LETTER OF MAP REVISION REQUEST FOR BUCHANAN WASH

City of Phoenix Project No. PW16610002

TECHNICAL DATA NOTEBOOK

November 2001

Prepared for:

City of Phoenix
200 W. Washington Street
Phoenix, Arizona 85003
(602) 262-4026

Submitted to:

EMCON/OWT
Solid Waste Services, a member of the
IT Group, Prime Consultant
305 South Euclid Avenue, Suite 101
Tucson Arizona 85719
(520) 792-2800

Prepared by:

TETRA TECH, INC.
INFRASTRUCTURE SOUTHWEST GROUP
4801 E. Washington St., Ste. 260
Phoenix, Arizona 85034-2004
(602) 682-3300

Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

LETTER OF MAP REVISION REQUEST

FOR BUCHANAN WASH

City of Phoenix Project No. PW16610002

TECHNICAL DATA NOTEBOOK

Prepared for:
City of Phoenix
200 West Washington Street
Phoenix, AZ 85003
(602) 262-4026

Submitted to:
EMCON/OWT
Solid Waste Services, A Member
of the IT Group, Prime Consultant
305 South Euclid Avenue, Suite 101
Tucson, AZ 85719
(520) 792-2800

Prepared by:
Tetra Tech Inc., Infrastructure Southwest Group
4801 E. Washington Street
Phoenix, AZ 85034
(602) 682-3300

NOVEMBER 2001

TABLE OF CONTENTS

Section 1: INTRODUCTION **1**

Section 2: ADWR AND FEMA FORMS **4**

2.1 STUDY DOCUMENT ABSTRACT 4
2.2 APPLICATION/CERTIFICATION FORMS 6

Section 3: SURVEY AND MAPPING INFORMATION **7**

3.1 FIELD SURVEY INFORMATION 7
3.2 MAPPING DESCRIPTION 7

Section 4: HYDROLOGIC ANALYSIS **8**

Section 5: HYDRAULIC ANALYSIS **9**

5.1 METHOD DESCRIPTION 9
5.2 WORK STUDY MAPS 9
5.3 PARAMETER ESTIMATION 9

5.3.1 Roughness Coefficients 9
5.3.2 Expansion and Contraction Coefficients 11

5.4 CROSS SECTION DESCRIPTION 11
5.5 MODELING CONSIDERATIONS 13

5.5.1 Hydraulic Jump and Drop Analysis 13
5.5.2 Bridges and Culverts 13
5.5.3 Levees and Dikes 13
5.5.4 Islands and Flow Splits 14
5.5.5 Ineffective Flow Areas 14
5.5.6 Supercritical Flow 14

5.6 FLOODWAY MODELING 14
5.7 PROBLEMS ENCOUNTERED 15
5.8 CALIBRATION 15
5.9 FINAL RESULTS 15

5.9.1 Hydraulic Analysis Results 15
5.9.2 Verification of Results 20

Section 6: EROSION AND SEDIMENT TRANSPORT **21**

Section 7: DRAFT FIS REPORT DATA **22**

7.1 SUMMARY OF DISCHARGES 22
7.2 FLOODWAY DATA 22
7.3 ANNOTATED FIRM MAP 24
7.4 FLOOD PROFILES 26

FIGURES

FIGURE 1: LOCATION MAP 2
FIGURE 2: REDUCED WORK STUDY MAP 10
FIGURE 3: SURVEY CROSS-SECTION 12
FIGURE 4: ANNOTATED FIRM MAP 25
FIGURE 5: FLOOD PROFILE 27

TABLES

TABLE 1: HYDROLOGIC SUMMARY 8
TABLE 2: HYDRAULIC ANALYSIS RESULTS 15
TABLE 3: CULVERT ANALYSIS RESULTS 17
TABLE 4: WATER-SURFACE ELEVATIONS 18
TABLE 5: COMPARISON OF WATER-SURFACE ELEVATIONS 19
TABLE 6: FLOODPLAIN/FLOODWAY SURFACE AREAS 20
TABLE 7: FLOODWAY DATA TABLE 23

APPENDICES

APPENDIX A: REFERENCES
APPENDIX B: GENERAL DOCUMENTATION & CORRESPONDENCE
APPENDIX C: SURVEY FIELD NOTES
APPENDIX D HYDROLOGIC ANALYSIS SUPPORTING DOUCMENTATION
APPENDIX E: HYDRAULIC ANALYSIS SUPPORTING DOCUMENTATION
APPENDIX F: EROSION AND SEDIMENT TRANSPORT ANALYSIS SUPPORTINTG DOCUMENTATION
APPENDIX G: PROJECT PLANS
APPENDIX H: FEMA FORM
APPENDIX I: FULL-SIZE WORK STUDY MAP

LETTER OF MAP REVISION REQUEST FOR BUCHANAN WASH

PHOENIX, MARICOPA COUNTY, ARIZONA

TECHNICAL DATA NOTEBOOK

Section 1: INTRODUCTION

This Technical Data Notebook (TDN) documents the hydraulic analysis conducted to define the revised floodplain/floodway limits proposed for Buchanan Wash, a tributary to Skunk Creek. The study area is located within the City of Phoenix, in Section 2 of Township 4 North, Range 2 East, and Sections 34 and 35 of Township 5 North, Range 2 East, G&SRB&M, Maricopa County, Arizona. See Figure 1 for a vicinity map.

This study was completed by Tetra Tech, Inc. for the City of Phoenix under subcontract to EMCON/OWT Solid Waste Services, a member of the IT Group (EMCON). The EMCON project number with the City of Phoenix is 65219. Mr. Marty Arambel is the Project Manager for the City of Phoenix and Mr. Garth Bowers is the Project Manager for EMCON.

The Buchanan Wash watershed is approximately 11 square miles in area and drains from north to south. Its confluence with Skunk Creek occurs just north of Happy Valley Road. The Central Arizona Project (CAP) Canal transects the lower portion of the watershed. Three 66-inch diameter pipe culverts convey the wash under the CAP Canal. The study limits are from the confluence with Skunk Creek to the CAP Canal. See Figure 1 for a project location map.

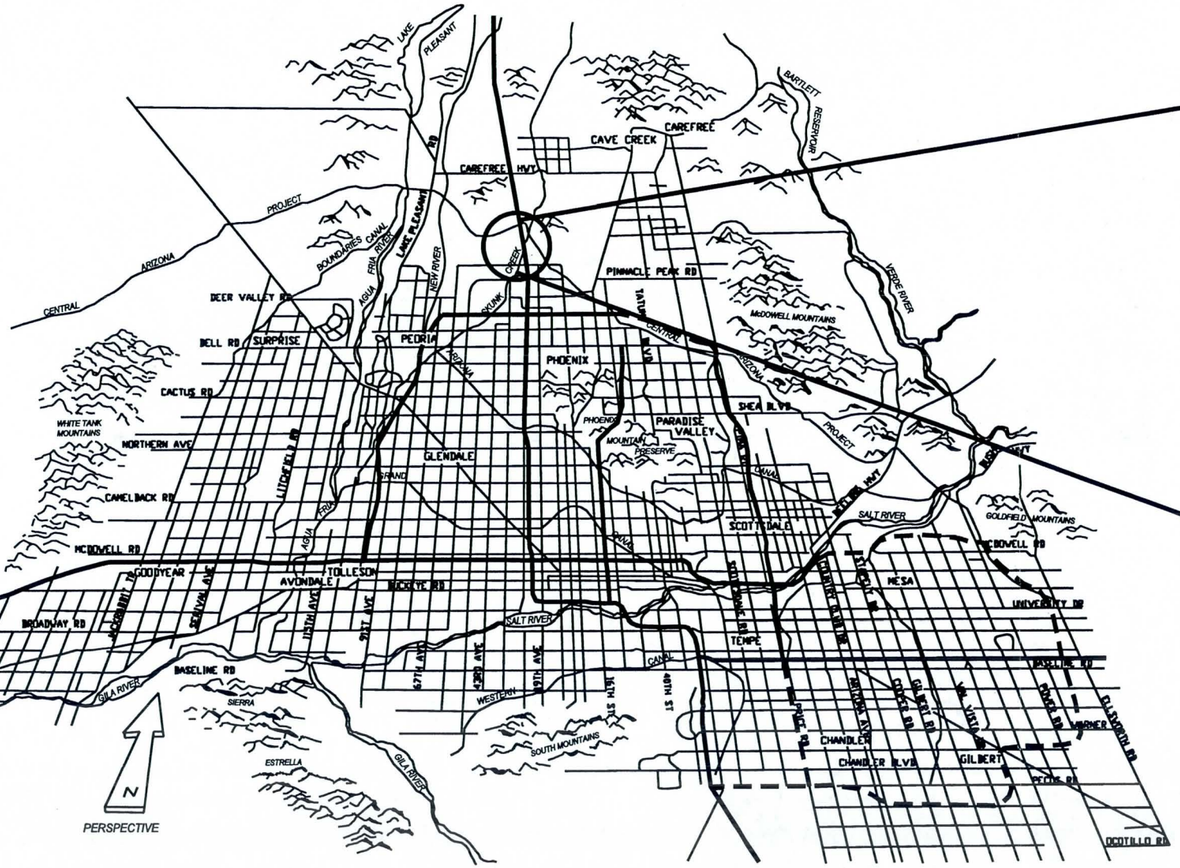
A map revision was conducted for the full length of the effective Flood Insurance Study (FIS) because of: 1) changes in water-surface elevations (WSEL) and floodplain/floodway boundaries resulting from various construction projects along and downstream of Buchanan Wash since the effective study was approved; 2) updated topographic mapping; and 3) a desire by the community to convert the effective model from HEC-2 to HEC-RAS. The construction projects include the Skunk Creek Landfill and associated levees above and below the confluence with Buchanan Wash, the Arizona Hillcrest residential development within the Buchanan Wash floodplain between 31st and 33rd Avenues, north of Jomax Road, and a four-celled box culvert at Pinnacle Vista Road. Selected plan sheets (photo-reduced) for all these projects and compaction certificates for the fill associated with the Arizona Hillcrest development are included in Appendix G.

As a result of the levee construction along Skunk Creek for the Skunk Creek Landfill, the Buchanan Wash channel has been diverted to Skunk Creek at a point approximately 2500 feet upstream of the natural confluence. The diversion point is approximately 1000 feet below the downstream limit of the currently effective FIS for Buchanan Wash. To make the proposed hydraulic model for Buchanan Wash independent of the effective model for Skunk Creek, as desired by the Federal Emergency Management Agency (FEMA), the effective limit of detailed study for Buchanan Wash is extended downstream approximately 2000 feet to the new confluence point.

BUCHANAN WASH

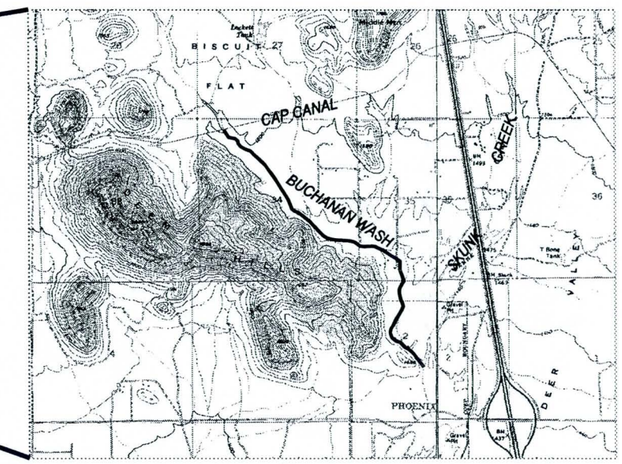
CITY OF PHOENIX

MARICOPA COUNTY, ARIZONA



VICINITY MAP

NOT TO SCALE



LOCATION MAP

N.T.S.

Prepared by

TETRA TECH, INC.
INFRASTRUCTURE SOUTHWEST GROUP
501 North 44th Street, Suite 125, Phoenix, AZ 85008
(602) 629-1100 FAX (602) 629-1186

Project No. EMCN-002

BUCN-CVR.DWG

FIGURE 1

The starting water-surface elevation for the currently effective Buchanan Wash HEC-2 model is the 100-year water-surface elevation of Skunk Creek. Because the starting water-surface elevation used for the proposed model is based on normal depth (slope-area method per FEMA) at the mouth of Buchanan Wash rather than the 100-year water-surface elevation of Skunk Creek, the proposed floodplain and floodway elevations are significantly lower in the downstream reaches of the wash when compared to the effective model. It is anticipated that a Letter of Map Revision (LOMR) request will be submitted for Skunk Creek in the near future to account for the changes resulting from the levee and landfill construction.

The hydraulic analysis of Buchanan Wash was conducted using the US Army Corps of Engineers HEC-RAS computer program, version 3.0.1. When run in HEC-2 mode, the HEC-RAS model duplicated the effective HEC-2 model precisely. When run in HEC-RAS mode, the effective model was duplicated within 0.3 feet. The differences are primarily due to the new algorithm used by HEC-RAS for computing conveyance. As requested by the City of Phoenix and the Flood Control District of Maricopa County, the proposed model uses the HEC-RAS algorithm.

The hydrology and the current effective hydraulic model (HEC-2) for the study reach were prepared by AGK Engineers, Inc. for the Flood Control District of Maricopa County in 1987 under Contract FCD 86-26. The hydrology was not modified for this study. The effective FIS 100-year discharges were used for the revised hydraulic analysis reported herein.

Section 2: ADWR AND FEMA FORMS

2.1 STUDY DOCUMENT ABSTRACT

STUDY DOCUMENTATION ABSTRACT		INITIAL STUDY	RESTUDY	CLOMR	LOMR	OTHER
Buchanan Wash					**X**	
SECTION 1: GENERAL INFORMATION						
1A	COMMUNITY	Phoenix, Arizona				
1B	COMMUNITY NUMBER	040051				
1C	COUNTY	Maricopa				
1D	STATE	Arizona				
1E	DATE STUDY ACCEPTED					
1F	STUDY CONTRACTOR CONTACT(S) ADDRESS PHONE	Tetra Tech Inc., Infrastructure Southwest Group Bart S. Bergendahl, P.E. 4801 E. Washington Street Phoenix, AZ 85034 (602) 682-3300				
1G	TECH REVIEWER (FEMA) PHONE					
1H	FEMA REGIONAL REVIEWER PHONE					
1I	STATE REVIEWER PHONE	Flood Control District of Maricopa County (602) 506-1501				
1J	LOCAL REVIEWER PHONE	City of Phoenix (602) 262-4026				
1K	RIVER OR STREAM NAME	Buchanan Wash				
1L	REACH DESCRIPTION	River Mile 0.043 – 1.935				
1K	STUDY TYPE	Riverine				

SECTION 2: MAPPING INFORMATION		
2A	USGS QUAD SHEET(S)	Hedgpeth Hills, Arizona, 7.5 Minute USGS QUAD Map
2B	MAPPING FOR HYDROLOGIC STUDY: TYPE/SOURCE SCALE DATE	N/A
2C	MAPPING FOR HYDRAULIC STUDY: TYPE/SOURCE SCALE DATE	Two-foot contour M&B Aerial Mapping, Inc. 1"=400" February 11, 2000 and January 24, 2001

SECTION 3: HYDROLOGY		
3A	MODEL OR METHOD USED (including vendor and version description)	Used Existing FIS Hydrologic Information
3B	STORM DURATION	
3C	HYETOGRAPH	
3D	FREQUENCIES DETERMINED	
3E	LIST OF GAGES USED IN FREQUENCY ANALYSIS OR CALIBRATION (Location, Years of Record, Gage Ownership)	
3F	RAINFALL AND REFERENCE	
3G	UNIQUE CONDITIONS AND PROBLEMS	
3H	COORDINATION OF Q'S (Agency, Date, Comments)	

SECTION 4: HYDRAULICS		
4A	MODEL OR METHOD USED (Including Vendor and Version Description)	HEC-RAS, Version 3.0.1 Corps of Engineers HEC March 2001
4B	REGIME	Subcritical
4C	FREQUENCIES FOR WHICH PROFILES WERE COMPUTED	100-Year
4D	METHOD OF FLOODWAY CALCULATION	Method Nos. 1 & 4 - See Attached Report
4E	UNIQUE CONDITIONS AND PROBLEMS	See Attached Report

ADDITIONAL STUDY INFORMATION	
ITEM	DESCRIPTION/DISCUSSION
Backup Report	Report provides technical appendices including HEC-RAS input and output and floodplain/floodway maps

2.2 APPLICATION/CERTIFICATION FORMS

The required FEMA application and certification forms (MT-2 Forms 1, 4, 5, 7 & 8) are included as Appendix H.

Section 3: SURVEY AND MAPPING INFORMATION

3.1 FIELD SURVEY INFORMATION

Control surveys of the project area were completed for topographic mapping purposes in February 2000, and January 2001 by Morrsion - Maierle, Inc., an Arizona Corporation. Additional survey for culvert and cross-section data was conducted in June, 2001. A copy of the field notes, control point summary, and list of Elevation Reference Marks (ERM) is included in Appendix C.

The vertical datum used for the effective topographic mapping (Sept. 1986) was NGVD29, while the datum for the new mapping was not clearly defined. Consequently, four control points common to both surveys (ERMs 517, 525, 526, 712) were compared to check the vertical datum. The elevations at all four points agree within 0.30 feet. ERM 525, located near the CAP Canal at the upper study limit, and ERM 712, located near the confluence with Skunk Creek, agree within 0.05 ft. Therefore, the water-surface elevations of this study are compared directly with the effective study without adjustment.

3.2 MAPPING DESCRIPTION

New two-foot contour mapping, prepared by M&B Aerial Mapping, Inc., was used to prepare the proposed Buchanan Wash hydraulic model. The mapping is based on aerial photography taken February 11, 2000, and January 24, 2001. The scale of the proposed work map is 1"=400'. As described above, the vertical datum approximates the NGVD29 datum of the effective work map. The horizontal datum is based on the State Plane Coordinate System of 1927. A copy of the survey control information is included in Appendix C.

Section 4: HYDROLOGIC ANALYSIS

The current effective FIS hydrologic data was used for this study. The effective FIS peak 100-year discharges used in the proposed model are summarized in Table 1 below.

Table 1: Hydrologic Summary

Cross Section Identification	Q_{100} (cfs)
1.935	1308
1.766	1609
1.098	2304

Section 5: HYDRAULIC ANALYSIS

5.1 METHOD DESCRIPTION

Standard hydraulic methods were used to determine the proposed 100-year floodplain/floodway boundaries for Buchanan Wash. Water surface profile modeling was done using the U.S. Army Corps of Engineers HEC-RAS computer program, as developed by the Hydrologic Engineering Center (Version 3.0.1, March 2001).

The study reach begins at Buchanan Wash River Mile 0.00, which is the new confluence of Buchanan Wash with Skunk Creek, and extends upstream to the Central Arizona Project (CAP) Canal. Levee construction along Skunk Creek for the Skunk Creek Landfill has diverted Buchanan Wash at a point approximately 2500 feet upstream of the natural confluence. To make the proposed hydraulic model for Buchanan Wash independent of the effective model for Skunk Creek, as desired by FEMA, the effective limit of detailed study for Buchanan Wash is extended downstream approximately 2000 feet to the new confluence point. The starting water-surface elevation for the proposed model was derived using the slope-area method as recommended by FEMA through the City of Phoenix. Since the flow regime is subcritical, the energy slope was estimated by measuring the channel slope immediately downstream of Section 0.043. The slope used to start the model is 0.003 ft./ft.

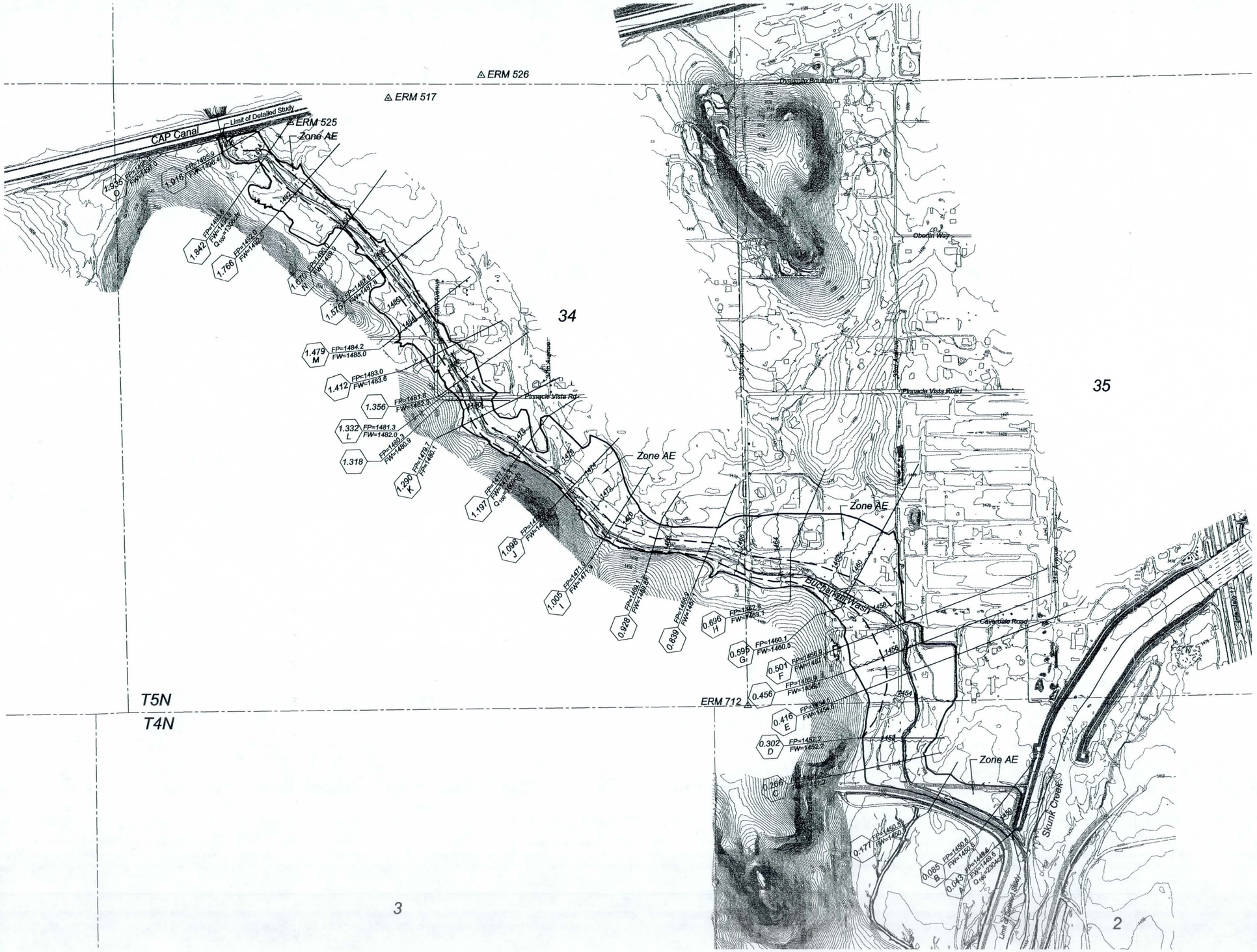
5.2 WORK STUDY MAPS

For easy comparison with the currently effective work study map, the work map for this study was prepared at the same scale (1" = 400'). Figure 2 is a photo-reduced copy of the work study map. A copy of the full-size work study map is included in Appendix I. All map nomenclature follows FEMA and Flood Control District of Maricopa County standards. The location of the hydraulic baseline and nomenclature on the proposed map did not change significantly from the effective map. Cross-sections were added to extend the model downstream to the new confluence and adjusted to reflect the presence of the box culvert on Pinnacle Vista Road. The hydraulic baseline generally follows the channel thalweg. The basis for cross-section stationing is River Mile 0.000 which is the new confluence of Buchanan Wash with Skunk Creek. For this study, the revised cross-section stationing begins at River Mile 0.043 and continues upstream to 1.935, which is immediately downstream of the CAP Canal.

5.3 PARAMETER ESTIMATION

5.3.1 Roughness Coefficients

The Manning's roughness coefficient used for this study is the same composite value used in the effective FIS model (0.055). However, for the new cross-sections that reflect the Skunk Creek levee construction in the lower reaches of the study, a value of 0.025 was used for that portion of the wetted perimeter composed of soil cement. A Manning's roughness coefficient of 0.013 was used for the inside of the box culvert at Pinnacle Vista Road. See Appendix E for a summary of the Manning's coefficients used in the proposed model.



THE BASE TOPOGRAPHIC MAPPING USED TO CONDUCT THIS FLOODPLAIN DELINEATION STUDY WAS PREPARED BY M & B AERIAL MAPPING COMPANY, INC. THIS MAPPING IS BASED ON AERIAL PHOTOGRAPHY TAKEN FEB 11, 2000 AND JAN 24, 2001. PROJECT CONTROL WAS PROVIDED BY MORRISON-MAIERLE, INC. TETRA TECH, INC. ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF THE CONTROL SURVEY OR THE BASE TOPOGRAPHIC MAPPING.

LEGEND

100-YR FLOODPLAIN BOUNDARY

FLOODWAY BOUNDARY

HYDRAULIC BASE LINE

CROSS SECTION — 0.10 A — CROSS SECTION RIVER MILE — INDEX CROSS SECTION — FP= 1483.6 FLOODPLAIN WATER SURFACE ELEVATION — FW= 1483.0 FLOODWAY WATER SURFACE ELEVATION

ELEVATION REFERENCE MARK — ERM XXX

BASE FLOOD ELEVATION — 1462

SFH ZONE DESIGNATION — ZONE AE

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929. CONVERSION FACTOR: NGVD 1929 +1.95' = NAVD 1988

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
517	1500.60	FOUND U.S. DEPARTMENT OF INTERIOR BRASS CAP ALONG C.A.P. CANAL. STAMPED POINT #44, STATION 373+41.83 150' RIGHT N: 996,684.42 E: 430,995.55
525	1502.21	FOUND U.S. DEPARTMENT OF INTERIOR BRASS CAP ALONG C.A.P. CANAL. POINT #43 STATION 386+00, 125' RIGHT N: 996,480.99 E: 430,163.65
526	1500.11	FOUND U.S. DEPARTMENT OF INTERIOR BRASS CAP ALONG C.A.P. CANAL. STAMPED POINT #44, STATION 402+67.37 125' RIGHT N: 996,877.09 E: 431,783.43
712	1555.08	FOUND STONE AT THE SOUTHEAST CORNER OF OF SECTION 34 T5N R2E N: 991,520.42 E: 434,056.21

NOTES

NO.	REVISION	BY	DATE
2			
1			

CITY OF PHOENIX
MARICOPA COUNTY, ARIZONA

BUCHANAN WASH

WORK STUDY MAP

LETTER OF MAP REVISION

TETRA TECH, INC.
INFRASTRUCTURE SOUTHWEST GROUP
4801 East Washington Street, Suite 250, Phoenix, AZ 85034
(602) 440-2000 FAX (602) 244-1164

Registered Professional Engineer (Civil) — Certificate No. 28660 — BART S. BERGENDAHL — Date Signed — ARIZONA, U.S.A.

	BY	DATE
DESIGN	DEJ	10/2001
DESIGN CHK.	BSB	10/2001
PLANS	CBC	10/2001
PLANS CHK.	BSB	10/2001

SHEET 01 OF 01

Figure 2

P:\Emcn-002\BW\BU01.dwg Mon Nov 19 15:10:56 2001 by CBC

5.3.2 Expansion and Contraction Coefficients

Where sudden flow expansion or contraction does not occur from one cross-section to the next, the standard expansion and contraction coefficients of 0.3 and 0.1, respectively, were used to compute these losses. These values are the same as the values used in the effective FIS model and are the recommended values for normal situations. A relatively sudden expansion does occur from Cross-section 0.456 into a detention pond constructed immediately downstream on the left overbank (Figure 2). The pond is reflected in Cross-section 0.416. Accordingly, the expansion coefficient was increased to 0.5 at Cross-section 0.456.

Due to the levee construction along Skunk Creek, a sudden contraction occurs at the mouth of Buchanan Wash (Cross-section 0.043). Consequently, the contraction coefficient at Cross-section 0.085 was increased to 0.3. Also due to the levee and landfill construction, Buchanan Wash is diverted between Cross-section 0.266 to 0.177. The diversion effectively constricts as well as redirects the flow. For this reason, a contraction coefficient of 0.5 was used at Cross-section 0.266.

The culvert at Pinnacle Vista Road is overtopped by the 100-year event on Buchanan Wash. Therefore, the standard expansion and contraction coefficients were used for Cross-section 1.332, immediately upstream of the roadway crossing. See Appendix E for a summary of the expansion and contraction coefficients used in the proposed model.

5.4 CROSS SECTION DESCRIPTION

To allow direct comparison of water-surface elevations between the effective and proposed models, the cross-sections in the proposed HEC-RAS model were placed at the same locations as those in the effective HEC-2 model. New cross-sections were needed in the lower reaches of the study to model the downstream extension of the study limits. New cross-sections were also needed upstream and downstream of Pinnacle Vista Road in order to model the new box culvert. The new cross-sections in the lower reaches were spaced no more than 500 feet apart and oriented perpendicular to the anticipated flow path. The culvert cross-sections were oriented parallel with the roadway and coded for a 22 degree skew. Cross-sections are labeled by river mile station, rounded to the nearest 1/1000th of a mile. All cross-sections are stationed from left to right, looking downstream, using 10,000 as the baseline station.

The cross-sections used in the modeling were obtained using "Softdesk" computer software, which runs within AutoCAD and cuts cross-sections using a digital terrain model (DTM). All cross-sections were checked for conformance with the topographic mapping. A field-surveyed cross-section was also obtained and checked against the mapping. Figure 3 shows that the mapped and surveyed cross-sections agree within a one-foot tolerance, except for the area behind the Skunk Creek Landfill levee. The area behind the levee has been filled approximately 12 feet to an elevation above the original top-of-levee. As a result, the original soil cement levee has effectively become soil cement bank protection. Plots of all cross-sections are contained in Appendix E.

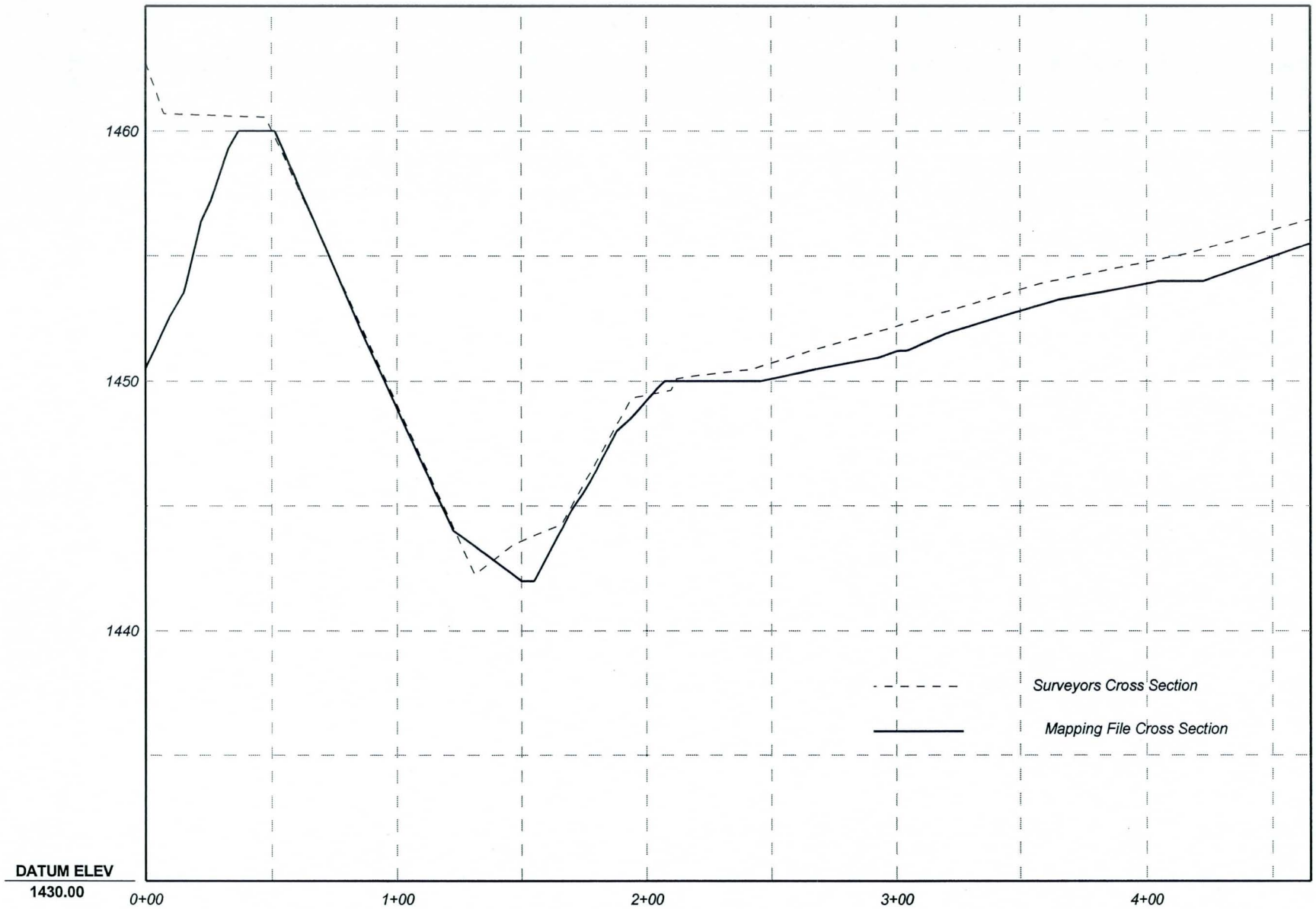

1460
1450
1440
Surveyors Cross Section
Mapping File Cross Section
DATUM ELEV
1430.00
0+00
1+00
2+00
3+00
4+00

FIGURE 3

5.5 MODELING CONSIDERATIONS

The proposed HEC-RAS model was coded for subcritical flow profile computations. The modeling results confirm the wash functions in this flow regime.

5.5.1 Hydraulic Jump and Drop Analysis

No hydraulic jump or drop analyses were required for this study.

5.5.2 Bridges and Culverts

There are no bridges and only one culvert in the study reach. The culvert is a four-celled 7x4-foot reinforced concrete box at the Pinnacle Vista Road crossing. The culvert is approximately 30 feet long with wing walls at both the inlet and outlet ends. As-built plans for the culvert are provided in Appendix G. pending

5.5.3 Levees and Dikes

Buchanan Wash has been impacted by two levee projects constructed along Skunk Creek. The first project was designed and constructed by the U.S. Army Corps of Engineers. This project was designed by the Corps to convey the Standard Project Flood (54,000 cfs) across Interstate Highway 17 to the Adobe Dam impoundment area. It included levees upstream and downstream of the I-17 crossing. Contract drawings dated 1981 were obtained (refer to *Gila River Basin, New River and Phoenix City Streams, Arizona – Skunk Creek Channel and Levees*, Spec. No. DACW09-82-B0004) and selected sheets are included in Appendix G. This levee project ends at a point approximately 700 feet upstream of Buchanan Wash on the west side of Skunk Creek.

In 1992, the Skunk Creek Channel Improvements Project confined Skunk Creek through the area designated for the Skunk Creek Landfill using levees and soil-cement bank protection. This improvement project was designed to allow the development of landfill cells along Skunk Creek and provide protection from erosion during the FEMA 100-year flood event. On the east side of Skunk Creek, the designated landfill area extends roughly from the end of the above-mentioned Corps of Engineers levee, downstream to Pinnacle Peak Road. On the west side of Skunk Creek, the landfill area extends from Buchanan Wash to the 35th Avenue alignment. An opening was left in the levee along the west side of Skunk Creek to allow Buchanan Wash to flow into Skunk Creek. There are no landfill cells on the west side of Skunk Creek, upstream of Buchanan Wash. Presently, there are active, inactive (closed), and planned landfill cells along this reach of Skunk Creek downstream of the Corps of Engineers' levees.

The elevation of the landfill cell behind the levee that diverts Buchanan Wash is now higher than the levee even though the study mapping does not reflect it. This is confirmed by the field cross-section shown in Figure 3. This portion of the mapping is based on 2000 aerial photography, while the cross-section was surveyed in June 2001. Selected sheets from the construction drawings for the Skunk Creek levee project are included in Appendix G.

5.5.4 Islands and Flow Splits

There are two small islands (unmapped) that develop along Buchanan Wash during the 100-year flood according to the proposed HEC-RAS model. One is located east of the main channel at Cross-section 0.696 and the other is west of the main channel at Cross-section 1.356 (re: cross-sections in Appendix E). Because of their size, they are not hydraulically significant.

5.5.5 Ineffective Flow Areas

Ineffective flow areas are designated to remove swales, small side channels, local depressions, or floodplain fringe areas from the hydraulic capacity of a cross-section because these areas do not contribute to the downstream conveyance of the flow. Such areas have been identified at Cross-sections 0.177, 0.416, 0.456, 0.501, 1.197, 1.479, and 1.935. The ineffective areas at Cross-sections 0.177 and 1.935 were coded as blocked obstructions since the areas will not be inundated. The ineffective areas at Cross-sections 0.416, 0.456, and 0.501 remove the local depression formed by the construction of an off-line detention basin associated with a new residential development north and east of Buchanan Wash.

5.5.6 Supercritical Flow

The HEC-RAS results indicate that supercritical flow does not occur within the study reach.

5.6 FLOODWAY MODELING

The floodway concept is used to define the amount of floodplain encroachment that is considered acceptable for development. The principle is that limited encroachment is likely to have an insignificant effect on all but the severest flood events. A floodway consists of the main channel of a stream plus sufficient overbank area to convey the 100-year flood without increasing flood heights by more than a specified amount. FEMA standards limit the maximum increase in floodway elevation to one foot (1') above the base flood elevation.

Only minor adjustments were made to the effective FIS regulatory floodway in the proposed HEC-RAS model. Since the effective regulatory mapping is not available in electronic format, the proposed hydraulic baseline and floodway limits were established on the proposed mapping by inspection using the available 1"= 400' work map. Accordingly, the floodway limits were scaled and coded into the proposed model using Method 1. Since the proposed baseline location is not identical to the currently effective baseline, only the floodplain widths can be compared directly. All proposed floodway widths were in reasonable agreement with the effective floodway widths upstream of current regulatory Cross-section C. Because most of the physical changes that have taken place along the wash since the effective model was developed (i.e., residential development and landfill construction) are downstream of Section C, the floodway geometry and associated hydraulic parameters have changed below that point.

The selection of floodway encroachment stations below current regulatory Cross-section C was based on: 1) removing equal conveyance from both sides of the floodplain (Method 4); 2) the desire to obtain a hydraulically smooth floodway; and 3) the impracticality of allowing encroachment into the floodplain at the detention basin and the borrow area adjacent to Buchanan Wash and the Skunk Creek levees. As shown on Figure 2, the resulting floodway is coincident with the floodplain from proposed Cross-section 0.501 to the Skunk Creek confluence on the east side of Buchanan Wash, and from Cross-section 0.302 to the Skunk Creek confluence on the west side of Buchanan Wash

5.7 PROBLEMS ENCOUNTERED

No modeling problems were encountered while preparing this LOMR request.

5.8 CALIBRATION

No independent calibration studies were conducted for the proposed HEC-RAS model.

5.9 FINAL RESULTS

5.9.1 Hydraulic Analysis Results

The results of the HEC-RAS hydraulic analysis conducted for the proposed revisions to the Buchanan Wash Flood Insurance Study are summarized in Table 2.

Table 2: Hydraulic Analysis Results

Cross Section Identifier	Peak Discharge (cfs)	WSEL (ft)	Critical WSEL (ft)	Average Velocity (ft/s)	Top Width of Flow (ft)	Hydraulic Depth of Flow (ft)	Maximum Channel Depth (ft)	Froude Number	Left Station where WSEL Meets Ground	Right Station where WSEL Meets Ground
1.935	1308	1496.2	1496.3	8.9	60.5	2.4	4.3	1.0	9971.4	10031.9
	1308	1497.0		6.7	77.5	2.6	5.0	0.7	9963.9	10043.1
1.916	1308	1495.9		2.9	345.8	3.5	3.9	0.3	9693.2	10039.0
	1308	1496.4		4.9	102.0	4.0	4.4	0.4	9940.0	10042.0
					Cc?					
1.842	1308	1493.8		6.7	140.2	3.3	3.9	0.7	9945.3	10085.5
	1308	1494.8		4.4	115.0	4.2	4.8	0.4	9960.0	10075.0
					Ce?					
1.766	1609	1492.0		3.6	375.6	3.7	4.0	0.3	9851.5	10227.2
	1609	1492.5		5.9	115.0	4.2	4.5	0.5	9915.0	10030.0
1.670	1609	1490.0		4.1	132.1	3.7	6.0	0.4	9909.8	10041.9
	1609	1489.9		4.6	100.0	4.9	5.9	0.4	9925.0	10025.0
1.575	1609	1487.6		5.5	180.8	5.2	5.6	0.4	9881.7	10062.5
	1609	1487.8		5.4	100.0	5.4	5.8	0.4	9950.0	10050.0

Cross Section Identifier	Peak Discharge (cfs)	WSEL (ft)	Critical WSEL (ft)	Average Velocity (ft/s)	Top Width of Flow (ft)	Hydraulic Depth of Flow (ft)	Maximum Channel Depth (ft)	Froude Number	Left Station where WSEL Meets Ground	Right Station where WSEL Meets Ground
1.479	1609	1484.2		6.4	357.3	3.9	4.2	0.6	9933.8	10394.2
	1609	1485.0		5.9	100.0	4.7	5.0	0.5	9970.0	10070.0
1.412	1609	1483.0		3.5	293.6	4.7	5.0	0.3	9882.7	10176.3
	1609	1483.6		4.7	100.0	5.3	5.6	0.4	9970.0	10070.0
1.356	1609	1481.8		4.5	262.8	3.2	5.8	0.5	9861.2	10136.0
	1609	1482.3		4.6	101.0	3.7	6.3	0.4	9950.0	10051.0
1.332	1609	1481.3	1479.9	3.9	375.9	4.8	5.3	0.3	9025.6	9401.5
	1609	1482.0	1479.9	3.6	150.0	5.5	6.0	0.3	9190.0	9340.0
1.326	Culvert									
1.318	1609	1480.3	1479.9	6.2	258.6	4.0	4.3	0.5	9111.6	9370.2
	1609	1480.9		4.9	150.0	4.6	4.9	0.4	9200.0	9350.0
1.290	1609	1479.7		3.7	318.4	3.1	3.7	0.4	9474.3	10173.2
	1609	1480.1		4.8	100.0	3.7	4.1	0.4	9980.0	10080.0
1.197	1609	1477.7		4.9	353.4	5.4	5.7	0.4	9604.3	10079.8
	1609	1478.1		4.9	100.0	5.8	6.1	0.4	9950.0	10050.0
1.098	2304	1474.9	1473.8	6.5	568.6	5.5	6.9	0.5	9483.4	10052.0
	2304	1475.0		7.1	100.0	5.7	7.0	0.5	9930.0	10030.0
1.005	2304	1471.0		7.5	437.4	4.5	5.0	0.6	9630.6	10068.0
	2304	1471.9		6.5	120.0	5.5	5.9	0.5	9920.0	10040.0
0.928	2304	1469.1		4.3	247.3	4.7	5.1	0.4	9795.9	10043.2
	2304	1469.8		5.9	110.0	5.4	5.8	0.5	9920.0	10030.0
0.839	2304	1466.9		5.7	306.2	4.4	4.9	0.5	9779.8	10086.0
	2304	1467.1		5.9	130.0	4.6	5.1	0.5	9920.0	10050.0
0.696	2304	1462.8	1461.8	5.0	563.8	4.2	4.8	0.4	9453.5	10096.1
	2304	1463.1		5.1	180.0	4.5	5.1	0.4	9880.0	10060.0
0.595	2304	1460.1	1459.3	5.3	831.8	5.6	7.3	0.4	9381.8	10213.7
	2304	1460.5	1459.4	5.5	230.0	6.0	7.8	0.4	9850.0	10080.0
0.501	2304	1456.9	1456.7	5.4	528.0	2.6	2.9	0.6	9920.7	10448.7
	2304	1457.1	1456.8	6.0	300.0	2.8	3.1	0.6	9920.0	10220.0

Cross Section Identifier	Peak Discharge (cfs)	WSEL (ft)	Critical WSEL (ft)	Average Velocity (ft/s)	Top Width of Flow (ft)	Hydraulic Depth of Flow (ft)	Maximum Channel Depth (ft)	Froude Number	Left Station where WSEL Meets Ground	Right Station where WSEL Meets Ground
0.456	2304	1455.9	1455.4	3.6	568.7	4.3	5.9	0.3	9852.2	10443.2
	2304	1456.1	1455.5	3.6	358.8	4.6	6.1	0.3	9851.2	10210.0
0.416	2304	1454.5	1454.3	7.3	843.6	4.2	6.5	0.6	9568.1	10411.7
	2304	1454.6	1454.5	8.1	630.0	4.3	6.6	0.7	9570.0	10200.0
0.302	2304	1452.2		4.0	624.5	5.9	8.2	0.3	9724.7	10349.2
	2304	1452.2		4.0	624.5	5.9	8.2	0.3	9724.7	10349.2
0.266	2304	1451.2	1451.0	6.5	521.8	5.9	7.2	0.5	9826.9	10348.7
	2304	1451.2	1451.0	6.5	521.8	5.9	7.2	0.5	9826.9	10348.7
					Ec?					
0.177	2304	1450.5		2.9	190.3	7.9	8.5	0.2	9844.7	10035.0
	2304	1450.5		2.9	190.3	7.9	8.5	0.2	9844.7	10035.0
0.085	2304	1450.6		0.8	369.7	8.3	10.6	0.1	9680.4	10050.1
	2304	1450.6		0.8	369.7	8.3	10.6	0.1	9680.4	10050.1
0.043	2304	1449.6	1447.9	7.1	85.7	6.0	7.6	0.5	9967.6	10053.3
	2304	1449.6	1447.9	7.1	85.7	6.0	7.6	0.5	9967.6	10053.3

The results of the hydraulic analysis conducted for the box culvert at Pinnacle Vista Road are summarized in Table 3. This roadway is overtopped during the 100-year event.

Table 3: Culvert Analysis Results

Cross Section Identifier	WSEL (ft)	EGL Elev. (ft)	Peak Discharge (cfs)	Discharge Through Structure (cfs)	Discharge Over Road (cfs)	Velocity Head (ft)	Friction Loss U/S (ft)	Entrance Loss Coefficient	Exit Loss Coefficient
1.326	1481.3	1481.5	1609	785.5	823.5	0.2	0.1	0.4	1.0
	1482.0	1482.1	1609	802	807	0.1	0.1	0.4	1.0

Table 4 summarizes the water-surface elevations for the floodplain and floodway of the effective FIS HEC-2 model, the duplicate effective FIS model using HEC-RAS in both the HEC-2 mode and the HEC-RAS mode, and the proposed HEC-RAS model. Table 5 summarizes the differences in water-surface elevations between the effective FIS HEC-2 model, the duplicate effective FIS HEC-RAS models, and the proposed HEC-RAS model (HEC-RAS mode).

Table 4: Water-Surface Elevations

Proposed Cross Section Identifier	Effective Cross Section Identifier	Effective FIS Floodplain WSEL (PF #1)	Effective FIS Floodway WSEL (PF #3)	Duplicate Effective (HEC_2 Mode) FIS FP WSEL (PF #1)	Duplicate Effective (HEC_2 Mode) FIS FW WSEL (PF #3)	Duplicate Effective (HEC_RAS Mode) FIS FP WSEL (PF #1)	Duplicate Effective (HEC_RAS Mode) FIS FW WSEL (PF #3)	Proposed Model Floodplain WSEL (PF #1)	Proposed Model Floodway WSEL (PF #2)
1.935								1496.2	1497.0
1.916	2.200 (R)	1496.0	1497.0	1496.0	1496.9	1496.1	1497.0	1495.9	1496.4
1.842	2.121 (Q)	1494.4	1495.2	1494.4	1495.2	1494.5	1495.2	1493.8	1494.8
1.766	2.045 (P)	1491.9	1492.7	1491.9	1492.7	1492.0	1492.7	1492.0	1492.5
1.670	1.951 (O)	1489.5	1490.5	1489.5	1490.5	1489.6	1490.5	1490.0	1489.9
1.575	1.856 (N)	1487.5	1488.5	1487.5	1488.5	1487.6	1488.5	1487.6	1487.8
1.479	1.761 (M)	1484.5	1485.2	1484.5	1485.2	1484.6	1485.2	1484.2	1485.0
1.412	1.695 (L)	1482.6	1483.6	1482.6	1483.6	1482.7	1483.6	1483.0	1483.6
1.356	1.638 (K)	1480.6	1481.4	1480.6	1481.4	1480.7	1481.4	1481.8	1482.3
1.332								1481.3	1482.0
1.326	Culvert							Culvert	Culvert
1.318								1480.3	1480.9
1.290	1.572 (J)	1479.0	1479.9	1479.0	1479.9	1479.1	1479.9	1479.7	1480.1
1.197	1.483 (I)	1477.3	1478.2	1477.3	1478.2	1477.3	1478.3	1477.7	1478.1
1.098	1.383 (H)	1474.3	1475.1	1474.3	1475.1	1474.6	1475.1	1474.9	1475.0
1.005	1.288 (G)	1471.6	1472.5	1471.6	1472.5	1471.8	1472.5	1471.0	1471.9
0.928	1.207 (F)	1469.0	1470.0	1469.1	1470.0	1469.1	1470.0	1469.1	1469.8
0.839	1.120 (E)	1466.6	1467.4	1466.6	1467.4	1466.8	1467.4	1466.9	1467.1
0.696	0.985 (D)	1463.2	1464.2	1463.2	1464.2	1463.5	1464.3	1462.8	1463.1
0.595	0.890 (C)	1460.5	1461.4	1460.5	1461.4	1460.5	1461.4	1460.1	1460.5
0.501	0.782 (B)	1460.4	1461.4	1460.4	1461.4	1460.4	1461.4	1456.9	1457.1
0.456								1455.9	1456.1
0.416	0.710 (A)	1460.4	1461.4	1460.4	1461.4	1460.4	1461.4	1454.5	1454.6
0.302			*1460					1452.2	1452.2
0.266			*1460					1451.2	1451.2
0.177			*1455					1450.5	1450.5
0.085			*1455					1450.6	1450.6
0.043			*1455					1449.6	1449.6

*Skunk Creek FIS
(A) Effective FIS Index Section

Table 5: Comparison of Water-Surface Elevations

New Cross Section Identifier	Old Cross Section Identifier	Effective FIS FW - Effective FIS FP (ft)	Duplicate (HEC_2 Mode) FP - Effective FIS FP (ft)	Duplicate FP (HEC_RAS Mode) - Effective FIS FP (ft)	Proposed FP - Duplicate FP (HEC_RAS Mode) (ft)	Proposed FW - Duplicate FW (HEC_RAS Mode) (ft)	Proposed FW - Proposed FP (ft)	Proposed FW - Duplicate FP (HEC_RAS Mode) (ft)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1.935							0.8	
1.916	2.200	1.0	0.0	0.1	-0.2	-0.6	0.5	0.3
1.842	2.121	0.8	0.0	0.1	-0.7	-0.4	1.0	0.3
1.766	2.045	0.8	0.0	0.1	0.0	-0.2	0.5	0.5
1.670	1.951	1.0	0.0	0.1	0.4	-0.6	-0.1	0.3
1.575	1.856	1.0	0.0	0.1	0.0	-0.7	0.2	0.2
1.479	1.761	0.7	0.0	0.1	-0.4	-0.2	0.8	0.4
1.412	1.695	1.0	0.0	0.1	0.3	0.0	0.6	0.9
1.356	1.638	0.8	0.0	0.1	1.1	0.9	0.5	1.6
1.332							0.7	
1.326	Culvert							
1.318							0.6	
1.290	1.572	0.9	0.0	0.1	0.6	0.2	0.4	1.0
1.197	1.483	0.9	0.0	0.0	0.4	-0.2	0.4	0.8
1.098	1.383	0.8	0.0	0.3	0.3	-0.1	0.1	0.4
1.005	1.288	0.9	0.0	0.2	-0.8	-0.6	0.9	0.1
0.928	1.207	1.0	0.0	0.0	0.0	-0.2	0.7	0.7
0.839	1.120	0.8	0.0	0.2	0.1	-0.3	0.2	0.3
0.696	0.985	1.0	0.0	0.3	-0.7	-1.2	0.3	-0.4
0.595	0.890	0.9	0.0	0.0	-0.4	-0.9	0.4	0.0
0.501	0.782	1.0	0.0	0.0	-3.5	-4.3	0.2	-3.3
0.456							0.2	
0.416	0.710	1.0	0.0	0.0	-5.9	-6.8	0.1	-5.8
0.302							0.0	
0.266							0.0	
0.177							0.0	
0.085							0.0	
0.043							0.0	

As shown in Column 4 of Table 5, the duplicate effective HEC-RAS model, run in HEC-2 mode, accurately reflects the Effective FIS model. However, since both the City of Phoenix and the Flood Control District of Maricopa County want the new regulatory model to be HEC-RAS, the duplicate model was also run in HEC-RAS mode. Column 5 demonstrates that this duplicate HEC-RAS model is accurate to within 0.3 feet. This duplicate model is used to quantify the changes in water-surface elevations in the proposed model. The larger differences in water-surface elevations in HEC-RAS mode are due to the different computational algorithms used by HEC-RAS. Column 3 demonstrates that the floodway surcharge for the effective model ranges from 0.7 to 1.0 feet, while Column 8 demonstrates that the floodway surcharge for the proposed model ranges from -0.1 to 1.0 feet. Columns 6 and 7 compare the duplicate effective and proposed floodplains and floodways, respectively. Column 9 demonstrates the surcharge when comparing the proposed floodway with the duplicate floodplain.

At Cross-section 1.356 the proposed floodplain is 1.1 feet higher than the duplicate floodplain and the proposed floodway is 1.6 feet higher than the duplicate floodplain. This increase is due to the concrete box culvert that has been built at this location (Pinnacle Vista Road) since the currently effective model was prepared. This exceeds allowable criteria. Prior to construction, a FP use permit should have been obtained.

The significant decreases in water-surface elevations from the effective model to the proposed model (e.g., Columns 6 and 7 of Table 5) that occur in the lower reaches of the wash (proposed model Cross-sections 0.696 to 0.456) are due to the difference in starting water-surface elevations. The currently effective model uses a backwater elevation of 1460.4 from Skunk Creek as the starting water-surface elevation for the Buchanan Wash model, while the proposed model uses the slope-area method of computing the starting water-surface elevation, as now desired by FEMA. FW shown not to increase > 1!

Need to substantiate reasoning before accepting these results.

Table 6 summarizes the surface area inundated by the floodplain and the floodway in the study reach. Surface area is reported in both square miles and acres.

Table 6: Floodplain/Floodway Surface Areas

	Floodplain Surface Area (mi^2)	Floodplain Surface Area (acres)	Floodway Surface Area (mi^2)	Floodway Surface Area (acres)
Study Reach	0.15	94.2	0.07	45.5

5.9.2 Verification of Results

The results of the HEC-RAS model compare well with the effective HEC-2 model and the proposed floodplain and floodway mapping compares well with the effective regulatory mapping where it applies.

Section 6: EROSION AND SEDIMENT TRANSPORT

An erosion and sediment transport analysis was not conducted for the Buchanan Wash Letter of Map Revision (LOMR) request. A scour analysis was conducted for the design of the Skunk Creek levees to determine the toe-down depth used for the soil cement armor protection (10 feet). A copy of this scour analysis is provided in Appendix F. These levees, which were constructed to protect the Skunk Creek Landfill, impacted Buchanan Wash by diverting it to Skunk Creek approximately 2500 feet upstream of the natural confluence point. The diversion point is approximately 1000 feet downstream of the downstream limit of the current Flood Insurance Study (FIS) for Buchanan Wash. The area behind this levee has been filled to an elevation above the original top-of-levee. As a result, the original soil cement levee has effectively become soil cement bank protection.

depositional contraction at section 0.177 & below. Should be discussed in terms of providing an improved section, or, scheduled sediment removal.

Section 7: DRAFT FIS REPORT DATA

7.1 SUMMARY OF DISCHARGES

The effective 100-year peak discharges are summarized in Table 1 of this report.

7.2 FLOODWAY DATA

The proposed FEMA floodway data is provided in Table 7.

FLOODING SOURCE		FLOODWAY			WATER SURFACE ELEVATION		
Cross Section	Distance [1]	Width (ft)	Section Area (ft^2)	Velocity (ft^2/s)	With Floodway (ft)	Without Floodway (ft)	Difference (ft)
A	0.043	86	347	7.1	1449.6	1449.6	0.0
B	0.085	370	3060	0.8	1450.6	1450.6	0.0
C	0.266	522	691	6.5	1451.2	1451.2	0.0
D	0.302	625	1103	4.0	1452.2	1452.2	0.0
E	0.416	630	561	8.1	1454.6	1454.5	0.1
F	0.501	300	495	6.0	1457.1	1456.9	0.2
G	0.595	230	614	5.5	1460.5	1460.1	0.4
H	0.696	180	568	5.1	1463.1	1462.8	0.3
I	1.005	120	444	6.5	1471.9	1471.0	0.9
J	1.098	100	392	7.1	1475.0	1474.9	0.1
K	1.290	100	346	4.8	1480.1	1479.7	0.4
L	1.326	150	366	7.2	1482.0	1481.3	0.7
M	1.479	100	331	5.9	1485.0	1484.2	0.8
N	1.670	100	391	4.6	1489.9	1490.0	-0.1
O	1.935	78	196	6.7	1497.0	1496.2	0.8

[1] Distance Upstream of Skunk Creek Conflunence (miles)
[2] Skunk Creek Main Stem Backwater Elevation is 1455.0

Table 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHOENIX, ARIZONA

FLOODWAY DATA

BUCHANAN WASH

7.3 ANNOTATED FIRM MAP

An Annotated Firm Map in FEMA format is in Figure 4.

MARICOPA COUNTY
UNINCORPORATED AREAS
040037

APPROXIMATE SCALE IN FEET
1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1185 OF 4350
(SEE MAP INDEX FOR PANELS NOT PRINTED)

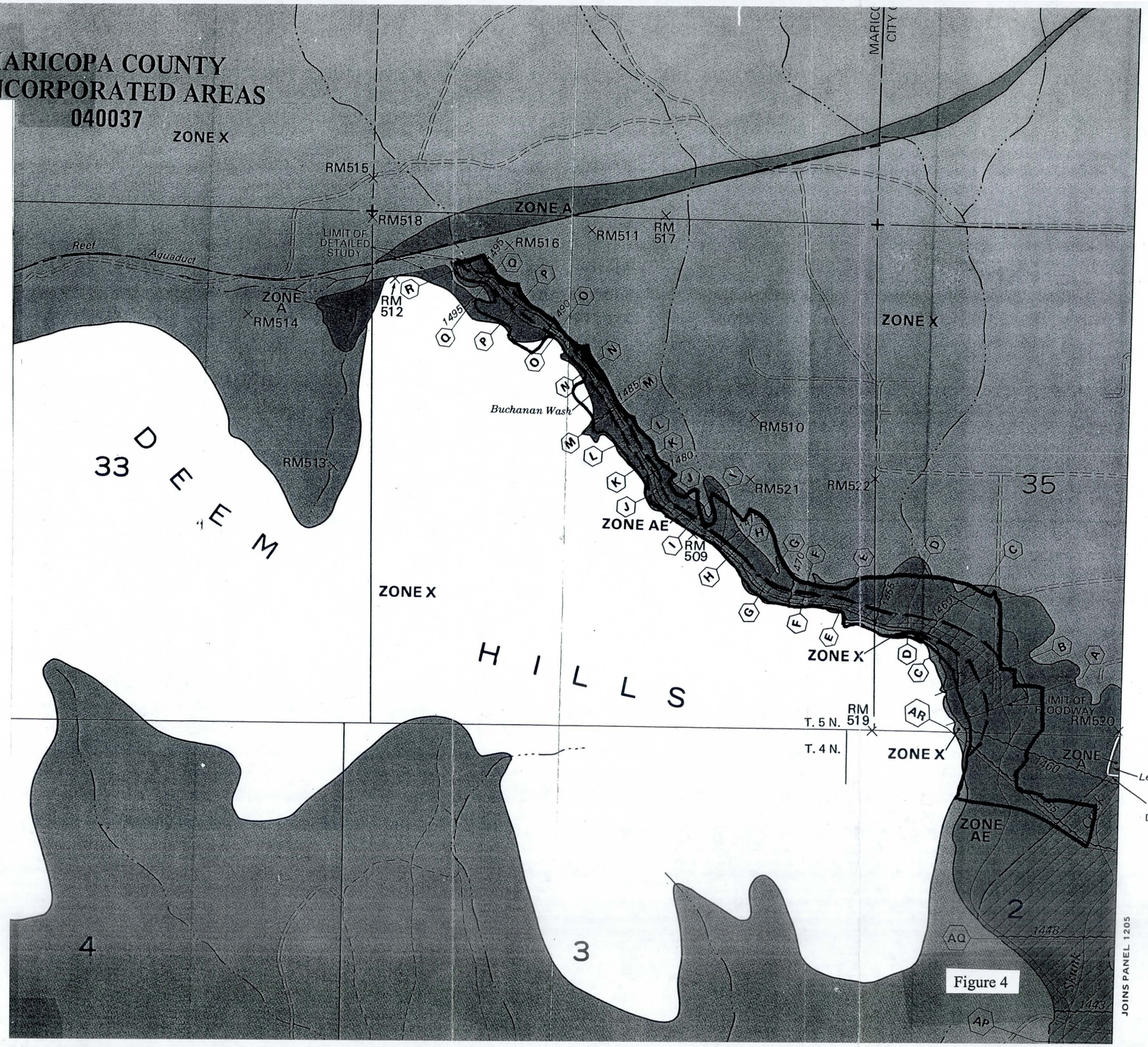
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
GLENDALE, CITY OF	040045	1185	G
PHOENIX, CITY OF	040051	1185	G

MAP NUMBER
04013C1185 G

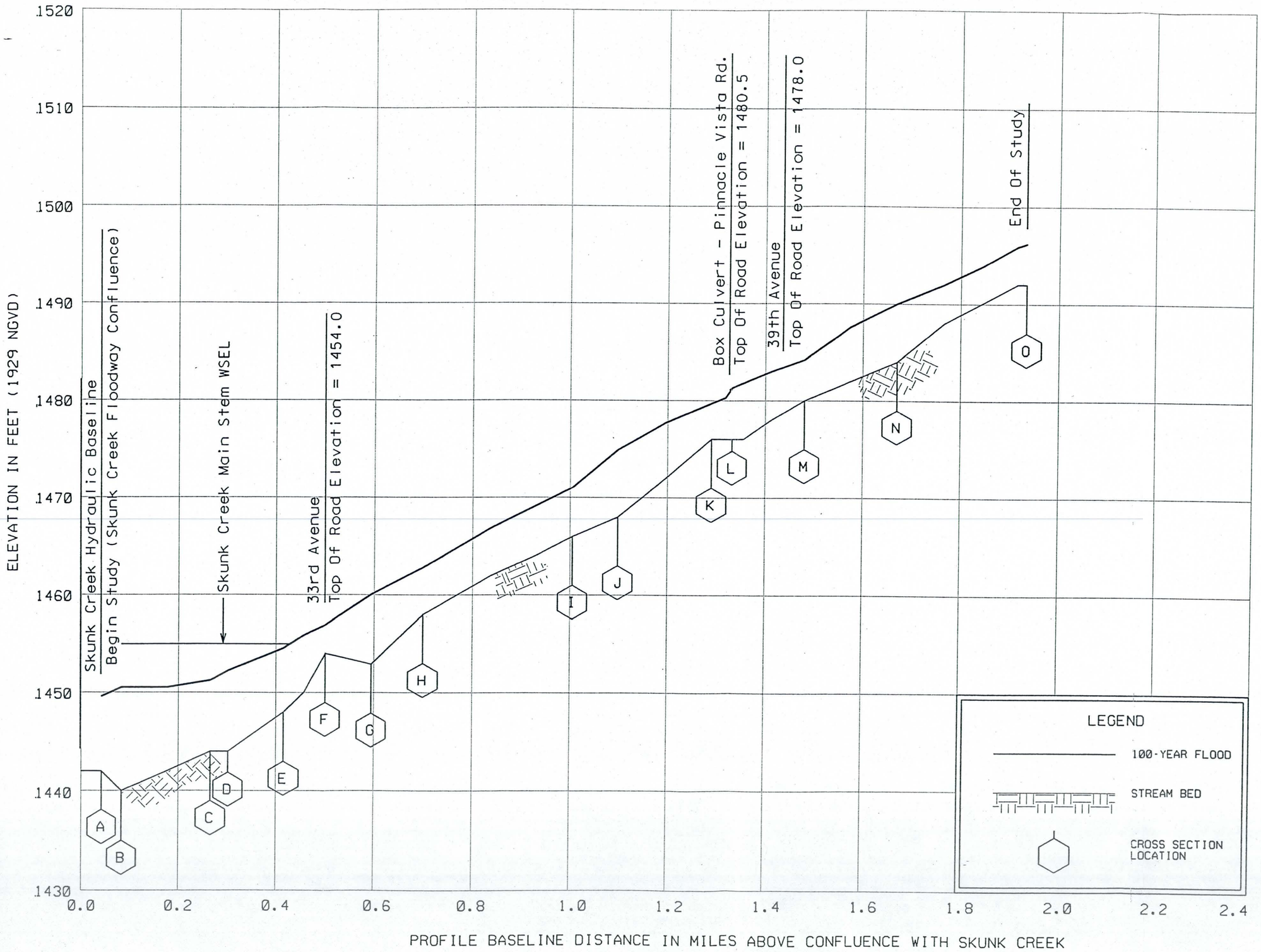
MAP REVISED:
JULY 19, 2001

Federal Emergency Management Agency



7.4 FLOOD PROFILES

The proposed flood profile for Buchanan Wash in FEMA format is provided on Figure 5.



FLOOD PROFILES

BUCHANAN WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF PHOENIX

FIGURE 5

...\Emcn-002\BW\Fema_profiles.dgn 06/03/2002 11:19:15 AM

APPENDIX A: REFERENCES

A.1 Data Collection Summary

Previous and applicable studies include;

The effective FIS study was completed by AGK Engineers, Inc. in 1987. The study reach began at the backwater limit of the Skunk Creek Study at Buchanan Wash and ended at the Central Arizona Project (CAP) Canal.

A.2 Referenced Documents

1. Flood Insurance Study for Maricopa County, Arizona and Incorporated Areas, Federal Emergency Management Agency (FEMA), Revised July 19, 2001.

2. Flood Control District of Maricopa County, Flood Insurance Study for Buchanan Wash from Skunk Creek to C.A.P. Canal, Maricopa County, Arizona, Contract FCD 86-26, November 1987, AGK Engineers, Inc.

3. U.S. Army Corps of Engineers, HEC-RAS River Analysis System User's Manual, (CPD-68), U.S. Army Corps of Engineers, Version 3.0., January, 2001.

4. U.S. Army Corps of Engineers, HEC-RAS River Analysis System Hydraulic Reference Manual, (CPD-69), U.S. Army Corps of Engineers, Version 3.0, January, 2001.

5. Chow, V.T., 'Open Channel Hydraulics,' McGraw-Hill Book Company, Inc., New York, 1959. Reissued 1988.

6. Federal Emergency and Management Agency, Flood Insurance Study Guidelines and Specifications for Study Contractors, FEMA 37, January 1995.

7. Arizona Department of Water Resources Flood Mitigation Section, Instructions for Organizing and Submitting Technical Documentation for Flood Studies, State Standard Attachment SSA1-97, November, 1997.

8. Federal Emergency and Management Agency, Appeals, Revisions, and Amendments to Nation Flood Insurance Program Maps, A guide for Community Officials, FIA-12, December 1993.

9. U.S. Geological Survey, Mesa, Arizona Topographic Quadrangle, 7.5 Minute Topographic Series, USGS N 3352.5-W11200/7.5, 1964.

10. Estimated Manning's Roughness Coefficients for Stream Channels and Floodplains in Maricopa County, Arizona, U.S. Geological Survey, April 1991

APPENDIX B: GENERAL DOCUMENTATION & CORRESPONDENCE

Richard Harris - FCDX <rph@mail.maricopa.gov>

07/02/02 10:06 AM

To: Hasan Mushtaq/STR/PHX@PHXENT
cc: Richard Harris - FCDX <rph@mail.maricopa.gov>, "'pedro.calza@tetratechgroup2.com'" <pedro.calza@tetratechgroup2.com>
Subject: 07/02/02 FW: Skunk Creek Levees, Skunk Creek and Buchanan Wash FD S

Hasan,

In response to your telephone message you left me this morning, I am forwarding the below e-mail that I sent some time back requesting information about the ACOE Skunk Creek Levees. As of now, I have not received a response back from them regarding my request. I tried calling Mr. Mazigat this morning, and learned that he will not be back at his office until July 9th (his phone # is (213) 452 3393). During my last call he seemed very agreeable to my request, so perhaps he has had difficulty in obtaining the needed verification. If you have any further questions, please call me at (602) 506-4528.

Thanks,

Richard

-----Original Message-----
From: Richard Harris - FCDX
Sent: Friday, May 24, 2002 3:15 PM
To: 'tmasigat@spl.usace.army.mil'
Cc: Richard Harris - FCDX; 'pedro.calza@tetratechgroup2.com'; 'hasan.mushtaq@phoenix.gov'
Subject: Skunk Creek Levees

Ted,

Per our conversation this afternoon, I am writing to request that the FCDMC receive a letter from the ACOE to verify that the original design for the Skunk Creek Levees was to accommodate the SPF, and that the levees were actually constructed to contain the design discharge. It would be helpful to us if you could include a set of the As-built plans for the levees. If you have any questions, please call me at 602-506-4528.

Thanks,

Richard InterScan_SafeStamp.t

City of Phoenix

STREET TRANSPORTATION DEPARTMENT

July 9, 2002

Andrea L. Ryon, P.E., Director
Engineering Division
Michael Baker Jr., Inc.
3601 Eisenhower Avenue, Suite 600
Alexandria, Virginia 22304-6425

Dear Ms. Ryon:

RE: LETTER OF MAP REVISION FOR BUCHANAN WASH
CASE NUMBER 02-09-290

The City of Phoenix will adopt and enforce the modified regulatory floodway, according to the Phoenix City Code, Article 1, Chapter 32B, Floodplains. A copy of the stated regulation is included with this submittal. The City of Phoenix also understands the responsibility and the liability for the inspections and to ensure flow carrying capacities for the Buchanan Wash. Attached is a copy of the City of Phoenix Policy and Procedure for Maintenance of Drainage Facilities. Also attached is a copy of the City of Phoenix Floodplain Ordinance. This submittal is in accordance with 65.12 of the National Flood Insurance Program Regulations.

If you have any technical questions, please contact Mr. Hasan Mushtaq, Ph. D., P.E., C.F.M., City of Phoenix Floodplain Manager, 200 West Washington Street, 5th Floor, Phoenix, Arizona 85003, phone number 602-262-4960, fax number 602-262-7322.

Sincerely,

Hasan Mushtaq, Ph. D., P.E., C.F.M.
Floodplain Manager

HM/DW/aff/maintenance.doc

Attachments

CITY OF PHOENIX	STREET MAINTENANCE DIVISION POLICY AND PROCEDURE	4.14 1 of 2 NUMBER
	MAINTENANCE OF DRAINAGE FACILITIES SUBJECT	12-02-92 ISSUE DATE

PURPOSE:

To insure all drainage facilities are maintained and kept clear from objects that may impede the flow of storm runoff.

POLICY:

All drainage facilities shall be inspected and cleaned on a maintenance schedule.

PROCEDURE:

1. The Street Maintenance Drainage Foreman shall visually inspect each drainage facility in his/her section once a month.

2. The Drainage Foreman shall schedule the cleaning as needed, but no more than the established service levels, unless it is determined that if allowed to exist could become an obstruction to drainage.

3. The following is the established service levels.

   a) Man-made Drainage Easements: Inspected and cleaned, if needed, once a month.

   b) Dedicated Natural Washes: Inspected monthly and cleaned of debris twice annually.

   c) Un-dedicated Natural Washes: Inspect twice annually and notify adjacent property owner to clean as needed. If the property owner does not remove the debris from the wash, the Foreman shall advise the area Street Maintenance Field Inspector who shall follow through by notifying NIH - Zoning Enforcement.

   d) Man-made Detention Basins: Inspect monthly and clean as needed.

   e) Storm Drainage Inlets: Inspect monthly and clean as needed.

The Street Maintenance Section shall respond to any complaints regarding the clogging of drainage facilities and correct the problem within five days of notification. The above service levels shall be followed for routine maintenance. Extenuating circumstances may require deviation.

DTM:ve

Chapter 32B

FLOODPLAINS*

---

* **Cross References:** Engineering and Architectural Services Department, § 2-27; Development Advisory Board, § 2-164 et seq.; building regulations, ch. 9; subdivisions, ch. 32; grading and drainage, ch. 32A.

State Law References: Floodplain management, A.R.S. § 48-3601 et seq.; municipal floodplain management programs, A.R.S. § 48-3610.

Article I. General

Sec. 32B-1. Implementation.
Sec. 32B-2. Definitions.

Article II. Regulations

Sec. 32B-3. Maps.
Sec. 32B-4. Classification of floodplains.
Sec. 32B-5. Regulation.
Sec. 32B-6. Interim elevations.
Sec. 32B-7. Coordination in floodplain management.
Sec. 32B-8. Non-prohibited construction.
Sec. 32B-9. Reserved.
Sec. 32B-9.1. Manufactured homes.
Sec. 32B-9.2. Mechanical and utility equipment.
Sec. 32B-9.3. Federal and State permits.
Sec. 32B-9.4. Openings in enclosures below a structure's lowest floor.
Sec. 32B-10. Sand and gravel operations.
Sec. 32B-11. Variance provisions.
Sec. 32B-12. Appeals.
Sec. 32B-13. Structures in violation of regulations.
Sec. 32B-14. Diversion of water flow.
Sec. 32B-15. Violation as separate offense.
Sec. 32B-16. Severability.
Sec. 32B-17. Floodplain plan review fees.

ARTICLE I.

GENERAL

Sec. 32B-1. Implementation.

To implement the regulation of the floodplain areas in the City of Phoenix, the City Council is designated as the Floodplain Board and the City Engineer is designated as the administrative agent for these regulations.
(Ord. No. G-2027, § 2)

Sec. 32B-2. Definitions.

Area of shallow flooding means a designated zone in which the base flood depths range from one to three feet; a clearly defined channel does not exist; the path of flooding is unpredictable and indeterminate; and high velocity flow may be evident.

Area of special flood hazard means the land within a floodplain which is subject to inundation by the base flood.

Base flood means the flood having a one percent chance of being equalled or exceeded in any given year, i.e., the one-hundred-year flood.

Development means any manmade change to improved or unimproved real estate, including, but not limited to, buildings and other structures, utilities, pipelines, mining, dredging, filling, grading, paving, or excavation located within the area of special flood hazard.

Dwelling unit means any structure usable for residential purposes and which may be located in a single- or multiple-dwelling building, which includes working, sleeping, eating, cooking, recreation facilities, or a combination thereof, except a structure used only for storage purposes.

Flood or *floodwaters* means a temporary overflow of water on land not normally covered by water.

Flood boundary and floodway maps (FBFM) means the official map for the community on which the Federal Insurance Administration has delineated the area of special flood hazard and the selected floodway.

Flood insurance rate maps (FIRM) means the official maps on which the Federal Insurance Administration has delineated both the areas of special flood hazard and the risk premium insurance rates applicable to the community.

Flood insurance study means the official report provided by the Federal Insurance Administration that includes flood profiles, the flood boundary and floodway maps, and the water surface elevations of the base flood.

Floodplain means the relatively flat area adjoining the channel of a watercourse, or areas where drainage is or may be restricted by natural or manmade structures which may have been or may be covered partially or wholly by floodwater from a base flood.

Floodplain Board or *Board* means the City Council acting as the "Floodplain Board."

Floodway fringe area means that portion of the area of special flood hazard that is not included in the selected floodway.

Lowest floor means the lowest floor of the lowest enclosed area (including basement). An unfinished or flood resistant enclosure, usable solely for parking of vehicles, building access or storage, in an area other than a basement area, is not considered a building's lowest floor, provided that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirements of this ordinance.

Manufactured home means a structure, transportable in one or more sections, which is built on a permanent chassis and is designed for use with or without a permanent foundation when connected to the required utilities. For floodplain management purposes the term "manufactured home" also includes park trailers, travel trailers, and other similar vehicles placed on a site for greater than one hundred eighty consecutive days. For insurance purposes the term "manufactured home" does not include park trailers, travel trailers, and other similar vehicles.

Manufactured home park or subdivision means a parcel (or contiguous parcels) of land divided into two or more manufactured home lots for rent or sale.

