************************************************************

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 velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross sections.
Warning: The cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth.  The program will try the cross section slice/secant

         method to find critical depth.

CROSS SECTION OUTPUT  Profile #50-YEAR
*****************************************************************************************
* E.G. Elev (ft)        * 2069.19  * Element                 *  Left OB  *  Channel  * Right OB *
* Vel Head (ft)         *    1.44  * Wt. n-Val.              *   0.041   *    0.031  *   0.074  *
* W.S. Elev (ft)        * 2067.75  * Reach Len. (ft)         *   91.04   *   75.10   *   49.83  *
* Crit W.S. (ft)        * 2067.75  * Flow Area (sq ft)       *    0.03   *   68.52   *    0.02  *
* E.G. Slope (ft/ft)    *0.011331  * Area (sq ft)            *    0.03   *   68.52   *    0.02  *
* Q Total (cfs)         *  660.00  * Flow (cfs)              *    0.02   *  659.97   *    0.01  *
* Top Width (ft)        *   24.59  * Top Width (ft)           *    0.39   *   24.00   *    0.20  *
* Vel Total (ft/s)      *    9.63  * Avg. Vel. (ft/s)         *    0.64   *    9.63   *    0.36  *
* Max Chl Dpth (ft)     *    3.51  * Hydr. Depth (ft)         *    0.07   *    2.86   *    0.10  *
* Conv. Total (cfs)     *  6200.4  * Conv. (cfs)              *     0.2   *  6200.1   *     0.1  *
* Length Wtd. (ft)      *   75.10  * Wetted Per. (ft)         *    0.42   *   26.42   *    0.28  *
* Min Ch El (ft)        * 2064.23  * Shear (lb/sq ft)         *    0.05   *    1.83   *    0.05  *
* Alpha                 *    1.00  * Stream Power (lb/ft s)   *    0.03   *   17.67   *    0.02  *
* Frctn Loss (ft)       *    0.65  * Cum Volume (acre-ft)     *    0.11   *    1.35   *    0.06  *
* C & E Loss (ft)       *    0.26  * Cum SA (acres)           *    7.64   *    2.01   *    2.60  *
*****************************************************************************************

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 velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
the
         need for additional cross sections.
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 OUTPUT  Profile #10-YEAR
*****************************************************************************************
* E.G. Elev (ft)        * 2068.04  * Element                 *  Left OB  *  Channel  * Right OB *
* Vel Head (ft)         *    1.12  * Wt. n-Val.              *           *    0.031  *          *
* W.S. Elev (ft)        * 2066.92  * Reach Len. (ft)         *   91.04   *   75.10   *   49.83  *
* Crit W.S. (ft)        * 2066.92  * Flow Area (sq ft)       *           *   49.32   *          *
* E.G. Slope (ft/ft)    *0.012147  * Area (sq ft)            *           *   49.32   *          *
* Q Total (cfs)         *  419.00  * Flow (cfs)              *           *  419.00   *          *
* Top Width (ft)        *   22.21  * Top Width (ft)           *           *   22.21   *          *
* Vel Total (ft/s)      *    8.50  * Avg. Vel. (ft/s)         *           *    8.50   *          *
* Max Chl Dpth (ft)     *    2.69  * Hydr. Depth (ft)         *           *    2.22   *          *
* Conv. Total (cfs)     *  3801.8  * Conv. (cfs)              *           *  3801.8   *          *
* Length Wtd. (ft)      *   75.10  * Wetted Per. (ft)         *           *   24.18   *          *
* Min Ch El (ft)        * 2064.23  * Shear (lb/sq ft)         *           *    1.55   *          *
* Alpha                 *    1.00  * Stream Power (lb/ft s)   *           *   13.14   *          *
* Frctn Loss (ft)       *    0.73  * Cum Volume (acre-ft)     *    0.03   *    0.99   *    0.03  *
* C & E Loss (ft)       *    0.18  * Cum SA (acres)           *    6.54   *    1.85   *    1.42  *
*****************************************************************************************

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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: SUNSET WASH
REACH: REACH #1 RS: 0.633

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2068.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.62	Wt. n-Val.		0.039	
W.S. Elev (ft)	2067.51	Reach Len. (ft)	123.02	136.65	141.33
Crit W.S. (ft)	2066.54	Flow Area (sq ft)		122.31	
E.G. Slope (ft/ft)	0.006421	Area (sq ft)	18.25	122.31	
Q Total (cfs)	770.00	Flow (cfs)		770.00	
Top Width (ft)	83.58	Top Width (ft)	44.18	39.40	
Vel Total (ft/s)	6.30	Avg. Vel. (ft/s)		6.30	
Max Chl Dpth (ft)	5.03	Hydr. Depth (ft)		3.10	
Conv. Total (cfs)	9609.0	Conv. (cfs)		9609.0	
Length Wtd. (ft)	136.65	Wetted Per. (ft)		41.31	
Min Ch El (ft)	2062.48	Shear (lb/sq ft)		1.19	
Alpha	1.00	Stream Power (lb/ft s)		7.47	
Frctn Loss (ft)	1.23	Cum Volume (acre-ft)	0.16	1.32	0.07
C & E Loss (ft)	0.06	Cum SA (acres)	7.97	1.98	2.84

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2068.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.62	Wt. n-Val.		0.039	
W.S. Elev (ft)	2067.50	Reach Len. (ft)	123.02	136.65	141.33
Crit W.S. (ft)	2066.54	Flow Area (sq ft)		122.12	
E.G. Slope (ft/ft)	0.006498	Area (sq ft)		122.12	
Q Total (cfs)	770.00	Flow (cfs)		770.00	
Top Width (ft)	39.39	Top Width (ft)		39.39	
Vel Total (ft/s)	6.31	Avg. Vel. (ft/s)		6.31	
Max Chl Dpth (ft)	5.02	Hydr. Depth (ft)		3.10	
Conv. Total (cfs)	9552.2	Conv. (cfs)		9552.2	
Length Wtd. (ft)	136.65	Wetted Per. (ft)		41.51	
Min Ch El (ft)	2062.48	Shear (lb/sq ft)		1.19	
Alpha	1.00	Stream Power (lb/ft s)		7.52	
Frctn Loss (ft)	1.22	Cum Volume (acre-ft)		1.34	
C & E Loss (ft)	0.06	Cum SA (acres)	0.98	2.10	0.09

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2067.71	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.59	Wt. n-Val.		0.039	
W.S. Elev (ft)	2067.13	Reach Len. (ft)	123.02	136.65	141.33
Crit W.S. (ft)	2066.21	Flow Area (sq ft)		107.48	
E.G. Slope (ft/ft)	0.006905	Area (sq ft)	3.99	107.48	
Q Total (cfs)	660.00	Flow (cfs)		660.00	
Top Width (ft)	62.07	Top Width (ft)	24.05	38.01	
Vel Total (ft/s)	6.14	Avg. Vel. (ft/s)		6.14	
Max Chl Dpth (ft)	4.65	Hydr. Depth (ft)		2.83	
Conv. Total (cfs)	7942.3	Conv. (cfs)		7942.3	
Length Wtd. (ft)	136.65	Wetted Per. (ft)		39.80	
Min Ch El (ft)	2062.48	Shear (lb/sq ft)		1.16	
Alpha	1.00	Stream Power (lb/ft s)		7.15	
Frctn Loss (ft)	1.25	Cum Volume (acre-ft)	0.11	1.20	0.06
C & E Loss (ft)	0.05	Cum SA (acres)	7.61	1.96	2.59

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2066.65	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.51	Wt. n-Val.		0.039	
W.S. Elev (ft)	2066.14	Reach Len. (ft)	123.02	136.65	141.33
Crit W.S. (ft)	2065.48	Flow Area (sq ft)		73.15	
E.G. Slope (ft/ft)	0.007878	Area (sq ft)		73.15	
Q Total (cfs)	419.00	Flow (cfs)		419.00	
Top Width (ft)	31.78	Top Width (ft)		31.78	
Vel Total (ft/s)	5.73	Avg. Vel. (ft/s)		5.73	
Max Chl Dpth (ft)	3.66	Hydr. Depth (ft)		2.30	
Conv. Total (cfs)	4720.7	Conv. (cfs)		4720.7	
Length Wtd. (ft)	136.65	Wetted Per. (ft)		33.18	
Min Ch El (ft)	2062.48	Shear (lb/sq ft)		1.08	
Alpha	1.00	Stream Power (lb/ft s)		6.21	
Frctn Loss (ft)	1.28	Cum Volume (acre-ft)	0.03	0.89	0.03
C & E Loss (ft)	0.03	Cum SA (acres)	6.54	1.80	1.42

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.607

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2066.83	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.24	Wt. n-Val.		0.039	
W.S. Elev (ft)	2065.60	Reach Len. (ft)	158.01	196.30	219.49
Crit W.S. (ft)	2065.34	Flow Area (sq ft)		86.28	
E.G. Slope (ft/ft)	0.013527	Area (sq ft)		86.28	
Q Total (cfs)	770.00	Flow (cfs)		770.00	
Top Width (ft)	27.92	Top Width (ft)		27.92	
Vel Total (ft/s)	8.92	Avg. Vel. (ft/s)		8.92	
Max Chl Dpth (ft)	4.26	Hydr. Depth (ft)		3.09	
Conv. Total (cfs)	6620.5	Conv. (cfs)		6620.5	
Length Wtd. (ft)	195.21	Wetted Per. (ft)		30.19	
Min Ch El (ft)	2061.34	Shear (lb/sq ft)		2.41	
Alpha	1.00	Stream Power (lb/ft s)		21.54	
Frctn Loss (ft)	2.03	Cum Volume (acre-ft)	0.14	1.00	0.07
C & E Loss (ft)	0.18	Cum SA (acres)	7.91	1.88	2.84

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2066.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.21	Wt. n-Val.		0.039	
W.S. Elev (ft)	2065.63	Reach Len. (ft)	158.01	196.30	219.49
Crit W.S. (ft)	2065.33	Flow Area (sq ft)		87.29	
E.G. Slope (ft/ft)	0.013056	Area (sq ft)		87.29	
Q Total (cfs)	770.00	Flow (cfs)		770.00	
Top Width (ft)	27.93	Top Width (ft)		27.93	
Vel Total (ft/s)	8.82	Avg. Vel. (ft/s)		8.82	
Max Chl Dpth (ft)	4.29	Hydr. Depth (ft)		3.13	
Conv. Total (cfs)	6738.7	Conv. (cfs)		6738.7	
Length Wtd. (ft)	196.30	Wetted Per. (ft)		30.27	
Min Ch El (ft)	2061.34	Shear (lb/sq ft)		2.35	
Alpha	1.00	Stream Power (lb/ft s)		20.74	
Frctn Loss (ft)	1.63	Cum Volume (acre-ft)		1.01	
C & E Loss (ft)	0.20	Cum SA (acres)	0.98	2.00	0.09

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2066.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.08	Wt. n-Val.		0.039	
W.S. Elev (ft)	2065.34	Reach Len. (ft)	158.01	196.30	219.49
Crit W.S. (ft)	2065.00	Flow Area (sq ft)		79.20	
E.G. Slope (ft/ft)	0.012625	Area (sq ft)		79.20	
Q Total (cfs)	660.00	Flow (cfs)		660.00	
Top Width (ft)	27.04	Top Width (ft)		27.04	
Vel Total (ft/s)	8.33	Avg. Vel. (ft/s)		8.33	
Max Chl Dpth (ft)	4.00	Hydr. Depth (ft)		2.93	
Conv. Total (cfs)	5874.0	Conv. (cfs)		5874.0	
Length Wtd. (ft)	195.52	Wetted Per. (ft)		29.16	
Min Ch El (ft)	2061.34	Shear (lb/sq ft)		2.14	
Alpha	1.00	Stream Power (lb/ft s)		17.84	
Frctn Loss (ft)	1.89	Cum Volume (acre-ft)	0.10	0.90	0.06

* C & E Loss (ft)	*	0.15	* Cum SA (acres)	*	7.58	*	1.86	*	2.59 *

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION OUTPUT Profile #10-YEAR

* E.G. Elev (ft)	*	2065.34	* Element	*	Left OB	*	Channel	*	Right OB *
* Vel Head (ft)	*	0.77	* Wt. n-Val.	*		*	0.039	*	*
* W.S. Elev (ft)	*	2064.57	* Reach Len. (ft)	*	158.01	*	196.30	*	219.49 *
* Crit W.S. (ft)	*		* Flow Area (sq ft)	*		*	59.46	*	*
* E.G. Slope (ft/ft)	*	0.011419	* Area (sq ft)	*		*	59.46	*	*
* Q Total (cfs)	*	419.00	* Flow (cfs)	*		*	419.00	*	*
* Top Width (ft)	*	24.40	* Top Width (ft)	*		*	24.40	*	*
* Vel Total (ft/s)	*	7.05	* Avg. Vel. (ft/s)	*		*	7.05	*	*
* Max Chl Dpth (ft)	*	3.23	* Hydr. Depth (ft)	*		*	2.44	*	*
* Conv. Total (cfs)	*	3921.1	* Conv. (cfs)	*		*	3921.1	*	*
* Length Wtd. (ft)	*	196.05	* Wetted Per. (ft)	*		*	26.11	*	*
* Min Ch El (ft)	*	2061.34	* Shear (lb/sq ft)	*		*	1.62	*	*
* Alpha	*	1.00	* Stream Power (lb/ft s)	*		*	11.44	*	*
* Frctn Loss (ft)	*	1.43	* Cum Volume (acre-ft)	*	0.03	*	0.68	*	0.03 *
* C & E Loss (ft)	*	0.13	* Cum SA (acres)	*	6.54	*	1.72	*	1.42 *

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

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.570

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	*	2064.63	* Element	*	Left OB	*	Channel	*	Right OB *
* Vel Head (ft)	*	0.64	* Wt. n-Val.	*	0.064	*	0.039	*	*
* W.S. Elev (ft)	*	2063.99	* Reach Len. (ft)	*	105.54	*	117.46	*	121.71 *
* Crit W.S. (ft)	*		* Flow Area (sq ft)	*	29.54	*	109.63	*	*
* E.G. Slope (ft/ft)	*	0.008219	* Area (sq ft)	*	29.54	*	109.63	*	*
* Q Total (cfs)	*	770.00	* Flow (cfs)	*	43.81	*	726.19	*	*
* Top Width (ft)	*	90.28	* Top Width (ft)	*	49.92	*	40.36	*	*
* Vel Total (ft/s)	*	5.53	* Avg. Vel. (ft/s)	*	1.48	*	6.62	*	*
* Max Chl Dpth (ft)	*	4.36	* Hydr. Depth (ft)	*	0.59	*	2.72	*	*
* Conv. Total (cfs)	*	8493.3	* Conv. (cfs)	*	483.3	*	8010.1	*	*
* Length Wtd. (ft)	*	117.01	* Wetted Per. (ft)	*	49.93	*	41.28	*	*
* Min Ch El (ft)	*	2059.62	* Shear (lb/sq ft)	*	0.30	*	1.36	*	*
* Alpha	*	1.36	* Stream Power (lb/ft s)	*	0.45	*	9.03	*	*
* Frctn Loss (ft)	*	1.19	* Cum Volume (acre-ft)	*	0.08	*	0.55	*	0.07 *
* C & E Loss (ft)	*	0.04	* Cum SA (acres)	*	7.82	*	1.73	*	2.84 *

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

CROSS SECTION OUTPUT Profile #FLOODWAY

* E.G. Elev (ft)	*	2065.02	* Element	*	Left OB	*	Channel	*	Right OB *
* Vel Head (ft)	*	0.55	* Wt. n-Val.	*		*	0.039	*	*
* W.S. Elev (ft)	*	2064.46	* Reach Len. (ft)	*	105.54	*	117.46	*	121.71 *
* Crit W.S. (ft)	*		* Flow Area (sq ft)	*		*	128.89	*	*
* E.G. Slope (ft/ft)	*	0.005738	* Area (sq ft)	*		*	128.89	*	*
* Q Total (cfs)	*	770.00	* Flow (cfs)	*		*	770.00	*	*
* Top Width (ft)	*	40.36	* Top Width (ft)	*		*	40.36	*	*
* Vel Total (ft/s)	*	5.97	* Avg. Vel. (ft/s)	*		*	5.97	*	*
* Max Chl Dpth (ft)	*	4.84	* Hydr. Depth (ft)	*		*	3.19	*	*
* Conv. Total (cfs)	*	10165.3	* Conv. (cfs)	*		*	10165.3	*	*
* Length Wtd. (ft)	*	117.46	* Wetted Per. (ft)	*		*	43.27	*	*
* Min Ch El (ft)	*	2059.62	* Shear (lb/sq ft)	*		*	1.07	*	*
* Alpha	*	1.00	* Stream Power (lb/ft s)	*		*	6.37	*	*
* Frctn Loss (ft)	*	0.76	* Cum Volume (acre-ft)	*		*	0.53	*	*
* C & E Loss (ft)	*	0.01	* Cum SA (acres)	*	0.98	*	1.84	*	0.09 *

CROSS SECTION OUTPUT Profile #50-YEAR

* E.G. Elev (ft)	*	2064.38	* Element	*	Left OB	*	Channel	*	Right OB *
* Vel Head (ft)	*	0.57	* Wt. n-Val.	*	0.064	*	0.039	*	*
* W.S. Elev (ft)	*	2063.81	* Reach Len. (ft)	*	105.54	*	117.46	*	121.71 *
* Crit W.S. (ft)	*		* Flow Area (sq ft)	*	21.30	*	102.54	*	*
* E.G. Slope (ft/ft)	*	0.007627	* Area (sq ft)	*	21.30	*	102.54	*	*
* Q Total (cfs)	*	660.00	* Flow (cfs)	*	26.82	*	633.18	*	*
* Top Width (ft)	*	83.18	* Top Width (ft)	*	43.52	*	39.66	*	*
* Vel Total (ft/s)	*	5.33	* Avg. Vel. (ft/s)	*	1.26	*	6.17	*	*
* Max Chl Dpth (ft)	*	4.19	* Hydr. Depth (ft)	*	0.49	*	2.59	*	*
* Conv. Total (cfs)	*	7557.5	* Conv. (cfs)	*	307.1	*	7250.4	*	*
* Length Wtd. (ft)	*	117.18	* Wetted Per. (ft)	*	43.53	*	40.56	*	*
* Min Ch El (ft)	*	2059.62	* Shear (lb/sq ft)	*	0.23	*	1.20	*	*
* Alpha	*	1.29	* Stream Power (lb/ft s)	*	0.29	*	7.43	*	*
* Frctn Loss (ft)	*	1.11	* Cum Volume (acre-ft)	*	0.06	*	0.49	*	0.06 *

* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 7.50	* 1.71	* 2.59 *

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

CROSS SECTION OUTPUT Profile #10-YEAR

* E.G. Elev (ft)	* 2063.78	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.34	* Wt. n-Val.	* 0.064	* 0.039	* *
* W.S. Elev (ft)	* 2063.45	* Reach Len. (ft)	* 105.54	* 117.46	* 121.71 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 7.85	* 88.42	* *
* E.G. Slope (ft/ft)	*0.005072	* Area (sq ft)	* 7.85	* 88.42	* *
* Q Total (cfs)	* 419.00	* Flow (cfs)	* 5.46	* 413.54	* *
* Top Width (ft)	* 67.05	* Top Width (ft)	* 28.83	* 38.22	* *
* Vel Total (ft/s)	* 4.35	* Avg. Vel. (ft/s)	* 0.69	* 4.68	* *
* Max Chl Dpth (ft)	* 3.82	* Hydr. Depth (ft)	* 0.27	* 2.31	* *
* Conv. Total (cfs)	* 5883.4	* Conv. (cfs)	* 76.6	* 5806.8	* *
* Length Wtd. (ft)	* 117.56	* Wetted Per. (ft)	* 28.84	* 39.08	* *
* Min Ch El (ft)	* 2059.62	* Shear (lb/sq ft)	* 0.09	* 0.72	* *
* Alpha	* 1.14	* Stream Power (lb/ft s)	* 0.06	* 3.35	* *
* Frctn Loss (ft)	* 0.93	* Cum Volume (acre-ft)	* 0.01	* 0.35	* 0.03 *
* C & E Loss (ft)	* 0.04	* Cum SA (acres)	* 6.48	* 1.58	* 1.42 *

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.547

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	* 2063.39	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.57	* Wt. n-Val.	* 0.064	* 0.039	* 0.064 *
* W.S. Elev (ft)	* 2062.83	* Reach Len. (ft)	* 56.43	* 57.78	* 58.01 *
* Crit W.S. (ft)	* 2062.83	* Flow Area (sq ft)	* 39.88	* 87.87	* 47.25 *
* E.G. Slope (ft/ft)	*0.012990	* Area (sq ft)	* 39.88	* 87.87	* 47.25 *
* Q Total (cfs)	* 770.00	* Flow (cfs)	* 57.00	* 594.41	* 118.59 *
* Top Width (ft)	* 194.69	* Top Width (ft)	* 100.42	* 44.56	* 49.71 *
* Vel Total (ft/s)	* 4.40	* Avg. Vel. (ft/s)	* 1.43	* 6.76	* 2.51 *
* Max Chl Dpth (ft)	* 3.77	* Hydr. Depth (ft)	* 0.40	* 1.97	* 0.95 *
* Conv. Total (cfs)	* 6755.9	* Conv. (cfs)	* 500.1	* 5215.3	* 1040.5 *
* Length Wtd. (ft)	* 57.78	* Wetted Per. (ft)	* 100.42	* 45.19	* 51.16 *
* Min Ch El (ft)	* 2059.06	* Shear (lb/sq ft)	* 0.32	* 1.58	* 0.75 *
* Alpha	* 1.88	* Stream Power (lb/ft s)	* 0.46	* 10.67	* 1.88 *
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	*	* 0.29	* *
* C & E Loss (ft)	*	* Cum SA (acres)	* 7.63	* 1.61	* 2.77 *

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION OUTPUT Profile #FLOODWAY

* E.G. Elev (ft)	* 2064.24	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.59	* Wt. n-Val.	*	* 0.039	* *
* W.S. Elev (ft)	* 2063.65	* Reach Len. (ft)	* 56.43	* 57.78	* 58.01 *
* Crit W.S. (ft)	* 2062.93	* Flow Area (sq ft)	*	* 124.55	* *
* E.G. Slope (ft/ft)	*0.007384	* Area (sq ft)	*	* 124.55	* *
* Q Total (cfs)	* 770.00	* Flow (cfs)	*	* 770.00	* *
* Top Width (ft)	* 44.56	* Top Width (ft)	*	* 44.56	* *
* Vel Total (ft/s)	* 6.18	* Avg. Vel. (ft/s)	*	* 6.18	* *
* Max Chl Dpth (ft)	* 4.59	* Hydr. Depth (ft)	*	* 2.80	* *
* Conv. Total (cfs)	* 8960.9	* Conv. (cfs)	*	* 8960.9	* *
* Length Wtd. (ft)	* 57.78	* Wetted Per. (ft)	*	* 48.00	* *
* Min Ch El (ft)	* 2059.06	* Shear (lb/sq ft)	*	* 1.20	* *
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 7.39	* *
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	*	* 0.18	* *
* C & E Loss (ft)	*	* Cum SA (acres)	* 0.98	* 1.73	* 0.09 *

Warning: The cross section had to be extended vertically during the critical depth calculations.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant

method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

* E.G. Elev (ft)	* 2063.23	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.50	* Wt. n-Val.	* 0.064	* 0.039	* 0.064 *
* W.S. Elev (ft)	* 2062.73	* Reach Len. (ft)	* 56.43	* 57.78	* 58.01 *
* Crit W.S. (ft)	* 2062.73	* Flow Area (sq ft)	* 30.71	* 83.59	* 42.48 *
* E.G. Slope (ft/ft)	*0.012027	* Area (sq ft)	* 30.71	* 83.59	* 42.48 *
* Q Total (cfs)	* 660.00	* Flow (cfs)	* 37.99	* 526.33	* 95.68 *
* Top Width (ft)	* 184.94	* Top Width (ft)	* 90.67	* 44.56	* 49.71 *
* Vel Total (ft/s)	* 4.21	* Avg. Vel. (ft/s)	* 1.24	* 6.30	* 2.25 *
* Max Chl Dpth (ft)	* 3.67	* Hydr. Depth (ft)	* 0.34	* 1.88	* 0.85 *
* Conv. Total (cfs)	* 6018.2	* Conv. (cfs)	* 346.4	* 4799.3	* 872.5 *
* Length Wtd. (ft)	* 57.78	* Wetted Per. (ft)	* 90.67	* 45.19	* 51.07 *
* Min Ch El (ft)	* 2059.06	* Shear (lb/sq ft)	* 0.25	* 1.39	* 0.62 *
* Alpha	* 1.83	* Stream Power (lb/ft s)	* 0.31	* 8.74	* 1.41 *
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	*	* 0.24	* *
* C & E Loss (ft)	*	* Cum SA (acres)	* 7.34	* 1.59	* 2.53 *

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2062.81	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.48	Wt. n-Val.	0.064	0.039	0.064
W.S. Elev (ft)	2062.34	Reach Len. (ft)	56.43	57.78	58.01
Crit W.S. (ft)	2062.34	Flow Area (sq ft)	1.65	66.03	22.88
E.G. Slope (ft/ft)	0.013881	Area (sq ft)	1.65	66.03	22.88
Q Total (cfs)	419.00	Flow (cfs)	0.56	381.60	36.85
Top Width (ft)	134.21	Top Width (ft)	39.94	44.56	49.71
Vel Total (ft/s)	4.63	Avg. Vel. (ft/s)	0.34	5.78	1.61
Max Chl Dpth (ft)	3.28	Hydr. Depth (ft)	0.04	1.48	0.46
Conv. Total (cfs)	3556.4	Conv. (cfs)	4.7	3238.9	312.7
Length Wtd. (ft)	57.78	Wetted Per. (ft)	39.94	45.19	50.67
Min Ch El (ft)	2059.06	Shear (lb/sq ft)	0.04	1.27	0.39
Alpha	1.43	Stream Power (lb/ft s)	0.01	7.32	0.63
Frctn Loss (ft)		Cum Volume (acre-ft)		0.14	
C & E Loss (ft)		Cum SA (acres)	6.40	1.46	1.35

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.537

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2062.29	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.76	Wt. n-Val.	0.064	0.039	0.064
W.S. Elev (ft)	2061.53	Reach Len. (ft)	83.75	64.74	56.13
Crit W.S. (ft)	2061.53	Flow Area (sq ft)	10.32	104.34	58.99
E.G. Slope (ft/ft)	0.011791	Area (sq ft)	10.32	104.34	58.99
Q Total (cfs)	960.00	Flow (cfs)	8.75	794.24	157.01
Top Width (ft)	145.66	Top Width (ft)	52.90	40.00	52.76
Vel Total (ft/s)	5.53	Avg. Vel. (ft/s)	0.85	7.61	2.66
Max Chl Dpth (ft)	5.31	Hydr. Depth (ft)	0.20	2.61	1.12
Conv. Total (cfs)	8841.0	Conv. (cfs)	80.6	7314.4	1446.0
Length Wtd. (ft)	65.03	Wetted Per. (ft)	52.91	41.81	54.39
Min Ch El (ft)	2056.22	Shear (lb/sq ft)	0.14	1.84	0.80
Alpha	1.61	Stream Power (lb/ft s)	0.12	13.98	2.13
Frctn Loss (ft)	0.67	Cum Volume (acre-ft)	7.70	3.63	3.13
C & E Loss (ft)	0.03	Cum SA (acres)	7.53	1.55	2.70

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 cross-section end points had to be extended vertically for the computed water surface.
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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2062.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.23	Wt. n-Val.		0.039	
W.S. Elev (ft)	2061.61	Reach Len. (ft)	83.75	64.74	56.13
Crit W.S. (ft)	2061.54	Flow Area (sq ft)		107.86	
E.G. Slope (ft/ft)	0.016861	Area (sq ft)		107.86	
Q Total (cfs)	960.00	Flow (cfs)		960.00	
Top Width (ft)	40.00	Top Width (ft)		40.00	
Vel Total (ft/s)	8.90	Avg. Vel. (ft/s)		8.90	
Max Chl Dpth (ft)	5.39	Hydr. Depth (ft)		2.70	
Conv. Total (cfs)	7393.0	Conv. (cfs)		7393.0	
Length Wtd. (ft)	64.74	Wetted Per. (ft)		44.71	
Min Ch El (ft)	2056.22	Shear (lb/sq ft)		2.54	
Alpha	1.00	Stream Power (lb/ft s)		22.60	
Frctn Loss (ft)	0.71	Cum Volume (acre-ft)	1.59	4.25	0.12
C & E Loss (ft)	0.18	Cum SA (acres)	0.98	1.67	0.09

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The cross section had to be extended vertically during the critical depth calculations.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2062.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.76	Wt. n-Val.	0.064	0.039	0.064
W.S. Elev (ft)	2061.29	Reach Len. (ft)	83.75	64.74	56.13
Crit W.S. (ft)	2061.29	Flow Area (sq ft)	1.42	94.80	46.41
E.G. Slope (ft/ft)	0.012892	Area (sq ft)	1.42	94.80	46.41
Q Total (cfs)	819.00	Flow (cfs)	0.78	707.83	110.39
Top Width (ft)	107.67	Top Width (ft)	14.91	40.00	52.76
Vel Total (ft/s)	5.74	Avg. Vel. (ft/s)	0.55	7.47	2.38

* Max Chl Dpth (ft)	*	5.07	* Hydr. Depth (ft)	*	0.10	*	2.37	*	0.88	*
* Conv. Total (cfs)	*	7213.1	* Conv. (cfs)	*	6.9	*	6234.0	*	972.2	*
* Length Wtd. (ft)	*	64.62	* Wetted Per. (ft)	*	14.91	*	41.81	*	54.15	*
* Min Ch El (ft)	*	2056.22	* Shear (lb/sq ft)	*	0.08	*	1.83	*	0.69	*
* Alpha	*	1.48	* Stream Power (lb/ft s)	*	0.04	*	13.63	*	1.64	*
* Frctn Loss (ft)	*	0.73	* Cum Volume (acre-ft)	*	6.50	*	3.30	*	2.57	*
* C & E Loss (ft)	*	0.04	* Cum SA (acres)	*	7.27	*	1.54	*	2.46	*

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 cross-section end points had to be extended vertically for the computed water surface.
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 OUTPUT Profile #10-YEAR

* E.G. Elev (ft)	*	2060.97	* Element	*	Left OB	*	Channel	*	Right OB	*
* Vel Head (ft)	*	1.18	* Wt. n-Val.	*		*	0.039	*	0.064	*
* W.S. Elev (ft)	*	2059.79	* Reach Len. (ft)	*	83.75	*	64.74	*	56.13	*
* Crit W.S. (ft)	*	2059.76	* Flow Area (sq ft)	*		*	53.72	*	0.61	*
* E.G. Slope (ft/ft)	*	0.017349	* Area (sq ft)	*		*	53.72	*	0.61	*
* Q Total (cfs)	*	470.00	* Flow (cfs)	*		*	469.17	*	0.83	*
* Top Width (ft)	*	23.78	* Top Width (ft)	*		*	21.84	*	1.95	*
* Vel Total (ft/s)	*	8.65	* Avg. Vel. (ft/s)	*		*	8.73	*	1.36	*
* Max Chl Dpth (ft)	*	3.56	* Hydr. Depth (ft)	*		*	2.46	*	0.31	*
* Conv. Total (cfs)	*	3568.3	* Conv. (cfs)	*		*	3562.0	*	6.3	*
* Length Wtd. (ft)	*	64.65	* Wetted Per. (ft)	*		*	23.40	*	2.04	*
* Min Ch El (ft)	*	2056.22	* Shear (lb/sq ft)	*		*	2.49	*	0.32	*
* Alpha	*	1.02	* Stream Power (lb/ft s)	*		*	21.72	*	0.44	*
* Frctn Loss (ft)	*	0.98	* Cum Volume (acre-ft)	*	3.57	*	2.45	*	1.56	*
* C & E Loss (ft)	*	0.17	* Cum SA (acres)	*	6.37	*	1.42	*	1.32	*

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: SUNSET WASH
REACH: REACH #1 RS: 0.524

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	*	2061.28	* Element	*	Left OB	*	Channel	*	Right OB	*
* Vel Head (ft)	*	0.87	* Wt. n-Val.	*	0.064	*	0.039	*	0.064	*
* W.S. Elev (ft)	*	2060.41	* Reach Len. (ft)	*	133.18	*	106.76	*	81.59	*
* Crit W.S. (ft)	*	2060.41	* Flow Area (sq ft)	*	59.93	*	106.30	*	6.03	*
* E.G. Slope (ft/ft)	*	0.008990	* Area (sq ft)	*	59.93	*	106.30	*	6.03	*
* Q Total (cfs)	*	960.00	* Flow (cfs)	*	98.91	*	845.92	*	15.17	*
* Top Width (ft)	*	126.17	* Top Width (ft)	*	92.32	*	31.96	*	1.89	*
* Vel Total (ft/s)	*	5.57	* Avg. Vel. (ft/s)	*	1.65	*	7.96	*	2.52	*
* Max Chl Dpth (ft)	*	4.62	* Hydr. Depth (ft)	*	0.65	*	3.33	*	3.19	*
* Conv. Total (cfs)	*	10124.8	* Conv. (cfs)	*	1043.2	*	8921.6	*	160.0	*
* Length Wtd. (ft)	*	109.91	* Wetted Per. (ft)	*	92.34	*	32.51	*	4.93	*
* Min Ch El (ft)	*	2055.79	* Shear (lb/sq ft)	*	0.36	*	1.84	*	0.69	*
* Alpha	*	1.81	* Stream Power (lb/ft s)	*	0.60	*	14.60	*	1.73	*
* Frctn Loss (ft)	*	0.89	* Cum Volume (acre-ft)	*	7.63	*	3.47	*	3.09	*
* C & E Loss (ft)	*	0.03	* Cum SA (acres)	*	7.39	*	1.50	*	2.67	*

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 OUTPUT Profile #FLOODWAY

* E.G. Elev (ft)	*	2061.96	* Element	*	Left OB	*	Channel	*	Right OB	*
* Vel Head (ft)	*	0.88	* Wt. n-Val.	*		*	0.039	*		*
* W.S. Elev (ft)	*	2061.08	* Reach Len. (ft)	*	133.18	*	106.76	*	81.59	*
* Crit W.S. (ft)	*		* Flow Area (sq ft)	*		*	127.75	*		*
* E.G. Slope (ft/ft)	*	0.007668	* Area (sq ft)	*		*	127.75	*		*
* Q Total (cfs)	*	960.00	* Flow (cfs)	*		*	960.00	*		*
* Top Width (ft)	*	31.96	* Top Width (ft)	*		*	31.96	*		*
* Vel Total (ft/s)	*	7.51	* Avg. Vel. (ft/s)	*		*	7.51	*		*
* Max Chl Dpth (ft)	*	5.29	* Hydr. Depth (ft)	*		*	4.00	*		*
* Conv. Total (cfs)	*	10962.9	* Conv. (cfs)	*		*	10962.9	*		*
* Length Wtd. (ft)	*	106.76	* Wetted Per. (ft)	*		*	37.80	*		*
* Min Ch El (ft)	*	2055.79	* Shear (lb/sq ft)	*		*	1.62	*		*
* Alpha	*	1.00	* Stream Power (lb/ft s)	*		*	12.16	*		*
* Frctn Loss (ft)	*	0.93	* Cum Volume (acre-ft)	*	1.59	*	4.08	*	0.12	*
* C & E Loss (ft)	*	0.08	* Cum SA (acres)	*	0.98	*	1.62	*	0.09	*

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2061.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.89	Wt. n-Val.	0.064	0.039	0.064
W.S. Elev (ft)	2060.12	Reach Len. (ft)	133.18	106.76	81.59
Crit W.S. (ft)	2060.12	Flow Area (sq ft)	34.59	96.92	5.48
E.G. Slope (ft/ft)	0.009859	Area (sq ft)	34.59	96.92	5.48
Q Total (cfs)	819.00	Flow (cfs)	45.47	759.43	14.09
Top Width (ft)	114.16	Top Width (ft)	80.31	31.96	1.89
Vel Total (ft/s)	5.98	Avg. Vel. (ft/s)	1.31	7.84	2.57
Max Chl Dpth (ft)	4.33	Hydr. Depth (ft)	0.43	3.03	2.90
Conv. Total (cfs)	8248.5	Conv. (cfs)	458.0	7648.6	141.9
Length Wtd. (ft)	109.10	Wetted Per. (ft)	80.32	32.51	4.64
Min Ch El (ft)	2055.79	Shear (lb/sq ft)	0.27	1.83	0.73
Alpha	1.60	Stream Power (lb/ft s)	0.35	14.38	1.87
Frctn Loss (ft)	0.94	Cum Volume (acre-ft)	6.47	3.16	2.53
C & E Loss (ft)	0.02	Cum SA (acres)	7.18	1.48	2.42

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2059.81	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.84	Wt. n-Val.		0.039	0.064
W.S. Elev (ft)	2058.97	Reach Len. (ft)	133.18	106.76	81.59
Crit W.S. (ft)		Flow Area (sq ft)		62.09	3.31
E.G. Slope (ft/ft)	0.013480	Area (sq ft)		62.09	3.31
Q Total (cfs)	470.00	Flow (cfs)		461.41	8.59
Top Width (ft)	29.96	Top Width (ft)		28.07	1.89
Vel Total (ft/s)	7.19	Avg. Vel. (ft/s)		7.43	2.60
Max Chl Dpth (ft)	3.18	Hydr. Depth (ft)		2.21	1.75
Conv. Total (cfs)	4048.1	Conv. (cfs)		3974.1	74.0
Length Wtd. (ft)	107.67	Wetted Per. (ft)		28.51	3.49
Min Ch El (ft)	2055.79	Shear (lb/sq ft)		1.83	0.80
Alpha	1.05	Stream Power (lb/ft s)		13.62	2.07
Frctn Loss (ft)	1.09	Cum Volume (acre-ft)	3.57	2.36	1.55
C & E Loss (ft)	0.01	Cum SA (acres)	6.37	1.38	1.32

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: SUNSET WASH
REACH: REACH #1 RS: 0.504

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2060.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.14	Wt. n-Val.	0.064	0.029	0.064
W.S. Elev (ft)	2058.92	Reach Len. (ft)	252.82	228.50	204.81
Crit W.S. (ft)	2058.92	Flow Area (sq ft)	59.91	83.25	8.93
E.G. Slope (ft/ft)	0.007398	Area (sq ft)	59.91	83.25	8.93
Q Total (cfs)	960.00	Flow (cfs)	160.85	782.30	16.85
Top Width (ft)	74.21	Top Width (ft)	38.31	26.43	9.47
Vel Total (ft/s)	6.31	Avg. Vel. (ft/s)	2.69	9.40	1.89
Max Chl Dpth (ft)	3.84	Hydr. Depth (ft)	1.56	3.15	0.94
Conv. Total (cfs)	11161.2	Conv. (cfs)	1870.1	9095.2	195.9
Length Wtd. (ft)	232.76	Wetted Per. (ft)	38.42	26.74	9.71
Min Ch El (ft)	2055.08	Shear (lb/sq ft)	0.72	1.44	0.42
Alpha	1.84	Stream Power (lb/ft s)	1.93	13.51	0.80
Frctn Loss (ft)	2.05	Cum Volume (acre-ft)	7.45	3.24	3.08
C & E Loss (ft)	0.12	Cum SA (acres)	7.20	1.43	2.66

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2060.94	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.71	Wt. n-Val.		0.029	
W.S. Elev (ft)	2059.24	Reach Len. (ft)	252.82	228.50	204.81

Crit W.S. (ft)	2059.24	Flow Area (sq ft)			91.60		
E.G. Slope (ft/ft)	0.010087	Area (sq ft)			91.60		
Q Total (cfs)	960.00	Flow (cfs)			960.00		
Top Width (ft)	26.43	Top Width (ft)			26.43		
Vel Total (ft/s)	10.48	Avg. Vel. (ft/s)			10.48		
Max Chl Dpth (ft)	4.16	Hydr. Depth (ft)			3.47		
Conv. Total (cfs)	9558.6	Conv. (cfs)			9558.6		
Length Wtd. (ft)	228.50	Wetted Per. (ft)			31.52		
Min Ch El (ft)	2055.08	Shear (lb/sq ft)			1.83		
Alpha	1.00	Stream Power (lb/ft s)			19.18		
Frctn Loss (ft)	2.32	Cum Volume (acre-ft)		1.59	3.81		0.12
C & E Loss (ft)	0.21	Cum SA (acres)		0.98	1.55		0.09

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2059.71	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.06	Wt. n-Val.	0.064	0.029	0.064	
W.S. Elev (ft)	2058.65	Reach Len. (ft)	252.82	228.50	204.81	
Crit W.S. (ft)	2058.65	Flow Area (sq ft)	49.75	76.07	6.55	
E.G. Slope (ft/ft)	0.007632	Area (sq ft)	49.75	76.07	6.55	
Q Total (cfs)	819.00	Flow (cfs)	123.89	683.74	11.37	
Top Width (ft)	70.96	Top Width (ft)	36.48	26.43	8.05	
Vel Total (ft/s)	6.19	Avg. Vel. (ft/s)	2.49	8.99	1.74	
Max Chl Dpth (ft)	3.57	Hydr. Depth (ft)	1.36	2.88	0.81	
Conv. Total (cfs)	9374.8	Conv. (cfs)	1418.2	7826.5	130.1	
Length Wtd. (ft)	232.59	Wetted Per. (ft)	36.58	26.74	8.26	
Min Ch El (ft)	2055.08	Shear (lb/sq ft)	0.65	1.36	0.38	
Alpha	1.79	Stream Power (lb/ft s)	1.61	12.18	0.66	
Frctn Loss (ft)	2.10	Cum Volume (acre-ft)	6.34	2.95	2.52	
C & E Loss (ft)	0.12	Cum SA (acres)	7.00	1.41	2.41	

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2058.71	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.80	Wt. n-Val.	0.064	0.029	0.064	
W.S. Elev (ft)	2057.91	Reach Len. (ft)	252.82	228.50	204.81	
Crit W.S. (ft)	2057.91	Flow Area (sq ft)	24.59	56.51	2.02	
E.G. Slope (ft/ft)	0.007922	Area (sq ft)	24.59	56.51	2.02	
Q Total (cfs)	470.00	Flow (cfs)	43.06	424.43	2.51	
Top Width (ft)	62.11	Top Width (ft)	31.50	26.43	4.18	
Vel Total (ft/s)	5.65	Avg. Vel. (ft/s)	1.75	7.51	1.24	
Max Chl Dpth (ft)	2.83	Hydr. Depth (ft)	0.78	2.14	0.48	
Conv. Total (cfs)	5280.4	Conv. (cfs)	483.7	4768.5	28.2	
Length Wtd. (ft)	231.72	Wetted Per. (ft)	31.54	26.74	4.32	
Min Ch El (ft)	2055.08	Shear (lb/sq ft)	0.39	1.05	0.23	
Alpha	1.60	Stream Power (lb/ft s)	0.68	7.85	0.29	
Frctn Loss (ft)	2.23	Cum Volume (acre-ft)	3.53	2.22	1.55	
C & E Loss (ft)	0.10	Cum SA (acres)	6.33	1.32	1.31	

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: SUNSET WASH
REACH: REACH #1 RS: 0.461

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2055.55	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.73	Wt. n-Val.	0.056	0.029	0.056	

W.S. Elev (ft)	2054.82	Reach Len. (ft)	140.50	156.62	176.52	
Crit W.S. (ft)	2054.82	Flow Area (sq ft)	59.06	98.89	7.39	
E.G. Slope (ft/ft)	0.010625	Area (sq ft)	134.15	98.89	7.39	
Q Total (cfs)	960.00	Flow (cfs)	202.22	747.16	10.62	
Top Width (ft)	252.74	Top Width (ft)	175.61	57.76	19.37	
Vel Total (ft/s)	5.81	Avg. Vel. (ft/s)	3.42	7.56	1.44	
Max Chl Dpth (ft)	2.04	Hydr. Depth (ft)	1.40	1.71	0.38	
Conv. Total (cfs)	9313.4	Conv. (cfs)	1961.9	7248.6	103.0	
Length Wtd. (ft)	155.51	Wetted Per. (ft)	42.16	57.79	19.39	
Min Ch El (ft)	2052.78	Shear (lb/sq ft)	0.93	1.13	0.25	
Alpha	1.39	Stream Power (lb/ft s)	3.18	8.58	0.36	
Frctn Loss (ft)	1.30	Cum Volume (acre-ft)	6.89	2.76	3.04	
C & E Loss (ft)	0.04	Cum SA (acres)	6.57	1.21	2.59	

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2056.18	Element			
Vel Head (ft)	1.01	Wt. n-Val.		0.029	
W.S. Elev (ft)	2055.17	Reach Len. (ft)	140.50	156.62	176.52
Crit W.S. (ft)	2055.17	Flow Area (sq ft)		118.88	
E.G. Slope (ft/ft)	0.010206	Area (sq ft)		118.88	
Q Total (cfs)	960.00	Flow (cfs)		960.00	
Top Width (ft)	57.76	Top Width (ft)		57.76	
Vel Total (ft/s)	8.08	Avg. Vel. (ft/s)		8.08	
Max Chl Dpth (ft)	2.39	Hydr. Depth (ft)		2.06	
Conv. Total (cfs)	9502.8	Conv. (cfs)		9502.8	
Length Wtd. (ft)	156.76	Wetted Per. (ft)		61.01	
Min Ch El (ft)	2052.78	Shear (lb/sq ft)		1.24	
Alpha	1.00	Stream Power (lb/ft s)		10.02	
Frctn Loss (ft)	1.33	Cum Volume (acre-ft)	1.59	3.26	0.12
C & E Loss (ft)	0.05	Cum SA (acres)	0.98	1.33	0.09

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 cross section had to be extended vertically during the critical depth 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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2055.33	Element			
Vel Head (ft)	0.66	Wt. n-Val.	0.056	0.029	0.056
W.S. Elev (ft)	2054.67	Reach Len. (ft)	140.50	156.62	176.52
Crit W.S. (ft)	2054.67	Flow Area (sq ft)	52.57	89.99	4.71
E.G. Slope (ft/ft)	0.010837	Area (sq ft)	108.19	89.99	4.71
Q Total (cfs)	819.00	Flow (cfs)	168.19	644.86	5.95
Top Width (ft)	233.92	Top Width (ft)	160.93	57.76	15.23
Vel Total (ft/s)	5.56	Avg. Vel. (ft/s)	3.20	7.17	1.26
Max Chl Dpth (ft)	1.89	Hydr. Depth (ft)	1.25	1.56	0.31
Conv. Total (cfs)	7867.3	Conv. (cfs)	1615.6	6194.5	57.2
Length Wtd. (ft)	155.52	Wetted Per. (ft)	42.16	57.79	15.24
Min Ch El (ft)	2052.78	Shear (lb/sq ft)	0.84	1.05	0.21
Alpha	1.38	Stream Power (lb/ft s)	2.70	7.55	0.26
Frctn Loss (ft)	1.38	Cum Volume (acre-ft)	5.88	2.51	2.49
C & E Loss (ft)	0.04	Cum SA (acres)	6.42	1.19	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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2054.70	Element			
Vel Head (ft)	0.48	Wt. n-Val.	0.056	0.029	0.056
W.S. Elev (ft)	2054.22	Reach Len. (ft)	140.50	156.62	176.52
Crit W.S. (ft)	2054.22	Flow Area (sq ft)	33.77	64.24	0.59
E.G. Slope (ft/ft)	0.011898	Area (sq ft)	48.28	64.24	0.59
Q Total (cfs)	470.00	Flow (cfs)	84.30	385.28	0.43

Top Width (ft)	165.05	Top Width (ft)	102.67	57.76	4.61	
Vel Total (ft/s)	4.77	Avg. Vel. (ft/s)	2.50	6.00	0.73	
Max Chl Dpth (ft)	1.44	Hydr. Depth (ft)	0.80	1.11	0.13	
Conv. Total (cfs)	4308.8	Conv. (cfs)	772.8	3532.1	3.9	
Length Wtd. (ft)	155.63	Wetted Per. (ft)	42.16	57.79	4.62	
Min Ch El (ft)	2052.78	Shear (lb/sq ft)	0.59	0.83	0.09	
Alpha	1.35	Stream Power (lb/ft s)	1.49	4.95	0.07	
Frctn Loss (ft)	1.46	Cum Volume (acre-ft)	3.32	1.90	1.54	
C & E Loss (ft)	0.03	Cum SA (acres)	5.94	1.09	1.29	

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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.431

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2053.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.11	Wt. n-Val.	0.064	0.025	0.064
W.S. Elev (ft)	2052.35	Reach Len. (ft)	361.98	375.35	384.72
Crit W.S. (ft)	2052.35	Flow Area (sq ft)	37.93	83.42	45.20
E.G. Slope (ft/ft)	0.006703	Area (sq ft)	37.93	83.42	45.20
Q Total (cfs)	960.00	Flow (cfs)	74.78	778.14	107.08
Top Width (ft)	99.60	Top Width (ft)	35.80	31.43	32.37
Vel Total (ft/s)	5.76	Avg. Vel. (ft/s)	1.97	9.33	2.37
Max Chl Dpth (ft)	2.75	Hydr. Depth (ft)	1.06	2.65	1.40
Conv. Total (cfs)	11725.5	Conv. (cfs)	913.4	9504.3	1307.8
Length Wtd. (ft)	372.56	Wetted Per. (ft)	35.92	31.43	32.49
Min Ch El (ft)	2049.60	Shear (lb/sq ft)	0.44	1.11	0.58
Alpha	2.15	Stream Power (lb/ft s)	0.87	10.36	1.38
Frctn Loss (ft)	2.18	Cum Volume (acre-ft)	6.61	2.43	2.93
C & E Loss (ft)	0.17	Cum SA (acres)	6.23	1.05	2.48

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2054.24	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.50	Wt. n-Val.		0.025	0.064
W.S. Elev (ft)	2052.73	Reach Len. (ft)	361.98	375.35	384.72
Crit W.S. (ft)	2052.73	Flow Area (sq ft)		95.58	5.97
E.G. Slope (ft/ft)	0.007154	Area (sq ft)		95.58	5.97
Q Total (cfs)	960.00	Flow (cfs)		946.67	13.33
Top Width (ft)	33.50	Top Width (ft)		31.43	2.07
Vel Total (ft/s)	9.45	Avg. Vel. (ft/s)		9.90	2.23
Max Chl Dpth (ft)	3.13	Hydr. Depth (ft)		3.04	2.88
Conv. Total (cfs)	11349.7	Conv. (cfs)		11192.1	157.6
Length Wtd. (ft)	375.41	Wetted Per. (ft)		34.56	4.92
Min Ch El (ft)	2049.60	Shear (lb/sq ft)		1.24	0.54
Alpha	1.08	Stream Power (lb/ft s)		12.23	1.21
Frctn Loss (ft)	2.74	Cum Volume (acre-ft)	1.59	2.87	0.11
C & E Loss (ft)	0.00	Cum SA (acres)	0.98	1.17	0.08

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 cross section had to be extended vertically during the critical depth 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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2053.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.06	Wt. n-Val.	0.064	0.025	0.064
W.S. Elev (ft)	2052.06	Reach Len. (ft)	361.98	375.35	384.72

Crit W.S. (ft)	2052.06	Flow Area (sq ft)	28.74	74.26	36.51	
E.G. Slope (ft/ft)	0.007373	Area (sq ft)	28.74	74.26	36.51	
Q Total (cfs)	819.00	Flow (cfs)	58.83	672.37	87.80	
Top Width (ft)	86.39	Top Width (ft)	27.51	31.43	27.45	
Vel Total (ft/s)	5.87	Avg. Vel. (ft/s)	2.05	9.05	2.40	
Max Chl Dpth (ft)	2.46	Hydr. Depth (ft)	1.04	2.36	1.33	
Conv. Total (cfs)	9537.9	Conv. (cfs)	685.1	7830.4	1022.5	
Length Wtd. (ft)	372.77	Wetted Per. (ft)	27.63	31.43	27.56	
Min Ch El (ft)	2049.60	Shear (lb/sq ft)	0.48	1.09	0.61	
Alpha	1.98	Stream Power (lb/ft s)	0.98	9.85	1.47	
Frctn Loss (ft)	2.16	Cum Volume (acre-ft)	5.66	2.22	2.41	
C & E Loss (ft)	0.17	Cum SA (acres)	6.12	1.03	2.27	

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2052.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.74	Wt. n-Val.	0.064	0.025	0.064
W.S. Elev (ft)	2051.41	Reach Len. (ft)	361.98	375.35	384.72
Crit W.S. (ft)	2051.41	Flow Area (sq ft)	14.63	54.06	21.03
E.G. Slope (ft/ft)	0.007579	Area (sq ft)	14.63	54.06	21.03
Q Total (cfs)	470.00	Flow (cfs)	26.08	401.55	42.37
Top Width (ft)	70.06	Top Width (ft)	17.57	31.43	21.05
Vel Total (ft/s)	5.24	Avg. Vel. (ft/s)	1.78	7.43	2.01
Max Chl Dpth (ft)	1.81	Hydr. Depth (ft)	0.83	1.72	1.00
Conv. Total (cfs)	5398.9	Conv. (cfs)	299.6	4612.6	486.7
Length Wtd. (ft)	373.51	Wetted Per. (ft)	17.67	31.43	21.13
Min Ch El (ft)	2049.60	Shear (lb/sq ft)	0.39	0.81	0.47
Alpha	1.74	Stream Power (lb/ft s)	0.70	6.04	0.95
Frctn Loss (ft)	1.99	Cum Volume (acre-ft)	3.22	1.69	1.50
C & E Loss (ft)	0.10	Cum SA (acres)	5.74	0.93	1.24

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNSET WASH
REACH: REACH #1 RS: 0.360

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2048.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.54	Wt. n-Val.	0.064	0.025	0.064
W.S. Elev (ft)	2047.80	Reach Len. (ft)	343.30	375.88	414.85
Crit W.S. (ft)	2047.80	Flow Area (sq ft)	279.66	88.78	10.11
E.G. Slope (ft/ft)	0.005239	Area (sq ft)	279.66	88.78	10.11
Q Total (cfs)	1146.00	Flow (cfs)	454.00	671.60	20.39
Top Width (ft)	339.84	Top Width (ft)	294.52	38.06	7.26
Vel Total (ft/s)	3.03	Avg. Vel. (ft/s)	1.62	7.56	2.02
Max Chl Dpth (ft)	2.55	Hydr. Depth (ft)	0.95	2.33	1.39
Conv. Total (cfs)	15833.0	Conv. (cfs)	6272.4	9278.8	281.7
Length Wtd. (ft)	369.51	Wetted Per. (ft)	294.54	38.08	7.69
Min Ch El (ft)	2045.25	Shear (lb/sq ft)	0.31	0.76	0.43
Alpha	3.78	Stream Power (lb/ft s)	0.50	5.77	0.87
Frctn Loss (ft)	2.12	Cum Volume (acre-ft)	5.29	1.69	2.69
C & E Loss (ft)	0.08	Cum SA (acres)	4.86	0.75	2.31

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2050.03	Element	Left OB	Channel	Right OB

Vel Head (ft)	1.51	Wt. n-Val.		0.025		
W.S. Elev (ft)	2048.52	Reach Len. (ft)	343.30	375.88	414.85	
Crit W.S. (ft)	2048.52	Flow Area (sq ft)		116.28		
E.G. Slope (ft/ft)	0.007424	Area (sq ft)		116.28		
Q Total (cfs)	1146.00	Flow (cfs)		1146.00		
Top Width (ft)	38.06	Top Width (ft)		38.06		
Vel Total (ft/s)	9.86	Avg. Vel. (ft/s)		9.86		
Max Chl Dpth (ft)	3.27	Hydr. Depth (ft)		3.06		
Conv. Total (cfs)	13300.7	Conv. (cfs)		13300.7		
Length Wtd. (ft)	375.68	Wetted Per. (ft)		43.55		
Min Ch El (ft)	2045.25	Shear (lb/sq ft)		1.24		
Alpha	1.00	Stream Power (lb/ft s)		12.19		
Frctn Loss (ft)	2.59	Cum Volume (acre-ft)	1.59	1.96	0.08	
C & E Loss (ft)	0.04	Cum SA (acres)	0.98	0.87	0.07	

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.
Warning: The parabolic search method failed to converge on critical depth. The program will try the cross section slice/secant method to find critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2048.18	Element			
Vel Head (ft)	0.48	Wt. n-Val.	0.064	0.025	0.064
W.S. Elev (ft)	2047.69	Reach Len. (ft)	343.30	375.88	414.85
Crit W.S. (ft)	2047.69	Flow Area (sq ft)	248.38	84.71	9.35
E.G. Slope (ft/ft)	0.004832	Area (sq ft)	248.38	84.71	9.35
Q Total (cfs)	975.00	Flow (cfs)	360.93	596.46	17.61
Top Width (ft)	335.76	Top Width (ft)	290.70	38.06	7.01
Vel Total (ft/s)	2.85	Avg. Vel. (ft/s)	1.45	7.04	1.88
Max Chl Dpth (ft)	2.44	Hydr. Depth (ft)	0.85	2.23	1.33
Conv. Total (cfs)	14026.5	Conv. (cfs)	5192.4	8580.8	253.3
Length Wtd. (ft)	369.88	Wetted Per. (ft)	290.71	38.08	7.41
Min Ch El (ft)	2045.25	Shear (lb/sq ft)	0.26	0.67	0.38
Alpha	3.85	Stream Power (lb/ft s)	0.37	4.72	0.72
Frctn Loss (ft)	2.06	Cum Volume (acre-ft)	4.51	1.53	2.21
C & E Loss (ft)	0.07	Cum SA (acres)	4.80	0.73	2.12

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2047.76	Element			
Vel Head (ft)	0.39	Wt. n-Val.	0.064	0.025	0.064
W.S. Elev (ft)	2047.37	Reach Len. (ft)	343.30	375.88	414.85
Crit W.S. (ft)	2047.37	Flow Area (sq ft)	156.20	72.43	7.21
E.G. Slope (ft/ft)	0.004201	Area (sq ft)	156.20	72.43	7.21
Q Total (cfs)	599.00	Flow (cfs)	159.11	428.36	11.53
Top Width (ft)	324.78	Top Width (ft)	280.48	38.06	6.24
Vel Total (ft/s)	2.54	Avg. Vel. (ft/s)	1.02	5.91	1.60
Max Chl Dpth (ft)	2.12	Hydr. Depth (ft)	0.56	1.90	1.16
Conv. Total (cfs)	9241.8	Conv. (cfs)	2454.8	6609.0	177.9
Length Wtd. (ft)	371.57	Wetted Per. (ft)	280.49	38.08	6.58
Min Ch El (ft)	2045.25	Shear (lb/sq ft)	0.15	0.50	0.29
Alpha	3.93	Stream Power (lb/ft s)	0.15	2.95	0.46
Frctn Loss (ft)	2.02	Cum Volume (acre-ft)	2.51	1.14	1.37
C & E Loss (ft)	0.05	Cum SA (acres)	4.50	0.63	1.12

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNSET WASH
REACH: REACH #1 RS: 0.289

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2045.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.35	Wt. n-Val.	0.100	0.025	0.100
W.S. Elev (ft)	2044.17	Reach Len. (ft)	100.44	106.55	115.05
Crit W.S. (ft)	2044.17	Flow Area (sq ft)	18.62	114.43	13.21
E.G. Slope (ft/ft)	0.006337	Area (sq ft)	488.31	114.43	315.84
Q Total (cfs)	1146.00	Flow (cfs)	38.36	1091.07	16.58
Top Width (ft)	660.00	Top Width (ft)	351.64	39.94	268.43
Vel Total (ft/s)	7.84	Avg. Vel. (ft/s)	2.06	9.53	1.25
Max Chl Dpth (ft)	3.79	Hydr. Depth (ft)	2.31	2.87	1.10
Conv. Total (cfs)	14395.7	Conv. (cfs)	481.9	13705.6	208.2
Length Wtd. (ft)	106.51	Wetted Per. (ft)	8.10	40.00	12.10
Min Ch El (ft)	2040.99	Shear (lb/sq ft)	0.91	1.13	0.43
Alpha	1.41	Stream Power (lb/ft s)	1.87	10.79	0.54
Frctn Loss (ft)	0.54	Cum Volume (acre-ft)	2.26	0.82	1.14
C & E Loss (ft)	0.44	Cum SA (acres)	2.31	0.41	1.00

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2045.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.37	Wt. n-Val.	0.100	0.025	0.100
W.S. Elev (ft)	2044.17	Reach Len. (ft)	100.44	106.55	115.05
Crit W.S. (ft)	2044.17	Flow Area (sq ft)	18.62	114.43	13.21
E.G. Slope (ft/ft)	0.006400	Area (sq ft)	18.62	114.43	13.21
Q Total (cfs)	1146.00	Flow (cfs)	33.34	1096.43	16.23
Top Width (ft)	60.00	Top Width (ft)	8.07	39.94	11.99
Vel Total (ft/s)	7.84	Avg. Vel. (ft/s)	1.79	9.58	1.23
Max Chl Dpth (ft)	3.18	Hydr. Depth (ft)	2.31	2.87	1.10
Conv. Total (cfs)	14325.3	Conv. (cfs)	416.8	13705.6	202.9
Length Wtd. (ft)	106.52	Wetted Per. (ft)	10.07	40.00	12.58
Min Ch El (ft)	2040.99	Shear (lb/sq ft)	0.74	1.14	0.42
Alpha	1.43	Stream Power (lb/ft s)	1.32	10.95	0.52
Frctn Loss (ft)	0.54	Cum Volume (acre-ft)	1.52	0.96	0.02
C & E Loss (ft)	0.45	Cum SA (acres)	0.94	0.53	0.02

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2045.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.21	Wt. n-Val.	0.100	0.025	0.100
W.S. Elev (ft)	2043.90	Reach Len. (ft)	100.44	106.55	115.05
Crit W.S. (ft)	2043.90	Flow Area (sq ft)	16.38	103.37	9.89
E.G. Slope (ft/ft)	0.006506	Area (sq ft)	391.46	103.37	246.74
Q Total (cfs)	975.00	Flow (cfs)	31.41	933.22	10.37
Top Width (ft)	627.11	Top Width (ft)	348.01	39.94	239.16
Vel Total (ft/s)	7.52	Avg. Vel. (ft/s)	1.92	9.03	1.05
Max Chl Dpth (ft)	3.51	Hydr. Depth (ft)	2.03	2.59	0.83
Conv. Total (cfs)	12088.2	Conv. (cfs)	389.4	11570.2	128.5
Length Wtd. (ft)	106.50	Wetted Per. (ft)	8.10	40.00	12.10
Min Ch El (ft)	2040.99	Shear (lb/sq ft)	0.82	1.05	0.33
Alpha	1.38	Stream Power (lb/ft s)	1.58	9.47	0.35
Frctn Loss (ft)	0.55	Cum Volume (acre-ft)	1.99	0.72	0.99
C & E Loss (ft)	0.39	Cum SA (acres)	2.28	0.40	0.95

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: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2044.09	Element	Left OB	Channel	Right OB

Vel Head (ft)	0.90	Wt. n-Val.	0.100	0.025	0.100	
W.S. Elev (ft)	2043.19	Reach Len. (ft)	100.44	106.55	115.05	
Crit W.S. (ft)	2043.19	Flow Area (sq ft)	10.68	75.15	3.25	
E.G. Slope (ft/ft)	0.007280	Area (sq ft)	152.43	75.15	133.91	
Q Total (cfs)	599.00	Flow (cfs)	16.28	580.17	2.55	
Top Width (ft)	432.72	Top Width (ft)	311.85	39.94	80.93	
Vel Total (ft/s)	6.72	Avg. Vel. (ft/s)	1.52	7.72	0.79	
Max Chl Dpth (ft)	2.81	Hydr. Depth (ft)	1.32	1.88	0.49	
Conv. Total (cfs)	7020.5	Conv. (cfs)	190.8	6799.7	29.9	
Length Wtd. (ft)	106.49	Wetted Per. (ft)	8.10	40.00	6.65	
Min Ch El (ft)	2040.99	Shear (lb/sq ft)	0.60	0.85	0.22	
Alpha	1.28	Stream Power (lb/ft s)	0.91	6.59	0.17	
Frctn Loss (ft)	0.57	Cum Volume (acre-ft)	1.29	0.51	0.70	
C & E Loss (ft)	0.29	Cum SA (acres)	2.17	0.30	0.70	

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: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.269

CROSS SECTION OUTPUT Profile #FLOODPLAIN

			Left OB	Channel	Right OB
E.G. Elev (ft)	2044.20	Element			
Vel Head (ft)	0.47	Wt. n-Val.	0.100	0.036	
W.S. Elev (ft)	2043.73	Reach Len. (ft)	15.00	15.00	15.00
Crit W.S. (ft)	2042.54	Flow Area (sq ft)	0.53	208.42	
E.G. Slope (ft/ft)	0.004179	Area (sq ft)	0.73	208.43	
Q Total (cfs)	1146.00	Flow (cfs)	0.15	1145.85	
Top Width (ft)	75.89	Top Width (ft)	6.14	69.76	
Vel Total (ft/s)	5.48	Avg. Vel. (ft/s)	0.29	5.50	
Max Chl Dpth (ft)	4.19	Hydr. Depth (ft)	0.16	3.00	
Conv. Total (cfs)	17726.7	Conv. (cfs)	2.3	17724.3	
Length Wtd. (ft)	15.00	Wetted Per. (ft)	3.27	70.47	
Min Ch El (ft)	2039.54	Shear (lb/sq ft)	0.04	0.77	
Alpha	1.00	Stream Power (lb/ft s)	0.01	4.24	
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	1.70	0.42	0.72
C & E Loss (ft)	0.21	Cum SA (acres)	1.90	0.28	0.64

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2044.20	Element			
Vel Head (ft)	0.47	Wt. n-Val.	0.100	0.036	
W.S. Elev (ft)	2043.73	Reach Len. (ft)	15.00	15.00	15.00
Crit W.S. (ft)	2042.57	Flow Area (sq ft)	0.53	208.43	
E.G. Slope (ft/ft)	0.004183	Area (sq ft)	0.53	208.43	
Q Total (cfs)	1146.00	Flow (cfs)	0.15	1145.85	
Top Width (ft)	72.70	Top Width (ft)	3.27	69.43	
Vel Total (ft/s)	5.48	Avg. Vel. (ft/s)	0.28	5.50	
Max Chl Dpth (ft)	4.19	Hydr. Depth (ft)	0.16	3.00	
Conv. Total (cfs)	17719.2	Conv. (cfs)	2.3	17716.9	
Length Wtd. (ft)	15.00	Wetted Per. (ft)	3.40	70.52	
Min Ch El (ft)	2039.54	Shear (lb/sq ft)	0.04	0.77	
Alpha	1.00	Stream Power (lb/ft s)	0.01	4.24	
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	1.49	0.57	
C & E Loss (ft)	0.21	Cum SA (acres)	0.93	0.40	