Mean sea level means, for purposes of the National Flood Insurance Program, the National Geodetic Vertical Datum (NGVD of 1929) or other datum, to which base flood elevations shown on a community's flood insurance rate map are referenced.

Person means any individual or his agent, firm, partnership, association, corporation, or any agent of the aforementioned groups, or a federal, State, County or municipal government agency or political subdivision thereof.

Reasonable alteration or repair means any modification or improvement to existing facilities in which the total cost does not exceed fifty percent of the real cash value assessed at the commencement of construction. A reasonable alteration, however, should not be construed to mean any improvement which would increase the flood hazard to that property or the properties of surrounding homes.

Regulatory flood elevation means the elevation which is one foot above the "base flood" elevation for a "watercourse" for which the "base flood" elevation has been determined and shall be as determined by the criteria developed by the City Engineer for all other watercourses.

Selected floodway means the limits, as determined by the City Engineer, where the permitted encroachment in the floodplain will allow passage of the one-hundred-year flood without increasing the flood heights more than one foot. Additional hydraulic criteria such as maximum flow velocities of five feet per second at the limits of the selected floodway, smooth transitions around developments, and equal conveyance removal from each side will be used in computing the lines of the selected floodway.

Start of construction includes substantial improvement, and means the date the

building permit was issued, provided the actual start of construction, repair, reconstruction, placement, or other improvement was within one hundred eighty days of the permit date. The actual start means either the first placement of permanent construction of a structure on a site, such as the pouring of slab or footings, the installation of piles, the construction of columns, or any work beyond the state of excavation; or the placement of a manufactured home on a foundation. Permanent construction does not include land preparation, such as clearing, grading and filling; nor does it include the installation of streets and/or walkways; nor does it include excavation for a basement, footings, piers, or foundations or the erection of temporary forms; nor does it include the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or not part of the main structure.

Structure means a walled and roofed building or "manufactured home" that may or may not be habitable, may or may not be constructed on a permanent foundation, and was manmade.

Substantial improvement means any repair, reconstruction or improvement of a structure, the cost of which equals or exceeds fifty percent of the market value of the structure either before the improvement or if the structure was damaged and is being restored, before the damage occurred. A substantial improvement will not be permitted nor should it be construed to mean any modification which will increase flood hazard risk.

Violation means the failure of a structure or other development to be fully compliant with the community's floodplain management regulations. A structure or other development without the elevation certificate, other certifications, or other evidence of compliance required by this chapter is presumed to be in violation until such time as that documentation is provided.

Watercourse means any lake, river, creek, stream, wash, arroyo, channel, or other body of water having banks and bed through which waters flow at least periodically. The term may include specifically designated areas in which flood damage may occur. (Ord. No. G-2027, § 2; Ord. No. G-3092, § 2)

Cross References: Definitions and rules of construction generally, § 1-2.

ARTICLE II.

REGULATIONS

Sec. 32B-3. Maps.

The areas of special flood hazard and the selected floodway for designated floodplains are shown on the current maps labeled "FIRM" and "Floodway," or as they may subsequently be amended, on file with the City Engineer, which maps are incorporated herein by reference. The maps are consistent with the criteria established by

the Arizona Department of Water Resources and Federal Emergency Management Agency. New or additional engineering data may be considered for re-evaluation of floodplain and floodway delineations if circumstances indicate such action is in the public interest. Any such scientific or technical data will be submitted to the office of the City Engineer for review and conformance with established policy.
(Ord. No. G-2027, § 2; Ord. No. G-2641, § 1; Ord. No. G-3092, § 3)

Sec. 32B-4. Classification of floodplains.

To encourage the safe and orderly development of floodplain land, the Board recognizes that the floodplains consist of two distinct areas: the floodway fringe area having lower water velocities and shallower depths of flow and, the selected floodway which contains greater flow depths and damaging velocities. The Board also recognizes that encroachment into the floodway fringe area will not substantially increase the flood hazard to adjoining properties. It is also recognized that development and construction within the selected floodway will require higher standards of engineering and construction than development within the floodway fringe area in order to insure that there is no substantial hazard to such development or construction and that it does not create a substantial hazard to other property within the floodplain.
(Ord. No. G-2027, § 2)

Sec. 32B-5. Regulation.

In order to promote the public health, safety and general welfare, the Floodplain Board will enforce the following regulations:

1. No person may either obstruct, divert, or reduce the capacity within the area of special flood hazard by constructing any development or altering the width or course of said floodways except as provided in these regulations.

2. Construction and development may occur within the floodway fringe and the areas of shallow flooding provided that the City Engineer review and approve all such requests for building permits prior to issuance by the Building Official. The City Engineer will ascertain that the proposed construction will incorporate appropriate floodproofing measures to the "regulatory flood elevation," or that the "lowest floor" is above the "regulatory flood elevation." A "dwelling unit" shall be so constructed so as to place the "lowest floor" elevation of the "dwelling unit" above the "regulatory flood elevation." Appropriate floodproofing measures may include, but not be limited to: providing access during flood events, maintaining electrical, water, and sewer services, designing foundations and structures to withstand hydraulic loadings expected during the base flood and designing windows, doorways and other openings located below the level of the base flood to prevent the entrance of floodwaters. Any

applicant for a building permit has the burden of furnishing the Development Services Director satisfactory evidence to enable him to either determine that the applicant's property does not fall within the area of special flood hazard or that there is no substantial hazard, either to the proposed development or to the property.

3. Construction and development may be permitted within the selected floodway subject to review and approval by the City Engineer, on an individual permit basis; however, no development in the selected floodway will be allowed which will increase the water surface elevation of the base flood.

4. These regulations do not affect the existing use of property in the areas of special flood hazard or the right to the continuation of that use, nor do they affect the reasonable repair or alteration of property for the purpose for which such property was lawfully used on February 12, 1974.

5. Any substantial improvements to existing structures must conform to the requirements of this chapter.

6. New developments which provide on-site waste disposal systems must locate them outside the boundary of the base flood.

7. Within one hundred twenty days after completion of any flood control project, the areas of special flood hazard and the selected floodway in the area benefited by such works will be redefined.

8. Any new building or development located or maintained within the area of special flood hazard must have prior written authorization from the City Engineer, except as specified in 32B-8 and 32B-10 of these regulations.

9. The owner must have a registered professional engineer, or registered land surveyor, certify to the Development Services Director the actual elevation of the minimum finished floor of any new or substantially improved structure located within the area of special flood hazard. A record of these certifications shall be maintained with the Development Services Director. In addition, where a nonresidential structure is intended to be made watertight below the base flood level, a registered professional engineer or registered architect shall develop and/or review structural design, specifications, and plans for the construction, and shall certify that the design and methods of construction are in accordance with accepted standards of practice for meeting the applicable provisions of this section. A record of such certification which includes the specific elevation (in relation to mean sea level) to which such structures are floodproofed shall be maintained with the Development Services Director.

10. The City Engineer and the Development Services Director will obtain and maintain for public inspection, all records pertaining to the provisions of this ordinance.

11. No development shall increase the one-hundred-year twenty-four-hour peak or the one-hundred-year two-hour peak whichever is higher. Nor shall the time of the peak change or the total runoff exceed the pre-development total runoff.

12. In areas of special flood hazard without a selected floodway or its flood insurance rate map (FIRM) [or] flood insurance flood boundary and floodway maps (FBFM): No new flood boundary and floodway maps, construction, substantial improvements, or other development (including fill) shall be permitted unless it is demonstrated that the cumulative effect of the proposed developments, when combined with all other existing and proposed developments will not increase the water surface elevation of the base flood more than one foot at a point within the community.

(Ord. No. G-2027, § 2; Ord. No. G-3092, § 4; Ord. No. G-3313, § 1)

Sec. 32B-6. Interim elevations.

When base flood elevations and delineations are not available due to recent annexation or other causes, the City Engineer may obtain, review, and reasonably utilize any base flood elevation data available from a federal, State, County or other political subdivision for the purpose of securing a base flood determination, until such time as the Federal Emergency Management Agency has published the final FIRM (flood insurance rate maps) and FBFW (flood boundary and floodway maps).
(Ord. No. G-2027, § 2; Ord. No. G-3313, § 1)

Sec. 32B-7. Coordination in floodplain management.

The Floodplain Board may adopt other regulations which provide for coordination with all other interested and affected political subdivisions and State agencies and may enter into agreements for cooperative regulations, planning, designs, and construction. The Development Services Director shall advise the Flood Control District of Maricopa County and any other adjacent jurisdiction having responsibility for floodplain management, in writing, and provide a copy of any development plan of all applications for floodplain use permits or variances to develop land in a floodplain or floodway within one mile of the boundary between the City's area of jurisdiction and the area of jurisdiction of the District. The Development Services Director shall also advise the District and any adjacent jurisdiction having responsibility for floodplain management in writing and provide a copy of any development plan of any major development proposed within a floodplain or floodway which could affect floodplains, floodways or watercourses outside the City's area of jurisdiction. Written notice and a copy of the plan of development shall be sent to any adjacent jurisdiction no later than

three working days after having been received.
(Ord. No. G-2027, § 2; Ord. No. G-3092, § 5; Ord. No. G-3313, § 1)

Sec. 32B-8. Non-prohibited construction.

Written authorization shall not be required nor shall the Floodplain Board prohibit:

1. The construction of bridges, culverts, dikes, and other structures necessary to the construction of public highways, roads, and streets intersecting or crossing a watercourse.

2. The construction of storage dams for watering livestock or wildlife structures on banks of a creek, stream, river, wash, arroyo or other watercourses to prevent erosion of or damage to adjoining land, or dams for the conservation of floodwaters as permitted by A.R.S. tit. 45, ch. 3.1 (A.R.S. § 45-801.01 et seq.).

3. Construction of tailing dams and waste disposal areas for use in connection with mining and metallurgical operations.

(Ord. No. G-2027, § 2)

Sec. 32B-9. Reserved.

Editors Note: Section 32B-9 was repealed; see Ord. No. G-3092, § 6.

Sec. 32B-9.1. Manufactured homes.

Any manufactured homes to be placed within the area of special flood hazard shall be installed using methods and practices which minimize flood damage. For the purposes of this requirement, manufactured homes must be elevated so that the bottom of the structural frame or the lowest point of any attached appliances, whichever is lower, is at or above the regulatory flood elevation and anchored to resist flotation, collapse, or lateral movement. Methods of anchoring may include, but are not limited to, use of over-the-top or frame ties to ground anchors. This requirement is in addition to applicable State requirements.
(Ord. No. G-3092, § 6)

Sec. 32B-9.2. Mechanical and utility equipment.

Electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities shall be designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding.
(Ord. No. G-3092, § 6)

Sec. 32B-9.3. Federal and State permits.

All development located within an area of special flood hazard shall obtain all permits required by State and federal law, specifically that required by section 404 of the Federal Water Pollution Control Amendments of 1972.
(Ord. No. G-3092, § 6)

Sec. 32B-9.4. Openings in enclosures below a structure's lowest floor.

For all new construction and substantial improvements, fully enclosed areas below the lowest floor that are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement must either be certified by a registered professional engineer or architect or must meet or exceed the following minimum criteria:

A minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided. The bottom of all openings shall be no higher than one foot above grade. Openings may be equipped with screens, louvers, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters.
(Ord. No. G-3092, § 6)

Sec. 32B-10. Sand and gravel operations.

Sand and gravel operations are allowed within the floodplain subject to the following conditions:

1. Within the selected floodway, sand and gravel operations may be conducted without permit provided that:

   (a) The operations are restricted to [the] extraction of sand and gravel for commercial purposes; and

   (b) Excavations are not so located nor of such depth as to present a hazard to other development, including, but not limited to, roads, bridges, culverts, and utilities.

2. No stockpiling, within the selected floodway, of material or tailings that may obstruct, divert, or retard the flow of floodwaters will be permitted except as reviewed and approved by the City Engineer, on an individual permit basis.

3. Stockpiling of sand and gravel products within the floodway fringe area may be done without permit provided that the operator furnishes the City Engineer satisfactory evidence that such stockpiling is within the floodway fringe area rather than in the selected floodway.

4. Excavations for sand and gravel for commercial purposes within the floodway fringe area which exceed the definitions contained in section 32A-6, paragraph (b)(1) [sic] (Grading and Drainage) of the City Code will be permitted subject to review and approval by the City Engineer, on an individual permit basis.

(Ord. No. G-2027, § 2)

Sec. 32B-11. Variance provisions.

A. The City Engineer may authorize variances from the terms of this chapter when a literal enforcement of any provisions of this ordinance would result in an unnecessary property hardship and when evidence is presented demonstrating to the satisfaction of the City Engineer that all of the following conditions are fulfilled:

1. That special conditions and circumstances exist which are peculiar to the land or structure involved and which are not applicable to other lands or structures within the same general area such as a new structure to be erected on a lot of one-half acre or less, contiguous to and surrounded by lots with existing structures built below the level of the base flood; and

2. That the alleged hardships caused by literal interpretation of the provisions of this chapter are property hardships which include more than personal inconvenience and financial hardships, and do not result from the action of the owner or the applicant; and

3. That the variances will not be detrimental to persons residing or working in the vicinity and to adjacent property, to the neighborhood and to the public welfare in general; and

4. That the variance is the minimum variance that will make possible the reasonable use of the land or structure; and

5. That appropriate and specific conditions have been stipulated by the City Engineer in connection with the variances as may be deemed necessary in order to fully carry out the intent of the Floodplain Ordinance. The stipulation may include, among other things, a requirement that the applicant insert a note on any future deed or other conveyance of the property stating that the property is located in a floodprone area. The notice will include the number of feet that the lowest non-floodproofed floor of the proposed structure is below the base flood level and a statement that the actuarial flood insurance rates increase as the first floor elevation decreases. A violation of any condition shall be considered a violation of the Floodplain Ordinance and such violation shall render the variance null and void; and

6. That the burden of proof in all matters heard by the City Engineer shall rest with the applicant. The granting of a variance is a matter of grace, resting on the discretion of the City Engineer, and a refusal is not a denial of a right, conditional or otherwise.

B. A variance will be issued for the reconstruction, rehabilitation, or restoration of all structures listed on the National or State Register of Historic Places or the State inventory of historic places, without regard to conflicting procedures and provisions set forth in this section.
(Ord. No. G-2027, § 2)

Sec. 32B-12. Appeals.

Appeals from decisions of the City Engineer in application of these regulations may be taken to the Development Advisory Board acting as the Floodplain Appeal Board. Any person aggrieved by a decision of the Floodplain Appeal Board may bring special action in a court of competent jurisdiction. The Floodplain Appeal Board, when reviewing an appeal from a decision of the City Engineer, shall follow the rules and standards set forth in this ordinance.
(Ord. No. G-2027, § 2; Ord. No. G-3313, § 1; Ord. No. G-4176, § 13, passed 5-19-1999, eff. 6-18-1999)

Sec. 32B-13. Structures in violation of regulations.

Except as provided in paragraphs 32B-8 and 32B-10, all new development located or maintained within any area of special flood hazard in violation of the regulations of this chapter and without written authorization from the Floodplain Board or the City Engineer as administrative agent of the Floodplain Board is hereby declared to be a public nuisance per se and may be abated, prevented or restrained by action of the City.
(Ord. No. G-2027, § 2)

Sec. 32B-14. Diversion of water flow.

A. It is unlawful for any person to divert, retard, or obstruct any watercourse in the City of Phoenix whenever such action creates a hazard to life or property without securing the written authorization required by the preceding regulations.

B. Any person violating the provisions of this section shall be guilty of a misdemeanor.
(Ord. No. G-2027, § 2)

Sec. 32B-15. Violation as separate offense.

Each day of violation of these regulations shall constitute a separate offense.

(Ord. No. G-2027, § 2)

Sec. 32B-16. Severability.

If any provision of this ordinance is held invalid, such invalidity shall not affect other provisions which can be given effect without the invalid provision, and to this end the provisions of this ordinance are declared to be severable.
(Ord. No. G-2027, § 2)

Sec. 32B-17. Floodplain plan review fees.

The Development Services Director shall collect the fees set forth in this section before providing floodplain plan review services:

FLOODPLAIN PLAN REVIEW
FEE SCHEDULE
Effective September 1, 1987

1. Generated through grading and drainage review:

   $240.00/plan sheet for office review.

   $170.00/plan sheet for third review and each thereafter.

   $240.00/plan sheet for revisions to approved plans.

   $125.00/plan sheet for updates to approved plans.

2. Generated through building safety check:

   $17.00/form, finished floor requirement. (Form 126-225D Rev.)

   $240.00/plan sheet for office review.

(Ord. No. G-2217, § 1; Ord. No. G-2226, § 2; Ord. No. G-2512, § 1; Ord. No. G-2629, § 1; Ord. No. G-2787, § 1; Ord. No. G-3011, § 1; Ord. No. G-3127, § 3)
Cross References: Development Services Department fee schedule, app. A.2.

CERTIFIED MAIL

City of Phoenix

STREET TRANSPORTATION DEPARTMENT

April 1, 2002

Mr. Ken Pierce
27602 North 31st Avenue
Phoenix, AZ. 85027

SUBJECT: NOTIFICATION OF FLOOD STUDY RESULTS

PARCEL NO: 205-05-006Z

Dear Mr. Pierce:

The City of Phoenix, under the authority of the National Flood Insurance Act of 1968 (P.F. 90-2448), as amended and the Flood Protection Act of 1973 (P.L. 93-234), has contracted with IT/EMCON to restudy the floodplain delineation of Skunk Creek/Buchanan Wash. The study boundary extends from 2700 ft. downstream of Pinnacle Peak Road to Interstate I-17 following Skunk Creek Wash, and from the confluence of Skunk Creek to Central Arizona Project (CAP) following Buchanan Wash. Additionally, Richmond American Homes has retained a separate consultant to study the effects of the proposed Riordan Ranch Development on Buchanan Wash, during the 100-year storm. Riordan Ranch is a proposed 160.0 gross acre, single-family residential development located south of Pinnacle Vista Drive and west of 35th Avenue. The project site is located in a portion of the south half of Section 34, Township 5 North, Range 2 East of the Gila and Salt River Base and Meridian, in the City of Phoenix, Maricopa County, Arizona.

The purpose of the City of Phoenix study is to determine flood related hazard zones and delineate areas that may be subject to inundation during a 100-year storm. The study and resulting maps will be used for floodplain management purposes and submitted to the Federal Emergency Management Agency (FEMA) for flood insurance information and revision of Flood Insurance Rate Maps. The current FEMA flood hazard zones are based on a floodplain study that was conducted in November 1987. There has not been an update of the floodplain/floodway boundary since that time. Both of the studies mentioned above more accurately model the existing conditions of Buchanan Wash, and include the analysis of a 4-barrel box culvert/wash crossing, located between 37th Avenue and 39th Avenue on Pinnacle Vista Drive. The effect that the existing box culvert has on the base flood elevation and flood hazard zones was not analyzed in the 1987 study and is not shown on the current FEMA flood hazard maps. The results of both the new studies for the City of Phoenix and Richmond American Homes show that the base flood elevation upstream of the culvert, at Pinnacle Vista Drive, is 1.0' higher than the current Flood Insurance Study from 1987. The increase in the water surface elevation diminishes at a distance of approximately 450.0' following the Buchanan Wash. The change in the base flood elevation poses no significant concerns since there is only minimal increase in the floodplain boundaries.

If you have any questions regarding this study please contact Mr. Hasan Mushtaq, Ph. D., P.E., C.F.M., of the City of Phoenix at (602) 262-4960.

Sincerely,

Hasan Mushtaq, Ph. D., P.E., C.F.M.
Floodplain Manager

HM/aff/notification.doc

200 West Washington Street, Fifth Floor • Phoenix, Arizona 85003-1611 • 602-262-6284 • FAX 602-495-2016
Recycled Paper

CERTIFIED MAIL

City of Phoenix

STREET TRANSPORTATION DEPARTMENT

April 1, 2002

Mr. & Mrs. David A. Williams
24420 North 40th Lane
Glendale, AZ. 85310

SUBJECT: NOTIFICATION OF FLOOD STUDY RESULTS

PARCEL NO: 205-05-017

Dear Mr. & Mrs. Williams:

The City of Phoenix, under the authority of the National Flood Insurance Act of 1968 (P.F. 90-2448), as amended and the Flood Protection Act of 1973 (P.L. 93-234), has contracted with IT/EMCON to restudy the floodplain delineation of Skunk Creek/Buchanan Wash. The study boundary extends from 2700 ft. downstream of Pinnacle Peak Road to Interstate I-17 following Skunk Creek Wash, and from the confluence of Skunk Creek to Central Arizona Project (CAP) following Buchanan Wash. Additionally, Richmond American Homes has retained a separate consultant to study the effects of the proposed Riordan Ranch Development on Buchanan Wash, during the 100-year storm. Riordan Ranch is a proposed 160.0 gross acre, single-family residential development located south of Pinnacle Vista Drive and west of 35th Avenue. The project site is located in a portion of the south half of Section 34, Township 5 North, Range 2 East of the Gila and Salt River Base and Meridian, in the City of Phoenix, Maricopa County, Arizona.

The purpose of the City of Phoenix study is to determine flood related hazard zones and delineate areas that may be subject to inundation during a 100-year storm. The study and resulting maps will be used for floodplain management purposes and submitted to the Federal Emergency Management Agency (FEMA) for flood insurance information and revision of Flood Insurance Rate Maps. The current FEMA flood hazard zones are based on a floodplain study that was conducted in November 1987. There has not been an update of the floodplain/floodway boundary since that time. Both of the studies mentioned above more accurately model the existing conditions of Buchanan Wash, and include the analysis of a 4-barrel box culvert/wash crossing, located between 37th Avenue and 39th Avenue on Pinnacle Vista Drive. The effect that the existing box culvert has on the base flood elevation and flood hazard zones was not analyzed in the 1987 study and is not shown on the current FEMA flood hazard maps. The results of both the new studies for the City of Phoenix and Richmond American Homes show that the base flood elevation upstream of the culvert, at Pinnacle Vista Drive, is 1.0' higher than the current Flood Insurance Study from 1987. The increase in the water surface elevation diminishes at a distance of approximately 450.0' following the Buchanan Wash. The change in the base flood elevation poses no significant concerns since there is only minimal increase in the floodplain boundaries.

If you have any questions regarding this study please contact Mr. Hasan Mushtaq, Ph. D., P.E., C.F.M., of the City of Phoenix at (602) 262-4960.

Sincerely,

Hasan Mushtaq, Ph. D., P.E., C.F.M.
Floodplain Manager

HM/aff/notification.doc

200 West Washington Street, Fifth Floor • Phoenix, Arizona 85003-1611 • 602-262-6284 • FAX 602-495-2016
Recycled Paper

CERTIFIED MAIL

City of Phoenix

STREET TRANSPORTATION DEPARTMENT

April 1, 2002

Mr. Carl G. Clovis
Ms. Nicole M. Broadwater
3420 East Laurel Lane
Phoenix, AZ. 85028

SUBJECT: NOTIFICATION OF FLOOD STUDY RESULTS

PARCEL NO: 205-05-021

Dear Mr. Clovis & Ms. Broadwater:

The City of Phoenix, under the authority of the National Flood Insurance Act of 1968 (P.F. 90-2448), as amended and the Flood Protection Act of 1973 (P.L. 93-234), has contracted with IT/EMCON to restudy the floodplain delineation of Skunk Creek/Buchanan Wash. The study boundary extends from 2700 ft. downstream of Pinnacle Peak Road to Interstate I-17 following Skunk Creek Wash, and from the confluence of Skunk Creek to Central Arizona Project (CAP) following Buchanan Wash. Additionally, Richmond American Homes has retained a separate consultant to study the effects of the proposed Riordan Ranch Development on Buchanan Wash, during the 100-year storm. Riordan Ranch is a proposed 160.0 gross acre, single-family residential development located south of Pinnacle Vista Drive and west of 35th Avenue. The project site is located in a portion of the south half of Section 34, Township 5 North, Range 2 East of the Gila and Salt River Base and Meridian, in the City of Phoenix, Maricopa County, Arizona.

The purpose of the City of Phoenix study is to determine flood related hazard zones and delineate areas that may be subject to inundation during a 100-year storm. The study and resulting maps will be used for floodplain management purposes and submitted to the Federal Emergency Management Agency (FEMA) for flood insurance information and revision of Flood Insurance Rate Maps. The current FEMA flood hazard zones are based on a floodplain study that was conducted in November 1987. There has not been an update of the floodplain/floodway boundary since that time. Both of the studies mentioned above more accurately model the existing conditions of Buchanan Wash, and include the analysis of a 4-barrel box culvert/wash crossing, located between 37th Avenue and 39th Avenue on Pinnacle Vista Drive. The effect that the existing box culvert has on the base flood elevation and flood hazard zones was not analyzed in the 1987 study and is not shown on the current FEMA flood hazard maps. The results of both the new studies for the City of Phoenix and Richmond American Homes show that the base flood elevation upstream of the culvert, at Pinnacle Vista Drive, is 1.0' higher than the current Flood Insurance Study from 1987. The increase in the water surface elevation diminishes at a distance of approximately 450.0' following the Buchanan Wash. The change in the base flood elevation poses no significant concerns since there is only minimal increase in the floodplain boundaries.

If you have any questions regarding this study please contact Mr. Hasan Mushtaq, Ph. D., P.E., C.F.M., of the City of Phoenix at (602) 262-4960.

Sincerely,

Hasan Mushtaq, Ph. D., P.E., C.F.M.
Floodplain Manager

HM/aff/notification.doc

200 West Washington Street, Fifth Floor • Phoenix, Arizona 85003-1611 • 602-262-6284 • FAX 602-495-2016
Recycled Paper

FFIDAVIT OF PUBLICATION

MCC214-SC FLOODPLAIN SKUNK CREEK/BUCHANAN WASH

2 Reference/PO # 6300004400

Arizona Business Gazette

The business resource

PO BOX 194
Phoenix, Arizona 85001-0194
(602) 444-7300 FAX (602) 444-7364

Notice

The City of Phoenix, under the authority of the National Flood Insurance Act of 1968 (P.L. 90-448), as amended and the Flood Protection Act of 1973 (P.L. 93-234), has contracted with IT/EMCON (Contract # PW16610002) to restudy the floodplain delineation of Skunk Creek/Buchanan Wash. The study boundary extends from 2700 ft. downstream of Pinnacle Peak Road to Interstate I-17 following Skunk Creek, and from the confluence of Buchanan Wash and Skunk Creek to Central Arizona Project (CAP) following Buchanan Wash. The current FEMA flood hazard zones within the project area are based on a floodplain study that was conducted in November 1987. The purpose of this study is to determine flood related hazard zones and delineate areas that may be subject to inundation during the 100-year storm event. The study and resulting mapping will be used for floodplain management purposes and submitted to the Federal Emergency Management Agency (FEMA) for flood insurance information and revision of Flood Insurance Rate Maps.

This announcement is intended to inform all interested persons that they have an opportunity to bring any relevant technical information to the attention of the City of Phoenix staff. Your comments should be addressed to Mr. Hasan Mushtaq, Ph.D., P.E., C.F.M., Floodplain Manager, City of Phoenix, 200 West Washington Street, 5th Floor, Phoenix, Arizona 85003-1611, Phone Number 602-262-4960, Fax 602-262-7322.

Published: February 7, 2002

STATE OF ARIZONA
COUNTY OF MARICOPA } SS.

Tom Bianco, being first duly sworn, upon oath deposes and says: That he is the legal advertising manager 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.

02/07/2002

Sworn to before me this
7TH day of
FEBRUARY A.D. 2002

OFFICIAL SEAL
GLORIA SALDIVAR
NOTARY PUBLIC-ARIZONA
MARICOPA COUNTY
My Comm. Expires Dec. 1, 2003

Notary Public

SKUNK CREEK LANDFILL PLAN MODIFICATION AND UPDATE
CONTRACT NO. SA-930222

CHANGE ORDER REQUEST

I. INTRODUCTION

The City of Phoenix has requested that Tetra Tech/Simons, Li & Associates, Inc. (TT/SLA) prepare the following scopes of work and cost proposals for additional work under the above contract. The additional work includes: 1) adding two reaches of the Skunk Creek channel to the Letter of Map Revision (LOMR) request being prepared under the current scope; and 2) preparing a separate LOMR request for Buchanan Wash.

The additional reaches of Skunk Creek include approximately 2700 feet of channel from the confluence with Buchanan Wash, upstream to Interstate Highway 17, and approximately 2700 feet channel from Pinnacle Peak Road, downstream to the Adobe Dam reservoir. These reaches include the existing Corps of Engineers' levee system and additional channelization of Skunk Creek, respectively.

The separate LOMR for Buchanan Wash extends from its confluence with Skunk Creek, approximately 9800 feet (1.85 mi.) upstream to the Central Arizona Project (CAP) Canal, and includes the existing Skunk Creek Landfill levee and the Kaufman & Broad, Hillcrest Subdivision, which is about to be constructed.

It is understood that the existing FIS hydrology for Skunk Creek and Buchanan Wash will be used to prepare the LOMR requests. It is also understood that the topographic mapping, survey control, field survey information, and the levee stability analyses, required to prepare the floodplain/floodway delineations and the LOMR requests, will be provided to TT/SLA. As a minimum, the topographic mapping prepared for this additional work should extend 200 feet beyond the lateral limits of FEMA's currently effective floodplain boundaries.

Since the LOMR requests will be prepared as two independent documents, the tasks required to accomplish the work and the fee proposals are presented separately below.

II. SKUNK CREEK LOMR EXTENSION

Description of Services

Task 1: Coordination

This task includes attending meetings, conducting telephone conferences, and preparing correspondence on behalf of the City to the Flood Control District of Maricopa County, the Federal Emergency Management Agency (FEMA), and their Technical Evaluation Consultant (Michael Baker, Jr., Inc.), as required, to gain approval of the Letter of Map Revision (LOMR) request. This task also includes responding to general review comments from the City and FEMA, or their consultant, regarding the LOMR analyses, mapping, and documentation.

Task 2: Data Collection and Review

This task includes the collection and detailed review of data required to prepare the LOMR request. This data will include the as-built plans for the levee designed and constructed by the US Army

Corps of Engineers, upstream of the landfill levees; the Corps levee design report, the sediment transport/scour analyses, and any interior drainage analysis; and the Corps levee stability analyses or certification of stability. Available compaction certificates from the Corps levee construction will also be sought. As-built plans will also be collected, along with the design report information, for the existing channelization downstream of Pinnacle Peak Road. This task also includes a site visit to verify existing conditions and document field conditions with photographs for model development and LOMR support.

Task 3: Extend Existing Conditions Model

Using the topographic mapping provided, the existing conditions HEC-2 model for the landfill reach will be extended, upstream of the Buchanan Wash confluence to Interstate Highway 17, and downstream of the Pinnacle Peak Road to the Adobe Dam reservoir. This model will define the hydraulic impacts of the Corps' levee system and the channelization downstream of Pinnacle Peak Road. The water-surface elevations resulting from this model will be compared to the effective 100-year flood profile to quantify the impact of the Corps' levee system and the channelization downstream of Pinnacle Peak Road on the effective floodplain/floodway upstream, downstream, and within the extension limits. This model will also be used to demonstrate to FEMA that the required amount of freeboard is provided by the existing Corps levee system.

Task 4: Prepare Split-flow Model

Due to the channelization and construction of the Pinnacle Peak Road Bridge over Skunk Creek, a split-flow condition occurs east of the bridge during the 100-year event. The split-flow overtops Pinnacle Peak Road and re-enters the channel at some point downstream. A separate HEC-2 model will be developed, using both available mapping and the new mapping provided, to define the path, water-surface profile, floodplain limit of the split flow.

Task 5: Extend Revised Floodplain/Floodway Mapping

Using the topographic mapping provided, the revised floodplain/floodway mapping and 100-year flood profile will be extended to include the existing Corps levee system and the channelization downstream of Pinnacle Peak Road. The mapping and profile will identify the resulting 100-year water-surface elevations upstream, downstream, and within the extended project areas, as required by FEMA.

Task 6: Revise LOMR Request Documentation

The LOMR request document being prepared for Skunk Creek, in accordance with Arizona Department of Water Resources State Standards Attachment 1-97, will be revised to include the Corps levee system upstream and the channelization downstream of the current project limits. The text, drawings, exhibits, tables, and documentation in the Technical Data Notebook (TDN) will be modified to summarize the hydraulic impacts of the existing levee system and channelization. The FEMA forms will be modified accordingly. One (1) draft copy of the TDN, including modifications, the appropriate input/output computer files, and the revised floodplain/floodway mapping, will be submitted to the City of Phoenix for review and approval. Three (3) copies of the final TDN will be submitted to the City. The City of Phoenix will submit the final TDN to FEMA, as required, and be responsible for all fees required by the reviewing agencies.

III. BUCHANAN WASH LOMR

Description of Services

Task 1: Coordination

This task includes attending meetings, conducting telephone conferences, and preparing correspondence on behalf of the City to the Flood Control District of Maricopa County, the Federal Emergency Management Agency (FEMA), and their Technical Evaluation Consultant (Michael Baker, Jr., Inc.), as required, to gain approval of the Letter of Map Revision (LOMR) request. This task also includes responding to general review comments from the City and FEMA, or their consultant, regarding the LOMR analyses, mapping, and documentation.

It is not uncommon for FEMA or their consultant to request additional support or specific changes during the LOMR application review process. Because it is difficult to estimate the time and effort that may be required to address such requests, a $2500 allowance is proposed to cover this potential item of work.

Task 2: Data Collection and Review

This task includes the collection and detailed review of data required to prepare the LOMR request. This data will include, but not be limited to, the following information: the effective Flood Insurance Study (FIS) floodplain/floodway work maps (both hard copy and digital); the effective water-surface profile computer model input and output files (both digital and hard copy); the effective Flood Insurance Rate Maps (FIRM maps); and the effective Floodway Maps. In addition, the as-built grading plans for the Kaufman & Broad, Hillcrest Subdivision and the as-built Skunk Creek levee plans and the levee design report containing the sediment transport/scour analyses and any interior drainage analysis will be required as LOMR request support. Available compaction certificates from the levee construction will also be sought. This task also includes a site visit to verify existing conditions and document field conditions with photographs for model development and LOMR support.

text should include results of this report in Section 6 refers to App. F, which doesn't analyze sedimentation

Task 3: Duplicate Effective Model

This task demonstrates to FEMA that the appropriate computer program and version is being used to quantify the impacts of the Skunk Creek levee/channelization system and the Kaufman & Broad development on the effective floodplain and floodway. The effective water-surface profile model will be provided by the Flood Control District of Maricopa County. This model will be used to duplicate the 100-year water-surface elevations of FEMA's effective Flood Insurance Study. The input and output data from this model will be reviewed and compared to the published Flood Insurance Study data. Any identified inconsistencies will be documented.

Task 4: Prepare Existing Conditions Model

Using the topographic mapping provided, an existing conditions model will be developed for Buchanan Wash from the Skunk Creek confluence to the CAP Canal. This model will define the hydraulics of the Skunk Creek levee system and the encroachments made within the Kaufman & Broad, Hillcrest Subdivision. The water-surface elevations resulting from this model will be compared to the effective 100-year flood profile to quantify the impact of the levee and subdivision construction on the effective floodplain/floodway upstream, downstream, and within the project

areas. This model will also be used to demonstrate to FEMA that the required amount of freeboard is provided by the existing levee system.

Task 5: Prepare Floodplain/Floodway Mapping

Using the topographic mapping provided, the floodplain/floodway boundaries and the 100-year flood profile will be revised from the confluence with Skunk Creek to the CAP Canal - a distance of approximately 1.85 miles. The revised mapping will reflect the updated topography, the existing Skunk Creek levee system, and the encroachments made within the Kaufman & Broad, Hillcrest Subdivision. The revised floodplain/floodway mapping and profile will identify the resulting 100-year water-surface elevations upstream, downstream, and within the project areas, as required by FEMA.

Task 6: Prepare LOMR Request Documentation

A LOMR request document will be prepared in accordance with Arizona Department of Water Resources State Standards Attachment 1-97. The document will include a Technical Data Notebook (TDN) which contains the text, drawings, exhibits, and tables required by FEMA to summarize the hydraulic impacts of the existing Skunk Creek levee system and the Kaufman & Broad, Hillcrest Subdivision. The appropriate FEMA forms will be completed. These will include: "Revision Requestor and Community Official Form" (Form 1); "Certification by Registered Professional Engineer Form" (Form 2); "Riverine and Hydraulic Analysis Form" (Form 4); "Riverine/Coastal Mapping Form" (Form 5); "Channelization Form" (Form 6); and "Levee/Floodwall System Analyses Form" (Form 8). One (1) draft copy of the TDN, including the appropriate input/output computer files and the revised floodplain/floodway mapping, will be submitted to the City of Phoenix for review and approval. Three (3) copies of the final TDN will be submitted to the City. The City of Phoenix will submit the final TDN to FEMA, as required, and be responsible for all fees required by the reviewing agencies.

APPENDIX C: SURVEY FIELD NOTES

C.1 Survey Field Notes for Aerial Mapping Control

MORRISON MAIERLE, INC.
an Arizona Corporation

Phone - 602-244-9662 Fax - 602-244-9472 E-Mail - jspring@m-m.net

MEMO

DATE: 10/16/01 Fax # --

TO: Bart B.

FROM: Jim Spring

SUBJECT: Survey Records

Bart:
Please find attached the survey notes for the work preformed on the Buchanan Wash Survey. All work was preformed by gps/rtk, control was tied to work that we have done on the Skunk Creek landfill project. Ties were made to monuments that you had requested put the data is related to Skunk Creek and not to any control established by the flood control.
If we can be of any more assistance or if you need further data please let me know.

Jim Spring, PLS
Vice President Survey Operations

```
4,990864.3251000000,437624.8002000000,1460.0733000000,BC N.END
5,990262.5448000000,434909.2826000000,1457.1700000000,N.W.BC ON SLOPE
7,985602.7321000000,437466.6993000000,1431.0800000000,REBAR
12,987133.9124000000,437558.8682000000,1434.8000000000,S.E.REBAR
13,987478.8550000000,436582.9716000000,0.0000000000,S.W.REBAR
14,982979.9902000000,437706.0183000000,1417.0209000000,#403 SE CELL#4
15,985457.1706994390,438002.9708334709,1428.4494359907,BASE PT
16,986915.8156000000,433818.2120000000,1422.5494000000,BCHH@35THAVE&HV
17,986857.9674000000,434500.0558000000,1426.8409000000,USGS@HV RD
18,990163.1327000000,436760.3466000000,1452.2653000000,BC MID N.CELL 6
19,990499.6897099989,436364.3694815729,1460.8371546525,CP N.E.#5 ON BNK
20,988630.7600000000,437560.9200000000,0.0000000000,N.E. APROX LINER
21,988583.7600000000,436482.4200000000,0.0000000000,N.W. APROX LINER
22,988601.0200000000,436495.2100000000,0.0000000000,N.W. APROX LINER
23,988651.7000000000,437557.0500000000,0.0000000000,N.E. APROX LINER
24,996409.2041465666,429975.3332079704,1499.7617168128,BLM CAP #42 ROW
30,976347.2064070209,436522.9700255044,1376.2725129279,BCHH 31&DV
31,981636.3115299502,433844.6579526350,1392.1168580913,BCHH 35&PINPEAK
32,981614.7778394422,431194.0284818947,1388.7018832242,BC 36&PINPEAK
33,986867.3903274266,437824.4391353563,1435.2132477433,BC ROW 29&HV
34,987399.6188735596,436071.9177839420,1438.9104500260,PK W.LEVY/800'N.
35,991520.4226028543,434056.2051023529,1555.0819500878,PT#712
36,992865.4896211622,434055.9565264719,1465.0811127515,MMI FP#1002
37,996877.0874482011,431783.4333485648,1500.1050831627,BM#526
38,996684.4176526918,430995.5518695822,1500.6017589574,BM#517
39,996480.9897867171,430163.6518100083,1502.2136819887,BM#525
50,994122.3531577294,431727.5149628359,1476.9371729762,HDWL
51,994130.7656582394,431720.4587956474,1478.8753415822,HDWL
52,994131.3302660194,431720.1343867290,1479.3833010847,HDWL
53,994131.0782576848,431681.7561385766,1479.5676189683,HDWL
54,994130.2609195462,431681.8842490159,1479.0511161545,HDWL
55,994120.8206234940,431681.8263385055,1476.9014044101,HDWL
56,994130.2277613092,431690.7351028275,1475.2361007787,INV
57,994130.5001952450,431711.3175907056,1475.2788948031,INV
58,994166.4744629667,431710.4083719203,1476.8900121097,HDWL
59,994157.8074789674,431710.1489181371,1479.0749301629,HDWL
60,994157.1870017096,431710.3276322110,1479.4639916005,HDWL
61,994156.6174905272,431672.2259167816,1479.7322520745,HDWL
62,994156.8675032079,431672.0029103772,1479.2315513939,HDWL
63,994164.4067177139,431665.3893291301,1477.5317971194,HDWL
64,994157.5947138201,431681.5647845685,1475.4776406147,INV
65,994157.9596222944,431701.0240049831,1475.4378438513,INV
66,994170.2032863667,431679.1270788335,1475.5127604577,FD REBAR
70,981781.4251190259,433543.4146261117,1389.7947333876,EG
71,981782.9524178613,433533.2898800715,1389.4743982288,TOP
72,981786.8518265772,433501.5317386231,1373.6353889376,TOE
73,981788.0097521718,433495.7324816468,1373.1600117438,EG
74,981789.1499204668,433490.7237045986,1374.9249884390,EG
75,981792.2033182567,433454.5715832250,1373.6802874001,EG
76,981815.2872117502,433387.2810463931,1374.2366959965,EG
77,981830.1373485001,433329.4588930656,1374.0665684406,EG
78,981838.8525792701,433284.3361987561,1374.6568014285,EG
79,981842.6285043196,433257.2517778406,1374.5526202728,TOE1
80,981847.8186438733,433227.6924331898,1389.3814501905,TOP1
81,981849.3481271877,433216.2562531683,1389.5683065729,EG
82,981852.5981290598,433200.0044467134,1391.8754203682,EG
83,990701.1487491447,435452.5333553744,1462.7446950566,TOP
```

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
22282
JAMES G.
SPRING
Date Signed 10/16/2009
ARIZONA U.S.A.

Text 1 of 2

```
84,990707.6267272769,435455.7510622522,1460.7022765020,GB
85,990742.0577325883,435476.8530608821,1460.5559235986,TOP1
86,990809.5898758936,435526.0588247624,1442.2539633848,TOE
87,990823.4227295979,435533.4894901547,1443.4584863147,GB1
88,990840.3301544500,435542.6025248082,1444.2636561972,GB2
89,990860.8349438176,435561.6466326427,1449.3157299889,GB3
90,990878.0559770942,435566.9467696527,1450.1075584925,FN
91,990875.8293406606,435566.4457098825,1449.6271539741,GB4
92,990885.0823077960,435572.6487992101,1450.2448974279,EG
93,990902.7132003189,435584.0426351845,1450.4715393718,EG
94,990923.1013118410,435598.0946896657,1451.2698080995,EG
95,990967.1259150160,435619.6078724991,1452.6711859617,EG
96,991003.4596379604,435641.9604308729,1453.9336894556,EG
97,991050.1937960568,435675.4253870886,1455.0945331754,EG
98,991094.4737890516,435695.7726421283,1456.4737466682,EG
99,992348.9579570772,437289.0105017098,1472.8878887743,TOP
100,992346.0504401168,437289.7982756807,1472.7644252249,ER
101,992337.2734244025,437295.6225731479,1472.5245540934,ER1
102,992334.4094257299,437297.4654125537,1472.5878721414,TOP1
103,992307.5448287821,437320.9247718651,1454.4131543150,TOE
104,992273.3302677437,437348.2307727767,1454.3821077800,EG
105,992251.7537002643,437364.7939703190,1454.5450975658,EG
106,992231.4107236988,437382.2122619058,1454.2431582075,EG
107,992212.1645619858,437398.7670491209,1454.6777351541,EG
108,992191.1530713728,437416.6563605859,1454.7502369640,EG
109,992170.6150705355,437433.6694964265,1453.9374402689,EG
110,992150.1208401815,437450.7495371650,1452.9529321656,EG
111,992128.5536168267,437467.4177912985,1453.8737954046,EG
112,992107.6702332180,437484.8022709491,1454.1931675443,EG
113,992095.9152718204,437494.6915284253,1454.1536983920,TOE1
114,992069.7789108009,437516.1391487535,1471.6017641993,TOP2
115,992066.3189154358,437518.8232347696,1471.6918070260,ER2
116,992058.1603330725,437525.5324529950,1472.1657556000,ER3
117,992053.5029758924,437528.7584131357,1472.1531091882,TOP4
118,992031.0095865517,437545.8404405314,1462.3182705697,TOE3
119,992008.7845942036,437561.5453143998,1461.4580126202,EG
```

Test 2 of 2

112.071666467,HT1325.6460
--20:45:31.84,Set Base receiver position, Base Pt: 15
BP,PN15,LA33.423260101,LN-112.071666467,HT1325.6460
--20:45:38.87,Solve for local Horizontal transformation, RMS N: 0.1779,
RMS E: 0.0518
HC,PN5,LA33.432007288,LN-112.075340762,HT1354.4350,--H,V
HC,PN7,LA33.423402660,LN-112.072301546,HT1328.3190,--H,V
HC,PN12,LA33.424918164,LN-112.072196390,HT1331.9610,--H,V
HC,PN13,LA33.425257416,LN-112.073352500,HT1335.2570,--H
HC,PN16,LA33.424694226,LN-112.080623806,HT1320.0675,--H,V
HC,PN17,LA33.424638482,LN-112.075816517,HT1324.2983,--H,V
HC,PN4,LA33.432608488,LN-112.072127492,HT1357.0590,--H
HC,PN24,LA33.442077146,LN-112.085199078,HT1397.2019,--H,V
--20:45:42.06,Solve for local Vertical transformation, RMS ELV: 0.0006
VC,PN5,LA33.432007288,LN-112.075340762,HT1354.4350,--H,V
VC,PN7,LA33.423402660,LN-112.072301546,HT1328.3190,--H,V
VC,PN12,LA33.424918164,LN-112.072196390,HT1331.9610,--H,V
VC,PN16,LA33.424694226,LN-112.080623806,HT1320.0675,--H,V
VC,PN17,LA33.424638482,LN-112.075816517,HT1324.2983,--H,V
VC,PN24,LA33.442077146,LN-112.085199078,HT1397.2019,--H,V
LH,PN15,Ha3.280830488,Hb0.006818573,Hc109238.064721569,Hd658055.97919059
4,SC1.000001293,RT0.070868
LV,PN15,Va0.000303868,Vb0.000150464,Vc57.370267624,Ba33.423260101,Bo-
112.071666467,Bh1325.6460
--Set BASE : record intrvl: OFF, elev cutoff: 8 deg, antenna ht: 6.680
--00:50:57.26,Set Base receiver position, Base Pt: 15
BP,PN15,LA33.423260101,LN-112.071666467,HT1325.6460
--Set BASE : record intrvl: OFF, elev cutoff: 8 deg, antenna ht: 6.680
--00:55:00.36,Set Base receiver position, Base Pt: 15
BP,PN15,LA33.423260101,LN-112.071666467,HT1325.6460
--Set ROVER: record intrvl: OFF, elev cutoff: 8 deg, antenna ht: 6.980
--Send Base position to Rover:LA33.423260101,LN-
112.071666467,HT1325.6460
--00:55:29.25,Set Base receiver position, Base Pt: 15
BP,PN15,LA33.423260101,LN-112.071666467,HT1325.6460
--00:55:36.17,Solve for local Horizontal transformation, RMS N: 0.1779,
RMS E: 0.0518
HC,PN5,LA33.432007288,LN-112.075340762,HT1354.4350,--H,V
HC,PN7,LA33.423402660,LN-112.072301546,HT1328.3190,--H,V
HC,PN12,LA33.424918164,LN-112.072196390,HT1331.9610,--H,V
HC,PN13,LA33.425257416,LN-112.073352500,HT1335.2570,--H
HC,PN16,LA33.424694226,LN-112.080623806,HT1320.0675,--H,V
HC,PN17,LA33.424638482,LN-112.075816517,HT1324.2983,--H,V
HC,PN4,LA33.432608488,LN-112.072127492,HT1357.0590,--H
HC,PN24,LA33.442077146,LN-112.085199078,HT1397.2019,--H,V
--00:55:39.36,Solve for local Vertical transformation, RMS ELV: 0.0006
VC,PN5,LA33.432007288,LN-112.075340762,HT1354.4350,--H,V
VC,PN7,LA33.423402660,LN-112.072301546,HT1328.3190,--H,V
VC,PN12,LA33.424918164,LN-112.072196390,HT1331.9610,--H,V
VC,PN16,LA33.424694226,LN-112.080623806,HT1320.0675,--H,V
VC,PN17,LA33.424638482,LN-112.075816517,HT1324.2983,--H,V
VC,PN24,LA33.442077146,LN-112.085199078,HT1397.2019,--H,V
LH,PN15,Ha3.280830488,Hb0.006818573,Hc109238.064721569,Hd658055.97919059
4,SC1.000001293,RT0.070868
LV,PN15,Va0.000303868,Vb0.000150464,Vc57.370267624,Ba33.423260101,Bo-
112.071666467,Bh1325.6460
--Set ROVER: record intrvl: OFF, elev cutoff: 8 deg, antenna ht: 5.210

5
10/22/01

This project
3170.002.03

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
22282
JAMES G.
SPRING
Date Signed 12/14/2001
ARIZONA U.S.A.

Raw Data File.

```
--Send Base position to Rover:LA33.423260101,LN-
112.071666467,HT1325.6460
--01:44:41.49,Set Base receiver position, Base Pt: 15
BP,PN15,LA33.423260101,LN-112.071666467,HT1325.6460
--01:44:49.18,Solve for local Horizontal transformation, RMS N: 0.1779,
RMS E: 0.0518
HC,PN5,LA33.432007288,LN-112.075340762,HT1354.4350,--H,V
HC,PN7,LA33.423402660,LN-112.072301546,HT1328.3190,--H,V
HC,PN12,LA33.424918164,LN-112.072196390,HT1331.9610,--H,V
HC,PN13,LA33.425257416,LN-112.073352500,HT1335.2570,--H
HC,PN16,LA33.424694226,LN-112.080623806,HT1320.0675,--H,V
HC,PN17,LA33.424638482,LN-112.075816517,HT1324.2983,--H,V
HC,PN4,LA33.432608488,LN-112.072127492,HT1357.0590,--H
HC,PN24,LA33.442077146,LN-112.085199078,HT1397.2019,--H,V
--01:44:52.37,Solve for local Vertical transformation, RMS ELV: 0.0006
VC,PN5,LA33.432007288,LN-112.075340762,HT1354.4350,--H,V
VC,PN7,LA33.423402660,LN-112.072301546,HT1328.3190,--H,V
VC,PN12,LA33.424918164,LN-112.072196390,HT1331.9610,--H,V
VC,PN16,LA33.424694226,LN-112.080623806,HT1320.0675,--H,V
VC,PN17,LA33.424638482,LN-112.075816517,HT1324.2983,--H,V
VC,PN24,LA33.442077146,LN-112.085199078,HT1397.2019,--H,V
LH,PN15,Ha3.280830488,Hb0.006818573,Hc109238.064721569,Hd658055.97919059
4,SC0.999999292,RT0.070868
LV,PN15,Va0.000303868,Vb0.000150464,Vc57.370267624,Ba33.423260101,Bo-
112.071666467,Bh1325.6460
--Check control point: 18, N err: -0.338, E err: -1.037, Elv err: -0.185
EP,TM19: 1:13.00,LA33.431912681,LN-
112.073150393,HT1349.1775,RH0.0087,RV0.0139,DH1.10,DV1.59
--Check control point: 18, N err: -0.362, E err: -1.041, Elv err: -0.148
EP,TM19: 1:30.00,LA33.431912657,LN-
112.073150399,HT1349.2148,RH0.0211,RV0.0305,DH1.10,DV1.59
--19:54:09.26,Solve for local Horizontal transformation, RMS N: 0.1779,
RMS E: 0.0518
HC,PN5,LA33.432007288,LN-112.075340762,HT1354.4350,--H,V
HC,PN7,LA33.423402660,LN-112.072301546,HT1328.3190,--H,V
HC,PN12,LA33.424918164,LN-112.072196390,HT1331.9610,--H,V
HC,PN13,LA33.425257416,LN-112.073352500,HT1335.2570,--H
HC,PN16,LA33.424694226,LN-112.080623806,HT1320.0675,--H,V
HC,PN17,LA33.424638482,LN-112.075816517,HT1324.2983,--H,V
HC,PN4,LA33.432608488,LN-112.072127492,HT1357.0590,--H
HC,PN24,LA33.442077146,LN-112.085199078,HT1397.2019,--H,V
--19:54:12.39,Solve for local Vertical transformation, RMS ELV: 0.0006
VC,PN5,LA33.432007288,LN-112.075340762,HT1354.4350,--H,V
VC,PN7,LA33.423402660,LN-112.072301546,HT1328.3190,--H,V
VC,PN12,LA33.424918164,LN-112.072196390,HT1331.9610,--H,V
VC,PN16,LA33.424694226,LN-112.080623806,HT1320.0675,--H,V
VC,PN17,LA33.424638482,LN-112.075816517,HT1324.2983,--H,V
VC,PN24,LA33.442077146,LN-112.085199078,HT1397.2019,--H,V
LH,PN15,Ha3.280830488,Hb0.006818573,Hc109238.064721569,Hd658055.97919059
4,SC0.999999292,RT0.070868
LV,PN15,Va0.000303868,Vb0.000150464,Vc57.370267624,Ba33.423260101,Bo-
112.071666467,Bh1325.6460
--Set BASE : record intrvl: OFF, elev cutoff:  8 deg, antenna ht: 6.680
--23:35:03.16,Set Base receiver position, Base Pt: 15
BP,PN15,LA33.423260101,LN-112.071666467,HT1325.6460
--Set ROVER: record intrvl: OFF, elev cutoff:  8 deg, antenna ht: 6.980
--Send Base position to Rover:LA33.423260101,LN-
```

```
112.071666467,HT1325.6460
--23:35:23.65,Set Base receiver position, Base Pt: 15
BP,PN15,LA33.423260101,LN-112.071666467,HT1325.6460
--23:35:34.86,Solve for local Horizontal transformation, RMS N: 0.1779,
RMS E: 0.0518
HC,PN5,LA33.432007288,LN-112.075340762,HT1354.4350,--H,V
HC,PN7,LA33.423402660,LN-112.072301546,HT1328.3190,--H,V
HC,PN12,LA33.424918164,LN-112.072196390,HT1331.9610,--H,V
HC,PN13,LA33.425257416,LN-112.073352500,HT1335.2570,--H
HC,PN16,LA33.424694226,LN-112.080623806,HT1320.0675,--H,V
HC,PN17,LA33.424638482,LN-112.075816517,HT1324.2983,--H,V
HC,PN4,LA33.432608488,LN-112.072127492,HT1357.0590,--H
HC,PN24,LA33.442077146,LN-112.085199078,HT1397.2019,--H,V
--23:35:38.04,Solve for local Vertical transformation, RMS ELV: 0.0006
VC,PN5,LA33.432007288,LN-112.075340762,HT1354.4350,--H,V
VC,PN7,LA33.423402660,LN-112.072301546,HT1328.3190,--H,V
VC,PN12,LA33.424918164,LN-112.072196390,HT1331.9610,--H,V
VC,PN16,LA33.424694226,LN-112.080623806,HT1320.0675,--H,V
VC,PN17,LA33.424638482,LN-112.075816517,HT1324.2983,--H,V
VC,PN24,LA33.442077146,LN-112.085199078,HT1397.2019,--H,V
LH,PN15,Ha3.280830488,Hb0.006818573,Hc109238.064721569,Hd658055.97919059
4,SC1.000001293,RT0.070868
LV,PN15,Va0.000303868,Vb0.000150464,Vc57.370267624,Ba33.423260101,Bo-
112.071666467,Bh1325.6460
EP,TM16:57:30.00,LA33.410244717,LN-
112.073395442,HT1274.0223,RH0.0198,RV0.0280,DH1.04,DV1.47
GS,PN30,N 976347.20641,E 436522.97003,EL1376.273,--BCHH 31&DV
EP,TM17:16:20.00,LA33.415471387,LN-
112.080578691,HT1289.8735,RH0.0201,RV0.0237,DH1.00,DV1.17
GS,PN31,N 981636.31153,E 433844.65795,EL1392.117,--BCHH 35&PINPEAK
EP,TM17:19:2.00,LA33.415444179,LN-
112.083715816,HT1286.7052,RH0.0144,RV0.0172,DH1.14,DV1.31
GS,PN32,N 981614.77784,E 431194.02848,EL1388.702,--BC 36&PINPEAK
EP,TM18: 5:18.00,LA33.435818826,LN-
112.083118123,HT1374.3198,RH0.0287,RV0.0494,DH1.44,DV2.48
GS,PN50,N 994122.35316,E 431727.51496,EL1476.937,--HDWL
EP,TM18: 5:51.00,LA33.435827132,LN-
112.083126500,HT1376.2583,RH0.0220,RV0.0391,DH1.44,DV2.48
GS,PN51,N 994130.76566,E 431720.45880,EL1478.875,--HDWL
EP,TM18: 6:8.00,LA33.435827690,LN-
112.083126886,HT1376.7662,RH0.0252,RV0.0436,DH1.43,DV2.48
GS,PN52,N 994131.33027,E 431720.13439,EL1479.383,--HDWL
EP,TM18: 6:37.00,LA33.435827354,LN-
112.083172326,HT1376.9541,RH0.0239,RV0.0414,DH1.43,DV2.48
GS,PN53,N 994131.07826,E 431681.75614,EL1479.568,--HDWL
EP,TM18: 6:56.00,LA33.435826546,LN-
112.083172172,HT1376.4376,RH0.0267,RV0.0463,DH1.43,DV2.48
GS,PN54,N 994130.26092,E 431681.88425,EL1479.051,--HDWL
EP,TM18: 7:16.00,LA33.435817207,LN-
112.083172215,HT1374.2884,RH0.0267,RV0.0463,DH1.43,DV2.48
GS,PN55,N 994120.82062,E 431681.82634,EL1476.901,--HDWL
EP,TM18: 8:3.00,LA33.435826533,LN-
112.083161693,HT1372.6218,RH0.0285,RV0.0495,DH1.43,DV2.48
GS,PN56,N 994130.22776,E 431690.73510,EL1475.236,--INV
EP,TM18: 8:24.00,LA33.435826849,LN-
112.083137323,HT1372.6627,RH0.0307,RV0.0535,DH1.42,DV2.48
GS,PN57,N 994130.50020,E 431711.31759,EL1475.279,--INV
```

```
EP,TM18:20:35.00,LA33.435862435,LN-
112.083138497,HT1374.2722,RH0.0262,RV0.0427,DH1.13,DV1.79
GS,PN58,N 994166.47446,E 431710.40837,EL1476.890,--HDWL
EP,TM18:21:59.00,LA33.435853860,LN-
112.083138780,HT1376.4576,RH0.0243,RV0.0391,DH1.13,DV1.81
GS,PN59,N 994157.80748,E 431710.14892,EL1479.075,--HDWL
EP,TM18:22:17.00,LA33.435853247,LN-
112.083138567,HT1376.8467,RH0.0243,RV0.0392,DH1.13,DV1.82
GS,PN60,N 994157.18700,E 431710.32763,EL1479.464,--HDWL
EP,TM18:22:51.00,LA33.435852598,LN-
112.083183679,HT1377.1185,RH0.0226,RV0.0365,DH1.13,DV1.83
GS,PN61,N 994156.61749,E 431672.22592,EL1479.732,--HDWL
EP,TM18:23:6.00,LA33.435852845,LN-
112.083183944,HT1376.6178,RH0.0292,RV0.0446,DH1.10,DV1.62
GS,PN62,N 994156.86750,E 431672.00291,EL1479.232,--HDWL
EP,TM18:23:51.00,LA33.435860288,LN-
112.083191795,HT1374.9183,RH0.0219,RV0.0327,DH1.10,DV1.64
GS,PN63,N 994164.40672,E 431665.38933,EL1477.532,--HDWL
EP,TM18:27:17.00,LA33.435853586,LN-
112.083172624,HT1372.8630,RH0.0176,RV0.0271,DH1.10,DV1.70
GS,PN64,N 994157.59471,E 431681.56478,EL1475.478,--INV
EP,TM18:27:48.00,LA33.435853990,LN-
112.083149585,HT1372.8213,RH0.0249,RV0.0357,DH1.25,DV1.79
GS,PN65,N 994157.95962,E 431701.02400,EL1475.438,--INV
EP,TM18:28:29.00,LA33.435866053,LN-
112.083175545,HT1372.8977,RH0.0157,RV0.0238,DH1.10,DV1.72
GS,PN66,N 994170.20329,E 431679.12708,EL1475.513,--FD REBAR
EP,TM19:59:26.00,LA33.415655634,LN-
112.080925401,HT1288.1588,RH0.0166,RV0.0283,DH0.92,DV1.56
GS,PN70,N 981823.20347,E 433552.13448,EL1390.384,--EG
--Set ROVER: record intrvl: OFF, elev cutoff:  8 deg, antenna ht: 6.980
--Send Base position to Rover:LA33.423260101,LN-
112.071666467,HT1325.6460
--02:47:45.09,Set Base receiver position, Base Pt: 15
BP,PN15,LA33.423260101,LN-112.071666467,HT1325.6460
--02:47:52.18,Solve for local Horizontal transformation, RMS N: 0.1779,
RMS E: 0.0518
HC,PN5,LA33.432007288,LN-112.075340762,HT1354.4350,--H,V
HC,PN7,LA33.423402660,LN-112.072301546,HT1328.3190,--H,V
HC,PN12,LA33.424918164,LN-112.072196390,HT1331.9610,--H,V
HC,PN13,LA33.425257416,LN-112.073352500,HT1335.2570,--H
HC,PN16,LA33.424694226,LN-112.080623806,HT1320.0675,--H,V
HC,PN17,LA33.424638482,LN-112.075816517,HT1324.2983,--H,V
HC,PN4,LA33.432608488,LN-112.072127492,HT1357.0590,--H
HC,PN24,LA33.442077146,LN-112.085199078,HT1397.2019,--H,V
--02:47:55.36,Solve for local Vertical transformation, RMS ELV: 0.0006
VC,PN5,LA33.432007288,LN-112.075340762,HT1354.4350,--H,V
VC,PN7,LA33.423402660,LN-112.072301546,HT1328.3190,--H,V
VC,PN12,LA33.424918164,LN-112.072196390,HT1331.9610,--H,V
VC,PN16,LA33.424694226,LN-112.080623806,HT1320.0675,--H,V
VC,PN17,LA33.424638482,LN-112.075816517,HT1324.2983,--H,V
VC,PN24,LA33.442077146,LN-112.085199078,HT1397.2019,--H,V
LH,PN15,Ha3.280830488,Hb0.006818573,Hc109238.064721569,Hd658055.97919059
4,SC1.000001293,RT0.070868
LV,PN15,Va0.000303868,Vb0.000150464,Vc57.370267624,Ba33.423260101,Bo-
112.071666467,Bh1325.6460
EP,TM20: 1:20.00,LA33.415614285,LN-
```

```
112.080935612,HT1287.5726,RH0.0167,RV0.0279,DH0.92,DV1.54
GS,PN70,N 981781.42512,E 433543.41463,EL1389.795,--EG
EP,TM20: 2:6.00,LA33.415615773,LN-
112.080947599,HT1287.2532,RH0.0157,RV0.0258,DH0.92,DV1.53
GS,PN71,N 981782.95242,E 433533.28988,EL1389.474,--TOP
EP,TM20: 4:28.00,LA33.415619561,LN-
112.080985197,HT1271.4169,RH0.0183,RV0.0299,DH0.92,DV1.50
GS,PN72,N 981786.85183,E 433501.53174,EL1373.635,--TOE
EP,TM20: 4:52.00,LA33.415620694,LN-
112.080992064,HT1270.9420,RH0.0167,RV0.0272,DH0.92,DV1.49
GS,PN73,N 981788.00975,E 433495.73248,EL1373.160,--EG
EP,TM20: 5:7.00,LA33.415621811,LN-
112.080997996,HT1272.7074,RH0.0204,RV0.0333,DH0.92,DV1.49
GS,PN74,N 981789.14992,E 433490.72370,EL1374.925,--EG
EP,TM20: 5:29.00,LA33.415624752,LN-
112.081040792,HT1271.4659,RH0.0205,RV0.0332,DH0.92,DV1.49
GS,PN75,N 981792.20332,E 433454.57158,EL1373.680,--EG
EP,TM20: 5:57.00,LA33.415647441,LN-
112.081120496,HT1272.0275,RH0.0183,RV0.0296,DH0.92,DV1.48
GS,PN76,N 981815.28721,E 433387.28105,EL1374.237,--EG
EP,TM20: 6:22.00,LA33.415662004,LN-
112.081188971,HT1271.8621,RH0.0184,RV0.0296,DH0.92,DV1.48
GS,PN77,N 981830.13735,E 433329.45889,EL1374.067,--EG
EP,TM20: 6:41.00,LA33.415670527,LN-
112.081242400,HT1272.4561,RH0.0205,RV0.0330,DH0.92,DV1.47
GS,PN78,N 981838.85258,E 433284.33620,EL1374.657,--EG
EP,TM20: 7:2.00,LA33.415674202,LN-
112.081274466,HT1272.3543,RH0.0168,RV0.0269,DH0.92,DV1.47
GS,PN79,N 981842.62850,E 433257.25178,EL1374.553,--TOE1
EP,TM20: 7:33.00,LA33.415679272,LN-
112.081309466,HT1287.1856,RH0.0156,RV0.0248,DH0.92,DV1.46
GS,PN80,N 981847.81864,E 433227.69243,EL1389.381,--TOP1
EP,TM20: 8:12.00,LA33.415680760,LN-
112.081323005,HT1287.3734,RH0.0124,RV0.0197,DH0.92,DV1.45
GS,PN81,N 981849.34813,E 433216.25625,EL1389.568,--EG
EP,TM20: 8:26.00,LA33.415683939,LN-
112.081342249,HT1289.6819,RH0.0184,RV0.0291,DH0.92,DV1.45
GS,PN82,N 981852.59813,E 433200.00445,EL1391.875,--EG
--Set BASE : record intrvl: OFF, elev cutoff:  8 deg, antenna ht: 6.680
--Set BASE : record intrvl: OFF, elev cutoff:  8 deg, antenna ht: 6.680
--Set BASE : record intrvl: OFF, elev cutoff:  8 deg, antenna ht: 6.680
--21:04:25.67,Set Base receiver position, Base Pt: 15
BP,PN15,LA33.423260101,LN-112.071666467,HT1325.6460
--Set ROVER: record intrvl: OFF, elev cutoff:  8 deg, antenna ht: 6.980
--Set ROVER: record intrvl: OFF, elev cutoff:  8 deg, antenna ht: 6.980
--Set ROVER: record intrvl: OFF, elev cutoff:  8 deg, antenna ht: 6.980
--Send Base position to Rover:LA33.423260101,LN-
112.071666467,HT1325.6460
--21:05:55.14,Set Base receiver position, Base Pt: 15
BP,PN15,LA33.423260101,LN-112.071666467,HT1325.6460
--21:06:02.17,Solve for local Horizontal transformation, RMS N: 0.1779,
RMS E: 0.0518
HC,PN5,LA33.432007288,LN-112.075340762,HT1354.4350,--H,V
HC,PN7,LA33.423402660,LN-112.072301546,HT1328.3190,--H,V
HC,PN12,LA33.424918164,LN-112.072196390,HT1331.9610,--H,V
HC,PN13,LA33.425257416,LN-112.073352500,HT1335.2570,--H
HC,PN16,LA33.424694226,LN-112.080623806,HT1320.0675,--H,V
```

```
HC,PN17,LA33.424638482,LN-112.075816517,HT1324.2983,--H,V
HC,PN4,LA33.432608488,LN-112.072127492,HT1357.0590,--H
HC,PN24,LA33.442077146,LN-112.085199078,HT1397.2019,--H,V
--21:06:05.47,Solve for local Vertical transformation, RMS ELV: 0.0006
VC,PN5,LA33.432007288,LN-112.075340762,HT1354.4350,--H,V
VC,PN7,LA33.423402660,LN-112.072301546,HT1328.3190,--H,V
VC,PN12,LA33.424918164,LN-112.072196390,HT1331.9610,--H,V
VC,PN16,LA33.424694226,LN-112.080623806,HT1320.0675,--H,V
VC,PN17,LA33.424638482,LN-112.075816517,HT1324.2983,--H,V
VC,PN24,LA33.442077146,LN-112.085199078,HT1397.2019,--H,V
LH,PN15,Ha3.280830488,Hb0.006818573,Hc109238.064721569,Hd658055.97919059
4,SC1.000001293,RT0.070868
LV,PN15,Va0.000303868,Vb0.000150464,Vc57.370267624,Ba33.423260101,Bo-
112.071666467,Bh1325.6460
EP,TM14:26:17.00,LA33.424654831,LN-
112.071881275,HT1332.3620,RH0.0116,RV0.0223,DH1.28,DV2.47
GS,PN33,N 986867.39033,E 437824.43914,EL1435.213,--BC ROW 29&HV
EP,TM14:48:40.00,LA33.425177691,LN-
112.073957185,HT1336.1973,RH0.0131,RV0.0236,DH1.28,DV2.31
GS,PN34,N 987399.61887,E 436071.91778,EL1438.910,--PK W.LEVY/800'N.
EP,TM15:21:44.00,LA33.433249969,LN-
112.080354093,HT1452.3675,RH0.0113,RV0.0145,DH0.99,DV1.27
GS,PN35,N 991520.42260,E 434056.20510,EL1555.082,--PT#712
EP,TM15:33:34.00,LA33.434580607,LN-
112.080357897,HT1362.3053,RH0.0125,RV0.0174,DH0.94,DV1.31
GS,PN36,N 992865.48962,E 434055.95653,EL1465.081,--MMI FP#1002
EP,TM15:54:44.00,LA33.442544131,LN-
112.083059339,HT1397.3568,RH0.0165,RV0.0261,DH1.01,DV1.60
GS,PN37,N 996877.08745,E 431783.43335,EL1500.105,--BM#526
EP,TM16: 0:54.00,LA33.442351744,LN-
112.083991770,HT1397.9353,RH0.0220,RV0.0354,DH1.02,DV1.64
GS,PN38,N 996684.41765,E 430995.55187,EL1500.602,--BM#517
EP,TM16: 8:17.00,LA33.442148594,LN-
112.084976284,HT1399.6336,RH0.0152,RV0.0225,DH0.92,DV1.32
GS,PN39,N 996480.98979,E 430163.65181,EL1502.214,--BM#525
--Set ROVER: record intrvl: OFF, elev cutoff:  8 deg, antenna ht: 6.980
--Send Base position to Rover:LA33.423260101,LN-
112.071666467,HT1325.6460
--01:40:06.15,Set Base receiver position, Base Pt: 15
BP,PN15,LA33.423260101,LN-112.071666467,HT1325.6460
--01:40:16.86,Solve for local Horizontal transformation, RMS N: 0.1779,
RMS E: 0.0518
HC,PN5,LA33.432007288,LN-112.075340762,HT1354.4350,--H,V
HC,PN7,LA33.423402660,LN-112.072301546,HT1328.3190,--H,V
HC,PN12,LA33.424918164,LN-112.072196390,HT1331.9610,--H,V
HC,PN13,LA33.425257416,LN-112.073352500,HT1335.2570,--H
HC,PN16,LA33.424694226,LN-112.080623806,HT1320.0675,--H,V
HC,PN17,LA33.424638482,LN-112.075816517,HT1324.2983,--H,V
HC,PN4,LA33.432608488,LN-112.072127492,HT1357.0590,--H
HC,PN24,LA33.442077146,LN-112.085199078,HT1397.2019,--H,V
--01:40:20.05,Solve for local Vertical transformation, RMS ELV: 0.0006
VC,PN5,LA33.432007288,LN-112.075340762,HT1354.4350,--H,V
VC,PN7,LA33.423402660,LN-112.072301546,HT1328.3190,--H,V
VC,PN12,LA33.424918164,LN-112.072196390,HT1331.9610,--H,V
VC,PN16,LA33.424694226,LN-112.080623806,HT1320.0675,--H,V
VC,PN17,LA33.424638482,LN-112.075816517,HT1324.2983,--H,V
VC,PN24,LA33.442077146,LN-112.085199078,HT1397.2019,--H,V
```

LH,PN15,Ha3.280830488,Hb0.006818573,Hc109238.064721569,Hd658055.97919059
4,SC1.000001293,RT0.070868
LV,PN15,Va0.000303868,Vb0.000150464,Vc57.370267624,Ba33.423260101,Bo-
112.071666467,Bh1325.6460
EP,TM18:54:53.00,LA33.432442496,LN-
112.074698839,HT1359.9382,RH0.0129,RV0.0229,DH0.91,DV1.62
GS,PN83,N 990701.14875,E 435452.53336,EL1462.745,--TOP
EP,TM18:55:33.00,LA33.432448911,LN-
112.074695046,HT1357.8952,RH0.0144,RV0.0257,DH0.91,DV1.63
GS,PN84,N 990707.62673,E 435455.75106,EL1460.702,--GB
EP,TM18:55:56.00,LA33.432483018,LN-
112.074670152,HT1357.7453,RH0.0182,RV0.0325,DH0.91,DV1.63
GS,PN85,N 990742.05773,E 435476.85306,EL1460.556,--TOP1
EP,TM18:57:5.00,LA33.432549931,LN-
112.074612069,HT1339.4357,RH0.0166,RV0.0299,DH0.91,DV1.64
GS,PN86,N 990809.58988,E 435526.05882,EL1442.254,--TOE
EP,TM18:57:26.00,LA33.432563631,LN-
112.074603307,HT1340.6389,RH0.0154,RV0.0277,DH0.91,DV1.64
GS,PN87,N 990823.42273,E 435533.48949,EL1443.458,--GB1
EP,TM18:57:56.00,LA33.432580377,LN-
112.074592562,HT1341.4425,RH0.0154,RV0.0278,DH0.91,DV1.64
GS,PN88,N 990840.33015,E 435542.60252,EL1444.264,--GB2
EP,TM18:58:23.00,LA33.432600702,LN-
112.074570067,HT1346.4919,RH0.0154,RV0.0279,DH0.91,DV1.65
GS,PN89,N 990860.83494,E 435561.64663,EL1449.316,--GB3
EP,TM18:58:45.00,LA33.432617750,LN-
112.074563837,HT1347.2824,RH0.0166,RV0.0302,DH0.91,DV1.65
GS,PN90,N 990878.05598,E 435566.94677,EL1450.108,--FN
EP,TM18:59:1.00,LA33.432615546,LN-
112.074564424,HT1346.8022,RH0.0166,RV0.0302,DH0.91,DV1.65
GS,PN91,N 990875.82934,E 435566.44571,EL1449.627,--GB4
EP,TM19: 1:31.00,LA33.432624713,LN-
112.074557104,HT1347.4189,RH0.0154,RV0.0282,DH0.91,DV1.66
GS,PN92,N 990885.08231,E 435572.64880,EL1450.245,--EG
EP,TM19: 1:59.00,LA33.432642179,LN-
112.074543660,HT1347.6437,RH0.0154,RV0.0282,DH0.91,DV1.67
GS,PN93,N 990902.71320,E 435584.04264,EL1450.472,--EG
EP,TM19: 2:32.00,LA33.432662379,LN-
112.074527075,HT1348.4397,RH0.0167,RV0.0309,DH0.90,DV1.67
GS,PN94,N 990923.10131,E 435598.09469,EL1451.270,--EG
EP,TM19: 2:56.00,LA33.432705977,LN-
112.074501718,HT1349.8371,RH0.0166,RV0.0306,DH0.90,DV1.67
GS,PN95,N 990967.12592,E 435619.60787,EL1452.671,--EG
EP,TM19: 3:19.00,LA33.432741969,LN-
112.074475347,HT1351.0959,RH0.0182,RV0.0336,DH0.90,DV1.67
GS,PN96,N 991003.45964,E 435641.96043,EL1453.934,--EG
EP,TM19: 3:49.00,LA33.432788273,LN-
112.074435846,HT1352.2515,RH0.0166,RV0.0307,DH0.90,DV1.67
GS,PN97,N 991050.19380,E 435675.42539,EL1455.095,--EG
EP,TM19: 4:18.00,LA33.432832121,LN-
112.074411870,HT1353.6268,RH0.0154,RV0.0285,DH0.90,DV1.67
GS,PN98,N 991094.47379,E 435695.77264,EL1456.474,--EG
EP,TM19:23:6.00,LA33.434076501,LN-
112.072528729,HT1369.8359,RH0.0143,RV0.0254,DH0.90,DV1.61
GS,PN99,N 992348.95796,E 437289.01050,EL1472.888,--TOP
EP,TM19:23:39.00,LA33.434073627,LN-
112.072527789,HT1369.7125,RH0.0170,RV0.0304,DH0.90,DV1.60

```
GS,PN100,N 992346.05044,E 437289.79828,EL1472.764,--ER
EP,TM19:24:18.00,LA33.434064956,LN-
112.072520871,HT1369.4725,RH0.0170,RV0.0303,DH0.90,DV1.60
GS,PN101,N 992337.27342,E 437295.62257,EL1472.525,--ER1
EP,TM19:25:2.00,LA33.434062126,LN-
112.072518682,HT1369.5358,RH0.0170,RV0.0301,DH0.90,DV1.59
GS,PN102,N 992334.40943,E 437297.46541,EL1472.588,--TOP1
--New Rover antenna height: 5.21
EP,TM19:26:33.00,LA33.434035599,LN-
112.072490841,HT1351.3601,RH0.0157,RV0.0276,DH0.90,DV1.58
GS,PN103,N 992307.54483,E 437320.92477,EL1454.413,--TOE
EP,TM19:27:50.00,LA33.434001808,LN-
112.072458426,HT1351.3281,RH0.0416,RV0.0723,DH0.90,DV1.56
GS,PN104,N 992273.33027,E 437348.23077,EL1454.382,--EG
EP,TM19:28:7.00,LA33.433980497,LN-
112.072438762,HT1351.4905,RH0.0465,RV0.0930,DH1.00,DV2.01
GS,PN105,N 992251.75370,E 437364.79397,EL1454.545,--EG
EP,TM19:28:19.00,LA33.433960409,LN-
112.072418089,HT1351.1879,RH0.0464,RV0.0928,DH1.00,DV2.01
GS,PN106,N 992231.41072,E 437382.21226,EL1454.243,--EG
EP,TM19:28:30.00,LA33.433941403,LN-
112.072398441,HT1351.6218,RH0.0464,RV0.0924,DH1.00,DV2.00
GS,PN107,N 992212.16456,E 437398.76705,EL1454.678,--EG
EP,TM19:28:40.00,LA33.433920654,LN-
112.072377209,HT1351.6936,RH0.0463,RV0.0922,DH1.00,DV2.00
GS,PN108,N 992191.15307,E 437416.65636,EL1454.750,--EG
EP,TM19:28:49.00,LA33.433900372,LN-
112.072357015,HT1350.8802,RH0.0463,RV0.0920,DH1.00,DV1.99
GS,PN109,N 992170.61507,E 437433.66950,EL1453.937,--EG
EP,TM19:28:59.00,LA33.433880133,LN-
112.072336742,HT1349.8950,RH0.0462,RV0.0918,DH1.00,DV1.99
GS,PN110,N 992150.12084,E 437450.74954,EL1452.953,--EG
EP,TM19:29:10.00,LA33.433858831,LN-
112.072316954,HT1350.8153,RH0.0461,RV0.0914,DH1.00,DV1.99
GS,PN111,N 992128.55362,E 437467.41779,EL1453.874,--EG
EP,TM19:29:20.00,LA33.433838208,LN-
112.072296320,HT1351.1341,RH0.0460,RV0.0912,DH1.00,DV1.98
GS,PN112,N 992107.67023,E 437484.80227,EL1454.193,--EG
EP,TM19:29:56.00,LA33.433826600,LN-
112.072284582,HT1351.0942,RH0.0157,RV0.0285,DH0.91,DV1.64
GS,PN113,N 992095.91527,E 437494.69153,EL1454.154,--TOE1
EP,TM19:31:20.00,LA33.433800788,LN-
112.072259124,HT1368.5415,RH0.0161,RV0.0277,DH0.84,DV1.40
GS,PN114,N 992069.77891,E 437516.13915,EL1471.602,--TOP2
EP,TM19:31:40.00,LA33.433797371,LN-
112.072255938,HT1368.6314,RH0.0172,RV0.0288,DH0.84,DV1.40
GS,PN115,N 992066.31892,E 437518.82323,EL1471.692,--ER2
EP,TM19:32:15.00,LA33.433789314,LN-
112.072247974,HT1369.1051,RH0.0157,RV0.0262,DH0.84,DV1.40
GS,PN116,N 992058.16033,E 437525.53245,EL1472.166,--ER3
EP,TM19:32:35.00,LA33.433784713,LN-
112.072244143,HT1369.0924,RH0.0157,RV0.0262,DH0.84,DV1.40
GS,PN117,N 992053.50298,E 437528.75841,EL1472.153,--TOP4
EP,TM19:33:8.00,LA33.433762496,LN-
112.072223863,HT1359.2570,RH0.0157,RV0.0295,DH0.99,DV1.90
GS,PN118,N 992031.00959,E 437545.84044,EL1462.318,--TOE3
EP,TM19:33:24.00,LA33.433740542,LN-
```

112.072205214,HT1358.3963,RH0.0173,RV0.0286,DH0.84,DV1.39
·GS,PN119,N 992008.78459,E 437561.54531,EL1461.458,--EG

APPENDIX D: HYDROLOGIC ANALYSIS SUPPORTING DOCUMENTATION

The current effective FIS hydrologic data was used for this LOMR study. The effective FIS peak 100-year discharges for the study reach are summarized in Table 1.

Table 1: Hydrologic Summary

Cross Section Identification	Q_{100} (cfs)
1.935	1308
1.766	1609
1.098	2304

APPENDIX E: HYDRAULIC ANALYSIS SUPPORTING DOCUMENTATION

E.1 Roughness Coefficient Estimation

E.2 Cross Section Plots

E.3 Expansion and Contraction Coefficients

E.4 Analysis of Structures

E.5 Hydraulic Calculations

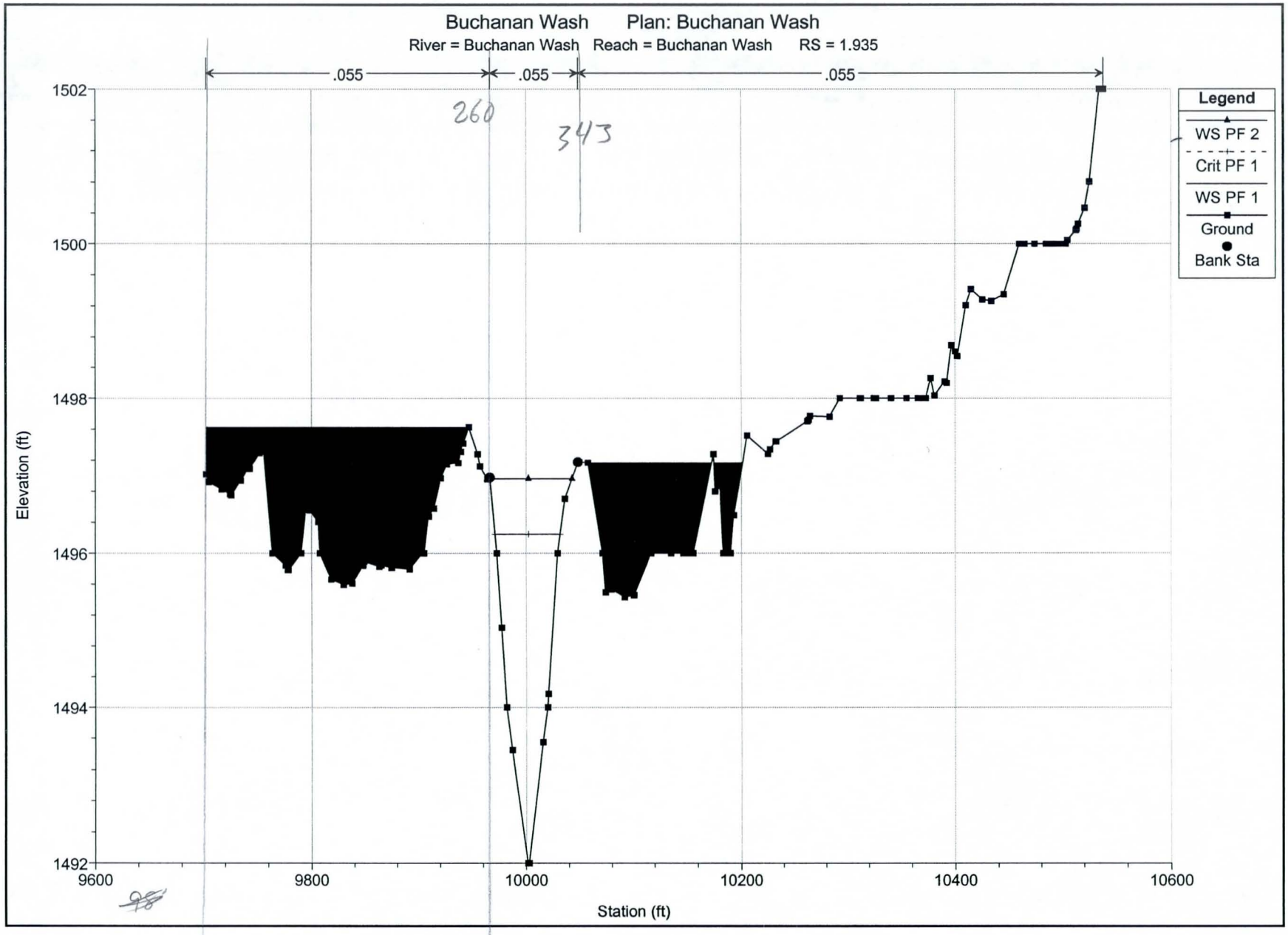
E.1 ROUGHNESS COEFFICIENT ESTIMATION

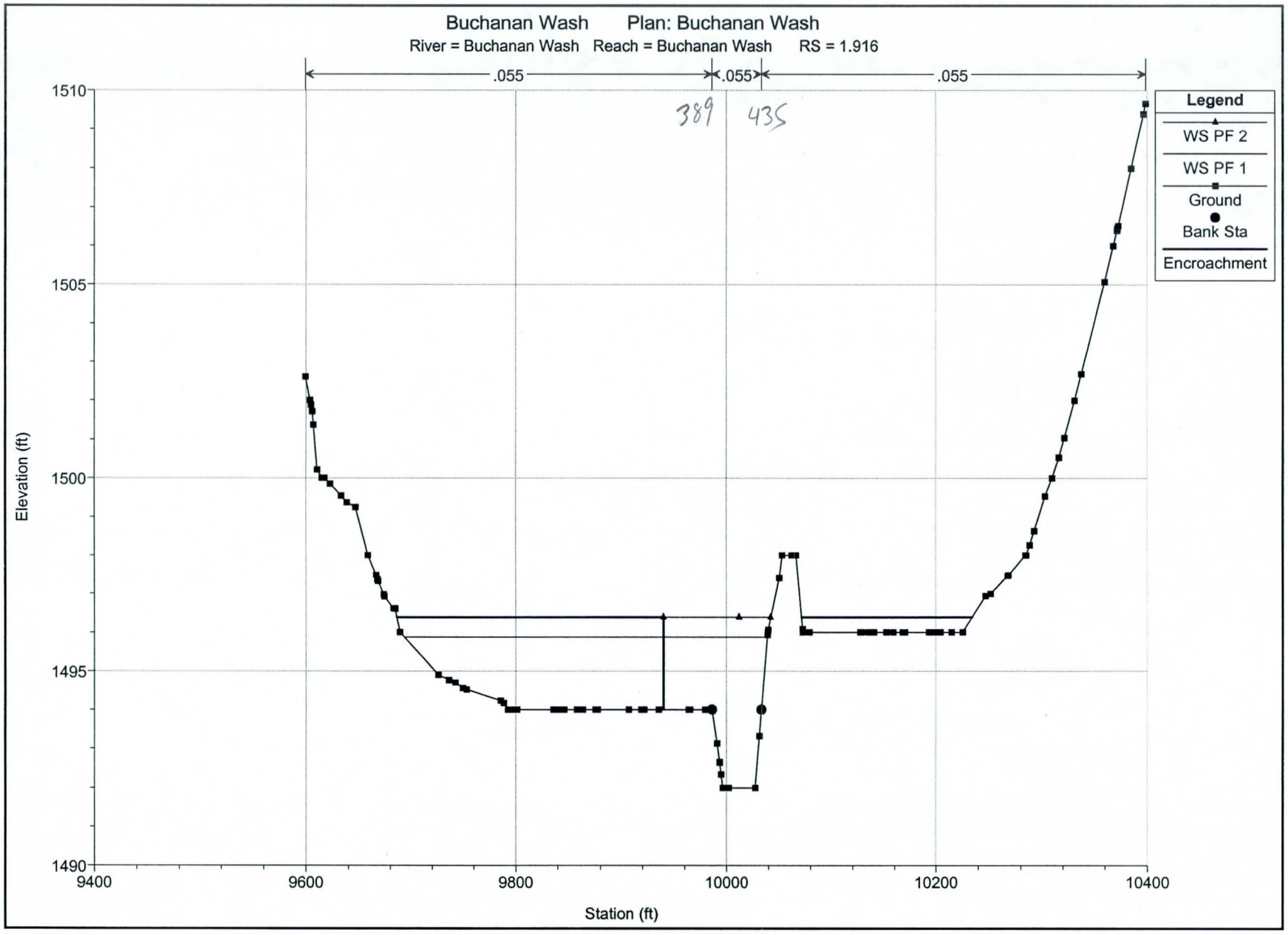
A summary of the revised Manning's roughness coefficients for each cross section is provided below.

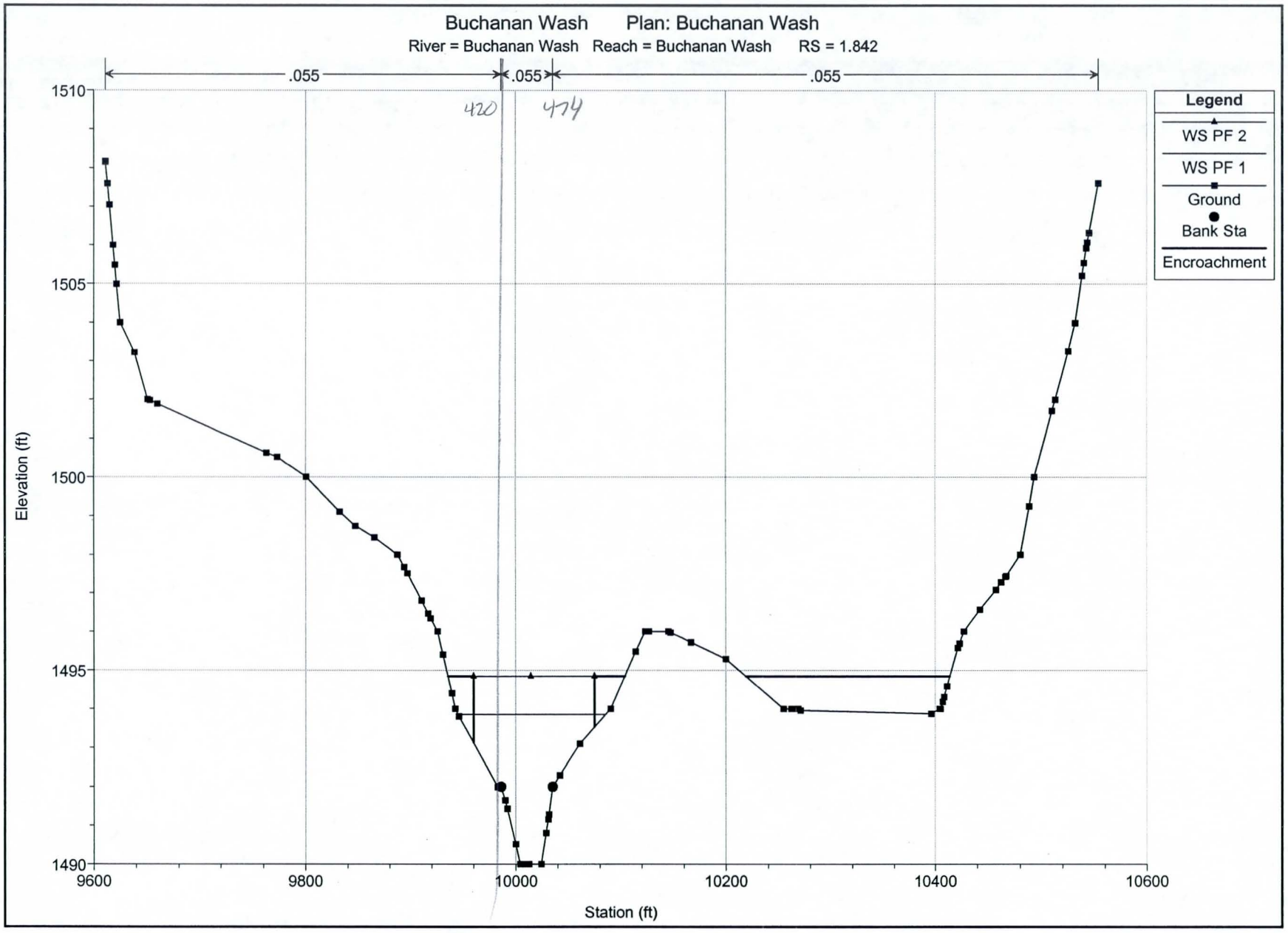
River Station	n1	n2	n3	n4
1.935	0.055	0.055	0.055	
1.916	0.055	0.055	0.055	
1.842	0.055	0.055	0.055	
1.766	0.055	0.055	0.055	
1.67	0.055	0.055	0.055	
1.575	0.055	0.055	0.055	
1.479	0.055	0.055	0.055	
1.412	0.055	0.055	0.055	
1.356	0.055	0.055	0.055	
1.332	0.055	0.055	0.055	
1.326				
1.318	0.055	0.055	0.055	
1.29	0.055	0.055	0.055	
1.197	0.055	0.055	0.055	
1.098	0.055	0.055	0.055	
1.005	0.055	0.055	0.055	
0.928	0.055	0.055	0.055	
0.839	0.055	0.055	0.055	
0.696	0.055	0.055	0.055	
0.595	0.055	0.055	0.055	
0.501	0.055	0.055	0.055	
0.456	0.055	0.055	0.055	
0.416	0.055	0.055	0.055	
0.302	0.055	0.055	0.055	
0.266	0.055	0.055	0.055	
0.177	0.055	0.055	0.055	0.025
0.085	0.055	0.055	0.025	
0.043	0.025	0.055	0.025	

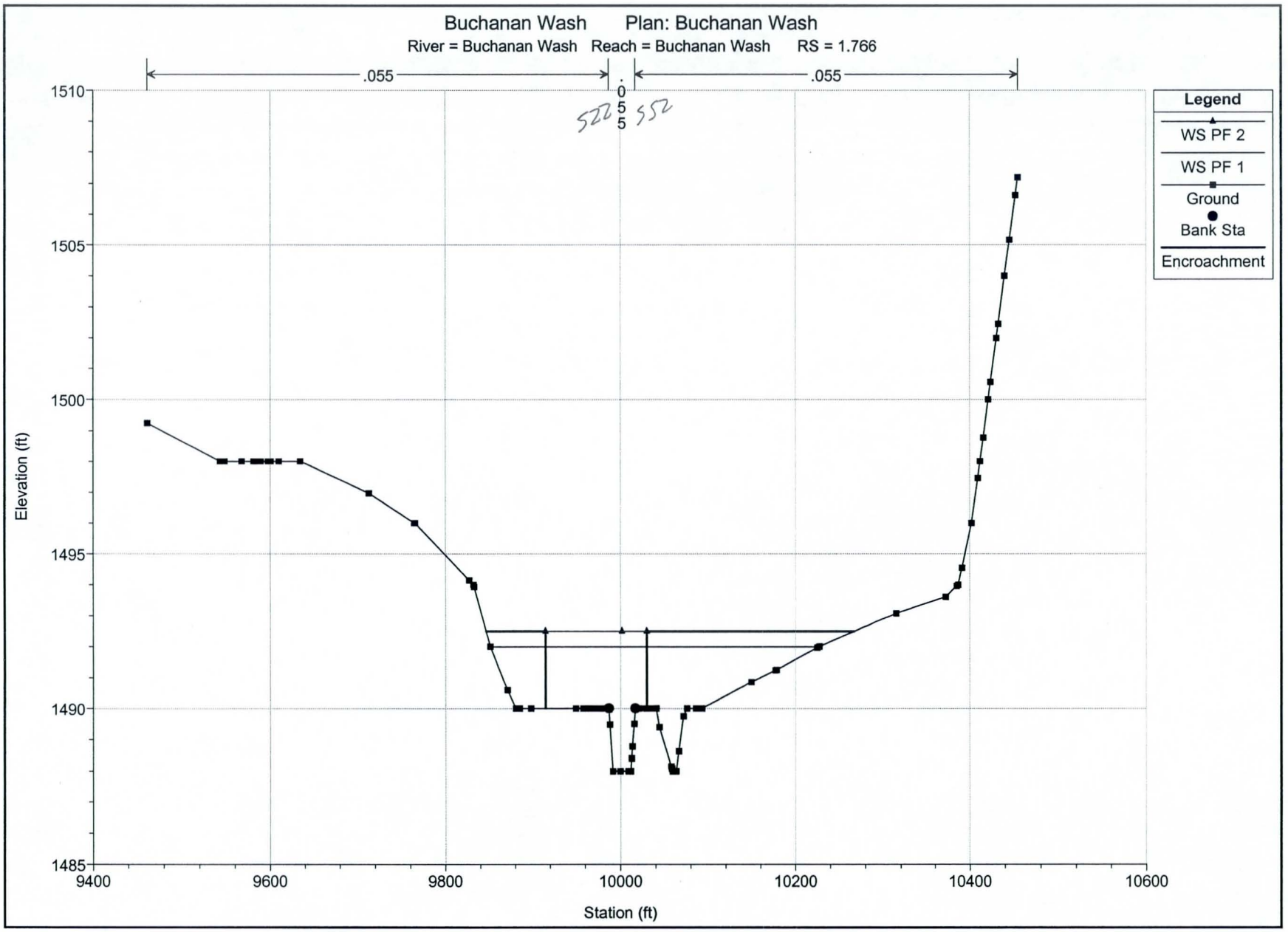
What method?
Why no photos?

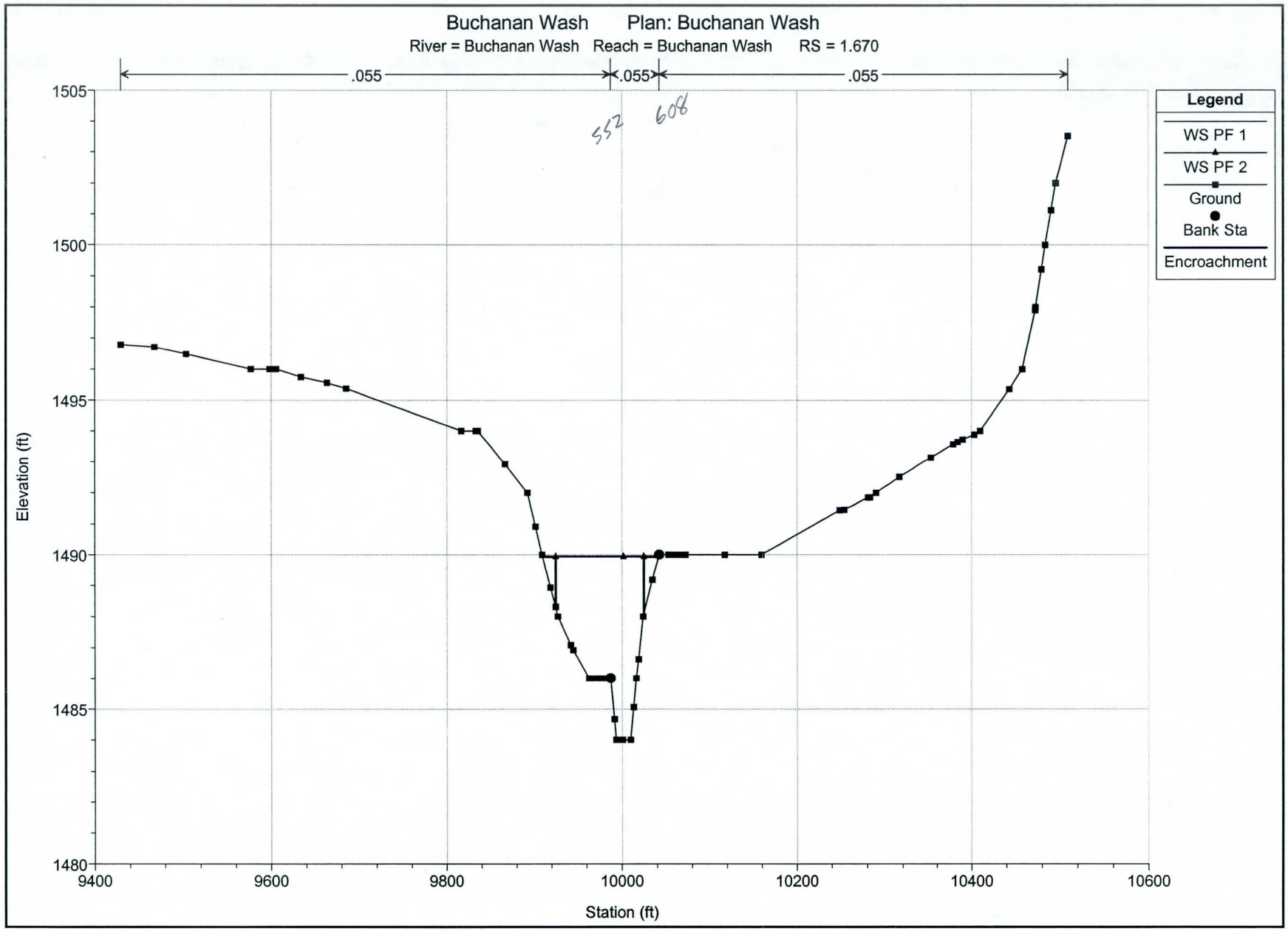
E.2 CROSS-SECTION PLOTS


Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 1.935
.055
.055
.055
260
343
Legend
WS PF 2
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1502
1500
1498
1496
1494
1492
9600
9800
10000
10200
10400
10600
Station (ft)
0

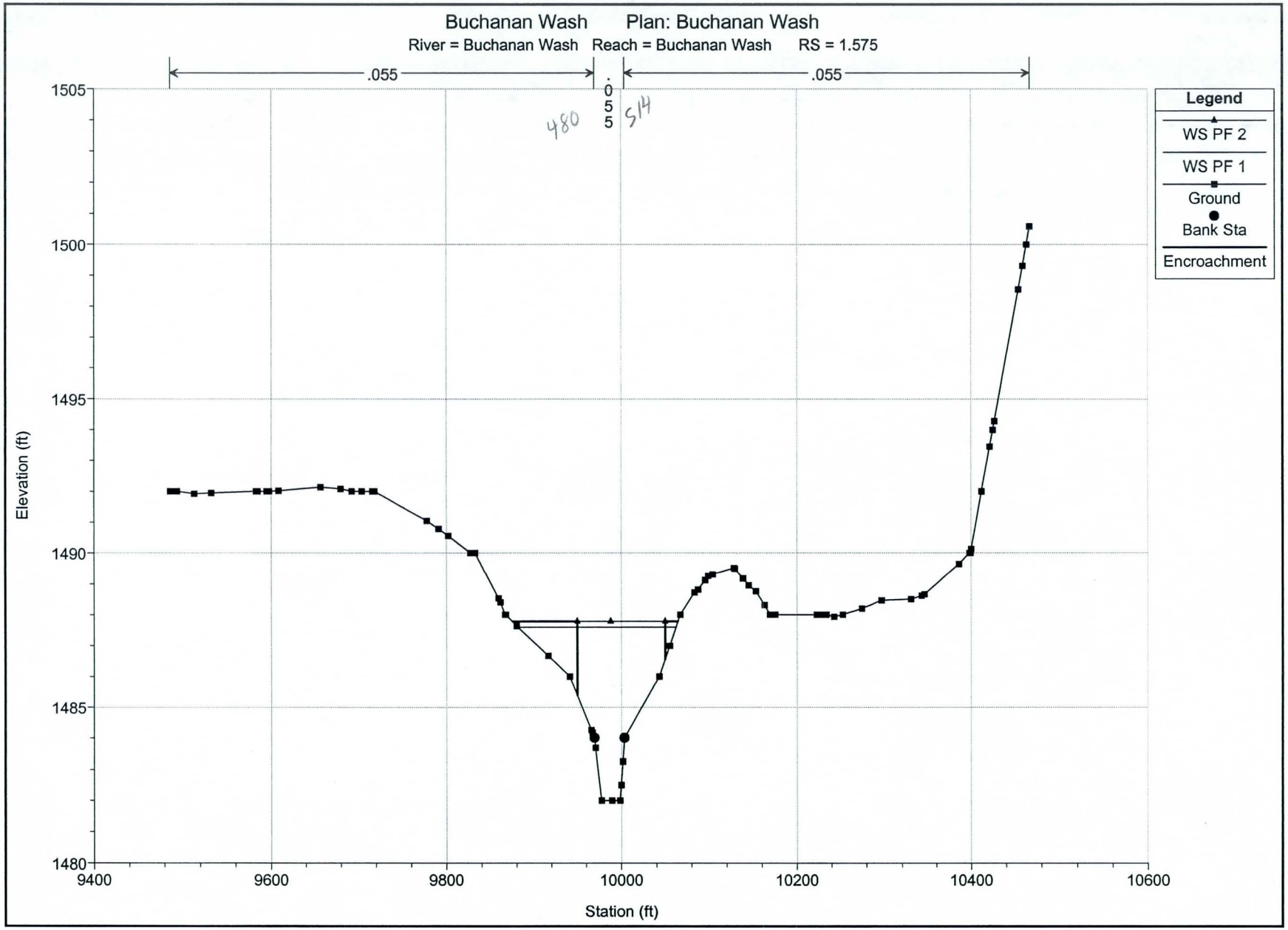

Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 1.916
.055
.055
.055
389
435
Legend
WS PF 2
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1510
1505
1500
1495
1490
9400
9600
9800
10000
10200
10400
Station (ft)


Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 1.842
.055
.055
.055
420
474
Legend
WS PF 2
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1510
1505
1500
1495
1490
9600
9800
10000
10200
10400
10600
Station (ft)

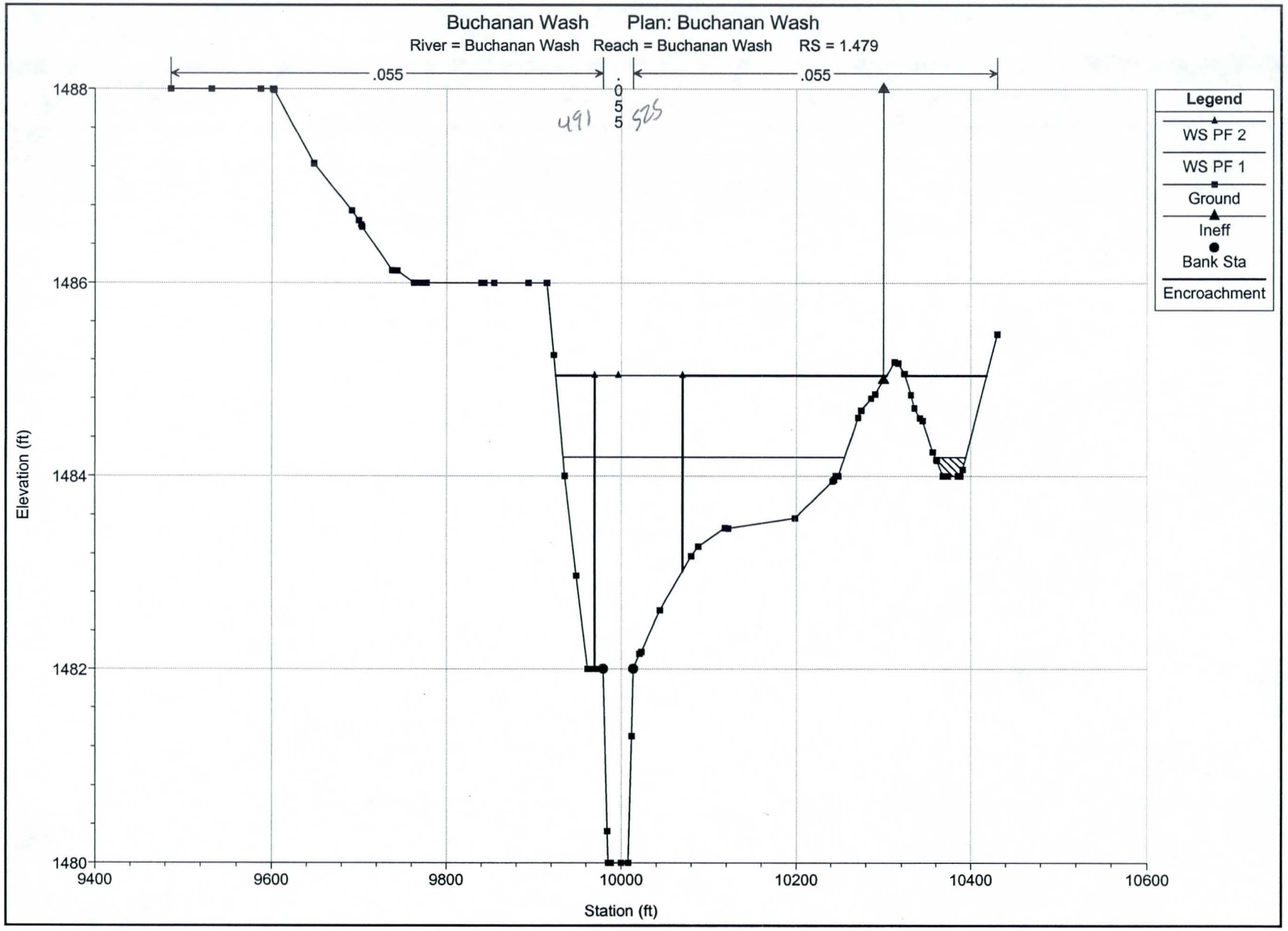

Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 1.766
.055
.055
.055
522 552
Legend
WS PF 2
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1510
1505
1500
1495
1490
1485
9400
9600
9800
10000
10200
10400
10600
Station (ft)


Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 1.670
.055
.055
.055
552
608
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Encroachment
Elevation (ft)
1505
1500
1495
1490
1485
1480
9400
9600
9800
10000
10200
10400
10600
Station (ft)

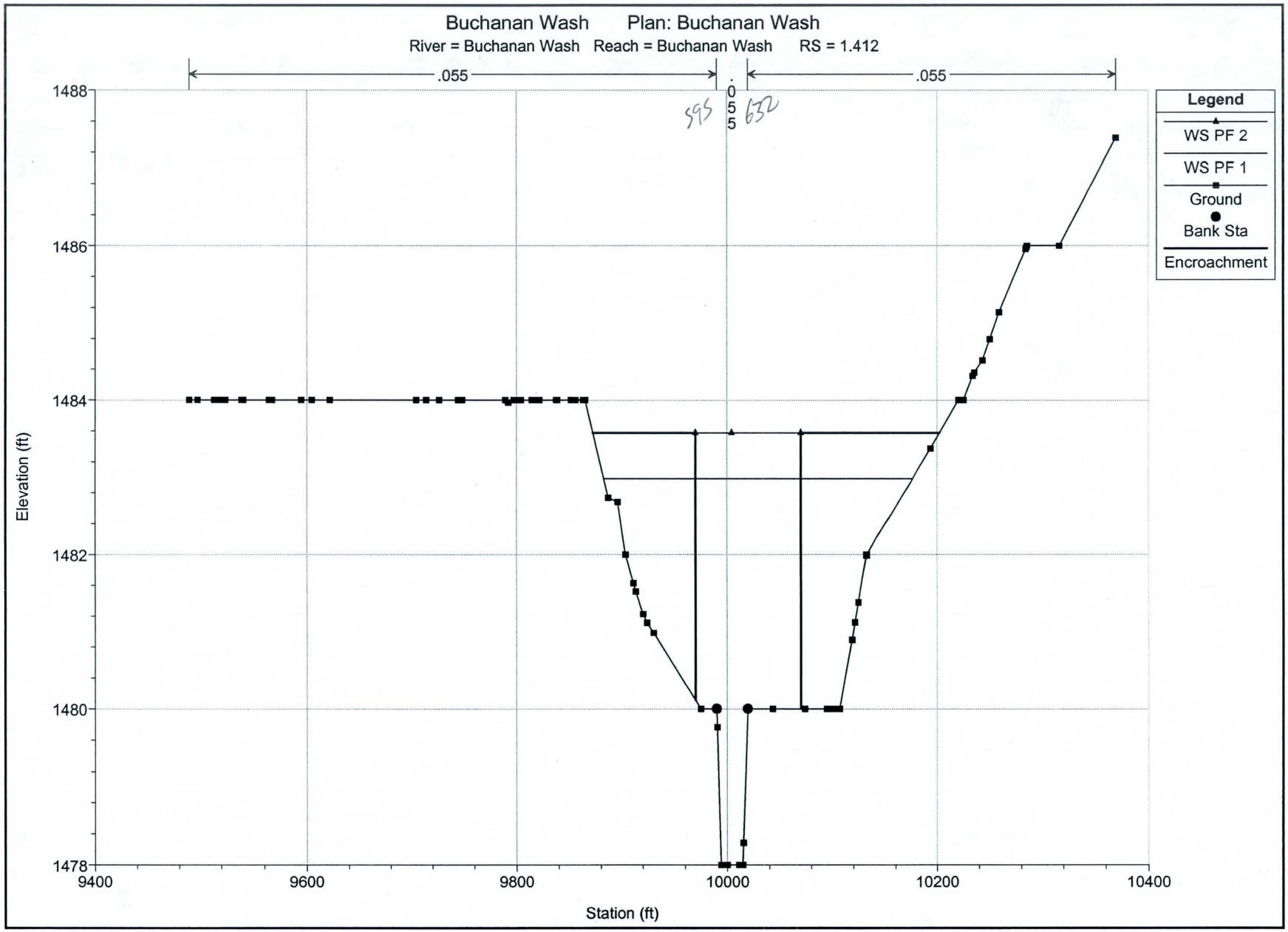
1" = 160'

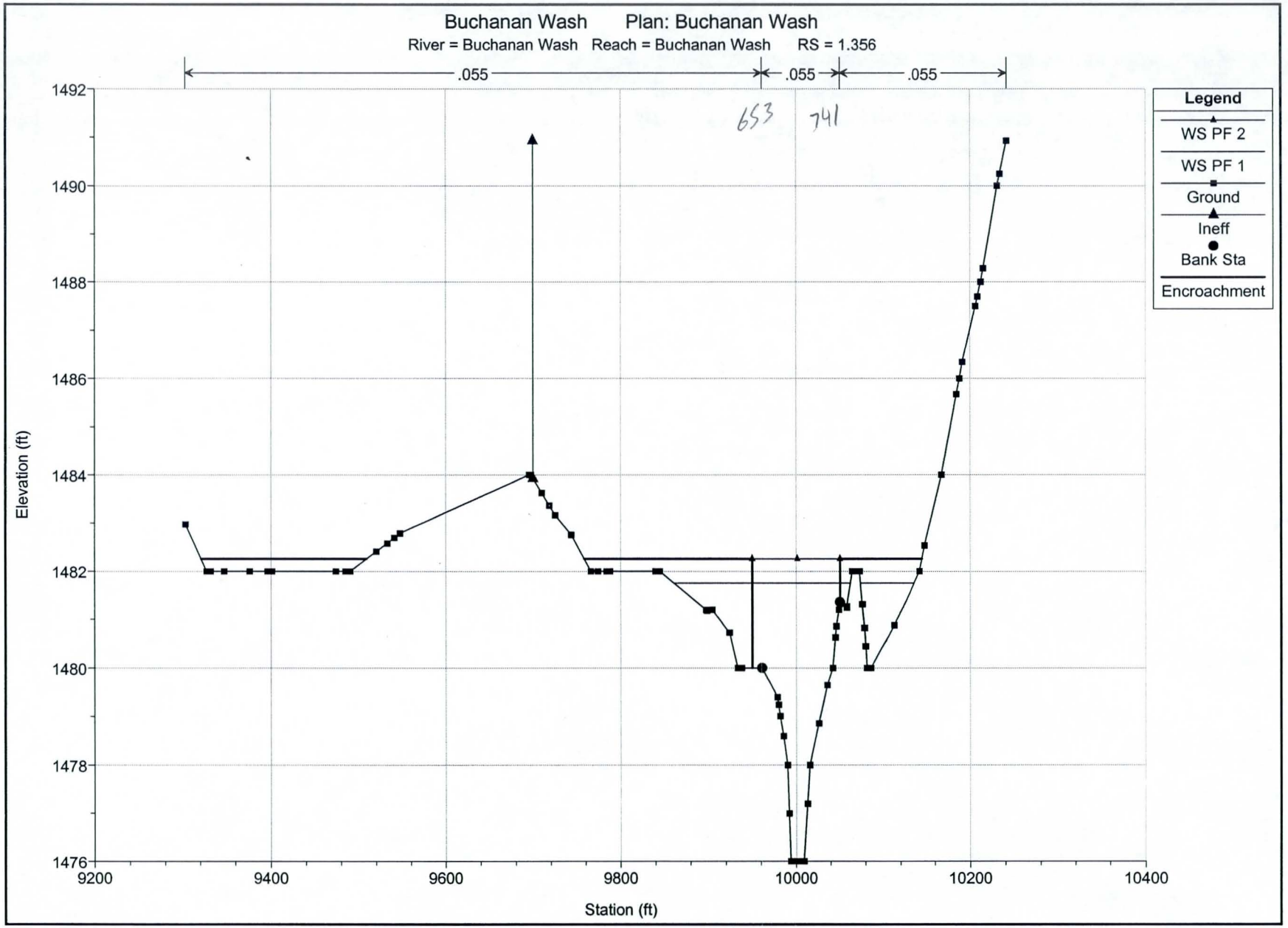

Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 1.575
.055
.055
0.055
480
514
Legend
WS PF 2
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1505
1500
1495
1490
1485
1480
9400
9600
9800
10000
10200
10400
10600
Station (ft)

1" = 160

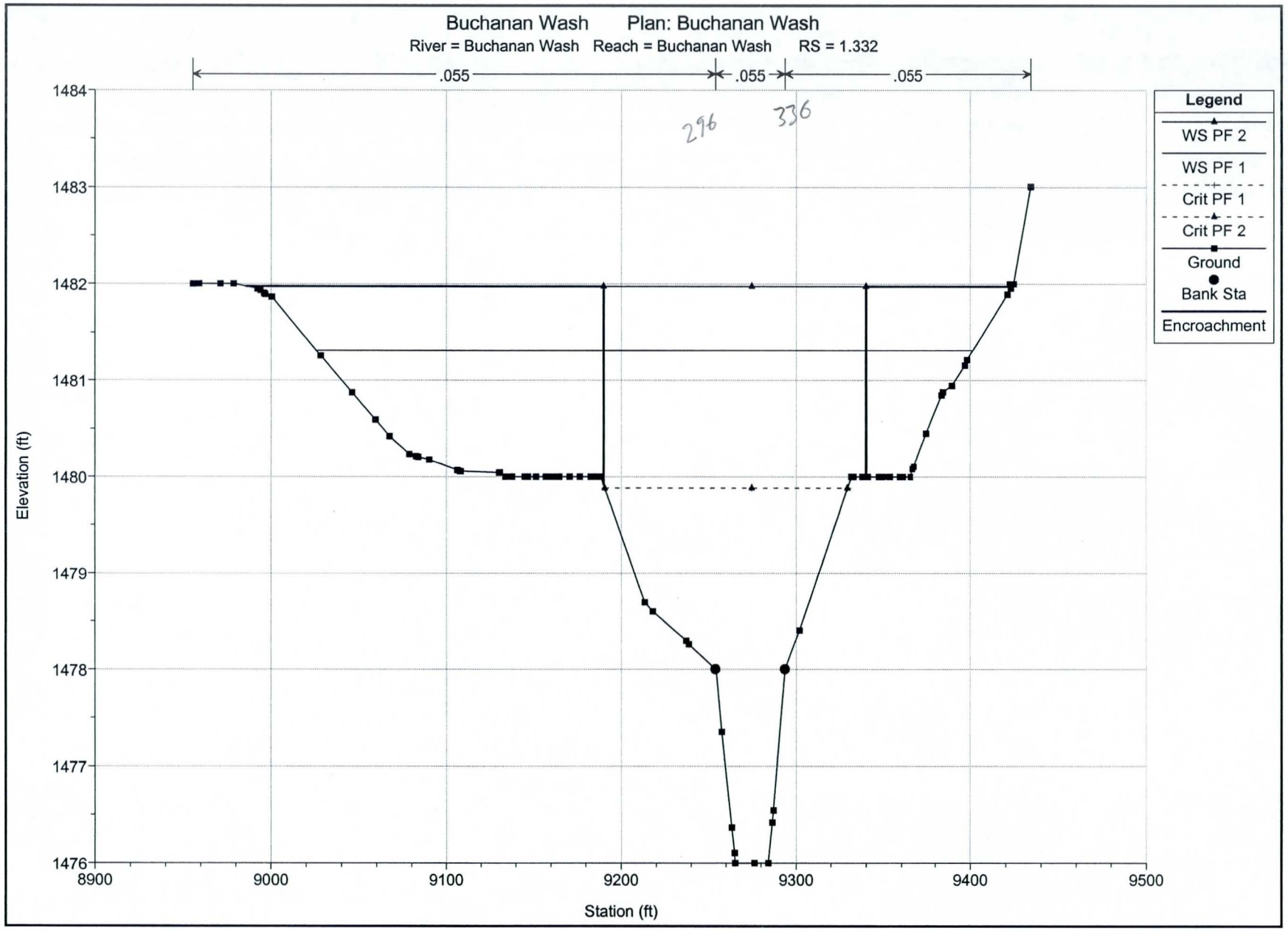

Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 1.479
.055
.055
0
5
5
491 525
Legend
WS PF 2
WS PF 1
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
1488
1486
1484
1482
1480
9400
9600
9800
10000
10200
10400
10600
Station (ft)

1" = 160'

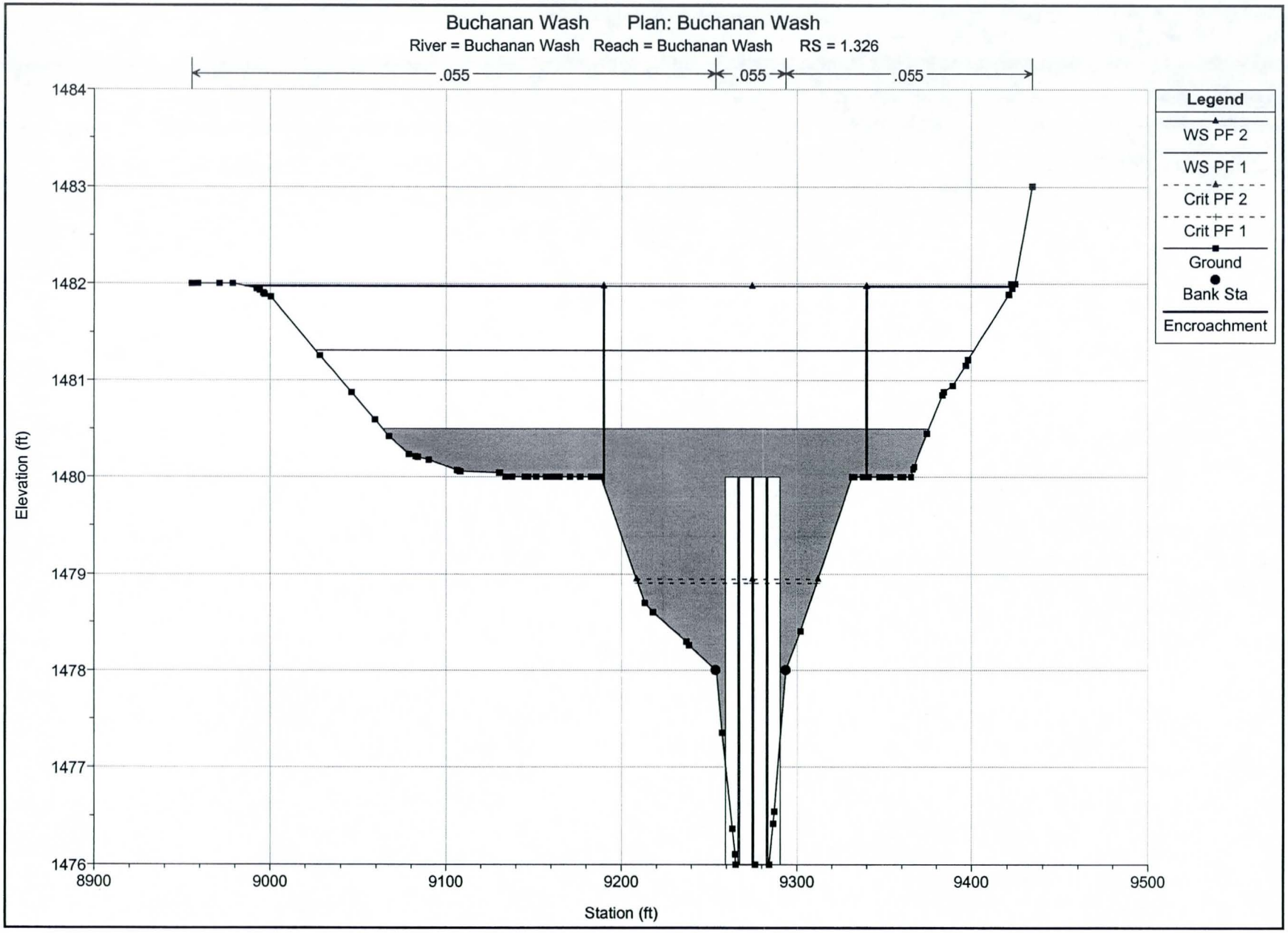

Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 1.412
.055
.055
.055
595 632
Legend
WS PF 2
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1488
1486
1484
1482
1480
1478
9400
9600
9800
10000
10200
10400
Station (ft)

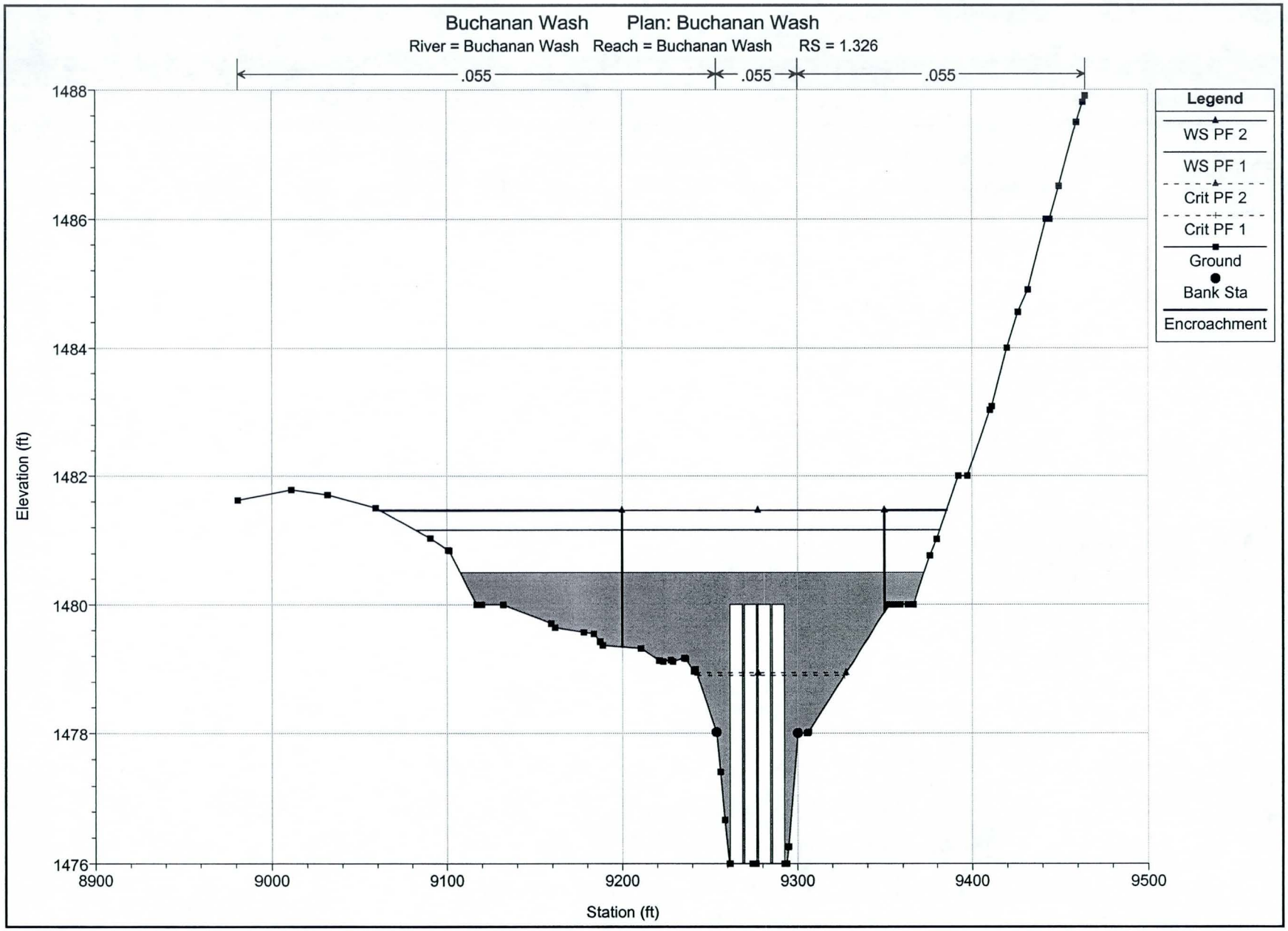

Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 1.356
.055
.055
.055
653
741
Legend
WS PF 2
WS PF 1
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
1492
1490
1488
1486
1484
1482
1480
1478
1476
9200
9400
9600
9800
10000
10200
10400
Station (ft)

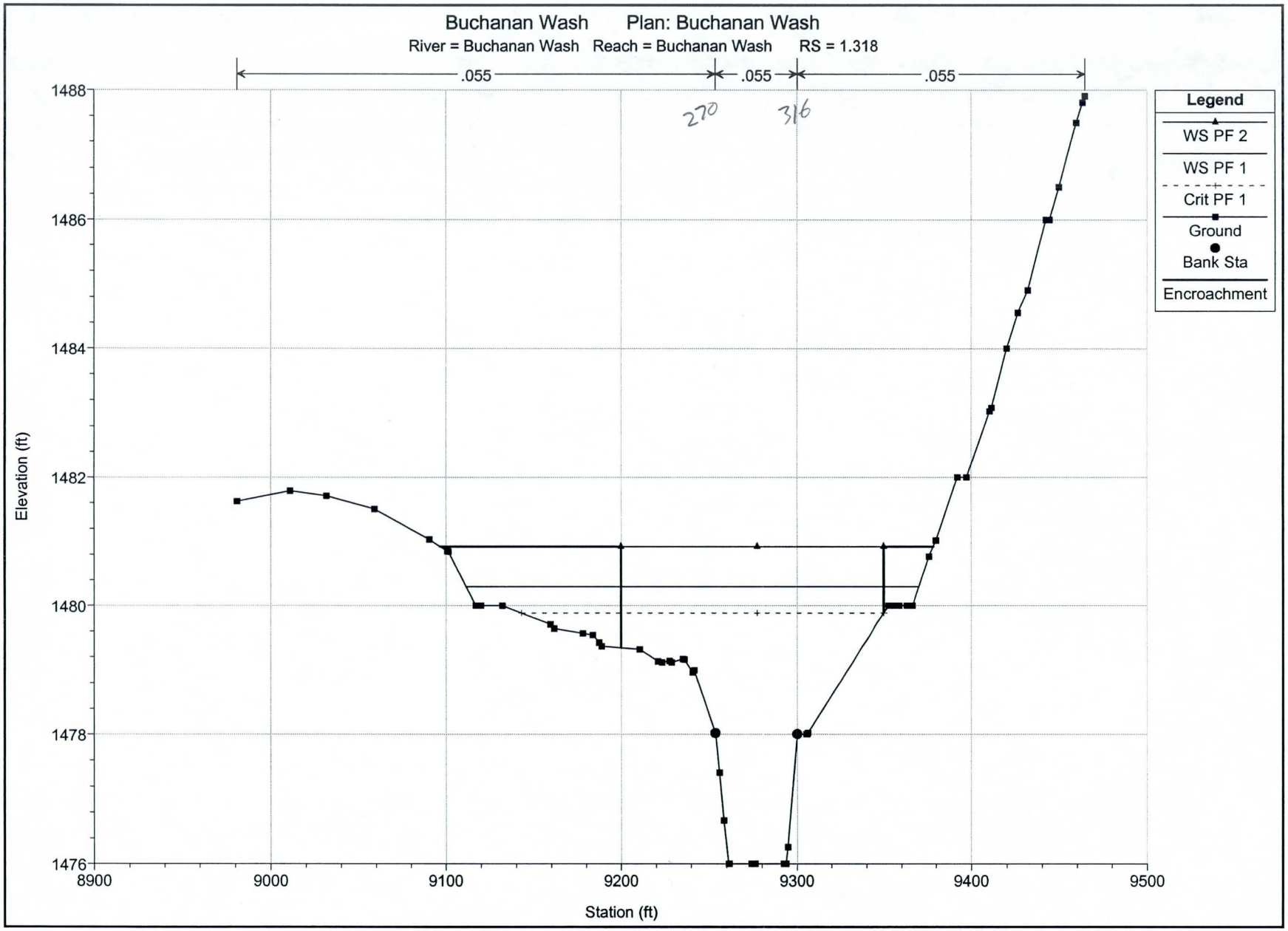
1" = 160'


Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 1.332
.055
.055
.055
296
336
Legend
WS PF 2
WS PF 1
Crit PF 1
Crit PF 2
Ground
Bank Sta
Encroachment
Elevation (ft)
1484
1483
1482
1481
1480
1479
1478
1477
1476
8900
9000
9100
9200
9300
9400
9500
Station (ft)

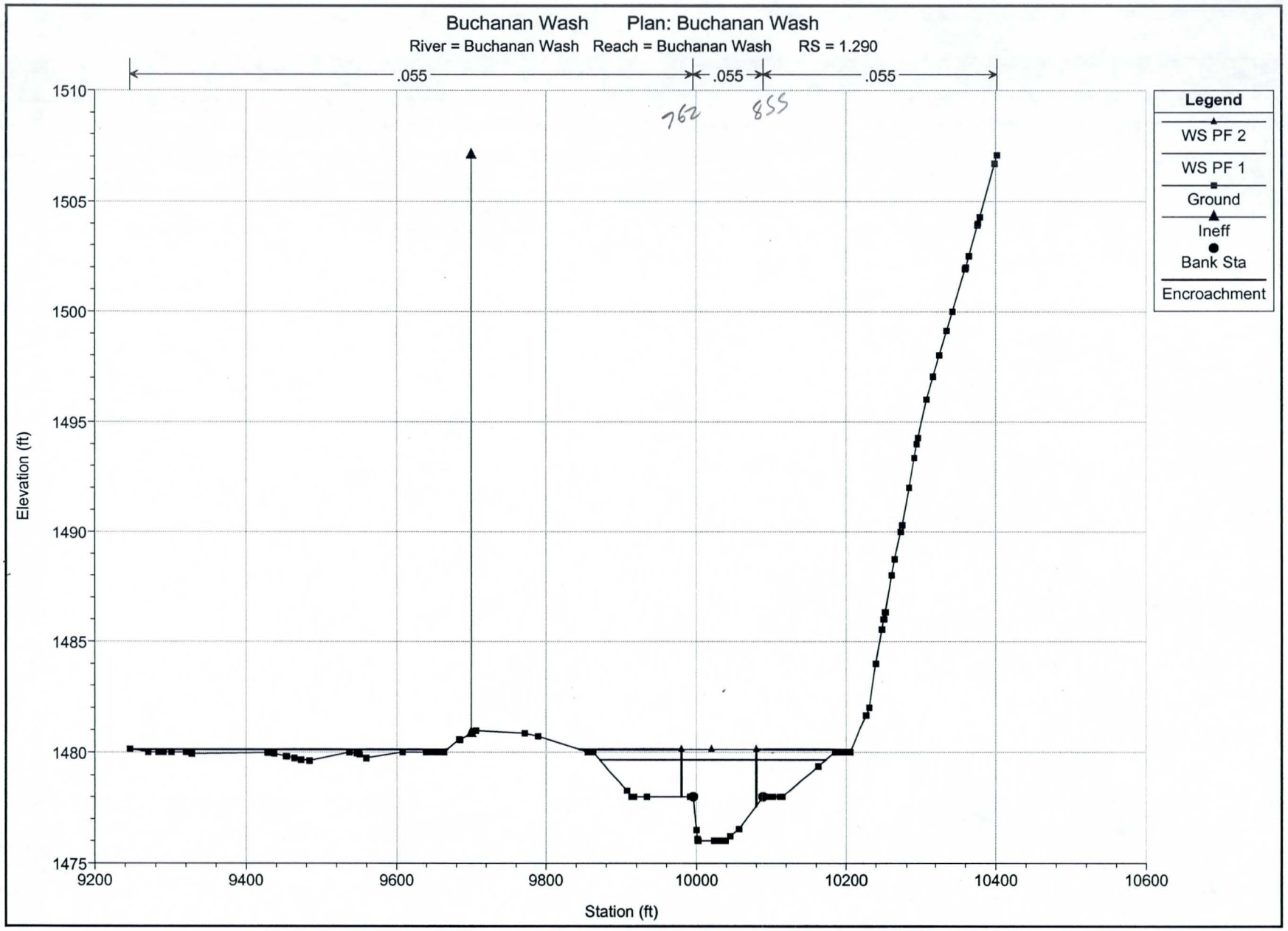
1" = 80


Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 1.326
.055
.055
.055
Legend
WS PF 2
WS PF 1
Crit PF 2
Crit PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1484
1483
1482
1481
1480
1479
1478
1477
1476
8900
9000
9100
9200
9300
9400
9500
Station (ft)

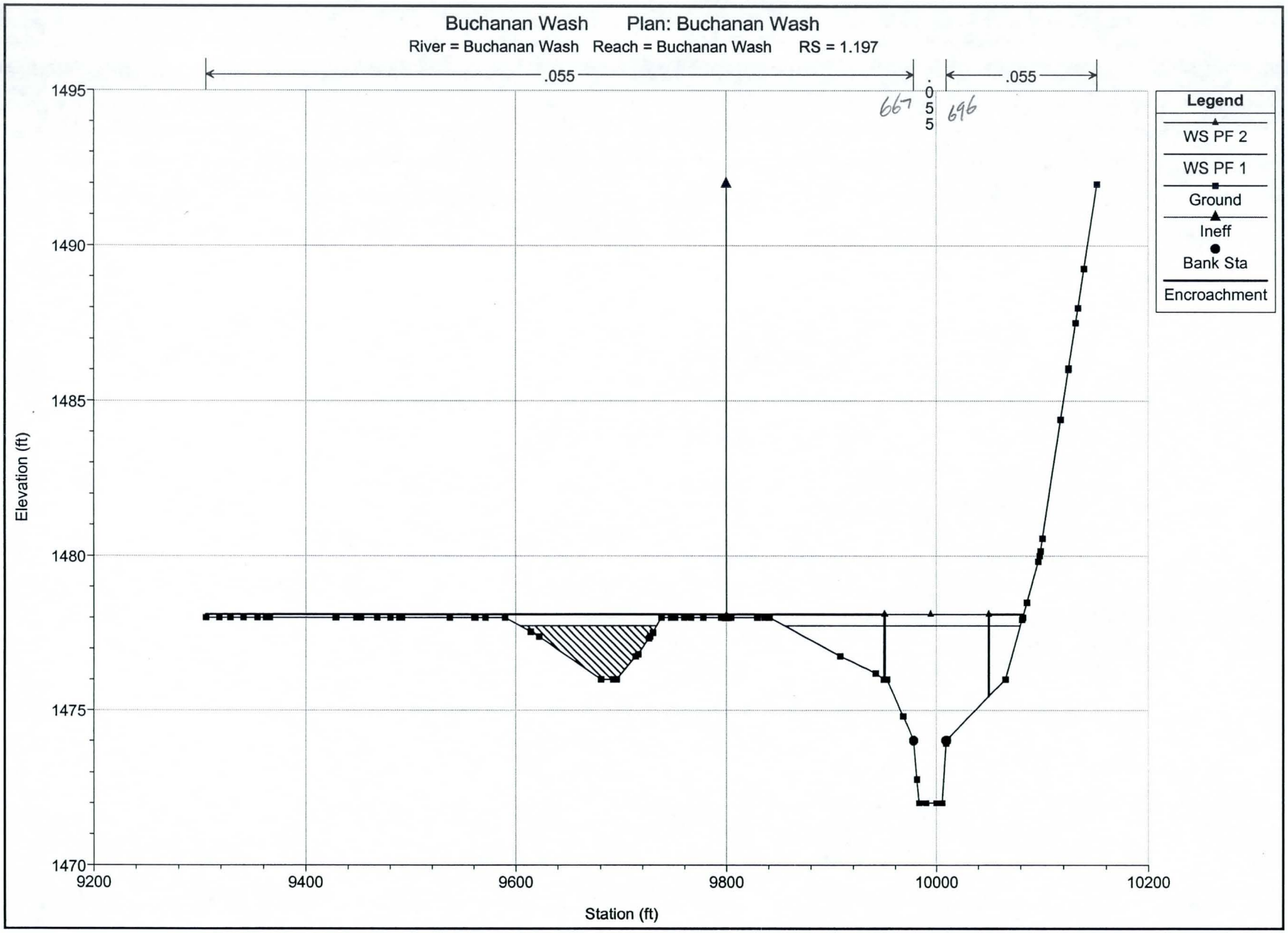

Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 1.326
.055
.055
.055
Legend
WS PF 2
WS PF 1
Crit PF 2
Crit PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1488
1486
1484
1482
1480
1478
1476
8900
9000
9100
9200
9300
9400
9500
Station (ft)


Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 1.318
.055
.055
.055
270
316
Legend
WS PF 2
WS PF 1
Crit PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1488
1486
1484
1482
1480
1478
1476
8900
9000
9100
9200
9300
9400
9500
Station (ft)

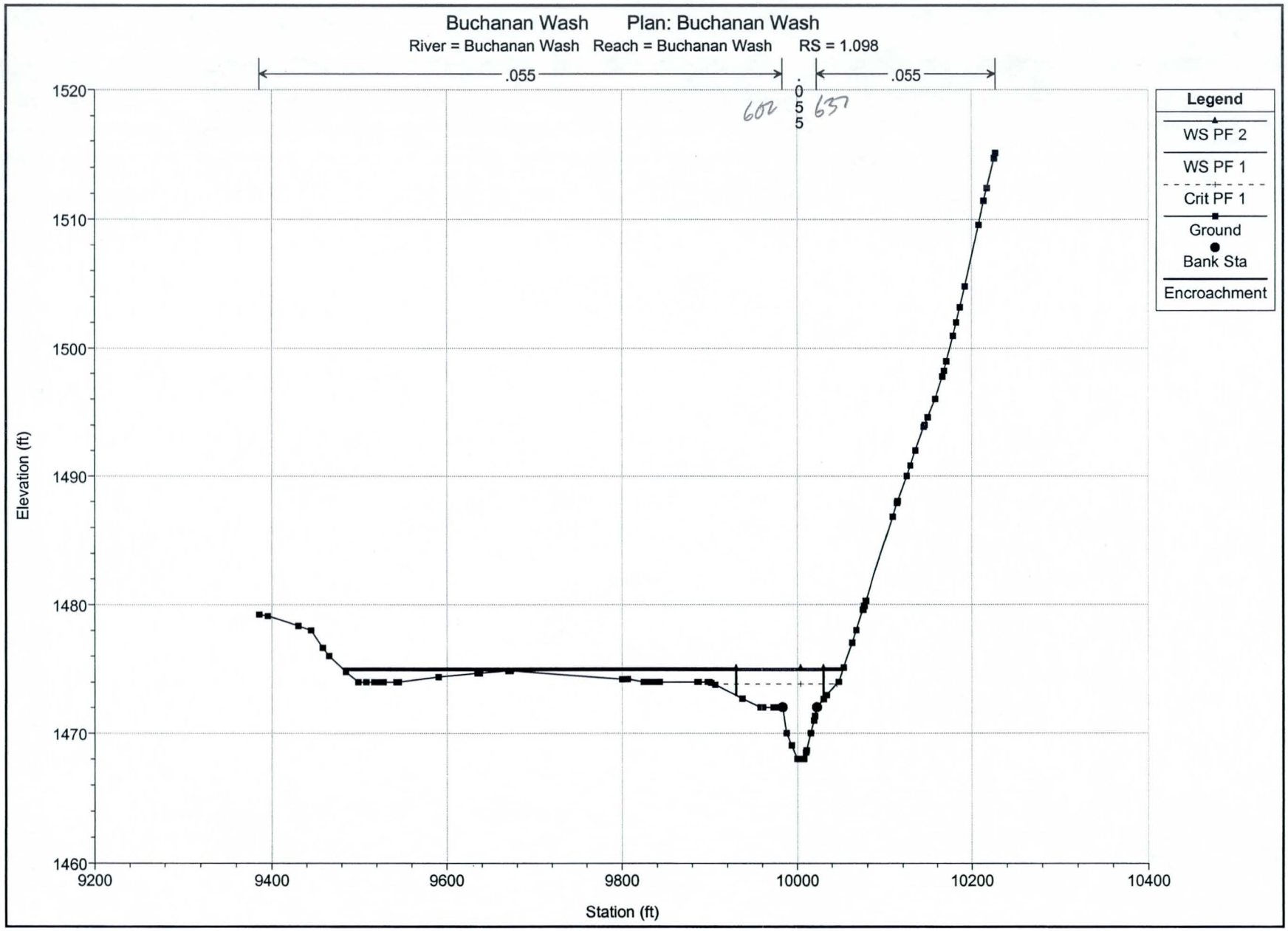
1" = 80'


Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 1.290
.055
.055
.055
762
855
Legend
WS PF 2
WS PF 1
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
1510
1505
1500
1495
1490
1485
1480
1475
9200
9400
9600
9800
10000
10200
10400
10600
Station (ft)

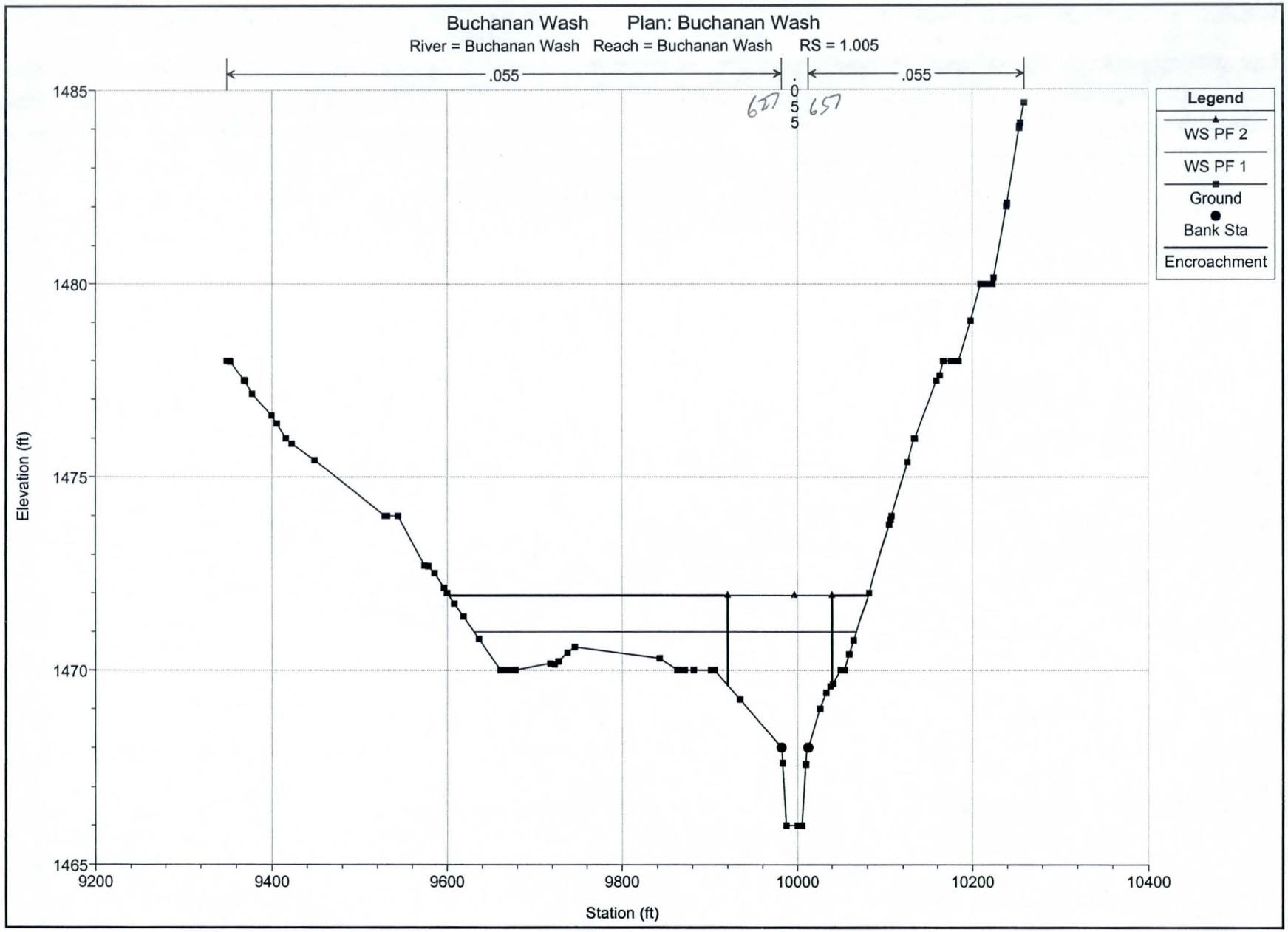
1" = 190'


Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 1.197
.055
.055
.055
667
696
Legend
WS PF 2
WS PF 1
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
1495
1490
1485
1480
1475
1470
9200
9400
9600
9800
10000
10200
Station (ft)

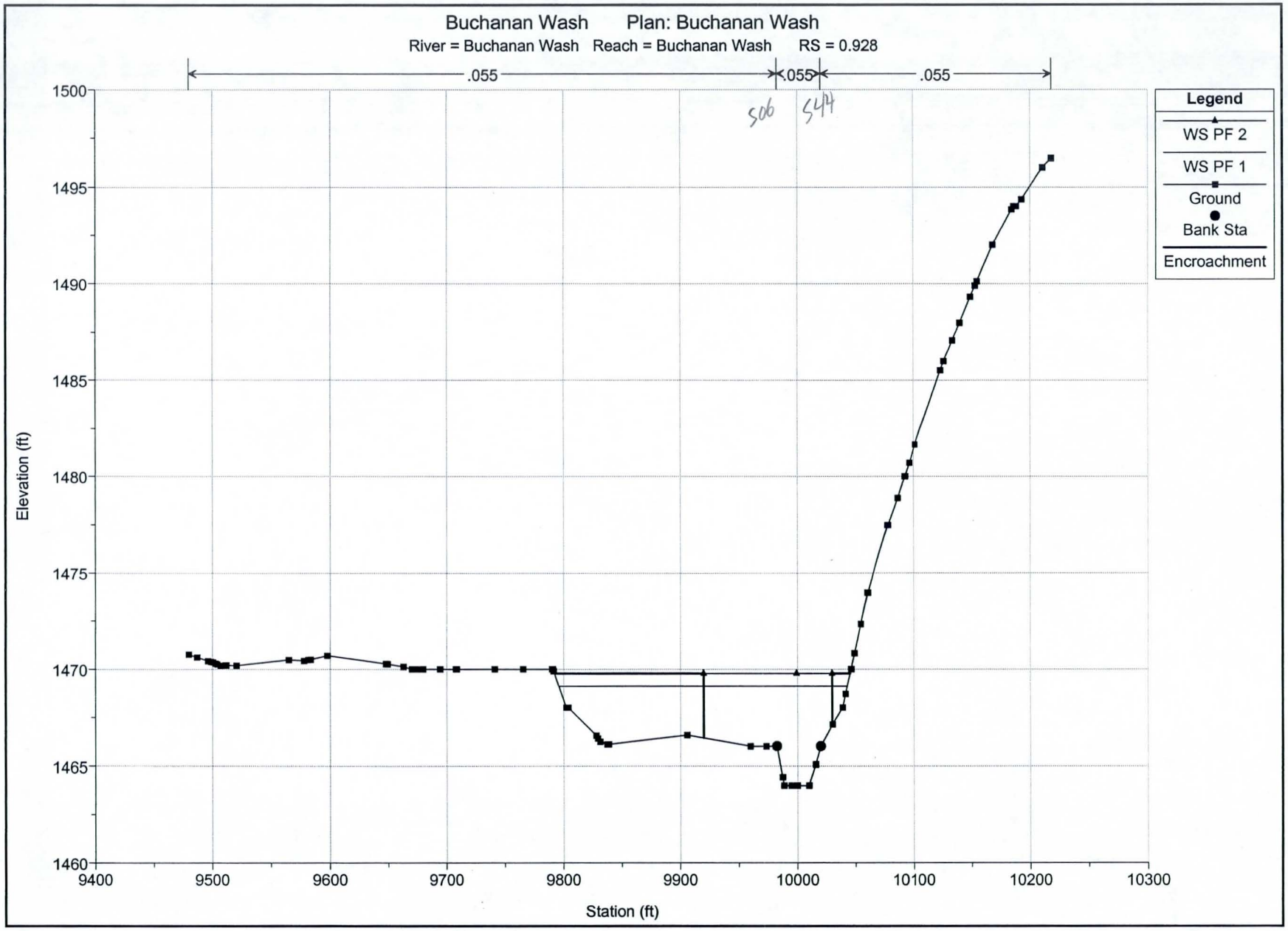
1" = 133'


Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 1.098
.055
.055
.055
602
637
Legend
WS PF 2
WS PF 1
Crit PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1520
1510
1500
1490
1480
1470
1460
9200
9400
9600
9800
10000
10200
10400
Station (ft)

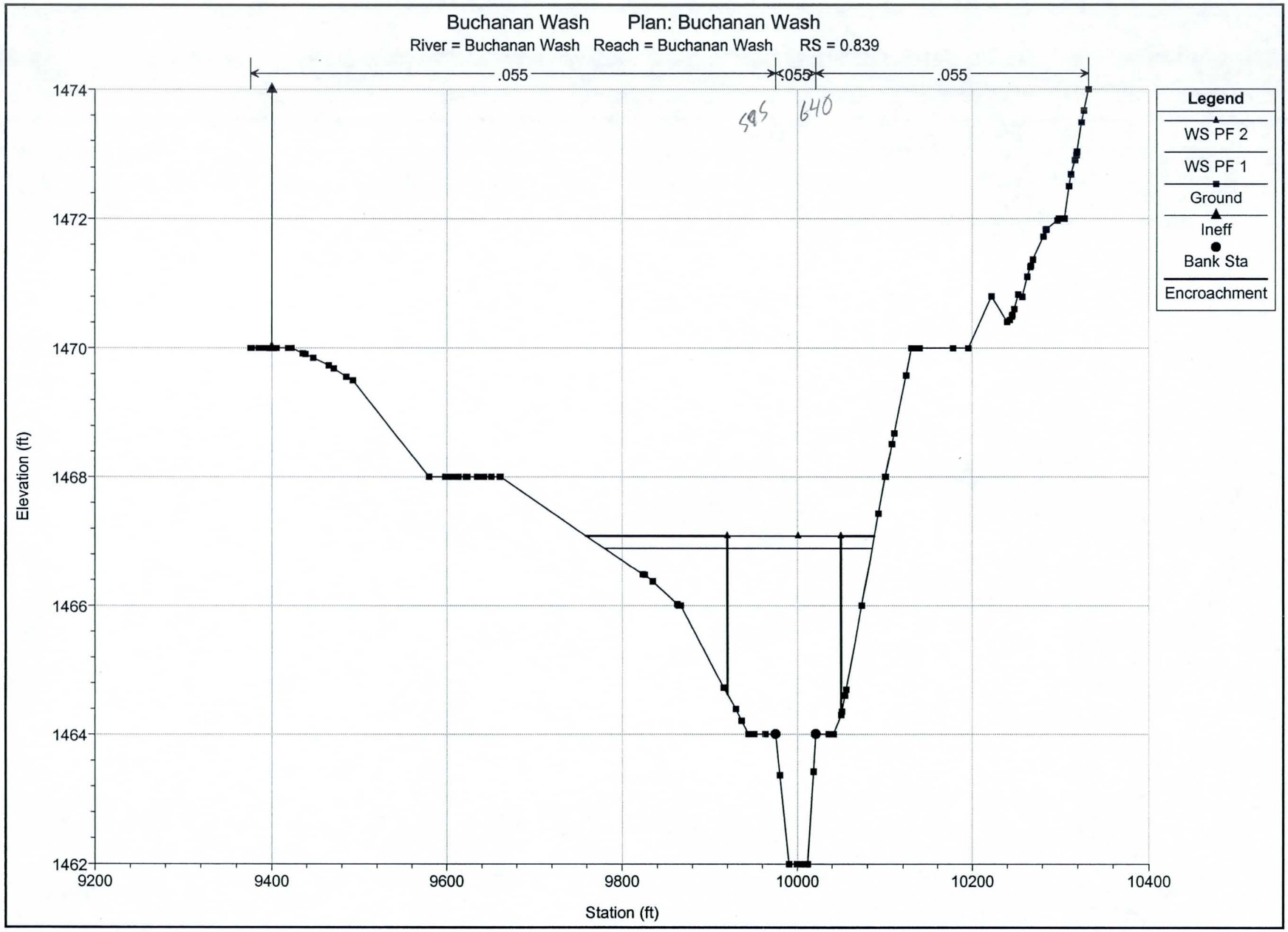
1" = 162'


Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 1.005
.055
.055
.055
657
657
Legend
WS PF 2
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1485
1480
1475
1470
1465
9200
9400
9600
9800
10000
10200
10400
Station (ft)

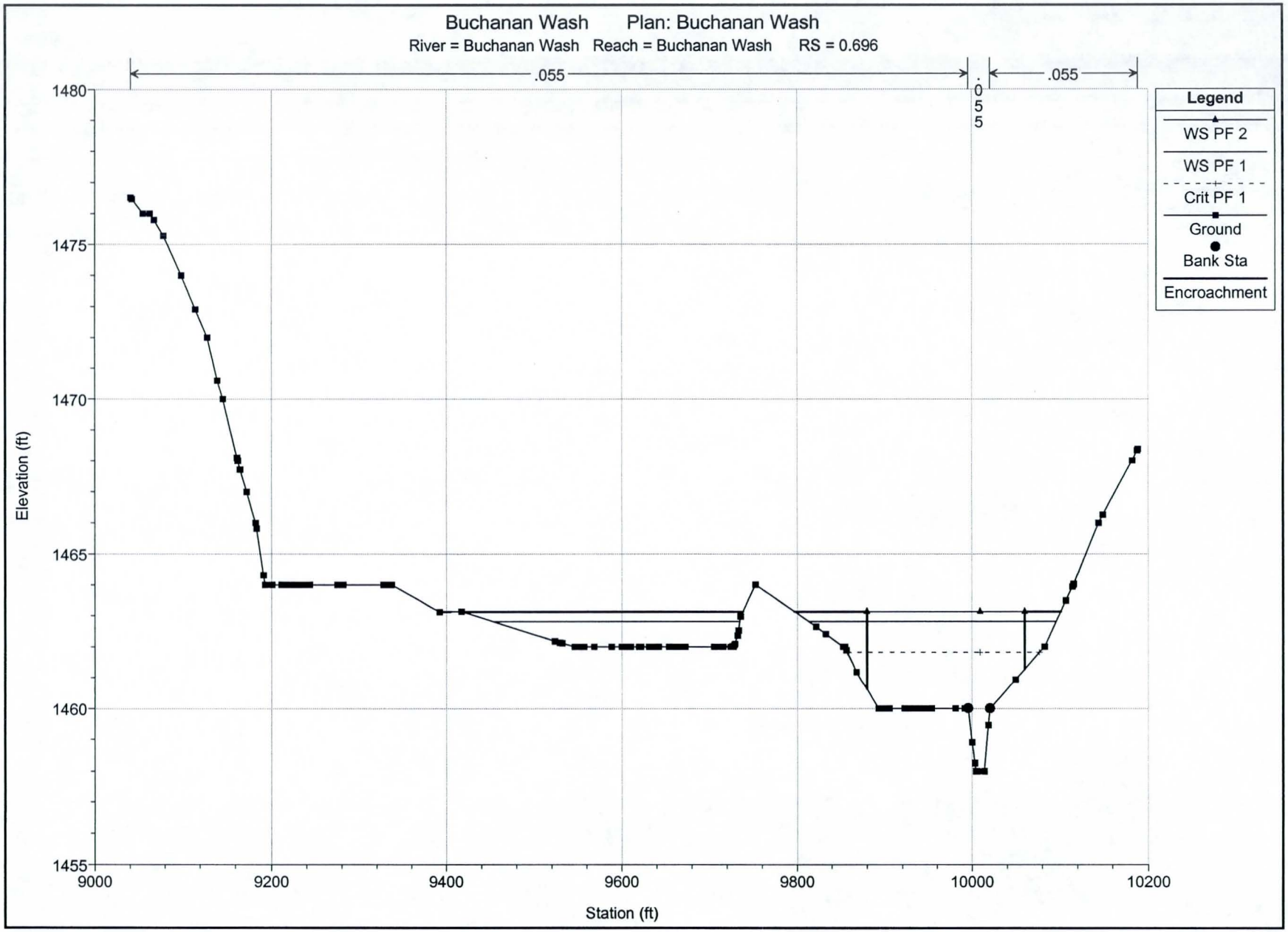
1" = 160'

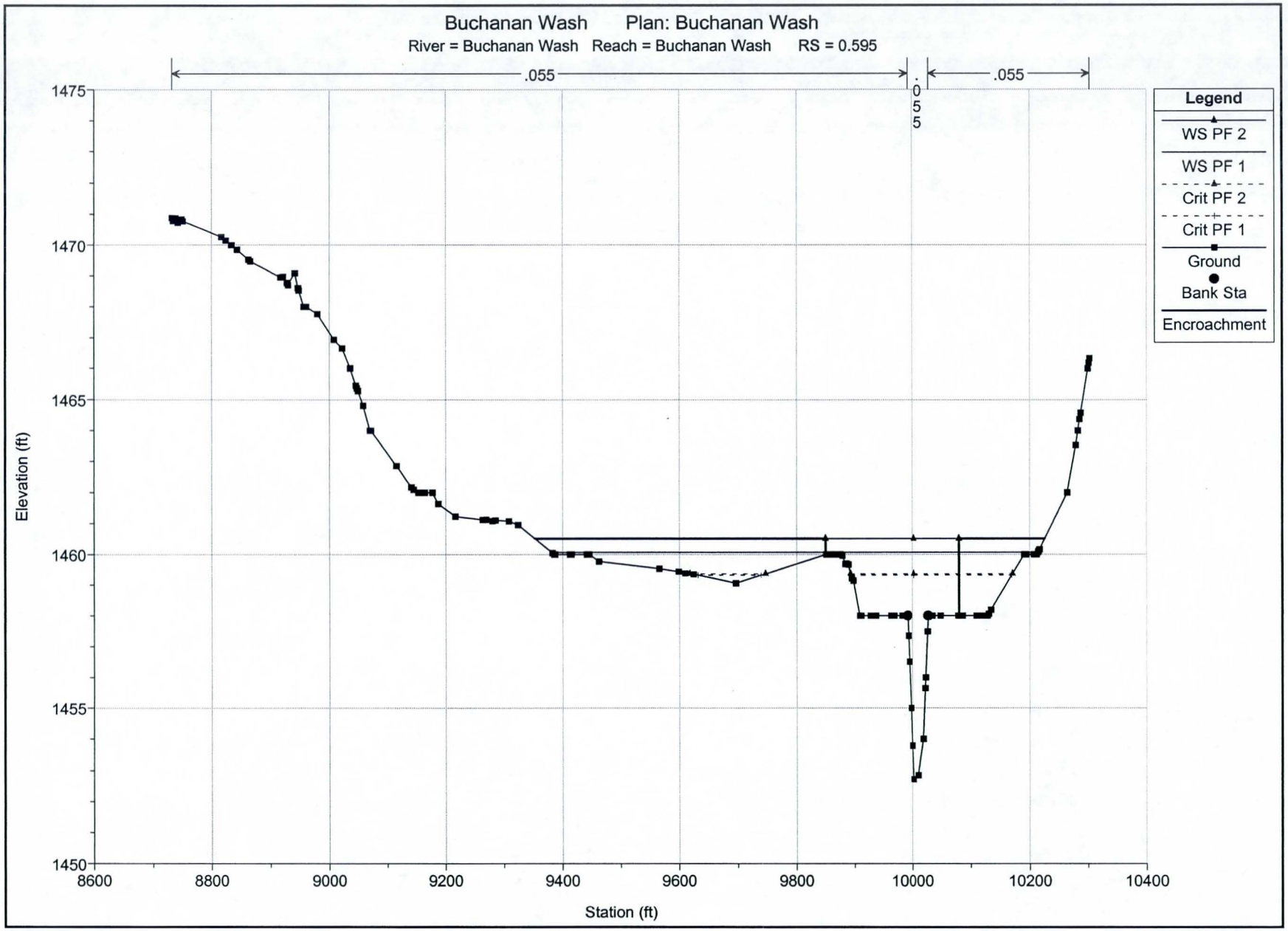

Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 0.928
.055
.055
.055
506
544
Legend
WS PF 2
WS PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1500
1495
1490
1485
1480
1475
1470
1465
1460
9400
9500
9600
9700
9800
9900
10000
10100
10200
10300
Station (ft)

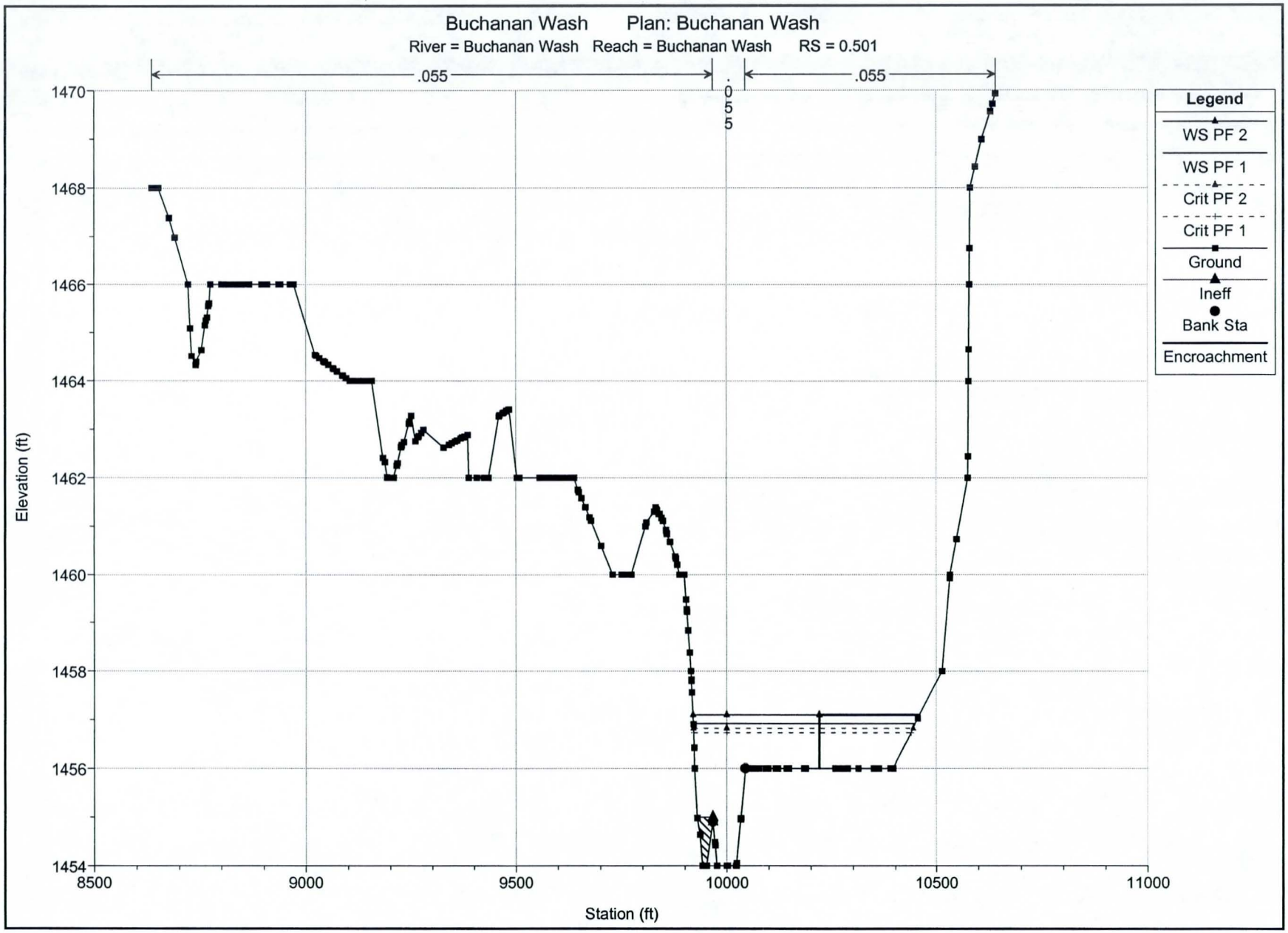
1" = 122'

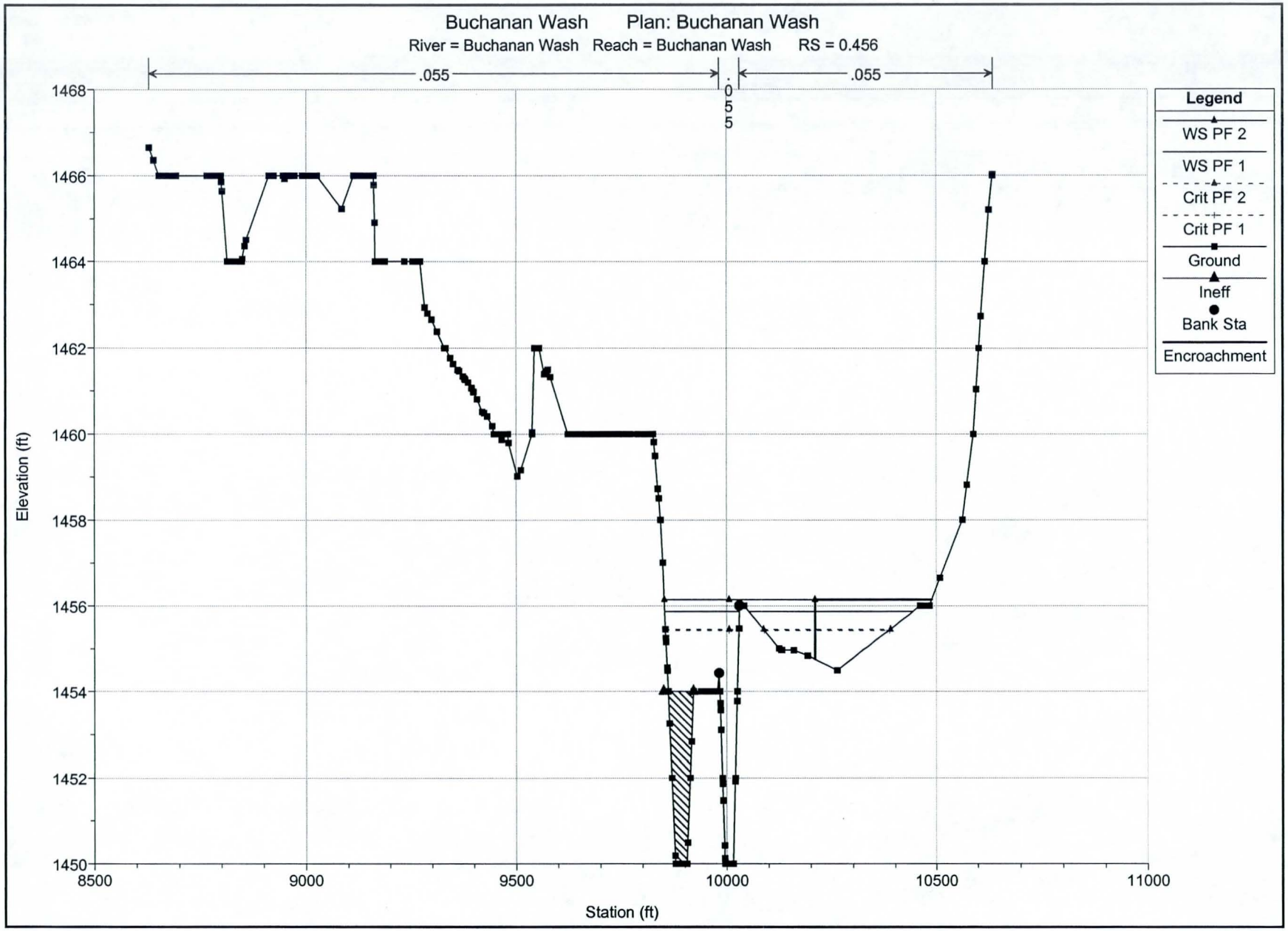

Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 0.839
.055
.055
.055
595
640
Legend
WS PF 2
WS PF 1
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
1474
1472
1470
1468
1466
1464
1462
9200
9400
9600
9800
10000
10200
10400
Station (ft)

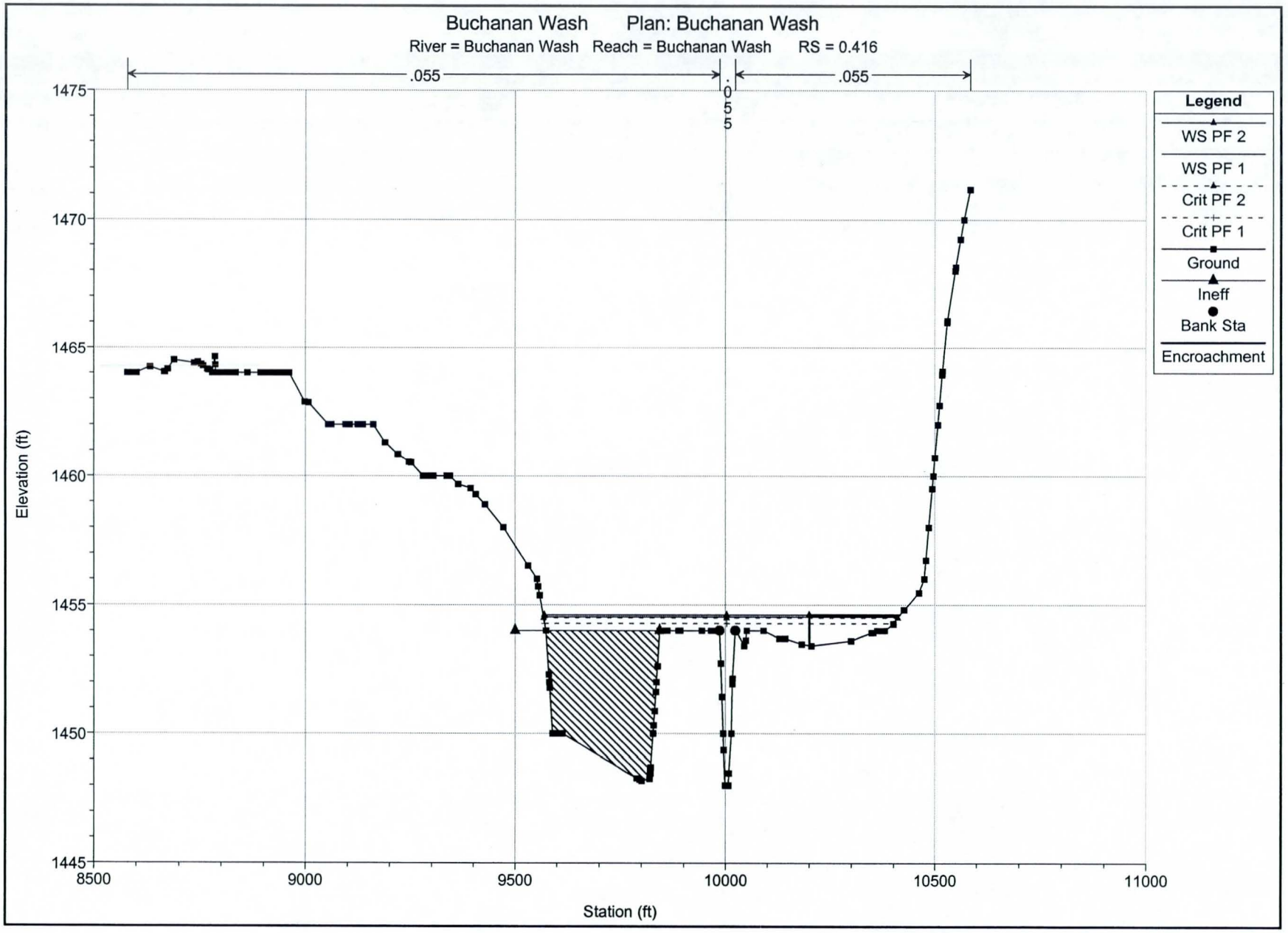
1" = 160'

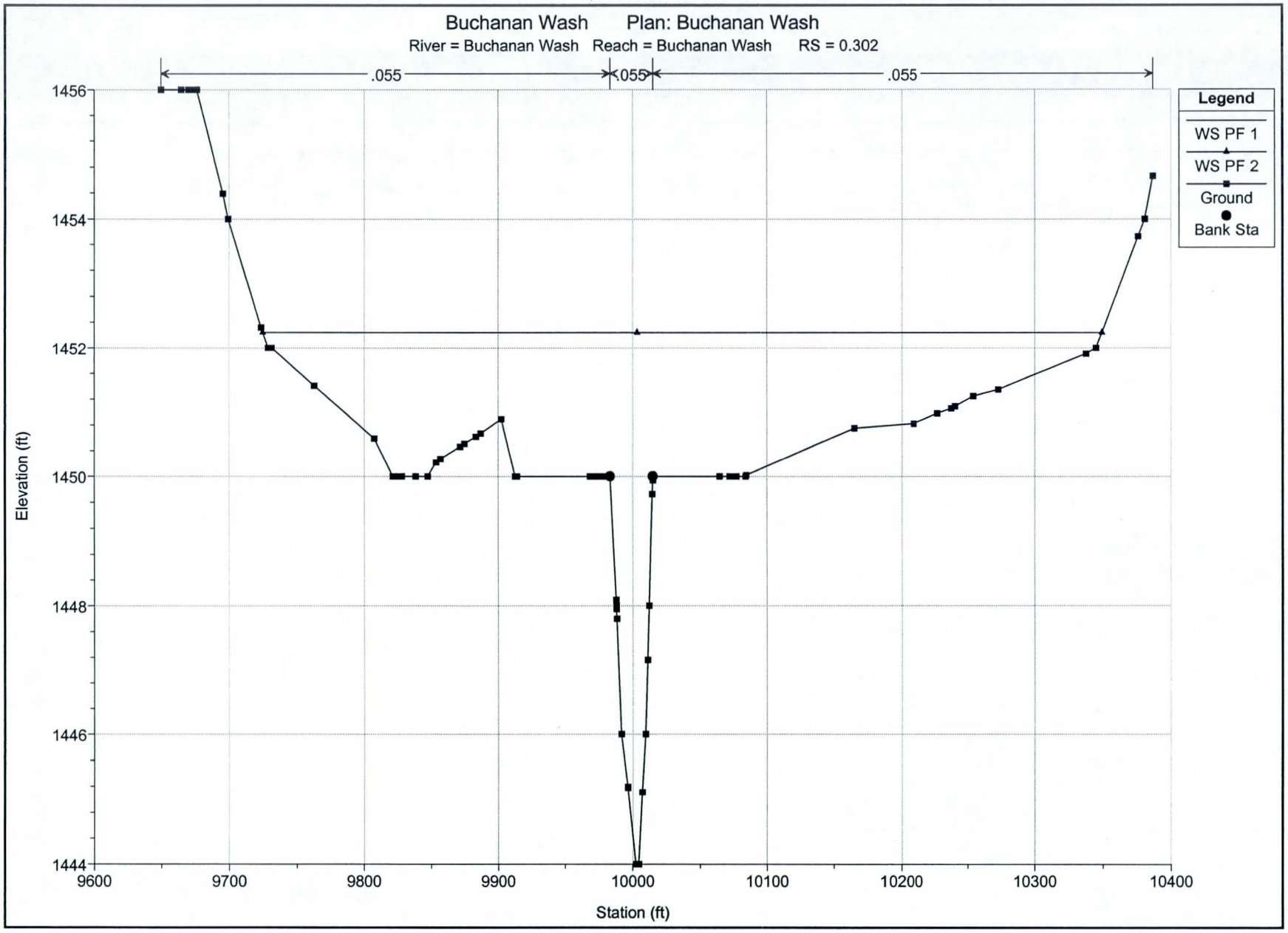

Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 0.696
.055
.055
.055
Legend
WS PF 2
WS PF 1
Crit PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1480
1475
1470
1465
1460
1455
9000
9200
9400
9600
9800
10000
10200
Station (ft)

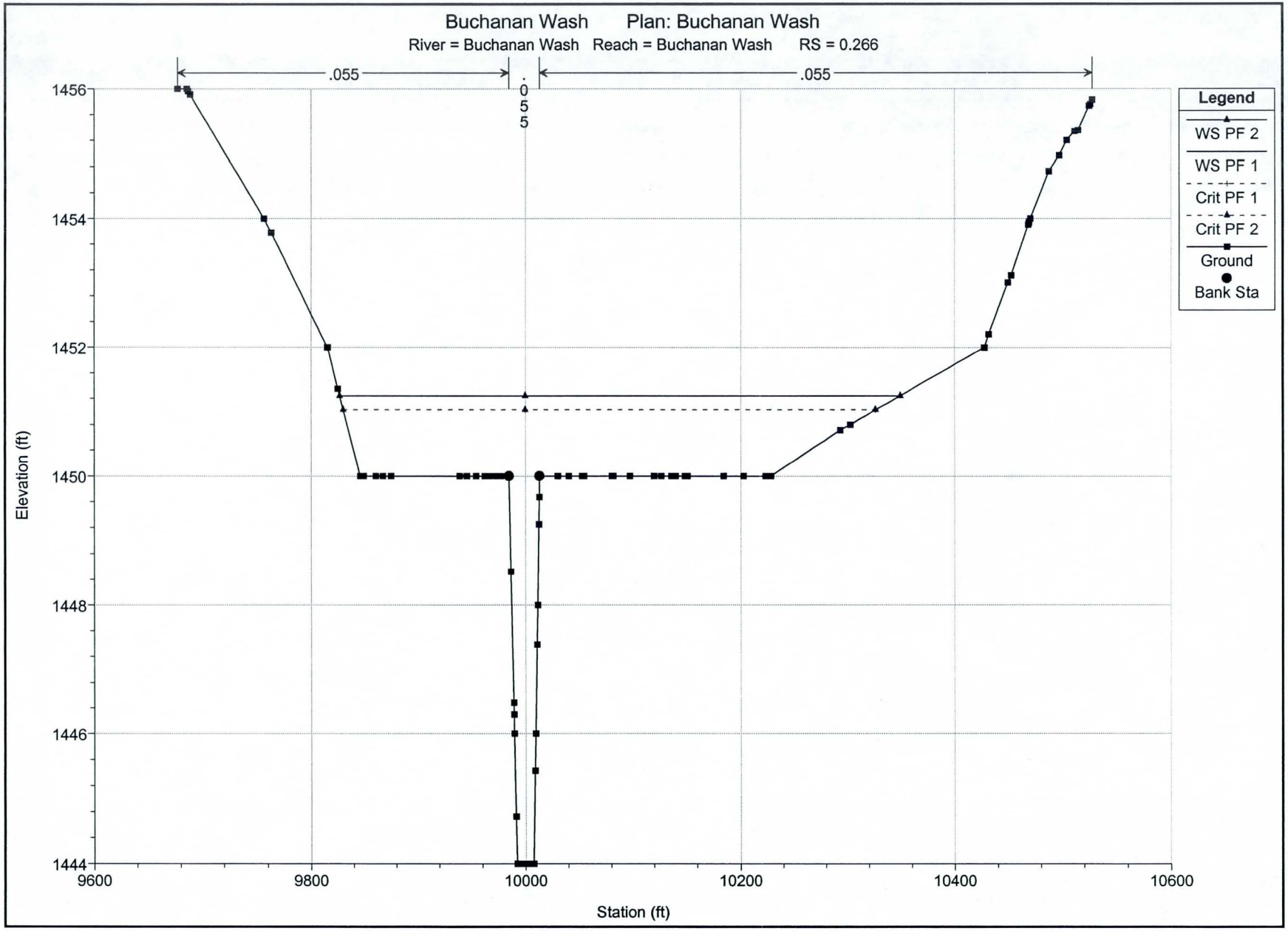

Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 0.595
.055
.055
.055
Legend
WS PF 2
WS PF 1
Crit PF 2
Crit PF 1
Ground
Bank Sta
Encroachment
Elevation (ft)
1475
1470
1465
1460
1455
1450
8600
8800
9000
9200
9400
9600
9800
10000
10200
10400
Station (ft)

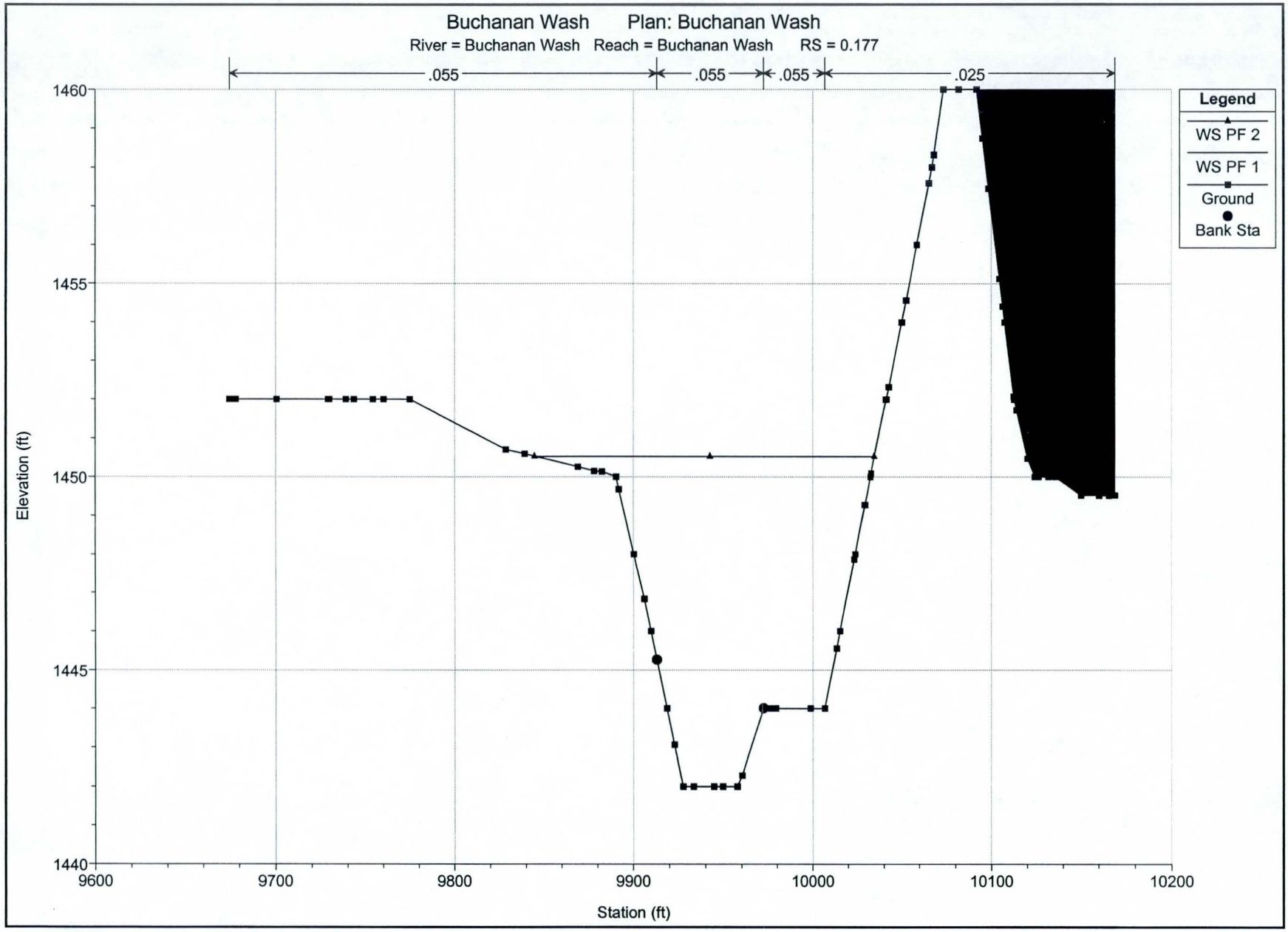

Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 0.501
.055
.055
.055
Legend
WS PF 2
WS PF 1
Crit PF 2
Crit PF 1
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
1470
1468
1466
1464
1462
1460
1458
1456
1454
8500
9000
9500
10000
10500
11000
Station (ft)

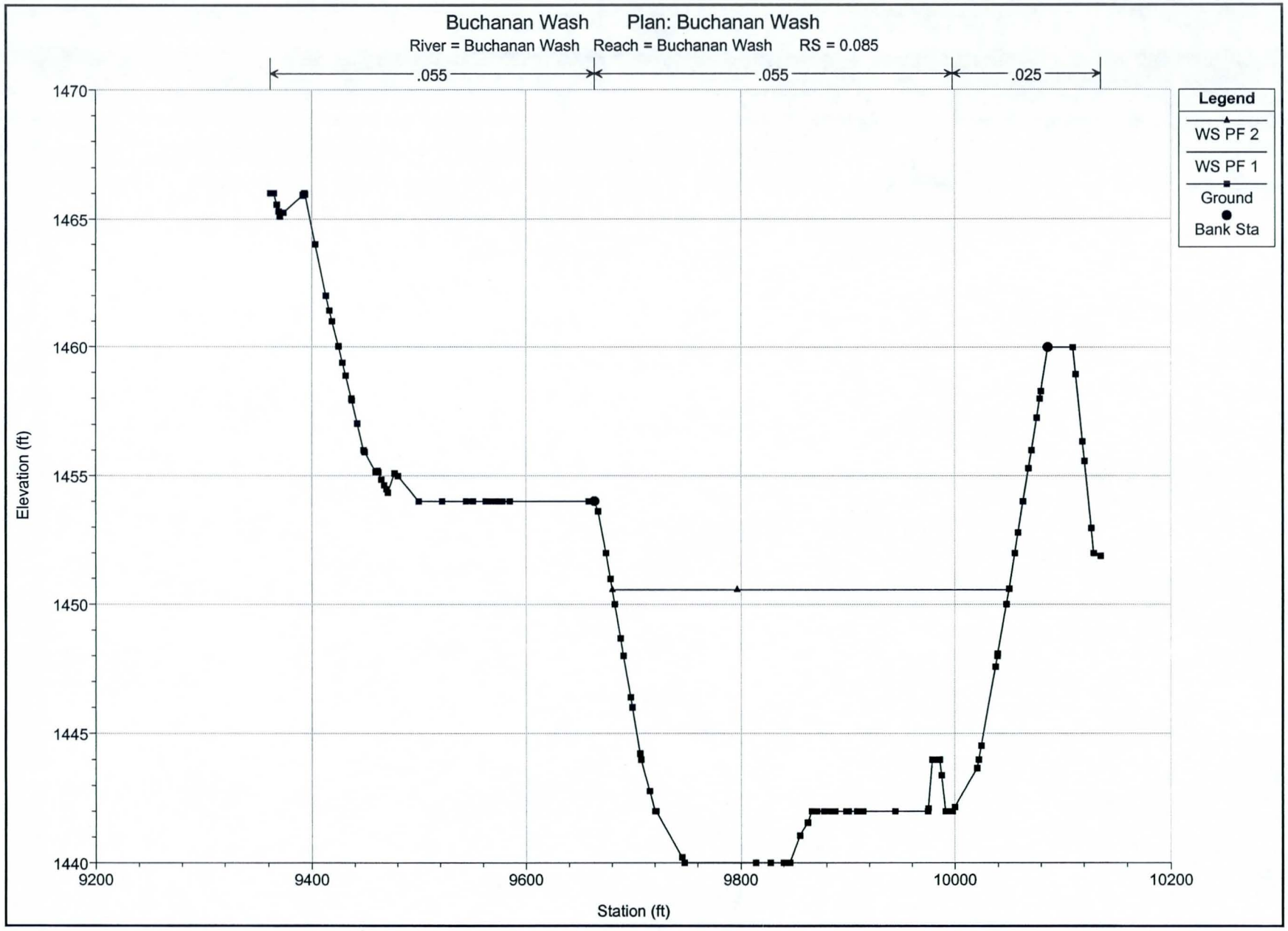

Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 0.456
.055
.055
.055
Legend
WS PF 2
WS PF 1
Crit PF 2
Crit PF 1
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
1468
1466
1464
1462
1460
1458
1456
1454
1452
1450
8500
9000
9500
10000
10500
11000
Station (ft)

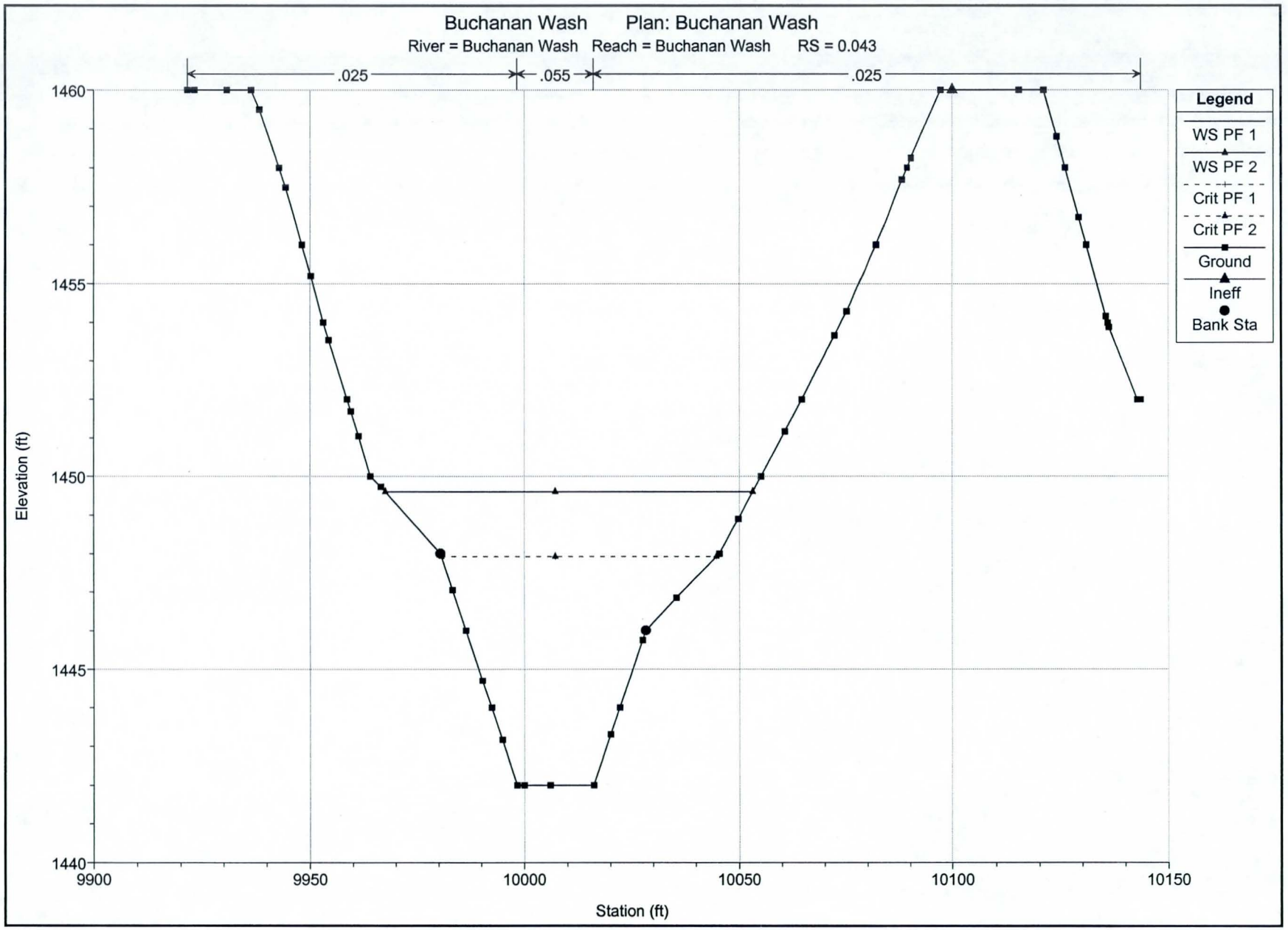

Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 0.416
.055
.055
.055
Legend
WS PF 2
WS PF 1
Crit PF 2
Crit PF 1
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
1475
1470
1465
1460
1455
1450
1445
8500
9000
9500
10000
10500
11000
Station (ft)


Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 0.302
.055
.055
.055
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
1456
1454
1452
1450
1448
1446
1444
9600
9700
9800
9900
10000
10100
10200
10300
10400
Station (ft)


Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 0.266
.055
.055
.055
Legend
WS PF 2
WS PF 1
Crit PF 1
Crit PF 2
Ground
Bank Sta
Elevation (ft)
1456
1454
1452
1450
1448
1446
1444
9600
9800
10000
10200
10400
10600
Station (ft)


Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 0.177
.055
.055
.055
.025
Legend
WS PF 2
WS PF 1
Ground
Bank Sta
Elevation (ft)
1460
1455
1450
1445
1440
9600
9700
9800
9900
10000
10100
10200
Station (ft)


Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 0.085
.055
.055
.025
Legend
WS PF 2
WS PF 1
Ground
Bank Sta
Elevation (ft)
1470
1465
1460
1455
1450
1445
1440
9200
9400
9600
9800
10000
10200
Station (ft)


Buchanan Wash Plan: Buchanan Wash
River = Buchanan Wash Reach = Buchanan Wash RS = 0.043
.025
.055
.025
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Ineff
Bank Sta
Elevation (ft)
1460
1455
1450
1445
1440
9900
9950
10000
10050
10100
10150
Station (ft)

E.3 EXPANSION AND CONTRACTION COEFFICIENTS

A summary of the contraction and expansion coefficients used is provided below.

River Station	Contraction	Expansion
1.935	0.1	0.3
1.916	0.1	0.3
1.842	0.1	0.3
1.766	0.1	0.3
1.67	0.1	0.3
1.575	0.1	0.3
1.479	0.1	0.3
1.412	0.1	0.3
1.356	0.1	0.3
1.332	0.1	0.3
1.326	Culvert	
1.318	0.1	0.3
1.29	0.1	0.3
1.197	0.1	0.3
1.098	0.1	0.3
1.005	0.1	0.3
0.928	0.1	0.3
0.839	0.1	0.3
0.696	0.1	0.3
0.595	0.1	0.3
0.501	0.1	0.3
0.456	0.1	0.5
0.416	0.1	0.3
0.302	0.1	0.3
0.266	0.5	0.3
0.177	0.1	0.3
0.085	0.3	0.3
0.043	0.1	0.5

E.4 ANALYSIS OF STRUCTURES

Plan: BuchWash Buchanan Wash Buchanan Wash RS: 1.326 Profile: PF 1 Culvert ID: Culvert #1

Culv Q (cfs)	785.47	Culv Ful Lngh (ft)	30.00
# Barrels	4	Culv Vel US (ft/s)	7.01
Q Barrel (cfs)	196.37	Culv Vel DS (ft/s)	7.01
E.G. US. (ft)	1481.45	Culv Inv El Up (ft)	1476.00
W.S. US. (ft)	1481.31	Culv Inv El Dn (ft)	1476.00
E.G. DS (ft)	1480.74	Culv Frctn Ls (ft)	0.08
W.S. DS (ft)	1480.30	Culv Ext Lss (ft)	0.32
Delta EG (ft)	0.70	Culv Ent Lss (ft)	0.31
Delta WS (ft)	1.02	Q Weir (cfs)	823.54
E.G. IC (ft)	1481.40	Weir Sta Lft (ft)	9019.30
E.G. OC (ft)	1481.45	Weir Sta Rgt (ft)	9406.16
Culvert Control	Outlet	Weir Submerg	0.00
Culv WS Inlet (ft)	1480.00	Weir Max Depth (ft)	0.95
Culv WS Outlet (ft)	1480.00	Weir Avg Depth (ft)	0.86
Culv Nml Depth (ft)		Wr Flw Area (sq ft)	332.15
Culv Crt Depth (ft)	2.90	Min El Weir Flow (ft)	1480.51

Plan: BuchWash Buchanan Wash Buchanan Wash RS: 1.326 Profile: PF 2 Culvert ID: Culvert #1

Culv Q (cfs)	801.58	Culv Ful Lngh (ft)	30.00
# Barrels	4	Culv Vel US (ft/s)	7.16
Q Barrel (cfs)	200.39	Culv Vel DS (ft/s)	7.16
E.G. US. (ft)	1482.12	Culv Inv El Up (ft)	1476.00
W.S. US. (ft)	1481.97	Culv Inv El Dn (ft)	1476.00
E.G. DS (ft)	1481.20	Culv Frctn Ls (ft)	0.09
W.S. DS (ft)	1480.93	Culv Ext Lss (ft)	0.52
Delta EG (ft)	0.92	Culv Ent Lss (ft)	0.32
Delta WS (ft)	1.05	Q Weir (cfs)	807.42
E.G. IC (ft)	1482.00	Weir Sta Lft (ft)	9190.00
E.G. OC (ft)	1482.12	Weir Sta Rgt (ft)	9340.00
Culvert Control	Outlet	Weir Submerg	0.26
Culv WS Inlet (ft)	1480.00	Weir Max Depth (ft)	1.62
Culv WS Outlet (ft)	1480.00	Weir Avg Depth (ft)	1.62
Culv Nml Depth (ft)		Wr Flw Area (sq ft)	243.66
Culv Crt Depth (ft)	2.94	Min El Weir Flow (ft)	1480.51

E.5-1 HYDRAULIC CALCULATIONS
HEC-2 EFFECTIVE FIS OUTPUT

BUCHANA WASH

SUMMARY PRINTOUT TABLE 110

SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
0.71	1460.42	0	1460.42	1064.97	925.88	210.74	1167.38	0	0	9985	10025	0
0.71	1461.42	1	1461.43	657.83	901.1	255.2	1147.7	0.28	9693.17	9985	10025	10351
0.71	1461.42	1	1461.43	658	901.37	255.15	1147.48	658	9693	9985	10025	10351
0.71	1461.42	1	1461.43	657.83	901.1	255.2	1147.7	0.28	9693.17	9985	10025	10351
0.782	1460.44	0	1460.45	902.21	565.22	271.71	1467.08	0	0	9966	10032	0
0.782	1461.44	1	1461.45	539.31	315.04	371.59	1617.38	0.33	9889.19	9966	10032	10446.8
0.782	1461.44	1	1461.45	538.69	315.87	372.07	1616.06	557	9889	9966	10032	10446
0.782	1461.44	1	1461.45	539.31	315.04	371.59	1617.38	0.33	9889.19	9966	10032	10446.8
0.89	1460.51	0	1460.71	758.28	792.59	894.24	617.17	0	0	9971	10014	0
0.89	1461.41	0.89	1461.77	177.64	1034.49	1269.51	0	0.59	9836.36	9971	10014	10014
0.89	1461.41	0.89	1461.77	178	1034.6	1269.4	0	178	9836	9971	10014	10014
0.89	1461.41	0.89	1461.77	177.64	1034.49	1269.51	0	0.59	9836.36	9971	10014	10014
0.985	1463.22	0	1463.43	583.56	1264.54	776.71	262.75	0	0	9978	10019	0
0.985	1464.31	1.09	1464.68	114.45	1204.18	1099.82	0	0.54	9904.55	9978	10019	10019
0.985	1464.21	0.99	1464.54	124	1289.24	1014.76	0	124	9895	9978	10019	10019
0.985	1464.22	1	1464.55	123.27	1284.37	1019.63	0	0.47	9895.73	9978	10019	10019
1.12	1466.57	0	1466.85	279.35	695.15	1339.67	269.18	0	0	9974	10037	0
1.12	1467.63	1.06	1468.07	88.24	423.35	1880.65	0	0.43	9948.76	9974	10037	10037
1.12	1467.42	0.85	1467.87	93	486.82	1817.18	0	93	9944	9974	10037	10037
1.12	1467.43	0.86	1467.88	92.35	478.23	1825.77	0	0.39	9944.65	9974	10037	10037
1.207	1469.05	0	1469.46	235.41	947.92	1154.85	201.23	0	0	9997	10030	0
1.207	1470.13	1.09	1470.74	88.73	817.91	1486.09	0	0.42	9941.27	9997	10030	10030
1.207	1470.02	0.97	1470.59	96	867.28	1436.72	0	96	9934	9997	10030	10030
1.207	1470.03	0.98	1470.61	95.12	860.84	1443.16	0	0.39	9934.88	9997	10030	10030
1.288	1471.57	0	1471.82	306.88	1112.2	894.42	297.38	0	0	9994	10032	0
1.288	1472.68	1.11	1473.11	93.61	1089.94	1214.06	0	0.62	9938.39	9994	10032	10032
1.288	1472.52	0.95	1472.9	103	1165.21	1138.79	0	103	9929	9994	10032	10032
1.288	1472.53	0.96	1472.91	103.08	1166.55	1137.45	0	0.54	9928.92	9994	10032	10032
SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
1.383	1474.27	0	1474.77	235.9	746.3	1410.59	147.11	0	0	9992	10030	0
1.383	1475.33	1.07	1476.08	63.77	464.66	1839.33	0	0.41	9966.23	9992	10030	10030
1.383	1475.11	0.85	1475.83	69	550.27	1753.73	0	69	9961	9992	10030	10030
1.383	1475.12	0.85	1475.84	68.63	545.66	1758.34	0	0.35	9961.37	9992	10030	10030
1.483	1477.26	0	1477.5	253.88	59.33	1074.63	475.04	0	0	9971	10025	0
1.483	1478.45	1.18	1478.78	63.45	0	1486.69	122.31	0.41	9971	9971	10025	10034.45
1.483	1478.23	0.97	1478.55	69	0	1405.9	203.09	69	9971	9971	10025	10040
1.483	1478.24	0.98	1478.56	69.27	0	1403.05	205.95	0.35	9971	9971	10025	10040.27
1.572	1478.98	0	1479.11	300.62	668.24	491.68	449.07	0	0	9985	10020	0
1.572	1480.07	1.1	1480.3	106.92	548.71	728.38	331.91	0.47	9941.18	9985	10020	10048.1
1.572	1479.89	0.92	1480.12	113	563.18	707.31	338.51	113	9938	9985	10020	10051
1.572	1479.9	0.92	1480.13	113.7	562.93	704.41	341.67	0.44	9937.84	9985	10020	10051.54
1.638	1480.59	0	1480.99	260.84	454.05	1041.41	113.54	0	0	9970	10020	0
1.638	1481.51	0.91	1482.27	54.9	35.42	1573.58	0	0.51	9965.1	9970	10020	10020
1.638	1481.42	0.83	1482.13	62	99.85	1509.15	0	62	9958	9970	10020	10020
1.638	1481.42	0.82	1482.13	61.53	95.28	1513.72	0	0.48	9958.47	9970	10020	10020
1.695	1482.64	0	1482.82	340.44	399.86	695.95	513.18	0	0	9978	10016	0
1.695	1483.79	1.15	1484.08	106	186.61	988.14	434.26	0.51	9955.21	9978	10016	10061.21
1.695	1483.62	0.98	1483.88	122	224.29	914.73	469.98	122	9950	9978	10016	10072
1.695	1483.62	0.99	1483.89	121.64	221.05	915.91	472.04	0.44	9950.48	9978	10016	10072.12

1.761	1484.51	0	1484.97	403.41	130.33	1068.76	409.91	0	0	9980	10017	0
1.761	1485.43	0.92	1486.28	48.69	0	1504.82	104.18	0.57	9980	9980	10017	10028.69
1.761	1485.23	0.72	1486.01	61	0	1418.08	190.91	61	9980	9980	10017	10041
1.761	1485.23	0.72	1486	61.82	0	1411.29	197.71	0.5	9980	9980	10017	10041.82
1.856	1487.51	0	1487.87	151.11	209.37	1197.28	202.34	0	0	9980	10019	0
1.856	1488.68	1.18	1489.22	42.16	19.07	1585.01	4.91	0.37	9977.84	9980	10019	10020
1.856	1488.46	0.95	1488.95	50	67.82	1497.87	43.31	50	9974	9980	10019	10024
1.856	1488.45	0.94	1488.95	49.54	61.09	1504.03	43.88	0.31	9974.51	9980	10019	10024.04
1.951	1489.53	0	1489.81	129.15	674.1	866.36	68.55	0	0	9981	10011	0
1.951	1490.75	1.22	1491.11	60.01	520.14	1088.85	0	0.33	9950.99	9981	10011	10011
1.951	1490.49	0.97	1490.83	66	583.09	1025.91	0	66	9945	9981	10011	10011
1.951	1490.51	0.98	1490.85	65.4	576.25	1032.75	0	0.28	9945.6	9981	10011	10011
2.045	1491.87	0	1492.11	281.71	591.43	650.8	366.77	0	0	9988	10019	0
2.045	1492.96	1.09	1493.36	99.26	482.18	930.44	196.38	0.5	9946.28	9988	10019	10045.54
2.045	1492.73	0.86	1493.1	111	519.26	875.17	214.56	111	9939	9988	10019	10050
2.045	1492.74	0.87	1493.11	111.87	516.71	869.09	223.2	0.43	9939.03	9988	10019	10050.9
2.121	1494.43	0	1494.85	136.39	254.62	939.59	113.79	0	0	9980	10019	0
2.121	1495.46	1.03	1496.11	39	0	1308	0	0.4	9980	9980	10019	10019
2.121	1495.23	0.8	1495.88	43	42.6	1265.4	0	43	9976	9980	10019	10019
2.121	1495.21	0.79	1495.88	42.52	36.27	1271.73	0	0.36	9976.48	9980	10019	10019
SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
2.2	1496	0	1496.06	336.4	728.22	579.77	0	0	0	9959	10036	0
2.2	1497.17	1.17	1497.26	170.9	455.57	852.43	0	0.44	9861.97	9959	10036	10036
2.2	1496.95	0.95	1497.03	187.32	519.87	788.13	0	191	9845	9959	10036	10036
2.2	1496.95	0.95	1497.03	187	518.78	789.22	0	0.38	9845.33	9959	10036	10036

E.5-2 HYDRAULIC CALCULATIONS
HEC-RAS DUPLICATE EFFECTIVE MODEL
(HEC-2 COMPUTATIONAL CONVEYANCE METHOD)

```
HEC-RAS Version 3.0.1  Mar 2001
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

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

PROJECT DATA
Project Title: Buchanan Wash Duplicate_HEC_2 Mode
Project File : DuplicateHEC2Mode.prj
Run Date and Time: 9/7/01 11:08:22 AM

Project in English units

Project Description:
FLOOD PLAIN ANALYSIS - MARICOPA COUNTY FLOOD CONTROL DIST.

FLD'WAY ENCROACH CALC. (NATURAL CONDITON) - 100 YR/6 HR STORM
BUCHANAN
WASH SKUNK CREEK TO C.A.P. CANAL OCT, 1987

PLAN DATA

Plan Title: Imported Plan 01
Plan File : p:\Emcn-002\BW\Model\Duplicate\DuplicateHEC2Mode.p01

Geometry Title: Imported Geom 01
Geometry File : p:\Emcn-002\BW\Model\Duplicate\DuplicateHEC2Mode.g01

Flow Title : Imported Flow 01
Flow File : p:\Emcn-002\BW\Model\Duplicate\DuplicateHEC2Mode.f01

Plan Description:
FP Profile 1
FW Profile 3
Conveyance Computational Method is set on HEC-2
Method
Computed HEC-2 Style

Plan Summary Information:

Number of:	Cross Sections =	18	Mulitple Openings =	0
	Culverts =	0	Inline Weirs =	0
	Bridges =	0		

Computational Information
Water surface calculation tolerance = 0.003
Critical depth calculaton tolerance = 0.003
Maximum number of interations = 20
Maximum difference tolerance = 0.1
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: Between every coordinate point (HEC2 Style)
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

Encroachment Data
Equal Conveyance = True
Left Offset = 0
Right Offset = 0

River = RIVER-1 Reach = Reach-1

RS	Profile	Method	Value1	Value2
2.2	PF 2	4	1	
2.121	PF 2	4	1	
2.045	PF 2	4	1	
1.951	PF 2	4	1	
1.856	PF 2	4	1	
1.761	PF 2	4	1	
1.695	PF 2	4	1	
1.638	PF 2	4	1	
1.572	PF 2	4	1	
1.483	PF 2	4	1	
1.383	PF 2	4	1	
1.288	PF 2	4	1	
1.207	PF 2	4	1	
1.12	PF 2	4	1	
0.985	PF 2	4	1	
0.89	PF 2	4	1	
0.782	PF 2	4	1	
0.71	PF 2	4	1	

River = RIVER-1 Reach = Reach-1

RS	Profile	Method	Value1	Value2
2.2	PF 3	1	9845	10036
2.121	PF 3	1	9976	10019
2.045	PF 3	1	9939	10050
1.951	PF 3	1	9945	10011
1.856	PF 3	1	9974	10024
1.761	PF 3	1	9980	10041
1.695	PF 3	1	9950	10072
1.638	PF 3	1	9958	10020
1.572	PF 3	1	9938	10051
1.483	PF 3	1	9971	10040
1.383	PF 3	1	9961	10030
1.288	PF 3	1	9929	10032
1.207	PF 3	1	9934	10030
1.12	PF 3	1	9944	10037
0.985	PF 3	1	9895	10019
0.89	PF 3	1	9836	10014
0.782	PF 3	1	9889	10446
0.71	PF 3	1	9693	10351

River = RIVER-1 Reach = Reach-1

RS	Profile	Method	Value1	Value2
2.2	PF 4	4	.8	
2.121	PF 4	4	.8	
2.045	PF 4	4	.8	
1.951	PF 4	4	.8	
1.856	PF 4	4	.8	
1.761	PF 4	4	.8	
1.695	PF 4	4	.9	
1.638	PF 4	4	.9	
1.572	PF 4	4	.8	
1.483	PF 4	4	.8	
1.383	PF 4	4	.8	
1.288	PF 4	4	.9	
1.207	PF 4	4	.9	
1.12	PF 4	4	.8	
0.985	PF 4	4	1	
0.89	PF 4	4	1	
0.782	PF 4	4	1	
0.71	PF 4	4	1	

FLOW DATA

Flow Title: Imported Flow 01
Flow File : p:\Emcn-002\BW\Model\Duplicate\DuplicateHEC2Mode.f01

Flow Data (cfs)

River	Reach	RS	PF 1	PF 2	PF 3	PF 4
RIVER-1	Reach-1	2.2	1308	1308	1308	1308
RIVER-1	Reach-1	2.045	1609	1609	1609	1609
RIVER-1	Reach-1	1.383	2304	2304	2304	2304

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
RIVER-1	Reach-1	PF 1		Known WS = 1460.42
RIVER-1	Reach-1	PF 2		Known WS = 1461.42
RIVER-1	Reach-1	PF 3		Known WS = 1461.42
RIVER-1	Reach-1	PF 4		Known WS = 1461.42

SUMMARY OF MANNING'S N VALUES

River:RIVER-1

Reach	River Sta.	n1	n2	n3
Reach-1	2.2	.055	.055	.055
Reach-1	2.121	.055	.055	.055
Reach-1	2.045	.055	.055	.055
Reach-1	1.951	.055	.055	.055
Reach-1	1.856	.055	.055	.055
Reach-1	1.761	.055	.055	.055
Reach-1	1.695	.055	.055	.055
Reach-1	1.638	.055	.055	.055
Reach-1	1.572	.055	.055	.055
Reach-1	1.483	.055	.055	.055
Reach-1	1.383	.055	.055	.055
Reach-1	1.288	.055	.055	.055
Reach-1	1.207	.055	.055	.055
Reach-1	1.12	.055	.055	.055
Reach-1	0.985	.055	.055	.055
Reach-1	0.89	.055	.055	.055
Reach-1	0.782	.055	.055	.055
Reach-1	0.71	.055	.055	.055

SUMMARY OF REACH LENGTHS

River: RIVER-1

Reach	River Sta.	Left	Channel	Right
Reach-1	2.2	400	417	425
Reach-1	2.121	405	410	415
Reach-1	2.045	505	505	510
Reach-1	1.951	510	502	495
Reach-1	1.856	502	502	502
Reach-1	1.761	360	350	340

Reach-1	1.695	297	300	303
Reach-1	1.638	360	350	330
Reach-1	1.572	410	470	500
Reach-1	1.483	530	528	528
Reach-1	1.383	470	502	510
Reach-1	1.288	380	428	440
Reach-1	1.207	450	459	480
Reach-1	1.12	640	713	730
Reach-1	0.985	600	502	490
Reach-1	0.89	740	570	400
Reach-1	0.782	380	380	360
Reach-1	0.71	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

Reach	River Sta.	Contr.	Expan.
Reach-1	2.2	.1	.3
Reach-1	2.121	.1	.3
Reach-1	2.045	.1	.3
Reach-1	1.951	.1	.3
Reach-1	1.856	.1	.3
Reach-1	1.761	.1	.3
Reach-1	1.695	.1	.3
Reach-1	1.638	.1	.3
Reach-1	1.572	.1	.3
Reach-1	1.483	.1	.3
Reach-1	1.383	.1	.3
Reach-1	1.288	.1	.3
Reach-1	1.207	.1	.3
Reach-1	1.12	.1	.3
Reach-1	0.985	.1	.3
Reach-1	0.89	.1	.3
Reach-1	0.782	.1	.3
Reach-1	0.71	.1	.3

Profile Output Table - Standard Table 1

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Ve
1 Chnl	Flow Area	Top Width	Froude # Chl					
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	
(ft/s)	(sq ft)	(ft)						
Reach-1	2.2	1308.00	1490.50	1496.0		1496.07	0.001524	
2.38	674.67	336.31	0.23					
Reach-1	2.2	1308.00	1490.50	1497.2		1497.26	0.001307	
2.60	566.17	171.16	0.22					
Reach-1	2.2	1308.00	1490.50	1496.9		1497.03	0.001315	
2.53	586.36	187.31	0.22					
Reach-1	2.2	1308.00	1490.50	1496.9		1497.02	0.001341	
2.55	581.56	186.48	0.22					
Reach-1	2.121	1308.00	1488.70	1494.4		1494.85	0.007239	
5.81	286.35	136.57	0.50					
Reach-1	2.121	1308.00	1488.70	1495.5		1496.11	0.007961	
6.50	201.09	39.00	0.50					
Reach-1	2.121	1308.00	1488.70	1495.2		1495.88	0.007752	
6.58	204.63	43.00	0.52					
Reach-1	2.121	1308.00	1488.70	1495.2		1495.86	0.007769	
6.57	205.39	43.55	0.52					
Reach-1	2.045	1609.00	1486.60	1491.9		1492.12	0.006056	
5.13	456.65	281.18	0.45					
Reach-1	2.045	1609.00	1486.60	1493.0		1493.35	0.005651	
5.79	340.66	99.44	0.45					

Reach-1	2.045		1609.00	1486.60	1492.7		1493.10	0.005813
5.70	352.05	111.00	0.45					
Reach-1	2.045		1609.00	1486.60	1492.7		1493.10	0.005700
5.65	355.55	111.74	0.45					
Reach-1	1.951		1609.00	1482.90	1489.5		1489.81	0.003556
5.00	408.64	129.19	0.37					
Reach-1	1.951		1609.00	1482.90	1490.7		1491.08	0.003620
5.22	339.55	59.99	0.35					
Reach-1	1.951		1609.00	1482.90	1490.5		1490.83	0.003543
5.08	352.84	66.00	0.34					
Reach-1	1.951		1609.00	1482.90	1490.5		1490.83	0.003640
5.14	348.37	65.22	0.35					
Reach-1	1.856		1609.00	1480.70	1487.5		1487.87	0.004171
5.41	383.70	150.73	0.40					
Reach-1	1.856		1609.00	1480.70	1488.7		1489.19	0.003853
5.88	284.35	43.47	0.40					
Reach-1	1.856		1609.00	1480.70	1488.5		1488.95	0.003867
5.78	298.40	50.00	0.39					
Reach-1	1.856		1609.00	1480.70	1488.4		1488.91	0.003918
5.79	298.42	50.64	0.40					
Reach-1	1.761		1609.00	1479.10	1484.5		1484.97	0.008434
6.49	398.86	403.81	0.54					
Reach-1	1.761		1609.00	1479.10	1485.4		1486.26	0.009577
7.55	226.31	49.83	0.57					
Reach-1	1.761		1609.00	1479.10	1485.2		1486.01	0.009680
7.43	238.70	61.00	0.58					
Reach-1	1.761		1609.00	1479.10	1485.3		1486.05	0.008858
7.18	248.18	62.74	0.55					
Reach-1	1.695		1609.00	1477.30	1482.6		1482.83	0.004348
4.45	535.98	340.78	0.39					
Reach-1	1.695		1609.00	1477.30	1483.8		1484.08	0.003845
4.93	394.22	106.45	0.38					
Reach-1	1.695		1609.00	1477.30	1483.6		1483.88	0.003706
4.74	418.55	122.00	0.37					
Reach-1	1.695		1609.00	1477.30	1483.7		1483.95	0.003892
4.89	402.89	114.00	0.38					
Reach-1	1.638		1609.00	1475.70	1480.6		1480.99	0.009014
5.89	377.62	260.62	0.55					
Reach-1	1.638		1609.00	1475.70	1481.5		1482.26	0.010241
7.13	230.26	54.24	0.60					
Reach-1	1.638		1609.00	1475.70	1481.4		1482.13	0.009771
6.91	244.00	62.00	0.58					
Reach-1	1.638		1609.00	1475.70	1481.3		1482.08	0.010851
7.16	234.15	60.66	0.61					
Reach-1	1.572		1609.00	1473.70	1479.0		1479.11	0.003333
3.70	582.14	300.69	0.34					
Reach-1	1.572		1609.00	1473.70	1480.1		1480.29	0.003095
4.23	432.52	108.31	0.34					
Reach-1	1.572		1609.00	1473.70	1479.9		1480.13	0.003340
4.29	430.12	113.00	0.35					
Reach-1	1.572		1609.00	1473.70	1479.8		1480.05	0.003138
4.13	450.55	121.20	0.34					
Reach-1	1.483		1609.00	1470.00	1477.3		1477.50	0.003556
4.34	469.63	253.89	0.36					
Reach-1	1.483		1609.00	1470.00	1478.4		1478.79	0.003350
4.78	349.92	63.35	0.35					
Reach-1	1.483		1609.00	1470.00	1478.2		1478.56	0.003371
4.68	358.10	69.00	0.35					
Reach-1	1.483		1609.00	1470.00	1478.2		1478.53	0.003377
4.68	359.64	69.87	0.35					

Reach-1	1.383		2304.00	1467.20	1474.3	1473.52	1474.77	0.006909
6.71	473.94	236.01	0.50					
Reach-1	1.383		2304.00	1467.20	1475.3		1476.07	0.007161
7.35	344.32	63.71	0.50					
Reach-1	1.383		2304.00	1467.20	1475.1		1475.83	0.007211
7.24	351.07	69.00	0.51					
Reach-1	1.383		2304.00	1467.20	1475.2		1475.87	0.006846
7.10	358.33	69.59	0.49					
Reach-1	1.288		2304.00	1465.50	1471.6		1471.82	0.005032
5.10	621.95	306.84	0.42					
Reach-1	1.288		2304.00	1465.50	1472.7		1473.10	0.004879
5.57	447.20	94.17	0.41					
Reach-1	1.288		2304.00	1465.50	1472.5		1472.90	0.004716
5.39	469.52	103.00	0.40					
Reach-1	1.288		2304.00	1465.50	1472.6		1472.97	0.004882
5.52	457.37	98.67	0.41					
Reach-1	1.207		2304.00	1463.00	1469.1		1469.47	0.006602
6.49	522.43	235.52	0.49					
Reach-1	1.207		2304.00	1463.00	1470.1		1470.74	0.006836
6.93	390.85	89.09	0.48					
Reach-1	1.207		2304.00	1463.00	1470.0		1470.59	0.006827
6.85	400.77	96.00	0.48					
Reach-1	1.207		2304.00	1463.00	1469.9		1470.55	0.007256
7.02	391.46	95.12	0.49					
Reach-1	1.12		2304.00	1461.10	1466.6		1466.85	0.004842
4.93	592.24	279.03	0.42					
Reach-1	1.12		2304.00	1461.10	1467.6		1468.08	0.004859
5.57	436.87	87.87	0.42					
Reach-1	1.12		2304.00	1461.10	1467.4		1467.87	0.005122
5.58	438.49	93.00	0.43					
Reach-1	1.12		2304.00	1461.10	1467.5		1467.92	0.004490
5.28	455.50	95.05	0.41					
Reach-1	0.985		2304.00	1458.10	1463.2	1462.22	1463.43	0.005115
4.77	684.30	584.20	0.42					
Reach-1	0.985		2304.00	1458.10	1464.3	1462.51	1464.68	0.004961
5.29	480.03	114.56	0.41					
Reach-1	0.985		2304.00	1458.10	1464.2	1462.38	1464.54	0.004507
4.99	506.89	124.00	0.39					
Reach-1	0.985		2304.00	1458.10	1464.3	1462.50	1464.68	0.004961
5.29	480.03	114.56	0.41					
Reach-1	0.89		2304.00	1454.00	1460.5		1460.71	0.004886
4.85	822.83	758.06	0.41					
Reach-1	0.89		2304.00	1454.00	1461.4		1461.77	0.005663
5.71	516.38	177.21	0.44					
Reach-1	0.89		2304.00	1454.00	1461.4		1461.77	0.005634
5.70	518.05	178.00	0.44					
Reach-1	0.89		2304.00	1454.00	1461.4		1461.77	0.005663
5.71	516.38	177.21	0.44					
Reach-1	0.782		2304.00	1454.50	1460.4		1460.45	0.000124
0.85	3180.22	902.41	0.07					
Reach-1	0.782		2304.00	1454.50	1461.4		1461.45	0.000125
0.97	2636.77	538.20	0.07					
Reach-1	0.782		2304.00	1454.50	1461.4		1461.45	0.000125
0.97	2638.88	538.70	0.07					
Reach-1	0.782		2304.00	1454.50	1461.4		1461.45	0.000125
0.97	2636.77	538.20	0.07					
Reach-1	0.71		2304.00	1449.50	1460.4	1456.13	1460.42	0.000040
0.64	4758.57	1064.97	0.04					
Reach-1	0.71		2304.00	1449.50	1461.4	1456.13	1461.43	0.000040
0.69	4039.25	657.68	0.04					

```
  Reach-1        0.71                2304.00    1449.50     1461.4    1456.13    1461.43    0.000040
  0.69    4041.18      658.00            0.04
  Reach-1        0.71                2304.00    1449.50     1461.4    1456.13    1461.43    0.000040
  0.69    4039.25      657.68            0.04


Profile Output Table - Standard Table 2

  Reach          River Sta       E.G. Elev  W.S. Elev   Vel Head  Frctn Loss  C & E Loss     Q Left  Q
Channel    Q Right  Top Width
                                     (ft)       (ft)       (ft)        (ft)        (ft)      (cfs)
  (cfs)      (cfs)       (ft)

  Reach-1        2.2                 1496.07    1496.00       0.06        1.18        0.04     728.06
 579.94                  336.31
  Reach-1        2.2                 1497.26    1497.17       0.09        1.10        0.06     455.85
 852.15                  171.16
  Reach-1        2.2                 1497.03    1496.95       0.08        1.09        0.06     519.66
 788.34                  187.31
  Reach-1        2.2                 1497.02    1496.94       0.08        1.11        0.06     515.09
 792.91                  186.48

  Reach-1        2.121               1494.85    1494.43       0.42        2.68        0.05     255.19
 938.16     114.65       136.57
  Reach-1        2.121               1496.11    1495.45       0.66        2.68        0.08
1308.00                   39.00
  Reach-1        2.121               1495.88    1495.22       0.66        2.69        0.08      42.60
1265.40                   43.00
  Reach-1        2.121               1495.86    1495.20       0.65        2.67        0.09      49.66
1258.34                   43.55

  Reach-1        2.045               1492.12    1491.88       0.24        2.31        0.00     590.97
 651.76     366.27       281.18
  Reach-1        2.045               1493.35    1492.95       0.40        2.26        0.01     488.18
 929.05     191.77        99.44
  Reach-1        2.045               1493.10    1492.73       0.37        2.26        0.01     519.34
 875.00     214.66       111.00
  Reach-1        2.045               1493.10    1492.74       0.37        2.27        0.01     519.42
 869.49     220.08       111.74

  Reach-1        1.951               1489.81    1489.53       0.28        1.94        0.01     674.26
 866.14      68.60       129.19
  Reach-1        1.951               1491.08    1490.72       0.37        1.88        0.02     518.43
1090.57                   59.99
  Reach-1        1.951               1490.83    1490.49       0.34        1.86        0.02     583.10
1025.90                   66.00
  Reach-1        1.951               1490.83    1490.48       0.35        1.90        0.01     572.75
1036.25                   65.22

  Reach-1        1.856               1487.87    1487.50       0.36        2.89        0.01     208.49
1198.89     201.61       150.73
  Reach-1        1.856               1489.19    1488.66       0.53        2.90        0.03      31.00
1570.06       7.94        43.47
  Reach-1        1.856               1488.95    1488.46       0.49        2.92        0.03      67.84
1497.82      43.34        50.00
  Reach-1        1.856               1488.91    1488.42       0.49        2.84        0.02      72.24
1491.05      45.71        50.64

  Reach-1        1.761               1484.97    1484.51       0.46        2.06        0.08     130.56
1066.15     412.29       403.81
  Reach-1        1.761               1486.26    1485.42       0.84        2.01        0.16
1495.33     113.67        49.83
  Reach-1        1.761               1486.01    1485.23       0.78        1.97        0.16
1418.28     190.72        61.00
  Reach-1        1.761               1486.05    1485.32       0.73        1.96        0.13
1397.36     211.64        62.74
```

Reach-1	1.695		1482.83	1482.65	0.18	1.82	0.02	400.15	
695.09	513.76	340.78							
Reach-1	1.695		1484.08	1483.79	0.29	1.78	0.05	185.72	
984.71	438.57	106.45							
Reach-1	1.695		1483.88	1483.62	0.26	1.70	0.04	224.36	
914.54	470.11	122.00							
Reach-1	1.695		1483.95	1483.67	0.28	1.83	0.05	203.27	
953.36	452.37	114.00							
Reach-1	1.638		1480.99	1480.60	0.40	1.80	0.08	452.92	
1043.59	112.49	260.62							
Reach-1	1.638		1482.26	1481.48	0.78	1.80	0.17	29.34	
1579.66		54.24							
Reach-1	1.638		1482.13	1481.42	0.71	1.86	0.14	99.81	
1509.19		62.00							
Reach-1	1.638		1482.08	1481.31	0.77	1.86	0.17	83.35	
1525.65		60.66							
Reach-1	1.572		1479.11	1478.98	0.13	1.60	0.01	668.26	
491.49	449.25	300.69							
Reach-1	1.572		1480.29	1480.07	0.22	1.49	0.01	551.69	
721.93	335.38	108.31							
Reach-1	1.572		1480.13	1479.90	0.23	1.56	0.01	563.30	
707.06	338.64	113.00							
Reach-1	1.572		1480.05	1479.85	0.21	1.51	0.01	578.73	
672.73	357.54	121.20							
Reach-1	1.483		1477.50	1477.27	0.23	2.70	0.03	59.45	
1074.46	475.09	253.89							
Reach-1	1.483		1478.79	1478.45	0.34	2.67	0.04		
1488.14	120.86	63.35							
Reach-1	1.483		1478.56	1478.24	0.32	2.69	0.04		
1405.98	203.02	69.00							
Reach-1	1.483		1478.53	1478.21	0.32	2.62	0.04		
1397.13	211.87	69.87							
Reach-1	1.383		1474.77	1474.27	0.50	2.87	0.07	746.68	
1410.11	147.20	236.01							
Reach-1	1.383		1476.07	1475.33	0.75	2.88	0.10	463.55	
1840.45		63.71							
Reach-1	1.383		1475.83	1475.11	0.71	2.83	0.10	550.24	
1753.76		69.00							
Reach-1	1.383		1475.87	1475.18	0.69	2.81	0.08	564.69	
1739.31		69.59							
Reach-1	1.288		1471.82	1471.57	0.25	2.34	0.02	1112.06	
894.62	297.32	306.84							
Reach-1	1.288		1473.10	1472.68	0.42	2.34	0.02	1092.85	
1211.15		94.17							
Reach-1	1.288		1472.90	1472.52	0.38	2.29	0.02	1165.34	
1138.66		103.00							
Reach-1	1.288		1472.97	1472.57	0.40	2.40	0.02	1128.17	
1175.83		98.67							
Reach-1	1.207		1469.47	1469.05	0.42	2.57	0.04	948.65	
1154.09	201.26	235.52							
Reach-1	1.207		1470.74	1470.14	0.60	2.61	0.05	822.72	
1481.28		89.09							
Reach-1	1.207		1470.59	1470.02	0.57	2.68	0.04	867.32	
1436.68		96.00							
Reach-1	1.207		1470.55	1469.95	0.60	2.57	0.06	848.30	
1455.70		95.12							
Reach-1	1.12		1466.85	1466.57	0.28	3.40	0.02	694.64	
1340.49	268.87	279.03							
Reach-1	1.12		1468.08	1467.63	0.45	3.37	0.02	417.52	
1886.48		87.87							

Reach-1	1.12		1467.87	1467.42	0.44	3.29	0.03	486.88	1817.12
		93.00							
Reach-1	1.12		1467.92	1467.52	0.40	3.23	0.01	552.13	1751.87
		95.05							
Reach-1	0.985		1463.43	1463.22	0.21	2.72	0.00	1265.02	776.08
262.90		584.20							
Reach-1	0.985		1464.68	1464.31	0.37	2.91	0.00	1205.82	1098.18
		114.56							
Reach-1	0.985		1464.54	1464.22	0.33	2.77	0.00	1289.36	1014.64
		124.00							
Reach-1	0.985		1464.68	1464.31	0.37	2.91	0.00	1205.82	1098.18
		114.56							
Reach-1	0.89		1460.71	1460.51	0.20	0.20	0.06	791.92	894.83
617.26		758.06							
Reach-1	0.89		1461.77	1461.40	0.37	0.21	0.11	1031.43	1272.57
		177.21							
Reach-1	0.89		1461.77	1461.40	0.36	0.21	0.11	1034.02	1269.98
		178.00							
Reach-1	0.89		1461.77	1461.40	0.37	0.21	0.11	1031.43	1272.57
		177.21							
Reach-1	0.782		1460.45	1460.44	0.01	0.02	0.00	565.36	271.54
1467.10		902.41							
Reach-1	0.782		1461.45	1461.44	0.01	0.02	0.00	312.37	371.75
1619.88		538.20							
Reach-1	0.782		1461.45	1461.44	0.01	0.02	0.00	315.88	372.02
1616.10		538.70							
Reach-1	0.782		1461.45	1461.44	0.01	0.02	0.00	312.37	371.75
1619.88		538.20							
Reach-1	0.71		1460.42	1460.42	0.00			925.88	210.74
1167.38		1064.97							
Reach-1	0.71		1461.43	1461.42	0.01			901.84	255.26
1146.90		657.68							
Reach-1	0.71		1461.43	1461.42	0.01			901.37	255.14
1147.49		658.00							
Reach-1	0.71		1461.43	1461.42	0.01			901.84	255.26
1146.90		657.68							

E.5-3 HYDRAULIC CALCULATIONS
HEC-RAS DUPLICATE EFFECTIVE MODEL
(HEC-RAS COMPUTATIONAL CONVEYANCE METHOD)

```
                    HEC-RAS Version 3.0.1  Mar 2001
                      U.S. Army Corp of Engineers
                     Hydrologic Engineering Center
                       609 Second Street, Suite D
                      Davis, California 95616-4687
                            (916) 756-1104

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


PROJECT DATA
Project Title: Buchanan Wash Duplicate_RAS Mode
Project File : DupRASMode.prj
Run Date and Time: 10/1/01 9:15:14 AM

Project in English units

Project Description:
FLOOD PLAIN ANALYSIS  -  MARICOPA COUNTY FLOOD CONTROL DIST.