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2043.82	Element			
Vel Head (ft)	0.43	Wt. n-Val.		0.036	
W.S. Elev (ft)	2043.39	Reach Len. (ft)	15.00	15.00	15.00
Crit W.S. (ft)	2042.28	Flow Area (sq ft)		185.10	
E.G. Slope (ft/ft)	0.004226	Area (sq ft)		185.10	
Q Total (cfs)	975.00	Flow (cfs)		975.00	
Top Width (ft)	66.28	Top Width (ft)		66.28	
Vel Total (ft/s)	5.27	Avg. Vel. (ft/s)		5.27	
Max Chl Dpth (ft)	3.85	Hydr. Depth (ft)		2.79	
Conv. Total (cfs)	14997.7	Conv. (cfs)		14997.7	
Length Wtd. (ft)	15.00	Wetted Per. (ft)		67.30	

```
* Min Ch El (ft)        * 2039.54  * Shear (lb/sq ft)       *          *    0.73  *          *
* Alpha                 *    1.00  * Stream Power (lb/ft s) *          *    3.82  *          *
* Frctn Loss (ft)       *    0.12  * Cum Volume (acre-ft)   *    1.53  *    0.37  *    0.66  *
* C & E Loss (ft)       *    0.20  * Cum SA (acres)         *    1.88  *    0.27  *    0.63  *
*****************************************************************************************

Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
         This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #10-YEAR
*****************************************************************************************
* E.G. Elev (ft)        * 2042.85  * Element               *  Left OB *  Channel * Right OB *
* Vel Head (ft)         *    0.32  * Wt. n-Val.            *          *    0.036  *          *
* W.S. Elev (ft)        * 2042.53  * Reach Len. (ft)       *   15.00  *   15.00  *   15.00  *
* Crit W.S. (ft)        * 2041.68  * Flow Area (sq ft)     *          *  132.17  *          *
* E.G. Slope (ft/ft)    *0.004135  * Area (sq ft)          *          *  132.17  *          *
* Q Total (cfs)         *  599.00  * Flow (cfs)            *          *  599.00  *          *
* Top Width (ft)        *   58.46  * Top Width (ft)        *          *   58.46  *          *
* Vel Total (ft/s)      *    4.53  * Avg. Vel. (ft/s)      *          *    4.53  *          *
* Max Chl Dpth (ft)     *    2.99  * Hydr. Depth (ft)      *          *    2.26  *          *
* Conv. Total (cfs)     *  9315.2  * Conv. (cfs)           *          *  9315.2  *          *
* Length Wtd. (ft)      *   15.00  * Wetted Per. (ft)      *          *   59.24  *          *
* Min Ch El (ft)        * 2039.54  * Shear (lb/sq ft)      *          *    0.58  *          *
* Alpha                 *    1.00  * Stream Power (lb/ft s) *          *    2.61  *          *
* Frctn Loss (ft)       *    0.12  * Cum Volume (acre-ft)   *    1.12  *    0.25  *    0.52  *
* C & E Loss (ft)       *    0.15  * Cum SA (acres)         *    1.81  *    0.18  *    0.59  *
*****************************************************************************************

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
         This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, energy was used.

CROSS SECTION


RIVER: SUNSET WASH
REACH: REACH #1          RS: 0.260


CROSS SECTION OUTPUT  Profile #FLOODPLAIN
*****************************************************************************************
* E.G. Elev (ft)        * 2042.47  * Element               *  Left OB *  Channel * Right OB *
* Vel Head (ft)         *    1.11  * Wt. n-Val.            *          *    0.036  *          *
* W.S. Elev (ft)        * 2041.36  * Reach Len. (ft)       *  104.19  *  148.26  *  138.32  *
* Crit W.S. (ft)        * 2041.36  * Flow Area (sq ft)     *          *  135.60  *          *
* E.G. Slope (ft/ft)    *0.014699  * Area (sq ft)          *          *  135.60  *          *
* Q Total (cfs)         * 1146.00  * Flow (cfs)            *          * 1146.00  *          *
* Top Width (ft)        *   60.80  * Top Width (ft)        *          *   60.80  *          *
* Vel Total (ft/s)      *    8.45  * Avg. Vel. (ft/s)      *          *    8.45  *          *
* Max Chl Dpth (ft)     *    3.14  * Hydr. Depth (ft)      *          *    2.23  *          *
* Conv. Total (cfs)     *  9452.4  * Conv. (cfs)           *          *  9452.4  *          *
* Length Wtd. (ft)      *  130.92  * Wetted Per. (ft)      *          *   61.78  *          *
* Min Ch El (ft)        * 2038.22  * Shear (lb/sq ft)      *          *    2.01  *          *
* Alpha                 *    1.00  * Stream Power (lb/ft s) *          *   17.02  *          *
* Frctn Loss (ft)       *    1.88  * Cum Volume (acre-ft)   *    1.70  *    0.26  *    0.72  *
* C & E Loss (ft)       *    0.40  * Cum SA (acres)         *    1.90  *    0.21  *    0.64  *
*****************************************************************************************

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 velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
the
         need for additional cross sections.
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.
Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #FLOODWAY
*****************************************************************************************
* E.G. Elev (ft)        * 2042.47  * Element               *  Left OB *  Channel * Right OB *
* Vel Head (ft)         *    1.07  * Wt. n-Val.            *          *    0.036  *          *
* W.S. Elev (ft)        * 2041.40  * Reach Len. (ft)       *  104.19  *  148.26  *  138.32  *
* Crit W.S. (ft)        * 2041.36  * Flow Area (sq ft)     *          *  137.86  *          *
* E.G. Slope (ft/ft)    *0.013960  * Area (sq ft)          *          *  137.86  *          *
* Q Total (cfs)         * 1146.00  * Flow (cfs)            *          * 1146.00  *          *
* Top Width (ft)        *   60.95  * Top Width (ft)        *          *   60.95  *          *
* Vel Total (ft/s)      *    8.31  * Avg. Vel. (ft/s)      *          *    8.31  *          *
* Max Chl Dpth (ft)     *    3.18  * Hydr. Depth (ft)      *          *    2.26  *          *
* Conv. Total (cfs)     *  9699.2  * Conv. (cfs)           *          *  9699.2  *          *
* Length Wtd. (ft)      *  128.61  * Wetted Per. (ft)      *          *   61.95  *          *
* Min Ch El (ft)        * 2038.22  * Shear (lb/sq ft)      *          *    1.94  *          *
* Alpha                 *    1.00  * Stream Power (lb/ft s) *          *   16.12  *          *
* Frctn Loss (ft)       *    1.81  * Cum Volume (acre-ft)   *    1.49  *    0.40  *          *
* C & E Loss (ft)       *    0.15  * Cum SA (acres)         *    0.93  *    0.33  *          *
*****************************************************************************************

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.
Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #50-YEAR
*****************************************************************************************
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E.G. Elev (ft)	2042.13	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.02	Wt. n-Val.		0.036		
W.S. Elev (ft)	2041.11	Reach Len. (ft)	104.19	148.26	138.32	
Crit W.S. (ft)	2041.11	Flow Area (sq ft)		120.32		
E.G. Slope (ft/ft)	0.015470	Area (sq ft)		120.32		
Q Total (cfs)	975.00	Flow (cfs)		975.00		
Top Width (ft)	59.81	Top Width (ft)		59.81		
Vel Total (ft/s)	8.10	Avg. Vel. (ft/s)		8.10		
Max Chl Dpth (ft)	2.89	Hydr. Depth (ft)		2.01		
Conv. Total (cfs)	7839.1	Conv. (cfs)		7839.1		
Length Wtd. (ft)	131.03	Wetted Per. (ft)		60.67		
Min Ch El (ft)	2038.22	Shear (lb/sq ft)		1.92		
Alpha	1.00	Stream Power (lb/ft s)		15.52		
Frctn Loss (ft)	1.89	Cum Volume (acre-ft)	1.53	0.22	0.66	
C & E Loss (ft)	0.38	Cum SA (acres)	1.88	0.20	0.63	

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2041.28	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.75	Wt. n-Val.		0.036		
W.S. Elev (ft)	2040.52	Reach Len. (ft)	104.19	148.26	138.32	
Crit W.S. (ft)	2040.52	Flow Area (sq ft)		85.92		
E.G. Slope (ft/ft)	0.016930	Area (sq ft)		85.92		
Q Total (cfs)	599.00	Flow (cfs)		599.00		
Top Width (ft)	57.51	Top Width (ft)		57.51		
Vel Total (ft/s)	6.97	Avg. Vel. (ft/s)		6.97		
Max Chl Dpth (ft)	2.30	Hydr. Depth (ft)		1.49		
Conv. Total (cfs)	4603.7	Conv. (cfs)		4603.7		
Length Wtd. (ft)	131.62	Wetted Per. (ft)		58.09		
Min Ch El (ft)	2038.22	Shear (lb/sq ft)		1.56		
Alpha	1.00	Stream Power (lb/ft s)		10.90		
Frctn Loss (ft)	1.84	Cum Volume (acre-ft)	1.12	0.15	0.52	
C & E Loss (ft)	0.29	Cum SA (acres)	1.81	0.12	0.59	

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.232

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2039.10	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.31	Wt. n-Val.	0.035	0.036	0.069	
W.S. Elev (ft)	2038.78	Reach Len. (ft)	119.47	184.63	176.91	
Crit W.S. (ft)		Flow Area (sq ft)	168.94	3.80	101.05	
E.G. Slope (ft/ft)	0.014033	Area (sq ft)	168.94	3.80	101.05	
Q Total (cfs)	1146.00	Flow (cfs)	832.37	6.40	307.23	
Top Width (ft)	270.46	Top Width (ft)	174.14	18.80	77.52	
Vel Total (ft/s)	4.19	Avg. Vel. (ft/s)	4.93	1.68	3.04	
Max Chl Dpth (ft)	1.89	Hydr. Depth (ft)	0.97	0.20	1.30	
Conv. Total (cfs)	9674.2	Conv. (cfs)	7026.6	54.0	2593.6	
Length Wtd. (ft)	133.76	Wetted Per. (ft)	174.22	18.83	77.66	
Min Ch El (ft)	2038.51	Shear (lb/sq ft)	0.85	0.18	1.14	
Alpha	1.15	Stream Power (lb/ft s)	4.19	0.30	3.47	
Frctn Loss (ft)	1.73	Cum Volume (acre-ft)	1.50	0.02	0.56	
C & E Loss (ft)	0.03	Cum SA (acres)	1.69	0.08	0.52	

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

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2040.51	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.77	Wt. n-Val.	0.035	0.036		
W.S. Elev (ft)	2039.73	Reach Len. (ft)	119.47	184.63	176.91	
Crit W.S. (ft)	2039.73	Flow Area (sq ft)	140.03	27.25		
E.G. Slope (ft/ft)	0.014267	Area (sq ft)	140.03	27.25		

* Q Total (cfs)	* 1146.00	* Flow (cfs)	* 1022.04	* 123.96	*	*
* Top Width (ft)	* 109.41	* Top Width (ft)	* 78.87	* 30.54	*	*
* Vel Total (ft/s)	* 6.85	* Avg. Vel. (ft/s)	* 7.30	* 4.55	*	*
* Max Chl Dpth (ft)	* 2.12	* Hydr. Depth (ft)	* 1.78	* 0.89	*	*
* Conv. Total (cfs)	* 9594.6	* Conv. (cfs)	* 8556.8	* 1037.8	*	*
* Length Wtd. (ft)	* 124.52	* Wetted Per. (ft)	* 81.09	* 30.73	*	*
* Min Ch El (ft)	* 2038.51	* Shear (lb/sq ft)	* 1.54	* 0.79	*	*
* Alpha	* 1.06	* Stream Power (lb/ft s)	* 11.23	* 3.59	*	*
* Frctn Loss (ft)	* 1.26	* Cum Volume (acre-ft)	* 1.33	* 0.12	*	*
* C & E Loss (ft)	* 0.12	* Cum SA (acres)	* 0.84	* 0.18	*	*

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: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #50-YEAR

* E.G. Elev (ft)	* 2038.96	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.27	* Wt. n-Val.	* 0.035	* 0.036	* 0.069 *
* W.S. Elev (ft)	* 2038.69	* Reach Len. (ft)	* 119.47	* 184.63	* 176.91 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 153.50	* 2.17	* 94.19 *
* E.G. Slope (ft/ft)	*0.013475	* Area (sq ft)	* 153.50	* 2.17	* 94.19 *
* Q Total (cfs)	* 975.00	* Flow (cfs)	* 701.48	* 2.57	* 270.95 *
* Top Width (ft)	* 265.72	* Top Width (ft)	* 171.85	* 17.69	* 76.18 *
* Vel Total (ft/s)	* 3.90	* Avg. Vel. (ft/s)	* 4.57	* 1.18	* 2.88 *
* Max Chl Dpth (ft)	* 1.80	* Hydr. Depth (ft)	* 0.89	* 0.12	* 1.24 *
* Conv. Total (cfs)	* 8399.1	* Conv. (cfs)	* 6042.9	* 22.2	* 2334.1 *
* Length Wtd. (ft)	* 134.10	* Wetted Per. (ft)	* 171.92	* 17.71	* 76.30 *
* Min Ch El (ft)	* 2038.51	* Shear (lb/sq ft)	* 0.75	* 0.10	* 1.04 *
* Alpha	* 1.14	* Stream Power (lb/ft s)	* 3.43	* 0.12	* 2.99 *
* Frctn Loss (ft)	* 1.70	* Cum Volume (acre-ft)	* 1.35	* 0.01	* 0.51 *
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 1.67	* 0.07	* 0.51 *

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

CROSS SECTION OUTPUT Profile #10-YEAR

* E.G. Elev (ft)	* 2038.63	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.17	* Wt. n-Val.	* 0.035	*	* 0.069 *
* W.S. Elev (ft)	* 2038.46	* Reach Len. (ft)	* 119.47	* 184.63	* 176.91 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 114.10	*	* 76.98 *
* E.G. Slope (ft/ft)	*0.011772	* Area (sq ft)	* 114.10	*	* 76.98 *
* Q Total (cfs)	* 599.00	* Flow (cfs)	* 409.66	*	* 189.34 *
* Top Width (ft)	* 236.95	* Top Width (ft)	* 165.77	*	* 71.18 *
* Vel Total (ft/s)	* 3.13	* Avg. Vel. (ft/s)	* 3.59	*	* 2.46 *
* Max Chl Dpth (ft)	* 1.57	* Hydr. Depth (ft)	* 0.69	*	* 1.08 *
* Conv. Total (cfs)	* 5520.9	* Conv. (cfs)	* 3775.8	*	* 1745.1 *
* Length Wtd. (ft)	* 135.75	* Wetted Per. (ft)	* 165.82	*	* 71.28 *
* Min Ch El (ft)	* 2038.51	* Shear (lb/sq ft)	* 0.51	*	* 0.79 *
* Alpha	* 1.09	* Stream Power (lb/ft s)	* 1.82	*	* 1.95 *
* Frctn Loss (ft)	* 1.66	* Cum Volume (acre-ft)	* 0.98	* 0.00	* 0.40 *
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 1.61	* 0.02	* 0.48 *

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: There is no flow in the channel. Check that the channel stations are correctly coded. To force flow into the channel, a levee or ineffective flow may have to be added or the Manning's n of the overbank could be increased.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.197

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	* 2037.35	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.21	* Wt. n-Val.	* 0.035	* 0.036	* 0.069 *
* W.S. Elev (ft)	* 2037.13	* Reach Len. (ft)	* 154.52	* 100.94	* 84.28 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 223.20	* 3.12	* 103.69 *
* E.G. Slope (ft/ft)	*0.011897	* Area (sq ft)	* 223.20	* 3.12	* 103.69 *
* Q Total (cfs)	* 1146.00	* Flow (cfs)	* 891.00	* 5.83	* 249.17 *
* Top Width (ft)	* 390.52	* Top Width (ft)	* 278.82	* 11.65	* 100.04 *
* Vel Total (ft/s)	* 3.47	* Avg. Vel. (ft/s)	* 3.99	* 1.87	* 2.40 *
* Max Chl Dpth (ft)	* 1.42	* Hydr. Depth (ft)	* 0.80	* 0.27	* 1.04 *
* Conv. Total (cfs)	* 10506.7	* Conv. (cfs)	* 8168.8	* 53.4	* 2284.4 *
* Length Wtd. (ft)	* 144.95	* Wetted Per. (ft)	* 278.87	* 11.70	* 100.20 *
* Min Ch El (ft)	* 2036.74	* Shear (lb/sq ft)	* 0.59	* 0.20	* 0.77 *
* Alpha	* 1.13	* Stream Power (lb/ft s)	* 2.37	* 0.37	* 1.85 *
* Frctn Loss (ft)	* 1.27	* Cum Volume (acre-ft)	* 0.96	* 0.00	* 0.14 *
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 1.07	* 0.01	* 0.16 *

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

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2038.33	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.36	Wt. n-Val.	0.035	0.036		
W.S. Elev (ft)	2037.97	Reach Len. (ft)	154.52	100.94	84.28	
Crit W.S. (ft)		Flow Area (sq ft)	224.28	18.19		
E.G. Slope (ft/ft)	0.007589	Area (sq ft)	224.28	18.19		
Q Total (cfs)	1146.00	Flow (cfs)	1092.23	53.77		
Top Width (ft)	171.06	Top Width (ft)	146.82	24.24		
Vel Total (ft/s)	4.73	Avg. Vel. (ft/s)	4.87	2.96		
Max Chl Dpth (ft)	2.00	Hydr. Depth (ft)	1.53	0.75		
Conv. Total (cfs)	13154.9	Conv. (cfs)	12537.7	617.2		
Length Wtd. (ft)	153.17	Wetted Per. (ft)	148.43	24.42		
Min Ch El (ft)	2036.74	Shear (lb/sq ft)	0.72	0.35		
Alpha	1.03	Stream Power (lb/ft s)	3.49	1.04		
Frctn Loss (ft)	1.09	Cum Volume (acre-ft)	0.83	0.03		
C & E Loss (ft)	0.00	Cum SA (acres)	0.53	0.06		

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

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2037.24	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.19	Wt. n-Val.	0.035	0.036	0.069	
W.S. Elev (ft)	2037.05	Reach Len. (ft)	154.52	100.94	84.28	
Crit W.S. (ft)		Flow Area (sq ft)	200.20	2.21	95.41	
E.G. Slope (ft/ft)	0.012002	Area (sq ft)	200.20	2.21	95.41	
Q Total (cfs)	975.00	Flow (cfs)	752.62	3.55	218.84	
Top Width (ft)	385.24	Top Width (ft)	275.45	10.39	99.39	
Vel Total (ft/s)	3.27	Avg. Vel. (ft/s)	3.76	1.61	2.29	
Max Chl Dpth (ft)	1.34	Hydr. Depth (ft)	0.73	0.21	0.96	
Conv. Total (cfs)	8899.9	Conv. (cfs)	6870.0	32.4	1997.6	
Length Wtd. (ft)	144.81	Wetted Per. (ft)	275.49	10.43	99.53	
Min Ch El (ft)	2036.74	Shear (lb/sq ft)	0.54	0.16	0.72	
Alpha	1.13	Stream Power (lb/ft s)	2.05	0.25	1.65	
Frctn Loss (ft)	1.27	Cum Volume (acre-ft)	0.87	0.00	0.13	
C & E Loss (ft)	0.01	Cum SA (acres)	1.06	0.01	0.15	

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

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2036.97	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.13	Wt. n-Val.	0.035	0.036	0.069	
W.S. Elev (ft)	2036.83	Reach Len. (ft)	154.52	100.94	84.28	
Crit W.S. (ft)		Flow Area (sq ft)	141.89	0.32	74.13	
E.G. Slope (ft/ft)	0.012671	Area (sq ft)	141.89	0.32	74.13	
Q Total (cfs)	599.00	Flow (cfs)	448.87	0.19	149.94	
Top Width (ft)	367.34	Top Width (ft)	263.40	6.76	97.18	
Vel Total (ft/s)	2.77	Avg. Vel. (ft/s)	3.16	0.61	2.02	
Max Chl Dpth (ft)	1.12	Hydr. Depth (ft)	0.54	0.05	0.76	
Conv. Total (cfs)	5321.3	Conv. (cfs)	3987.6	1.7	1332.0	
Length Wtd. (ft)	144.05	Wetted Per. (ft)	263.43	6.77	97.26	
Min Ch El (ft)	2036.74	Shear (lb/sq ft)	0.43	0.04	0.60	
Alpha	1.11	Stream Power (lb/ft s)	1.35	0.02	1.22	
Frctn Loss (ft)	1.29	Cum Volume (acre-ft)	0.63	0.00	0.10	
C & E Loss (ft)	0.01	Cum SA (acres)	1.02	0.01	0.14	

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

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.178

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2036.06	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.17	Wt. n-Val.	0.035		0.069	
W.S. Elev (ft)	2035.89	Reach Len. (ft)				
Crit W.S. (ft)	2035.59	Flow Area (sq ft)	317.86		43.03	
E.G. Slope (ft/ft)	0.006702	Area (sq ft)	317.86		43.03	
Q Total (cfs)	1146.00	Flow (cfs)	1087.18		58.82	
Top Width (ft)	388.46	Top Width (ft)	325.47		62.98	
Vel Total (ft/s)	3.18	Avg. Vel. (ft/s)	3.42		1.37	
Max Chl Dpth (ft)	1.34	Hydr. Depth (ft)	0.98		0.68	
Conv. Total (cfs)	13998.1	Conv. (cfs)	13279.7		718.4	

Length Wtd. (ft)		Wetted Per. (ft)	325.61			63.04
Min Ch El (ft)	2036.70	Shear (lb/sq ft)	0.41			0.29
Alpha	1.11	Stream Power (lb/ft s)	1.40			0.39
Frctn Loss (ft)		Cum Volume (acre-ft)				
C & E Loss (ft)		Cum SA (acres)				

Warning: Divided flow computed for this cross-section.
Warning: There is no flow in the channel. Check that the channel stations are correctly coded. To force flow into the channel, a
levee or ineffective flow may have to be added or the Manning's n of the overbank could be increased.

CROSS SECTION OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2037.24	Element			
Vel Head (ft)	0.35	Wt. n-Val.	0.035	0.036	
W.S. Elev (ft)	2036.89	Reach Len. (ft)			
Crit W.S. (ft)	2036.48	Flow Area (sq ft)	241.65	4.27	
E.G. Slope (ft/ft)	0.006699	Area (sq ft)	241.65	4.27	
Q Total (cfs)	1146.00	Flow (cfs)	1142.05	3.95	
Top Width (ft)	179.93	Top Width (ft)	150.18	29.76	
Vel Total (ft/s)	4.66	Avg. Vel. (ft/s)	4.73	0.93	
Max Chl Dpth (ft)	2.12	Hydr. Depth (ft)	1.61	0.14	
Conv. Total (cfs)	14001.2	Conv. (cfs)	13952.9	48.3	
Length Wtd. (ft)		Wetted Per. (ft)	152.36	29.77	
Min Ch El (ft)	2036.70	Shear (lb/sq ft)	0.66	0.06	
Alpha	1.03	Stream Power (lb/ft s)	3.14	0.06	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2035.95	Element			
Vel Head (ft)	0.15	Wt. n-Val.	0.035		0.069
W.S. Elev (ft)	2035.80	Reach Len. (ft)			
Crit W.S. (ft)	2035.52	Flow Area (sq ft)	287.87		37.34
E.G. Slope (ft/ft)	0.006703	Area (sq ft)	287.87		37.34
Q Total (cfs)	975.00	Flow (cfs)	926.88		48.12
Top Width (ft)	382.46	Top Width (ft)	322.75		59.72
Vel Total (ft/s)	3.00	Avg. Vel. (ft/s)	3.22		1.29
Max Chl Dpth (ft)	1.25	Hydr. Depth (ft)	0.89		0.63
Conv. Total (cfs)	11909.1	Conv. (cfs)	11321.4		587.8
Length Wtd. (ft)		Wetted Per. (ft)	322.88		59.77
Min Ch El (ft)	2036.70	Shear (lb/sq ft)	0.37		0.26
Alpha	1.11	Stream Power (lb/ft s)	1.20		0.34
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: Divided flow computed for this cross-section.
Warning: There is no flow in the channel. Check that the channel stations are correctly coded. To force flow into the channel, a
levee or ineffective flow may have to be added or the Manning's n of the overbank could be increased.

CROSS SECTION OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2035.67	Element			
Vel Head (ft)	0.11	Wt. n-Val.	0.035		0.069
W.S. Elev (ft)	2035.56	Reach Len. (ft)			
Crit W.S. (ft)	2035.34	Flow Area (sq ft)	212.88		24.80
E.G. Slope (ft/ft)	0.006699	Area (sq ft)	212.88		24.80
Q Total (cfs)	599.00	Flow (cfs)	570.46		28.54
Top Width (ft)	361.23	Top Width (ft)	314.26		46.97
Vel Total (ft/s)	2.52	Avg. Vel. (ft/s)	2.68		1.15
Max Chl Dpth (ft)	1.01	Hydr. Depth (ft)	0.68		0.53
Conv. Total (cfs)	7318.4	Conv. (cfs)	6969.7		348.7
Length Wtd. (ft)		Wetted Per. (ft)	314.36		47.01
Min Ch El (ft)	2036.70	Shear (lb/sq ft)	0.28		0.22
Alpha	1.09	Stream Power (lb/ft s)	0.76		0.25
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: Divided flow computed for this cross-section.
Warning: There is no flow in the channel. Check that the channel stations are correctly coded. To force flow into the channel, a
levee or ineffective flow may have to be added or the Manning's n of the overbank could be increased.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #3 RS: 1.902

CROSS SECTION OUTPUT Profile #FLOODPLAIN

			Left OB	Channel	Right OB
E.G. Elev (ft)	2186.19	Element			
Vel Head (ft)	0.94	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2185.25	Reach Len. (ft)	364.59	385.83	386.41
Crit W.S. (ft)	2185.25	Flow Area (sq ft)	4.98	64.97	1.01
E.G. Slope (ft/ft)	0.011265	Area (sq ft)	4.98	64.97	1.01
Q Total (cfs)	515.00	Flow (cfs)	5.54	507.77	1.69
Top Width (ft)	51.35	Top Width (ft)	19.49	29.99	1.87
Vel Total (ft/s)	7.26	Avg. Vel. (ft/s)	1.11	7.82	1.67

Max Chl Dpth (ft)	3.67	Hydr. Depth (ft)	0.26	2.17	0.54	
Conv. Total (cfs)	4852.1	Conv. (cfs)	52.2	4784.0	16.0	
Length Wtd. (ft)	385.50	Wetted Per. (ft)	19.49	31.06	2.16	
Min Ch El (ft)	2181.58	Shear (lb/sq ft)	0.18	1.47	0.33	
Alpha	1.14	Stream Power (lb/ft s)	0.20	11.50	0.55	
Frctn Loss (ft)	3.19	Cum Volume (acre-ft)	0.92	3.95	0.74	
C & E Loss (ft)	0.09	Cum SA (acres)	1.87	2.09	1.60	

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 OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2186.19	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.94	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2185.25	Reach Len. (ft)	364.59	385.83	386.41
Crit W.S. (ft)	2185.25	Flow Area (sq ft)	4.98	64.97	1.01
E.G. Slope (ft/ft)	0.011265	Area (sq ft)	4.98	64.97	1.01
Q Total (cfs)	515.00	Flow (cfs)	5.54	507.77	1.69
Top Width (ft)	51.35	Top Width (ft)	19.49	29.99	1.87
Vel Total (ft/s)	7.26	Avg. Vel. (ft/s)	1.11	7.82	1.67
Max Chl Dpth (ft)	3.67	Hydr. Depth (ft)	0.26	2.17	0.54
Conv. Total (cfs)	4852.1	Conv. (cfs)	52.2	4784.0	16.0
Length Wtd. (ft)	385.50	Wetted Per. (ft)	19.49	31.06	2.16
Min Ch El (ft)	2181.58	Shear (lb/sq ft)	0.18	1.47	0.33
Alpha	1.14	Stream Power (lb/ft s)	0.20	11.50	0.55
Frctn Loss (ft)	3.19	Cum Volume (acre-ft)	0.92	3.95	0.74
C & E Loss (ft)	0.09	Cum SA (acres)	1.87	2.09	1.60

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 OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2185.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.89	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2185.02	Reach Len. (ft)	364.59	385.83	386.41
Crit W.S. (ft)	2185.02	Flow Area (sq ft)	1.39	57.97	0.63
E.G. Slope (ft/ft)	0.012423	Area (sq ft)	1.39	57.97	0.63
Q Total (cfs)	443.00	Flow (cfs)	1.03	441.04	0.93
Top Width (ft)	42.38	Top Width (ft)	10.92	29.99	1.47
Vel Total (ft/s)	7.38	Avg. Vel. (ft/s)	0.74	7.61	1.49
Max Chl Dpth (ft)	3.44	Hydr. Depth (ft)	0.13	1.93	0.43
Conv. Total (cfs)	3974.5	Conv. (cfs)	9.2	3957.0	8.4
Length Wtd. (ft)	385.77	Wetted Per. (ft)	10.92	31.06	1.70
Min Ch El (ft)	2181.58	Shear (lb/sq ft)	0.10	1.45	0.29
Alpha	1.06	Stream Power (lb/ft s)	0.07	11.01	0.43
Frctn Loss (ft)	4.53	Cum Volume (acre-ft)	0.61	3.55	0.42
C & E Loss (ft)	0.00	Cum SA (acres)	1.26	2.08	0.95

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 OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2185.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.78	Wt. n-Val.		0.033	0.057
W.S. Elev (ft)	2184.36	Reach Len. (ft)	364.59	385.83	386.41
Crit W.S. (ft)	2184.36	Flow Area (sq ft)		39.49	0.03
E.G. Slope (ft/ft)	0.015003	Area (sq ft)		39.49	0.03
Q Total (cfs)	279.00	Flow (cfs)		278.98	0.02
Top Width (ft)	26.58	Top Width (ft)		26.25	0.33
Vel Total (ft/s)	7.06	Avg. Vel. (ft/s)		7.06	0.61
Max Chl Dpth (ft)	2.78	Hydr. Depth (ft)		1.50	0.10
Conv. Total (cfs)	2277.8	Conv. (cfs)		2277.6	0.2
Length Wtd. (ft)	385.83	Wetted Per. (ft)		27.24	0.38
Min Ch El (ft)	2181.58	Shear (lb/sq ft)		1.36	0.08
Alpha	1.00	Stream Power (lb/ft s)		9.59	0.05
Frctn Loss (ft)	5.68	Cum Volume (acre-ft)	0.24	2.58	0.17
C & E Loss (ft)	0.00	Cum SA (acres)	0.51	1.98	0.56

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.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #3 RS: 1.829

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2179.76	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.64	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2179.12	Reach Len. (ft)	292.74	275.99	239.47
Crit W.S. (ft)	2179.12	Flow Area (sq ft)	10.21	68.21	34.93
E.G. Slope (ft/ft)	0.006347	Area (sq ft)	10.21	68.21	34.93
Q Total (cfs)	515.00	Flow (cfs)	11.91	460.48	42.61
Top Width (ft)	135.29	Top Width (ft)	32.36	25.42	77.51
Vel Total (ft/s)	4.54	Avg. Vel. (ft/s)	1.17	6.75	1.22
Max Chl Dpth (ft)	3.93	Hydr. Depth (ft)	0.32	2.68	0.45
Conv. Total (cfs)	6464.5	Conv. (cfs)	149.5	5780.1	534.8
Length Wtd. (ft)	274.81	Wetted Per. (ft)	32.37	26.42	77.61
Min Ch El (ft)	2175.19	Shear (lb/sq ft)	0.12	1.02	0.18
Alpha	1.98	Stream Power (lb/ft s)	0.15	6.91	0.22
Frctn Loss (ft)	1.99	Cum Volume (acre-ft)	0.86	3.36	0.58
C & E Loss (ft)	0.03	Cum SA (acres)	1.65	1.85	1.25

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

E.G. Elev (ft)	2179.76	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.64	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2179.12	Reach Len. (ft)	292.74	275.99	239.47
Crit W.S. (ft)	2179.12	Flow Area (sq ft)	10.21	68.21	34.93
E.G. Slope (ft/ft)	0.006347	Area (sq ft)	10.21	68.21	34.93
Q Total (cfs)	515.00	Flow (cfs)	11.91	460.48	42.61
Top Width (ft)	135.29	Top Width (ft)	32.36	25.42	77.51
Vel Total (ft/s)	4.54	Avg. Vel. (ft/s)	1.17	6.75	1.22
Max Chl Dpth (ft)	3.93	Hydr. Depth (ft)	0.32	2.68	0.45
Conv. Total (cfs)	6464.5	Conv. (cfs)	149.5	5780.1	534.8
Length Wtd. (ft)	274.81	Wetted Per. (ft)	32.37	26.42	77.61
Min Ch El (ft)	2175.19	Shear (lb/sq ft)	0.12	1.02	0.18
Alpha	1.98	Stream Power (lb/ft s)	0.15	6.91	0.22
Frctn Loss (ft)	1.99	Cum Volume (acre-ft)	0.86	3.36	0.58
C & E Loss (ft)	0.03	Cum SA (acres)	1.65	1.85	1.25

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: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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 OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2179.55	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.93	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2178.63	Reach Len. (ft)	292.74	275.99	239.47
Crit W.S. (ft)	2178.63	Flow Area (sq ft)	1.75	55.62	5.36
E.G. Slope (ft/ft)	0.011122	Area (sq ft)	1.75	55.62	5.36
Q Total (cfs)	443.00	Flow (cfs)	1.53	433.80	7.67
Top Width (ft)	49.47	Top Width (ft)	9.80	25.42	14.25
Vel Total (ft/s)	7.06	Avg. Vel. (ft/s)	0.87	7.80	1.43
Max Chl Dpth (ft)	3.44	Hydr. Depth (ft)	0.18	2.19	0.38
Conv. Total (cfs)	4200.7	Conv. (cfs)	14.5	4113.5	72.7
Length Wtd. (ft)	275.81	Wetted Per. (ft)	9.81	26.42	14.28
Min Ch El (ft)	2175.19	Shear (lb/sq ft)	0.12	1.46	0.26
Alpha	1.20	Stream Power (lb/ft s)	0.11	11.40	0.37
Frctn Loss (ft)	3.10	Cum Volume (acre-ft)	0.60	3.04	0.39
C & E Loss (ft)	0.01	Cum SA (acres)	1.17	1.84	0.88

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

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        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 OUTPUT  Profile #10-YEAR
*****************************************************************************************************
* E.G. Elev (ft)        * 2178.76  * Element                  *  Left OB *  Channel * Right OB *
* Vel Head (ft)         *    0.80  * Wt. n-Val.               *          *    0.033 *    0.057 *
* W.S. Elev (ft)        * 2177.96  * Reach Len. (ft)          *  292.74  *  275.99  *  239.47  *
* Crit W.S. (ft)        * 2177.96  * Flow Area (sq ft)        *          *    38.90 *     0.25 *
* E.G. Slope (ft/ft)    *0.014434  * Area (sq ft)             *          *    38.90 *     0.25 *
* Q Total (cfs)         *  279.00  * Flow (cfs)               *          *   278.84 *     0.16 *
* Top Width (ft)        *   27.24  * Top Width (ft)            *          *    24.54 *     2.70 *
* Vel Total (ft/s)      *    7.13  * Avg. Vel. (ft/s)          *          *     7.17 *     0.65 *
* Max Chl Dpth (ft)     *    2.77  * Hydr. Depth (ft)          *          *     1.59 *     0.09 *
* Conv. Total (cfs)     *  2322.3  * Conv. (cfs)               *          *   2320.9 *      1.4 *
* Length Wtd. (ft)      *  275.98  * Wetted Per. (ft)          *          *    25.50 *     2.70 *
* Min Ch El (ft)        * 2175.19  * Shear (lb/sq ft)          *          *     1.37 *     0.08 *
* Alpha                 *    1.01  * Stream Power (lb/ft s)    *          *     9.85 *     0.05 *
* Frctn Loss (ft)       *    3.98  * Cum Volume (acre-ft)      *     0.24 *     2.23 *     0.17 *
* C & E Loss (ft)       *    0.02  * Cum SA (acres)            *     0.51 *     1.76 *     0.55 *
*****************************************************************************************************

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: SUNSET WASH
REACH: REACH #3            RS: 1.777


CROSS SECTION OUTPUT  Profile #FLOODPLAIN
*****************************************************************************************************
* E.G. Elev (ft)        * 2174.66  * Element                  *  Left OB *  Channel * Right OB *
* Vel Head (ft)         *    0.91  * Wt. n-Val.               *   0.057  *    0.033 *    0.057 *
* W.S. Elev (ft)        * 2173.75  * Reach Len. (ft)          *  315.35  *  263.53  *  184.50  *
* Crit W.S. (ft)        * 2173.75  * Flow Area (sq ft)        *   15.47  *    61.82 *     6.55 *
* E.G. Slope (ft/ft)    *0.008352  * Area (sq ft)             *   15.47  *    61.82 *     6.55 *
* Q Total (cfs)         *  515.00  * Flow (cfs)               *   21.96  *   486.77 *     6.27 *
* Top Width (ft)        *   82.84  * Top Width (ft)            *   36.08  *    21.05 *    25.71 *
* Vel Total (ft/s)      *    6.14  * Avg. Vel. (ft/s)          *    1.42  *     7.87 *     0.96 *
* Max Chl Dpth (ft)     *    4.26  * Hydr. Depth (ft)          *    0.43  *     2.94 *     0.25 *
* Conv. Total (cfs)     *  5635.4  * Conv. (cfs)               *   240.2  *   5326.5 *     68.6 *
* Length Wtd. (ft)      *  258.01  * Wetted Per. (ft)          *   36.21  *    23.35 *    25.71 *
* Min Ch El (ft)        * 2169.49  * Shear (lb/sq ft)          *    0.22  *     1.38 *     0.13 *
* Alpha                 *    1.56  * Stream Power (lb/ft s)    *    0.32  *    10.87 *     0.13 *
* Frctn Loss (ft)       *    2.17  * Cum Volume (acre-ft)      *    0.77  *     2.95 *     0.47 *
* C & E Loss (ft)       *    0.03  * Cum SA (acres)            *    1.42  *     1.70 *     0.96 *
*****************************************************************************************************

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: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
the
        need for additional cross sections.
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 OUTPUT  Profile #FLOODWAY
*****************************************************************************************************
* E.G. Elev (ft)        * 2174.66  * Element                  *  Left OB *  Channel * Right OB *
* Vel Head (ft)         *    0.91  * Wt. n-Val.               *   0.057  *    0.033 *    0.057 *
* W.S. Elev (ft)        * 2173.75  * Reach Len. (ft)          *  315.35  *  263.53  *  184.50  *
* Crit W.S. (ft)        * 2173.75  * Flow Area (sq ft)        *   15.47  *    61.82 *     6.55 *
* E.G. Slope (ft/ft)    *0.008352  * Area (sq ft)             *   15.47  *    61.82 *     6.55 *
* Q Total (cfs)         *  515.00  * Flow (cfs)               *   21.96  *   486.77 *     6.27 *
* Top Width (ft)        *   82.84  * Top Width (ft)            *   36.08  *    21.05 *    25.71 *
* Vel Total (ft/s)      *    6.14  * Avg. Vel. (ft/s)          *    1.42  *     7.87 *     0.96 *
* Max Chl Dpth (ft)     *    4.26  * Hydr. Depth (ft)          *    0.43  *     2.94 *     0.25 *
* Conv. Total (cfs)     *  5635.4  * Conv. (cfs)               *   240.2  *   5326.5 *     68.6 *
* Length Wtd. (ft)      *  258.01  * Wetted Per. (ft)          *   36.21  *    23.35 *    25.71 *
* Min Ch El (ft)        * 2169.49  * Shear (lb/sq ft)          *    0.22  *     1.38 *     0.13 *
* Alpha                 *    1.56  * Stream Power (lb/ft s)    *    0.32  *    10.87 *     0.13 *
* Frctn Loss (ft)       *    2.17  * Cum Volume (acre-ft)      *    0.77  *     2.95 *     0.47 *
* C & E Loss (ft)       *    0.03  * Cum SA (acres)            *    1.42  *     1.70 *     0.96 *
*****************************************************************************************************

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: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
the
        need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
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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 OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2174.37	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.07	Wt. n-Val.	0.057	0.033		
W.S. Elev (ft)	2173.29	Reach Len. (ft)	315.35	263.53	184.50	
Crit W.S. (ft)	2173.29	Flow Area (sq ft)	4.27	52.29		
E.G. Slope (ft/ft)	0.011329	Area (sq ft)	4.27	52.29		
Q Total (cfs)	443.00	Flow (cfs)	5.51	437.49		
Top Width (ft)	33.73	Top Width (ft)	13.35	20.38		
Vel Total (ft/s)	7.83	Avg. Vel. (ft/s)	1.29	8.37		
Max Chl Dpth (ft)	3.80	Hydr. Depth (ft)	0.32	2.57		
Conv. Total (cfs)	4162.0	Conv. (cfs)	51.8	4110.3		
Length Wtd. (ft)	258.63	Wetted Per. (ft)	13.42	22.67		
Min Ch El (ft)	2169.49	Shear (lb/sq ft)	0.22	1.63		
Alpha	1.13	Stream Power (lb/ft s)	0.29	13.65		
Frctn Loss (ft)	2.51	Cum Volume (acre-ft)	0.58	2.70	0.38	
C & E Loss (ft)	0.09	Cum SA (acres)	1.09	1.69	0.84	

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: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2173.36	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.02	Wt. n-Val.		0.033		
W.S. Elev (ft)	2172.34	Reach Len. (ft)	315.35	263.53	184.50	
Crit W.S. (ft)	2172.34	Flow Area (sq ft)		34.45		
E.G. Slope (ft/ft)	0.014408	Area (sq ft)		34.45		
Q Total (cfs)	279.00	Flow (cfs)		279.00		
Top Width (ft)	17.08	Top Width (ft)		17.08		
Vel Total (ft/s)	8.10	Avg. Vel. (ft/s)		8.10		
Max Chl Dpth (ft)	2.85	Hydr. Depth (ft)		2.02		
Conv. Total (cfs)	2324.4	Conv. (cfs)		2324.4		
Length Wtd. (ft)	261.67	Wetted Per. (ft)		18.78		
Min Ch El (ft)	2169.49	Shear (lb/sq ft)		1.65		
Alpha	1.00	Stream Power (lb/ft s)		13.36		
Frctn Loss (ft)	3.36	Cum Volume (acre-ft)	0.24	2.00	0.16	
C & E Loss (ft)	0.08	Cum SA (acres)	0.51	1.63	0.54	

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: SUNSET WASH
REACH: REACH #3 RS: 1.727

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2169.70	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.83	Wt. n-Val.	0.057	0.033	0.057	
W.S. Elev (ft)	2168.87	Reach Len. (ft)	133.01	172.54	197.32	
Crit W.S. (ft)	2168.87	Flow Area (sq ft)	2.92	53.99	36.18	
E.G. Slope (ft/ft)	0.008452	Area (sq ft)	2.92	53.99	36.18	
Q Total (cfs)	515.00	Flow (cfs)	4.04	428.31	82.65	
Top Width (ft)	65.08	Top Width (ft)	6.53	19.72	38.83	
Vel Total (ft/s)	5.53	Avg. Vel. (ft/s)	1.38	7.93	2.28	
Max Chl Dpth (ft)	3.46	Hydr. Depth (ft)	0.45	2.74	0.93	
Conv. Total (cfs)	5601.7	Conv. (cfs)	43.9	4658.8	899.0	
Length Wtd. (ft)	173.09	Wetted Per. (ft)	6.67	20.35	38.87	
Min Ch El (ft)	2165.41	Shear (lb/sq ft)	0.23	1.40	0.49	
Alpha	1.74	Stream Power (lb/ft s)	0.32	11.10	1.12	
Frctn Loss (ft)	1.30	Cum Volume (acre-ft)	0.71	2.60	0.38	
C & E Loss (ft)	0.02	Cum SA (acres)	1.27	1.58	0.83	

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2169.70	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.83	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2168.87	Reach Len. (ft)	133.01	172.54	197.32
Crit W.S. (ft)	2168.87	Flow Area (sq ft)	2.92	53.99	36.18
E.G. Slope (ft/ft)	0.008452	Area (sq ft)	2.92	53.99	36.18
Q Total (cfs)	515.00	Flow (cfs)	4.04	428.31	82.65
Top Width (ft)	65.08	Top Width (ft)	6.53	19.72	38.83
Vel Total (ft/s)	5.53	Avg. Vel. (ft/s)	1.38	7.93	2.28
Max Chl Dpth (ft)	3.46	Hydr. Depth (ft)	0.45	2.74	0.93
Conv. Total (cfs)	5601.7	Conv. (cfs)	43.9	4658.8	899.0
Length Wtd. (ft)	173.09	Wetted Per. (ft)	6.67	20.35	38.87
Min Ch El (ft)	2165.41	Shear (lb/sq ft)	0.23	1.40	0.49
Alpha	1.74	Stream Power (lb/ft s)	0.32	11.10	1.12
Frctn Loss (ft)	1.30	Cum Volume (acre-ft)	0.71	2.60	0.38
C & E Loss (ft)	0.02	Cum SA (acres)	1.27	1.58	0.83

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 OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2169.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.77	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2168.69	Reach Len. (ft)	133.01	172.54	197.32
Crit W.S. (ft)	2168.69	Flow Area (sq ft)	1.86	50.38	29.24
E.G. Slope (ft/ft)	0.008418	Area (sq ft)	1.86	50.38	29.24
Q Total (cfs)	443.00	Flow (cfs)	2.23	380.81	59.96
Top Width (ft)	61.63	Top Width (ft)	5.09	19.72	36.81
Vel Total (ft/s)	5.44	Avg. Vel. (ft/s)	1.20	7.56	2.05
Max Chl Dpth (ft)	3.28	Hydr. Depth (ft)	0.36	2.55	0.79
Conv. Total (cfs)	4828.2	Conv. (cfs)	24.3	4150.5	653.5
Length Wtd. (ft)	173.20	Wetted Per. (ft)	5.22	20.35	36.85
Min Ch El (ft)	2165.41	Shear (lb/sq ft)	0.19	1.30	0.42
Alpha	1.68	Stream Power (lb/ft s)	0.22	9.83	0.86
Frctn Loss (ft)	1.29	Cum Volume (acre-ft)	0.56	2.39	0.32
C & E Loss (ft)	0.01	Cum SA (acres)	1.02	1.57	0.77

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2168.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.77	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2168.01	Reach Len. (ft)	133.01	172.54	197.32
Crit W.S. (ft)	2168.01	Flow Area (sq ft)	0.11	36.96	8.43
E.G. Slope (ft/ft)	0.011506	Area (sq ft)	0.11	36.96	8.43
Q Total (cfs)	279.00	Flow (cfs)	0.09	265.69	13.22
Top Width (ft)	40.53	Top Width (ft)	0.75	19.72	20.06
Vel Total (ft/s)	6.13	Avg. Vel. (ft/s)	0.76	7.19	1.57
Max Chl Dpth (ft)	2.60	Hydr. Depth (ft)	0.15	1.87	0.42
Conv. Total (cfs)	2601.0	Conv. (cfs)	0.8	2476.9	123.2
Length Wtd. (ft)	173.12	Wetted Per. (ft)	0.81	20.35	20.08
Min Ch El (ft)	2165.41	Shear (lb/sq ft)	0.10	1.30	0.30
Alpha	1.31	Stream Power (lb/ft s)	0.08	9.38	0.47
Frctn Loss (ft)	2.25	Cum Volume (acre-ft)	0.24	1.78	0.15
C & E Loss (ft)	0.04	Cum SA (acres)	0.50	1.52	0.50

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: SUNSET WASH
REACH: REACH #3 RS: 1.694

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2167.39	Element	Left OB	Channel	Right OB

Vel Head (ft)	0.77	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2166.62	Reach Len. (ft)	161.82	237.54	267.87
Crit W.S. (ft)	2166.62	Flow Area (sq ft)	29.94	55.98	18.40
E.G. Slope (ft/ft)	0.006710	Area (sq ft)	29.94	55.98	18.40
Q Total (cfs)	515.00	Flow (cfs)	53.47	429.46	32.07
Top Width (ft)	80.37	Top Width (ft)	38.90	16.55	24.92
Vel Total (ft/s)	4.94	Avg. Vel. (ft/s)	1.79	7.67	1.74
Max Chl Dpth (ft)	4.59	Hydr. Depth (ft)	0.77	3.38	0.74
Conv. Total (cfs)	6287.0	Conv. (cfs)	652.7	5242.8	391.5
Length Wtd. (ft)	232.82	Wetted Per. (ft)	39.14	18.66	24.95
Min Ch El (ft)	2162.03	Shear (lb/sq ft)	0.32	1.26	0.31
Alpha	2.04	Stream Power (lb/ft s)	0.57	9.64	0.54
Frctn Loss (ft)	1.89	Cum Volume (acre-ft)	0.66	2.38	0.26
C & E Loss (ft)	0.03	Cum SA (acres)	1.20	1.51	0.68

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2167.39	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.77	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2166.62	Reach Len. (ft)	161.82	237.54	267.87
Crit W.S. (ft)	2166.62	Flow Area (sq ft)	29.94	55.98	18.40
E.G. Slope (ft/ft)	0.006710	Area (sq ft)	29.94	55.98	18.40
Q Total (cfs)	515.00	Flow (cfs)	53.47	429.46	32.07
Top Width (ft)	80.37	Top Width (ft)	38.90	16.55	24.92
Vel Total (ft/s)	4.94	Avg. Vel. (ft/s)	1.79	7.67	1.74
Max Chl Dpth (ft)	4.59	Hydr. Depth (ft)	0.77	3.38	0.74
Conv. Total (cfs)	6287.0	Conv. (cfs)	652.7	5242.8	391.5
Length Wtd. (ft)	232.82	Wetted Per. (ft)	39.14	18.66	24.95
Min Ch El (ft)	2162.03	Shear (lb/sq ft)	0.32	1.26	0.31
Alpha	2.04	Stream Power (lb/ft s)	0.57	9.64	0.54
Frctn Loss (ft)	1.89	Cum Volume (acre-ft)	0.66	2.38	0.26
C & E Loss (ft)	0.03	Cum SA (acres)	1.20	1.51	0.68

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 OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2167.17	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.74	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2166.43	Reach Len. (ft)	161.82	237.54	267.87
Crit W.S. (ft)	2166.43	Flow Area (sq ft)	22.55	52.81	13.82
E.G. Slope (ft/ft)	0.006666	Area (sq ft)	22.55	52.81	13.82
Q Total (cfs)	443.00	Flow (cfs)	33.62	388.41	20.97
Top Width (ft)	77.70	Top Width (ft)	38.24	16.55	22.91
Vel Total (ft/s)	4.97	Avg. Vel. (ft/s)	1.49	7.35	1.52
Max Chl Dpth (ft)	4.40	Hydr. Depth (ft)	0.59	3.19	0.60
Conv. Total (cfs)	5425.7	Conv. (cfs)	411.7	4757.2	256.9
Length Wtd. (ft)	233.85	Wetted Per. (ft)	38.45	18.66	22.94
Min Ch El (ft)	2162.03	Shear (lb/sq ft)	0.24	1.18	0.25
Alpha	1.93	Stream Power (lb/ft s)	0.36	8.66	0.38
Frctn Loss (ft)	1.95	Cum Volume (acre-ft)	0.52	2.19	0.22
C & E Loss (ft)	0.03	Cum SA (acres)	0.96	1.50	0.63

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2166.33	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.12	Wt. n-Val.		0.033	
W.S. Elev (ft)	2165.21	Reach Len. (ft)	161.82	237.54	267.87
Crit W.S. (ft)	2165.21	Flow Area (sq ft)		32.85	
E.G. Slope (ft/ft)	0.014857	Area (sq ft)		32.85	
Q Total (cfs)	279.00	Flow (cfs)		279.00	
Top Width (ft)	15.13	Top Width (ft)		15.13	
Vel Total (ft/s)	8.49	Avg. Vel. (ft/s)		8.49	
Max Chl Dpth (ft)	3.18	Hydr. Depth (ft)		2.17	
Conv. Total (cfs)	2289.0	Conv. (cfs)		2289.0	
Length Wtd. (ft)	236.83	Wetted Per. (ft)		17.07	
Min Ch El (ft)	2162.03	Shear (lb/sq ft)		1.79	

* Alpha	*	1.00	* Stream Power (lb/ft s)	*		*	15.16	*	
* Frctn Loss (ft)	*	3.18	* Cum Volume (acre-ft)	*	0.24	*	1.64	*	0.13 *
* C & E Loss (ft)	*	0.09	* Cum SA (acres)	*	0.50	*	1.45	*	0.45 *

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: SUNSET WASH
REACH: REACH #3 RS: 1.649

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	*	2163.17	* Element	*	Left OB	*	Channel	*	Right OB *
* Vel Head (ft)	*	1.10	* Wt. n-Val.	*	0.057	*	0.033	*	0.057 *
* W.S. Elev (ft)	*	2162.06	* Reach Len. (ft)	*	215.90	*	176.24	*	135.84 *
* Crit W.S. (ft)	*	2162.06	* Flow Area (sq ft)	*	14.43	*	53.72	*	5.34 *
* E.G. Slope (ft/ft)	*	0.009980	* Area (sq ft)	*	14.43	*	53.72	*	5.34 *
* Q Total (cfs)	*	515.00	* Flow (cfs)	*	29.12	*	471.92	*	13.96 *
* Top Width (ft)	*	45.38	* Top Width (ft)	*	21.02	*	19.53	*	4.83 *
* Vel Total (ft/s)	*	7.01	* Avg. Vel. (ft/s)	*	2.02	*	8.78	*	2.61 *
* Max Chl Dpth (ft)	*	3.22	* Hydr. Depth (ft)	*	0.69	*	2.75	*	1.11 *
* Conv. Total (cfs)	*	5155.2	* Conv. (cfs)	*	291.5	*	4723.9	*	139.8 *
* Length Wtd. (ft)	*	180.41	* Wetted Per. (ft)	*	21.15	*	19.68	*	5.31 *
* Min Ch El (ft)	*	2158.84	* Shear (lb/sq ft)	*	0.43	*	1.70	*	0.63 *
* Alpha	*	1.45	* Stream Power (lb/ft s)	*	0.86	*	14.94	*	1.64 *
* Frctn Loss (ft)	*	1.82	* Cum Volume (acre-ft)	*	0.57	*	2.08	*	0.18 *
* C & E Loss (ft)	*	0.11	* Cum SA (acres)	*	1.09	*	1.41	*	0.59 *

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.

CROSS SECTION OUTPUT Profile #FLOODWAY

* E.G. Elev (ft)	*	2163.17	* Element	*	Left OB	*	Channel	*	Right OB *
* Vel Head (ft)	*	1.10	* Wt. n-Val.	*	0.057	*	0.033	*	0.057 *
* W.S. Elev (ft)	*	2162.06	* Reach Len. (ft)	*	215.90	*	176.24	*	135.84 *
* Crit W.S. (ft)	*	2162.06	* Flow Area (sq ft)	*	14.43	*	53.72	*	5.34 *
* E.G. Slope (ft/ft)	*	0.009980	* Area (sq ft)	*	14.43	*	53.72	*	5.34 *
* Q Total (cfs)	*	515.00	* Flow (cfs)	*	29.12	*	471.92	*	13.96 *
* Top Width (ft)	*	45.38	* Top Width (ft)	*	21.02	*	19.53	*	4.83 *
* Vel Total (ft/s)	*	7.01	* Avg. Vel. (ft/s)	*	2.02	*	8.78	*	2.61 *
* Max Chl Dpth (ft)	*	3.22	* Hydr. Depth (ft)	*	0.69	*	2.75	*	1.11 *
* Conv. Total (cfs)	*	5155.2	* Conv. (cfs)	*	291.5	*	4723.9	*	139.8 *
* Length Wtd. (ft)	*	180.41	* Wetted Per. (ft)	*	21.15	*	19.68	*	5.31 *
* Min Ch El (ft)	*	2158.84	* Shear (lb/sq ft)	*	0.43	*	1.70	*	0.63 *
* Alpha	*	1.45	* Stream Power (lb/ft s)	*	0.86	*	14.94	*	1.64 *
* Frctn Loss (ft)	*	1.82	* Cum Volume (acre-ft)	*	0.57	*	2.08	*	0.18 *
* C & E Loss (ft)	*	0.11	* Cum SA (acres)	*	1.09	*	1.41	*	0.59 *

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.

CROSS SECTION OUTPUT Profile #50-YEAR

* E.G. Elev (ft)	*	2162.83	* Element	*	Left OB	*	Channel	*	Right OB *
* Vel Head (ft)	*	1.04	* Wt. n-Val.	*	0.057	*	0.033	*	0.057 *
* W.S. Elev (ft)	*	2161.79	* Reach Len. (ft)	*	215.90	*	176.24	*	135.84 *
* Crit W.S. (ft)	*	2161.79	* Flow Area (sq ft)	*	9.90	*	48.41	*	4.11 *
* E.G. Slope (ft/ft)	*	0.010698	* Area (sq ft)	*	9.90	*	48.41	*	4.11 *
* Q Total (cfs)	*	443.00	* Flow (cfs)	*	22.05	*	410.76	*	10.19 *
* Top Width (ft)	*	36.83	* Top Width (ft)	*	13.06	*	19.53	*	4.23 *
* Vel Total (ft/s)	*	7.10	* Avg. Vel. (ft/s)	*	2.23	*	8.49	*	2.48 *
* Max Chl Dpth (ft)	*	2.95	* Hydr. Depth (ft)	*	0.76	*	2.48	*	0.97 *
* Conv. Total (cfs)	*	4283.1	* Conv. (cfs)	*	213.2	*	3971.4	*	98.5 *
* Length Wtd. (ft)	*	179.92	* Wetted Per. (ft)	*	13.18	*	19.68	*	4.66 *
* Min Ch El (ft)	*	2158.84	* Shear (lb/sq ft)	*	0.50	*	1.64	*	0.59 *
* Alpha	*	1.33	* Stream Power (lb/ft s)	*	1.12	*	13.94	*	1.46 *
* Frctn Loss (ft)	*	1.86	* Cum Volume (acre-ft)	*	0.46	*	1.91	*	0.16 *
* C & E Loss (ft)	*	0.11	* Cum SA (acres)	*	0.86	*	1.40	*	0.55 *

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2161.99	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.83	Wt. n-Val.	0.057	0.033	0.057	
W.S. Elev (ft)	2161.16	Reach Len. (ft)	215.90	176.24	135.84	
Crit W.S. (ft)	2161.16	Flow Area (sq ft)	3.62	36.05	1.87	
E.G. Slope (ft/ft)	0.012203	Area (sq ft)	3.62	36.05	1.87	
Q Total (cfs)	279.00	Flow (cfs)	6.79	268.41	3.80	
Top Width (ft)	29.17	Top Width (ft)	6.79	19.53	2.85	
Vel Total (ft/s)	6.72	Avg. Vel. (ft/s)	1.88	7.45	2.04	
Max Chl Dpth (ft)	2.32	Hydr. Depth (ft)	0.53	1.85	0.65	
Conv. Total (cfs)	2525.7	Conv. (cfs)	61.5	2429.8	34.4	
Length Wtd. (ft)	177.98	Wetted Per. (ft)	6.88	19.68	3.14	
Min Ch El (ft)	2158.84	Shear (lb/sq ft)	0.40	1.40	0.45	
Alpha	1.19	Stream Power (lb/ft s)	0.75	10.39	0.92	
Frctn Loss (ft)	1.96	Cum Volume (acre-ft)	0.24	1.45	0.12	
C & E Loss (ft)	0.08	Cum SA (acres)	0.49	1.35	0.44	

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: SUNSET WASH
REACH: REACH #3 RS: 1.616

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2159.59	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.74	Wt. n-Val.	0.057	0.033		
W.S. Elev (ft)	2158.86	Reach Len. (ft)	256.40	311.15	305.11	
Crit W.S. (ft)	2158.86	Flow Area (sq ft)	35.81	56.00		
E.G. Slope (ft/ft)	0.010251	Area (sq ft)	35.81	56.00		
Q Total (cfs)	515.00	Flow (cfs)	93.50	421.50		
Top Width (ft)	61.44	Top Width (ft)	36.08	25.36		
Vel Total (ft/s)	5.61	Avg. Vel. (ft/s)	2.61	7.53		
Max Chl Dpth (ft)	3.02	Hydr. Depth (ft)	0.99	2.21		
Conv. Total (cfs)	5086.6	Conv. (cfs)	923.4	4163.1		
Length Wtd. (ft)	304.75	Wetted Per. (ft)	36.40	26.40		
Min Ch El (ft)	2155.83	Shear (lb/sq ft)	0.63	1.36		
Alpha	1.51	Stream Power (lb/ft s)	1.64	10.22		
Frctn Loss (ft)	2.94	Cum Volume (acre-ft)	0.45	1.86	0.18	
C & E Loss (ft)	0.03	Cum SA (acres)	0.95	1.32	0.58	

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2159.59	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.74	Wt. n-Val.	0.057	0.033		
W.S. Elev (ft)	2158.86	Reach Len. (ft)	256.40	311.15	305.11	
Crit W.S. (ft)	2158.86	Flow Area (sq ft)	35.81	56.00		
E.G. Slope (ft/ft)	0.010251	Area (sq ft)	35.81	56.00		
Q Total (cfs)	515.00	Flow (cfs)	93.50	421.50		
Top Width (ft)	61.44	Top Width (ft)	36.08	25.36		
Vel Total (ft/s)	5.61	Avg. Vel. (ft/s)	2.61	7.53		
Max Chl Dpth (ft)	3.02	Hydr. Depth (ft)	0.99	2.21		
Conv. Total (cfs)	5086.6	Conv. (cfs)	923.4	4163.1		
Length Wtd. (ft)	304.75	Wetted Per. (ft)	36.40	26.40		
Min Ch El (ft)	2155.83	Shear (lb/sq ft)	0.63	1.36		
Alpha	1.51	Stream Power (lb/ft s)	1.64	10.22		
Frctn Loss (ft)	2.94	Cum Volume (acre-ft)	0.45	1.86	0.18	
C & E Loss (ft)	0.03	Cum SA (acres)	0.95	1.32	0.58	

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 OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2159.38	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.68	Wt. n-Val.	0.057	0.033		
W.S. Elev (ft)	2158.70	Reach Len. (ft)	256.40	311.15	305.11	
Crit W.S. (ft)	2158.70	Flow Area (sq ft)	30.36	52.18		
E.G. Slope (ft/ft)	0.009989	Area (sq ft)	30.36	52.18		
Q Total (cfs)	443.00	Flow (cfs)	70.47	372.53		
Top Width (ft)	60.94	Top Width (ft)	35.83	25.11		
Vel Total (ft/s)	5.37	Avg. Vel. (ft/s)	2.32	7.14		
Max Chl Dpth (ft)	2.87	Hydr. Depth (ft)	0.85	2.08		
Conv. Total (cfs)	4432.3	Conv. (cfs)	705.1	3727.3		
Length Wtd. (ft)	305.94	Wetted Per. (ft)	36.11	26.11		
Min Ch El (ft)	2155.83	Shear (lb/sq ft)	0.52	1.25		
Alpha	1.52	Stream Power (lb/ft s)	1.22	8.90		
Frctn Loss (ft)	3.07	Cum Volume (acre-ft)	0.36	1.71	0.16	
C & E Loss (ft)	0.04	Cum SA (acres)	0.74	1.31	0.54	

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2158.82	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.56	Wt. n-Val.	0.057	0.033		
W.S. Elev (ft)	2158.26	Reach Len. (ft)	256.40	311.15	305.11	
Crit W.S. (ft)	2158.26	Flow Area (sq ft)	14.64	41.20		
E.G. Slope (ft/ft)	0.009952	Area (sq ft)	14.64	41.20		
Q Total (cfs)	279.00	Flow (cfs)	21.53	257.47		
Top Width (ft)	58.50	Top Width (ft)	34.27	24.23		
Vel Total (ft/s)	5.00	Avg. Vel. (ft/s)	1.47	6.25		
Max Chl Dpth (ft)	2.43	Hydr. Depth (ft)	0.43	1.70		
Conv. Total (cfs)	2796.7	Conv. (cfs)	215.8	2581.0		
Length Wtd. (ft)	308.67	Wetted Per. (ft)	34.43	25.10		
Min Ch El (ft)	2155.83	Shear (lb/sq ft)	0.26	1.02		
Alpha	1.45	Stream Power (lb/ft s)	0.39	6.37		
Frctn Loss (ft)	3.51	Cum Volume (acre-ft)	0.19	1.30	0.12	
C & E Loss (ft)	0.03	Cum SA (acres)	0.39	1.26	0.44	

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: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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: SUNSET WASH
REACH: REACH #3 RS: 1.557

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2155.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.05	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2154.08	Reach Len. (ft)	269.73	286.67	291.54
Crit W.S. (ft)	2154.08	Flow Area (sq ft)	15.08	57.57	0.90
E.G. Slope (ft/ft)	0.009091	Area (sq ft)	15.08	57.57	0.90
Q Total (cfs)	515.00	Flow (cfs)	26.84	486.86	1.30
Top Width (ft)	46.61	Top Width (ft)	24.72	20.12	1.77
Vel Total (ft/s)	7.00	Avg. Vel. (ft/s)	1.78	8.46	1.44
Max Chl Dpth (ft)	3.36	Hydr. Depth (ft)	0.61	2.86	0.51
Conv. Total (cfs)	5401.4	Conv. (cfs)	281.5	5106.3	13.6
Length Wtd. (ft)	286.24	Wetted Per. (ft)	24.87	20.82	2.04
Min Ch El (ft)	2150.72	Shear (lb/sq ft)	0.34	1.57	0.25
Alpha	1.38	Stream Power (lb/ft s)	0.61	13.27	0.36
Frctn Loss (ft)	3.12	Cum Volume (acre-ft)	0.30	1.46	0.17
C & E Loss (ft)	0.07	Cum SA (acres)	0.77	1.15	0.58

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2155.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.05	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2154.08	Reach Len. (ft)	269.73	286.67	291.54
Crit W.S. (ft)	2154.08	Flow Area (sq ft)	15.08	57.57	0.90
E.G. Slope (ft/ft)	0.009091	Area (sq ft)	15.08	57.57	0.90
Q Total (cfs)	515.00	Flow (cfs)	26.84	486.86	1.30
Top Width (ft)	46.61	Top Width (ft)	24.72	20.12	1.77
Vel Total (ft/s)	7.00	Avg. Vel. (ft/s)	1.78	8.46	1.44
Max Chl Dpth (ft)	3.36	Hydr. Depth (ft)	0.61	2.86	0.51
Conv. Total (cfs)	5401.4	Conv. (cfs)	281.5	5106.3	13.6
Length Wtd. (ft)	286.24	Wetted Per. (ft)	24.87	20.82	2.04
Min Ch El (ft)	2150.72	Shear (lb/sq ft)	0.34	1.57	0.25
Alpha	1.38	Stream Power (lb/ft s)	0.61	13.27	0.36
Frctn Loss (ft)	3.12	Cum Volume (acre-ft)	0.30	1.46	0.17
C & E Loss (ft)	0.07	Cum SA (acres)	0.77	1.15	0.58

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 OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2154.82	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.03	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2153.79	Reach Len. (ft)	269.73	286.67	291.54
Crit W.S. (ft)	2153.79	Flow Area (sq ft)	8.73	51.71	0.46
E.G. Slope (ft/ft)	0.010082	Area (sq ft)	8.73	51.71	0.46
Q Total (cfs)	443.00	Flow (cfs)	13.73	428.72	0.56
Top Width (ft)	39.97	Top Width (ft)	18.58	20.12	1.27
Vel Total (ft/s)	7.27	Avg. Vel. (ft/s)	1.57	8.29	1.21
Max Chl Dpth (ft)	3.06	Hydr. Depth (ft)	0.47	2.57	0.36
Conv. Total (cfs)	4412.0	Conv. (cfs)	136.7	4269.7	5.5
Length Wtd. (ft)	286.41	Wetted Per. (ft)	18.73	20.82	1.46
Min Ch El (ft)	2150.72	Shear (lb/sq ft)	0.29	1.56	0.20
Alpha	1.26	Stream Power (lb/ft s)	0.46	12.96	0.24
Frctn Loss (ft)	3.40	Cum Volume (acre-ft)	0.25	1.33	0.15
C & E Loss (ft)	0.08	Cum SA (acres)	0.58	1.15	0.54

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2153.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.87	Wt. n-Val.	0.057	0.033	
W.S. Elev (ft)	2153.04	Reach Len. (ft)	269.73	286.67	291.54
Crit W.S. (ft)	2153.04	Flow Area (sq ft)	2.11	36.62	
E.G. Slope (ft/ft)	0.013080	Area (sq ft)	2.11	36.62	
Q Total (cfs)	279.00	Flow (cfs)	3.78	275.22	
Top Width (ft)	24.49	Top Width (ft)	4.42	20.08	
Vel Total (ft/s)	7.20	Avg. Vel. (ft/s)	1.79	7.52	
Max Chl Dpth (ft)	2.31	Hydr. Depth (ft)	0.48	1.82	
Conv. Total (cfs)	2439.5	Conv. (cfs)	33.1	2406.4	
Length Wtd. (ft)	286.56	Wetted Per. (ft)	4.52	20.77	
Min Ch El (ft)	2150.72	Shear (lb/sq ft)	0.38	1.44	
Alpha	1.07	Stream Power (lb/ft s)	0.68	10.82	
Frctn Loss (ft)	4.06	Cum Volume (acre-ft)	0.14	1.02	0.12
C & E Loss (ft)	0.07	Cum SA (acres)	0.28	1.11	0.44

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: SUNSET WASH
REACH: REACH #3 RS: 1.502

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2150.21	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.81	Wt. n-Val.		0.033	0.057
W.S. Elev (ft)	2149.40	Reach Len. (ft)	220.80	190.84	144.65
Crit W.S. (ft)	2149.40	Flow Area (sq ft)		71.19	1.50
E.G. Slope (ft/ft)	0.013283	Area (sq ft)		71.19	1.50
Q Total (cfs)	515.00	Flow (cfs)		513.41	1.59
Top Width (ft)	50.09	Top Width (ft)		42.99	7.10
Vel Total (ft/s)	7.09	Avg. Vel. (ft/s)		7.21	1.06
Max Chl Dpth (ft)	2.95	Hydr. Depth (ft)		1.66	0.21
Conv. Total (cfs)	4468.4	Conv. (cfs)		4454.6	13.8
Length Wtd. (ft)	189.50	Wetted Per. (ft)		43.45	7.11
Min Ch El (ft)	2146.45	Shear (lb/sq ft)		1.36	0.17
Alpha	1.03	Stream Power (lb/ft s)		9.80	0.19
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	0.25	1.03	0.16
C & E Loss (ft)	0.39	Cum SA (acres)	0.69	0.95	0.55

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: 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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2150.21	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.81	Wt. n-Val.		0.033	0.057
W.S. Elev (ft)	2149.40	Reach Len. (ft)	220.80	190.84	144.65
Crit W.S. (ft)	2149.40	Flow Area (sq ft)		71.19	1.50
E.G. Slope (ft/ft)	0.013283	Area (sq ft)		71.19	1.50
Q Total (cfs)	515.00	Flow (cfs)		513.41	1.59
Top Width (ft)	50.09	Top Width (ft)		42.99	7.10
Vel Total (ft/s)	7.09	Avg. Vel. (ft/s)		7.21	1.06
Max Chl Dpth (ft)	2.95	Hydr. Depth (ft)		1.66	0.21
Conv. Total (cfs)	4468.4	Conv. (cfs)		4454.6	13.8
Length Wtd. (ft)	189.50	Wetted Per. (ft)		43.45	7.11
Min Ch El (ft)	2146.45	Shear (lb/sq ft)		1.36	0.17
Alpha	1.03	Stream Power (lb/ft s)		9.80	0.19
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	0.25	1.03	0.16
C & E Loss (ft)	0.39	Cum SA (acres)	0.69	0.95	0.55

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: 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 OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2149.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.76	Wt. n-Val.		0.033	0.057
W.S. Elev (ft)	2149.22	Reach Len. (ft)	220.80	190.84	144.65
Crit W.S. (ft)	2149.22	Flow Area (sq ft)		63.34	0.45
E.G. Slope (ft/ft)	0.014159	Area (sq ft)		63.34	0.45
Q Total (cfs)	443.00	Flow (cfs)		442.68	0.32
Top Width (ft)	46.17	Top Width (ft)		42.07	4.10
Vel Total (ft/s)	6.95	Avg. Vel. (ft/s)		6.99	0.71
Max Chl Dpth (ft)	2.77	Hydr. Depth (ft)		1.51	0.11
Conv. Total (cfs)	3723.0	Conv. (cfs)		3720.3	2.6
Length Wtd. (ft)	189.53	Wetted Per. (ft)		42.51	4.10
Min Ch El (ft)	2146.45	Shear (lb/sq ft)		1.32	0.10
Alpha	1.01	Stream Power (lb/ft s)		9.20	0.07
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	0.22	0.96	0.15
C & E Loss (ft)	0.36	Cum SA (acres)	0.52	0.94	0.52

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: 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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2149.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.62	Wt. n-Val.		0.033	
W.S. Elev (ft)	2148.73	Reach Len. (ft)	220.80	190.84	144.65
Crit W.S. (ft)	2148.73	Flow Area (sq ft)		44.13	
E.G. Slope (ft/ft)	0.015399	Area (sq ft)		44.13	
Q Total (cfs)	279.00	Flow (cfs)		279.00	
Top Width (ft)	36.29	Top Width (ft)		36.29	
Vel Total (ft/s)	6.32	Avg. Vel. (ft/s)		6.32	
Max Chl Dpth (ft)	2.28	Hydr. Depth (ft)		1.22	

Conv. Total (cfs)	2248.3	Conv. (cfs)		2248.3		
Length Wtd. (ft)	189.47	Wetted Per. (ft)		36.67		
Min Ch El (ft)	2146.45	Shear (lb/sq ft)		1.16		
Alpha	1.00	Stream Power (lb/ft s)		7.31		
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	0.14	0.75	0.12	
C & E Loss (ft)	0.30	Cum SA (acres)	0.26	0.92	0.44	

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: 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: SUNSET WASH
REACH: REACH #3 RS: 1.466

CROSS SECTION OUTPUT Profile #FLOODPLAIN

			Left OB	Channel	Right OB
E.G. Elev (ft)	2149.52	Element			
Vel Head (ft)	0.04	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2149.48	Reach Len. (ft)	105.42	102.76	118.28
Crit W.S. (ft)	2145.50	Flow Area (sq ft)	99.84	264.08	97.25
E.G. Slope (ft/ft)	0.000138	Area (sq ft)	99.84	264.08	97.25
Q Total (cfs)	515.00	Flow (cfs)	34.20	430.42	50.38
Top Width (ft)	184.93	Top Width (ft)	92.92	48.04	43.96
Vel Total (ft/s)	1.12	Avg. Vel. (ft/s)	0.34	1.63	0.52
Max Chl Dpth (ft)	6.41	Hydr. Depth (ft)	1.07	5.50	2.21
Conv. Total (cfs)	43796.8	Conv. (cfs)	2908.7	36604.0	4284.1
Length Wtd. (ft)	102.76	Wetted Per. (ft)	93.23	48.90	44.27
Min Ch El (ft)	2143.07	Shear (lb/sq ft)	0.01	0.05	0.02
Alpha	1.81	Stream Power (lb/ft s)	0.00	0.08	0.01
Frctn Loss (ft)		Cum Volume (acre-ft)		0.30	
C & E Loss (ft)		Cum SA (acres)	0.46	0.75	0.46

CROSS SECTION OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2149.52	Element			
Vel Head (ft)	0.04	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2149.48	Reach Len. (ft)	105.42	102.76	118.28
Crit W.S. (ft)	2145.50	Flow Area (sq ft)	99.84	264.08	97.25
E.G. Slope (ft/ft)	0.000138	Area (sq ft)	99.84	264.08	97.25
Q Total (cfs)	515.00	Flow (cfs)	34.20	430.42	50.38
Top Width (ft)	184.93	Top Width (ft)	92.92	48.04	43.96
Vel Total (ft/s)	1.12	Avg. Vel. (ft/s)	0.34	1.63	0.52
Max Chl Dpth (ft)	6.41	Hydr. Depth (ft)	1.07	5.50	2.21
Conv. Total (cfs)	43796.8	Conv. (cfs)	2908.7	36604.0	4284.1
Length Wtd. (ft)	102.76	Wetted Per. (ft)	93.23	48.90	44.27
Min Ch El (ft)	2143.07	Shear (lb/sq ft)	0.01	0.05	0.02
Alpha	1.81	Stream Power (lb/ft s)	0.00	0.08	0.01
Frctn Loss (ft)		Cum Volume (acre-ft)		0.30	
C & E Loss (ft)		Cum SA (acres)	0.46	0.75	0.46

CROSS SECTION OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2149.36	Element			
Vel Head (ft)	0.03	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2149.33	Reach Len. (ft)	105.42	102.76	118.28
Crit W.S. (ft)	2145.33	Flow Area (sq ft)	86.75	256.81	90.70
E.G. Slope (ft/ft)	0.000115	Area (sq ft)	86.75	256.81	90.70
Q Total (cfs)	443.00	Flow (cfs)	26.30	374.92	41.78
Top Width (ft)	171.57	Top Width (ft)	80.92	48.04	42.61
Vel Total (ft/s)	1.02	Avg. Vel. (ft/s)	0.30	1.46	0.46
Max Chl Dpth (ft)	6.26	Hydr. Depth (ft)	1.07	5.35	2.13
Conv. Total (cfs)	41284.4	Conv. (cfs)	2450.7	34939.7	3894.1
Length Wtd. (ft)	102.76	Wetted Per. (ft)	81.20	48.90	42.91
Min Ch El (ft)	2143.07	Shear (lb/sq ft)	0.01	0.04	0.02
Alpha	1.76	Stream Power (lb/ft s)	0.00	0.06	0.01
Frctn Loss (ft)		Cum Volume (acre-ft)		0.26	
C & E Loss (ft)		Cum SA (acres)	0.32	0.74	0.44

CROSS SECTION OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2148.88	Element			
Vel Head (ft)	0.02	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2148.87	Reach Len. (ft)	105.42	102.76	118.28
Crit W.S. (ft)	2144.90	Flow Area (sq ft)	53.45	234.50	71.88
E.G. Slope (ft/ft)	0.000067	Area (sq ft)	53.45	234.50	71.88
Q Total (cfs)	279.00	Flow (cfs)	10.19	245.66	23.14
Top Width (ft)	149.46	Top Width (ft)	62.95	48.04	38.46
Vel Total (ft/s)	0.78	Avg. Vel. (ft/s)	0.19	1.05	0.32
Max Chl Dpth (ft)	5.80	Hydr. Depth (ft)	0.85	4.88	1.87
Conv. Total (cfs)	34104.4	Conv. (cfs)	1246.2	30029.3	2829.0
Length Wtd. (ft)	102.76	Wetted Per. (ft)	63.21	48.90	38.74
Min Ch El (ft)	2143.07	Shear (lb/sq ft)	0.00	0.02	0.01
Alpha	1.62	Stream Power (lb/ft s)	0.00	0.02	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)		0.14	

* C & E Loss (ft)	*	* Cum SA (acres)	* 0.10	* 0.74	* 0.38 *

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #3 RS: 1.447

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	* 2143.65	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.69	* Wt. n-Val.	* 0.057	* 0.033	* *
* W.S. Elev (ft)	* 2142.96	* Reach Len. (ft)	* 254.74	* 257.87	* 260.66 *
* Crit W.S. (ft)	* 2142.96	* Flow Area (sq ft)	* 21.16	* 71.24	* *
* E.G. Slope (ft/ft)	*0.009461	* Area (sq ft)	* 21.16	* 71.24	* *
* Q Total (cfs)	* 515.00	* Flow (cfs)	* 27.40	* 487.60	* *
* Top Width (ft)	* 96.43	* Top Width (ft)	* 63.99	* 32.44	* *
* Vel Total (ft/s)	* 5.57	* Avg. Vel. (ft/s)	* 1.30	* 6.84	* *
* Max Chl Dpth (ft)	* 5.38	* Hydr. Depth (ft)	* 0.33	* 2.20	* *
* Conv. Total (cfs)	* 5294.6	* Conv. (cfs)	* 281.7	* 5012.9	* *
* Length Wtd. (ft)	* 258.09	* Wetted Per. (ft)	* 64.14	* 36.47	* *
* Min Ch El (ft)	* 2137.58	* Shear (lb/sq ft)	* 0.19	* 1.15	* *
* Alpha	* 1.43	* Stream Power (lb/ft s)	* 0.25	* 7.90	* *
* Frctn Loss (ft)	* 2.36	* Cum Volume (acre-ft)	* 0.09	* 0.85	* 0.33 *
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 0.27	* 0.65	* 0.40 *

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

* E.G. Elev (ft)	* 2143.65	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.69	* Wt. n-Val.	* 0.057	* 0.033	* *
* W.S. Elev (ft)	* 2142.96	* Reach Len. (ft)	* 254.74	* 257.87	* 260.66 *
* Crit W.S. (ft)	* 2142.96	* Flow Area (sq ft)	* 21.16	* 71.24	* *
* E.G. Slope (ft/ft)	*0.009461	* Area (sq ft)	* 21.16	* 71.24	* *
* Q Total (cfs)	* 515.00	* Flow (cfs)	* 27.40	* 487.60	* *
* Top Width (ft)	* 96.43	* Top Width (ft)	* 63.99	* 32.44	* *
* Vel Total (ft/s)	* 5.57	* Avg. Vel. (ft/s)	* 1.30	* 6.84	* *
* Max Chl Dpth (ft)	* 5.38	* Hydr. Depth (ft)	* 0.33	* 2.20	* *
* Conv. Total (cfs)	* 5294.6	* Conv. (cfs)	* 281.7	* 5012.9	* *
* Length Wtd. (ft)	* 258.09	* Wetted Per. (ft)	* 64.14	* 36.47	* *
* Min Ch El (ft)	* 2137.58	* Shear (lb/sq ft)	* 0.19	* 1.15	* *
* Alpha	* 1.43	* Stream Power (lb/ft s)	* 0.25	* 7.90	* *
* Frctn Loss (ft)	* 2.36	* Cum Volume (acre-ft)	* 0.09	* 0.85	* 0.33 *
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 0.27	* 0.65	* 0.40 *

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: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #50-YEAR

* E.G. Elev (ft)	* 2143.44	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.77	* Wt. n-Val.	* 0.057	* 0.033	* *
* W.S. Elev (ft)	* 2142.67	* Reach Len. (ft)	* 254.74	* 257.87	* 260.66 *
* Crit W.S. (ft)	* 2142.67	* Flow Area (sq ft)	* 5.63	* 61.88	* *
* E.G. Slope (ft/ft)	*0.012002	* Area (sq ft)	* 5.63	* 61.88	* *
* Q Total (cfs)	* 443.00	* Flow (cfs)	* 4.82	* 438.18	* *
* Top Width (ft)	* 68.38	* Top Width (ft)	* 36.35	* 32.04	* *
* Vel Total (ft/s)	* 6.56	* Avg. Vel. (ft/s)	* 0.86	* 7.08	* *
* Max Chl Dpth (ft)	* 5.09	* Hydr. Depth (ft)	* 0.15	* 1.93	* *
* Conv. Total (cfs)	* 4043.7	* Conv. (cfs)	* 44.0	* 3999.7	* *
* Length Wtd. (ft)	* 258.14	* Wetted Per. (ft)	* 36.47	* 35.97	* *
* Min Ch El (ft)	* 2137.58	* Shear (lb/sq ft)	* 0.12	* 1.29	* *
* Alpha	* 1.15	* Stream Power (lb/ft s)	* 0.10	* 9.13	* *
* Frctn Loss (ft)	* 2.48	* Cum Volume (acre-ft)	* 0.04	* 0.78	* 0.29 *
* C & E Loss (ft)	* 0.07	* Cum SA (acres)	* 0.18	* 0.65	* 0.38 *

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: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2142.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.71	Wt. n-Val.		0.033	
W.S. Elev (ft)	2142.02	Reach Len. (ft)	254.74	257.87	260.66
Crit W.S. (ft)	2142.02	Flow Area (sq ft)		41.25	
E.G. Slope (ft/ft)	0.017107	Area (sq ft)		41.25	
Q Total (cfs)	279.00	Flow (cfs)		279.00	
Top Width (ft)	29.96	Top Width (ft)		29.96	
Vel Total (ft/s)	6.76	Avg. Vel. (ft/s)		6.76	
Max Chl Dpth (ft)	4.44	Hydr. Depth (ft)		1.38	
Conv. Total (cfs)	2133.1	Conv. (cfs)		2133.1	
Length Wtd. (ft)	258.02	Wetted Per. (ft)		33.52	
Min Ch El (ft)	2137.58	Shear (lb/sq ft)		1.31	
Alpha	1.00	Stream Power (lb/ft s)		8.89	
Frctn Loss (ft)	2.90	Cum Volume (acre-ft)	0.00	0.58	0.14
C & E Loss (ft)	0.08	Cum SA (acres)	0.03	0.64	0.32

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: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNSET WASH
REACH: REACH #3 RS: 1.398

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2138.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.74	Wt. n-Val.	0.062	0.033	0.057
W.S. Elev (ft)	2137.34	Reach Len. (ft)	269.98	276.25	268.52
Crit W.S. (ft)	2137.34	Flow Area (sq ft)	4.04	50.00	52.94
E.G. Slope (ft/ft)	0.008845	Area (sq ft)	4.04	50.00	52.94
Q Total (cfs)	515.00	Flow (cfs)	4.69	391.80	118.51
Top Width (ft)	90.42	Top Width (ft)	10.92	18.87	60.63
Vel Total (ft/s)	4.81	Avg. Vel. (ft/s)	1.16	7.84	2.24
Max Chl Dpth (ft)	3.64	Hydr. Depth (ft)	0.37	2.65	0.87
Conv. Total (cfs)	5475.9	Conv. (cfs)	49.9	4165.9	1260.1
Length Wtd. (ft)	275.28	Wetted Per. (ft)	10.95	19.86	60.67
Min Ch El (ft)	2133.70	Shear (lb/sq ft)	0.20	1.39	0.48
Alpha	2.07	Stream Power (lb/ft s)	0.24	10.89	1.08
Frctn Loss (ft)	3.33	Cum Volume (acre-ft)	0.02	0.49	0.17
C & E Loss (ft)	0.11	Cum SA (acres)	0.05	0.50	0.22

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

E.G. Elev (ft)	2138.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.74	Wt. n-Val.	0.062	0.033	0.057
W.S. Elev (ft)	2137.34	Reach Len. (ft)	269.98	276.25	268.52
Crit W.S. (ft)	2137.34	Flow Area (sq ft)	4.04	50.00	52.94
E.G. Slope (ft/ft)	0.008845	Area (sq ft)	4.04	50.00	52.94
Q Total (cfs)	515.00	Flow (cfs)	4.69	391.80	118.51
Top Width (ft)	90.42	Top Width (ft)	10.92	18.87	60.63
Vel Total (ft/s)	4.81	Avg. Vel. (ft/s)	1.16	7.84	2.24
Max Chl Dpth (ft)	3.64	Hydr. Depth (ft)	0.37	2.65	0.87
Conv. Total (cfs)	5475.9	Conv. (cfs)	49.9	4165.9	1260.1
Length Wtd. (ft)	275.28	Wetted Per. (ft)	10.95	19.86	60.67
Min Ch El (ft)	2133.70	Shear (lb/sq ft)	0.20	1.39	0.48
Alpha	2.07	Stream Power (lb/ft s)	0.24	10.89	1.08
Frctn Loss (ft)	3.33	Cum Volume (acre-ft)	0.02	0.49	0.17
C & E Loss (ft)	0.11	Cum SA (acres)	0.05	0.50	0.22

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

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 OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2137.88	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.64	Wt. n-Val.	0.062	0.033	0.057
W.S. Elev (ft)	2137.24	Reach Len. (ft)	269.98	276.25	268.52
Crit W.S. (ft)	2137.24	Flow Area (sq ft)	3.03	48.12	47.03
E.G. Slope (ft/ft)	0.007837	Area (sq ft)	3.03	48.12	47.03
Q Total (cfs)	443.00	Flow (cfs)	3.01	345.98	94.01
Top Width (ft)	86.61	Top Width (ft)	9.45	18.87	58.29
Vel Total (ft/s)	4.51	Avg. Vel. (ft/s)	0.99	7.19	2.00
Max Chl Dpth (ft)	3.54	Hydr. Depth (ft)	0.32	2.55	0.81
Conv. Total (cfs)	5004.1	Conv. (cfs)	34.0	3908.2	1062.0
Length Wtd. (ft)	275.36	Wetted Per. (ft)	9.47	19.86	58.34
Min Ch El (ft)	2133.70	Shear (lb/sq ft)	0.16	1.19	0.39
Alpha	2.03	Stream Power (lb/ft s)	0.16	8.52	0.79
Frctn Loss (ft)	3.14	Cum Volume (acre-ft)	0.01	0.45	0.15
C & E Loss (ft)	0.09	Cum SA (acres)	0.04	0.50	0.21

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2137.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.56	Wt. n-Val.	0.062	0.033	0.057
W.S. Elev (ft)	2136.78	Reach Len. (ft)	269.98	276.25	268.52
Crit W.S. (ft)	2136.78	Flow Area (sq ft)	0.24	39.35	22.00
E.G. Slope (ft/ft)	0.007958	Area (sq ft)	0.24	39.35	22.00
Q Total (cfs)	279.00	Flow (cfs)	0.11	249.34	29.55
Top Width (ft)	71.53	Top Width (ft)	2.58	18.87	50.07
Vel Total (ft/s)	4.53	Avg. Vel. (ft/s)	0.44	6.34	1.34
Max Chl Dpth (ft)	3.08	Hydr. Depth (ft)	0.09	2.09	0.44
Conv. Total (cfs)	3127.5	Conv. (cfs)	1.2	2795.0	331.3
Length Wtd. (ft)	275.81	Wetted Per. (ft)	2.59	19.86	50.10
Min Ch El (ft)	2133.70	Shear (lb/sq ft)	0.05	0.98	0.22
Alpha	1.76	Stream Power (lb/ft s)	0.02	6.24	0.29
Frctn Loss (ft)	3.30	Cum Volume (acre-ft)	0.00	0.34	0.07
C & E Loss (ft)	0.09	Cum SA (acres)	0.02	0.50	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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNSET WASH
REACH: REACH #3 RS: 1.346

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2127.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.37	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2126.72	Reach Len. (ft)			
Crit W.S. (ft)	2126.72	Flow Area (sq ft)	1.93	103.38	3.12
E.G. Slope (ft/ft)	0.017535	Area (sq ft)	1.93	103.38	3.12
Q Total (cfs)	515.00	Flow (cfs)	3.62	506.74	4.64
Top Width (ft)	154.45	Top Width (ft)	4.72	138.70	11.02
Vel Total (ft/s)	4.75	Avg. Vel. (ft/s)	1.88	4.90	1.49
Max Chl Dpth (ft)	0.95	Hydr. Depth (ft)	0.41	0.75	0.28
Conv. Total (cfs)	3889.1	Conv. (cfs)	27.4	3826.8	35.0
Length Wtd. (ft)		Wetted Per. (ft)	4.79	138.71	11.04
Min Ch El (ft)	2125.77	Shear (lb/sq ft)	0.44	0.82	0.31
Alpha	1.05	Stream Power (lb/ft s)	0.83	4.00	0.46
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.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2127.08	Element		Left OB	Channel	Right OB
Vel Head (ft)	0.37	Wt. n-Val.		0.057	0.033	0.057
W.S. Elev (ft)	2126.72	Reach Len. (ft)				
Crit W.S. (ft)	2126.72	Flow Area (sq ft)		1.93	103.38	3.12
E.G. Slope (ft/ft)	0.017535	Area (sq ft)		1.93	103.38	3.12
Q Total (cfs)	515.00	Flow (cfs)		3.62	506.74	4.64
Top Width (ft)	154.45	Top Width (ft)		4.72	138.70	11.02
Vel Total (ft/s)	4.75	Avg. Vel. (ft/s)		1.88	4.90	1.49
Max Chl Dpth (ft)	0.95	Hydr. Depth (ft)		0.41	0.75	0.28
Conv. Total (cfs)	3889.1	Conv. (cfs)		27.4	3826.8	35.0
Length Wtd. (ft)		Wetted Per. (ft)		4.79	138.71	11.04
Min Ch El (ft)	2125.77	Shear (lb/sq ft)		0.44	0.82	0.31
Alpha	1.05	Stream Power (lb/ft s)		0.83	4.00	0.46
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.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2126.98	Element		Left OB	Channel	Right OB
Vel Head (ft)	0.33	Wt. n-Val.		0.057	0.033	0.057
W.S. Elev (ft)	2126.65	Reach Len. (ft)				
Crit W.S. (ft)	2126.65	Flow Area (sq ft)		1.61	93.70	2.40
E.G. Slope (ft/ft)	0.018083	Area (sq ft)		1.61	93.70	2.40
Q Total (cfs)	443.00	Flow (cfs)		2.90	436.79	3.31
Top Width (ft)	152.68	Top Width (ft)		4.32	138.70	9.66
Vel Total (ft/s)	4.53	Avg. Vel. (ft/s)		1.80	4.66	1.38
Max Chl Dpth (ft)	0.88	Hydr. Depth (ft)		0.37	0.68	0.25
Conv. Total (cfs)	3294.4	Conv. (cfs)		21.6	3248.2	24.6
Length Wtd. (ft)		Wetted Per. (ft)		4.38	138.71	9.68
Min Ch El (ft)	2125.77	Shear (lb/sq ft)		0.41	0.76	0.28
Alpha	1.04	Stream Power (lb/ft s)		0.75	3.55	0.39
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.

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2126.72	Element		Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.		0.057	0.033	0.057
W.S. Elev (ft)	2126.47	Reach Len. (ft)				
Crit W.S. (ft)	2126.47	Flow Area (sq ft)		0.94	69.15	0.99
E.G. Slope (ft/ft)	0.019943	Area (sq ft)		0.94	69.15	0.99
Q Total (cfs)	279.00	Flow (cfs)		1.48	276.45	1.07
Top Width (ft)	148.21	Top Width (ft)		3.29	138.70	6.22
Vel Total (ft/s)	3.93	Avg. Vel. (ft/s)		1.58	4.00	1.08
Max Chl Dpth (ft)	0.70	Hydr. Depth (ft)		0.28	0.50	0.16
Conv. Total (cfs)	1975.6	Conv. (cfs)		10.5	1957.6	7.6
Length Wtd. (ft)		Wetted Per. (ft)		3.34	138.71	6.22
Min Ch El (ft)	2125.77	Shear (lb/sq ft)		0.35	0.62	0.20
Alpha	1.03	Stream Power (lb/ft s)		0.55	2.48	0.21
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.

CROSS SECTION

RIVER: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.256

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2155.76	Element		Left OB	Channel	Right OB
Vel Head (ft)	0.55	Wt. n-Val.			0.030	0.057
W.S. Elev (ft)	2155.21	Reach Len. (ft)		201.37	201.18	200.68
Crit W.S. (ft)	2155.21	Flow Area (sq ft)			68.42	2.04
E.G. Slope (ft/ft)	0.013217	Area (sq ft)			68.42	2.04
Q Total (cfs)	412.00	Flow (cfs)			408.77	3.23
Top Width (ft)	67.45	Top Width (ft)			62.20	5.25
Vel Total (ft/s)	5.85	Avg. Vel. (ft/s)			5.97	1.59
Max Chl Dpth (ft)	3.88	Hydr. Depth (ft)			1.10	0.39
Conv. Total (cfs)	3583.7	Conv. (cfs)			3555.6	28.1
Length Wtd. (ft)	201.18	Wetted Per. (ft)			63.67	5.31
Min Ch El (ft)	2151.33	Shear (lb/sq ft)			0.89	0.32
Alpha	1.04	Stream Power (lb/ft s)			5.30	0.50
Frctn Loss (ft)	2.56	Cum Volume (acre-ft)			0.42	0.01
C & E Loss (ft)	0.01	Cum SA (acres)		0.09	1.75	0.10

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 OUTPUT  Profile #FLOODWAY
*************************************************************************************************
* E.G. Elev (ft)        * 2155.76  * Element                 *  Left OB *  Channel * Right OB *
* Vel Head (ft)         *    0.55  * Wt. n-Val.              *          *    0.030 *    0.057 *
* W.S. Elev (ft)        * 2155.21  * Reach Len. (ft)         *  201.37  *  201.18  *  200.68  *
* Crit W.S. (ft)        * 2155.21  * Flow Area (sq ft)       *          *   68.42  *    2.04  *
* E.G. Slope (ft/ft)    *0.013217  * Area (sq ft)            *          *   68.42  *    2.04  *
* Q Total (cfs)         *  412.00  * Flow (cfs)               *          *  408.77  *    3.23  *
* Top Width (ft)        *   67.45  * Top Width (ft)           *          *   62.20  *    5.25  *
* Vel Total (ft/s)      *    5.85  * Avg. Vel. (ft/s)         *          *    5.97  *    1.59  *
* Max Chl Dpth (ft)     *    3.88  * Hydr. Depth (ft)         *          *    1.10  *    0.39  *
* Conv. Total (cfs)     *  3583.7  * Conv. (cfs)              *          *  3555.6  *    28.1  *
* Length Wtd. (ft)      *  201.18  * Wetted Per. (ft)         *          *   63.67  *    5.31  *
* Min Ch El (ft)        * 2151.33  * Shear (lb/sq ft)         *          *    0.89  *    0.32  *
* Alpha                 *    1.04  * Stream Power (lb/ft s)   *          *    5.30  *    0.50  *
* Frctn Loss (ft)       *    2.56  * Cum Volume (acre-ft)     *          *    0.42  *    0.01  *
* C & E Loss (ft)       *    0.01  * Cum SA (acres)           *    0.09  *    1.75  *    0.10  *
*************************************************************************************************

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 OUTPUT  Profile #50-YEAR
*************************************************************************************************
* E.G. Elev (ft)        * 2155.59  * Element                 *  Left OB *  Channel * Right OB *
* Vel Head (ft)         *    0.50  * Wt. n-Val.              *          *    0.030 *    0.057 *
* W.S. Elev (ft)        * 2155.09  * Reach Len. (ft)         *  201.37  *  201.18  *  200.68  *
* Crit W.S. (ft)        * 2155.09  * Flow Area (sq ft)       *          *   61.03  *    1.46  *
* E.G. Slope (ft/ft)    *0.013723  * Area (sq ft)            *          *   61.03  *    1.46  *
* Q Total (cfs)         *  350.00  * Flow (cfs)               *          *  347.89  *    2.11  *
* Top Width (ft)        *   65.67  * Top Width (ft)           *          *   61.23  *    4.44  *
* Vel Total (ft/s)      *    5.60  * Avg. Vel. (ft/s)         *          *    5.70  *    1.45  *
* Max Chl Dpth (ft)     *    3.76  * Hydr. Depth (ft)         *          *    1.00  *    0.33  *
* Conv. Total (cfs)     *  2987.7  * Conv. (cfs)              *          *  2969.7  *    18.0  *
* Length Wtd. (ft)      *  201.18  * Wetted Per. (ft)         *          *   62.67  *    4.49  *
* Min Ch El (ft)        * 2151.33  * Shear (lb/sq ft)         *          *    0.83  *    0.28  *
* Alpha                 *    1.03  * Stream Power (lb/ft s)   *          *    4.76  *    0.40  *
* Frctn Loss (ft)       *    2.67  * Cum Volume (acre-ft)     *          *    0.38  *    0.01  *
* C & E Loss (ft)       *    0.01  * Cum SA (acres)           *    0.08  *    1.72  *    0.08  *
*************************************************************************************************

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: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
the
        need for additional cross sections.
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 OUTPUT  Profile #10-YEAR
*************************************************************************************************
* E.G. Elev (ft)        * 2155.18  * Element                 *  Left OB *  Channel * Right OB *
* Vel Head (ft)         *    0.41  * Wt. n-Val.              *          *    0.030 *    0.057 *
* W.S. Elev (ft)        * 2154.77  * Reach Len. (ft)         *  201.37  *  201.18  *  200.68  *
* Crit W.S. (ft)        * 2154.77  * Flow Area (sq ft)       *          *   42.61  *    0.39  *
* E.G. Slope (ft/ft)    *0.015331  * Area (sq ft)            *          *   42.61  *    0.39  *
* Q Total (cfs)         *  220.00  * Flow (cfs)               *          *  219.62  *    0.38  *
* Top Width (ft)        *   56.30  * Top Width (ft)           *          *   54.01  *    2.29  *
* Vel Total (ft/s)      *    5.12  * Avg. Vel. (ft/s)         *          *    5.15  *    0.98  *
* Max Chl Dpth (ft)     *    3.44  * Hydr. Depth (ft)         *          *    0.79  *    0.17  *
* Conv. Total (cfs)     *  1776.8  * Conv. (cfs)              *          *  1773.7  *     3.1  *
* Length Wtd. (ft)      *  201.18  * Wetted Per. (ft)         *          *   55.31  *    2.31  *
* Min Ch El (ft)        * 2151.33  * Shear (lb/sq ft)         *          *    0.74  *    0.16  *
* Alpha                 *    1.01  * Stream Power (lb/ft s)   *          *    3.80  *    0.16  *
* Frctn Loss (ft)       *    2.98  * Cum Volume (acre-ft)     *          *    0.27  *    0.00  *
* C & E Loss (ft)       *    0.01  * Cum SA (acres)           *    0.02  *    1.49  *    0.03  *
*************************************************************************************************

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: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
the
        need for additional cross sections.
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
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RIVER: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.218

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2151.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.59	Wt. n-Val.		0.030	0.064
W.S. Elev (ft)	2150.82	Reach Len. (ft)	43.05	43.12	43.30
Crit W.S. (ft)	2150.82	Flow Area (sq ft)		66.19	2.17
E.G. Slope (ft/ft)	0.012226	Area (sq ft)		66.19	2.17
Q Total (cfs)	412.00	Flow (cfs)		409.73	2.27
Top Width (ft)	62.74	Top Width (ft)		54.41	8.33
Vel Total (ft/s)	6.03	Avg. Vel. (ft/s)		6.19	1.05
Max Chl Dpth (ft)	1.56	Hydr. Depth (ft)		1.22	0.26
Conv. Total (cfs)	3726.2	Conv. (cfs)		3705.7	20.5
Length Wtd. (ft)	43.12	Wetted Per. (ft)		55.09	8.35
Min Ch El (ft)	2149.26	Shear (lb/sq ft)		0.92	0.20
Alpha	1.05	Stream Power (lb/ft s)		5.68	0.21
Frctn Loss (ft)		Cum Volume (acre-ft)		0.11	
C & E Loss (ft)		Cum SA (acres)	0.09	1.48	0.07

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2151.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.59	Wt. n-Val.		0.030	0.064
W.S. Elev (ft)	2150.82	Reach Len. (ft)	43.05	43.12	43.30
Crit W.S. (ft)	2150.82	Flow Area (sq ft)		66.19	2.17
E.G. Slope (ft/ft)	0.012226	Area (sq ft)		66.19	2.17
Q Total (cfs)	412.00	Flow (cfs)		409.73	2.27
Top Width (ft)	62.74	Top Width (ft)		54.41	8.33
Vel Total (ft/s)	6.03	Avg. Vel. (ft/s)		6.19	1.05
Max Chl Dpth (ft)	1.56	Hydr. Depth (ft)		1.22	0.26
Conv. Total (cfs)	3726.2	Conv. (cfs)		3705.7	20.5
Length Wtd. (ft)	43.12	Wetted Per. (ft)		55.09	8.35
Min Ch El (ft)	2149.26	Shear (lb/sq ft)		0.92	0.20
Alpha	1.05	Stream Power (lb/ft s)		5.68	0.21
Frctn Loss (ft)		Cum Volume (acre-ft)		0.11	
C & E Loss (ft)		Cum SA (acres)	0.09	1.48	0.07

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2151.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.55	Wt. n-Val.		0.030	0.064
W.S. Elev (ft)	2150.68	Reach Len. (ft)	43.05	43.12	43.30
Crit W.S. (ft)	2150.68	Flow Area (sq ft)		58.57	1.17
E.G. Slope (ft/ft)	0.012831	Area (sq ft)		58.57	1.17
Q Total (cfs)	350.00	Flow (cfs)		348.95	1.05
Top Width (ft)	58.73	Top Width (ft)		52.91	5.82
Vel Total (ft/s)	5.86	Avg. Vel. (ft/s)		5.96	0.90
Max Chl Dpth (ft)	1.42	Hydr. Depth (ft)		1.11	0.20
Conv. Total (cfs)	3089.8	Conv. (cfs)		3080.6	9.2
Length Wtd. (ft)	43.12	Wetted Per. (ft)		53.52	5.84
Min Ch El (ft)	2149.26	Shear (lb/sq ft)		0.88	0.16
Alpha	1.03	Stream Power (lb/ft s)		5.22	0.14
Frctn Loss (ft)		Cum Volume (acre-ft)		0.10	
C & E Loss (ft)		Cum SA (acres)	0.08	1.46	0.05

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2150.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.43	Wt. n-Val.		0.030	0.064
W.S. Elev (ft)	2150.35	Reach Len. (ft)	43.05	43.12	43.30
Crit W.S. (ft)	2150.35	Flow Area (sq ft)		41.75	0.07
E.G. Slope (ft/ft)	0.014344	Area (sq ft)		41.75	0.07
Q Total (cfs)	220.00	Flow (cfs)		219.97	0.03
Top Width (ft)	50.69	Top Width (ft)		49.40	1.30
Vel Total (ft/s)	5.26	Avg. Vel. (ft/s)		5.27	0.41
Max Chl Dpth (ft)	1.09	Hydr. Depth (ft)		0.85	0.06
Conv. Total (cfs)	1836.9	Conv. (cfs)		1836.7	0.2
Length Wtd. (ft)	43.12	Wetted Per. (ft)		49.87	1.30
Min Ch El (ft)	2149.26	Shear (lb/sq ft)		0.75	0.05
Alpha	1.00	Stream Power (lb/ft s)		3.95	0.02
Frctn Loss (ft)		Cum Volume (acre-ft)		0.07	
C & E Loss (ft)		Cum SA (acres)	0.02	1.25	0.03

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION

RIVER: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.209

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2151.02	Element	Left OB	Channel	Right OB

Vel Head (ft)	0.58	Wt. n-Val.	0.064	0.030	0.064
W.S. Elev (ft)	2150.45	Reach Len. (ft)	165.84	169.01	176.85
Crit W.S. (ft)	2150.45	Flow Area (sq ft)	3.96	65.04	4.85
E.G. Slope (ft/ft)	0.010822	Area (sq ft)	3.96	65.04	4.85
Q Total (cfs)	412.00	Flow (cfs)	4.12	401.12	6.76
Top Width (ft)	74.52	Top Width (ft)	13.90	49.60	11.01
Vel Total (ft/s)	5.58	Avg. Vel. (ft/s)	1.04	6.17	1.40
Max Chl Dpth (ft)	1.55	Hydr. Depth (ft)	0.28	1.31	0.44
Conv. Total (cfs)	3960.4	Conv. (cfs)	39.6	3855.8	65.0
Length Wtd. (ft)	169.02	Wetted Per. (ft)	13.99	49.66	11.05
Min Ch El (ft)	2148.89	Shear (lb/sq ft)	0.19	0.88	0.30
Alpha	1.19	Stream Power (lb/ft s)	0.20	5.46	0.41
Frctn Loss (ft)	2.00	Cum Volume (acre-ft)	0.03	0.48	0.01
C & E Loss (ft)	0.01	Cum SA (acres)	0.09	1.43	0.06

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 OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2151.02	Element			
Vel Head (ft)	0.58	Wt. n-Val.	0.064	0.030	0.064
W.S. Elev (ft)	2150.45	Reach Len. (ft)	165.84	169.01	176.85
Crit W.S. (ft)	2150.45	Flow Area (sq ft)	3.96	65.04	4.85
E.G. Slope (ft/ft)	0.010822	Area (sq ft)	3.96	65.04	4.85
Q Total (cfs)	412.00	Flow (cfs)	4.12	401.12	6.76
Top Width (ft)	74.52	Top Width (ft)	13.90	49.60	11.01
Vel Total (ft/s)	5.58	Avg. Vel. (ft/s)	1.04	6.17	1.40
Max Chl Dpth (ft)	1.55	Hydr. Depth (ft)	0.28	1.31	0.44
Conv. Total (cfs)	3960.4	Conv. (cfs)	39.6	3855.8	65.0
Length Wtd. (ft)	169.02	Wetted Per. (ft)	13.99	49.66	11.05
Min Ch El (ft)	2148.89	Shear (lb/sq ft)	0.19	0.88	0.30
Alpha	1.19	Stream Power (lb/ft s)	0.20	5.46	0.41
Frctn Loss (ft)	2.00	Cum Volume (acre-ft)	0.03	0.48	0.01
C & E Loss (ft)	0.01	Cum SA (acres)	0.09	1.43	0.06

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 OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2150.84	Element			
Vel Head (ft)	0.54	Wt. n-Val.	0.064	0.030	0.064
W.S. Elev (ft)	2150.30	Reach Len. (ft)	165.84	169.01	176.85
Crit W.S. (ft)	2150.30	Flow Area (sq ft)	2.04	58.00	3.41
E.G. Slope (ft/ft)	0.011663	Area (sq ft)	2.04	58.00	3.41
Q Total (cfs)	350.00	Flow (cfs)	1.55	344.07	4.38
Top Width (ft)	71.07	Top Width (ft)	12.19	49.60	9.28
Vel Total (ft/s)	5.52	Avg. Vel. (ft/s)	0.76	5.93	1.28
Max Chl Dpth (ft)	1.41	Hydr. Depth (ft)	0.17	1.17	0.37
Conv. Total (cfs)	3240.9	Conv. (cfs)	14.4	3186.0	40.5
Length Wtd. (ft)	169.02	Wetted Per. (ft)	12.26	49.66	9.31
Min Ch El (ft)	2148.89	Shear (lb/sq ft)	0.12	0.85	0.27
Alpha	1.14	Stream Power (lb/ft s)	0.09	5.04	0.34
Frctn Loss (ft)	2.12	Cum Volume (acre-ft)	0.02	0.42	0.01
C & E Loss (ft)	0.00	Cum SA (acres)	0.07	1.41	0.05

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: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2150.40	Element			
Vel Head (ft)	0.42	Wt. n-Val.	0.064	0.030	0.064
W.S. Elev (ft)	2149.98	Reach Len. (ft)	165.84	169.01	176.85
Crit W.S. (ft)	2149.98	Flow Area (sq ft)	0.01	42.13	1.08
E.G. Slope (ft/ft)	0.013717	Area (sq ft)	0.01	42.13	1.08
Q Total (cfs)	220.00	Flow (cfs)	0.00	218.97	1.02
Top Width (ft)	55.30	Top Width (ft)	0.46	49.60	5.24
Vel Total (ft/s)	5.09	Avg. Vel. (ft/s)	0.21	5.20	0.95
Max Chl Dpth (ft)	1.09	Hydr. Depth (ft)	0.02	0.85	0.21
Conv. Total (cfs)	1878.5	Conv. (cfs)	0.0	1869.7	8.8
Length Wtd. (ft)	169.03	Wetted Per. (ft)	0.46	49.66	5.26

* Min Ch El (ft)	* 2148.89	* Shear (lb/sq ft)	* 0.02	* 0.73	* 0.18	*
* Alpha	* 1.04	* Stream Power (lb/ft s)	* 0.00	* 3.78	* 0.17	*
* Frctn Loss (ft)	* 2.29	* Cum Volume (acre-ft)	* 0.00	* 0.28	* 0.00	*
* C & E Loss (ft)	* 0.06	* Cum SA (acres)	* 0.02	* 1.20	* 0.02	*

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: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.177

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	* 2147.41	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.61	* Wt. n-Val.	* 0.064	* 0.030	* 0.057 *
* W.S. Elev (ft)	* 2146.80	* Reach Len. (ft)	* 97.07	* 98.08	* 101.23 *
* Crit W.S. (ft)	* 2146.80	* Flow Area (sq ft)	* 6.16	* 63.58	* 0.01 *
* E.G. Slope (ft/ft)	*0.013028	* Area (sq ft)	* 6.16	* 63.58	* 0.01 *
* Q Total (cfs)	* 412.00	* Flow (cfs)	* 10.27	* 401.72	* 0.00 *
* Top Width (ft)	* 64.98	* Top Width (ft)	* 12.30	* 52.33	* 0.36 *
* Vel Total (ft/s)	* 5.91	* Avg. Vel. (ft/s)	* 1.67	* 6.32	* 0.32 *
* Max Chl Dpth (ft)	* 4.32	* Hydr. Depth (ft)	* 0.50	* 1.22	* 0.04 *
* Conv. Total (cfs)	* 3609.5	* Conv. (cfs)	* 90.0	* 3519.5	* 0.0 *
* Length Wtd. (ft)	* 98.07	* Wetted Per. (ft)	* 12.34	* 53.82	* 0.36 *
* Min Ch El (ft)	* 2142.48	* Shear (lb/sq ft)	* 0.41	* 0.96	* 0.03 *
* Alpha	* 1.12	* Stream Power (lb/ft s)	* 0.68	* 6.07	* 0.01 *
* Frctn Loss (ft)	* 1.13	* Cum Volume (acre-ft)	* 0.01	* 0.23	* 0.00 *
* C & E Loss (ft)	* 0.06	* Cum SA (acres)	* 0.04	* 1.23	* 0.04 *

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 OUTPUT Profile #FLOODWAY

* E.G. Elev (ft)	* 2147.41	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.61	* Wt. n-Val.	* 0.064	* 0.030	* 0.057 *
* W.S. Elev (ft)	* 2146.80	* Reach Len. (ft)	* 97.07	* 98.08	* 101.23 *
* Crit W.S. (ft)	* 2146.80	* Flow Area (sq ft)	* 6.16	* 63.58	* 0.01 *
* E.G. Slope (ft/ft)	*0.013028	* Area (sq ft)	* 6.16	* 63.58	* 0.01 *
* Q Total (cfs)	* 412.00	* Flow (cfs)	* 10.27	* 401.72	* 0.00 *
* Top Width (ft)	* 64.98	* Top Width (ft)	* 12.30	* 52.33	* 0.36 *
* Vel Total (ft/s)	* 5.91	* Avg. Vel. (ft/s)	* 1.67	* 6.32	* 0.32 *
* Max Chl Dpth (ft)	* 4.32	* Hydr. Depth (ft)	* 0.50	* 1.22	* 0.04 *
* Conv. Total (cfs)	* 3609.5	* Conv. (cfs)	* 90.0	* 3519.5	* 0.0 *
* Length Wtd. (ft)	* 98.07	* Wetted Per. (ft)	* 12.34	* 53.82	* 0.36 *
* Min Ch El (ft)	* 2142.48	* Shear (lb/sq ft)	* 0.41	* 0.96	* 0.03 *
* Alpha	* 1.12	* Stream Power (lb/ft s)	* 0.68	* 6.07	* 0.01 *
* Frctn Loss (ft)	* 1.13	* Cum Volume (acre-ft)	* 0.01	* 0.23	* 0.00 *
* C & E Loss (ft)	* 0.06	* Cum SA (acres)	* 0.04	* 1.23	* 0.04 *

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 OUTPUT Profile #50-YEAR

* E.G. Elev (ft)	* 2147.23	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.55	* Wt. n-Val.	* 0.064	* 0.030	* *
* W.S. Elev (ft)	* 2146.68	* Reach Len. (ft)	* 97.07	* 98.08	* 101.23 *
* Crit W.S. (ft)	* 2146.68	* Flow Area (sq ft)	* 4.72	* 57.08	* *
* E.G. Slope (ft/ft)	*0.013495	* Area (sq ft)	* 4.72	* 57.08	* *
* Q Total (cfs)	* 350.00	* Flow (cfs)	* 7.33	* 342.67	* *
* Top Width (ft)	* 62.85	* Top Width (ft)	* 10.79	* 52.06	* *
* Vel Total (ft/s)	* 5.66	* Avg. Vel. (ft/s)	* 1.55	* 6.00	* *
* Max Chl Dpth (ft)	* 4.20	* Hydr. Depth (ft)	* 0.44	* 1.10	* *
* Conv. Total (cfs)	* 3012.8	* Conv. (cfs)	* 63.1	* 2949.8	* *
* Length Wtd. (ft)	* 98.07	* Wetted Per. (ft)	* 10.82	* 53.55	* *
* Min Ch El (ft)	* 2142.48	* Shear (lb/sq ft)	* 0.37	* 0.90	* *
* Alpha	* 1.10	* Stream Power (lb/ft s)	* 0.57	* 5.39	* *
* Frctn Loss (ft)	* 1.33	* Cum Volume (acre-ft)	* 0.01	* 0.20	* *
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 0.03	* 1.21	* 0.03 *

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2146.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.61	Wt. n-Val.	0.064	0.030	
W.S. Elev (ft)	2146.12	Reach Len. (ft)	97.07	98.08	101.23
Crit W.S. (ft)	2146.12	Flow Area (sq ft)	0.58	35.02	
E.G. Slope (ft/ft)	0.013376	Area (sq ft)	0.58	35.02	
Q Total (cfs)	220.00	Flow (cfs)	0.43	219.57	
Top Width (ft)	33.04	Top Width (ft)	3.90	29.14	
Vel Total (ft/s)	6.18	Avg. Vel. (ft/s)	0.75	6.27	
Max Chl Dpth (ft)	3.64	Hydr. Depth (ft)	0.15	1.20	
Conv. Total (cfs)	1902.2	Conv. (cfs)	3.7	1898.4	
Length Wtd. (ft)	98.08	Wetted Per. (ft)	3.91	30.59	
Min Ch El (ft)	2142.48	Shear (lb/sq ft)	0.12	0.96	
Alpha	1.03	Stream Power (lb/ft s)	0.09	5.99	
Frctn Loss (ft)	1.35	Cum Volume (acre-ft)	0.00	0.13	
C & E Loss (ft)	0.09	Cum SA (acres)	0.01	1.05	0.01

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: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.159

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2144.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.49	Wt. n-Val.		0.030	
W.S. Elev (ft)	2144.44	Reach Len. (ft)	33.51	33.72	34.48
Crit W.S. (ft)	2144.35	Flow Area (sq ft)		73.45	
E.G. Slope (ft/ft)	0.010275	Area (sq ft)		73.45	
Q Total (cfs)	412.00	Flow (cfs)		412.00	
Top Width (ft)	61.26	Top Width (ft)		61.26	
Vel Total (ft/s)	5.61	Avg. Vel. (ft/s)		5.61	
Max Chl Dpth (ft)	3.73	Hydr. Depth (ft)		1.20	
Conv. Total (cfs)	4064.5	Conv. (cfs)		4064.5	
Length Wtd. (ft)	33.72	Wetted Per. (ft)		62.19	
Min Ch El (ft)	2140.71	Shear (lb/sq ft)		0.76	
Alpha	1.00	Stream Power (lb/ft s)		4.25	
Frctn Loss (ft)		Cum Volume (acre-ft)		0.08	
C & E Loss (ft)		Cum SA (acres)	0.02	1.10	0.03

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2144.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.49	Wt. n-Val.		0.030	
W.S. Elev (ft)	2144.44	Reach Len. (ft)	33.51	33.72	34.48
Crit W.S. (ft)	2144.35	Flow Area (sq ft)		73.45	
E.G. Slope (ft/ft)	0.010275	Area (sq ft)		73.45	
Q Total (cfs)	412.00	Flow (cfs)		412.00	
Top Width (ft)	61.26	Top Width (ft)		61.26	
Vel Total (ft/s)	5.61	Avg. Vel. (ft/s)		5.61	
Max Chl Dpth (ft)	3.73	Hydr. Depth (ft)		1.20	
Conv. Total (cfs)	4064.5	Conv. (cfs)		4064.5	
Length Wtd. (ft)	33.72	Wetted Per. (ft)		62.19	
Min Ch El (ft)	2140.71	Shear (lb/sq ft)		0.76	
Alpha	1.00	Stream Power (lb/ft s)		4.25	
Frctn Loss (ft)		Cum Volume (acre-ft)		0.08	
C & E Loss (ft)		Cum SA (acres)	0.02	1.10	0.03

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2144.75	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.53	Wt. n-Val.		0.030	
W.S. Elev (ft)	2144.21	Reach Len. (ft)	33.51	33.72	34.48
Crit W.S. (ft)	2144.21	Flow Area (sq ft)		59.86	
E.G. Slope (ft/ft)	0.013659	Area (sq ft)		59.86	
Q Total (cfs)	350.00	Flow (cfs)		350.00	
Top Width (ft)	58.06	Top Width (ft)		58.06	
Vel Total (ft/s)	5.85	Avg. Vel. (ft/s)		5.85	
Max Chl Dpth (ft)	3.50	Hydr. Depth (ft)		1.03	
Conv. Total (cfs)	2994.7	Conv. (cfs)		2994.7	

Length Wtd. (ft)	33.72	Wetted Per. (ft)		58.96		
Min Ch El (ft)	2140.71	Shear (lb/sq ft)		0.87		
Alpha	1.00	Stream Power (lb/ft s)		5.06		
Frctn Loss (ft)		Cum Volume (acre-ft)		0.07		
C & E Loss (ft)		Cum SA (acres)	0.02	1.09	0.03	

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2144.32	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.42	Wt. n-Val.		0.030		
W.S. Elev (ft)	2143.90	Reach Len. (ft)	33.51	33.72	34.48	
Crit W.S. (ft)	2143.90	Flow Area (sq ft)		42.16		
E.G. Slope (ft/ft)	0.014163	Area (sq ft)		42.16		
Q Total (cfs)	220.00	Flow (cfs)		220.00		
Top Width (ft)	49.77	Top Width (ft)		49.77		
Vel Total (ft/s)	5.22	Avg. Vel. (ft/s)		5.22		
Max Chl Dpth (ft)	3.18	Hydr. Depth (ft)		0.85		
Conv. Total (cfs)	1848.6	Conv. (cfs)		1848.6		
Length Wtd. (ft)	33.72	Wetted Per. (ft)		50.62		
Min Ch El (ft)	2140.71	Shear (lb/sq ft)		0.74		
Alpha	1.00	Stream Power (lb/ft s)		3.84		
Frctn Loss (ft)		Cum Volume (acre-ft)		0.05		
C & E Loss (ft)		Cum SA (acres)	0.01	0.96	0.01	

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION

RIVER: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.152

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2144.14	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.57	Wt. n-Val.		0.030	0.057	
W.S. Elev (ft)	2143.58	Reach Len. (ft)	45.98	40.80	21.30	
Crit W.S. (ft)	2143.58	Flow Area (sq ft)		68.19	0.23	
E.G. Slope (ft/ft)	0.013163	Area (sq ft)		68.19	0.23	
Q Total (cfs)	412.00	Flow (cfs)		411.79	0.21	
Top Width (ft)	62.81	Top Width (ft)		61.55	1.26	
Vel Total (ft/s)	6.02	Avg. Vel. (ft/s)		6.04	0.93	
Max Chl Dpth (ft)	3.17	Hydr. Depth (ft)		1.11	0.18	
Conv. Total (cfs)	3591.0	Conv. (cfs)		3589.2	1.8	
Length Wtd. (ft)	40.75	Wetted Per. (ft)		62.25	1.31	
Min Ch El (ft)	2140.41	Shear (lb/sq ft)		0.90	0.14	
Alpha	1.01	Stream Power (lb/ft s)		5.44	0.13	
Frctn Loss (ft)	0.53	Cum Volume (acre-ft)	0.00	0.21	0.00	
C & E Loss (ft)	0.01	Cum SA (acres)	0.02	1.05	0.03	

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: 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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2144.14	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.57	Wt. n-Val.		0.030	0.057	
W.S. Elev (ft)	2143.58	Reach Len. (ft)	45.98	40.80	21.30	
Crit W.S. (ft)	2143.58	Flow Area (sq ft)		68.19	0.23	
E.G. Slope (ft/ft)	0.013163	Area (sq ft)		68.19	0.23	
Q Total (cfs)	412.00	Flow (cfs)		411.79	0.21	
Top Width (ft)	62.81	Top Width (ft)		61.55	1.26	
Vel Total (ft/s)	6.02	Avg. Vel. (ft/s)		6.04	0.93	
Max Chl Dpth (ft)	3.17	Hydr. Depth (ft)		1.11	0.18	
Conv. Total (cfs)	3591.0	Conv. (cfs)		3589.2	1.8	
Length Wtd. (ft)	40.75	Wetted Per. (ft)		62.25	1.31	
Min Ch El (ft)	2140.41	Shear (lb/sq ft)		0.90	0.14	
Alpha	1.01	Stream Power (lb/ft s)		5.44	0.13	
Frctn Loss (ft)	0.53	Cum Volume (acre-ft)	0.00	0.21	0.00	
C & E Loss (ft)	0.01	Cum SA (acres)	0.02	1.05	0.03	

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: 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 OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2143.97	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.50	Wt. n-Val.		0.030	0.057	
W.S. Elev (ft)	2143.47	Reach Len. (ft)	45.98	40.80	21.30	
Crit W.S. (ft)	2143.47	Flow Area (sq ft)		61.42	0.11	
E.G. Slope (ft/ft)	0.013380	Area (sq ft)		61.42	0.11	
Q Total (cfs)	350.00	Flow (cfs)		349.92	0.08	
Top Width (ft)	62.12	Top Width (ft)		61.25	0.87	

Vel Total (ft/s)	5.69	Avg. Vel. (ft/s)			5.70		0.73
Max Chl Dpth (ft)	3.06	Hydr. Depth (ft)			1.00		0.12
Conv. Total (cfs)	3025.8	Conv. (cfs)			3025.2		0.7
Length Wtd. (ft)	40.77	Wetted Per. (ft)			61.93		0.91
Min Ch El (ft)	2140.41	Shear (lb/sq ft)			0.83		0.10
Alpha	1.00	Stream Power (lb/ft s)			4.72		0.07
Frctn Loss (ft)	0.54	Cum Volume (acre-ft)		0.00	0.18		0.00
C & E Loss (ft)	0.01	Cum SA (acres)		0.02	1.04		0.03

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: 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 OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2143.57	Element			
Vel Head (ft)	0.39	Wt. n-Val.		0.030	
W.S. Elev (ft)	2143.18	Reach Len. (ft)	45.98	40.80	21.30
Crit W.S. (ft)	2143.17	Flow Area (sq ft)		43.75	
E.G. Slope (ft/ft)	0.015365	Area (sq ft)		43.75	
Q Total (cfs)	220.00	Flow (cfs)		220.00	
Top Width (ft)	58.40	Top Width (ft)		58.40	
Vel Total (ft/s)	5.03	Avg. Vel. (ft/s)		5.03	
Max Chl Dpth (ft)	2.77	Hydr. Depth (ft)		0.75	
Conv. Total (cfs)	1774.8	Conv. (cfs)		1774.8	
Length Wtd. (ft)	40.80	Wetted Per. (ft)		59.04	
Min Ch El (ft)	2140.41	Shear (lb/sq ft)		0.71	
Alpha	1.00	Stream Power (lb/ft s)		3.57	
Frctn Loss (ft)	0.62	Cum Volume (acre-ft)	0.00	0.13	
C & E Loss (ft)	0.01	Cum SA (acres)	0.01	0.92	0.01

CROSS SECTION

RIVER: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.145

CROSS SECTION OUTPUT Profile #FLOODPLAIN

			Left OB	Channel	Right OB
E.G. Elev (ft)	2143.55	Element			
Vel Head (ft)	0.60	Wt. n-Val.		0.030	0.057
W.S. Elev (ft)	2142.95	Reach Len. (ft)	38.52	35.07	22.34
Crit W.S. (ft)	2142.94	Flow Area (sq ft)		65.85	1.47
E.G. Slope (ft/ft)	0.012693	Area (sq ft)		65.85	1.47
Q Total (cfs)	412.00	Flow (cfs)		409.99	2.01
Top Width (ft)	59.36	Top Width (ft)		54.82	4.54
Vel Total (ft/s)	6.12	Avg. Vel. (ft/s)		6.23	1.37
Max Chl Dpth (ft)	3.40	Hydr. Depth (ft)		1.20	0.32
Conv. Total (cfs)	3657.0	Conv. (cfs)		3639.1	17.9
Length Wtd. (ft)	35.04	Wetted Per. (ft)		55.88	4.59
Min Ch El (ft)	2139.55	Shear (lb/sq ft)		0.93	0.25
Alpha	1.03	Stream Power (lb/ft s)		5.81	0.35
Frctn Loss (ft)	0.26	Cum Volume (acre-ft)	0.00	0.14	0.00
C & E Loss (ft)	0.14	Cum SA (acres)	0.02	1.00	0.03

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2143.55	Element			
Vel Head (ft)	0.60	Wt. n-Val.		0.030	0.057
W.S. Elev (ft)	2142.95	Reach Len. (ft)	38.52	35.07	22.34
Crit W.S. (ft)	2142.94	Flow Area (sq ft)		65.85	1.47
E.G. Slope (ft/ft)	0.012693	Area (sq ft)		65.85	1.47
Q Total (cfs)	412.00	Flow (cfs)		409.99	2.01
Top Width (ft)	59.36	Top Width (ft)		54.82	4.54
Vel Total (ft/s)	6.12	Avg. Vel. (ft/s)		6.23	1.37
Max Chl Dpth (ft)	3.40	Hydr. Depth (ft)		1.20	0.32
Conv. Total (cfs)	3657.0	Conv. (cfs)		3639.1	17.9
Length Wtd. (ft)	35.04	Wetted Per. (ft)		55.88	4.59
Min Ch El (ft)	2139.55	Shear (lb/sq ft)		0.93	0.25
Alpha	1.03	Stream Power (lb/ft s)		5.81	0.35
Frctn Loss (ft)	0.26	Cum Volume (acre-ft)	0.00	0.14	0.00
C & E Loss (ft)	0.14	Cum SA (acres)	0.02	1.00	0.03

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2143.37	Element			
Vel Head (ft)	0.54	Wt. n-Val.		0.030	0.057
W.S. Elev (ft)	2142.83	Reach Len. (ft)	38.52	35.07	22.34
Crit W.S. (ft)	2142.83	Flow Area (sq ft)		59.19	0.94
E.G. Slope (ft/ft)	0.013039	Area (sq ft)		59.19	0.94
Q Total (cfs)	350.00	Flow (cfs)		348.94	1.06
Top Width (ft)	58.64	Top Width (ft)		54.59	4.06
Vel Total (ft/s)	5.82	Avg. Vel. (ft/s)		5.90	1.12
Max Chl Dpth (ft)	3.28	Hydr. Depth (ft)		1.08	0.23

Conv. Total (cfs)	3065.1	Conv. (cfs)			3055.8		9.3
Length Wtd. (ft)	35.05	Wetted Per. (ft)			55.61		4.09
Min Ch El (ft)	2139.55	Shear (lb/sq ft)			0.87		0.19
Alpha	1.02	Stream Power (lb/ft s)			5.11		0.21
Frctn Loss (ft)	0.29	Cum Volume (acre-ft)		0.00	0.13		0.00
C & E Loss (ft)	0.12	Cum SA (acres)		0.02	0.99		0.02

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: 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 OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2142.94	Element			
Vel Head (ft)	0.41	Wt. n-Val.		0.030	
W.S. Elev (ft)	2142.53	Reach Len. (ft)	38.52	35.07	22.34
Crit W.S. (ft)	2142.53	Flow Area (sq ft)		42.71	
E.G. Slope (ft/ft)	0.015127	Area (sq ft)		42.71	
Q Total (cfs)	220.00	Flow (cfs)		220.00	
Top Width (ft)	53.98	Top Width (ft)		53.98	
Vel Total (ft/s)	5.15	Avg. Vel. (ft/s)		5.15	
Max Chl Dpth (ft)	2.98	Hydr. Depth (ft)		0.79	
Conv. Total (cfs)	1788.7	Conv. (cfs)		1788.7	
Length Wtd. (ft)	35.07	Wetted Per. (ft)		54.93	
Min Ch El (ft)	2139.55	Shear (lb/sq ft)		0.73	
Alpha	1.00	Stream Power (lb/ft s)		3.78	
Frctn Loss (ft)	0.34	Cum Volume (acre-ft)	0.00	0.09	
C & E Loss (ft)	0.09	Cum SA (acres)	0.01	0.86	0.01

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: 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: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.138

CROSS SECTION OUTPUT Profile #FLOODPLAIN

			Left OB	Channel	Right OB
E.G. Elev (ft)	2143.15	Element			
Vel Head (ft)	0.32	Wt. n-Val.	0.064	0.030	0.057
W.S. Elev (ft)	2142.83	Reach Len. (ft)	32.04	32.07	32.29
Crit W.S. (ft)	2142.44	Flow Area (sq ft)	2.84	89.87	0.42
E.G. Slope (ft/ft)	0.004996	Area (sq ft)	2.84	89.87	0.42
Q Total (cfs)	412.00	Flow (cfs)	2.39	409.30	0.31
Top Width (ft)	68.93	Top Width (ft)	7.70	59.64	1.59
Vel Total (ft/s)	4.42	Avg. Vel. (ft/s)	0.84	4.55	0.74
Max Chl Dpth (ft)	3.74	Hydr. Depth (ft)	0.37	1.51	0.27
Conv. Total (cfs)	5829.1	Conv. (cfs)	33.8	5790.9	4.4
Length Wtd. (ft)	32.07	Wetted Per. (ft)	7.73	60.57	1.68
Min Ch El (ft)	2139.09	Shear (lb/sq ft)	0.11	0.46	0.08
Alpha	1.05	Stream Power (lb/ft s)	0.10	2.11	0.06
Frctn Loss (ft)		Cum Volume (acre-ft)		0.08	
C & E Loss (ft)		Cum SA (acres)	0.02	0.95	0.03

CROSS SECTION OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2143.15	Element			
Vel Head (ft)	0.32	Wt. n-Val.	0.064	0.030	0.057
W.S. Elev (ft)	2142.83	Reach Len. (ft)	32.04	32.07	32.29
Crit W.S. (ft)	2142.44	Flow Area (sq ft)	2.84	89.87	0.42
E.G. Slope (ft/ft)	0.004996	Area (sq ft)	2.84	89.87	0.42
Q Total (cfs)	412.00	Flow (cfs)	2.39	409.30	0.31
Top Width (ft)	68.93	Top Width (ft)	7.70	59.64	1.59
Vel Total (ft/s)	4.42	Avg. Vel. (ft/s)	0.84	4.55	0.74
Max Chl Dpth (ft)	3.74	Hydr. Depth (ft)	0.37	1.51	0.27
Conv. Total (cfs)	5829.1	Conv. (cfs)	33.8	5790.9	4.4
Length Wtd. (ft)	32.07	Wetted Per. (ft)	7.73	60.57	1.68
Min Ch El (ft)	2139.09	Shear (lb/sq ft)	0.11	0.46	0.08
Alpha	1.05	Stream Power (lb/ft s)	0.10	2.11	0.06
Frctn Loss (ft)		Cum Volume (acre-ft)		0.08	
C & E Loss (ft)		Cum SA (acres)	0.02	0.95	0.03

CROSS SECTION OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2142.94	Element			
Vel Head (ft)	0.31	Wt. n-Val.	0.064	0.030	0.057
W.S. Elev (ft)	2142.64	Reach Len. (ft)	32.04	32.07	32.29
Crit W.S. (ft)	2142.34	Flow Area (sq ft)	1.55	78.37	0.17
E.G. Slope (ft/ft)	0.005726	Area (sq ft)	1.55	78.37	0.17
Q Total (cfs)	350.00	Flow (cfs)	1.14	348.76	0.10

Top Width (ft)	66.34	Top Width (ft)	5.68	59.64	1.02
Vel Total (ft/s)	4.37	Avg. Vel. (ft/s)	0.74	4.45	0.58
Max Chl Dpth (ft)	3.55	Hydr. Depth (ft)	0.27	1.31	0.17
Conv. Total (cfs)	4625.5	Conv. (cfs)	15.1	4609.1	1.3
Length Wtd. (ft)	32.07	Wetted Per. (ft)	5.71	60.57	1.07
Min Ch El (ft)	2139.09	Shear (lb/sq ft)	0.10	0.46	0.06
Alpha	1.03	Stream Power (lb/ft s)	0.07	2.06	0.03
Frctn Loss (ft)		Cum Volume (acre-ft)		0.07	
C & E Loss (ft)		Cum SA (acres)	0.02	0.94	0.02

CROSS SECTION OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2142.51	Element			
Vel Head (ft)	0.23	Wt. n-Val.	0.064	0.030	
W.S. Elev (ft)	2142.27	Reach Len. (ft)	32.04	32.07	32.29
Crit W.S. (ft)	2142.04	Flow Area (sq ft)	0.17	56.64	
E.G. Slope (ft/ft)	0.006654	Area (sq ft)	0.17	56.64	
Q Total (cfs)	220.00	Flow (cfs)	0.06	219.94	
Top Width (ft)	61.07	Top Width (ft)	1.88	59.19	
Vel Total (ft/s)	3.87	Avg. Vel. (ft/s)	0.38	3.88	
Max Chl Dpth (ft)	3.18	Hydr. Depth (ft)	0.09	0.96	
Conv. Total (cfs)	2697.0	Conv. (cfs)	0.8	2696.3	
Length Wtd. (ft)	32.07	Wetted Per. (ft)	1.89	60.12	
Min Ch El (ft)	2139.09	Shear (lb/sq ft)	0.04	0.39	
Alpha	1.01	Stream Power (lb/ft s)	0.01	1.52	
Frctn Loss (ft)		Cum Volume (acre-ft)		0.05	
C & E Loss (ft)		Cum SA (acres)	0.01	0.82	0.01

CROSS SECTION

RIVER: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.132

CROSS SECTION OUTPUT Profile #FLOODPLAIN

			Left OB	Channel	Right OB
E.G. Elev (ft)	2142.51	Element			
Vel Head (ft)	0.57	Wt. n-Val.	0.064	0.030	0.057
W.S. Elev (ft)	2141.94	Reach Len. (ft)	29.34	29.46	29.92
Crit W.S. (ft)	2141.94	Flow Area (sq ft)	1.43	67.34	0.74
E.G. Slope (ft/ft)	0.012191	Area (sq ft)	1.43	67.34	0.74
Q Total (cfs)	412.00	Flow (cfs)	1.67	409.68	0.65
Top Width (ft)	65.73	Top Width (ft)	4.59	56.75	4.40
Vel Total (ft/s)	5.93	Avg. Vel. (ft/s)	1.17	6.08	0.88
Max Chl Dpth (ft)	3.29	Hydr. Depth (ft)	0.31	1.19	0.17
Conv. Total (cfs)	3731.4	Conv. (cfs)	15.1	3710.4	5.9
Length Wtd. (ft)	29.46	Wetted Per. (ft)	4.63	57.39	4.41
Min Ch El (ft)	2138.65	Shear (lb/sq ft)	0.23	0.89	0.13
Alpha	1.05	Stream Power (lb/ft s)	0.27	5.43	0.11
Frctn Loss (ft)	0.36	Cum Volume (acre-ft)	0.00	0.18	0.01
C & E Loss (ft)	0.00	Cum SA (acres)	0.01	0.91	0.03

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: 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 OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2142.51	Element			
Vel Head (ft)	0.57	Wt. n-Val.	0.064	0.030	0.057
W.S. Elev (ft)	2141.94	Reach Len. (ft)	29.34	29.46	29.92
Crit W.S. (ft)	2141.94	Flow Area (sq ft)	1.43	67.34	0.74
E.G. Slope (ft/ft)	0.012191	Area (sq ft)	1.43	67.34	0.74
Q Total (cfs)	412.00	Flow (cfs)	1.67	409.68	0.65
Top Width (ft)	65.73	Top Width (ft)	4.59	56.75	4.40
Vel Total (ft/s)	5.93	Avg. Vel. (ft/s)	1.17	6.08	0.88
Max Chl Dpth (ft)	3.29	Hydr. Depth (ft)	0.31	1.19	0.17
Conv. Total (cfs)	3731.4	Conv. (cfs)	15.1	3710.4	5.9
Length Wtd. (ft)	29.46	Wetted Per. (ft)	4.63	57.39	4.41
Min Ch El (ft)	2138.65	Shear (lb/sq ft)	0.23	0.89	0.13
Alpha	1.05	Stream Power (lb/ft s)	0.27	5.43	0.11
Frctn Loss (ft)	0.36	Cum Volume (acre-ft)	0.00	0.18	0.01
C & E Loss (ft)	0.00	Cum SA (acres)	0.01	0.91	0.03

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: 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 OUTPUT Profile #50-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2142.34	Element			
Vel Head (ft)	0.52	Wt. n-Val.	0.064	0.030	0.057
W.S. Elev (ft)	2141.82	Reach Len. (ft)	29.34	29.46	29.92
Crit W.S. (ft)	2141.82	Flow Area (sq ft)	0.91	60.22	0.29
E.G. Slope (ft/ft)	0.012832	Area (sq ft)	0.91	60.22	0.29
Q Total (cfs)	350.00	Flow (cfs)	0.94	348.87	0.19
Top Width (ft)	63.16	Top Width (ft)	3.66	56.75	2.75

Vel Total (ft/s)	5.70	Avg. Vel. (ft/s)	1.03	5.79	0.66	
Max Chl Dpth (ft)	3.17	Hydr. Depth (ft)	0.25	1.06	0.11	
Conv. Total (cfs)	3089.7	Conv. (cfs)	8.3	3079.7	1.7	
Length Wtd. (ft)	29.46	Wetted Per. (ft)	3.70	57.39	2.76	
Min Ch El (ft)	2138.65	Shear (lb/sq ft)	0.20	0.84	0.08	
Alpha	1.03	Stream Power (lb/ft s)	0.20	4.87	0.06	
Frctn Loss (ft)	0.38	Cum Volume (acre-ft)	0.00	0.16	0.01	
C & E Loss (ft)	0.00	Cum SA (acres)	0.01	0.90	0.02	

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: 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 OUTPUT Profile #10-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2141.92	Element			
Vel Head (ft)	0.39	Wt. n-Val.	0.064	0.030	
W.S. Elev (ft)	2141.53	Reach Len. (ft)	29.34	29.46	29.92
Crit W.S. (ft)	2141.53	Flow Area (sq ft)	0.16	43.81	
E.G. Slope (ft/ft)	0.014366	Area (sq ft)	0.16	43.81	
Q Total (cfs)	220.00	Flow (cfs)	0.10	219.90	
Top Width (ft)	57.23	Top Width (ft)	1.52	55.71	
Vel Total (ft/s)	5.00	Avg. Vel. (ft/s)	0.61	5.02	
Max Chl Dpth (ft)	2.88	Hydr. Depth (ft)	0.11	0.79	
Conv. Total (cfs)	1835.5	Conv. (cfs)	0.8	1834.7	
Length Wtd. (ft)	29.46	Wetted Per. (ft)	1.54	56.35	
Min Ch El (ft)	2138.65	Shear (lb/sq ft)	0.09	0.70	
Alpha	1.01	Stream Power (lb/ft s)	0.06	3.50	
Frctn Loss (ft)	0.44	Cum Volume (acre-ft)	0.00	0.11	0.00
C & E Loss (ft)	0.00	Cum SA (acres)	0.00	0.78	0.01

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: 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: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.126

CROSS SECTION OUTPUT Profile #FLOODPLAIN

			Left OB	Channel	Right OB
E.G. Elev (ft)	2141.82	Element			
Vel Head (ft)	0.58	Wt. n-Val.		0.030	0.057
W.S. Elev (ft)	2141.24	Reach Len. (ft)	25.03	24.89	24.50
Crit W.S. (ft)	2141.24	Flow Area (sq ft)		67.18	1.04
E.G. Slope (ft/ft)	0.012566	Area (sq ft)	0.00	67.18	1.04
Q Total (cfs)	412.00	Flow (cfs)		410.93	1.07
Top Width (ft)	62.17	Top Width (ft)		57.25	4.92
Vel Total (ft/s)	6.04	Avg. Vel. (ft/s)		6.12	1.03
Max Chl Dpth (ft)	3.38	Hydr. Depth (ft)		1.17	0.21
Conv. Total (cfs)	3675.3	Conv. (cfs)		3665.8	9.5
Length Wtd. (ft)	24.87	Wetted Per. (ft)		58.09	4.94
Min Ch El (ft)	2137.86	Shear (lb/sq ft)		0.91	0.16
Alpha	1.02	Stream Power (lb/ft s)		5.55	0.17
Frctn Loss (ft)	0.14	Cum Volume (acre-ft)	0.00	0.13	0.01
C & E Loss (ft)	0.18	Cum SA (acres)	0.01	0.87	0.03

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: 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 OUTPUT Profile #FLOODWAY

			Left OB	Channel	Right OB
E.G. Elev (ft)	2141.82	Element			
Vel Head (ft)	0.58	Wt. n-Val.		0.030	0.057
W.S. Elev (ft)	2141.24	Reach Len. (ft)	25.03	24.89	24.50
Crit W.S. (ft)	2141.24	Flow Area (sq ft)		67.18	1.04
E.G. Slope (ft/ft)	0.012566	Area (sq ft)	0.00	67.18	1.04
Q Total (cfs)	412.00	Flow (cfs)		410.93	1.07
Top Width (ft)	62.17	Top Width (ft)		57.25	4.92
Vel Total (ft/s)	6.04	Avg. Vel. (ft/s)		6.12	1.03
Max Chl Dpth (ft)	3.38	Hydr. Depth (ft)		1.17	0.21
Conv. Total (cfs)	3675.3	Conv. (cfs)		3665.8	9.5
Length Wtd. (ft)	24.87	Wetted Per. (ft)		58.09	4.94
Min Ch El (ft)	2137.86	Shear (lb/sq ft)		0.91	0.16
Alpha	1.02	Stream Power (lb/ft s)		5.55	0.17
Frctn Loss (ft)	0.14	Cum Volume (acre-ft)	0.00	0.13	0.01
C & E Loss (ft)	0.18	Cum SA (acres)	0.01	0.87	0.03

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: 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 OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2141.64	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.52	Wt. n-Val.		0.030	0.057	
W.S. Elev (ft)	2141.12	Reach Len. (ft)	25.03	24.89	24.50	
Crit W.S. (ft)	2141.12	Flow Area (sq ft)		60.10	0.52	
E.G. Slope (ft/ft)	0.013053	Area (sq ft)		60.10	0.52	
Q Total (cfs)	350.00	Flow (cfs)		349.57	0.43	
Top Width (ft)	60.32	Top Width (ft)		56.85	3.47	
Vel Total (ft/s)	5.77	Avg. Vel. (ft/s)		5.82	0.83	
Max Chl Dpth (ft)	3.26	Hydr. Depth (ft)		1.06	0.15	
Conv. Total (cfs)	3063.4	Conv. (cfs)		3059.7	3.8	
Length Wtd. (ft)	24.87	Wetted Per. (ft)		57.68	3.48	
Min Ch El (ft)	2137.86	Shear (lb/sq ft)		0.85	0.12	
Alpha	1.01	Stream Power (lb/ft s)		4.94	0.10	
Frctn Loss (ft)	0.14	Cum Volume (acre-ft)	0.00	0.12	0.01	
C & E Loss (ft)	0.17	Cum SA (acres)	0.01	0.86	0.02	

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: 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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2141.22	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.41	Wt. n-Val.		0.030		
W.S. Elev (ft)	2140.81	Reach Len. (ft)	25.03	24.89	24.50	
Crit W.S. (ft)	2140.81	Flow Area (sq ft)		43.01		
E.G. Slope (ft/ft)	0.015372	Area (sq ft)		43.01		
Q Total (cfs)	220.00	Flow (cfs)		220.00		
Top Width (ft)	55.80	Top Width (ft)		55.80		
Vel Total (ft/s)	5.12	Avg. Vel. (ft/s)		5.12		
Max Chl Dpth (ft)	2.95	Hydr. Depth (ft)		0.77		
Conv. Total (cfs)	1774.4	Conv. (cfs)		1774.4		
Length Wtd. (ft)	24.88	Wetted Per. (ft)		56.58		
Min Ch El (ft)	2137.86	Shear (lb/sq ft)		0.73		
Alpha	1.00	Stream Power (lb/ft s)		3.73		
Frctn Loss (ft)	0.15	Cum Volume (acre-ft)	0.00	0.08	0.00	
C & E Loss (ft)	0.14	Cum SA (acres)	0.00	0.74	0.01	

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: 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: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.122

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2141.48	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.22	Wt. n-Val.	0.064	0.030	0.057	
W.S. Elev (ft)	2141.26	Reach Len. (ft)	29.95	29.95	30.02	
Crit W.S. (ft)	2140.72	Flow Area (sq ft)	4.96	95.02	22.77	
E.G. Slope (ft/ft)	0.003231	Area (sq ft)	4.96	95.02	22.77	
Q Total (cfs)	412.00	Flow (cfs)	4.12	371.58	36.29	
Top Width (ft)	87.76	Top Width (ft)	9.85	57.68	20.23	
Vel Total (ft/s)	3.36	Avg. Vel. (ft/s)	0.83	3.91	1.59	
Max Chl Dpth (ft)	2.83	Hydr. Depth (ft)	0.50	1.65	1.13	
Conv. Total (cfs)	7248.1	Conv. (cfs)	72.5	6537.1	638.5	
Length Wtd. (ft)	29.95	Wetted Per. (ft)	9.90	58.04	20.42	
Min Ch El (ft)	2138.43	Shear (lb/sq ft)	0.10	0.33	0.22	
Alpha	1.24	Stream Power (lb/ft s)	0.08	1.29	0.36	
Frctn Loss (ft)		Cum Volume (acre-ft)		0.08		
C & E Loss (ft)		Cum SA (acres)	0.01	0.84	0.02	

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2141.48	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.22	Wt. n-Val.	0.064	0.030	0.057	
W.S. Elev (ft)	2141.26	Reach Len. (ft)	29.95	29.95	30.02	
Crit W.S. (ft)	2140.72	Flow Area (sq ft)	4.96	95.02	22.77	
E.G. Slope (ft/ft)	0.003231	Area (sq ft)	4.96	95.02	22.77	
Q Total (cfs)	412.00	Flow (cfs)	4.12	371.58	36.29	

Top Width (ft)	87.76	Top Width (ft)	9.85	57.68	20.23
Vel Total (ft/s)	3.36	Avg. Vel. (ft/s)	0.83	3.91	1.59
Max Chl Dpth (ft)	2.83	Hydr. Depth (ft)	0.50	1.65	1.13
Conv. Total (cfs)	7248.1	Conv. (cfs)	72.5	6537.1	638.5
Length Wtd. (ft)	29.95	Wetted Per. (ft)	9.90	58.04	20.42
Min Ch El (ft)	2138.43	Shear (lb/sq ft)	0.10	0.33	0.22
Alpha	1.24	Stream Power (lb/ft s)	0.08	1.29	0.36
Frctn Loss (ft)		Cum Volume (acre-ft)		0.08	
C & E Loss (ft)		Cum SA (acres)	0.01	0.84	0.02

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2141.32	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.	0.064	0.030	0.057
W.S. Elev (ft)	2141.12	Reach Len. (ft)	29.95	29.95	30.02
Crit W.S. (ft)	2140.62	Flow Area (sq ft)	3.69	87.03	20.00
E.G. Slope (ft/ft)	0.003168	Area (sq ft)	3.69	87.03	20.00
Q Total (cfs)	350.00	Flow (cfs)	2.75	317.88	29.37
Top Width (ft)	85.99	Top Width (ft)	8.50	57.68	19.81
Vel Total (ft/s)	3.16	Avg. Vel. (ft/s)	0.75	3.65	1.47
Max Chl Dpth (ft)	2.69	Hydr. Depth (ft)	0.43	1.51	1.01
Conv. Total (cfs)	6218.2	Conv. (cfs)	48.9	5647.4	521.8
Length Wtd. (ft)	29.95	Wetted Per. (ft)	8.54	58.04	19.98
Min Ch El (ft)	2138.43	Shear (lb/sq ft)	0.09	0.30	0.20
Alpha	1.23	Stream Power (lb/ft s)	0.06	1.08	0.29
Frctn Loss (ft)		Cum Volume (acre-ft)		0.07	
C & E Loss (ft)		Cum SA (acres)	0.01	0.83	0.01

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2140.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	Wt. n-Val.	0.064	0.030	0.057
W.S. Elev (ft)	2140.78	Reach Len. (ft)	29.95	29.95	30.02
Crit W.S. (ft)	2140.38	Flow Area (sq ft)	1.35	67.25	13.38
E.G. Slope (ft/ft)	0.003080	Area (sq ft)	1.35	67.25	13.38
Q Total (cfs)	220.00	Flow (cfs)	0.71	203.90	15.39
Top Width (ft)	81.60	Top Width (ft)	5.14	57.68	18.78
Vel Total (ft/s)	2.68	Avg. Vel. (ft/s)	0.53	3.03	1.15
Max Chl Dpth (ft)	2.35	Hydr. Depth (ft)	0.26	1.17	0.71
Conv. Total (cfs)	3964.3	Conv. (cfs)	12.8	3674.3	277.3
Length Wtd. (ft)	29.95	Wetted Per. (ft)	5.17	58.04	18.89
Min Ch El (ft)	2138.43	Shear (lb/sq ft)	0.05	0.22	0.14
Alpha	1.20	Stream Power (lb/ft s)	0.03	0.68	0.16
Frctn Loss (ft)		Cum Volume (acre-ft)		0.05	
C & E Loss (ft)		Cum SA (acres)	0.00	0.71	0.01

CROSS SECTION

RIVER: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.116

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2141.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.59	Wt. n-Val.		0.030	0.057
W.S. Elev (ft)	2140.59	Reach Len. (ft)	72.19	72.14	72.08
Crit W.S. (ft)	2140.59	Flow Area (sq ft)		66.73	0.89
E.G. Slope (ft/ft)	0.012757	Area (sq ft)		66.73	0.89
Q Total (cfs)	412.00	Flow (cfs)		411.24	0.76
Top Width (ft)	62.52	Top Width (ft)		56.87	5.66
Vel Total (ft/s)	6.09	Avg. Vel. (ft/s)		6.16	0.85
Max Chl Dpth (ft)	3.39	Hydr. Depth (ft)		1.17	0.16
Conv. Total (cfs)	3647.8	Conv. (cfs)		3641.1	6.7
Length Wtd. (ft)	72.14	Wetted Per. (ft)		57.71	5.66
Min Ch El (ft)	2137.20	Shear (lb/sq ft)		0.92	0.12
Alpha	1.02	Stream Power (lb/ft s)		5.67	0.11
Frctn Loss (ft)	0.92	Cum Volume (acre-ft)	0.00	0.39	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.01	0.80	0.01

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2141.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.59	Wt. n-Val.		0.030	0.057
W.S. Elev (ft)	2140.59	Reach Len. (ft)	72.19	72.14	72.08
Crit W.S. (ft)	2140.59	Flow Area (sq ft)		66.73	0.89
E.G. Slope (ft/ft)	0.012757	Area (sq ft)		66.73	0.89
Q Total (cfs)	412.00	Flow (cfs)		411.24	0.76
Top Width (ft)	62.52	Top Width (ft)		56.87	5.66
Vel Total (ft/s)	6.09	Avg. Vel. (ft/s)		6.16	0.85
Max Chl Dpth (ft)	3.39	Hydr. Depth (ft)		1.17	0.16
Conv. Total (cfs)	3647.8	Conv. (cfs)		3641.1	6.7
Length Wtd. (ft)	72.14	Wetted Per. (ft)		57.71	5.66

* Min Ch El (ft)	* 2137.20	* Shear (lb/sq ft)	*	*	0.92 *	0.12 *
* Alpha	* 1.02	* Stream Power (lb/ft s)	*	*	5.67 *	0.11 *
* Frctn Loss (ft)	* 0.92	* Cum Volume (acre-ft)	* 0.00	*	0.39 *	0.00 *
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 0.01	*	0.80 *	0.01 *

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 OUTPUT Profile #50-YEAR

* E.G. Elev (ft)	* 2141.00	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.53	* Wt. n-Val.	*	* 0.030	* 0.057	*
* W.S. Elev (ft)	* 2140.47	* Reach Len. (ft)	* 72.19	* 72.14	* 72.08	*
* Crit W.S. (ft)	* 2140.47	* Flow Area (sq ft)	*	* 59.98	* 0.34	*
* E.G. Slope (ft/ft)	*0.013058	* Area (sq ft)	*	* 59.98	* 0.34	*
* Q Total (cfs)	* 350.00	* Flow (cfs)	*	* 349.79	* 0.21	*
* Top Width (ft)	* 60.02	* Top Width (ft)	*	* 56.51	* 3.50	*
* Vel Total (ft/s)	* 5.80	* Avg. Vel. (ft/s)	*	* 5.83	* 0.63	*
* Max Chl Dpth (ft)	* 3.27	* Hydr. Depth (ft)	*	* 1.06	* 0.10	*
* Conv. Total (cfs)	* 3062.9	* Conv. (cfs)	*	* 3061.0	* 1.9	*
* Length Wtd. (ft)	* 72.14	* Wetted Per. (ft)	*	* 57.34	* 3.51	*
* Min Ch El (ft)	* 2137.20	* Shear (lb/sq ft)	*	* 0.85	* 0.08	*
* Alpha	* 1.01	* Stream Power (lb/ft s)	*	* 4.97	* 0.05	*
* Frctn Loss (ft)	* 0.98	* Cum Volume (acre-ft)	* 0.00	* 0.34	* 0.00	*
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 0.01	* 0.79	* 0.01	*

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 OUTPUT Profile #10-YEAR

* E.G. Elev (ft)	* 2140.58	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.41	* Wt. n-Val.	*	* 0.030	*	*
* W.S. Elev (ft)	* 2140.17	* Reach Len. (ft)	* 72.19	* 72.14	* 72.08	*
* Crit W.S. (ft)	* 2140.17	* Flow Area (sq ft)	*	* 42.94	*	*
* E.G. Slope (ft/ft)	*0.014662	* Area (sq ft)	*	* 42.94	*	*
* Q Total (cfs)	* 220.00	* Flow (cfs)	*	* 220.00	*	*
* Top Width (ft)	* 53.61	* Top Width (ft)	*	* 53.61	*	*
* Vel Total (ft/s)	* 5.12	* Avg. Vel. (ft/s)	*	* 5.12	*	*
* Max Chl Dpth (ft)	* 2.97	* Hydr. Depth (ft)	*	* 0.80	*	*
* Conv. Total (cfs)	* 1816.9	* Conv. (cfs)	*	* 1816.9	*	*
* Length Wtd. (ft)	* 72.14	* Wetted Per. (ft)	*	* 54.38	*	*
* Min Ch El (ft)	* 2137.20	* Shear (lb/sq ft)	*	* 0.72	*	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 3.70	*	*
* Frctn Loss (ft)	* 1.09	* Cum Volume (acre-ft)	*	* 0.22	*	*
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	*	* 0.67	*	*

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: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.102

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	* 2139.69	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.57	* Wt. n-Val.	* 0.064	* 0.030	* 0.057	*
* W.S. Elev (ft)	* 2139.11	* Reach Len. (ft)	* 68.14	* 67.52	* 68.34	*
* Crit W.S. (ft)	* 2139.11	* Flow Area (sq ft)	* 0.01	* 67.70	* 0.40	*
* E.G. Slope (ft/ft)	*0.012803	* Area (sq ft)	* 0.01	* 67.70	* 0.40	*
* Q Total (cfs)	* 412.00	* Flow (cfs)	* 0.01	* 411.70	* 0.29	*
* Top Width (ft)	* 62.33	* Top Width (ft)	* 0.10	* 59.10	* 3.13	*
* Vel Total (ft/s)	* 6.05	* Avg. Vel. (ft/s)	* 0.35	* 6.08	* 0.74	*
* Max Chl Dpth (ft)	* 3.37	* Hydr. Depth (ft)	* 0.14	* 1.15	* 0.13	*
* Conv. Total (cfs)	* 3641.1	* Conv. (cfs)	* 0.0	* 3638.5	* 2.6	*
* Length Wtd. (ft)	* 67.52	* Wetted Per. (ft)	* 0.30	* 59.90	* 3.14	*
* Min Ch El (ft)	* 2135.74	* Shear (lb/sq ft)	* 0.04	* 0.90	* 0.10	*
* Alpha	* 1.01	* Stream Power (lb/ft s)	* 0.01	* 5.49	* 0.08	*
* Frctn Loss (ft)	* 0.86	* Cum Volume (acre-ft)	* 0.00	* 0.28	* 0.00	*
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 0.01	* 0.70	* 0.00	*

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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2139.69	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.57	Wt. n-Val.	0.064	0.030	0.057
W.S. Elev (ft)	2139.11	Reach Len. (ft)	68.14	67.52	68.34
Crit W.S. (ft)	2139.11	Flow Area (sq ft)	0.01	67.70	0.40
E.G. Slope (ft/ft)	0.012803	Area (sq ft)	0.01	67.70	0.40
Q Total (cfs)	412.00	Flow (cfs)	0.01	411.70	0.29
Top Width (ft)	62.33	Top Width (ft)	0.10	59.10	3.13
Vel Total (ft/s)	6.05	Avg. Vel. (ft/s)	0.35	6.08	0.74
Max Chl Dpth (ft)	3.37	Hydr. Depth (ft)	0.14	1.15	0.13
Conv. Total (cfs)	3641.1	Conv. (cfs)	0.0	3638.5	2.6
Length Wtd. (ft)	67.52	Wetted Per. (ft)	0.30	59.90	3.14
Min Ch El (ft)	2135.74	Shear (lb/sq ft)	0.04	0.90	0.10
Alpha	1.01	Stream Power (lb/ft s)	0.01	5.49	0.08
Frctn Loss (ft)	0.86	Cum Volume (acre-ft)	0.00	0.28	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.01	0.70	0.00

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 OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2139.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.53	Wt. n-Val.	0.001	0.030	0.057
W.S. Elev (ft)	2138.98	Reach Len. (ft)	68.14	67.52	68.34
Crit W.S. (ft)	2138.98	Flow Area (sq ft)	0.00	59.67	0.08
E.G. Slope (ft/ft)	0.014097	Area (sq ft)	0.00	59.67	0.08
Q Total (cfs)	350.00	Flow (cfs)	0.00	349.96	0.04
Top Width (ft)	60.60	Top Width (ft)	0.05	59.10	1.45
Vel Total (ft/s)	5.86	Avg. Vel. (ft/s)	0.24	5.87	0.47
Max Chl Dpth (ft)	3.24	Hydr. Depth (ft)	0.07	1.01	0.06
Conv. Total (cfs)	2947.9	Conv. (cfs)	0.0	2947.5	0.3
Length Wtd. (ft)	67.52	Wetted Per. (ft)	0.16	59.90	1.45
Min Ch El (ft)	2135.74	Shear (lb/sq ft)		0.88	0.05
Alpha	1.00	Stream Power (lb/ft s)		5.14	0.02
Frctn Loss (ft)	0.95	Cum Volume (acre-ft)	0.00	0.24	0.00
C & E Loss (ft)	0.00	Cum SA (acres)	0.01	0.69	0.00

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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2139.10	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.41	Wt. n-Val.		0.030	
W.S. Elev (ft)	2138.69	Reach Len. (ft)	68.14	67.52	68.34
Crit W.S. (ft)	2138.69	Flow Area (sq ft)		43.00	
E.G. Slope (ft/ft)	0.015484	Area (sq ft)		43.00	
Q Total (cfs)	220.00	Flow (cfs)		220.00	
Top Width (ft)	56.06	Top Width (ft)		56.06	
Vel Total (ft/s)	5.12	Avg. Vel. (ft/s)		5.12	
Max Chl Dpth (ft)	2.95	Hydr. Depth (ft)		0.77	
Conv. Total (cfs)	1768.0	Conv. (cfs)		1768.0	
Length Wtd. (ft)	67.52	Wetted Per. (ft)		56.85	
Min Ch El (ft)	2135.74	Shear (lb/sq ft)		0.73	
Alpha	1.00	Stream Power (lb/ft s)		3.74	
Frctn Loss (ft)	0.96	Cum Volume (acre-ft)		0.15	
C & E Loss (ft)	0.07	Cum SA (acres)		0.58	

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: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.090

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2138.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.55	Wt. n-Val.		0.030	
W.S. Elev (ft)	2137.50	Reach Len. (ft)	71.31	71.07	70.52
Crit W.S. (ft)	2137.50	Flow Area (sq ft)		69.03	
E.G. Slope (ft/ft)	0.012738	Area (sq ft)		69.03	
Q Total (cfs)	412.00	Flow (cfs)		412.00	
Top Width (ft)	61.74	Top Width (ft)		61.74	
Vel Total (ft/s)	5.97	Avg. Vel. (ft/s)		5.97	
Max Chl Dpth (ft)	3.31	Hydr. Depth (ft)		1.12	
Conv. Total (cfs)	3650.5	Conv. (cfs)		3650.5	
Length Wtd. (ft)	71.07	Wetted Per. (ft)		62.56	
Min Ch El (ft)	2134.19	Shear (lb/sq ft)		0.88	
Alpha	1.00	Stream Power (lb/ft s)		5.24	
Frctn Loss (ft)		Cum Volume (acre-ft)		0.17	
C & E Loss (ft)		Cum SA (acres)	0.01	0.61	

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2138.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.55	Wt. n-Val.		0.030	
W.S. Elev (ft)	2137.50	Reach Len. (ft)	71.31	71.07	70.52
Crit W.S. (ft)	2137.50	Flow Area (sq ft)		69.03	
E.G. Slope (ft/ft)	0.012738	Area (sq ft)		69.03	
Q Total (cfs)	412.00	Flow (cfs)		412.00	
Top Width (ft)	61.74	Top Width (ft)		61.74	
Vel Total (ft/s)	5.97	Avg. Vel. (ft/s)		5.97	
Max Chl Dpth (ft)	3.31	Hydr. Depth (ft)		1.12	
Conv. Total (cfs)	3650.5	Conv. (cfs)		3650.5	
Length Wtd. (ft)	71.07	Wetted Per. (ft)		62.56	
Min Ch El (ft)	2134.19	Shear (lb/sq ft)		0.88	
Alpha	1.00	Stream Power (lb/ft s)		5.24	
Frctn Loss (ft)		Cum Volume (acre-ft)		0.17	
C & E Loss (ft)		Cum SA (acres)	0.01	0.61	

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2137.88	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.53	Wt. n-Val.		0.030	
W.S. Elev (ft)	2137.34	Reach Len. (ft)	71.31	71.07	70.52
Crit W.S. (ft)	2137.34	Flow Area (sq ft)		59.76	
E.G. Slope (ft/ft)	0.014081	Area (sq ft)		59.76	
Q Total (cfs)	350.00	Flow (cfs)		350.00	
Top Width (ft)	59.29	Top Width (ft)		59.29	
Vel Total (ft/s)	5.86	Avg. Vel. (ft/s)		5.86	
Max Chl Dpth (ft)	3.15	Hydr. Depth (ft)		1.01	
Conv. Total (cfs)	2949.5	Conv. (cfs)		2949.5	
Length Wtd. (ft)	71.07	Wetted Per. (ft)		60.08	
Min Ch El (ft)	2134.19	Shear (lb/sq ft)		0.87	
Alpha	1.00	Stream Power (lb/ft s)		5.12	
Frctn Loss (ft)		Cum Volume (acre-ft)		0.15	
C & E Loss (ft)		Cum SA (acres)	0.01	0.60	

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2137.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.64	Wt. n-Val.		0.030	
W.S. Elev (ft)	2136.76	Reach Len. (ft)	71.31	71.07	70.52
Crit W.S. (ft)	2136.76	Flow Area (sq ft)		34.32	
E.G. Slope (ft/ft)	0.013062	Area (sq ft)		34.32	
Q Total (cfs)	220.00	Flow (cfs)		220.00	
Top Width (ft)	27.79	Top Width (ft)		27.79	
Vel Total (ft/s)	6.41	Avg. Vel. (ft/s)		6.41	
Max Chl Dpth (ft)	2.57	Hydr. Depth (ft)		1.24	
Conv. Total (cfs)	1924.9	Conv. (cfs)		1924.9	
Length Wtd. (ft)	71.07	Wetted Per. (ft)		28.49	
Min Ch El (ft)	2134.19	Shear (lb/sq ft)		0.98	
Alpha	1.00	Stream Power (lb/ft s)		6.30	
Frctn Loss (ft)		Cum Volume (acre-ft)		0.09	
C & E Loss (ft)		Cum SA (acres)		0.51	

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION

RIVER: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.076

CROSS SECTION OUTPUT Profile #FLOODPLAIN

E.G. Elev (ft)	2131.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.98	Wt. n-Val.		0.030	
W.S. Elev (ft)	2130.38	Reach Len. (ft)	354.56	352.45	344.81
Crit W.S. (ft)	2130.38	Flow Area (sq ft)		51.84	
E.G. Slope (ft/ft)	0.011315	Area (sq ft)		51.84	
Q Total (cfs)	412.00	Flow (cfs)		412.00	
Top Width (ft)	26.65	Top Width (ft)		26.65	
Vel Total (ft/s)	7.95	Avg. Vel. (ft/s)		7.95	
Max Chl Dpth (ft)	2.52	Hydr. Depth (ft)		1.95	
Conv. Total (cfs)	3873.3	Conv. (cfs)		3873.3	
Length Wtd. (ft)	352.45	Wetted Per. (ft)		27.98	
Min Ch El (ft)	2127.86	Shear (lb/sq ft)		1.31	
Alpha	1.00	Stream Power (lb/ft s)		10.40	
Frctn Loss (ft)	3.61	Cum Volume (acre-ft)	0.00	0.59	
C & E Loss (ft)	0.34	Cum SA (acres)	0.01	0.54	

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #FLOODWAY

E.G. Elev (ft)	2131.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.98	Wt. n-Val.		0.030	
W.S. Elev (ft)	2130.38	Reach Len. (ft)	354.56	352.45	344.81
Crit W.S. (ft)	2130.38	Flow Area (sq ft)		51.84	
E.G. Slope (ft/ft)	0.011315	Area (sq ft)		51.84	
Q Total (cfs)	412.00	Flow (cfs)		412.00	
Top Width (ft)	26.65	Top Width (ft)		26.65	
Vel Total (ft/s)	7.95	Avg. Vel. (ft/s)		7.95	
Max Chl Dpth (ft)	2.52	Hydr. Depth (ft)		1.95	
Conv. Total (cfs)	3873.3	Conv. (cfs)		3873.3	
Length Wtd. (ft)	352.45	Wetted Per. (ft)		27.98	
Min Ch El (ft)	2127.86	Shear (lb/sq ft)		1.31	
Alpha	1.00	Stream Power (lb/ft s)		10.40	
Frctn Loss (ft)	3.61	Cum Volume (acre-ft)	0.00	0.59	
C & E Loss (ft)	0.34	Cum SA (acres)	0.01	0.54	

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #50-YEAR

E.G. Elev (ft)	2131.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.91	Wt. n-Val.		0.030	
W.S. Elev (ft)	2130.15	Reach Len. (ft)	354.56	352.45	344.81
Crit W.S. (ft)	2130.15	Flow Area (sq ft)		45.83	
E.G. Slope (ft/ft)	0.011690	Area (sq ft)		45.83	
Q Total (cfs)	350.00	Flow (cfs)		350.00	
Top Width (ft)	25.73	Top Width (ft)		25.73	
Vel Total (ft/s)	7.64	Avg. Vel. (ft/s)		7.64	
Max Chl Dpth (ft)	2.29	Hydr. Depth (ft)		1.78	
Conv. Total (cfs)	3237.1	Conv. (cfs)		3237.1	
Length Wtd. (ft)	352.45	Wetted Per. (ft)		26.91	
Min Ch El (ft)	2127.86	Shear (lb/sq ft)		1.24	
Alpha	1.00	Stream Power (lb/ft s)		9.49	
Frctn Loss (ft)	3.67	Cum Volume (acre-ft)	0.00	0.53	
C & E Loss (ft)	0.32	Cum SA (acres)	0.01	0.53	

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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 OUTPUT Profile #10-YEAR

E.G. Elev (ft)	2130.33	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.69	Wt. n-Val.		0.030	
W.S. Elev (ft)	2129.64	Reach Len. (ft)	354.56	352.45	344.81
Crit W.S. (ft)	2129.64	Flow Area (sq ft)		32.98	
E.G. Slope (ft/ft)	0.012581	Area (sq ft)		32.98	

* Q Total (cfs)	* 220.00	* Flow (cfs)	*	* 220.00	*
* Top Width (ft)	* 24.24	* Top Width (ft)	*	* 24.24	*
* Vel Total (ft/s)	* 6.67	* Avg. Vel. (ft/s)	*	* 6.67	*
* Max Chl Dpth (ft)	* 1.77	* Hydr. Depth (ft)	*	* 1.36	*
* Conv. Total (cfs)	* 1961.4	* Conv. (cfs)	*	* 1961.4	*
* Length Wtd. (ft)	* 352.45	* Wetted Per. (ft)	*	* 25.06	*
* Min Ch El (ft)	* 2127.86	* Shear (lb/sq ft)	*	* 1.03	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 6.90	*
* Frctn Loss (ft)	* 3.80	* Cum Volume (acre-ft)	*	* 0.38	*
* C & E Loss (ft)	* 0.24	* Cum SA (acres)	*	* 0.47	*

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: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.009

CROSS SECTION OUTPUT Profile #FLOODPLAIN

* E.G. Elev (ft)	* 2124.13	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.30	* Wt. n-Val.	* 0.057	* 0.030	*
* W.S. Elev (ft)	* 2123.83	* Reach Len. (ft)	*	*	*
* Crit W.S. (ft)	* 2123.72	* Flow Area (sq ft)	* 0.17	* 93.63	*
* E.G. Slope (ft/ft)	*0.009333	* Area (sq ft)	* 0.17	* 93.63	*
* Q Total (cfs)	* 412.00	* Flow (cfs)	* 0.10	* 411.90	*
* Top Width (ft)	* 107.41	* Top Width (ft)	* 1.56	* 105.85	*
* Vel Total (ft/s)	* 4.39	* Avg. Vel. (ft/s)	* 0.57	* 4.40	*
* Max Chl Dpth (ft)	* 2.41	* Hydr. Depth (ft)	* 0.11	* 0.88	*
* Conv. Total (cfs)	* 4264.6	* Conv. (cfs)	* 1.0	* 4263.6	*
* Length Wtd. (ft)	*	* Wetted Per. (ft)	* 1.58	* 106.21	*
* Min Ch El (ft)	* 2121.42	* Shear (lb/sq ft)	* 0.06	* 0.51	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	* 0.04	* 2.26	*
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	*	*	*
* C & E Loss (ft)	*	* Cum SA (acres)	*	*	*

CROSS SECTION OUTPUT Profile #FLOODWAY

* E.G. Elev (ft)	* 2124.13	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.30	* Wt. n-Val.	* 0.057	* 0.030	*
* W.S. Elev (ft)	* 2123.83	* Reach Len. (ft)	*	*	*
* Crit W.S. (ft)	* 2123.72	* Flow Area (sq ft)	* 0.17	* 93.63	*
* E.G. Slope (ft/ft)	*0.009333	* Area (sq ft)	* 0.17	* 93.63	*
* Q Total (cfs)	* 412.00	* Flow (cfs)	* 0.10	* 411.90	*
* Top Width (ft)	* 107.41	* Top Width (ft)	* 1.56	* 105.85	*
* Vel Total (ft/s)	* 4.39	* Avg. Vel. (ft/s)	* 0.57	* 4.40	*
* Max Chl Dpth (ft)	* 2.41	* Hydr. Depth (ft)	* 0.11	* 0.88	*
* Conv. Total (cfs)	* 4264.6	* Conv. (cfs)	* 1.0	* 4263.6	*
* Length Wtd. (ft)	*	* Wetted Per. (ft)	* 1.58	* 106.21	*
* Min Ch El (ft)	* 2121.42	* Shear (lb/sq ft)	* 0.06	* 0.51	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	* 0.04	* 2.26	*
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	*	*	*
* C & E Loss (ft)	*	* Cum SA (acres)	*	*	*

CROSS SECTION OUTPUT Profile #50-YEAR

* E.G. Elev (ft)	* 2124.01	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.26	* Wt. n-Val.	* 0.057	* 0.030	*
* W.S. Elev (ft)	* 2123.75	* Reach Len. (ft)	*	*	*
* Crit W.S. (ft)	* 2123.62	* Flow Area (sq ft)	* 0.05	* 84.73	*
* E.G. Slope (ft/ft)	*0.009342	* Area (sq ft)	* 0.05	* 84.73	*
* Q Total (cfs)	* 350.00	* Flow (cfs)	* 0.02	* 349.98	*
* Top Width (ft)	* 106.65	* Top Width (ft)	* 1.27	* 105.38	*
* Vel Total (ft/s)	* 4.13	* Avg. Vel. (ft/s)	* 0.30	* 4.13	*
* Max Chl Dpth (ft)	* 2.33	* Hydr. Depth (ft)	* 0.04	* 0.80	*
* Conv. Total (cfs)	* 3621.1	* Conv. (cfs)	* 0.2	* 3620.9	*
* Length Wtd. (ft)	*	* Wetted Per. (ft)	* 1.28	* 105.74	*
* Min Ch El (ft)	* 2121.42	* Shear (lb/sq ft)	* 0.02	* 0.47	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	* 0.01	* 1.93	*
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	*	*	*
* C & E Loss (ft)	*	* Cum SA (acres)	*	*	*

CROSS SECTION OUTPUT Profile #10-YEAR

* E.G. Elev (ft)	* 2123.71	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.20	* Wt. n-Val.	*	* 0.030	*
* W.S. Elev (ft)	* 2123.51	* Reach Len. (ft)	*	*	*
* Crit W.S. (ft)	* 2123.38	* Flow Area (sq ft)	*	* 60.66	*
* E.G. Slope (ft/ft)	*0.009340	* Area (sq ft)	*	* 60.66	*
* Q Total (cfs)	* 220.00	* Flow (cfs)	*	* 220.00	*
* Top Width (ft)	* 91.64	* Top Width (ft)	*	* 91.64	*
* Vel Total (ft/s)	* 3.63	* Avg. Vel. (ft/s)	*	* 3.63	*
* Max Chl Dpth (ft)	* 2.09	* Hydr. Depth (ft)	*	* 0.66	*
* Conv. Total (cfs)	* 2276.4	* Conv. (cfs)	*	* 2276.4	*

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* Length Wtd. (ft)       *          * Wetted Per. (ft)       *          *   91.98  *          *
* Min Ch El (ft)         * 2121.42  * Shear (lb/sq ft)       *          *    0.38  *          *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    1.39  *          *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *          *          *          *
* C & E Loss (ft)        *          * Cum SA (acres)         *          *          *          *
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                    HEC-RAS Version 4.1.0 Jan 2010
                     U.S. Army Corps 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

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PROJECT DATA
Project Title: Wickenburg_Phase1
Project File : WKB1_500yr.prj
Run Date and Time: 1/24/2012 1:47:09 PM

Project in English units

Project Description:
Wickenburg Area Drainage Master Study/Plan (ADMS/P)
Phase 1 Hydraulic Model
for Sunset Wash, Sunset Wash Tributary 1 and Sunnycove Wash

Prepared
by:
Hoskin Ryan Consultants, Inc.
6245 N. 24th Parkway, Suite 100
Phoenix,
AZ 85016

Prepared for:
Flood Control District of Maricopa County
(FCDMC)
2801 W. Durango Street
Phoenix, AZ 85009

FCDMC Contract No.
2009-C030

FCDMC Project Manager: Gregory L. Jones

Topographic Mapping:
prepared during the Wickenburg Mapping Project (FCDMC 03-66), dated July 7th,
2004. Provided by the FCDMC and used to create the 2-foot contour interval
mapping.

Vertical Datum: NAVD88

Geographic Coordinate System is State
Plane Arizona Central (NAD83)

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PLAN DATA

Plan Title: Wickenburg_Phase1_500year
Plan File : g:\Projects\10\10-003 Wickenburg ADMS\01-Phase 1\Hydro\HEC-RAS\WKB1_500yr.p04

          Geometry Title: Wickenburg_Phase1
          Geometry File : g:\Projects\10\10-003 Wickenburg ADMS\01-Phase 1\Hydro\HEC-RAS\WKB1_500yr.g01

          Flow Title    : 500-year, 6-hour
          Flow File     : g:\Projects\10\10-003 Wickenburg ADMS\01-Phase 1\Hydro\HEC-RAS\WKB1_500yr.f01

Plan Summary Information:
Number of:  Cross Sections =  121    Multiple Openings  =    0
            Culverts       =   13    Inline Structures  =    0
            Bridges        =    1    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

Encroachment Data
   Equal Conveyance = True
   Left Offset      =        0
   Right Offset     =        0

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FLOW DATA

Flow Title: 500-year, 6-hour
Flow File : g:\Projects\10\10-003 Wickenburg ADMS\01-Phase 1\Hydro\HEC-RAS\WKB1_500yr.f01

Flow Data (cfs)

River	Reach	RS	500-YEAR
SUNNYCOVE WASH	REACH #1	0.400	180
SUNNYCOVE WASH	REACH #1	0.263	428
SUNNYCOVE WASH	REACH #2	3.132	1344
SUNNYCOVE WASH	REACH #2	2.901	1414
SUNNYCOVE WASH	REACH #2	2.592	1790
SUNNYCOVE WASH	REACH #2	1.830	2102
SUNSET WASH	REACH #2	1.197	75
SUNSET WASH	REACH #2	1.117	662
SUNSET WASH	REACH #1	0.753	1028
SUNSET WASH	REACH #1	0.537	1550
SUNSET WASH	REACH #3	1.902	696
SUNSET WASH	TRIBUTARY 1	0.256	551

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
SUNNYCOVE WASH	REACH #2	500-YEAR		Normal S = 0.02
SUNSET WASH	REACH #1	500-YEAR		Normal S = 0.0067
SUNSET WASH	REACH #3	500-YEAR		Normal S = 0.02073
SUNSET WASH	TRIBUTARY 1	500-YEAR		Normal S = 0.00933

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.400

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2111.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.	0.049	0.039	0.035
W.S. Elev (ft)	2110.87	Reach Len. (ft)	229.53	185.77	170.71
Crit W.S. (ft)	2110.87	Flow Area (sq ft)	0.05	42.08	0.02
E.G. Slope (ft/ft)	0.028703	Area (sq ft)	0.05	42.08	0.02
Q Total (cfs)	180.00	Flow (cfs)	0.03	179.95	0.02
Top Width (ft)	79.73	Top Width (ft)	1.28	77.91	0.54
Vel Total (ft/s)	4.27	Avg. Vel. (ft/s)	0.56	4.28	0.87
Max Chl Dpth (ft)	1.20	Hydr. Depth (ft)	0.04	0.54	0.04
Conv. Total (cfs)	1062.5	Conv. (cfs)	0.2	1062.2	0.1
Length Wtd. (ft)	186.29	Wetted Per. (ft)	1.28	78.05	0.55
Min Ch El (ft)	2109.67	Shear (lb/sq ft)	0.06	0.97	0.07
Alpha	1.00	Stream Power (lb/ft s)	0.04	4.13	0.07
Frctn Loss (ft)	0.23	Cum Volume (acre-ft)	0.12	1.25	0.08
C & E Loss (ft)	0.08	Cum SA (acres)	1.19	1.86	0.93

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.365

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2107.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.049	0.039	0.035
W.S. Elev (ft)	2107.96	Reach Len. (ft)	179.96	133.12	128.74
Crit W.S. (ft)		Flow Area (sq ft)	8.88	186.04	0.60
E.G. Slope (ft/ft)	0.000392	Area (sq ft)	8.88	186.04	0.60
Q Total (cfs)	180.00	Flow (cfs)	4.29	175.54	0.17
Top Width (ft)	147.90	Top Width (ft)	12.14	132.72	3.04
Vel Total (ft/s)	0.92	Avg. Vel. (ft/s)	0.48	0.94	0.28
Max Chl Dpth (ft)	2.56	Hydr. Depth (ft)	0.73	1.40	0.20
Conv. Total (cfs)	9093.7	Conv. (cfs)	216.8	8868.4	8.5
Length Wtd. (ft)	136.30	Wetted Per. (ft)	12.29	132.94	3.07
Min Ch El (ft)	2105.40	Shear (lb/sq ft)	0.02	0.03	0.00
Alpha	1.03	Stream Power (lb/ft s)	0.01	0.03	0.00
Frctn Loss (ft)	0.11	Cum Volume (acre-ft)	0.10	0.76	0.08
C & E Loss (ft)	0.01	Cum SA (acres)	1.16	1.41	0.92

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.340

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2107.85	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.	0.049	0.039	0.035
W.S. Elev (ft)	2107.76	Reach Len. (ft)	231.01	240.22	244.75
Crit W.S. (ft)		Flow Area (sq ft)	14.80	47.85	18.43
E.G. Slope (ft/ft)	0.002606	Area (sq ft)	14.80	47.85	18.43
Q Total (cfs)	180.00	Flow (cfs)	22.63	130.97	26.40
Top Width (ft)	77.77	Top Width (ft)	14.92	28.60	34.25
Vel Total (ft/s)	2.22	Avg. Vel. (ft/s)	1.53	2.74	1.43
Max Chl Dpth (ft)	2.07	Hydr. Depth (ft)	0.99	1.67	0.54
Conv. Total (cfs)	3526.2	Conv. (cfs)	443.3	2565.8	517.1
Length Wtd. (ft)	239.97	Wetted Per. (ft)	15.08	28.65	34.29
Min Ch El (ft)	2105.69	Shear (lb/sq ft)	0.16	0.27	0.09
Alpha	1.23	Stream Power (lb/ft s)	0.24	0.74	0.13
Frctn Loss (ft)	1.30	Cum Volume (acre-ft)	0.05	0.40	0.05
C & E Loss (ft)	0.06	Cum SA (acres)	1.10	1.17	0.87

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.294

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2106.49	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.72	Wt. n-Val.	0.049	0.039	0.035
W.S. Elev (ft)	2105.77	Reach Len. (ft)	97.97	80.84	54.11
Crit W.S. (ft)	2105.68	Flow Area (sq ft)	0.06	26.34	0.04
E.G. Slope (ft/ft)	0.017489	Area (sq ft)	0.06	26.34	0.04
Q Total (cfs)	180.00	Flow (cfs)	0.05	179.91	0.04
Top Width (ft)	16.54	Top Width (ft)	0.61	15.54	0.39
Vel Total (ft/s)	6.81	Avg. Vel. (ft/s)	0.84	6.83	1.06
Max Chl Dpth (ft)	3.20	Hydr. Depth (ft)	0.10	1.69	0.09
Conv. Total (cfs)	1361.1	Conv. (cfs)	0.4	1360.4	0.3
Length Wtd. (ft)	81.04	Wetted Per. (ft)	0.65	16.69	0.43
Min Ch El (ft)	2102.57	Shear (lb/sq ft)	0.11	1.72	0.09
Alpha	1.01	Stream Power (lb/ft s)	0.09	11.77	0.10
Frctn Loss (ft)	0.28	Cum Volume (acre-ft)	0.01	0.20	0.00
C & E Loss (ft)	0.32	Cum SA (acres)	1.06	1.04	0.77

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.279

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2105.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.049	0.039	0.035
W.S. Elev (ft)	2105.80	Reach Len. (ft)	77.42	82.51	83.60
Crit W.S. (ft)	2104.58	Flow Area (sq ft)	7.46	73.83	1.29
E.G. Slope (ft/ft)	0.001449	Area (sq ft)	7.46	73.83	1.29
Q Total (cfs)	180.00	Flow (cfs)	5.84	173.09	1.06
Top Width (ft)	52.28	Top Width (ft)	13.29	35.51	3.48
Vel Total (ft/s)	2.18	Avg. Vel. (ft/s)	0.78	2.34	0.82
Max Chl Dpth (ft)	3.36	Hydr. Depth (ft)	0.56	2.08	0.37
Conv. Total (cfs)	4729.4	Conv. (cfs)	153.6	4547.9	28.0
Length Wtd. (ft)	82.51	Wetted Per. (ft)	13.33	35.92	3.56
Min Ch El (ft)	2102.44	Shear (lb/sq ft)	0.05	0.19	0.03
Alpha	1.12	Stream Power (lb/ft s)	0.04	0.44	0.03
Frctn Loss (ft)		Cum Volume (acre-ft)		0.11	
C & E Loss (ft)		Cum SA (acres)	1.05	1.00	0.77

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.263

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2104.18	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.74	Wt. n-Val.	0.049	0.035		
W.S. Elev (ft)	2103.44	Reach Len. (ft)	45.34	99.22	161.90	
Crit W.S. (ft)	2103.44	Flow Area (sq ft)	15.41	57.25		
E.G. Slope (ft/ft)	0.009005	Area (sq ft)	15.41	57.25		
Q Total (cfs)	428.00	Flow (cfs)	22.47	405.53		
Top Width (ft)	77.03	Top Width (ft)	54.64	22.39		
Vel Total (ft/s)	5.89	Avg. Vel. (ft/s)	1.46	7.08		
Max Chl Dpth (ft)	3.34	Hydr. Depth (ft)	0.28	2.56		
Conv. Total (cfs)	4510.2	Conv. (cfs)	236.8	4273.4		
Length Wtd. (ft)	90.82	Wetted Per. (ft)	54.69	24.55		
Min Ch El (ft)	2100.10	Shear (lb/sq ft)	0.16	1.31		
Alpha	1.37	Stream Power (lb/ft s)	0.23	9.29		
Frctn Loss (ft)	0.38	Cum Volume (acre-ft)	0.13	0.43	0.01	
C & E Loss (ft)	0.29	Cum SA (acres)	0.99	0.94	0.77	

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: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: 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: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.245

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2103.41	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.16	Wt. n-Val.	0.049	0.035	0.055	
W.S. Elev (ft)	2103.25	Reach Len. (ft)	26.92	29.17	30.85	
Crit W.S. (ft)		Flow Area (sq ft)	93.09	82.23	3.95	
E.G. Slope (ft/ft)	0.002438	Area (sq ft)	93.09	82.23	3.95	
Q Total (cfs)	428.00	Flow (cfs)	116.63	306.53	4.84	
Top Width (ft)	159.94	Top Width (ft)	121.58	34.33	4.03	
Vel Total (ft/s)	2.39	Avg. Vel. (ft/s)	1.25	3.73	1.23	
Max Chl Dpth (ft)	3.28	Hydr. Depth (ft)	0.77	2.40	0.98	
Conv. Total (cfs)	8667.9	Conv. (cfs)	2362.0	6207.9	98.1	
Length Wtd. (ft)	28.46	Wetted Per. (ft)	121.62	34.68	4.48	
Min Ch El (ft)	2099.97	Shear (lb/sq ft)	0.12	0.36	0.13	
Alpha	1.82	Stream Power (lb/ft s)	0.15	1.35	0.16	
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	0.08	0.27	0.00	
C & E Loss (ft)	0.01	Cum SA (acres)	0.89	0.88	0.76	

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.239

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2103.34	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.14	Wt. n-Val.	0.049	0.035	0.055	
W.S. Elev (ft)	2103.21	Reach Len. (ft)	67.37	67.73	75.52	
Crit W.S. (ft)	2102.33	Flow Area (sq ft)	108.16	73.57	5.22	
E.G. Slope (ft/ft)	0.001437	Area (sq ft)	161.03	73.57	5.22	
Q Total (cfs)	428.00	Flow (cfs)	158.84	264.36	4.80	
Top Width (ft)	191.78	Top Width (ft)	165.32	20.58	5.88	
Vel Total (ft/s)	2.29	Avg. Vel. (ft/s)	1.47	3.59	0.92	
Max Chl Dpth (ft)	4.21	Hydr. Depth (ft)	1.44	3.57	0.89	
Conv. Total (cfs)	11291.3	Conv. (cfs)	4190.5	6974.1	126.7	
Length Wtd. (ft)	67.73	Wetted Per. (ft)	74.89	22.05	6.14	
Min Ch El (ft)	2099.00	Shear (lb/sq ft)	0.13	0.30	0.08	
Alpha	1.68	Stream Power (lb/ft s)	0.19	1.08	0.07	
Frctn Loss (ft)		Cum Volume (acre-ft)		0.22		
C & E Loss (ft)		Cum SA (acres)	0.81	0.86	0.75	

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.226

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2101.24	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.65	Wt. n-Val.	0.055	0.035		
W.S. Elev (ft)	2100.59	Reach Len. (ft)	76.04	55.89	33.05	
Crit W.S. (ft)	2100.59	Flow Area (sq ft)	0.21	66.19		
E.G. Slope (ft/ft)	0.016019	Area (sq ft)	0.21	66.19		

Q Total (cfs)	428.00	Flow (cfs)	0.14	427.86		
Top Width (ft)	52.34	Top Width (ft)	2.49	49.85		
Vel Total (ft/s)	6.45	Avg. Vel. (ft/s)	0.65	6.46		
Max Chl Dpth (ft)	2.34	Hydr. Depth (ft)	0.08	1.33		
Conv. Total (cfs)	3381.7	Conv. (cfs)	1.1	3380.6		
Length Wtd. (ft)	55.13	Wetted Per. (ft)	2.49	50.17		
Min Ch El (ft)	2098.25	Shear (lb/sq ft)	0.08	1.32		
Alpha	1.01	Stream Power (lb/ft s)	0.05	8.53		
Frctn Loss (ft)	0.34	Cum Volume (acre-ft)	1.16	2.15	0.98	
C & E Loss (ft)	0.15	Cum SA (acres)	0.68	0.80	0.75	

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.216

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2099.76	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.34	Wt. n-Val.	0.055	0.035	0.055
W.S. Elev (ft)	2099.43	Reach Len. (ft)	109.25	113.57	127.29
Crit W.S. (ft)		Flow Area (sq ft)	13.44	69.05	25.77
E.G. Slope (ft/ft)	0.003200	Area (sq ft)	13.44	69.05	25.77
Q Total (cfs)	428.00	Flow (cfs)	25.63	350.98	51.39
Top Width (ft)	48.65	Top Width (ft)	9.23	22.35	17.07
Vel Total (ft/s)	3.95	Avg. Vel. (ft/s)	1.91	5.08	1.99
Max Chl Dpth (ft)	3.53	Hydr. Depth (ft)	1.46	3.09	1.51
Conv. Total (cfs)	7565.8	Conv. (cfs)	453.0	6204.3	908.4
Length Wtd. (ft)	114.29	Wetted Per. (ft)	9.65	22.43	17.30
Min Ch El (ft)	2095.89	Shear (lb/sq ft)	0.28	0.62	0.30
Alpha	1.40	Stream Power (lb/ft s)	0.53	3.13	0.59
Frctn Loss (ft)	0.67	Cum Volume (acre-ft)	1.15	2.07	0.97
C & E Loss (ft)	0.08	Cum SA (acres)	0.67	0.76	0.74

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.194

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2099.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.19	Wt. n-Val.	0.055	0.035	0.055
W.S. Elev (ft)	2097.83	Reach Len. (ft)	183.85	186.13	187.15
Crit W.S. (ft)	2097.83	Flow Area (sq ft)	0.29	48.63	0.95
E.G. Slope (ft/ft)	0.013855	Area (sq ft)	0.29	48.63	0.95
Q Total (cfs)	428.00	Flow (cfs)	0.37	426.11	1.52
Top Width (ft)	23.14	Top Width (ft)	1.07	19.52	2.55
Vel Total (ft/s)	8.58	Avg. Vel. (ft/s)	1.24	8.76	1.60
Max Chl Dpth (ft)	4.32	Hydr. Depth (ft)	0.28	2.49	0.37
Conv. Total (cfs)	3636.1	Conv. (cfs)	3.1	3620.0	12.9
Length Wtd. (ft)	185.96	Wetted Per. (ft)	1.20	20.94	2.66
Min Ch El (ft)	2093.51	Shear (lb/sq ft)	0.21	2.01	0.31
Alpha	1.04	Stream Power (lb/ft s)	0.26	17.60	0.50
Frctn Loss (ft)	2.34	Cum Volume (acre-ft)	1.13	1.91	0.93
C & E Loss (ft)	0.19	Cum SA (acres)	0.65	0.70	0.71

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.159

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2095.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.56	Wt. n-Val.	0.055	0.035	0.055
W.S. Elev (ft)	2094.52	Reach Len. (ft)	372.88	368.68	360.58
Crit W.S. (ft)	2094.52	Flow Area (sq ft)	28.62	56.66	0.78
E.G. Slope (ft/ft)	0.011447	Area (sq ft)	28.62	56.66	0.78
Q Total (cfs)	428.00	Flow (cfs)	63.24	363.95	0.81
Top Width (ft)	79.66	Top Width (ft)	42.70	33.36	3.60
Vel Total (ft/s)	4.97	Avg. Vel. (ft/s)	2.21	6.42	1.04
Max Chl Dpth (ft)	2.84	Hydr. Depth (ft)	0.67	1.70	0.22
Conv. Total (cfs)	4000.3	Conv. (cfs)	591.1	3401.6	7.6
Length Wtd. (ft)	368.98	Wetted Per. (ft)	42.81	33.70	3.62
Min Ch El (ft)	2091.68	Shear (lb/sq ft)	0.48	1.20	0.15
Alpha	1.45	Stream Power (lb/ft s)	1.06	7.72	0.16
Frctn Loss (ft)	4.83	Cum Volume (acre-ft)	1.07	1.69	0.93
C & E Loss (ft)	0.02	Cum SA (acres)	0.56	0.59	0.70

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: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.089

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2087.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.71	Wt. n-Val.	0.055	0.035	0.055
W.S. Elev (ft)	2086.92	Reach Len. (ft)	293.21	281.13	263.99
Crit W.S. (ft)	2086.92	Flow Area (sq ft)	1.05	62.47	0.69
E.G. Slope (ft/ft)	0.015082	Area (sq ft)	1.05	62.47	0.69
Q Total (cfs)	428.00	Flow (cfs)	1.92	425.02	1.06
Top Width (ft)	46.25	Top Width (ft)	2.43	41.71	2.11
Vel Total (ft/s)	6.67	Avg. Vel. (ft/s)	1.83	6.80	1.53
Max Chl Dpth (ft)	1.96	Hydr. Depth (ft)	0.43	1.50	0.33
Conv. Total (cfs)	3485.0	Conv. (cfs)	15.6	3460.8	8.6
Length Wtd. (ft)	277.44	Wetted Per. (ft)	2.58	41.91	2.21
Min Ch El (ft)	2084.96	Shear (lb/sq ft)	0.38	1.40	0.29
Alpha	1.04	Stream Power (lb/ft s)	0.70	9.55	0.45
Frctn Loss (ft)	0.73	Cum Volume (acre-ft)	0.95	1.18	0.92
C & E Loss (ft)	0.20	Cum SA (acres)	0.37	0.27	0.68

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.036

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2082.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.055	0.035	0.055
W.S. Elev (ft)	2082.23	Reach Len. (ft)	73.64	74.31	75.38
Crit W.S. (ft)	2081.81	Flow Area (sq ft)	84.06	54.70	222.38
E.G. Slope (ft/ft)	0.001047	Area (sq ft)	84.06	54.70	222.38
Q Total (cfs)	428.00	Flow (cfs)	73.08	118.82	236.10
Top Width (ft)	278.33	Top Width (ft)	84.71	27.51	166.11
Vel Total (ft/s)	1.19	Avg. Vel. (ft/s)	0.87	2.17	1.06
Max Chl Dpth (ft)	2.13	Hydr. Depth (ft)	0.99	1.99	1.34
Conv. Total (cfs)	13229.0	Conv. (cfs)	2258.9	3672.5	7297.6
Length Wtd. (ft)	74.56	Wetted Per. (ft)	84.74	27.51	166.13
Min Ch El (ft)	2080.15	Shear (lb/sq ft)	0.06	0.13	0.09
Alpha	1.47	Stream Power (lb/ft s)	0.06	0.28	0.09
Frctn Loss (ft)	0.13	Cum Volume (acre-ft)	0.66	0.81	0.24
C & E Loss (ft)	0.03	Cum SA (acres)	0.07	0.05	0.17

Warning: Multiple water surfaces were found that could balance the energy equation. The program selected the water surface

whose main channel velocity head was the closest to the previously computed cross section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #1 RS: 0.022

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2082.11	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.35	Wt. n-Val.	0.064	0.035	0.064
W.S. Elev (ft)	2081.76	Reach Len. (ft)	330.00	330.00	330.00
Crit W.S. (ft)		Flow Area (sq ft)	2.52	87.54	10.93
E.G. Slope (ft/ft)	0.003138	Area (sq ft)	2.52	87.54	10.93
Q Total (cfs)	428.00	Flow (cfs)	2.65	417.74	7.61
Top Width (ft)	61.06	Top Width (ft)	3.03	30.22	27.81
Vel Total (ft/s)	4.24	Avg. Vel. (ft/s)	1.05	4.77	0.70
Max Chl Dpth (ft)	3.33	Hydr. Depth (ft)	0.83	2.90	0.39
Conv. Total (cfs)	7640.4	Conv. (cfs)	47.3	7457.3	135.8
Length Wtd. (ft)	330.00	Wetted Per. (ft)	3.46	30.80	27.93
Min Ch El (ft)	2078.43	Shear (lb/sq ft)	0.14	0.56	0.08
Alpha	1.24	Stream Power (lb/ft s)	0.15	2.66	0.05
Frctn Loss (ft)	2.23	Cum Volume (acre-ft)	0.59	0.69	0.04
C & E Loss (ft)	0.15	Cum SA (acres)			

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 3.132

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2331.15	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.67	Wt. n-Val.	0.035	0.030	0.035
W.S. Elev (ft)	2330.49	Reach Len. (ft)	141.91	141.71	141.66
Crit W.S. (ft)	2330.49	Flow Area (sq ft)	11.19	195.72	6.31
E.G. Slope (ft/ft)	0.010573	Area (sq ft)	11.19	195.72	6.31
Q Total (cfs)	1344.00	Flow (cfs)	27.72	1299.81	16.47
Top Width (ft)	171.17	Top Width (ft)	26.15	131.42	13.60
Vel Total (ft/s)	6.30	Avg. Vel. (ft/s)	2.48	6.64	2.61
Max Chl Dpth (ft)	1.78	Hydr. Depth (ft)	0.43	1.49	0.46
Conv. Total (cfs)	13070.5	Conv. (cfs)	269.6	12640.7	160.2
Length Wtd. (ft)	141.70	Wetted Per. (ft)	26.17	131.44	13.63
Min Ch El (ft)	2328.71	Shear (lb/sq ft)	0.28	0.98	0.31
Alpha	1.08	Stream Power (lb/ft s)	0.70	6.53	0.80
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	0.13	1.67	1.47
C & E Loss (ft)	0.32	Cum SA (acres)	12.69	11.11	13.76

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: 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: SUNNYCOVE WASH
REACH: REACH #2 RS: 3.105

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2330.19	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.045	0.035	0.045
W.S. Elev (ft)	2330.17	Reach Len. (ft)	75.04	75.06	75.03
Crit W.S. (ft)	2326.38	Flow Area (sq ft)	69.69	498.64	898.46
E.G. Slope (ft/ft)	0.000114	Area (sq ft)	69.69	498.64	898.46
Q Total (cfs)	1344.00	Flow (cfs)	22.64	694.78	626.57
Top Width (ft)	490.83	Top Width (ft)	78.63	89.51	322.69
Vel Total (ft/s)	0.92	Avg. Vel. (ft/s)	0.32	1.39	0.70
Max Chl Dpth (ft)	7.99	Hydr. Depth (ft)	0.89	5.57	2.78
Conv. Total (cfs)	125916.1	Conv. (cfs)	2121.6	65092.6	58701.9
Length Wtd. (ft)	75.06	Wetted Per. (ft)	78.72	92.48	322.81
Min Ch El (ft)	2322.18	Shear (lb/sq ft)	0.01	0.04	0.02
Alpha	1.47	Stream Power (lb/ft s)	0.00	0.05	0.01
Frctn Loss (ft)		Cum Volume (acre-ft)		0.54	
C & E Loss (ft)		Cum SA (acres)	12.52	10.75	13.21

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 3.091

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2326.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.72	Wt. n-Val.	0.045	0.033	0.045
W.S. Elev (ft)	2325.88	Reach Len. (ft)	161.13	166.69	164.71
Crit W.S. (ft)		Flow Area (sq ft)	0.43	195.84	3.04
E.G. Slope (ft/ft)	0.005285	Area (sq ft)	0.43	195.84	3.04
Q Total (cfs)	1344.00	Flow (cfs)	0.39	1339.05	4.56
Top Width (ft)	71.19	Top Width (ft)	1.73	63.35	6.11
Vel Total (ft/s)	6.74	Avg. Vel. (ft/s)	0.92	6.84	1.50
Max Chl Dpth (ft)	3.90	Hydr. Depth (ft)	0.25	3.09	0.50
Conv. Total (cfs)	18487.8	Conv. (cfs)	5.4	18419.7	62.7
Length Wtd. (ft)	166.28	Wetted Per. (ft)	1.80	64.87	6.17
Min Ch El (ft)	2321.98	Shear (lb/sq ft)	0.08	1.00	0.16
Alpha	1.02	Stream Power (lb/ft s)	0.07	6.81	0.24
Frctn Loss (ft)	0.82	Cum Volume (acre-ft)	22.15	28.89	20.44
C & E Loss (ft)	0.00	Cum SA (acres)	12.45	10.61	12.93

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 3.060

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2325.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.73	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2325.04	Reach Len. (ft)	323.55	342.36	325.27
Crit W.S. (ft)	2325.04	Flow Area (sq ft)	79.20	123.66	133.77
E.G. Slope (ft/ft)	0.004650	Area (sq ft)	79.20	123.66	133.77
Q Total (cfs)	1344.00	Flow (cfs)	106.99	982.44	254.57
Top Width (ft)	275.84	Top Width (ft)	119.23	29.29	127.32
Vel Total (ft/s)	3.99	Avg. Vel. (ft/s)	1.35	7.94	1.90
Max Chl Dpth (ft)	4.94	Hydr. Depth (ft)	0.66	4.22	1.05
Conv. Total (cfs)	19708.4	Conv. (cfs)	1568.9	14406.5	3733.0
Length Wtd. (ft)	336.02	Wetted Per. (ft)	119.58	29.71	128.23
Min Ch El (ft)	2320.10	Shear (lb/sq ft)	0.19	1.21	0.30
Alpha	2.95	Stream Power (lb/ft s)	0.26	9.60	0.58
Frctn Loss (ft)	1.92	Cum Volume (acre-ft)	22.01	28.28	20.18
C & E Loss (ft)	0.01	Cum SA (acres)	12.22	10.44	12.68

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: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.995

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2322.21	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.85	Wt. n-Val.	0.058	0.033	0.060
W.S. Elev (ft)	2321.36	Reach Len. (ft)	478.57	495.95	490.12
Crit W.S. (ft)	2321.36	Flow Area (sq ft)	167.37	81.69	30.65
E.G. Slope (ft/ft)	0.007208	Area (sq ft)	167.37	81.69	30.65
Q Total (cfs)	1344.00	Flow (cfs)	511.69	770.23	62.08
Top Width (ft)	152.92	Top Width (ft)	99.80	20.92	32.20
Vel Total (ft/s)	4.80	Avg. Vel. (ft/s)	3.06	9.43	2.03
Max Chl Dpth (ft)	4.29	Hydr. Depth (ft)	1.68	3.90	0.95
Conv. Total (cfs)	15830.3	Conv. (cfs)	6026.9	9072.2	731.2
Length Wtd. (ft)	491.44	Wetted Per. (ft)	100.44	21.09	32.43
Min Ch El (ft)	2317.07	Shear (lb/sq ft)	0.75	1.74	0.43
Alpha	2.37	Stream Power (lb/ft s)	2.29	16.43	0.86
Frctn Loss (ft)	3.31	Cum Volume (acre-ft)	21.09	27.47	19.57
C & E Loss (ft)	0.00	Cum SA (acres)	11.41	10.24	12.08

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.901

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2315.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.86	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2314.77	Reach Len. (ft)	350.30	361.80	393.51
Crit W.S. (ft)	2314.77	Flow Area (sq ft)	22.13	108.54	159.70
E.G. Slope (ft/ft)	0.006334	Area (sq ft)	22.13	108.54	159.70
Q Total (cfs)	1414.00	Flow (cfs)	47.33	962.41	404.26
Top Width (ft)	166.38	Top Width (ft)	20.90	27.10	118.38
Vel Total (ft/s)	4.87	Avg. Vel. (ft/s)	2.14	8.87	2.53
Max Chl Dpth (ft)	5.28	Hydr. Depth (ft)	1.06	4.01	1.35
Conv. Total (cfs)	17766.6	Conv. (cfs)	594.7	12092.5	5079.4
Length Wtd. (ft)	370.28	Wetted Per. (ft)	21.14	27.89	118.50
Min Ch El (ft)	2309.49	Shear (lb/sq ft)	0.41	1.54	0.53
Alpha	2.34	Stream Power (lb/ft s)	0.89	13.65	1.35
Frctn Loss (ft)	2.95	Cum Volume (acre-ft)	20.05	26.39	18.50
C & E Loss (ft)	0.01	Cum SA (acres)	10.75	9.97	11.24

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.832

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2310.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.92	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2309.17	Reach Len. (ft)	496.90	493.39	489.66
Crit W.S. (ft)	2309.17	Flow Area (sq ft)	31.29	101.91	108.46
E.G. Slope (ft/ft)	0.010336	Area (sq ft)	31.29	101.91	108.46
Q Total (cfs)	1414.00	Flow (cfs)	83.22	931.15	399.63
Top Width (ft)	133.18	Top Width (ft)	31.04	36.08	66.06
Vel Total (ft/s)	5.85	Avg. Vel. (ft/s)	2.66	9.14	3.68
Max Chl Dpth (ft)	3.10	Hydr. Depth (ft)	1.01	2.82	1.64
Conv. Total (cfs)	13908.1	Conv. (cfs)	818.6	9158.8	3930.7
Length Wtd. (ft)	493.54	Wetted Per. (ft)	31.14	36.14	66.16
Min Ch El (ft)	2306.07	Shear (lb/sq ft)	0.65	1.82	1.06
Alpha	1.73	Stream Power (lb/ft s)	1.72	16.62	3.90
Frctn Loss (ft)	5.80	Cum Volume (acre-ft)	19.83	25.51	17.28
C & E Loss (ft)	0.01	Cum SA (acres)	10.54	9.70	10.40

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.739

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2303.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.87	Wt. n-Val.	0.060	0.033	0.057
W.S. Elev (ft)	2302.67	Reach Len. (ft)	495.93	431.55	392.82
Crit W.S. (ft)	2302.67	Flow Area (sq ft)	156.29	62.09	35.64
E.G. Slope (ft/ft)	0.013471	Area (sq ft)	156.29	62.09	35.64
Q Total (cfs)	1414.00	Flow (cfs)	623.71	634.88	155.42
Top Width (ft)	138.49	Top Width (ft)	95.45	22.68	20.37
Vel Total (ft/s)	5.57	Avg. Vel. (ft/s)	3.99	10.22	4.36
Max Chl Dpth (ft)	2.83	Hydr. Depth (ft)	1.64	2.74	1.75
Conv. Total (cfs)	12183.0	Conv. (cfs)	5373.8	5470.1	1339.1
Length Wtd. (ft)		Wetted Per. (ft)	95.54	22.69	20.60
Min Ch El (ft)	2299.84	Shear (lb/sq ft)	1.38	2.30	1.46
Alpha	1.81	Stream Power (lb/ft s)	5.49	23.53	6.34
Frctn Loss (ft)		Cum Volume (acre-ft)	18.77	24.58	16.47
C & E Loss (ft)		Cum SA (acres)	9.82	9.37	9.92

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.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.657

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2297.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.11	Wt. n-Val.	0.060	0.035	0.057
W.S. Elev (ft)	2296.42	Reach Len. (ft)	289.00	346.56	404.01
Crit W.S. (ft)	2296.42	Flow Area (sq ft)	22.75	131.29	49.75
E.G. Slope (ft/ft)	0.010552	Area (sq ft)	22.75	131.29	49.75
Q Total (cfs)	1414.00	Flow (cfs)	65.70	1195.14	153.16
Top Width (ft)	102.41	Top Width (ft)	18.66	43.46	40.29
Vel Total (ft/s)	6.94	Avg. Vel. (ft/s)	2.89	9.10	3.08
Max Chl Dpth (ft)	3.42	Hydr. Depth (ft)	1.22	3.02	1.23
Conv. Total (cfs)	13765.4	Conv. (cfs)	639.6	11634.8	1491.0
Length Wtd. (ft)	358.29	Wetted Per. (ft)	18.80	43.53	40.36
Min Ch El (ft)	2293.00	Shear (lb/sq ft)	0.80	1.99	0.81
Alpha	1.48	Stream Power (lb/ft s)	2.30	18.09	2.50
Frctn Loss (ft)	2.35	Cum Volume (acre-ft)	17.75	23.63	16.09
C & E Loss (ft)	0.19	Cum SA (acres)	9.17	9.04	9.64

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.592

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2292.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.47	Wt. n-Val.	0.060	0.035	0.057
W.S. Elev (ft)	2292.11	Reach Len. (ft)	119.02	151.06	183.93
Crit W.S. (ft)		Flow Area (sq ft)	16.37	185.84	181.73
E.G. Slope (ft/ft)	0.004799	Area (sq ft)	16.37	185.84	181.73
Q Total (cfs)	1790.00	Flow (cfs)	19.98	1182.90	587.12
Top Width (ft)	160.36	Top Width (ft)	27.21	58.16	74.99
Vel Total (ft/s)	4.66	Avg. Vel. (ft/s)	1.22	6.37	3.23
Max Chl Dpth (ft)	4.15	Hydr. Depth (ft)	0.60	3.20	2.42
Conv. Total (cfs)	25838.7	Conv. (cfs)	288.4	17075.2	8475.1
Length Wtd. (ft)	154.97	Wetted Per. (ft)	27.28	58.37	75.95
Min Ch El (ft)	2287.96	Shear (lb/sq ft)	0.18	0.95	0.72
Alpha	1.39	Stream Power (lb/ft s)	0.22	6.07	2.32
Frctn Loss (ft)	1.07	Cum Volume (acre-ft)	17.62	22.36	15.02
C & E Loss (ft)	0.12	Cum SA (acres)	9.01	8.64	9.11

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.563

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2291.39	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.65	Wt. n-Val.	0.057	0.035	0.057
W.S. Elev (ft)	2289.74	Reach Len. (ft)	403.13	354.16	306.31
Crit W.S. (ft)	2289.74	Flow Area (sq ft)	45.40	142.30	12.14
E.G. Slope (ft/ft)	0.010794	Area (sq ft)	45.40	142.30	12.14
Q Total (cfs)	1790.00	Flow (cfs)	190.45	1555.81	43.74
Top Width (ft)	66.72	Top Width (ft)	23.23	36.35	7.14
Vel Total (ft/s)	8.96	Avg. Vel. (ft/s)	4.19	10.93	3.60
Max Chl Dpth (ft)	3.99	Hydr. Depth (ft)	1.95	3.91	1.70

* Conv. Total (cfs)	* 17229.4	* Conv. (cfs)	* 1833.2	* 14975.2	* 421.0	*
* Length Wtd. (ft)	* 353.76	* Wetted Per. (ft)	* 23.56	* 36.46	* 7.91	*
* Min Ch El (ft)	* 2285.75	* Shear (lb/sq ft)	* 1.30	* 2.63	* 1.03	*
* Alpha	* 1.32	* Stream Power (lb/ft s)	* 5.45	* 28.75	* 3.73	*
* Frctn Loss (ft)	* 3.28	* Cum Volume (acre-ft)	* 17.53	* 21.80	* 14.61	*
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 8.94	* 8.48	* 8.94	*

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.496

CROSS SECTION OUTPUT Profile #500-YEAR

* E.G. Elev (ft)	* 2286.65	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 1.55	* Wt. n-Val.	* 0.057	* 0.033	* 0.057	*
* W.S. Elev (ft)	* 2285.10	* Reach Len. (ft)	* 321.65	* 335.45	* 333.37	*
* Crit W.S. (ft)	* 2285.10	* Flow Area (sq ft)	* 20.97	* 133.08	* 76.11	*
* E.G. Slope (ft/ft)	*0.008052	* Area (sq ft)	* 20.97	* 133.08	* 76.11	*
* Q Total (cfs)	* 1790.00	* Flow (cfs)	* 74.95	* 1457.09	* 257.96	*
* Top Width (ft)	* 83.45	* Top Width (ft)	* 10.34	* 29.62	* 43.50	*
* Vel Total (ft/s)	* 7.78	* Avg. Vel. (ft/s)	* 3.57	* 10.95	* 3.39	*
* Max Chl Dpth (ft)	* 4.84	* Hydr. Depth (ft)	* 2.03	* 4.49	* 1.75	*
* Conv. Total (cfs)	* 19948.1	* Conv. (cfs)	* 835.3	* 16238.1	* 2874.8	*
* Length Wtd. (ft)	* 330.78	* Wetted Per. (ft)	* 11.10	* 29.83	* 43.64	*
* Min Ch El (ft)	* 2280.26	* Shear (lb/sq ft)	* 0.95	* 2.24	* 0.88	*
* Alpha	* 1.65	* Stream Power (lb/ft s)	* 3.39	* 24.55	* 2.97	*
* Frctn Loss (ft)	* 2.33	* Cum Volume (acre-ft)	* 17.22	* 20.68	* 14.30	*
* C & E Loss (ft)	* 0.32	* Cum SA (acres)	* 8.79	* 8.21	* 8.76	*

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.432

CROSS SECTION OUTPUT Profile #500-YEAR

* E.G. Elev (ft)	* 2280.57	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.50	* Wt. n-Val.	* 0.057	* 0.033	* 0.057	*
* W.S. Elev (ft)	* 2280.07	* Reach Len. (ft)	* 164.74	* 281.80	* 317.21	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 280.91	* 76.37	* 31.37	*
* E.G. Slope (ft/ft)	*0.006239	* Area (sq ft)	* 280.91	* 76.37	* 31.37	*
* Q Total (cfs)	* 1790.00	* Flow (cfs)	* 1084.08	* 618.54	* 87.38	*
* Top Width (ft)	* 151.16	* Top Width (ft)	* 109.29	* 22.19	* 19.68	*
* Vel Total (ft/s)	* 4.61	* Avg. Vel. (ft/s)	* 3.86	* 8.10	* 2.79	*
* Max Chl Dpth (ft)	* 3.69	* Hydr. Depth (ft)	* 2.57	* 3.44	* 1.59	*
* Conv. Total (cfs)	* 22661.8	* Conv. (cfs)	* 13724.7	* 7830.9	* 1106.3	*
* Length Wtd. (ft)	* 236.66	* Wetted Per. (ft)	* 109.49	* 22.22	* 19.94	*
* Min Ch El (ft)	* 2276.38	* Shear (lb/sq ft)	* 1.00	* 1.34	* 0.61	*
* Alpha	* 1.51	* Stream Power (lb/ft s)	* 3.86	* 10.84	* 1.71	*
* Frctn Loss (ft)	* 1.73	* Cum Volume (acre-ft)	* 16.11	* 19.87	* 13.88	*
* C & E Loss (ft)	* 0.12	* Cum SA (acres)	* 8.35	* 8.01	* 8.52	*

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.379

CROSS SECTION OUTPUT Profile #500-YEAR

* E.G. Elev (ft)	* 2278.73	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 1.66	* Wt. n-Val.	* 0.057	* 0.033	* 0.057	*
* W.S. Elev (ft)	* 2277.07	* Reach Len. (ft)	* 331.81	* 311.94	* 290.99	*

Crit W.S. (ft)	2277.07	Flow Area (sq ft)	88.92	117.99	21.15	
E.G. Slope (ft/ft)	0.008641	Area (sq ft)	88.92	117.99	21.15	
Q Total (cfs)	1790.00	Flow (cfs)	345.37	1369.88	74.76	
Top Width (ft)	80.37	Top Width (ft)	43.58	25.39	11.40	
Vel Total (ft/s)	7.85	Avg. Vel. (ft/s)	3.88	11.61	3.53	
Max Chl Dpth (ft)	4.74	Hydr. Depth (ft)	2.04	4.65	1.86	
Conv. Total (cfs)	19255.7	Conv. (cfs)	3715.2	14736.2	804.2	
Length Wtd. (ft)	313.19	Wetted Per. (ft)	43.83	25.54	12.01	
Min Ch El (ft)	2272.33	Shear (lb/sq ft)	1.09	2.49	0.95	
Alpha	1.73	Stream Power (lb/ft s)	4.25	28.93	3.36	
Frctn Loss (ft)	2.88	Cum Volume (acre-ft)	15.41	19.24	13.69	
C & E Loss (ft)	0.02	Cum SA (acres)	8.06	7.85	8.40	

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.320

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2273.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.59	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2272.38	Reach Len. (ft)	329.37	310.98	280.86
Crit W.S. (ft)	2272.38	Flow Area (sq ft)	35.95	131.30	45.12
E.G. Slope (ft/ft)	0.009775	Area (sq ft)	35.95	131.30	45.12
Q Total (cfs)	1790.00	Flow (cfs)	153.68	1450.79	185.53
Top Width (ft)	71.97	Top Width (ft)	16.30	33.56	22.10
Vel Total (ft/s)	8.43	Avg. Vel. (ft/s)	4.27	11.05	4.11
Max Chl Dpth (ft)	4.15	Hydr. Depth (ft)	2.21	3.91	2.04
Conv. Total (cfs)	18104.6	Conv. (cfs)	1554.4	14673.7	1876.5
Length Wtd. (ft)	309.80	Wetted Per. (ft)	16.83	33.58	22.39
Min Ch El (ft)	2268.23	Shear (lb/sq ft)	1.30	2.39	1.23
Alpha	1.44	Stream Power (lb/ft s)	5.57	26.37	5.06
Frctn Loss (ft)	2.85	Cum Volume (acre-ft)	14.94	18.35	13.47
C & E Loss (ft)	0.03	Cum SA (acres)	7.83	7.64	8.29

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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: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.261

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2269.19	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.84	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2267.35	Reach Len. (ft)	300.38	305.66	292.49
Crit W.S. (ft)	2267.35	Flow Area (sq ft)	14.00	147.45	28.10
E.G. Slope (ft/ft)	0.008653	Area (sq ft)	14.00	147.45	28.10
Q Total (cfs)	1790.00	Flow (cfs)	49.77	1661.83	78.40
Top Width (ft)	62.25	Top Width (ft)	6.67	32.98	22.60
Vel Total (ft/s)	9.44	Avg. Vel. (ft/s)	3.56	11.27	2.79
Max Chl Dpth (ft)	5.10	Hydr. Depth (ft)	2.10	4.47	1.24
Conv. Total (cfs)	19242.6	Conv. (cfs)	535.0	17864.8	842.8
Length Wtd. (ft)	305.07	Wetted Per. (ft)	7.88	33.41	22.76
Min Ch El (ft)	2262.24	Shear (lb/sq ft)	0.96	2.38	0.67
Alpha	1.33	Stream Power (lb/ft s)	3.41	26.87	1.86
Frctn Loss (ft)	2.80	Cum Volume (acre-ft)	14.75	17.35	13.24
C & E Loss (ft)	0.05	Cum SA (acres)	7.74	7.41	8.15

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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: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.203

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2262.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.68	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2260.84	Reach Len. (ft)	410.17	450.67	490.30
Crit W.S. (ft)	2260.84	Flow Area (sq ft)	16.16	159.34	12.19
E.G. Slope (ft/ft)	0.009774	Area (sq ft)	16.16	159.34	12.19
Q Total (cfs)	1790.00	Flow (cfs)	51.54	1697.04	41.42
Top Width (ft)	61.66	Top Width (ft)	11.38	42.93	7.34
Vel Total (ft/s)	9.54	Avg. Vel. (ft/s)	3.19	10.65	3.40
Max Chl Dpth (ft)	4.13	Hydr. Depth (ft)	1.42	3.71	1.66
Conv. Total (cfs)	18105.9	Conv. (cfs)	521.3	17165.7	419.0
Length Wtd. (ft)	450.43	Wetted Per. (ft)	11.73	43.06	8.06
Min Ch El (ft)	2256.71	Shear (lb/sq ft)	0.84	2.26	0.92
Alpha	1.19	Stream Power (lb/ft s)	2.68	24.05	3.14
Frctn Loss (ft)	4.35	Cum Volume (acre-ft)	14.64	16.28	13.10
C & E Loss (ft)	0.02	Cum SA (acres)	7.68	7.14	8.05

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need for additional cross sections.
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defaulted to critical depth.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.118

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2256.10	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.89	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2254.20	Reach Len. (ft)	474.96	473.09	470.63
Crit W.S. (ft)	2254.20	Flow Area (sq ft)	9.35	155.80	7.49
E.G. Slope (ft/ft)	0.009523	Area (sq ft)	9.35	155.80	7.49
Q Total (cfs)	1790.00	Flow (cfs)	28.55	1742.36	19.09
Top Width (ft)	51.38	Top Width (ft)	6.46	37.77	7.15
Vel Total (ft/s)	10.37	Avg. Vel. (ft/s)	3.05	11.18	2.55
Max Chl Dpth (ft)	4.57	Hydr. Depth (ft)	1.45	4.12	1.05
Conv. Total (cfs)	18343.1	Conv. (cfs)	292.5	17854.9	195.7
Length Wtd. (ft)	472.69	Wetted Per. (ft)	7.11	38.37	7.48
Min Ch El (ft)	2249.63	Shear (lb/sq ft)	0.78	2.41	0.60
Alpha	1.13	Stream Power (lb/ft s)	2.39	26.99	1.52
Frctn Loss (ft)	5.05	Cum Volume (acre-ft)	14.52	14.65	12.99
C & E Loss (ft)	0.07	Cum SA (acres)	7.60	6.72	7.96

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need for additional cross sections.
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defaulted to critical depth.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 2.028

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2247.55	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.67	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2245.88	Reach Len. (ft)	543.25	516.73	445.55
Crit W.S. (ft)	2245.88	Flow Area (sq ft)	19.65	83.66	108.07
E.G. Slope (ft/ft)	0.012078	Area (sq ft)	19.65	83.66	108.07
Q Total (cfs)	1790.00	Flow (cfs)	89.15	1054.92	645.93
Top Width (ft)	64.58	Top Width (ft)	8.80	20.55	35.23
Vel Total (ft/s)	8.47	Avg. Vel. (ft/s)	4.54	12.61	5.98
Max Chl Dpth (ft)	4.46	Hydr. Depth (ft)	2.23	4.07	3.07
Conv. Total (cfs)	16287.3	Conv. (cfs)	811.2	9598.8	5877.3
Length Wtd. (ft)	499.33	Wetted Per. (ft)	9.86	20.57	35.86
Min Ch El (ft)	2241.42	Shear (lb/sq ft)	1.50	3.07	2.27
Alpha	1.50	Stream Power (lb/ft s)	6.82	38.67	13.58
Frctn Loss (ft)	4.54	Cum Volume (acre-ft)	14.36	13.35	12.37
C & E Loss (ft)	0.13	Cum SA (acres)	7.51	6.40	7.74

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need for additional cross sections.
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defaulted to critical depth.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.930

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2240.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.25	Wt. n-Val.	0.060	0.033	0.057
W.S. Elev (ft)	2239.54	Reach Len. (ft)	314.10	334.19	353.01
Crit W.S. (ft)	2239.54	Flow Area (sq ft)	68.37	113.46	104.30
E.G. Slope (ft/ft)	0.007095	Area (sq ft)	68.37	113.46	104.30
Q Total (cfs)	1790.00	Flow (cfs)	231.51	1209.74	348.75
Top Width (ft)	111.92	Top Width (ft)	32.68	23.93	55.31
Vel Total (ft/s)	6.26	Avg. Vel. (ft/s)	3.39	10.66	3.34
Max Chl Dpth (ft)	4.97	Hydr. Depth (ft)	2.09	4.74	1.89
Conv. Total (cfs)	21251.2	Conv. (cfs)	2748.5	14362.3	4140.5
Length Wtd. (ft)	332.13	Wetted Per. (ft)	33.06	24.07	55.50
Min Ch El (ft)	2234.57	Shear (lb/sq ft)	0.92	2.09	0.83
Alpha	2.06	Stream Power (lb/ft s)	3.10	22.26	2.78
Frctn Loss (ft)	2.59	Cum Volume (acre-ft)	13.82	12.18	11.28
C & E Loss (ft)	0.00	Cum SA (acres)	7.26	6.14	7.27

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need for additional cross sections.
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defaulted to critical depth.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.867

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2236.19	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.26	Wt. n-Val.	0.062	0.033	0.057
W.S. Elev (ft)	2234.92	Reach Len. (ft)	187.09	193.59	197.38
Crit W.S. (ft)	2234.92	Flow Area (sq ft)	156.73	93.82	32.56
E.G. Slope (ft/ft)	0.008635	Area (sq ft)	156.73	93.82	32.56
Q Total (cfs)	1790.00	Flow (cfs)	592.91	1058.55	138.55
Top Width (ft)	104.75	Top Width (ft)	70.42	21.17	13.15
Vel Total (ft/s)	6.32	Avg. Vel. (ft/s)	3.78	11.28	4.26
Max Chl Dpth (ft)	4.53	Hydr. Depth (ft)	2.23	4.43	2.47
Conv. Total (cfs)	19262.5	Conv. (cfs)	6380.4	11391.2	1490.9
Length Wtd. (ft)	192.11	Wetted Per. (ft)	70.79	21.19	13.98
Min Ch El (ft)	2230.40	Shear (lb/sq ft)	1.19	2.39	1.26
Alpha	2.04	Stream Power (lb/ft s)	4.52	26.93	5.34
Frctn Loss (ft)	1.62	Cum Volume (acre-ft)	13.00	11.38	10.73
C & E Loss (ft)	0.01	Cum SA (acres)	6.88	5.97	7.00

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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: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.830

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2233.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.24	Wt. n-Val.	0.062	0.033	0.057
W.S. Elev (ft)	2232.11	Reach Len. (ft)	273.57	276.78	275.85
Crit W.S. (ft)	2232.11	Flow Area (sq ft)	128.43	157.67	26.72
E.G. Slope (ft/ft)	0.008243	Area (sq ft)	128.43	157.67	26.72
Q Total (cfs)	2102.00	Flow (cfs)	424.81	1593.76	83.43
Top Width (ft)	126.02	Top Width (ft)	68.31	40.33	17.38
Vel Total (ft/s)	6.72	Avg. Vel. (ft/s)	3.31	10.11	3.12
Max Chl Dpth (ft)	4.58	Hydr. Depth (ft)	1.88	3.91	1.54

* Conv. Total (cfs)	* 23151.9	* Conv. (cfs)	* 4678.9	* 17554.1	* 918.9	*
* Length Wtd. (ft)	* 276.07	* Wetted Per. (ft)	* 68.53	* 40.55	* 17.64	*
* Min Ch El (ft)	* 2227.53	* Shear (lb/sq ft)	* 0.96	* 2.00	* 0.78	*
* Alpha	* 1.77	* Stream Power (lb/ft s)	* 3.19	* 20.23	* 2.43	*
* Frctn Loss (ft)	* 2.47	* Cum Volume (acre-ft)	* 12.39	* 10.82	* 10.59	*
* C & E Loss (ft)	* 0.05	* Cum SA (acres)	* 6.59	* 5.83	* 6.93	*

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CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.778

CROSS SECTION OUTPUT Profile #500-YEAR

* E.G. Elev (ft)	* 2229.83	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 1.08	* Wt. n-Val.	* 0.057	* 0.033	* 0.057	*
* W.S. Elev (ft)	* 2228.76	* Reach Len. (ft)	* 234.89	* 236.05	* 238.39	*
* Crit W.S. (ft)	* 2228.76	* Flow Area (sq ft)	* 94.66	* 130.48	* 124.71	*
* E.G. Slope (ft/ft)	*0.009736	* Area (sq ft)	* 94.66	* 130.48	* 124.71	*
* Q Total (cfs)	* 2102.00	* Flow (cfs)	* 359.00	* 1322.83	* 420.17	*
* Top Width (ft)	* 173.69	* Top Width (ft)	* 52.77	* 37.85	* 83.07	*
* Vel Total (ft/s)	* 6.01	* Avg. Vel. (ft/s)	* 3.79	* 10.14	* 3.37	*
* Max Chl Dpth (ft)	* 3.53	* Hydr. Depth (ft)	* 1.79	* 3.45	* 1.50	*
* Conv. Total (cfs)	* 21303.1	* Conv. (cfs)	* 3638.3	* 13406.5	* 4258.3	*
* Length Wtd. (ft)	*	* Wetted Per. (ft)	* 52.88	* 37.85	* 83.19	*
* Min Ch El (ft)	* 2225.23	* Shear (lb/sq ft)	* 1.09	* 2.10	* 0.91	*
* Alpha	* 1.92	* Stream Power (lb/ft s)	* 4.13	* 21.24	* 3.07	*
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	* 11.69	* 9.91	* 10.11	*
* C & E Loss (ft)	*	* Cum SA (acres)	* 6.21	* 5.58	* 6.61	*

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.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.733

CROSS SECTION OUTPUT Profile #500-YEAR

* E.G. Elev (ft)	* 2227.04	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 1.02	* Wt. n-Val.	* 0.057	* 0.033	* 0.057	*
* W.S. Elev (ft)	* 2226.02	* Reach Len. (ft)	* 273.11	* 276.32	* 285.93	*
* Crit W.S. (ft)	* 2226.02	* Flow Area (sq ft)	* 12.60	* 90.86	* 239.64	*
* E.G. Slope (ft/ft)	*0.011261	* Area (sq ft)	* 12.60	* 90.86	* 239.64	*
* Q Total (cfs)	* 2102.00	* Flow (cfs)	* 40.09	* 985.64	* 1076.27	*
* Top Width (ft)	* 151.12	* Top Width (ft)	* 9.89	* 25.99	* 115.24	*
* Vel Total (ft/s)	* 6.13	* Avg. Vel. (ft/s)	* 3.18	* 10.85	* 4.49	*
* Max Chl Dpth (ft)	* 4.18	* Hydr. Depth (ft)	* 1.27	* 3.50	* 2.08	*
* Conv. Total (cfs)	* 19808.4	* Conv. (cfs)	* 377.8	* 9288.2	* 10142.3	*
* Length Wtd. (ft)	* 279.93	* Wetted Per. (ft)	* 10.21	* 26.56	* 115.84	*
* Min Ch El (ft)	* 2221.84	* Shear (lb/sq ft)	* 0.87	* 2.40	* 1.45	*
* Alpha	* 1.75	* Stream Power (lb/ft s)	* 2.76	* 26.08	* 6.53	*
* Frctn Loss (ft)	* 2.58	* Cum Volume (acre-ft)	* 11.40	* 9.31	* 9.11	*
* C & E Loss (ft)	* 0.04	* Cum SA (acres)	* 6.04	* 5.41	* 6.07	*

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.
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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: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.681

CROSS SECTION OUTPUT Profile #500-YEAR

* E.G. Elev (ft)	* 2222.88	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.88	* Wt. n-Val.	* 0.057	* 0.033	* 0.057	*
* W.S. Elev (ft)	* 2222.00	* Reach Len. (ft)	* 336.96	* 333.04	* 319.82	*

Crit W.S. (ft)	2222.00	Flow Area (sq ft)	154.35	103.30	157.90	
E.G. Slope (ft/ft)	0.007688	Area (sq ft)	154.35	103.30	157.90	
Q Total (cfs)	2102.00	Flow (cfs)	411.25	1037.91	652.84	
Top Width (ft)	211.83	Top Width (ft)	122.44	25.42	63.97	
Vel Total (ft/s)	5.06	Avg. Vel. (ft/s)	2.66	10.05	4.13	
Max Chl Dpth (ft)	4.14	Hydr. Depth (ft)	1.26	4.06	2.47	
Conv. Total (cfs)	23973.4	Conv. (cfs)	4690.3	11837.4	7445.7	
Length Wtd. (ft)	328.86	Wetted Per. (ft)	122.63	25.44	64.90	
Min Ch El (ft)	2217.86	Shear (lb/sq ft)	0.60	1.95	1.17	
Alpha	2.21	Stream Power (lb/ft s)	1.61	19.58	4.83	
Frctn Loss (ft)	2.92	Cum Volume (acre-ft)	10.88	8.69	7.81	
C & E Loss (ft)	0.05	Cum SA (acres)	5.62	5.25	5.48	

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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: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.618

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2218.68	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.36	Wt. n-Val.	0.060	0.033	0.060	
W.S. Elev (ft)	2217.32	Reach Len. (ft)	355.44	357.61	360.99	
Crit W.S. (ft)	2217.32	Flow Area (sq ft)	15.31	107.13	174.92	
E.G. Slope (ft/ft)	0.010382	Area (sq ft)	15.31	107.13	174.92	
Q Total (cfs)	2102.00	Flow (cfs)	47.91	1240.30	813.79	
Top Width (ft)	106.78	Top Width (ft)	10.67	26.47	69.64	
Vel Total (ft/s)	7.07	Avg. Vel. (ft/s)	3.13	11.58	4.65	
Max Chl Dpth (ft)	4.42	Hydr. Depth (ft)	1.44	4.05	2.51	
Conv. Total (cfs)	20629.7	Conv. (cfs)	470.2	12172.7	7986.9	
Length Wtd. (ft)	358.24	Wetted Per. (ft)	11.09	26.72	69.87	
Min Ch El (ft)	2212.90	Shear (lb/sq ft)	0.89	2.60	1.62	
Alpha	1.76	Stream Power (lb/ft s)	2.80	30.08	7.55	
Frctn Loss (ft)	4.04	Cum Volume (acre-ft)	10.22	7.89	6.59	
C & E Loss (ft)	0.12	Cum SA (acres)	5.11	5.05	4.99	

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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: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.550

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2213.04	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.97	Wt. n-Val.	0.060	0.033	0.060	
W.S. Elev (ft)	2212.07	Reach Len. (ft)	329.03	380.95	410.03	
Crit W.S. (ft)	2212.07	Flow Area (sq ft)	170.13	71.58	130.51	
E.G. Slope (ft/ft)	0.012291	Area (sq ft)	170.13	71.58	130.51	
Q Total (cfs)	2102.00	Flow (cfs)	778.37	820.41	503.22	
Top Width (ft)	177.66	Top Width (ft)	78.78	20.54	78.33	
Vel Total (ft/s)	5.65	Avg. Vel. (ft/s)	4.58	11.46	3.86	
Max Chl Dpth (ft)	3.63	Hydr. Depth (ft)	2.16	3.49	1.67	
Conv. Total (cfs)	18960.0	Conv. (cfs)	7020.9	7400.1	4539.1	
Length Wtd. (ft)		Wetted Per. (ft)	79.09	20.58	78.41	
Min Ch El (ft)	2208.44	Shear (lb/sq ft)	1.65	2.67	1.28	
Alpha	1.96	Stream Power (lb/ft s)	7.55	30.59	4.92	
Frctn Loss (ft)		Cum Volume (acre-ft)	9.47	7.15	5.32	
C & E Loss (ft)		Cum SA (acres)	4.74	4.86	4.37	

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CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.478

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2208.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.70	Wt. n-Val.	0.062	0.033	0.062
W.S. Elev (ft)	2207.90	Reach Len. (ft)	332.97	334.12	313.99
Crit W.S. (ft)	2207.57	Flow Area (sq ft)	327.04	71.67	7.99
E.G. Slope (ft/ft)	0.010241	Area (sq ft)	327.04	71.67	7.99
Q Total (cfs)	2102.00	Flow (cfs)	1364.48	714.48	23.04
Top Width (ft)	172.16	Top Width (ft)	144.63	22.12	5.41
Vel Total (ft/s)	5.17	Avg. Vel. (ft/s)	4.17	9.97	2.88
Max Chl Dpth (ft)	3.77	Hydr. Depth (ft)	2.26	3.24	1.48
Conv. Total (cfs)	20771.0	Conv. (cfs)	13483.1	7060.2	227.7
Length Wtd. (ft)	328.78	Wetted Per. (ft)	144.95	22.15	6.16
Min Ch El (ft)	2204.39	Shear (lb/sq ft)	1.44	2.07	0.83
Alpha	1.69	Stream Power (lb/ft s)	6.02	20.62	2.39
Frctn Loss (ft)	4.17	Cum Volume (acre-ft)	7.59	6.53	4.67
C & E Loss (ft)	0.01	Cum SA (acres)	3.90	4.67	3.98

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

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.415

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2204.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.79	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2203.62	Reach Len. (ft)	535.06	461.21	370.41
Crit W.S. (ft)	2203.62	Flow Area (sq ft)	80.40	83.69	222.99
E.G. Slope (ft/ft)	0.016153	Area (sq ft)	80.40	83.69	222.99
Q Total (cfs)	2102.00	Flow (cfs)	267.28	835.90	998.83
Top Width (ft)	227.93	Top Width (ft)	70.36	32.68	124.89
Vel Total (ft/s)	5.43	Avg. Vel. (ft/s)	3.32	9.99	4.48
Max Chl Dpth (ft)	3.42	Hydr. Depth (ft)	1.14	2.56	1.79
Conv. Total (cfs)	16538.7	Conv. (cfs)	2102.9	6576.9	7858.9
Length Wtd. (ft)	430.76	Wetted Per. (ft)	70.52	33.23	125.05
Min Ch El (ft)	2200.20	Shear (lb/sq ft)	1.15	2.54	1.80
Alpha	1.72	Stream Power (lb/ft s)	3.82	25.37	8.05
Frctn Loss (ft)	4.27	Cum Volume (acre-ft)	6.03	5.93	3.84
C & E Loss (ft)	0.03	Cum SA (acres)	3.08	4.46	3.51

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Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
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need for additional cross sections.
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defaulted to critical depth.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.327

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2199.81	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.06	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2198.75	Reach Len. (ft)	224.89	303.29	348.39
Crit W.S. (ft)	2198.75	Flow Area (sq ft)	23.96	131.17	243.59
E.G. Slope (ft/ft)	0.006705	Area (sq ft)	23.96	131.17	243.59
Q Total (cfs)	2102.00	Flow (cfs)	78.70	1330.90	692.39
Top Width (ft)	175.41	Top Width (ft)	10.17	25.89	139.35
Vel Total (ft/s)	5.27	Avg. Vel. (ft/s)	3.28	10.15	2.84
Max Chl Dpth (ft)	5.46	Hydr. Depth (ft)	2.36	5.07	1.75
Conv. Total (cfs)	25670.9	Conv. (cfs)	961.2	16253.8	8455.9
Length Wtd. (ft)	303.16	Wetted Per. (ft)	11.07	26.30	139.74
Min Ch El (ft)	2193.28	Shear (lb/sq ft)	0.91	2.09	0.73
Alpha	2.46	Stream Power (lb/ft s)	2.98	21.18	2.07
Frctn Loss (ft)	2.21	Cum Volume (acre-ft)	5.39	4.79	1.85
C & E Loss (ft)	0.02	Cum SA (acres)	2.58	4.15	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.
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need for additional cross sections.
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defaulted to critical depth.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.270

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2194.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.01	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2193.96	Reach Len. (ft)	358.86	405.63	416.26
Crit W.S. (ft)	2193.96	Flow Area (sq ft)	152.65	184.19	21.16
E.G. Slope (ft/ft)	0.007917	Area (sq ft)	152.65	184.19	21.16
Q Total (cfs)	2102.00	Flow (cfs)	370.90	1653.84	77.27
Top Width (ft)	182.99	Top Width (ft)	124.88	50.03	8.08
Vel Total (ft/s)	5.87	Avg. Vel. (ft/s)	2.43	8.98	3.65
Max Chl Dpth (ft)	4.49	Hydr. Depth (ft)	1.22	3.68	2.62
Conv. Total (cfs)	23623.3	Conv. (cfs)	4168.3	18586.7	868.3
Length Wtd. (ft)	391.37	Wetted Per. (ft)	125.53	50.26	9.44
Min Ch El (ft)	2189.52	Shear (lb/sq ft)	0.60	1.81	1.11
Alpha	1.88	Stream Power (lb/ft s)	1.46	16.26	4.04
Frctn Loss (ft)	2.61	Cum Volume (acre-ft)	4.93	3.70	0.80
C & E Loss (ft)	0.08	Cum SA (acres)	2.23	3.88	1.80

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.
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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: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.193

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2190.68	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.76	Wt. n-Val.	0.062	0.033	0.062
W.S. Elev (ft)	2189.92	Reach Len. (ft)	169.70	156.02	134.52
Crit W.S. (ft)		Flow Area (sq ft)	260.98	108.80	42.45
E.G. Slope (ft/ft)	0.005686	Area (sq ft)	260.98	108.80	42.45
Q Total (cfs)	2102.00	Flow (cfs)	957.78	1015.53	128.69
Top Width (ft)	132.40	Top Width (ft)	89.62	23.71	19.07
Vel Total (ft/s)	5.10	Avg. Vel. (ft/s)	3.67	9.33	3.03
Max Chl Dpth (ft)	4.87	Hydr. Depth (ft)	2.91	4.59	2.23
Conv. Total (cfs)	27874.9	Conv. (cfs)	12701.2	13467.1	1706.6
Length Wtd. (ft)	160.95	Wetted Per. (ft)	90.19	23.87	19.54
Min Ch El (ft)	2185.05	Shear (lb/sq ft)	1.03	1.62	0.77
Alpha	1.88	Stream Power (lb/ft s)	3.77	15.10	2.34
Frctn Loss (ft)	0.24	Cum Volume (acre-ft)	3.23	2.33	0.49
C & E Loss (ft)	0.18	Cum SA (acres)	1.35	3.54	1.67

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.164

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2190.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.	0.062	0.033	0.062
W.S. Elev (ft)	2190.11	Reach Len. (ft)	132.32	71.08	40.42
Crit W.S. (ft)		Flow Area (sq ft)	548.87	257.80	91.28
E.G. Slope (ft/ft)	0.000678	Area (sq ft)	548.87	257.80	91.28
Q Total (cfs)	2102.00	Flow (cfs)	940.97	1045.04	115.99
Top Width (ft)	190.61	Top Width (ft)	119.96	39.66	30.98
Vel Total (ft/s)	2.34	Avg. Vel. (ft/s)	1.71	4.05	1.27
Max Chl Dpth (ft)	7.27	Hydr. Depth (ft)	4.58	6.50	2.95
Conv. Total (cfs)	80716.9	Conv. (cfs)	36133.4	40129.4	4454.1
Length Wtd. (ft)	89.44	Wetted Per. (ft)	120.56	40.11	31.42
Min Ch El (ft)	2182.84	Shear (lb/sq ft)	0.19	0.27	0.12
Alpha	1.75	Stream Power (lb/ft s)	0.33	1.10	0.16
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	1.65	1.68	0.29
C & E Loss (ft)	0.05	Cum SA (acres)	0.94	3.43	1.59

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.150

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2190.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2190.12	Reach Len. (ft)	98.63	122.07	115.27
Crit W.S. (ft)	2185.04	Flow Area (sq ft)	539.02	329.93	523.69
E.G. Slope (ft/ft)	0.000233	Area (sq ft)	539.02	329.93	523.69
Q Total (cfs)	2102.00	Flow (cfs)	660.45	875.77	565.78
Top Width (ft)	228.60	Top Width (ft)	86.34	39.67	102.59
Vel Total (ft/s)	1.51	Avg. Vel. (ft/s)	1.23	2.65	1.08
Max Chl Dpth (ft)	8.58	Hydr. Depth (ft)	6.24	8.32	5.10
Conv. Total (cfs)	137810.9	Conv. (cfs)	43300.1	57417.1	37093.7
Length Wtd. (ft)	122.07	Wetted Per. (ft)	87.84	39.75	103.07
Min Ch El (ft)	2181.54	Shear (lb/sq ft)	0.09	0.12	0.07
Alpha	1.63	Stream Power (lb/ft s)	0.11	0.32	0.08
Frctn Loss (ft)		Cum Volume (acre-ft)		1.20	
C & E Loss (ft)		Cum SA (acres)	0.63	3.36	1.53

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.127

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2184.37	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.82	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2183.55	Reach Len. (ft)	179.80	191.64	190.11
Crit W.S. (ft)		Flow Area (sq ft)	23.37	201.18	154.67
E.G. Slope (ft/ft)	0.005021	Area (sq ft)	23.37	201.18	154.67
Q Total (cfs)	2102.00	Flow (cfs)	57.18	1634.01	410.81
Top Width (ft)	132.21	Top Width (ft)	12.92	42.17	77.12
Vel Total (ft/s)	5.54	Avg. Vel. (ft/s)	2.45	8.12	2.66
Max Chl Dpth (ft)	7.88	Hydr. Depth (ft)	1.81	4.77	2.01
Conv. Total (cfs)	29664.2	Conv. (cfs)	807.0	23059.8	5797.5
Length Wtd. (ft)	190.81	Wetted Per. (ft)	13.51	45.35	79.08
Min Ch El (ft)	2175.67	Shear (lb/sq ft)	0.54	1.39	0.61
Alpha	1.72	Stream Power (lb/ft s)	1.33	11.29	1.63
Frctn Loss (ft)	1.09	Cum Volume (acre-ft)	0.88	11.33	2.10
C & E Loss (ft)	0.25	Cum SA (acres)	0.52	3.25	1.29

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION

RIVER: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.091

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2183.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.64	Wt. n-Val.	0.062	0.035	0.062
W.S. Elev (ft)	2181.39	Reach Len. (ft)	185.33	191.33	203.84
Crit W.S. (ft)	2181.39	Flow Area (sq ft)	37.02	137.81	119.81
E.G. Slope (ft/ft)	0.006578	Area (sq ft)	37.02	137.81	119.81
Q Total (cfs)	2102.00	Flow (cfs)	136.14	1602.04	363.82
Top Width (ft)	95.06	Top Width (ft)	13.06	21.80	60.20
Vel Total (ft/s)	7.13	Avg. Vel. (ft/s)	3.68	11.63	3.04
Max Chl Dpth (ft)	7.20	Hydr. Depth (ft)	2.83	6.32	1.99
Conv. Total (cfs)	25916.9	Conv. (cfs)	1678.5	19752.6	4485.7
Length Wtd. (ft)	192.95	Wetted Per. (ft)	14.22	22.21	61.36
Min Ch El (ft)	2174.19	Shear (lb/sq ft)	1.07	2.55	0.80
Alpha	2.07	Stream Power (lb/ft s)	3.93	29.62	2.43
Frctn Loss (ft)	1.27	Cum Volume (acre-ft)	0.75	10.58	1.50
C & E Loss (ft)	0.04	Cum SA (acres)	0.46	3.11	0.99

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 1.054

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2180.42	Element		Left OB	Channel	Right OB
Vel Head (ft)	1.51	Wt. n-Val.		0.062	0.035	0.062
W.S. Elev (ft)	2178.92	Reach Len. (ft)		239.07	304.60	349.02
Crit W.S. (ft)	2178.92	Flow Area (sq ft)		11.76	172.10	103.06
E.G. Slope (ft/ft)	0.006565	Area (sq ft)		11.76	172.10	103.06
Q Total (cfs)	2102.00	Flow (cfs)		27.19	1815.87	258.94
Top Width (ft)	108.79	Top Width (ft)		8.62	30.32	69.84
Vel Total (ft/s)	7.33	Avg. Vel. (ft/s)		2.31	10.55	2.51
Max Chl Dpth (ft)	7.02	Hydr. Depth (ft)		1.36	5.68	1.48
Conv. Total (cfs)	25941.8	Conv. (cfs)		335.6	22410.5	3195.7
Length Wtd. (ft)	306.80	Wetted Per. (ft)		9.05	32.04	70.03
Min Ch El (ft)	2171.90	Shear (lb/sq ft)		0.53	2.20	0.60
Alpha	1.81	Stream Power (lb/ft s)		1.23	23.23	1.52
Frctn Loss (ft)	2.42	Cum Volume (acre-ft)		0.65	9.90	0.98
C & E Loss (ft)	0.01	Cum SA (acres)		0.42	2.99	0.69

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 0.997

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2172.33	Element		Left OB	Channel	Right OB
Vel Head (ft)	1.64	Wt. n-Val.		0.060	0.032	0.060
W.S. Elev (ft)	2170.70	Reach Len. (ft)		370.31	314.05	271.52
Crit W.S. (ft)	2170.70	Flow Area (sq ft)		21.27	180.50	26.95
E.G. Slope (ft/ft)	0.009624	Area (sq ft)		21.27	180.50	26.95
Q Total (cfs)	2102.00	Flow (cfs)		75.38	1925.66	100.96
Top Width (ft)	75.46	Top Width (ft)		11.53	50.30	13.63
Vel Total (ft/s)	9.19	Avg. Vel. (ft/s)		3.54	10.67	3.75
Max Chl Dpth (ft)	4.11	Hydr. Depth (ft)		1.84	3.59	1.98
Conv. Total (cfs)	21427.0	Conv. (cfs)		768.4	19629.5	1029.2
Length Wtd. (ft)	314.05	Wetted Per. (ft)		12.07	50.36	14.08
Min Ch El (ft)	2166.58	Shear (lb/sq ft)		1.06	2.15	1.15
Alpha	1.25	Stream Power (lb/ft s)		3.75	22.97	4.31
Frctn Loss (ft)	3.07	Cum Volume (acre-ft)		0.56	8.67	0.46
C & E Loss (ft)	0.06	Cum SA (acres)		0.36	2.71	0.35

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 0.937

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2167.59	Element		Left OB	Channel	Right OB
Vel Head (ft)	1.44	Wt. n-Val.		0.060	0.032	0.060
W.S. Elev (ft)	2166.16	Reach Len. (ft)		293.29	212.90	164.16
Crit W.S. (ft)	2166.16	Flow Area (sq ft)		17.22	200.95	20.04
E.G. Slope (ft/ft)	0.009925	Area (sq ft)		17.22	200.95	20.04
Q Total (cfs)	2102.00	Flow (cfs)		51.84	1982.97	67.19
Top Width (ft)	89.01	Top Width (ft)		12.46	64.32	12.23
Vel Total (ft/s)	8.82	Avg. Vel. (ft/s)		3.01	9.87	3.35
Max Chl Dpth (ft)	4.18	Hydr. Depth (ft)		1.38	3.12	1.64
Conv. Total (cfs)	21099.1	Conv. (cfs)		520.4	19904.4	674.4
Length Wtd. (ft)	213.44	Wetted Per. (ft)		12.77	64.50	12.65
Min Ch El (ft)	2161.98	Shear (lb/sq ft)		0.84	1.93	0.98
Alpha	1.19	Stream Power (lb/ft s)		2.52	19.05	3.29
Frctn Loss (ft)	2.02	Cum Volume (acre-ft)		0.39	7.29	0.31
C & E Loss (ft)	0.00	Cum SA (acres)		0.26	2.30	0.27

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 0.897

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2164.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.45	Wt. n-Val.	0.059	0.030	0.059
W.S. Elev (ft)	2162.61	Reach Len. (ft)	248.07	246.71	237.21
Crit W.S. (ft)	2162.61	Flow Area (sq ft)	7.95	212.75	5.12
E.G. Slope (ft/ft)	0.009069	Area (sq ft)	7.95	212.75	5.12
Q Total (cfs)	2102.00	Flow (cfs)	23.38	2068.67	9.95
Top Width (ft)	83.43	Top Width (ft)	4.83	71.74	6.85
Vel Total (ft/s)	9.31	Avg. Vel. (ft/s)	2.94	9.72	1.95
Max Chl Dpth (ft)	3.29	Hydr. Depth (ft)	1.64	2.97	0.75
Conv. Total (cfs)	22073.1	Conv. (cfs)	245.5	21723.1	104.5
Length Wtd. (ft)	246.63	Wetted Per. (ft)	5.84	71.88	7.00
Min Ch El (ft)	2159.32	Shear (lb/sq ft)	0.77	1.68	0.41
Alpha	1.08	Stream Power (lb/ft s)	2.26	16.29	0.80
Frctn Loss (ft)	2.09	Cum Volume (acre-ft)	0.31	6.28	0.27
C & E Loss (ft)	0.02	Cum SA (acres)	0.20	1.97	0.23

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 0.850

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2160.75	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.67	Wt. n-Val.	0.059	0.030	0.059
W.S. Elev (ft)	2159.07	Reach Len. (ft)	140.71	227.52	284.13
Crit W.S. (ft)	2159.07	Flow Area (sq ft)	38.71	177.75	15.79
E.G. Slope (ft/ft)	0.007953	Area (sq ft)	38.71	177.75	15.79
Q Total (cfs)	2102.00	Flow (cfs)	133.40	1922.07	46.53
Top Width (ft)	76.41	Top Width (ft)	20.06	46.29	10.06
Vel Total (ft/s)	9.05	Avg. Vel. (ft/s)	3.45	10.81	2.95
Max Chl Dpth (ft)	4.06	Hydr. Depth (ft)	1.93	3.84	1.57
Conv. Total (cfs)	23570.9	Conv. (cfs)	1495.9	21553.2	521.8
Length Wtd. (ft)	224.44	Wetted Per. (ft)	20.36	46.40	10.50
Min Ch El (ft)	2155.01	Shear (lb/sq ft)	0.94	1.90	0.75
Alpha	1.32	Stream Power (lb/ft s)	3.25	20.56	2.20
Frctn Loss (ft)	1.90	Cum Volume (acre-ft)	0.18	5.18	0.21
C & E Loss (ft)	0.02	Cum SA (acres)	0.13	1.63	0.19

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 0.807

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2157.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.60	Wt. n-Val.	0.059	0.030	0.059
W.S. Elev (ft)	2156.33	Reach Len. (ft)	334.50	259.69	209.40
Crit W.S. (ft)	2156.33	Flow Area (sq ft)	14.61	199.64	1.83
E.G. Slope (ft/ft)	0.009015	Area (sq ft)	14.61	199.64	1.83
Q Total (cfs)	2102.00	Flow (cfs)	48.10	2050.52	3.38
Top Width (ft)	71.48	Top Width (ft)	8.37	61.21	1.91
Vel Total (ft/s)	9.73	Avg. Vel. (ft/s)	3.29	10.27	1.85
Max Chl Dpth (ft)	4.08	Hydr. Depth (ft)	1.75	3.26	0.96
Conv. Total (cfs)	22138.3	Conv. (cfs)	506.6	21596.1	35.6
Length Wtd. (ft)	259.96	Wetted Per. (ft)	9.05	61.85	2.68
Min Ch El (ft)	2152.25	Shear (lb/sq ft)	0.91	1.82	0.38
Alpha	1.09	Stream Power (lb/ft s)	2.99	18.66	0.71
Frctn Loss (ft)	2.36	Cum Volume (acre-ft)	0.09	4.19	0.15
C & E Loss (ft)	0.05	Cum SA (acres)	0.08	1.35	0.15

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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: SUNNYCOVE WASH
REACH: REACH #2 RS: 0.758

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2153.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.44	Wt. n-Val.	0.059	0.030	0.059
W.S. Elev (ft)	2152.48	Reach Len. (ft)	321.53	343.19	425.28
Crit W.S. (ft)	2152.48	Flow Area (sq ft)	0.23	211.62	16.32
E.G. Slope (ft/ft)	0.009141	Area (sq ft)	0.23	211.62	16.32
Q Total (cfs)	2102.00	Flow (cfs)	0.20	2056.31	45.49
Top Width (ft)	84.72	Top Width (ft)	0.87	71.00	12.85
Vel Total (ft/s)	9.21	Avg. Vel. (ft/s)	0.89	9.72	2.79
Max Chl Dpth (ft)	3.82	Hydr. Depth (ft)	0.26	2.98	1.27
Conv. Total (cfs)	21985.9	Conv. (cfs)	2.1	21508.0	475.8
Length Wtd. (ft)	344.05	Wetted Per. (ft)	1.01	71.99	13.10
Min Ch El (ft)	2148.66	Shear (lb/sq ft)	0.13	1.68	0.71
Alpha	1.09	Stream Power (lb/ft s)	0.11	16.30	1.98
Frctn Loss (ft)	3.07	Cum Volume (acre-ft)	0.03	2.97	0.11
C & E Loss (ft)	0.02	Cum SA (acres)	0.05	0.96	0.11

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 0.693

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2149.30	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.60	Wt. n-Val.	0.059	0.030	0.059
W.S. Elev (ft)	2147.69	Reach Len. (ft)	186.51	270.51	384.68
Crit W.S. (ft)	2147.69	Flow Area (sq ft)	4.33	205.50	0.86
E.G. Slope (ft/ft)	0.008712	Area (sq ft)	4.33	205.50	0.86
Q Total (cfs)	2102.00	Flow (cfs)	8.01	2093.10	0.89
Top Width (ft)	71.09	Top Width (ft)	6.04	62.20	2.86
Vel Total (ft/s)	9.98	Avg. Vel. (ft/s)	1.85	10.19	1.04
Max Chl Dpth (ft)	4.31	Hydr. Depth (ft)	0.72	3.30	0.30
Conv. Total (cfs)	22520.9	Conv. (cfs)	85.8	22425.6	9.5
Length Wtd. (ft)	270.51	Wetted Per. (ft)	6.20	62.84	2.92
Min Ch El (ft)	2143.38	Shear (lb/sq ft)	0.38	1.78	0.16
Alpha	1.04	Stream Power (lb/ft s)	0.70	18.11	0.17
Frctn Loss (ft)	2.41	Cum Volume (acre-ft)	0.02	1.32	0.02
C & E Loss (ft)	0.07	Cum SA (acres)	0.02	0.43	0.04

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: SUNNYCOVE WASH
REACH: REACH #2 RS: 0.642

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2143.32	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.38	Wt. n-Val.	0.059	0.030	0.059
W.S. Elev (ft)	2141.93	Reach Len. (ft)			
Crit W.S. (ft)	2141.93	Flow Area (sq ft)	3.20	220.30	4.60
E.G. Slope (ft/ft)	0.009081	Area (sq ft)	3.20	220.30	4.60

Q Total (cfs)	2102.00	Flow (cfs)	5.76	2086.88	9.36	
Top Width (ft)	87.31	Top Width (ft)	4.73	76.91	5.67	
Vel Total (ft/s)	9.22	Avg. Vel. (ft/s)	1.80	9.47	2.03	
Max Chl Dpth (ft)	3.83	Hydr. Depth (ft)	0.68	2.86	0.81	
Conv. Total (cfs)	22058.3	Conv. (cfs)	60.5	21899.7	98.2	
Length Wtd. (ft)		Wetted Per. (ft)	4.92	77.48	5.90	
Min Ch El (ft)	2138.10	Shear (lb/sq ft)	0.37	1.61	0.44	
Alpha	1.05	Stream Power (lb/ft s)	0.66	15.27	0.90	
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.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #2 RS: 1.197

CROSS SECTION OUTPUT Profile #500-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2111.03	Element			
Vel Head (ft)	0.00	Wt. n-Val.	0.064	0.040	0.064
W.S. Elev (ft)	2111.03	Reach Len. (ft)	139.89	140.93	142.56
Crit W.S. (ft)		Flow Area (sq ft)	2.11	136.30	8.22
E.G. Slope (ft/ft)	0.000040	Area (sq ft)	2.11	136.30	8.22
Q Total (cfs)	75.00	Flow (cfs)	0.24	73.51	1.26
Top Width (ft)	48.85	Top Width (ft)	2.84	38.52	7.49
Vel Total (ft/s)	0.51	Avg. Vel. (ft/s)	0.11	0.54	0.15
Max Chl Dpth (ft)	3.91	Hydr. Depth (ft)	0.74	3.54	1.10
Conv. Total (cfs)	11793.6	Conv. (cfs)	37.1	11559.0	197.5
Length Wtd. (ft)	140.87	Wetted Per. (ft)	3.20	39.51	7.82
Min Ch El (ft)	2107.12	Shear (lb/sq ft)	0.00	0.01	0.00
Alpha	1.09	Stream Power (lb/ft s)	0.00	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	25.76	3.56	0.78
C & E Loss (ft)	0.03	Cum SA (acres)	14.43	1.22	0.97

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #2 RS: 1.170

CROSS SECTION OUTPUT Profile #500-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2110.98	Element			
Vel Head (ft)	0.29	Wt. n-Val.	0.064	0.040	0.064
W.S. Elev (ft)	2110.69	Reach Len. (ft)	299.79	277.90	234.94
Crit W.S. (ft)	2110.69	Flow Area (sq ft)	6.85	13.92	0.06
E.G. Slope (ft/ft)	0.020876	Area (sq ft)	6.85	13.92	0.06
Q Total (cfs)	75.00	Flow (cfs)	10.32	64.63	0.05
Top Width (ft)	40.45	Top Width (ft)	22.75	17.13	0.56
Vel Total (ft/s)	3.60	Avg. Vel. (ft/s)	1.51	4.64	0.75
Max Chl Dpth (ft)	1.07	Hydr. Depth (ft)	0.30	0.81	0.11
Conv. Total (cfs)	519.1	Conv. (cfs)	71.4	447.3	0.3
Length Wtd. (ft)	277.40	Wetted Per. (ft)	22.76	17.29	0.61
Min Ch El (ft)	2109.62	Shear (lb/sq ft)	0.39	1.05	0.14
Alpha	1.46	Stream Power (lb/ft s)	0.59	4.87	0.10
Frctn Loss (ft)	3.78	Cum Volume (acre-ft)	25.74	3.32	0.77
C & E Loss (ft)	0.06	Cum SA (acres)	14.39	1.13	0.96

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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: SUNSET WASH
REACH: REACH #2 RS: 1.117

CROSS SECTION OUTPUT Profile #500-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2106.80	Element			
Vel Head (ft)	0.94	Wt. n-Val.	0.064	0.040	0.064
W.S. Elev (ft)	2105.86	Reach Len. (ft)	508.90	531.99	559.75
Crit W.S. (ft)	2105.86	Flow Area (sq ft)	15.16	68.85	18.66
E.G. Slope (ft/ft)	0.013042	Area (sq ft)	15.16	68.85	18.66

Q Total (cfs)	662.00	Flow (cfs)	51.36	570.67	39.97	
Top Width (ft)	60.68	Top Width (ft)	10.06	25.20	25.42	
Vel Total (ft/s)	6.45	Avg. Vel. (ft/s)	3.39	8.29	2.14	
Max Chl Dpth (ft)	3.01	Hydr. Depth (ft)	1.51	2.73	0.73	
Conv. Total (cfs)	5796.9	Conv. (cfs)	449.7	4997.2	350.0	
Length Wtd. (ft)	521.41	Wetted Per. (ft)	10.50	25.21	25.71	
Min Ch El (ft)	2102.85	Shear (lb/sq ft)	1.18	2.22	0.59	
Alpha	1.45	Stream Power (lb/ft s)	3.98	18.43	1.27	
Frctn Loss (ft)	0.22	Cum Volume (acre-ft)	25.67	3.05	0.72	
C & E Loss (ft)	0.28	Cum SA (acres)	14.28	1.00	0.89	

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNSET WASH
REACH: REACH #2 RS: 1.016

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2097.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.064	0.040	0.064
W.S. Elev (ft)	2097.50	Reach Len. (ft)	477.49	481.09	483.72
Crit W.S. (ft)	2097.50	Flow Area (sq ft)	1350.09	62.46	6.27
E.G. Slope (ft/ft)	0.000125	Area (sq ft)	1350.09	62.46	6.27
Q Total (cfs)	662.00	Flow (cfs)	605.06	55.38	1.56
Top Width (ft)	620.40	Top Width (ft)	594.50	19.50	6.40
Vel Total (ft/s)	0.47	Avg. Vel. (ft/s)	0.45	0.89	0.25
Max Chl Dpth (ft)	3.93	Hydr. Depth (ft)	2.27	3.20	0.98
Conv. Total (cfs)	59217.6	Conv. (cfs)	54124.5	4953.8	139.3
Length Wtd. (ft)	478.08	Wetted Per. (ft)	595.02	20.02	6.69
Min Ch El (ft)	2093.57	Shear (lb/sq ft)	0.02	0.02	0.01
Alpha	1.15	Stream Power (lb/ft s)	0.01	0.02	0.00
Frctn Loss (ft)	0.14	Cum Volume (acre-ft)	17.69	2.25	0.56
C & E Loss (ft)	0.00	Cum SA (acres)	10.75	0.72	0.69

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: Critical depth could not be determined within the specified number of iterations. The program used the iteration with the lowest energy.
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: SUNSET WASH
REACH: REACH #2 RS: 0.925

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2087.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.064	0.040	0.064
W.S. Elev (ft)	2087.40	Reach Len. (ft)	243.16	242.03	241.97
Crit W.S. (ft)	2087.40	Flow Area (sq ft)	537.21	62.19	0.05
E.G. Slope (ft/ft)	0.001510	Area (sq ft)	537.21	62.19	0.05
Q Total (cfs)	662.00	Flow (cfs)	502.17	159.82	0.01
Top Width (ft)	534.65	Top Width (ft)	510.00	24.36	0.28
Vel Total (ft/s)	1.10	Avg. Vel. (ft/s)	0.93	2.57	0.21
Max Chl Dpth (ft)	3.49	Hydr. Depth (ft)	1.05	2.55	0.17
Conv. Total (cfs)	17037.0	Conv. (cfs)	12923.7	4113.1	0.3
Length Wtd. (ft)	242.48	Wetted Per. (ft)	510.19	26.18	0.44
Min Ch El (ft)	2083.91	Shear (lb/sq ft)	0.10	0.22	0.01
Alpha	1.85	Stream Power (lb/ft s)	0.09	0.58	0.00
Frctn Loss (ft)	0.56	Cum Volume (acre-ft)	7.35	1.56	0.52
C & E Loss (ft)	0.04	Cum SA (acres)	4.69	0.48	0.65

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: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: Critical depth could not be determined within the specified number of iterations. The program used the iteration with

the
lowest energy.
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: SUNSET WASH
REACH: REACH #2 RS: 0.880

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2083.41	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.45	Wt. n-Val.	0.064	0.025		
W.S. Elev (ft)	2082.96	Reach Len. (ft)	109.90	115.17	96.20	
Crit W.S. (ft)	2082.63	Flow Area (sq ft)	14.89	116.57		
E.G. Slope (ft/ft)	0.003930	Area (sq ft)	259.09	116.57	98.48	
Q Total (cfs)	662.00	Flow (cfs)	25.97	636.04		
Top Width (ft)	625.92	Top Width (ft)	424.68	65.77	135.47	
Vel Total (ft/s)	5.04	Avg. Vel. (ft/s)	1.74	5.46		
Max Chl Dpth (ft)	2.00	Hydr. Depth (ft)	1.31	1.77		
Conv. Total (cfs)	10560.0	Conv. (cfs)	414.2	10145.8		
Length Wtd. (ft)	113.14	Wetted Per. (ft)	11.36	65.78		
Min Ch El (ft)	2080.96	Shear (lb/sq ft)	0.32	0.43		
Alpha	1.13	Stream Power (lb/ft s)	0.56	2.37		
Frctn Loss (ft)	0.46	Cum Volume (acre-ft)	5.12	1.07	0.25	
C & E Loss (ft)	0.01	Cum SA (acres)	2.08	0.23	0.27	

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #2 RS: 0.858

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2082.93	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.59	Wt. n-Val.	0.052	0.025	0.030	
W.S. Elev (ft)	2082.34	Reach Len. (ft)	94.51	155.14	151.30	
Crit W.S. (ft)	2082.34	Flow Area (sq ft)	59.92	68.53	24.59	
E.G. Slope (ft/ft)	0.004201	Area (sq ft)	267.00	68.53	48.32	
Q Total (cfs)	662.00	Flow (cfs)	73.49	474.21	114.31	
Top Width (ft)	468.50	Top Width (ft)	397.84	28.17	42.49	
Vel Total (ft/s)	4.33	Avg. Vel. (ft/s)	1.23	6.92	4.65	
Max Chl Dpth (ft)	2.86	Hydr. Depth (ft)	0.54	2.43	2.00	
Conv. Total (cfs)	10213.1	Conv. (cfs)	1133.7	7315.9	1763.5	
Length Wtd. (ft)	125.56	Wetted Per. (ft)	111.20	28.47	14.12	
Min Ch El (ft)	2079.48	Shear (lb/sq ft)	0.14	0.63	0.46	
Alpha	2.04	Stream Power (lb/ft s)	0.17	4.37	2.12	
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	4.46	0.82	0.08	
C & E Loss (ft)	0.17	Cum SA (acres)	1.05	0.11	0.07	

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: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #2 RS: 0.828

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2080.99	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.02	Wt. n-Val.	0.052	0.025	0.064	
W.S. Elev (ft)	2080.96	Reach Len. (ft)	393.00	393.00	393.00	
Crit W.S. (ft)		Flow Area (sq ft)	622.49	44.26	0.01	
E.G. Slope (ft/ft)	0.000886	Area (sq ft)	622.49	44.26	0.01	
Q Total (cfs)	662.00	Flow (cfs)	565.22	96.78	0.00	
Top Width (ft)	599.95	Top Width (ft)	567.57	31.90	0.48	
Vel Total (ft/s)	0.99	Avg. Vel. (ft/s)	0.91	2.19	0.05	

Max Chl Dpth (ft)	2.56	Hydr. Depth (ft)	1.10	1.39	0.02
Conv. Total (cfs)	22241.6	Conv. (cfs)	18990.0	3251.5	0.0
Length Wtd. (ft)	393.00	Wetted Per. (ft)	568.14	32.21	0.48
Min Ch El (ft)	2078.40	Shear (lb/sq ft)	0.06	0.08	0.00
Alpha	1.42	Stream Power (lb/ft s)	0.06	0.17	0.00
Frctn Loss (ft)	1.08	Cum Volume (acre-ft)	3.50	0.62	0.00
C & E Loss (ft)	0.19	Cum SA (acres)			

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.753

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2079.72	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.88	Wt. n-Val.	0.100	0.031	0.074
W.S. Elev (ft)	2077.84	Reach Len. (ft)	87.41	84.79	81.91
Crit W.S. (ft)	2077.84	Flow Area (sq ft)	0.08	93.42	0.04
E.G. Slope (ft/ft)	0.010440	Area (sq ft)	152.50	93.42	0.04
Q Total (cfs)	1028.00	Flow (cfs)	0.03	1027.95	0.02
Top Width (ft)	186.13	Top Width (ft)	161.33	24.51	0.29
Vel Total (ft/s)	10.99	Avg. Vel. (ft/s)	0.38	11.00	0.46
Max Chl Dpth (ft)	5.40	Hydr. Depth (ft)	0.14	3.81	0.15
Conv. Total (cfs)	10061.0	Conv. (cfs)	0.3	10060.5	0.2
Length Wtd. (ft)	84.96	Wetted Per. (ft)	0.60	27.74	0.42
Min Ch El (ft)	2072.44	Shear (lb/sq ft)	0.08	2.19	0.07
Alpha	1.00	Stream Power (lb/ft s)	0.03	24.15	0.03
Frctn Loss (ft)	0.28	Cum Volume (acre-ft)	0.46	0.64	0.01
C & E Loss (ft)	0.74	Cum SA (acres)	12.50	2.45	10.13

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: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.737

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2077.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.39	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2076.83	Reach Len. (ft)	57.97	58.68	59.01
Crit W.S. (ft)	2075.19	Flow Area (sq ft)	70.64	163.42	12.86
E.G. Slope (ft/ft)	0.001626	Area (sq ft)	309.33	163.42	12.86
Q Total (cfs)	1028.00	Flow (cfs)	142.44	877.85	7.70
Top Width (ft)	360.31	Top Width (ft)	302.06	32.67	25.58
Vel Total (ft/s)	4.16	Avg. Vel. (ft/s)	2.02	5.37	0.60
Max Chl Dpth (ft)	6.72	Hydr. Depth (ft)	1.63	5.00	0.50
Conv. Total (cfs)	25494.9	Conv. (cfs)	3532.6	21771.2	191.1
Length Wtd. (ft)	58.68	Wetted Per. (ft)	43.58	35.27	26.26
Min Ch El (ft)	2070.11	Shear (lb/sq ft)	0.16	0.47	0.05
Alpha	1.45	Stream Power (lb/ft s)	0.33	2.53	0.03
Frctn Loss (ft)		Cum Volume (acre-ft)		0.39	
C & E Loss (ft)		Cum SA (acres)	12.04	2.40	10.10

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.726

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2075.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.91	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2074.45	Reach Len. (ft)	93.91	93.72	93.59
Crit W.S. (ft)	2074.42	Flow Area (sq ft)	44.55	105.68	9.35

E.G. Slope (ft/ft)	0.007674	Area (sq ft)	44.55	105.68	9.35
Q Total (cfs)	1028.00	Flow (cfs)	144.50	869.47	14.03
Top Width (ft)	90.77	Top Width (ft)	43.11	35.89	11.78
Vel Total (ft/s)	6.44	Avg. Vel. (ft/s)	3.24	8.23	1.50
Max Chl Dpth (ft)	5.17	Hydr. Depth (ft)	1.03	2.94	0.79
Conv. Total (cfs)	11734.6	Conv. (cfs)	1649.5	9925.0	160.1
Length Wtd. (ft)	93.75	Wetted Per. (ft)	43.14	38.54	11.86
Min Ch El (ft)	2069.28	Shear (lb/sq ft)	0.49	1.31	0.38
Alpha	1.42	Stream Power (lb/ft s)	1.60	10.81	0.57
Frctn Loss (ft)	0.64	Cum Volume (acre-ft)	0.81	1.02	0.05
C & E Loss (ft)	0.12	Cum SA (acres)	11.81	2.35	10.08

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.708

CROSS SECTION OUTPUT Profile #500-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2074.60	Element			
Vel Head (ft)	0.66	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2073.94	Reach Len. (ft)	154.20	154.96	155.66
Crit W.S. (ft)	2073.94	Flow Area (sq ft)	83.98	110.20	10.43
E.G. Slope (ft/ft)	0.006035	Area (sq ft)	83.98	110.20	10.43
Q Total (cfs)	1028.00	Flow (cfs)	214.49	801.98	11.53
Top Width (ft)	204.49	Top Width (ft)	147.87	39.19	17.43
Vel Total (ft/s)	5.02	Avg. Vel. (ft/s)	2.55	7.28	1.11
Max Chl Dpth (ft)	4.57	Hydr. Depth (ft)	0.57	2.81	0.60
Conv. Total (cfs)	13232.9	Conv. (cfs)	2761.0	10323.5	148.4
Length Wtd. (ft)	154.71	Wetted Per. (ft)	147.95	40.33	17.46
Min Ch El (ft)	2069.37	Shear (lb/sq ft)	0.21	1.03	0.22
Alpha	1.69	Stream Power (lb/ft s)	0.55	7.49	0.25
Frctn Loss (ft)	0.91	Cum Volume (acre-ft)	0.67	0.79	0.03
C & E Loss (ft)	0.04	Cum SA (acres)	11.60	2.27	10.05

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: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNSET WASH
REACH: REACH #1 RS: 0.679

CROSS SECTION OUTPUT Profile #500-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2072.80	Element			
Vel Head (ft)	0.52	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2072.28	Reach Len. (ft)	56.17	56.16	56.18
Crit W.S. (ft)	2072.28	Flow Area (sq ft)	178.25	72.26	4.32
E.G. Slope (ft/ft)	0.005728	Area (sq ft)	178.25	72.26	4.32
Q Total (cfs)	1028.00	Flow (cfs)	474.96	546.86	6.18
Top Width (ft)	212.99	Top Width (ft)	186.16	22.54	4.29
Vel Total (ft/s)	4.03	Avg. Vel. (ft/s)	2.66	7.57	1.43
Max Chl Dpth (ft)	4.52	Hydr. Depth (ft)	0.96	3.21	1.01
Conv. Total (cfs)	13582.4	Conv. (cfs)	6275.4	7225.4	81.6
Length Wtd. (ft)	56.16	Wetted Per. (ft)	186.18	23.98	4.74
Min Ch El (ft)	2067.75	Shear (lb/sq ft)	0.34	1.08	0.33
Alpha	2.07	Stream Power (lb/ft s)	0.91	8.16	0.47
Frctn Loss (ft)	0.33	Cum Volume (acre-ft)	0.20	0.46	0.01
C & E Loss (ft)	0.05	Cum SA (acres)	11.01	2.16	10.01

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: 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: SUNSET WASH
REACH: REACH #1 RS: 0.668

CROSS SECTION OUTPUT Profile #500-YEAR

			Left OB	Channel	Right OB
E.G. Elev (ft)	2072.11	Element			
Vel Head (ft)	0.70	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2071.41	Reach Len. (ft)	54.56	54.93	55.20
Crit W.S. (ft)	2071.41	Flow Area (sq ft)	136.05	76.24	3.49
E.G. Slope (ft/ft)	0.006138	Area (sq ft)	136.05	76.24	3.49
Q Total (cfs)	1028.00	Flow (cfs)	393.28	631.33	3.39

Top Width (ft)	161.43	Top Width (ft)	132.40	22.55	6.48
Vel Total (ft/s)	4.76	Avg. Vel. (ft/s)	2.89	8.28	0.97
Max Chl Dpth (ft)	4.44	Hydr. Depth (ft)	1.03	3.38	0.54
Conv. Total (cfs)	13121.1	Conv. (cfs)	5019.7	8058.1	43.3
Length Wtd. (ft)	54.93	Wetted Per. (ft)	132.44	23.28	7.20
Min Ch El (ft)	2066.97	Shear (lb/sq ft)	0.39	1.25	0.19
Alpha	2.00	Stream Power (lb/ft s)	1.14	10.39	0.18
Frctn Loss (ft)		Cum Volume (acre-ft)		0.37	
C & E Loss (ft)		Cum SA (acres)	10.81	2.13	10.00

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.658

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2071.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.79	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2070.35	Reach Len. (ft)	58.62	56.76	56.23
Crit W.S. (ft)	2070.35	Flow Area (sq ft)	80.27	105.47	40.60
E.G. Slope (ft/ft)	0.004281	Area (sq ft)	80.27	105.47	40.60
Q Total (cfs)	1028.00	Flow (cfs)	165.22	830.87	31.91
Top Width (ft)	213.08	Top Width (ft)	99.16	23.70	90.22
Vel Total (ft/s)	4.54	Avg. Vel. (ft/s)	2.06	7.88	0.79
Max Chl Dpth (ft)	5.45	Hydr. Depth (ft)	0.81	4.45	0.45
Conv. Total (cfs)	15712.4	Conv. (cfs)	2525.2	12699.4	487.8
Length Wtd. (ft)	57.03	Wetted Per. (ft)	99.25	26.49	91.01
Min Ch El (ft)	2064.90	Shear (lb/sq ft)	0.22	1.06	0.12
Alpha	2.47	Stream Power (lb/ft s)	0.44	8.38	0.09
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	0.71	1.99	0.17
C & E Loss (ft)	0.05	Cum SA (acres)	10.66	2.10	9.94

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: Divided flow computed for this cross-section.
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: SUNSET WASH
REACH: REACH #1 RS: 0.647

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2070.45	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.68	Wt. n-Val.	0.041	0.031	0.074
W.S. Elev (ft)	2069.77	Reach Len. (ft)	91.04	75.10	49.83
Crit W.S. (ft)	2069.77	Flow Area (sq ft)	93.00	117.15	44.82
E.G. Slope (ft/ft)	0.003142	Area (sq ft)	93.00	117.15	44.82
Q Total (cfs)	1028.00	Flow (cfs)	148.44	849.52	30.04
Top Width (ft)	254.18	Top Width (ft)	133.38	24.00	96.80
Vel Total (ft/s)	4.03	Avg. Vel. (ft/s)	1.60	7.25	0.67
Max Chl Dpth (ft)	5.54	Hydr. Depth (ft)	0.70	4.88	0.46
Conv. Total (cfs)	18339.8	Conv. (cfs)	2648.2	15155.7	535.9
Length Wtd. (ft)	76.60	Wetted Per. (ft)	133.55	26.42	97.55
Min Ch El (ft)	2064.23	Shear (lb/sq ft)	0.14	0.87	0.09
Alpha	2.70	Stream Power (lb/ft s)	0.22	6.31	0.06
Frctn Loss (ft)	0.30	Cum Volume (acre-ft)	0.59	1.85	0.12
C & E Loss (ft)	0.04	Cum SA (acres)	10.50	2.07	9.82

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: SUNSET WASH
REACH: REACH #1 RS: 0.633

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2068.75	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.55	Wt. n-Val.	0.064	0.039	0.064
W.S. Elev (ft)	2068.20	Reach Len. (ft)	123.02	136.65	141.33
Crit W.S. (ft)		Flow Area (sq ft)	84.88	149.67	0.28
E.G. Slope (ft/ft)	0.004866	Area (sq ft)	84.88	149.67	0.28
Q Total (cfs)	1028.00	Flow (cfs)	92.41	935.41	0.18

* Top Width (ft)	* 194.47	* Top Width (ft)	* 153.97	* 39.57	* 0.93	*
* Vel Total (ft/s)	* 4.38	* Avg. Vel. (ft/s)	* 1.09	* 6.25	* 0.64	*
* Max Chl Dpth (ft)	* 5.72	* Hydr. Depth (ft)	* 0.55	* 3.78	* 0.30	*
* Conv. Total (cfs)	* 14737.4	* Conv. (cfs)	* 1324.8	* 13410.0	* 2.5	*
* Length Wtd. (ft)	* 135.93	* Wetted Per. (ft)	* 154.00	* 41.50	* 1.11	*
* Min Ch El (ft)	* 2062.48	* Shear (lb/sq ft)	* 0.17	* 1.10	* 0.08	*
* Alpha	* 1.86	* Stream Power (lb/ft s)	* 0.18	* 6.85	* 0.05	*
* Frctn Loss (ft)	* 0.97	* Cum Volume (acre-ft)	* 0.41	* 1.62	* 0.09	*
* C & E Loss (ft)	* 0.08	* Cum SA (acres)	* 10.20	* 2.02	* 9.76	*

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.607

CROSS SECTION OUTPUT Profile #500-YEAR

* E.G. Elev (ft)	* 2067.70	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 1.37	* Wt. n-Val.	* 0.064	* 0.039	* 0.064	*
* W.S. Elev (ft)	* 2066.34	* Reach Len. (ft)	* 158.01	* 196.30	* 219.49	*
* Crit W.S. (ft)	* 2066.34	* Flow Area (sq ft)	* 16.06	* 106.92	* 0.42	*
* E.G. Slope (ft/ft)	*0.011428	* Area (sq ft)	* 16.06	* 106.92	* 0.42	*
* Q Total (cfs)	* 1028.00	* Flow (cfs)	* 15.96	* 1011.57	* 0.48	*
* Top Width (ft)	* 92.36	* Top Width (ft)	* 63.29	* 27.93	* 1.14	*
* Vel Total (ft/s)	* 8.33	* Avg. Vel. (ft/s)	* 0.99	* 9.46	* 1.14	*
* Max Chl Dpth (ft)	* 5.00	* Hydr. Depth (ft)	* 0.25	* 3.83	* 0.37	*
* Conv. Total (cfs)	* 9616.4	* Conv. (cfs)	* 149.3	* 9462.7	* 4.5	*
* Length Wtd. (ft)	* 194.50	* Wetted Per. (ft)	* 63.48	* 30.20	* 1.36	*
* Min Ch El (ft)	* 2061.34	* Shear (lb/sq ft)	* 0.18	* 2.53	* 0.22	*
* Alpha	* 1.27	* Stream Power (lb/ft s)	* 0.18	* 23.90	* 0.25	*
* Frctn Loss (ft)	* 2.12	* Cum Volume (acre-ft)	* 0.27	* 1.21	* 0.09	*
* C & E Loss (ft)	* 0.14	* Cum SA (acres)	* 9.90	* 1.91	* 9.76	*

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: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNSET WASH
REACH: REACH #1 RS: 0.570

CROSS SECTION OUTPUT Profile #500-YEAR

* E.G. Elev (ft)	* 2065.13	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.90	* Wt. n-Val.	* 0.064	* 0.039	* 0.064	*
* W.S. Elev (ft)	* 2064.23	* Reach Len. (ft)	* 105.54	* 117.46	* 121.71	*
* Crit W.S. (ft)	* 2064.07	* Flow Area (sq ft)	* 43.27	* 119.61	* 0.12	*
* E.G. Slope (ft/ft)	*0.010450	* Area (sq ft)	* 43.27	* 119.61	* 0.12	*
* Q Total (cfs)	* 1028.00	* Flow (cfs)	* 81.12	* 946.81	* 0.07	*
* Top Width (ft)	* 102.97	* Top Width (ft)	* 61.63	* 40.36	* 0.98	*
* Vel Total (ft/s)	* 6.31	* Avg. Vel. (ft/s)	* 1.87	* 7.92	* 0.58	*
* Max Chl Dpth (ft)	* 4.61	* Hydr. Depth (ft)	* 0.70	* 2.96	* 0.12	*
* Conv. Total (cfs)	* 10056.2	* Conv. (cfs)	* 793.6	* 9261.9	* 0.7	*
* Length Wtd. (ft)	* 116.55	* Wetted Per. (ft)	* 61.64	* 41.29	* 1.01	*
* Min Ch El (ft)	* 2059.62	* Shear (lb/sq ft)	* 0.46	* 1.89	* 0.08	*
* Alpha	* 1.46	* Stream Power (lb/ft s)	* 0.86	* 14.96	* 0.05	*
* Frctn Loss (ft)	* 1.26	* Cum Volume (acre-ft)	* 0.16	* 0.70	* 0.09	*
* C & E Loss (ft)	* 0.18	* Cum SA (acres)	* 9.67	* 1.76	* 9.75	*

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: SUNSET WASH
REACH: REACH #1 RS: 0.547

CROSS SECTION OUTPUT Profile #500-YEAR

* E.G. Elev (ft)	* 2063.70	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.54	* Wt. n-Val.	* 0.064	* 0.039	* 0.064	*
* W.S. Elev (ft)	* 2063.15	* Reach Len. (ft)	* 56.43	* 57.78	* 58.01	*
* Crit W.S. (ft)	* 2063.15	* Flow Area (sq ft)	* 86.65	* 102.30	* 63.35	*

E.G. Slope (ft/ft)	0.011188	Area (sq ft)	86.65	102.30	63.35	
Q Total (cfs)	1028.00	Flow (cfs)	138.71	710.68	178.61	
Top Width (ft)	258.92	Top Width (ft)	164.65	44.56	49.71	
Vel Total (ft/s)	4.07	Avg. Vel. (ft/s)	1.60	6.95	2.82	
Max Chl Dpth (ft)	4.09	Hydr. Depth (ft)	0.53	2.30	1.27	
Conv. Total (cfs)	9719.1	Conv. (cfs)	1311.4	6719.0	1688.7	
Length Wtd. (ft)	57.78	Wetted Per. (ft)	164.66	45.19	51.49	
Min Ch El (ft)	2059.06	Shear (lb/sq ft)	0.37	1.58	0.86	
Alpha	2.11	Stream Power (lb/ft s)	0.59	10.98	2.42	
Frctn Loss (ft)		Cum Volume (acre-ft)		0.40		
C & E Loss (ft)		Cum SA (acres)	9.40	1.64	9.68	

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.537

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2063.04	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.87	Wt. n-Val.	0.064	0.039	0.064
W.S. Elev (ft)	2062.18	Reach Len. (ft)	83.75	64.74	56.13
Crit W.S. (ft)	2062.18	Flow Area (sq ft)	59.09	130.29	93.22
E.G. Slope (ft/ft)	0.011144	Area (sq ft)	59.09	130.29	93.22
Q Total (cfs)	1550.00	Flow (cfs)	107.31	1118.04	324.65
Top Width (ft)	185.40	Top Width (ft)	92.64	40.00	52.76
Vel Total (ft/s)	5.48	Avg. Vel. (ft/s)	1.82	8.58	3.48
Max Chl Dpth (ft)	5.95	Hydr. Depth (ft)	0.64	3.26	1.77
Conv. Total (cfs)	14682.8	Conv. (cfs)	1016.5	10590.9	3075.3
Length Wtd. (ft)	64.28	Wetted Per. (ft)	92.65	41.81	55.04
Min Ch El (ft)	2056.22	Shear (lb/sq ft)	0.44	2.17	1.18
Alpha	1.86	Stream Power (lb/ft s)	0.81	18.61	4.10
Frctn Loss (ft)	0.52	Cum Volume (acre-ft)	11.64	4.62	9.60
C & E Loss (ft)	0.19	Cum SA (acres)	9.23	1.59	9.62

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 cross-section end points had to be extended vertically for the computed water surface.
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: SUNSET WASH
REACH: REACH #1 RS: 0.524

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2061.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.48	Wt. n-Val.	0.064	0.039	0.064
W.S. Elev (ft)	2060.92	Reach Len. (ft)	133.18	106.76	45.00
Crit W.S. (ft)	2060.92	Flow Area (sq ft)	114.21	122.45	300.94
E.G. Slope (ft/ft)	0.006151	Area (sq ft)	114.21	122.45	300.94
Q Total (cfs)	1550.00	Flow (cfs)	182.81	885.73	481.46
Top Width (ft)	535.70	Top Width (ft)	138.54	31.96	365.20
Vel Total (ft/s)	2.88	Avg. Vel. (ft/s)	1.60	7.23	1.60
Max Chl Dpth (ft)	5.13	Hydr. Depth (ft)	0.82	3.83	0.82
Conv. Total (cfs)	19763.4	Conv. (cfs)	2330.9	11293.6	6138.9
Length Wtd. (ft)	92.73	Wetted Per. (ft)	138.56	32.51	365.43
Min Ch El (ft)	2055.79	Shear (lb/sq ft)	0.32	1.45	0.32
Alpha	3.73	Stream Power (lb/ft s)	0.51	10.46	0.51
Frctn Loss (ft)	0.46	Cum Volume (acre-ft)	11.48	4.43	9.34
C & E Loss (ft)	0.02	Cum SA (acres)	9.01	1.53	9.35

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: 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: SUNSET WASH
REACH: REACH #1 RS: 0.504

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2060.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.63	Wt. n-Val.	0.064	0.029	0.064
W.S. Elev (ft)	2059.88	Reach Len. (ft)	252.82	228.50	163.00
Crit W.S. (ft)	2059.88	Flow Area (sq ft)	99.66	108.52	318.17

E.G. Slope (ft/ft)	0.004010	Area (sq ft)	99.66	108.52	318.17
Q Total (cfs)	1550.00	Flow (cfs)	247.35	896.01	406.65
Top Width (ft)	463.96	Top Width (ft)	45.26	26.43	392.26
Vel Total (ft/s)	2.94	Avg. Vel. (ft/s)	2.48	8.26	1.28
Max Chl Dpth (ft)	4.80	Hydr. Depth (ft)	2.20	4.11	0.81
Conv. Total (cfs)	24476.0	Conv. (cfs)	3905.8	14148.8	6421.3
Length Wtd. (ft)	218.29	Wetted Per. (ft)	45.44	26.74	392.59
Min Ch El (ft)	2055.08	Shear (lb/sq ft)	0.55	1.02	0.20
Alpha	4.71	Stream Power (lb/ft s)	1.36	8.39	0.26
Frctn Loss (ft)	0.98	Cum Volume (acre-ft)	11.15	4.15	9.03
C & E Loss (ft)	0.04	Cum SA (acres)	8.73	1.46	8.95

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: SUNSET WASH
REACH: REACH #1 RS: 0.461

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2056.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.49	Wt. n-Val.	0.064	0.029	0.064
W.S. Elev (ft)	2055.68	Reach Len. (ft)	140.50	156.62	176.52
Crit W.S. (ft)	2055.68	Flow Area (sq ft)	95.32	148.57	252.69
E.G. Slope (ft/ft)	0.005014	Area (sq ft)	311.71	148.57	252.69
Q Total (cfs)	1550.00	Flow (cfs)	269.93	1011.48	268.59
Top Width (ft)	769.13	Top Width (ft)	225.38	57.76	485.99
Vel Total (ft/s)	3.12	Avg. Vel. (ft/s)	2.83	6.81	1.06
Max Chl Dpth (ft)	2.90	Hydr. Depth (ft)	2.26	2.57	0.52
Conv. Total (cfs)	21890.7	Conv. (cfs)	3812.2	14285.2	3793.3
Length Wtd. (ft)	159.89	Wetted Per. (ft)	42.16	57.79	486.05
Min Ch El (ft)	2052.78	Shear (lb/sq ft)	0.71	0.80	0.16
Alpha	3.27	Stream Power (lb/ft s)	2.00	5.48	0.17
Frctn Loss (ft)	0.52	Cum Volume (acre-ft)	9.96	3.48	7.96
C & E Loss (ft)	0.02	Cum SA (acres)	7.94	1.24	7.31

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.431

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2053.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.41	Wt. n-Val.	0.064	0.025	0.064
W.S. Elev (ft)	2053.52	Reach Len. (ft)	361.98	375.35	384.72
Crit W.S. (ft)	2053.52	Flow Area (sq ft)	160.14	120.36	538.31
E.G. Slope (ft/ft)	0.002278	Area (sq ft)	160.14	120.36	538.31
Q Total (cfs)	1550.00	Flow (cfs)	140.36	835.85	573.79
Top Width (ft)	829.46	Top Width (ft)	227.50	31.43	570.53
Vel Total (ft/s)	1.89	Avg. Vel. (ft/s)	0.88	6.94	1.07
Max Chl Dpth (ft)	3.92	Hydr. Depth (ft)	0.70	3.83	0.94
Conv. Total (cfs)	32473.2	Conv. (cfs)	2940.6	17511.3	12021.2
Length Wtd. (ft)	373.59	Wetted Per. (ft)	227.66	31.43	570.68
Min Ch El (ft)	2049.60	Shear (lb/sq ft)	0.10	0.54	0.13
Alpha	7.39	Stream Power (lb/ft s)	0.09	3.78	0.14
Frctn Loss (ft)	1.28	Cum Volume (acre-ft)	9.20	2.99	6.35
C & E Loss (ft)	0.02	Cum SA (acres)	7.21	1.08	5.17

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNSET WASH
REACH: REACH #1 RS: 0.360

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2048.68	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.63	Wt. n-Val.	0.064	0.025	0.064
W.S. Elev (ft)	2048.05	Reach Len. (ft)	343.30	375.88	414.85
Crit W.S. (ft)		Flow Area (sq ft)	354.15	98.24	11.99
E.G. Slope (ft/ft)	0.005761	Area (sq ft)	354.15	98.24	11.99
Q Total (cfs)	1550.00	Flow (cfs)	689.39	833.69	26.92
Top Width (ft)	350.93	Top Width (ft)	305.01	38.06	7.86
Vel Total (ft/s)	3.34	Avg. Vel. (ft/s)	1.95	8.49	2.25
Max Chl Dpth (ft)	2.80	Hydr. Depth (ft)	1.16	2.58	1.53
Conv. Total (cfs)	20422.0	Conv. (cfs)	9083.0	10984.2	354.7
Length Wtd. (ft)	368.82	Wetted Per. (ft)	305.03	38.08	8.34
Min Ch El (ft)	2045.25	Shear (lb/sq ft)	0.42	0.93	0.52
Alpha	3.64	Stream Power (lb/ft s)	0.81	7.87	1.16
Frctn Loss (ft)	2.16	Cum Volume (acre-ft)	7.06	2.05	3.92
C & E Loss (ft)	0.10	Cum SA (acres)	5.00	0.78	2.62

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.289

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2046.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.63	Wt. n-Val.	0.100	0.025	0.100
W.S. Elev (ft)	2044.78	Reach Len. (ft)	100.44	106.55	115.05
Crit W.S. (ft)	2044.78	Flow Area (sq ft)	23.55	138.85	20.54
E.G. Slope (ft/ft)	0.005967	Area (sq ft)	705.52	138.85	481.14
Q Total (cfs)	1550.00	Flow (cfs)	55.07	1461.37	33.56
Top Width (ft)	669.97	Top Width (ft)	358.22	39.94	271.81
Vel Total (ft/s)	8.47	Avg. Vel. (ft/s)	2.34	10.52	1.63
Max Chl Dpth (ft)	4.40	Hydr. Depth (ft)	2.92	3.48	1.71
Conv. Total (cfs)	20066.0	Conv. (cfs)	713.0	18918.5	434.5
Length Wtd. (ft)	106.53	Wetted Per. (ft)	8.10	40.00	12.10
Min Ch El (ft)	2040.99	Shear (lb/sq ft)	1.08	1.29	0.63
Alpha	1.46	Stream Power (lb/ft s)	2.53	13.61	1.03
Frctn Loss (ft)	0.50	Cum Volume (acre-ft)	2.88	1.03	1.58
C & E Loss (ft)	0.53	Cum SA (acres)	2.39	0.44	1.28

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.269

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2045.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.56	Wt. n-Val.	0.100	0.036	
W.S. Elev (ft)	2044.44	Reach Len. (ft)	15.00	15.00	15.00
Crit W.S. (ft)	2043.11	Flow Area (sq ft)	2.85	257.63	
E.G. Slope (ft/ft)	0.003761	Area (sq ft)	11.05	258.83	56.54
Q Total (cfs)	1550.00	Flow (cfs)	2.37	1547.63	
Top Width (ft)	218.63	Top Width (ft)	20.29	71.41	126.93
Vel Total (ft/s)	5.95	Avg. Vel. (ft/s)	0.83	6.01	
Max Chl Dpth (ft)	4.90	Hydr. Depth (ft)	0.87	3.71	
Conv. Total (cfs)	25274.4	Conv. (cfs)	38.6	25235.8	
Length Wtd. (ft)	15.00	Wetted Per. (ft)	3.27	70.47	
Min Ch El (ft)	2039.54	Shear (lb/sq ft)	0.20	0.86	
Alpha	1.02	Stream Power (lb/ft s)	0.17	5.16	
Frctn Loss (ft)	0.11	Cum Volume (acre-ft)	2.06	0.54	0.87
C & E Loss (ft)	0.24	Cum SA (acres)	1.95	0.31	0.76

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.260

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2043.20	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.29	Wt. n-Val.		0.036		
W.S. Elev (ft)	2041.91	Reach Len. (ft)	104.19	148.26	138.32	
Crit W.S. (ft)	2041.91	Flow Area (sq ft)		170.22		
E.G. Slope (ft/ft)	0.014116	Area (sq ft)		170.22	10.78	
Q Total (cfs)	1550.00	Flow (cfs)		1550.00		
Top Width (ft)	109.05	Top Width (ft)		66.10	42.95	
Vel Total (ft/s)	9.11	Avg. Vel. (ft/s)		9.11		
Max Chl Dpth (ft)	3.69	Hydr. Depth (ft)		2.58		
Conv. Total (cfs)	13045.9	Conv. (cfs)		13045.9		
Length Wtd. (ft)	130.79	Wetted Per. (ft)		67.28		
Min Ch El (ft)	2038.22	Shear (lb/sq ft)		2.23		
Alpha	1.00	Stream Power (lb/ft s)		20.30		
Frctn Loss (ft)	1.91	Cum Volume (acre-ft)	2.06	0.34	0.85	
C & E Loss (ft)	0.44	Cum SA (acres)	1.95	0.24	0.73	

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: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.232

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2039.38	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.41	Wt. n-Val.	0.035	0.036	0.069	
W.S. Elev (ft)	2038.97	Reach Len. (ft)	119.47	184.63	176.91	
Crit W.S. (ft)		Flow Area (sq ft)	201.69	7.50	115.70	
E.G. Slope (ft/ft)	0.015107	Area (sq ft)	201.69	7.50	115.70	
Q Total (cfs)	1550.00	Flow (cfs)	1140.81	19.08	390.11	
Top Width (ft)	280.02	Top Width (ft)	178.62	21.09	80.31	
Vel Total (ft/s)	4.77	Avg. Vel. (ft/s)	5.66	2.54	3.37	
Max Chl Dpth (ft)	2.08	Hydr. Depth (ft)	1.13	0.36	1.44	
Conv. Total (cfs)	12610.7	Conv. (cfs)	9281.6	155.2	3173.9	
Length Wtd. (ft)	133.28	Wetted Per. (ft)	178.72	21.16	80.47	
Min Ch El (ft)	2038.51	Shear (lb/sq ft)	1.06	0.33	1.36	
Alpha	1.16	Stream Power (lb/ft s)	6.02	0.85	4.57	
Frctn Loss (ft)	1.76	Cum Volume (acre-ft)	1.81	0.03	0.65	
C & E Loss (ft)	0.04	Cum SA (acres)	1.73	0.09	0.53	

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

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #1 RS: 0.197

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2037.58	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.27	Wt. n-Val.	0.035	0.036	0.069	
W.S. Elev (ft)	2037.31	Reach Len. (ft)	154.52	100.94	84.28	
Crit W.S. (ft)		Flow Area (sq ft)	273.36	5.43	121.58	
E.G. Slope (ft/ft)	0.011701	Area (sq ft)	273.36	5.43	121.58	
Q Total (cfs)	1550.00	Flow (cfs)	1218.21	12.65	319.14	
Top Width (ft)	401.69	Top Width (ft)	285.90	14.36	101.43	
Vel Total (ft/s)	3.87	Avg. Vel. (ft/s)	4.46	2.33	2.62	
Max Chl Dpth (ft)	1.60	Hydr. Depth (ft)	0.96	0.38	1.20	
Conv. Total (cfs)	14329.1	Conv. (cfs)	11261.9	116.9	2950.3	
Length Wtd. (ft)	145.13	Wetted Per. (ft)	285.95	14.44	101.64	
Min Ch El (ft)	2036.74	Shear (lb/sq ft)	0.70	0.27	0.87	
Alpha	1.14	Stream Power (lb/ft s)	3.11	0.64	2.29	