FLD'WAY ENCROACH CALC. (NATURAL CONDITON)  -  100 YR/6 HR STORM
      BUCHANAN
WASH           SKUNK CREEK TO C.A.P. CANAL   OCT, 1987



PLAN DATA

Plan Title: Imported Plan 01
Plan File : p:\Emcn-002\BW\Model\Duplicate\DupRASMode.p01

           Geometry Title: Imported Geom 01
           Geometry File : p:\Emcn-002\BW\Model\Duplicate\DupRASMode.g01

           Flow Title    : Imported Flow 01
           Flow File     : p:\Emcn-002\BW\Model\Duplicate\DupRASMode.f01

Plan Description:
FP  Profile 1
FW Profile 3

Computed HEC-RAS Style


Plan Summary Information:
Number of:  Cross Sections =   18    Mulitple Openings =    0
            Culverts       =    0    Inline Weirs      =    0
            Bridges        =    0

Computational Information
    Water surface calculation tolerance =  0.003
    Critical depth calculaton tolerance =  0.003
    Maximum number of interations       =  20
    Maximum difference tolerance        =  0.1
    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 = RIVER-1 Reach = Reach-1

RS	Profile	Method	Value1	Value2
2.2	PF 2	4	1	
2.121	PF 2	4	1	
2.045	PF 2	4	1	
1.951	PF 2	4	1	
1.856	PF 2	4	1	
1.761	PF 2	4	1	
1.695	PF 2	4	1	
1.638	PF 2	4	1	
1.572	PF 2	4	1	
1.483	PF 2	4	1	
1.383	PF 2	4	1	
1.288	PF 2	4	1	
1.207	PF 2	4	1	
1.12	PF 2	4	1	
0.985	PF 2	4	1	
0.89	PF 2	4	1	
0.782	PF 2	4	1	
0.71	PF 2	4	1	

River = RIVER-1 Reach = Reach-1

RS	Profile	Method	Value1	Value2
2.2	PF 3	1	9845	10036
2.121	PF 3	1	9976	10019
2.045	PF 3	1	9939	10050
1.951	PF 3	1	9945	10011
1.856	PF 3	1	9974	10024
1.761	PF 3	1	9980	10041
1.695	PF 3	1	9950	10072
1.638	PF 3	1	9958	10020
1.572	PF 3	1	9938	10051
1.483	PF 3	1	9971	10040
1.383	PF 3	1	9961	10030
1.288	PF 3	1	9929	10032
1.207	PF 3	1	9934	10030
1.12	PF 3	1	9944	10037
0.985	PF 3	1	9895	10019
0.89	PF 3	1	9836	10014
0.782	PF 3	1	9889	10446
0.71	PF 3	1	9693	10351

River = RIVER-1 Reach = Reach-1

RS	Profile	Method	Value1	Value2
2.2	PF 4	4	.8	
2.121	PF 4	4	.8	
2.045	PF 4	4	.8	
1.951	PF 4	4	.8	
1.856	PF 4	4	.8	
1.761	PF 4	4	.8	
1.695	PF 4	4	.9	
1.638	PF 4	4	.9	
1.572	PF 4	4	.8	
1.483	PF 4	4	.8	
1.383	PF 4	4	.8	
1.288	PF 4	4	.9	
1.207	PF 4	4	.9	
1.12	PF 4	4	.8	
0.985	PF 4	4	1	
0.89	PF 4	4	1	
0.782	PF 4	4	1	
0.71	PF 4	4	1	

FLOW DATA

Flow Title: Imported Flow 01
Flow File : p:\Emcn-002\BW\Model\Duplicate\DupRASMode.f01

Flow Data (cfs)

River	Reach	RS	PF 1	PF 2	PF 3	PF 4
RIVER-1	Reach-1	2.2	1308	1308	1308	1308
RIVER-1	Reach-1	2.045	1609	1609	1609	1609
RIVER-1	Reach-1	1.383	2304	2304	2304	2304

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
RIVER-1	Reach-1	PF 1		Known WS = 1460.42
RIVER-1	Reach-1	PF 2		Known WS = 1461.42
RIVER-1	Reach-1	PF 3		Known WS = 1461.42
RIVER-1	Reach-1	PF 4		Known WS = 1461.42

SUMMARY OF MANNING'S N VALUES

River:RIVER-1

Reach	River Sta.	n1	n2	n3
Reach-1	2.2	.055	.055	.055
Reach-1	2.121	.055	.055	.055
Reach-1	2.045	.055	.055	.055
Reach-1	1.951	.055	.055	.055
Reach-1	1.856	.055	.055	.055
Reach-1	1.761	.055	.055	.055
Reach-1	1.695	.055	.055	.055
Reach-1	1.638	.055	.055	.055
Reach-1	1.572	.055	.055	.055
Reach-1	1.483	.055	.055	.055
Reach-1	1.383	.055	.055	.055
Reach-1	1.288	.055	.055	.055
Reach-1	1.207	.055	.055	.055
Reach-1	1.12	.055	.055	.055
Reach-1	0.985	.055	.055	.055
Reach-1	0.89	.055	.055	.055
Reach-1	0.782	.055	.055	.055
Reach-1	0.71	.055	.055	.055

SUMMARY OF REACH LENGTHS

River: RIVER-1

Reach	River Sta.	Left	Channel	Right
Reach-1	2.2	400	417	425
Reach-1	2.121	405	410	415
Reach-1	2.045	505	505	510
Reach-1	1.951	510	502	495
Reach-1	1.856	502	502	502
Reach-1	1.761	360	350	340
Reach-1	1.695	297	300	303

Reach-1	1.638	360	350	330
Reach-1	1.572	410	470	500
Reach-1	1.483	530	528	528
Reach-1	1.383	470	502	510
Reach-1	1.288	380	428	440
Reach-1	1.207	450	459	480
Reach-1	1.12	640	713	730
Reach-1	0.985	600	502	490
Reach-1	0.89	740	570	400
Reach-1	0.782	380	380	360
Reach-1	0.71	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

Reach	River Sta.	Contr.	Expan.
Reach-1	2.2	.1	.3
Reach-1	2.121	.1	.3
Reach-1	2.045	.1	.3
Reach-1	1.951	.1	.3
Reach-1	1.856	.1	.3
Reach-1	1.761	.1	.3
Reach-1	1.695	.1	.3
Reach-1	1.638	.1	.3
Reach-1	1.572	.1	.3
Reach-1	1.483	.1	.3
Reach-1	1.383	.1	.3
Reach-1	1.288	.1	.3
Reach-1	1.207	.1	.3
Reach-1	1.12	.1	.3
Reach-1	0.985	.1	.3
Reach-1	0.89	.1	.3
Reach-1	0.782	.1	.3
Reach-1	0.71	.1	.3

Profile Output Table - Standard Table 1

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Ve
1 Chnl	Flow Area	Top Width	Froude # Chl					
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	
(ft/s)	(sq ft)	(ft)						
Reach-1	2.2	1308.00	1490.50	1496.1		1496.15	0.001627	
2.47	701.84	343.33	0.23					
Reach-1	2.2	1308.00	1490.50	1497.3		1497.35	0.001383	
2.70	562.28	166.55	0.22					
Reach-1	2.2	1308.00	1490.50	1497.0		1497.07	0.001366	
2.59	593.11	187.40	0.22					
Reach-1	2.2	1308.00	1490.50	1497.0		1497.10	0.001431	
2.66	576.12	181.15	0.23					
Reach-1	2.121	1308.00	1488.70	1494.5		1494.90	0.006887	
5.73	295.04	138.08	0.49					
Reach-1	2.121	1308.00	1488.70	1495.5		1496.17	0.007568	
6.40	204.48	39.00	0.49					
Reach-1	2.121	1308.00	1488.70	1495.2		1495.89	0.007674	
6.56	205.30	43.00	0.52					
Reach-1	2.121	1308.00	1488.70	1495.3		1495.91	0.007325	
6.44	209.88	43.88	0.51					
Reach-1	2.045	1609.00	1486.60	1492.0		1492.21	0.006137	
5.24	482.17	293.12	0.45					
Reach-1	2.045	1609.00	1486.60	1493.0		1493.46	0.005728	
5.90	331.70	92.02	0.45					
Reach-1	2.045	1609.00	1486.60	1492.7		1493.11	0.005863	

5.73	353.08	111.00	0.45					
Reach-1	2.045		1609.00	1486.60	1492.8		1493.22	0.005776
5.76	346.13	104.35	0.45					
Reach-1	1.951		1609.00	1482.90	1489.6		1489.89	0.003562
5.05	418.43	131.25	0.37					
Reach-1	1.951		1609.00	1482.90	1490.8		1491.17	0.003640
5.27	336.30	58.25	0.35					
Reach-1	1.951		1609.00	1482.90	1490.5		1490.83	0.003547
5.08	352.87	66.00	0.34					
Reach-1	1.951		1609.00	1482.90	1490.6		1490.91	0.003659
5.18	344.46	63.20	0.35					
Reach-1	1.856		1609.00	1480.70	1487.6		1487.94	0.004162
5.44	394.33	154.13	0.40					
Reach-1	1.856		1609.00	1480.70	1488.7		1489.27	0.003841
5.91	278.39	41.23	0.40					
Reach-1	1.856		1609.00	1480.70	1488.5		1488.95	0.003870
5.78	298.32	50.00	0.40					
Reach-1	1.856		1609.00	1480.70	1488.5		1489.00	0.003901
5.82	294.44	48.48	0.40					
Reach-1	1.761		1609.00	1479.10	1484.6		1485.04	0.008462
6.56	423.51	408.86	0.54					
Reach-1	1.761		1609.00	1479.10	1485.5		1486.35	0.009611
7.61	221.49	46.31	0.58					
Reach-1	1.761		1609.00	1479.10	1485.2		1486.02	0.009611
7.41	239.29	61.00	0.57					
Reach-1	1.761		1609.00	1479.10	1485.4		1486.14	0.008906
7.25	242.29	58.09	0.55					
Reach-1	1.695		1609.00	1477.30	1482.7		1482.86	0.004474
4.54	545.93	343.91	0.39					
Reach-1	1.695		1609.00	1477.30	1483.8		1484.12	0.003993
5.04	384.80	102.79	0.39					
Reach-1	1.695		1609.00	1477.30	1483.6		1483.89	0.003724
4.75	419.26	122.00	0.37					
Reach-1	1.695		1609.00	1477.30	1483.7		1483.99	0.004042
4.99	392.88	109.88	0.39					
Reach-1	1.638		1609.00	1475.70	1480.7		1481.05	0.008431
5.78	398.19	263.59	0.54					
Reach-1	1.638		1609.00	1475.70	1481.6		1482.32	0.009452
6.94	237.27	55.01	0.57					
Reach-1	1.638		1609.00	1475.70	1481.4		1482.14	0.009640
6.88	245.06	62.00	0.58					
Reach-1	1.638		1609.00	1475.70	1481.4		1482.13	0.009990
6.97	241.07	61.09	0.59					
Reach-1	1.572		1609.00	1473.70	1479.1		1479.18	0.003452
3.82	604.05	304.61	0.34					
Reach-1	1.572		1609.00	1473.70	1480.1		1480.37	0.003215
4.35	426.46	105.04	0.34					
Reach-1	1.572		1609.00	1473.70	1479.9		1480.15	0.003339
4.30	432.76	113.00	0.35					
Reach-1	1.572		1609.00	1473.70	1479.9		1480.13	0.003261
4.25	440.02	116.11	0.34					
Reach-1	1.483		1609.00	1470.00	1477.3		1477.52	0.003652
4.40	473.04	254.15	0.36					
Reach-1	1.483		1609.00	1470.00	1478.5		1478.81	0.003447
4.85	343.09	61.47	0.36					
Reach-1	1.483		1609.00	1470.00	1478.3		1478.58	0.003366
4.69	359.72	69.00	0.35					
Reach-1	1.483		1609.00	1470.00	1478.2		1478.56	0.003454
4.74	355.71	68.39	0.35					

Reach-1	1.383		2304.00	1467.20	1474.6		1475.05	0.005588
6.29	567.14	273.18	0.46					
Reach-1	1.383		2304.00	1467.20	1475.8		1476.39	0.005609
6.75	374.66	64.20	0.45					
Reach-1	1.383		2304.00	1467.20	1475.1		1475.84	0.007248
7.27	352.14	69.00	0.51					
Reach-1	1.383		2304.00	1467.20	1475.6		1476.20	0.005388
6.53	390.46	70.06	0.44					
Reach-1	1.288		2304.00	1465.50	1471.8		1472.11	0.006224
5.88	946.42	1430.95	0.47					
Reach-1	1.288		2304.00	1465.50	1472.9		1473.44	0.006337
6.48	389.15	77.99	0.47					
Reach-1	1.288		2304.00	1465.50	1472.5		1472.91	0.004726
5.40	470.26	103.00	0.40					
Reach-1	1.288		2304.00	1465.50	1472.8		1473.32	0.006325
6.41	395.13	81.27	0.47					
Reach-1	1.207		2304.00	1463.00	1469.1		1469.53	0.006304
6.40	540.77	239.31	0.48					
Reach-1	1.207		2304.00	1463.00	1470.2		1470.81	0.006490
6.80	397.48	88.67	0.47					
Reach-1	1.207		2304.00	1463.00	1470.0		1470.59	0.006837
6.85	400.75	96.00	0.48					
Reach-1	1.207		2304.00	1463.00	1470.0		1470.63	0.006808
6.86	399.12	94.38	0.48					
Reach-1	1.12		2304.00	1461.10	1466.8		1467.05	0.004550
4.93	653.15	300.44	0.41					
Reach-1	1.12		2304.00	1461.10	1467.9		1468.31	0.004538
5.52	438.26	83.42	0.41					
Reach-1	1.12		2304.00	1461.10	1467.4		1467.88	0.005057
5.56	440.24	93.00	0.43					
Reach-1	1.12		2304.00	1461.10	1467.8		1468.16	0.004218
5.27	463.18	91.32	0.40					
Reach-1	0.985		2304.00	1458.10	1463.5	1462.27	1463.70	0.005144
5.02	876.24	710.53	0.43					
Reach-1	0.985		2304.00	1458.10	1464.6	1462.76	1465.03	0.004919
5.47	470.67	105.01	0.42					
Reach-1	0.985		2304.00	1458.10	1464.3	1462.47	1464.58	0.004488
5.00	512.69	124.00	0.39					
Reach-1	0.985		2304.00	1458.10	1464.6	1462.76	1465.03	0.004919
5.47	470.67	105.01	0.42					
Reach-1	0.89		2304.00	1454.00	1460.5		1460.74	0.005903
5.32	813.87	755.50	0.45					
Reach-1	0.89		2304.00	1454.00	1461.3		1461.82	0.007146
6.37	450.63	143.73	0.50					
Reach-1	0.89		2304.00	1454.00	1461.4		1461.78	0.005813
5.79	518.16	178.00	0.45					
Reach-1	0.89		2304.00	1454.00	1461.3		1461.82	0.007146
6.37	450.63	143.73	0.50					
Reach-1	0.782		2304.00	1454.50	1460.4		1460.45	0.000132
0.88	3181.54	902.46	0.07					
Reach-1	0.782		2304.00	1454.50	1461.4		1461.45	0.000132
1.00	2601.17	530.40	0.07					
Reach-1	0.782		2304.00	1454.50	1461.4		1461.45	0.000129
0.98	2639.14	538.71	0.07					
Reach-1	0.782		2304.00	1454.50	1461.4		1461.45	0.000132
1.00	2601.17	530.40	0.07					
Reach-1	0.71		2304.00	1449.50	1460.4	1456.20	1460.42	0.000042
0.66	4758.57	1064.97	0.04					
Reach-1	0.71		2304.00	1449.50	1461.4	1456.20	1461.43	0.000042
0.71	3933.98	637.97	0.04					
Reach-1	0.71		2304.00	1449.50	1461.4	1456.20	1461.43	0.000040

```
 0.70     4041.18      658.00          0.04
 Reach-1       0.71                2304.00     1449.50     1461.4     1456.20     1461.43     0.000042
 0.71     3933.98      637.97          0.04
```

Profile Output Table - Standard Table 2

Reach	River Sta		E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
Reach-1	2.2		1496.15	1496.08	0.06	1.21	0.03	691.32	616.68		343.33
Reach-1	2.2		1497.35	1497.26	0.09	1.13	0.05	404.65	903.35		166.55
Reach-1	2.2		1497.07	1496.98	0.08	1.12	0.06	493.97	814.03		187.40
Reach-1	2.2		1497.10	1497.01	0.09	1.14	0.05	465.79	842.21		181.15
Reach-1	2.121		1494.90	1494.50	0.40	2.64	0.05	249.74	938.45	119.81	138.08
Reach-1	2.121		1496.17	1495.54	0.64	2.64	0.07		1308.00		39.00
Reach-1	2.121		1495.89	1495.24	0.65	2.70	0.08	42.68	1265.32		43.00
Reach-1	2.121		1495.91	1495.28	0.63	2.62	0.07	54.64	1253.36		43.88
Reach-1	2.045		1492.21	1491.96	0.25	2.32	0.00	611.72	679.98	317.30	293.12
Reach-1	2.045		1493.46	1493.05	0.42	2.28	0.01	533.12	963.33	112.55	92.02
Reach-1	2.045		1493.11	1492.74	0.38	2.27	0.01	514.36	881.49	213.15	111.00
Reach-1	2.045		1493.22	1492.83	0.39	2.29	0.01	561.89	902.34	144.76	104.35
Reach-1	1.951		1489.89	1489.60	0.28	1.94	0.01	662.88	885.83	60.29	131.25
Reach-1	1.951		1491.17	1490.80	0.37	1.88	0.02	495.66	1113.34		58.25
Reach-1	1.951		1490.83	1490.49	0.34	1.86	0.02	582.41	1026.59		66.00
Reach-1	1.951		1490.91	1490.56	0.36	1.90	0.01	550.83	1058.17		63.20
Reach-1	1.856		1487.94	1487.57	0.37	2.89	0.01	187.19	1222.16	199.65	154.13
Reach-1	1.856		1489.27	1488.74	0.54	2.90	0.03	5.25	1596.05	7.70	41.23
Reach-1	1.856		1488.95	1488.46	0.49	2.91	0.03	67.83	1497.84	43.33	50.00
Reach-1	1.856		1489.00	1488.50	0.50	2.84	0.02	48.06	1516.75	44.20	48.48
Reach-1	1.761		1485.04	1484.57	0.48	2.09	0.09	134.96	1092.35	381.68	408.86
Reach-1	1.761		1486.35	1485.48	0.87	2.06	0.17		1525.52	83.48	46.31
Reach-1	1.761		1486.02	1485.24	0.78	1.97	0.16		1417.45	191.55	61.00
Reach-1	1.761		1486.14	1485.39	0.75	2.01	0.14		1427.69	181.31	58.09

Reach-1	1.695		1482.86	1482.67	0.19	1.80	0.02	395.48	
713.38	500.15	343.91							
Reach-1	1.695		1484.12	1483.81	0.31	1.76	0.04	139.59	
1009.96	459.45	102.79							
Reach-1	1.695		1483.89	1483.62	0.26	1.70	0.04	219.61	
918.53	470.86	122.00							
Reach-1	1.695		1483.99	1483.69	0.30	1.81	0.04	176.35	
978.00	454.65	109.88							
Reach-1	1.638		1481.05	1480.67	0.38	1.80	0.07	435.78	
1046.85	126.37	263.59							
Reach-1	1.638		1482.32	1481.58	0.74	1.79	0.15	37.21	
1571.79		55.01							
Reach-1	1.638		1482.14	1481.44	0.70	1.85	0.14	100.40	
1508.60		62.00							
Reach-1	1.638		1482.13	1481.41	0.73	1.85	0.15	90.54	
1518.46		61.09							
Reach-1	1.572		1479.18	1479.05	0.13	1.65	0.01	647.78	
516.23	444.99	304.61							
Reach-1	1.572		1480.37	1480.14	0.23	1.55	0.01	507.88	
753.72	347.40	105.04							
Reach-1	1.572		1480.15	1479.92	0.22	1.56	0.01	562.17	
712.80	334.03	113.00							
Reach-1	1.572		1480.13	1479.92	0.22	1.56	0.01	537.75	
703.10	368.14	116.11							
Reach-1	1.483		1477.52	1477.28	0.24	2.45	0.02	57.25	
1094.04	457.71	254.15							
Reach-1	1.483		1478.81	1478.46	0.35	2.39	0.03		
1515.07	93.93	61.47							
Reach-1	1.483		1478.58	1478.26	0.32	2.69	0.04		
1414.60	194.40	69.00							
Reach-1	1.483		1478.56	1478.23	0.33	2.34	0.02		
1422.74	186.26	68.39							
Reach-1	1.383		1475.05	1474.63	0.42	2.90	0.04	718.20	
1409.23	176.58	273.18							
Reach-1	1.383		1476.39	1475.77	0.63	2.93	0.02	501.27	
1802.73		64.20							
Reach-1	1.383		1475.84	1475.13	0.72	2.84	0.10	539.07	
1764.93		69.00							
Reach-1	1.383		1476.20	1475.62	0.58	2.87	0.01	595.62	
1708.38		70.06							
Reach-1	1.288		1472.11	1471.82	0.29	2.57	0.01	849.20	
1086.71	368.09	1430.95							
Reach-1	1.288		1473.44	1472.88	0.56	2.63	0.00	845.93	
1458.07		77.99							
Reach-1	1.288		1472.91	1472.52	0.38	2.29	0.02	1161.79	
1142.21		103.00							
Reach-1	1.288		1473.32	1472.77	0.55	2.69	0.00	887.30	
1416.70		81.27							
Reach-1	1.207		1469.53	1469.13	0.40	2.44	0.04	958.38	
1154.79	190.82	239.31							
Reach-1	1.207		1470.81	1470.23	0.58	2.46	0.04	829.46	
1474.54		88.67							
Reach-1	1.207		1470.59	1470.02	0.58	2.67	0.04	866.36	
1437.64		96.00							
Reach-1	1.207		1470.63	1470.05	0.58	2.41	0.05	857.44	
1446.56		94.38							
Reach-1	1.12		1467.05	1466.78	0.27	3.32	0.02	621.47	
1406.58	275.95	300.44							
Reach-1	1.12		1468.31	1467.86	0.44	3.26	0.02	352.44	
1951.56		83.42							
Reach-1	1.12		1467.88	1467.44	0.44	3.26	0.04	487.67	

1816.33			93.00							
Reach-1	1.12			1468.16	1467.77	0.40	3.13	0.00	475.23	
1828.77			91.32							
Reach-1	0.985			1463.70	1463.51	0.19	2.96	0.00	1102.90	
875.95	325.15		710.53							
Reach-1	0.985			1465.03	1464.64	0.39	3.20	0.01	1095.26	
1208.74			105.01							
Reach-1	0.985			1464.58	1464.26	0.32	2.80	0.01	1276.25	
1027.75			124.00							
Reach-1	0.985			1465.03	1464.64	0.39	3.20	0.01	1095.26	
1208.74			105.01							
Reach-1	0.89			1460.74	1460.50	0.24	0.22	0.07	719.39	
979.02	605.59		755.50							
Reach-1	0.89			1461.82	1461.34	0.48	0.23	0.14	901.23	
1402.77			143.73							
Reach-1	0.89			1461.78	1461.41	0.37	0.22	0.11	1013.79	
1290.21			178.00							
Reach-1	0.89			1461.82	1461.34	0.48	0.23	0.14	901.23	
1402.77			143.73							
Reach-1	0.782			1460.45	1460.44	0.01	0.03	0.00	539.31	
279.79	1484.90		902.46							
Reach-1	0.782			1461.45	1461.44	0.01	0.03	0.00	274.24	
382.97	1646.79		530.40							
Reach-1	0.782			1461.45	1461.44	0.01	0.02	0.00	312.33	
377.48	1614.19		538.71							
Reach-1	0.782			1461.45	1461.44	0.01	0.03	0.00	274.24	
382.97	1646.79		530.40							
Reach-1	0.71			1460.42	1460.42	0.00			897.18	
216.97	1189.85		1064.97							
Reach-1	0.71			1461.43	1461.42	0.01			777.59	
262.81	1263.60		637.97							
Reach-1	0.71			1461.43	1461.42	0.01			896.56	
256.57	1150.87		658.00							
Reach-1	0.71			1461.43	1461.42	0.01			777.59	
262.81	1263.60		637.97							

E.5-4 HYDRAULIC CALCULATIONS
PROPOSED HEC-RAS MODEL

HEC-RAS Version 3.0.1 Mar 2001
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

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

PROJECT DATA
Project Title: Buchanan Wash
Project File : BuchananWash.prj
Run Date and Time: 10/5/01 8:53:38 AM

Project in English units

Project Description:
Buchanan Wash LOMR
Tetra Tech, Inc. ISG May 2001

As a result of the
construction of the Skunk Creek Landfill, the natural drainage pattern for Buchanan Wash was altered significantly. Several new cross-sections below the current effective FIS were input to more accurately model the confluence of Buchanan and Skunk Creek. With the new mapping, the effective FIS cross-sections were recut with new topographic mapping in their former locations and renumbered. Additional cross-sectios were added in locations of interest as necessary.

Starting WSEL
The initial boundary condition is the
normal slope area method.

Encroachments
Method 4 was used to initially
place the encroachments. From this point, the existing FIS encroachments were matched using Method 1. Then further Method 1 adjustments were made to model the changes along the watercourse and smooth the floodway.

PLAN DATA

Plan Title: Buchanan Wash
Plan File : p:\Emcn-002\BW\Model\BuchananWash.p01

Geometry Title: Buchanan Wash Geometry
Geometry File : p:\Emcn-002\BW\Model\BuchananWash.g01

Flow Title : Buchanan 100-Year Discharge
Flow File : p:\Emcn-002\BW\Model\BuchananWash.f01

Plan Summary Information:
Number of: Cross Sections = 27 Mulitple Openings = 0
Culverts = 1 Inline Weirs = 0
Bridges = 0

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

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

Encroachment Data
Equal Conveyance = True
Left Offset = 0
Right Offset = 0

River = Buchanan Wash Reach = Buchanan Wash

RS	Profile	Method	Value1	Value2
1.935	PF 2	1	9930	10050
1.916	PF 2	1	9940	10042
1.842	PF 2	1	9960	10075
1.766	PF 2	1	9915	10030
1.670	PF 2	1	9925	10025
1.575	PF 2	1	9950	10050
1.479	PF 2	1	9970	10070
1.412	PF 2	1	9970	10070
1.356	PF 2	1	9950	10051
1.332	PF 2	1	9190	9340
1.326	PF 2	1	9190	9340
1.318	PF 2	1	9200	9350
1.290	PF 2	1	9980	10080
1.197	PF 2	1	9950	10050
1.098	PF 2	1	9930	10030
1.005	PF 2	1	9920	10040
0.928	PF 2	1	9920	10030
0.839	PF 2	1	9920	10050
0.696	PF 2	1	9880	10060
0.595	PF 2	1	9850	10080
0.501	PF 2	1	9920	10220
0.456	PF 2	1	9850	10210
0.416	PF 2	1	9570	10200
0.302	PF 2	1	9720	10360
0.266	PF 2	1	9810	10430
0.177	PF 2	1	9750	10170
0.085	PF 2	1	9650	10080

FLOW DATA

Flow Title: Buchanan 100-Year Discharge
Flow File : p:\Emcn-002\BW\Model\BuchananWash.f01

Flow Data (cfs)

River	Reach	RS	PF 1	PF 2
Buchanan Wash	Buchanan Wash	1.935	1308	1308
Buchanan Wash	Buchanan Wash	1.766	1609	1609
Buchanan Wash	Buchanan Wash	1.098	2304	2304

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Buchanan Wash	Buchanan Wash	PF 1		Normal S = .003
Buchanan Wash	Buchanan Wash	PF 2		Normal S = .003

GEOMETRY DATA

Geometry Title: Buchanan Wash Geometry
Geometry File : p:\Emcn-002\BW\Model\BuchananWash.g01

CROSS SECTION RIVER: Buchanan Wash
REACH: Buchanan Wash RS: 1.935

INPUT
Description: 1.935 Adjacent to CAP bank
Station Elevation Data num= 146

```
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9703.081497.0179705.6321496.9269705.8391496.9199717.2991496.8229724.5131496.761
9724.7931496.7589725.8181496.7469734.4291496.9369741.2351497.0869742.7321497.087
9751.9591497.2929755.2751497.3729763.835    14969776.2031495.8449778.1011495.781
9778.4891495.7829790.404    14969795.1221496.6039798.0381496.5529806.4871496.404
9807.977    14969818.5471495.6599830.241 1495.599838.0841495.6089848.1361495.841
9848.4161495.8479848.6431495.8539849.5071495.892 9863.451495.8289864.1211495.843
9865.3651495.8459874.8531495.8149875.4261495.817 9891.691495.7949891.8991495.796
9903.736    14969905.305    1496 9909.281496.4749909.8151496.4719914.4871496.576
9920.7971496.9679926.5981497.1489937.2491497.1649939.6791497.3119941.2561497.419
9941.7731497.4199947.0661497.6299955.1711497.2819957.476 1497.129964.1051496.954
9966.5851496.9729973.076    14969977.3741495.0379981.998    14949987.3071493.448
10001.74    149210002.83    149210015.761493.54910020.09    149410020.891494.174
10029.51    149610036.331496.70110048.731497.173 10049.81497.17810057.911497.168
10071.38    149610074.281495.49210077.651495.52810079.291495.54610080.131495.529
10092.041495.42710100.631495.45110101.011495.45410116.67    149610116.79    1496
10116.92    149610135.23    149610146.83    149610146.92    149610147.06    1496
10151.34    149610155.94    149610174.491497.28110176.041496.79710180.451496.865
10183.57    149610187.15    149610188.68    149610190.35    149610193.211496.488
10193.521496.48810205.761497.52310225.331497.28410227.321497.34310232.471497.446
10232.941497.44710262.291497.70510263.391497.723 10264.71497.77110283.091497.764
10292.81    149810311.78    149810312.41    1498 10324.8    149810326.85    1498
10339.86    149810340.33    149810354.27    149810365.62    149810365.92    1498
10367.41    149810372.77    149810377.251498.265 10380.91498.03610390.361498.222
10391.971498.20110396.471498.693 10399.91498.61310401.58 1498.5510401.911498.549
 10409.71499.21110414.631499.41810425.231499.28410433.511499.264   10445 1499.35
10459.63    150010463.83    150010464.36    150010473.74    150010484.66    1500
10485.61    150010490.77    1500 10496.1    150010499.35    150010500.66    1500
10502.47    150010503.11    1500 10504.5 1500.0510512.571500.18210513.131500.198
10514.531500.26210520.471500.46710524.921500.80610534.36    150210536.08    1502
10538.13    1502
```

Manning's n Values num= 3

```
     Sta   n Val     Sta   n Val     Sta   n Val
 9703.08    .0559966.585    .05510048.73    .055
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
     9966.58510048.73               70  100.93     100             .1       .3
Blocked Obstructions     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
 9703.089947.0661497.629 10049.810538.13 1497.17
```

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1497.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.22	Wt. n-Val.		0.055	
W.S. Elev (ft)	1496.25	Reach Len. (ft)	70.00	100.93	100.00
Crit W.S. (ft)	1496.25	Flow Area (sq ft)		147.74	
E.G. Slope (ft/ft)	0.033121	Area (sq ft)		147.74	
Q Total (cfs)	1308.00	Flow (cfs)		1308.00	
Top Width (ft)	60.46	Top Width (ft)		60.46	
Vel Total (ft/s)	8.85	Avg. Vel. (ft/s)		8.85	
Max Chl Dpth (ft)	4.25	Hydr. Depth (ft)		2.44	
Conv. Total (cfs)	7187.1	Conv. (cfs)		7187.1	
Length Wtd. (ft)	91.25	Wetted Per. (ft)		61.14	
Min Ch El (ft)	1492.00	Shear (lb/sq ft)		5.00	
Alpha	1.00	Stream Power (lb/ft s)		44.24	
Frctn Loss (ft)	0.51	Cum Volume (acre-ft)	72.99	67.45	39.03
C & E Loss (ft)	0.34	Cum SA (acres)	51.27	12.53	29.21

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 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 #PF 2

E.G. Elev (ft)	1497.65	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.69	Wt. n-Val.	0.000	0.055	
W.S. Elev (ft)	1496.96	Reach Len. (ft)	70.00	100.93	100.00
Crit W.S. (ft)		Flow Area (sq ft)	0.00	195.67	
E.G. Slope (ft/ft)	0.017724	Area (sq ft)	0.00	195.67	
Q Total (cfs)	1308.00	Flow (cfs)	0.00	1308.00	
Top Width (ft)	77.50	Top Width (ft)	1.04	76.46	
Vel Total (ft/s)	6.68	Avg. Vel. (ft/s)	0.07	6.68	
Max Chl Dpth (ft)	4.96	Hydr. Depth (ft)	0.00	2.56	
Conv. Total (cfs)	9824.9	Conv. (cfs)	0.0	9824.9	
Length Wtd. (ft)	96.57	Wetted Per. (ft)	1.04	77.22	
Min Ch El (ft)	1492.00	Shear (lb/sq ft)		2.80	
Alpha	1.00	Stream Power (lb/ft s)		18.74	
Frctn Loss (ft)	0.83	Cum Volume (acre-ft)	50.97	70.45	27.28
C & E Loss (ft)	0.12	Cum SA (acres)	19.26	12.28	14.94

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: Buchanan Wash
REACH: Buchanan Wash      RS: 1.916

INPUT
Description: 2.200
Station Elevation Data    num=     117
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9599.361502.6099603.768    15029604.5731501.8899605.8131501.7179606.8891501.376
9610.5471500.2159614.986    15009617.171    15009622.569 1499.859622.6141499.848
```

```
9633.184 1499.549638.4451499.3649646.8371499.2419658.322    14989666.1691497.487
9667.401 1497.37    96681497.3299673.3531496.9789674.1671496.925  9682.91496.615
9683.9991496.6159684.3051496.6079688.833    14969688.908    14969725.9371494.901
9735.8721494.7669736.0661494.7639742.2221494.6989749.4161494.5569753.0671494.516
 9785.811494.2289788.5461494.167 9792.57    14949796.213    14949798.313    1494
9801.201    14949835.584    14949837.106    14949840.883    14949842.035    1494
9843.942    14949846.086    14949857.892    14949862.302    1494 9863.56    1494
9875.441    1494 9875.93    1494 9876.15    1494 9876.99    14949877.374    1494
9907.028    14949918.926    14949921.588    1494 9935.35    14949963.935    1494
9964.791    14949965.117    14949979.543    14949986.288    14949990.9931493.123
 9993.53 1492.659994.8861492.3459996.425    1492   10000    149210001.88    1492
10027.37    149210031.331493.31710033.39    1494 10039.21495.92910039.41    1496
10039.791496.06310050.371497.39810052.99    149810062.21    149810063.24    1498
10066.33    149810072.481496.07810072.73    149610078.98    149610127.75    1496
10128.88    149610135.37    1496 10137.9    149610140.67    149610152.11    1496
10158.65    149610167.29    149610169.72    149610193.56    149610195.42    1496
10199.61    149610204.44    149610214.96    1496 10225.5    149610246.971496.938
10251.59 1496.9910267.741497.45810268.361497.47910284.62    1498 10285.2    1498
10288.631498.26210292.791498.62710303.281499.53310309.95    150010316.081500.542
10321.25 1501.0510330.93    150210337.381502.68810359.831505.07210367.99    1506
10371.461506.40710371.711506.43610372.071506.47210372.581506.52910384.84    1508
10396.431509.39110398.52 1509.66
```

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9599.36	.055	9986.28	.055	10033.39	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9986.28	10033.39	230	389.3	380	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1495.95	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1495.87	Reach Len. (ft)	230.00	389.30	380.00
Crit W.S. (ft)		Flow Area (sq ft)	471.05	165.86	5.28
E.G. Slope (ft/ft)	0.002200	Area (sq ft)	471.05	165.86	5.28
Q Total (cfs)	1308.00	Flow (cfs)	818.93	482.89	6.19
Top Width (ft)	345.84	Top Width (ft)	293.09	47.10	5.64
Vel Total (ft/s)	2.04	Avg. Vel. (ft/s)	1.74	2.91	1.17
Max Chl Dpth (ft)	3.87	Hydr. Depth (ft)	1.61	3.52	0.94
Conv. Total (cfs)	27887.3	Conv. (cfs)	17460.0	10295.4	131.9
Length Wtd. (ft)	331.37	Wetted Per. (ft)	293.12	47.62	5.94
Min Ch El (ft)	1492.00	Shear (lb/sq ft)	0.22	0.48	0.12
Alpha	1.21	Stream Power (lb/ft s)	0.38	1.39	0.14
Frctn Loss (ft)	1.46	Cum Volume (acre-ft)	72.61	67.09	39.03
C & E Loss (ft)	0.05	Cum SA (acres)	51.03	12.40	29.21

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 #PF 2

E.G. Elev (ft)	1496.69	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1496.39	Reach Len. (ft)	230.00	389.30	380.00
Crit W.S. (ft)		Flow Area (sq ft)	110.45	190.04	8.89
E.G. Slope (ft/ft)	0.005104	Area (sq ft)	110.45	190.04	8.89
Q Total (cfs)	1308.00	Flow (cfs)	368.15	922.83	17.02
Top Width (ft)	102.00	Top Width (ft)	46.29	47.10	8.61
Vel Total (ft/s)	4.23	Avg. Vel. (ft/s)	3.33	4.86	1.91
Max Chl Dpth (ft)	4.39	Hydr. Depth (ft)	2.39	4.03	1.03
Conv. Total (cfs)	18308.4	Conv. (cfs)	5153.1	12917.1	238.2
Length Wtd. (ft)	355.32	Wetted Per. (ft)	48.67	47.62	9.00
Min Ch El (ft)	1492.00	Shear (lb/sq ft)	0.72	1.27	0.31
Alpha	1.11	Stream Power (lb/ft s)	2.41	6.17	0.60

Frctn Loss (ft)	1.58	Cum Volume (acre-ft)	50.88	70.00	27.27
C & E Loss (ft)	0.02	Cum SA (acres)	19.22	12.14	14.93

Warning: The energy loss was 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: Buchanan Wash
REACH: Buchanan Wash RS: 1.842

INPUT
Description: 2.121
Station Elevation Data num= 85

```
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9611.041508.1519612.8981507.5929614.7111507.0489618.199    15069619.9251505.482
9621.5721504.9879624.805    15049638.5021503.2199650.949    15029653.1731501.975
9660.0491501.8859762.8971500.6289773.102 1500.529800.527    15009832.4421499.101
9847.3021498.735 9865.331498.4419887.345    1498 9893.711497.6749896.9991497.511
 9910.361496.8039916.7491496.4669919.0091496.3399925.591    14969930.7591495.405
9939.2321494.3999942.511    14949946.1051493.8069982.894    1492 9986.17    1492
9989.8891491.6499991.8731491.435   10000 1490.5110004.37    149010007.07    1490
10012.54    149010024.33    149010028.851490.79710030.891491.15810031.56 1491.29
10035.16    149210035.54    149210042.061492.298   100611493.09810090.47    1494
 10114.21495.48310123.35    149610126.79    149610145.18    149610147.391495.969
10166.79 1495.7210199.971495.28410254.75    149410261.98    149410265.11    1494
10266.57    149410268.64    1494 10270.71493.95910396.38 1493.8710404.23    1494
10405.19    149410407.221494.18410408.551494.30510411.431494.58210421.521495.579
10423.07 1495.69 10427.2    1496 10442.51496.56710457.461497.08310462.461497.279
10466.47 1497.4210467.151497.44510480.33    149810488.511499.25110493.31    1500
10509.831501.71710512.98    150210525.321503.264 10531.9    150410538.411505.213
10540.251505.54310542.381505.92610543.311506.082 10545.1 1506.3310553.761507.614
```

Manning's n Values num= 3

```
     Sta   n Val     Sta   n Val     Sta   n Val
 9611.04    .055 9986.17    .05510035.16    .055
```

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9986.171	0035.16	400	401.78	430	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1494.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.59	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1493.85	Reach Len. (ft)	400.00	401.78	430.00
Crit W.S. (ft)		Flow Area (sq ft)	40.89	159.17	42.81
E.G. Slope (ft/ft)	0.012853	Area (sq ft)	40.89	159.17	42.81
Q Total (cfs)	1308.00	Flow (cfs)	125.18	1065.24	117.58
Top Width (ft)	140.24	Top Width (ft)	40.87	48.99	50.38
Vel Total (ft/s)	5.39	Avg. Vel. (ft/s)	3.06	6.69	2.75
Max Chl Dpth (ft)	3.85	Hydr. Depth (ft)	1.00	3.25	0.85
Conv. Total (cfs)	11537.4	Conv. (cfs)	1104.2	9396.1	1037.1
Length Wtd. (ft)	408.94	Wetted Per. (ft)	40.91	49.28	50.42
Min Ch El (ft)	1490.00	Shear (lb/sq ft)	0.80	2.59	0.68
Alpha	1.31	Stream Power (lb/ft s)	2.46	17.34	1.87
Frctn Loss (ft)	2.20	Cum Volume (acre-ft)	71.26	65.64	38.82
C & E Loss (ft)	0.15	Cum SA (acres)	50.15	11.97	28.96

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

CROSS SECTION OUTPUT Profile #PF 2

E.G. Elev (ft)	1495.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1494.84	Reach Len. (ft)	400.00	401.78	430.00
Crit W.S. (ft)		Flow Area (sq ft)	61.53	207.85	80.69
E.G. Slope (ft/ft)	0.003922	Area (sq ft)	61.53	207.85	80.69
Q Total (cfs)	1308.00	Flow (cfs)	176.31	917.93	213.76

Top Width (ft)	115.00	Top Width (ft)	26.17	48.99	39.84
Vel Total (ft/s)	3.74	Avg. Vel. (ft/s)	2.87	4.42	2.65
Max Chl Dpth (ft)	4.84	Hydr. Depth (ft)	2.35	4.24	2.03
Conv. Total (cfs)	20886.6	Conv. (cfs)	2815.4	14657.8	3413.4
Length Wtd. (ft)	404.44	Wetted Per. (ft)	27.92	49.28	41.19
Min Ch El (ft)	1490.00	Shear (lb/sq ft)	0.54	1.03	0.48
Alpha	1.14	Stream Power (lb/ft s)	1.55	4.56	1.27
Frctn Loss (ft)	2.19	Cum Volume (acre-ft)	50.42	68.23	26.88
C & E Loss (ft)	0.01	Cum SA (acres)	19.03	11.71	14.72

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

CROSS SECTION RIVER: Buchanan Wash
REACH: Buchanan Wash RS: 1.766

INPUT
Description: 2.045
Station Elevation Data num= 84

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9461.51	1499.259	543.418	1498	9548.48	1498	9567.832	1498	9581.578	1498
9584.415	1498	9587.5	1498	9589.731	1498	9597.626	1498	9600.765	1498
9610.142	1498	9634.549	1498	9713.152	1496	9699.764	1797	9765.388	1496
9827.427	1494	9832.273	1494	9832.996	1493	9299851.416		1492	9871.167
1490.594									
9880.905	1490	9885.271	1490	9898.368	1490	9949.75	1490	9957.941	1490
9965.181	1490	9968.293	1490	9971.08	1490	9972.279	1490	9974.012	1490
9977.142	1490	9979.177	1490	9987.15	1490	9988.264	1489	4779991.744	1488
10000	1488	10009.23	1488	10011.77	1488	10012.83	1488	40510013.811	488.778
10015.89	1489	50610017.31	1490	10021.6	1490	10029.44	1490	10033.91	1490
10036.64	1490	10039.65	1490	10040.94	1490	10044.47	1489	39210057.95	1488.15
10058.71	1488	08510059.53	1488	10062.49	1488	10063.51	1488	10066.46	1488.627
10071.87	1489	74810075.85	1490	10086.13	1490	10087.29	1490	10089.82	1490
10093.09	1490	10149.57	1490	85110177.34	1491	23110178.68	1491	2510225.05	1491.959
10225.43	1491	96510227.52	1492	10314.731	1493	07410372.221	1493	61110384.971	1493.958
10386.57	1494	103911494.54	710401.68	1496	10408.931	1497.452	10411.5	1498	
10415.16	1498	78310420.85	1500	10423.51	1500	56710430.19	1502	10432.35	1502.461
10439.54	1504	10445.021	1505	17310451.771	1506	61810454.461	1507.194		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9461.51	.055	9987.15	.055	10017.31	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9987.15	10017.31	500	508.03	555	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1492.10	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1491.99	Reach Len. (ft)	500.00	508.03	555.00
Crit W.S. (ft)		Flow Area (sq ft)	242.11	110.28	323.73
E.G. Slope (ft/ft)	0.003246	Area (sq ft)	242.11	110.28	323.73
Q Total (cfs)	1609.00	Flow (cfs)	548.17	396.21	664.62
Top Width (ft)	375.64	Top Width (ft)	135.65	30.16	209.84
Vel Total (ft/s)	2.38	Avg. Vel. (ft/s)	2.26	3.59	2.05
Max Chl Dpth (ft)	3.99	Hydr. Depth (ft)	1.78	3.66	1.54
Conv. Total (cfs)	28241.8	Conv. (cfs)	9621.7	6954.5	11665.7
Length Wtd. (ft)	514.42	Wetted Per. (ft)	135.71	30.93	210.16
Min Ch El (ft)	1488.00	Shear (lb/sq ft)	0.36	0.72	0.31
Alpha	1.18	Stream Power (lb/ft s)	0.82	2.60	0.64
Frctn Loss (ft)	1.90	Cum Volume (acre-ft)	69.96	64.39	37.01
C & E Loss (ft)	0.01	Cum SA (acres)	49.34	11.61	27.68

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

CROSS SECTION OUTPUT Profile #PF 2

E.G. Elev (ft)	1492.88	Element	Left OB	Channel	Right OB

Vel Head (ft)	0.39	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1492.49	Reach Len. (ft)	500.00	508.03	555.00
Crit W.S. (ft)		Flow Area (sq ft)	179.74	125.29	31.61
E.G. Slope (ft/ft)	0.007389	Area (sq ft)	179.74	125.29	31.61
Q Total (cfs)	1609.00	Flow (cfs)	749.91	739.37	119.72
Top Width (ft)	115.00	Top Width (ft)	72.15	30.16	12.69
Vel Total (ft/s)	4.78	Avg. Vel. (ft/s)	4.17	5.90	3.79
Max Chl Dpth (ft)	4.49	Hydr. Depth (ft)	2.49	4.15	2.49
Conv. Total (cfs)	18718.8	Conv. (cfs)	8724.2	8601.7	1392.8
Length Wtd. (ft)	506.02	Wetted Per. (ft)	74.64	30.93	15.18
Min Ch El (ft)	1488.00	Shear (lb/sq ft)	1.11	1.87	0.96
Alpha	1.10	Stream Power (lb/ft s)	4.63	11.03	3.64
Frctn Loss (ft)	2.64	Cum Volume (acre-ft)	49.32	66.69	26.32
C & E Loss (ft)	0.03	Cum SA (acres)	18.58	11.34	14.46

Warning: The energy loss was 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: Buchanan Wash
REACH: Buchanan Wash RS: 1.670

INPUT
Description: 1.951
Station Elevation Data num= 72

```
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  9429.61496.7869467.767 1496.719503.5921496.4869576.888    14969598.438    1496
9602.473    14969605.481    14969633.8241495.7419663.2241495.5589685.1141495.372
9816.504    14949833.324    14949835.127    14949835.583    14949866.865 1492.93
9892.538    14929892.584    14929901.8351490.9139909.386    14909918.9391488.931
9924.8551488.3099927.282    14889942.1051487.0719944.9911486.9129962.916    1486
9965.668    14869972.966    14869976.019    14869979.006    14869987.351    1486
9991.6711484.6729993.656    14849998.969    1484   10000    148410001.11    1484
10010.07    148410013.581485.06210016.35    148610018.991486.61810024.12    1488
10034.621489.17710042.39    149010042.79    149010043.76    149010053.07    1490
10060.11    149010063.49    149010065.28    149010072.42    1490 10117.2    1490
10159.55    1490   10249 1491.4410254.171491.452 10281.41491.84310283.541491.853
10290.19    149210316.091492.51410352.721493.14310378.741493.56510383.721493.645
10389.421493.72210402.841493.87910409.53    149410443.271495.351 10457.9    1496
 10472.41497.91410472.87    149810479.531499.21410483.81    150010490.571501.126
10495.76    150210509.341503.506
```

Manning's n Values num= 3

```
     Sta   n Val     Sta   n Val     Sta   n Val
  9429.6    .0559987.351    .05510042.39    .055
```

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9987.35	110042.39	510	500.86	490	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1490.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.	0.055	0.055	
W.S. Elev (ft)	1489.95	Reach Len. (ft)	510.00	500.86	490.00
Crit W.S. (ft)		Flow Area (sq ft)	220.47	200.37	
E.G. Slope (ft/ft)	0.004255	Area (sq ft)	220.47	200.37	
Q Total (cfs)	1609.00	Flow (cfs)	778.68	830.32	
Top Width (ft)	132.12	Top Width (ft)	77.53	54.58	
Vel Total (ft/s)	3.82	Avg. Vel. (ft/s)	3.53	4.14	
Max Chl Dpth (ft)	5.95	Hydr. Depth (ft)	2.84	3.67	
Conv. Total (cfs)	24667.7	Conv. (cfs)	11938.0	12729.7	
Length Wtd. (ft)	502.69	Wetted Per. (ft)	77.70	55.57	
Min Ch El (ft)	1484.00	Shear (lb/sq ft)	0.75	0.96	
Alpha	1.02	Stream Power (lb/ft s)	2.66	3.97	
Frctn Loss (ft)	2.25	Cum Volume (acre-ft)	67.30	62.58	34.94
C & E Loss (ft)	0.01	Cum SA (acres)	48.12	11.11	26.34

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

CROSS SECTION OUTPUT Profile #PF 2

E.G. Elev (ft)	1490.20	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.27	Wt. n-Val.	0.055	0.055	
W.S. Elev (ft)	1489.93	Reach Len. (ft)	510.00	500.86	490.00
Crit W.S. (ft)		Flow Area (sq ft)	206.14	183.96	
E.G. Slope (ft/ft)	0.003889	Area (sq ft)	206.14	183.96	
Q Total (cfs)	1609.00	Flow (cfs)	756.97	852.03	
Top Width (ft)	100.00	Top Width (ft)	62.35	37.65	
Vel Total (ft/s)	4.12	Avg. Vel. (ft/s)	3.67	4.63	
Max Chl Dpth (ft)	5.93	Hydr. Depth (ft)	3.31	4.89	
Conv. Total (cfs)	25800.7	Conv. (cfs)	12138.2	13662.5	
Length Wtd. (ft)	502.28	Wetted Per. (ft)	64.06	40.36	
Min Ch El (ft)	1484.00	Shear (lb/sq ft)	0.78	1.11	
Alpha	1.04	Stream Power (lb/ft s)	2.87	5.13	
Frctn Loss (ft)	2.07	Cum Volume (acre-ft)	47.10	64.89	26.12
C & E Loss (ft)	0.01	Cum SA (acres)	17.80	10.95	14.38

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: Buchanan Wash
REACH: Buchanan Wash RS: 1.575

INPUT
Description: 1.856
Station Elevation Data num= 82

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9486.56	14929	486.838	14929	494.261	14929	513.417	1491.929	532.589	1491.946
9582.936	14929	583.304	14929	583.318	14929	583.321	14929	584.706	1492
9594.884	1491.989	597.763	14929	608.328	1492.008	608.386	1492.008	656.495	1492.129
9679.797	1492.069	692.451	14929	703.992	14929	715.933	14929	718.365	1492
9777.857	1491.041	9791.415	1490.782	9802.197	1490.557	9827.477	14909	832.851	1490
9859.677	1488.533	9861.832	1488.403	9867.103	14889	867.852	14889	880.391	1487.629
9916.504	1486.669	9941.263	14869	965.807	1484.251	9967.082	1484.166	9969.577	1484
9970.629	1483.687	9977.811	14829	989.617	14829	998.541	1482	10000	1482.5
10001.87	1483.253	10003.86	14841	0004.331	1484.024	10043.35	14861	0055.311	1486.991
10067.27	14881	0083.361	1488.719	10087.521	1488.817	10095.541	1489.123	10098.891	1489.255
10104.14	1489.302	10128.271	1489.511	10129.321	1489.487	10138.421	1489.172	10144.9	1488.95
10153.39	1488.764	10163.361	1488.312	10169.39	14881	0173.81	1488	10175.3	1488
10223.06	14881	0228.24	14881	0233.97	14881	0242.74	1487.928	10252.74	1488
10274.75	1488.193	10297.321	1488.461	10330.01	1488.505	10342.93	1488.612	10346.36	1488.664
10385.92	1489.641	10398.13	14901	0399.01	1490	10399.81	1490.123	10411.83	1492
10421.21	1493.463	10424.65	14941	0426.47	1494.285	10454.04	1498.548	10458.87	1499.314
10463.03	14901	0466.551	1500.599						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9486.56	.055	9969.577	.055	10003.86	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9969.57	10003.86	505	505.7	540	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1487.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.33	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1487.60	Reach Len. (ft)	505.00	505.70	540.00
Crit W.S. (ft)		Flow Area (sq ft)	121.05	178.58	117.79
E.G. Slope (ft/ft)	0.004713	Area (sq ft)	121.05	178.58	117.79
Q Total (cfs)	1609.00	Flow (cfs)	277.69	983.81	347.49
Top Width (ft)	180.81	Top Width (ft)	87.92	34.28	58.61
Vel Total (ft/s)	3.85	Avg. Vel. (ft/s)	2.29	5.51	2.95
Max Chl Dpth (ft)	5.60	Hydr. Depth (ft)	1.38	5.21	2.01
Conv. Total (cfs)	23436.2	Conv. (cfs)	4044.8	14329.9	5061.5
Length Wtd. (ft)	514.74	Wetted Per. (ft)	88.01	34.89	58.73
Min Ch El (ft)	1482.00	Shear (lb/sq ft)	0.40	1.51	0.59
Alpha	1.44	Stream Power (lb/ft s)	0.93	8.30	1.74
Frctn Loss (ft)	3.33	Cum Volume (acre-ft)	65.30	60.40	34.28
C & E Loss (ft)	0.01	Cum SA (acres)	47.15	10.60	26.01

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

CROSS SECTION OUTPUT Profile #PF 2

E.G. Elev (ft)	1488.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.35	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1487.78	Reach Len. (ft)	505.00	505.70	540.00
Crit W.S. (ft)		Flow Area (sq ft)	60.62	184.85	119.69
E.G. Slope (ft/ft)	0.004353	Area (sq ft)	60.62	184.85	119.69
Q Total (cfs)	1609.00	Flow (cfs)	212.21	1001.41	395.38
Top Width (ft)	100.00	Top Width (ft)	19.58	34.28	46.14
Vel Total (ft/s)	4.41	Avg. Vel. (ft/s)	3.50	5.42	3.30
Max Chl Dpth (ft)	5.78	Hydr. Depth (ft)	3.10	5.39	2.59
Conv. Total (cfs)	24386.4	Conv. (cfs)	3216.3	15177.5	5992.5
Length Wtd. (ft)	515.56	Wetted Per. (ft)	22.03	34.89	47.44
Min Ch El (ft)	1482.00	Shear (lb/sq ft)	0.75	1.44	0.69
Alpha	1.16	Stream Power (lb/ft s)	2.62	7.80	2.27
Frctn Loss (ft)	2.67	Cum Volume (acre-ft)	45.54	62.77	25.45
C & E Loss (ft)	0.01	Cum SA (acres)	17.32	10.53	14.12

Warning: The energy loss was 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: Buchanan Wash
REACH: Buchanan Wash RS: 1.479

INPUT
Description: 1.761
Station Elevation Data num= 74

```
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
 9486.18     14889532.129     14889587.464     14889601.325     14889601.809     1488
 9601.88     14889602.6081487.9879648.2261487.2299691.5221486.7489699.7231486.647
9702.1731486.6049703.4381486.5819737.7681486.1299741.2251486.127 9743.191486.127
9743.4521486.1269762.758     14869769.997     14869772.618     14869776.918     1486
9840.026     14869843.143     14869854.567     14869894.082     1486 9914.97     1486
9915.241     14869923.008 1485.259935.777     14849948.907 1482.97 9961.84     1482
9964.531     14829971.744     14829979.602     14829984.1031480.3289985.138     1480
9988.286     1480   10000     1480 10008.2     148010012.121481.303 10014.1     1482
10021.041482.15610023.151482.17710044.06 1482.6110079.841483.17110087.971483.272
10118.461483.46310122.041483.45810198.751483.56510241.951483.94710243.751483.962
 10245.7     148410248.57     148410271.351484.60410274.791484.67610285.941484.802
10290.661484.84610311.961485.17810316.111485.16410323.051485.05810330.421484.838
10334.791484.70210341.611484.59910344.721484.57110356.231484.24910360.38 1484.17
10360.931484.15810367.87     148410370.28     148410371.16     1484 10373.5     1484
10384.83     148410387.83     148410390.451484.06510430.431485.469
```

Manning's n Values num= 3

```
     Sta   n Val      Sta   n Val      Sta   n Val
 9486.18    .0559979.602    .055 10014.1    .055
```

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

9979.602	10014.1	355	351.78	335	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
888			F

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1484.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.39	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1484.20	Reach Len. (ft)	355.00	351.78	335.00
Crit W.S. (ft)		Flow Area (sq ft)	70.63	133.50	212.69
E.G. Slope (ft/ft)	0.009403	Area (sq ft)	70.63	133.50	218.10
Q Total (cfs)	1609.00	Flow (cfs)	246.63	850.89	511.48
Top Width (ft)	357.26	Top Width (ft)	45.82	34.50	276.95

Vel Total (ft/s)	3.86	Avg. Vel. (ft/s)	3.49	6.37	2.40
Max Chl Dpth (ft)	4.20	Hydr. Depth (ft)	1.54	3.87	0.88
Conv. Total (cfs)	16592.6	Conv. (cfs)	2543.3	8774.7	5274.6
Length Wtd. (ft)	346.05	Wetted Per. (ft)	45.91	35.18	241.85
Min Ch El (ft)	1480.00	Shear (lb/sq ft)	0.90	2.23	0.52
Alpha	1.69	Stream Power (lb/ft s)	3.15	14.20	1.24
Frctn Loss (ft)	1.42	Cum Volume (acre-ft)	64.19	58.59	32.20
C & E Loss (ft)	0.09	Cum SA (acres)	46.37	10.20	23.93

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

CROSS SECTION OUTPUT Profile #PF 2

			Left OB	Channel	Right OB
E.G. Elev (ft)	1485.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.42	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1485.04	Reach Len. (ft)	355.00	351.78	335.00
Crit W.S. (ft)		Flow Area (sq ft)	29.18	162.59	139.65
E.G. Slope (ft/ft)	0.006253	Area (sq ft)	29.18	162.59	139.65
Q Total (cfs)	1609.00	Flow (cfs)	108.86	963.80	536.34
Top Width (ft)	100.00	Top Width (ft)	9.60	34.50	55.90
Vel Total (ft/s)	4.85	Avg. Vel. (ft/s)	3.73	5.93	3.84
Max Chl Dpth (ft)	5.04	Hydr. Depth (ft)	3.04	4.71	2.50
Conv. Total (cfs)	20347.7	Conv. (cfs)	1376.7	12188.4	6782.6
Length Wtd. (ft)	345.98	Wetted Per. (ft)	12.64	35.18	57.93
Min Ch El (ft)	1480.00	Shear (lb/sq ft)	0.90	1.80	0.94
Alpha	1.14	Stream Power (lb/ft s)	3.36	10.69	3.61
Frctn Loss (ft)	1.57	Cum Volume (acre-ft)	45.02	60.75	23.84
C & E Loss (ft)	0.05	Cum SA (acres)	17.15	10.14	13.49

Warning: The energy loss was 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: Buchanan Wash
REACH: Buchanan Wash RS: 1.412

INPUT
Description: 1.695
Station Elevation Data num= 81

```
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
 9489.44     14849497.438     14849512.968     14849518.285     14849522.267     1484
 9523.68     14849539.023     14849540.713     1484  9564.2     14849567.169     1484
9594.619     14849604.671     14849621.753     14849704.446     14849713.941     1484
9726.539     14849744.536     14849748.402     14849789.392     14849791.9731483.971
9792.1571483.9689797.308     14849799.985     14849804.081     1484 9814.48     1484
9819.818     14849821.591     14849837.558     1484 9838.44     14849851.588     1484
9855.874     14849863.081     14849864.931     14849886.9741482.7339896.056 1482.68
9903.299     14829903.553     1482 9911.081481.6259913.147 1481.529920.1951481.226
9923.9391481.1149930.2931480.983 9974.97     14809989.316     14809990.174     1480
9990.5621479.7659994.023     1478   10000     147810011.15     147810014.43     1478
10015.131478.28410019.36     148010019.49     148010043.29     148010073.92     1480
10094.75     148010100.53     148010104.65     148010107.06     148010118.871480.891
10121.66 1481.1210125.081481.37910132.781481.98810132.831481.99110132.891481.996
10132.94     148210193.791483.37710220.37     148410225.23     148410233.711484.315
10235.231484.35710243.181484.51810250.011484.79610258.871485.13910284.161485.957
10284.761485.98210285.33     148610285.44     148610285.54     148610315.95     1486
10369.561487.386
```

Manning's n Values num= 3

```
     Sta   n Val      Sta   n Val      Sta   n Val
 9489.44     .0559990.174     .05510019.36     .055
```

```
Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.   Expan.
      9990.17410019.36               300  296.39     305              .1       .3
```

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1483.09	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1482.98	Reach Len. (ft)	300.00	296.39	305.00
Crit W.S. (ft)		Flow Area (sq ft)	206.52	136.65	334.16
E.G. Slope (ft/ft)	0.002282	Area (sq ft)	206.52	136.65	334.16
Q Total (cfs)	1609.00	Flow (cfs)	411.65	483.85	713.50
Top Width (ft)	293.61	Top Width (ft)	107.51	29.19	156.91
Vel Total (ft/s)	2.38	Avg. Vel. (ft/s)	1.99	3.54	2.14
Max Chl Dpth (ft)	4.98	Hydr. Depth (ft)	1.92	4.68	2.13
Conv. Total (cfs)	33685.7	Conv. (cfs)	8618.3	10129.7	14937.7
Length Wtd. (ft)	299.30	Wetted Per. (ft)	107.58	30.07	157.00
Min Ch El (ft)	1478.00	Shear (lb/sq ft)	0.27	0.65	0.30
Alpha	1.21	Stream Power (lb/ft s)	0.55	2.29	0.65
Frctn Loss (ft)	1.05	Cum Volume (acre-ft)	63.06	57.50	30.08
C & E Loss (ft)	0.02	Cum SA (acres)	45.75	9.95	22.26

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

CROSS SECTION OUTPUT Profile #PF 2

E.G. Elev (ft)	1483.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1483.58	Reach Len. (ft)	300.00	296.39	305.00
Crit W.S. (ft)		Flow Area (sq ft)	71.88	154.04	181.10
E.G. Slope (ft/ft)	0.003454	Area (sq ft)	71.88	154.04	181.10
Q Total (cfs)	1609.00	Flow (cfs)	239.51	726.89	642.59
Top Width (ft)	100.00	Top Width (ft)	20.17	29.19	50.64
Vel Total (ft/s)	3.95	Avg. Vel. (ft/s)	3.33	4.72	3.55
Max Chl Dpth (ft)	5.58	Hydr. Depth (ft)	3.56	5.28	3.58
Conv. Total (cfs)	27376.2	Conv. (cfs)	4075.2	12367.6	10933.4
Length Wtd. (ft)	298.46	Wetted Per. (ft)	23.64	30.07	54.22
Min Ch El (ft)	1478.00	Shear (lb/sq ft)	0.66	1.10	0.72
Alpha	1.07	Stream Power (lb/ft s)	2.18	5.21	2.56
Frctn Loss (ft)	1.24	Cum Volume (acre-ft)	44.61	59.47	22.61
C & E Loss (ft)	0.01	Cum SA (acres)	17.03	9.88	13.08

Warning: The energy loss was 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: Buchanan Wash
REACH: Buchanan Wash RS: 1.356

INPUT
Description: 1.638
Station Elevation Data num= 92

```
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
 9303.28 1482.979327.506     14829328.545     14829329.839     14829330.789     1482
9331.965     14829347.742     14829375.766     14829396.419     14829401.532     1482
9474.152     14829485.166     14829485.476     14829489.638     14829490.418     1482
9520.2911482.4069533.0781482.5739541.0831482.6939547.4911482.7849695.671     1484
9696.091     14849696.175     14849697.436     14849697.602     14849709.9061483.625
9718.5051483.3619725.3031483.1619743.6521482.7549743.7061482.7519766.101     1482
  9774.1     14829783.766     14829787.888     14829839.961     14829844.902     1482
9897.6571481.1959898.701 1481.189904.3031481.2019923.9411480.7289924.259 1480.73
9933.736     14809938.099     14809961.297     14809978.7151479.392 9980.191479.238
9981.9671479.0049985.7541478.5919990.356     14789992.2731476.9939994.111     1476
   10000     147610002.12     147610009.18     147610013.281477.19310016.05     1478
 10026.51478.85210036.161479.64510042.58     148010045.461480.63210046.491480.859
10049.581481.20310050.981481.35910053.041481.32510058.651481.24710058.831481.269
10064.87     148210065.46     148210066.48     148210073.79     1482 10076.71481.314
10079.061480.82610079.061480.82510080.371480.44910081.92     148010083.76     1480
10086.92     148010112.881480.87910142.55     148210148.651482.53210167.51     1484
10184.431485.67710187.68     148610190.931486.34310205.751487.50310208.191487.698
10211.74     148810211.92     148810211.98     148810214.671488.27810230.67     1490
 10233.51490.24710241.311490.925
```

```
Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9303.28    .0559961.297    .05510050.98    .055

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      9961.29710050.98              205  129.16      75             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
888        F
```

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1482.02	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.27	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1481.75	Reach Len. (ft)	205.00	129.16	75.00
Crit W.S. (ft)		Flow Area (sq ft)	91.11	287.69	63.26
E.G. Slope (ft/ft)	0.006049	Area (sq ft)	91.11	287.69	63.26
Q Total (cfs)	1609.00	Flow (cfs)	179.70	1304.43	124.86
Top Width (ft)	262.79	Top Width (ft)	100.13	89.68	72.98
Vel Total (ft/s)	3.64	Avg. Vel. (ft/s)	1.97	4.53	1.97
Max Chl Dpth (ft)	5.75	Hydr. Depth (ft)	0.91	3.21	0.87
Conv. Total (cfs)	20687.7	Conv. (cfs)	2310.5	16771.8	1605.4
Length Wtd. (ft)	140.98	Wetted Per. (ft)	100.17	90.76	73.26
Min Ch El (ft)	1476.00	Shear (lb/sq ft)	0.34	1.20	0.33
Alpha	1.31	Stream Power (lb/ft s)	0.68	5.43	0.64
Frctn Loss (ft)	0.53	Cum Volume (acre-ft)	62.04	56.06	28.69
C & E Loss (ft)	0.04	Cum SA (acres)	45.03	9.54	21.46

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 #PF 2

			Left OB	Channel	Right OB
E.G. Elev (ft)	1482.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.32	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1482.26	Reach Len. (ft)	205.00	129.16	75.00
Crit W.S. (ft)		Flow Area (sq ft)	25.50	333.04	0.02
E.G. Slope (ft/ft)	0.005134	Area (sq ft)	25.50	333.04	0.02
Q Total (cfs)	1609.00	Flow (cfs)	75.24	1533.76	0.00
Top Width (ft)	101.00	Top Width (ft)	11.30	89.68	0.02
Vel Total (ft/s)	4.49	Avg. Vel. (ft/s)	2.95	4.61	0.14
Max Chl Dpth (ft)	6.26	Hydr. Depth (ft)	2.26	3.71	0.90
Conv. Total (cfs)	22455.4	Conv. (cfs)	1050.0	21405.3	0.0
Length Wtd. (ft)	138.45	Wetted Per. (ft)	13.55	90.76	0.92
Min Ch El (ft)	1476.00	Shear (lb/sq ft)	0.60	1.18	0.01
Alpha	1.02	Stream Power (lb/ft s)	1.78	5.42	0.00
Frctn Loss (ft)	0.40	Cum Volume (acre-ft)	44.27	57.81	21.97
C & E Loss (ft)	0.05	Cum SA (acres)	16.92	9.47	12.90

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: Buchanan Wash
REACH: Buchanan Wash      RS: 1.332

INPUT
Description: 1.332 Near Culvert
Station Elevation Data    num=      83
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
8955.4651481.9978955.553    14828956.051    14828958.859    1482 8971.09    1482
 8978.62    14828992.3191481.9488994.1131481.9348996.1791481.904 8996.851481.892
9000.4781481.8659028.2321481.2579045.9981480.8759059.3511480.5949067.4611480.422
9078.7361480.2369082.6111480.2169083.8341480.2089090.0811480.1789106.4121480.068
9106.6311480.0659108.0071480.0579108.2691480.0579130.4731480.0429130.8551480.043
9134.167    14809137.825    14809145.106    14809146.659    14809146.989    1480
9147.039    14809151.566    14809157.235    14809159.582    14809162.787    1480
9163.074    14809164.935    14809170.856    14809176.616    14809182.808    1480
```

```
9186.047    14809188.448    14809213.4941478.6979218.0841478.6019237.1721478.296
9238.539 1478.269253.909    14789254.297    14789257.611 1477.359263.3681476.369
9264.9251476.1049265.263    14769276.206    14769284.216    14769286.5161476.421
9287.1921476.5449293.767    14789302.0931478.402  9331.8    14809332.875    1480
 9338.04    14809340.812    14809341.017    14809347.581    14809349.444    1480
9353.356    14809359.263    14809360.589    14809365.243    14809366.504 1480.08
9366.6151480.0829367.3851480.1069374.7381480.4519383.5931480.8479384.3531480.879
9389.4251480.9449396.8131481.154 9398.131481.2149420.9671481.8939422.219    1482
9422.8031481.9579424.389    14829434.1611483.003

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
8955.465    .0559253.909    .0559293.767    .055

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      9253.9099293.767              65   71.81      75             .1       .3
Skew Angle = 22

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)          1481.45    Element                  Left OB    Channel   Right OB
  Vel Head (ft)              0.13    Wt. n-Val.                0.055      0.055      0.055
  W.S. Elev (ft)          1481.31    Reach Len. (ft)           65.00      71.81      75.00
  Crit W.S. (ft)          1479.88    Flow Area (sq ft)        337.58     190.96     153.48
  E.G. Slope (ft/ft)     0.002584    Area (sq ft)             337.58     190.96     153.48
  Q Total (cfs)           1609.00    Flow (cfs)               601.72     740.50     266.78
  Top Width (ft)           375.85    Top Width (ft)           228.27      39.86     107.72
  Vel Total (ft/s)           2.36    Avg. Vel. (ft/s)           1.78       3.88       1.74
  Max Chl Dpth (ft)          5.31    Hydr. Depth (ft)           1.48       4.79       1.42
  Conv. Total (cfs)       31651.6    Conv. (cfs)             11836.8    14566.9     5248.0
  Length Wtd. (ft)          71.81    Wetted Per. (ft)         228.33      40.25     107.80
  Min Ch El (ft)          1476.00    Shear (lb/sq ft)           0.24       0.77       0.23
  Alpha                      1.55    Stream Power (lb/ft s)     0.43       2.97       0.40
  Frctn Loss (ft)                    Cum Volume (acre-ft)      61.03      55.35      28.50
  C & E Loss (ft)                    Cum SA (acres)            44.26       9.35      21.30


CROSS SECTION OUTPUT    Profile #PF 2

  E.G. Elev (ft)          1482.12    Element                  Left OB    Channel   Right OB
  Vel Head (ft)              0.15    Wt. n-Val.                0.055      0.055      0.055
  W.S. Elev (ft)          1481.97    Reach Len. (ft)           65.00      71.81      75.00
  Crit W.S. (ft)          1479.88    Flow Area (sq ft)        209.25     217.23     129.93
  E.G. Slope (ft/ft)     0.001886    Area (sq ft)             209.25     217.23     129.93
  Q Total (cfs)           1609.00    Flow (cfs)               529.83     784.16     295.01
  Top Width (ft)           150.00    Top Width (ft)            63.91      39.86      46.23
  Vel Total (ft/s)           2.89    Avg. Vel. (ft/s)           2.53       3.61       2.27
  Max Chl Dpth (ft)          5.97    Hydr. Depth (ft)           3.27       5.45       2.81
  Conv. Total (cfs)       37051.6    Conv. (cfs)             12200.7    18057.4     6793.5
  Length Wtd. (ft)          71.81    Wetted Per. (ft)          66.00      40.25      48.26
  Min Ch El (ft)          1476.00    Shear (lb/sq ft)           0.37       0.64       0.32
  Alpha                      1.12    Stream Power (lb/ft s)     0.95       2.29       0.72
  Frctn Loss (ft)                    Cum Volume (acre-ft)      43.72      57.00      21.86
  C & E Loss (ft)                    Cum SA (acres)            16.75       9.28      12.86


CULVERT                 RIVER: Buchanan Wash
REACH: Buchanan Wash       RS: 1.326

INPUT
Description:
Distance from Upstream XS =       13
Deck/Roadway Width        =       30
Weir Coefficient          =      2.6
Bridge Deck/Roadway Skew  =       22
Upstream  Deck/Roadway Coordinates
    num=        5
     Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord      Sta Hi Cord Lo Cord
    8470  1480.5             9960  1480.5            10070  1480.5
   10124    1482            10250    1490
```

```
Upstream Bridge Cross Section Data
Station Elevation Data    num=      83
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
8955.4651481.9978955.553    14828956.051    14828958.859    1482 8971.09    1482
 8978.62    14828992.3191481.9488994.1131481.9348996.1791481.904 8996.851481.892
9000.4781481.8659028.2321481.2579045.9981480.8759059.3511480.5949067.4611480.422
9078.7361480.2369082.6111480.2169083.8341480.2089090.0811480.1789106.4121480.068
9106.6311480.0659108.0071480.0579108.2691480.0579130.4731480.0429130.8551480.043
9134.167    14809137.825    14809145.106    14809146.659    14809146.989    1480
9147.039    14809151.566    14809157.235    14809159.582    14809162.787    1480
9163.074    14809164.935    14809170.856    14809176.616    14809182.808    1480
9186.047    14809188.448    14809213.4941478.6979218.0841478.6019237.1721478.296
9238.539 1478.269253.909    14789254.297    14789257.611 1477.359263.3681476.369
9264.9251476.1049265.263    14769276.206    14769284.216    14769286.5161476.421
9287.1921476.5449293.767    14789302.0931478.402  9331.8    14809332.875    1480
 9338.04    14809340.812    14809341.017    14809347.581    14809349.444    1480
9353.356    14809359.263    14809360.589    14809365.243    14809366.504 1480.08
9366.6151480.0829367.3851480.1069374.7381480.4519383.5931480.8479384.3531480.879
9389.4251480.9449396.8131481.154 9398.131481.2149420.9671481.8939422.219    1482
9422.8031481.9579424.389    14829434.1611483.003

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
8955.465    .0559253.909    .0559293.767    .055

Bank Sta: Left   Right    Coeff Contr.   Expan.
      9253.9099293.767             .1        .3
Skew Angle = 22

Downstream  Deck/Roadway Coordinates
    num=       5
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    8470  1480.5            9960  1480.5           10070  1480.5
   10124    1482           10250    1490

Downstream Bridge Cross Section Data
Station Elevation Data    num=      72
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
8981.0831481.6249011.0611481.7849031.6651481.7069059.025  1481.59090.5241481.034
 9100.751480.8489101.4241480.8439117.075    14809118.084    14809120.042    1480
9132.105    14809132.137    14809132.153    14809132.2891479.9969159.5511479.705
9161.6451479.6419178.1471479.5669183.7811479.5439187.3351479.4249187.426 1479.42
 9188.791479.3689210.585 1479.329210.7031479.3189221.0831479.1319223.3451479.119
9227.6561479.1389228.8521479.1199235.4081479.1689236.1911479.1629240.8271478.965
  9241.81478.9959253.7411478.0169253.7821478.0149253.8011478.0139253.895    1478
9256.0111477.416 9258.521476.6739261.139    14769261.522    14769274.119    1476
9276.289    14769292.534    14769293.655    14769293.804    14769294.8791476.259
9300.257    14789305.467    14789305.478    14789305.765    14789306.1821478.015
9306.3021478.0199352.772    14809355.118    1480 9358.53    14809362.879    1480
9365.781    14809366.458    14809376.0551480.7669379.9381481.0179392.169    1482
9397.212    14829410.1461483.0299411.2311483.0849419.891    14849426.1321484.557
 9431.871484.9039442.209    14869444.138    14869449.5231486.5119459.4821487.498
 9463.19 1487.819464.4521487.907

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
8981.083    .0559253.741    .0559300.257    .055

Bank Sta: Left   Right    Coeff Contr.   Expan.
      9253.7419300.257             .1        .3
Skew Angle = 22

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  1
```

```
Culvert Name      Shape      Rise    Span
Culvert #1           Box       4       7
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 3 - Wingwall flared 0 deg. (sides extended straight)
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    n Value   Entrance Loss Coef   Exit Loss Coef
                13      30       .013                   .4                1
Number of Barrels =  4
Upstream   Elevation =  1476
Centerline Stations
    Sta.    Sta.    Sta.    Sta.
    9263    9271    9279    9287
Downstream Elevation =  1476
Centerline Stations
    Sta.    Sta.    Sta.    Sta.
    9265    9273    9281    9289

CULVERT OUTPUT    Profile #PF 1
Culvert ID : Culvert #1

  Culv Q (cfs)              785.47    Culv Ful Lngh (ft)        30.00
  # Barrels                      4    Culv Vel US (ft/s)         7.01
  Q Barrel (cfs)            196.37    Culv Vel DS (ft/s)         7.01
  E.G. US. (ft)            1481.45    Culv Inv El Up (ft)     1476.00
  W.S. US. (ft)            1481.31    Culv Inv El Dn (ft)     1476.00
  E.G. DS (ft)             1480.74    Culv Frctn Ls (ft)         0.08
  W.S. DS (ft)             1480.30    Culv Ext Lss (ft)          0.32
  Delta EG (ft)               0.70    Culv Ent Lss (ft)          0.31
  Delta WS (ft)               1.02    Q Weir (cfs)             823.54
  E.G. IC (ft)             1481.40    Weir Sta Lft (ft)       9019.30
  E.G. OC (ft)             1481.45    Weir Sta Rgt (ft)       9406.16
  Culvert Control           Outlet    Weir Submerg               0.00
  Culv WS Inlet (ft)       1480.00    Weir Max Depth (ft)        0.95
  Culv WS Outlet (ft)      1480.00    Weir Avg Depth (ft)        0.86
  Culv Nml Depth (ft)                 Wr Flw Area (sq ft)      332.15
  Culv Crt Depth (ft)         2.90    Min El Weir Flow (ft)   1480.51


CULVERT OUTPUT    Profile #PF 2
Culvert ID : Culvert #1

  Culv Q (cfs)              801.58    Culv Ful Lngh (ft)        30.00
  # Barrels                      4    Culv Vel US (ft/s)         7.16
  Q Barrel (cfs)            200.39    Culv Vel DS (ft/s)         7.16
  E.G. US. (ft)            1482.12    Culv Inv El Up (ft)     1476.00
  W.S. US. (ft)            1481.97    Culv Inv El Dn (ft)     1476.00
  E.G. DS (ft)             1481.20    Culv Frctn Ls (ft)         0.09
  W.S. DS (ft)             1480.93    Culv Ext Lss (ft)          0.52
  Delta EG (ft)               0.92    Culv Ent Lss (ft)          0.32
  Delta WS (ft)               1.05    Q Weir (cfs)             807.42
  E.G. IC (ft)             1482.00    Weir Sta Lft (ft)       9190.00
  E.G. OC (ft)             1482.12    Weir Sta Rgt (ft)       9340.00
  Culvert Control           Outlet    Weir Submerg               0.26
  Culv WS Inlet (ft)       1480.00    Weir Max Depth (ft)        1.62
  Culv WS Outlet (ft)      1480.00    Weir Avg Depth (ft)        1.62
  Culv Nml Depth (ft)                 Wr Flw Area (sq ft)      243.66
  Culv Crt Depth (ft)         2.94    Min El Weir Flow (ft)   1480.51


CROSS SECTION          RIVER: Buchanan Wash
REACH: Buchanan Wash      RS: 1.318

INPUT
Description:
Station Elevation Data    num=      72
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
8981.0831481.6249011.0611481.7849031.6651481.7069059.025  1481.59090.5241481.034
 9100.751480.8489101.4241480.8439117.075    14809118.084    14809120.042    1480
9132.105    14809132.137    14809132.153    14809132.2891479.9969159.5511479.705
9161.6451479.6419178.1471479.5669183.7811479.5439187.3351479.4249187.426 1479.42
```

```
 9188.791479.3689210.585 1479.329210.7031479.3189221.0831479.1319223.3451479.119
9227.6561479.1389228.8521479.1199235.4081479.1689236.1911479.1629240.8271478.965
  9241.81478.9959253.7411478.0169253.7821478.0149253.8011478.0139253.895    1478
9256.0111477.416 9258.521476.6739261.139    14769261.522    14769274.119    1476
9276.289    14769292.534    14769293.655    14769293.804    14769294.8791476.259
9300.257    14789305.467    14789305.478    14789305.765    14789306.1821478.015
9306.3021478.0199352.772    14809355.118    1480 9358.53    14809362.879    1480
9365.781    14809366.458    14809376.0551480.7669379.9381481.0179392.169    1482
9397.212    14829410.1461483.0299411.2311483.0849419.891    14849426.1321484.557
 9431.871484.9039442.209    14869444.138    14869449.5231486.5119459.4821487.498
 9463.19 1487.819464.4521487.907

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
8981.083    .0559253.741    .0559300.257    .055

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      9253.7419300.257              105   150.9     190             .1       .3
Skew Angle = 22

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)          1480.74    Element                  Left OB    Channel   Right OB
  Vel Head (ft)              0.45    Wt. n-Val.                0.055      0.055      0.055
  W.S. Elev (ft)          1480.30    Reach Len. (ft)          105.00     150.90     190.00
  Crit W.S. (ft)          1479.88    Flow Area (sq ft)        116.52     186.22      78.29
  E.G. Slope (ft/ft)     0.008342    Area (sq ft)             116.52     186.22      78.29
  Q Total (cfs)           1609.00    Flow (cfs)               251.75    1149.02     208.23
  Top Width (ft)           258.60    Top Width (ft)           142.17      46.52      69.92
  Vel Total (ft/s)           4.22    Avg. Vel. (ft/s)           2.16       6.17       2.66
  Max Chl Dpth (ft)          4.30    Hydr. Depth (ft)           0.82       4.00       1.12
  Conv. Total (cfs)       17616.3    Conv. (cfs)              2756.3    12580.2     2279.8
  Length Wtd. (ft)         146.61    Wetted Per. (ft)         142.23      47.09      69.97
  Min Ch El (ft)          1476.00    Shear (lb/sq ft)           0.43       2.06       0.58
  Alpha                      1.62    Stream Power (lb/ft s)     0.92      12.71       1.55
  Frctn Loss (ft)            0.83    Cum Volume (acre-ft)      60.69      55.04      28.30
  C & E Loss (ft)            0.09    Cum SA (acres)            43.99       9.28      21.15


CROSS SECTION OUTPUT    Profile #PF 2

  E.G. Elev (ft)          1481.20    Element                  Left OB    Channel   Right OB
  Vel Head (ft)              0.28    Wt. n-Val.                0.055      0.055      0.055
  W.S. Elev (ft)          1480.93    Reach Len. (ft)          105.00     150.90     190.00
  Crit W.S. (ft)                     Flow Area (sq ft)        101.13     215.44     103.95
  E.G. Slope (ft/ft)     0.004262    Area (sq ft)             101.13     215.44     103.95
  Q Total (cfs)           1609.00    Flow (cfs)               266.50    1047.11     295.38
  Top Width (ft)           150.00    Top Width (ft)            53.74      46.52      49.74
  Vel Total (ft/s)           3.83    Avg. Vel. (ft/s)           2.64       4.86       2.84
  Max Chl Dpth (ft)          4.92    Hydr. Depth (ft)           1.88       4.63       2.09
  Conv. Total (cfs)       24646.2    Conv. (cfs)              4082.2    16039.4     4524.6
  Length Wtd. (ft)         149.22    Wetted Per. (ft)          55.37      47.09      50.83
  Min Ch El (ft)          1476.00    Shear (lb/sq ft)           0.49       1.22       0.54
  Alpha                      1.23    Stream Power (lb/ft s)     1.28       5.92       1.55
  Frctn Loss (ft)            0.74    Cum Volume (acre-ft)      43.49      56.64      21.66
  C & E Loss (ft)            0.01    Cum SA (acres)            16.66       9.21      12.78


CROSS SECTION          RIVER: Buchanan Wash
REACH: Buchanan Wash      RS: 1.290

INPUT
Description: 1.572
Station Elevation Data    num=     114
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9246.011480.141 9270.34    14809283.836    14809290.475    14809300.665    1480
9319.967    14809327.5381479.9269327.8591479.9249428.0161479.9769429.3491479.964
9437.1781479.9369452.6761479.8219454.0481479.8099464.0811479.7449473.1091479.674
9484.0661479.6229536.9171479.9889537.1441479.9879537.1591479.9879546.5571479.946
9550.8781479.8999550.912  1479.99559.4981479.7489607.732    14809639.136    1480
9639.495    14809642.892    14809643.074    14809644.811    14809645.202    1480
```

```
  9647.7    14809653.512    14809653.839    14809659.879    1480 9663.41    1480
9683.9751480.5639685.0931480.5449706.5141480.9619771.6131480.8449789.6861480.702
9855.473    14809856.184    14809859.263    14809859.841    14809862.603    1480
9907.3861478.2869913.437    14789914.932    14789916.036    14789916.615    1478
9933.875    14789991.275    14789993.359    14789993.391    14789995.508    1478
 9995.58    1478   10000  1476.510001.431476.07810001.62    147610002.03    1476
10002.51    147610023.55    147610023.71    147610030.75    147610037.75    1476
10038.23    147610038.93    147610045.391476.20210056.96 1476.5410089.59    1478
 10089.8    147810095.34    147810100.22    147810102.27    147810111.65    1478
10114.37    147810114.79    147810162.951479.38910185.28    148010189.67    1480
10192.63    148010195.29    148010199.58    148010202.77    1480 10205.5    1480
10227.011481.65310230.89    148210240.241483.99710240.241483.99910240.25    1484
10247.99 1485.54 10250.3    148610251.941486.32710260.34    148810264.431488.754
 10272.5    149010274.171490.29910283.64    149210291.171493.35110294.78    1494
10296.481494.27410308.21    149610317.041497.03710325.46    149810335.311499.125
10342.96    150010359.791501.92510360.45    150210364.641502.513 10376.11503.924
10376.72    150410378.99 1504.2810398.631506.69610401.611507.063

Manning's n Values          num=        3
     Sta   n Val     Sta   n Val     Sta   n Val
 9246.01    .055 9995.58    .05510089.59    .055

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9995.5810089.59              445  486.94     505             .1       .3
Ineffective Flow     num=        1
   Sta L   Sta R    Elev  Permanent
888        T

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)          1479.83    Element                  Left OB    Channel   Right OB
  Vel Head (ft)              0.16    Wt. n-Val.                0.055      0.055      0.055
  W.S. Elev (ft)          1479.67    Reach Len. (ft)          445.00     486.94     505.00
  Crit W.S. (ft)                     Flow Area (sq ft)        171.25     292.54      90.38
  E.G. Slope (ft/ft)      0.004109   Area (sq ft)             171.63     292.54      90.38
  Q Total (cfs)           1609.00    Flow (cfs)               367.10    1077.03     164.87
  Top Width (ft)           318.41    Top Width (ft)           140.83      94.01      83.57
  Vel Total (ft/s)           2.90    Avg. Vel. (ft/s)           2.14       3.68       1.82
  Max Chl Dpth (ft)          3.67    Hydr. Depth (ft)           1.38       3.11       1.08
  Conv. Total (cfs)       25101.3    Conv. (cfs)              5727.0    16802.3     2572.0
  Length Wtd. (ft)         481.89    Wetted Per. (ft)         124.35      94.37      83.60
  Min Ch El (ft)          1476.00    Shear (lb/sq ft)           0.35       0.80       0.28
  Alpha                      1.24    Stream Power (lb/ft s)     0.76       2.93       0.51
  Frctn Loss (ft)            1.85    Cum Volume (acre-ft)      60.34      54.21      27.93
  C & E Loss (ft)            0.01    Cum SA (acres)            43.64       9.04      20.82


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

CROSS SECTION OUTPUT    Profile #PF 2

  E.G. Elev (ft)          1480.47    Element                  Left OB    Channel   Right OB
  Vel Head (ft)              0.35    Wt. n-Val.                0.055      0.055
  W.S. Elev (ft)          1480.12    Reach Len. (ft)          445.00     486.94     505.00
  Crit W.S. (ft)                     Flow Area (sq ft)         33.02     312.56
  E.G. Slope (ft/ft)      0.005809   Area (sq ft)              33.02     312.56
  Q Total (cfs)           1609.00    Flow (cfs)               103.05    1505.95
  Top Width (ft)           100.00    Top Width (ft)            15.58      84.42
  Vel Total (ft/s)           4.66    Avg. Vel. (ft/s)           3.12       4.82
  Max Chl Dpth (ft)          4.12    Hydr. Depth (ft)           2.12       3.70
  Conv. Total (cfs)       21111.1    Conv. (cfs)              1352.1    19759.0
  Length Wtd. (ft)         484.77    Wetted Per. (ft)          17.70      87.32
  Min Ch El (ft)          1476.00    Shear (lb/sq ft)           0.68       1.30
  Alpha                      1.03    Stream Power (lb/ft s)     2.11       6.25
  Frctn Loss (ft)            2.05    Cum Volume (acre-ft)      43.33      55.73      21.43
  C & E Loss (ft)            0.02    Cum SA (acres)            16.58       8.98      12.67


Warning: The energy loss was 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: Buchanan Wash
REACH: Buchanan Wash RS: 1.197

INPUT
Description: 1.483
Station Elevation Data num= 84

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9305.86	14789318.424		14789328.717		14789341.049		14789354.207		1478
9362.335	14789365.869		14789428.139		14789428.737		14789447.901		1478
9452.074	14789467.659		14789480.071		14789488.574		14789488.894		1478
9491.178	14789536.917		14789560.454		14789560.901		1478 9561.32		1478
9570.947	14789589.844		14789614.256	1477.542	9622.201	1477.385	9680.701		1476
9692.249	14769692.823		14769693.397		14769694.533		14769694.915		1476
9695.543	14769713.376	1476.744	9715.866	1476.813	9726.047	1477.327	9727.199	1477.387	
9729.888	1477.511	9737.942		14789747.092		14789750.879		14789759.531	1478
9766.096	14789777.726		14789794.738		14789799.896		14789804.448		1478
9829.112	14789830.179		14789830.575		14789833.084		1478 9839.42		1478
9840.745	14789840.974		14789908.003	1476.752	9941.727	1476.198	9949.329		1476
9951.408	14769951.997		14769967.447	1474.796	9977.867		14749981.294	1472.77	
9983.396	14729989.937		1472 10000		147210005.48		1472 10009.31	1473.913	
10009.48	147410010.871	474.05	110065.66		147610081.431	477.92	710081.481	477.931	
10082.02	147810085.921	478.48	910096.581	479.81	610097.95		148010098.891	480.151	
10100.671	480.556	10117.541	484.391	10124.61		148610124.671	486.012	10124.821	486.047
10131.47	1487.521	0133.63		148810139.321	489.261	10151.611	491.984		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9305.86	.055	9977.867	.055	10009.48	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9977.86	10009.48	615	523.26	520	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
888			F

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1477.97	Element			
Vel Head (ft)	0.24	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1477.73	Reach Len. (ft)	615.00	523.26	520.00
Crit W.S. (ft)		Flow Area (sq ft)	155.61	171.54	165.48
E.G. Slope (ft/ft)	0.003578	Area (sq ft)	279.75	171.54	165.48
Q Total (cfs)	1609.00	Flow (cfs)	295.09	841.46	472.45
Top Width (ft)	353.42	Top Width (ft)	251.48	31.61	70.33
Vel Total (ft/s)	3.27	Avg. Vel. (ft/s)	1.90	4.91	2.86
Max Chl Dpth (ft)	5.73	Hydr. Depth (ft)	1.27	5.43	2.35
Conv. Total (cfs)	26899.3	Conv. (cfs)	4933.3	14067.5	7898.4
Length Wtd. (ft)	547.53	Wetted Per. (ft)	122.41	32.44	70.47
Min Ch El (ft)	1472.00	Shear (lb/sq ft)	0.28	1.18	0.52
Alpha	1.47	Stream Power (lb/ft s)	0.54	5.79	1.50
Frctn Loss (ft)	2.65	Cum Volume (acre-ft)	58.04	51.61	26.45
C & E Loss (ft)	0.02	Cum SA (acres)	41.64	8.33	19.92

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

CROSS SECTION OUTPUT Profile #PF 2

			Left OB	Channel	Right OB
E.G. Elev (ft)	1478.39	Element			
Vel Head (ft)	0.28	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1478.11	Reach Len. (ft)	615.00	523.26	520.00
Crit W.S. (ft)		Flow Area (sq ft)	84.72	183.52	137.17
E.G. Slope (ft/ft)	0.003229	Area (sq ft)	84.72	183.52	137.17
Q Total (cfs)	1609.00	Flow (cfs)	259.58	894.56	454.86
Top Width (ft)	100.00	Top Width (ft)	27.87	31.61	40.52
Vel Total (ft/s)	3.97	Avg. Vel. (ft/s)	3.06	4.87	3.32
Max Chl Dpth (ft)	6.11	Hydr. Depth (ft)	3.04	5.81	3.39

Conv. Total (cfs)	28315.3	Conv. (cfs)	4568.1	15742.6	8004.7
Length Wtd. (ft)	544.31	Wetted Per. (ft)	30.05	32.44	43.21
Min Ch El (ft)	1472.00	Shear (lb/sq ft)	0.57	1.14	0.64
Alpha	1.13	Stream Power (lb/ft s)	1.74	5.56	2.12
Frctn Loss (ft)	2.69	Cum Volume (acre-ft)	42.72	52.95	20.64
C & E Loss (ft)	0.03	Cum SA (acres)	16.35	8.34	12.43

Warning: The energy loss was 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: Buchanan Wash
REACH: Buchanan Wash RS: 1.098

INPUT
Description: 1.383
Station Elevation Data num= 91

```
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
 9385.871479.2389395.5821479.1159430.2551478.3559444.843     14789458.1841476.651
9465.536     14769484.7921474.7949499.156     14749508.154     14749517.292     1474
 9518.08     14749520.428     14749525.639     14749527.845     14749542.529     1474
 9545.04     14749590.5321474.3919634.4921474.686 9637.341474.6979669.7941474.868
9672.6121474.8699800.2231474.2129805.8021474.2279806.4041474.233 9824.61     1474
9826.366     14749826.937     14749826.988     14749833.034     14749839.214     1474
9842.727     1474 9885.73     14749887.114     14749897.541     14749899.293     1474
9901.5211473.9169905.9321473.7669936.8291472.6839957.877     14729960.458     1472
9972.745     1472 9972.93     14729973.656     14729978.923     14729983.206     1472
9983.331     14729983.3541471.9899987.698     14709993.659 1469.04    10000     1468
10006.78     146810007.65     146810009.731468.49110010.511468.66810015.47     1470
 10019.11470.99610020.251471.31210022.64     147210030.181472.63610033.791472.945
10047.55     147410053.131475.11810062.651477.02510067.51     147810075.461479.591
10076.861479.89810078.581480.27110108.661486.82410113.541487.88710113.811487.946
 10114.1     148810114.281488.03410124.61     149010128.931490.82210135.12     1492
10144.811493.84410145.77     149410149.361494.58210158.09     149610166.251497.758
10168.221498.20710170.971498.955 10178.31500.94610182.18     150210186.461503.163
10192.061504.77910207.741509.58510213.411511.43310217.071512.42210225.481514.696
10226.861515.068
```

Manning's n Values num= 3

```
     Sta   n Val     Sta   n Val     Sta   n Val
 9385.87    .0559983.331    .05510022.64    .055
```

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

```
      9983.33110022.64              465  491.72     505             .1       .3
```

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1475.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.42	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1474.88	Reach Len. (ft)	465.00	491.72	505.00
Crit W.S. (ft)	1473.83	Flow Area (sq ft)	410.27	216.09	48.25
E.G. Slope (ft/ft)	0.006154	Area (sq ft)	410.27	216.09	48.25
Q Total (cfs)	2304.00	Flow (cfs)	762.07	1399.93	141.99
Top Width (ft)	568.59	Top Width (ft)	499.96	39.31	29.32
Vel Total (ft/s)	3.42	Avg. Vel. (ft/s)	1.86	6.48	2.94
Max Chl Dpth (ft)	6.88	Hydr. Depth (ft)	0.82	5.50	1.65
Conv. Total (cfs)	29370.2	Conv. (cfs)	9714.5	17845.6	1810.1
Length Wtd. (ft)	482.80	Wetted Per. (ft)	500.03	40.43	29.48
Min Ch El (ft)	1468.00	Shear (lb/sq ft)	0.32	2.05	0.63
Alpha	2.33	Stream Power (lb/ft s)	0.59	13.30	1.85
Frctn Loss (ft)	3.83	Cum Volume (acre-ft)	53.16	49.29	25.17
C & E Loss (ft)	0.00	Cum SA (acres)	36.34	7.91	19.33

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.

CROSS SECTION OUTPUT Profile #PF 2

E.G. Elev (ft)	1475.66	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.62	Wt. n-Val.	0.055	0.055	0.055

W.S. Elev (ft)	1475.04	Reach Len. (ft)	465.00	491.72	505.00
Crit W.S. (ft)		Flow Area (sq ft)	149.30	222.15	20.07
E.G. Slope (ft/ft)	0.007087	Area (sq ft)	149.30	222.15	20.07
Q Total (cfs)	2304.00	Flow (cfs)	657.15	1573.25	73.60
Top Width (ft)	100.00	Top Width (ft)	53.33	39.31	7.36
Vel Total (ft/s)	5.88	Avg. Vel. (ft/s)	4.40	7.08	3.67
Max Chl Dpth (ft)	7.04	Hydr. Depth (ft)	2.80	5.65	2.73
Conv. Total (cfs)	27367.6	Conv. (cfs)	7805.9	18687.5	874.2
Length Wtd. (ft)	484.07	Wetted Per. (ft)	55.46	40.43	9.80
Min Ch El (ft)	1468.00	Shear (lb/sq ft)	1.19	2.43	0.91
Alpha	1.16	Stream Power (lb/ft s)	5.24	17.22	3.32
Frctn Loss (ft)	3.21	Cum Volume (acre-ft)	41.07	50.52	19.70
C & E Loss (ft)	0.05	Cum SA (acres)	15.78	7.91	12.15

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: Buchanan Wash
REACH: Buchanan Wash RS: 1.005

INPUT
Description: 1.288
Station Elevation Data num= 98

```
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
 9349.31    14789349.344    14789352.223    1478 9352.28    14789352.9041477.982
9368.6871477.494 9368.99 1477.48 9369.331477.4689377.5361477.1399399.6861476.588
9405.4941476.3829415.802    14769422.5391475.8589448.5721475.4429528.805    1474
9531.292    14749531.433    14749531.535    14749544.073    14749574.3491472.717
9578.2881472.6999585.754 1472.52 9596.481472.1389599.652    14729599.866    1472
9608.012 1471.739618.5621471.3939636.1221470.8119660.712    14709667.565    1470
9669.681    14709671.712    1470 9672.03    1470 9677.92    14709718.0331470.168
9718.3391470.1669722.9011470.1479727.135 1470.229727.564 1470.239737.7181470.449
9745.8671470.5989842.5411470.3049862.506    14709865.334    14709870.884    1470
9881.122    14709900.788    1470 9903.56    14709904.807    14709933.8281469.237
  9982.1    14689983.1611467.6149987.382    1466   10000    146610001.38    1466
10005.54    146610009.861467.583   10011    146810012.62    146810026.071468.998
10033.171469.40510038.041469.57810040.951469.64810049.68    147010051.58    1470
10051.73    147010054.08    147010054.53    147010059.441470.41810064.761470.767
10082.47    147210104.371473.773   101061473.90710107.21    1474 10125.11475.392
10133.03    147610134.18    147610158.871477.48710162.611477.62810166.47    1478
10167.04    147810175.39    147810182.19    147810184.09    147810197.74 1479.05
10209.17    148010214.04    148010218.48    148010218.76    1480 10222.7    1480
10224.121480.16110238.73    148210239.131482.049 10239.51482.087 10253.5    1484
10253.781484.03910254.571484.12710259.181484.659
```

Manning's n Values num= 3

```
     Sta   n Val     Sta   n Val     Sta   n Val
 9349.31    .055  9982.1    .05510012.62    .055
```

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
9982.110012.62 360 408.16 420 .1 .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1471.47	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.47	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1470.99	Reach Len. (ft)	360.00	408.16	420.00
Crit W.S. (ft)		Flow Area (sq ft)	352.72	138.38	79.00
E.G. Slope (ft/ft)	0.010641	Area (sq ft)	352.72	138.38	79.00
Q Total (cfs)	2304.00	Flow (cfs)	985.20	1040.20	278.60
Top Width (ft)	437.40	Top Width (ft)	351.49	30.52	55.40
Vel Total (ft/s)	4.04	Avg. Vel. (ft/s)	2.79	7.52	3.53
Max Chl Dpth (ft)	4.99	Hydr. Depth (ft)	1.00	4.53	1.43
Conv. Total (cfs)	22334.9	Conv. (cfs)	9550.5	10083.6	2700.8
Length Wtd. (ft)	383.65	Wetted Per. (ft)	351.54	31.24	55.49
Min Ch El (ft)	1466.00	Shear (lb/sq ft)	0.67	2.94	0.95
Alpha	1.86	Stream Power (lb/ft s)	1.86	22.12	3.34
Frctn Loss (ft)	2.07	Cum Volume (acre-ft)	49.09	47.29	24.43
C & E Loss (ft)	0.09	Cum SA (acres)	31.79	7.51	18.84

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

CROSS SECTION OUTPUT Profile #PF 2

E.G. Elev (ft)	1472.41	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.47	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1471.94	Reach Len. (ft)	360.00	408.16	420.00
Crit W.S. (ft)		Flow Area (sq ft)	195.08	167.21	82.18
E.G. Slope (ft/ft)	0.006217	Area (sq ft)	195.08	167.21	82.18
Q Total (cfs)	2304.00	Flow (cfs)	869.47	1089.85	344.68
Top Width (ft)	120.00	Top Width (ft)	62.10	30.52	27.38
Vel Total (ft/s)	5.18	Avg. Vel. (ft/s)	4.46	6.52	4.19
Max Chl Dpth (ft)	5.94	Hydr. Depth (ft)	3.14	5.48	3.00
Conv. Total (cfs)	29220.8	Conv. (cfs)	11027.2	13822.2	4371.5
Length Wtd. (ft)	389.67	Wetted Per. (ft)	64.46	31.24	29.75
Min Ch El (ft)	1466.00	Shear (lb/sq ft)	1.17	2.08	1.07
Alpha	1.12	Stream Power (lb/ft s)	5.24	13.54	4.50
Frctn Loss (ft)	2.19	Cum Volume (acre-ft)	39.23	48.32	19.11
C & E Loss (ft)	0.02	Cum SA (acres)	15.17	7.52	11.95

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 RIVER: Buchanan Wash
REACH: Buchanan Wash RS: 0.928

INPUT
Description: 1.207
Station Elevation Data num= 75

```
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
9480.0551470.7619487.2291470.6069496.4981470.4129498.8821470.3759500.7241470.354
9502.9021470.2889504.2681470.2629507.3531470.1869511.609 1470.219512.0621470.199
9520.8981470.1899565.122 1470.489578.0261470.4269581.7541470.4769583.7141470.494
9597.873  1470.79647.6241470.2649649.3581470.2579662.8921470.1219670.117    1470
 9671.77    14709675.661    14709679.786    14709694.392    14709707.909    1470
9708.742    14709741.312    14709765.553    14709790.362    14709790.845    1470
9791.4191469.9029802.417    14689803.963    14689828.0171466.5489829.5241466.403
9831.5411466.2299837.5691466.0899838.6961466.0939905.9431466.5729959.977    1466
9973.427    1466 9982.71    14669987.4621464.4299988.682    14649994.963    1464
   10000    146410010.17    146410015.721465.08410020.33    146610030.341467.114
10039.08    146810041.671468.70810046.38    147010049.38 1470.8210054.881472.327
10060.871473.96410077.741477.46910086.131478.88110092.17    1480   100961480.711
10101.221481.67710123.051485.52210125.97    148610133.451487.09710139.69    1488
10148.631489.32310152.741489.89910154.361490.12510167.75    149210183.97 1493.83
10185.61    149410187.85    149410192.491494.36510210.44    149610217.881496.461
```

Manning's n Values num= 3

```
     Sta   n Val     Sta   n Val     Sta   n Val
9480.055    .055 9982.71    .05510020.33    .055
```

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9982.71	10020.33	480	471.49	465	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1469.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.18	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1469.12	Reach Len. (ft)	480.00	471.49	465.00
Crit W.S. (ft)		Flow Area (sq ft)	492.84	176.60	41.69
E.G. Slope (ft/ft)	0.003263	Area (sq ft)	492.84	176.60	41.69
Q Total (cfs)	2304.00	Flow (cfs)	1451.51	757.15	95.34
Top Width (ft)	247.26	Top Width (ft)	186.79	37.62	22.85
Vel Total (ft/s)	3.24	Avg. Vel. (ft/s)	2.95	4.29	2.29
Max Chl Dpth (ft)	5.12	Hydr. Depth (ft)	2.64	4.69	1.82
Conv. Total (cfs)	40331.7	Conv. (cfs)	25408.8	13254.0	1669.0
Length Wtd. (ft)	474.77	Wetted Per. (ft)	186.95	38.14	23.11

Min Ch El (ft)	1464.00	Shear (lb/sq ft)	0.54	0.94	0.37
Alpha	1.12	Stream Power (lb/ft s)	1.58	4.04	0.84
Frctn Loss (ft)	2.09	Cum Volume (acre-ft)	45.60	45.81	23.85
C & E Loss (ft)	0.01	Cum SA (acres)	29.57	7.19	18.46

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

CROSS SECTION OUTPUT Profile #PF 2

E.G. Elev (ft)	1470.20	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.42	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1469.78	Reach Len. (ft)	480.00	471.49	465.00
Crit W.S. (ft)		Flow Area (sq ft)	228.81	201.43	31.38
E.G. Slope (ft/ft)	0.005112	Area (sq ft)	228.81	201.43	31.38
Q Total (cfs)	2304.00	Flow (cfs)	1011.67	1179.97	112.36
Top Width (ft)	110.00	Top Width (ft)	62.71	37.62	9.67
Vel Total (ft/s)	4.99	Avg. Vel. (ft/s)	4.42	5.86	3.58
Max Chl Dpth (ft)	5.78	Hydr. Depth (ft)	3.65	5.35	3.25
Conv. Total (cfs)	32224.2	Conv. (cfs)	14149.4	16503.3	1571.5
Length Wtd. (ft)	473.97	Wetted Per. (ft)	66.07	38.14	12.44
Min Ch El (ft)	1464.00	Shear (lb/sq ft)	1.11	1.69	0.81
Alpha	1.08	Stream Power (lb/ft s)	4.89	9.87	2.88
Frctn Loss (ft)	2.69	Cum Volume (acre-ft)	37.48	46.59	18.56
C & E Loss (ft)	0.00	Cum SA (acres)	14.65	7.20	11.77

Warning: The energy loss was 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: Buchanan Wash
REACH: Buchanan Wash RS: 0.839

INPUT
Description: 1.120
Station Elevation Data num= 109

```
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
 9375.97     14709377.121     14709385.403     14709389.406     14709394.296     1470
9405.452     14709418.768     14709418.848     14709418.852     14709420.531     1470
9422.435     14709422.466     14709435.2791469.9149435.6711469.9169438.6711469.905
9447.4121469.8459465.0941469.7329470.7021469.685 9485.131469.5589492.6841469.503
9579.692     14689598.238     14689603.504     14689603.773     14689605.106     1468
9610.183     14689613.244     14689621.859     14689623.491     14689634.965     1468
9635.094     14689642.019     14689642.558     14689651.053     14689660.779     1468
9661.446     14689823.7351466.4829825.7251466.4779835.0011466.3749862.5281466.022
9862.5851466.0229862.858 1466.029864.388     14669866.648     1466 9915.631464.725
9929.5341464.3919936.1251464.2099944.003     14649945.674     14649950.512     1464
9963.476     14649975.423     14649980.2041463.3739990.558     14629999.652     1462
   10006     1462 10011.9     146210018.561463.42710021.24     146410035.73     1464
10038.27     146410040.65     146410041.71     1464 10050.41464.30210051.321464.353
10054.711464.60110056.081464.69410074.17     146610093.121467.43410100.73     1468
10107.671468.51410110.181468.68310123.561469.57810129.49     147010135.41     1470
10138.06     147010139.61     147010139.78     1470 10177.9     147010195.29     1470
10222.011470.80210240.031470.40910242.951470.43910245.311470.49510245.931470.516
10248.181470.60310252.64 1470.8310257.181470.79510262.971471.10310266.391471.254
10267.141471.27510269.321471.36810281.461471.721 10284.21471.82710284.531471.832
10284.881471.83810297.18 1471.9710297.381471.97210298.92     147210299.46     1472
10305.24     147210310.441472.50210312.59 1472.69 10317.11472.90610318.681472.981
10319.23 1473.0310324.351473.48310327.241473.66910332.37     1474
```

Manning's n Values num= 3

```
     Sta    n Val      Sta    n Val      Sta    n Val
 9375.97     .0559975.423     .05510021.24     .055
```

```
Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
      9975.42310021.24                715    752.2      765              .1        .3
Ineffective Flow      num=        1
   Sta L    Sta R     Elev  Permanent
888         T
```

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1467.21	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1466.89	Reach Len. (ft)	715.00	752.20	765.00
Crit W.S. (ft)		Flow Area (sq ft)	274.42	199.68	129.93
E.G. Slope (ft/ft)	0.006230	Area (sq ft)	274.42	199.68	129.93
Q Total (cfs)	2304.00	Flow (cfs)	733.15	1130.45	440.40
Top Width (ft)	306.21	Top Width (ft)	195.66	45.82	64.74
Vel Total (ft/s)	3.81	Avg. Vel. (ft/s)	2.67	5.66	3.39
Max Chl Dpth (ft)	4.89	Hydr. Depth (ft)	1.40	4.36	2.01
Conv. Total (cfs)	29191.1	Conv. (cfs)	9288.9	14322.5	5579.7
Length Wtd. (ft)	736.49	Wetted Per. (ft)	195.69	46.16	64.84
Min Ch El (ft)	1462.00	Shear (lb/sq ft)	0.55	1.68	0.78
Alpha	1.39	Stream Power (lb/ft s)	1.46	9.52	2.64
Frctn Loss (ft)	4.19	Cum Volume (acre-ft)	41.37	43.77	22.94
C & E Loss (ft)	0.04	Cum SA (acres)	27.46	6.74	17.99

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

CROSS SECTION OUTPUT Profile #PF 2

E.G. Elev (ft)	1467.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.42	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1467.09	Reach Len. (ft)	715.00	752.20	765.00
Crit W.S. (ft)		Flow Area (sq ft)	163.60	208.66	87.66
E.G. Slope (ft/ft)	0.006345	Area (sq ft)	163.60	208.66	87.66
Q Total (cfs)	2304.00	Flow (cfs)	703.67	1227.66	372.67
Top Width (ft)	130.00	Top Width (ft)	55.42	45.82	28.76
Vel Total (ft/s)	5.01	Avg. Vel. (ft/s)	4.30	5.88	4.25
Max Chl Dpth (ft)	5.09	Hydr. Depth (ft)	2.95	4.55	3.05
Conv. Total (cfs)	28924.8	Conv. (cfs)	8834.0	15412.2	4678.6
Length Wtd. (ft)	737.15	Wetted Per. (ft)	57.90	46.16	31.57
Min Ch El (ft)	1462.00	Shear (lb/sq ft)	1.12	1.79	1.10
Alpha	1.08	Stream Power (lb/ft s)	4.81	10.53	4.68
Frctn Loss (ft)	4.07	Cum Volume (acre-ft)	35.32	44.37	17.92
C & E Loss (ft)	0.04	Cum SA (acres)	14.00	6.74	11.56

Warning: The energy loss was 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: Buchanan Wash
REACH: Buchanan Wash RS: 0.696

INPUT
Description: Former 0.985
Station Elevation Data num= 144

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9040.821	1476.511	9042.337	1476.469	9054.879	1476	9062.599	1476	9067.439	1475.795
9078.347	1475.287	9098.818	1474	9114.851	1472.907	9128.162	1472	9139.605	1470.602
9146.093	1470	9161.904	1468.097	9162.711	1468	9165.174	1467.704	9172.292	1466.99
9182.289	1466	9183.338	1465.817	9191.305	1464.312	9193.022	1464	9193.431	1464
9200.985	1464	9211.63	1464	9217.332	1464	9222.717	1464	9223.176	1464
9223.487	1464	9224.528	1464	9229.813	1464	9232.48	1464	9234.082	1464
9235.984	1464	9236.082	1464	9237.756	1464	9241.378	1464	9243.263	1464
9274.926	1464	9278.44	1464	9281.511	1464	9281.58	1464	9327.692	1464
9332.682	1464	9335.958	1464	9336.408	1464	9337.291	1464	9392.485	1463.115
9417.274	1463.131	9523.725	1462.176	9529.31	1462.13	9531.92	1462.111	9546.141	1462
9547.931	1462	9548.889	1462	9552.756	1462	9553.363	1462	9556.322	1462
9556.983	1462	9568.451	1462	9588.322	1462	9600.057	1462	9601.482	1462
9604.415	1462	9607.399	1462	9610.587	1462	9619.997	1462	9620.065	1462
9622.08	1462	9631.213	1462	9635.915	1462	9636.55	1462	9637.299	1462
9640.639	1462	9642.107	1462	9654.129	1462	9658.336	1462	9664.389	1462
9669.983	1462	9672.263	1462	9705.198	1462	9705.449	1462	9706.476	1462
9713.721	1462	9715.769	1462	9723.987	1462	9725.68	1462	9725.875	1462.017
9726.778	1462	9727.321	1462	9727.383	1462	9728.326	1462.057	9728.46	1462.059
9728.75	1462.074	9729.001	1462.092	9732.019	1462.359	9733.153	1462.519	9735.352	1462.966
9752.47	1464	9821.829	1462.642	9832.867	1462.403	9852.886	1462	9854.803	1462

```
9854.908    14629856.5861461.8839868.0721461.1729893.795    14609897.817    1460
9903.094    14609904.901    14609905.022    14609922.332    14609928.807    1460
9933.612    14609939.881    14609943.167    14609944.247    1460 9948.92    1460
9949.483    1460 9950.35    14609950.839    14609953.397    14609953.975    1460
9981.216    14609991.525    1460 9995.71    1460   10000  1458.910003.021458.245
10004.08    145810006.04    1458   10014    145810018.591459.458 10020.3    1460
10020.57    146010049.631460.92610082.65    146210082.89    146210083.07    1462
10107.031463.47910114.461463.935 10115.5    146410115.75 1464.0210144.26    1466
10149.05 1466.26   10182    146810187.24 1468.3310188.151468.381

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9040.82    .055 9995.71    .055 10020.3    .055

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9995.71 10020.3              645  533.49     500             .1       .3

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)          1462.98    Element                  Left OB    Channel   Right OB
  Vel Head (ft)              0.17    Wt. n-Val.                0.055      0.055      0.055
  W.S. Elev (ft)          1462.81    Reach Len. (ft)          645.00     533.49     500.00
  Crit W.S. (ft)          1461.81    Flow Area (sq ft)        564.62     103.79     118.78
  E.G. Slope (ft/ft)     0.005204    Area (sq ft)             564.62     103.79     118.78
  Q Total (cfs)           2304.00    Flow (cfs)              1471.20     520.68     312.12
  Top Width (ft)           563.72    Top Width (ft)           463.31      24.59      75.83
  Vel Total (ft/s)           2.93    Avg. Vel. (ft/s)           2.61       5.02       2.63
  Max Chl Dpth (ft)          4.81    Hydr. Depth (ft)           1.22       4.22       1.57
  Conv. Total (cfs)       31937.1    Conv. (cfs)             20393.1     7217.5     4326.5
  Length Wtd. (ft)         576.61    Wetted Per. (ft)         463.43      25.14      75.88
  Min Ch El (ft)          1458.00    Shear (lb/sq ft)           0.40       1.34       0.51
  Alpha                      1.28    Stream Power (lb/ft s)     1.03       6.73       1.34
  Frctn Loss (ft)            2.67    Cum Volume (acre-ft)      34.48      41.15      20.75
  C & E Loss (ft)            0.01    Cum SA (acres)            22.05       6.14      16.76

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

CROSS SECTION OUTPUT    Profile #PF 2

  E.G. Elev (ft)          1463.39    Element                  Left OB    Channel   Right OB
  Vel Head (ft)              0.27    Wt. n-Val.                0.055      0.055      0.055
  W.S. Elev (ft)          1463.12    Reach Len. (ft)          645.00     533.49     500.00
  Crit W.S. (ft)                     Flow Area (sq ft)        357.09     111.61      99.20
  E.G. Slope (ft/ft)     0.004848    Area (sq ft)             357.09     111.61      99.20
  Q Total (cfs)           2304.00    Flow (cfs)              1403.67     567.15     333.18
  Top Width (ft)           180.00    Top Width (ft)           115.71      24.59      39.70
  Vel Total (ft/s)           4.06    Avg. Vel. (ft/s)           3.93       5.08       3.36
  Max Chl Dpth (ft)          5.12    Hydr. Depth (ft)           3.09       4.54       2.50
  Conv. Total (cfs)       33089.1    Conv. (cfs)             20158.9     8145.2     4785.0
  Length Wtd. (ft)         578.31    Wetted Per. (ft)         118.22      25.14      41.58
  Min Ch El (ft)          1458.00    Shear (lb/sq ft)           0.91       1.34       0.72
  Alpha                      1.06    Stream Power (lb/ft s)     3.59       6.83       2.43
  Frctn Loss (ft)            2.56    Cum Volume (acre-ft)      31.05      41.61      16.28
  C & E Loss (ft)            0.00    Cum SA (acres)            12.59       6.14      10.96

Warning: The energy loss was 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: Buchanan Wash
REACH: Buchanan Wash      RS: 0.595

INPUT
Description: Former 0.890
Station Elevation Data    num=     140
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 8732.541470.8788734.5851470.7838735.3061470.8038738.7351470.8748742.7241470.726
8749.3481470.8318751.459 1470.778817.5461470.2688824.6471470.156 8834.14    1470
```

```
8843.0981469.852 8862.651469.529 8865.721469.4788916.9661468.9468921.3021468.972
8927.9291468.7738930.1781468.7048941.5881469.0898946.9931468.6028947.9921468.528
8956.695    1468  8957.4    14688958.135    14688960.826    14688979.8681467.768
9008.367 1466.949022.4061466.6589035.912    14669045.6071465.4449047.2191465.363
9049.508 1465.289058.3421464.8049069.896    14649071.442    14649115.4021462.848
9141.4771462.1649145.0041462.091 9152.96    14629153.717    14629156.192    1462
9159.557    14629163.955    14629164.251    14629164.315    14629177.088    1462
9187.531 1461.64 9216.731461.2289263.4721461.115 9266.391461.1219269.4621461.128
9280.1231461.0829285.3561461.1029308.2951461.0759324.267 1460.959383.0881460.044
9385.745    14609385.965    14609387.599    14609412.872    14609415.444    1460
9441.917    14609443.356    14609443.933    14609445.773    14609462.5821459.766
9566.2171459.5329599.3181459.4359610.689 1459.389624.5361459.346 9696.571459.049
9851.312    14609859.738    14609868.789    14609870.247    14609871.576    1460
9874.212    14609875.725    1460 9879.261459.9579884.5981459.6849886.1511459.702
9889.4011459.6659895.4121459.2149898.0741459.1319909.968    14589911.349    1458
9927.466    14589930.652    14589930.772    14589932.464    14589937.123    1458
 9962.22    14589962.952    14589963.221    14589967.909    14589981.882    1458
9991.042    14589992.4141457.347 9994.181456.5069997.3881454.987   100001453.788
10002.111452.72610010.911452.853 10019.4    145410022.931455.642 10023.7    1456
10026.891457.48510028.12    145810028.22    145810029.77    1458 10035.1    1458
10049.17    145810078.81    145810085.63    145810109.51    145810116.33    1458
10118.41    145810121.91    145810122.59    145810127.63    145810129.541458.054
10129.961458.068 10133.8 1458.1910190.42    146010193.81    1460 10206.9    1460
 10210.7    146010211.25    146010211.46    146010211.68    146010213.951460.073
10214.871460.10710216.33 1460.1610263.92    146210278.751463.52910282.25    1464
10284.981464.36710287.091464.57610299.51    146610301.161466.18510302.411466.333
```

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
8732.54	.055	9991.042	.055	10028.12	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9991.04	10028.12	635	497.19	360	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1460.30	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1460.06	Reach Len. (ft)	635.00	497.19	360.00
Crit W.S. (ft)	1459.31	Flow Area (sq ft)	428.41	207.45	273.79
E.G. Slope (ft/ft)	0.004153	Area (sq ft)	428.41	207.45	273.79
Q Total (cfs)	2304.00	Flow (cfs)	589.79	1096.41	617.80
Top Width (ft)	831.86	Top Width (ft)	609.24	37.08	185.54
Vel Total (ft/s)	2.53	Avg. Vel. (ft/s)	1.38	5.29	2.26
Max Chl Dpth (ft)	7.34	Hydr. Depth (ft)	0.70	5.59	1.48
Conv. Total (cfs)	35750.4	Conv. (cfs)	9151.6	17012.7	9586.2
Length Wtd. (ft)	479.92	Wetted Per. (ft)	609.32	39.22	185.57
Min Ch El (ft)	1452.73	Shear (lb/sq ft)	0.18	1.37	0.38
Alpha	2.36	Stream Power (lb/ft s)	0.25	7.25	0.86
Frctn Loss (ft)	3.09	Cum Volume (acre-ft)	27.13	39.25	18.50
C & E Loss (ft)	0.01	Cum SA (acres)	14.11	5.76	15.26

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

CROSS SECTION OUTPUT Profile #PF 2

E.G. Elev (ft)	1460.82	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1460.51	Reach Len. (ft)	635.00	497.19	360.00
Crit W.S. (ft)	1459.36	Flow Area (sq ft)	259.41	224.03	130.28
E.G. Slope (ft/ft)	0.004066	Area (sq ft)	259.41	224.03	130.28
Q Total (cfs)	2304.00	Flow (cfs)	668.99	1233.23	401.77
Top Width (ft)	230.00	Top Width (ft)	141.04	37.08	51.88
Vel Total (ft/s)	3.75	Avg. Vel. (ft/s)	2.58	5.50	3.08
Max Chl Dpth (ft)	7.79	Hydr. Depth (ft)	1.84	6.04	2.51
Conv. Total (cfs)	36132.0	Conv. (cfs)	10491.3	19339.9	6300.7
Length Wtd. (ft)	499.22	Wetted Per. (ft)	141.64	39.22	54.39

Min Ch El (ft)	1452.73	Shear (lb/sq ft)	0.46	1.45	0.61
Alpha	1.41	Stream Power (lb/ft s)	1.20	7.98	1.88
Frctn Loss (ft)	3.30	Cum Volume (acre-ft)	26.48	39.55	14.96
C & E Loss (ft)	0.01	Cum SA (acres)	10.69	5.76	10.43

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: Buchanan Wash
REACH: Buchanan Wash RS: 0.501

INPUT
Description: Section 0.782 in old study

Ineffective Flow Areas reflect the retention basin for the Arizona Hillcrest Subdivision. It is assumed the full depth of the retention basin will not act as conveyance area.

Station Elevation Data num= 279

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
8635.48	14688	642.139	14688	647.536	14688	649.667	14688	650.937	1468
8675.91	1467.376	8689.109	1466.979	8721.194	14668	726.365	1465.089	8729.761	1464.512
8739.215	1464.325	8740.487	1464.386	8752.894	1464.636	8760.823	1465.149	8763.356	1465.252
8766.108	1465.313	8768.893	1465.553	8770.183	1465.596	8770.945	1465.606	8774.013	1466
8800.406	14668	806.774	14668	815.609	14668	826.128	14668	827.613	1466
8829.278	14668	831.712	14668	833.399	14668	839.277	14668	845.919	1466
8850.093	14668	865.729	14668	895.104	14668	900.608	14668	904.611	1466
8905.998	14668	908.321	14668	935.362	14668	939.827	14668	962.998	1466
8965.164	14668	966.265	14668	968.021	14668	969.869	14668	971.068	1466
9021.945	1464.533	9024.914	1464.514	9032.404	1464.464	9041.714	1464.405	9043.987	1464.39
9045.809	1464.379	9053.344	1464.328	9064.181	1464.259	9065.898	1464.248	9073.585	1464.197
9074.322	1464.192	9086.76	1464.113	9087.64	1464.107	9095.218	1464.057	9095.362	1464.057
9104.262	14649	108.899	1464	9109.5	14649	120.653	14649	121.355	1464
9129.919	14649	132.824	14649	136.192	14649	139.237	14649	149.705	1464
9153.155	1464	9156.17	14649	182.531	1462.419	187.056	1462.321	9192.388	1462.008
9192.419	1462.007	9192.566	14629	195.007	14629	195.936	14629	203.053	1462
9204.655	14629	206.078	14629	208.154	14629	215.418	1462.249	9217.13	1462.3
9225.425	1462.633	9226.574	1462.654	9226.632	1462.656	9227.262	1462.681	9232.08	1462.739
9244.09	1463.119	9245.658	1463.159	9245.705	1463.161	9249.688	1463.278	9259.642	1462.758
9265.685	1462.839	9267.723	1462.865	9274.016	1462.927	9278.864	1462.999	9327.015	1462.623
9339.893	1462.683	9346.607	1462.717	9354.705	1462.759	9358.915	1462.773	9359.857	1462.775
9368.016	1462.815	9371.365	1462.835	9372.325	1462.849	9374.545	1462.836	9377.604	1462.854
9377.701	1462.854	9384.809	1462.889	9387.454	14629	406.373	14629	407.028	1462
9424.172	14629	434.321	14629	459.123	1463.271	9461.085	1463.295	9468.052	1463.331
9469.208	1463.337	9470.921	1463.359	9476.339	1463.378	9476.488	1463.378	9477.82	1463.385
9481.952	1463.407	9483.584	1463.413	9502.201	14629	505.967	14629	508.469	1462
9556.97	14629	558.603	1462	9561.86	14629	569.589	14629	572.453	1462
9574.869	14629	580.071	1462	9592.2	14629	595.901	14629	597.072	1462
9597.224	14629	600.426	14629	601.129	14629	605.171	14629	617.998	1462
9618.84	14629	622.355	14629	622.596	14629	626.398	14629	632.071	1462
9634.653	14629	637.311	14629	638.515	1462	9647.35	1461.752	9649.954	1461.701
9655.977	1461.578	9665.39	1461.394	9675.082	1461.183	9678.362	1461.114	9702.279	1460.593
9729.325	14609	750.678	1460	9760.7	1460	9760.87	14609	761.161	1460
9761.793	14609	773.737	14609	807.205	1461.001	9809.558	1461.079	9828.041	1461.302
9831.043	1461.388	9832.887	1461.352	9834.433	1461.325	9838.406	1461.254	9840.829	1461.26
9844.994	1461.176	9845.255	1461.169	9848.372	1461.112	9855.636	1460.926	9856.011	1460.914
9857.834	1460.857	9858.237	1460.841	9865.427	1460.676	9877.645	1460.374	9879.14	1460.337
9879.268	1460.33	9882.234	1460.201	9887.777	14609	887.925	14609	888.506	1460
9895.839	1460	9896.29	14609	898.931	14609	902.869	1459.481	9904.446	1459.273
9904.61	1459.26	9905.05	1459.226	9908.275	1458.841	9911.751	1458.38	9914.471	1458
9915.727	1457.825	9915.898	1457.801	9917.235	1457.555	9920.799	1456.899	9922.409	1456.416
9923.797	14569	930.118	1454.982	9936.802	1454.642	9942.14	14549	949.848	1454
9950.184	14549	950.454	14549	951.941	14549	967.052	1454.909	9971.398	1454.484
9972.166	1454.427	9976.579	1454	10000	1454	10002.2	14541	0021.79	1454
10022.96	14541	0023.03	14541	0023.34	1454.03	10023.62	1454.055	10032.91	1454.956
10033.38	1454.975	10043.99	1456	10045.5	14561	0058.33	14561	0067.44	1456
10072.07	14561	0073.31	14561	0075.01	14561	0076.57	14561	0084.61	1456
10088.93	14561	0095.68	14561	0095.91	14561	0098.55	1456	10116.4	1456

```
10120.46    145610121.52    145610142.27    145610148.08    145610183.91    1456
10187.68    145610258.37    145610272.53    145610277.22    145610287.14    1456
10312.88    145610349.42    145610356.01    145610362.06    1456 10388.7    1456
10392.75    145610393.88    145610394.12    145610454.941457.02110513.73    1458
10532.071459.92410532.441459.95210532.78    146010532.82    146010548.261460.735
10574.67    146210574.78    146210575.181462.446 10576.6    1464 10577.21464.656
10578.42    1466 10579.11466.74510580.25    1468 10580.5    146810592.121468.428
 10607.71468.98610628.591469.56410633.361469.71610640.561469.932

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 8635.48    .0559967.052    .05510043.99    .055

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      9967.05210043.99              260  235.61     225             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
888        T

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)          1457.21    Element                    Left OB    Channel   Right OB
  Vel Head (ft)              0.29    Wt. n-Val.                  0.055      0.055      0.055
  W.S. Elev (ft)          1456.92    Reach Len. (ft)           260.00     235.61     225.00
  Crit W.S. (ft)          1456.73    Flow Area (sq ft)          81.12     199.08     345.72
  E.G. Slope (ft/ft)     0.011270    Area (sq ft)              104.10     199.08     345.72
  Q Total (cfs)           2304.00    Flow (cfs)                336.48    1074.84     892.68
  Top Width (ft)           527.98    Top Width (ft)             46.34      76.94     404.70
  Vel Total (ft/s)           3.68    Avg. Vel. (ft/s)            4.15       5.40       2.58
  Max Chl Dpth (ft)          2.92    Hydr. Depth (ft)            1.75       2.59       0.85
  Conv. Total (cfs)       21703.3    Conv. (cfs)               3169.6    10124.8     8408.9
  Length Wtd. (ft)         240.90    Wetted Per. (ft)           46.63      77.08     404.70
  Min Ch El (ft)          1454.00    Shear (lb/sq ft)            1.22       1.82       0.60
  Alpha                      1.38    Stream Power (lb/ft s)      5.08       9.81       1.55
  Frctn Loss (ft)            1.14    Cum Volume (acre-ft)       23.25      36.93      15.94
  C & E Loss (ft)            0.05    Cum SA (acres)              9.33       5.11      12.82

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.

CROSS SECTION OUTPUT    Profile #PF 2

  E.G. Elev (ft)          1457.50    Element                    Left OB    Channel   Right OB
  Vel Head (ft)              0.41    Wt. n-Val.                  0.055      0.055      0.055
  W.S. Elev (ft)          1457.10    Reach Len. (ft)           260.00     235.61     225.00
  Crit W.S. (ft)          1456.82    Flow Area (sq ft)          89.48     212.84     192.70
  E.G. Slope (ft/ft)     0.012609    Area (sq ft)              112.47     212.84     192.70
  Q Total (cfs)           2304.00    Flow (cfs)                414.66    1270.88     618.46
  Top Width (ft)           300.00    Top Width (ft)             47.05      76.94     176.01
  Vel Total (ft/s)           4.65    Avg. Vel. (ft/s)            4.63       5.97       3.21
  Max Chl Dpth (ft)          3.09    Hydr. Depth (ft)            1.90       2.77       1.09
  Conv. Total (cfs)       20518.1    Conv. (cfs)               3692.7    11317.7     5507.6
  Length Wtd. (ft)         242.92    Wetted Per. (ft)           47.40      77.08     177.10
  Min Ch El (ft)          1454.00    Shear (lb/sq ft)            1.49       2.17       0.86
  Alpha                      1.21    Stream Power (lb/ft s)      6.89      12.98       2.75
  Frctn Loss (ft)            1.13    Cum Volume (acre-ft)       23.77      37.06      13.63
  C & E Loss (ft)            0.08    Cum SA (acres)              9.32       5.11       9.49

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.

CROSS SECTION          RIVER: Buchanan Wash
REACH: Buchanan Wash      RS: 0.456
```

INPUT
Description: Section 0.456 placed to reflect retention basin and property boundary of Arizona Hillcrest property.

Ineffective Flow Areas
reflect the retention basin for the Arizona Hillcrest Subdivision. It is assumed the full depth of the retention basin will not act as conveyance area.

Station Elevation Data num= 277

```
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 8629.371466.6468640.0911466.3568653.045    14668667.635    14668678.398    1466
8685.581    14668693.535    14668766.081    14668769.063    14668769.192    1466
  8772.8    14668774.245    14668776.499    14668782.608    14668790.616    1466
 8791.52    14668799.382    14668799.419    14668800.4151465.858 8802.171465.644
8814.088    14648828.103    14648838.877    14648841.857    14648847.187    1464
8848.731    1464 8848.86    14648850.1551464.053 8855.981464.3578859.1641464.503
8913.084    14668917.431    14668920.275    14668923.665    14668946.138    1466
  8949.51465.9268949.9851465.9298959.4831465.9968960.173    14668960.203    1466
8962.547    14668962.798    14668963.372    14668972.974    14668973.016    1466
8973.104    14668991.538    14669005.479    14669007.818    14669009.094    1466
9021.266    14669021.881    14669024.489    14669025.761    14669084.1681465.231
9112.981    14669127.913    14669128.393    1466 9131.57    14669132.596    1466
9133.818    14669134.178    14669134.557    14669139.692    14669141.932    1466
9142.593    14669143.787    1466 9143.83    14669143.883    14669144.447    1466
 9144.58    14669145.212    14669147.017    14669152.485    14669152.628    1466
 9157.85    14669159.592    14669160.228    14669160.6691465.786 9162.541464.914
9164.201    14649164.307    14649164.602    14649171.877    14649172.101    1464
9180.519    14649187.673    14649234.019    1464 9253.71    14649262.575    1464
9267.764    14649268.228    14649271.305    14649282.9291462.933 9289.471462.798
9299.0761462.6529311.743 1462.389328.998    14629329.974    14629331.755    1462
9331.792    14629343.0451461.7659350.2141461.6289350.2651461.6279360.8991461.489
9364.3421461.4639373.2771461.3429376.6061461.2979377.023 1461.299378.1731461.273
9379.016 1461.269385.5871461.1989393.8471461.0699394.2771461.0619398.1541460.982
9398.6041460.9729407.2141460.8069419.5131460.5179424.178 1460.499430.9261460.414
9443.3541460.185  9447.3    14609456.409    14609456.955    14609462.899    1460
9464.179    14609466.1151459.8699468.649    14609475.965    14609476.535    1460
9478.299    14609480.488    14609481.9511459.7979503.1291459.0169511.3351459.158
9538.227    14609538.274    14609538.4091460.0439538.4191460.0469544.042    1462
9548.841    1462 9554.87    14629567.068 1461.399569.8031461.4189571.4551461.437
9572.5261461.4559575.9521461.4929581.2081461.3249623.135    14609628.683    1460
9635.511    14609643.894    14609653.433    14609657.678    14609668.081    1460
9669.247    14609670.475    14609678.805    14609683.926    14609689.147    1460
9695.397    14609709.986    14609717.548    14609720.999    14609725.183    1460
9729.608    14609737.068    14609743.464    14609746.047    14609758.213    1460
9760.548    14609762.555    14609770.375    14609772.369    14609788.847    1460
9795.627    14609795.724    14609802.096    14609804.062    14609812.851    1460
9814.894    14609818.051    14609818.795    14609825.236    14609827.0861459.813
9830.2591459.4949836.1821458.732 9836.381458.7179838.8971458.5089842.311    1458
9843.134    14589847.8761457.0049853.7621455.4549854.8971455.255 9855.451455.158
9858.2081454.5679858.5751454.4889860.673    1454 9863.881453.2549869.271    1452
9877.0561450.1899877.869    14509883.252    14509890.985    14509894.505    1450
9902.334    14509903.475    14509905.127    14509907.0381450.4879912.906    1452
9916.2031452.8369920.828    14549921.353    14549938.929    14549947.152    1454
9959.914    1454 9963.65    14549964.843    14549965.718    14549971.563    1454
9977.948    14549981.7661454.434 9983.05    1454 9983.59    14549984.6861453.724
9985.3031453.568  9986.61453.1069989.704    14529990.0951451.8619991.2051451.465
9994.6371450.4239995.6191450.1259995.7991450.0439995.893    1450   10000    1450
10008.99    145010009.42    145010014.28    145010015.54    145010015.58    1450
 10020.21451.915 10020.4    145210024.681453.77710025.22    145410028.76 1455.47
10030.04    145610030.21    145610030.35    145610034.58    145610036.34    1456
10036.57    145610041.08    145610125.051455.01110130.131454.97210131.43 1454.97
10159.771454.96510192.731454.83910262.851454.50210460.39    145610464.49    1456
10468.59    1456 10478.7    145610479.13    145610481.62    145610482.05    1456
10483.48    145610508.691456.64810562.81    1458 10573.71458.81610589.17    1460
10595.931461.04410602.13    146210607.321462.73510616.59    146410625.941465.209
10634.22    146610634.451466.023
```

Manning's n Values num= 3

```
     Sta   n Val     Sta   n Val     Sta   n Val
 8629.37    .0559981.766    .05510030.04    .055
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
     9981.76610030.04              210  210.92     200            .1        .5
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
888       T
```

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1456.02	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1455.88	Reach Len. (ft)	210.00	210.92	200.00
Crit W.S. (ft)	1455.43	Flow Area (sq ft)	409.28	207.95	305.01
E.G. Slope (ft/ft)	0.002602	Area (sq ft)	409.28	207.95	305.01
Q Total (cfs)	2304.00	Flow (cfs)	1206.52	742.42	355.06
Top Width (ft)	570.42	Top Width (ft)	129.61	47.98	392.82
Vel Total (ft/s)	2.50	Avg. Vel. (ft/s)	2.95	3.57	1.16
Max Chl Dpth (ft)	5.88	Hydr. Depth (ft)	3.16	4.33	0.78
Conv. Total (cfs)	45170.7	Conv. (cfs)	23654.2	14555.4	6961.1
Length Wtd. (ft)	207.98	Wetted Per. (ft)	130.81	49.87	392.83
Min Ch El (ft)	1450.00	Shear (lb/sq ft)	0.51	0.68	0.13
Alpha	1.42	Stream Power (lb/ft s)	1.50	2.42	0.15
Frctn Loss (ft)	1.01	Cum Volume (acre-ft)	21.72	35.83	14.26
C & E Loss (ft)	0.03	Cum SA (acres)	8.81	4.77	10.76

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

CROSS SECTION OUTPUT Profile #PF 2

E.G. Elev (ft)	1456.30	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1456.15	Reach Len. (ft)	210.00	210.92	200.00
Crit W.S. (ft)	1455.45	Flow Area (sq ft)	445.05	221.20	161.69
E.G. Slope (ft/ft)	0.002387	Area (sq ft)	445.05	221.20	161.69
Q Total (cfs)	2304.00	Flow (cfs)	1321.49	784.84	197.67
Top Width (ft)	358.89	Top Width (ft)	130.66	48.27	179.96
Vel Total (ft/s)	2.78	Avg. Vel. (ft/s)	2.97	3.55	1.22
Max Chl Dpth (ft)	6.15	Hydr. Depth (ft)	3.41	4.58	0.90
Conv. Total (cfs)	47162.9	Conv. (cfs)	27051.0	16065.6	4046.3
Length Wtd. (ft)	209.05	Wetted Per. (ft)	131.89	50.18	181.36
Min Ch El (ft)	1450.00	Shear (lb/sq ft)	0.50	0.66	0.13
Alpha	1.22	Stream Power (lb/ft s)	1.49	2.33	0.16
Frctn Loss (ft)	1.02	Cum Volume (acre-ft)	22.11	35.89	12.71
C & E Loss (ft)	0.05	Cum SA (acres)	8.79	4.77	8.57

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: Buchanan Wash
REACH: Buchanan Wash RS: 0.416

INPUT
Description: Section 0.710 in old study

Ineffective Flow Areas reflect the retention basin for the Arizona Hillcrest Subdivision. It is assumed the full depth of the retention basin will not act as conveyance area.

Station Elevation Data num= 190

```
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
 8579.83    14648586.223    14648592.832    14648593.379    14648598.017    1464
8598.625    14648600.713    14648632.0671464.237 8632.291464.2388632.6271464.228
8665.9421464.0438666.2551464.0348667.2971464.0358667.5431464.0428667.5891464.044
```

```
8673.8691464.1488673.9261464.1498673.9981464.1498688.7361464.5068688.8871464.506
8735.7831464.3858744.5341464.4168744.9981464.4318752.9621464.3448757.1551464.274
8766.5621464.1498768.1431464.1288769.2471464.1218770.9081464.1118778.607    1464
8785.0541464.6368785.9521464.3138787.354    14648789.476    14648792.384    1464
8794.682    14648794.959    14648795.835    14648799.048    14648800.717    1464
 8806.81    14648809.723    14648814.045    14648818.168    14648829.564    1464
8833.584    14648861.581    14648892.718    14648897.862    1464 8904.43    1464
8910.633    14648917.225    14648929.348    14648938.972    14648943.191    1464
8948.451    14648950.631    14648954.894    14648960.915    14648998.1631462.875
9007.2591462.8459054.108    14629061.363    14629095.638    14629100.513    1462
9101.764    14629105.377    14629124.169    14629136.647    14629161.174    1462
 9189.141461.3039219.4941460.845 9245.831460.5469251.0151460.5269279.638    1460
9280.698    1460 9282.19    14609283.126    14609290.461    14609292.982    1460
9294.839    14609304.056    14609335.992    14609344.013    14609363.6771459.676
9393.3551459.5219405.1521459.2879426.9991458.888 9471.46    1458  9531.11456.524
9552.387    14569555.1371455.7059558.7821455.3669573.947    14549580.945  1452.3
9582.116    14529583.0011451.7739589.909    14509589.972    14509594.231    1450
9595.339    14509602.213    14509603.154    14509613.337    14509788.5361448.279
9795.2521448.2219800.5941448.1759819.0581448.2539819.6921448.4049820.3671448.633
9820.9321448.4739821.3551448.5749821.7681448.6969827.269    14509828.6151450.312
9831.0291450.8719833.909 1451.619835.429    14529837.7841452.622  9843.1    1454
9847.304    14549847.306    14549857.489    14549860.769    14549887.096    1454
9891.678    14549943.257    14549965.172    14549965.969    14549977.895    1454
9977.976    1454 9978.35    14549978.712    1454 9978.76    14549985.359    1454
9986.006    1454  9988.61452.7269991.2221451.4239994.114    14509995.4371449.365
9998.516    1448   10000    144810003.91    144810006.74    144810007.651448.479
10013.73    1450 10016.21451.921 10016.3    1452 10016.4  1452.110016.821452.147
10023.48    145410024.93    145410043.881453.40910048.041453.61610050.57    1454
10090.61    145410128.931453.69510138.55 1453.6910142.841453.68610182.031453.473
10204.86 1453.4110299.641453.60110348.321453.91810351.05 1453.9310352.751453.932
10353.331453.93210363.21    145410370.17    145410378.05    145410399.55 1454.26
10424.351454.805 10462.21455.454 10475.2    145610479.121456.733 10485.9    1458
10493.951459.505 10496.6    146010500.431460.71610507.69    146210511.561462.743
10517.721463.94110518.08    146410518.551464.078 10530.1    146610530.591466.061
10548.74    146810550.151468.14410561.511469.228 10569.6    147010584.911471.159

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 8579.83    .0559986.006    .05510023.48    .055

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      9986.00610023.48              670  601.53     500             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
888       T

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)          1454.98    Element                  Left OB    Channel   Right OB
  Vel Head (ft)              0.46    Wt. n-Val.                0.055      0.055     0.055
  W.S. Elev (ft)          1454.52    Reach Len. (ft)          670.00     601.53    500.00
  Crit W.S. (ft)          1454.28    Flow Area (sq ft)        214.91     156.10    300.26
  E.G. Slope (ft/ft)     0.012048    Area (sq ft)            1440.93     156.10    300.26
  Q Total (cfs)           2304.00    Flow (cfs)               408.30    1144.98    750.72
  Top Width (ft)           843.09    Top Width (ft)           417.81      37.47    387.81
  Vel Total (ft/s)           3.43    Avg. Vel. (ft/s)           1.90       7.33      2.50
  Max Chl Dpth (ft)          6.52    Hydr. Depth (ft)           0.51       4.17      0.77
  Conv. Total (cfs)       20990.8    Conv. (cfs)              3719.9    10431.4    6839.5
  Length Wtd. (ft)         585.14    Wetted Per. (ft)         419.09      40.13    387.86
  Min Ch El (ft)          1448.00    Shear (lb/sq ft)           0.39       2.93      0.58
  Alpha                      2.50    Stream Power (lb/ft s)     0.73      21.46      1.46
  Frctn Loss (ft)            2.52    Cum Volume (acre-ft)      17.26      34.95     12.87
  C & E Loss (ft)            0.10    Cum SA (acres)             7.49       4.56      8.97

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.
Warning: The energy loss was 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 #PF 2

E.G. Elev (ft)	1455.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.64	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1454.59	Reach Len. (ft)	670.00	601.53	500.00
Crit W.S. (ft)	1454.49	Flow Area (sq ft)	244.83	158.81	148.83
E.G. Slope (ft/ft)	0.014796	Area (sq ft)	1470.85	158.81	148.83
Q Total (cfs)	2304.00	Flow (cfs)	563.68	1305.78	434.54
Top Width (ft)	630.00	Top Width (ft)	416.01	37.47	176.52
Vel Total (ft/s)	4.17	Avg. Vel. (ft/s)	2.30	8.22	2.92
Max Chl Dpth (ft)	6.59	Hydr. Depth (ft)	0.59	4.24	0.84
Conv. Total (cfs)	18941.1	Conv. (cfs)	4634.0	10734.8	3572.3
Length Wtd. (ft)	594.42	Wetted Per. (ft)	417.52	40.13	177.73
Min Ch El (ft)	1448.00	Shear (lb/sq ft)	0.54	3.66	0.77
Alpha	2.37	Stream Power (lb/ft s)	1.25	30.06	2.26
Frctn Loss (ft)	2.71	Cum Volume (acre-ft)	17.49	34.97	12.00
C & E Loss (ft)	0.16	Cum SA (acres)	7.47	4.56	7.76

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 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.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,
water surface was used.