```
* Frctn Loss (ft)        *    1.26  * Cum Volume (acre-ft)   *    1.16  *    0.01  *    0.17  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *    1.09  *    0.02  *    0.17  *
*****************************************************************************************************

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

CROSS SECTION


RIVER: SUNSET WASH
REACH: REACH #1            RS: 0.178


CROSS SECTION OUTPUT  Profile #500-YEAR
*****************************************************************************************************
* E.G. Elev (ft)         * 2036.30  * Element                 *  Left OB *  Channel * Right OB *
* Vel Head (ft)          *    0.22  * Wt. n-Val.              *   0.035  *          *   0.069  *
* W.S. Elev (ft)         * 2036.09  * Reach Len. (ft)         *          *          *          *
* Crit W.S. (ft)         * 2035.76  * Flow Area (sq ft)       *  382.60  *          *   56.07  *
* E.G. Slope (ft/ft)     *0.006710  * Area (sq ft)            *  382.60  *          *   56.07  *
* Q Total (cfs)          * 1550.00  * Flow (cfs)              * 1464.19  *          *   85.81  *
* Top Width (ft)         *  400.61  * Top Width (ft)          *  331.28  *          *   69.33  *
* Vel Total (ft/s)       *    3.53  * Avg. Vel. (ft/s)        *    3.83  *          *    1.53  *
* Max Chl Dpth (ft)      *    1.54  * Hydr. Depth (ft)        *    1.15  *          *    0.81  *
* Conv. Total (cfs)      * 18921.8  * Conv. (cfs)             * 17874.2  *          *  1047.5  *
* Length Wtd. (ft)       *          * Wetted Per. (ft)        *  331.44  *          *   69.40  *
* Min Ch El (ft)         * 2036.70  * Shear (lb/sq ft)        *    0.48  *          *    0.34  *
* Alpha                  *    1.12  * Stream Power (lb/ft s)  *    1.85  *          *    0.52  *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)    *          *          *          *
* C & E Loss (ft)        *          * Cum SA (acres)          *          *          *          *
*****************************************************************************************************

Warning: Divided flow computed for this cross-section.
Warning: There is no flow in the channel.  Check that the channel stations are correctly coded. To force flow into the channel,
a
         levee or ineffective flow may have to be added or the Manning's n of the overbank could be increased.