CROSS SECTION RIVER: Buchanan Wash
REACH: Buchanan Wash RS: 0.302

INPUT
Description: 0.302
Station Elevation Data num= 79

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9649.66	1456	9664.57	1456	9670.01	1456	9673.15	1456	9673.5	1456
9675.57	1456	9675.87	1456	9675.94	1456	9695.31	1454.39	9699.21	1454
9723.42	1452.32	9728.47	1452	9728.84	1452	9729.17	1452	9730.56	1452
9731.19	1452	9762.67	1451.41	9807.48	1450.59	9821.35	1450	9825.97	1450
9827.35	1450	9828.05	1450	9838.4	1450	9847.28	1450	9853.7	1450.22
9856.75	1450.27	9871.57	1450.46	9874.77	1450.51	9883.31	1450.62	9886.85	1450.67
9902.26	1450.89	9912.54	1450	9914.07	1450	9968.34	1450	9970.34	1450
9973.33	1450	9977.57	1450	9978.18	1450	9981.03	1450	9983.12	1450
9983.38	1450	9987.82	1448.09	9988.02	1448	9988.15	1447.95	9988.48	1447.8
9991.74	1446	9996.51	1445.19	9996.55	1445.18	10002.47	1444	10004.08	1444
10004.57	1444	10007.25	1445.11	10009.65	1446	10011.2	1447.16	10012.33	1448
10014.65	1449.73	10015.03	1449.94	10015.15	1450	10015.53	1450	10064.58	1450
10072.2	1450	10072.32	1450	10076.29	1450	10077.11	1450	10083.81	1450
10083.87	1450	10084.4	1450.02	10165.23	1450.75	10209.1	1450.82	10226.9	1450.98
10237.43	1451.06	10240.22	1451.09	10253.92	1451.25	10272.83	1451.35	10337.64	1451.91
10344.95	1452	10375.52	1453.73	10380.45	1454	10386.41	1454.66		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9649.66	.055	9983.38	.055	10015.15	.055

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9983.38	10015.15	180	193	230	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1452.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1452.25	Reach Len. (ft)	180.00	193.00	230.00
Crit W.S. (ft)		Flow Area (sq ft)	433.72	188.99	486.49

E.G. Slope (ft/ft)	0.002188	Area (sq ft)	433.72	188.99	486.49
Q Total (cfs)	2304.00	Flow (cfs)	773.07	741.30	789.64
Top Width (ft)	624.82	Top Width (ft)	258.84	31.77	334.20
Vel Total (ft/s)	2.08	Avg. Vel. (ft/s)	1.78	3.92	1.62
Max Chl Dpth (ft)	8.25	Hydr. Depth (ft)	1.68	5.95	1.46
Conv. Total (cfs)	49256.0	Conv. (cfs)	16527.0	15847.8	16881.2
Length Wtd. (ft)	201.83	Wetted Per. (ft)	258.93	34.56	334.22
Min Ch El (ft)	1444.00	Shear (lb/sq ft)	0.23	0.75	0.20
Alpha	1.60	Stream Power (lb/ft s)	0.41	2.93	0.32
Frctn Loss (ft)	0.74	Cum Volume (acre-ft)	2.84	32.56	8.35
C & E Loss (ft)	0.03	Cum SA (acres)	2.28	4.08	4.82

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 #PF 2

E.G. Elev (ft)	1452.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1452.25	Reach Len. (ft)	180.00	193.00	230.00
Crit W.S. (ft)		Flow Area (sq ft)	433.69	188.99	486.45
E.G. Slope (ft/ft)	0.002188	Area (sq ft)	433.69	188.99	486.45
Q Total (cfs)	2304.00	Flow (cfs)	773.05	741.34	789.60
Top Width (ft)	624.82	Top Width (ft)	258.84	31.77	334.20
Vel Total (ft/s)	2.08	Avg. Vel. (ft/s)	1.78	3.92	1.62
Max Chl Dpth (ft)	8.25	Hydr. Depth (ft)	1.68	5.95	1.46
Conv. Total (cfs)	49251.2	Conv. (cfs)	16525.1	15847.2	16878.9
Length Wtd. (ft)	201.83	Wetted Per. (ft)	258.92	34.56	334.22
Min Ch El (ft)	1444.00	Shear (lb/sq ft)	0.23	0.75	0.20
Alpha	1.60	Stream Power (lb/ft s)	0.41	2.93	0.32
Frctn Loss (ft)	0.74	Cum Volume (acre-ft)	2.84	32.56	8.36
C & E Loss (ft)	0.03	Cum SA (acres)	2.28	4.08	4.82

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: Buchanan Wash
REACH: Buchanan Wash RS: 0.266

INPUT
Description: Cross-Section 0.266
Station Elevation Data num= 84

```
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
 9677.35     14569686.064     14569687.1281455.9659688.9881455.9139756.171     1454
9762.9951453.7799815.152     14529815.674     14529825.187 1451.359846.129     1450
9847.472     14509849.528     14509860.794     1450 9867.46     14509875.183     1450
9939.197     14509945.714     14509954.301     14509962.389     14509962.606     1450
9966.592     14509966.684     14509972.453     14509976.293     14509977.096     1450
9984.769     14509986.5941448.5199989.107 1446.489989.3361446.2959989.699     1446
9991.2691444.7279992.355     14449993.222     14449993.631     14449997.361     1444
9999.153     144410003.77     144410007.53     144410008.951445.43710009.51     1446
10010.881447.38910011.48     144810012.711449.24910013.131449.67410013.41     1450
10030.27     145010030.42     1450 10040.5     145010053.12     145010054.75     1450
10080.79     145010082.05     1450 10097.5     145010119.92     145010119.97     1450
10126.63     145010135.92     145010140.01     145010148.42     1450 10150.9     1450
10184.56     145010202.99     145010223.62     145010228.57     145010293.371450.715
10302.77  1450.810427.33     145210427.46     1452 10427.7     145210431.471452.208
10449.221453.00810452.311453.11910468.121453.90410468.521453.925 10469.11453.952
10470.03     145410487.461454.727   104971454.966 10504.1  1455.210511.321455.339
 10514.51455.35610524.581455.731 10525.61455.75910527.351455.828
```

Manning's n Values num= 3

```
     Sta    n Val      Sta    n Val      Sta    n Val
 9677.35     .0559984.769     .05510013.41     .055
```

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9984.76	10013.41	380	467.87	590	.5	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	1451.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.39	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1451.19	Reach Len. (ft)	380.00	467.87	590.00
Crit W.S. (ft)	1451.03	Flow Area (sq ft)	176.19	166.21	322.41
E.G. Slope (ft/ft)	0.007369	Area (sq ft)	176.19	166.21	322.41
Q Total (cfs)	2304.00	Flow (cfs)	440.95	1126.83	736.22
Top Width (ft)	515.75	Top Width (ft)	157.12	28.64	329.98
Vel Total (ft/s)	3.47	Avg. Vel. (ft/s)	2.50	6.78	2.28
Max Chl Dpth (ft)	7.19	Hydr. Depth (ft)	1.12	5.80	0.98
Conv. Total (cfs)	26840.1	Conv. (cfs)	5136.8	13126.8	8576.5
Length Wtd. (ft)	501.47	Wetted Per. (ft)	157.16	33.25	329.99
Min Ch El (ft)	1444.00	Shear (lb/sq ft)	0.52	2.30	0.45
Alpha	2.11	Stream Power (lb/ft s)	1.29	15.59	1.03
Frctn Loss (ft)	0.85	Cum Volume (acre-ft)	1.58	31.78	6.22
C & E Loss (ft)	0.08	Cum SA (acres)	1.42	3.95	3.07

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 #PF 2

E.G. Elev (ft)	1451.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.39	Wt. n-Val.	0.055	0.055	0.055
W.S. Elev (ft)	1451.19	Reach Len. (ft)	380.00	467.87	590.00
Crit W.S. (ft)	1451.03	Flow Area (sq ft)	176.24	166.22	322.53
E.G. Slope (ft/ft)	0.007364	Area (sq ft)	176.24	166.22	322.53
Q Total (cfs)	2304.00	Flow (cfs)	441.03	1126.58	736.39
Top Width (ft)	515.79	Top Width (ft)	157.13	28.64	330.02
Vel Total (ft/s)	3.46	Avg. Vel. (ft/s)	2.50	6.78	2.28
Max Chl Dpth (ft)	7.19	Hydr. Depth (ft)	1.12	5.80	0.98
Conv. Total (cfs)	26848.8	Conv. (cfs)	5139.4	13128.2	8581.2
Length Wtd. (ft)	501.47	Wetted Per. (ft)	157.17	33.25	330.03
Min Ch El (ft)	1444.00	Shear (lb/sq ft)	0.52	2.30	0.45
Alpha	2.11	Stream Power (lb/ft s)	1.29	15.57	1.03
Frctn Loss (ft)	0.85	Cum Volume (acre-ft)	1.58	31.78	6.22
C & E Loss (ft)	0.08	Cum SA (acres)	1.43	3.95	3.07

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: Buchanan Wash
REACH: Buchanan Wash RS: 0.177

INPUT
Description: 0.177
Station Elevation Data num= 69

```
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
 9674.62     14529678.067     14529700.544     14529729.273     14529729.811     1452
9739.118     14529743.646     14529754.261     14529760.141     14529774.887     1452
9828.6131450.7089839.2081450.5969869.0641450.2559878.0851450.1489882.4611450.132
9890.542     14509891.9811449.6799900.362     14489906.1951446.8319909.876     1446
9913.1381445.2639918.732     14449922.8821443.0639927.588     14429933.501     1442
9944.819     14429949.677     14429957.674     14429960.466 1442.299972.593     1444
9976.378     14449979.425     14449998.891     144410006.83     144410013.541445.556
10015.51     144610023.511447.86310024.09     144810029.571449.27610032.69     1450
10033.061450.08710041.29     1452 10042.71452.32810049.89     145410052.331454.569
10058.48     145610065.271457.59610066.95     145810067.931458.31310073.21     1460
10081.71     146010091.64     146010094.96 1458.7310098.281457.45310104.391455.125
10106.26 1454.4110107.33     145410112.351452.08210112.56     1452 10113.9 1451.73
 10120.11450.46910124.19     145010126.31     145010131.82     145010135.48     1450
10150.171449.519 10160.31449.51310165.59 1449.5110168.961449.524
```

Manning's n Values num= 4

```
     Sta   n Val      Sta   n Val      Sta   n Val      Sta   n Val
 9674.62     .0559913.138     .0559972.593     .05510006.83     .025
```

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

```
      9913.1389972.593              515  487.43  487.43              .1       .3
```

Blocked Obstructions num= 1

Sta L	Sta R	Elev
1008	010168.96	

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	1450.66	Element			
Vel Head (ft)	0.12	Wt. n-Val.	0.055	0.055	0.044
W.S. Elev (ft)	1450.53	Reach Len. (ft)	515.00	487.43	487.43
Crit W.S. (ft)		Flow Area (sq ft)	76.38	469.46	315.76
E.G. Slope (ft/ft)	0.000731	Area (sq ft)	76.38	469.46	315.76
Q Total (cfs)	2304.00	Flow (cfs)	59.77	1352.56	891.67
Top Width (ft)	190.25	Top Width (ft)	68.41	59.46	62.39
Vel Total (ft/s)	2.67	Avg. Vel. (ft/s)	0.78	2.88	2.82
Max Chl Dpth (ft)	8.53	Hydr. Depth (ft)	1.12	7.90	5.06
Conv. Total (cfs)	85194.1	Conv. (cfs)	2210.3	50013.1	32970.8
Length Wtd. (ft)	487.79	Wetted Per. (ft)	68.91	59.95	63.13
Min Ch El (ft)	1442.00	Shear (lb/sq ft)	0.05	0.36	0.23
Alpha	1.12	Stream Power (lb/ft s)	0.04	1.03	0.64
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	0.48	28.36	1.90
C & E Loss (ft)	0.03	Cum SA (acres)	0.44	3.48	0.41

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 #PF 2

			Left OB	Channel	Right OB
E.G. Elev (ft)	1450.66	Element			
Vel Head (ft)	0.12	Wt. n-Val.	0.055	0.055	0.044
W.S. Elev (ft)	1450.53	Reach Len. (ft)	515.00	487.43	487.43
Crit W.S. (ft)		Flow Area (sq ft)	76.41	469.48	315.78
E.G. Slope (ft/ft)	0.000731	Area (sq ft)	76.41	469.48	315.78
Q Total (cfs)	2304.00	Flow (cfs)	59.78	1352.53	891.68
Top Width (ft)	190.29	Top Width (ft)	68.45	59.46	62.39
Vel Total (ft/s)	2.67	Avg. Vel. (ft/s)	0.78	2.88	2.82
Max Chl Dpth (ft)	8.53	Hydr. Depth (ft)	1.12	7.90	5.06
Conv. Total (cfs)	85202.4	Conv. (cfs)	2210.8	50016.9	32974.7
Length Wtd. (ft)	487.79	Wetted Per. (ft)	68.94	59.95	63.14
Min Ch El (ft)	1442.00	Shear (lb/sq ft)	0.05	0.36	0.23
Alpha	1.12	Stream Power (lb/ft s)	0.04	1.03	0.64
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	0.48	28.36	1.90
C & E Loss (ft)	0.03	Cum SA (acres)	0.44	3.48	0.41

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: Buchanan Wash
REACH: Buchanan Wash RS: 0.085

INPUT
Description: 0.085
Station Elevation Data num= 126

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9361.87	1466	9365.14	1466	9367.83	1465.56	9369.51	1465.29	9370.65	1465.1
9373.66	1465.25	9391.92	1465.91	9392.1	1465.94	9393.3	1465.99	9393.58	1466
9393.84	1465.95	9403.44	1464	9413.27	1462.01	9413.3	1462	9416.53	1461.42
9418.86	1461	9424.88	1460.04	9425.02	1460.02	9425.06	1460.01	9428.68	1459.39
9431.63	1458.88	9436.84	1458	9437.01	1457.97	9437.31	1457.92	9442.39	1457.03
9448.31	1456	9448.99	1455.94	9449.15	1455.93	9449.35	1455.91	9459.85	1455.14
9461.39	1455.18	9462.16	1455.13	9465.02	1454.84	9467.77	1454.62	9469.81	1454.47
9471.13	1454.34	9477.55	1455.08	9480.53	1454.98	9500.12	1454	9521.99	1454
9544.34	1454	9550.75	1454	9562.74	1454	9568.49	1454	9569.5	1454
9574.92	1454	9576.06	1454	9578.23	1454	9585.09	1454	9658.46	1454
9660.55	1454	9661.41	1454	9664.1	1454	9667.28	1453.62	9674.48	1452
9678.66	1450.98	9682.67	1450	9688.09	1448.68	9690.86	1448	9697.51	1446.38
9699.04	1446	9706.36	1444.22	9707.23	1444	9715.34	1442.78	9720.43	1442
9721.28	1442	9745.4	1440.21	9747.7	1440	9813.98	1440	9827.74	1440
9839.93	1440	9845.24	1440	9845.78	1440	9855.04	1441.05	9862.39	1441.56
9866.01	1442	9866.71	1442	9870.8	1442	9877.62	1442	9883.92	1442

```
 9886.02    1442 9887.35    1442 9887.89    1442 9898.24    1442 9900.37    1442
 9908.53    1442 9913.91    1442 9943.81    1442  9974.8    1442    9975    1442
 9975.23 1442.11 9979.15    1444 9982.32    1444 9985.95    1444 9987.52 1443.41
 9991.26    1442 9996.24    1442 9997.72    1442   10000 1442.1610020.49 1443.68
10022.09    144410024.48 1444.5210037.54 1447.5810039.37    144810039.47 1448.03
10039.73 1448.0910047.76    145010050.28  1450.610055.69    145210058.78  1452.8
10063.41    145410068.35 1455.2810071.13    1456   10076 1457.2610078.85    1458
10079.95  1458.310086.43 1459.9710086.57    146010086.68    1460 10109.7    1460
10112.25 1458.9610118.66 1456.3510120.56 1455.5710126.94 1452.9810129.23    1452
10135.49 1451.89

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9361.87    .055  9664.1    .055 9997.72    .025

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        9664.110086.57              245  224.46  224.46             .3      .3

CROSS SECTION OUTPUT    Profile #PF 1

  E.G. Elev (ft)          1450.57    Element                    Left OB    Channel   Right OB
  Vel Head (ft)              0.01    Wt. n-Val.                            0.051
  W.S. Elev (ft)          1450.56    Reach Len. (ft)            245.00     224.46     224.46
  Crit W.S. (ft)                     Flow Area (sq ft)                    3059.45
  E.G. Slope (ft/ft)      0.000041   Area (sq ft)                         3059.45
  Q Total (cfs)           2304.00    Flow (cfs)                           2304.00
  Top Width (ft)           369.74    Top Width (ft)                        369.74
  Vel Total (ft/s)           0.75    Avg. Vel. (ft/s)                        0.75
  Max Chl Dpth (ft)         10.56    Hydr. Depth (ft)                        8.27
  Conv. Total (cfs)       360707.5   Conv. (cfs)                         360707.5
  Length Wtd. (ft)         224.59    Wetted Per. (ft)                      372.53
  Min Ch El (ft)          1440.00    Shear (lb/sq ft)                        0.02
  Alpha                      1.00    Stream Power (lb/ft s)                  0.02
  Frctn Loss (ft)            0.03    Cum Volume (acre-ft)        0.03        8.62       0.13
  C & E Loss (ft)            0.21    Cum SA (acres)              0.04        1.08       0.06

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 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:    Manning's n values were composited to a single value in the main channel.

CROSS SECTION OUTPUT    Profile #PF 2

  E.G. Elev (ft)          1450.57    Element                    Left OB    Channel   Right OB
  Vel Head (ft)              0.01    Wt. n-Val.                            0.051
  W.S. Elev (ft)          1450.56    Reach Len. (ft)            245.00     224.46     224.46
  Crit W.S. (ft)                     Flow Area (sq ft)                    3059.58
  E.G. Slope (ft/ft)      0.000041   Area (sq ft)                         3059.58
  Q Total (cfs)           2304.00    Flow (cfs)                           2304.00
  Top Width (ft)           369.74    Top Width (ft)                        369.74
  Vel Total (ft/s)           0.75    Avg. Vel. (ft/s)                        0.75
  Max Chl Dpth (ft)         10.56    Hydr. Depth (ft)                        8.27
  Conv. Total (cfs)       360733.0   Conv. (cfs)                         360733.0
  Length Wtd. (ft)         224.59    Wetted Per. (ft)                      372.53
  Min Ch El (ft)          1440.00    Shear (lb/sq ft)                        0.02
  Alpha                      1.00    Stream Power (lb/ft s)                  0.02
  Frctn Loss (ft)            0.03    Cum Volume (acre-ft)        0.03        8.62       0.13
  C & E Loss (ft)            0.21    Cum SA (acres)              0.04        1.08       0.06

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 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:    Manning's n values were composited to a single value in the main channel.

CROSS SECTION          RIVER: Buchanan Wash
REACH: Buchanan Wash      RS: 0.043
```

```
INPUT
Description: 0.043
Station Elevation Data     num=       54
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
 9921.66     1460 9923.24     1460 9930.85     1460 9936.35     1460 9938.28   1459.5
 9942.85     1458 9944.38  1457.49 9948.17     1456 9950.25   1455.2 9953.09     1454
 9954.38  1453.54 9958.66     1452 9959.52  1451.69 9961.31  1451.05 9964.05     1450
 9966.52  1449.73 9980.52     1448 9983.33  1447.05 9986.43     1446 9990.28   1444.7
 9992.43     1444 9994.96  1443.16 9998.36     1442   10000     144210006.02     1442
10016.11     144210020.05  1443.310022.18     144410027.52 1445.7510028.31     1446
 10035.4  1446.8510045.48     144810049.85   1448.910055.17     145010060.69  1451.17
10064.67     145210072.33  1453.6710075.18  1454.2910082.12     145610087.99  1457.69
10089.23     145810090.21  1458.2410097.28     146010115.21     146010120.93     1460
10123.95  1458.7910125.91     1458 10129.1  1456.72 10130.9     145610135.46  1454.17
10135.88     145410136.16  1453.8910142.79     1452 10143.6     1452

Manning's n Values         num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
 9921.66     .025 9998.36     .05510016.11     .025

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
       9980.5210028.31                 0        0        0              .1        .5
Ineffective Flow      num=        1
   Sta L    Sta R     Elev  Permanent
888        T

CROSS SECTION OUTPUT     Profile #PF 1

  E.G. Elev (ft)           1450.33    Element                    Left OB    Channel   Right OB
  Vel Head (ft)               0.72    Wt. n-Val.                  0.025      0.037      0.025
  W.S. Elev (ft)           1449.60    Reach Len. (ft)
  Crit W.S. (ft)           1447.92    Flow Area (sq ft)           10.40     285.38      50.72
  E.G. Slope (ft/ft)      0.003001    Area (sq ft)                10.40     285.38      50.72
  Q Total (cfs)            2304.00    Flow (cfs)                  29.06    2011.81     263.13
  Top Width (ft)             85.70    Top Width (ft)              12.97      47.79      24.94
  Vel Total (ft/s)            6.65    Avg. Vel. (ft/s)             2.80       7.05       5.19
  Max Chl Dpth (ft)           7.60    Hydr. Depth (ft)             0.80       5.97       2.03
  Conv. Total (cfs)        42057.4    Conv. (cfs)                 530.5    36723.8     4803.1
  Length Wtd. (ft)                    Wetted Per. (ft)            13.07      49.41      25.22
  Min Ch El (ft)           1442.00    Shear (lb/sq ft)             0.15       1.08       0.38
  Alpha                       1.05    Stream Power (lb/ft s)       0.42       7.63       1.95
  Frctn Loss (ft)                     Cum Volume (acre-ft)
  C & E Loss (ft)                     Cum SA (acres)


Note:    Manning's n values were composited to a single value in the main channel.

CROSS SECTION OUTPUT     Profile #PF 2

  E.G. Elev (ft)           1450.33    Element                    Left OB    Channel   Right OB
  Vel Head (ft)               0.72    Wt. n-Val.                  0.025      0.037      0.025
  W.S. Elev (ft)           1449.60    Reach Len. (ft)
  Crit W.S. (ft)           1447.92    Flow Area (sq ft)           10.40     285.38      50.72
  E.G. Slope (ft/ft)      0.003001    Area (sq ft)                10.40     285.38      50.72
  Q Total (cfs)            2304.00    Flow (cfs)                  29.06    2011.81     263.13
  Top Width (ft)             85.70    Top Width (ft)              12.97      47.79      24.94
  Vel Total (ft/s)            6.65    Avg. Vel. (ft/s)             2.80       7.05       5.19
  Max Chl Dpth (ft)           7.60    Hydr. Depth (ft)             0.80       5.97       2.03
  Conv. Total (cfs)        42057.4    Conv. (cfs)                 530.5    36723.8     4803.1
  Length Wtd. (ft)                    Wetted Per. (ft)            13.07      49.41      25.22
  Min Ch El (ft)           1442.00    Shear (lb/sq ft)             0.15       1.08       0.38
  Alpha                       1.05    Stream Power (lb/ft s)       0.42       7.63       1.95
  Frctn Loss (ft)                     Cum Volume (acre-ft)
  C & E Loss (ft)                     Cum SA (acres)
```

Note: Manning's n values were composited to a single value in the main channel.

SUMMARY OF MANNING'S N VALUES

River:Buchanan Wash

Reach	River Sta.	n1	n2	n3	n4
Buchanan Wash	1.935	.055	.055	.055	
Buchanan Wash	1.916	.055	.055	.055	
Buchanan Wash	1.842	.055	.055	.055	
Buchanan Wash	1.766	.055	.055	.055	
Buchanan Wash	1.670	.055	.055	.055	
Buchanan Wash	1.575	.055	.055	.055	
Buchanan Wash	1.479	.055	.055	.055	
Buchanan Wash	1.412	.055	.055	.055	
Buchanan Wash	1.356	.055	.055	.055	
Buchanan Wash	1.332	.055	.055	.055	
Buchanan Wash	1.326	Culvert			
Buchanan Wash	1.318	.055	.055	.055	
Buchanan Wash	1.290	.055	.055	.055	
Buchanan Wash	1.197	.055	.055	.055	
Buchanan Wash	1.098	.055	.055	.055	
Buchanan Wash	1.005	.055	.055	.055	
Buchanan Wash	0.928	.055	.055	.055	
Buchanan Wash	0.839	.055	.055	.055	
Buchanan Wash	0.696	.055	.055	.055	
Buchanan Wash	0.595	.055	.055	.055	
Buchanan Wash	0.501	.055	.055	.055	
Buchanan Wash	0.456	.055	.055	.055	
Buchanan Wash	0.416	.055	.055	.055	
Buchanan Wash	0.302	.055	.055	.055	
Buchanan Wash	0.266	.055	.055	.055	
Buchanan Wash	0.177	.055	.055	.055	.025
Buchanan Wash	0.085	.055	.055	.025	
Buchanan Wash	0.043	.025	.055	.025	

SUMMARY OF REACH LENGTHS

River: Buchanan Wash

Reach	River Sta.	Left	Channel	Right
Buchanan Wash	1.935	70	100.93	100
Buchanan Wash	1.916	230	389.3	380
Buchanan Wash	1.842	400	401.78	430
Buchanan Wash	1.766	500	508.03	555
Buchanan Wash	1.670	510	500.86	490
Buchanan Wash	1.575	505	505.7	540
Buchanan Wash	1.479	355	351.78	335
Buchanan Wash	1.412	300	296.39	305
Buchanan Wash	1.356	205	129.16	75
Buchanan Wash	1.332	65	71.81	75
Buchanan Wash	1.326	Culvert		
Buchanan Wash	1.318	105	150.9	190
Buchanan Wash	1.290	445	486.94	505
Buchanan Wash	1.197	615	523.26	520
Buchanan Wash	1.098	465	491.72	505
Buchanan Wash	1.005	360	408.16	420
Buchanan Wash	0.928	480	471.49	465
Buchanan Wash	0.839	715	752.2	765
Buchanan Wash	0.696	645	533.49	500
Buchanan Wash	0.595	635	497.19	360
Buchanan Wash	0.501	260	235.61	225
Buchanan Wash	0.456	210	210.92	200
Buchanan Wash	0.416	670	601.53	500
Buchanan Wash	0.302	180	193	230
Buchanan Wash	0.266	380	467.87	590
Buchanan Wash	0.177	515	487.43	487.43
Buchanan Wash	0.085	245	224.46	224.46
Buchanan Wash	0.043	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Buchanan Wash

Reach	River Sta.	Contr.	Expan.
Buchanan Wash	1.935	.1	.3
Buchanan Wash	1.916	.1	.3
Buchanan Wash	1.842	.1	.3
Buchanan Wash	1.766	.1	.3
Buchanan Wash	1.670	.1	.3
Buchanan Wash	1.575	.1	.3
Buchanan Wash	1.479	.1	.3
Buchanan Wash	1.412	.1	.3
Buchanan Wash	1.356	.1	.3
Buchanan Wash	1.332	.1	.3
Buchanan Wash	1.326	Culvert	
Buchanan Wash	1.318	.1	.3
Buchanan Wash	1.290	.1	.3
Buchanan Wash	1.197	.1	.3
Buchanan Wash	1.098	.1	.3
Buchanan Wash	1.005	.1	.3
Buchanan Wash	0.928	.1	.3
Buchanan Wash	0.839	.1	.3
Buchanan Wash	0.696	.1	.3
Buchanan Wash	0.595	.1	.3
Buchanan Wash	0.501	.1	.3
Buchanan Wash	0.456	.1	.5
Buchanan Wash	0.416	.1	.3
Buchanan Wash	0.302	.1	.3
Buchanan Wash	0.266	.5	.3
Buchanan Wash	0.177	.1	.3
Buchanan Wash	0.085	.3	.3
Buchanan Wash	0.043	.1	.5

Profile Output Table - Standard Table 1

Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Buchanan Wash	1.935	1308.00	1492.00	1496.2	1496.25	1497.46	0.033121	8.85	147.74	60.46	1.00
Buchanan Wash	1.935	1308.00	1492.00	1497.0		1497.65	0.017724	6.68	195.67	77.50	0.74
Buchanan Wash	1.916	1308.00	1492.00	1495.9		1495.95	0.002200	2.91	642.18	345.84	0.27
Buchanan Wash	1.916	1308.00	1492.00	1496.4		1496.69	0.005104	4.86	309.38	102.00	0.43
Buchanan Wash	1.842	1308.00	1490.00	1493.8		1494.44	0.012853	6.69	242.87	140.24	0.65
Buchanan Wash	1.842	1308.00	1490.00	1494.8		1495.09	0.003922	4.42	350.07	115.00	0.38
Buchanan Wash	1.766	1609.00	1488.00	1492.0		1492.10	0.003246	3.59	676.13	375.64	0.33
Buchanan Wash	1.766	1609.00	1488.00	1492.5		1492.88	0.007389	5.90	336.64	115.00	0.51
Buchanan Wash	1.670	1609.00	1484.00	1490.0		1490.18	0.004255	4.14	420.84	132.12	0.38
Buchanan Wash	1.670	1609.00	1484.00	1489.9		1490.20	0.003889	4.63	390.09	100.00	0.37
Buchanan Wash	1.575	1609.00	1482.00	1487.6		1487.93	0.004713	5.51	417.43	180.81	0.43
Buchanan Wash	1.575	1609.00	1482.00	1487.8		1488.13	0.004353	5.42	365.15	100.00	0.41
Buchanan Wash	1.479	1609.00	1480.00	1484.2		1484.59	0.009403	6.37	416.82	357.26	0.57
Buchanan Wash	1.479	1609.00	1480.00	1485.0		1485.46	0.006253	5.93	331.41	100.00	0.48
Buchanan Wash	1.412	1609.00	1478.00	1483.0		1483.09	0.002282	3.54	677.33	293.61	0.29
Buchanan Wash	1.412	1609.00	1478.00	1483.6		1483.84	0.003454	4.72	407.01	100.00	0.36
Buchanan Wash	1.356	1609.00	1476.00	1481.8		1482.02	0.006049	4.53	442.06	262.79	0.45
Buchanan Wash	1.356	1609.00	1476.00	1482.3		1482.58	0.005134	4.61	358.56	101.00	0.42
Buchanan Wash	1.332	1609.00	1476.00	1481.3	1479.88	1481.45	0.002584	3.88	682.03	375.85	0.31
Buchanan Wash	1.332	1609.00	1476.00	1482.0	1479.88	1482.12	0.001886	3.61	556.41	150.00	0.27
Buchanan Wash	1.326	Culvert									
Buchanan Wash	1.318	1609.00	1476.00	1480.3	1479.88	1480.74	0.008342	6.17	381.03	258.60	0.54
Buchanan Wash	1.318	1609.00	1476.00	1480.9		1481.20	0.004262	4.86	420.51	150.00	0.40
Buchanan Wash	1.290	1609.00	1476.00	1479.7		1479.83	0.004109	3.68	554.17	318.41	0.37
Buchanan Wash	1.290	1609.00	1476.00	1480.1		1480.47	0.005809	4.82	345.58	100.00	0.44
Buchanan Wash	1.197	1609.00	1472.00	1477.7		1477.97	0.003578	4.91	492.63	353.42	0.37
Buchanan Wash	1.197	1609.00	1472.00	1478.1		1478.39	0.003229	4.87	405.41	100.00	0.36
Buchanan Wash	1.098	2304.00	1468.00	1474.9	1473.83	1475.31	0.006154	6.48	674.61	568.59	0.49
Buchanan Wash	1.098	2304.00	1468.00	1475.0		1475.66	0.007087	7.08	391.52	100.00	0.52
Buchanan Wash	1.005	2304.00	1466.00	1471.0		1471.47	0.010641	7.52	570.10	437.40	0.62
Buchanan Wash	1.005	2304.00	1466.00	1471.9		1472.41	0.006217	6.52	444.47	120.00	0.49

Buchanan Wash	0.928	2304.00	1464.00	1469.1		1469.31	0.003263	4.29	711.12	247.26	0.35
Buchanan Wash	0.928	2304.00	1464.00	1469.8		1470.20	0.005112	5.86	461.62	110.00	0.45
Buchanan Wash	0.839	2304.00	1462.00	1466.9		1467.21	0.006230	5.66	604.04	306.21	0.48
Buchanan Wash	0.839	2304.00	1462.00	1467.1		1467.51	0.006345	5.88	459.92	130.00	0.49
Buchanan Wash	0.696	2304.00	1458.00	1462.8	1461.81	1462.98	0.005204	5.02	787.20	563.72	0.43
Buchanan Wash	0.696	2304.00	1458.00	1463.1		1463.39	0.004848	5.08	567.89	180.00	0.42
Buchanan Wash	0.595	2304.00	1452.73	1460.1	1459.31	1460.30	0.004153	5.29	909.64	831.86	0.39
Buchanan Wash	0.595	2304.00	1452.73	1460.5	1459.36	1460.82	0.004066	5.50	613.72	230.00	0.39
Buchanan Wash	0.501	2304.00	1454.00	1456.9	1456.73	1457.21	0.011270	5.40	625.91	527.98	0.59
Buchanan Wash	0.501	2304.00	1454.00	1457.1	1456.82	1457.50	0.012609	5.97	495.03	300.00	0.63
Buchanan Wash	0.456	2304.00	1450.00	1455.9	1455.43	1456.02	0.002602	3.57	922.23	570.42	0.30
Buchanan Wash	0.456	2304.00	1450.00	1456.2	1455.45	1456.30	0.002387	3.55	827.94	358.89	0.29
Buchanan Wash	0.416	2304.00	1448.00	1454.5	1454.28	1454.98	0.012048	7.33	671.28	843.09	0.63
Buchanan Wash	0.416	2304.00	1448.00	1454.6	1454.49	1455.23	0.014796	8.22	552.47	630.00	0.70
Buchanan Wash	0.302	2304.00	1444.00	1452.2		1452.36	0.002188	3.92	1109.20	624.82	0.28
Buchanan Wash	0.302	2304.00	1444.00	1452.2		1452.36	0.002188	3.92	1109.12	624.82	0.28
Buchanan Wash	0.266	2304.00	1444.00	1451.2	1451.03	1451.59	0.007369	6.78	664.80	515.75	0.50
Buchanan Wash	0.266	2304.00	1444.00	1451.2	1451.03	1451.59	0.007364	6.78	664.99	515.79	0.50
Buchanan Wash	0.177	2304.00	1442.00	1450.5		1450.66	0.000731	2.88	861.60	190.25	0.18
Buchanan Wash	0.177	2304.00	1442.00	1450.5		1450.66	0.000731	2.88	861.67	190.29	0.18
Buchanan Wash	0.085	2304.00	1440.00	1450.6		1450.57	0.000041	0.75	3059.45	369.74	0.05
Buchanan Wash	0.085	2304.00	1440.00	1450.6		1450.57	0.000041	0.75	3059.58	369.74	0.05
Buchanan Wash	0.043	2304.00	1442.00	1449.6	1447.92	1450.33	0.003001	7.05	346.50	85.70	0.51
Buchanan Wash	0.043	2304.00	1442.00	1449.6	1447.92	1450.33	0.003001	7.05	346.50	85.70	0.51

Profile Output Table - Standard Table 2

Reach	River Sta	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
Buchanan Wash	1.935	1497.46	1496.25	1.22	0.51	0.34		1308.00		60.46
Buchanan Wash	1.935	1497.65	1496.96	0.69	0.83	0.12	0.00	1308.00		77.50
Buchanan Wash	1.916	1495.95	1495.87	0.08	1.46	0.05	818.93	482.89	6.19	345.84
Buchanan Wash	1.916	1496.69	1496.39	0.31	1.58	0.02	368.15	922.83	17.02	102.00
Buchanan Wash	1.842	1494.44	1493.85	0.59	2.20	0.15	125.18	1065.24	117.58	140.24
Buchanan Wash	1.842	1495.09	1494.84	0.25	2.19	0.01	176.31	917.93	213.76	115.00
Buchanan Wash	1.766	1492.10	1491.99	0.10	1.90	0.01	548.17	396.21	664.62	375.64
Buchanan Wash	1.766	1492.88	1492.49	0.39	2.64	0.03	749.91	739.37	119.72	115.00
Buchanan Wash	1.670	1490.18	1489.95	0.23	2.25	0.01	778.68	830.32		132.12
Buchanan Wash	1.670	1490.20	1489.93	0.27	2.07	0.01	756.97	852.03		100.00
Buchanan Wash	1.575	1487.93	1487.60	0.33	3.33	0.01	277.69	983.81	347.49	180.81
Buchanan Wash	1.575	1488.13	1487.78	0.35	2.67	0.01	212.21	1001.41	395.38	100.00
Buchanan Wash	1.479	1484.59	1484.20	0.39	1.42	0.09	246.63	850.89	511.48	357.26
Buchanan Wash	1.479	1485.46	1485.04	0.42	1.57	0.05	108.86	963.80	536.34	100.00
Buchanan Wash	1.412	1483.09	1482.98	0.11	1.05	0.02	411.65	483.85	713.50	293.61
Buchanan Wash	1.412	1483.84	1483.58	0.26	1.24	0.01	239.51	726.89	642.59	100.00
Buchanan Wash	1.356	1482.02	1481.75	0.27	0.53	0.04	179.70	1304.43	124.86	262.79
Buchanan Wash	1.356	1482.58	1482.26	0.32	0.40	0.05	75.24	1533.76	0.00	101.00
Buchanan Wash	1.332	1481.45	1481.31	0.13			601.72	740.50	266.78	375.85
Buchanan Wash	1.332	1482.12	1481.97	0.15			529.83	784.16	295.01	150.00
Buchanan Wash	1.326	Culvert								
Buchanan Wash	1.318	1480.74	1480.30	0.45	0.83	0.09	251.75	1149.02	208.23	258.60
Buchanan Wash	1.318	1481.20	1480.93	0.28	0.74	0.01	266.50	1047.11	295.38	150.00
Buchanan Wash	1.290	1479.83	1479.67	0.16	1.85	0.01	367.10	1077.03	164.87	318.41
Buchanan Wash	1.290	1480.47	1480.12	0.35	2.05	0.02	103.05	1505.95		100.00
Buchanan Wash	1.197	1477.97	1477.73	0.24	2.65	0.02	295.09	841.46	472.45	353.42
Buchanan Wash	1.197	1478.39	1478.11	0.28	2.69	0.03	259.58	894.56	454.86	100.00
Buchanan Wash	1.098	1475.31	1474.88	0.42	3.83	0.00	762.07	1399.93	141.99	568.59
Buchanan Wash	1.098	1475.66	1475.04	0.62	3.21	0.05	657.15	1573.25	73.60	100.00
Buchanan Wash	1.005	1471.47	1470.99	0.47	2.07	0.09	985.20	1040.20	278.60	437.40
Buchanan Wash	1.005	1472.41	1471.94	0.47	2.19	0.02	869.47	1089.85	344.68	120.00

Buchanan Wash	0.928	1469.31	1469.12	0.18	2.09	0.01	1451.51	757.15	95.34	247.26
Buchanan Wash	0.928	1470.20	1469.78	0.42	2.69	0.00	1011.67	1179.97	112.36	110.00
Buchanan Wash	0.839	1467.21	1466.89	0.31	4.19	0.04	733.15	1130.45	440.40	306.21
Buchanan Wash	0.839	1467.51	1467.09	0.42	4.07	0.04	703.67	1227.66	372.67	130.00
Buchanan Wash	0.696	1462.98	1462.81	0.17	2.67	0.01	1471.20	520.68	312.12	563.72
Buchanan Wash	0.696	1463.39	1463.12	0.27	2.56	0.00	1403.67	567.15	333.18	180.00
Buchanan Wash	0.595	1460.30	1460.06	0.24	3.09	0.01	589.79	1096.41	617.80	831.86
Buchanan Wash	0.595	1460.82	1460.51	0.31	3.30	0.01	668.99	1233.23	401.77	230.00
Buchanan Wash	0.501	1457.21	1456.92	0.29	1.14	0.05	336.48	1074.84	892.68	527.98
Buchanan Wash	0.501	1457.50	1457.10	0.41	1.13	0.08	414.66	1270.88	618.46	300.00
Buchanan Wash	0.456	1456.02	1455.88	0.14	1.01	0.03	1206.52	742.42	355.06	570.42
Buchanan Wash	0.456	1456.30	1456.15	0.15	1.02	0.05	1321.49	784.84	197.67	358.89
Buchanan Wash	0.416	1454.98	1454.52	0.46	2.52	0.10	408.30	1144.98	750.72	843.09
Buchanan Wash	0.416	1455.23	1454.59	0.64	2.71	0.16	563.68	1305.78	434.54	630.00
Buchanan Wash	0.302	1452.36	1452.25	0.11	0.74	0.03	773.07	741.30	789.64	624.82
Buchanan Wash	0.302	1452.36	1452.25	0.11	0.74	0.03	773.05	741.34	789.60	624.82
Buchanan Wash	0.266	1451.59	1451.19	0.39	0.85	0.08	440.95	1126.83	736.22	515.75
Buchanan Wash	0.266	1451.59	1451.19	0.39	0.85	0.08	441.03	1126.58	736.39	515.79
Buchanan Wash	0.177	1450.66	1450.53	0.12	0.05	0.03	59.77	1352.56	891.67	190.25
Buchanan Wash	0.177	1450.66	1450.53	0.12	0.05	0.03	59.78	1352.53	891.68	190.29
Buchanan Wash	0.085	1450.57	1450.56	0.01	0.03	0.21		2304.00		369.74
Buchanan Wash	0.085	1450.57	1450.56	0.01	0.03	0.21		2304.00		369.74
Buchanan Wash	0.043	1450.33	1449.60	0.72			29.06	2011.81	263.13	85.70
Buchanan Wash	0.043	1450.33	1449.60	0.72			29.06	2011.81	263.13	85.70

APPENDIX F: EROSION AND SEDIMENT TRANSPORT ANALYSIS SUPPORTING DOCUMENTATION

A copy of the scour analysis conducted for the Skunk Creek Levees is provided herein.

Not sealed

HES HARZA ENVIRONMENTAL SERVICES, INC.

SUBJECT	CONFIRMATION OF BANK SCOUR DEPTH PROTECTION	PROJECT	Skunk Creek
		FILE NUMBER	1639G
COMPUTED	REM	DATE	2-2-87
CHECKED		Page	1 of 3 Pages

BACKGROUND

Improvements to Skunk Creek are required through the landfill site to protect the channel sides from erosion and prevent flooding of the landfill site. Initial studies with HEC-2 indicated channel cross sections could be modified and the banks lined to meet the objectives and maintain close to the same velocities as represented by a 1984 COE HEC-2 analysis of "existing" conditions. Adjustments were made to the cross sections and channel slope during final design to balance cut and fill. More recent topographic data were also used to depict the "existing" channel bottom. The final design shows continuation of the soil cement lining at a 1:1 slope for 10 feet below the new channel bottom. This extension of the lining is provided to prevent under cutting of the lined bank.

should be provided ?

The cross sections shown in the final design were input to HEC-2 to check the 100 year flood profile against the top of bank design. With the final design cross sections the freeboard at Sta. 46+45 is about 1' for the 100 year flood. Adjustment to the top of bank profile needs to be made to provide 3' freeboard along improved channel.

Scour of the channel bottom is expected to occur where the velocity increases and the bed load capacity is increased. For the 10 year flood there are sections where the velocity will increase from 4 to 5 fps. At one channel cross section (RM. 10.30) the velocity is 5.6 fps and the velocity at the downstream cross section is 10.3 fps. The limit of channel degradation in the higher velocity section will be met when the bottom material is scoured sufficiently to provide a cross section with a 5.6 fps velocity. This would result in an 85% increase in cross sectional area.

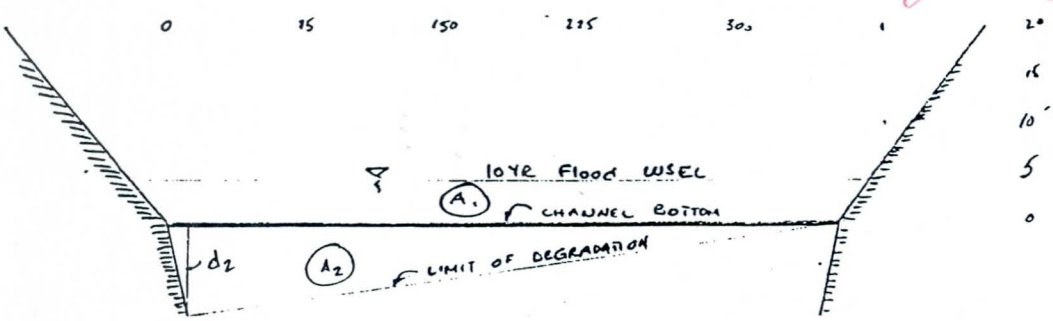
HES HARZA ENVIRONMENTAL SERVICES, INC.

SUBJECT	Scour depth protection	PROJECT	Skunk Creek
		FILE NUMBER	16396
COMPUTED	RCM	CHECKED	
		DATE	2-2-87

As the creek is flooded from time to time there will be shifts in the channel bottom. Some areas will degrade and others will aggrade. Because the flow entering the site is coming at high velocity and is assumed to be carrying its full bed load, the long term effect should be a slight overall aggradation of the improved channel. Localized scour will, however, occur. To assess the potential for localized scour the following are assumed:

1) Upstream velocity = 5 fps
2) Degrading channel section velocity = 11 fps
3) Channel bottom will erode on one side, not uniformly.
4) Typical bottom channel width of degrading section is 350'

This section does not exist, today



At 11 fps for 15,000 cfs (10yr flood), $A_1 = 15000/11 = 1363 ft^2$

At 5 fps for 15,000 cfs, $A_1 + A_2 = 15,000/5 = 3000 ft^2$ $\therefore A_2 = 1637 ft^2$

$A_2 \simeq \frac{1}{2}(350)(d_2) = 1637$

$d_2 = 9.35'$

Provision of 10' extension from toe of bank to protect from scour undercutting bank slope is adequate for nonuniform channel degradation

HES HARZA ENVIRONMENTAL SERVICES, INC.

SUBJECT	Scour depth protection	PROJECT	Skunk Creek
		FILE NUMBER	1639G
COMPUTED	REM	CHECKED	
		DATE	2-2-87

Check to see if degradation limited by armouring

Tractive force (TF) = $\gamma d S$ in #/ft²

$\gamma = 62.4$ #/ft³

d = depth of flow, ft, assume 3.5' for 15,000 cfs through high velocity section

S = bottom slope (ft/ft) - channel slope varies in final design from 0.000 to over 0.01. Use $S = .005$ as example case

$$TF = 62.4 \times 3.5 \times .005$$
$$= 1.09 \text{ \#/ft}^2$$

From Fig 14-14 of Tractive Force versus transportable sediment size in Design of Small Dams, pg 792, Second Ed 1973, Bur. Rec.

the diameter would be ~ 60 mm

∴ try 60 mm as representative armouring size

depth of scour, $y_d = y_a \left(\frac{1}{\Delta p} - 1\right)$

where y_a = thickness of armouring layer

Δp = decimal % of material larger than armouring size

if $y_d = 10'$ and $y_a = 0.5'$

$$\Delta p = \left(\frac{y_d}{y_a} + 1\right)^{-1} = \frac{1}{21} = .047$$

∴ to armour at or before 10' depth of scour, ~ 4.7% of bed material must larger than 60 mm (2.3")

The material gradation throughout the study reach is highly variable and essentially indeterminate for the purpose of "fine tuning" the depth of bank toe protection.

∴ No change in selection of 10' depth of bank toe protection

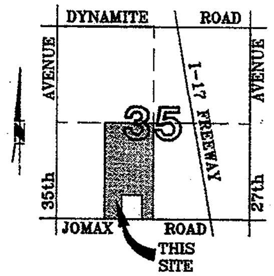
APPENDIX G: PROJECT PLANS

Selected sheets from the Corps of Engineers' levee plans, the Skunk Creek Channel Improvement plans, the Arizona Hillcrest Development plans, and the plans for the box culvert at Pinnacle Vista Road are included.

GRADING PLANS FOR

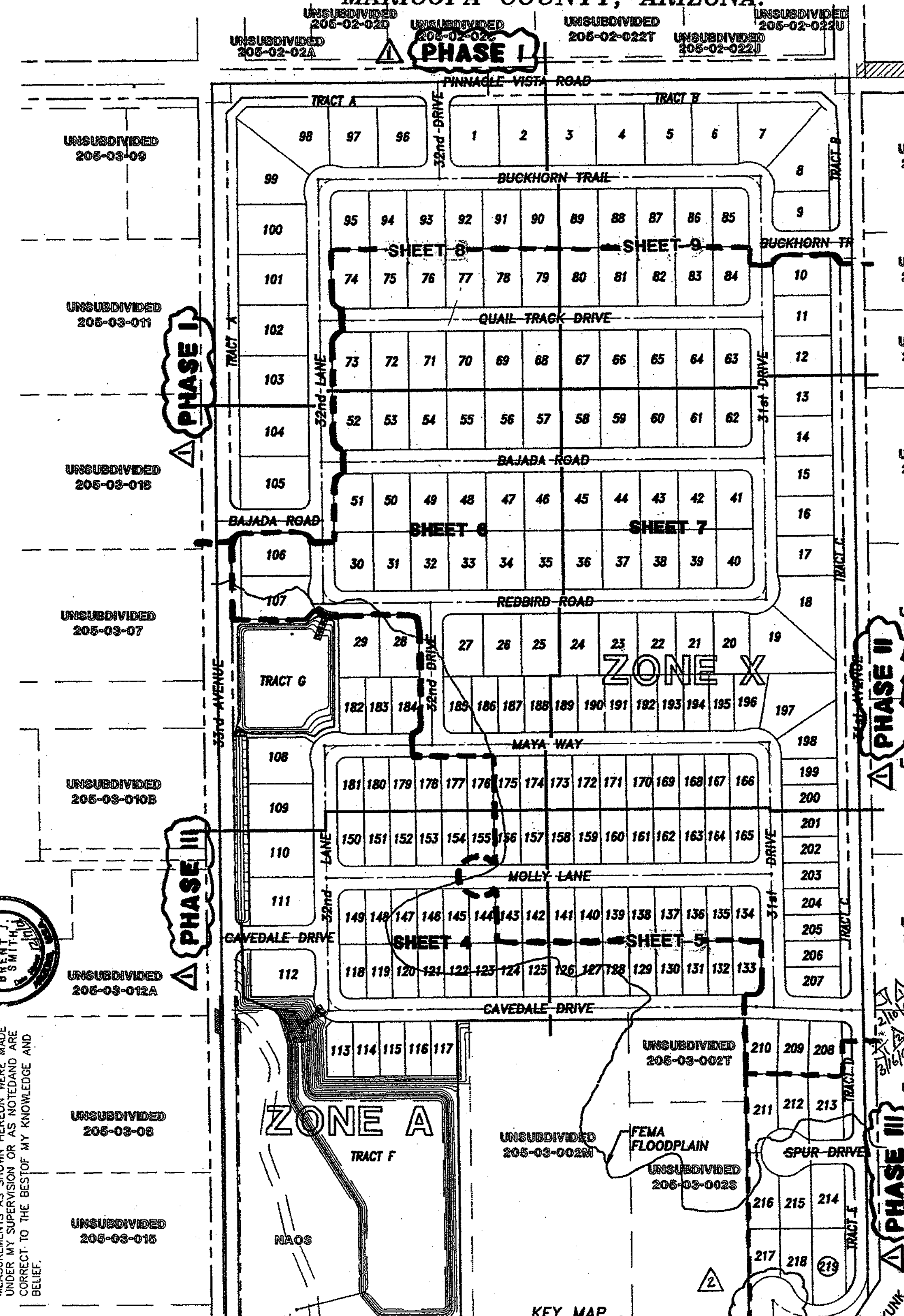
ARIZONA HILLCREST

A PORTION OF THE EAST HALF OF THE SOUTHWEST QUARTER SECTION 35, SECTION 35, TOWNSHIP 5 NORTH, RANGE 2 EAST, OF THE GILA AND SALT RIVER BASE AND MERIDIAN, CITY OF PHOENIX, MARICOPA COUNTY, ARIZONA.



VICINITY MAP
N.T.S

SCALE: 1" = 150'
0 150 300 450



KEY MAP

CITY OF PHOENIX GRADING & DRAINAGE NOTES

1. A GRADING PERMIT IS REQUIRED UNDER CHAPTER 32A OF THE PHOENIX CITY CODE.
2. HAUL PERMITS, WHEN REQUIRED, MUST BE OBTAINED PRIOR TO OR CONCURRENTLY WITH THE GRADING AND DRAINAGE PERMIT.
3. EXCAVATING CONTRACTOR MUST GIVE LOCATION FOR WASTING EXCESS EXCAVATION AND A LETTER FROM OWNER GIVING PERMISSION FOR DUMPING PRIOR TO STARTING ON-SITE CONSTRUCTION. IF EXCESS EXCAVATION EXCEEDS 100 CUBIC YARDS, THE DISPOSAL SITE WILL ALSO REQUIRE A GRADING AND DRAINAGE PERMIT.
4. DEVELOPMENT SERVICES DEPARTMENT'S FIELD INSPECTION GROUP SHALL BE NOTIFIED 48 HOURS BEFORE ANY ON-SITE CONSTRUCTION BEGINS, TELEPHONE (602) 262-7811.
5. MINIMUM FINISH FLOOR ELEVATIONS SHOWN ARE SAFE FROM THE 100 YEAR FLOOD OR PER MINIMUM SPECIFIED IN THE CITY OF PHOENIX STORM DRAIN DESIGN MANUAL, WHICHEVER IS GREATER.
6. STAKING PAD ELEVATIONS IS THE RESPONSIBILITY OF THE OWNER AND HIS ENGINEER. THE OWNER'S ENGINEER SHALL SUBMIT THREE SEALED COPIES OF THIS GRADING AND DRAINAGE PLAN DESIGNATED AS "RECORD DRAWING" (BEARING AN ORIGINAL SIGNATURE) PRIOR TO THE REQUEST FOR FINAL INSPECTION.
7. A SEPARATE PERMIT IS NECESSARY FOR ANY OFF-SITE CONSTRUCTION.
8. AN APPROVED GRADING AND DRAINAGE PLAN SHALL BE ON THE JOB SITE AT ALL TIMES. DEVIATIONS FROM THE PLAN MUST BE PRECEDED BY AN APPROVED PLAN REVISION.
9. DRYWELLS, WHEN REQUIRED, MUST BE DRILLED A MINIMUM OF 10 FEET INTO PERMEABLE POROUS STRATA OR PERCOLATION TESTS WILL BE REQUIRED. THE GRADING AND DRAINAGE INSPECTOR MUST BE PRESENT BEFORE BACKFILL OR WALL PIPES ARE PLACED WITHIN ANY DRYWELLS.
10. THE OWNER/DEVELOPER SHALL BE RESPONSIBLE FOR REGISTERING THE DRYWELLS SHOWN ON PLAN WITH THE ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY (A.D.E.Q.). FOR INFORMATION ABOUT SPECIFIC REQUIREMENTS, CONTACT THE WATER PERMITS UNIT AT (602)207-4678.
11. GRADING AND DRAINAGE PLAN APPROVAL INCLUDES THE CONSTRUCTION OF ALL SURFACE IMPROVEMENTS SHOWN ON THE APPROVED PLAN INCLUDING, BUT NOT LIMITED TO, RETENTION AREAS, SEDIMENTATION BASINS, AND/OR OTHER DRAINAGE FACILITIES, DRAINAGE PATTERNS, WALLS, CURBS, ASPHALT PAVEMENT, AND BUILDING FLOOR ELEVATIONS.
12. CONTRACTOR SHALL PROVIDE LEVEL BOTTOM IN ALL RETENTION BASINS AT ELEVATIONS SHOWN ON THE PLANS. SLOPE PROTECTION SHALL BE APPLIED TO PREVENT EROSION.
13. GRADES SHOWN IN RETENTION BASINS ARE DESIGN FINISHED GRADES. SHOULD THE CONTRACTOR OR ANY SUBCONTRACTOR PLAN TO PLACE SPOIL DIRT FROM FOOTINGS, UTILITY TRENCHES, LANDSCAPING, SWIMMING POOLS, ETC. IN THE BASINS, THEN THE BASINS SHOULD BE SUFFICIENTLY OVER-EXCAVATED DURING THE ROUGH GRADING OPERATION TO ALLOW FOR THE PLACEMENT OF THE FILL OR LANDSCAPING MATERIALS.
14. CONTRACTOR IS RESPONSIBLE FOR LOCATING AND CONFIRMING DEPTHS OF ALL THE EXISTING UTILITY LINES WITHIN PROPOSED RETENTION BASIN AREAS. IF THE BASIN CANNOT BE CONSTRUCTED PER PLAN BECAUSE OF CONFLICTS, THE CONTRACTOR SHOULD DISCUSS MODIFICATION OF BASIN CONFIGURATION WITH THE CITY INSPECTOR TO DETERMINE IF A PLAN REVISION OR A FIELD CHANGE IS REQUIRED.
15. ALL DRAINAGE PROTECTIVE DEVICES SUCH AS SWALES, INTERCEPTOR DITCHES, PIPES, PROTECTIVE BERMS, BARRIER WALLS, CONCRETE CHANNELS OR OTHER MEASURES DESIGNED TO PROTECT ADJACENT BUILDINGS OR PROPERTY FROM STORM RUNOFF MUST BE COMPLETED PRIOR TO BUILDING CONSTRUCTION.
16. ALL KNOWN EXISTING UNDERGROUND UTILITIES WITHIN PROPOSED RETENTION AREAS HAVE BEEN DESIGNED TO MAINTAIN A MINIMUM 15" OF COVER OVER CITY OWNED UTILITY LINES AND THE MINIMUM SPECIFIED BY OTHER UTILITY OWNERS.
17. REQUIRED RETAINING WALLS SHOWN ON THE GRADING AND DRAINAGE PLANS ARE TO BE REVIEWED, PERMITTED, AND INSPECTED BY THE BUILDING SAFETY BRANCH OF THE DEVELOPMENT SERVICES DEPARTMENT.
18. CERTIFICATE OF OCCUPANCY (C. OF O.) AND/OR FINAL ELECTRICAL CLEARANCE FOR ANY BUILDING IS DENIED UNTIL ALL GRADING AND DRAINAGE IMPROVEMENTS ARE COMPLETED.
19. DAMAGE AND/OR DISPLACED CONCRETE CURB, GUTTER, SIDEWALK, OR DRIVEWAY SLAB THAT IS WITHIN THE RIGHT-OF-WAY SHALL BE REPAIRED OR REPLACED, AS NOTED BY CITY INSPECTORS, BEFORE FINAL ACCEPTANCE OF THE WORK.
20. RETENTION BASIN SIDE SLOPES SHALL BE A MAXIMUM OF 4:1 UNLESS APPROVAL IS RECEIVED FROM THE PLAN RECEIVER FOR A STEEPER SLOPE.

AS BUILT CERTIFICATION: PHASE III-
I HEREBY CERTIFY THAT THE "RECORD DRAWING" MEASUREMENTS AS SHOWN HEREON WERE MADE UNDER MY SUPERVISION OR AS NOTEDAND ARE CORRECT TO THE BESTOF MY KNOWLEDGE AND BELIEF.
(Seal: 29891 BRENT J. SMITH)

ESTIMATED EARTHWORK QUANTITIES

(NOT TO BE USED FOR BIDDING PURPOSE CONTRACTOR IS RESPONSIBLE FOR HIS OWN CUT & FILL QUANTITIES)

	CUT (C.Y.)	FILL (C.Y.)
RAW QUANTITIES	160,060	118,720
*GROUND LOSS=0.20' OVER SITE	-22,978	
*COMPACTION SHRINKAGE=15%	-17,808	
TOTALS	119,274	118,720
NET CUT	554	

NOTE: IN AREAS WHERE GREATER THAN 12" OF FILL IS REQUIRED THE SOIL SHALL BE PLACED IN 6" COMPACTED LIFTS.

NET AC OF SITE= 72.25 AC

DEVELOPER

DOUG OBERG
KAUFMAN & BROAD
432 NORTH 44TH STREET, STE 115
PHOENIX, ARIZONA 85008
PHONE: (602) 306-1000
FAX: (602) 220-4897

ENGINEER

KENNETH M. TARR, P.E.
AMERICAN ENGINEERING CO.
21442 N. 20TH AVENUE
PHOENIX, ARIZONA 85027
PHONE (602) 582-0260
FAX (602) 582-0953

SHEET INDEX

1	COVER SHEET
2-3	NOTES & DETAIL SHEETS
4-9	GRADING SHEETS

BENCHMARK:

U.S.C & G.S. BRASS CAP IN CONCRETE POST ON WESTERLY RIGHT OF WAY OF I-17 0.17 MILES NORTH OF DYNAMITE ROAD STAMPED "M343 1959" ELEVATION = 1510.27 C.O.P. DATUM.

CITY OF PHOENIX GRADING & DRAINAGE NOTES-CONTINUED

21. THE ENGINEERING DESIGN ON THESE PLANS ARE ONLY APPROVED BY THE CITY IN SCOPE AND NOT IN DETAIL. CONSTRUCTION QUANTITIED ON THESE PLANS ARE NOT VERIFIED BY THE CITY. APPROVAL OF THESE PLANS ARE FORPERMIT PURPOSES ONLY AND SHALL NOT PREVENT THE CITY FROM REQUIRING CORRECTION OF ERRORS IN THE PLANS WHERE SUCH ERRORS ARE SUBSEQUENTLY FOUND TO BE IN VIOLATION OF ANY LAW, ORIDINANCE, HEALTH, SAFTEY OR OTHER DESIGN ISSUES.
22. THE DEVELOPER/BUILDER SHALL BE RESPONSIBLE FOR INSURING THAT ALL ON-LOT DRAINAGE PROTECTIVE DEVICES SUCH AS SIDE YARDS SWALES, DRIVEWAY SWALES, WALL OPENINGS, BERMS, ETC. ARE CONSTRUCTED ACCORDING TO THE APPROVED PLANS PRIOR TO OCCUPANCY OF ANY STRUCTURE.
23. IF FINISHED GRADE DIFFERENTIAL EXCEEDS 1.0', A RETAINING WALL SHALL BE CONSTRUCTED. STRUCTURAL CALCULATIONS AND FINAL RETAINING WALL DESIGN SHALL BE PROVIDED BY THE BUILDER OR HIS REPRESENTITVE. THE DESIGN SHALL BE REVIEWED, APPROVED, PERMITTED, AND INSPECTED BY THE BUILDING SAFTEY BRANCH OF THE DEVELOPMENT SERVICES DEPARTMENT
24. SHOULD RETENTION BASINS FAIL TO DRAIN WITHIN 36 HOURS, ADDITIONAL DRYWELL SHALL BE INSTALLED BY THE DEVELOPER OWNER.

AS-BUILT CERTIFICATION PHASE -I-

I HEREBY CERTIFY THAT THE "RECORD DRAWING" MEASUREMENTS AND SURVEY MONUMENTS AS SHOWN HEREON WERE MADE UNDER MY SUPERVISION OR AS NOTED AND ARE CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

Laurence R. Gates — 3-13-01
REGISTERED LAND SURVEYOR/ENGINEER — DATE
11116
REGISTRATION NUMBER
(Seal: LAURENCE R GATES)

APPROVAL BY PARKS DEPT.

J. Newman — 19 OCT 99
CITY OF PHOENIX PARKS DEPT. — DATE

City of Phoenix
These plans have been approved by the Development Services Department for the issuance of the following permit(s):

Grading	DZI	Ph. —	Date 1-21-00
SWMP		Ph.	Date
Paving		Ph.	Date
Concrete		Ph.	Date
Drain Fac		Ph.	Date
Water		Ph.	Date
Wastewater		Ph.	Date

2/16/00 △1
3/16/00 △2

These plans have been approved by the Development Services Department for the issuance of the following permit(s):

Grading	DZI	Occ.	Date 10-19-99 AT RISK G/D ONLY
Paving		Occ.	Date
Concrete		Occ.	Date
Drain. Fac.		Occ.	Date
Water		Occ.	Date
Wastewater		Occ.	Date
Other		Occ.	Date

APPROVED FOR ...
PERMIT CONDITIONALLY ISSUED AS OWNER'S RISK AND WILL BE SUPERSEDED BY FULL GRADING & DRAINAGE PERMIT UPON FINAL PLAN APPROVAL. THIS PERMIT IS APPROVED FOR GRADING/NO OTHER CONSTRUCTION IS PERMITTED.
BY DZI DATE 10-19-99

Two working days before you dig CALL FOR THE BLUE STAKES
263-1100
Blue Stake Center CALL COLLECT

AS-BUILT CERTIFICATION: PHASE II-
I HEREBY CERTIFY THAT THE "RECORD DRAWING" MEASUREMENTS AS SHOWN HEREON WERE MADE UNDER MY SUPERVISION OR AS NOTED AND ARE CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.
(Seal: 11116 LAURENCE R. GATES ARIZONA, U.S.A.)

△1 REVISION 1: ADDED PHASING. FEB. 7, 2000 Kenneth M Tarr, P.E.
△2 REVISION 2: REDESIGN OF CUL-DE-SAC JOMAX RD. MAR. 14, 2000 Kenneth M. Tarr, P.E.

MANAGING ENGINEER/SURVEYOR KENNETH M. TARR, P.E.
PROJECT COORDINATION M.G. VARADIN, E.I.T.
DESIGN/LAYOUT MGV | DRAFTED AS | CHECKED KMT
DRAWING SCALE(S) 1"=150'

AMERICAN ENGINEERING CO.
A DIVISION OF Robert Bein, William Frost & Associates
Professional Engineers, Planners & Surveyors
21442 NORTH 20TH AVENUE . PHOENIX, ARIZONA 85027 . (623)-582-0260

OWNER/DEVELOPER KAUFMAN & BROAD OF ARIZONA INC.
PROJECT NAME ARIZONA HILLCREST
PLAN TYPE GRADING PLANS

SEALED (Seal: CERTIFICATE NO. 31317 KENNETH M. TARR ARIZONA, U.S.A.)

ORIGINAL PLAN DATE JUL/1999
LATEST REVISION DATE OCT/1999
SHEET NUMBER 1 OF 9
PROJECT NUMBER 100006

DIS# 98-8110 P98265 Q.S. # 49-21

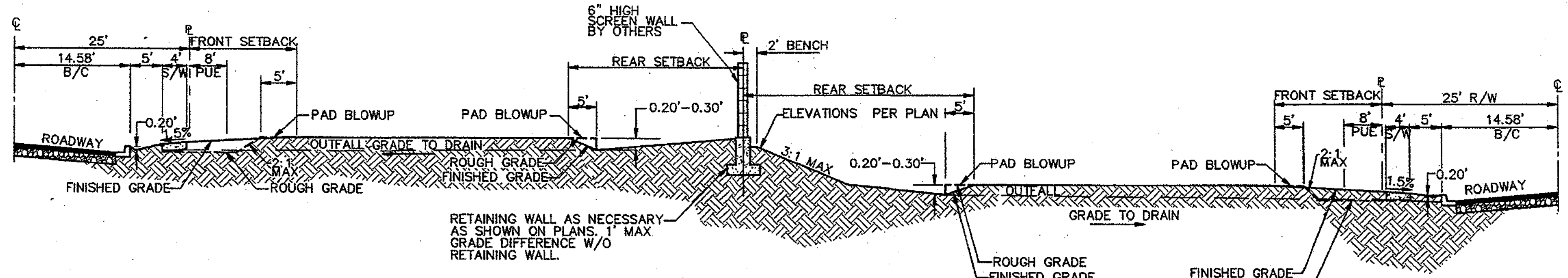
AutoCAD File: H:\pdata\45100006\dwg\Grading\0006G01.dwg Plotted at: Wed Oct 13 14:35:54 1999
RBF User Name ?

ENGINEER'S NOTES

1. THE ENGINEER WILL NOT BE RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES OR PROCEDURES OR FOR SAFETY PRECAUTIONS OR PROGRAMS UTILIZED IN CONNECTION WITH THE WORK, AND HE WILL NOT BE RESPONSIBLE FOR THE CONTRACTOR'S FAILURE TO CARRY OUT THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
2. EXISTING UTILITIES SHOWN ON THESE PLANS HAVE BEEN LOCATED ACCORDING TO INFORMATION PROVIDED BY THE AGENCY OPERATING EACH UTILITY. LOCATIONS SHOWN ARE APPROXIMATE ONLY, AND ARE NOT RELIABLE FOR CONSTRUCTION PURPOSES. CALL BLUE STAKE FOR FIELD LOCATION @ 263-1100.
3. THE ENGINEER AND APPLICABLE AGENCY MUST APPROVE, PRIOR TO CONSTRUCTION, ANY ALTERATION OR VARIANCE FROM THESE PLANS. ANY VARIATIONS FROM THESE PLANS SHALL BE PROPOSED ON CONSTRUCTION FIELD PRINTS AND TRANSMITTED TO THE ENGINEER.
4. THE CONTRACTOR SHALL PROTECT AND MAINTAIN ALL EXISTING UTILITIES ON THE SITE. ANY DAMAGE TO EXISTING UTILITIES, WHETHER SHOWN OR NOT ON THE DRAWING, SHALL BE REPAIRED/REPLACED AT THE CONTRACTOR'S EXPENSE. EXISTING SURFACE FEATURES AND FENCING SHALL BE REPLACED IN KIND.
5. ANY INSPECTION BY THE CITY, COUNTY, OR THE ENGINEER, SHALL NOT, IN ANY WAY, RELIEVE THE CONTRACTOR FROM ANY OBLIGATION TO PERFORM THE WORK IN STRICT COMPLIANCE WITH THE APPLICABLE CODES AND AGENCY REQUIREMENTS.
6. CONTRACTOR TO LOCATE ALL EXISTING PROPERTY MONUMENTS PRIOR TO CONSTRUCTION. ANY MONUMENTS DISTURBED DURING THE CONSTRUCTION OF THIS PROJECT SHALL BE REPLACED BY A REGISTERED LAND SURVEYOR AT THE CONTRACTOR'S EXPENSE.
7. NOTHING CONTAINED IN THE CONTRACT DOCUMENTS SHALL CREATE, NOR SHALL BE CONSTRUED TO CREATE, ANY CONTRACTUAL RELATIONSHIP BETWEEN THE ENGINEER AND THE CONTRACTOR OR ANY SUBCONTRACTOR.
8. THE CONTRACTOR SHALL MAKE NO CLAIM AGAINST THE OWNER OR THE ENGINEER REGARDING ALLEGED INACCURACY OF CONSTRUCTION STAKES SET BY THE ENGINEER UNLESS ALL SURVEY STAKES SET BY THE ENGINEER ARE MAINTAINED INTACT AND CAN BE VERIFIED AS TO THEIR ORIGIN. IF, IN THE OPINION OF THE ENGINEER, THE STAKES ARE NOT MAINTAINED INTACT AND CANNOT BE VERIFIED AS TO THEIR ORIGIN, ANY REMEDIAL WORK REQUIRED TO CORRECT ANY ITEM OR IMPROPER CONSTRUCTION WORK IN THIS DEVELOPMENT SHALL BE PERFORMED AT THE SOLE EXPENSE OF THE RESPONSIBLE CONTRACTOR OR SUBCONTRACTOR.
9. CONTRACTOR IS RESPONSIBLE FOR PROTECTING ALL STORM DRAIN PIPES AND DRAINAGE FACILITIES FROM DAMAGE DURING ALL STAGES OF CONSTRUCTION. THE DEPTH OF COVER ON THE STORM DRAINAGE PIPE IS DESIGNED FOR FINAL GRADE THEREFORE, EXTRA CARE SUCH AS BERMING OVER PIPES, FLAGGING OR SIGNAGE SHOULD BE USED DURING CONSTRUCTION TO MAINTAIN COVER OR PROTECT THE PIPES.

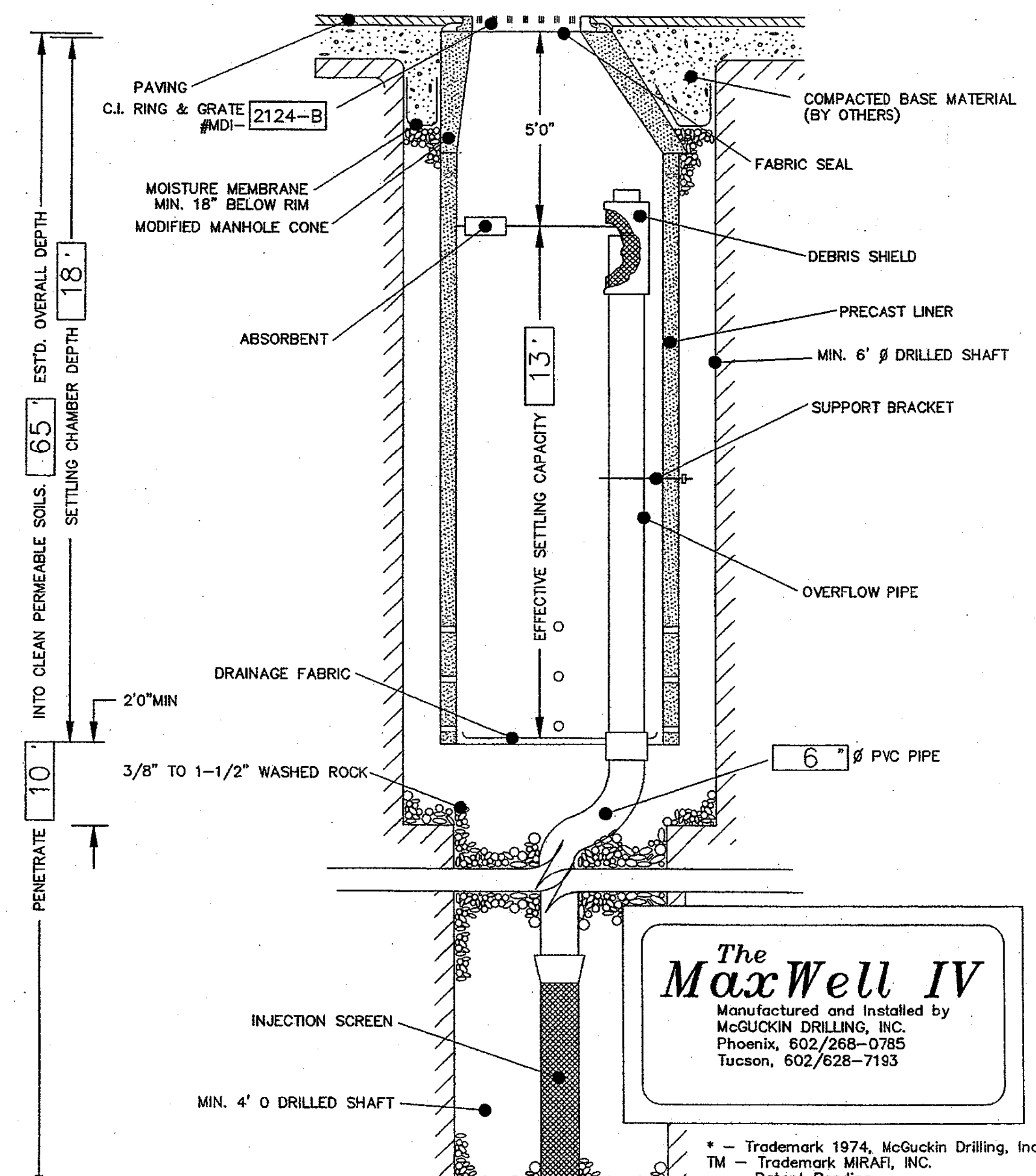
GENERAL GRADING NOTES

1. CONTRACTOR TO FOLLOW RECOMMENDATIONS LISTED IN THE SOILS INVESTIGATION REPORT FOR ARIZONA PINNACLE VISTA PREPARED BY CONSTRUCTION INSPECTING AND TESTING CO. INC., SHOULD ANY CONFLICTS ARISE BETWEEN THE SOILS INVESTIGATION REPORT AND THESE GRADING PLANS, THE CIVIL ENGINEER SHALL BE CONTACTED AND THE SOILS INVESTIGATION REPORT RECOMMENDATIONS SHALL BE FOLLOWED.
2. THE ENGINEER MAKES NO REPRESENTATION OR GUARANTEE REGARDING EARTHWORK QUANTITIES OR THAT THE EARTHWORK FOR THIS PROJECT WILL BALANCE DUE TO VARYING FIELD CONDITIONS, CHANGING SOIL TYPES, ALLOWABLE CONSTRUCTION TOLERANCES AND CONSTRUCTION METHODS THAT ARE BEYOND THE CONTROL OF THE ENGINEER.
3. PRIOR TO BIDDING THE WORK THE CONTRACTOR SHALL THOROUGHLY SATISFY HIMSELF AS TO THE ACTUAL CONDITIONS AND EARTHWORK QUANTITIES, IF ANY. NO CLAIM SHALL BE MADE AGAINST THE OWNER/DEVELOPER OR ENGINEER FOR ANY EXCESS OR DEFICIENCY THEREIN, ACTUAL OR RELATIVE.
4. THE ENGINEER WILL PERFORM FIELD SURVEYS FOR PAD ELEVATION CERTIFICATIONS UPON NOTIFICATION BY THE GRADING CONTRACTOR THAT THE PADS ARE COMPLETE AND READY FOR CERTIFICATION. IT IS UNDERSTOOD THAT THE CERTIFICATION PROVIDES ONLY A REPRESENTATIVE ELEVATION OF THE AVERAGE GRADE OF EACH LOT, BUILDINGS OR UNIT PAD, AND SHALL NOT BE CONSTRUED TO INCLUDE YARD AND STREET SUBGRADE CERTIFICATION OR CERTIFICATION THAT THE ENTIRE PAD IS LEVEL, THAT IT WAS CONSTRUCTED IN THE DESIGNED LOCATION OR WAS GRADED TO THE CROSS-SECTION SET FORTH ON THE PLANS OR AS DESIGNATED IN THE SOILS REPORT.
5. THE CITY OF PHOENIX POLICE DEPARTMENT ENFORCES LAWS REGULATING THE OPERATION OF COMMERCIAL VEHICLES. THIS INCLUDES ENFORCEMENT OF FEDERAL, STATE, COUNTY, AND LOCAL LAWS AND ORDINANCES QUESTIONS REGARDING COMMERCIAL VEHICLE ENFORCEMENT MAY BE DIRECTED TO THE COMMERCIAL VEHICLE ENFORCEMENT SUPERVISOR AT (602) 495-7813 (SOUTH RESOURCE BUREAU) OR (602) 495-6784 (NORTH RESOURCE BUREAU).