CROSS SECTION


RIVER: SUNSET WASH
REACH: REACH #3            RS: 1.902


CROSS SECTION OUTPUT  Profile #500-YEAR
*****************************************************************************************************
* E.G. Elev (ft)         * 2186.76  * Element                 *  Left OB *  Channel * Right OB *
* Vel Head (ft)          *    0.96  * Wt. n-Val.              *   0.057  *   0.033  *   0.057  *
* W.S. Elev (ft)         * 2185.80  * Reach Len. (ft)         *  364.59  *  385.83  *  386.41  *
* Crit W.S. (ft)         * 2185.80  * Flow Area (sq ft)       *   22.59  *   81.21  *    2.28  *
* E.G. Slope (ft/ft)     *0.008981  * Area (sq ft)            *   22.59  *   81.21  *    2.28  *
* Q Total (cfs)          *  696.00  * Flow (cfs)              *   33.84  *  657.70  *    4.46  *
* Top Width (ft)         *   80.62  * Top Width (ft)          *   47.83  *   29.99  *    2.81  *
* Vel Total (ft/s)       *    6.56  * Avg. Vel. (ft/s)        *    1.50  *    8.10  *    1.95  *
* Max Chl Dpth (ft)      *    4.22  * Hydr. Depth (ft)        *    0.47  *    2.71  *    0.81  *
* Conv. Total (cfs)      *  7344.1  * Conv. (cfs)             *   357.1  *  6940.0  *    47.1  *
* Length Wtd. (ft)       *  384.82  * Wetted Per. (ft)        *   47.84  *   31.06  *    3.25  *
* Min Ch El (ft)         * 2181.58  * Shear (lb/sq ft)        *    0.26  *    1.47  *    0.39  *
* Alpha                  *    1.44  * Stream Power (lb/ft s)  *    0.40  *   11.87  *    0.77  *
* Frctn Loss (ft)        *    2.73  * Cum Volume (acre-ft)    *    1.85  *    4.70  *    1.32  *
* C & E Loss (ft)        *    0.11  * Cum SA (acres)          *    3.01  *    2.11  *    2.13  *
*****************************************************************************************************

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: SUNSET WASH
REACH: REACH #3            RS: 1.829


CROSS SECTION OUTPUT  Profile #500-YEAR
*****************************************************************************************************
* E.G. Elev (ft)         * 2180.12  * Element                 *  Left OB *  Channel * Right OB *
* Vel Head (ft)          *    0.61  * Wt. n-Val.              *   0.057  *   0.033  *   0.057  *
* W.S. Elev (ft)         * 2179.51  * Reach Len. (ft)         *  292.74  *  275.99  *  239.47  *
* Crit W.S. (ft)         * 2179.51  * Flow Area (sq ft)       *   27.22  *   78.02  *   65.04  *
* E.G. Slope (ft/ft)     *0.005729  * Area (sq ft)            *   27.22  *   78.02  *   65.04  *
* Q Total (cfs)          *  696.00  * Flow (cfs)              *   35.62  *  547.34  *  113.05  *
* Top Width (ft)         *  154.28  * Top Width (ft)          *   50.36  *   25.42  *   78.51  *
* Vel Total (ft/s)       *    4.09  * Avg. Vel. (ft/s)        *    1.31  *    7.02  *    1.74  *
* Max Chl Dpth (ft)      *    4.32  * Hydr. Depth (ft)        *    0.54  *    3.07  *    0.83  *
* Conv. Total (cfs)      *  9195.5  * Conv. (cfs)             *   470.6  *  7231.4  *  1493.6  *
* Length Wtd. (ft)       *  273.38  * Wetted Per. (ft)        *   50.38  *   26.42  *   78.67  *
* Min Ch El (ft)         * 2175.19  * Shear (lb/sq ft)        *    0.19  *    1.06  *    0.30  *
* Alpha                  *    2.35  * Stream Power (lb/ft s)  *    0.25  *    7.41  *    0.51  *
```

* Frctn Loss (ft)	* 1.54	* Cum Volume (acre-ft)	* 1.64	* 3.99	* 1.02	*
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 2.60	* 1.86	* 1.77	*

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: SUNSET WASH
REACH: REACH #3 RS: 1.777

CROSS SECTION OUTPUT Profile #500-YEAR

* E.G. Elev (ft)	* 2175.11	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.69	* Wt. n-Val.	* 0.057	* 0.033	* 0.057	*
* W.S. Elev (ft)	* 2174.42	* Reach Len. (ft)	* 315.35	* 263.53	* 184.50	*
* Crit W.S. (ft)	* 2174.42	* Flow Area (sq ft)	* 53.91	* 75.96	* 34.15	*
* E.G. Slope (ft/ft)	*0.005575	* Area (sq ft)	* 53.91	* 75.96	* 34.15	*
* Q Total (cfs)	* 696.00	* Flow (cfs)	* 91.01	* 560.66	* 44.33	*
* Top Width (ft)	* 150.30	* Top Width (ft)	* 66.55	* 21.05	* 62.70	*
* Vel Total (ft/s)	* 4.24	* Avg. Vel. (ft/s)	* 1.69	* 7.38	* 1.30	*
* Max Chl Dpth (ft)	* 4.93	* Hydr. Depth (ft)	* 0.81	* 3.61	* 0.54	*
* Conv. Total (cfs)	* 9321.4	* Conv. (cfs)	* 1218.9	* 7508.9	* 593.7	*
* Length Wtd. (ft)	* 256.54	* Wetted Per. (ft)	* 66.74	* 23.35	* 62.72	*
* Min Ch El (ft)	* 2169.49	* Shear (lb/sq ft)	* 0.28	* 1.13	* 0.19	*
* Alpha	* 2.46	* Stream Power (lb/ft s)	* 0.47	* 8.36	* 0.25	*
* Frctn Loss (ft)	* 1.71	* Cum Volume (acre-ft)	* 1.37	* 3.50	* 0.75	*
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 2.21	* 1.71	* 1.38	*

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: SUNSET WASH
REACH: REACH #3 RS: 1.727

CROSS SECTION OUTPUT Profile #500-YEAR

* E.G. Elev (ft)	* 2170.22	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.91	* Wt. n-Val.	* 0.057	* 0.033	* 0.057	*
* W.S. Elev (ft)	* 2169.32	* Reach Len. (ft)	* 133.01	* 172.54	* 197.32	*
* Crit W.S. (ft)	* 2169.32	* Flow Area (sq ft)	* 6.62	* 62.80	* 55.32	*
* E.G. Slope (ft/ft)	*0.008068	* Area (sq ft)	* 6.62	* 62.80	* 55.32	*
* Q Total (cfs)	* 696.00	* Flow (cfs)	* 11.62	* 538.35	* 146.03	*
* Top Width (ft)	* 75.92	* Top Width (ft)	* 10.03	* 19.72	* 46.17	*
* Vel Total (ft/s)	* 5.58	* Avg. Vel. (ft/s)	* 1.76	* 8.57	* 2.64	*
* Max Chl Dpth (ft)	* 3.91	* Hydr. Depth (ft)	* 0.66	* 3.18	* 1.20	*
* Conv. Total (cfs)	* 7748.7	* Conv. (cfs)	* 129.4	* 5993.5	* 1625.7	*
* Length Wtd. (ft)	* 172.88	* Wetted Per. (ft)	* 10.20	* 20.35	* 46.23	*
* Min Ch El (ft)	* 2165.41	* Shear (lb/sq ft)	* 0.33	* 1.55	* 0.60	*
* Alpha	* 1.87	* Stream Power (lb/ft s)	* 0.57	* 13.32	* 1.59	*
* Frctn Loss (ft)	* 1.30	* Cum Volume (acre-ft)	* 1.15	* 3.08	* 0.56	*
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 1.93	* 1.59	* 1.15	*

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: SUNSET WASH
REACH: REACH #3 RS: 1.694

CROSS SECTION OUTPUT Profile #500-YEAR

* E.G. Elev (ft)	* 2167.87	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.85	* Wt. n-Val.	* 0.057	* 0.033	* 0.057	*
* W.S. Elev (ft)	* 2167.02	* Reach Len. (ft)	* 161.82	* 237.54	* 267.87	*

Crit W.S. (ft)	2167.02	Flow Area (sq ft)	45.54	62.51	29.07	
E.G. Slope (ft/ft)	0.006981	Area (sq ft)	45.54	62.51	29.07	
Q Total (cfs)	696.00	Flow (cfs)	107.18	526.43	62.39	
Top Width (ft)	86.47	Top Width (ft)	40.26	16.55	29.66	
Vel Total (ft/s)	5.08	Avg. Vel. (ft/s)	2.35	8.42	2.15	
Max Chl Dpth (ft)	4.99	Hydr. Depth (ft)	1.13	3.78	0.98	
Conv. Total (cfs)	8329.9	Conv. (cfs)	1282.8	6300.4	746.7	
Length Wtd. (ft)	229.50	Wetted Per. (ft)	40.55	18.66	29.71	
Min Ch El (ft)	2162.03	Shear (lb/sq ft)	0.49	1.46	0.43	
Alpha	2.13	Stream Power (lb/ft s)	1.15	12.29	0.92	
Frctn Loss (ft)	1.65	Cum Volume (acre-ft)	1.07	2.84	0.37	
C & E Loss (ft)	0.02	Cum SA (acres)	1.85	1.52	0.98	

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: SUNSET WASH
REACH: REACH #3 RS: 1.649

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2163.81	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.04	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2162.77	Reach Len. (ft)	215.90	176.24	135.84
Crit W.S. (ft)	2162.77	Flow Area (sq ft)	37.26	67.51	9.32
E.G. Slope (ft/ft)	0.007411	Area (sq ft)	37.26	67.51	9.32
Q Total (cfs)	696.00	Flow (cfs)	75.75	595.16	25.09
Top Width (ft)	69.07	Top Width (ft)	43.08	19.53	6.46
Vel Total (ft/s)	6.10	Avg. Vel. (ft/s)	2.03	8.82	2.69
Max Chl Dpth (ft)	3.93	Hydr. Depth (ft)	0.86	3.46	1.44
Conv. Total (cfs)	8084.6	Conv. (cfs)	879.9	6913.3	291.5
Length Wtd. (ft)	182.06	Wetted Per. (ft)	43.21	19.68	7.09
Min Ch El (ft)	2158.84	Shear (lb/sq ft)	0.40	1.59	0.61
Alpha	1.80	Stream Power (lb/ft s)	0.81	13.99	1.64
Frctn Loss (ft)	1.60	Cum Volume (acre-ft)	0.92	2.48	0.25
C & E Loss (ft)	0.05	Cum SA (acres)	1.70	1.42	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: SUNSET WASH
REACH: REACH #3 RS: 1.616

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2160.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.88	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2159.20	Reach Len. (ft)	256.40	311.15	305.11
Crit W.S. (ft)	2159.20	Flow Area (sq ft)	48.25	64.76	0.77
E.G. Slope (ft/ft)	0.010612	Area (sq ft)	48.25	64.76	0.77
Q Total (cfs)	696.00	Flow (cfs)	154.47	541.19	0.33
Top Width (ft)	74.28	Top Width (ft)	36.65	25.68	11.95
Vel Total (ft/s)	6.12	Avg. Vel. (ft/s)	3.20	8.36	0.43
Max Chl Dpth (ft)	3.37	Hydr. Depth (ft)	1.32	2.52	0.06
Conv. Total (cfs)	6756.4	Conv. (cfs)	1499.6	5253.6	3.2
Length Wtd. (ft)	302.23	Wetted Per. (ft)	37.07	26.78	11.96
Min Ch El (ft)	2155.83	Shear (lb/sq ft)	0.86	1.60	0.04
Alpha	1.51	Stream Power (lb/ft s)	2.76	13.39	0.02
Frctn Loss (ft)	2.75	Cum Volume (acre-ft)	0.71	2.21	0.24
C & E Loss (ft)	0.02	Cum SA (acres)	1.50	1.33	0.84

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: SUNSET WASH
REACH: REACH #3 RS: 1.557

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2155.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.11	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2154.67	Reach Len. (ft)	269.73	286.67	291.54
Crit W.S. (ft)	2154.67	Flow Area (sq ft)	33.48	69.50	2.26
E.G. Slope (ft/ft)	0.007873	Area (sq ft)	33.48	69.50	2.26
Q Total (cfs)	696.00	Flow (cfs)	71.72	620.17	4.12
Top Width (ft)	60.33	Top Width (ft)	37.40	20.12	2.81
Vel Total (ft/s)	6.61	Avg. Vel. (ft/s)	2.14	8.92	1.82
Max Chl Dpth (ft)	3.95	Hydr. Depth (ft)	0.90	3.45	0.80
Conv. Total (cfs)	7844.0	Conv. (cfs)	808.3	6989.3	46.4
Length Wtd. (ft)	285.78	Wetted Per. (ft)	37.57	20.82	3.24
Min Ch El (ft)	2150.72	Shear (lb/sq ft)	0.44	1.64	0.34
Alpha	1.63	Stream Power (lb/ft s)	0.94	14.64	0.62
Frctn Loss (ft)	2.65	Cum Volume (acre-ft)	0.47	1.73	0.23
C & E Loss (ft)	0.07	Cum SA (acres)	1.28	1.16	0.79

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: SUNSET WASH
REACH: REACH #3 RS: 1.502

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2150.70	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.86	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2149.84	Reach Len. (ft)	220.80	190.84	144.65
Crit W.S. (ft)	2149.84	Flow Area (sq ft)	4.15	90.41	6.55
E.G. Slope (ft/ft)	0.011086	Area (sq ft)	4.15	90.41	6.55
Q Total (cfs)	696.00	Flow (cfs)	5.56	681.15	9.29
Top Width (ft)	74.37	Top Width (ft)	12.11	44.64	17.62
Vel Total (ft/s)	6.88	Avg. Vel. (ft/s)	1.34	7.53	1.42
Max Chl Dpth (ft)	3.39	Hydr. Depth (ft)	0.34	2.03	0.37
Conv. Total (cfs)	6610.3	Conv. (cfs)	52.8	6469.3	88.2
Length Wtd. (ft)	189.48	Wetted Per. (ft)	12.19	45.13	17.64
Min Ch El (ft)	2146.45	Shear (lb/sq ft)	0.24	1.39	0.26
Alpha	1.17	Stream Power (lb/ft s)	0.32	10.44	0.36
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	0.35	1.21	0.20
C & E Loss (ft)	0.41	Cum SA (acres)	1.13	0.95	0.72

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: 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: SUNSET WASH
REACH: REACH #3 RS: 1.466

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2149.87	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2149.82	Reach Len. (ft)	105.42	102.76	118.28
Crit W.S. (ft)	2145.86	Flow Area (sq ft)	134.03	280.15	112.57
E.G. Slope (ft/ft)	0.000196	Area (sq ft)	134.03	280.15	112.57
Q Total (cfs)	696.00	Flow (cfs)	57.49	566.03	72.48
Top Width (ft)	200.83	Top Width (ft)	105.00	48.04	47.79
Vel Total (ft/s)	1.32	Avg. Vel. (ft/s)	0.43	2.02	0.64
Max Chl Dpth (ft)	6.75	Hydr. Depth (ft)	1.28	5.83	2.36
Conv. Total (cfs)	49665.0	Conv. (cfs)	4102.5	40390.8	5171.7
Length Wtd. (ft)	102.76	Wetted Per. (ft)	105.34	48.90	48.12
Min Ch El (ft)	2143.07	Shear (lb/sq ft)	0.02	0.07	0.03
Alpha	1.94	Stream Power (lb/ft s)	0.01	0.14	0.02
Frctn Loss (ft)		Cum Volume (acre-ft)		0.40	
C & E Loss (ft)		Cum SA (acres)	0.83	0.75	0.61

CROSS SECTION

RIVER: SUNSET WASH
REACH: REACH #3 RS: 1.447

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2144.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.69	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2143.37	Reach Len. (ft)	254.74	257.87	260.66
Crit W.S. (ft)	2143.37	Flow Area (sq ft)	50.89	84.69	0.86
E.G. Slope (ft/ft)	0.008302	Area (sq ft)	50.89	84.69	0.86
Q Total (cfs)	696.00	Flow (cfs)	92.71	602.74	0.55
Top Width (ft)	115.07	Top Width (ft)	75.62	32.92	6.54
Vel Total (ft/s)	5.10	Avg. Vel. (ft/s)	1.82	7.12	0.64
Max Chl Dpth (ft)	5.79	Hydr. Depth (ft)	0.67	2.57	0.13
Conv. Total (cfs)	7638.8	Conv. (cfs)	1017.5	6615.2	6.1
Length Wtd. (ft)	258.05	Wetted Per. (ft)	75.78	37.06	6.60
Min Ch El (ft)	2137.58	Shear (lb/sq ft)	0.35	1.18	0.07
Alpha	1.70	Stream Power (lb/ft s)	0.63	8.43	0.04
Frctn Loss (ft)	1.94	Cum Volume (acre-ft)	0.27	1.02	0.57
C & E Loss (ft)	0.02	Cum SA (acres)	0.61	0.65	0.54

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: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNSET WASH
REACH: REACH #3 RS: 1.398

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2138.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.66	Wt. n-Val.	0.062	0.033	0.057
W.S. Elev (ft)	2137.87	Reach Len. (ft)	269.98	276.25	268.52
Crit W.S. (ft)	2137.87	Flow Area (sq ft)	18.52	60.00	90.59
E.G. Slope (ft/ft)	0.006829	Area (sq ft)	18.52	60.00	90.59
Q Total (cfs)	696.00	Flow (cfs)	16.33	466.52	213.15
Top Width (ft)	160.49	Top Width (ft)	62.31	18.87	79.31
Vel Total (ft/s)	4.12	Avg. Vel. (ft/s)	0.88	7.78	2.35
Max Chl Dpth (ft)	4.17	Hydr. Depth (ft)	0.30	3.18	1.14
Conv. Total (cfs)	8422.6	Conv. (cfs)	197.6	5645.6	2579.4
Length Wtd. (ft)	274.92	Wetted Per. (ft)	62.34	19.86	79.36
Min Ch El (ft)	2133.70	Shear (lb/sq ft)	0.13	1.29	0.49
Alpha	2.49	Stream Power (lb/ft s)	0.11	10.01	1.14
Frctn Loss (ft)	2.77	Cum Volume (acre-ft)	0.07	0.59	0.29
C & E Loss (ft)	0.06	Cum SA (acres)	0.21	0.50	0.28

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNSET WASH
REACH: REACH #3 RS: 1.346

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2127.32	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.44	Wt. n-Val.	0.057	0.033	0.057
W.S. Elev (ft)	2126.88	Reach Len. (ft)			
Crit W.S. (ft)	2126.88	Flow Area (sq ft)	2.78	126.04	5.02
E.G. Slope (ft/ft)	0.016361	Area (sq ft)	2.78	126.04	5.02
Q Total (cfs)	696.00	Flow (cfs)	5.69	681.00	9.30
Top Width (ft)	156.48	Top Width (ft)	5.67	138.70	12.11
Vel Total (ft/s)	5.20	Avg. Vel. (ft/s)	2.05	5.40	1.85
Max Chl Dpth (ft)	1.11	Hydr. Depth (ft)	0.49	0.91	0.41
Conv. Total (cfs)	5441.3	Conv. (cfs)	44.5	5324.1	72.7
Length Wtd. (ft)		Wetted Per. (ft)	5.75	138.71	12.14
Min Ch El (ft)	2125.77	Shear (lb/sq ft)	0.49	0.93	0.42
Alpha	1.06	Stream Power (lb/ft s)	1.01	5.01	0.78
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.

CROSS SECTION

RIVER: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.256

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2156.10	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.66	Wt. n-Val.		0.030	0.057
W.S. Elev (ft)	2155.44	Reach Len. (ft)	201.37	201.18	200.68
Crit W.S. (ft)	2155.44	Flow Area (sq ft)		82.94	3.44
E.G. Slope (ft/ft)	0.012542	Area (sq ft)		82.94	3.44
Q Total (cfs)	551.00	Flow (cfs)		544.68	6.32
Top Width (ft)	69.70	Top Width (ft)		62.88	6.82
Vel Total (ft/s)	6.38	Avg. Vel. (ft/s)		6.57	1.84
Max Chl Dpth (ft)	4.11	Hydr. Depth (ft)		1.32	0.50
Conv. Total (cfs)	4920.1	Conv. (cfs)		4863.6	56.5
Length Wtd. (ft)	201.17	Wetted Per. (ft)		64.39	6.89
Min Ch El (ft)	2151.33	Shear (lb/sq ft)		1.01	0.39
Alpha	1.05	Stream Power (lb/ft s)		6.62	0.72
Frctn Loss (ft)	2.43	Cum Volume (acre-ft)		0.53	0.02
C & E Loss (ft)	0.01	Cum SA (acres)	0.11	1.78	0.16

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: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.218

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2151.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.69	Wt. n-Val.		0.030	0.064
W.S. Elev (ft)	2151.10	Reach Len. (ft)	43.05	43.12	43.30
Crit W.S. (ft)	2151.10	Flow Area (sq ft)		81.37	5.10
E.G. Slope (ft/ft)	0.011633	Area (sq ft)		81.37	5.10
Q Total (cfs)	551.00	Flow (cfs)		544.26	6.74
Top Width (ft)	70.52	Top Width (ft)		57.28	13.24
Vel Total (ft/s)	6.37	Avg. Vel. (ft/s)		6.69	1.32
Max Chl Dpth (ft)	1.84	Hydr. Depth (ft)		1.42	0.38
Conv. Total (cfs)	5108.6	Conv. (cfs)		5046.1	62.5
Length Wtd. (ft)	43.12	Wetted Per. (ft)		58.08	13.27
Min Ch El (ft)	2149.26	Shear (lb/sq ft)		1.02	0.28
Alpha	1.09	Stream Power (lb/ft s)		6.81	0.37
Frctn Loss (ft)		Cum Volume (acre-ft)		0.15	
C & E Loss (ft)		Cum SA (acres)	0.11	1.51	0.11

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION

RIVER: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.209

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2151.39	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.69	Wt. n-Val.	0.064	0.030	0.064
W.S. Elev (ft)	2150.70	Reach Len. (ft)	165.84	169.01	176.85
Crit W.S. (ft)	2150.70	Flow Area (sq ft)	7.57	77.56	8.22
E.G. Slope (ft/ft)	0.010397	Area (sq ft)	7.57	77.56	8.22
Q Total (cfs)	551.00	Flow (cfs)	11.43	527.25	12.33
Top Width (ft)	80.63	Top Width (ft)	14.75	49.60	16.28
Vel Total (ft/s)	5.90	Avg. Vel. (ft/s)	1.51	6.80	1.50
Max Chl Dpth (ft)	1.81	Hydr. Depth (ft)	0.51	1.56	0.51
Conv. Total (cfs)	5403.8	Conv. (cfs)	112.1	5170.9	120.9
Length Wtd. (ft)	169.01	Wetted Per. (ft)	14.88	49.66	16.32
Min Ch El (ft)	2148.89	Shear (lb/sq ft)	0.33	1.01	0.33
Alpha	1.27	Stream Power (lb/ft s)	0.50	6.89	0.49
Frctn Loss (ft)	1.86	Cum Volume (acre-ft)	0.04	0.59	0.02
C & E Loss (ft)	0.00	Cum SA (acres)	0.11	1.45	0.10

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: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.177

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2147.78	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.70	Wt. n-Val.	0.064	0.030	0.057
W.S. Elev (ft)	2147.08	Reach Len. (ft)	97.07	98.08	101.23
Crit W.S. (ft)	2147.08	Flow Area (sq ft)	9.97	77.87	0.30
E.G. Slope (ft/ft)	0.011639	Area (sq ft)	9.97	77.87	0.30
Q Total (cfs)	551.00	Flow (cfs)	18.48	532.27	0.25
Top Width (ft)	69.65	Top Width (ft)	15.60	52.33	1.72
Vel Total (ft/s)	6.25	Avg. Vel. (ft/s)	1.85	6.84	0.86
Max Chl Dpth (ft)	4.59	Hydr. Depth (ft)	0.64	1.49	0.17
Conv. Total (cfs)	5107.2	Conv. (cfs)	171.3	4933.6	2.4
Length Wtd. (ft)	98.06	Wetted Per. (ft)	15.65	53.82	1.75
Min Ch El (ft)	2142.48	Shear (lb/sq ft)	0.46	1.05	0.12
Alpha	1.16	Stream Power (lb/ft s)	0.86	7.19	0.11
Frctn Loss (ft)	1.02	Cum Volume (acre-ft)	0.01	0.29	0.00
C & E Loss (ft)	0.07	Cum SA (acres)	0.05	1.26	0.06

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: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.159

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2145.29	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.57	Wt. n-Val.		0.030	0.057
W.S. Elev (ft)	2144.72	Reach Len. (ft)	33.51	33.72	34.48
Crit W.S. (ft)	2144.61	Flow Area (sq ft)		90.86	0.26
E.G. Slope (ft/ft)	0.009341	Area (sq ft)		90.86	0.26
Q Total (cfs)	551.00	Flow (cfs)		550.80	0.20
Top Width (ft)	64.29	Top Width (ft)		62.80	1.49
Vel Total (ft/s)	6.05	Avg. Vel. (ft/s)		6.06	0.77
Max Chl Dpth (ft)	4.01	Hydr. Depth (ft)		1.45	0.17
Conv. Total (cfs)	5701.0	Conv. (cfs)		5699.0	2.1
Length Wtd. (ft)	33.72	Wetted Per. (ft)		63.76	1.52
Min Ch El (ft)	2140.71	Shear (lb/sq ft)		0.83	0.10
Alpha	1.00	Stream Power (lb/ft s)		5.04	0.08
Frctn Loss (ft)		Cum Volume (acre-ft)		0.10	
C & E Loss (ft)		Cum SA (acres)	0.03	1.13	0.05

CROSS SECTION

RIVER: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.152

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2144.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.67	Wt. n-Val.		0.030	0.057
W.S. Elev (ft)	2143.83	Reach Len. (ft)	45.98	40.80	21.30
Crit W.S. (ft)	2143.83	Flow Area (sq ft)		83.65	0.65
E.G. Slope (ft/ft)	0.012077	Area (sq ft)		83.65	0.65
Q Total (cfs)	551.00	Flow (cfs)		550.18	0.82
Top Width (ft)	64.37	Top Width (ft)		62.23	2.14
Vel Total (ft/s)	6.54	Avg. Vel. (ft/s)		6.58	1.26
Max Chl Dpth (ft)	3.42	Hydr. Depth (ft)		1.34	0.30
Conv. Total (cfs)	5013.8	Conv. (cfs)		5006.3	7.5
Length Wtd. (ft)	40.70	Wetted Per. (ft)		62.98	2.22
Min Ch El (ft)	2140.41	Shear (lb/sq ft)		1.00	0.22
Alpha	1.01	Stream Power (lb/ft s)		6.59	0.28
Frctn Loss (ft)	0.49	Cum Volume (acre-ft)	0.00	0.25	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.03	1.08	0.05

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: 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: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.145

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2143.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.71	Wt. n-Val.		0.030	0.057
W.S. Elev (ft)	2143.22	Reach Len. (ft)	38.52	35.07	22.34
Crit W.S. (ft)	2143.21	Flow Area (sq ft)		80.25	2.79
E.G. Slope (ft/ft)	0.011805	Area (sq ft)		80.25	2.79
Q Total (cfs)	551.00	Flow (cfs)		546.07	4.93
Top Width (ft)	60.91	Top Width (ft)		55.32	5.59
Vel Total (ft/s)	6.64	Avg. Vel. (ft/s)		6.80	1.77
Max Chl Dpth (ft)	3.67	Hydr. Depth (ft)		1.45	0.50
Conv. Total (cfs)	5071.4	Conv. (cfs)		5026.0	45.4
Length Wtd. (ft)	35.02	Wetted Per. (ft)		56.44	5.67
Min Ch El (ft)	2139.55	Shear (lb/sq ft)		1.05	0.36
Alpha	1.04	Stream Power (lb/ft s)		7.13	0.64
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	0.00	0.18	0.00
C & E Loss (ft)	0.16	Cum SA (acres)	0.03	1.02	0.05

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.138

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2143.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.40	Wt. n-Val.	0.064	0.030	0.057
W.S. Elev (ft)	2143.12	Reach Len. (ft)	32.04	32.07	32.29
Crit W.S. (ft)	2142.71	Flow Area (sq ft)	5.51	107.23	1.01
E.G. Slope (ft/ft)	0.004903	Area (sq ft)	5.51	107.23	1.01
Q Total (cfs)	551.00	Flow (cfs)	5.76	544.25	0.99
Top Width (ft)	72.76	Top Width (ft)	10.66	59.64	2.46
Vel Total (ft/s)	4.84	Avg. Vel. (ft/s)	1.04	5.08	0.98
Max Chl Dpth (ft)	4.03	Hydr. Depth (ft)	0.52	1.80	0.41
Conv. Total (cfs)	7868.7	Conv. (cfs)	82.2	7772.3	14.1
Length Wtd. (ft)	32.07	Wetted Per. (ft)	10.71	60.57	2.59
Min Ch El (ft)	2139.09	Shear (lb/sq ft)	0.16	0.54	0.12
Alpha	1.09	Stream Power (lb/ft s)	0.16	2.75	0.12
Frctn Loss (ft)		Cum Volume (acre-ft)		0.10	
C & E Loss (ft)		Cum SA (acres)	0.03	0.98	0.05

CROSS SECTION

RIVER: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.132

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2142.88	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.70	Wt. n-Val.	0.064	0.030	0.057
W.S. Elev (ft)	2142.17	Reach Len. (ft)	29.34	29.46	29.92
Crit W.S. (ft)	2142.17	Flow Area (sq ft)	2.69	80.51	1.95
E.G. Slope (ft/ft)	0.011867	Area (sq ft)	2.69	80.51	1.95
Q Total (cfs)	551.00	Flow (cfs)	3.84	544.43	2.73
Top Width (ft)	68.66	Top Width (ft)	6.30	56.75	5.61
Vel Total (ft/s)	6.47	Avg. Vel. (ft/s)	1.43	6.76	1.40
Max Chl Dpth (ft)	3.52	Hydr. Depth (ft)	0.43	1.42	0.35
Conv. Total (cfs)	5058.1	Conv. (cfs)	35.2	4997.8	25.1
Length Wtd. (ft)	29.46	Wetted Per. (ft)	6.36	57.39	5.66
Min Ch El (ft)	2138.65	Shear (lb/sq ft)	0.31	1.04	0.26
Alpha	1.08	Stream Power (lb/ft s)	0.45	7.03	0.36
Frctn Loss (ft)	0.34	Cum Volume (acre-ft)	0.00	0.21	0.01
C & E Loss (ft)	0.01	Cum SA (acres)	0.02	0.93	0.05

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: 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: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.126

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2142.19	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.69	Wt. n-Val.	0.064	0.030	0.057
W.S. Elev (ft)	2141.50	Reach Len. (ft)	25.03	24.89	24.50
Crit W.S. (ft)	2141.50	Flow Area (sq ft)	0.29	81.88	2.68
E.G. Slope (ft/ft)	0.011518	Area (sq ft)	0.29	81.88	2.68
Q Total (cfs)	551.00	Flow (cfs)	0.18	547.18	3.64
Top Width (ft)	67.52	Top Width (ft)	2.36	57.25	7.92
Vel Total (ft/s)	6.49	Avg. Vel. (ft/s)	0.61	6.68	1.36
Max Chl Dpth (ft)	3.64	Hydr. Depth (ft)	0.12	1.43	0.34
Conv. Total (cfs)	5134.0	Conv. (cfs)	1.7	5098.4	33.9
Length Wtd. (ft)	24.87	Wetted Per. (ft)	2.37	58.09	7.95
Min Ch El (ft)	2137.86	Shear (lb/sq ft)	0.09	1.01	0.24
Alpha	1.05	Stream Power (lb/ft s)	0.05	6.77	0.33
Frctn Loss (ft)	0.14	Cum Volume (acre-ft)	0.00	0.16	0.01
C & E Loss (ft)	0.20	Cum SA (acres)	0.02	0.90	0.04

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 conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: 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: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.122

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2141.80	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.	0.064	0.030	0.057
W.S. Elev (ft)	2141.52	Reach Len. (ft)	29.95	29.95	30.02
Crit W.S. (ft)	2140.95	Flow Area (sq ft)	7.79	109.74	28.04
E.G. Slope (ft/ft)	0.003492	Area (sq ft)	7.79	109.74	28.04
Q Total (cfs)	551.00	Flow (cfs)	7.82	491.19	51.99
Top Width (ft)	91.09	Top Width (ft)	12.41	57.68	21.00
Vel Total (ft/s)	3.78	Avg. Vel. (ft/s)	1.00	4.48	1.85
Max Chl Dpth (ft)	3.09	Hydr. Depth (ft)	0.63	1.90	1.34
Conv. Total (cfs)	9324.0	Conv. (cfs)	132.3	8312.0	879.8
Length Wtd. (ft)	29.95	Wetted Per. (ft)	12.47	58.04	21.23
Min Ch El (ft)	2138.43	Shear (lb/sq ft)	0.14	0.41	0.29
Alpha	1.27	Stream Power (lb/ft s)	0.14	1.85	0.53
Frctn Loss (ft)		Cum Volume (acre-ft)		0.11	
C & E Loss (ft)		Cum SA (acres)	0.01	0.86	0.03

CROSS SECTION

RIVER: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.116

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2141.55	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.69	Wt. n-Val.		0.030	0.057
W.S. Elev (ft)	2140.86	Reach Len. (ft)	72.19	72.14	72.08
Crit W.S. (ft)	2140.86	Flow Area (sq ft)		82.11	3.06
E.G. Slope (ft/ft)	0.011542	Area (sq ft)		82.11	3.06
Q Total (cfs)	551.00	Flow (cfs)		547.40	3.60
Top Width (ft)	68.89	Top Width (ft)		57.66	11.23
Vel Total (ft/s)	6.47	Avg. Vel. (ft/s)		6.67	1.18
Max Chl Dpth (ft)	3.66	Hydr. Depth (ft)		1.42	0.27
Conv. Total (cfs)	5128.7	Conv. (cfs)		5095.2	33.6
Length Wtd. (ft)	72.14	Wetted Per. (ft)		58.55	11.25
Min Ch El (ft)	2137.20	Shear (lb/sq ft)		1.01	0.20
Alpha	1.06	Stream Power (lb/ft s)		6.74	0.23
Frctn Loss (ft)	0.84	Cum Volume (acre-ft)	0.00	0.49	0.01
C & E Loss (ft)	0.00	Cum SA (acres)	0.01	0.82	0.02

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: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.102

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2140.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.69	Wt. n-Val.	0.064	0.030	0.057
W.S. Elev (ft)	2139.37	Reach Len. (ft)	68.14	67.52	68.34
Crit W.S. (ft)	2139.37	Flow Area (sq ft)	0.05	82.55	1.56
E.G. Slope (ft/ft)	0.011765	Area (sq ft)	0.05	82.55	1.56
Q Total (cfs)	551.00	Flow (cfs)	0.03	549.21	1.77
Top Width (ft)	65.41	Top Width (ft)	0.20	59.10	6.12
Vel Total (ft/s)	6.55	Avg. Vel. (ft/s)	0.51	6.65	1.13
Max Chl Dpth (ft)	3.62	Hydr. Depth (ft)	0.27	1.40	0.25
Conv. Total (cfs)	5079.9	Conv. (cfs)	0.2	5063.4	16.3
Length Wtd. (ft)	67.52	Wetted Per. (ft)	0.57	59.90	6.14
Min Ch El (ft)	2135.74	Shear (lb/sq ft)	0.07	1.01	0.19
Alpha	1.03	Stream Power (lb/ft s)	0.03	6.73	0.21
Frctn Loss (ft)	0.81	Cum Volume (acre-ft)	0.00	0.35	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.01	0.73	0.01

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: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.090

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2138.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.66	Wt. n-Val.		0.030	0.057
W.S. Elev (ft)	2137.74	Reach Len. (ft)	71.31	71.07	70.52
Crit W.S. (ft)	2137.74	Flow Area (sq ft)		84.23	0.19
E.G. Slope (ft/ft)	0.012165	Area (sq ft)		84.23	0.19
Q Total (cfs)	551.00	Flow (cfs)		550.90	0.10
Top Width (ft)	65.67	Top Width (ft)		63.43	2.24
Vel Total (ft/s)	6.53	Avg. Vel. (ft/s)		6.54	0.55
Max Chl Dpth (ft)	3.55	Hydr. Depth (ft)		1.33	0.08
Conv. Total (cfs)	4995.7	Conv. (cfs)		4994.8	0.9
Length Wtd. (ft)	71.07	Wetted Per. (ft)		64.30	2.24
Min Ch El (ft)	2134.19	Shear (lb/sq ft)		0.99	0.06
Alpha	1.00	Stream Power (lb/ft s)		6.51	0.04
Frctn Loss (ft)		Cum Volume (acre-ft)		0.22	
C & E Loss (ft)		Cum SA (acres)	0.01	0.63	0.00

Warning: During subcritical analysis, the water surface upstream of culvert went to critical depth.

CROSS SECTION

RIVER: SUNSET WASH
REACH: TRIBUTARY 1 RS: 0.076

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2131.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.08	Wt. n-Val.		0.030	
W.S. Elev (ft)	2130.88	Reach Len. (ft)	354.56	352.45	344.81
Crit W.S. (ft)	2130.88	Flow Area (sq ft)		65.96	
E.G. Slope (ft/ft)	0.010852	Area (sq ft)		65.96	
Q Total (cfs)	551.00	Flow (cfs)		551.00	
Top Width (ft)	30.47	Top Width (ft)		30.47	
Vel Total (ft/s)	8.35	Avg. Vel. (ft/s)		8.35	
Max Chl Dpth (ft)	3.02	Hydr. Depth (ft)		2.16	
Conv. Total (cfs)	5289.2	Conv. (cfs)		5289.2	
Length Wtd. (ft)	352.45	Wetted Per. (ft)		32.02	
Min Ch El (ft)	2127.86	Shear (lb/sq ft)		1.40	
Alpha	1.00	Stream Power (lb/ft s)		11.66	
Frctn Loss (ft)	3.54	Cum Volume (acre-ft)	0.00	0.72	
C & E Loss (ft)	0.35	Cum SA (acres)	0.01	0.56	

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 velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
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: SUNSET WASH

REACH: TRIBUTARY 1 RS: 0.009

CROSS SECTION OUTPUT Profile #500-YEAR

E.G. Elev (ft)	2124.38	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.38	Wt. n-Val.	0.057	0.030	
W.S. Elev (ft)	2124.00	Reach Len. (ft)			
Crit W.S. (ft)	2123.89	Flow Area (sq ft)	0.49	111.83	
E.G. Slope (ft/ft)	0.009337	Area (sq ft)	0.49	111.83	
Q Total (cfs)	551.00	Flow (cfs)	0.45	550.55	
Top Width (ft)	108.94	Top Width (ft)	2.14	106.80	
Vel Total (ft/s)	4.91	Avg. Vel. (ft/s)	0.93	4.92	
Max Chl Dpth (ft)	2.58	Hydr. Depth (ft)	0.23	1.05	
Conv. Total (cfs)	5702.4	Conv. (cfs)	4.7	5697.7	
Length Wtd. (ft)		Wetted Per. (ft)	2.18	107.18	
Min Ch El (ft)	2121.42	Shear (lb/sq ft)	0.13	0.61	
Alpha	1.01	Stream Power (lb/ft s)	0.12	2.99	
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

E.5.3 SUMMARY TABLES

WICKENBURG AREA DRAINAGE MASTER STUDY/PLAN
Flow Summary used in HEC-RAS Model

River/Reach Name	River Station (RS)	HEC-1 ID	10-Year, 6-Hour (cfs)	50-Year, 6-Hour (cfs)	100-Year, 6-Hour (cfs)	500-Year, 6-Hour (cfs)
Sunnycove Wash / Reach 2	3.132	SC1	549	863	1006	1344
	2.901	C1	554	893	1048	1414
	2.592	C2	690	1124	1322	1790
	1.83	C3	831	1316	1542	2102
Sunnycove Wash / Reach 1	0.4	SC6A	78*	119*	137*	180*
	0.263	SC6	186	282	326	428
Sunset Wash / Reach 3	1.902	SN1B	279*	443*	515*	696*
Sunset Wash / Reach 2	1.197	SN2A	30*	48*	56*	75*
	0.925	SN2	264	421	493	662
Sunset Wash / Reach 1	0.753	C6	419	660	770	1028
	0.537	C7	470**	819**	960**	1550
	0.36	C7	599	975	1146	N/A
Sunset Wash / Tributary 1	0.256	SN1A	220*	350*	412*	551*

Note: * Prorated Flow. Refer to the prorated flow calculations in Exhibit 6.
** Flow= HEC-1 ID: C7 flow - flow split to the south, cfs. Refer to the flow split calculations in Appendix E.4.

HEC-RAS Plan: Wickenburg_P River: SUNNYCOVE WASH Reach: REACH #2

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
REACH #2	3.132	1006.00	2328.71	2330.23	2330.23	2330.80	0.011460	6.10	170.74	160.85	0.97
REACH #2	3.132	1006.00	2328.71	2330.23	2330.23	2330.80	0.011308	6.07	170.98	155.00	0.96
REACH #2	3.105	1006.00	2322.18	2329.76	2325.86	2329.77	0.000093	1.19	1270.39	465.84	0.09
REACH #2	3.105	1006.00	2322.18	2330.06	2325.86	2330.13	0.000282	2.06	489.46	89.51	0.15
REACH #2	3.100	Culvert									
REACH #2	3.091	1006.00	2321.98	2325.80		2326.22	0.003236	5.26	193.64	70.54	0.53
REACH #2	3.091	1006.00	2321.98	2326.04		2326.41	0.002603	4.88	205.96	63.35	0.48
REACH #2	3.060	1006.00	2320.10	2324.25	2324.25	2325.27	0.007296	8.67	173.16	131.03	0.82
REACH #2	3.060	1006.00	2320.10	2325.22		2325.85	0.003219	6.79	221.41	127.00	0.57
REACH #2	2.995	1006.00	2317.07	2321.00	2321.00	2321.75	0.006668	8.51	227.22	144.25	0.80
REACH #2	2.995	1006.00	2317.07	2321.63	2321.63	2323.69	0.014376	11.52	87.33	20.92	0.99
REACH #2	2.901	1048.00	2309.49	2314.42	2314.42	2315.17	0.005748	7.94	232.21	160.92	0.73
REACH #2	2.901	1048.00	2309.49	2314.45	2314.45	2315.86	0.009696	9.83	122.96	45.47	0.90
REACH #2	2.832	1048.00	2306.07	2308.76	2308.76	2309.57	0.010780	8.40	189.21	122.20	0.95
REACH #2	2.832	1048.00	2306.07	2309.55	2309.30	2310.82	0.010341	9.06	115.66	36.08	0.89
REACH #2	2.739	1048.00	2299.84	2302.35	2302.35	2303.07	0.012740	9.15	210.18	134.42	1.04
REACH #2	2.739	1048.00	2299.84	2303.35	2303.35	2304.94	0.013753	10.95	115.43	35.71	1.04
REACH #2	2.657	1048.00	2293.00	2295.93	2295.93	2296.91	0.011455	8.42	155.88	91.33	0.93
REACH #2	2.657	1048.00	2293.00	2295.98	2295.98	2297.27	0.014054	9.20	117.11	46.15	1.01
REACH #2	2.592	1322.00	2287.96	2291.41		2291.89	0.006591	6.33	279.61	142.08	0.71
REACH #2	2.592	1322.00	2287.96	2291.79	2291.43	2292.76	0.009156	7.92	167.00	58.16	0.82
REACH #2	2.563	1322.00	2285.75	2289.08	2289.08	2290.48	0.011455	9.96	157.47	61.59	0.97
REACH #2	2.563	1322.00	2285.75	2289.34	2289.29	2291.01	0.013877	10.34	127.83	36.35	0.97
REACH #2	2.496	1322.00	2280.26	2284.40	2284.40	2285.77	0.008554	10.08	175.10	73.65	0.91
REACH #2	2.496	1322.00	2280.26	2284.54	2284.54	2286.48	0.011673	11.21	121.37	31.28	1.00
REACH #2	2.432	1322.00	2276.38	2279.40		2279.88	0.007801	7.84	291.55	139.15	0.83
REACH #2	2.432	1322.00	2276.38	2280.36	2280.36	2282.08	0.011973	11.84	149.45	45.00	1.08
REACH #2	2.379	1322.00	2272.33	2276.38	2276.38	2277.81	0.008899	10.58	175.83	70.16	0.94
REACH #2	2.379	1322.00	2272.33	2276.42	2276.42	2278.34	0.012378	11.63	128.42	33.45	1.03
REACH #2	2.320	1322.00	2268.23	2271.73	2271.73	2273.08	0.010335	10.07	167.36	66.86	0.98
REACH #2	2.320	1322.00	2268.23	2272.08	2272.08	2273.86	0.010338	10.78	126.86	35.39	1.00
REACH #2	2.261	1322.00	2262.24	2266.54	2266.54	2268.16	0.009684	10.44	143.00	52.56	0.96
REACH #2	2.261	1322.00	2262.24	2266.57	2266.57	2268.15	0.009351	10.32	143.53	48.00	0.95
REACH #2	2.203	1322.00	2256.71	2260.19	2260.19	2261.59	0.010397	9.67	149.06	57.59	0.97
REACH #2	2.203	1322.00	2256.71	2260.20	2260.20	2261.76	0.012836	10.02	131.96	42.93	1.01
REACH #2	2.118	1322.00	2249.63	2253.45	2253.45	2255.05	0.010402	10.22	135.75	46.93	0.98
REACH #2	2.118	1322.00	2249.63	2253.49	2253.49	2255.05	0.009978	10.09	137.52	46.00	0.96
REACH #2	2.028	1322.00	2241.42	2245.22	2245.22	2246.62	0.012621	11.45	169.62	61.67	1.09
REACH #2	2.028	1322.00	2241.42	2246.21	2246.21	2248.37	0.014138	12.51	122.37	28.53	1.05
REACH #2	1.930	1322.00	2234.57	2239.02	2239.02	2240.09	0.006680	9.57	228.97	107.09	0.82
REACH #2	1.930	1322.00	2234.57	2239.83	2239.36	2241.70	0.010576	10.99	120.29	23.93	0.86
REACH #2	1.867	1322.00	2230.40	2234.40	2234.40	2235.48	0.008304	10.17	228.89	101.59	0.91
REACH #2	1.867	1322.00	2230.40	2235.39	2235.39	2237.82	0.012476	12.59	109.84	22.56	1.00
REACH #2	1.830	1542.00	2227.53	2231.58	2231.58	2232.65	0.008232	9.16	246.23	121.97	0.88
REACH #2	1.830	1542.00	2227.53	2231.77	2231.77	2233.55	0.012218	10.73	143.71	40.33	1.00
REACH #2	1.778	1542.00	2225.23	2228.12	2228.05	2229.12	0.011361	9.55	250.81	134.13	1.00
REACH #2	1.778	1542.00	2225.23	2229.08		2230.42	0.008831	9.66	177.54	47.52	0.88

HEC-RAS Plan: Wickenburg_P River: SUNNYCOVE WASH Reach: REACH #2 (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
REACH #2	1.733	1542.00	2221.84	2225.61	2225.61	2226.47	0.010691	9.73	282.02	148.12	0.98
REACH #2	1.733	1542.00	2221.84	2226.61	2226.61	2228.10	0.010786	10.94	186.90	58.98	0.95
REACH #2	1.681	1542.00	2217.86	2221.62	2221.62	2222.38	0.006996	8.98	336.18	208.41	0.82
REACH #2	1.681	1542.00	2217.86	2222.19	2222.19	2224.23	0.010696	12.21	150.48	37.20	1.04
REACH #2	1.618	1542.00	2212.90	2216.77	2216.77	2217.92	0.010260	10.43	239.40	102.41	0.98
REACH #2	1.618	1542.00	2212.90	2217.76	2217.76	2220.01	0.012073	12.32	136.52	31.00	1.03
REACH #2	1.550	1542.00	2208.44	2211.69	2211.69	2212.49	0.011378	10.21	306.07	169.64	1.02
REACH #2	1.550	1542.00	2208.44	2212.68	2212.41	2214.03	0.009598	11.28	208.09	60.00	0.98
REACH #2	1.478	1542.00	2204.39	2207.45	2207.21	2208.04	0.010344	9.07	330.16	167.87	0.96
REACH #2	1.478	1542.00	2204.39	2208.34	2208.34	2209.78	0.014072	11.57	194.36	63.90	1.06
REACH #2	1.415	1542.00	2200.20	2203.33	2203.33	2203.97	0.014970	8.87	321.14	224.91	1.04
REACH #2	1.415	1542.00	2200.20	2204.32		2205.09	0.008862	8.68	283.51	120.00	0.85
REACH #2	1.327	1542.00	2193.28	2198.32	2198.32	2199.21	0.005872	8.95	324.25	173.42	0.73
REACH #2	1.327	1542.00	2193.28	2198.32	2198.32	2200.51	0.010812	12.16	142.21	34.00	0.99
REACH #2	1.270	1542.00	2189.52	2193.00	2193.00	2194.42	0.014948	10.08	192.52	111.00	1.08
REACH #2	1.270	1542.00	2189.52	2193.98		2194.94	0.006253	8.01	203.35	55.10	0.73
REACH #2	1.193	1542.00	2185.05	2189.32		2189.97	0.005567	8.41	334.25	127.98	0.74
REACH #2	1.193	1542.00	2185.05	2189.91	2189.89	2191.80	0.009299	11.91	169.54	45.00	0.98
REACH #2	1.164	1542.00	2182.84	2189.50		2189.60	0.000540	3.39	783.17	184.77	0.25
REACH #2	1.164	1542.00	2182.84	2190.32		2190.84	0.001802	5.79	266.35	39.66	0.39
REACH #2	1.150	1542.00	2181.54	2189.51	2184.62	2189.54	0.000168	2.14	1254.52	221.00	0.14
REACH #2	1.150	1542.00	2181.54	2190.48	2184.95	2190.60	0.000310	3.15	681.03	85.28	0.19
REACH #2	1.137	Culvert									
REACH #2	1.127	1542.00	2175.67	2182.60	2182.42	2183.53	0.006995	8.27	257.29	125.62	0.75
REACH #2	1.127	1542.00	2175.67	2182.90		2183.86	0.006682	8.15	218.31	64.86	0.71
REACH #2	1.091	1542.00	2174.19	2180.62	2180.62	2182.09	0.006486	10.58	223.20	90.14	0.79
REACH #2	1.091	1542.00	2174.19	2180.63	2180.63	2182.32	0.007151	11.12	193.62	64.90	0.83
REACH #2	1.054	1542.00	2171.90	2177.59	2177.59	2179.51	0.010789	11.32	155.59	60.62	0.96
REACH #2	1.054	1542.00	2171.90	2177.60	2177.60	2179.61	0.011074	11.48	141.60	37.00	0.97
REACH #2	0.997	1542.00	2166.58	2170.04	2170.04	2171.41	0.010387	9.70	180.78	71.71	1.00
REACH #2	0.997	1542.00	2166.58	2170.18	2170.18	2171.73	0.011837	9.99	154.39	50.30	1.00
REACH #2	0.937	1542.00	2161.98	2165.57	2165.57	2166.78	0.010877	9.00	187.72	84.06	1.00
REACH #2	0.937	1542.00	2161.98	2165.64	2165.64	2166.95	0.012122	9.20	167.53	64.32	1.01
REACH #2	0.897	1542.00	2159.32	2162.06	2162.06	2163.25	0.009762	8.80	180.76	80.22	1.00
REACH #2	0.897	1542.00	2159.32	2162.06	2162.06	2163.29	0.010606	8.88	173.57	71.74	1.01
REACH #2	0.850	1542.00	2155.01	2158.40	2158.40	2159.81	0.008449	9.81	182.55	71.79	0.97
REACH #2	0.850	1542.00	2155.01	2158.44	2158.44	2160.05	0.009755	10.27	154.93	49.03	1.01
REACH #2	0.807	1542.00	2152.25	2155.74	2155.74	2157.04	0.009527	9.24	174.41	69.50	1.00
REACH #2	0.807	1542.00	2152.25	2155.75	2155.75	2157.10	0.009937	9.34	167.58	62.46	1.00
REACH #2	0.758	1542.00	2148.66	2151.93	2151.93	2153.11	0.009759	8.78	182.94	80.95	0.99
REACH #2	0.758	1542.00	2148.66	2151.93	2151.93	2153.17	0.010487	8.93	172.69	70.95	1.01
REACH #2	0.693	1542.00	2143.38	2147.05	2147.05	2148.39	0.009626	9.30	166.90	65.22	1.00
REACH #2	0.693	1542.00	2143.38	2147.05	2147.05	2148.40	0.009867	9.33	165.26	61.85	1.01
REACH #2	0.642	1542.00	2138.10	2141.40	2141.40	2142.54	0.009823	8.58	182.33	83.56	0.99
REACH #2	0.642	1542.00	2138.10	2141.37	2141.37	2142.55	0.010549	8.70	177.32	76.91	1.01

HEC-RAS Plan: Wickenburg_P River: SUNNYCOVE WASH Reach: REACH #1

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
REACH #1	0.400	137.00	2109.67	2110.79	2110.79	2111.01	0.028042	3.81	35.96	77.83	0.99
REACH #1	0.400	137.00	2109.67	2110.79	2110.79	2111.01	0.027532	3.79	36.17	77.84	0.98
REACH #1	0.365	137.00	2105.40	2107.72		2107.73	0.000428	0.87	160.55	145.31	0.14
REACH #1	0.365	137.00	2105.40	2107.81		2107.82	0.000346	0.82	166.83	132.72	0.13
REACH #1	0.340	137.00	2105.69	2107.50		2107.60	0.003206	2.72	61.48	74.12	0.40
REACH #1	0.340	137.00	2105.69	2107.52		2107.69	0.005285	3.35	40.88	28.60	0.49
REACH #1	0.294	137.00	2102.57	2105.57		2106.11	0.015396	5.90	23.21	15.50	0.85
REACH #1	0.294	137.00	2102.57	2106.46		2106.67	0.003477	3.70	37.11	15.60	0.42
REACH #1	0.279	137.00	2102.44	2105.54	2104.37	2105.60	0.001373	2.08	69.18	48.13	0.27
REACH #1	0.279	137.00	2102.44	2106.49	2104.37	2106.52	0.000293	1.28	119.92	56.30	0.14
REACH #1	0.269	Culvert									
REACH #1	0.263	326.00	2100.10	2103.15	2102.66	2103.77	0.008324	6.34	55.19	43.51	0.74
REACH #1	0.263	326.00	2100.10	2103.97		2104.31	0.003217	4.72	69.17	22.85	0.48
REACH #1	0.245	326.00	2099.97	2102.92		2103.10	0.003048	3.78	127.75	152.14	0.46
REACH #1	0.245	326.00	2099.97	2103.85		2104.01	0.001552	3.17	102.91	34.33	0.32
REACH #1	0.239	326.00	2100.02	2102.85	2102.42	2103.00	0.003023	3.93	130.12	177.01	0.47
REACH #1	0.239	326.00	2100.02	2103.81	2102.42	2103.96	0.001674	3.46	114.16	41.30	0.34
REACH #1	0.233	Culvert									
REACH #1	0.226	326.00	2099.28	2100.74	2100.74	2101.27	0.017221	5.84	56.39	56.35	0.99
REACH #1	0.226	326.00	2099.28	2100.75	2100.75	2101.27	0.016712	5.79	56.84	54.42	0.98
REACH #1	0.216	326.00	2095.89	2098.92		2099.23	0.003617	4.80	84.69	44.61	0.53
REACH #1	0.216	326.00	2095.89	2099.02		2099.48	0.005687	5.44	59.93	22.35	0.59
REACH #1	0.194	326.00	2093.51	2097.39	2097.39	2098.41	0.015263	8.10	40.40	20.83	0.99
REACH #1	0.194	326.00	2093.51	2097.40	2097.40	2098.42	0.015656	8.10	40.25	19.52	0.99
REACH #1	0.159	326.00	2091.68	2094.30	2094.30	2094.80	0.011721	5.93	68.83	77.37	0.86
REACH #1	0.159	326.00	2091.68	2094.32	2094.32	2094.80	0.011253	5.85	69.51	74.50	0.84
REACH #1	0.089	326.00	2084.96	2086.67	2086.67	2087.27	0.015894	6.21	53.16	44.78	0.98
REACH #1	0.089	326.00	2084.96	2086.68	2086.66	2087.28	0.016368	6.21	52.50	41.71	0.98
REACH #1	0.036	326.00	2080.15	2081.54	2081.54	2082.19	0.018777	6.94	52.82	220.14	1.07
REACH #1	0.036	326.00	2080.15	2081.86	2081.86	2082.65	0.016409	7.22	46.48	28.74	1.00
REACH #1	0.022	326.00	2078.43	2081.12		2081.46	0.004325	4.74	71.56	37.05	0.56
REACH #1	0.022	326.00	2078.43	2081.17		2081.51	0.004500	4.69	69.53	30.22	0.54

HEC-RAS Plan: Wickenburg_P River: SUNSET WASH Reach: TRIBUTARY 1 Profile: FLOODPLAIN

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
TRIBUTARY 1	0.256	412.00	2151.33	2155.21	2155.21	2155.76	0.013217	5.97	70.46	67.45	1.00
TRIBUTARY 1	0.218	412.00	2149.26	2150.82	2150.82	2151.42	0.012226	6.19	68.36	62.74	0.99
TRIBUTARY 1	0.213	Culvert									
TRIBUTARY 1	0.209	412.00	2148.89	2150.45	2150.45	2151.02	0.010822	6.17	73.84	74.52	0.95
TRIBUTARY 1	0.177	412.00	2142.48	2146.80	2146.80	2147.41	0.013028	6.32	69.76	64.98	1.01
TRIBUTARY 1	0.159	412.00	2140.71	2144.44	2144.35	2144.93	0.010275	5.61	73.45	61.26	0.90
TRIBUTARY 1	0.155	Culvert									
TRIBUTARY 1	0.152	412.00	2140.41	2143.58	2143.58	2144.14	0.013163	6.04	68.42	62.81	1.01
TRIBUTARY 1	0.145	412.00	2139.55	2142.95	2142.94	2143.55	0.012693	6.23	67.32	59.36	1.00
TRIBUTARY 1	0.138	412.00	2139.09	2142.83	2142.44	2143.15	0.004996	4.55	93.14	68.93	0.65
TRIBUTARY 1	0.135	Culvert									
TRIBUTARY 1	0.132	412.00	2138.65	2141.94	2141.94	2142.51	0.012191	6.08	69.50	65.73	0.98
TRIBUTARY 1	0.126	412.00	2137.86	2141.24	2141.24	2141.82	0.012566	6.12	68.21	62.17	1.00
TRIBUTARY 1	0.122	412.00	2138.43	2141.26	2140.72	2141.48	0.003231	3.91	122.75	87.76	0.54
TRIBUTARY 1	0.119	Culvert									
TRIBUTARY 1	0.116	412.00	2137.20	2140.59	2140.59	2141.18	0.012757	6.16	67.61	62.52	1.00
TRIBUTARY 1	0.102	412.00	2135.74	2139.11	2139.11	2139.69	0.012803	6.08	68.11	62.33	1.00
TRIBUTARY 1	0.090	412.00	2134.19	2137.50	2137.50	2138.05	0.012779	5.98	68.95	61.72	1.00
TRIBUTARY 1	0.082	Culvert									
TRIBUTARY 1	0.076	412.00	2127.86	2130.38	2130.38	2131.36	0.011360	7.96	51.77	26.64	1.01
TRIBUTARY 1	0.009	412.00	2121.42	2123.83	2123.72	2124.13	0.009333	4.40	93.80	107.41	0.82

HEC-RAS Plan: Wickenburg_P River: SUNSET WASH Reach: REACH #3 Profile: FLOODPLAIN

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
REACH #3	1.902	515.00	2181.58	2185.25	2185.25	2186.19	0.011265	7.82	70.96	51.35	0.94
REACH #3	1.829	515.00	2175.19	2179.12	2179.12	2179.76	0.006347	6.75	113.35	135.29	0.73
REACH #3	1.777	515.00	2169.49	2173.75	2173.75	2174.66	0.008352	7.87	83.83	82.84	0.81
REACH #3	1.727	515.00	2165.41	2168.87	2168.87	2169.70	0.008452	7.93	93.09	65.08	0.84
REACH #3	1.694	515.00	2162.03	2166.62	2166.62	2167.39	0.006710	7.67	104.32	80.37	0.74
REACH #3	1.649	515.00	2158.84	2162.06	2162.06	2163.17	0.009980	8.78	73.49	45.38	0.93
REACH #3	1.616	515.00	2155.83	2158.86	2158.86	2159.59	0.010251	7.53	91.82	61.44	0.89
REACH #3	1.557	515.00	2150.72	2154.08	2154.08	2155.13	0.009091	8.46	73.55	46.61	0.88
REACH #3	1.502	515.00	2146.45	2149.40	2149.40	2150.21	0.013283	7.21	72.68	50.09	0.99
REACH #3	1.466	515.00	2143.07	2149.48	2145.50	2149.52	0.000138	1.63	461.17	184.93	0.12
REACH #3	1.456	Culvert									
REACH #3	1.447	515.00	2137.58	2142.96	2142.96	2143.65	0.009461	6.84	92.40	96.43	0.81
REACH #3	1.398	515.00	2133.70	2137.34	2137.34	2138.08	0.008845	7.84	106.98	90.42	0.85
REACH #3	1.346	515.00	2125.77	2126.72	2126.72	2127.08	0.017535	4.90	108.43	154.45	1.00

HEC-RAS Plan: Wickenburg_P River: SUNSET WASH Reach: REACH #2

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
REACH #2	1.197	56.00	2107.12	2110.86		2110.86	0.000027	0.42	138.44	47.95	0.04
REACH #2	1.197	56.00	2107.12	2110.86		2110.87	0.000031	0.43	129.97	38.52	0.04
REACH #2	1.170	56.00	2109.62	2110.58	2110.56	2110.82	0.020601	4.18	16.54	36.35	0.88
REACH #2	1.170	56.00	2109.62	2110.57	2110.55	2110.82	0.021092	4.20	15.49	27.55	0.89
REACH #2	1.117	56.00	2102.85	2103.65	2103.65	2103.91	0.030338	4.15	14.08	28.62	1.02
REACH #2	1.117	56.00	2102.85	2103.65	2103.65	2103.90	0.029504	4.11	14.20	28.53	1.01
REACH #2	1.019	56.00	2094.08	2095.86		2095.97	0.003628	2.73	21.55	19.16	0.41
REACH #2	1.019	56.00	2094.08	2095.89		2096.00	0.003370	2.67	22.11	19.16	0.40
REACH #2	0.925	493.00	2083.91	2087.17	2087.17	2088.35	0.019597	8.72	56.58	24.90	1.01
REACH #2	0.925	493.00	2083.91	2087.16	2087.16	2088.35	0.020069	8.74	56.43	24.26	1.01
REACH #2	0.880	493.00	2080.96	2082.69	2082.36	2083.04	0.003829	4.82	110.48	528.40	0.69
REACH #2	0.880	493.00	2080.96	2083.39	2082.40	2083.57	0.001198	3.41	145.19	66.13	0.41
REACH #2	0.858	493.00	2079.48	2081.93	2081.93	2082.52	0.004999	6.68	94.80	271.09	0.83
REACH #2	0.858	493.00	2079.48	2082.83	2082.05	2083.34	0.002346	5.84	88.90	35.00	0.60
REACH #2	0.828	493.00	2078.40	2080.87		2080.95	0.002423	3.49	293.35	289.78	0.54
REACH #2	0.828	493.00	2078.40	2081.61	2081.61	2082.68	0.007931	8.32	59.26	27.20	0.99

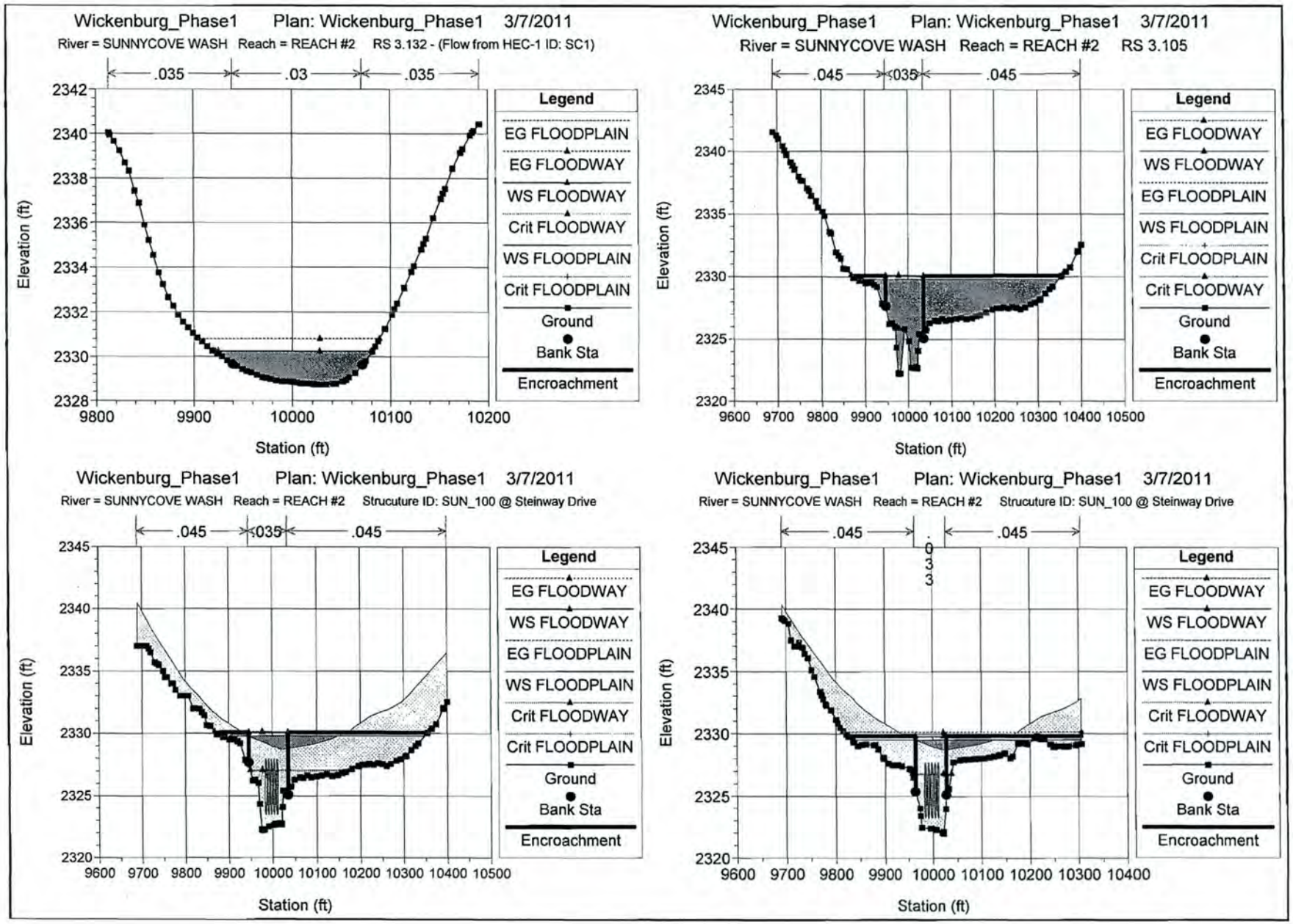
HEC-RAS Plan: Wickenburg_P River: SUNSET WASH Reach: REACH #1

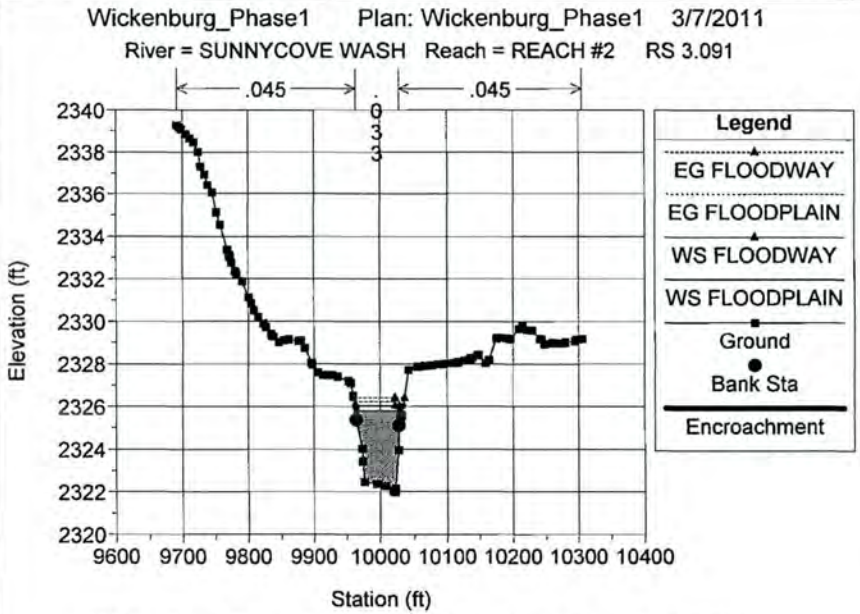
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
REACH #1	0.753	770.00	2072.44	2077.10	2077.10	2078.71	0.011041	10.20	75.46	158.31	1.00
REACH #1	0.753	770.00	2072.44	2077.10	2077.10	2078.71	0.011041	10.20	75.46	23.23	1.00
REACH #1	0.737	770.00	2070.11	2074.40	2074.40	2075.70	0.011388	9.15	84.18	32.70	1.00
REACH #1	0.737	770.00	2070.11	2075.38	2074.40	2076.01	0.003805	6.42	132.47	63.99	0.60
REACH #1	0.732	Culvert									
REACH #1	0.726	770.00	2069.28	2074.28		2074.90	0.005510	6.70	144.30	87.48	0.71
REACH #1	0.726	770.00	2069.28	2074.28		2074.89	0.005499	6.69	140.68	76.00	0.71
REACH #1	0.708	770.00	2069.37	2073.38	2073.38	2074.19	0.008942	7.64	122.65	89.46	0.90
REACH #1	0.708	770.00	2069.37	2073.42	2073.40	2074.21	0.008440	7.51	121.02	75.00	0.87
REACH #1	0.679	770.00	2067.75	2072.03	2072.03	2072.52	0.005483	7.02	203.01	200.54	0.72
REACH #1	0.679	770.00	2067.75	2072.27		2073.07	0.006423	8.00	123.95	55.00	0.79
REACH #1	0.668	770.00	2066.97	2071.09	2071.09	2071.71	0.005737	7.50	169.14	135.58	0.75
REACH #1	0.668	770.00	2066.97	2072.07	2071.20	2072.75	0.003501	7.05	129.10	38.40	0.62
REACH #1	0.663	Culvert									
REACH #1	0.658	770.00	2064.90	2069.42	2069.42	2070.50	0.006967	8.59	106.06	57.67	0.81
REACH #1	0.658	770.00	2064.90	2069.42	2069.42	2070.49	0.007097	8.56	105.91	54.52	0.80
REACH #1	0.647	770.00	2064.23	2068.07	2068.07	2069.65	0.010707	10.07	76.87	25.82	0.99
REACH #1	0.647	770.00	2064.23	2068.08	2068.08	2069.65	0.011184	10.05	76.60	24.00	0.99
REACH #1	0.633	770.00	2062.48	2067.51	2066.54	2068.13	0.006421	6.30	122.31	83.58	0.63
REACH #1	0.633	770.00	2062.48	2067.50	2066.54	2068.12	0.006498	6.31	122.12	39.39	0.63
REACH #1	0.607	770.00	2061.34	2065.60	2065.34	2066.83	0.013527	8.92	86.28	27.92	0.89
REACH #1	0.607	770.00	2061.34	2065.63	2065.33	2066.84	0.013056	8.82	87.29	27.93	0.88
REACH #1	0.570	770.00	2059.62	2063.99		2064.63	0.008219	6.62	139.17	90.28	0.71
REACH #1	0.570	770.00	2059.62	2064.46		2065.02	0.005738	5.97	128.89	40.36	0.59
REACH #1	0.547	770.00	2059.06	2062.83	2062.83	2063.39	0.012990	6.76	175.00	194.69	0.85
REACH #1	0.547	770.00	2059.06	2063.65	2062.93	2064.24	0.007384	6.18	124.55	44.56	0.65
REACH #1	0.542	Culvert									
REACH #1	0.537	960.00	2056.22	2061.53	2061.53	2062.29	0.011791	7.61	173.65	145.66	0.83
REACH #1	0.537	960.00	2056.22	2061.61	2061.54	2062.84	0.016861	8.90	107.86	40.00	0.96
REACH #1	0.524	960.00	2055.79	2060.41	2060.41	2061.28	0.008990	7.96	172.26	126.17	0.77
REACH #1	0.524	960.00	2055.79	2061.08		2061.96	0.007668	7.51	127.75	31.96	0.66
REACH #1	0.504	960.00	2055.08	2058.92	2058.92	2060.06	0.007398	9.40	152.08	74.21	0.93
REACH #1	0.504	960.00	2055.08	2059.24	2059.24	2060.94	0.010087	10.48	91.60	26.43	0.99
REACH #1	0.461	960.00	2052.78	2054.82	2054.82	2055.55	0.010625	7.56	165.34	252.74	1.02
REACH #1	0.461	960.00	2052.78	2055.17	2055.17	2056.18	0.010206	8.08	118.88	57.76	0.99
REACH #1	0.431	960.00	2049.60	2052.35	2052.35	2053.46	0.006703	9.33	166.55	99.60	1.01
REACH #1	0.431	960.00	2049.60	2052.73	2052.73	2054.24	0.007154	9.90	101.55	33.50	1.00
REACH #1	0.360	1146.00	2045.25	2047.80	2047.80	2048.34	0.005239	7.56	378.55	339.84	0.87
REACH #1	0.360	1146.00	2045.25	2048.52	2048.52	2050.03	0.007424	9.86	116.28	38.06	0.99
REACH #1	0.289	1146.00	2040.99	2044.17	2044.17	2045.52	0.006337	9.53	146.26	660.00	0.99
REACH #1	0.289	1146.00	2040.99	2044.17	2044.17	2045.54	0.006400	9.58	146.26	60.00	1.00
REACH #1	0.269	1146.00	2039.54	2043.73	2042.54	2044.20	0.004179	5.50	208.95	75.89	0.56
REACH #1	0.269	1146.00	2039.54	2043.73	2042.57	2044.20	0.004183	5.50	208.96	72.70	0.56
REACH #1	0.264	Bridge									
REACH #1	0.260	1146.00	2038.22	2041.36	2041.36	2042.47	0.014699	8.45	135.60	60.80	1.00
REACH #1	0.260	1146.00	2038.22	2041.40	2041.36	2042.47	0.013960	8.31	137.86	60.95	0.97

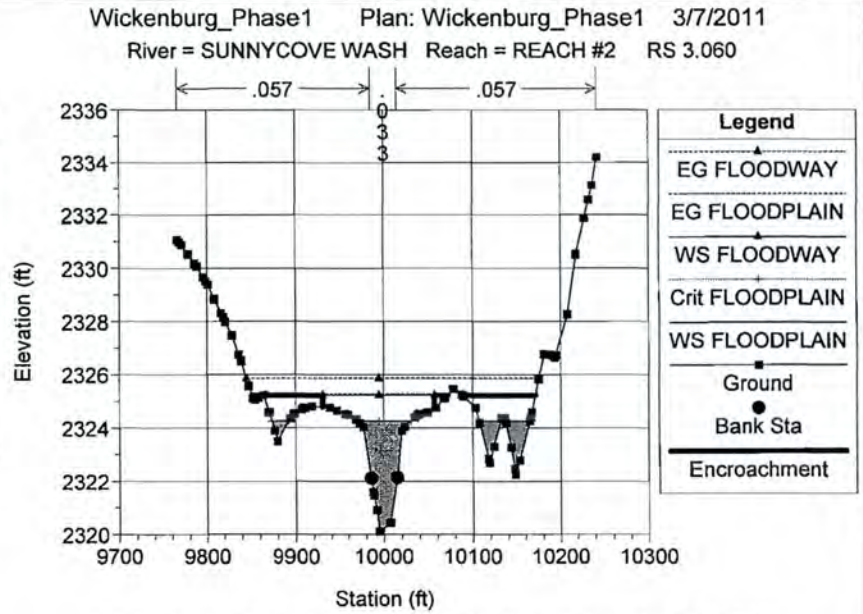
HEC-RAS Plan: Wickenburg_P River: SUNSET WASH Reach: REACH #1 (Continued)

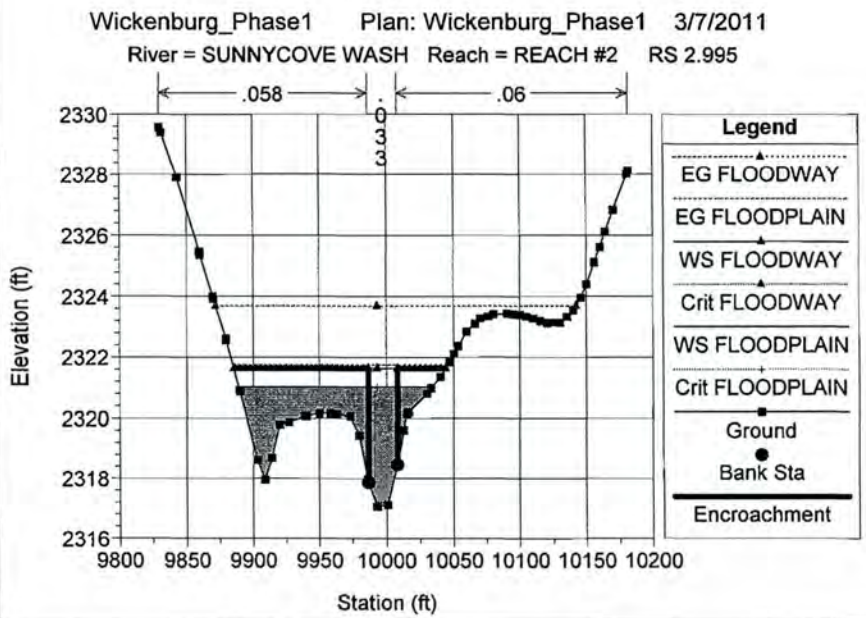
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
REACH #1	0.232	1146.00	2038.51	2038.78		2039.10	0.014033	1.68	273.79	270.46	0.66
REACH #1	0.232	1146.00	2038.51	2039.73	2039.73	2040.51	0.014267	4.55	167.27	109.41	0.85
REACH #1	0.197	1146.00	2036.74	2037.13		2037.35	0.011897	1.87	330.01	390.52	0.64
REACH #1	0.197	1146.00	2036.74	2037.97		2038.33	0.007589	2.96	242.47	171.06	0.60
REACH #1	0.178	1146.00	2036.70	2035.89	2035.59	2036.06	0.006702		360.89	388.46	0.00
REACH #1	0.178	1146.00	2036.70	2036.89	2036.48	2037.24	0.006699	0.93	245.92	179.93	0.43

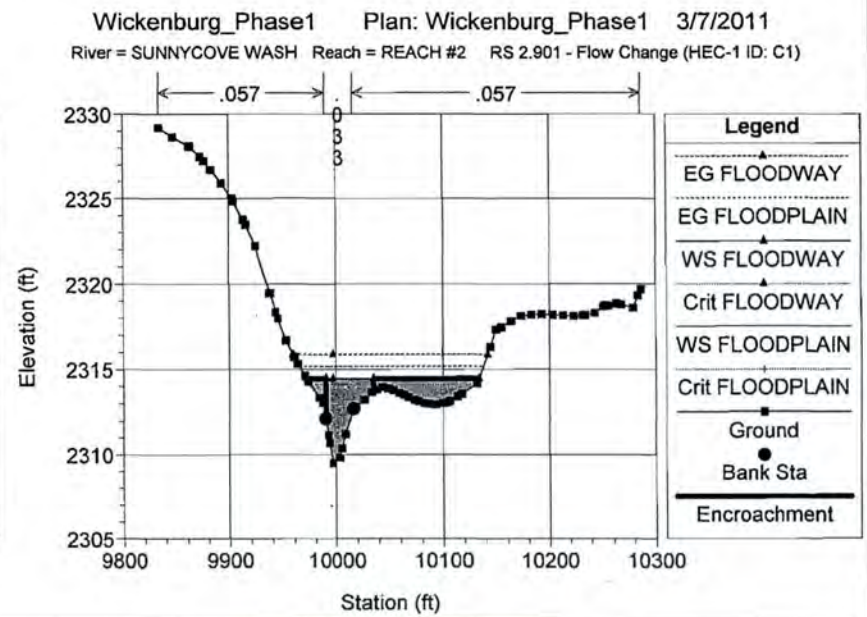
E.5.4 CROSS-SECTIONS

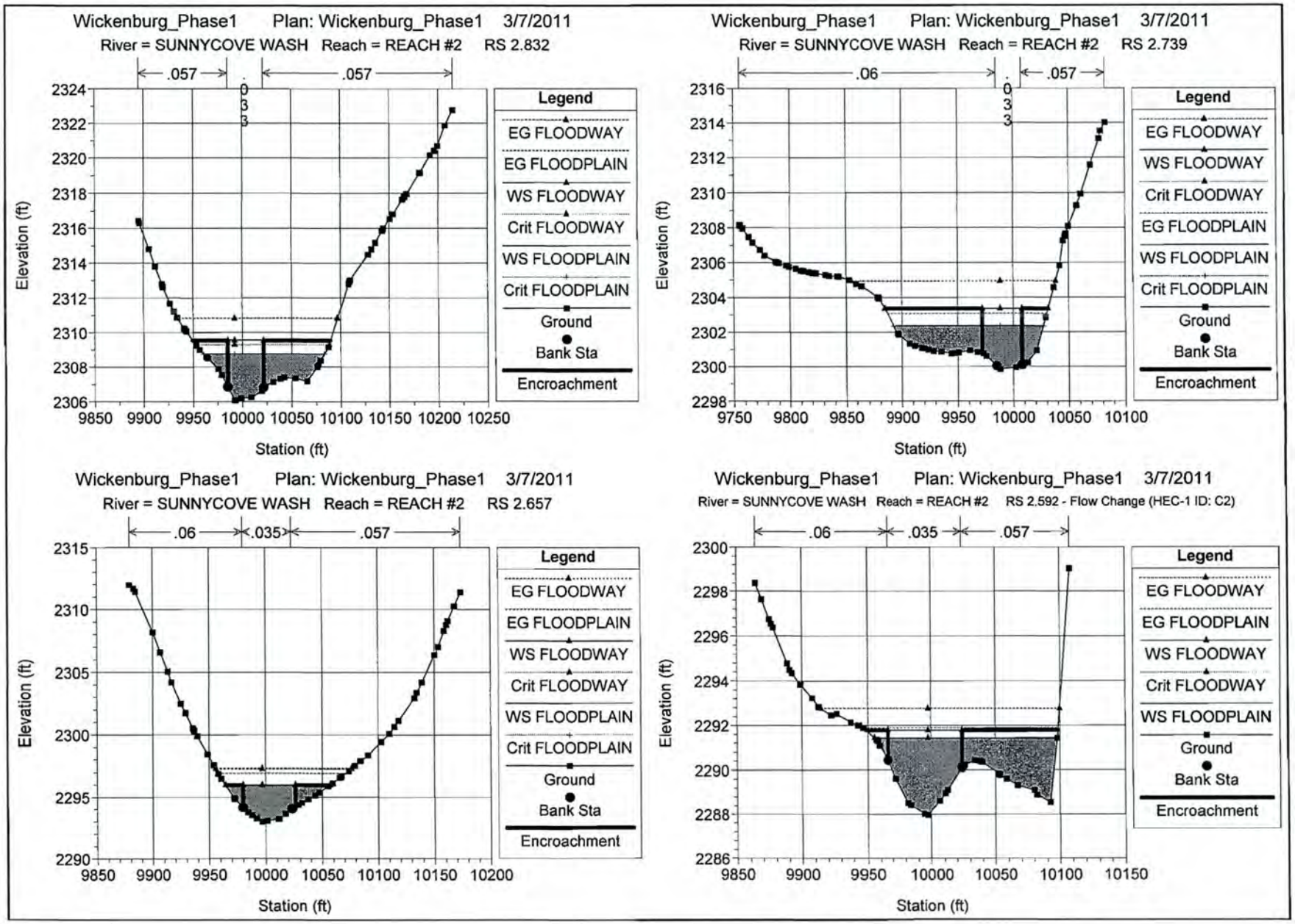

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 3.132 - (Flow from HEC-1 ID: SC1)
.035
.03
.035
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 3.105
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 Strucuture ID: SUN_100 @ Steinway Drive
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODWAY
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 Strucuture ID: SUN_100 @ Steinway Drive
.045
.033
.045
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODWAY
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment

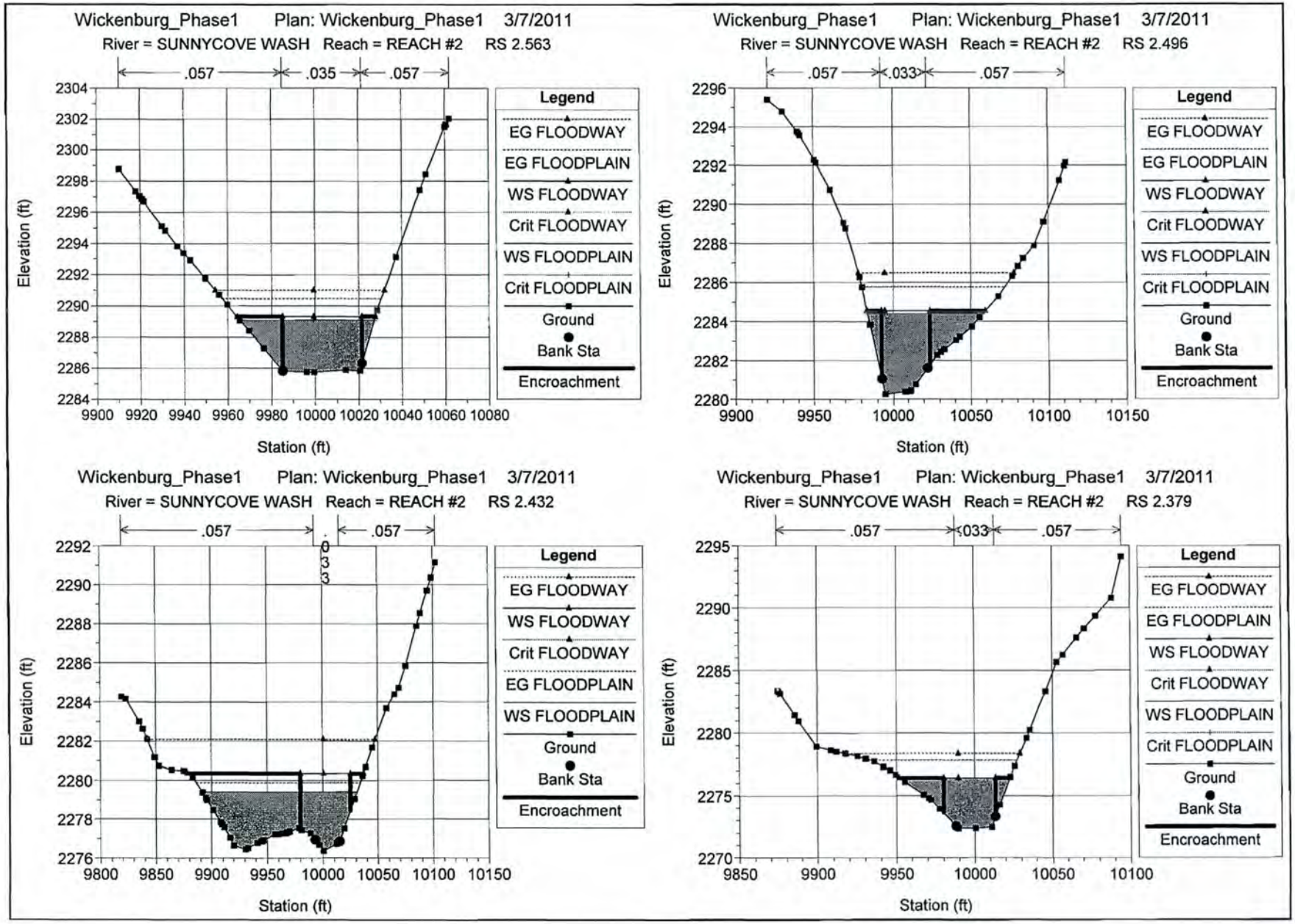

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 3.091
.045
.033
.045
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Ground
Bank Sta
Encroachment

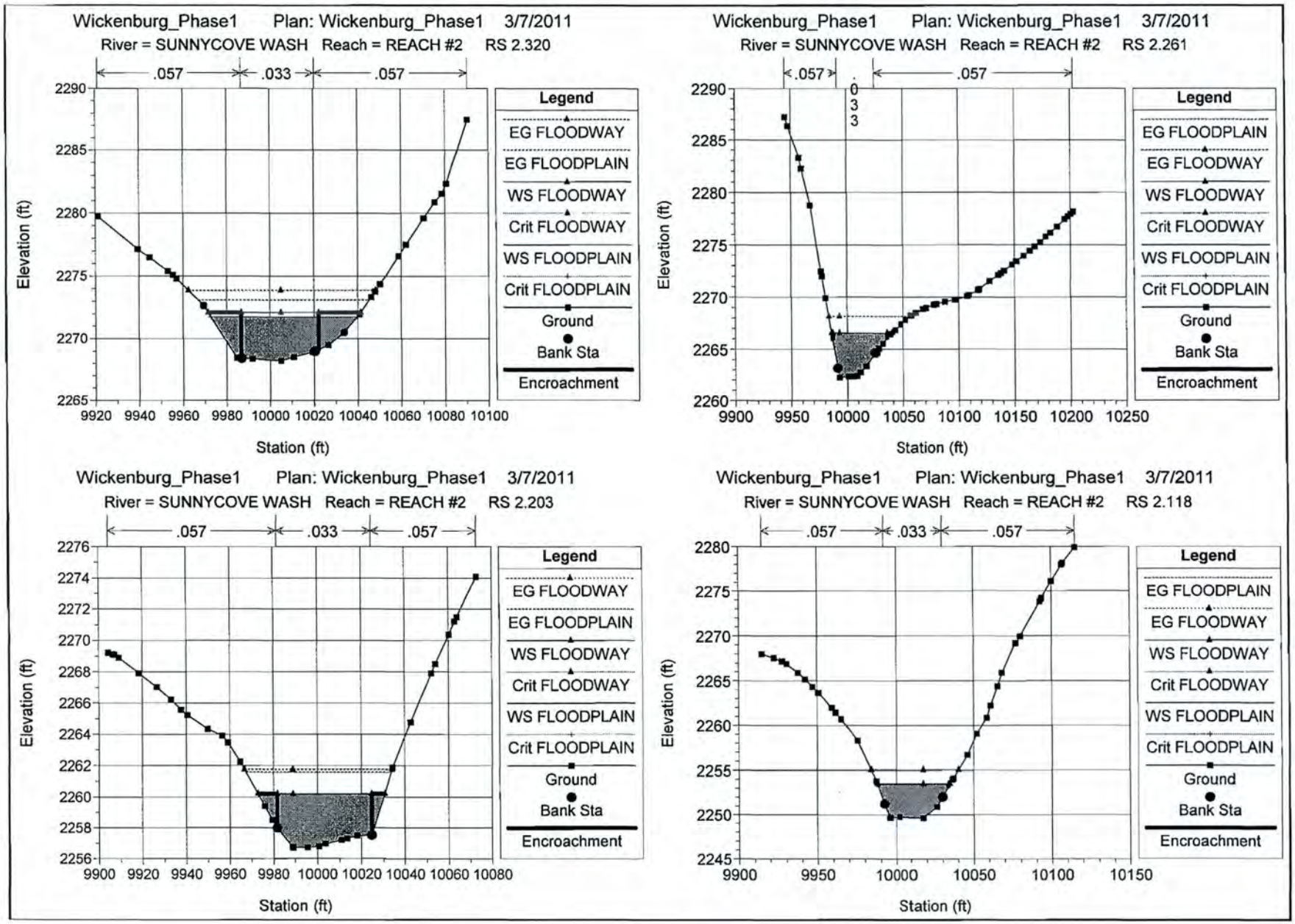

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 3.060
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODPLAIN
WS FLOODPLAIN
Ground
Bank Sta
Encroachment

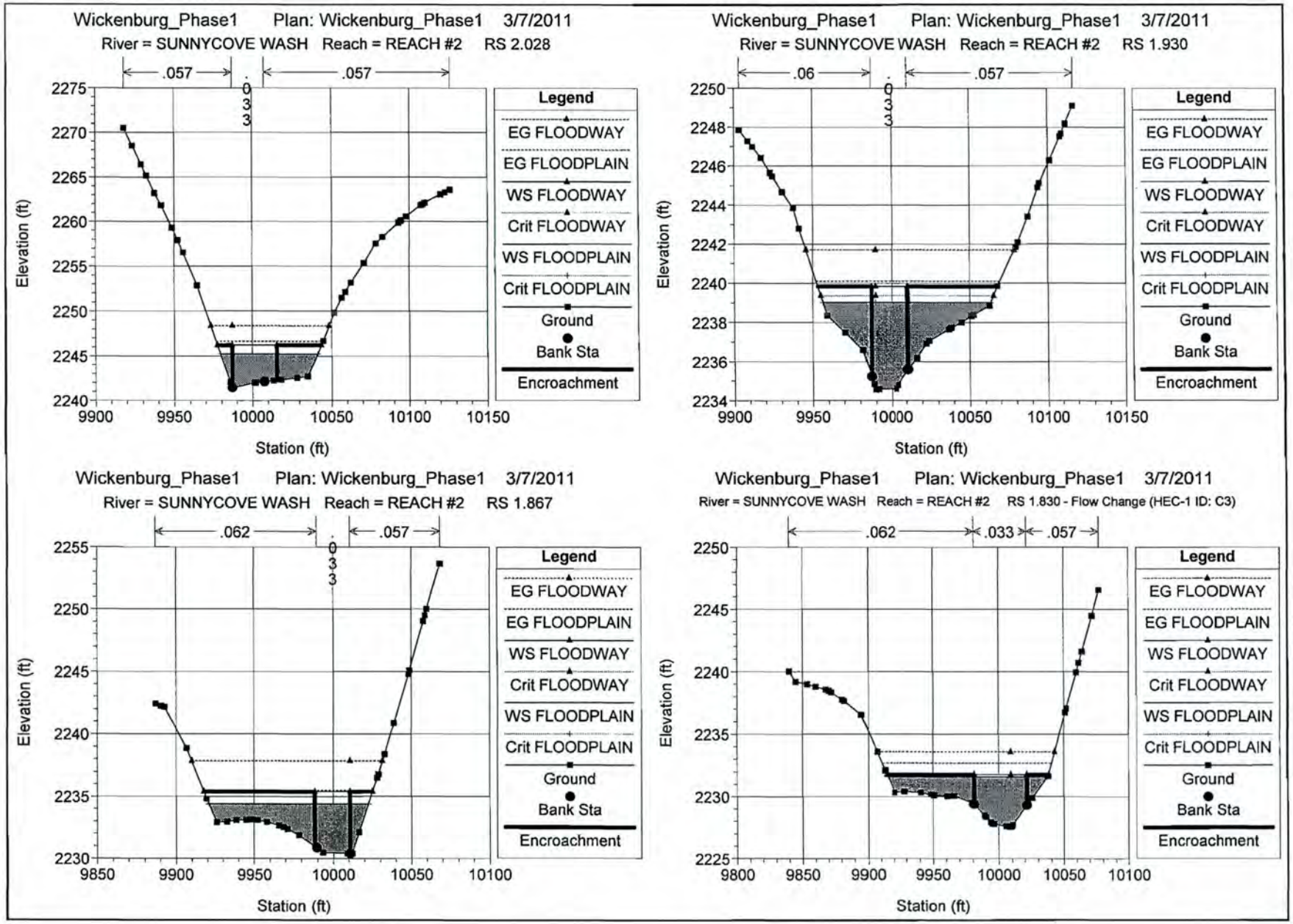

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 2.995
.058
.033
.06
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment

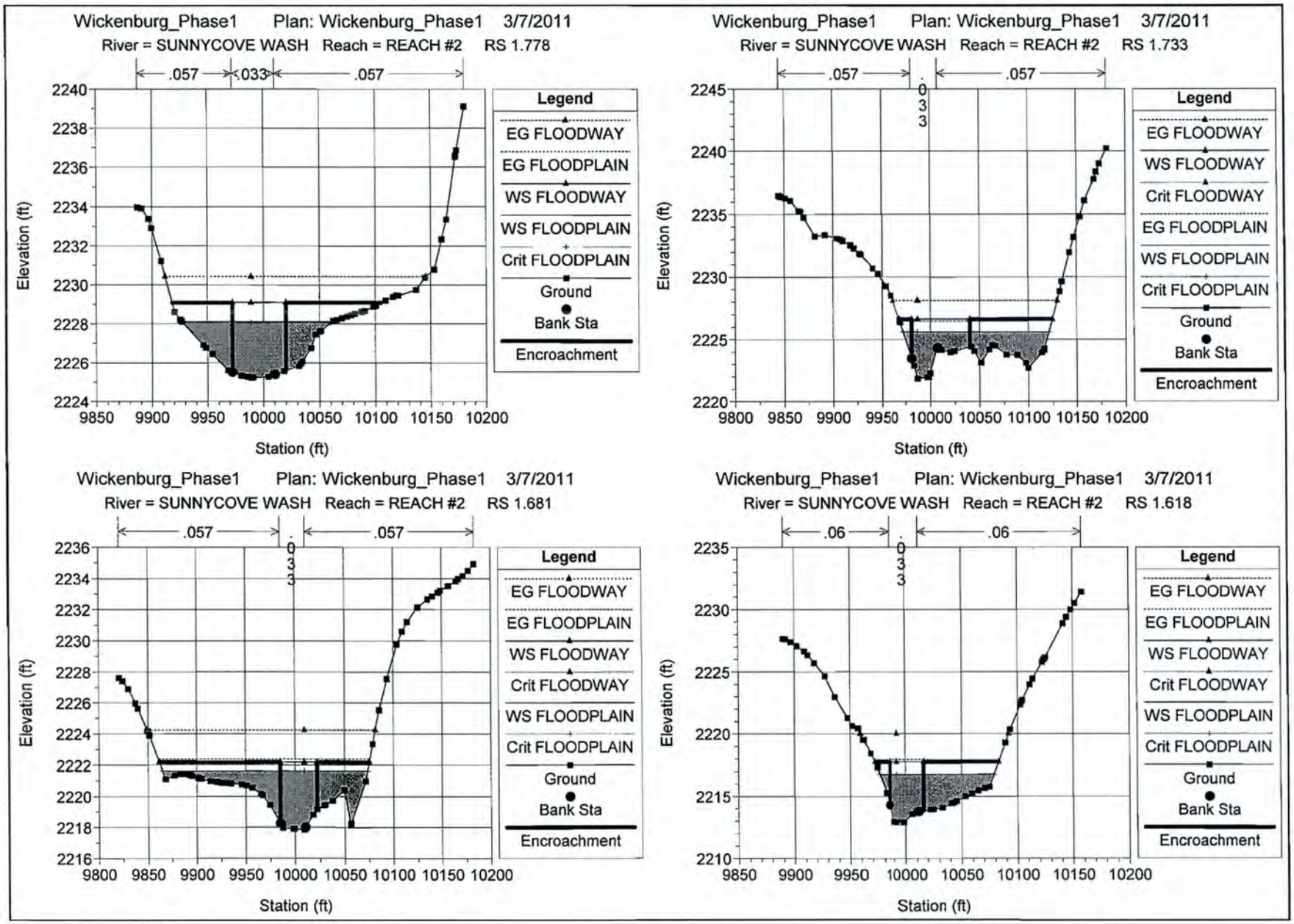

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 2.901 - Flow Change (HEC-1 ID: C1)
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment

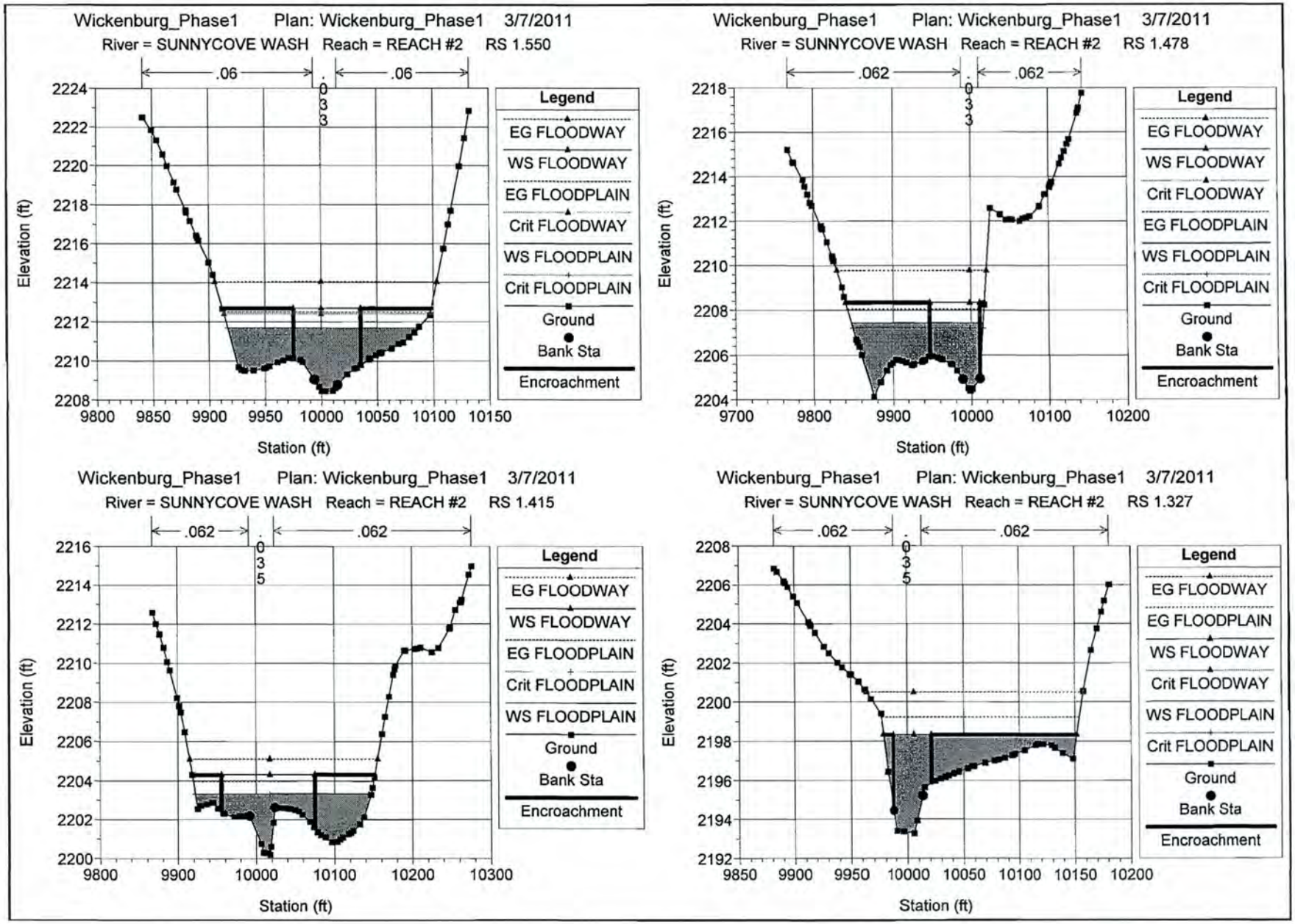

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 2.832
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 2.739
.06
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
Crit FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 2.657
.06
.035
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 2.592 - Flow Change (HEC-1 ID: C2)
.06
.035
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Ground
Bank Sta
Encroachment

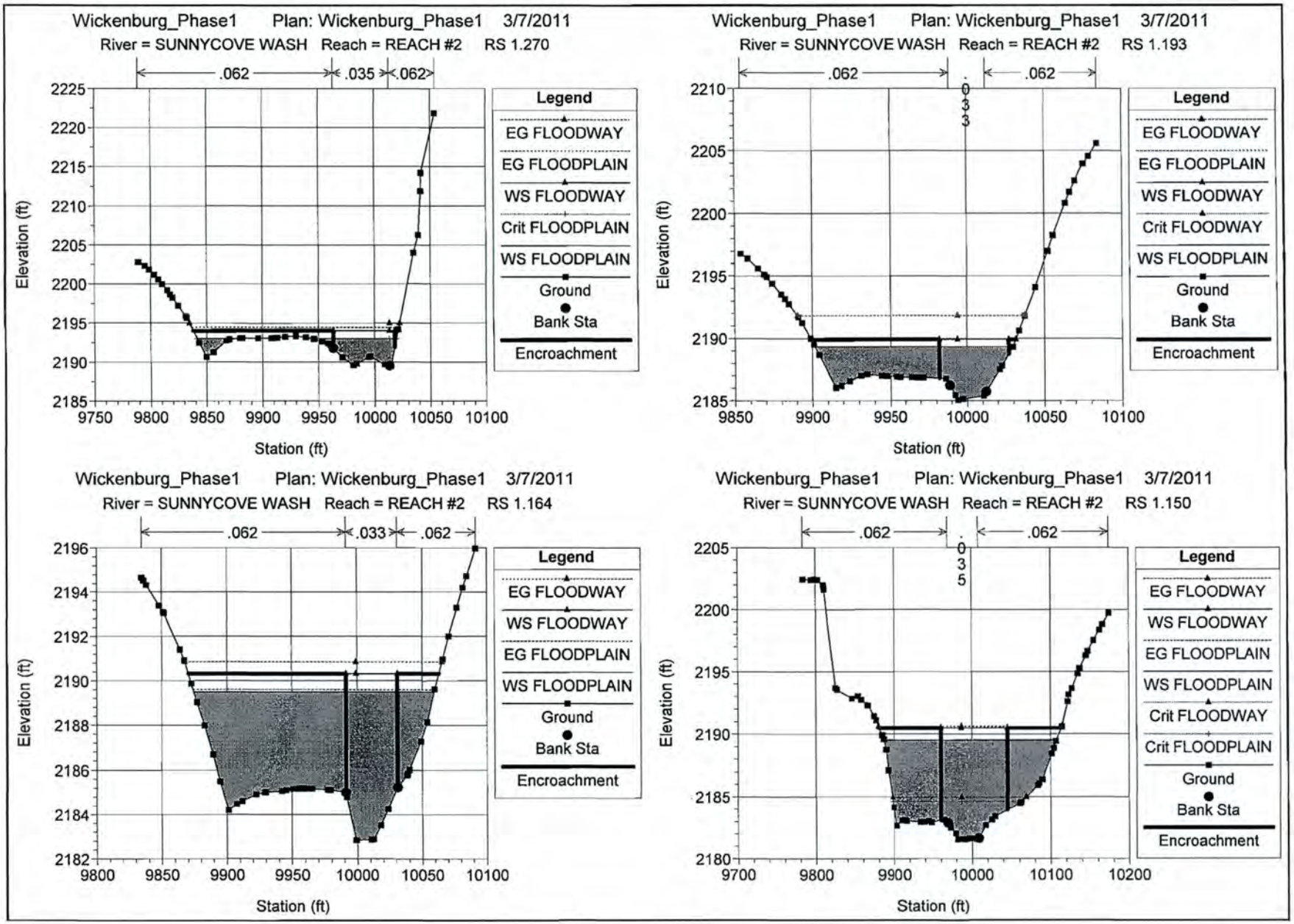

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 2.563
.057
.035
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 2.496
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 2.432
.057
.057
.033
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
Crit FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 2.379
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment

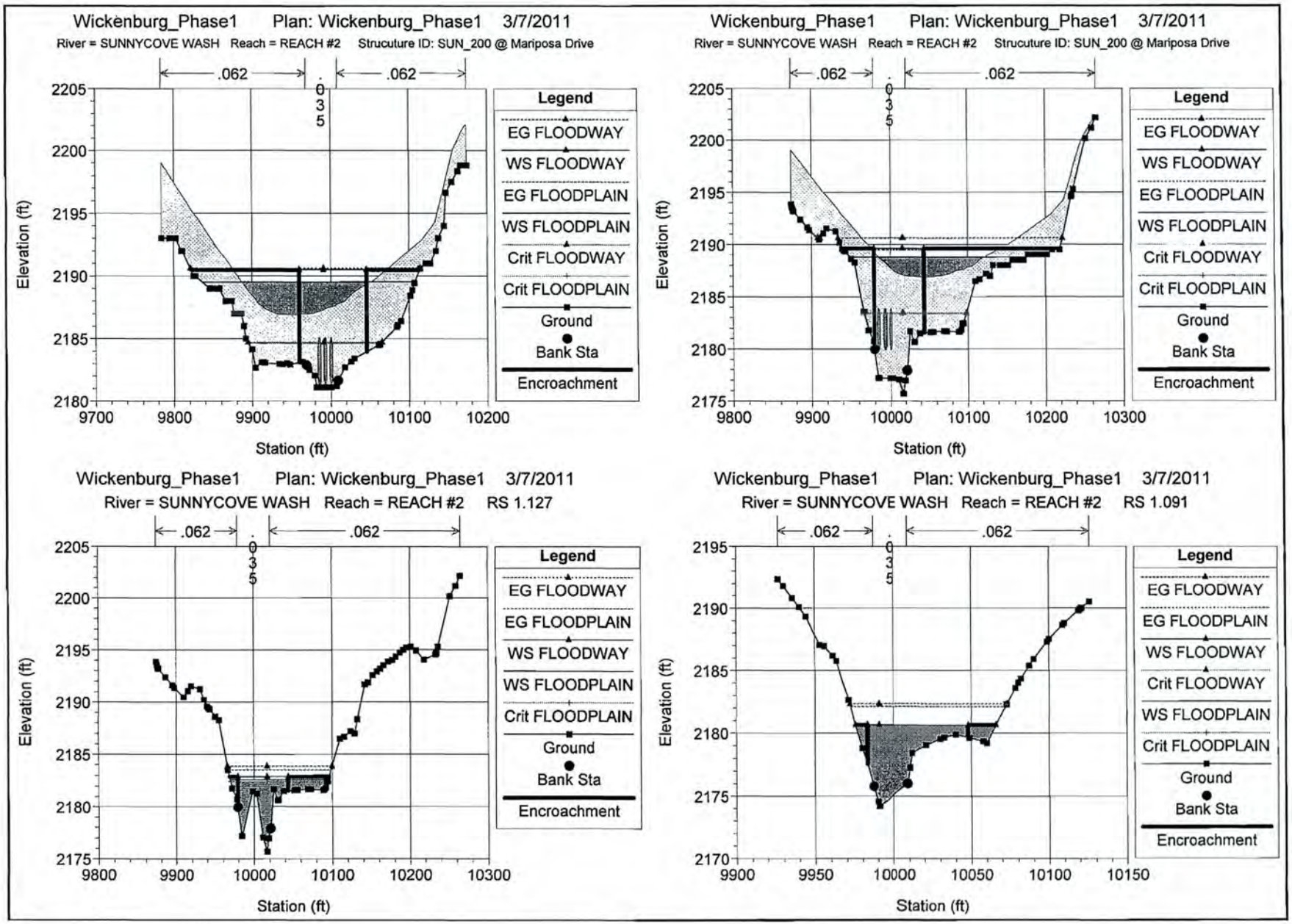

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 2.320
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 2.261
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 2.203
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 2.118
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment

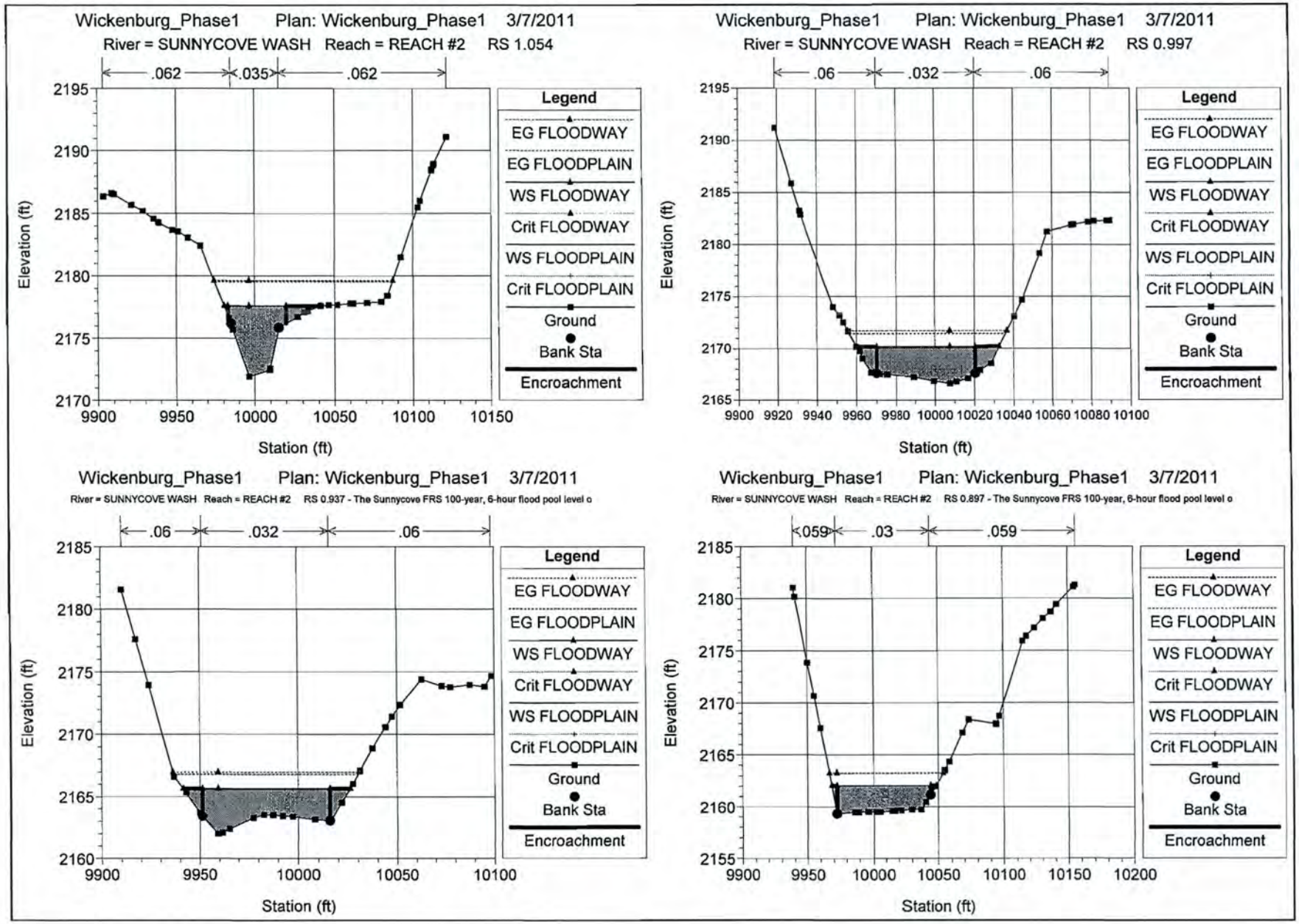

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 2.028
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 1.930
.06
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 1.867
.062
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 1.830 - Flow Change (HEC-1 ID: C3)
.062
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment

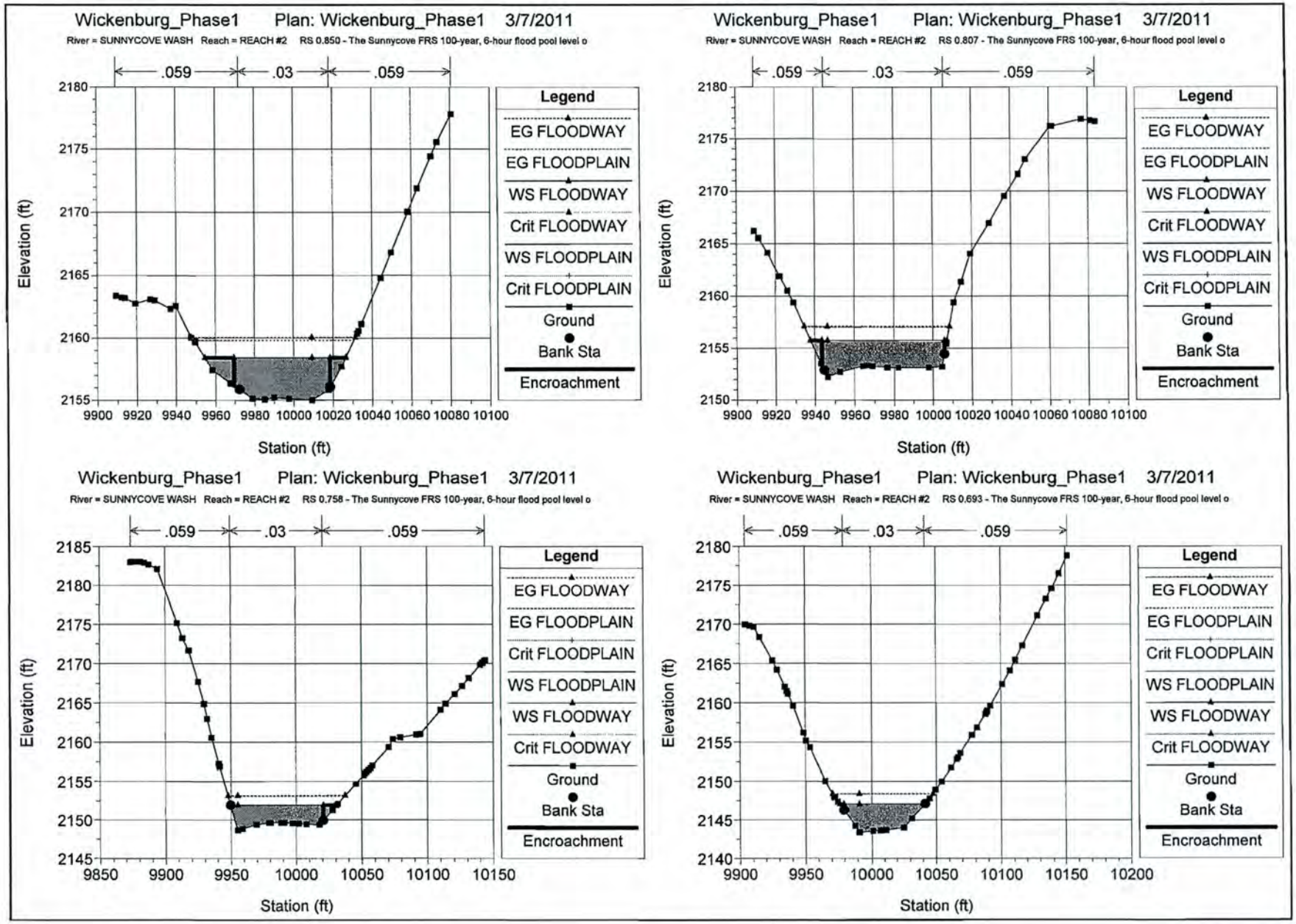

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 1.778
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 1.733
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
Crit FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 1.681
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 1.618
.06
.033
.06
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment


Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 1.550
.06
.033
.06
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 1.478
.062
.033
.062
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
Crit FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 1.415
.062
.035
.062
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
Crit FLOODPLAIN
WS FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 1.327
.062
.035
.062
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment


Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 1.270
.062
.035
.062
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODPLAIN
WS FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 1.193
.062
.033
.062
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 1.164
.062
.033
.062
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 1.150
.062
.035
.062
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODWAY
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment

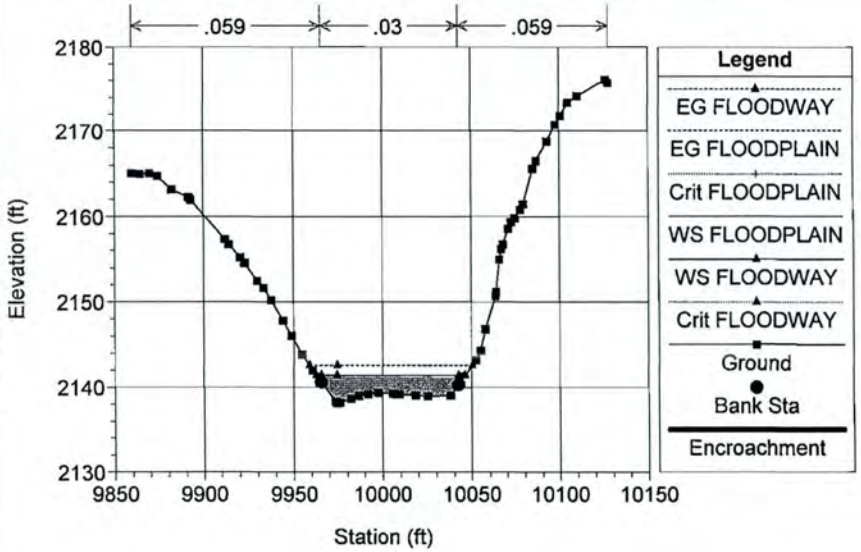

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 Strucuture ID: SUN_200 @ Mariposa Drive
.062
.035
.062
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODWAY
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 Strucuture ID: SUN_200 @ Mariposa Drive
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 1.127
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 1.091

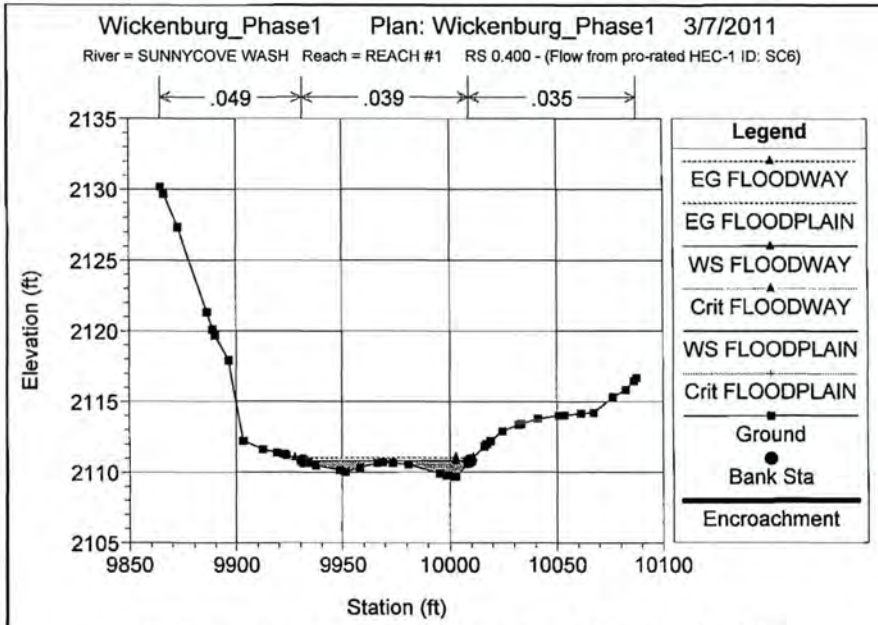

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 1.054
.062
.035
.062
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 0.997
.06
.032
.06
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 0.937 - The Sunnycove FRS 100-year, 6-hour flood pool level o
.06
.032
.06
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 0.897 - The Sunnycove FRS 100-year, 6-hour flood pool level o
.059
.03
.059
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment

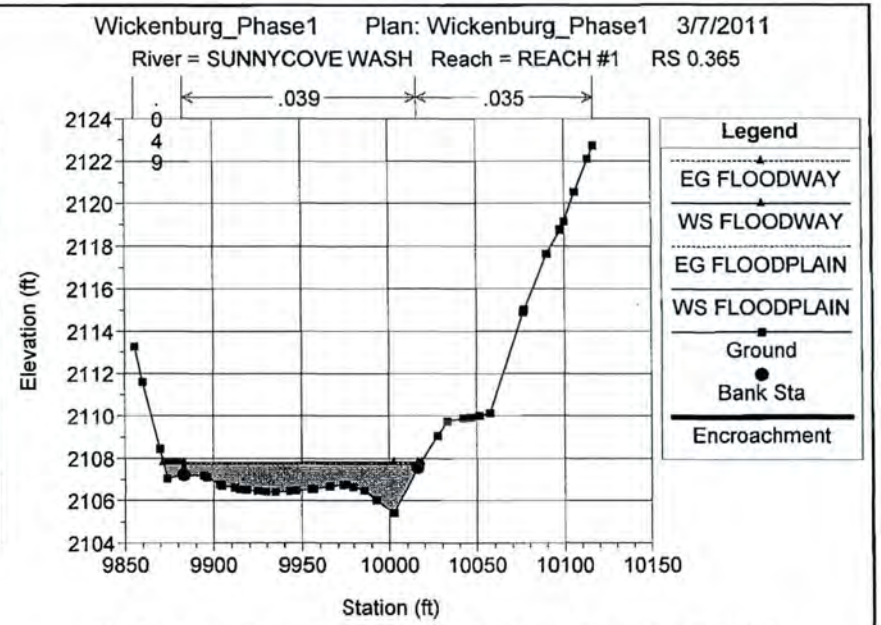

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 0.850 - The Sunnycove FRS 100-year, 6-hour flood pool level o
.059
.03
.059
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 0.807 - The Sunnycove FRS 100-year, 6-hour flood pool level o
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 0.758 - The Sunnycove FRS 100-year, 6-hour flood pool level o
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #2 RS 0.693 - The Sunnycove FRS 100-year, 6-hour flood pool level o

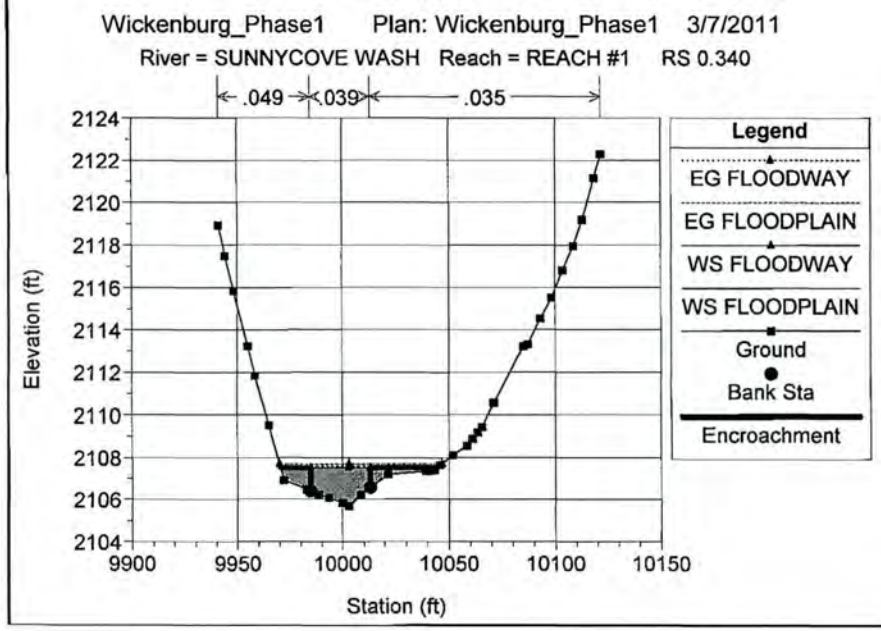
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011

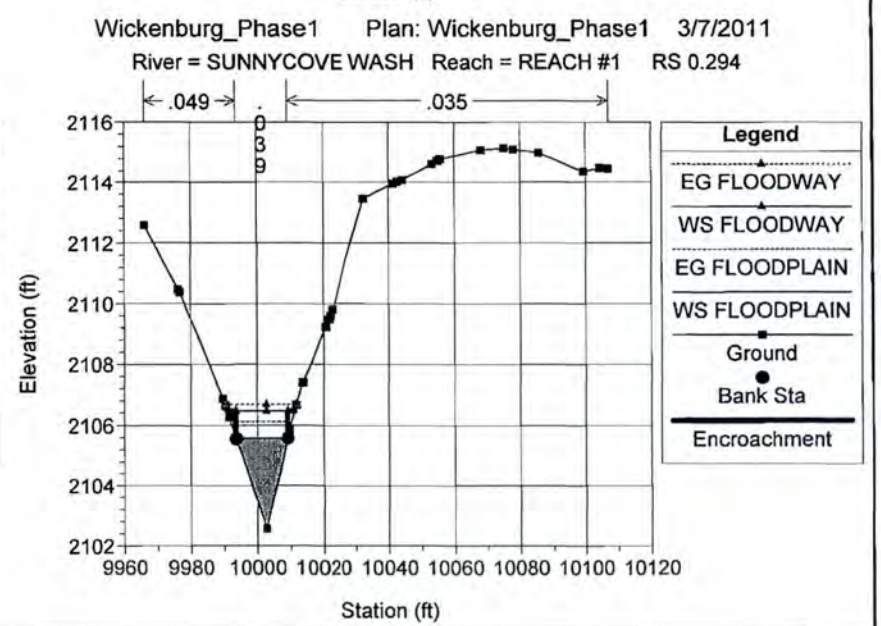
River = SUNNYCOVE WASH Reach = REACH #2 RS 0.642 - The Sunnycove FRS 100-year, 6-hour flood pool level o

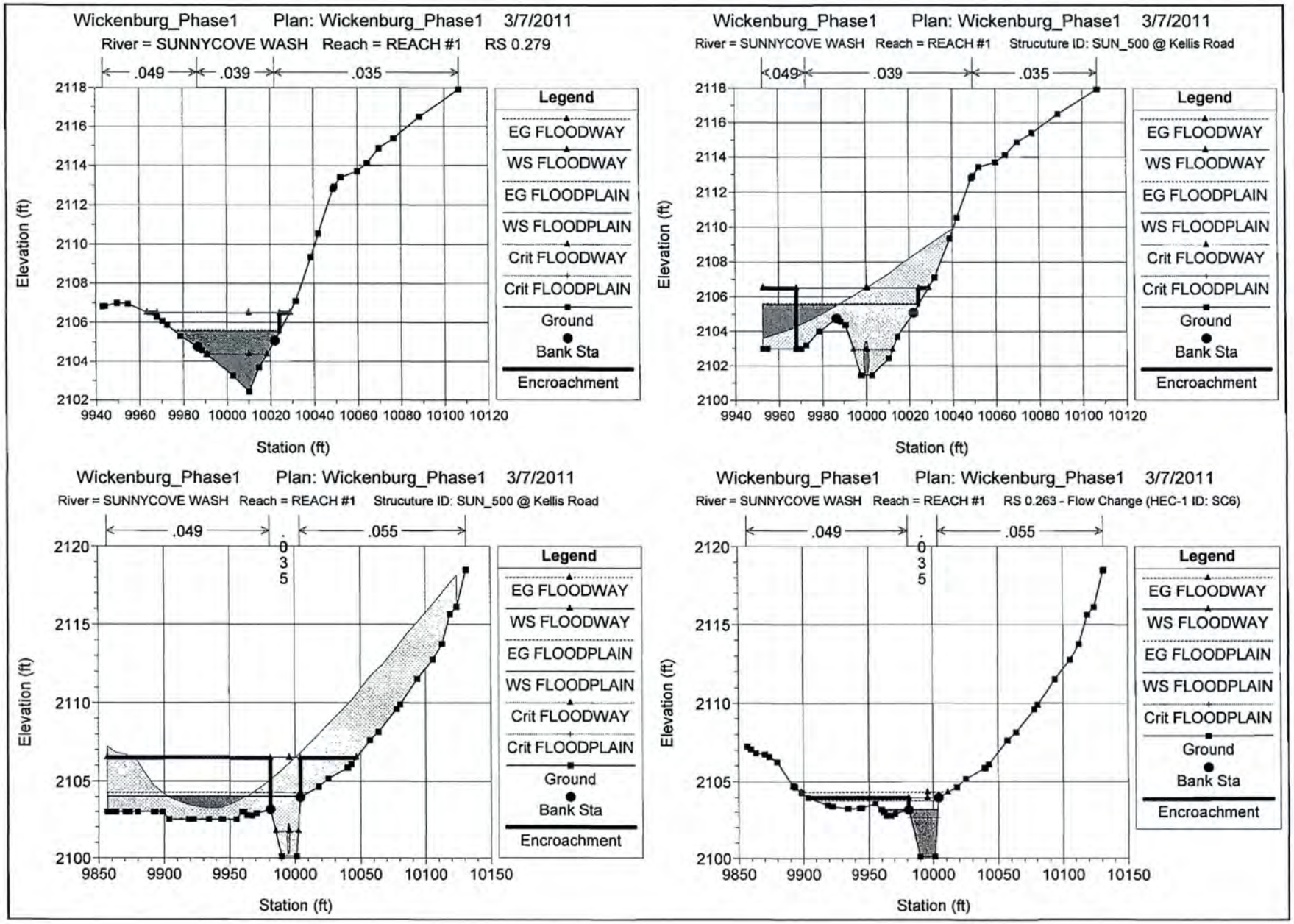


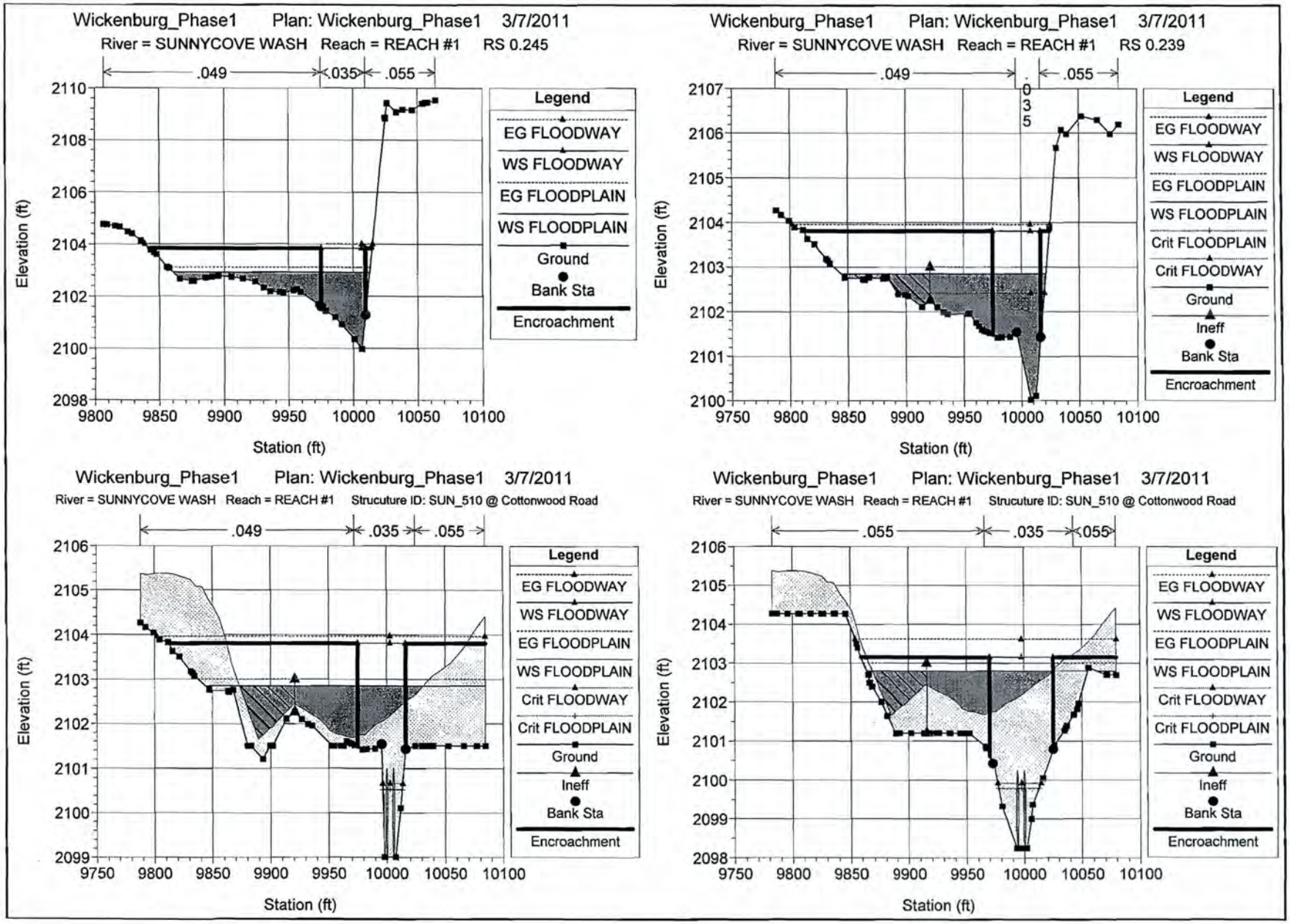

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #1 RS 0.400 - (Flow from pro-rated HEC-1 ID: SC6)
.049
.039
.035
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment

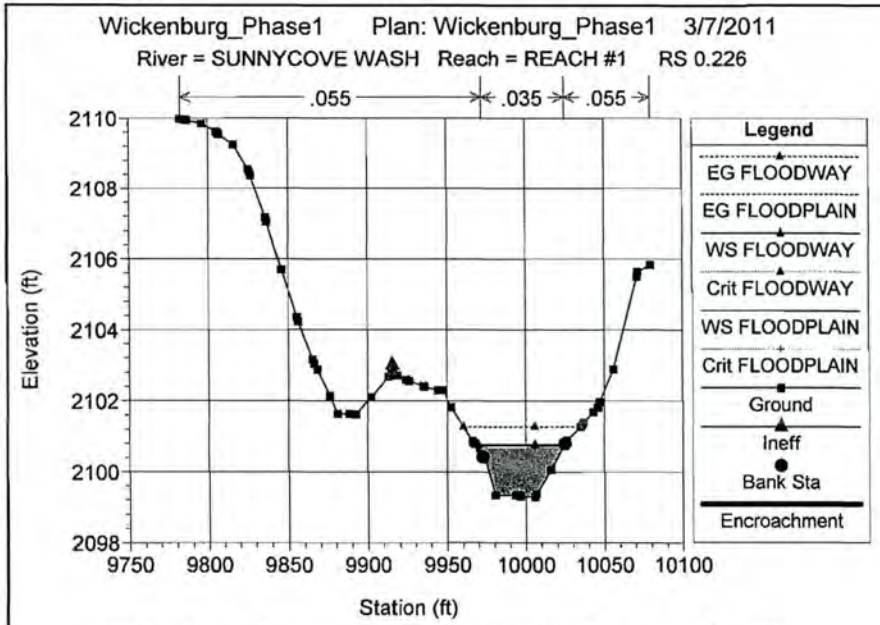

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #1 RS 0.365
.049
.039
.035
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Ground
Bank Sta
Encroachment

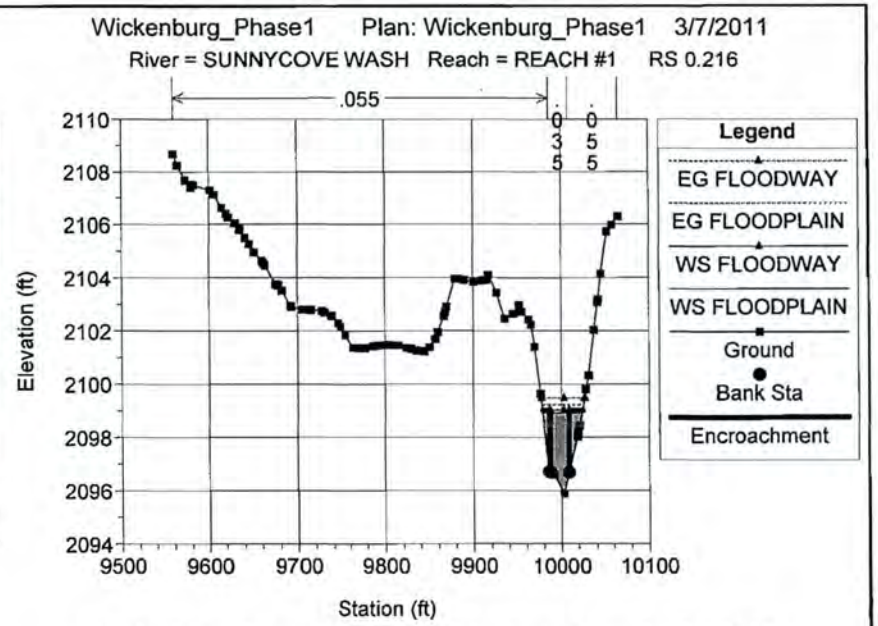

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #1 RS 0.340
.049
.039
.035
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Ground
Bank Sta
Encroachment

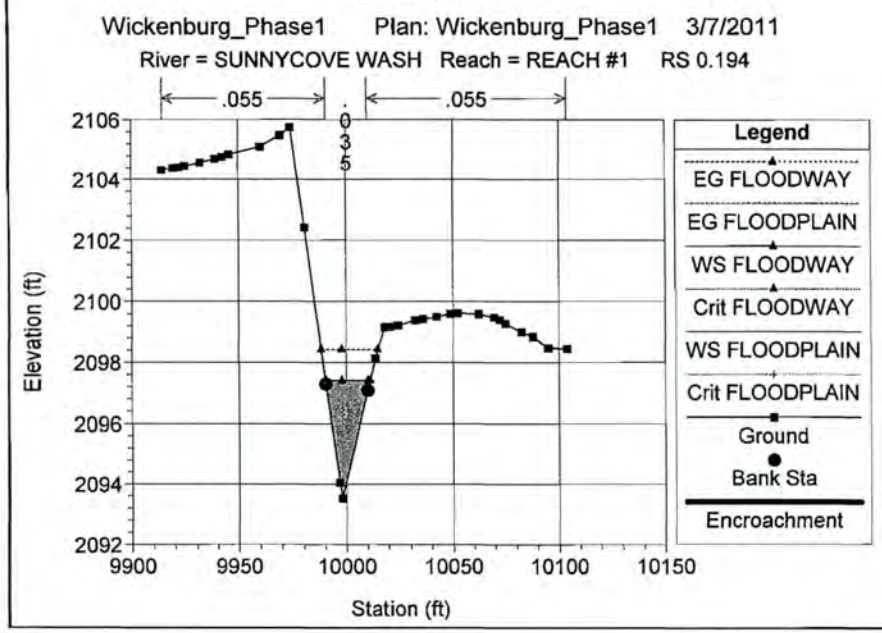

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #1 RS 0.294
.049
.035
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Ground
Bank Sta
Encroachment

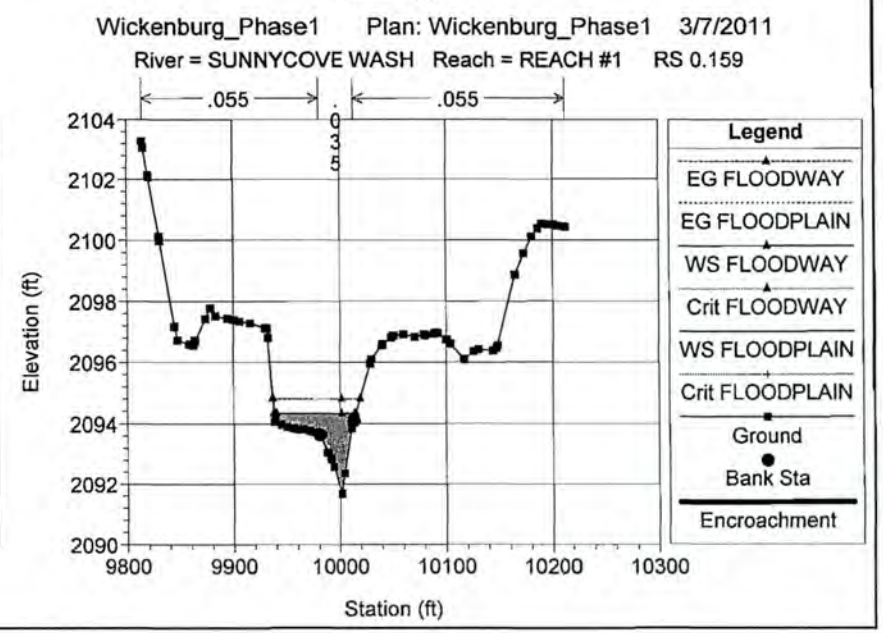

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #1 RS 0.279
.049
.039
.035
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODWAY
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #1 Strucuture ID: SUN_500 @ Kellis Road
.049
.039
.035
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODWAY
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #1 Strucuture ID: SUN_500 @ Kellis Road
.049
.035
.055
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODWAY
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #1 RS 0.263 - Flow Change (HEC-1 ID: SC6)
.049
.035
.055
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment

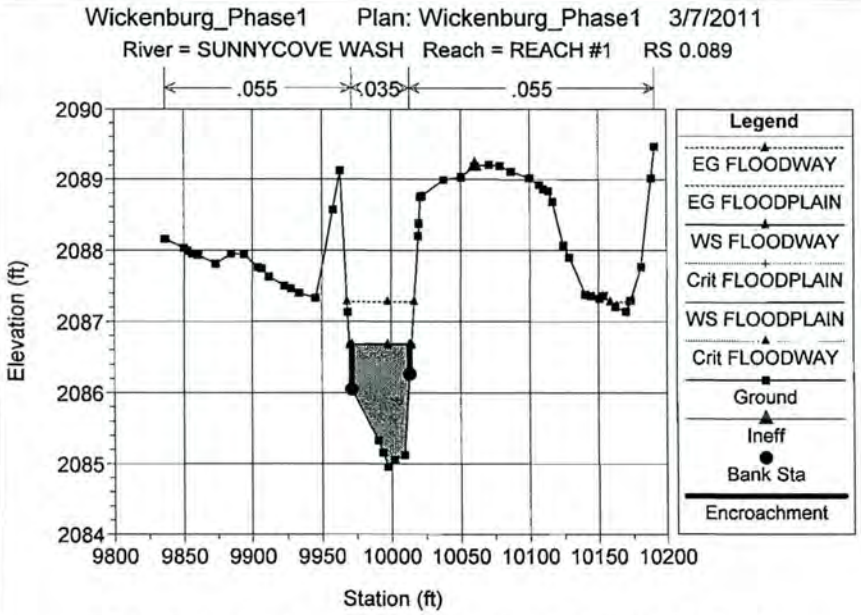

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #1 RS 0.245
.049
.035
.055
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #1 RS 0.239
.049
.035
.055
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Ineff
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #1 Strucuture ID: SUN_510 @ Cottonwood Road
.049
.035
.055
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODWAY
Crit FLOODPLAIN
Ground
Ineff
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #1 Strucuture ID: SUN_510 @ Cottonwood Road
.055
.035
.055
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODWAY
Crit FLOODPLAIN
Ground
Ineff
Bank Sta
Encroachment

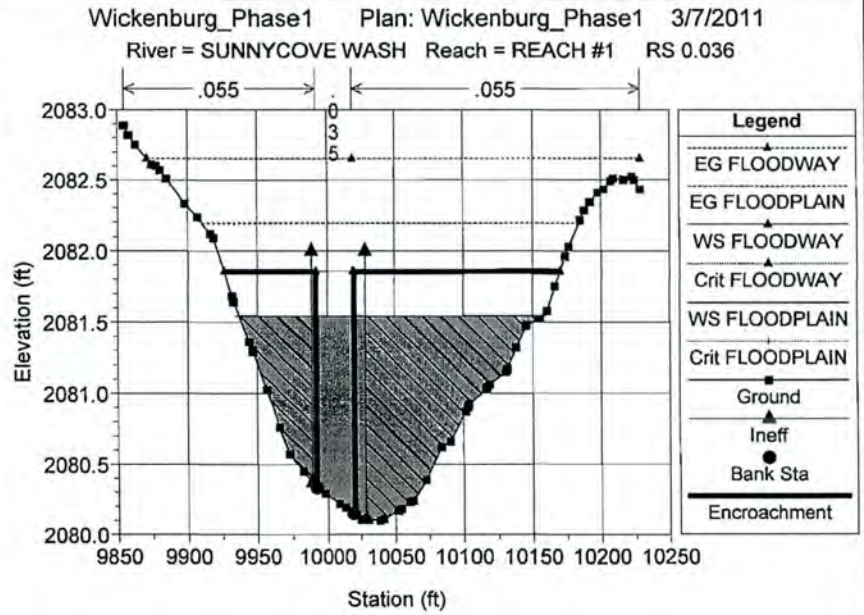

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #1 RS 0.226
.055
.035
.055
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Ineff
Bank Sta
Encroachment

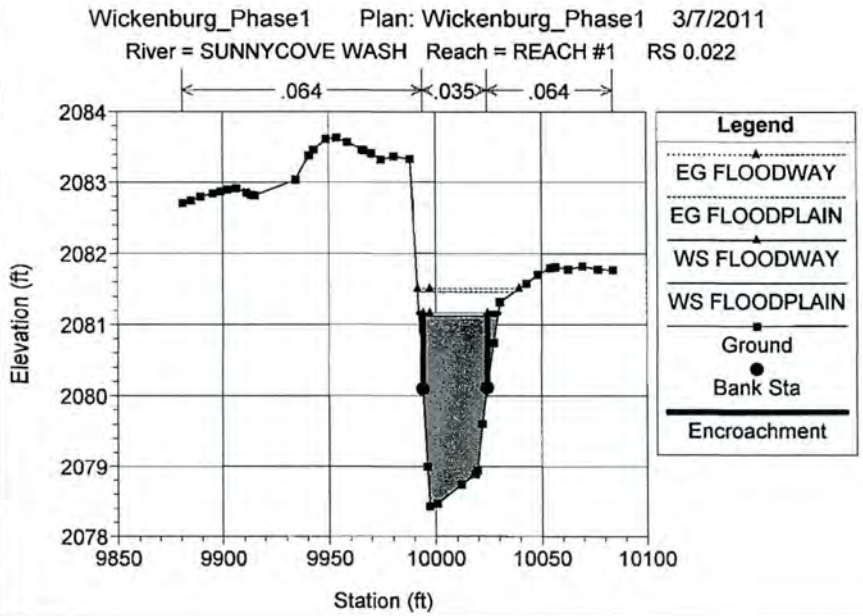

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #1 RS 0.216
.055
.035
.055
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Ground
Bank Sta
Encroachment

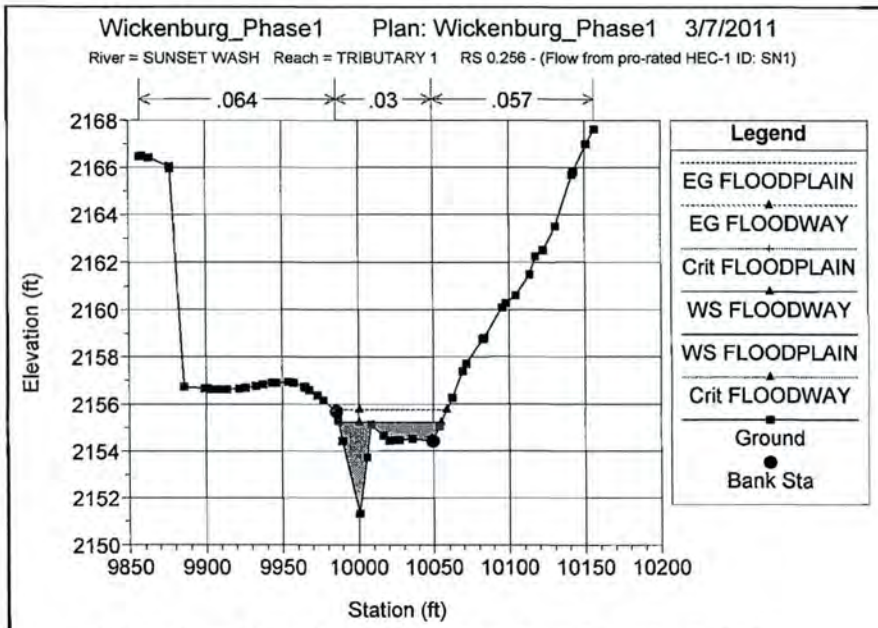

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #1 RS 0.194
.055
.035
.055
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment

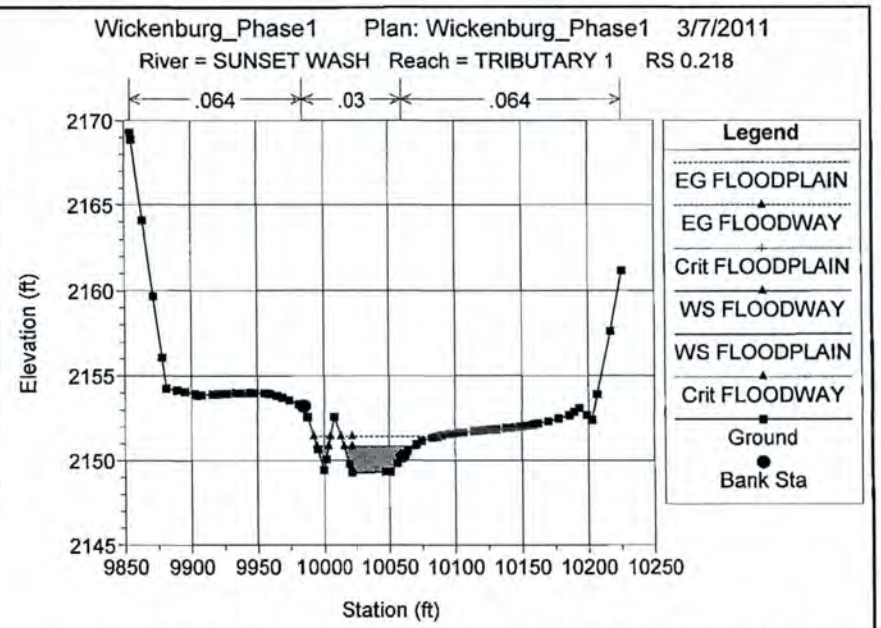

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #1 RS 0.159
.055
.035
.055
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment

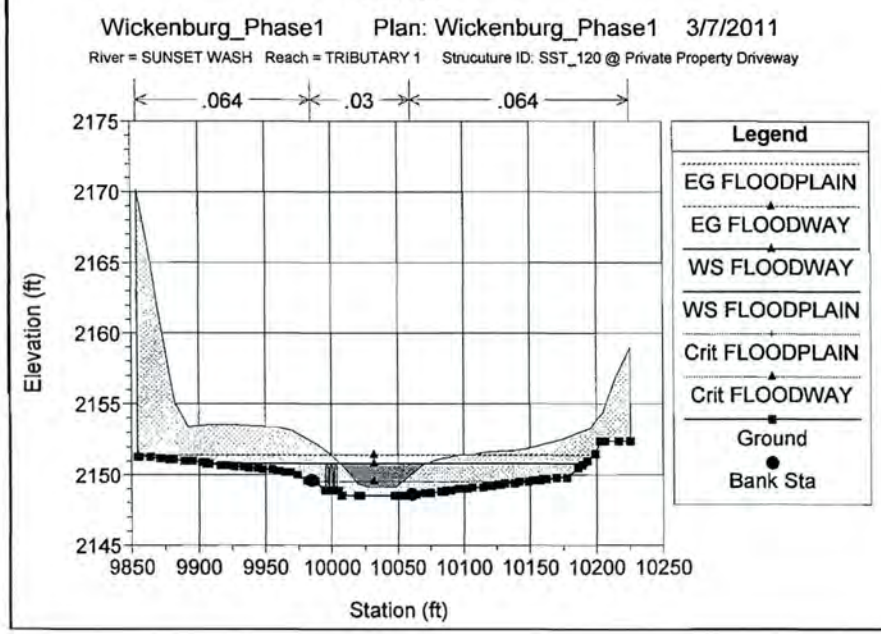

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #1 RS 0.089
.055
.035
.055
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODPLAIN
WS FLOODPLAIN
Crit FLOODWAY
Ground
Ineff
Bank Sta
Encroachment

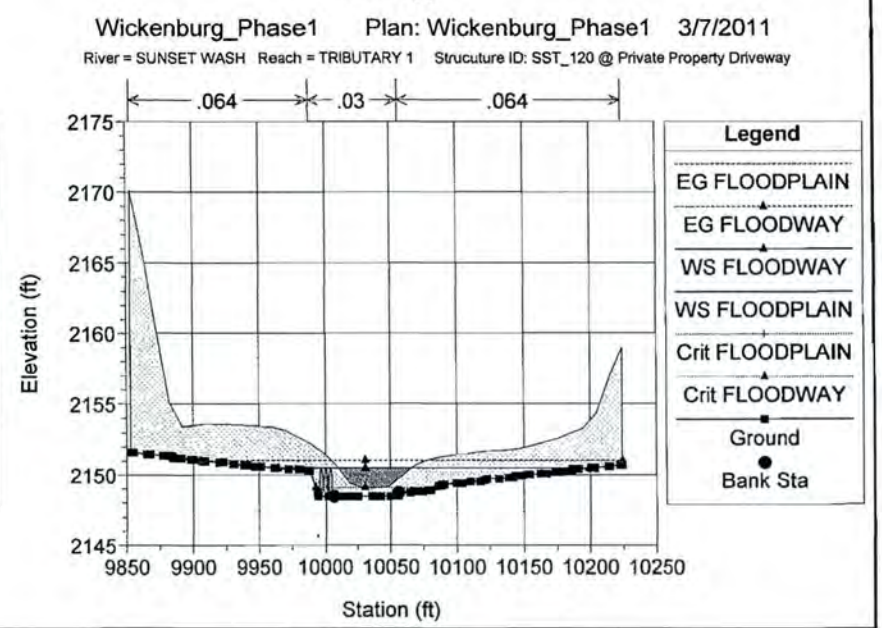

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #1 RS 0.036
.055
.035
.055
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Ineff
Bank Sta
Encroachment

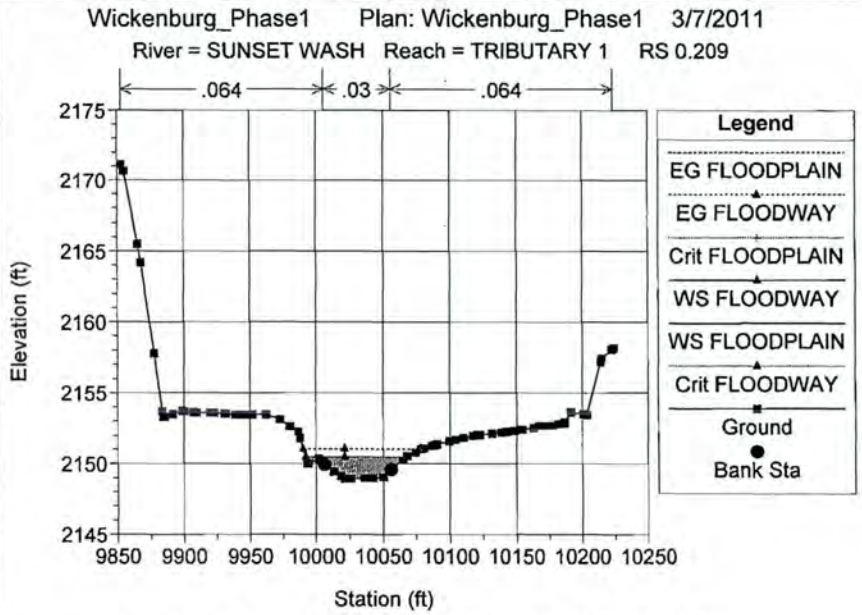

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNNYCOVE WASH Reach = REACH #1 RS 0.022
.064
.035
.064
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Ground
Bank Sta
Encroachment

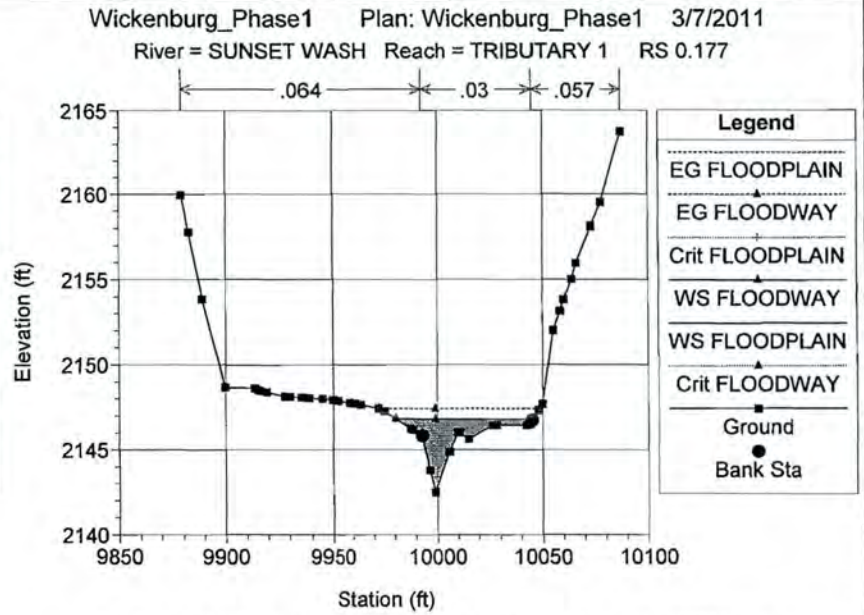

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 RS 0.256 - (Flow from pro-rated HEC-1 ID: SN1)
.064
.03
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta

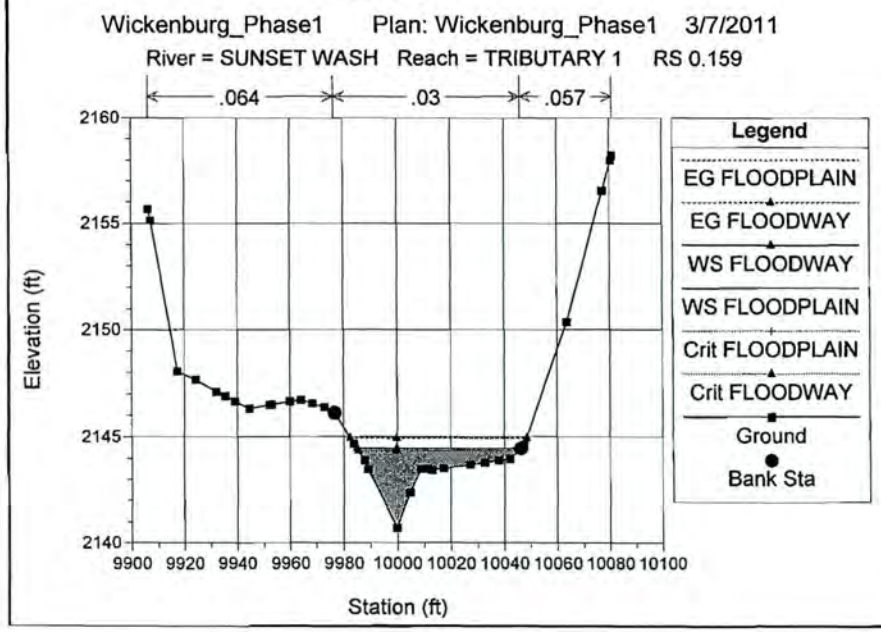

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 RS 0.218
.064
.03
.064
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta

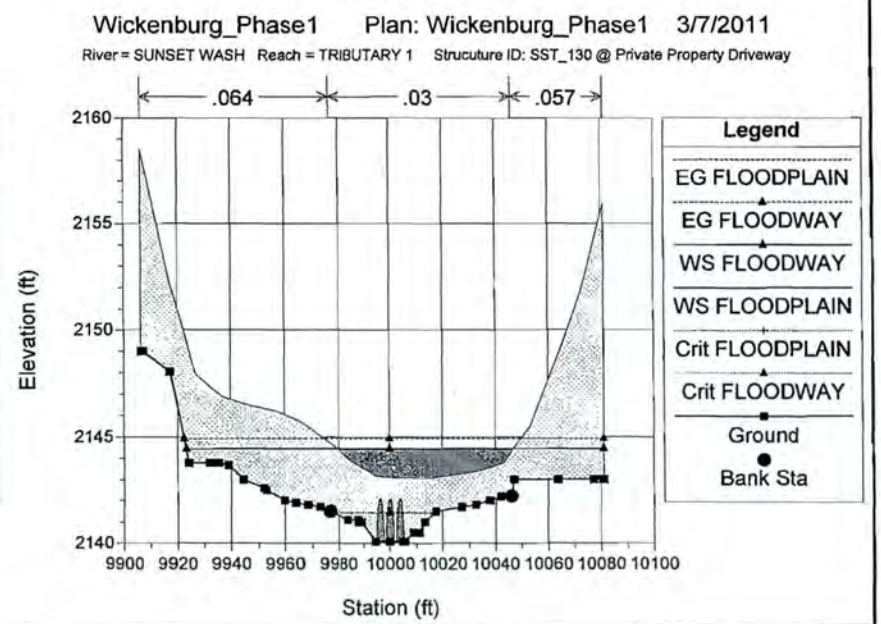

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 Strucuture ID: SST_120 @ Private Property Driveway
.064
.03
.064
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta

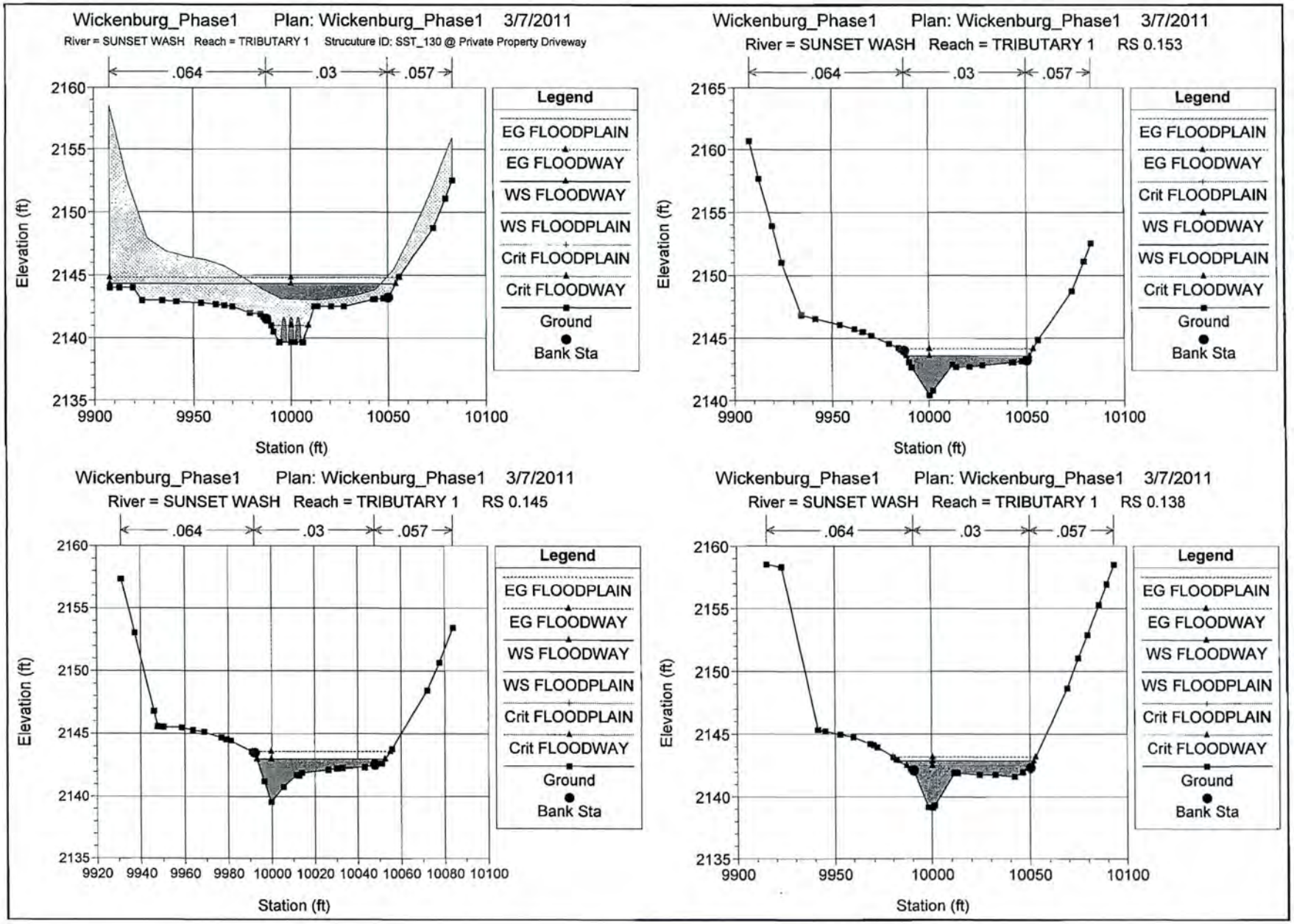

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 Strucuture ID: SST_120 @ Private Property Driveway
.064
.03
.064
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta

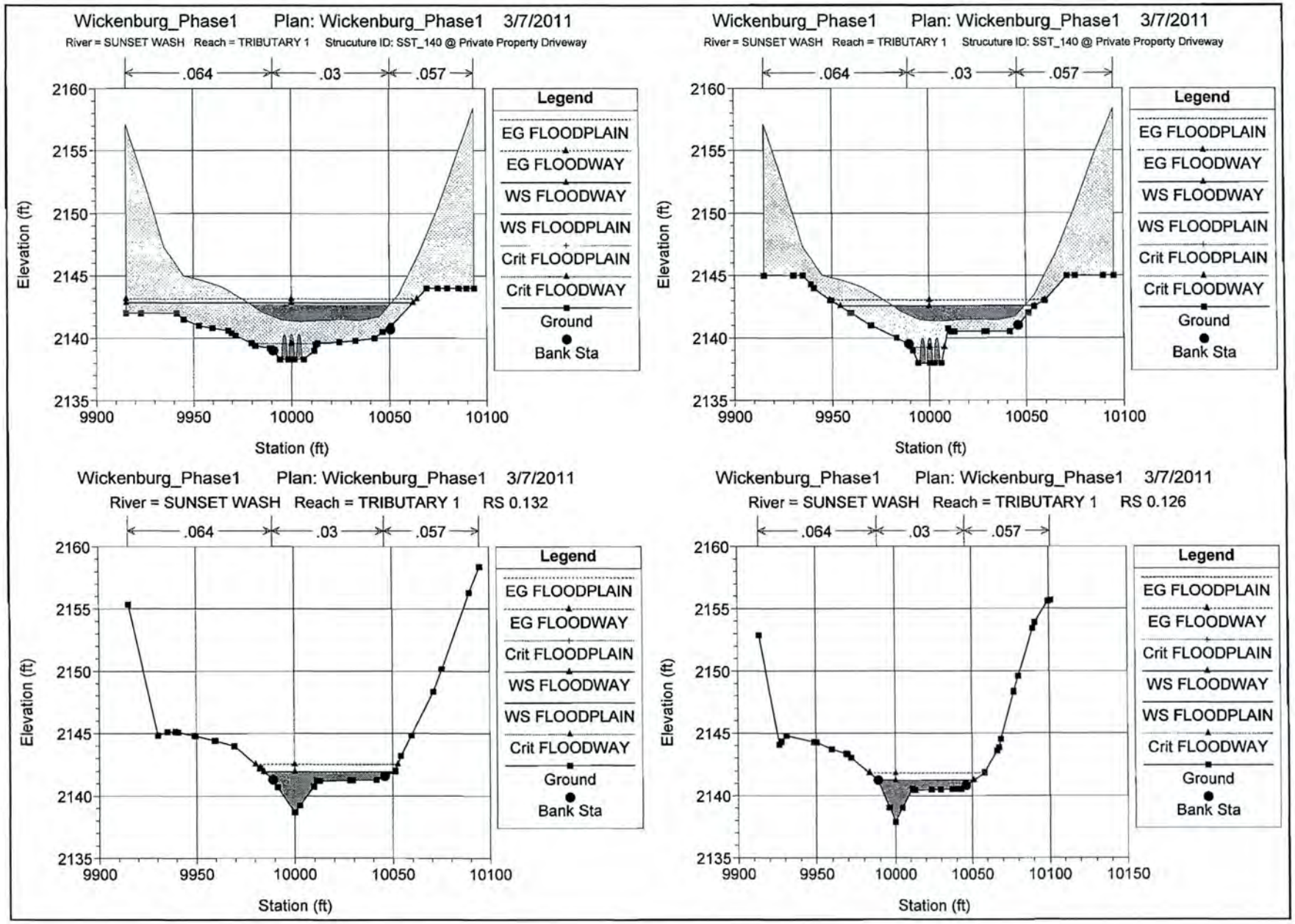

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 RS 0.209
.064
.03
.064
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta

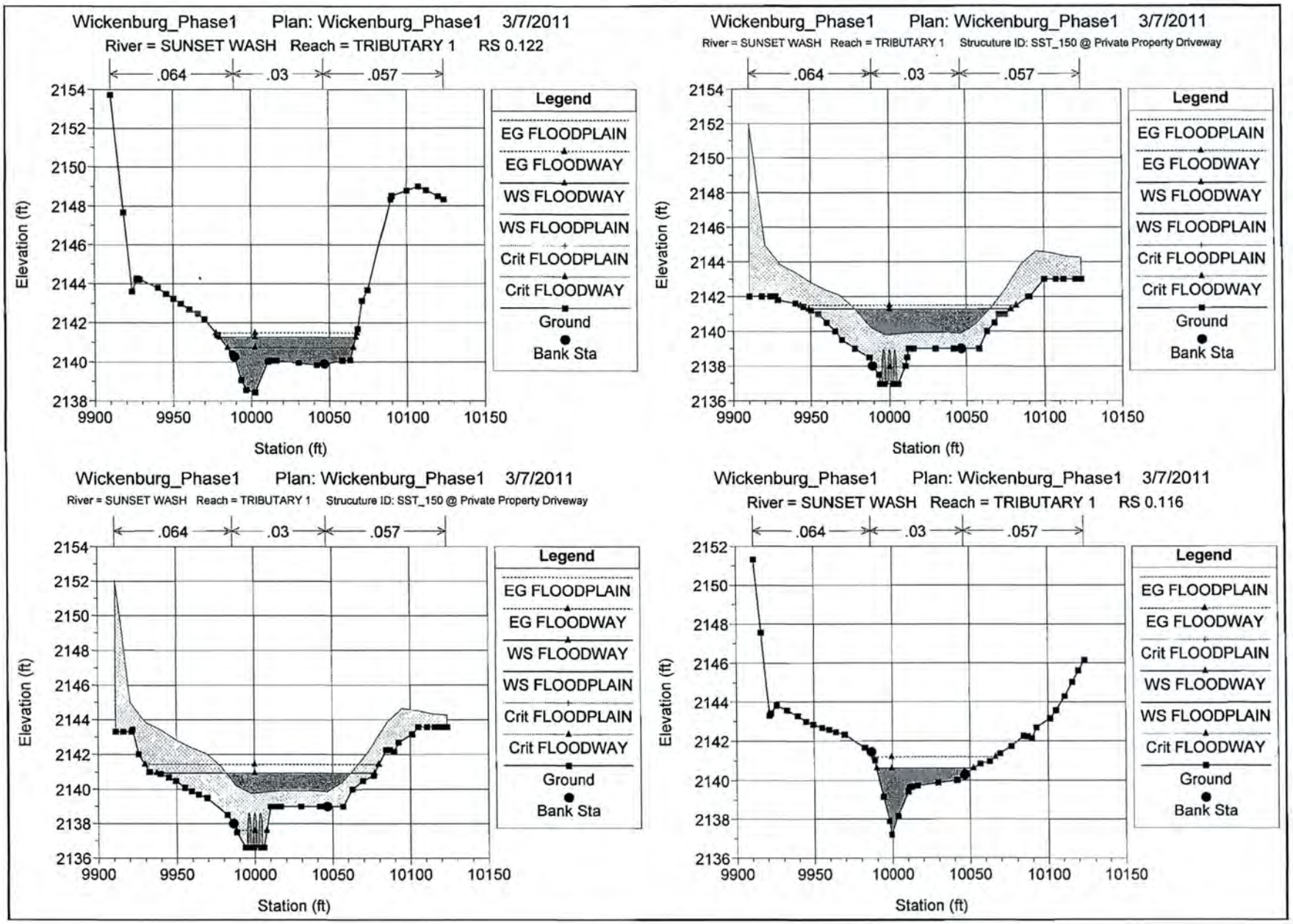

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 RS 0.177
.064
.03
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta

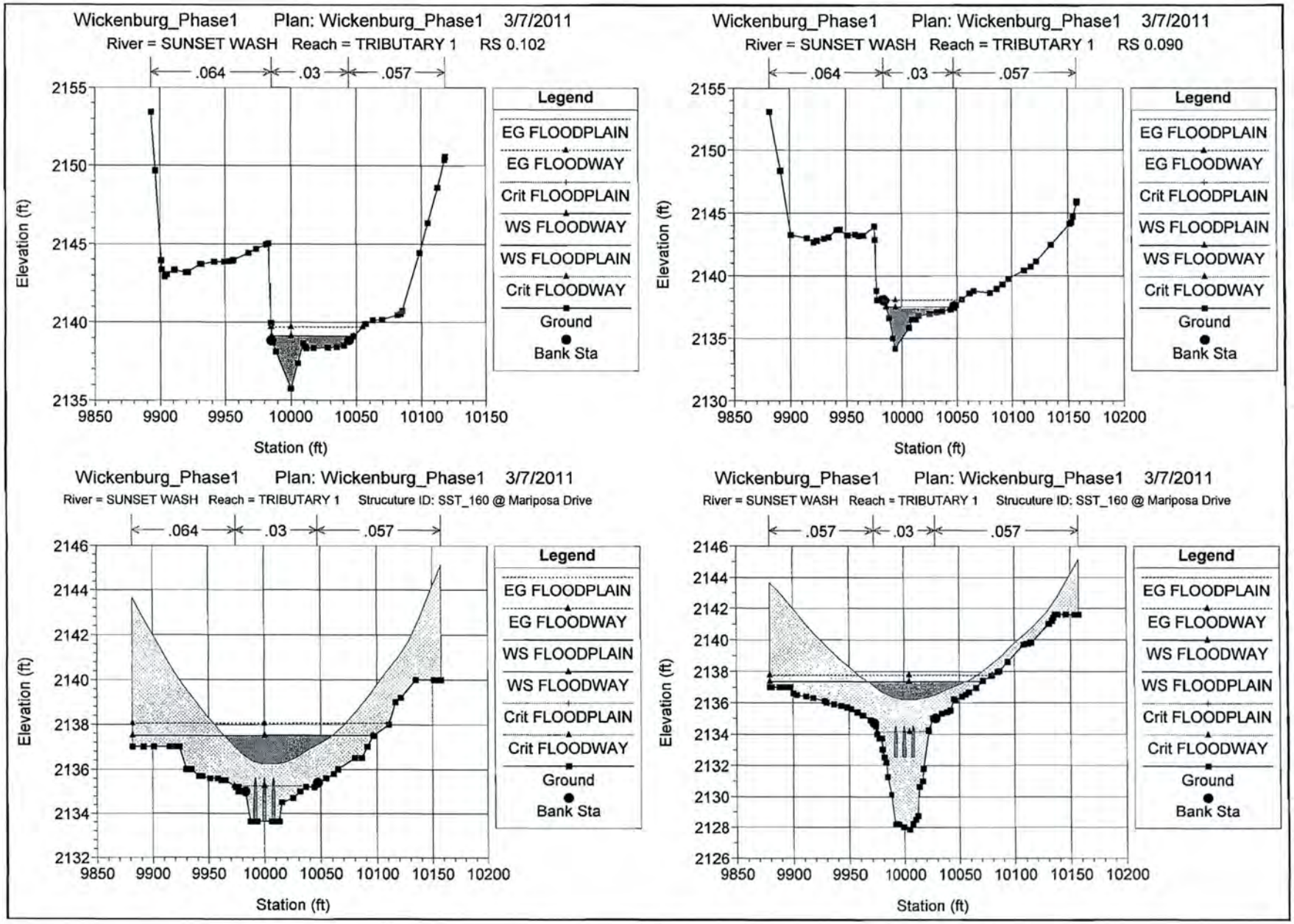

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 RS 0.159
.064
.03
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta

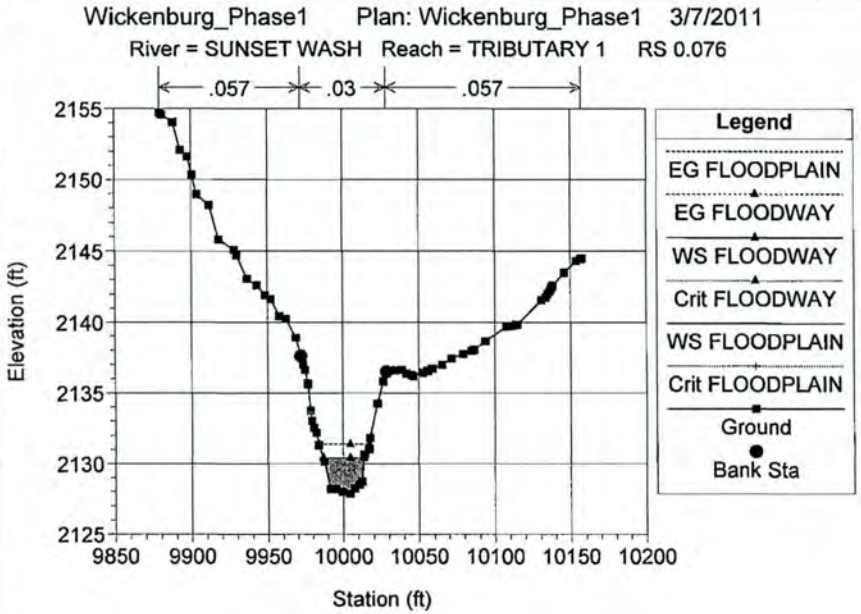

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 Strucuture ID: SST_130 @ Private Property Driveway
.064
.03
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta

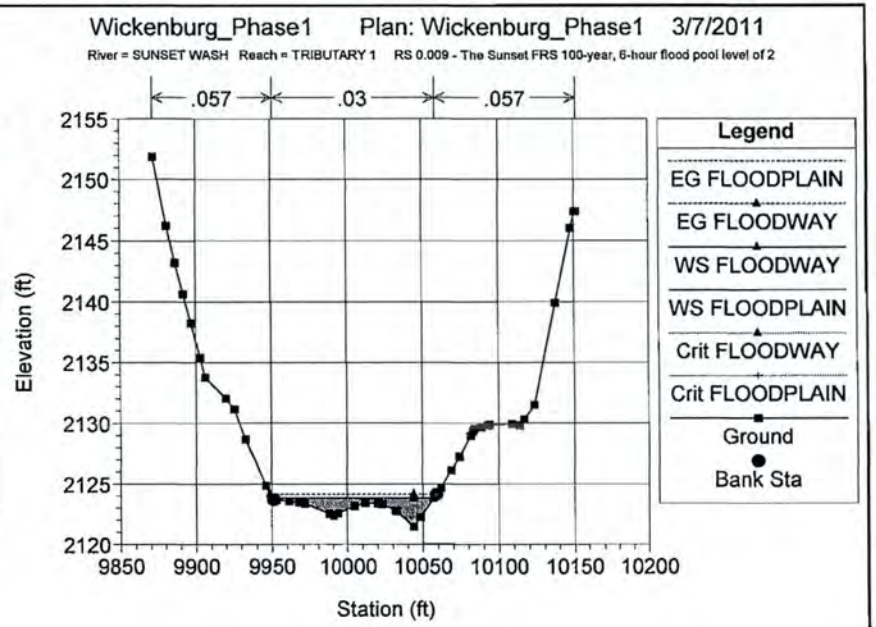

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 Strucuture ID: SST_130 @ Private Property Driveway
.064
.03
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 RS 0.153
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 RS 0.145
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 RS 0.138

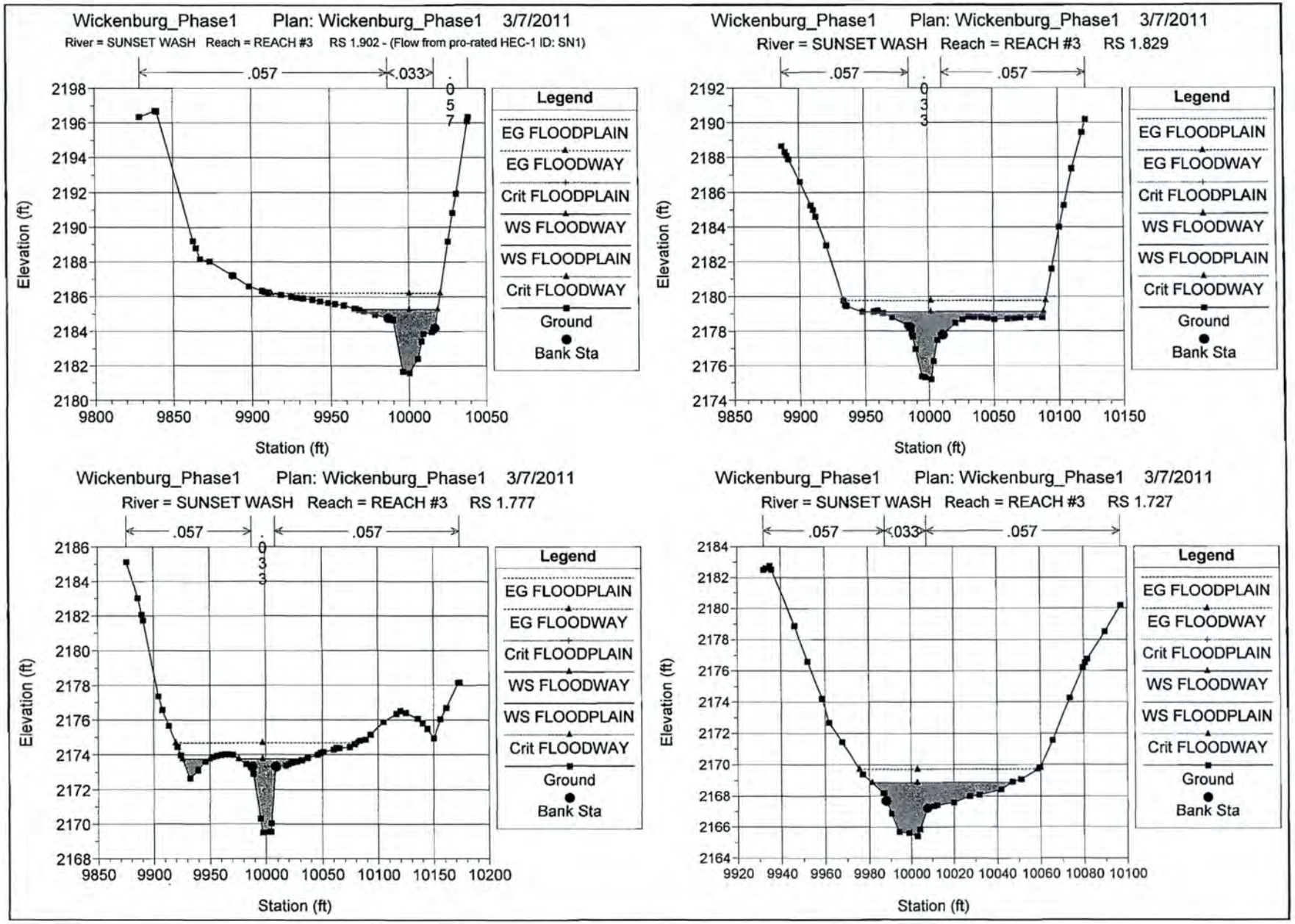

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 Strucuture ID: SST_140 @ Private Property Driveway
.064
.03
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 Strucuture ID: SST_140 @ Private Property Driveway
.064
.03
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 RS 0.132
.064
.03
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 RS 0.126
.064
.03
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta

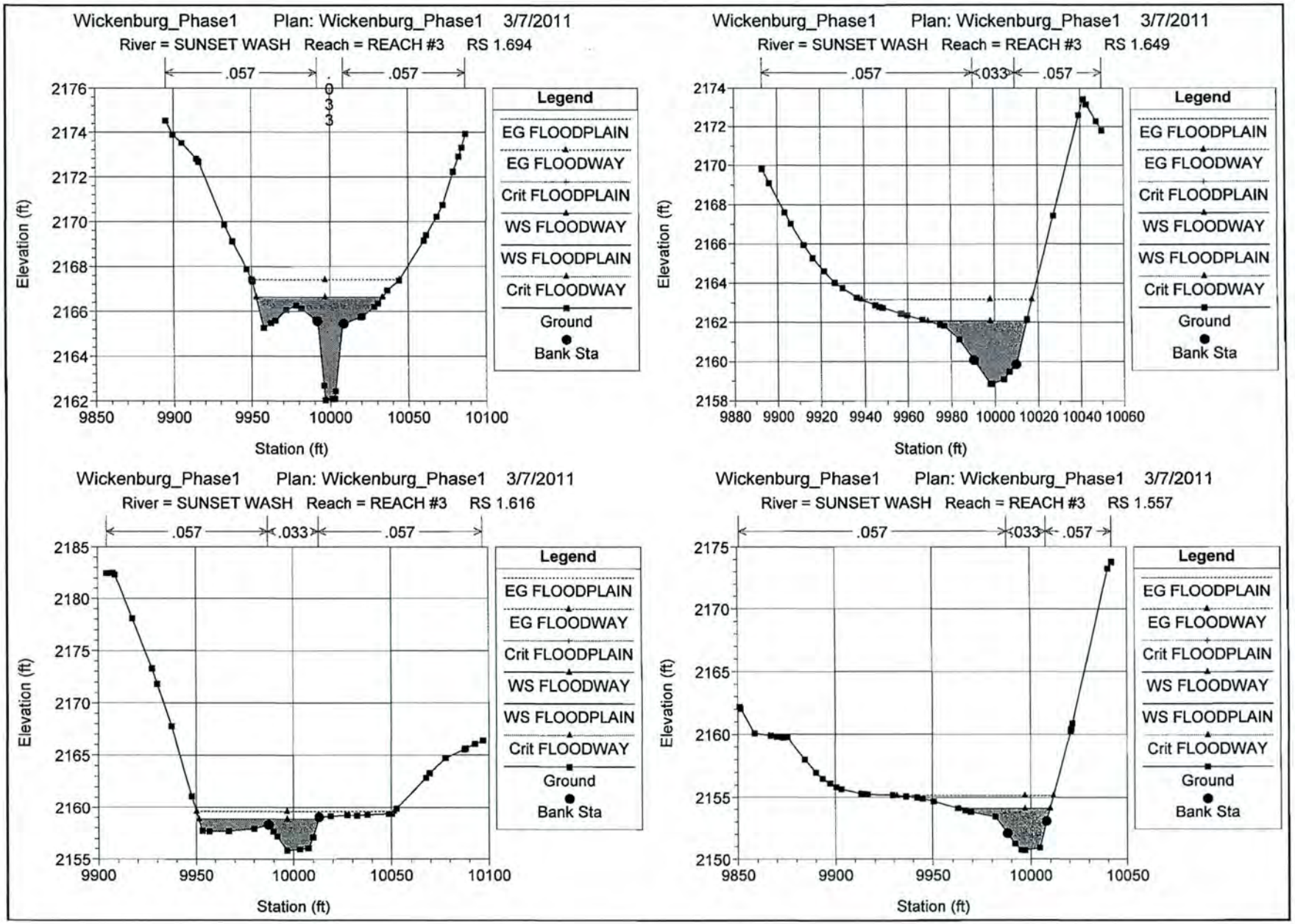

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 RS 0.122
.064
.03
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 Strucuture ID: SST_150 @ Private Property Driveway
.064
.03
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 Strucuture ID: SST_150 @ Private Property Driveway
.064
.03
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 RS 0.116
.064
.03
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta

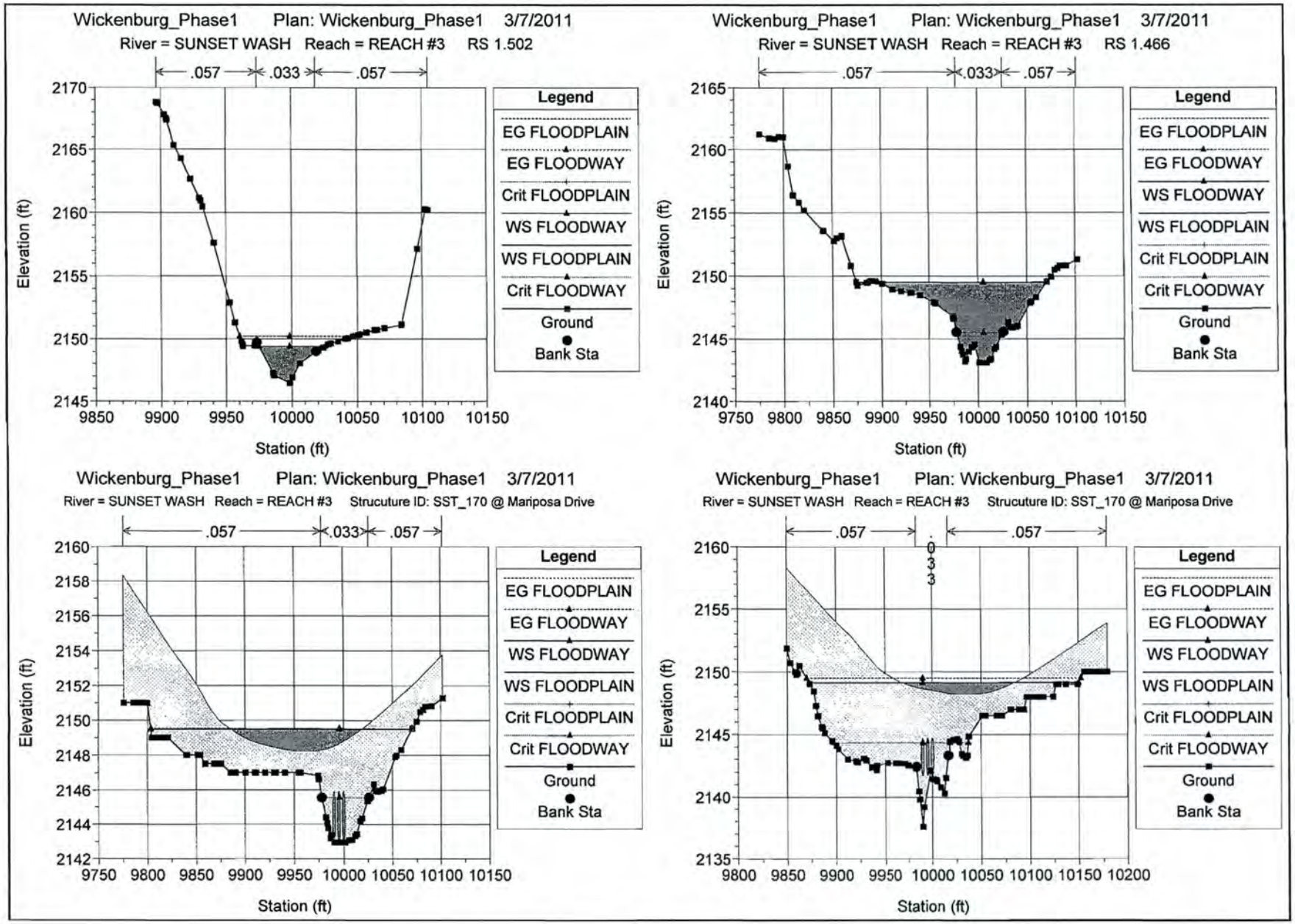

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 RS 0.102
.064
.03
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 RS 0.090
.064
.03
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
Ground
Bank Sta
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 Strucuture ID: SST_160 @ Mariposa Drive
.064
.03
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODPLAIN
WS FLOODWAY
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 Strucuture ID: SST_160 @ Mariposa Drive
.057
.03
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta

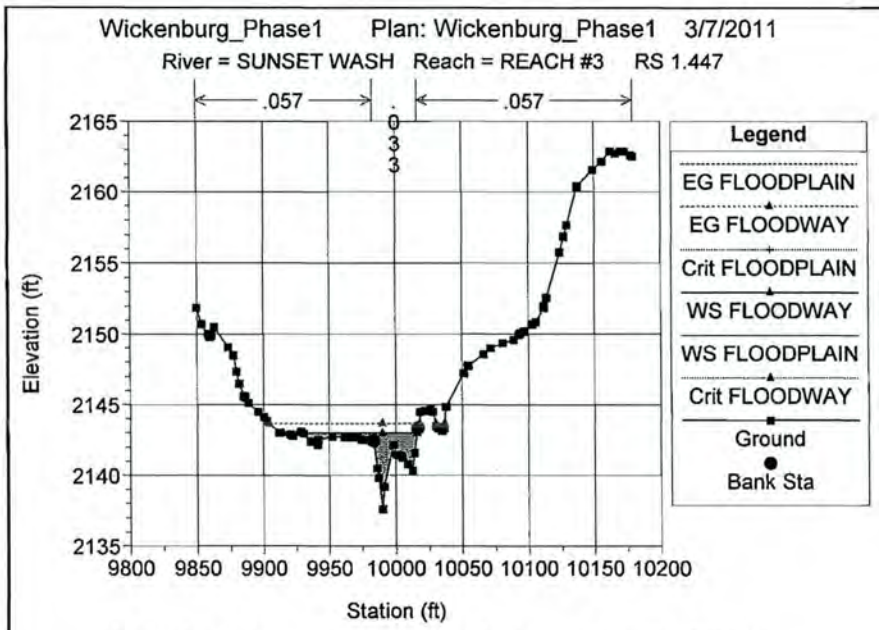

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 RS 0.076
.057
.03
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta

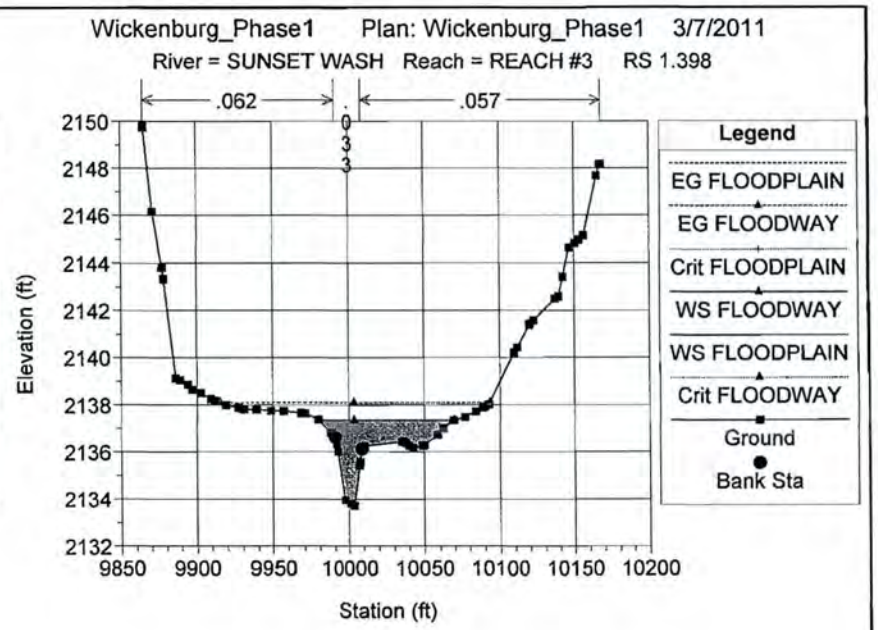

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = TRIBUTARY 1 RS 0.009 - The Sunset FRS 100-year, 6-hour flood pool level of 2
.057
.03
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Crit FLOODPLAIN
Ground
Bank Sta

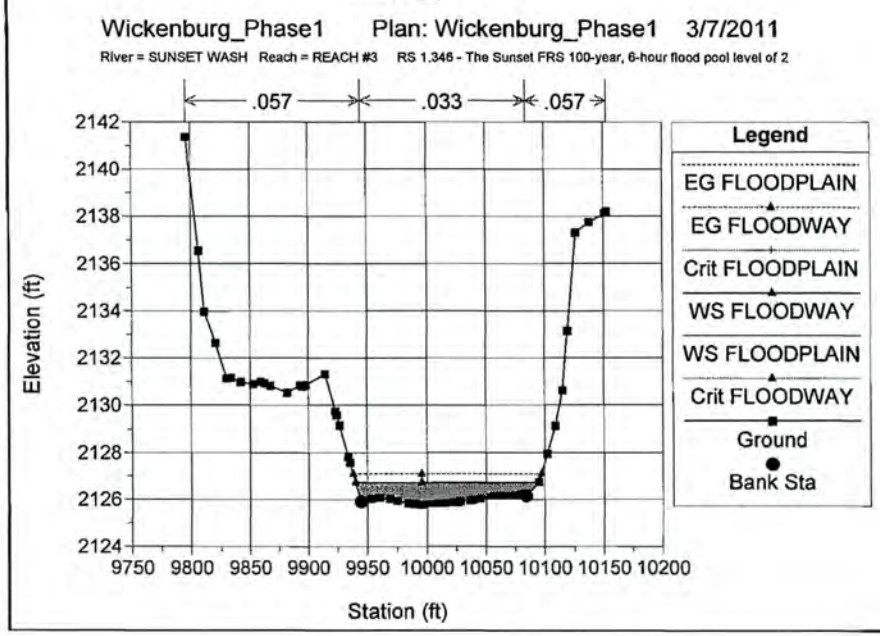

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #3 RS 1.902 - (Flow from pro-rated HEC-1 ID: SN1)
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #3 RS 1.829
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #3 RS 1.777
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #3 RS 1.727
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta

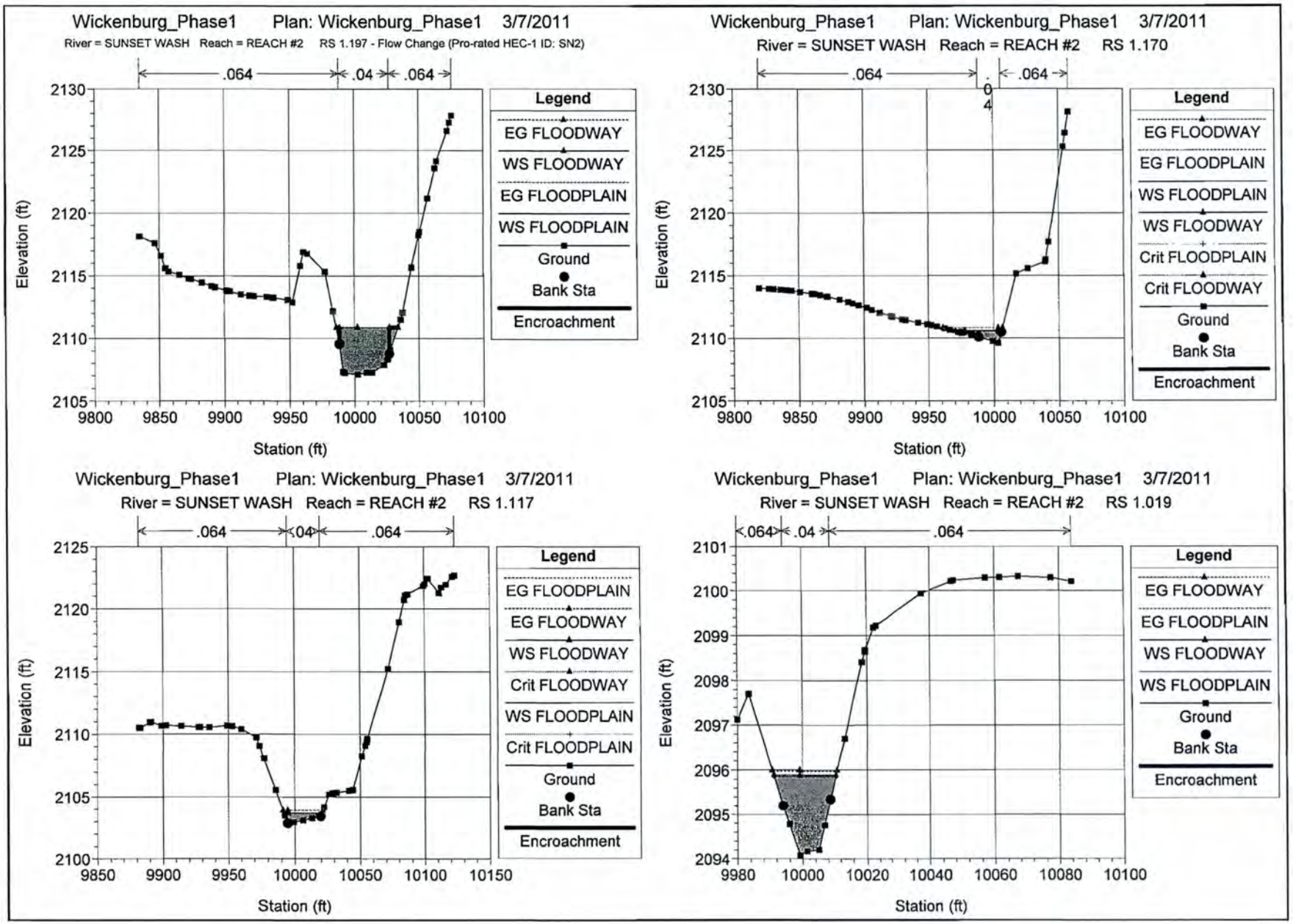

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #3 RS 1.694
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #3 RS 1.649
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #3 RS 1.616
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #3 RS 1.557
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta

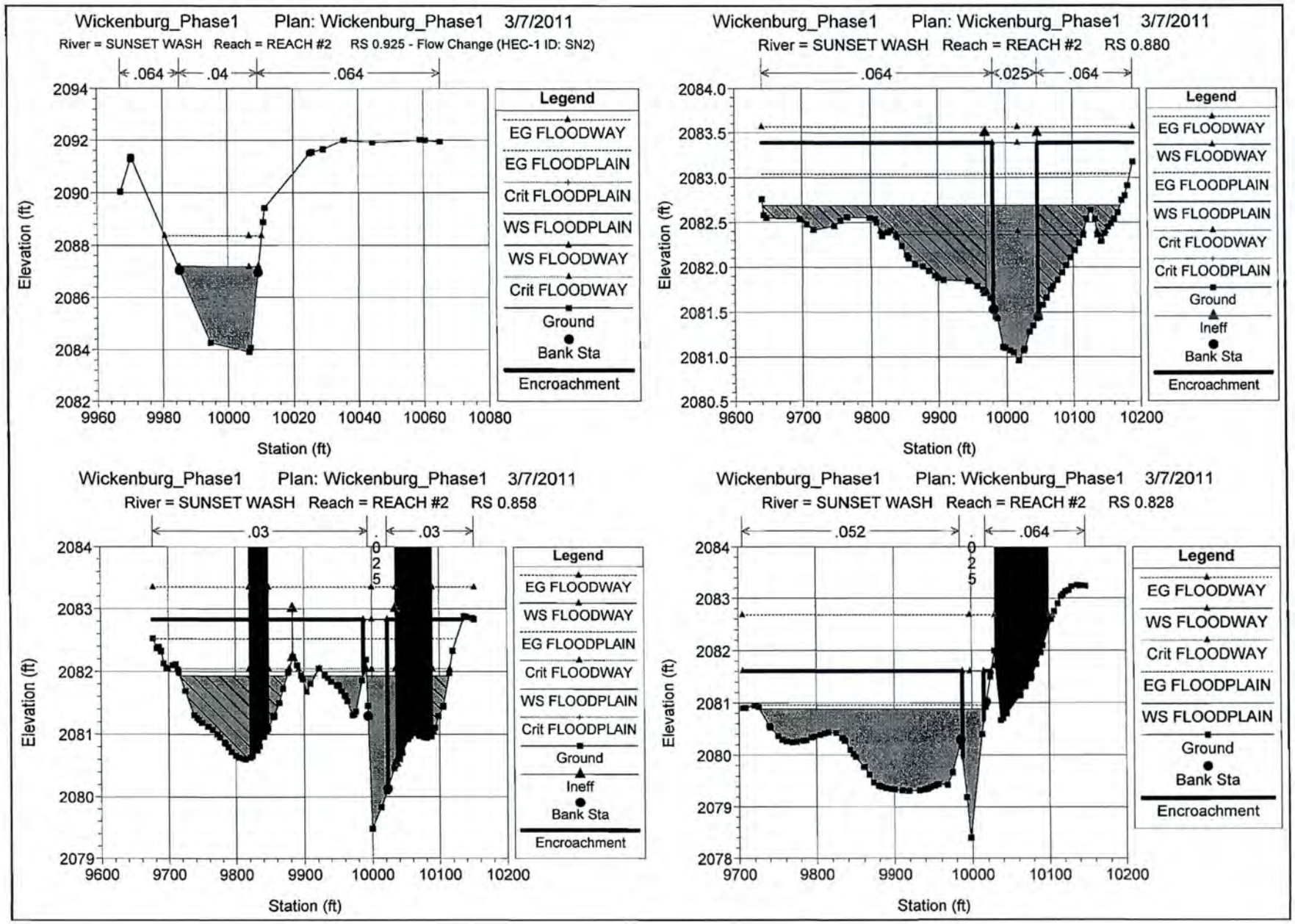

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #3 RS 1.502
.057 .033 .057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #3 RS 1.466
.057 .033 .057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #3 Strucuture ID: SST_170 @ Mariposa Drive
.057 .033 .057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #3 Strucuture ID: SST_170 @ Mariposa Drive
.057 .033 .057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta

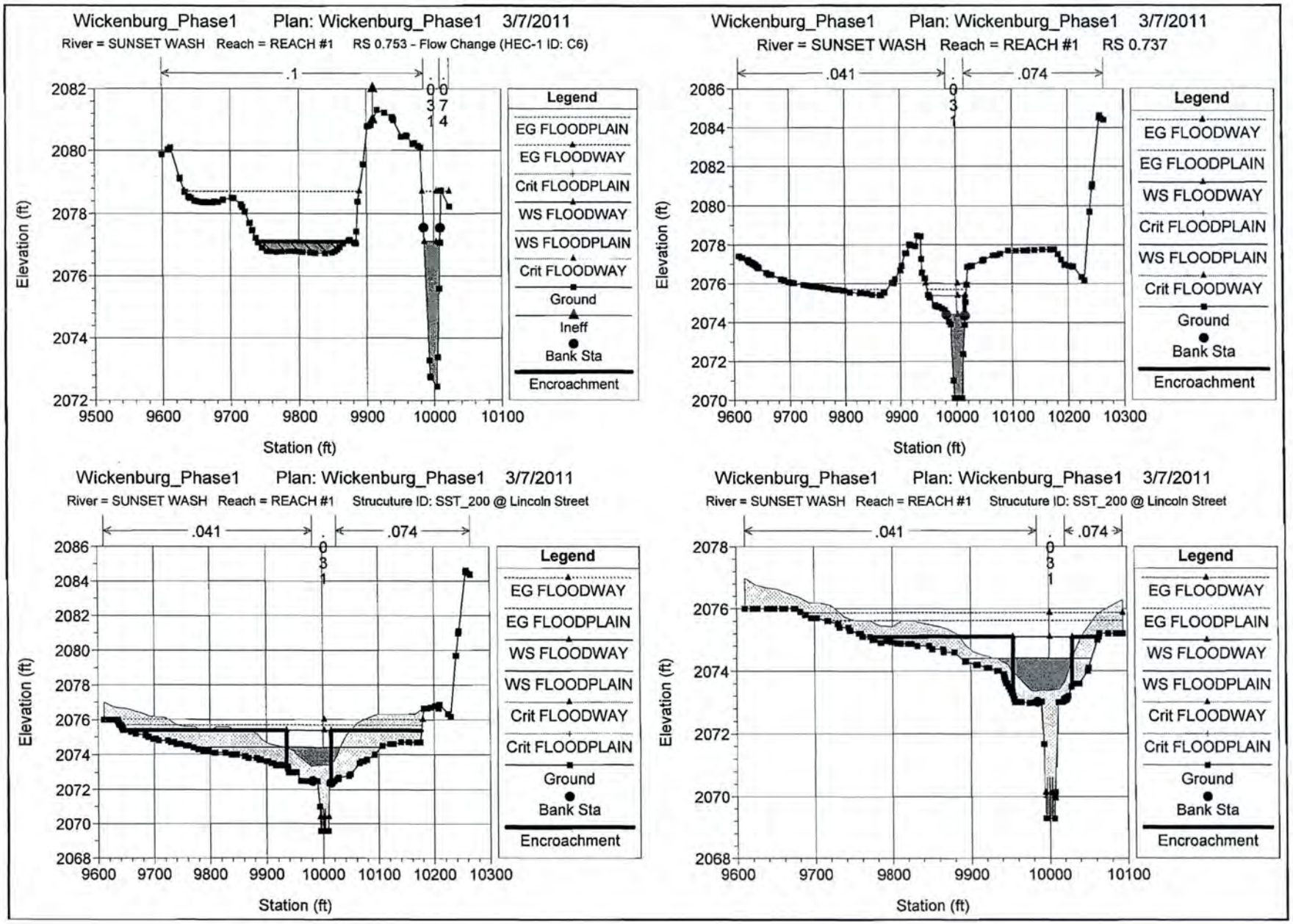

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #3 RS 1.447
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta

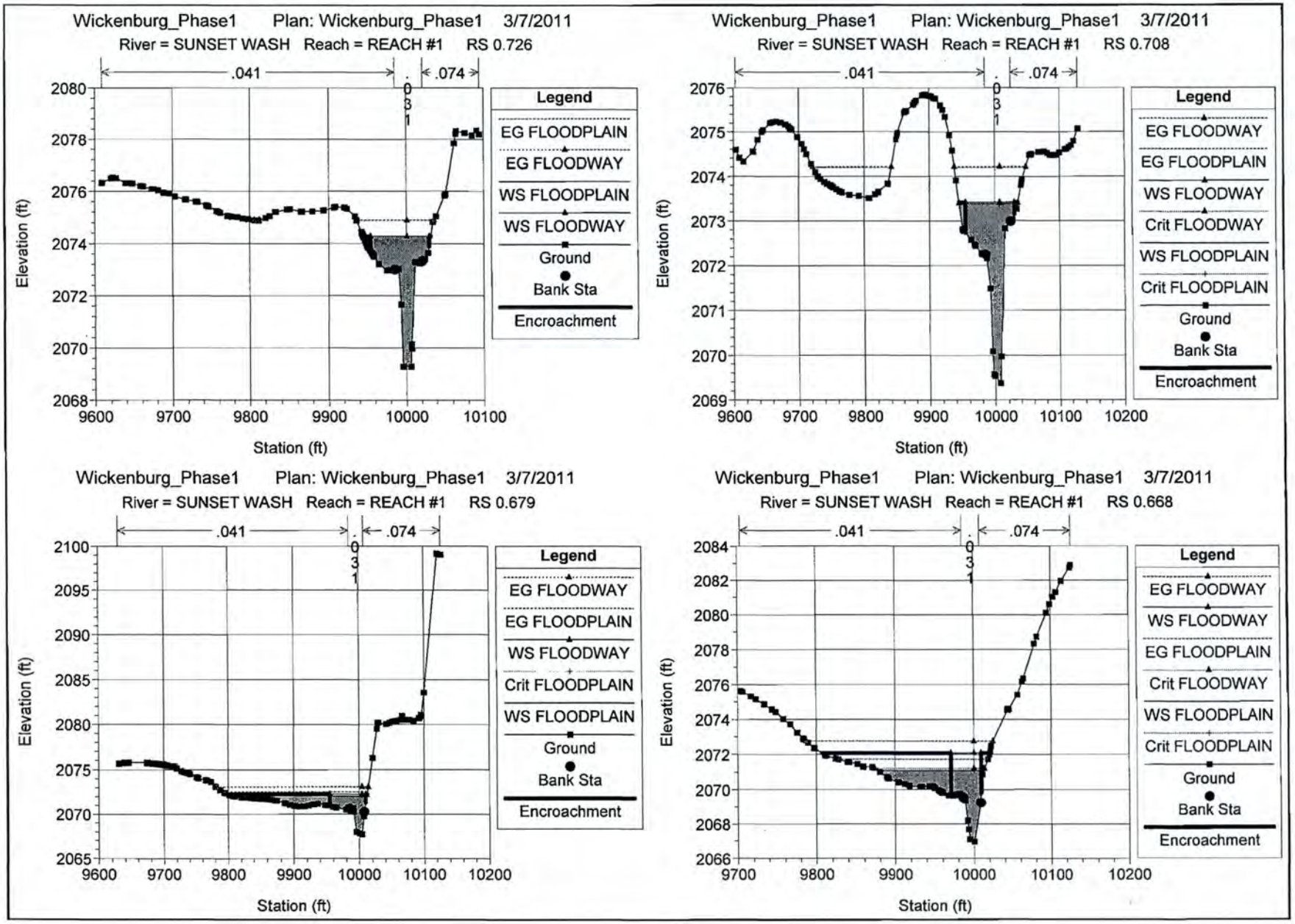

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #3 RS 1.398
.062
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta

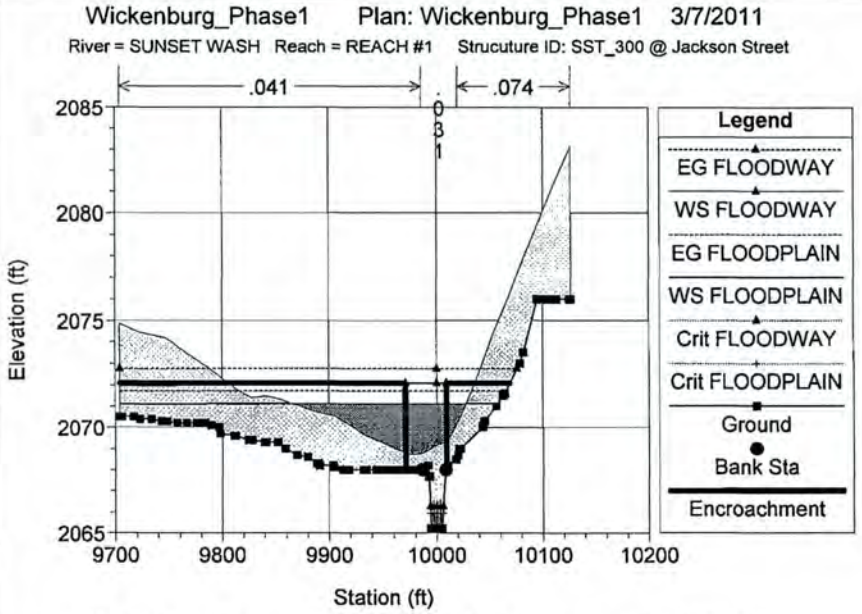

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #3 RS 1.346 - The Sunset FRS 100-year, 6-hour flood pool level of 2
.057
.033
.057
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta

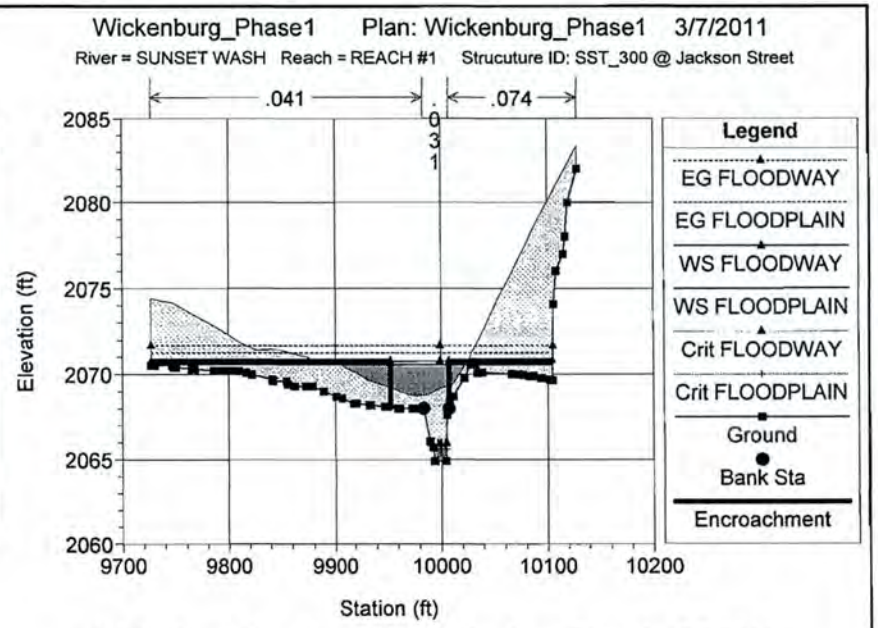

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #2 RS 1.197 - Flow Change (Pro-rated HEC-1 ID: SN2)
.064
.04
.064
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #2 RS 1.170
.064
.064
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
WS FLOODWAY
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #2 RS 1.117
.064
.04
.064
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #2 RS 1.019
.064
.04
.064
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Ground
Bank Sta
Encroachment

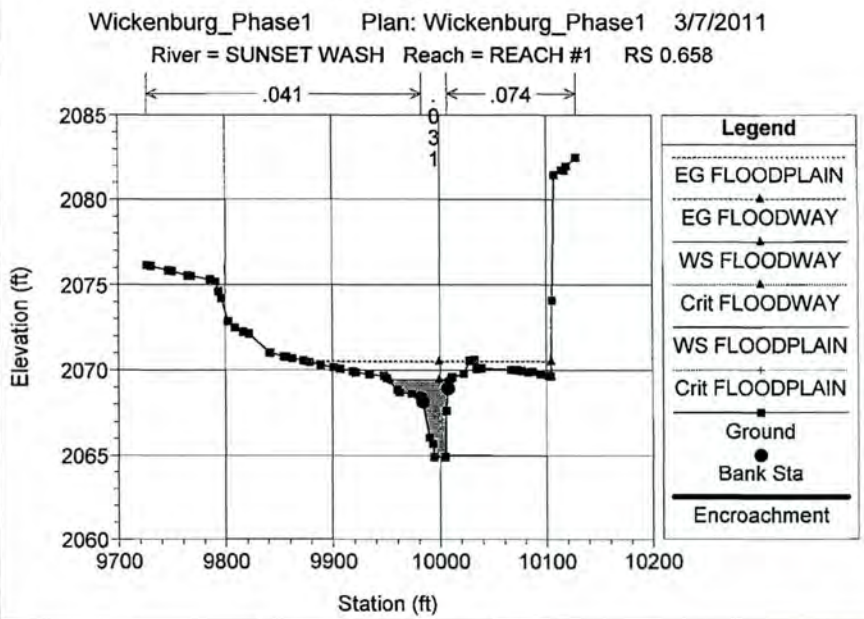

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #2 RS 0.925 - Flow Change (HEC-1 ID: SN2)
.064 .04 .064
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
Crit FLOODPLAIN
WS FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #2 RS 0.880
.064 .025 .064
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODWAY
Crit FLOODPLAIN
Ground
Ineff
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #2 RS 0.858
.03 .025 .03
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Ineff
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #2 RS 0.828
.052 .025 .064
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
Crit FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Ground
Bank Sta
Encroachment

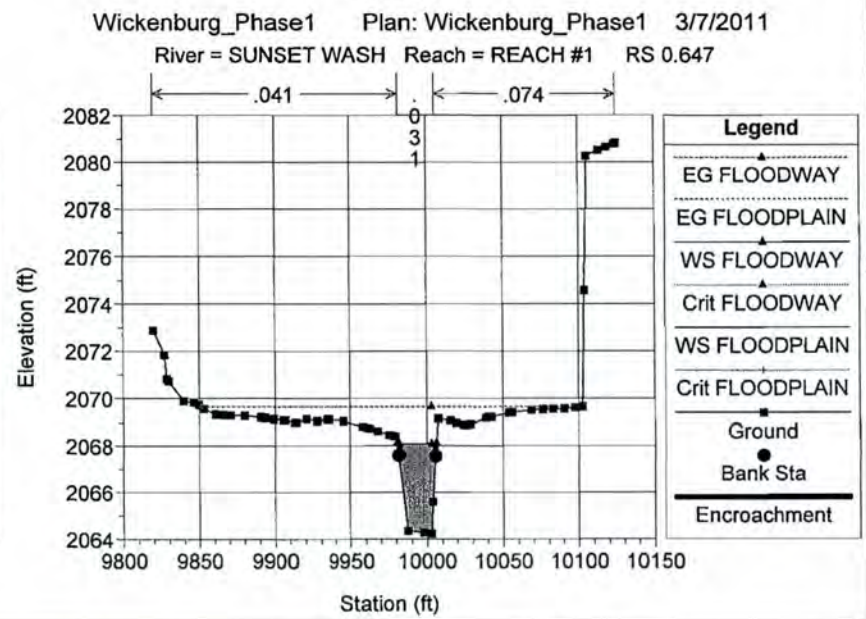

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #1 RS 0.753 - Flow Change (HEC-1 ID: C6)
.1
.031
.074
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Ineff
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #1 RS 0.737
.041
.031
.074
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODPLAIN
WS FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #1 Strucuture ID: SST_200 @ Lincoln Street
.041
.031
.074
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #1 Strucuture ID: SST_200 @ Lincoln Street
.041
.031
.074
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment

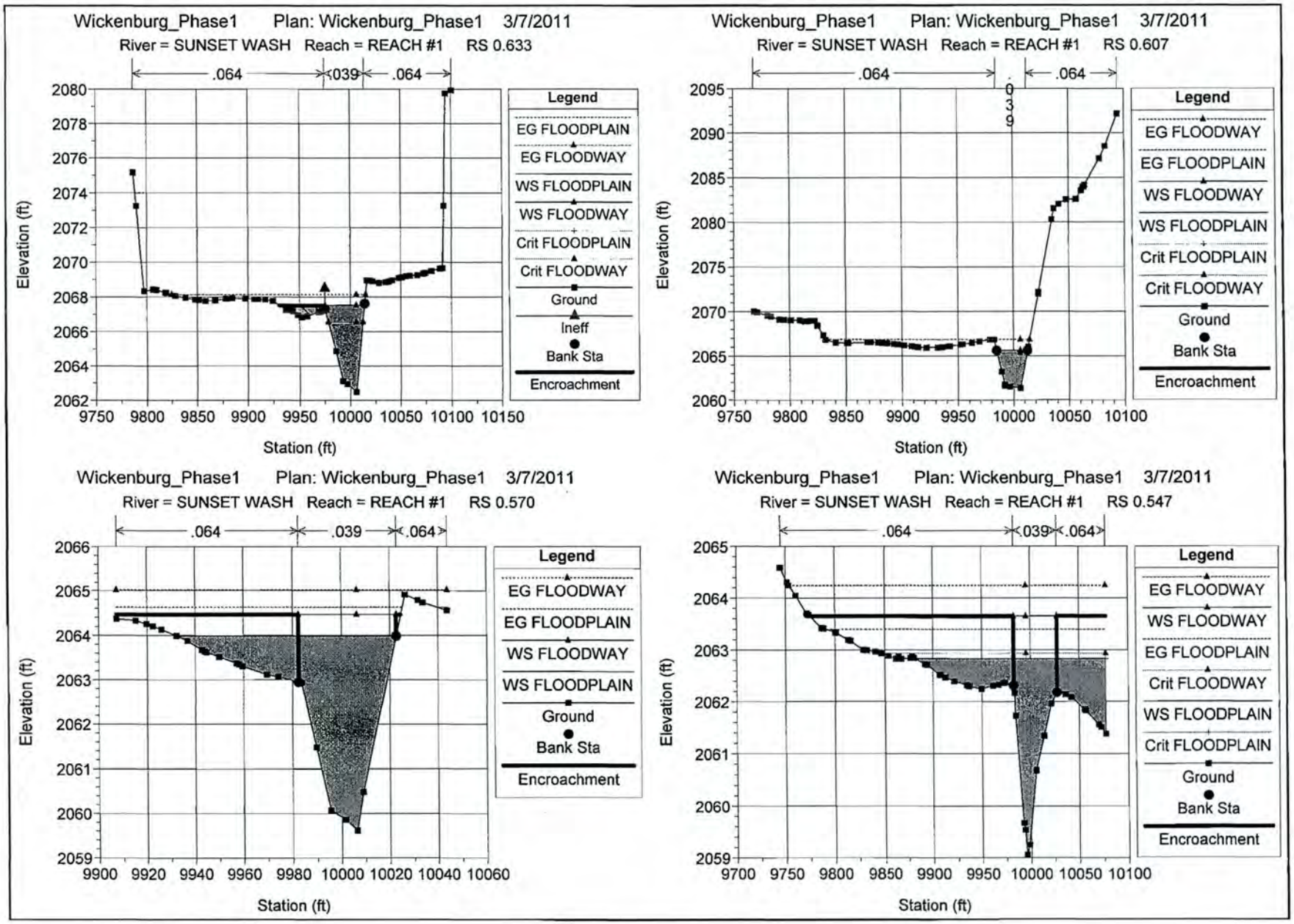

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #1 RS 0.726
.041
.074
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODPLAIN
WS FLOODWAY
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #1 RS 0.708
.041
.074
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #1 RS 0.679
.041
.074
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODPLAIN
WS FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #1 RS 0.668
.041
.074
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment

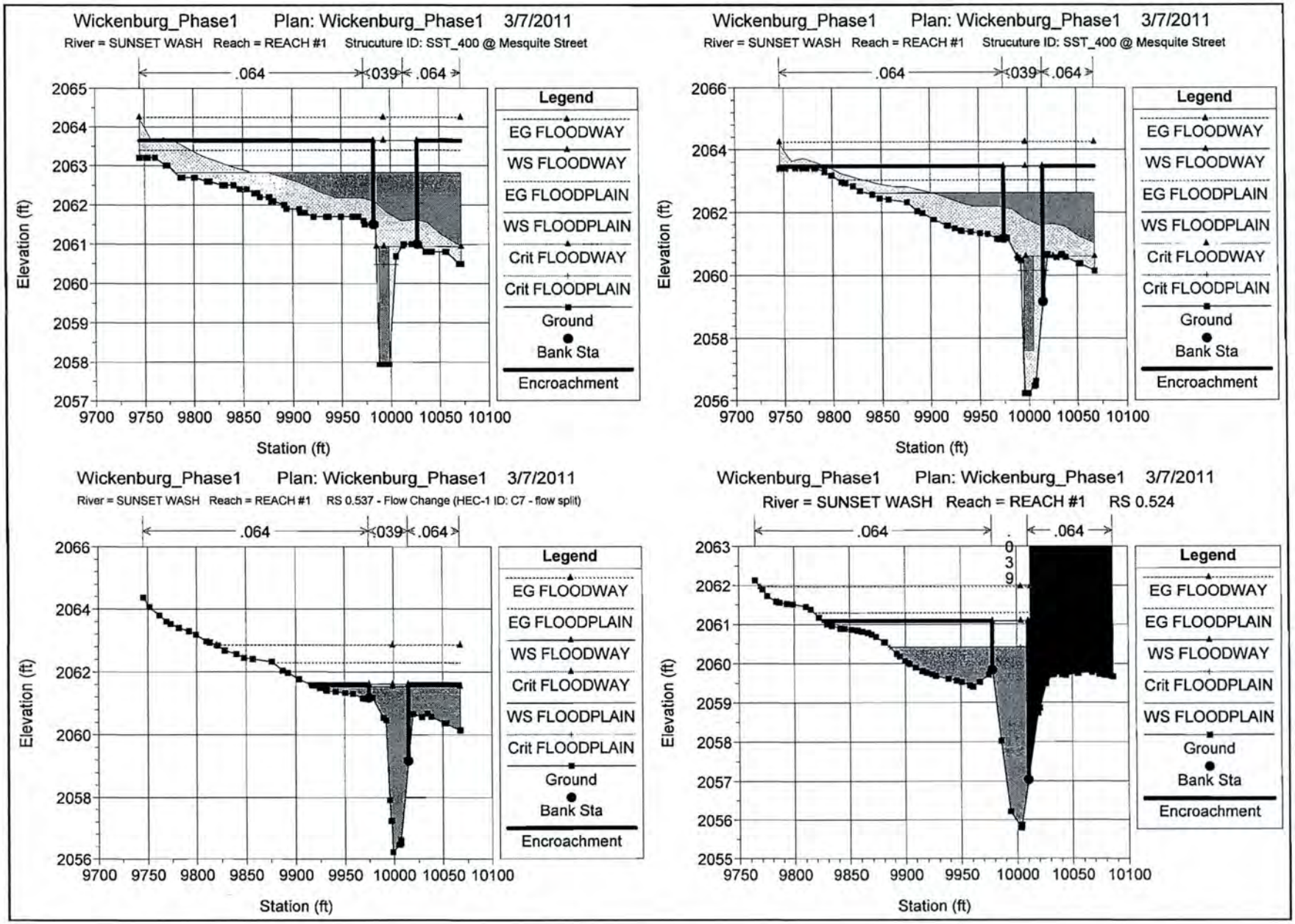

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #1 Strucuture ID: SST_300 @ Jackson Street
.041
.031
.074
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODWAY
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment

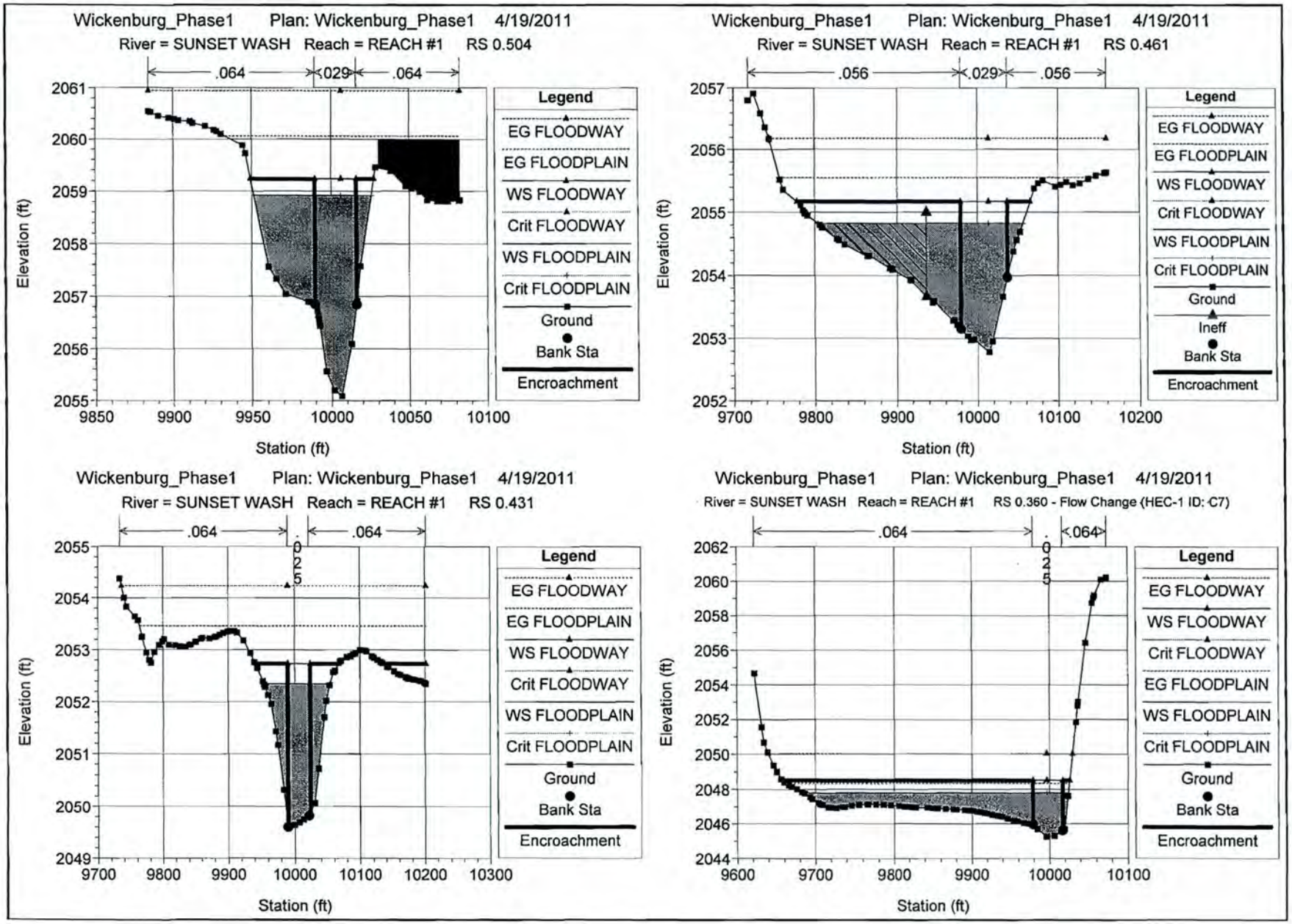

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #1 Strucuture ID: SST_300 @ Jackson Street
.041
.031
.074
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment

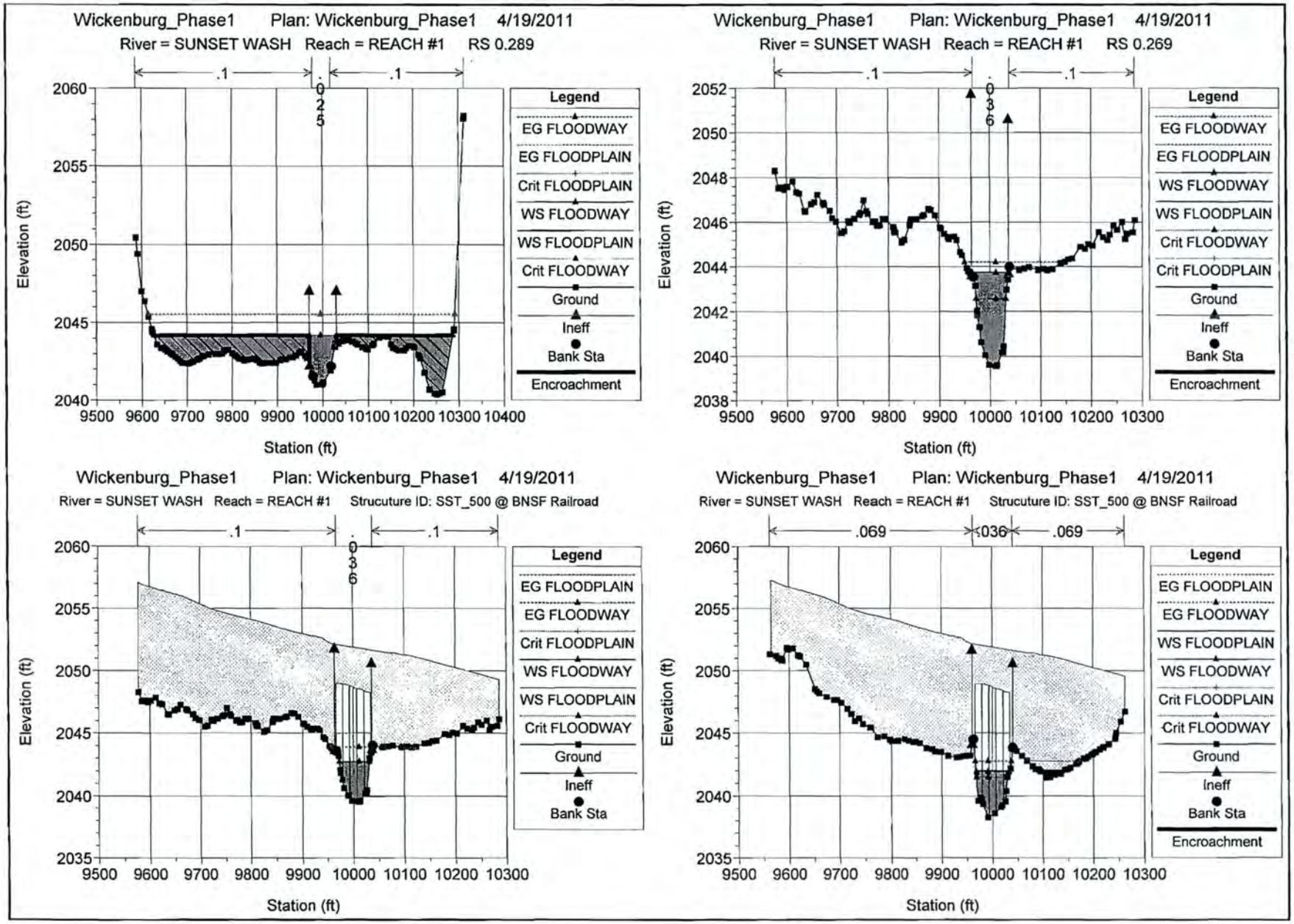

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #1 RS 0.658
.041
.031
.074
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment

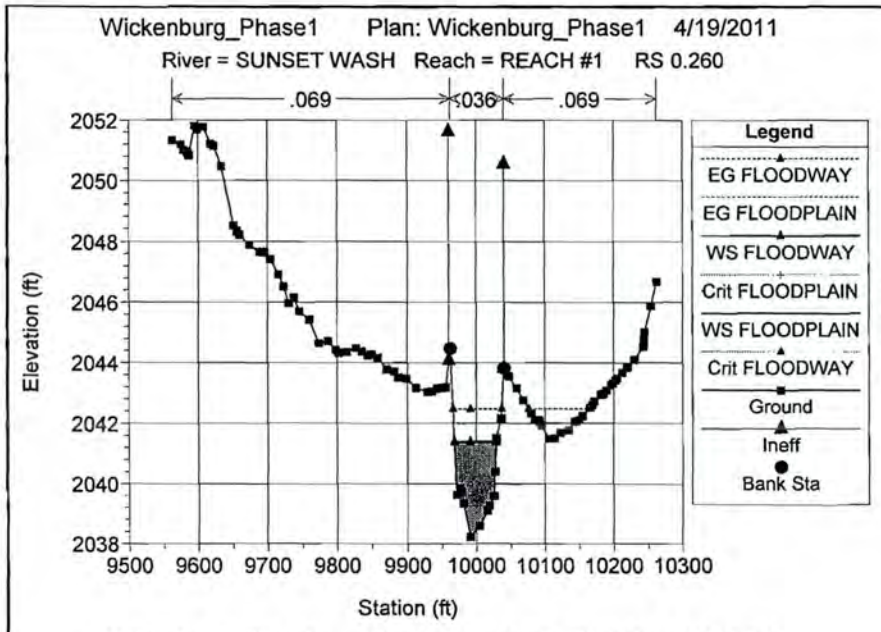

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #1 RS 0.647
.041
.031
.074
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment

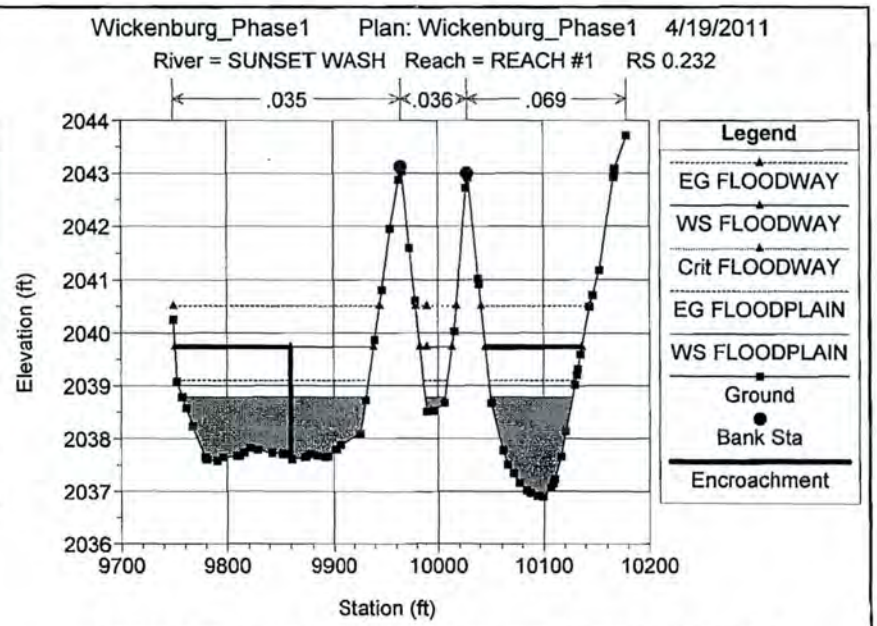

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #1 RS 0.633
.064
.039
.064
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODPLAIN
WS FLOODWAY
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Ineff
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #1 RS 0.607
.064
.039
.064
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #1 RS 0.570
.064
.039
.064
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #1 RS 0.547
.064
.039
.064
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment

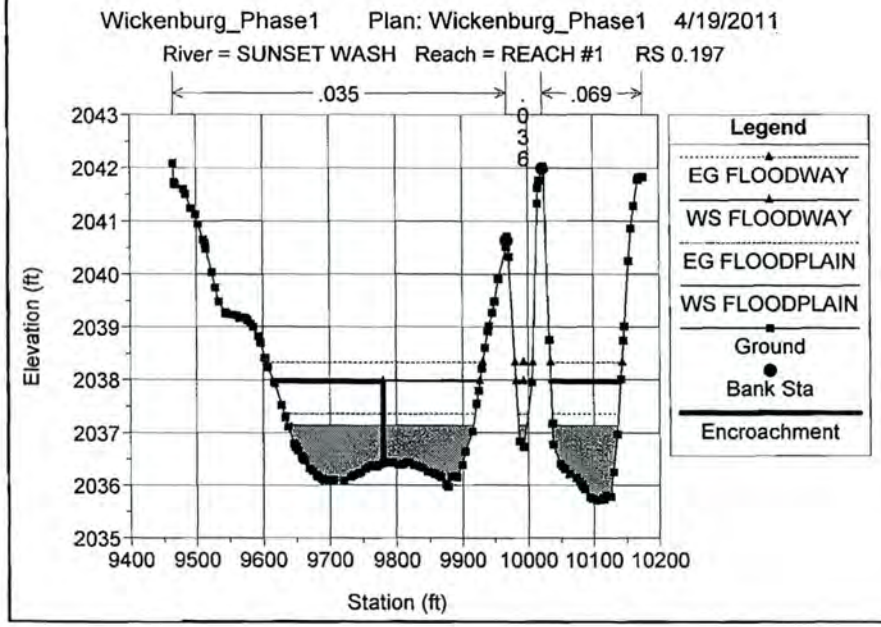

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #1 Strucuture ID: SST_400 @ Mesquite Street
.064
.039
.064
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODWAY
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #1 Strucuture ID: SST_400 @ Mesquite Street
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #1 RS 0.537 - Flow Change (HEC-1 ID: C7 - flow split)
Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
River = SUNSET WASH Reach = REACH #1 RS 0.524

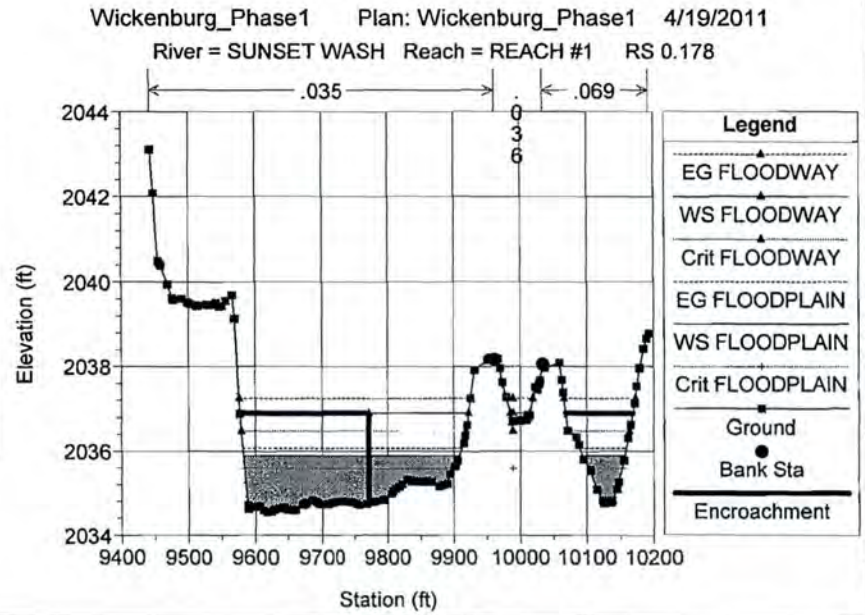

Wickenburg_Phase1 Plan: Wickenburg_Phase1 4/19/2011
River = SUNSET WASH Reach = REACH #1 RS 0.504
.064
.029
.064
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 4/19/2011
River = SUNSET WASH Reach = REACH #1 RS 0.461
.056
.029
.056
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Ineff
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 4/19/2011
River = SUNSET WASH Reach = REACH #1 RS 0.431
.064
.025
.064
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODWAY
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 4/19/2011
River = SUNSET WASH Reach = REACH #1 RS 0.360 - Flow Change (HEC-1 ID: C7)
.064
.025
.064
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
Crit FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment


Wickenburg_Phase1 Plan: Wickenburg_Phase1 4/19/2011
River = SUNSET WASH Reach = REACH #1 RS 0.289
.1
.025
.1
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Ineff
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 4/19/2011
River = SUNSET WASH Reach = REACH #1 RS 0.269
.1
.036
.1
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Crit FLOODPLAIN
Ground
Ineff
Bank Sta
Encroachment
Wickenburg_Phase1 Plan: Wickenburg_Phase1 4/19/2011
River = SUNSET WASH Reach = REACH #1 Strucuture ID: SST_500 @ BNSF Railroad
.1
.036
.1
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
Crit FLOODPLAIN
WS FLOODWAY
WS FLOODPLAIN
Crit FLOODWAY
Ground
Ineff
Bank Sta
Wickenburg_Phase1 Plan: Wickenburg_Phase1 4/19/2011
River = SUNSET WASH Reach = REACH #1 Strucuture ID: SST_500 @ BNSF Railroad
.069
.036
.069
Elevation (ft)
Station (ft)
Legend
EG FLOODPLAIN
EG FLOODWAY
WS FLOODPLAIN
WS FLOODWAY
Crit FLOODPLAIN
Crit FLOODWAY
Ground
Ineff
Bank Sta
Encroachment

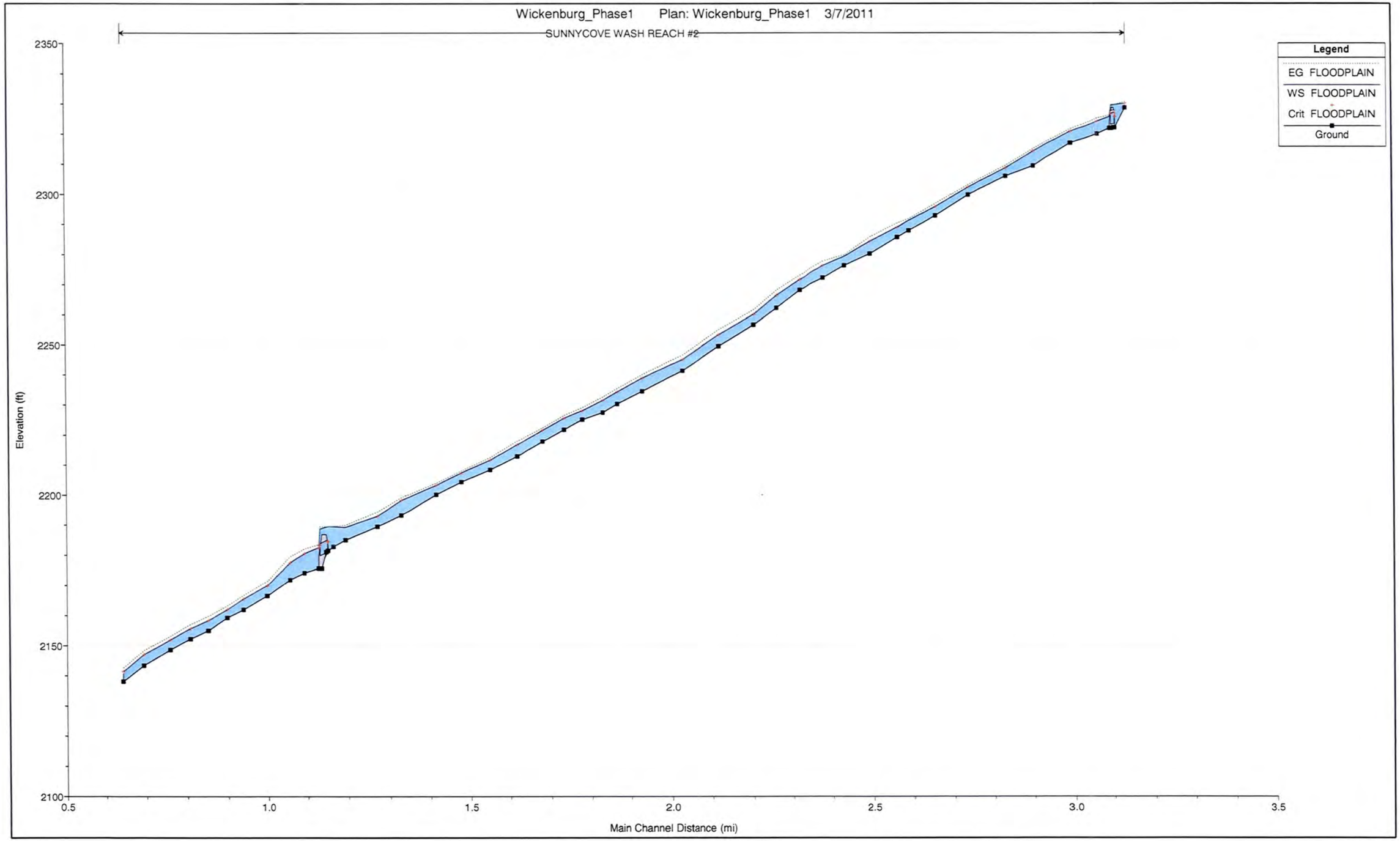

Wickenburg_Phase1 Plan: Wickenburg_Phase1 4/19/2011
River = SUNSET WASH Reach = REACH #1 RS 0.260
.069
.036
.069
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
EG FLOODPLAIN
WS FLOODWAY
Crit FLOODPLAIN
WS FLOODPLAIN
Crit FLOODWAY
Ground
Ineff
Bank Sta

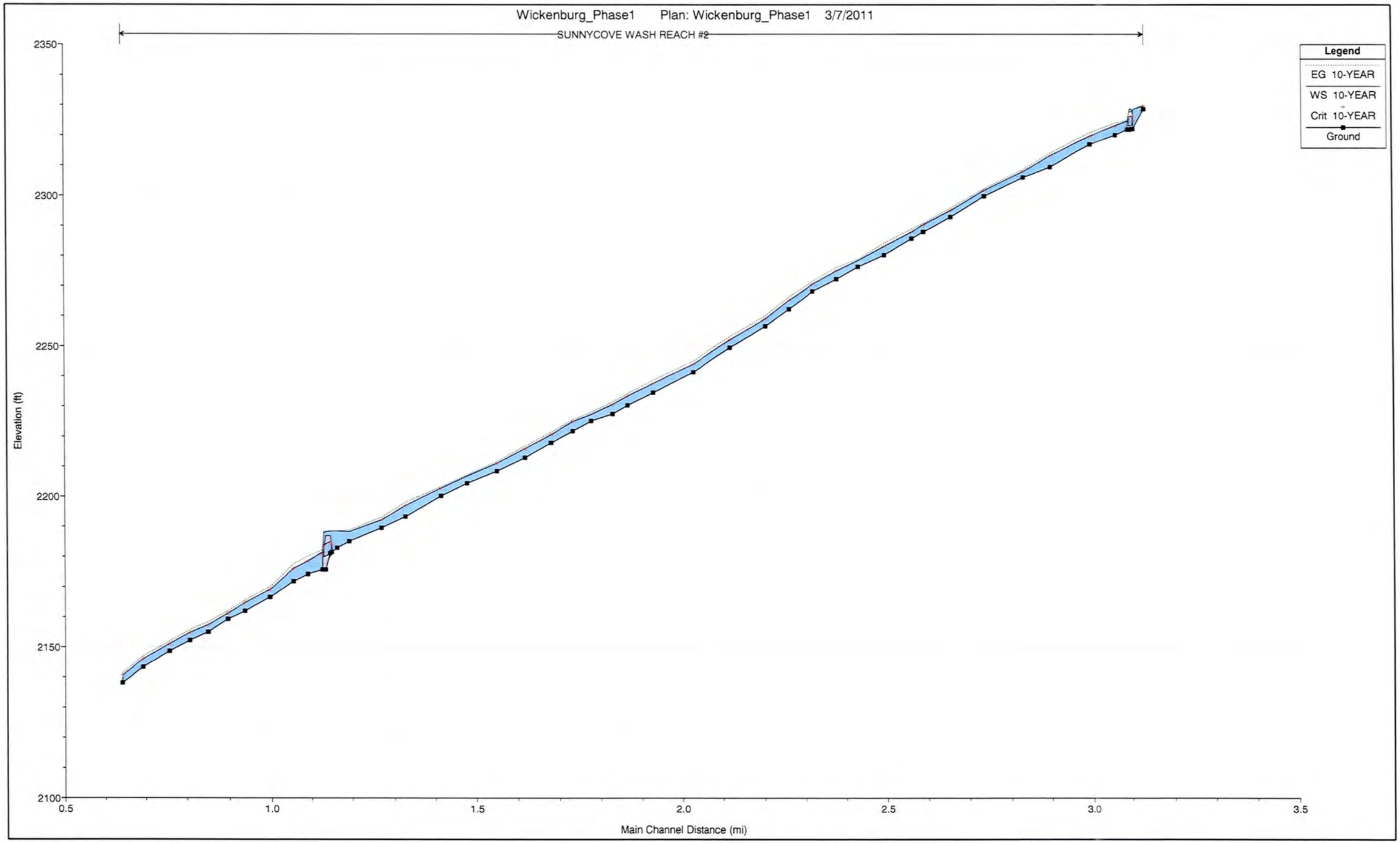

Wickenburg_Phase1 Plan: Wickenburg_Phase1 4/19/2011
River = SUNSET WASH Reach = REACH #1 RS 0.232
.035
.036
.069
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
Crit FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Ground
Bank Sta
Encroachment

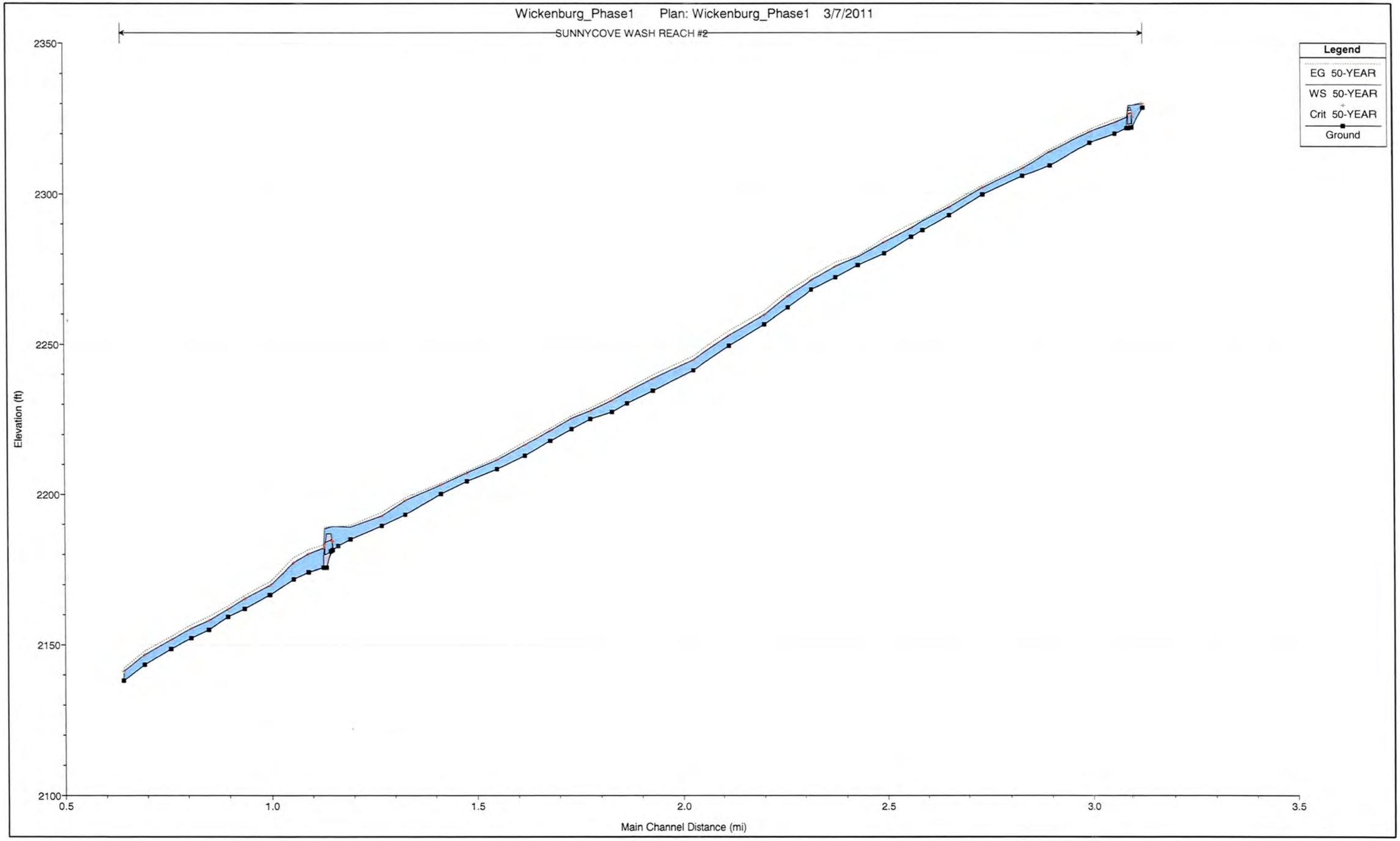

Wickenburg_Phase1 Plan: Wickenburg_Phase1 4/19/2011
River = SUNSET WASH Reach = REACH #1 RS 0.197
.035
.036
.069
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Ground
Bank Sta
Encroachment

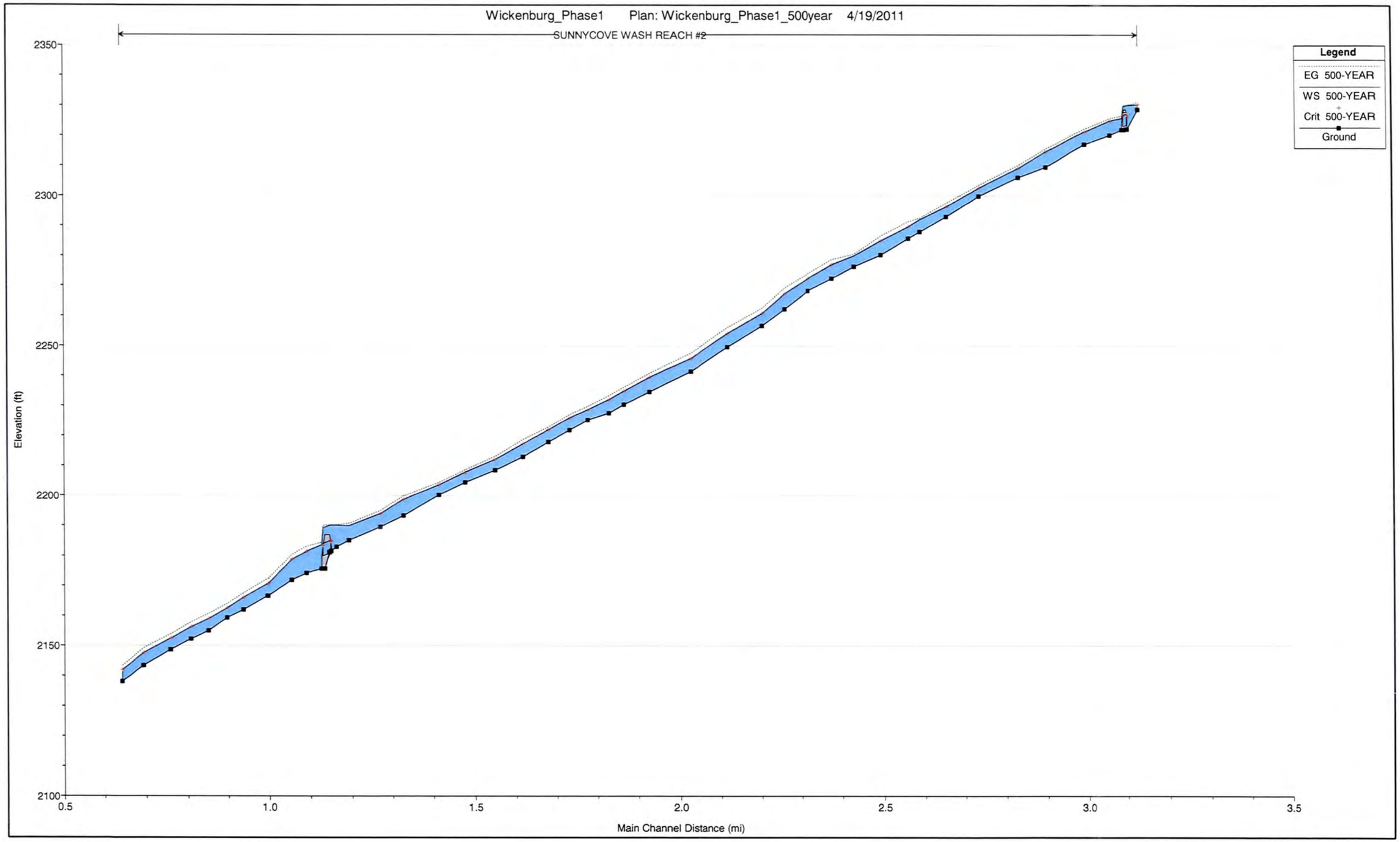

Wickenburg_Phase1 Plan: Wickenburg_Phase1 4/19/2011
River = SUNSET WASH Reach = REACH #1 RS 0.178
.035
.036
.069
Elevation (ft)
Station (ft)
Legend
EG FLOODWAY
WS FLOODWAY
Crit FLOODWAY
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Bank Sta
Encroachment

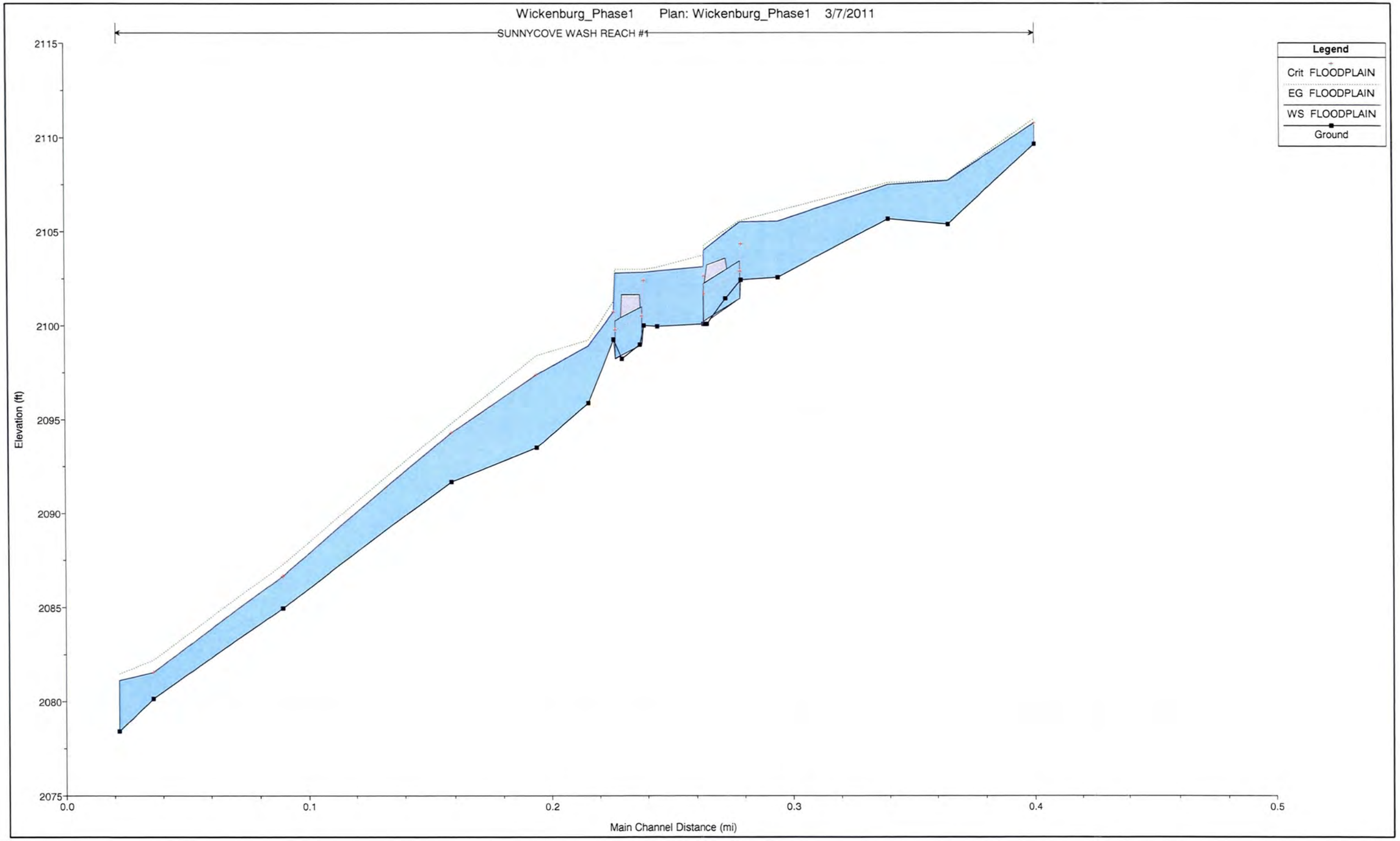
E.5.5 FLOOD PROFILES

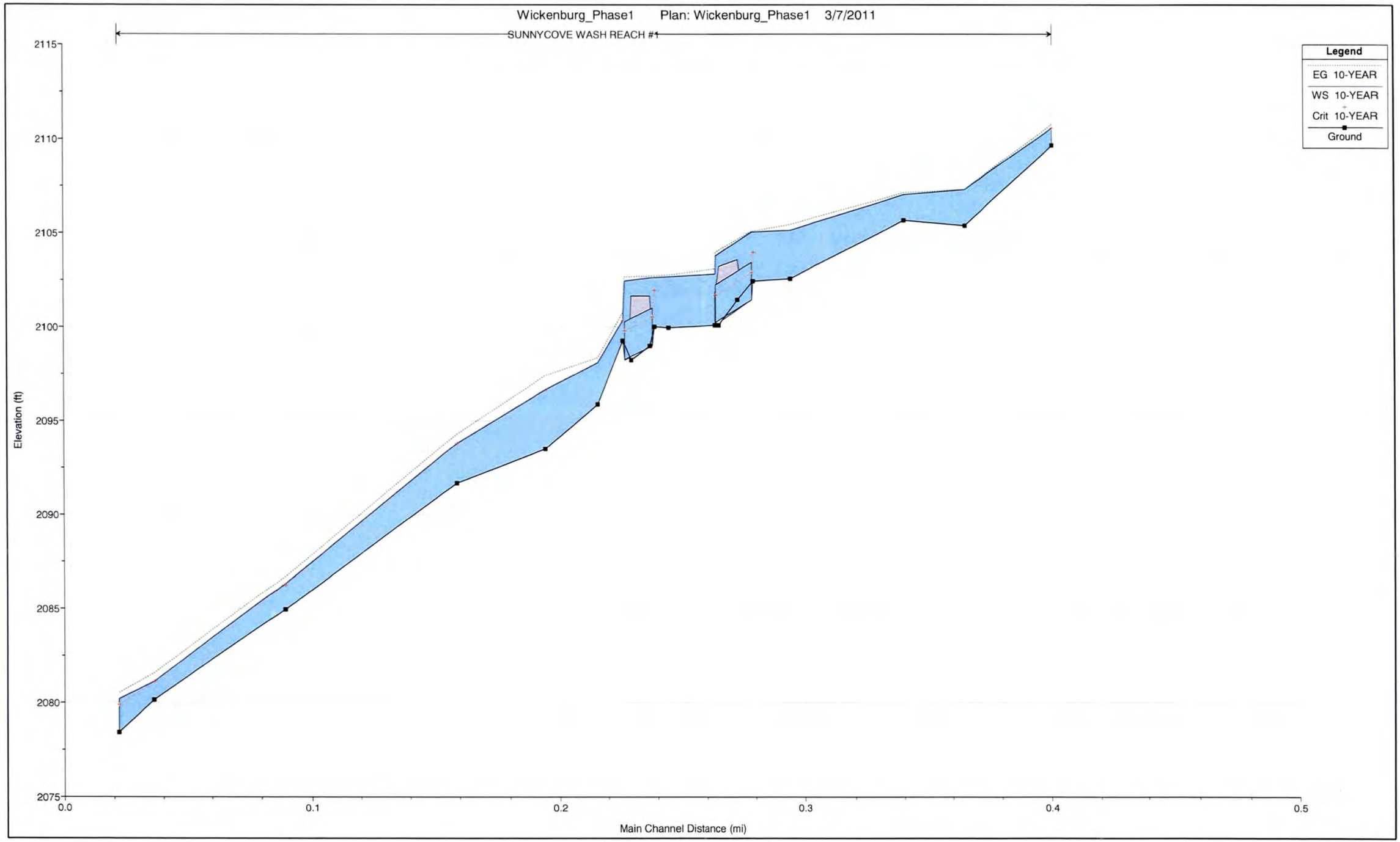

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
SUNNYCOVE WASH REACH #2
Legend
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Elevation (ft)
2350
2300
2250
2200
2150
2100
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Main Channel Distance (mi)

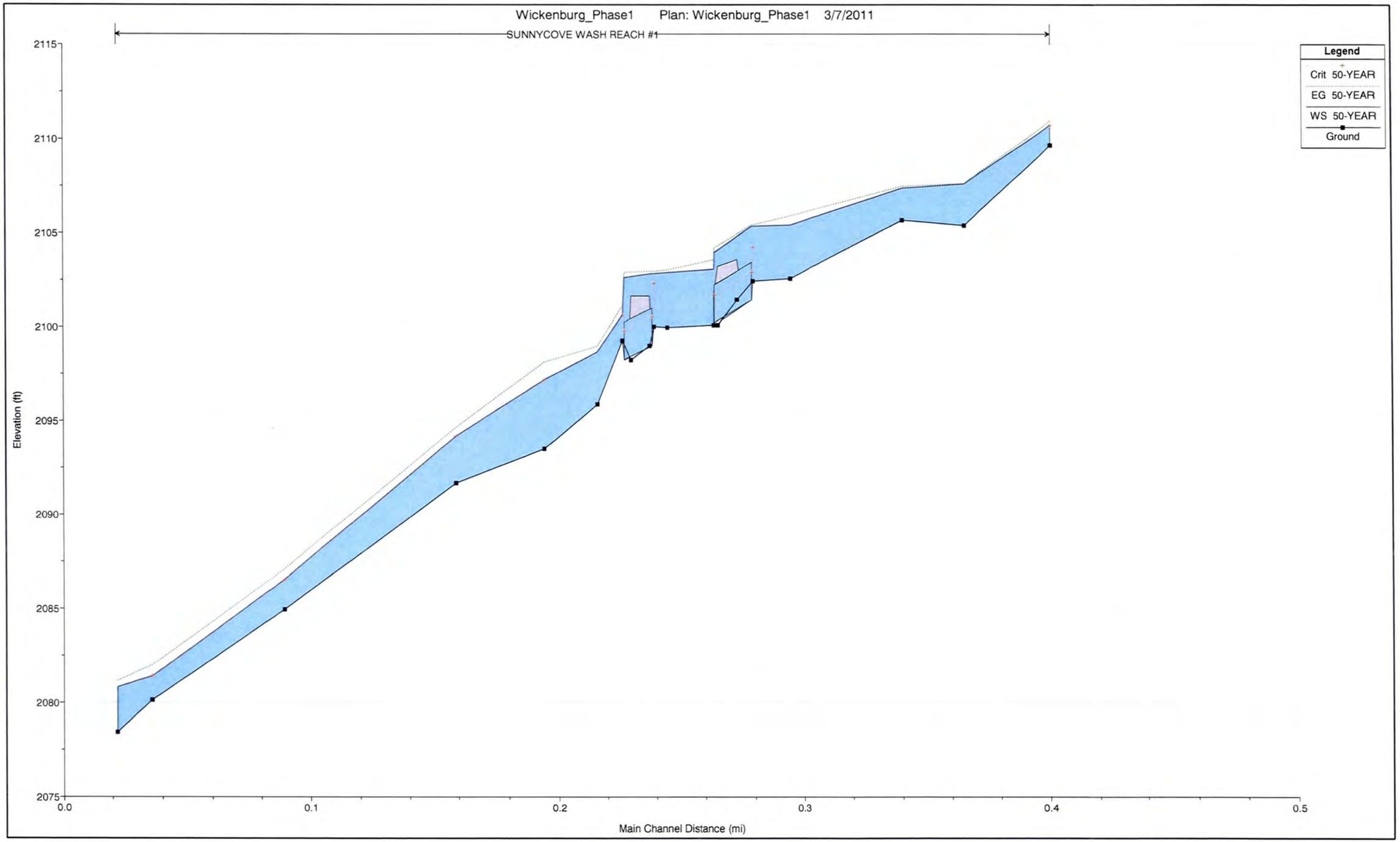

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
SUNNYCOVE WASH REACH #2
Legend
EG 10-YEAR
WS 10-YEAR
Crit 10-YEAR
Ground
Elevation (ft)
2350
2300
2250
2200
2150
2100
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Main Channel Distance (mi)

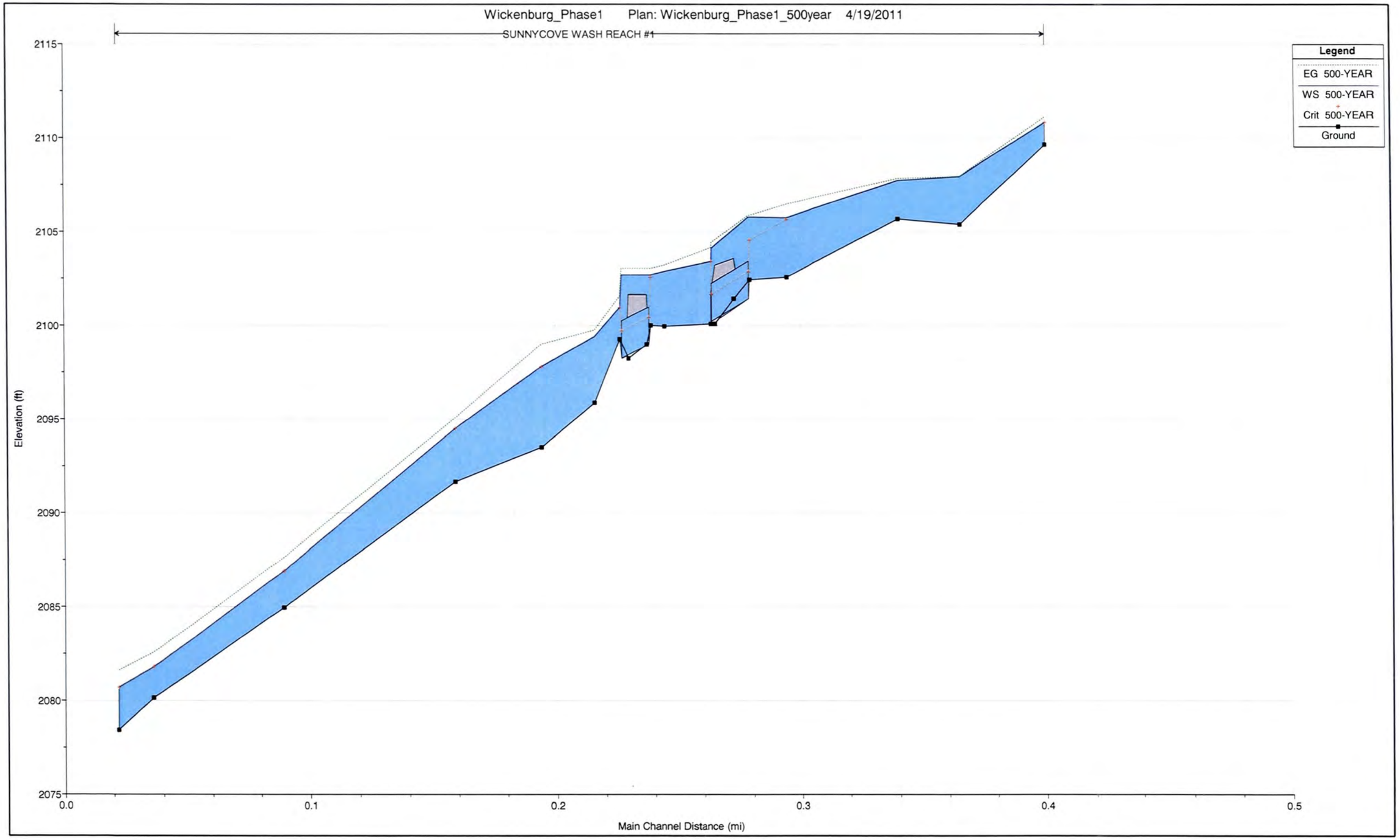

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
SUNNYCOVE WASH REACH #2
Legend
EG 50-YEAR
WS 50-YEAR
Crit 50-YEAR
Ground
Elevation (ft)
2350
2300
2250
2200
2150
2100
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Main Channel Distance (mi)

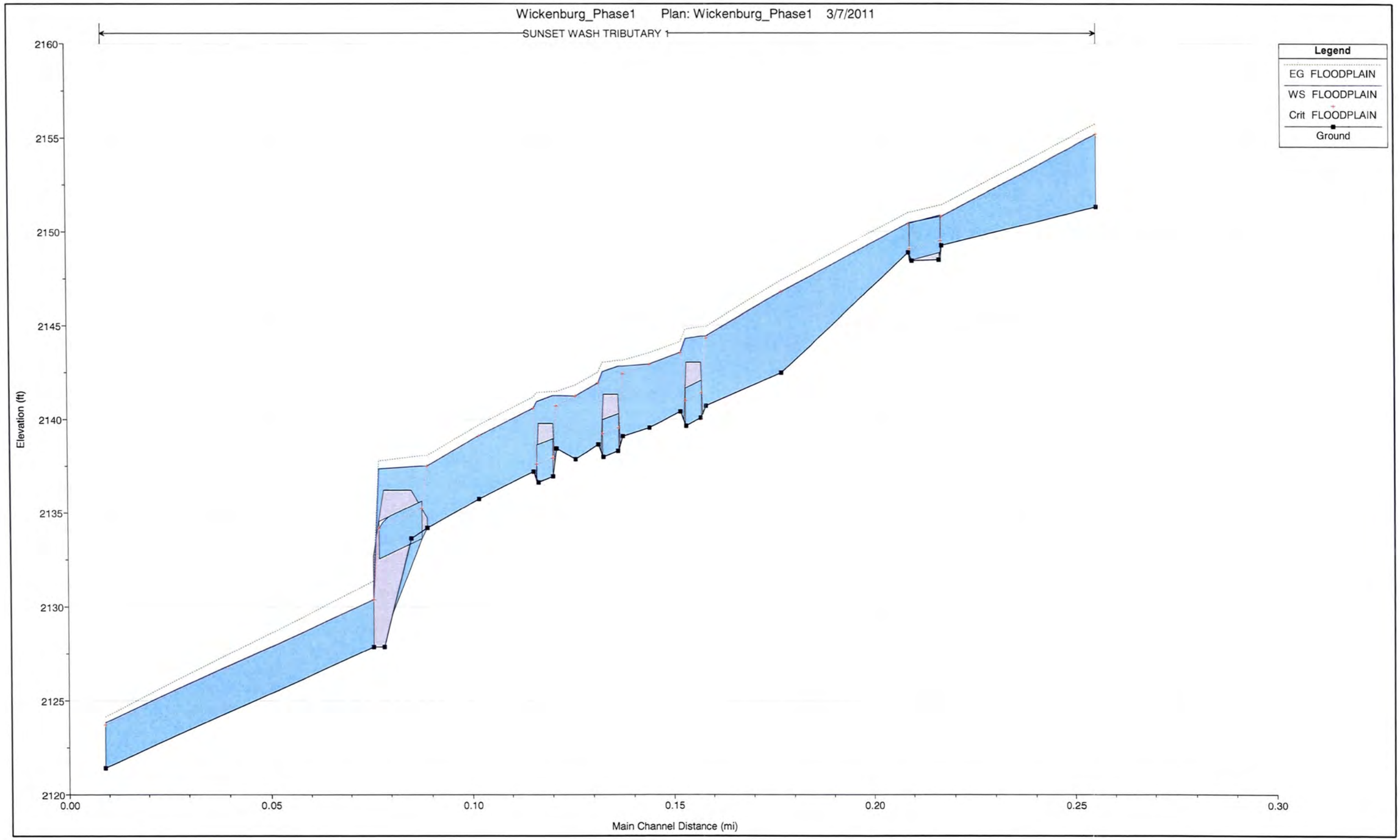

Wickenburg_Phase1 Plan: Wickenburg_Phase1_500year 4/19/2011
SUNNYCOVE WASH REACH #2
Legend
EG 500-YEAR
WS 500-YEAR
Crit 500-YEAR
Ground
Elevation (ft)
2350
2300
2250
2200
2150
2100
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Main Channel Distance (mi)

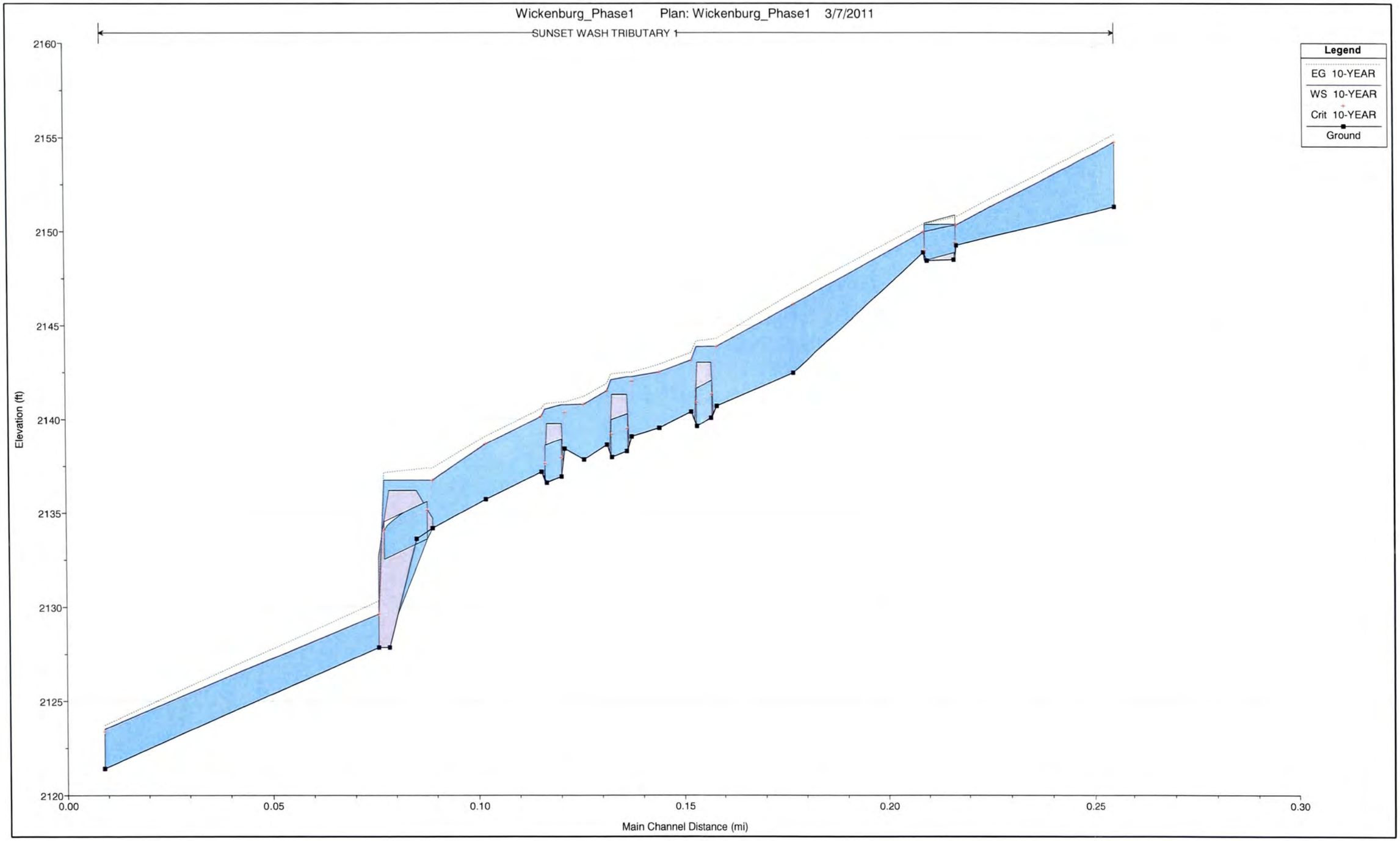

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
SUNNYCOVE WASH REACH #1
Legend
Crit FLOODPLAIN
EG FLOODPLAIN
WS FLOODPLAIN
Ground
Elevation (ft)
2115
2110
2105
2100
2095
2090
2085
2080
2075
0.0
0.1
0.2
0.3
0.4
0.5
Main Channel Distance (mi)

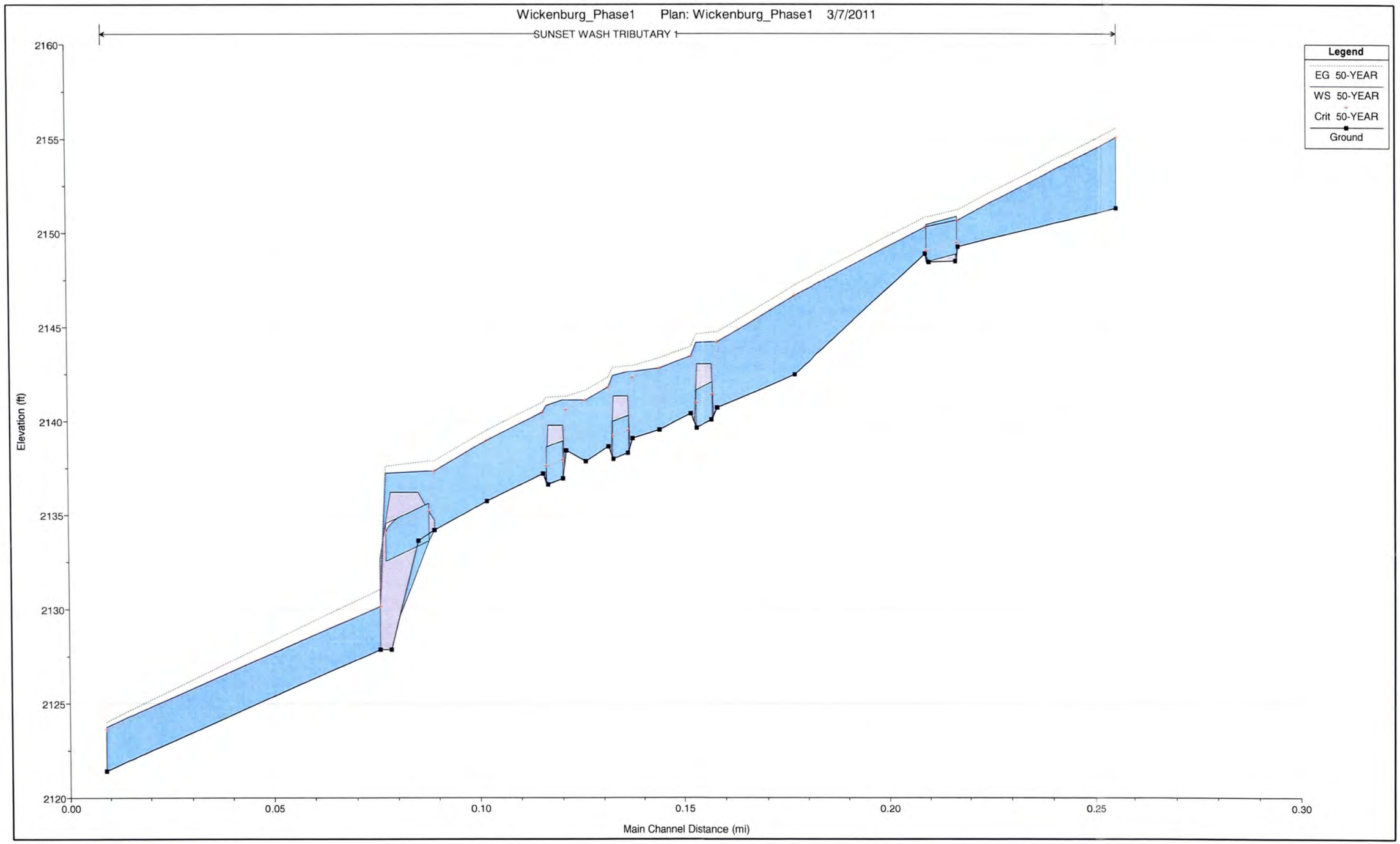

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
SUNNYCOVE WASH REACH #1
Legend
EG 10-YEAR
WS 10-YEAR
Crit 10-YEAR
Ground
Elevation (ft)
2115
2110
2105
2100
2095
2090
2085
2080
2075
0.0
0.1
0.2
0.3
0.4
0.5
Main Channel Distance (mi)

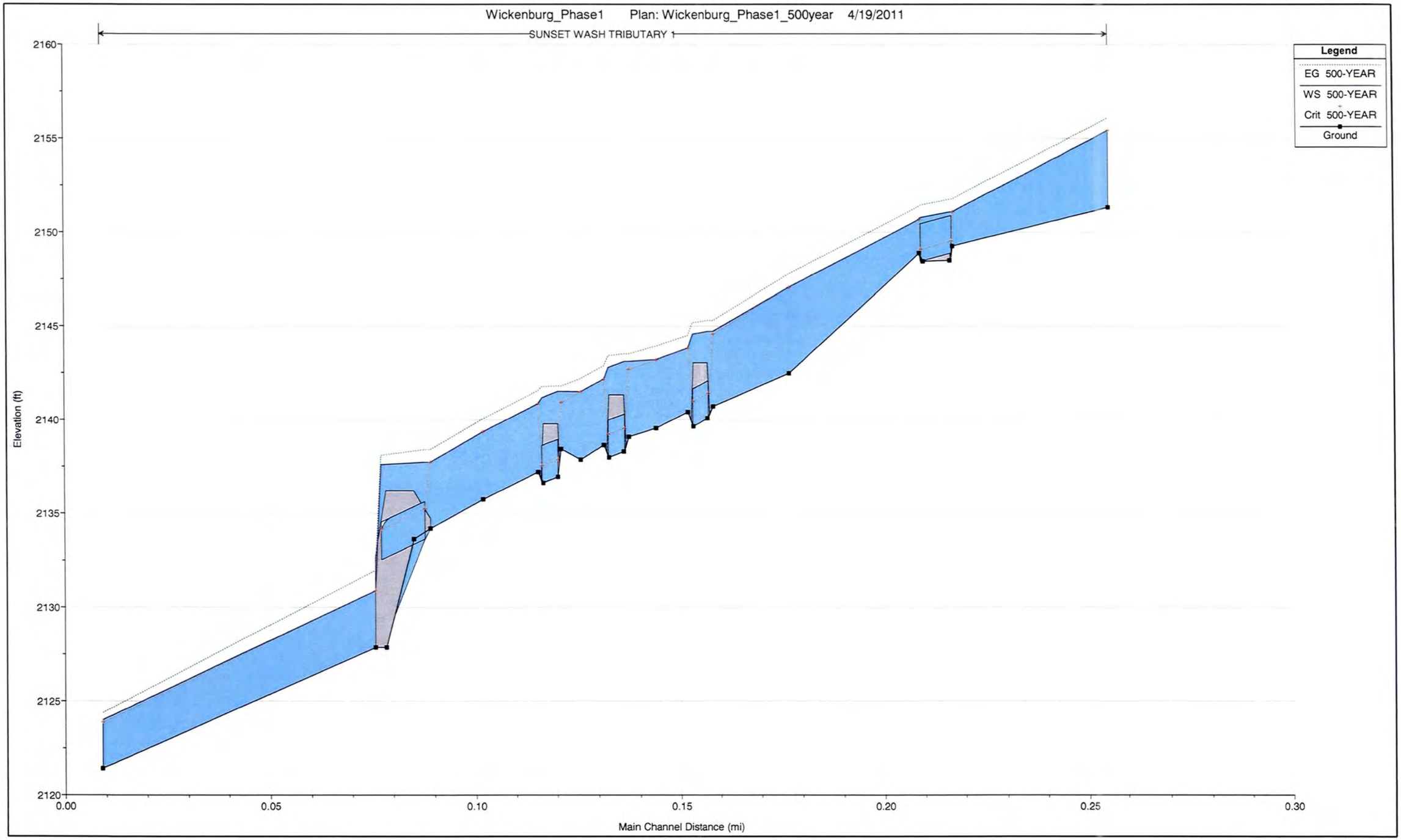

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
SUNNYCOVE WASH REACH #1
Legend
Crit 50-YEAR
EG 50-YEAR
WS 50-YEAR
Ground
Elevation (ft)
2115
2110
2105
2100
2095
2090
2085
2080
2075
0.0
0.1
0.2
0.3
0.4
0.5
Main Channel Distance (mi)

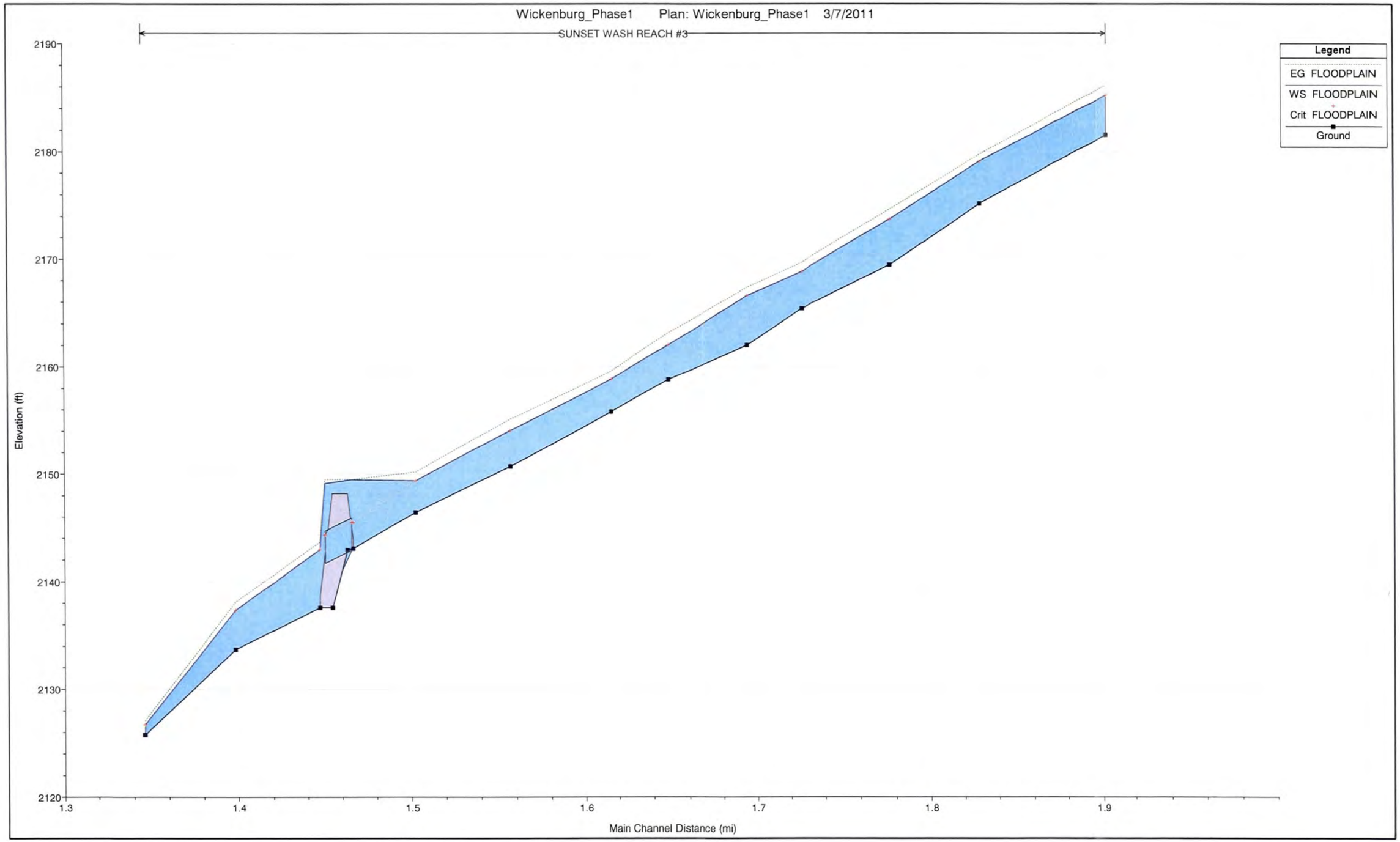

Wickenburg_Phase1 Plan: Wickenburg_Phase1_500year 4/19/2011
SUNNYCOVE WASH REACH #1
Legend
EG 500-YEAR
WS 500-YEAR
Crit 500-YEAR
Ground
Elevation (ft)
2115
2110
2105
2100
2095
2090
2085
2080
2075
0.0
0.1
0.2
0.3
0.4
0.5
Main Channel Distance (mi)

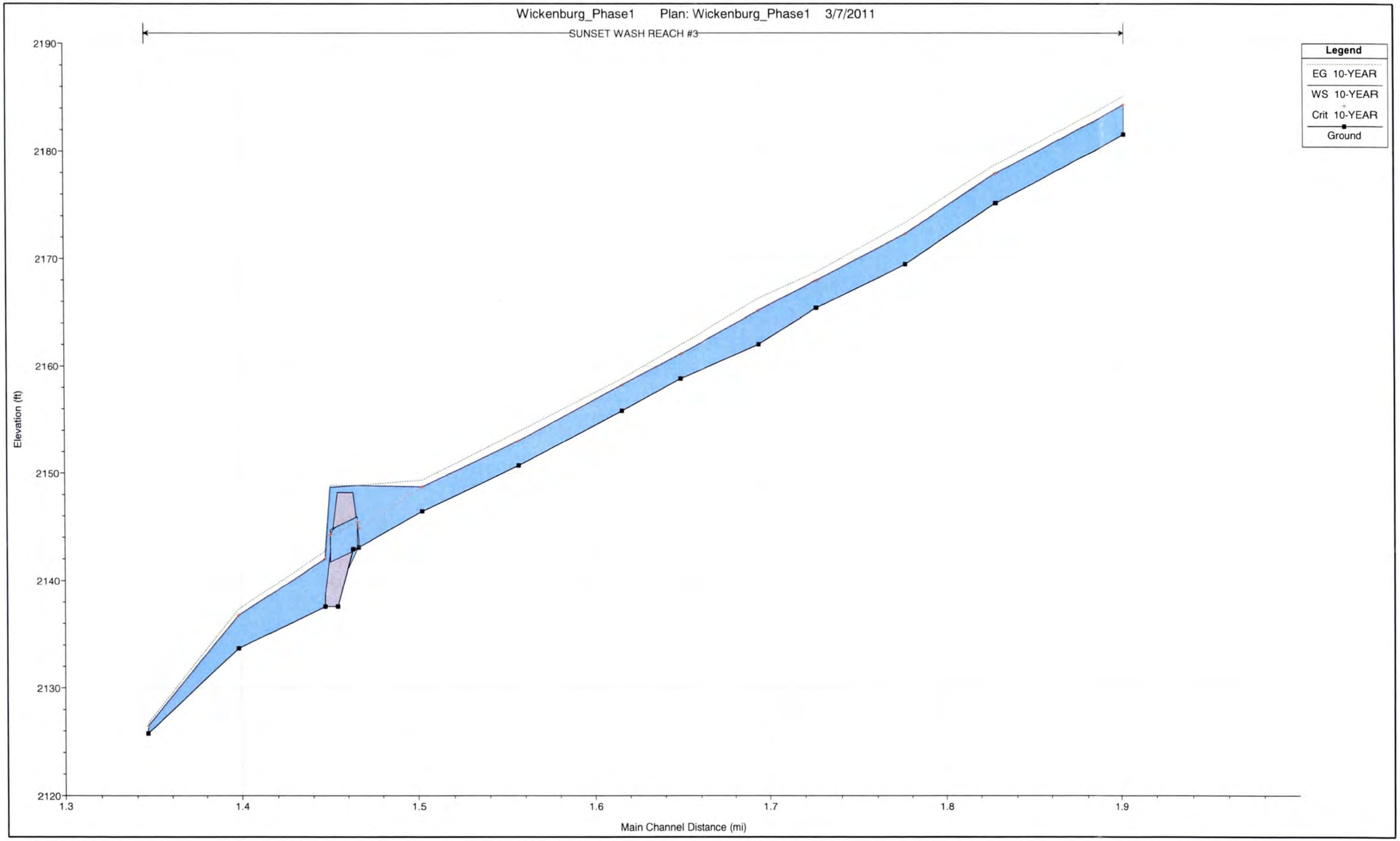

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
SUNSET WASH TRIBUTARY 1
Legend
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Elevation (ft)
2160
2155
2150
2145
2140
2135
2130
2125
2120
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Main Channel Distance (mi)

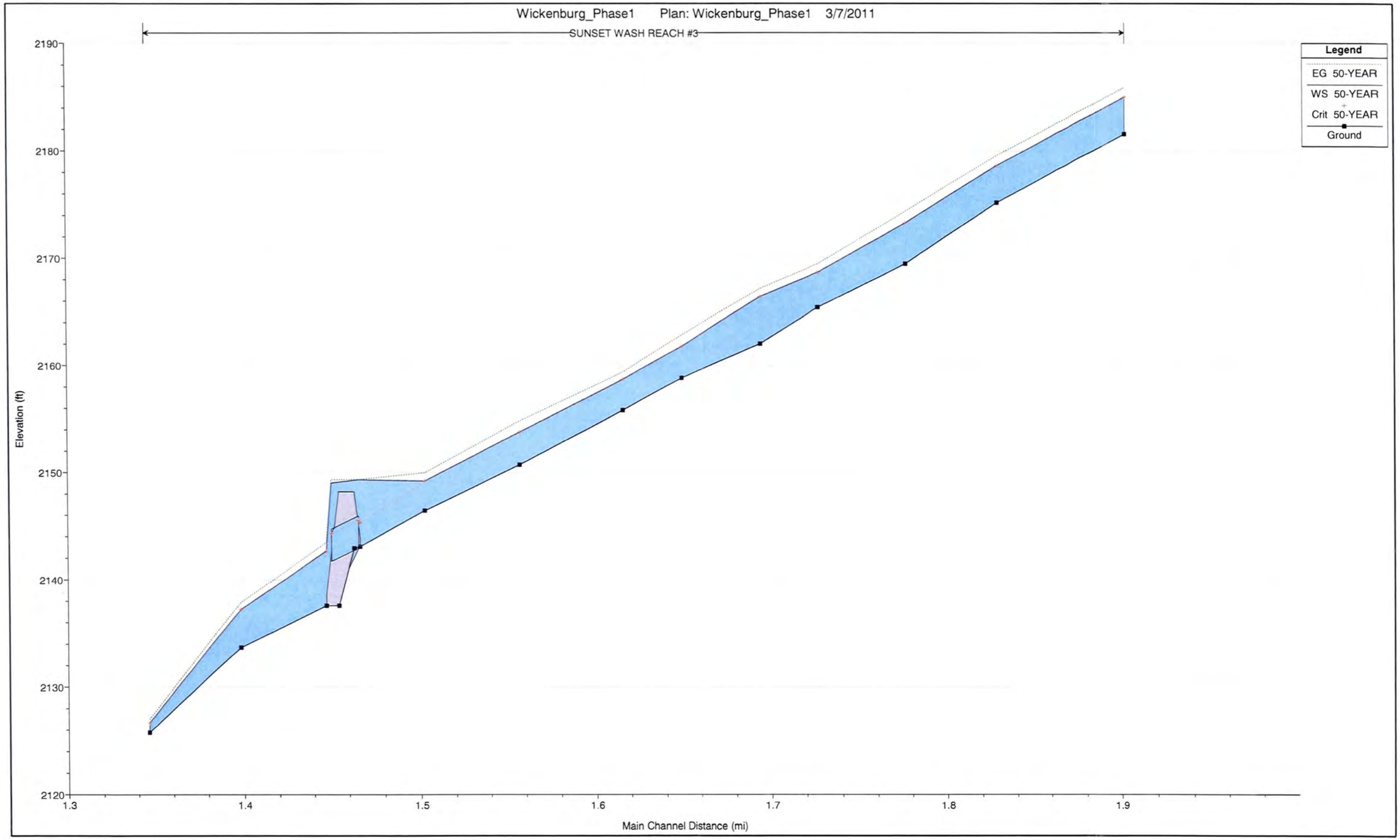

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
SUNSET WASH TRIBUTARY 1
Legend
EG 10-YEAR
WS 10-YEAR
Crit 10-YEAR
Ground
Elevation (ft)
2160
2155
2150
2145
2140
2135
2130
2125
2120
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Main Channel Distance (mi)

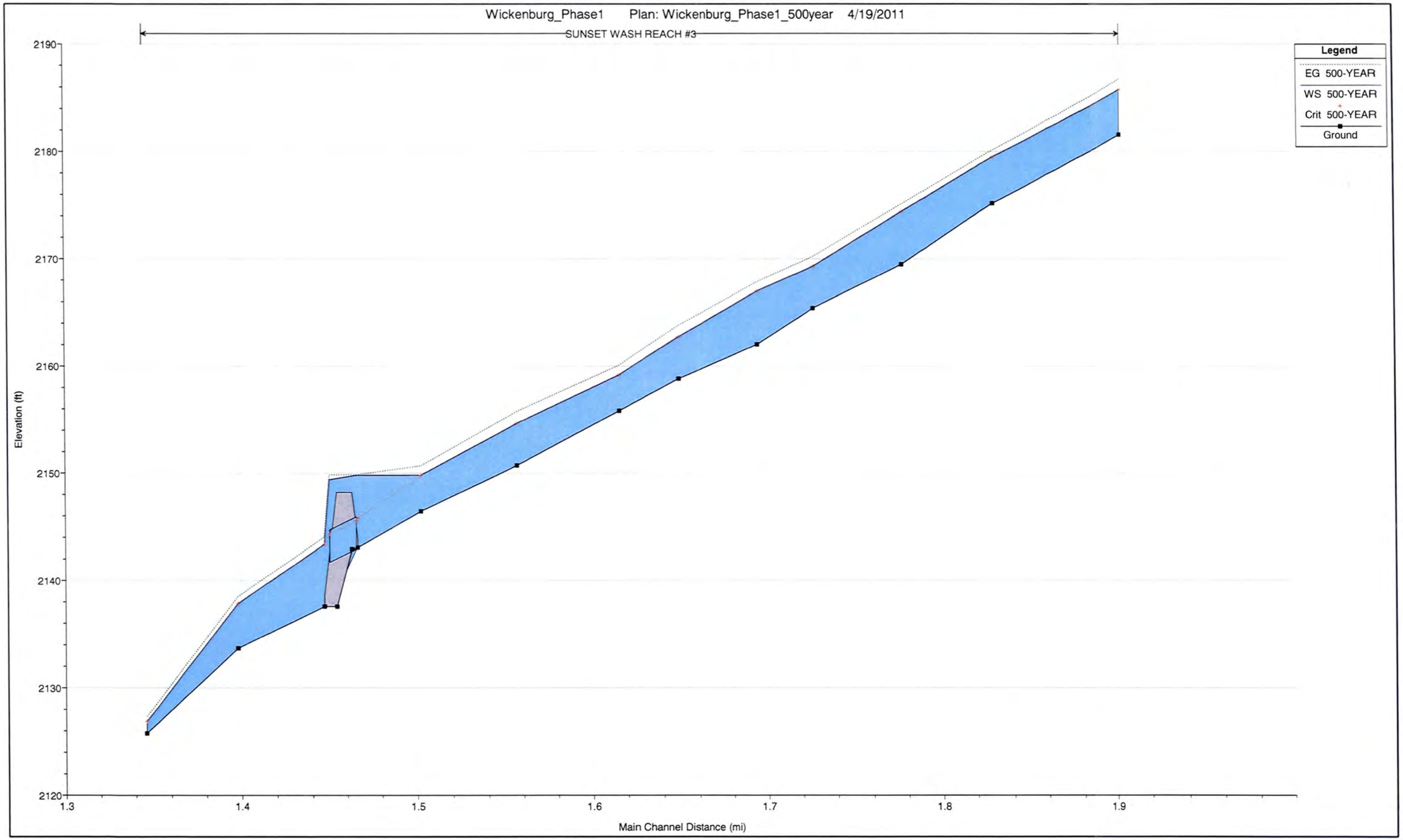

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
SUNSET WASH TRIBUTARY 1
Legend
EG 50-YEAR
WS 50-YEAR
Crit 50-YEAR
Ground
Elevation (ft)
2160
2155
2150
2145
2140
2135
2130
2125
2120
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Main Channel Distance (mi)

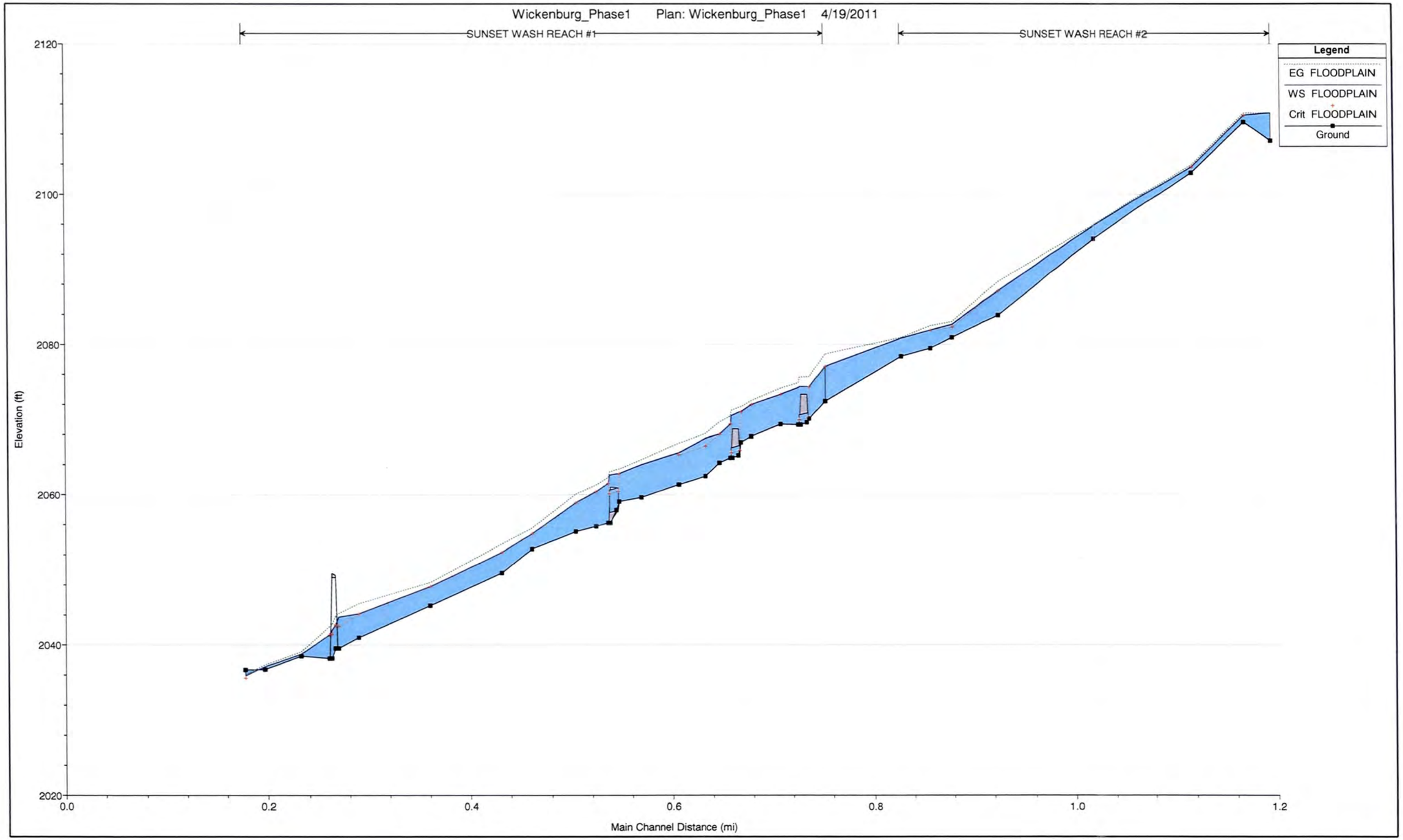

Wickenburg_Phase1 Plan: Wickenburg_Phase1_500year 4/19/2011
SUNSET WASH TRIBUTARY 1
Legend
EG 500-YEAR
WS 500-YEAR
Crit 500-YEAR
Ground
Elevation (ft)
2160
2155
2150
2145
2140
2135
2130
2125
2120
0.00
0.05
0.10
0.15
0.20
0.25
0.30
Main Channel Distance (mi)

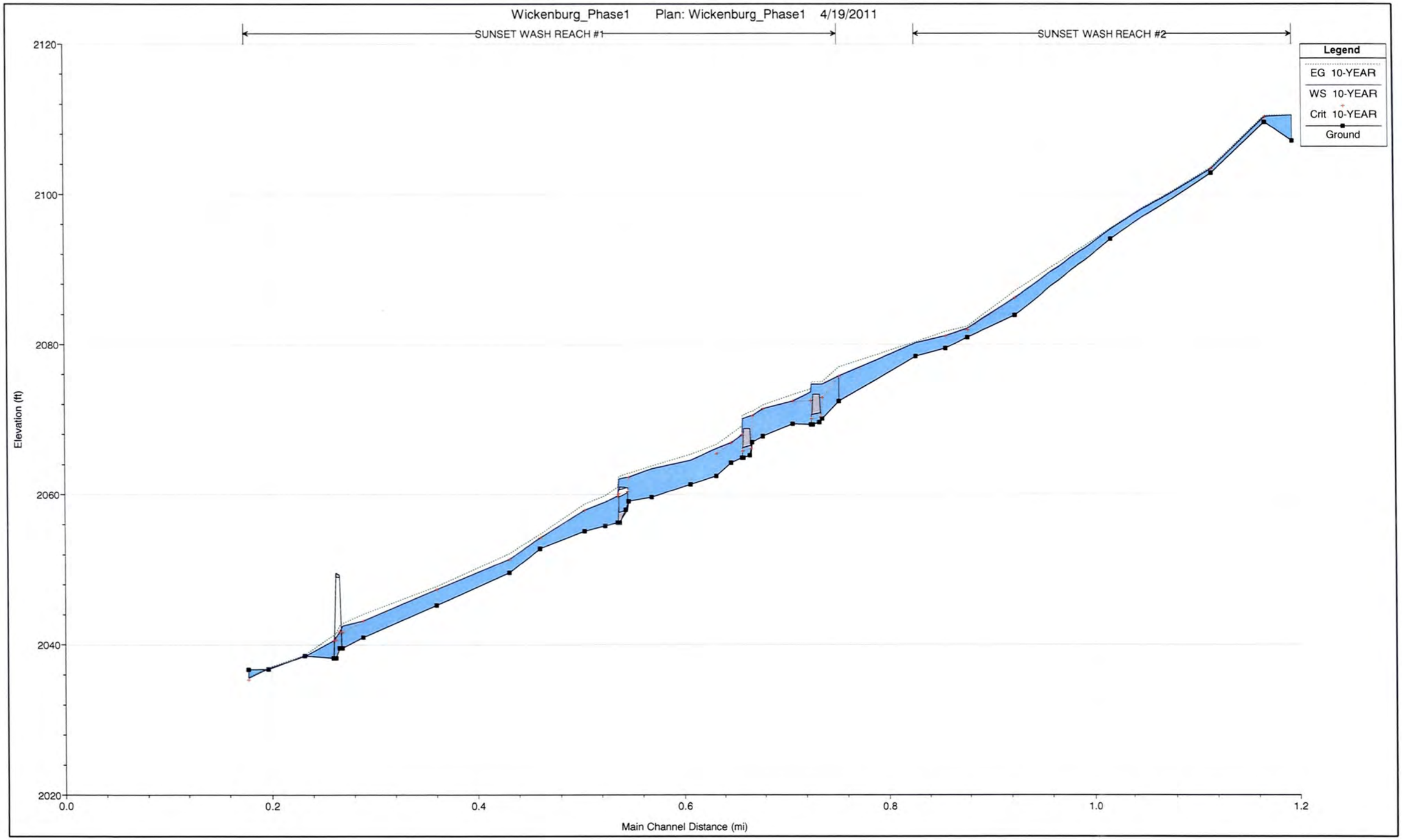

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
SUNSET WASH REACH #3
Legend
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Elevation (ft)
2190
2180
2170
2160
2150
2140
2130
2120
1.3
1.4
1.5
1.6
1.7
1.8
1.9
Main Channel Distance (mi)

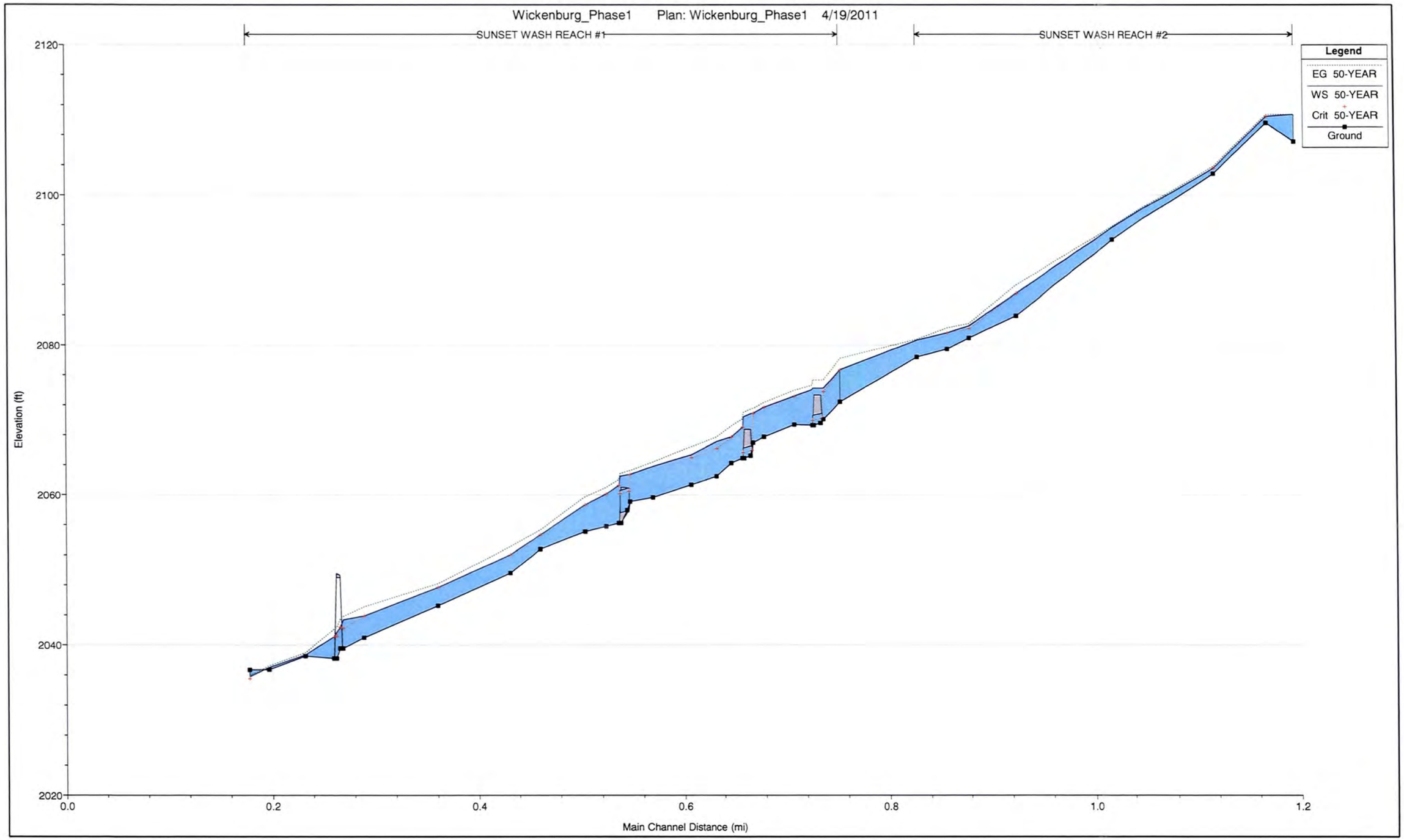

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
SUNSET WASH REACH #3
Legend
EG 10-YEAR
WS 10-YEAR
Crit 10-YEAR
Ground
Elevation (ft)
2190
2180
2170
2160
2150
2140
2130
2120
1.3
1.4
1.5
1.6
1.7
1.8
1.9
Main Channel Distance (mi)

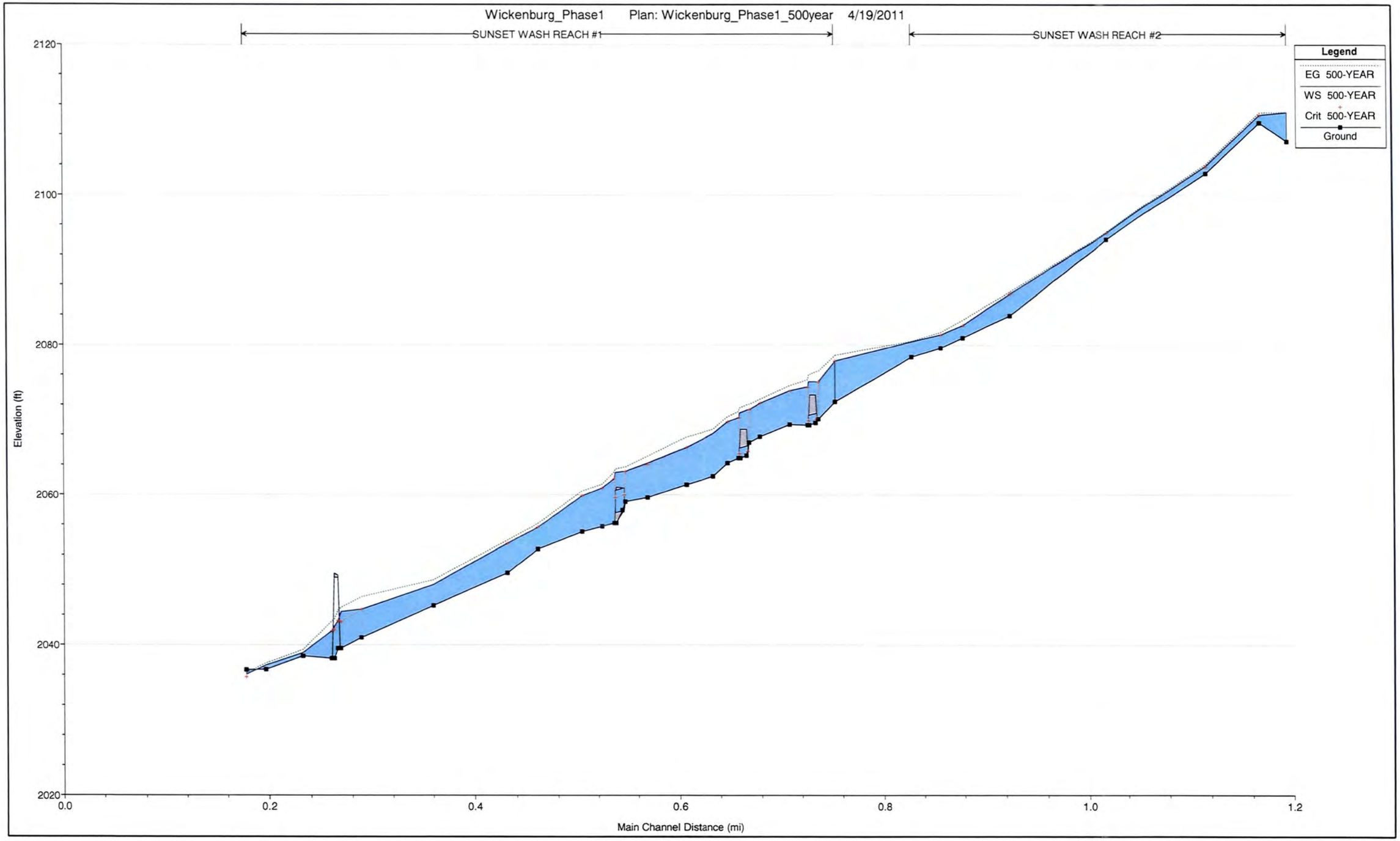

Wickenburg_Phase1 Plan: Wickenburg_Phase1 3/7/2011
SUNSET WASH REACH #3
Legend
EG 50-YEAR
WS 50-YEAR
Crit 50-YEAR
Ground
Elevation (ft)
2190
2180
2170
2160
2150
2140
2130
2120
1.3
1.4
1.5
1.6
1.7
1.8
1.9
Main Channel Distance (mi)


Wickenburg_Phase1 Plan: Wickenburg_Phase1_500year 4/19/2011
SUNSET WASH REACH #3
Legend
EG 500-YEAR
WS 500-YEAR
Crit 500-YEAR
Ground
Elevation (ft)
2190
2180
2170
2160
2150
2140
2130
2120
1.3
1.4
1.5
1.6
1.7
1.8
1.9
Main Channel Distance (mi)


Wickenburg_Phase1 Plan: Wickenburg_Phase1 4/19/2011
SUNSET WASH REACH #1
SUNSET WASH REACH #2
Legend
EG FLOODPLAIN
WS FLOODPLAIN
Crit FLOODPLAIN
Ground
Elevation (ft)
2120
2100
2080
2060
2040
2020
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Main Channel Distance (mi)


Wickenburg_Phase1 Plan: Wickenburg_Phase1 4/19/2011
SUNSET WASH REACH #1
SUNSET WASH REACH #2
Legend
EG 10-YEAR
WS 10-YEAR
Crit 10-YEAR
Ground
Elevation (ft)
2120
2100
2080
2060
2040
2020
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Main Channel Distance (mi)


Wickenburg_Phase1 Plan: Wickenburg_Phase1 4/19/2011
SUNSET WASH REACH #1
SUNSET WASH REACH #2
Legend
EG 50-YEAR
WS 50-YEAR
Crit 50-YEAR
Ground
Elevation (ft)
2120
2100
2080
2060
2040
2020
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Main Channel Distance (mi)


Wickenburg_Phase1 Plan: Wickenburg_Phase1_500year 4/19/2011
SUNSET WASH REACH #1
SUNSET WASH REACH #2
Legend
EG 500-YEAR
WS 500-YEAR
Crit 500-YEAR
Ground
Elevation (ft)
2120
2100
2080
2060
2040
2020
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Main Channel Distance (mi)

E.5.6 MODELING WARNING AND ERROR MESSAGES

HEC-RAS

The following types of warning messages are encountered for the steady flow HEC-RAS model. Discussions regarding the messages are also provided.

1. Message: The conveyance ratio is higher than 1.4 or less than 0.7, which may indicate the need for additional Cross-Sections.
   Response: The distance between 2 neighboring Cross-Sections in the HEC-RAS model is generally less than 500 feet. Cross-Sections are located where channel geometry (including slope, n value etc.) changes. It is believed that no additional Cross-Sections are necessary.

2. Message: The Cross-Section end points had to be extended vertically for the computed water surface.
   Response: This occurs at the flow split locations. Therefore, the WSE is generally higher than the Cross-Section end points. No changes are necessary.

3. Message: The velocity head has changed by more than 0.5 feet. This may indicate the need for additional Cross-Sections.
   Response: As discussed above, no additional Cross-Sections are necessary.

4. Message: The energy loss was greater than 1.0 foot between the current and previous cross section. This may indicate the need for additional cross sections.
   Response: As discussed above, no additional Cross-Sections are necessary.

5. Message: 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.
   Response: At some Cross-Sections with dramatic changes in geometry or discharge, the flow profile changes, e.g. from M2 to S2. It is okay to set critical depth at these locations.

6. Message: 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.
   Response: As discussed on Item #5 above, it is okay to set critical depth at these locations.

7. Message: Divided flow computed for this Cross-Section.
   Response: Divided flows, wherever they occur, are due to the braided channel nature of the wash.

8. Message: River: Sunnycove Wash - Reach 1, RS: 0.233 (Culvert): During subcritical analysis, while trying to calculate culvert and weir flow, the program could not get a balance of energy

within the specified tolerance and number of trials. The program used the solution with the minimum error.
Response: Since this occurs where the flow split occurs, and the bounding Cross-Sections have dramatic changes in geometry. It is difficult to balance the energy. It is okay to set the solution with the minimum error.

9. Message: During the culvert inlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.
Response: Since the culverts don't have enough capacity to convey the flow, water will back up and overtop the culverts, causing this warning error. As a result, it becomes difficult to balance the energy. It is okay if this warning is present.

10. Message: During the culvert outlet control computations, the program could not balance the culvert/weir flow. The reported inlet energy grade answer may not be valid.
Response: As discussed on Item #9 above, it is okay if the warning is present.

11. Message: The Cross-Section had to be extended vertically during the critical depth calculations.
Response: This occurs in Profile 2, which is used for the floodway run. Encroachment Method #1 is used. Therefore, it is okay to extend the Cross-Sections vertically during the critical depth calculations.

12. Message: The parabolic search method failed to converge on critical depth. The program will try the Cross-Section slice/secant method to find critical depth.
Response: This occurs in Profile 2, which is used for the floodway run. Encroachment Method #1 is used. Therefore, it is okay if the program uses the slice/secant method to find the critical depth.

13. Message: Critical depth could not be determined with the specified number of iterations. The program used the iteration with the lowest energy.
Response: This occurs in Profile 2, which is used for the floodway run. Encroachment Method #1 is used. Therefore, it is okay if the program uses the iteration with the lowest energy.

14. Message: River: Sunnycove Wash - Reach 2, RS: 0.642 & River: Sunset Wash - Reach 3, RS 1.346: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth). Water surface set to critical depth.
Response: These Cross-Sections are within the Sunnycove FRS and Sunset FRS, respectively. As a result, the 100-year, 6-hour flood pool level elevations supersede the wash critical depth elevations. Therefore, it is okay to set critical depth at this locations.

15. Message: During subcritical analysis, the water surface upstream of culvert went to critical depth.
    Response: Since the bounding Cross-Sections have dramatic changes in geometry. It is difficult to balance the energy. It is okay to set the solution at critical depth.

16. Message: River: Sunset Wash - Reach 1, RS: 0.264 (Bridge): Pier drag coefficient of 2.0 assumed for Class B flow.
    Response: As specified in Chapter 5 of the HEC-RAS Reference Manual, the drag coefficient for square edge piers is 2.00. Therefore, it is okay is to use this coefficient.

17. Message: River: Sunset Wash - Tributary 1, RS: 0.213 (Culvert): During subcritical analysis, with the exit loss set = 1.0, the projected WSEL in culvert has a lower energy than the downstream energy. Most likely, the downstream Cross-Section blocks part of the culvert or the ineffective area is set too far out. Instead of projecting the WSEL, the program did an energy balance to get the WSEL inside the culvert at the downstream end.
    Response: The downstream Cross-Section does block part of the culvert. In addition, the majority of the flow gets on the adjacent street which could cause the lower energy within the culvert. As a result, it is okay for the energy balance to occur.

CHECK-RAS NT

The following warning messages were generated by CHECK-RAS NT, and they are addressed below.

1. Message: River: Sunset Wash - Reach 2, RS: 0.858: Right overbank n value is less than 0.035. The n value for overbank is usually larger than 0.035. The n values should be reevaluated.
   Response: The right overbank n values is set at 0.03 because obstructions have been placed at this Cross-Section.

2. Message: River: Sunset Wash - Reach 2, RS: 0.858: Left overbank n value is less than 0.035. The n value for overbank is usually larger than 0.035. The n values should be reevaluated.
   Response: The right overbank n values is set at 0.03 because obstructions have been placed at this Cross-Section.

3. Message: Channel n value is equal to or less than 0.025. The n value of the channel is usually larger than 0.025. The n value should be reevaluated it if is not representing a concrete lined channel.
   Response: Since the washes continue within the street section, the n-values are equal to or less than 0.025 represent the asphalt road section.

4. Message: The channel n value of 0.036 for the upstream internal bridge opening section is equal or larger than the channel n value of 0.036 at Section 3. Usually, the channel n value of the bridge opening section is less than the channel n value of section 3. The selection of the n value(s) should be reevaluated.
   Response: The n value of 0.036 for the internal bridge opening section is okay because it represents the vegetation that is currently present.

5. Message: The channel n value of 0.036 for the downstream internal bridge opening section is equal or larger than the channel n value of 0.036 at Section 3. Usually, the channel n value of the bridge opening section is less than the channel n value of section 3. The selection of the n value(s) should be reevaluated.
   Response: The n value of 0.036 for the internal bridge opening section is okay because it represents the vegetation that is currently present.

CHECK-RAS XS

The following warning messages were generated by CHECK-RAS XS, and they are addressed below.

1. Message: Left levee option is used at this river station. Please investigate whether the NFIP requirements for levees are met.
   Response: The levee option is used to encroach the wash cross section because the Cross-Section depicts areas which don't convey any runoff. Therefore, removing the levee is not necessary.

2. Message: Right levee option is used at this river station. Please investigate whether the NFIP requirements for levees are met.
   Response: Refer to response for Item #1 above.

3. Message: Discharge is different between the upstream side and downstream side of the structure.
   Response: As flow increases downstream, the flow increases coincidently just downstream of the culvert.

4. Message: There is no flow on the right overbank at the downstream cross section. There is no flow on the left overbank at this section.
   Response: It is okay if there is no flow on the left and right overbanks. The bank stations where chosen based on the amount of vegetation present.

5. Message: Constant discharge used for the Sunset Wash - Reach 3.
   Response: Since this discharge within this wash is pro-rated, it was decided by the District to use a constant discharge.

6. Message: Constant discharge used for the Sunset Wash - Tributary 1.
   Response: Refer to response for Item #5 above.

7. Message: This Cross-Section is located too far upstream from the critical depth Cross-Section.
   Response: The distance between 2 neighboring Cross-Sections in the HEC-RAS model is generally less than 500 feet. Cross-Sections are located where channel geometry (including slope, n value etc.) changes. It is believed that no additional Cross-Sections are necessary.

8. Message: Junction option is used. For flood insurance study, this option should be used if the tributary and main stream can have coincident peaks, or it may be used for the stream without floodway. It may also be used if the discharges at different time periods are known from rainfall-runoff models.
   Response: Both (Sunset Wash - Reach 2 and Sunnycove Wash - Reach 1) have coincident peaks. Therefore, the junction option is okay.

CHECK-RAS Structure

The following warning messages were generated by CHECK-RAS Structure, and they are addressed below.

1. Message: RS 3.1: The starting station of 9690 from upstream road/weir data is greater than the starting station of 9689.18 from upstream internal section / section 3. The high chord elevation of 2340.46 for the starting road/weir station is greater than the ground elevation of 2337 for the same ground station. The road/weir Profile may need to be extended.
   Response: The deck/roadway data is from the existing contours at Culvert RS 0.269. The upstream/downstream internal sections are defaulted to the upstream /downstream Cross-Sections (RS 3.105 and 3.091). Since the Cross-Sections are wide, it is okay to leave the road/weir Profile as is because it does not affect any of the calculations. Also, the roadway elevations are always higher than the ground elevation at the same ground stations. This is a typical comment for many of the culverts. Therefore, it is okay to keep these settings for all culverts.

2. Message: RS 0.269: The end station of 10124.46 from downstream road/weir data is less than the end station of 10131.75 from downstream internal section. The high chord elevation of 2118.15

for the end road/weir station is greater than the ground elevation of 2116.164 for the same ground station. The road/weir Profile may be extended.
Response: Refer to response for Item #1 above.

3. Message: RS 0.269: The channel distance of 1.010002 at downstream internal section is less than height of the culvert opening of 2. Section 2 should be placed at the foot of the road embankment or wing walls. Distances at sections 2, 3 & 4 should be adjusted.
Response: If section 2 is moved further downstream, the head loss between the cross sections will be less. Currently, the head loss between the cross sections is low. Therefore, there is no need to move any cross sections. This is a typical comment for many of the culverts. Therefore, there is no need to move any cross sections for any of the culverts.

4. Message: RS 0.269 This is a culvert: Encroachment method was not specified at this river station. For flood insurance studies, encroachment method 4 and 1 should be used.
Response: Encroachment Method #1 is used for all of the Cross-Sections. This method does not allow to encroach within the culverts. Therefore, no change is required. This is a typical comment for many of the culverts. Therefore, it is okay to keep these settings for all culverts.

5. Message: RS 0.269 This is a culvert: The right most weir station of 10000.33 for the floodway profile is equal or greater than the right most weir station of 9988.22 for the natural profile. The floodway weir flow boundary is equal to or outside of the natural profile weir flow boundary. Encroachment computations should be investigated.
Response: Since the road slopes to the north, the flow weirs over the left overbank. The encroachment stations are set to be along the bank stations to keep the flow within the wash section. Therefore, no change is required.

6. Message: RS 0.279: The left station effective of 9976.23 for the natural profile is less than the left channel bank station of 9986.61. The left encroachment station is outside the channel. The left encroachment station of 9968 is less than the left station effective of 9976.23 for the natural profile. The left encroachment station should be adjusted.
Response: If the encroachment station is adjusted to station 9986.61, the change in WSE becomes more than 1.00-foot. After many iterations, the encroachment station of 9968 is optimal. This could be due to the flow split at the downstream culvert.

7. Message: RS 0.239 This is section 3: Weir flow occurs at Culvert Group 1. However, the ineffective flow elevation of 2103 between stations 9787.97 and 9920.84 is equal to or greater than the WSEL of 2102.85. The LMnTpRdU is 2101.65. The ineffective flow elevation should be equal to or lower than the MnTpRd. It should also be less than the WSEL.

Response: If the ineffective flow elevation is greater than either LMnTpRdD or the MXLoCdD, it does not affect the WSEL. It is okay to keep these settings.

8. Message: RS 0.226: This is section 2. Weir flow occurs at Culvert Group 1. However, the ineffective flow elevation of 2103 between stations 9782.57 and 9915.54 is equal to or greater than the WSEL of 2100.74. The LMnTpRdD is 2101.65 and the MXLoCdD is 2100.27. The ineffective flow elevation should be between the LMnTpRdD and the MXLoCdD If LMnTpRdD is greater than MXLoCdD. Otherwise, it should be equal to LMnTpRdD. It should also be less than the WSEL.
   Response: If the ineffective flow elevation is greater than either LMnTpRdD or the MXLoCdD, it does not affect the WSEL. It is okay to keep these settings.

9. Message: RS 0.226: This is section 2. Left encroachment station 9970 is more than the left ineffective flow station 9915.54 and equal to or greater than the right ineffective flow station. The effective flow is totally blocked by the encroachment stations. the encroachment stations should be adjusted.
   Response: There is no right ineffective flow stations at this Cross-Section. The encroachment stations are placed at the bank stations in which there is no effective flow area being blocked. No adjustments are required.

10. Message: RS 0.239: This is section 3. Left encroachment station 9975 is more than the left ineffective flow station 9920.84 and equal to or greater than the right ineffective flow station. The effective flow is totally blocked by the encroachment stations. the encroachment stations should be adjusted.
    Response: Refer to response for Item #9 above.

11. Message: RS 3.1 This is a culvert: The left most weir station of 9945.67 for the floodway profile is equal or less than the left most weir station of 9946.55 for the natural profile. The floodway weir flow boundary is equal to or outside of the natural profile weir flow boundary. Encroachment computations should be investigated.
    Response: The encroachment stations are set at the bank stations of the culvert bounding Cross-Sections to keep the flow within the wash section. Therefore, no change is required.

12. Message: RS 0.753 This is section 4: Ineffective flow option was considered at this section. However, it should be a fully expanded Cross-Section. Ineffective flow stations and elevations should be cleared from this section, unless the areas beyond the ineffective flow stations are not within the flow path of the stream. This message should be ignored if this section is Section 2 of the upstream Cross-Section.

Response: The ineffective flow area is used because the left overbank area has many obstructions and water is not effectively flowing through this area.

13. Message: RS 0.289 This is section 4: Ineffective flow option was considered at this section. However, it should be a fully expanded Cross-Section. Ineffective flow stations and elevations should be cleared from this section, unless the areas beyond the ineffective flow stations are not within the flow path of the stream. This message should be ignored if this section is Section 2 of the upstream Cross-Section.
    Response: The ineffective flow area is used because the overbank areas have many obstructions and water is not effectively flowing through this area.

14. Message: RS 0.26: This is section 2. The left encroachment station 9968 is greater than the left bank station of 9962.53. The left encroachment station is within the channel. The encroachment station and /or channel bank station should be reevaluated.
    Response: The bank stations are set based on vegetation. Since the WSE doesn't spread beyond the bank stations, the encroachment stations are placed within the channel. No adjustments are required.

15. Message: RS 0.26: This is section 2. The right encroachment station of 10032 is less than the right bank station of 10040.34. The encroachment station and /or channel bank station should be reevaluated.
    Response: Refer to response for Item #14 above.

16. Message: RS 0.26: This is section 2. Left encroachment station 9968 is more than the left ineffective flow station 9960.54 and less than the right ineffective flow station 10040.34. Left encroachment station is within the effective flow area. Left encroachment station should at least be equal to the left ineffective flow station.
    Response: The left encroachment station is set at the WSE. No adjustments are required. Also, refer to response for Item #14 above.

17. Message: RS 0.26: This is section 2. Right encroachment station 10032 is less than the right ineffective flow station 10040.34 and greater than the left ineffective flow station 9960.54. Right encroachment station is within the effective flow area. Right encroachment station should at least be equal to the right ineffective flow station.
    Response: The right encroachment station is set at the WSE. No adjustments are required. Also, refer to response for Item #14 above.

18. Message: RS 0.269: This is section 3. The right encroachment station 10036.35 is less than the right bank station of 10038.33. The right encroachment station is within the channel. The encroachment station and/or channel bank station should be reevaluated.
    Response: Refer to response for Item #14 above.

19. Message: RS 0.218: This is section 3. Weir flow occurs at Culvert Group 1. The velocity head at section 3 is more than 0.5 foot and more than the velocity head at section 4. Section 3 should be recoded to represent the natural valley Cross-Section.
    Response: Section 3 already depicts the natural Cross-Section. As a result, no adjustments are required. This is a comment for other Cross-Sections. Therefore, it is okay to keep the existing settings for all Cross-Sections.

CHECK-RAS Floodway

The following warning messages were generated by CHECK-RAS Floodway, and they are addressed below.

1. Message: RS 0.269 This is a culvert: Floodway encroachment method is not selected at this section.
   Response: Encroachment Method #1 is used for all of the Cross-Sections. This method does not allow to encroach within the culverts. Therefore, no change is required. This is a typical comment for many of the culverts. Therefore, it is okay to keep these settings for all culverts.

2. Message: River: Sunset Wash - Tributary 1, RS 1.902: Floodway encroachment method is not selected at this section.
   Response: No floodway is performed on Sunset Wash - Tributary 1 and Sunset Wash - Reach 3. This is a typical comment for all Cross-Sections within these two washes. Therefore, no changes are required.

3. Message: RS 1.902: The left and right bank stations may not be at the proper location.
   Response: The bank stations are set based on vegetation. This is a typical comment for most of the Cross-Sections. Therefore, no changes are required.

4. Message: RS 0.828: Left encroachment station 9988 is more than the left channel bank station 9985.52 and less than the right channel bank station 10018.44. Left encroachment station is within the channel. The encroachment station or channel bank station should be adjusted.
   Response: The left encroachment station is set at roadway width. As a result, no adjustments are required.

5. Message: RS 0.828: Right encroachment station 10015.2 is less than the right channel bank station 10018.44 and greater than the left channel bank station 9985.52. Right encroachment station is within the channel. The encroachment station or channel bank station should be adjusted.
   Response: The right encroachment station is set at roadway width. As a result, no adjustments are required.

6. Message: RS 0.753: Left station effective of 9985.58 for the floodway profile is more than the left channel bank station of 9984.73. The left side of the floodway boundary is within the channel. the left encroachment station of 9935 is less than the left channel bank station. The left encroachment station should be the same as the left channel bank station.
   Response: The left encroachment station is set left side of the roadway width. This is to keep a consistent encroachment station within the bounding Cross-Sections. As a result, no adjustments are required.

Appendix F: Erosion and Sediment Transportation Supporting Documentation

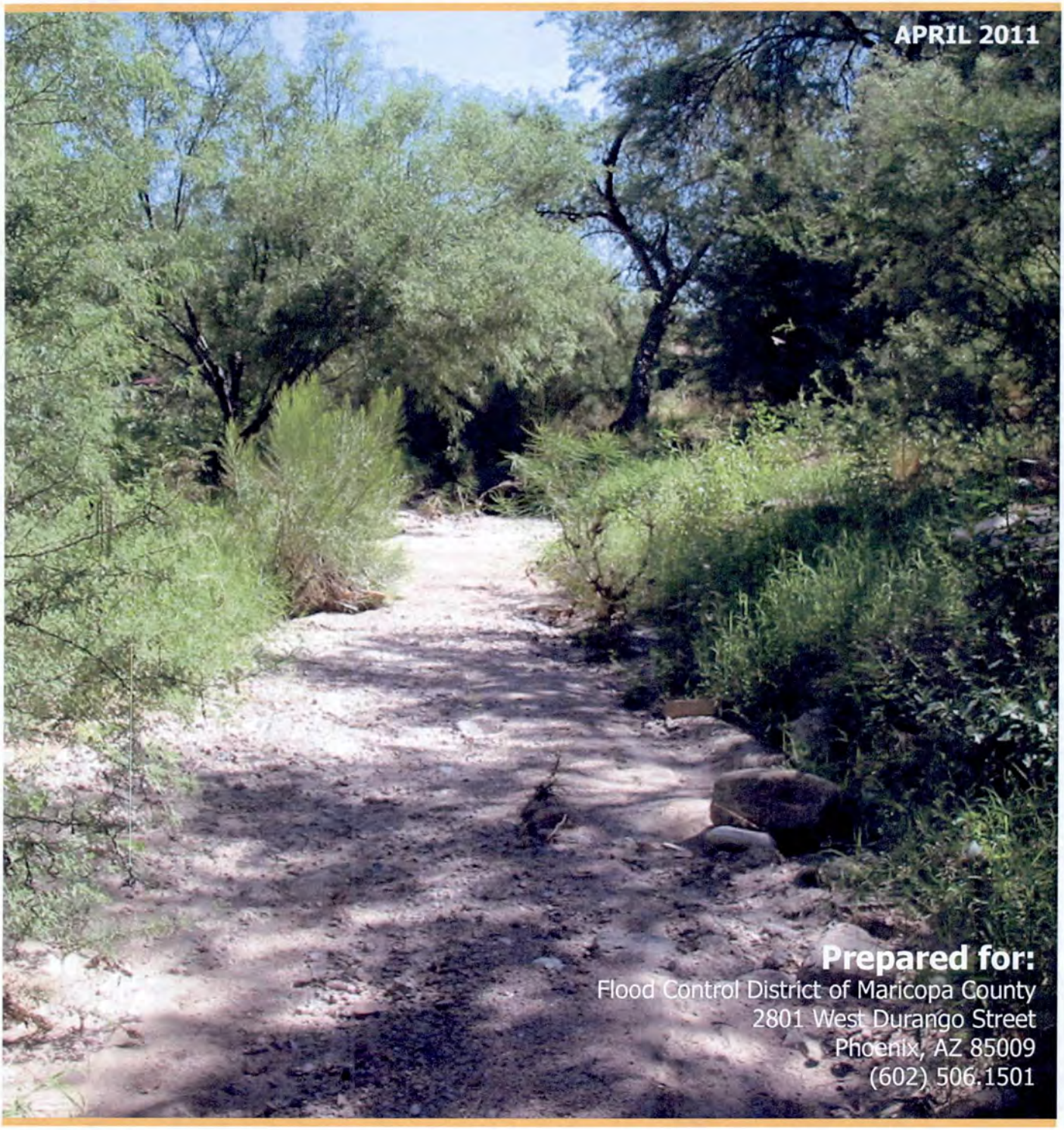
Note: Erosion and Sediment Transportation analysis is not covered by the scope of this study.

Appendix G: Field Reconnaissance Report

The *Wickenburg Area Drainage Master Study/Plan Phase 1 Field Reconnaissance Report*, prepared by Hoskin-Ryan Consultants, Inc. is included as Appendix G.

Wickenburg Area Drainage Master Study/Plan

FCD 2009-C030 - PHASE 1 FIELD RECONNAISSANCE REPORT



APRIL 2011

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EXPIRES 3/31/2012

1 INTRODUCTION

Hoskin-Ryan Consultants, Inc., (HRC) has been contracted by the Flood Control District of Maricopa County (District) to prepare the Wickenburg Area Drainage Master Study/Plan (ADMS/P). The ADMS/P lies within the watershed encompassing and surrounding the Town of Wickenburg in the north part of Maricopa County (Figure 1). The ADMS portion of the project identifies and quantifies known and potential flood hazards in the Wickenburg area, and where future flood control measures should be focused. If deemed necessary, the ADMP portion of the project will be initiated to identify alternatives and propose solutions to remediate flood hazards. This study is a joint effort between the District and the Town of Wickenburg (Town).

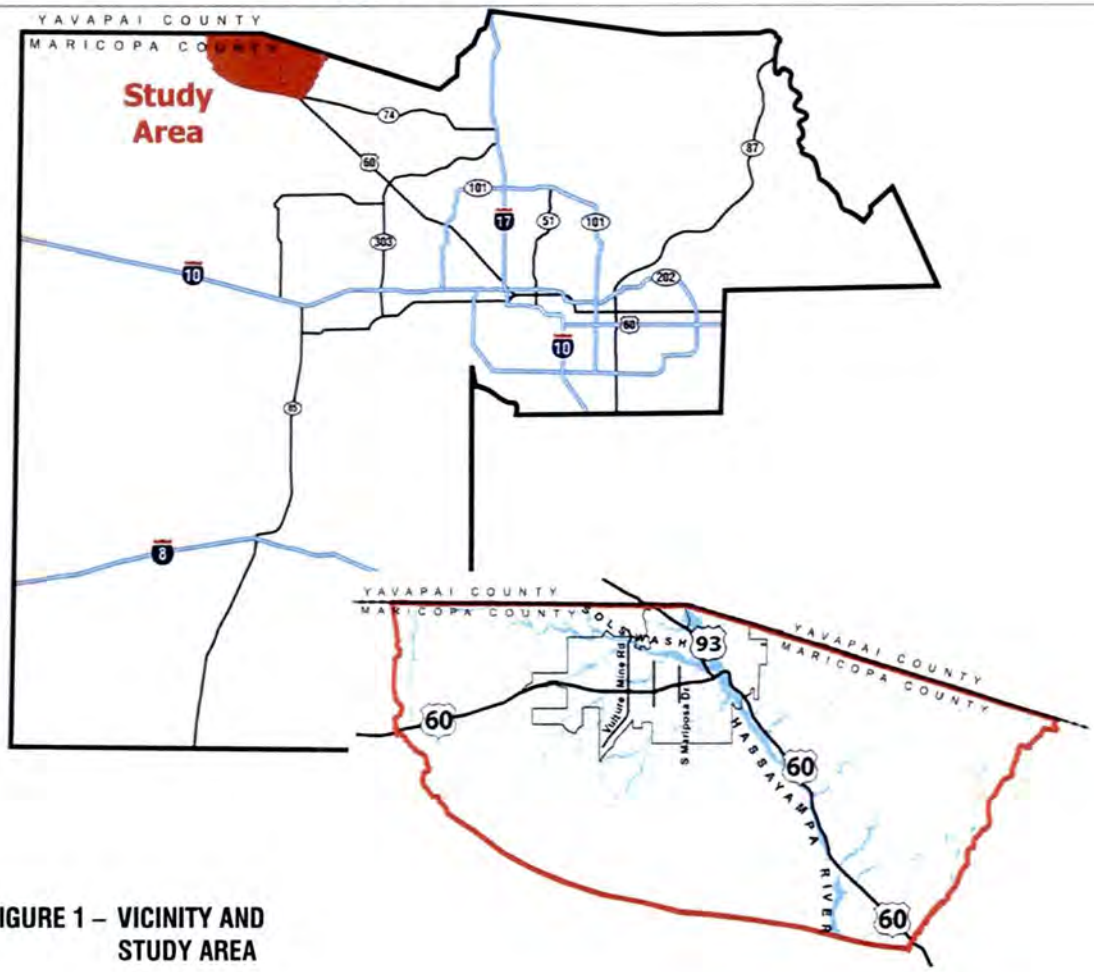


FIGURE 1 – VICINITY AND STUDY AREA

The study is an update of the Wickenburg Area Drainage Master Study (WADMS), completed in 1992. Since the WADMS, there have been advancements in the technology used to identify flood hazards, precipitation data has changed, and recent and more accurate digital topography is available. Growth, development, and other factors have modified drainage patterns in some areas, resulting in changes to the flood hazards.

The ADMS will be completed in three phases (Figure 2). The first phase (Figure 3) identifies the current floodplain and flood hazards for Sunset Wash and Sunny Cove Wash. The second phase addresses the floodplains that occur within, or in close proximity to, the Town limits. The third phase delineates floodplains for selected washes outside of the Town's jurisdictional limits.

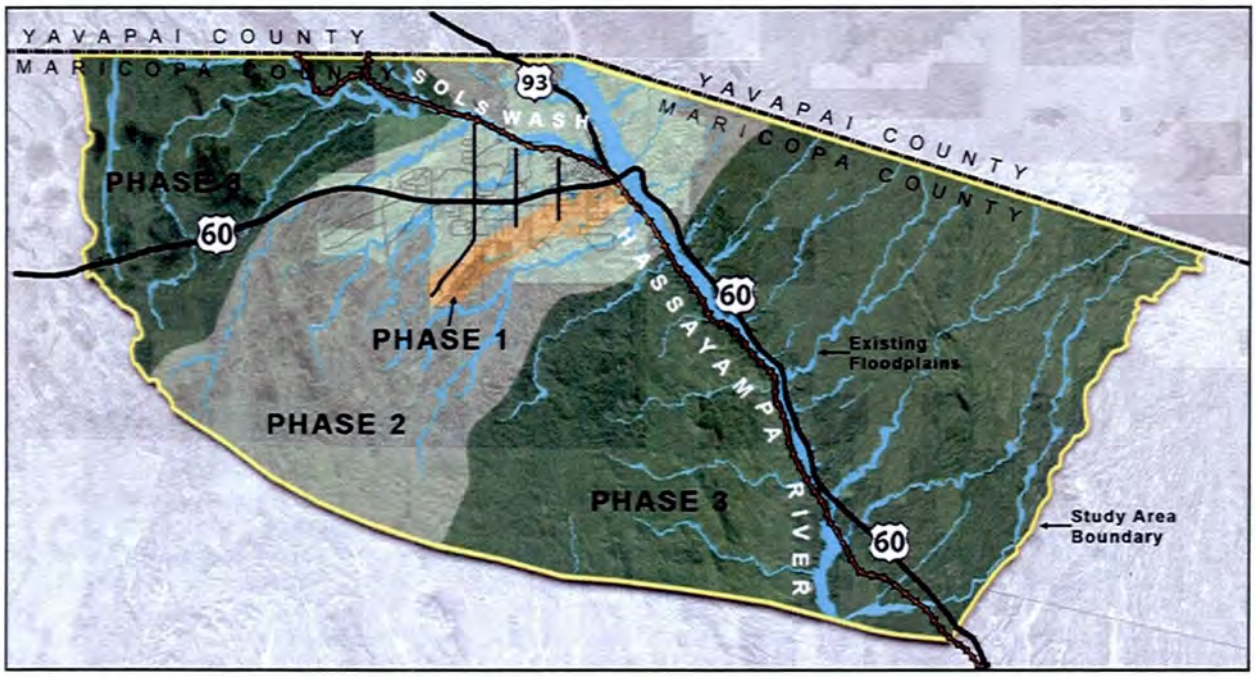


FIGURE 2 – STUDY PHASES

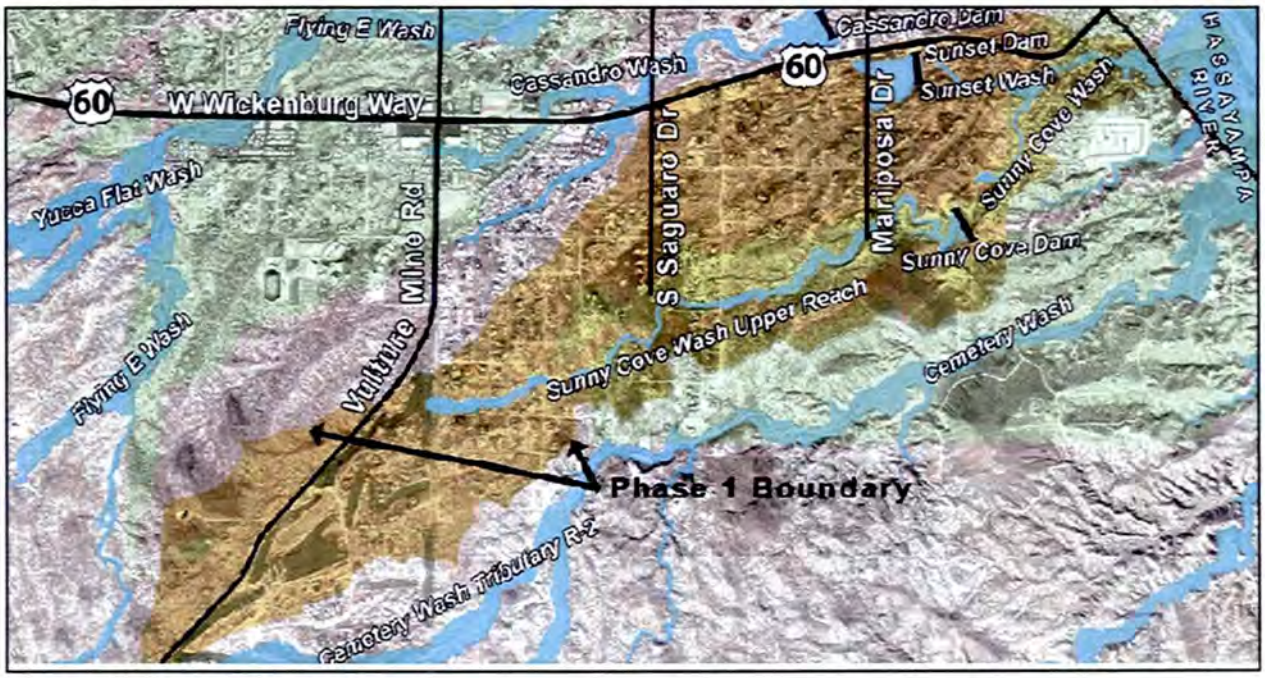


FIGURE 3 – PHASE 1 WATERSHED

Completion of the ADMS will allow the District and the Town to identify flood risk areas, permitting future development to occur in an informed manner. The ADMP (Phase 4) may recommend structural facilities, such as channels and basins, or non-structural methods such as development codes, for selected areas.

1.1 Purpose of Report

The purpose of the Field Reconnaissance Report is to present and summarize the investigation of roughness coefficients or Manning's "n" values ("n" values) and channel bank stations for Phase 1. In addition, floodplain conditions affecting the delineation, hydraulic structure and obstruction descriptions are identified. The "n" values and channel bank stations are a component of the hydraulic modeling (HEC-RAS). The documentation to support the estimation of "n" values, includes channel, structure and floodplain characteristics.

1.2 Project Team

This study is performed under the authority of the District, in cooperation with the Town. Key members of the consultant team are as follows:

Hoskin Ryan Consultants, Inc.

- Project Manager – Paul Hoskin, PE
- Assistant Project Manager – Kristyn Van Meter, PE
- Assistant Project Manager – Douglas Both, CFM

The HRC consultant team comprises firms of various disciplines required to complete all portions of the study. HRC is the Prime Consultant with the responsibilities of Project Management and technical analysis. Dewberry and Coe and Van Loo Consultants, Inc., are assisting HRC with data collection, hydrology, hydraulics, and floodplain delineation. EPG is assisting with data collection, the existing conditions analysis, and the flood hazard assessment. Bender Consulting Services is assisting with Public Involvement. Geological Consultants, Inc., is providing soils and bedrock analysis and Alpha Geotechnical is providing soils sampling and testing. Del Sol Group is providing environmental analysis.

2 MANNING'S "n" VALUE ESTIMATION

Phase 1 of the Wickenburg ADMS/P consists of approximately four linear miles of detailed hydraulics modeling and delineation. Phase 1 consists of Sunset Wash (upstream and downstream of Sunset Dam) and Sunnycove Wash (upstream and downstream of Sunnycove Dam).

During a field reconnaissance trip on September 2, 2010, thirteen accessible "n" value locations were identified to document the existing wash conditions. The "n" values for each location were identified with the aid of aerial and ground photographs (Figure 4). Refer to Appendix A for the photographs of the channel and floodplain characteristics. The following factors are considered in the

computation of "n" values for each wash:

- Bed material particle size
- Degree of irregularity of the bank slopes
- Effect of obstruction
- Degree of meandering
- Vegetation
- Variation in channel cross-section

The density and type of vegetation have a significant impact on the "n" values. Some of the vegetation within the floodplain includes the following types:

- Creosote Bush
- Ironwood Tree
- Mesquite Tree
- Saltbrush
- Annual Grasses and Weeds

2.1 Methodology

Manning's roughness coefficients are determined in accordance with the methodology described in *Selection of Manning's Roughness Coefficient for Natural and Constructed Vegetated and Non-Vegetated Channels in Central Arizona* (Reference 1). The method described in this publication selects a base value for the roughness coefficient based exclusively on bed material. This base value is then adjusted to account for vegetation, irregularities, obstructions and channel cross-section variations. In addition, a multiplier is applied to the adjusted "n" value when meandering of the reach is significant.

2.2 "n" Value Determination

The base roughness coefficient in this study is selected based on the average particle size observed in the field. The typical bed materials in the study area range from coarse sand to medium boulder and the typical values of the roughness coefficient range from 0.020 to 0.050. After these

values are adjusted for the effects of vegetation, irregularities, etc. the final estimate of the roughness coefficients ranges from 0.025 in the smooth sections of the channel to 0.074 in heavily vegetated areas.

The majority of the obstructions are along Sunset Wash within the Town limits. The main obstructions consist of residential properties. Within this area, the "n" value is approximately 0.064. The base values and adjustments of "n" values, along with the photographic documentation, are included in Appendix A.

3 BANK STATION PLACEMENT

Bank station locations are placed in the cross-sections for the HEC-RAS model after evaluating the contour mapping, and aerial photography. For most of the reaches, heavier vegetation is located within the overbank, in comparison to the main channel.

4 HYDRAULIC STRUCTURES

There are fourteen hydraulic structures within the Phase 1 floodplain delineation. All fourteen structures were surveyed and photos were taken at each of the structures. Table 1 summarizes the hydraulic structures present within the Phase 1 floodplain delineation. Refer to Appendix B for the structures survey information.

In the previous ADMS, the only structures that existed within the Phase 1 floodplain delineation are located at the Mariposa Drive (SUN_200), Jackson Street (SST_300), Mesquite Street (SST_400) and the BNSF Rail Road (SST_500) crossing. There are no observable changes to these structures since the previous ADMS.

Table 1: Hydraulic Structure Summary

Structure Location	Structure ID	Downstream RS	No. of Conduits	Structure Type	Length (ft)	Size (inch)	
						H	W
Sunnycove Wash - Reach 2							
Steinway Drive	SUN_100	3.091	5	RCP	50.0'	54"	54"
Mariposa Drive	SUN_200	1.127	3	CMP	100.0'	48"	48"
Sunnycove Wash - Reach 1							
Kellis Road	SUN_500	0.263	1	CMP	79.0'	24"	24"
Cottonwood Road	SUN_510	0.226	2	CMP	60.0'	24"	24"
Sunset Wash - Reach 3							
Mariposa Drive	SST_170	1.447	3	CMP	82.0'	36"	36"
Sunset Wash - Reach 1							
Lincoln Street	SST_200	0.726	3	CMP	47.0'	16"	20"
Jackson Street	SST_300	0.658	3	CMP	46.0'	16"	20"
Mesquite Street	SST_400	0.537	1	CBC	47.0'	3'	10'
Sunset Wash - Tributary 1							
Private Driveway	SST_120	0.209	3	CMP	40.0'	24"	32"
Private Driveway	SST_130	0.152	3	CMP	21.0'	24"	32"
Private Driveway	SST_140	0.132	3	CMP	21.0'	24"	32"
Private Driveway	SST_150	0.116	3	CMP	21.0'	24"	32"
Mariposa Drive	SST_160	0.076	3	CMP	56.0'	24"	36"
Sunset Wash - Reach 1 (Bridge)							
Structure Location	**Structure ID**	**Downstream RS**	**No. of Piers**	**Pier Width (ft)**	**Piers @ Feet**	**Size (ft)**	**Size (ft)**
						H	**W**
BNSF Rail Road Crossing	SST_500	0.260	4	1.00'	13'±	9.71'±	86.1'±

5 REFERENCES

1. Phillips, Jeff V. and Saeid Tadayon, United States Geological Survey, *Selection of Manning's Roughness Coefficient for Natural and Constructed Vegetated and Non-Vegetated Channels, and Vegetation Maintenance Plan Guidelines for Vegetated Channels in Central Arizona*, 2007.

2. Arizona Department of Water Resources, *State Standard 1-97 Requirement for Flood Study Technical Documentation*, November 1997.

3. Arizona Department of Water Resources, *State Standard 2-96 Requirement for Floodplain and Floodway Delineation in Riverine Environments*, July 1996.

4. Arizona Department of Water Resources, *State Standard 9-02 State Standard for Floodplain Hydraulic Modeling*, July 2002.

5. Black and Veatch, *Wickenburg Area Drainage Master Study, Technical Documentation Report*, May 1994.

6. Federal Emergency Management Agency, *Guidelines and Specifications for Flood Hazard Mapping Partners*, April 2003.

7. Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Arizona, Hydraulics,* Draft June 24, 2010.

8. Flood Control District of Maricopa County, *Drainage Policies and Standards for Maricopa County, Arizona*, Draft July 2010.

9. Flood Control District of Maricopa County, *Scope of Work, Contract FCD 2009C0303, Wickenburg Area Drainage Master Study/Plan (ADMS/P)*, July 12, 2010.

10. Town of Wickenburg, *The Code of the Town of Wickenburg, Arizona, Chapter 15 Floodplain Regulations*, 2004.

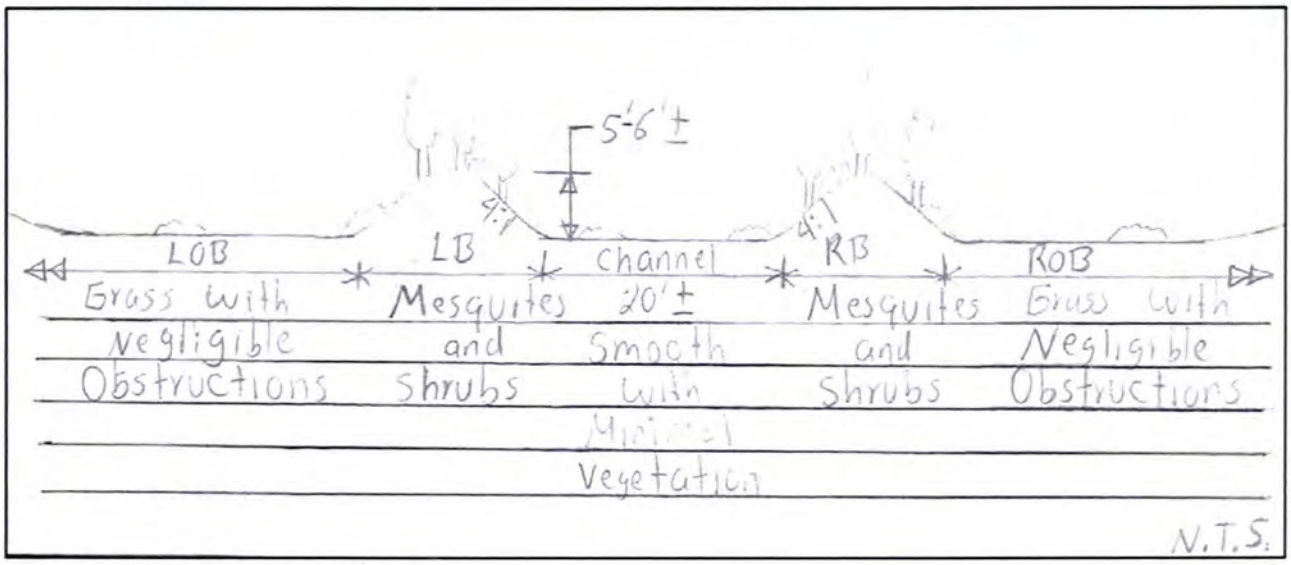
11. Wood, Patel & Associates, Inc., *Flood Insurance Study, Approximate Zone A Floodplain Delineation Studies, Wickenburg Area, Maricopa County, Arizona, Technical Data Notebook,* July 7, 2000.

Appendix A: Manning's "n" Value Calculation Sheets, with Photographs and Tables

Wash Name:	Sunset Wash			Date:	9/2/10
Location Desc.:	Tegner Street crossing			Loc. No.:	1
GPS Lat:	33°57'56"N	GPS Long:	112°43'34"W	RS:	

View Downstream

View Upstream



Cross-Section, View Downstream

Section	LOB		CHNL		ROB
Base 'n' Value	0.025		0.025		0.025
n_1 Degree of Irregularity	0.000		0.000		0.000
n_2 Variation in Chnl Cross-Sect.	0.000		0.000		0.000
n_3 Effect of Obstructions	0.005		0.001		0.005
n_4 Amount of Vegetation	0.005		0.008		0.005
m Degree of Meandering	1		1		1
Manning's 'n' Value	0.035		0.034		0.035

Wash Name:	Sunset Wash			Date:	9/2/10
Location Desc.:	Tegner Street crossing			Loc. No.:	1
GPS Lat:	33°57'56"N	GPS Long:	112°43'34"W	RS:	

View downstream LOB

View downstream ROB

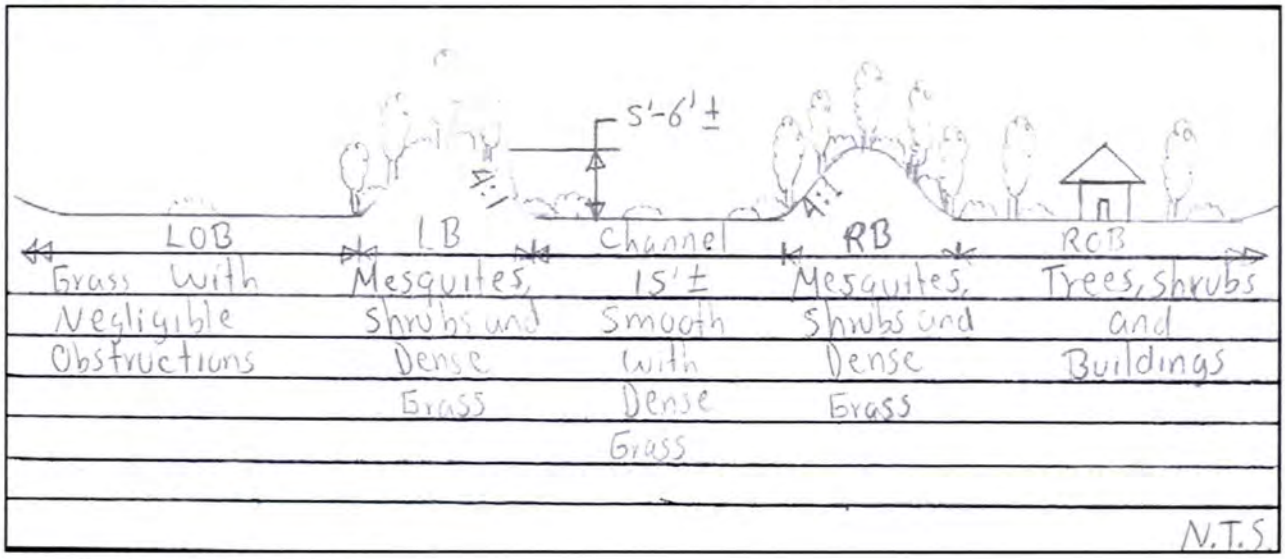
View upstream LOB

View upstream ROB

Wash Name:	Sunset Wash			Date:	9/2/10
Location Desc.:	Between Tegner Street and rail road			Loc. No.:	2
GPS Lat:	33°57'55"N	GPS Long:	112°43'37"W	RS:	

View Downstream

View Upstream



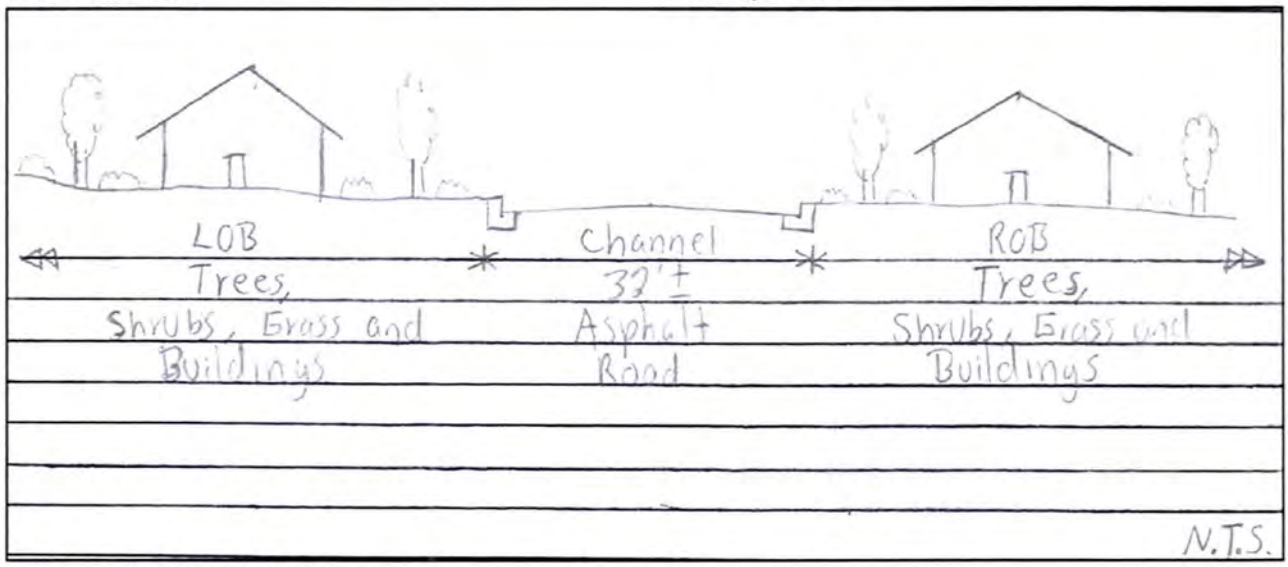
Cross-Section, View Downstream

Section	LOB		CHNL		ROB
Base 'n' Value	0.025		0.025		0.025
n_1 Degree of Irregularity	0.000		0.000		0.002
n_2 Variation in Chnl Cross-Sect.	0.000		0.000		0.002
n_3 Effect of Obstructions	0.005		0.001		0.020
n_4 Amount of Vegetation	0.005		0.010		0.020
m Degree of Meandering	1		1		1
Manning's 'n' Value	0.035		0.036		0.069

Wash Name:	Sunset Wash			Date:	9/2/10
Location Desc.:	Coolwater Lane alignment (west of rail road)			Loc. No.:	3
GPS Lat:	33°57'54"N	GPS Long:	112°43'42"W	RS:	

View Downstream

View Upstream



Cross-Section, View Downstream

Section	LOB		CHNL		ROB
Base 'n' Value	0.025		0.020		0.025
n_1 Degree of Irregularity	0.002		0.000		0.002
n_2 Variation in Chnl Cross-Sect.	0.002		0.000		0.002
n_3 Effect of Obstructions	0.010		0.005		0.010
n_4 Amount of Vegetation	0.025		0.000		0.025
m Degree of Meandering	1		1		1
Manning's 'n' Value	0.064		0.025		0.064

Wash Name:	Sunset Wash			Date:	9/2/10
Location Desc.:	Coolwater Lane alignment (west of rail road)			Loc. No.:	3
GPS Lat:	33°57'54"N	GPS Long:	112°43'42"W	RS:	

View upstream LOB

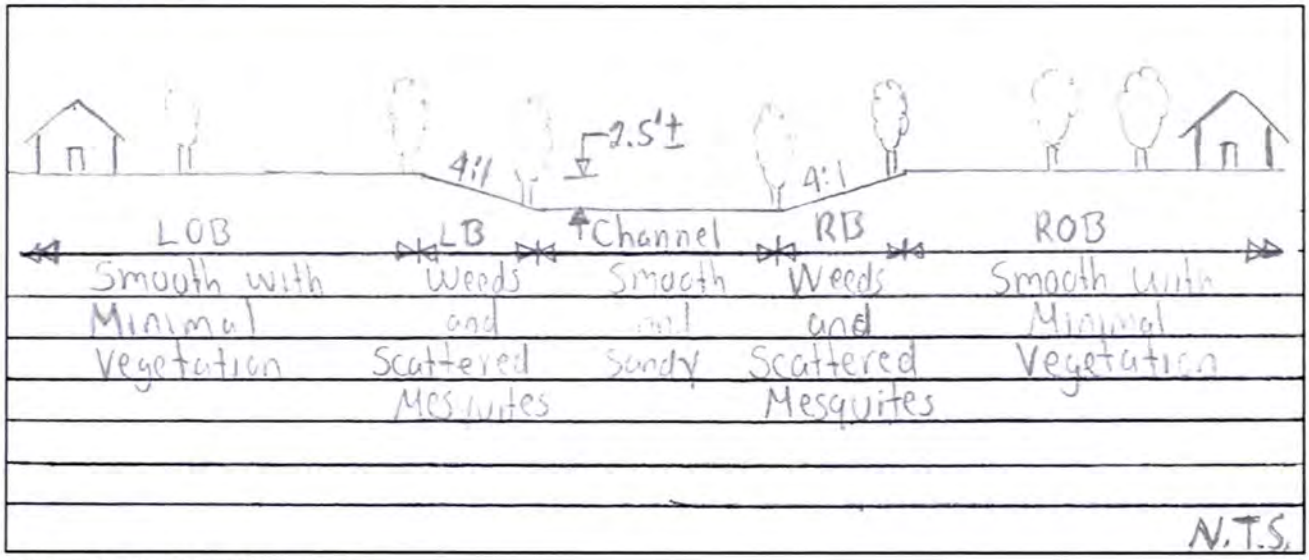
View downstream ROB

FIELD RECONNAISSANCE NOTES

Wash Name:	Sunset Wash			Date:	9/2/10
Location Desc.:	North of Park Street and Sylvan Road intersection			Loc. No.:	4
GPS Lat:	33°57'56"N	GPS Long:	112°43'53"W	RS:	

View Downstream

View Upstream



Cross-Section, View Downstream

Section	LOB		CHNL		ROB
Base 'n' Value	0.025		0.025		0.025
n_1 Degree of Irregularity	0.000		0.000		0.000
n_2 Variation in Chnl Cross-Sect.	0.002		0.000		0.002
n_3 Effect of Obstructions	0.010		0.002		0.010
n_4 Amount of Vegetation	0.010		0.005		0.010
m Degree of Meandering	1		1		1
Manning's 'n' Value	0.047		0.032		0.047

Wash Name:	Sunset Wash			Date:	9/2/10
Location Desc.:	North of Park Street and Sylvan Road intersection			Loc. No.:	4
GPS Lat:	33°57'56"N	GPS Long:	112°43'53"W	RS:	

View downstream LOB

View downstream ROB

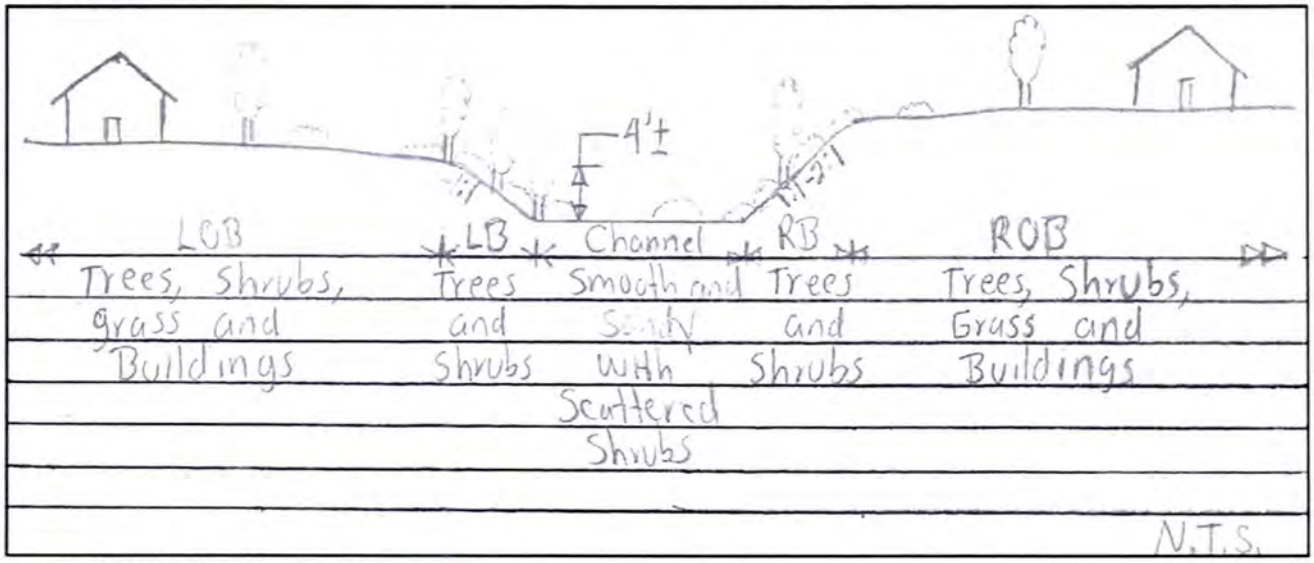
View upstream LOB

View upstream ROB

Wash Name:	Sunset Wash			Date:	9/2/10
Location Desc.:	Madison Street Crossing			Loc. No.:	5
GPS Lat:	33°57'54"N	GPS Long:	112°43'59"W	RS:	

View Downstream

View Upstream



Cross-Section, View Downstream

Section	LOB		CHNL		ROB
Base 'n' Value	0.025		0.028		0.025
n_1 Degree of Irregularity	0.002		0.000		0.002
n_2 Variation in Chnl Cross-Sect.	0.002		0.000		0.002
n_3 Effect of Obstructions	0.010		0.001		0.010
n_4 Amount of Vegetation	0.025		0.010		0.025
m Degree of Meandering	1		1		1
Manning's 'n' Value	0.064		0.039		0.064

Wash Name:	Sunset Wash			Date:	9/2/10
Location Desc.:	Madison Street Crossing			Loc. No.:	5
GPS Lat:	33°57'54"N	GPS Long:	112°43'59"W	RS:	

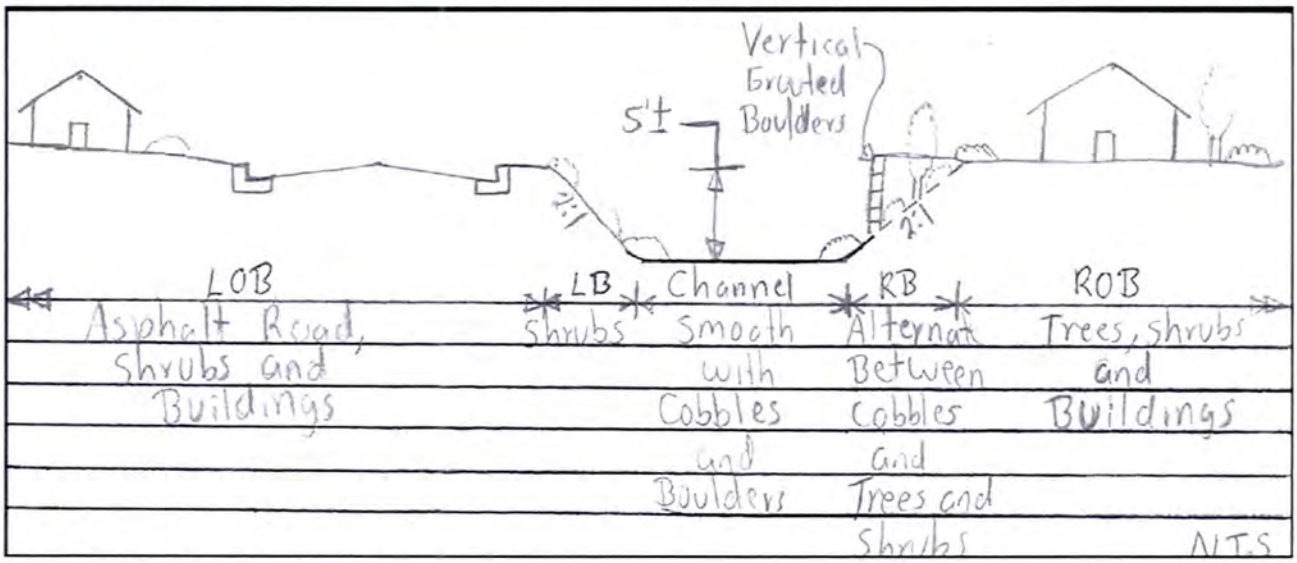
View downstream LOB

View downstream ROB

Wash Name:	Sunset Wash			Date:	9/2/10
Location Desc.:	Southwest corner of Lincoln Street and Center Street			Loc. No.:	6
GPS Lat:	33°57'50"N	GPS Long:	112°44'07"W	RS:	

View Downstream

View Upstream



Cross-Section, View Downstream

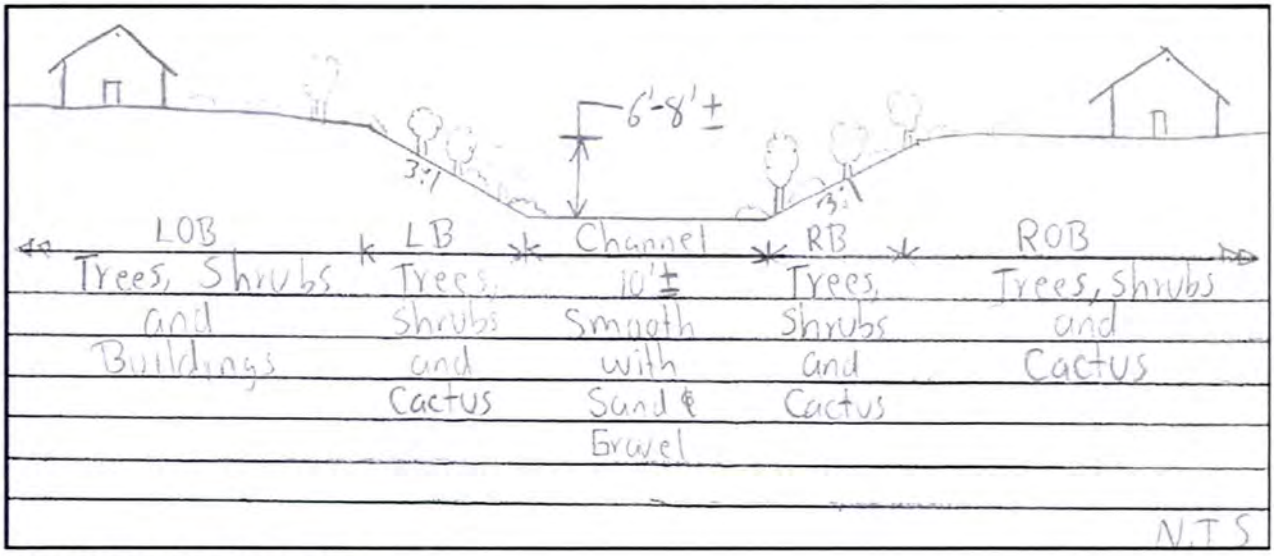
Section	LOB		CHNL		ROB
Base 'n' Value	0.020		0.028		0.025
n_1 Degree of Irregularity	0.000		0.000		0.002
n_2 Variation in Chnl Cross-Sect.	0.001		0.000		0.002
n_3 Effect of Obstructions	0.015		0.001		0.020
n_4 Amount of Vegetation	0.005		0.002		0.025
m Degree of Meandering	1		1		1
Manning's 'n' Value	0.041		0.031		0.074

FIELD RECONNAISSANCE NOTES

Wash Name:	Sunset Wash			Date:	9/2/10
Location Desc.:	Downstream of Sunset Dam west of Kellis Road			Loc. No.:	7
GPS Lat:	33°57'51"N	GPS Long:	112°44'16"W	RS:	

View Downstream

View Upstream



Cross-Section, View Downstream

Section	LOB		CHNL		ROB
Base 'n' Value	0.025		0.020		0.025
n_1 Degree of Irregularity	0.002		0.000		0.002
n_2 Variation in Chnl Cross-Sect.	0.002		0.000		0.002
n_3 Effect of Obstructions	0.010		0.000		0.010
n_4 Amount of Vegetation	0.025		0.015		0.025
m Degree of Meandering	1		1		1
Manning's 'n' Value	0.064		0.035		0.064

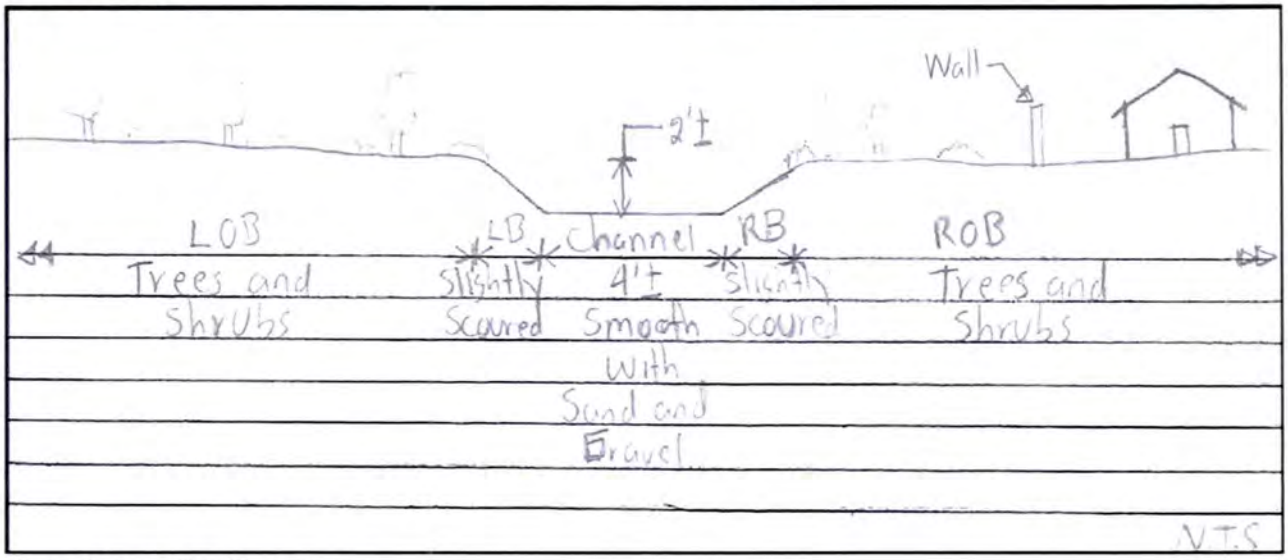
Wash Name:	Sunset Wash			Date:	9/2/10
Location Desc.:	Grant Street alignment			Loc. No.:	7
GPS Lat:	33°57'51"N	GPS Long:	112°44'16"W	RS:	

View downstream at Grant Street alignment

Wash Name:	Sunnycove Wash			Date:	9/2/10
Location Desc.:	South of Lost Canyon Road crossing			Loc. No.:	8
GPS Lat:	33°57'42"N	GPS Long:	112°44'12"W	RS:	

View Downstream

View Upstream



Cross-Section, View Downstream

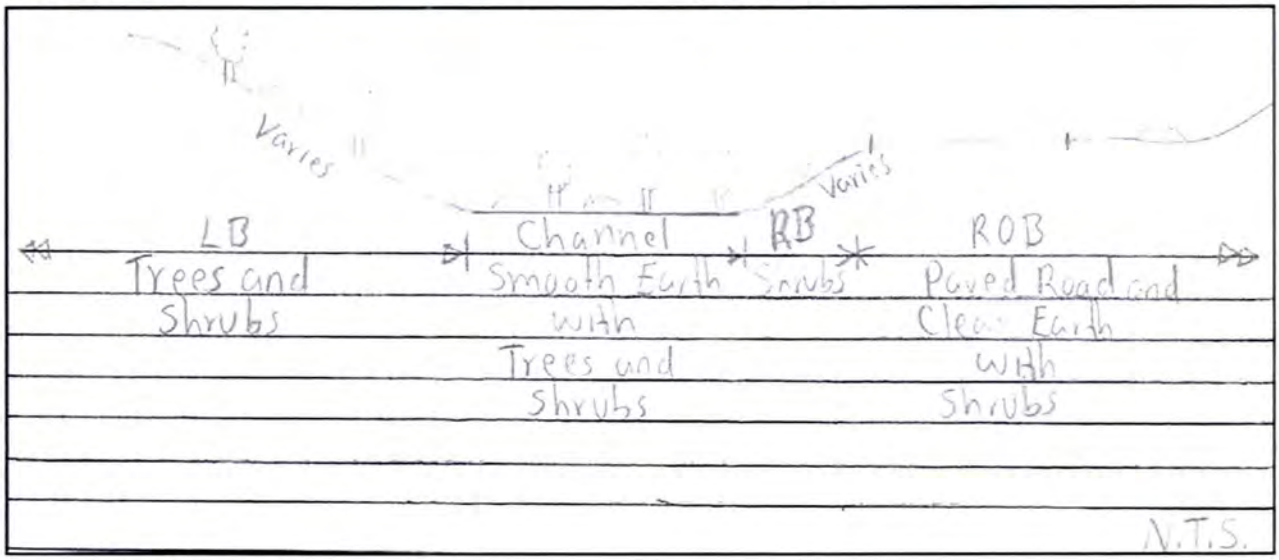
Section	LOB		CHNL		ROB
Base 'n' Value	0.025		0.025		0.025
n_1 Degree of Irregularity	0.001		0.008		0.001
n_2 Variation in Chnl Cross-Sect.	0.000		0.000		0.000
n_3 Effect of Obstructions	0.004		0.000		0.004
n_4 Amount of Vegetation	0.025		0.002		0.025
m Degree of Meandering	1		1		1
Manning's 'n' Value	0.055		0.035		0.055

FIELD RECONNAISSANCE NOTES

Wash Name:	Sunnycove Wash			Date:	9/2/10
Location Desc.:	Downstream of Sunnycove Dam (west of Kellis Road)			Loc. No.:	9
GPS Lat:	33°57'34"N	GPS Long:	112°44'16"W	RS:	

View Downstream

View Upstream



Cross-Section, View Downstream

Section	LOB		CHNL		ROB
Base 'n' Value	0.025		0.025		0.02
n_1 Degree of Irregularity	0.000		0.000		0.000
n_2 Variation in Chnl Cross-Sect.	0.000		0.000		0.003
n_3 Effect of Obstructions	0.004		0.004		0.002
n_4 Amount of Vegetation	0.020		0.010		0.010
m Degree of Meandering	1		1		1
Manning's 'n' Value	0.049		0.039		0.035

Wash Name:	Sunnycove Wash			Date:	9/2/10
Location Desc.:	Downstream of Sunnycove Dam (west of Kellis Road)			Loc. No.:	9
GPS Lat:	33°57'34"N	GPS Long:	112°44'16"W	RS:	

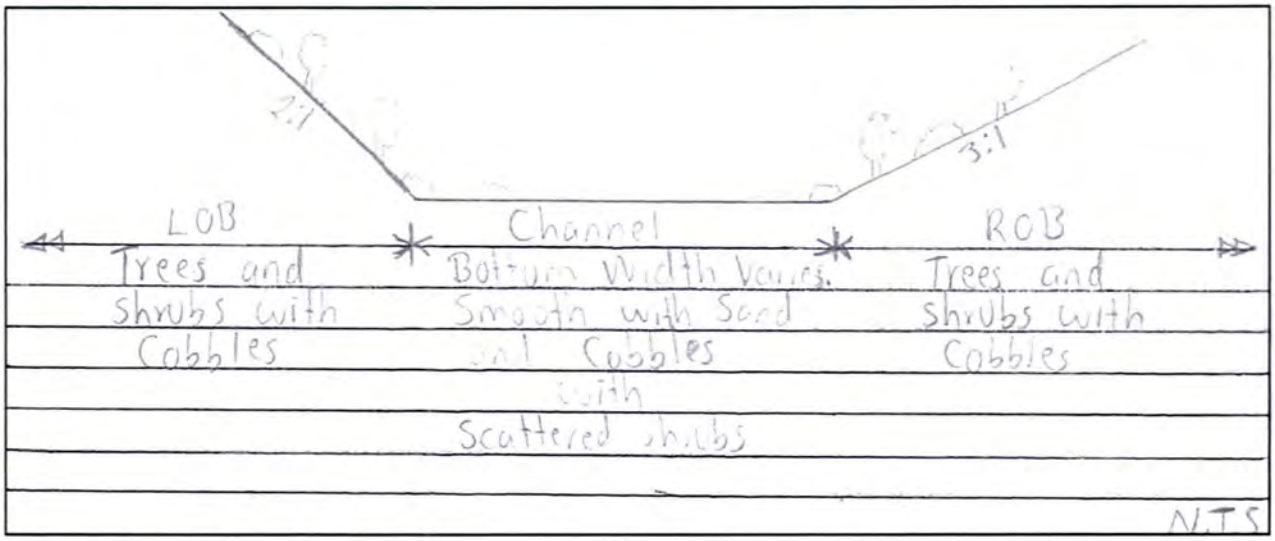
View downstream ROB

View upstream ROB

Wash Name:	Sunnycove Wash Upper Reach			Date:	9/2/10
Location Desc.:	Agua Drive crossing (upstream of Sunnycove Dam)			Loc. No.:	10
GPS Lat:	33°57'29"N	GPS Long:	112°44'37"W	RS:	

View Downstream

View Upstream



Cross-Section, View Downstream

Section	LOB		CHNL		ROB
Base 'n' Value	0.030		0.025		0.030
n_1 Degree of Irregularity	0.000		0.000		0.000
n_2 Variation in Chnl Cross-Sect.	0.002		0.003		0.002
n_3 Effect of Obstructions	0.002		0.000		0.002
n_4 Amount of Vegetation	0.025		0.002		0.025
m Degree of Meandering	1		1		1
Manning's 'n' Value	0.059		0.030		0.059

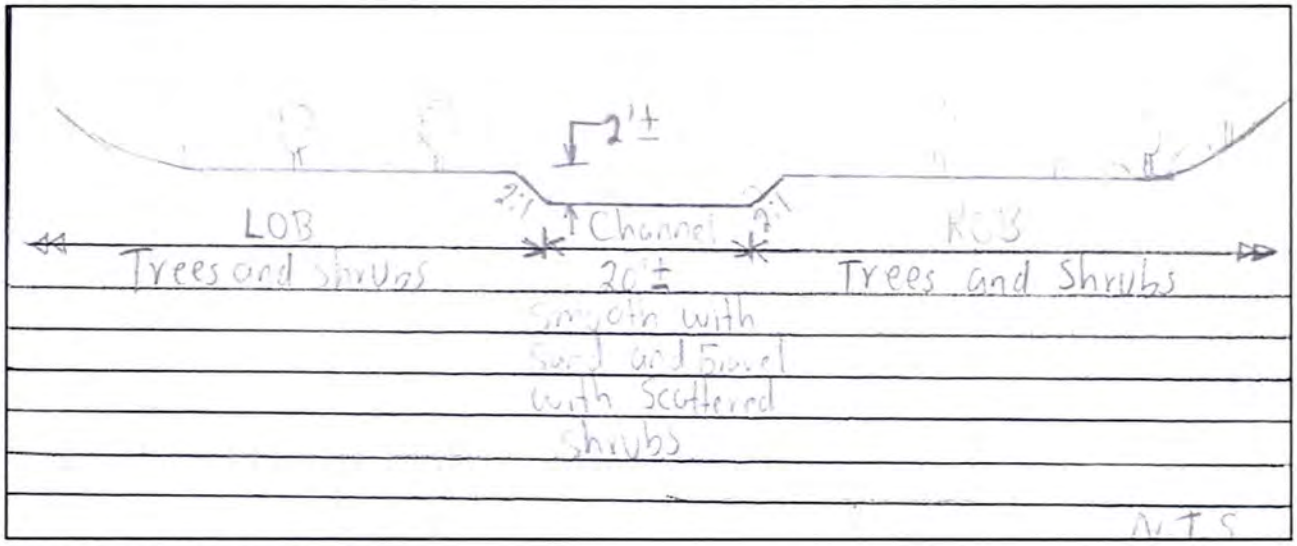
Wash Name:	Sunnycove Wash Upper Reach			Date:	9/2/10
Location Desc.:	Agua Drive crossing (upstream of Sunnycove Dam)			Loc. No.:	10
GPS Lat:	33°57'29"N	GPS Long:	112°44'37"W	RS:	

View upstream ROB

Wash Name:	Sunnycove Wash Upper Reach			Date:	9/2/10
Location Desc.:	Upstream of Mariposa Road crossing			Loc. No.:	11
GPS Lat:	33°57'24"N	GPS Long:	112°44'45"W	RS:	

View Downstream

View Upstream



Cross-Section, View Downstream

Section	LOB		CHNL		ROB
Base 'n' Value	0.030		0.026		0.030
n_1 Degree of Irregularity	0.000		0.002		0.000
n_2 Variation in Chnl Cross-Sect.	0.002		0.005		0.002
n_3 Effect of Obstructions	0.005		0.000		0.005
n_4 Amount of Vegetation	0.025		0.002		0.025
m Degree of Meandering	1		1		1
Manning's 'n' Value	0.062		0.035		0.062

Wash Name:	Sunnycove Wash Upper Reach			Date:	9/2/10
Location Desc.:	Upstream of Mariposa Road crossing			Loc. No.:	11
GPS Lat:	33°57'24"N	GPS Long:	112°44'45"W	RS:	

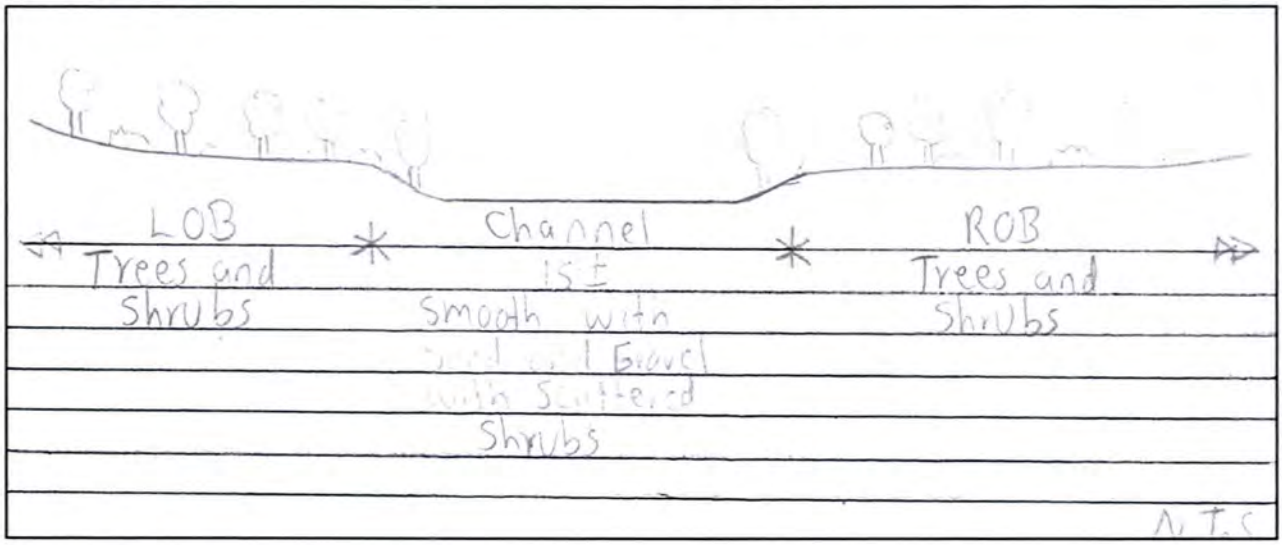
View downstream LOB

View downstream ROB

Wash Name:	Sunnycove Wash Upper Reach			Date:	9/2/10
Location Desc.:	Downstream of Ocotillo Drive crossing			Loc. No.:	12
GPS Lat:	33°57'11"N	GPS Long:	112°45'15"W	RS:	

View Downstream

View Upstream



Cross-Section, View Downstream

Section	LOB		CHNL		ROB
Base 'n' Value	0.030		0.026		0.030
n_1 Degree of Irregularity	0.000		0.000		0.000
n_2 Variation in Chnl Cross-Sect.	0.002		0.003		0.002
n_3 Effect of Obstructions	0.010		0.000		0.010
n_4 Amount of Vegetation	0.015		0.002		0.015
m Degree of Meandering	1		1		1
Manning's 'n' Value	0.057		0.031		0.057

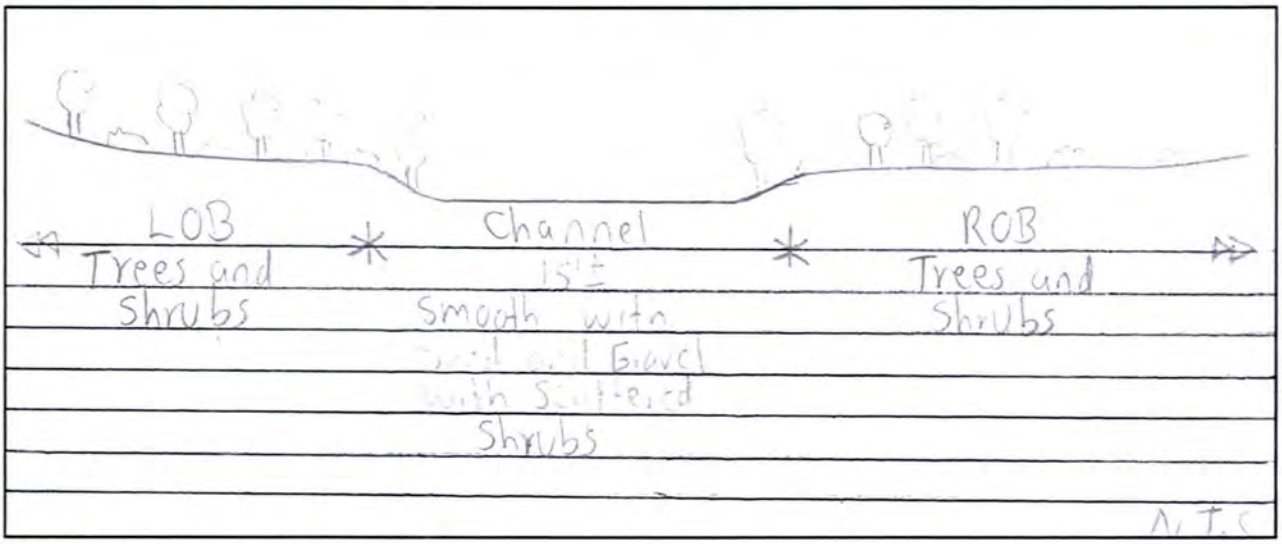
Wash Name:	Sunnycove Wash Upper Reach			Date:	9/2/10
Location Desc.:	Downstream of Ocotillo Drive crossing			Loc. No.:	12
GPS Lat:	33°57'11"N	GPS Long:	112°45'15"W	RS:	

View downstream LOB

Wash Name:	Sunnycove Wash Upper Reach			Date:	9/2/10
Location Desc.:	Between Vulture Mine Road and Ocotillo Drive			Loc. No.:	13
GPS Lat:	33°56'58"N	GPS Long:	112°45'43"W	RS:	

View Downstream

View Upstream



Cross-Section, View Downstream

Section	LOB		CHNL		ROB
Base 'n' Value	0.030		0.026		0.030
n_1 Degree of Irregularity	0.000		0.000		0.000
n_2 Variation in Chnl Cross-Sect.	0.002		0.005		0.002
n_3 Effect of Obstructions	0.005		0.000		0.005
n_4 Amount of Vegetation	0.020		0.002		0.020
m Degree of Meandering	1		1		1
Manning's 'n' Value	0.057		0.033		0.057

Wash Name:	Sunnycove Wash Upper Reach			Date:	9/2/10
Location Desc.:	Between Vulture Mine Road and Ocotillo Drive			Loc. No.:	13
GPS Lat:	33°56'58"N	GPS Long:	112°45'43"W	RS:	

View downstream LOB

View downstream ROB

View upstream LOB

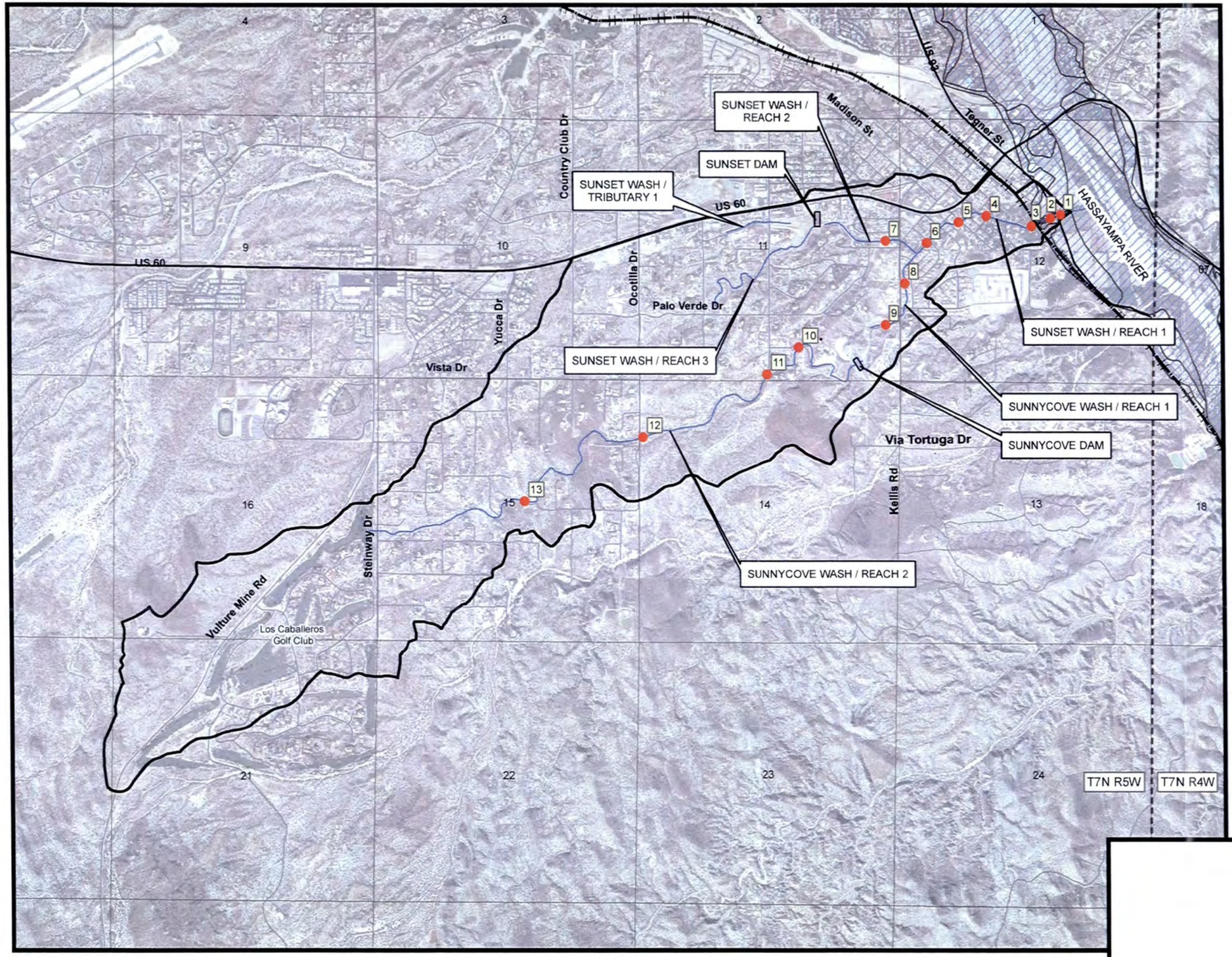
WICKENBURG AREA DRAINAGE MASTER STUDY/PLAN
PHASE 1 WASHES
Manning's "n"-Value Calculation

Location #	Wash Name	LOB							Channel							ROB						
		Base Value[1]	Adjustments for Roughness Factors[2]				Degree of[3] Meandering, m	Calculated[4] n-Value	Base Value[1]	Adjustments for Roughness Factors[2]				Degree of[3] Meandering, m	Calculated[4] n-Value	Base Value[1]	Adjustments for Roughness Factors[2]				Degree of[3] Meandering, m	Calculated[4] n-Value
		n_0	n_1	n_2	n_3	n_4			n_0	n_1	n_2	n_3	n_4			n_0	n_1	n_2	n_3	n_4		
1	Sunset Wash - Reaches 1 & 2	0.025	0.000	0.000	0.005	0.005	1.0	**0.035**	0.025	0.000	0.000	0.001	0.008	1.0	**0.034**	0.025	0.000	0.000	0.005	0.005	1.0	**0.035**
2		0.025	0.000	0.000	0.005	0.005	1.0	**0.035**	0.025	0.000	0.000	0.001	0.010	1.0	**0.036**	0.025	0.002	0.002	0.020	0.020	1.0	**0.069**
3		0.025	0.002	0.002	0.010	0.025	1.0	**0.064**	0.020	0.000	0.000	0.005	0.000	1.0	**0.025**	0.025	0.002	0.002	0.010	0.025	1.0	**0.064**
4		0.025	0.000	0.002	0.010	0.010	1.0	**0.047**	0.025	0.000	0.000	0.002	0.005	1.0	**0.032**	0.025	0.000	0.002	0.010	0.010	1.0	**0.047**
5		0.025	0.002	0.002	0.010	0.025	1.0	**0.064**	0.028	0.000	0.000	0.001	0.010	1.0	**0.039**	0.025	0.002	0.002	0.010	0.025	1.0	**0.064**
6		0.020	0.000	0.001	0.015	0.005	1.0	**0.041**	0.028	0.000	0.000	0.001	0.002	1.0	**0.031**	0.025	0.002	0.002	0.020	0.025	1.0	**0.074**
7		0.025	0.002	0.002	0.010	0.025	1.0	**0.064**	0.020	0.000	0.000	0.000	0.015	1.0	**0.035**	0.025	0.002	0.002	0.010	0.025	1.0	**0.064**
8	SunnyCove Wash- Reach 1	0.025	0.001	0.000	0.004	0.025	1.0	**0.055**	0.025	0.008	0.000	0.000	0.002	1.0	**0.035**	0.025	0.001	0.000	0.004	0.025	1.0	**0.055**
9		0.025	0.000	0.000	0.004	0.020	1.0	**0.049**	0.025	0.000	0.000	0.004	0.010	1.0	**0.039**	0.020	0.000	0.003	0.002	0.010	1.0	**0.035**
10	SunnyCove Wash - Reach 2	0.030	0.000	0.002	0.002	0.025	1.0	**0.059**	0.025	0.000	0.003	0.000	0.002	1.0	**0.030**	0.030	0.000	0.002	0.002	0.025	1.0	**0.059**
11		0.030	0.000	0.002	0.005	0.025	1.0	**0.062**	0.026	0.002	0.005	0.000	0.002	1.0	**0.035**	0.030	0.000	0.002	0.005	0.025	1.0	**0.062**
12		0.030	0.000	0.002	0.010	0.015	1.0	**0.057**	0.026	0.000	0.003	0.000	0.002	1.0	**0.031**	0.030	0.000	0.002	0.010	0.015	1.0	**0.057**
13		0.030	0.000	0.002	0.005	0.020	1.0	**0.057**	0.026	0.000	0.005	0.000	0.002	1.0	**0.033**	0.030	0.000	0.002	0.005	0.020	1.0	**0.057**

Reference: Phillips, J.V., and Tadayon, S., 2006, *Selection of Manning's Roughness Coefficient for Natural and Constructed Vegetated and Non-Vegetated Channels, and Vegetation Maintenance Plan Guidelines for Vegetated Channels in Central Arizona: U.S. Geological Survey, Scientific Investigations Report 2006-5108, 41 p.*

Notes:

1. n_0 = Base value of n for a straight, uniform channels (Tables 1 and 2)
2. Adjustments for roughness factors other than meanders (Table 3), where:
   n_1 = Degree of Irregularity
   n_2 = Variation in channel cross section
   n_3 = Effect of obstructions
   n_4 = Amount of Vegetation
3. m = Degree of meandering (Table 3)
4. n- value = $(n_0 + n_1 + n_2 + n_3 + n_4)*m$



Legend

- Phase I Watershed Boundary
- Effective Floodplain
- Flowline
- Railroad
- Dam
- Township and Range
- Sections
- n-Value Location and ID

N

0 500 1,000 2,000 Feet

1 in = 2,000 ft

Hoskin • Ryan Consultants, Inc.
6245 N. 24th Parkway #100 Phoenix, AZ 85016
Office: (602) 252.8384 Fax: (602) 252.8385

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WICKENBURG AREA DRAINAGE MASTER STUDY / PLAN

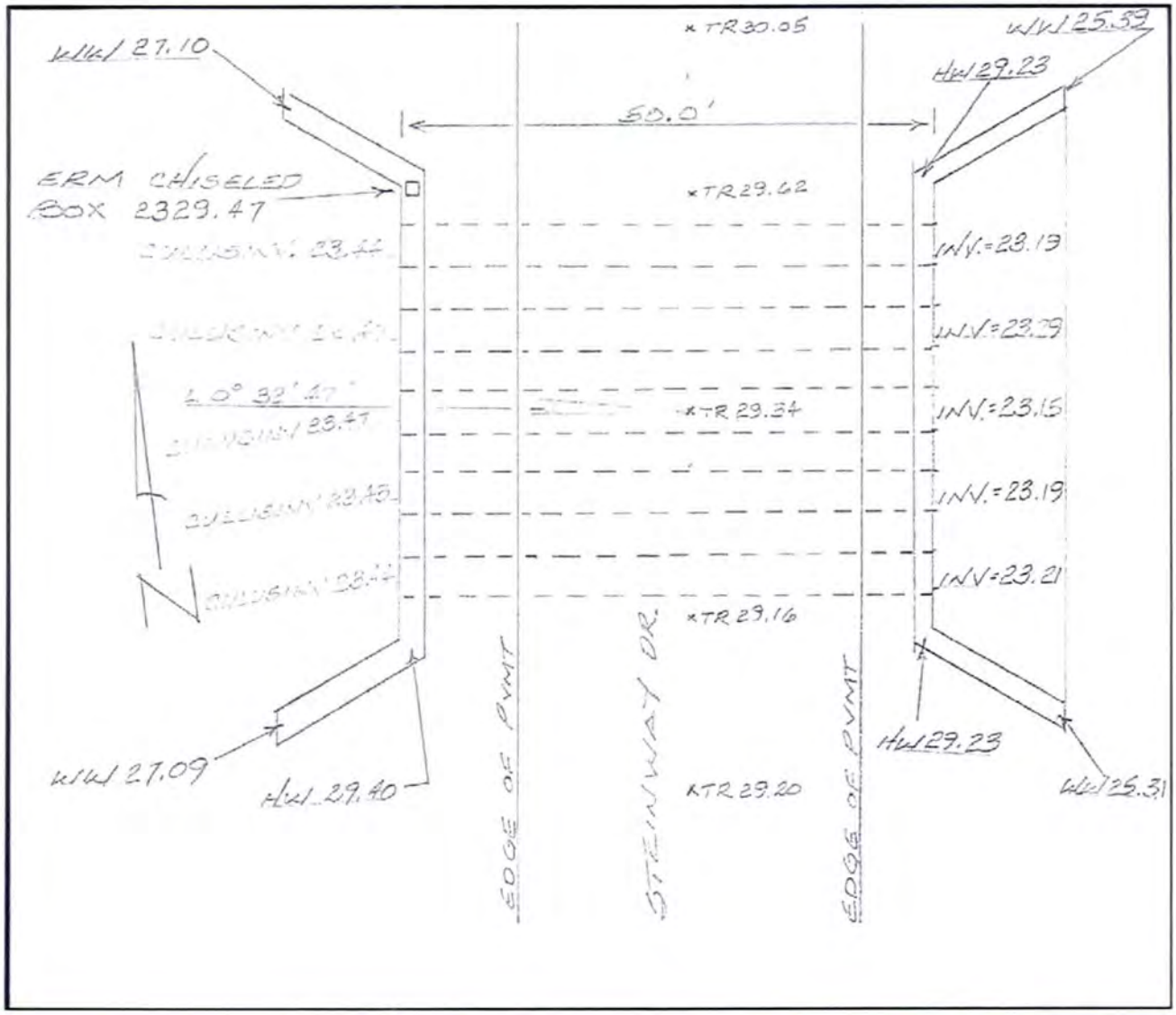
F.C.D. Contract No. 2009-C030

"n" VALUE LOCATION MAP
FIGURE 4

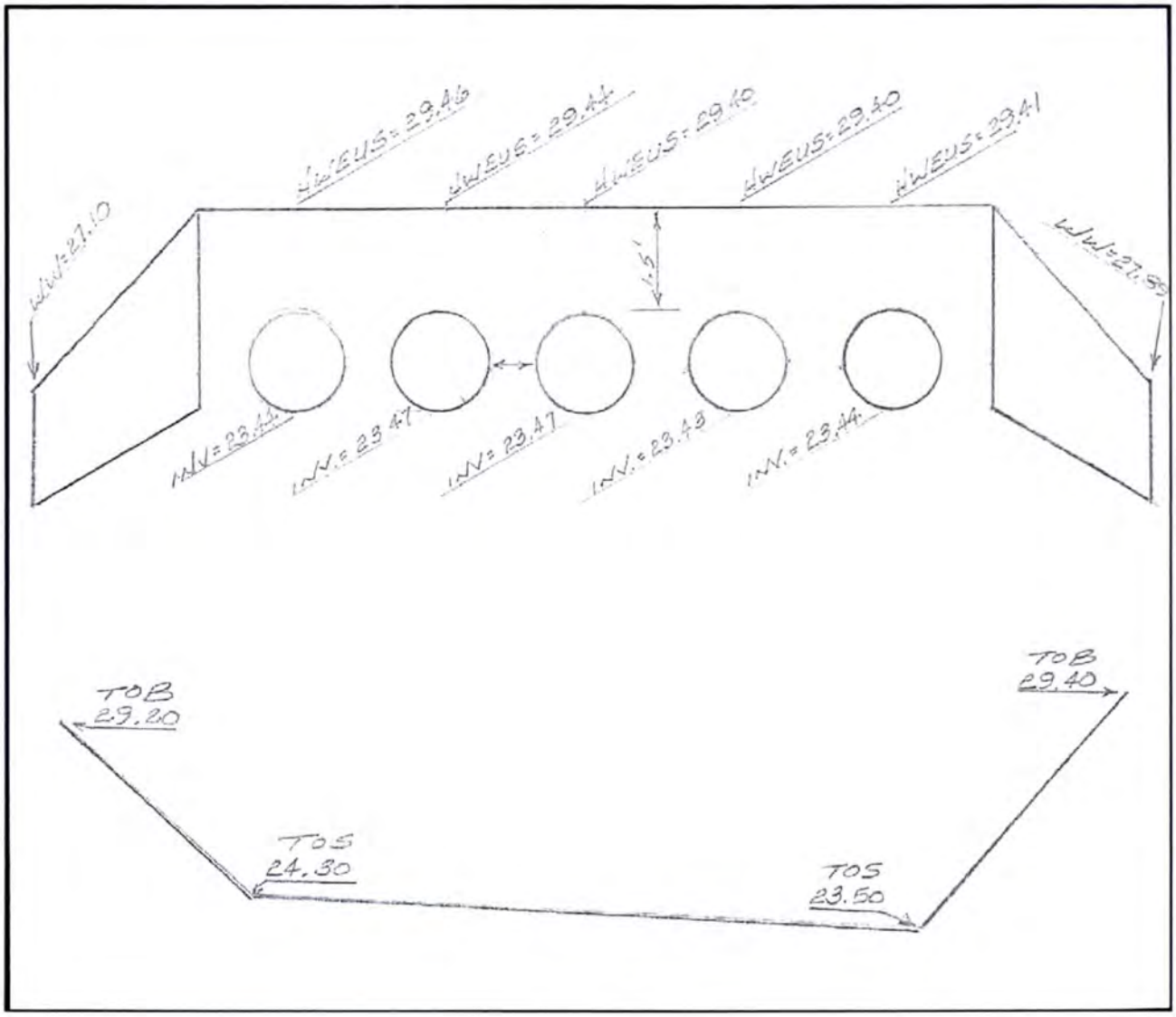
Appendix B: Hydraulic Structures Survey Information

Wash Name:	Sunnycove Wash Upper Reach			ID:	SUN_100
Location:	Steinway Drive			RS:	3.100
Benchmark ID:		Elev:	2329.47	PC:	IM:
GPS Lat:		GPS Long:		Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW
CULVERT	NUM#	5	TYPE	RCP	LENGTH	50.0'	SIZE	H:	54"	W:	54"	SKEW
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER		
ADDITIONAL COMMENTS:												



Wash Name:	Sunnycove Wash Upper Reach	ID:	SUN_100
Location:	Steinway Drive	RS:	3.100
GPS Lat:	GPS Long:		



Wash Name:	Sunnycove Wash Upper Reach	ID:	SUN_100
Location:	Steinway Drive	RS:	3.100
GPS Lat:	GPS Long:		

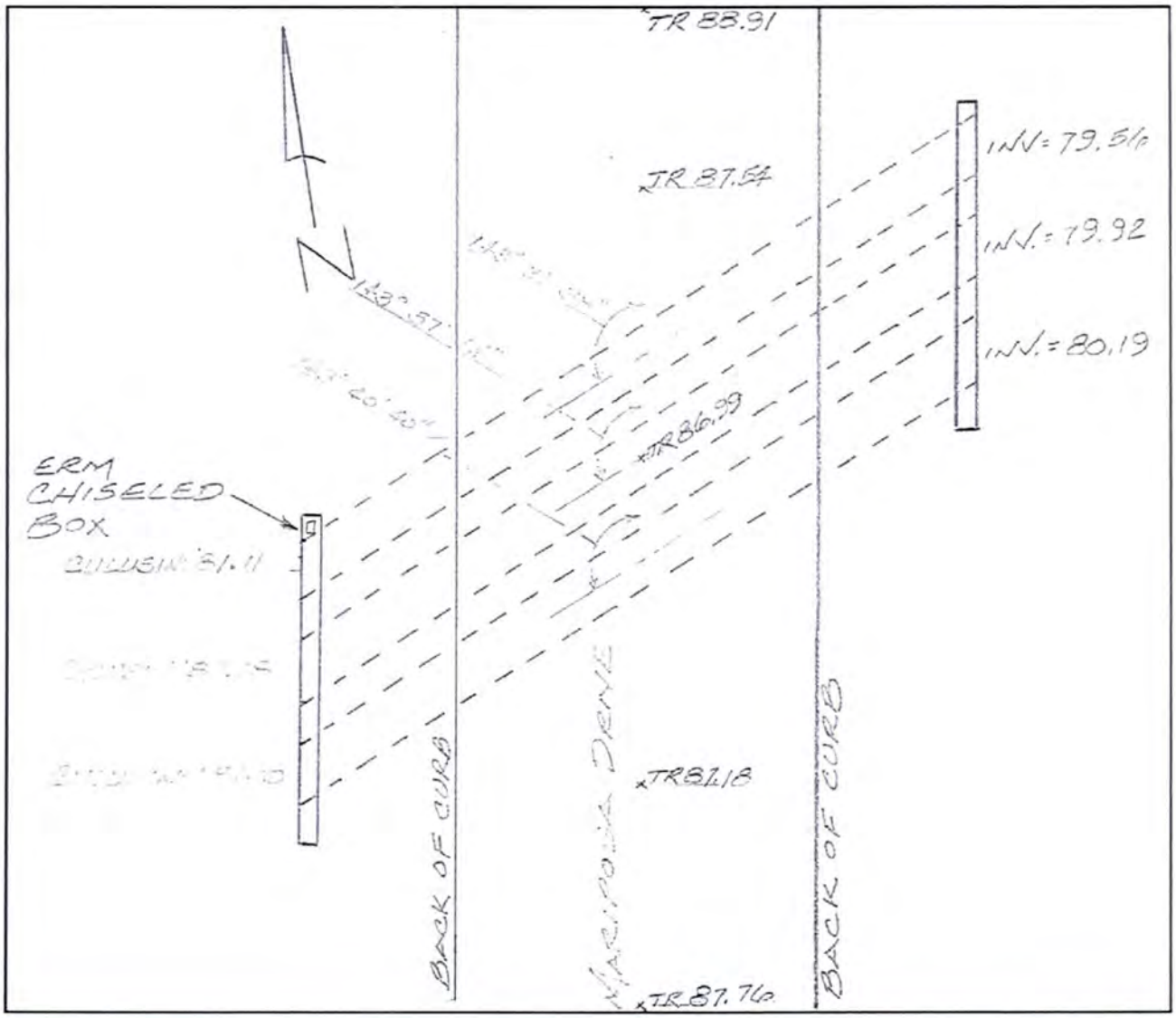
View to East, Upstream of Culvert

View to West, Downstream of Culvert

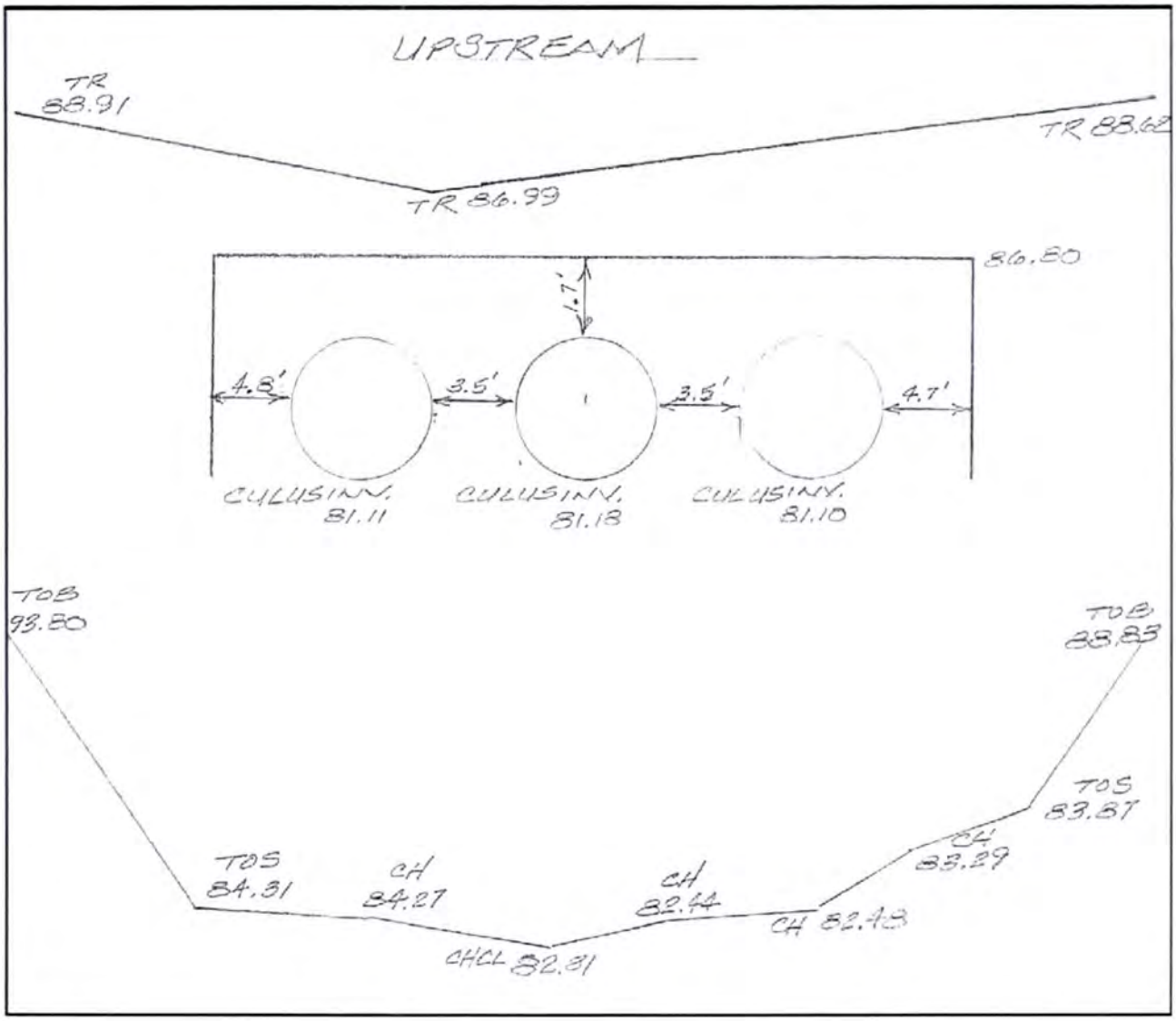
View to North, from Culvert Crossing

Wash Name:	Sunnycove Wash Upper Reach			ID:	SUN_200
Location:	Mariposa Drive			RS:	1.137
Benchmark ID:		Elev:	2186.79	PC:	IM:
GPS Lat:		GPS Long:		Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	3	TYPE	CMP	LENGTH	100.0'	SIZE	H:	48"	W:	48"	SKEW	53° L
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:													



Wash Name:	Sunnycove Wash Upper Reach	ID:	SUN_200
Location:	Mariposa Drive	RS:	1.137
GPS Lat:	GPS Long:		



Wash Name:	Sunnycove Wash Upper Reach	ID:	SUN_200
Location:	Mariposa Drive	RS:	1.137
GPS Lat:	GPS Long:		

View to East, Upstream of Culvert

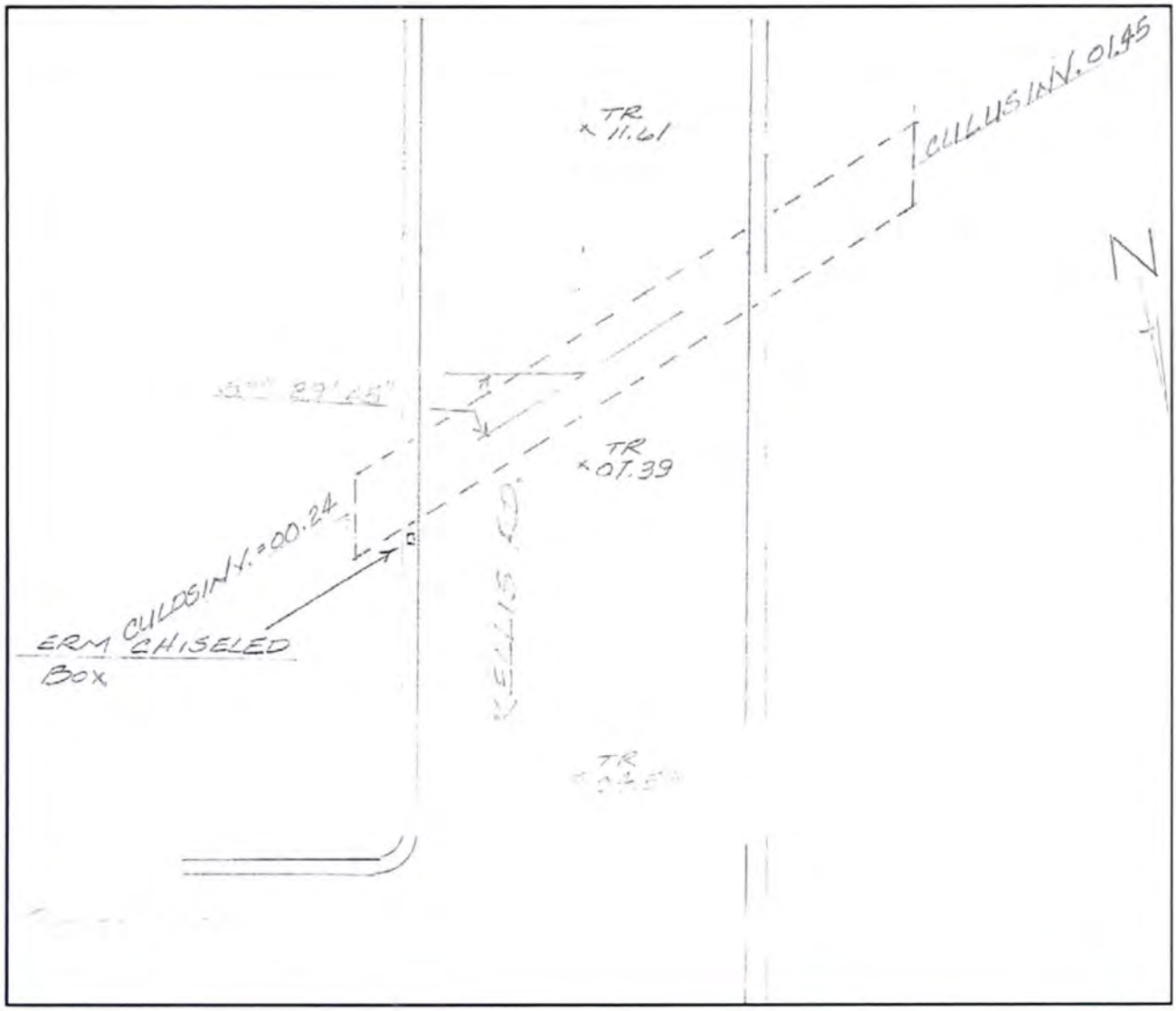
View to West, Downstream of Culvert

View to North, from Culvert Crossing

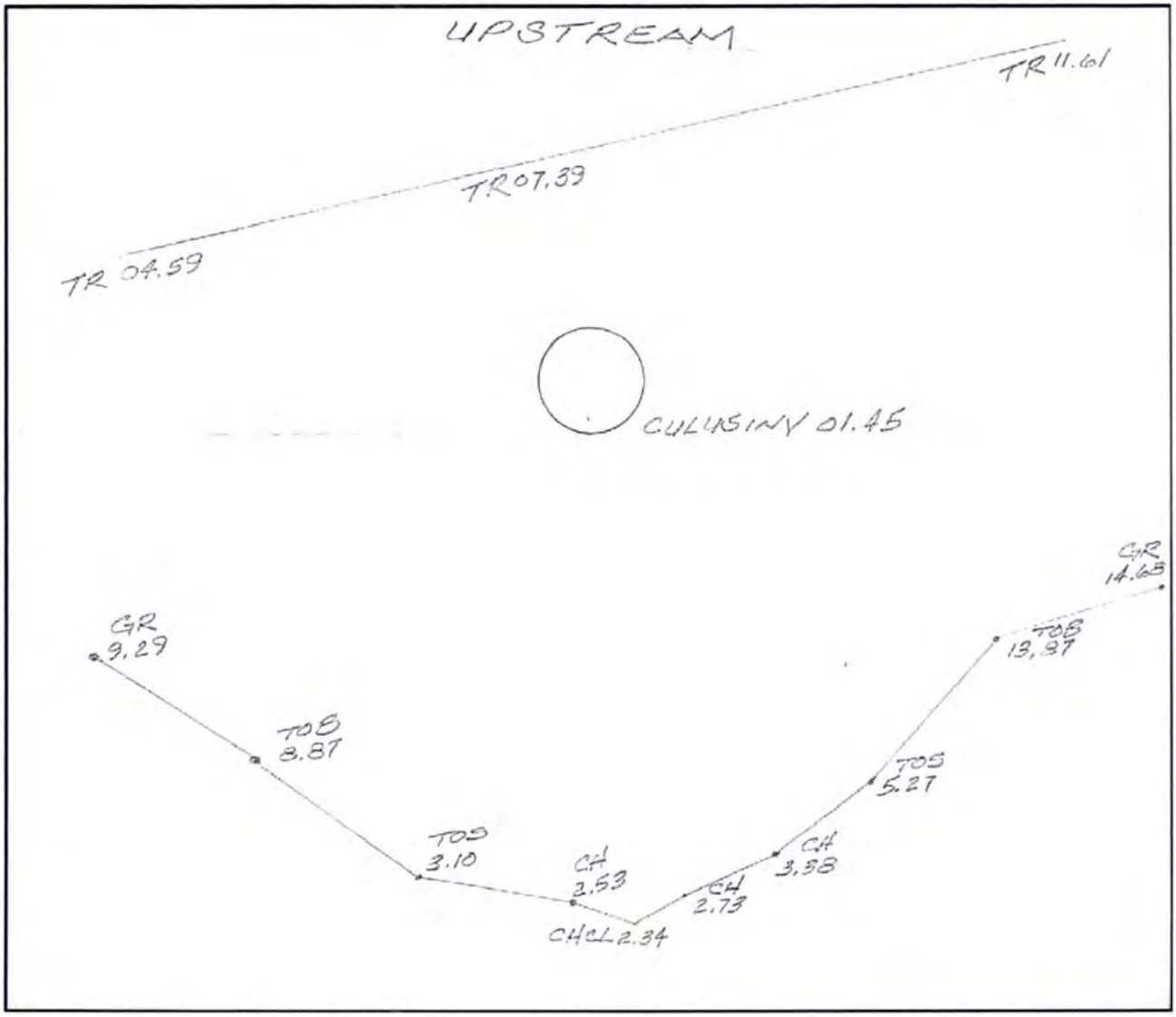
View to South, from Culvert Crossing

Wash Name:	Sunnycove Wash					ID:	SUN_500
Location:	Kellis Road					RS:	0.269
Benchmark ID:		Elev:	2108.45	PC:		IM:	
GPS Lat:			GPS Long:			Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	1	TYPE	CMP	LENGTH	79.0'	SIZE	H:	24"	W:	24"	SKEW	37° L
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:			No headwall on either side of culvert										



Wash Name:	Sunnycove Wash	ID:	SUN_500
Location:	Kellis Road	RS:	0.269
GPS Lat:	GPS Long:		



Wash Name:	Sunnycove Wash	ID:	SUN_500
Location:	Kellis Road	RS:	0.269
GPS Lat:	GPS Long:		

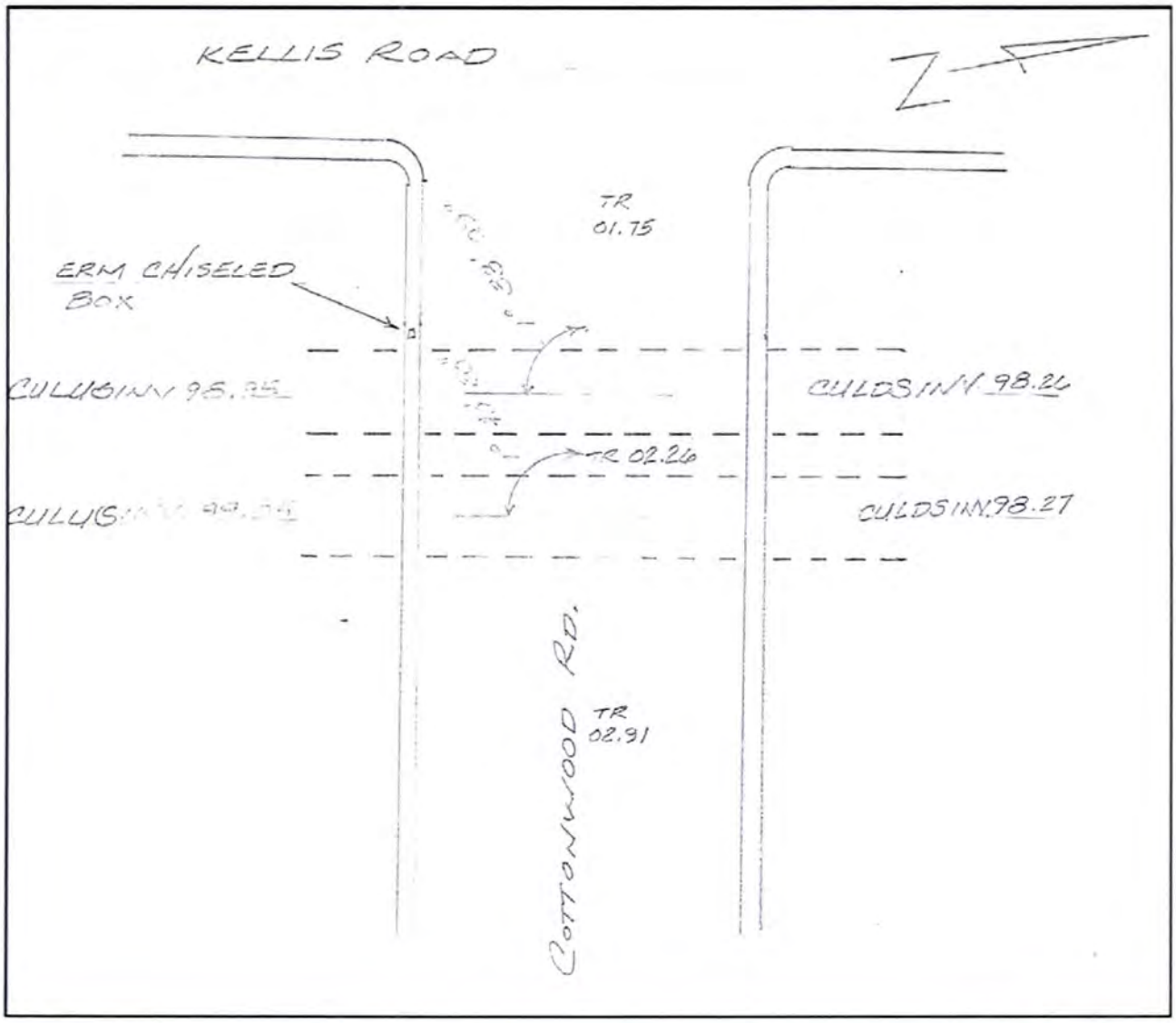
View to East, Upstream of Culvert

View to East, Downstream of Culvert

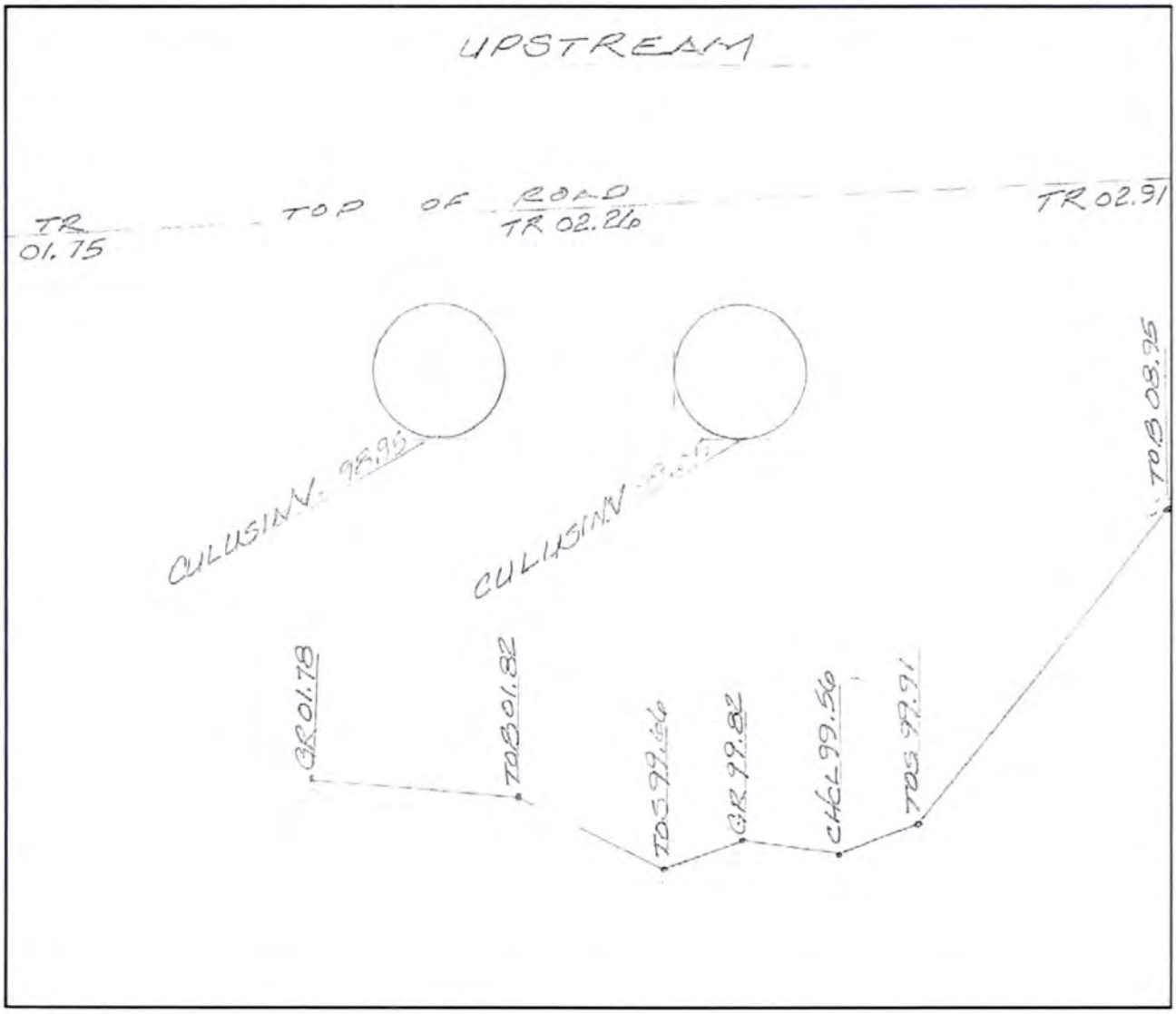
View to North, from Culvert Crossing

Wash Name:	Sunnycove Wash			ID:	SUN_510
Location:	Cottonwood Road			RS:	0.233
Benchmark ID:		Elev:	2102.36	PC:	IM:
GPS Lat:		GPS Long:		Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	2	TYPE	CMP	LENGTH	60.0'	SIZE	H:	24"	W:	24"	SKEW	2° L
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:	No headwall on either side of culvert												



Wash Name:	Sunnycove Wash	ID:	SUN_510
Location:	Cottonwood Road	RS:	0.233
GPS Lat:	GPS Long:		



Wash Name:	Sunnycove Wash	ID:	SUN_510
Location:	Cottonwood Road	RS:	0.233
GPS Lat:	GPS Long:		

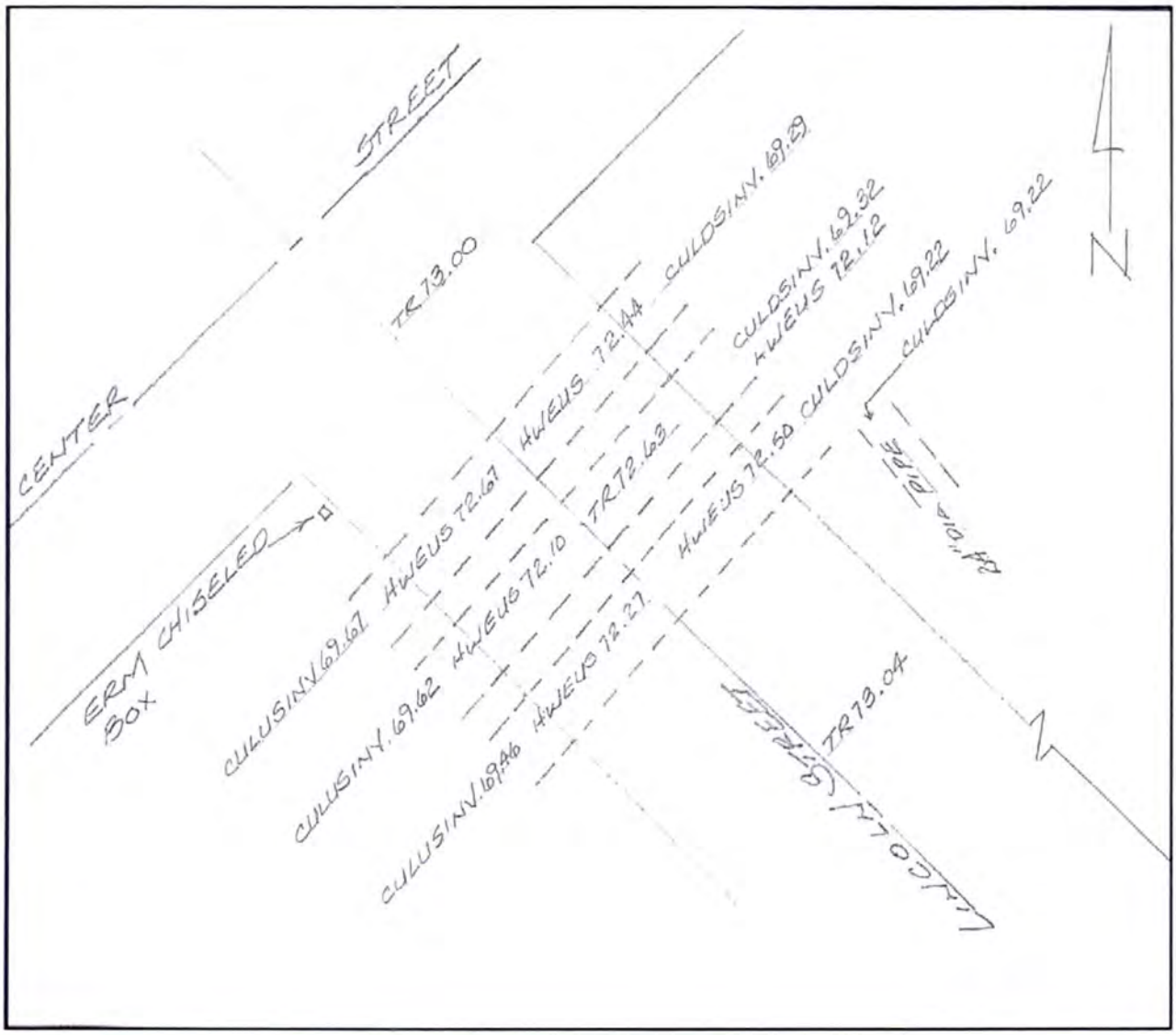
View to North, Upstream of Culvert

View to South, Downstream of Culvert

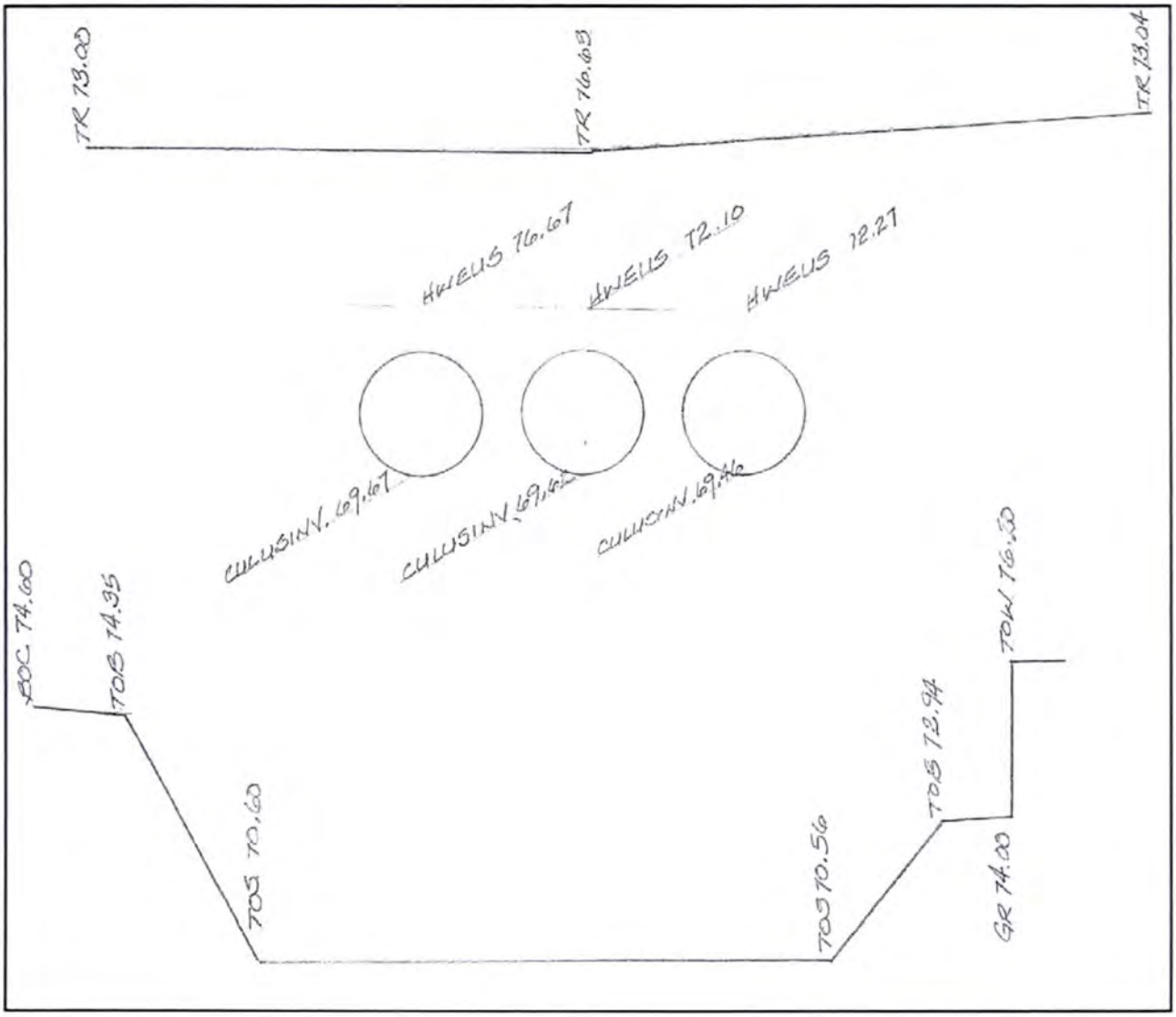
View to West, from Culvert Crossing

Wash Name:	Sunset Wash					ID:	SST_200
Location:	Lincoln Street					RS:	0.732
Benchmark ID:		Elev:	2073.60	PC:		IM:	
GPS Lat:			GPS Long:			Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	3	TYPE	CMP	LENGTH	47.0'	SIZE	H:	16"	W:	20"	SKEW	2° L
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:	No headwall on either side of culvert												



Wash Name:	Sunset Wash	ID:	SST_200
Location:	Lincoln Street	RS:	0.732
GPS Lat:	GPS Long:		



Wash Name:	Sunset Wash	ID:	SST_200
Location:	Lincoln Street	RS:	0.732
GPS Lat:	GPS Long:		

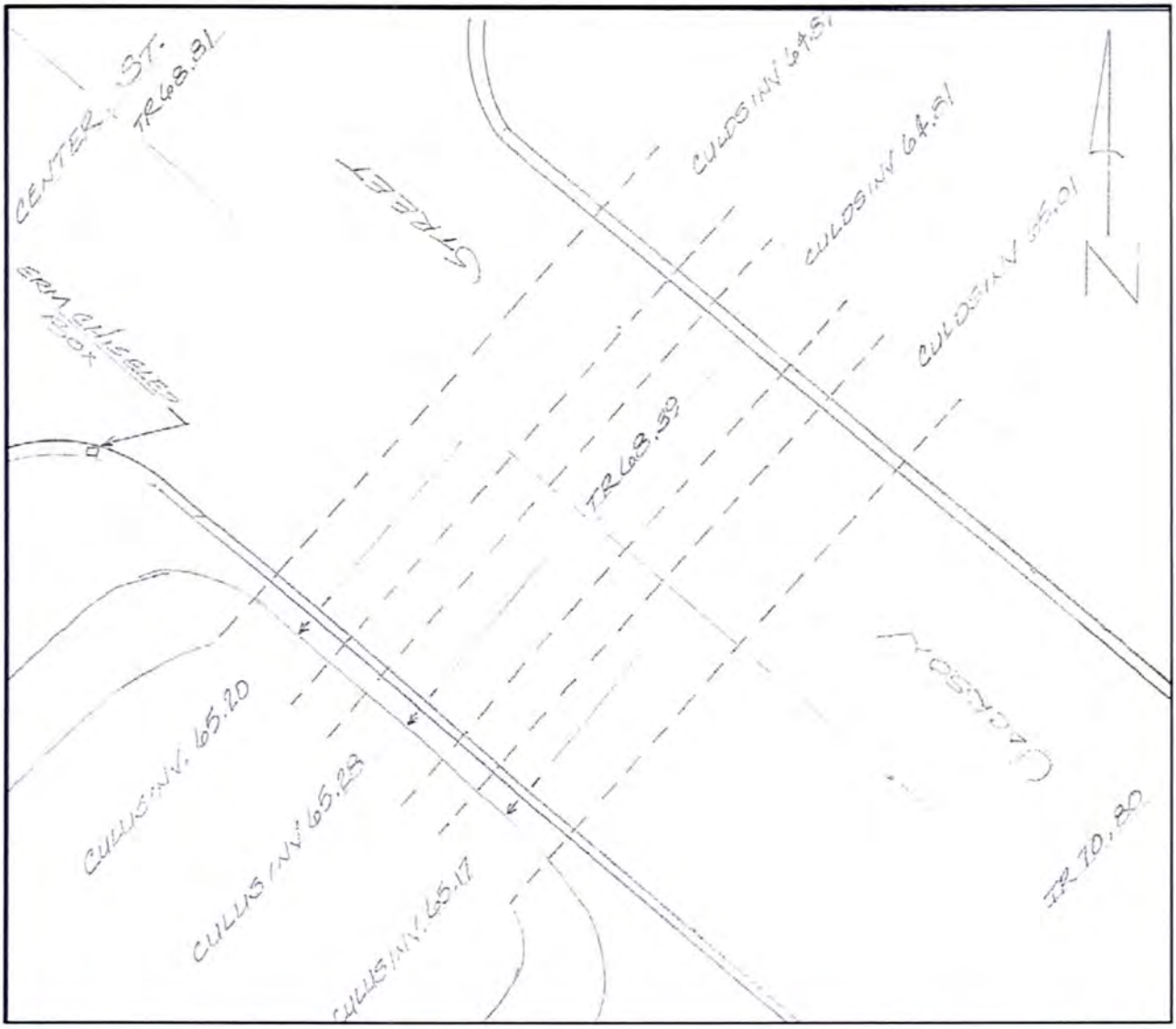
View to Northeast, Upstream of Culvert

View to Southwest, Downstream of Culvert

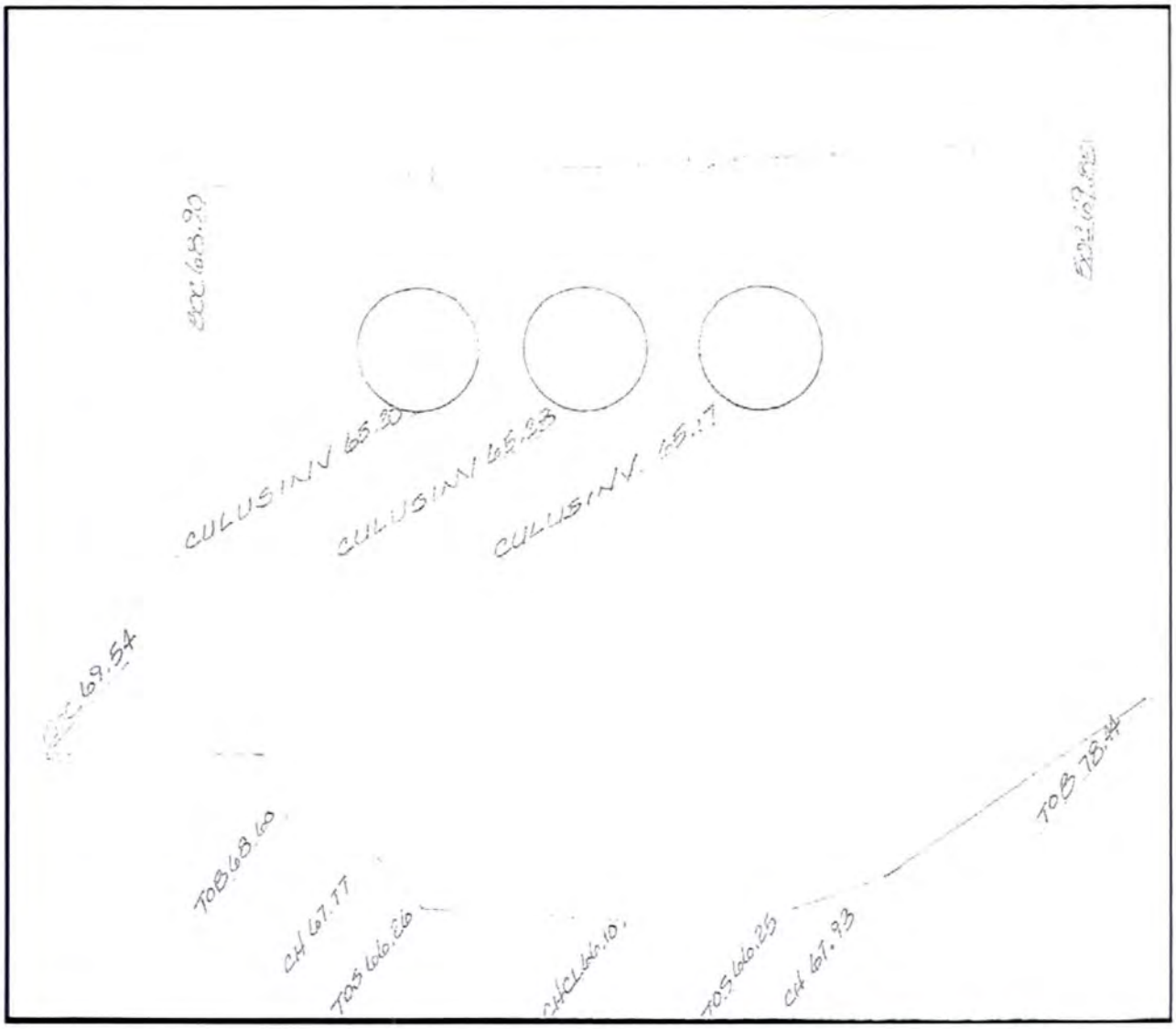
View to Northwest, from Culvert Crossing

Wash Name:	Sunset Wash			ID:	SST_300
Location:	Jackson Street			RS:	0.663
Benchmark ID:		Elev:	2069.01	PC:	IM:
GPS Lat:		GPS Long:		Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	3	TYPE	CMP	LENGTH	46.0'	SIZE	H:	16"	W:	20"	SKEW	0°
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:	No headwall on either side of culvert												



Wash Name:	Sunset Wash	ID:	SST_300
Location:	Jackson Street	RS:	0.663
GPS Lat:	GPS Long:		



Wash Name:	Sunset Wash	ID:	SST_300
Location:	Jackson Street	RS:	0.663
GPS Lat:	GPS Long:		

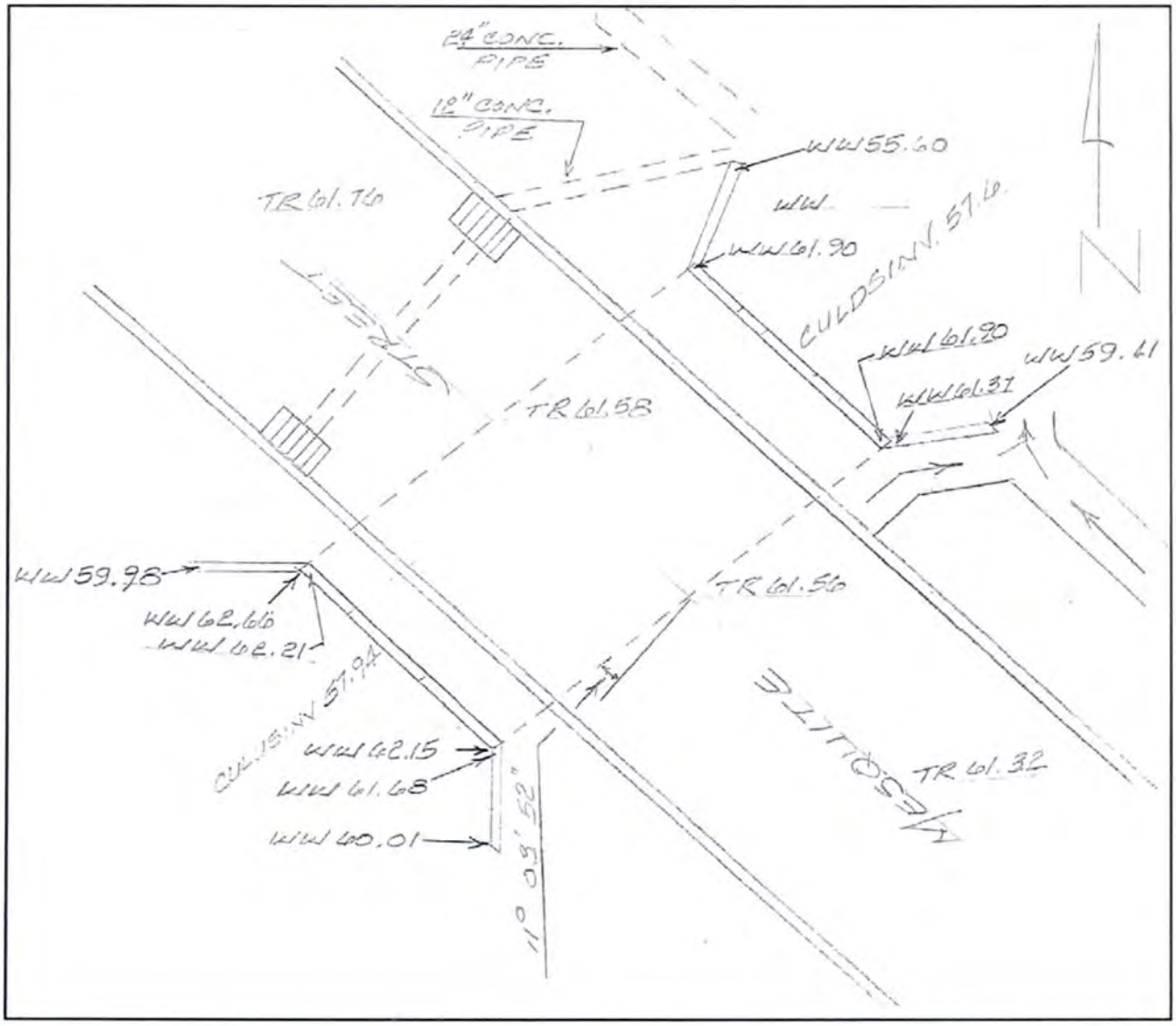
View to Northeast, Upstream of Culvert

View to Northeast, Upstream of Culvert

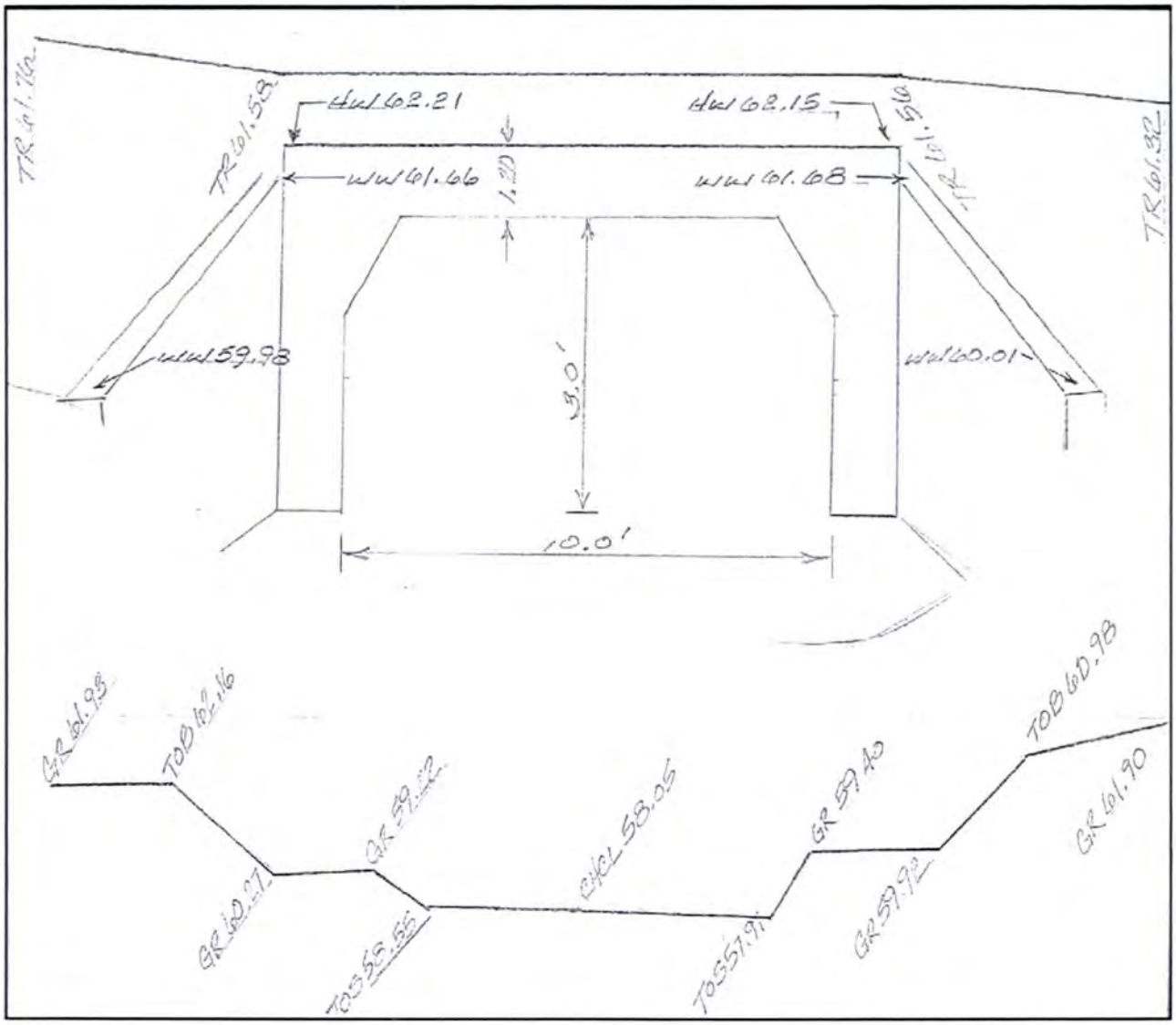
View to Northeast, Downstream of Culvert

Wash Name:	Sunset Wash					ID:	SST_400
Location:	Mesquite Drive					RS:	0.542
Benchmark ID:		Elev:	2062.23	PC:		IM:	
GPS Lat:			GPS Long:			Photo ID:	

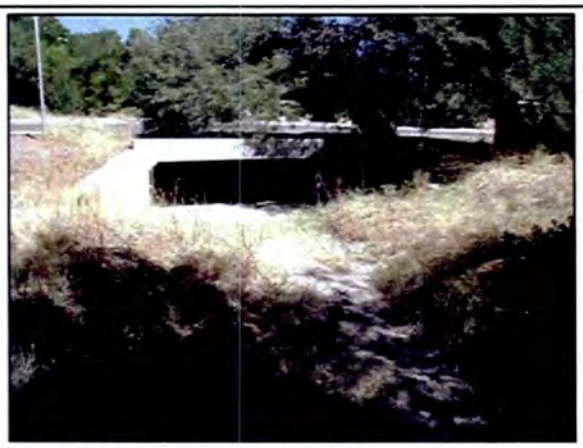
BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	1	TYPE	CBC	LENGTH	47'	SIZE	H:	3'	W:	10'	SKEW	11° R
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:													



Wash Name:	Sunset Wash	ID:	SST_400
Location:	Mesquite Drive	RS:	0.542
GPS Lat:	GPS Long:		



Wash Name:	Sunset Wash	ID:	SST_400
Location:	Mesquite Drive	RS:	0.542
GPS Lat:	GPS Long:		


View to Northeast, Upstream of Culvert

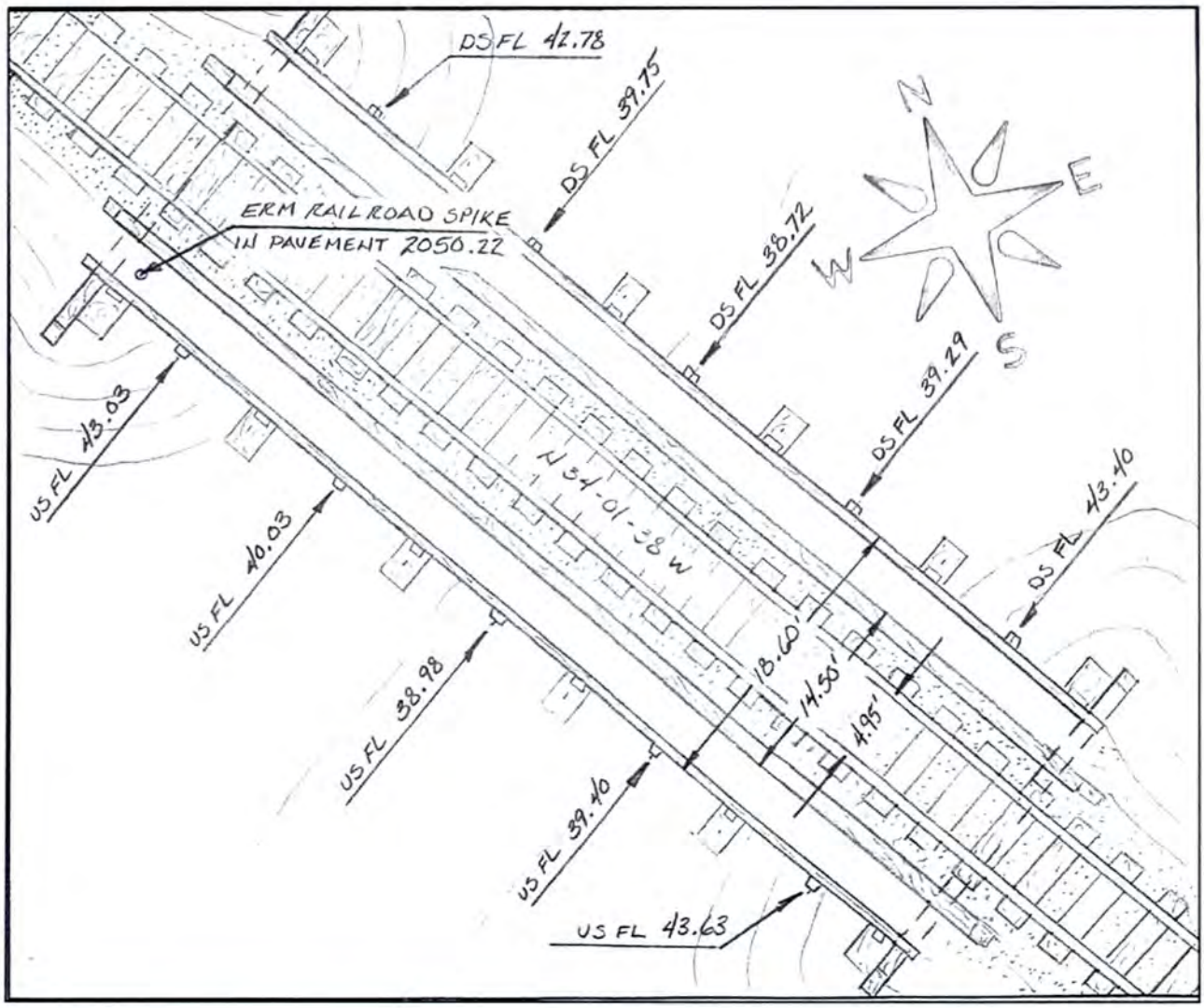
View to Southwest, Downstream of Culvert

View to West, Downstream of Culvert

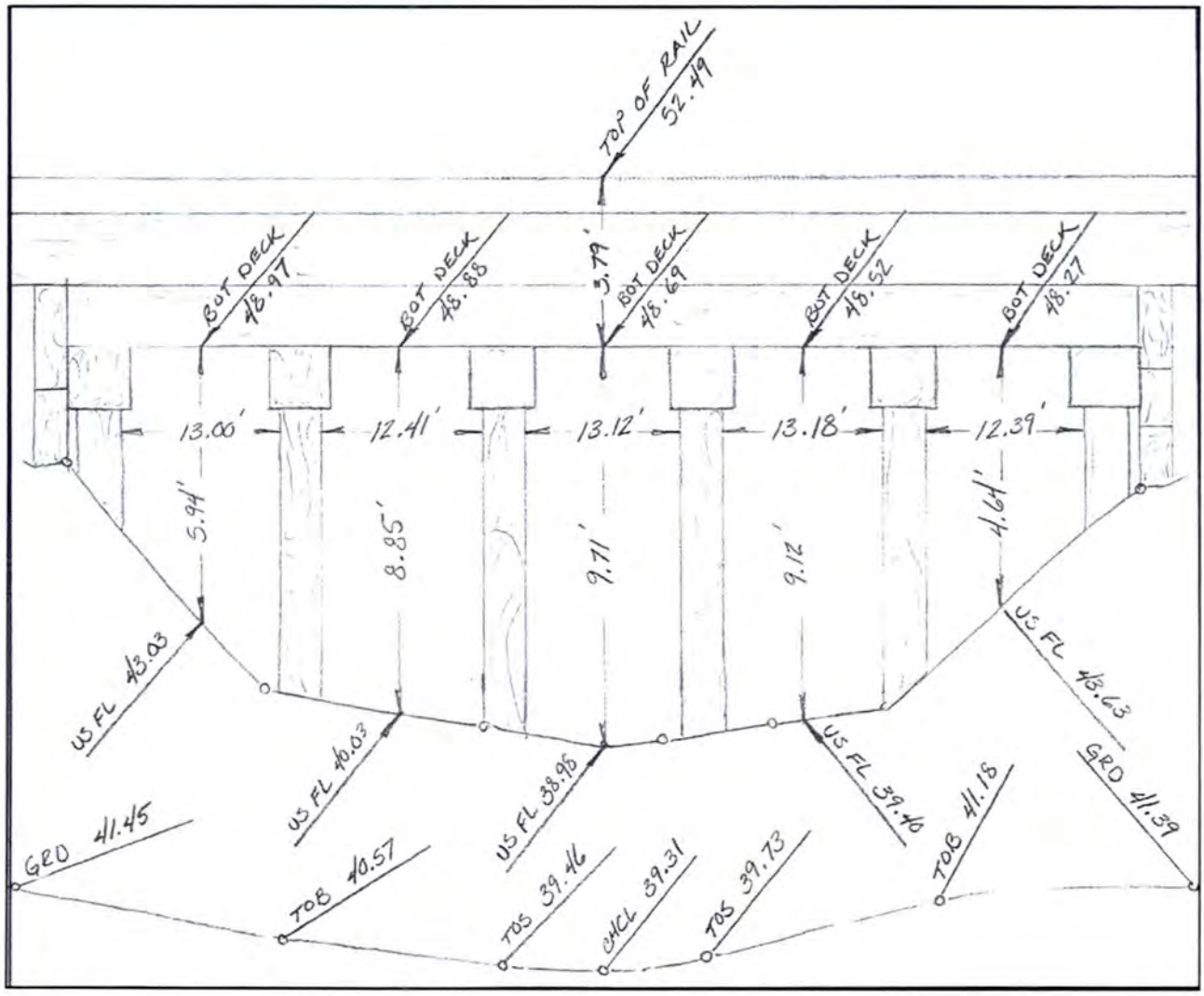
View to Southeast, from Culvert Crossing

Wash Name:	Sunset Wash	ID:	SST_500
Location:	BNSF Railroad Crossing	RS:	0.264
Benchmark ID:	Elev:	PC:	IM:
GPS Lat:	GPS Long:	Photo ID:	

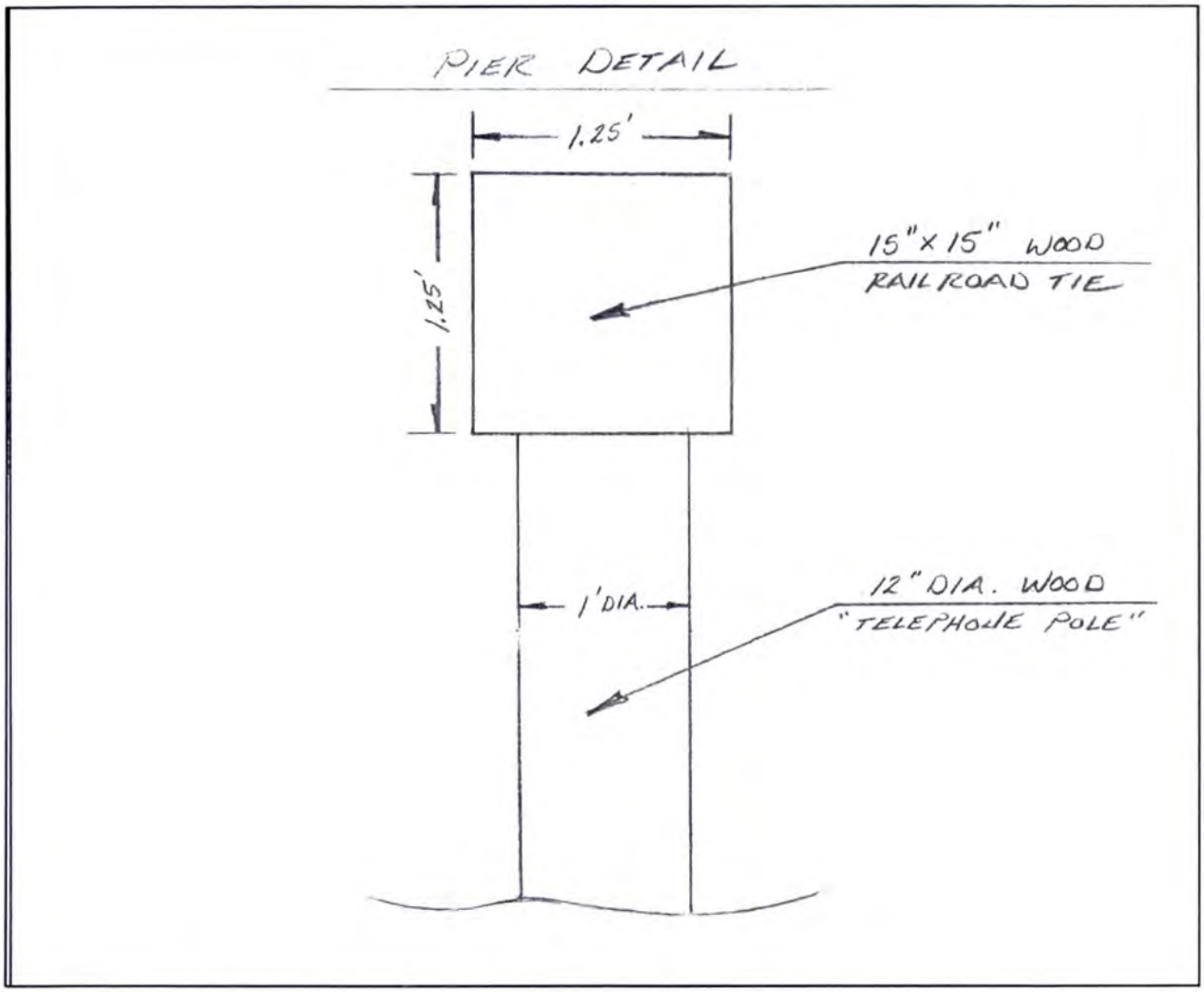
BRIDGE	RAIL	DECK	Wood	WIDTH	18.60'	PIER(S)	4	@	13'±	SKEW
CULVERT	NUM#	TYPE		LENGTH		SIZE	H:		W:	SKEW
DAM	TOP WIDTH			SIDESLOPE	US:		DS:		RISER	
ADDITIONAL COMMENTS:	Located at BNSF mile post 140.2									



Wash Name:	Sunset Wash	ID:	SST_500
Location:	BNSF Railroad Crossing	RS:	0.264
GPS Lat:	GPS Long:		



Wash Name:	Sunset Wash	ID:	SST_500
Location:	BNSF Railroad Crossing	RS:	0.264
GPS Lat:	GPS Long:		



Wash Name:	Sunset Wash	ID:	SST_500
Location:	BNSF Railroad Crossing	RS:	0.264
GPS Lat:	GPS Long:		

View to East, Upstream of Culvert

View to West, Downstream of Culvert

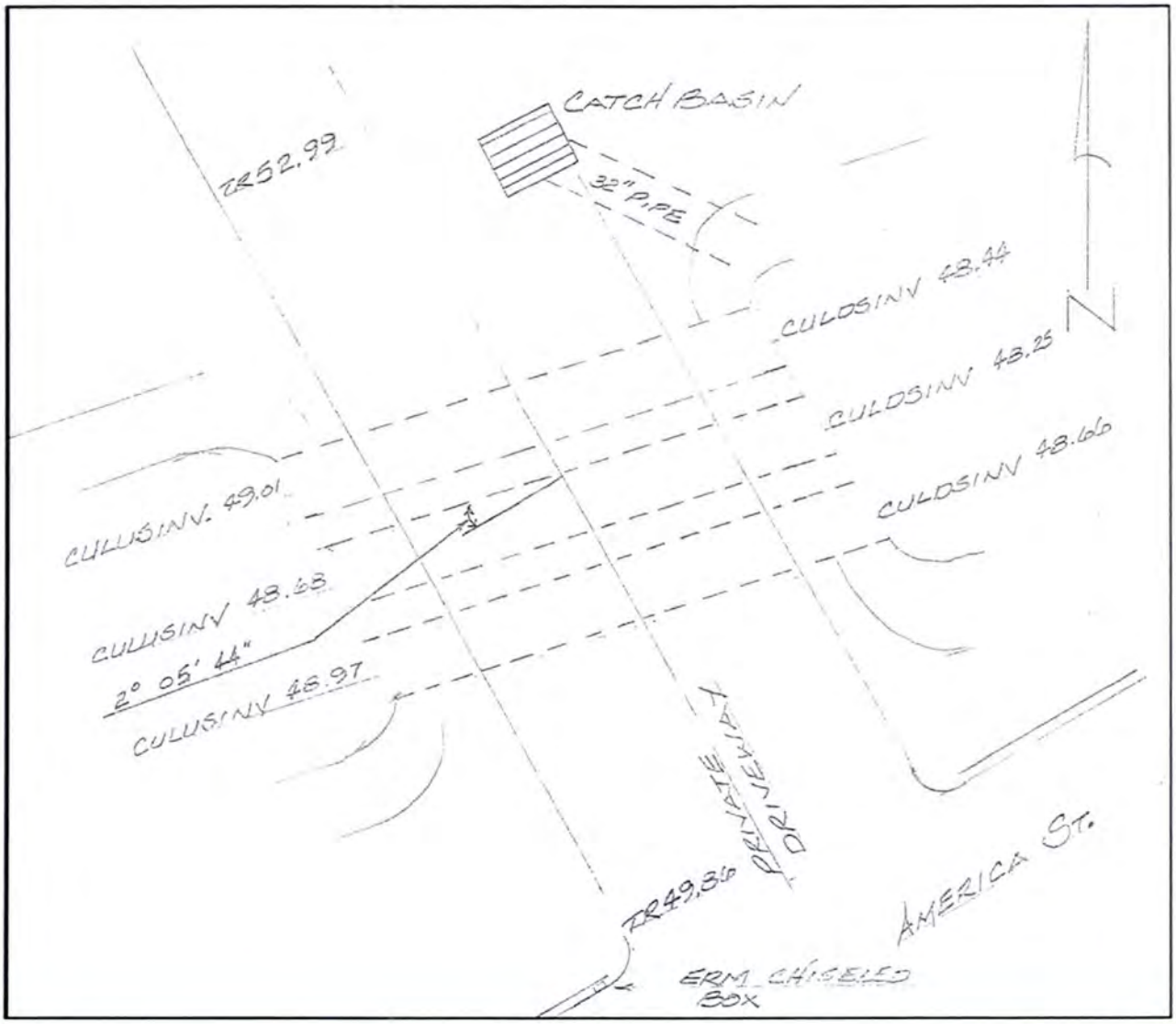
View to Northeast, Downstream of Culvert

View to Southwest, Downstream of Culvert

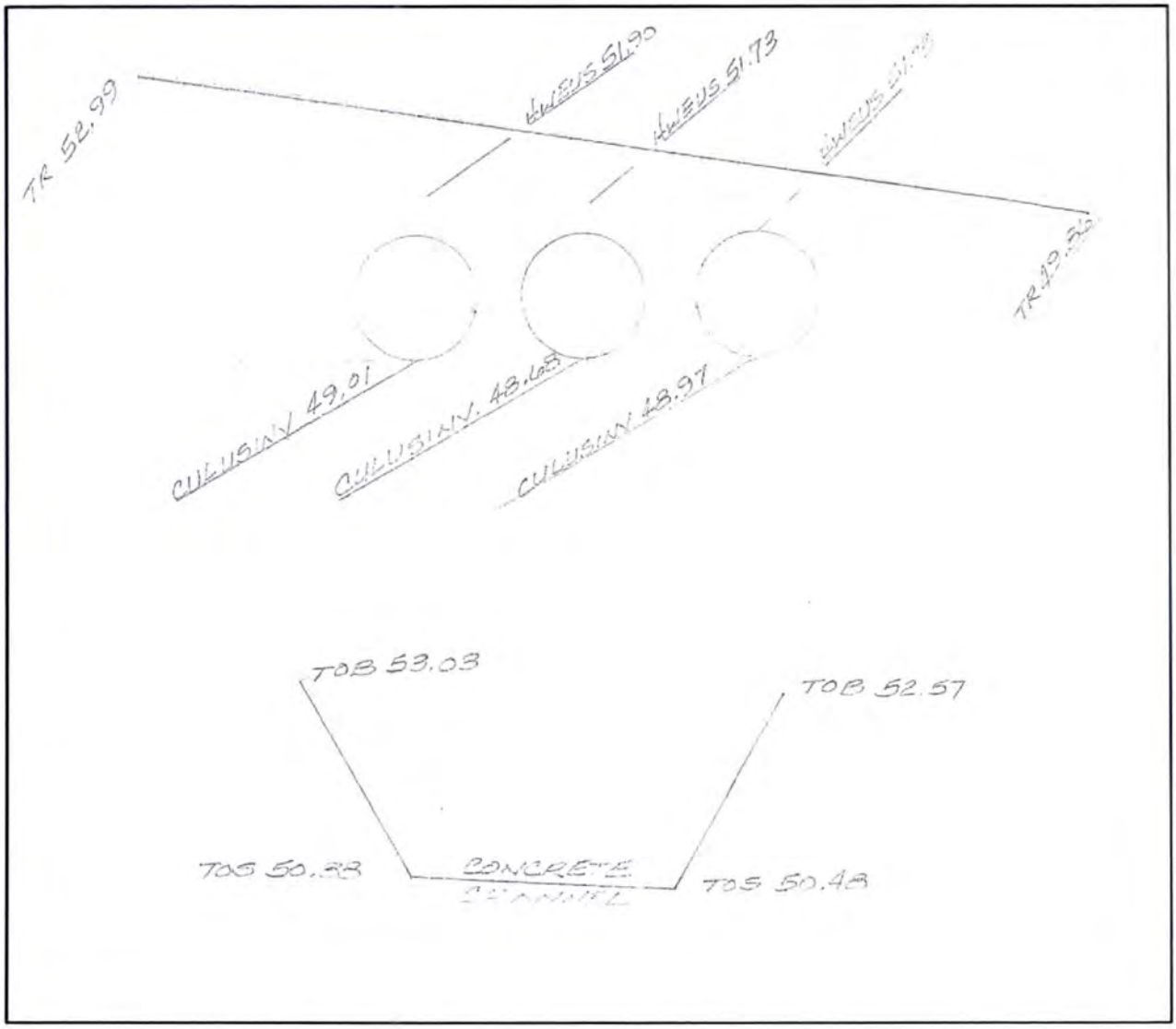
View to North, On Railroad Tracks

Wash Name:	Sunset Wash Tributary			ID:	SST_120
Location:	America Street and Private Driveway			RS:	0.213
Benchmark ID:		Elev: 2149.87	PC:	IM:	
GPS Lat:		GPS Long:		Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	3	TYPE	CMP	LENGTH	40.0'	SIZE	H:	24"	W:	32"	SKEW	2° R
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:	No headwall on either side of culvert												



Wash Name:	Sunset Wash Tributary	ID:	SST_120
Location:	America Street and Private Driveway	RS:	0.213
GPS Lat:	GPS Long:		



Wash Name:	Sunset Wash Tributary	ID:	SST_120
Location:	America Street and Private Driveway	RS:	0.213
GPS Lat:	GPS Long:		

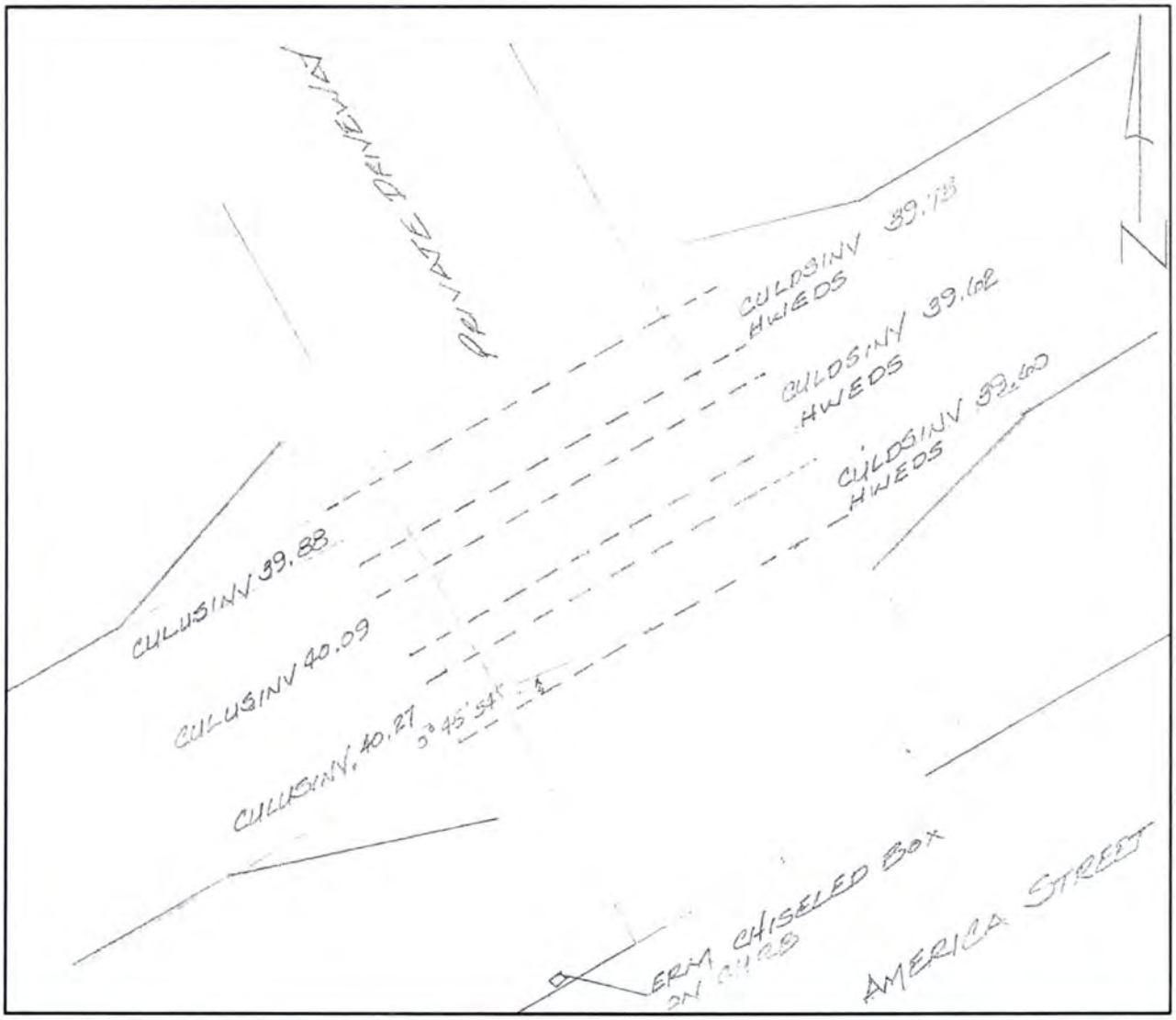
View to East, Upstream of Culvert

View to West, Downstream of Culvert

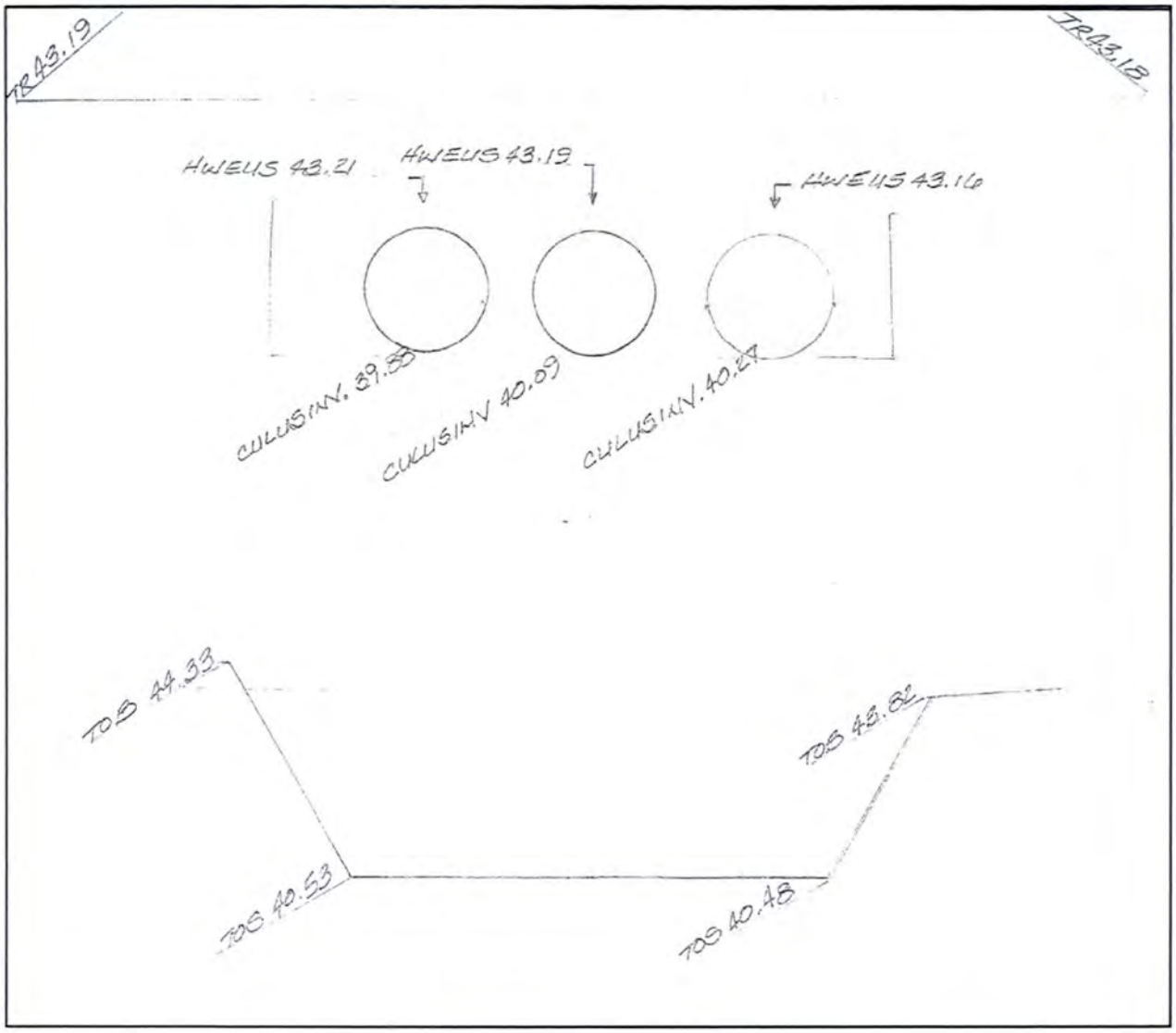
View to North, from Culvert Crossing

Wash Name:	Sunset Wash Tributary			ID:	SST_130
Location:	America Street and Private Driveway			RS:	0.155
Benchmark ID:		Elev: 2143.66	PC:	IM:	
GPS Lat:		GPS Long:		Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	3	TYPE	CMP	LENGTH	21.0'	SIZE	H:	24"	W:	32"	SKEW	1° R
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:	No headwall on either side of culvert												



Wash Name:	Sunset Wash Tributary	ID:	SST_130
Location:	America Street and Private Driveway	RS:	0.155
GPS Lat:	GPS Long:		



Wash Name:	Sunset Wash Tributary	ID:	SST_130
Location:	America Street and Private Driveway	RS:	0.155
GPS Lat:	GPS Long:		

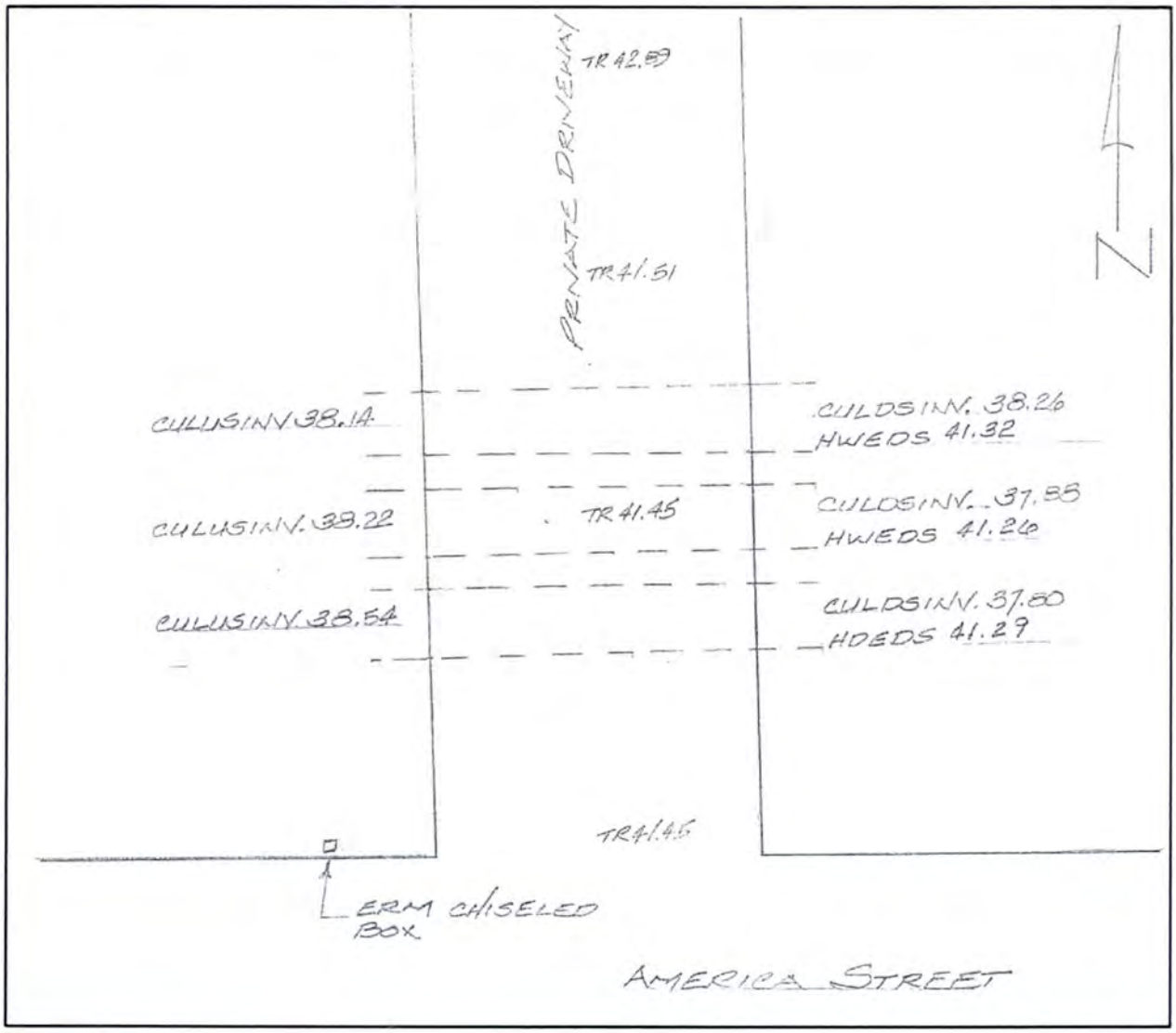
View to East, Upstream of Culvert

View to West, Downstream of Culvert

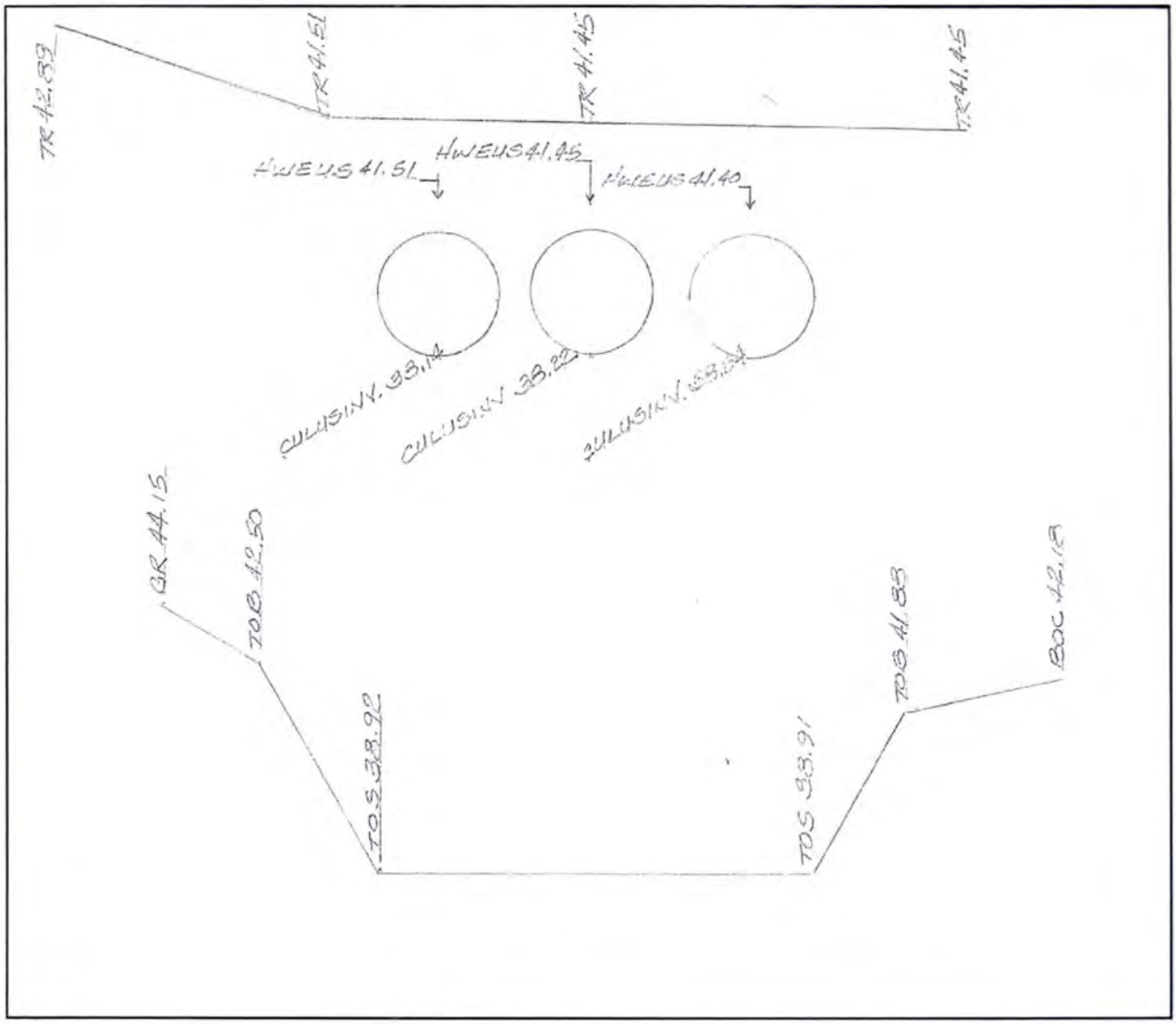
View to North, from Culvert Crossing

Wash Name:	Sunset Wash Tributary	ID:	SST_140
Location:	America Street and Private Driveway	RS:	0.135
Benchmark ID:	Elev:	PC:	IM:
GPS Lat:	GPS Long:	Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	3	TYPE	CMP	LENGTH	21.0'	SIZE	H:	24"	W:	32"	SKEW	2° R
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:	No headwall on either side of culvert												



Wash Name:	Sunset Wash Tributary	ID:	SST_140
Location:	America Street and Private Driveway	RS:	0.135
GPS Lat:	GPS Long:		



Wash Name:	Sunset Wash Tributary	ID:	SST_140
Location:	America Street and Private Driveway	RS:	0.135
GPS Lat:	GPS Long:		

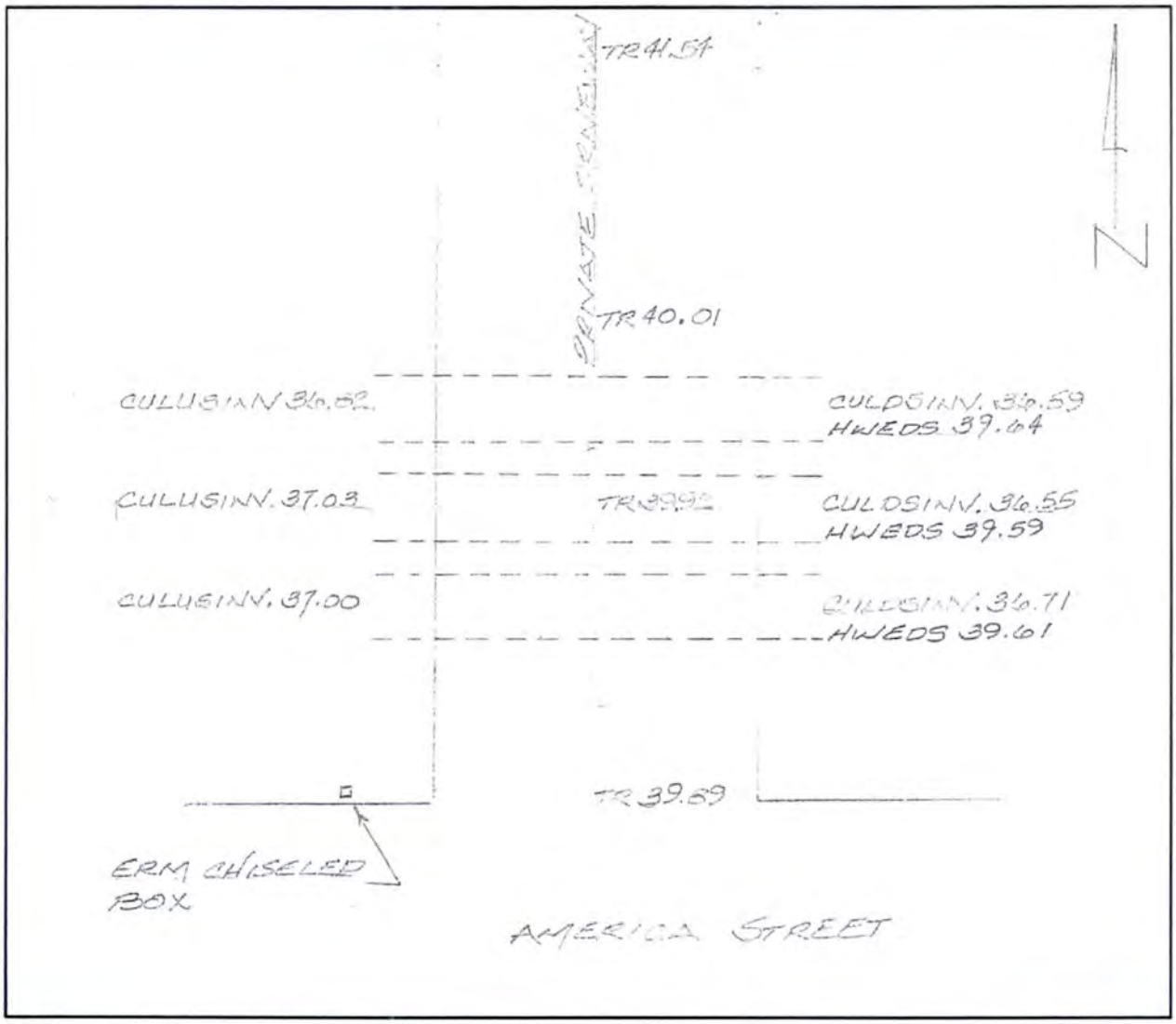
View to East, Upstream of Culvert

View to West, Downstream of Culvert

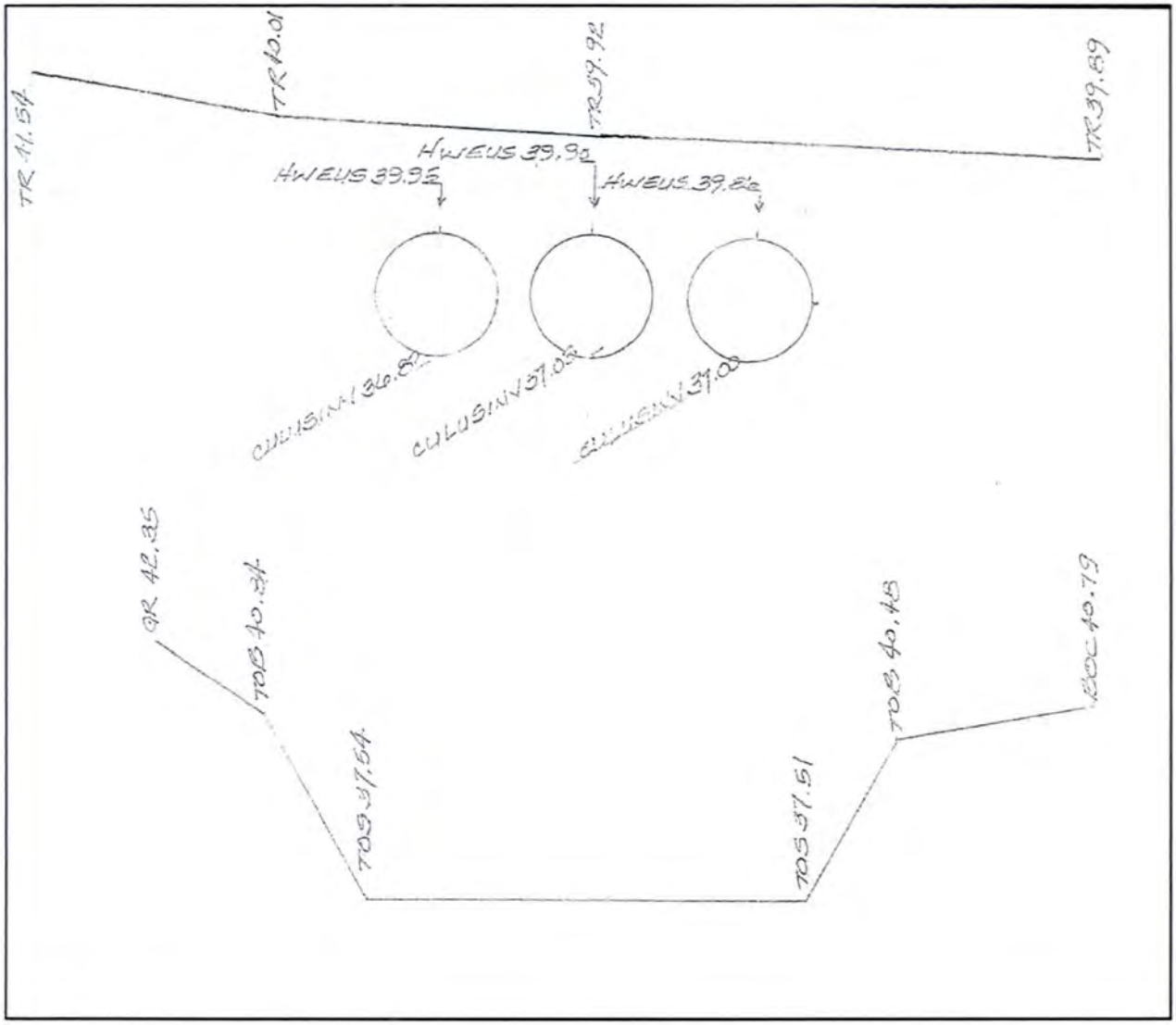
View to North, from Culvert Crossing

Wash Name:	Sunset Wash Tributary			ID:	SST_150
Location:	America Street and Private Driveway			RS:	0.119
Benchmark ID:		Elev: 2145.55	PC:	IM:	
GPS Lat:		GPS Long:		Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	3	TYPE	CMP	LENGTH	21.0'	SIZE	H:	24"	W:	32"	SKEW	0°
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:	No headwall on either side of culvert												



Wash Name:	Sunset Wash Tributary	ID:	SST_150
Location:	America Street and Private Driveway	RS:	0.119
GPS Lat:	GPS Long:		



Wash Name:	Sunset Wash Tributary	ID:	SST_150
Location:	America Street and Private Driveway	RS:	0.119
GPS Lat:	GPS Long:		

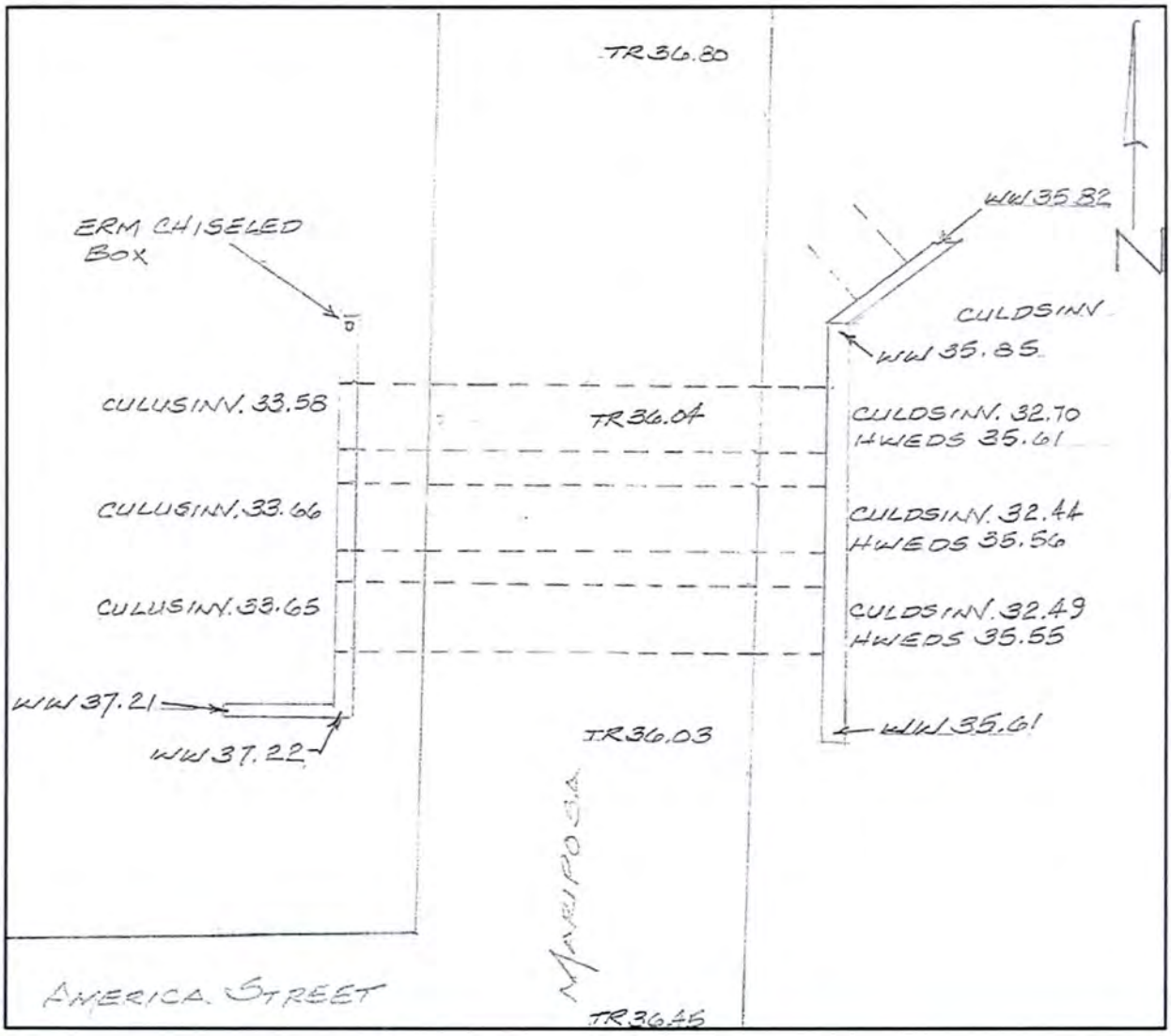
View to East, Upstream of Culvert

View to West, Downstream of Culvert

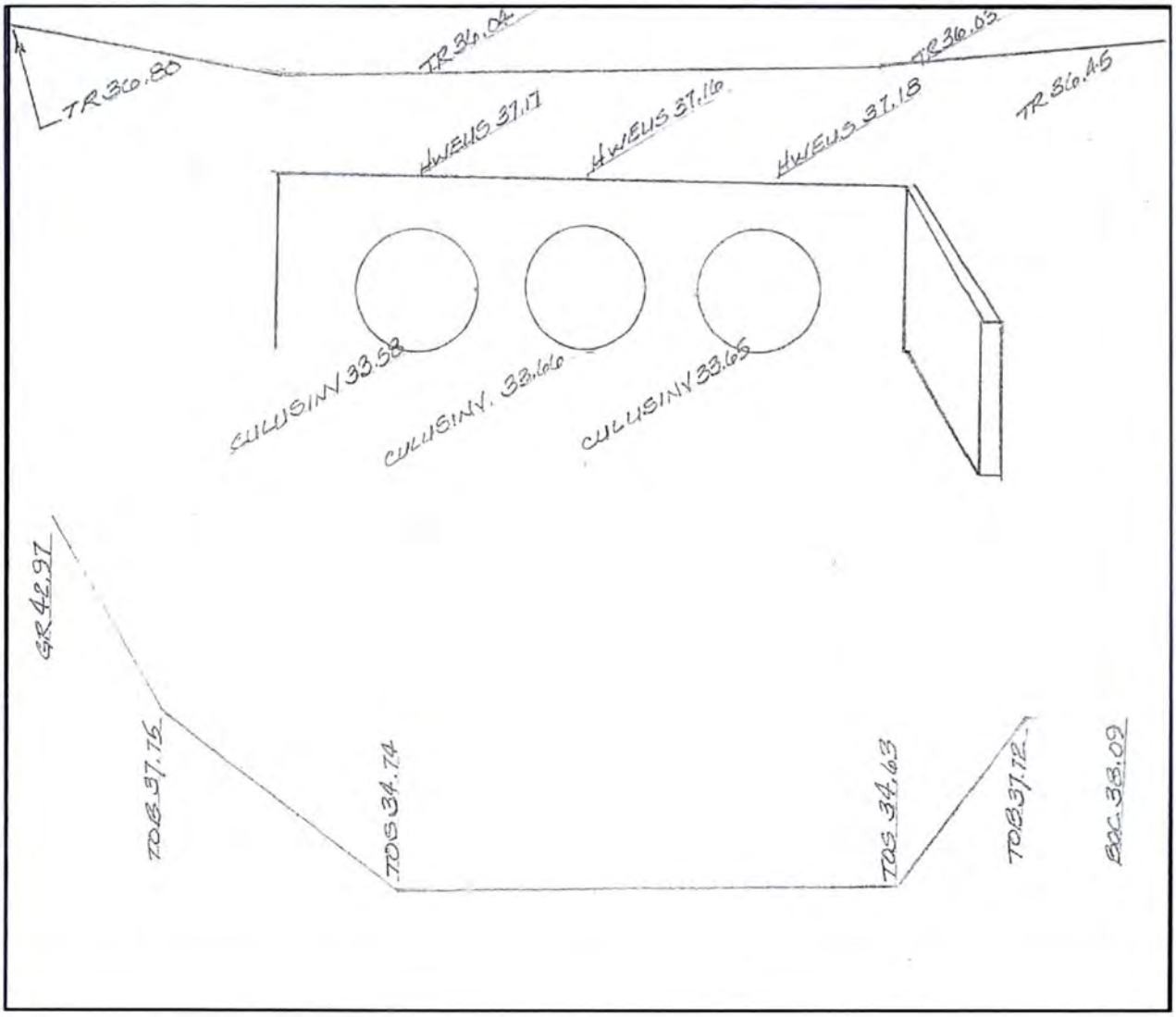
View to North, from Culvert Crossing

Wash Name:	Sunset Wash Tributary			ID:	SST_160
Location:	Mariposa Drive and America Street			RS:	0.082
Benchmark ID:		Elev: 2137.18	PC:	IM:	
GPS Lat:		GPS Long:		Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	3	TYPE	CMP	LENGTH	56.0'	SIZE	H:	24"	W:	36"	SKEW	0°
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:	No headwall on either side of culvert												



Wash Name:	Sunset Wash Tributary	ID:	SST_160
Location:	Mariposa Drive and America Street	RS:	0.082
GPS Lat:	GPS Long:		



Wash Name:	Sunset Wash Tributary	ID:	SST_160
Location:	Mariposa Drive and America Street	RS:	0.082
GPS Lat:	GPS Long:		

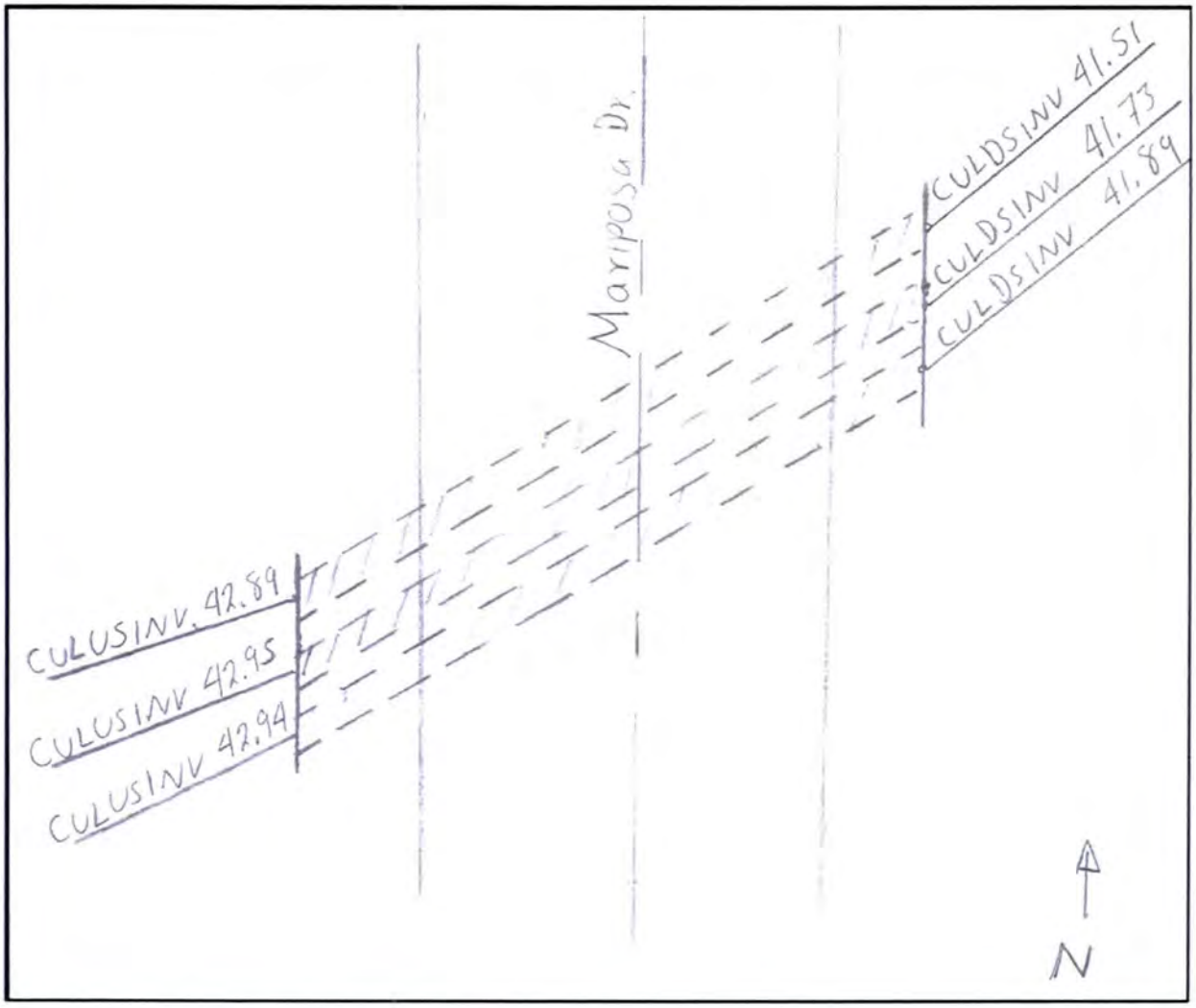
View to East, Upstream of Culvert

View to West, Downstream of Culvert

View to North, from Culvert Crossing

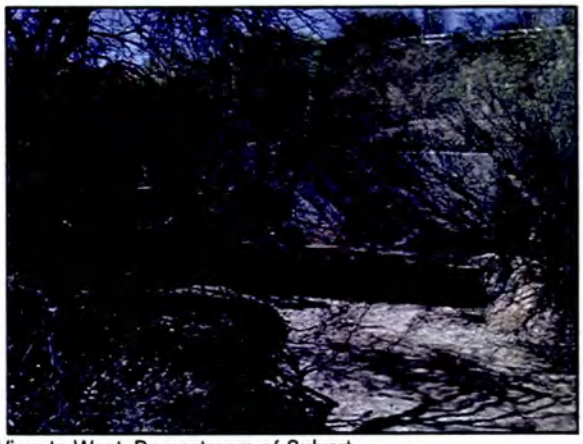
Wash Name:	Sunset Wash	ID:	SST_170
Location:	Mariposa Drive	RS:	1.456
Benchmark ID:	Elev:	PC:	IM:
GPS Lat:	GPS Long:	Photo ID:	

BRIDGE	RAIL		DECK		WIDTH		PIER(S)		@			SKEW	
CULVERT	NUM#	3	TYPE	CMP	LENGTH	82.0'	SIZE	H:	36"	W:	36"	SKEW	0°
DAM	TOP WIDTH				SIDESLOPE	US:		DS:		RISER			
ADDITIONAL COMMENTS:													



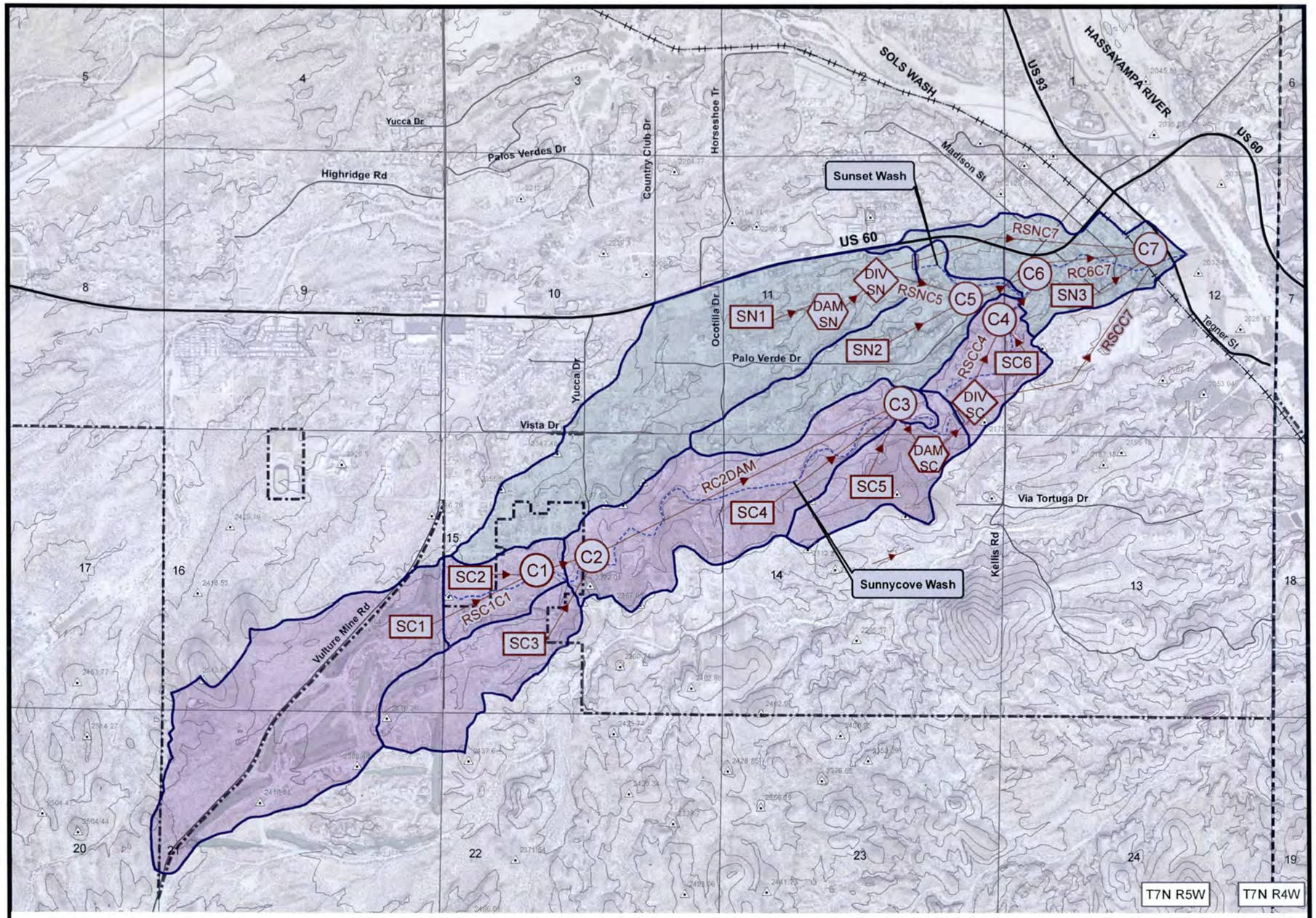
Wash Name:	Sunset Wash	ID:	SST_170
Location:	Mariposa Drive	RS:	1.456
GPS Lat:	GPS Long:		

View to East, Upstream of Culvert


View to West, Downstream of Culvert

View to North, from Culvert Crossing

View to South, from Culvert Crossing



Legend

- SN3 — Sub-Basin ID
- C4 — Concentration Point
- DIV SN — Flow Diversion
- DAM SC — Storage Routing
- RSNC5 — Routing Reach
- Sunnycove Wash Subbasins
- Sunset Wash Subbasins
- Flow Line
- Streets
- Railroad
- City Boundary
- 10 — Sections
- Township and Range
- 2053.94 — Elevation Reference
- 2000 — Elevation in Feet

Reference:
Wickenburg Topographic Mapping, dated 7/7/2004, provided by FCDMC in 2010

N

0 1,000 2,000 Feet

1 in = 2,000 ft

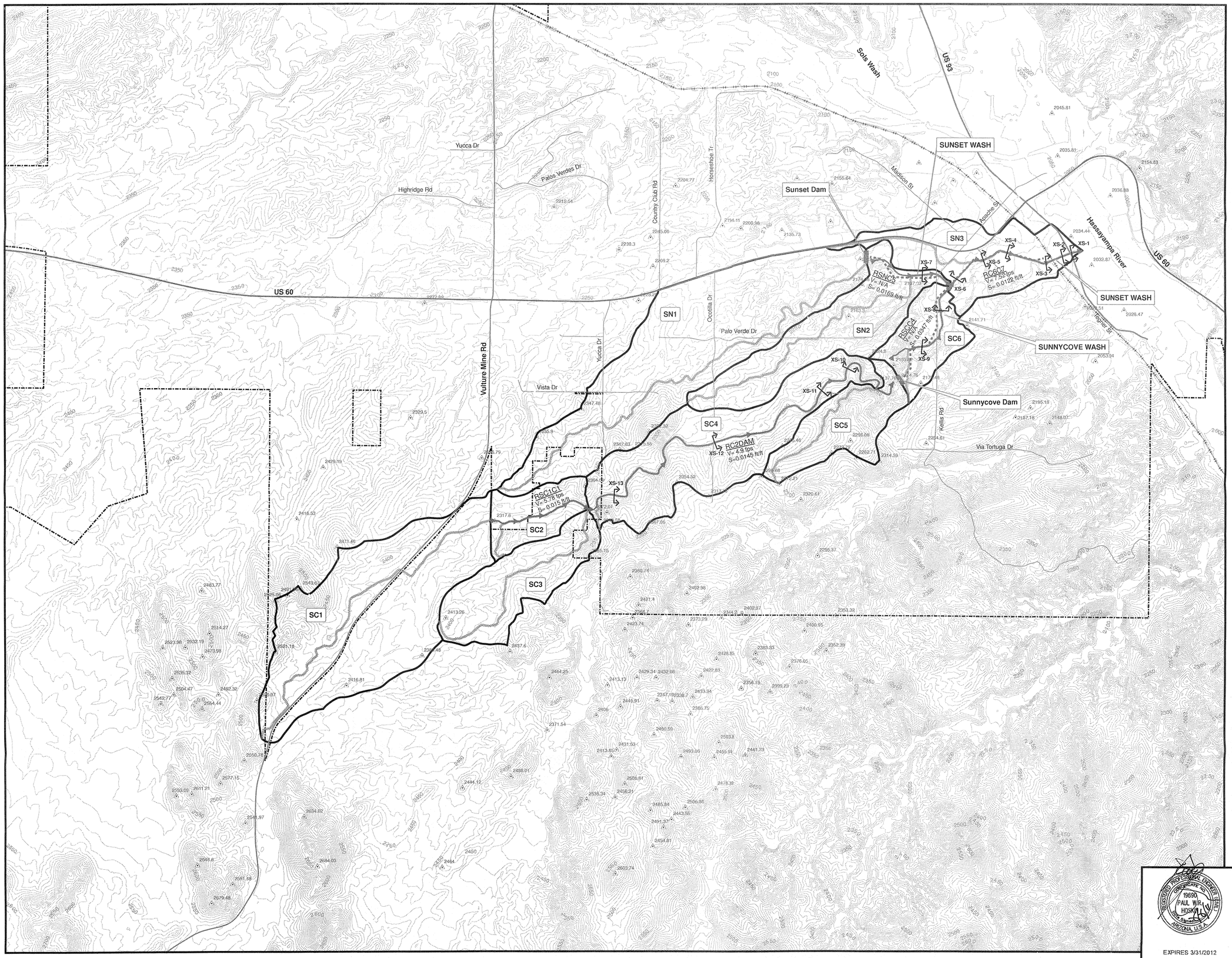
Hoskin • Ryan Consultants, Inc.
6245 N. 24th Parkway #100 Phoenix, AZ 85016
Office: (602) 252.8384 Fax: (602) 252.8385

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

WICKENBURG
AREA DRAINAGE MASTER STUDY / PLAN
HYDROLOGY PHASE 1

F.C.D. Contract No. 2009-C030

HEC SCHEMATIC MAP
EXHIBIT 1



Legend

- Watershed Boundary
- SN3 Sub-basin ID
- Tc Flow Path
- Routing Reach
- Storm Drain
- XS-2 Cross Sections for Routing Reach 'n' Values
- Streets
- Railroad
- City Boundary
- Elevation Reference
- Elevation in Feet

Note:
See FCD 2009-C030 - Phase 1 Field Reconnaissance Report for cross section photographs and Mannings 'n' value calculations.

Reference:
Wickenburg Topographic Mapping, dated 7/7/2004, provided by FCDMC in 2010

N

0 1,000 2,000 Feet

1 in = 1,000 ft

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REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 19690 PAUL W. HOSKIN Date Signed ARIZONA, U.S.A.

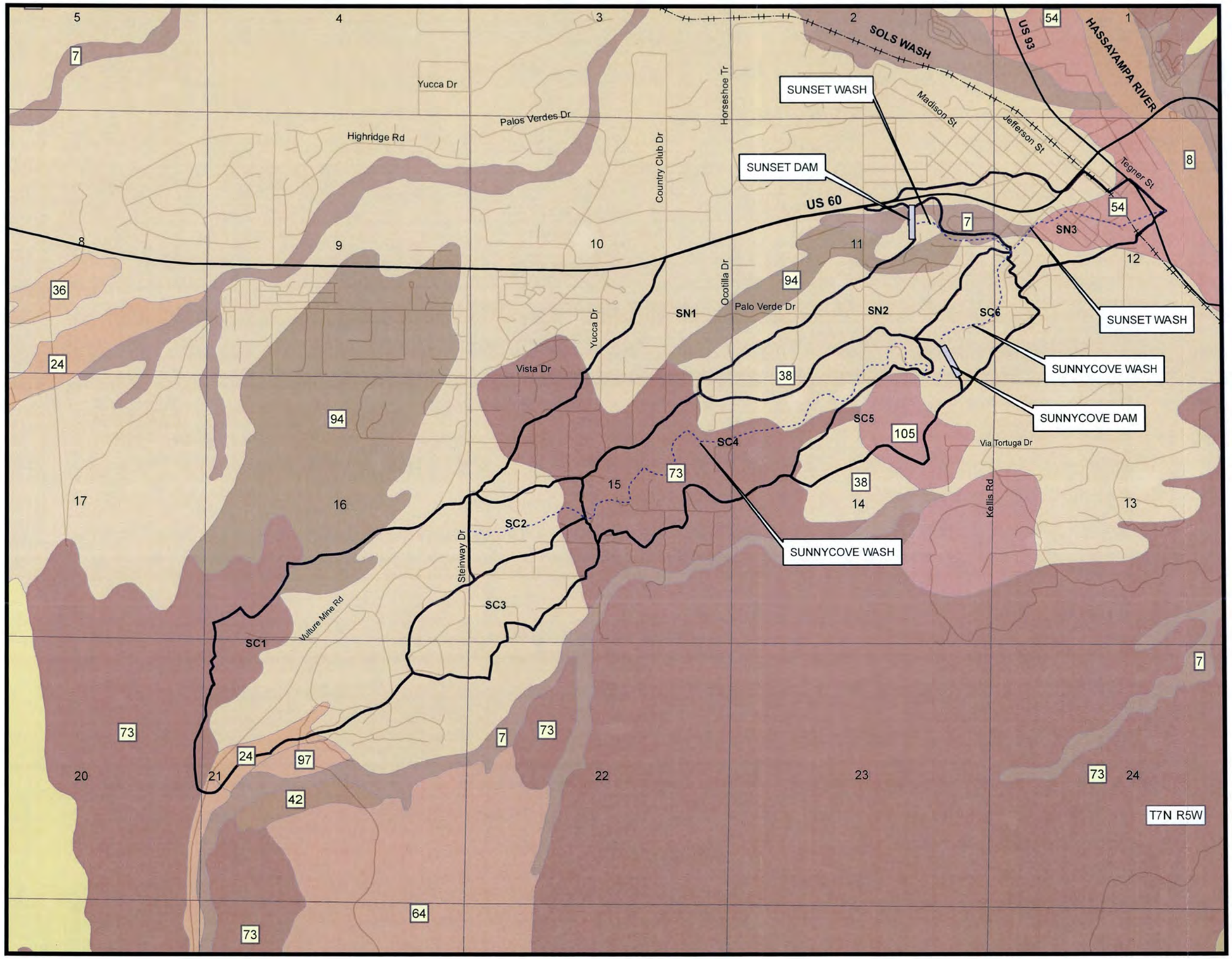
EXPIRES 3/31/2012

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WICKENBURG
AREA DRAINAGE MASTER STUDY / PLAN
HYDROLOGY PHASE 1

F.C.D. Contract No. 2009-C030

ROUTING MAP
EXHIBIT 2



Legend

- Watershed Boundary
- SC1 Sub-basin ID
- Flow Line
- Streets
- Railroad
- Township and Range
- 6 Anthony-Arizo complex
- 7 Anthony-Arizo complex
- 8 Arizo cobbly sandy loam
- 24 Continental clay loam
- 28 Continental-Ohaco complex
- 36 Eba-Continental complex
- 38 Eba-Continental-Cave association
- 42 Eba-Pinaleno complex
- 54 Gila fine sandy loams
- 62 Gran-Wickenburg complex
- 64 Gran-Wickenburg-Rock outcrop
- 73 Lehmans-Rock outcrop complex
- 94 Nickel-Cave complex
- 97 Pinaleno-Tres Hermanos complex
- 105 Rock outcrop-Lehmans complex
- 120 Tres Hermanos gravelly sandy loams

Reference:
National Resources Conservation Service (NRCS) soil survey data for Maricopa County, provided by FCDMC in 2010

N

0 1,000 2,000 Feet

1 in = 2,000 ft

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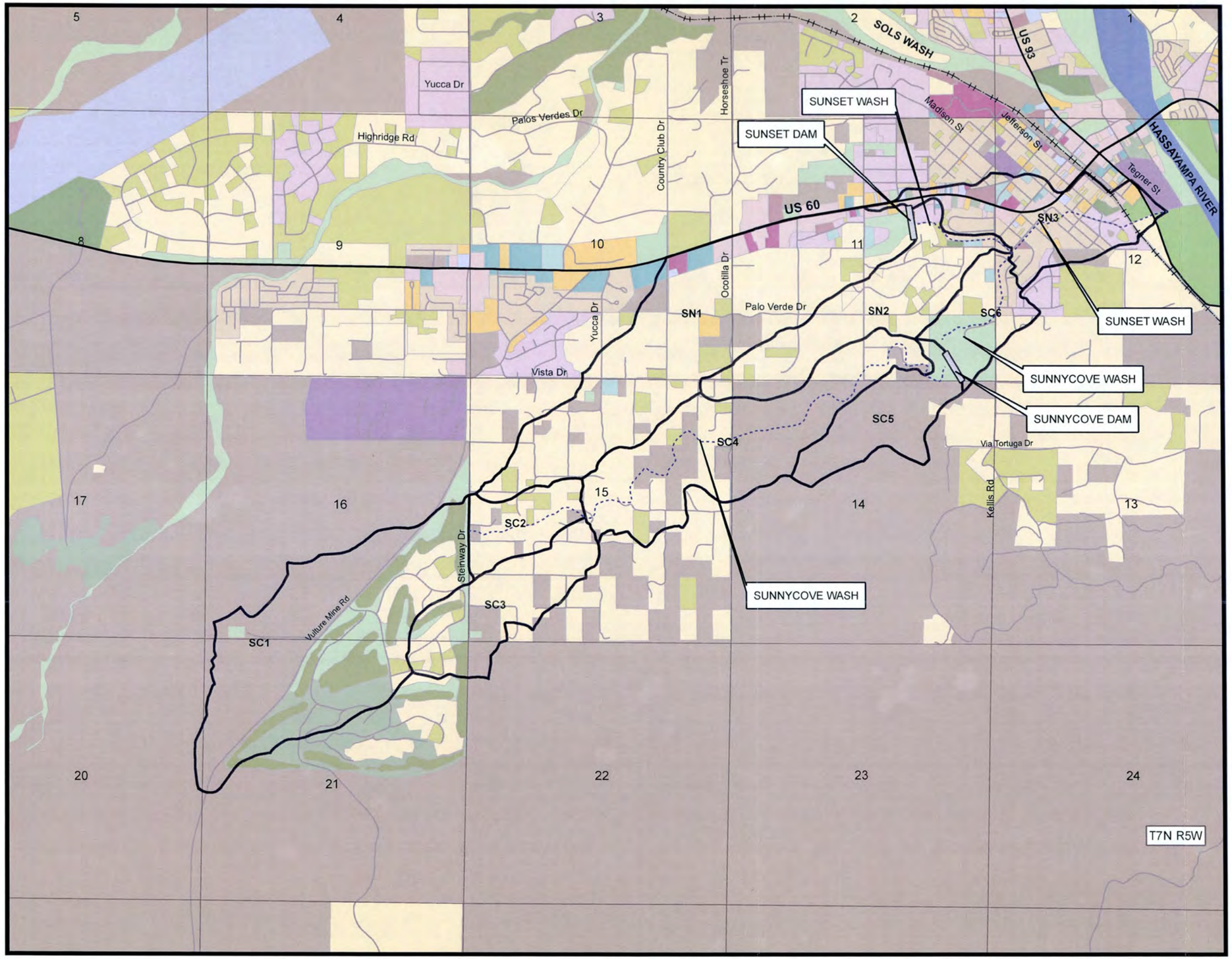
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

WICKENBURG
AREA DRAINAGE MASTER STUDY / PLAN
HYDROLOGY PHASE 1

F.C.D. Contract No. 2009-C030

SOILS MAP
EXHIBIT 3



Legend

- Watershed Boundary
- SC1 Sub-basin ID
- Flow Line
- Streets
- Railroad
- Township and Range
- Sections
- Active Open Space
- Agriculture
- Airport
- Cemetery
- Community Commercial
- Developing Employment Generating
- Developing Residential
- Educational
- Golf Courses
- Large Lot Residential
- Light Industrial
- Medical/Nursing Home
- Medium Density Residential
- Mixed Use
- Office Low Rise
- Other Employment
- Passive Open Space
- Public/Special Event/Military
- Religious Institutions
- Rural Residential
- Small Lot Residential
- Specialty Commercial
- Tourist and Visitor Accomodations
- Vacant
- Water

N

0 1,000 2,000 Feet

1 in = 2,000 ft

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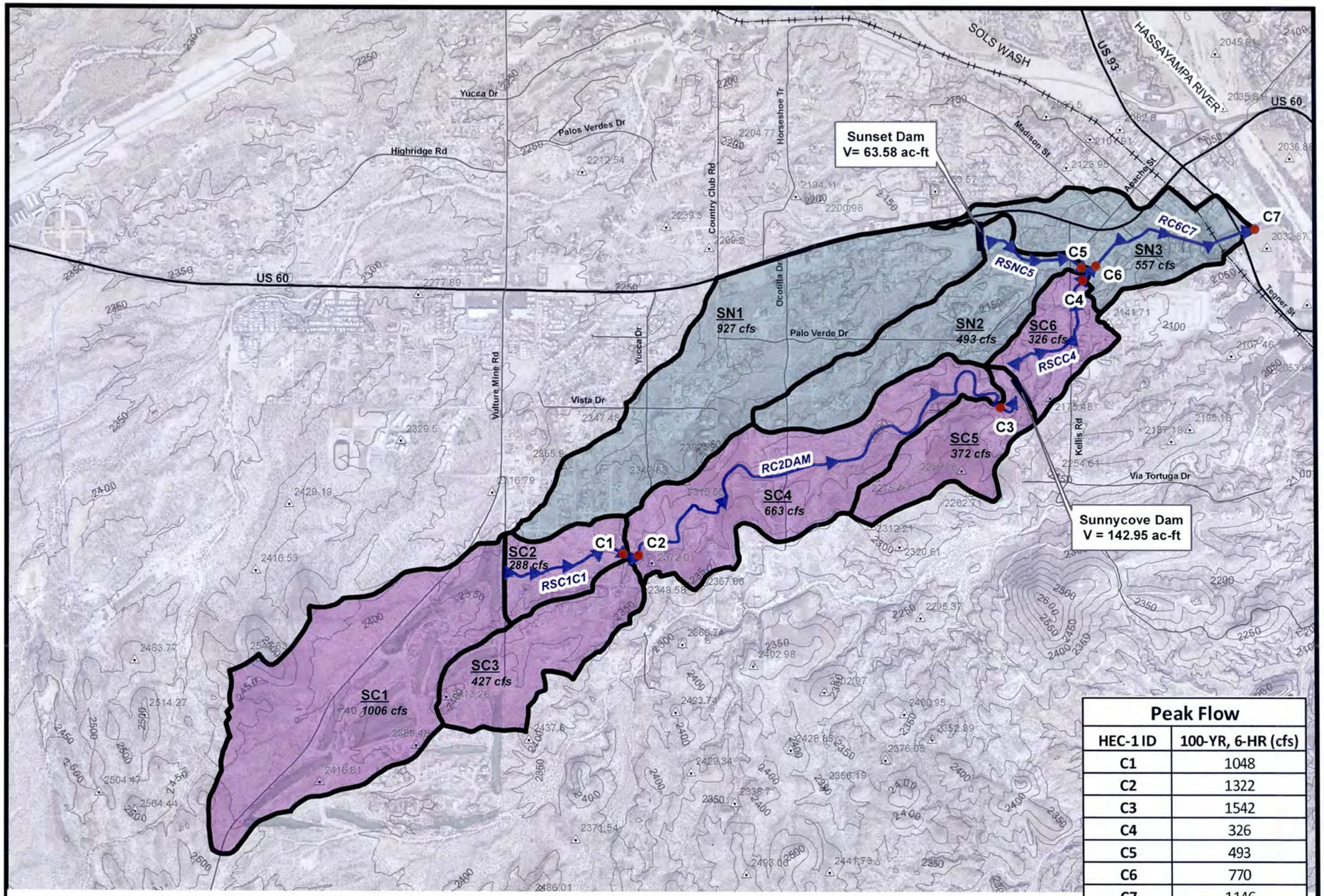
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

WICKENBURG
AREA DRAINAGE MASTER STUDY / PLAN
HYDROLOGY PHASE 1

F.C.D. Contract No. 2009-C030

EXISTING LAND USE MAP
EXHIBIT 4



Peak Flow	
HEC-1 ID	100-YR, 6-HR (cfs)
C1	1048
C2	1322
C3	1542
C4	326
C5	493
C6	770
C7	1146
RSC1C1	974
RC2DAM	1168
RSNC5	0
RSCC4	0
RCSC7	704

Legend

- Sunset Wash Subbasins
- Sunnycove Wash Subbasins
- SN3 — Subbasin ID
- 430 cfs — Subbasin Q : 100-yr, 6-hr (cfs)
- C3 — Concentration Point
- RC6C7 — Reach Hec-1 ID
- Routing Reach
- Streets
- Railroad
- 2053.94 — Elevation Reference
- 2000 — Elevation in Feet

N

0 1,000 2,000 Feet

1 in = 2,000 ft

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FLOOD CONTROL DISTRICT
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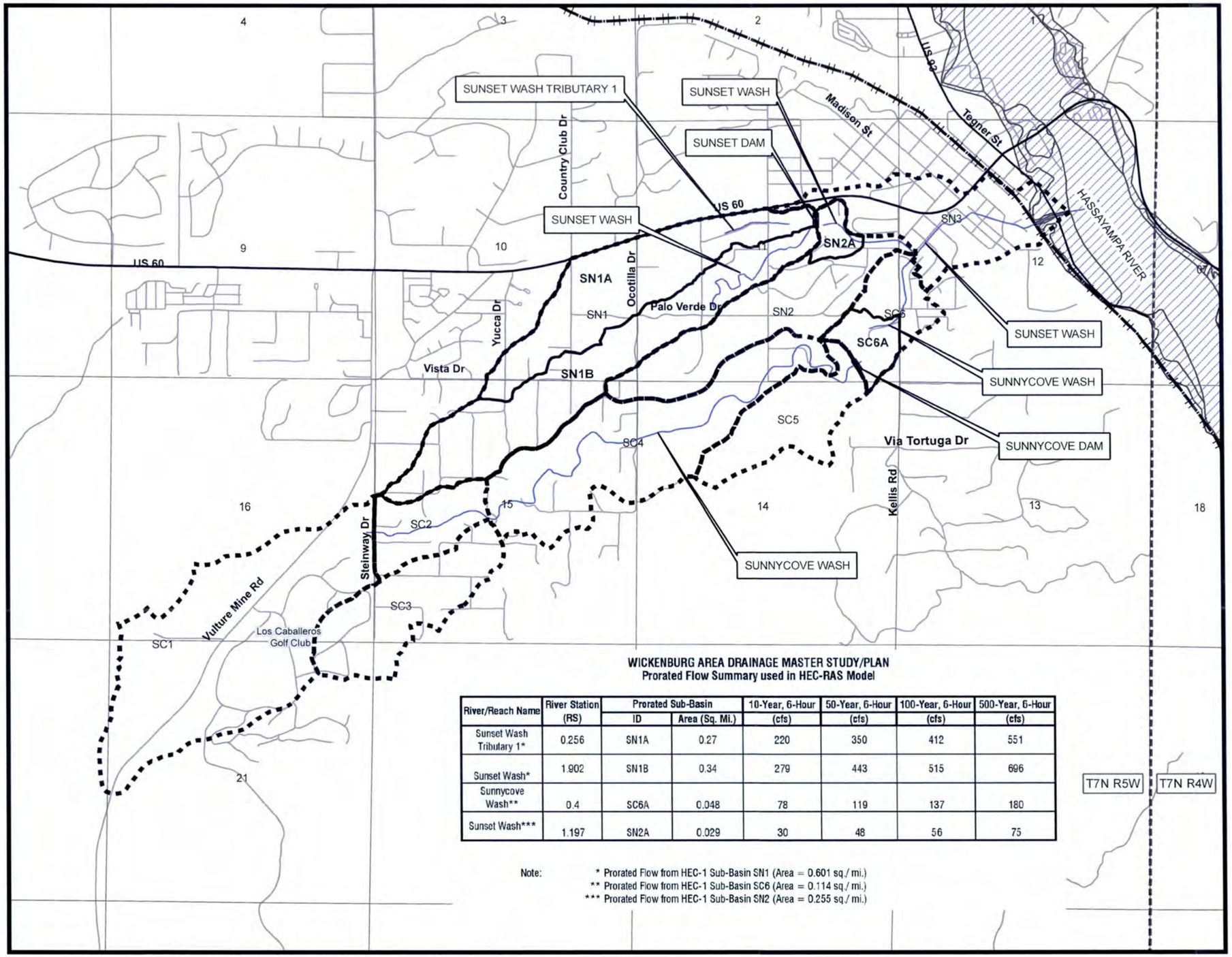
WICKENBURG
AREA DRAINAGE MASTER STUDY / PLAN
HYDROLOGY PHASE 1

F.C.D. Contract No. 2009-C030

FLOW MAP
EXHIBIT 5



WICKENBURG AREA DRAINAGE MASTER STUDY/PLAN
Prorated Flow Summary used in HEC-RAS Model

River/Reach Name	River Station (RS)	Prorated Sub-Basin		10-Year, 6-Hour (cfs)	50-Year, 6-Hour (cfs)	100-Year, 6-Hour (cfs)	500-Year, 6-Hour (cfs)
		ID	Area (Sq. Mi.)				
Sunset Wash Tributary 1*	0.256	SN1A	0.27	220	350	412	551
Sunset Wash*	1.902	SN1B	0.34	279	443	515	696
Sunnycove Wash**	0.4	SC6A	0.048	78	119	137	180
Sunset Wash***	1.197	SN2A	0.029	30	48	56	75

Note:
* Prorated Flow from HEC-1 Sub-Basin SN1 (Area = 0.601 sq./ mi.)
** Prorated Flow from HEC-1 Sub-Basin SC6 (Area = 0.114 sq./ mi.)
*** Prorated Flow from HEC-1 Sub-Basin SN2 (Area = 0.255 sq./ mi.)

Legend

- PRORATED SUB-BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- SN2A PRORATED SUB-BASIN ID
- SN2 SUB-BASIN ID
- EFFECTIVE FLOODPLAIN
- FLOWLINE
- RAILROAD
- DAM
- TOWNSHIP AND RAMGE
- SECTION

N

0 1,000 2,000 Feet
1 in = 2,000 ft

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FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

WICKENBURG
AREA DRAINAGE MASTER STUDY / PLAN

F.C.D. Contract No. 2009-C030

PRORATED FLOW MAP
EXHIBIT 6

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WICKENBURG AREA DRAINAGE MASTER STUDY / PLAN
PHASE 1 FLOODPLAIN WORK MAPS
SUNSET WASH, SUNSET WASH TRIBUTARY 1 AND SUNNYCOVE WASH FLOODPLAIN DELINEATION

FCD CONTRACT NO. 2009-C030

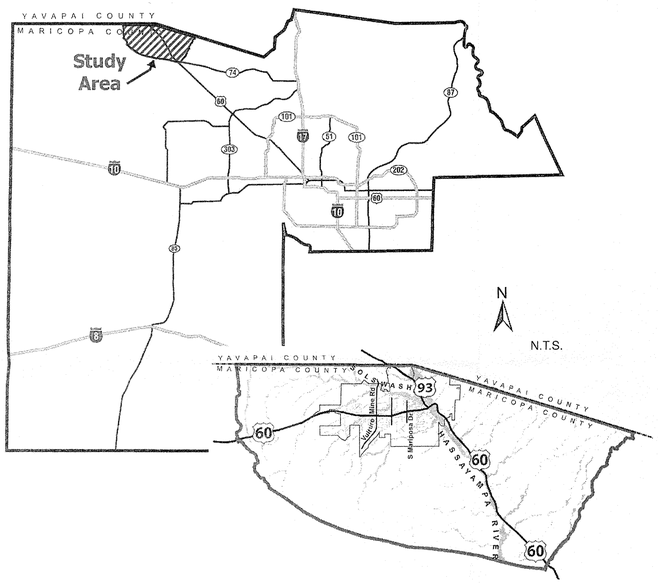
HYDROLOGY/HYDRAULICS
WICKENBURG ADMS
PHASE 1 TDN
PREPARED BY HOSKIN RYAN CONSULTANTS
REPORT DATED: APRIL 2011

HORIZONTAL CONTROL
BASED ON HARN ARIZONA STATE PLANE COORDINATE SYSTEM (AZSPC)

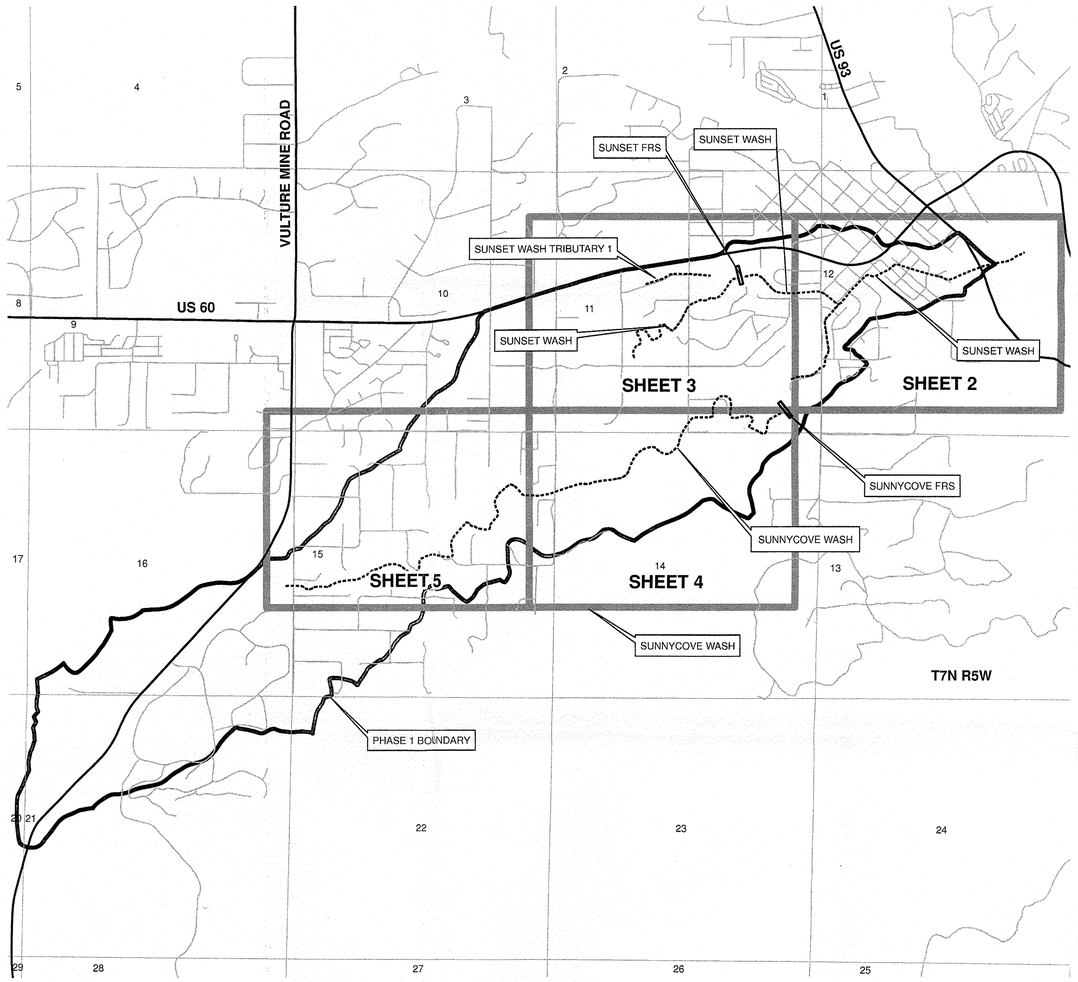
TOPOGRAPHY SOURCE
WICKENBURG MAPPING PROJECT
FCD CONTRACT NO. 03-66
2 FOOT CONTOUR INTERVAL
DATE FLOWN: JULY 2004
DATUM: NAD 1983, NAVD 1988

PROJECT BENCHMARK
NATIONAL GEODETIC SURVEY (NGS) HEIGHT MODERNIZATION POINTS LOCATED THROUGHOUT THE STUDY AREA

SUPPLEMENTAL SURVEY
HOSKIN RYAN CONSULTANTS
SURVEY REPORT DATED: APRIL 2011



LOCATION MAP
N.T.S.



VICINITY MAP
N.T.S.

RECOMMENDED BY _____ DATE
APPROVED BY _____ DATE
CHIEF ENGINEER AND GENERAL MANAGER

Hoskin•Ryan Consultants, Inc.
CREATIVE ENGINEERING SOLUTIONS
6245 N. 24th Parkway #100 Phoenix, AZ 85016
Office: (602) 252.8384 Fax: (602) 252.8365

WICKENBURG AREA DRAINAGE MASTER STUDY / PLAN PHASE 1

F.C.D. CONTRACT No. 2009-C030

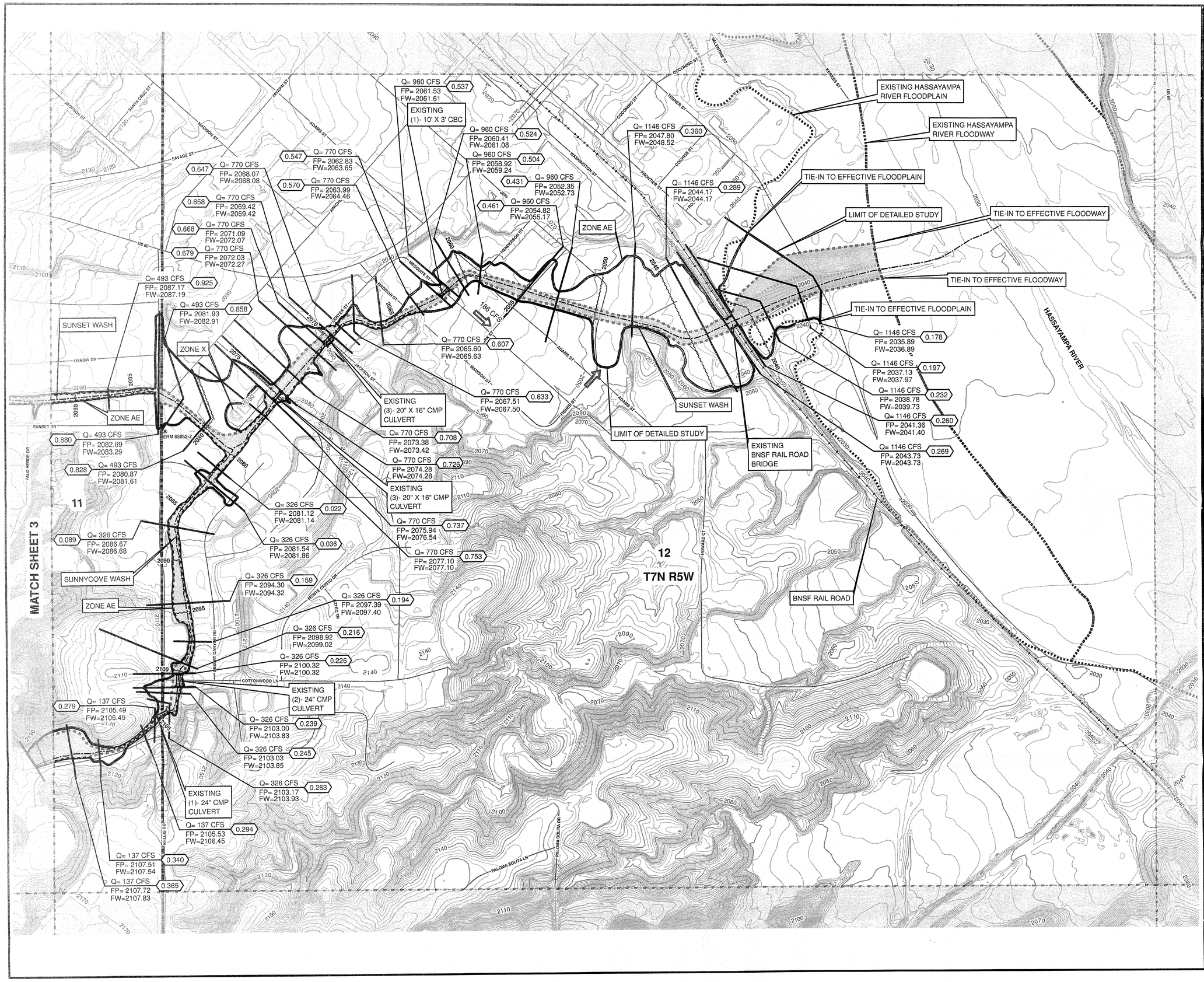
100-YEAR FLOODPLAIN WORK MAPS

	BY	DATE
DESIGN	N.Z., P.Z.	2/2012
DESIGN CHK.	D.B.	2/2012
PLANS	N.Z., L.M.	2/2012
PLANS CHK.	D.B., P.W.R.H.	2/2012

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 36690 PAUL W.R. HOSKIN Date Signed 2/6/12 ARIZONA, U.S.A.

EXPIRES 3/31/2012

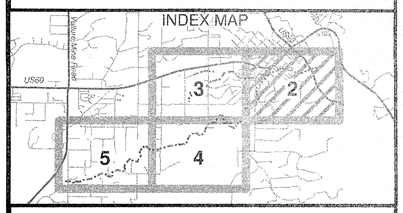
SHEET 1 OF 5



LEGEND

- CROSS-SECTION CUT LINE
- 2030 BASE FLOOD ELEVATIONS
- PROFILE BASE LINE
- 100-YEAR FLOODWAY BOUNDARY
- 100-YEAR FLOODPLAIN BOUNDARY
- 15 TOWNSHIP AND RANGE
- SECTION LINE AND ID
- STREETS
- RAILROAD
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EFFECTIVE FLOODPLAIN BOUNDARY
- ERM 65062-Z ELEV. REFERENCE MARK
- FLOW SPLIT DIRECTION
- EXISTING CULVERT
- 0.159 Q= 412 CFS FP= 2144.44 FW= 2145.44 — RIVER STATION, FLOW RATE, FLOODPLAIN ELEVATION AND FLOODWAY ELEVATION

INDEX MAP



DATUM CONVERSION:

SUNSET WASH:
NGVD 29 + 2.185 = NADV88

SUNNYCOVE WASH:
NGVD 29 + 2.188 = NAVD88

0 50 100 200 300 400 Feet
1 in = 200 ft

TOPOGRAPHY SOURCE
WICKENBURG MAPPING PROJECT: FCD CONTRACT NO. 03-66
2 FOOT CONTOUR INTERVAL
DATE FLOWN: JULY 2004
DATUM: NAD 1983, NAVD 1988

ELEVATION REFERENCE MARKS

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

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
56062-Z		CALCULATED POSITION, NOTHING FOUND OR SET. NOTE- POSITION FALLS IN THE MIDDLE OF A PALM TREE.

Hoskin•Ryan Consultants, Inc.
CREATIVE ENGINEERING SOLUTIONS
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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WICKENBURG
AREA DRAINAGE MASTER STUDY / PLAN
PHASE 1

F.C.D. CONTRACT No. 2009-C030

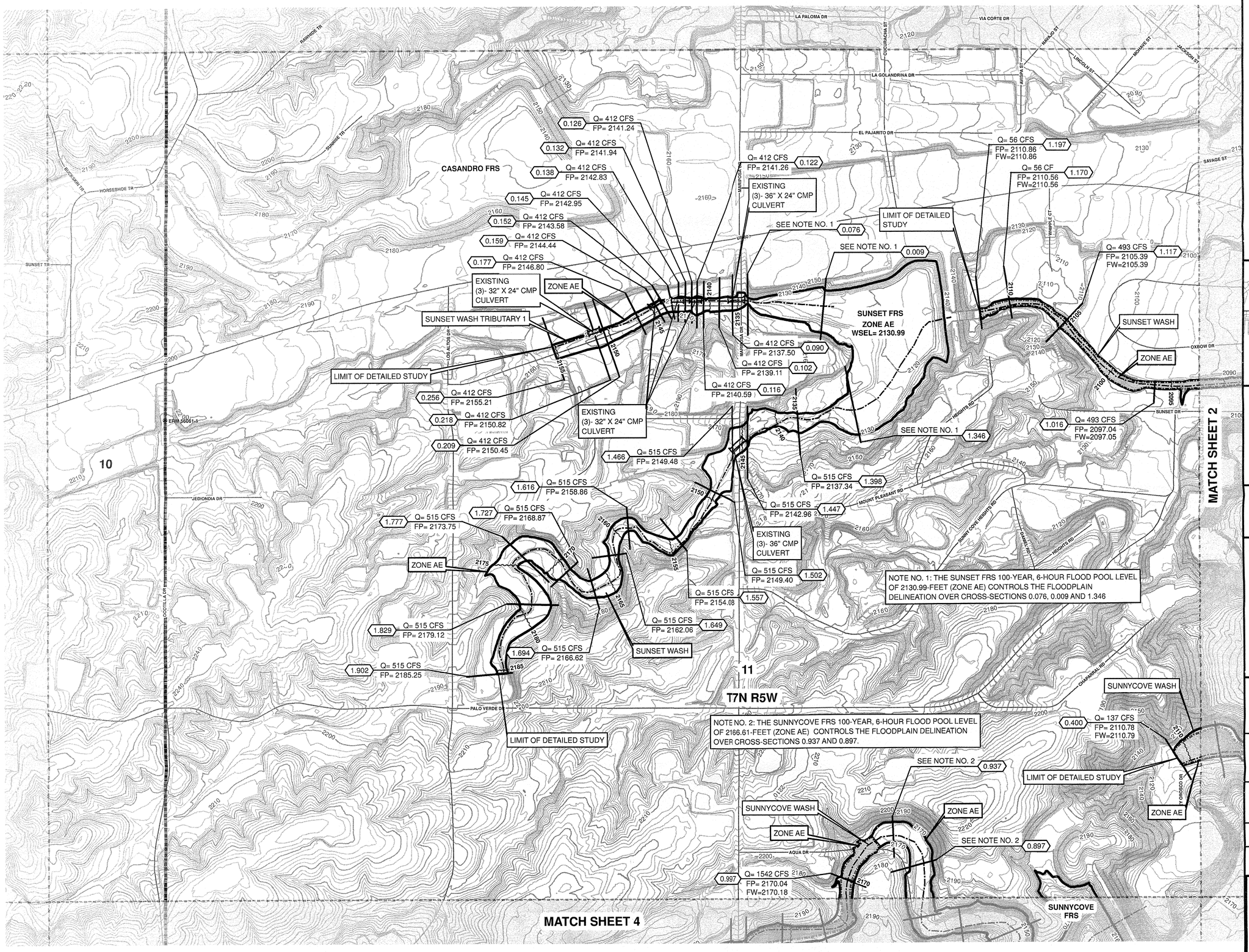
100-YEAR FLOODPLAIN WORK MAPS

REGISTERED PROFESSIONAL ENGINEER (CIVIL) 16690 PAUL W. R. HOSKIN Date Signed 2/3/12 ARIZONA, U.S.A.

EXPIRES 3/31/2012

	BY	DATE
DESIGN	N.Z., P.Z.	2/2012
DESIGN CHK.	D.B.	2/2012
PLANS	N.Z., L.M.	2/2012
PLANS CHK.	D.B., P.W.R.H.	2/2012

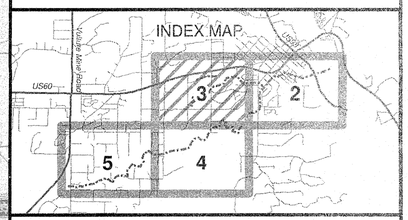
SHEET 2 OF 5



LEGEND

- CROSS-SECTION CUT LINE
- 2050 BASE FLOOD ELEVATIONS
- PROFILE BASE LINE
- 100-YEAR FLOODWAY BOUNDARY
- 100-YEAR FLOODPLAIN BOUNDARY
- TOWNSHIP AND RANGE
- 15 SECTION LINE AND ID
- STREETS
- RAILROAD
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- ERM 65062-Z ELEV. REFERENCE MARK
- FLOW SPLIT DIRECTION
- EXISTING CULVERT
- 0.159 Q= 412 CFS FP= 2144.44 FW= 2145.44 — RIVER STATION, FLOW RATE, FLOODPLAIN ELEVATION AND FLOODWAY ELEVATION

INDEX MAP



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SUNNYCOVE WASH:
NGVD 29 + 2.188 = NAVD88

0 50 100 200 300 400 Feet
1 in = 200 ft

TOPOGRAPHY SOURCE
WICKENBURG MAPPING PROJECT: FCD CONTRACT NO. 03-66
2 FOOT CONTOUR INTERVAL
DATE FLOWN: JULY 2004
DATUM: NAD 1983, NAVD 1988

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

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
56061-1	2188.671	FD 3" BC FL NO STAMPING

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WICKENBURG
AREA DRAINAGE MASTER STUDY / PLAN
PHASE 1

F.C.D. CONTRACT No. 2009-C030

100-YEAR FLOODPLAIN WORK MAPS

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 19690 PAUL W.R. HOSKIN Date Signed 2/2/12 ARIZONA, U.S.A.

EXPIRES 3/31/2012

	BY	DATE
DESIGN	N.Z., P.Z.	2/2012
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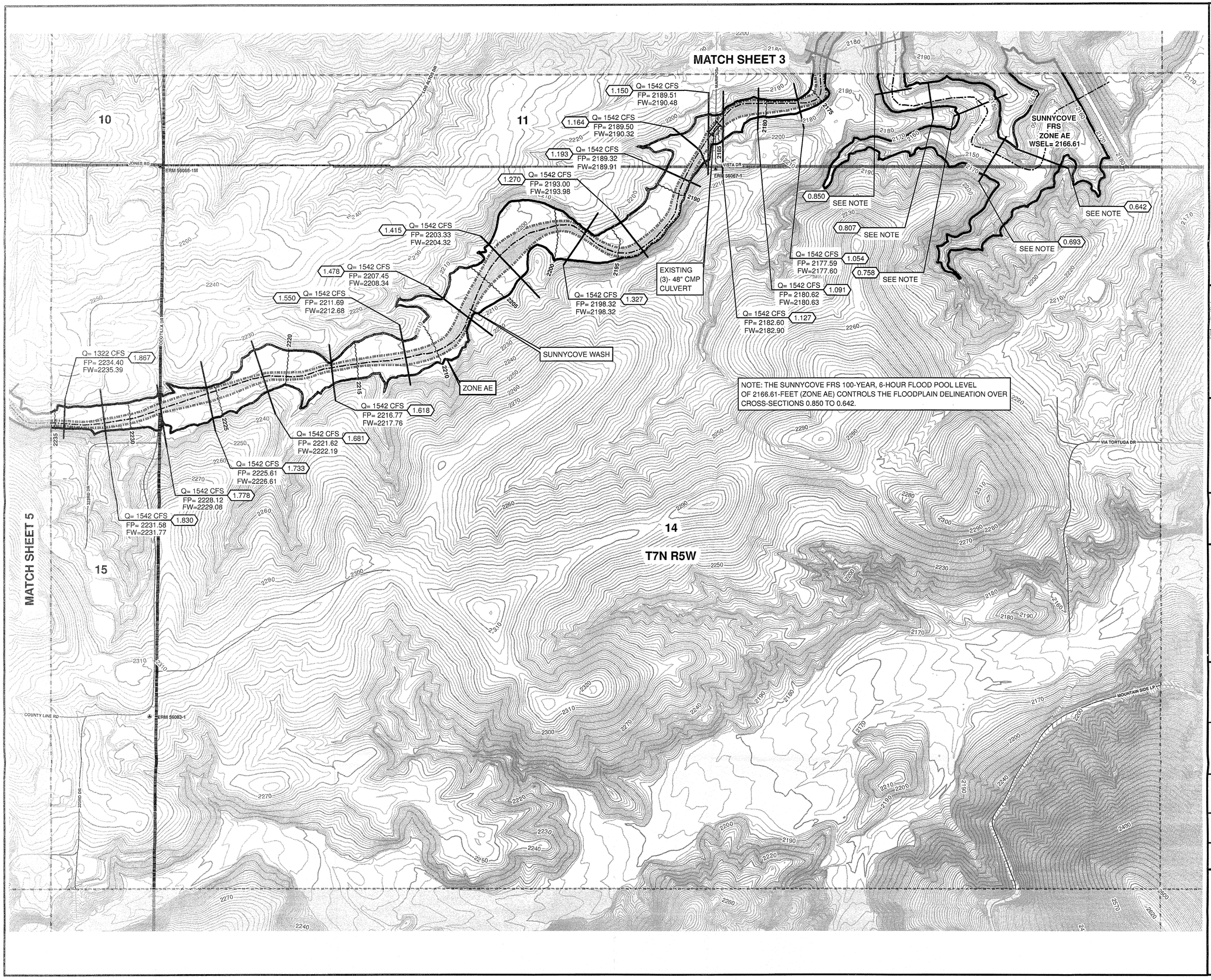
PLANS	N.Z.	2/2012
PLANS CHK.	D.B., P.W.R.H.	2/2012

SHEET 3 OF 5



LEGEND

- CROSS-SECTION CUT LINE
- 2065 BASE FLOOD ELEVATIONS
- PROFILE BASE LINE
- 100-YEAR FLOODWAY BOUNDARY
- 100-YEAR FLOODPLAIN BOUNDARY
- 15 TOWNSHIP AND RANGE
- SECTION LINE AND ID
- STREETS
- RAILROAD
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- ERM 65062-Z ELEV. REFERENCE MARK
- FLOW SPLIT DIRECTION
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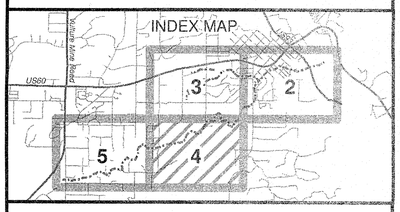

DATUM CONVERSION:

SUNNYCOVE WASH:
NGVD 29 + 2.188 = NAVD88

0 50 100 200 300 400 Feet
1 in = 200 ft

TOPOGRAPHY SOURCE

WICKENBURG MAPPING PROJECT: FCD CONTRACT NO. 03-66
2 FOOT CONTOUR INTERVAL
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ELEVATION REFERENCE MARKS

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I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
56067-1	2200.09	FD 1" IP 0.3' UP W/ 2 1/2" GLO BC STAMPED "S11 S14 1948"
56068-1M	2238.314	FD 1/2" RB W/O ID FL, REPLACED WITH 1/2" ROUND SST. METAL ROD 0.4' DN W/ 3" MARICOPA COUNTY BC STAMPED "T7N R5W S10 S11 S15 S14 2005 37174"
56083-1	2298.954	FD 1" IP 0.7' UP W/ 2 1/2" GLO BC STAMPED "1/4 S15 S14 1948"

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WICKENBURG AREA DRAINAGE MASTER STUDY / PLAN PHASE 1

F.C.D. CONTRACT No. 2009-C030

100-YEAR FLOODPLAIN WORK MAPS

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 19690 PAUL W.R. HOSKIN Date Signed 2/17/12 ARIZONA, U.S.A.

EXPIRES 3/31/2012

	BY	DATE
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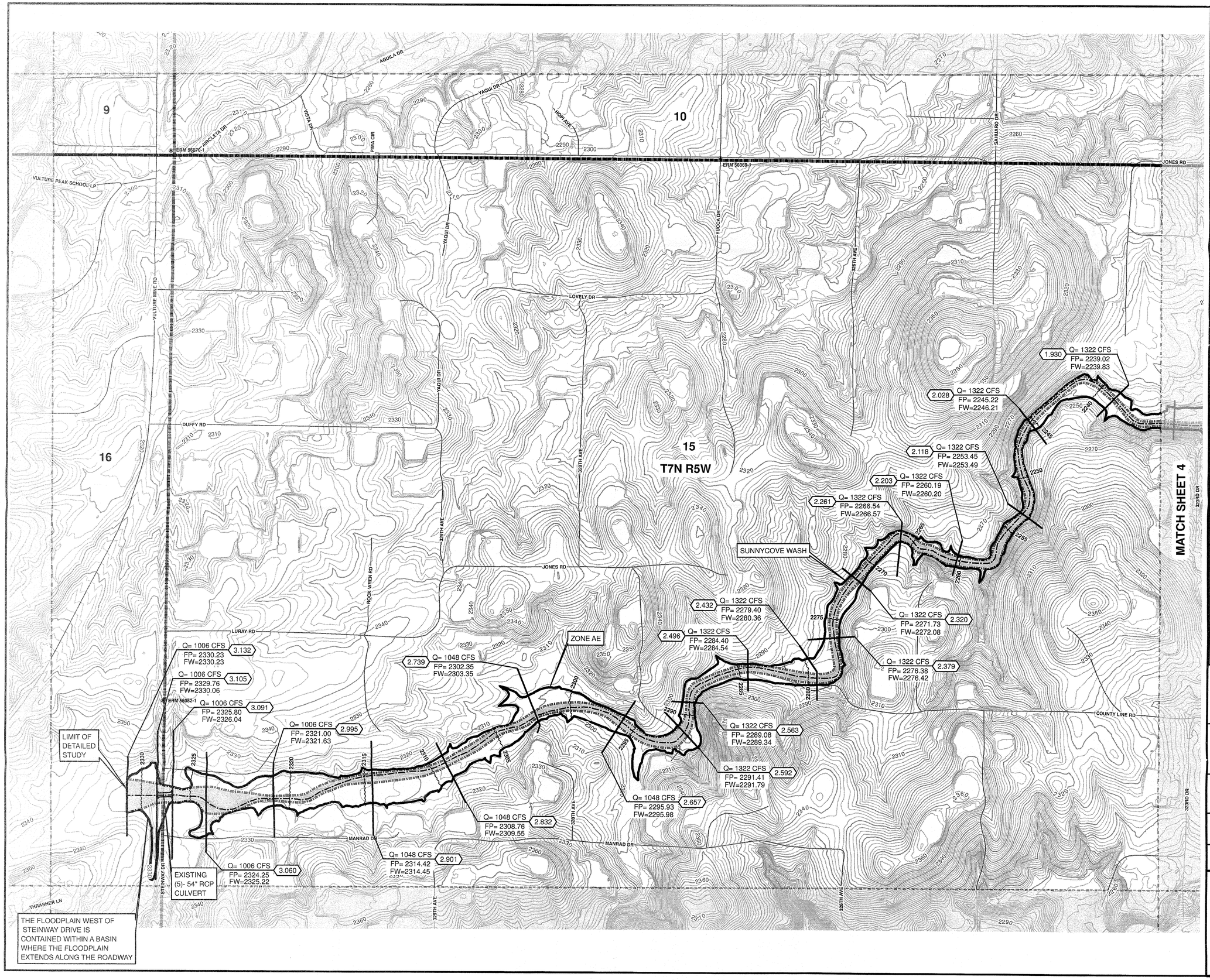
PLANS CHK.	D.B., P.W.R.H.	2/2012

SHEET 4 OF 5



LEGEND

- CROSS-SECTION CUT LINE
- 2095 BASE FLOOD ELEVATIONS
- PROFILE BASE LINE
- 100-YEAR FLOODWAY BOUNDARY
- 100-YEAR FLOODPLAIN BOUNDARY
- 15 TOWNSHIP AND RANGE
- 15 SECTION LINE AND ID
- STREETS
- RAILROAD
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
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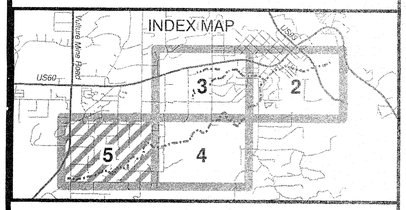

DATUM CONVERSION:

SUNNYCOVE WASH:
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TOPOGRAPHY SOURCE

WICKENBURG MAPPING PROJECT: FCD CONTRACT NO. 03-66
2 FOOT CONTOUR INTERVAL
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ELEVATION REFERENCE MARKS

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

I.D. NUMBER	ELEV. (FT)	DESCRIPTION/LOCATION
56069-1	2282.912	FD 3" BC FL STAMPED "1999 1/4 S10 S15 LS 25074" NOTE- SET IN CONC
56070-1	2300.721	FD 2" IP 0.8' UP W/ 2 1/2" GLO BC STAMPED "T7NR5W S9 S10 S15 S16 1948"
56082-1	2349.169	FD 1" IP IN HH 0.45' DN W/ 3" MCDOT BC STAMPED "T5NR7W 1/4 16 LS 26411"

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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

WICKENBURG AREA DRAINAGE MASTER STUDY / PLAN PHASE 1

F.C.D. CONTRACT No. 2009-C030

100-YEAR FLOODPLAIN WORK MAPS

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 19690 PAUL W. R. HOSKIN Date Signed 2/6/12 ARIZONA, U.S.A.

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