SECTION A-A
NTS

DRYWELL DETAIL AND SPECIFICATIONS



* – Trademark 1974, McGuckin Drilling, Inc.
TM – Trademark MIRAFI, INC.
– Patent Pending

PRECAST LINER – REINFORCED 4000 PSI CONCRETE. 48" ID. 54" OD.

MANHOLE CONE – STANDARD UTILITY CONSTRUCTION. – EXCEPT FLAT BOTTOM.

OVERFLOW PIPE – SCHEDULE 40 PVC MATED TO DRAINAGE PIPE BELOW ROCK.

BRACKETS– FORMED 12 GA. STEEL FUSION BONDED EPOXY COATED.

DEBRIS SHIELD – ROLLED 16 GA. STEEL X 36" LENGTH WITH ROLLED 16 GA. X .265" MAX. SWO FLATTENED EXPANDED STEEL SCREEN X 12" LENGTH. FUSION BONDED EPOXY COATED.

DRAINAGE PIPE – ADS HIGHWAY GRADE OR EQUAL.

RINGS AND GRATES – CLEAN CAST IRON WITH WORDING "STORM WATER ONLY" IN RAISED LETTERS MACHINED MATING SURFACES BOLTED IN TWO LOCATIONS.

ROCK – CLEAN WASHED ROCK – BETWEEN 3/8" AND 1-1/2", SIZED TO COMPLIMENT SOIL CONDITIONS.

MOISTURE MEMBRANE– 6 MIL PLASTIC. PLACE SECURELY AGAINST CONE AND HOLE SIDEWALL.

DRAINAGE FABRIC – NON-WOVEN GEOTEXTILE FABRIC. PLACE FABRIC TIGHTLY AGAINST LINER AND PIPE.

ABSORBENT – HYDROPHOBIC PETROCHEMICAL SPONGE –MIN. 4 QT. CAPACITY STANDARD IN ALL PAVED DRAINAGE AREAS.

DRAINAGE SCREENS – ROLLED 10 GA. X .625" MAX. SWO FLATTENED EXPANDED STEEL, FUSION BONDED EPOXY COATED 96" OVERALL LENGTH WITH MDI-B COUPLER OR EQUAL.

HOLES ARE TO BE DRILLED IN A MANNER TO PREVENT CONTAMINATION OF PERMEABLE SOILS. HOLE SHAFT TO BE A MINIMUM OF 4'0 TO MAXIMIZE SURFACE WALL AREA.

DRAINAGE PIPE SHALL BE SUSPENDED DURING BACKFILL OPERATIONS TO PREVENT BUCKLING OR BREAKAGE.

CENTER PRECAST LINER IN HOLE AND ALIGN SECTIONS TO MAXIMIZE BEARING SURFACE.

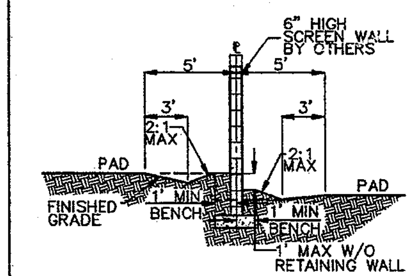
SECURE RING AND GRATE TO CONE WITH MORTAR. RIM ELEVATION 0.02' OF PLANS.

DRYWELL MANUFACTURER IS TO INSTALL U.V. RESISTANT FABRIC SEAL BENEATH GRATE. GENERAL CONTRACTOR TO REMOVE AT END OF PROJECT, AFTER PAVING AND LANDSCAPING ARE COMPLETE.

NOTE:
IF THE TESTED CAPACITY OF THESE DRYWELLS IS LESS THAN 0.50 CFS, THEN MORE DRYWELLS MUST BE INSTALLED UNTIL THE REQUIRED CAPACITY IS REACHED.

LOT NUMBERS	FRONT ** SETBACK	REAR SETBACK
1-112	10.0'	15.0'
113-219	18.0'	15.0'

** GARAGE SETBACK A MINIMUM OF 18' FROM BACK OF S/W. SEE SETBACK EXHIBIT FOR EXACT BUILDING SETBACK.



SECTION B-B
NTS

LEGEND

◉	SURVEY MONUMENT
1002	EXISTING CONTOURS
2.00%	PROPOSED STREET SLOPE
82.6	(RECTANGLE) FINISHED GRADE AT REAR PROPERTY CORNER
79.5	EXISTING GROUND ELEVATION
(81.93)	PROPOSED TOP OF CURB ELEV.
(98.31)	EXISTING TOP OF CURB ELEV.
FF=	MIN. FINISHED FLOOR ELEVATION
PAD=	MIN. BUILDING PAD ELEVATION
HW=	HIGH WATER ELEVATION
BTM=	BASIN BOTTOM ELEVATION
◆	INDICATES GRADE BREAK
TW= BW=	TOP OF RETAINING WALL FINISHED SURFACE AT BOTTOM OF RET. WALL
FL= 03.71	FLOW LINE ELEVATION
	TOP AND BOTTOM OF SLOPE
	STORM DRAIN
⇐	DRAINAGE ARROW
NG 10.10	NATURAL GRADE ELEVATION
	RETAINING WALL
	LOOSE RIP-RAP
	GUNNITE SPILLWAY
VNAE	VEHICULAR NON ACCESS EASEMENT

MANAGING ENGINEER/SURVEYOR KENNETH M. TARR, P.E.
PROJECT COORDINATION M.G. VARADIN, E.I.T.
FIELD SURVEY | DRAFTED | CHECKED
DESIGN/LAYOUT MGV | DRAFTED AS | CHECKED KMT
DRAWING SCALE(S) N.T.S.

AMERICAN ENGINEERING CO.
A DIVISION OF Robert Bein, William Frost & Associates
Professional Engineers, Planners & Surveyors
21442 NORTH 20TH AVENUE . PHOENIX, ARIZONA 85027 . (623)-582-0260

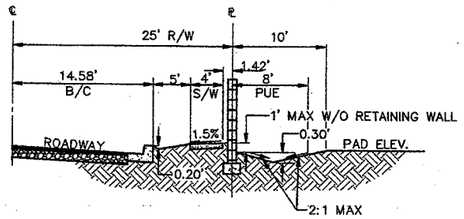
OWNER/DEVELOPER KAUFMAN & BROAD OF ARIZONA INC.
PROJECT NAME ARIZONA HILLCREST
PLAN TYPE NOTES & DETAIL SHEET

SEALED
Registered Professional Engineer (Civil) CERTIFICATE NO. 31317 KENNETH M. TARR Date Signed 10/13/99 ARIZONA, U.S.A.

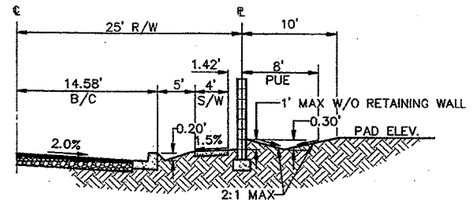
ORIGINAL PLAN DATE JUL/1999
LATEST REVISION DATE OCT/1999
SHEET NUMBER 2 OF 9
PROJECT NUMBER 100006

DIS# 98-8110 P98265 Q.S. # 49-21

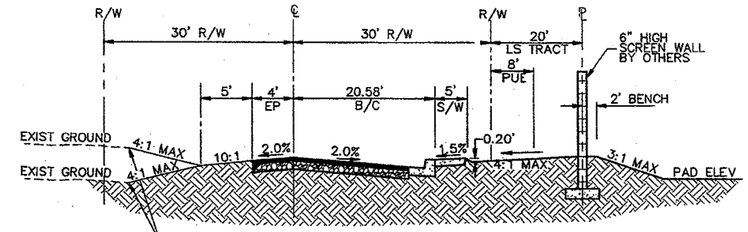
AutoCAD File: H:\pdata\45100006\dwg\Grading\0006602.dwg Plotted at: Wed Oct 13 14:24:42 1999
RBF User Name ?



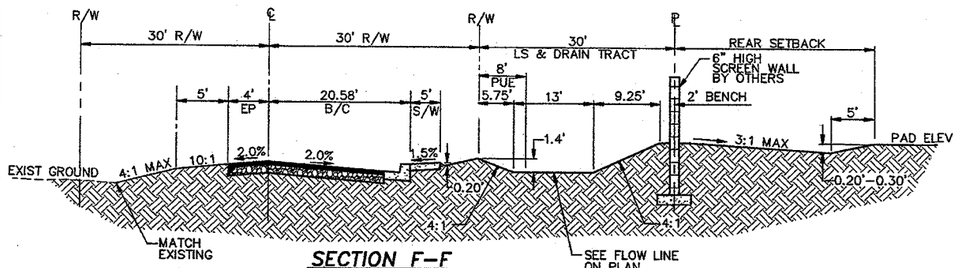
SECTION C-C
NTS



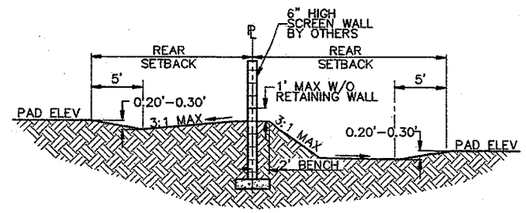
SECTION D-D
NTS



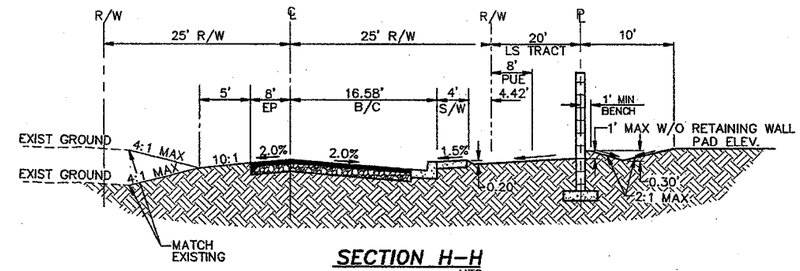
SECTION E-E
NTS



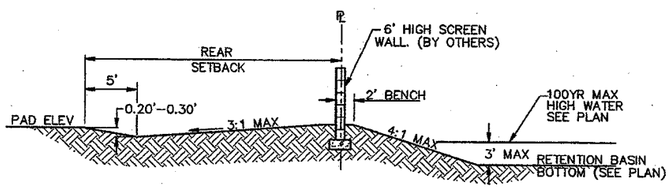
SECTION F-F
NTS



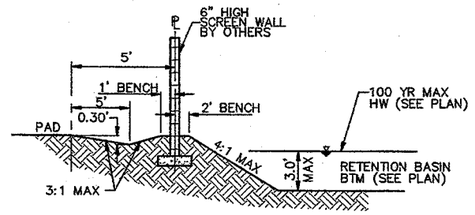
SECTION G-G
NTS



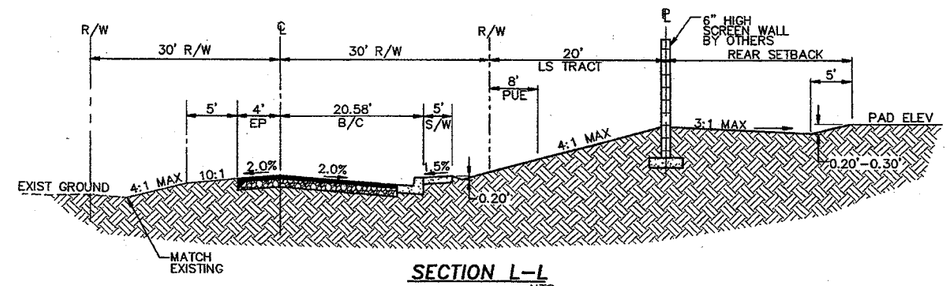
SECTION H-H
NTS



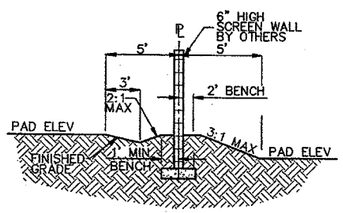
SECTION J-J
NTS



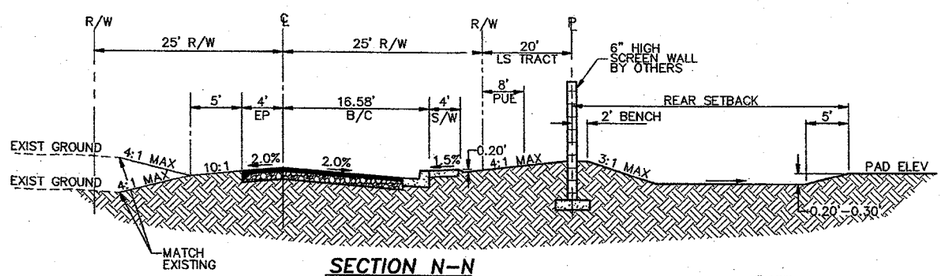
SECTION K-K
NTS



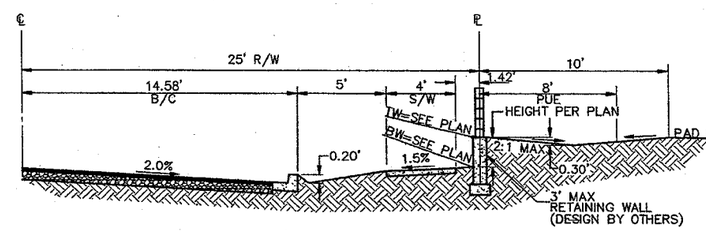
SECTION L-L
NTS



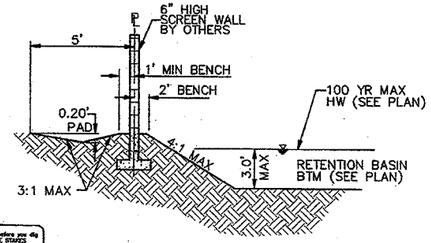
SECTION M-M
NTS



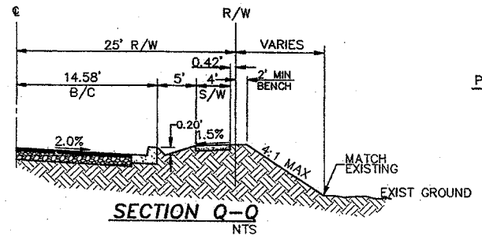
SECTION N-N
NTS



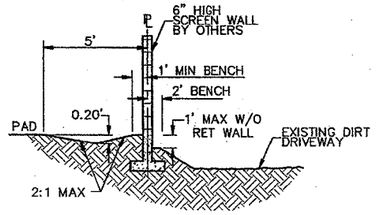
SECTION O-O
NTS



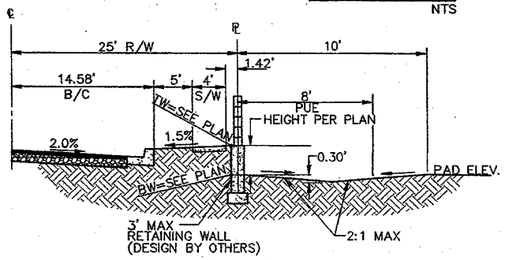
SECTION P-P
NTS



SECTION Q-Q
NTS



SECTION R-R
NTS



SECTION S-S
NTS

Two working days before you dig
CALL FOR THE BLUE STAKES
602-263-1100
Blue Stake Center
CALL COLLECT

ARIZONA HILLCREST
GRADING PLAN

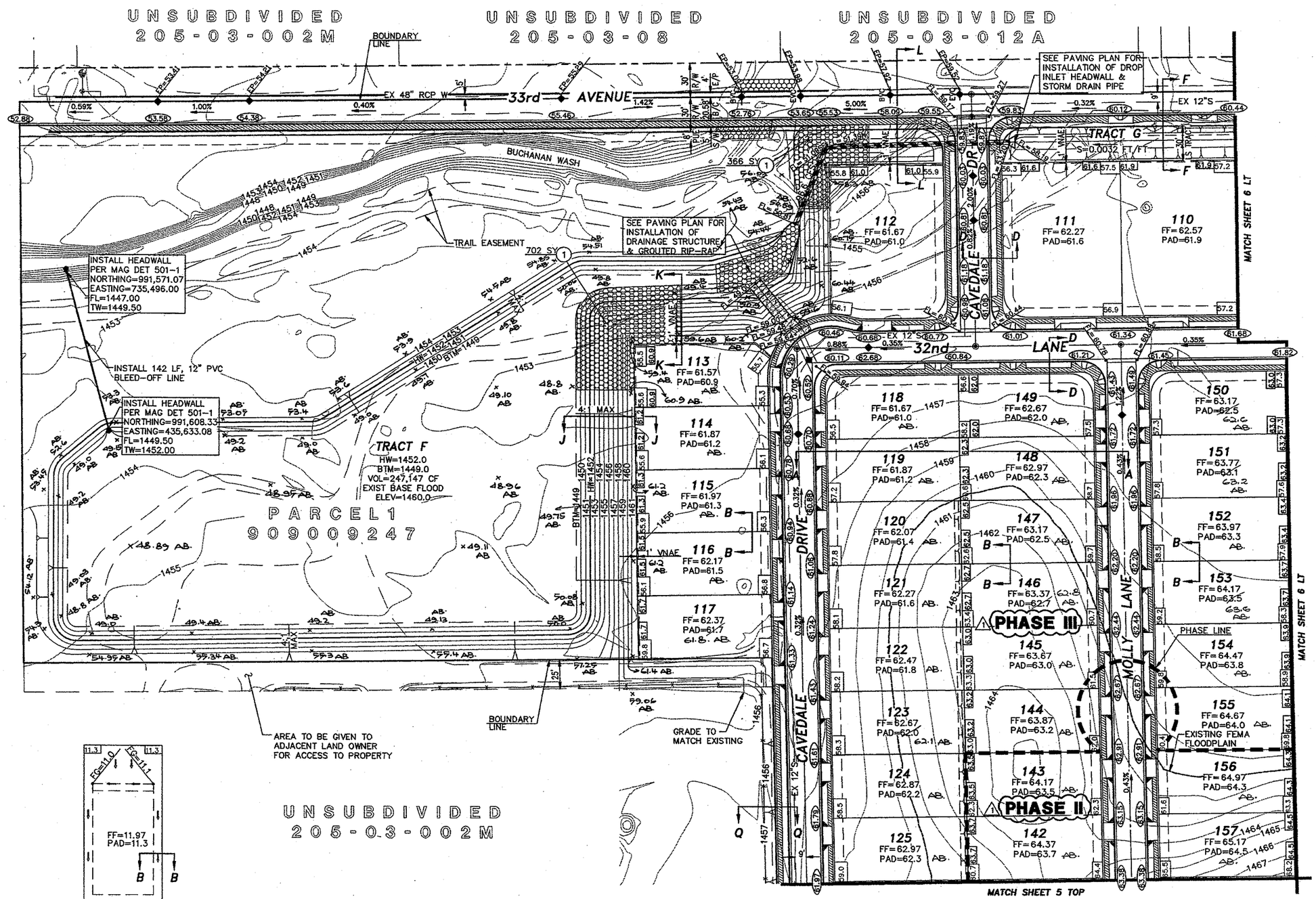
AMERICAN ENGINEERING CO.
Robert Bein, William Frost & Associates
PROFESSIONAL ENGINEERS, PLANNERS & SURVEYORS
21442 NORTH 30TH AVENUE, PHOENIX, ARIZONA 85027, (623)-582-0260

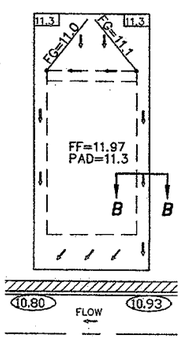
LAYOUT	DRAFTED	CHECKED
MGV	LJY	KMT

DRAWING SCALE(S): N.T.S.
ORIGINAL PLAN DATE: JUL/1999
LATEST REVISION: OCT/1999
PROJECT NUMBER: 100006
SHEET NO. 3 OF 9 SHEETS

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 31217 KENNETH M. TARR ARIZONA, U.S.A.

AutoCAD File: it:\pdata\45100006\dwg\Grading\0006003.dwg Plotted at: Wed Oct 13 14:25:44 1999
RBF User Name ?





TYPICAL LOT DRAINAGE

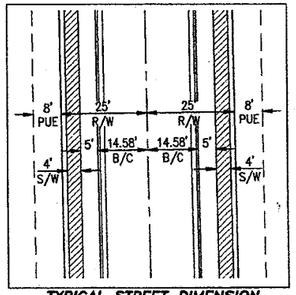
SCALE 1" = 40'

0 40 80 120

GRADING CONSTRUCTION NOTES

1. INSTALL GROUTED RIP-RAP PER MAG STD DET 555.

NOTE:
A FLOODPLAIN STUDY OF A COMBINATION OF BUCHANAN WASH & SKUNK CREEK IS CURRENTLY BEING PRODUCED BY TETRATECH FOR THE CITY OF PHOENIX, MARICOPA COUNTY, & KAUFMAN & BROAD. THIS STUDY WILL ESTABLISH A NEW FLOODPLAIN AT A LOWER ELEVATION THROUGH A LETTER OF MAP REVISION.



TYPICAL STREET DIMENSION
(UNLESS OTHERWISE NOTED)
SCALE: 1"=20'

Two working days before you dig CALL FOR THE BLUE STAKES 602-263-1100 Blue Stake Center CALL COLLECT

ARIZONA HILLCREST GRADING PLAN

Robert Bein, William Frost & Associates
PROFESSIONAL ENGINEERS, PLANNERS & SURVEYORS
2142 NORTH 20TH AVENUE PHOENIX, ARIZONA, 85027
(623) 582-0260 • FAX (623) 582-0953

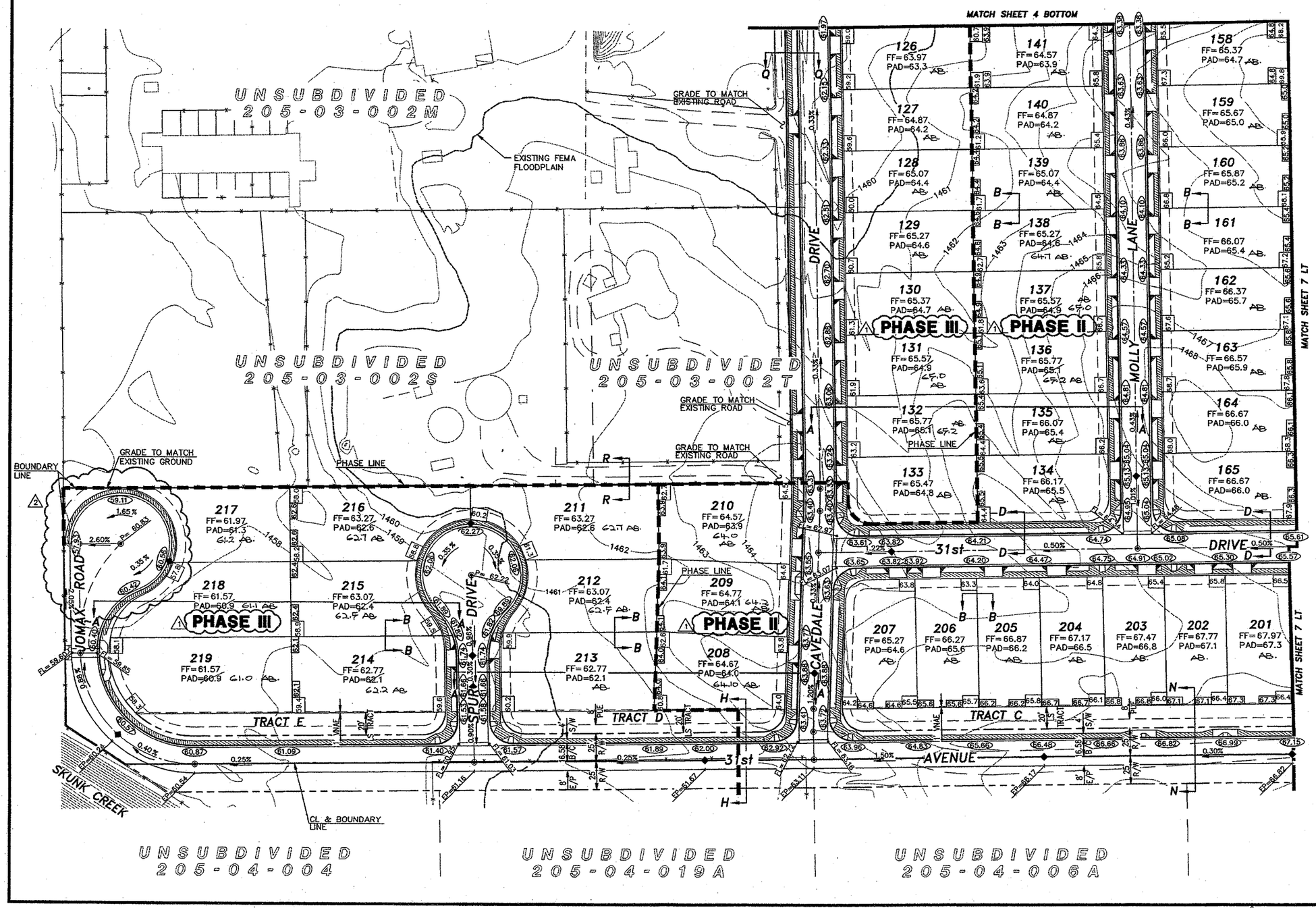
LAYOUT	DRAFTED	CHECKED
MGV	LJY	KMT

DRAWING SCALE(S)	1" = 40'	
ORIGINAL PLAN DATE	JUL/1999	SHEET NO.
LATEST REVISION	SEP/1999	4
PROJECT NUMBER	100006	OF 9 SHEETS

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 31317 KENNETH M. TARR Date Signed 7/6/99 ARIZONA, U.S.A.

1 REVISION 1: ADDED PHASING FEB. 07, 2000

AutoCAD File: H:\pdata\M5100006\dwg\Grading\0006604.dwg Plotted at: Tue Feb 08 12:13:42 2000
JGA



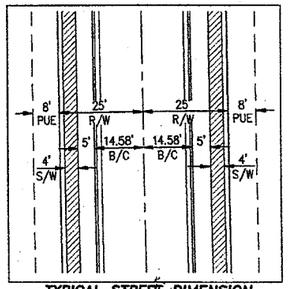
SCALE 1" = 40'

0 40 80 120

GRADING CONSTRUCTION NOTES

1. INSTALL GROUTED RIP-RAP PER MAG STD DET 555.

NOTE:
A FLOODPLAIN STUDY OF A COMBINATION OF BUCHANAN WASH & SKUNK CREEK IS CURRENTLY BEING PRODUCED BY TETRATECH FOR THE CITY OF PHOENIX, MARICOPA COUNTY, & KAUFMAN & BROAD. THIS STUDY WILL ESTABLISH A NEW FLOODPLAIN AT A LOWER ELEVATION THROUGH A LETTER OF MAP REVISION.



TYPICAL STREET DIMENSION
(UNLESS OTHERWISE NOTED)
SCALE: 1"=20'

Two working days before you dig CALL FOR THE BLUE STAKES
602-263-1100
Blue Stake Center CALL COLLECT

ARIZONA HILLCREST GRADING PLAN

Robert Bein, William Frost & Associates
PROFESSIONAL ENGINEERS, PLANNERS & SURVEYORS
21442 NORTH 20TH AVENUE, PHOENIX, ARIZONA, 85027
(623) 582-0980 • FAX (623) 582-0953

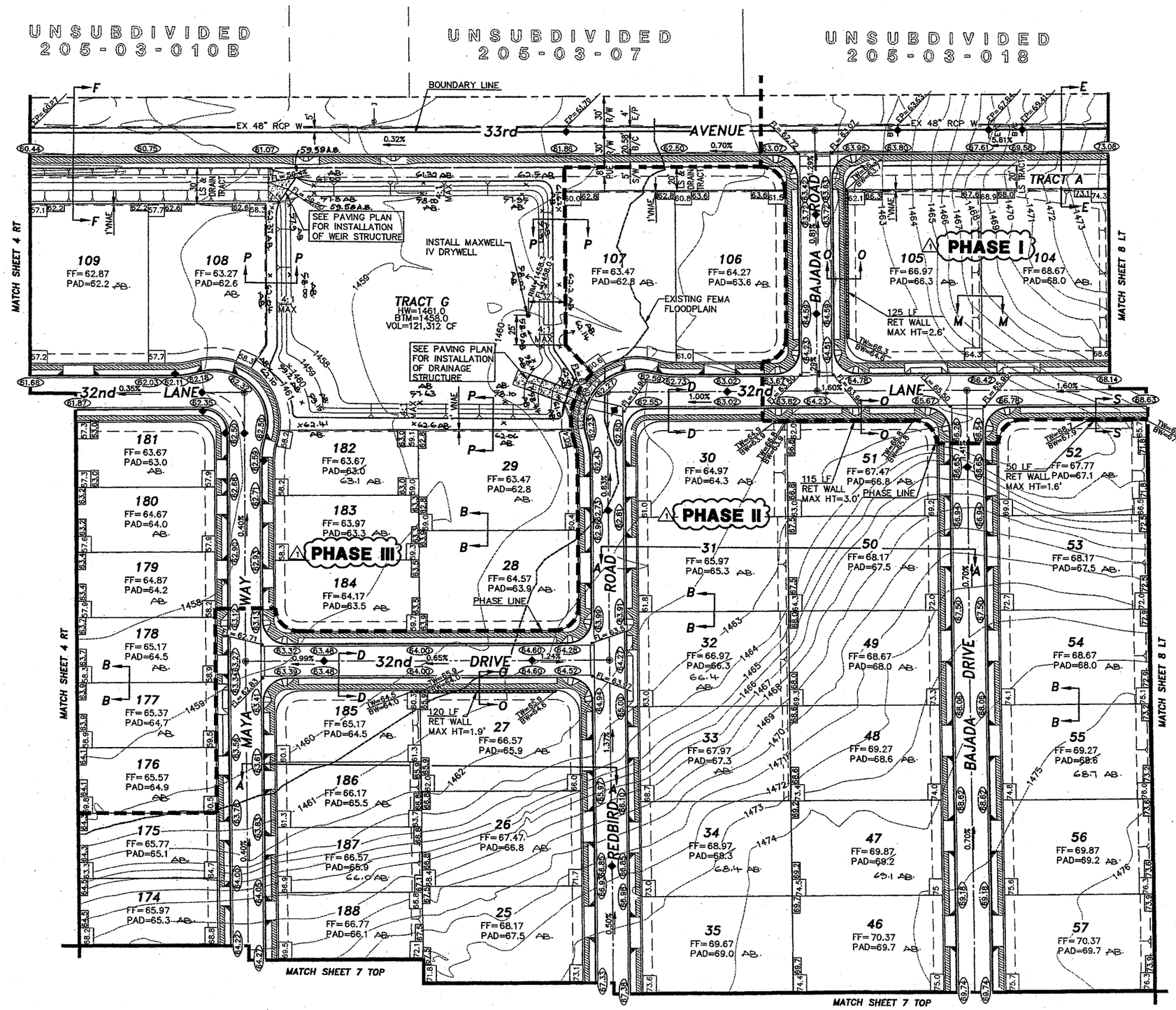
LAYOUT	DRAFTED	CHECKED
MGV	LJY	KMT

DRAWING SCALE(S)	1" = 40'
ORIGINAL PLAN DATE	JUL/1999
LATEST REVISION	OCT/1999
PROJECT NUMBER	100006
SHEET NO.	5 OF 9 SHEETS

REGISTERED PROFESSIONAL ENGINEER (CIVIL) 31217 KENNETH M. TARR, ARIZONA, U.S.A.

1 REVISION 1: ADDED PHASING FEB. 07, 2000
2 REVISION 2: REDESIGN OF CUL-DE-SAC JOMAX RD. MAR. 14, 2000

AutoCAD File: H:\data\4510006\dwg\Grading\0006605.dwg Plotted at: Tue Mar 14 15:45:03 2000
JGA

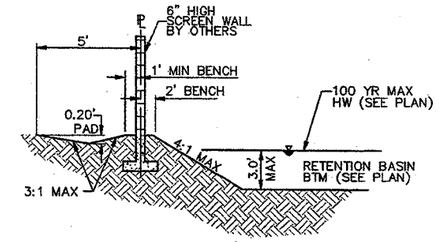


SCALE 1" = 40'

0 40 80 120

GRADING CONSTRUCTION NOTES

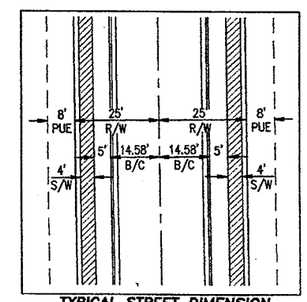
1. INSTALL GROUTED RIP-RAP PER MAG STD DET 555.



SECTION P-P

NTS

NOTE:
A FLOODPLAIN STUDY OF A COMBINATION OF BUCHANAN WASH & SKUNK CREEK IS CURRENTLY BEING PRODUCED BY TETRATECH FOR THE CITY OF PHOENIX, MARICOPA COUNTY, & KAUFMAN & BROAD. THIS STUDY WILL ESTABLISH A NEW FLOODPLAIN AT A LOWER ELEVATION THROUGH A LETTER OF MAP REVISION.



TYPICAL STREET DIMENSION

(UNLESS OTHERWISE NOTED)
SCALE: 1"=20'

Two working days before you dig CALL FOR THE BLUE STAKES
602-263-1100
Blue Stake Center CALL COLLECT

ARIZONA HILLCREST GRADING PLAN

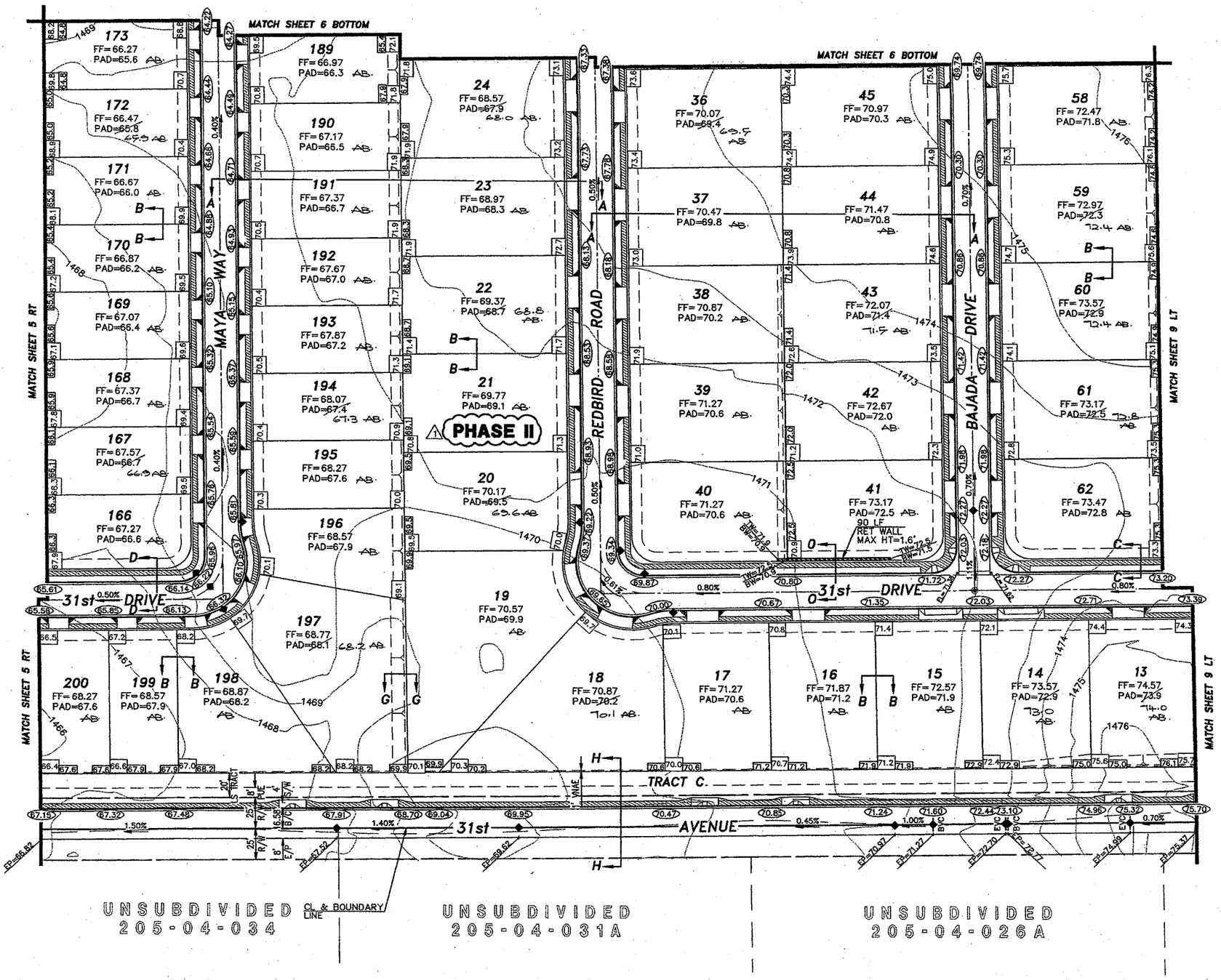
Robert Bein, William Frost & Associates
PROFESSIONAL ENGINEERS, PLANNERS & SURVEYORS
21442 NORTH 20TH AVENUE PHOENIX, ARIZONA, 85027
(623) 582-0260 * FAX (623) 582-0953

LAYOUT	DRAFTED	CHECKED
MGV	LJY	KMT

DRAWING SCALE(S): 1" = 40'
ORIGINAL PLAN DATE: JUL/1999
LATEST REVISION: OCT/1999
PROJECT NUMBER: 100006
SHEET NO. 6 OF 9 SHEETS

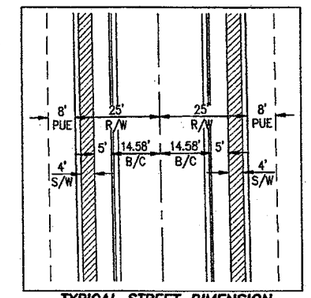
REVISION 1: ADDED PHASING FEB. 07, 2000

AutoCAD File: H:\update\45100006\dwg\Grading\00006006.dwg Plotted at: Tue Feb 08 12:11:49 2000 JGA



SCALE 1" = 40'

0 40 80 120



TYPICAL STREET DIMENSION
(UNLESS OTHERWISE NOTED)
SCALE: 1"=20'

CALL FOR 24 BLUE STAKES
602-263-1100

ARIZONA HILLCREST GRADING PLAN

Robert Bein, William Frost & Associates
PROFESSIONAL ENGINEERS, PLANNERS & SURVEYORS
21442 NORTH 20TH AVENUE PHOENIX, ARIZONA 85027
(623) 582-0260 * FAX (623) 582-0663

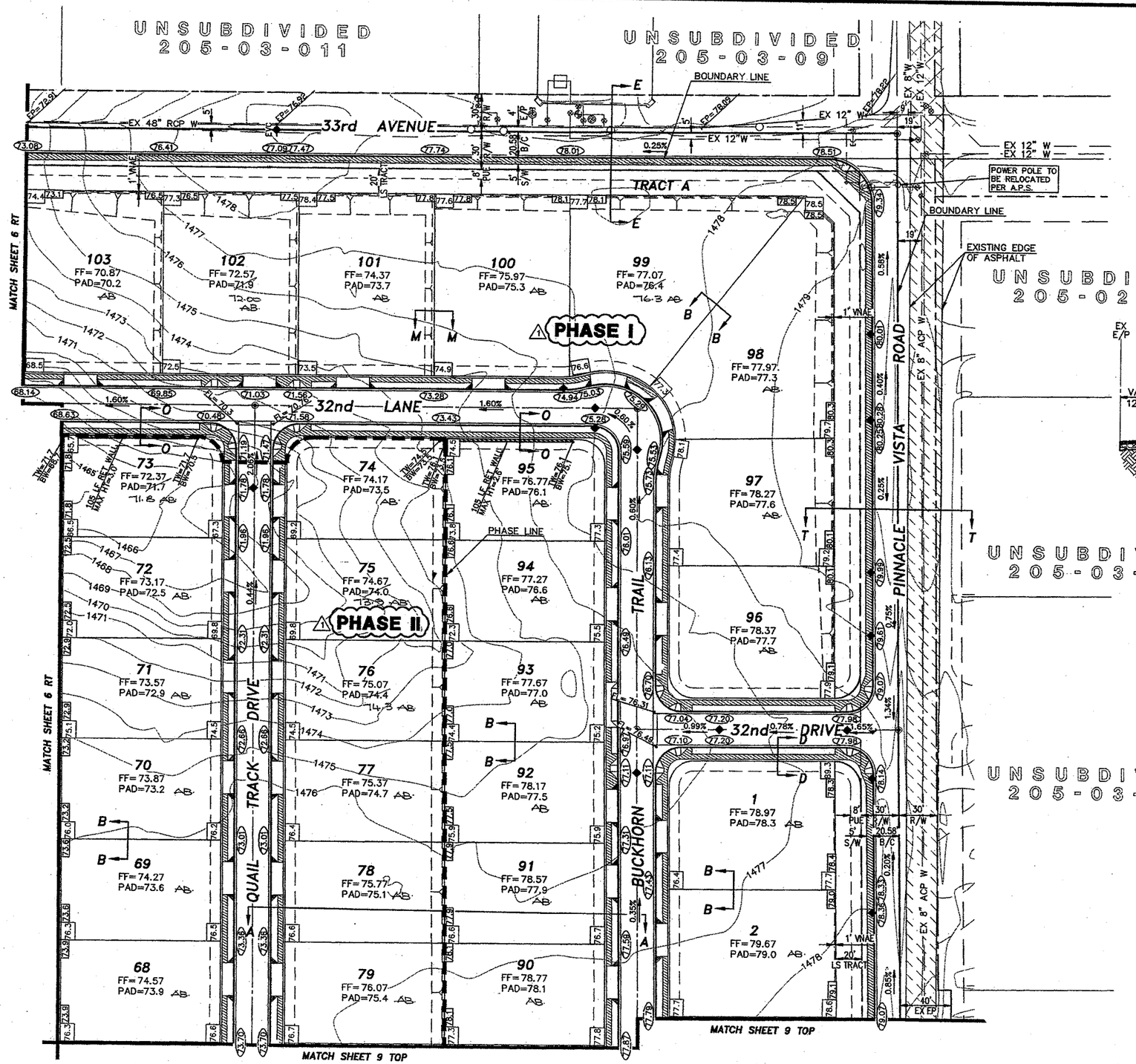
LAYOUT	DRAFTED	CHECKED
MGV	LJY	KMT

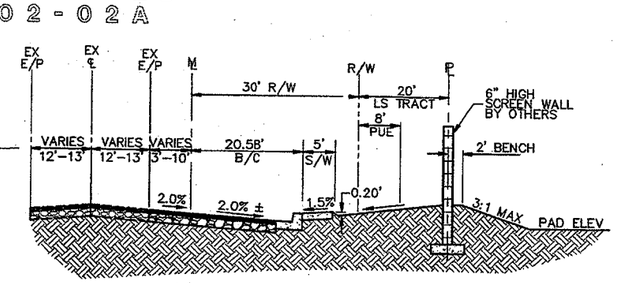
DRAWING SCALE(S)	1" = 40'
ORIGINAL PLAN DATE	JUL/1999
LATEST REVISION	OCT/1999
PROJECT NUMBER	100006
SHEET NO.	7 OF 9 SHEETS

Registered Professional Engineer (Civil) CERTIFICATE NO. 21317 KENNETH M. TARR Date Signed 2/8/00 ARIZONA, U.S.A.

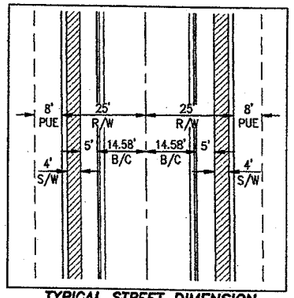
1 REVISION 1: ADDED PHASING FEB. 07, 2000

AutoCAD File: H:\update\M5100006\dwg\Grading\100006G7.dwg Plotted at: Tue Feb 08 12:10:54 2000
JGA





SECTION T-T
PINNACLE VISTA ROAD FACING EAST
NTS



TYPICAL STREET DIMENSION
(UNLESS OTHERWISE NOTED)
SCALE: 1"=20'

Two working days before you dig CALL FOR THE BLUE STAKES
602-263-1100
The Blue Card CALL COLLECT

ARIZONA HILLCREST
GRADING PLAN

Robert Bein, William Frost & Associates
PROFESSIONAL ENGINEERS, PLANNERS & SURVEYORS
21442 NORTH 20TH AVENUE PHOENIX, ARIZONA, 85027
(623) 582-0360 * FAX (623) 582-0953

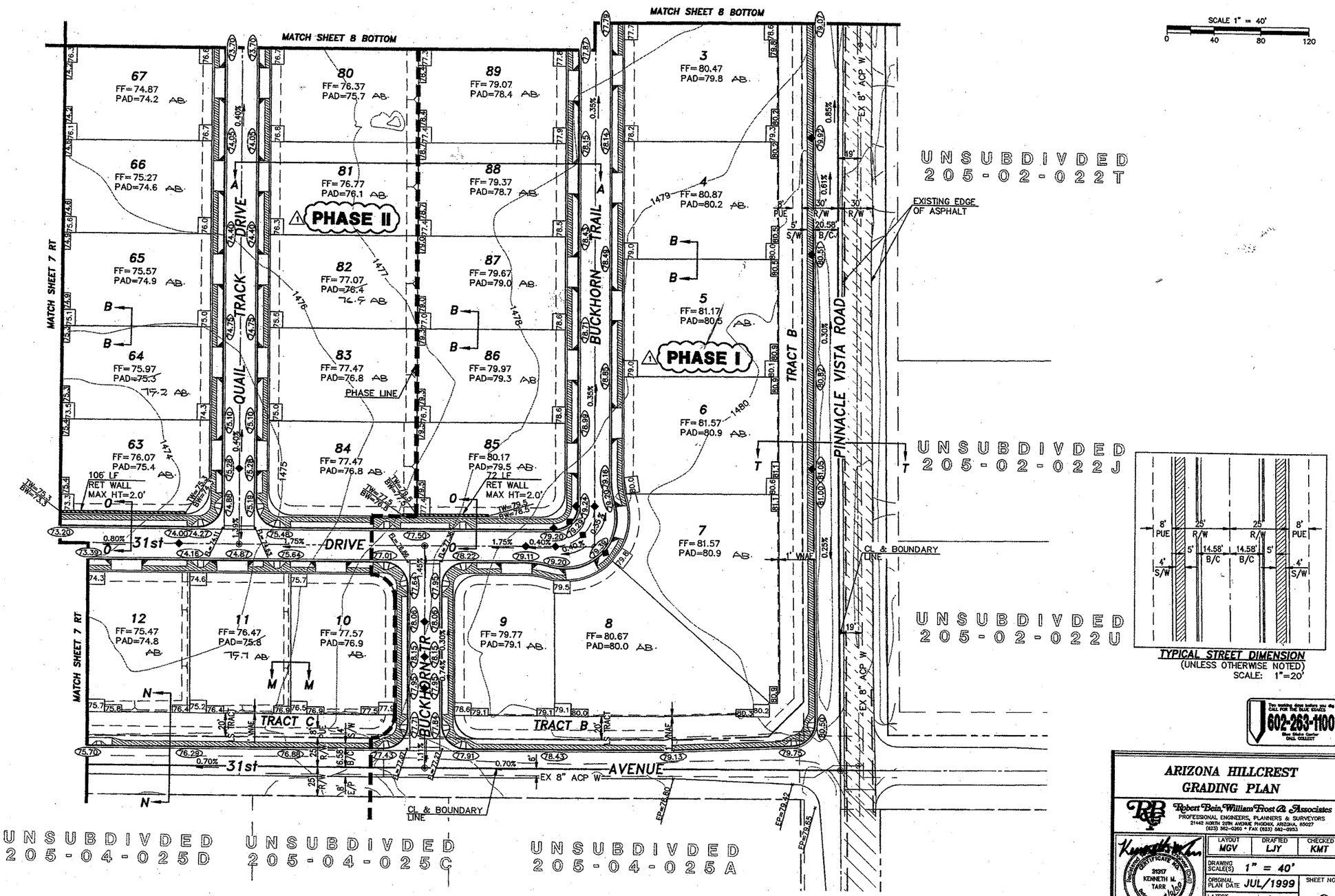
LAYOUT	DRAFTED	CHECKED
MGV	LJY	KMT

DRAWING SCALE(S)	1" = 40'
ORIGINAL PLAN DATE	JUL/1999
LATEST REVISION	OCT/1999
PROJECT NUMBER	100006
SHEET NO.	8 OF 9 SHEETS

REGISTERED PROFESSIONAL ENGINEER CERTIFICATE NO. 33217 KENNETH M. TARR Date Signed 2/8/00 ARIZONA, U.S.A.

1 REVISION 1: ADDED PHASING FEB. 07, 2000

AutoCAD File: H:\pdata\45100006\dwg\Grading\0006GB.dwg Plotted at: Tue Feb 08 12:10:01 2000
JGA



ARIZONA HILLCREST GRADING PLAN

Robert Bein, William Frost & Associates
PROFESSIONAL ENGINEERS, PLANNERS & SURVEYORS
21442 NORTH 20TH AVENUE PHOENIX, ARIZONA, 85027
(623) 582-0260 • FAX (623) 582-0953

LAYOUT	DRAFTED	CHECKED
MGV	LJY	KMT

DRAWING SCALE(S): 1" = 40'
ORIGINAL PLAN DATE: JUL/1999
LATEST REVISION: OCT/1999
PROJECT NUMBER: 100006
SHEET NO. 9 OF 9 SHEETS

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 31317 KENNETH M. TARR Date Signed 4/6/00 ARIZONA, U.S.A.

1 REVISION 1: ADDED PHASING FEB. 07, 2000

AutoCAD File: H:\data\45100006\dwg\Grading\W0006g09.dwg Plotted at: Tue Feb 08 12:06:12 2000
JGA

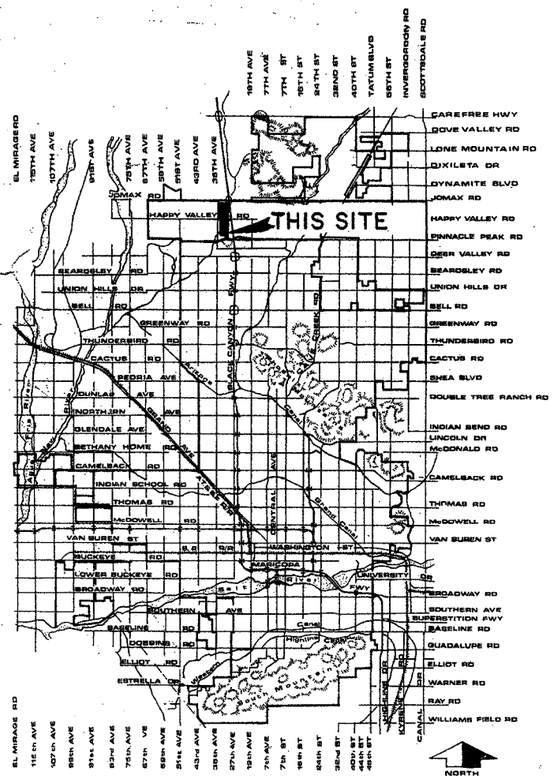
As-Built Drawings for Culvert at Pinnacle Vista Road

CITY OF PHOENIX

ENGINEERING & ARCHITECTURAL SERVICES
PROJECT MANAGEMENT

SKUNK CREEK CHANNEL IMPROVEMENTS
INDEX NUMBER SA-884080

1992



Vicinity Map

MAYOR

PAUL JOHNSON

CITY COUNCIL

DISTRICT NO. 1 THELDA WILLIAMS
DISTRICT NO. 2 FRANCES BARWOOD
DISTRICT NO. 3 SKIP RIMSZA
DISTRICT NO. 4 CRAIG TRIBKEN
DISTRICT NO. 5 JOHN NELSON
DISTRICT NO. 6 KATHY DUBS
DISTRICT NO. 7 MARY ROSE WILCOX
DISTRICT NO. 8 CALVIN C. GOODE

CITY MANAGER - FRANK FAIRBANKS

CITY ENGINEER - KENNY HARRIS, P.E.

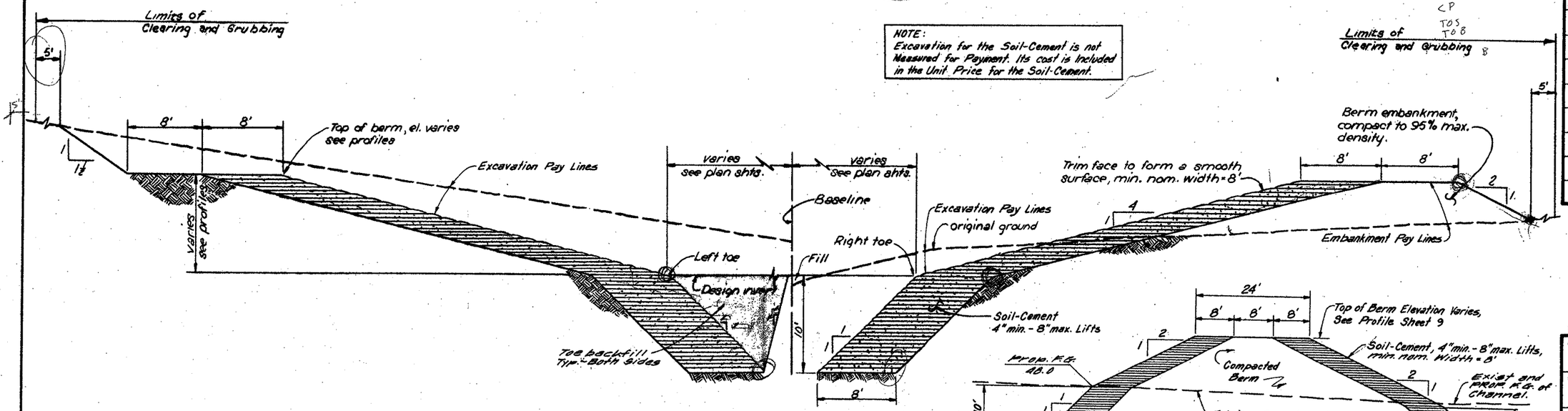
APPROVALS

ENGINEERING SUPERVISOR — DATE 4/21/92

PUBLIC WORKS DIRECTOR — DATE

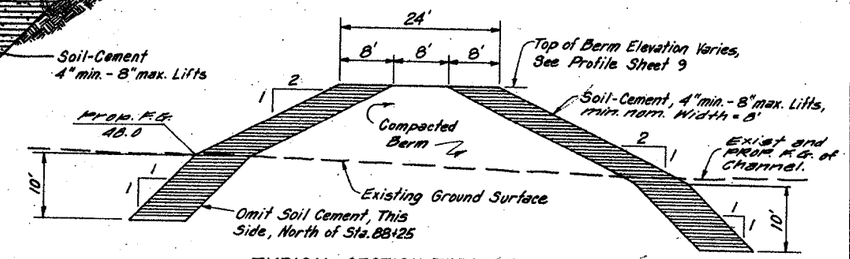
MOREA·HALL engineering, inc.
1820 W. Maricopa Freeway
Phoenix, Arizona 85007
Phone: 602-258-4428
CIVIL · SANITARY · STRUCTURAL · SURVEY

1997 - SKUNK CREEK PLANNING INFORM...

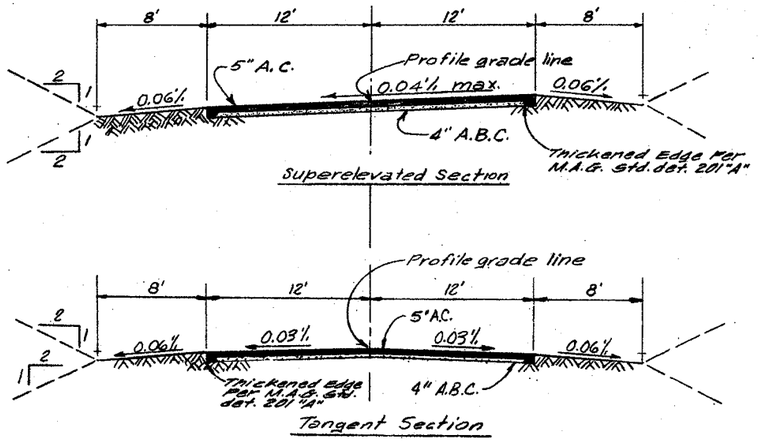


NOTE:
Excavation for the Soil-Cement is not Measured for Payment. Its cost is included in the Unit Price for the Soil-Cement.

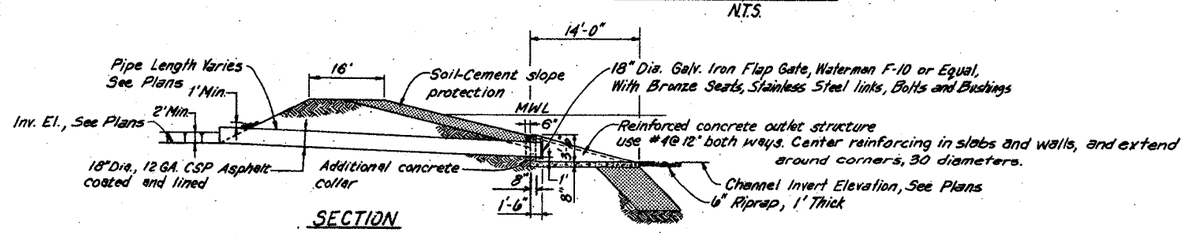
TYPICAL SECTION THROUGH CHANNEL
SOUTH OF HAPPY VALLEY ROAD
N.T.S.



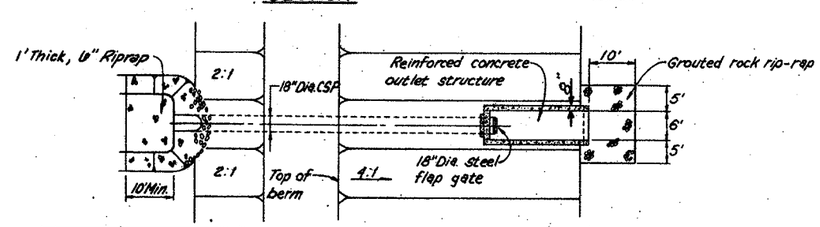
TYPICAL SECTION THROUGH SPECIAL BERM LEFT, STA. 87+25 TO CORPS OF ENGINEERS BERM
N.T.S.



CROSS SECTION OF HAPPY VALLEY RD.
Scale in 1" = 5'

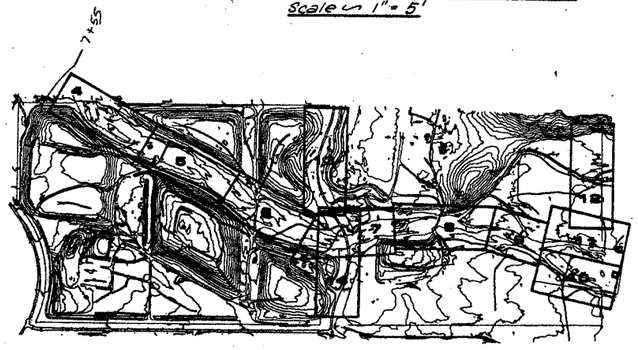


SECTION



See Plan Sheets for Locations for These Inlets

PLAN
CROSS DRAIN
N.T.S.



SHEET INDEX

BENCH MARK: "Skunk," Elev. 1488.90
Brass cap at N 19,991.92, E 9,789.24
227.4 Ft. East of the ℄ of the I-17
E. Frontage Rd., along the N. Line
of TWP. 4 N. 0.15 Mi. S. of S. end
of the bridge over Skunk Creek

SHEET INDEX

No.	Title
1	TITLE SHEET
2-3	TYPICAL CROSS SECTIONS & DETAILS
4-12	PLAN & PROFILES
13-14	HAPPY VALLEY ROAD IMPROVEMENTS
15-22	CHANNEL CROSS SECTIONS
23	ROCK EXCAVATION PLAN
24-28	PLANTING PLANS
29-33	IRRIGATION PLANS
34	ELECTRICAL PLAN

Revisions	Date

Seal

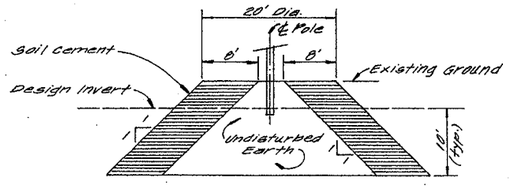
Designed By: C. MOREA
Drawn By: M. CROSS
Checked By: C. MOREA
Date: APR. 24, 1992

SKUNK CREEK CHANNEL IMPROVEMENTS
INDEX NO. SA-884080

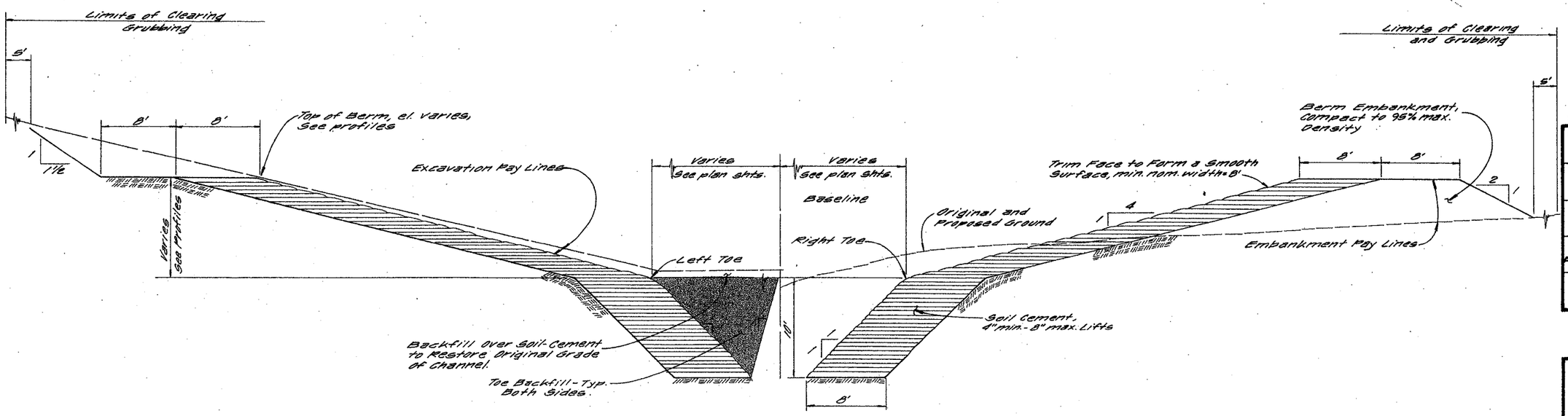
True:

Sheet 2 of 34

CITY OF PHOENIX • ENGINEERING DEPARTMENT • DESIGN DIVISION



SOIL CEMENT AROUND POLE



TYPICAL SECTION THROUGH CHANNEL
NORTH OF HAPPY VALLEY ROAD
N.T.S.

Revisions	Date

Seal

Designed By: C. MOREA

Drawn By: M. CROSS

Checked By: C. MOREA

Date: APR. 24, 1992

Title: SKUNK CREEK CHANNEL IMPROVEMENTS INDEX NO. SA-884080

Sheet 3 OF 34

CITY OF PHOENIX • ENGINEERING DEPARTMENT • DESIGN DIVISION

Revisions	Date

Seal

Designed By: C. MOREA

Drawn By: M. CROSS

Checked By: C. MOREA

Date: APR. 24, 1992

Title: SKUNK CREEK CHANNEL IMPROVEMENTS
INDEX NO. SA-884080

Sheet 10 of 34

CITY OF PHOENIX • ENGINEERING DEPARTMENT • DESIGN DIVISION

LAYOUT GEOMETRY BASELINE / TOP OF SLOPE

PT	@ STA.	OFFSET LT.	OFFSET RT.	CURVE DATA Δ	R	T	L	E
TTE	88+55.32	1451.5		27°03'24"	1900'	473.50'	929.34'	50.15'

Revisions	Date

Seal

Designed By: C. MOREA

Drawn By: M. CROSS

Checked By: C. MOREA

Date: APR. 24, 1992

Title: SKUNK CREEK CHANNEL IMPROVEMENTS INDEX NO. SA-884080

Sheet 12 of 34

CITY OF PHOENIX • ENGINEERING DEPARTMENT • DESIGN DIVISION

GAF Drafrace 790

VALUE ENGINEERING PAYS

GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA
SKUNK CREEK CHANNEL AND LEVEES
VICINITY OF BLACK CANYON HIGHWAY (I-17)
MARICOPA COUNTY, ARIZONA

INDEX TO CONTRACT DRAWINGS

FILE NO.	TITLE	SHEET NO.
252/73	TITLE SHEET AND INDEX TO CONTRACT DRAWINGS	C-1
252/74	PROJECT LOCATION	C-2
252/75	GENERAL PLAN - SHEET 1	C-3
252/76	GENERAL PLAN - SHEET 2	C-4
252/77	PLAN OF EXPLORATION	C-5
252/78	SOIL LOGS	C-6
252/79	BORROW & MISCELLANEOUS FILL DETAILS - SHEET 1	C-7
252/80	BORROW & MISCELLANEOUS FILL DETAILS - SHEET 2	C-8
252/81	WEST LEVEE - PLAN AND PROFILE STA. 169+69.62 TO 162+00	C-9
252/82	WEST LEVEE - PLAN AND PROFILE STA. 162+00 TO 148+15.87	C-10
252/83	WEST LEVEE - PLAN AND PROFILE STA. 148+15.87 TO 138+00	C-11
252/84	WEST LEVEE - PLAN AND PROFILE STA. 138+00 TO 127+00	C-12
252/85	WEST LEVEE - PLAN AND PROFILE STA. 127+00 TO 116+00	C-13
252/86	WEST LEVEE - PLAN AND PROFILE STA. 116+00 TO 106+78.67	C-14
252/87	EAST LEVEE - PLAN AND PROFILE STA. 137+50 TO 128+00	C-15
252/88	EAST LEVEE - PLAN AND PROFILE STA. 128+00 TO 117+00	C-16
252/89	EAST LEVEE - PLAN AND PROFILE STA. 117+00 TO 106+28.67	C-17
252/90	CHANNEL - PLAN AND PROFILE STA. 106+28.67 TO 98+20	C-18
252/91	CHANNEL - PLAN AND PROFILE STA. 98+20 TO 93+44.02	C-19
252/92	CHANNEL - PLAN AND PROFILE STA. 93+44.02 TO 86+50	C-20
252/93	CHANNEL - PLAN AND PROFILE STA. 86+50 TO 79+00	C-21
252/94	CHANNEL - PLAN AND PROFILE STA. 79+00 TO 73+00	C-22
252/95	WEST LEVEE SECTIONS STA. 168+00 TO 128+00	C-23
252/96	WEST LEVEE SECTIONS STA. 124+00 TO 106+30	C-24
252/97	EAST LEVEE SECTIONS STA. 135+50 TO 106+30	C-25
252/98	CHANNEL SECTIONS STA. 106+33.67 TO 100+00	C-26
252/99	CHANNEL SECTIONS STA. 98+00 TO 93+50	C-27
252/100	CHANNEL SECTIONS STA. 93+00 TO 86+00	C-28
252/101	CHANNEL SECTIONS STA. 84+00 TO 79+00	C-29
252/102	CHANNEL SECTIONS STA. 78+00 TO 74+00	C-30
252/103	WEST LEVEE & CHANNEL ACCESS ROAD DETAIL	C-31
252/104	EAST LEVEE & CHANNEL ACCESS ROAD DETAIL	C-32
252/105	PROFILE ACCESS ROADS	C-33
252/106	TURN AROUNDS, FENCING AND GUARD RAIL	C-34
252/107	SIDE DRAIN	C-35
252/108	CHANNEL PLAN	S-1
252/109	SOUTH CHANNEL WALL ELEVATION	S-2
252/110	NORTH CHANNEL WALL ELEVATION	S-3
252/111	CHANNEL WALL SECTIONS AND DETAILS	S-4
252/112	PIER NOSE EXTENSIONS	S-5
252/113	HEAD WALL	S-6
252/114	MISCELLANEOUS STRUCTURAL DETAILS	S-7
252/115	SIDE DRAIN BOX CULVERT	S-8
252/116	LANDSCAPE PLAN SHEET 1	L-1
252/117	LANDSCAPE PLAN SHEET 2	L-2

LIST OF ABBREVIATIONS

B.C.	Begin Curve	E.G.	Each Side
E.C.	End Curve	E.W.	Each Way
B.V.C.	Begin Vertical Curve	Exist.	Existing
P.V.I.	Point of Vertical Intersection	Exp. Jt. Mat'l.	Expansion Joint Material
E.V.C.	End Vertical Curve	Horiz.	Horizontal
R/W	Right-of-Way	Lg.	Long
Int.	Intersection	Min.	Minimum
Pvmt.	Pavement	Opp. Hd.	Opposite Hand
A.C.	Asphaltic Concrete	R	Radius
Tel. Cs.	Telephone Cable	Ref.	Reference
Grd.	Ground	Reinf.	Reinforcing
Conc.	Concrete	Sim.	Similar
SEC.	Section	Sta.	Station
COR.	Corner	Thru	Through
Alt.	Alternate	Typ.	Typical
C.J.	Construction Joint	@	and
Cl.	Clear	@	at
Clr.	Clear	℄	centerline
Cont.	Continuous	ø	diameter
dia.	Diameter	#/'	feet per foot
Dim.	Dimension	#	number
do	Ditto		
B.F.	Back Face		
E.F.R.	East Frontage Road		
El.	Elevation		
Elev.	Elevation		

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
	REVISIONS		

Sverdrup — Sverdrup & Parcel and Associates, Inc. Engineers Architects Planners, 1655 West Alameda Drive, Tempe, Arizona 85282, 602-968-6048

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: C.R.B.
DRAWN BY: D.A.L.
CHECKED BY: M.R.S.

GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA
SKUNK CREEK CHANNEL AND LEVEES
VICINITY OF BLACK CANYON HIGHWAY (I-17)

TITLE SHEET AND
INDEX TO CONTRACT DRAWINGS

SIGNATURES AFFIXED HEREON INDICATE OFFICAL RECOMMENDATION AND APPROVAL OF ALL DRAWINGS IN THIS SET AS INDEXED ON THIS SHEET.

APPROVAL RECOMMENDED: Walter Rakelich, CHIEF, DESIGN BRANCH
APPROVAL RECOMMENDED: Paul L. Lerner, CHIEF, SAFETY OFFICE
SUBMITTED BY: Jenrich
PREPARED UNDER THE DIRECTION OF: PAUL W. TAYLOR, COL, CORPS OF ENGINEERS, U.S.A. DISTRICT ENGINEER
APPROVED: Robert J. Hall, CHIEF ENGINEERING DIV.
DATE: 12 15 81
SPEC NO. DACW09-82-B-0004
DISTRICT FILE NO.
SHEET C-1

ENVIRONMENTAL ENHANCEMENT THRU ENGINEERING

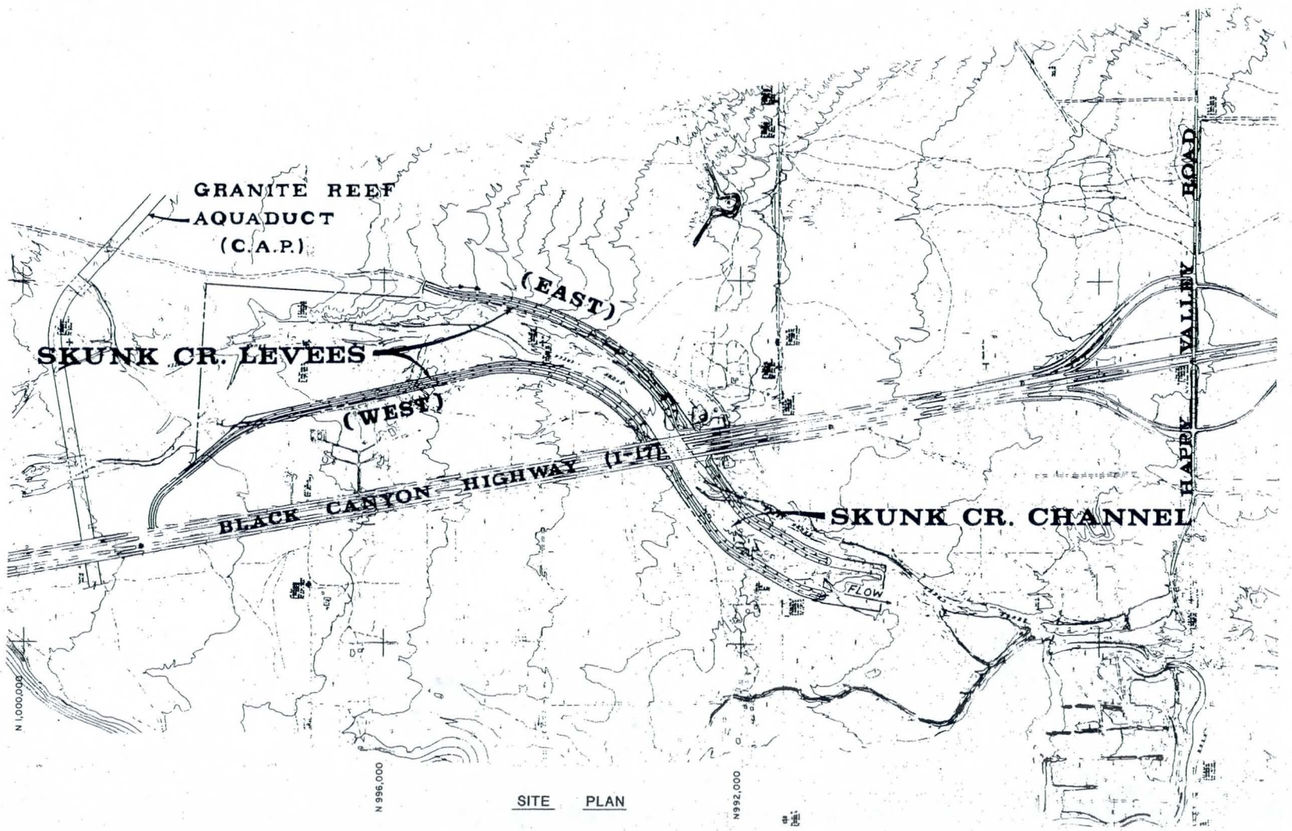
CENTRAL FILES
DRAWER # 215

OFFICE USE ONLY
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
CONSTRUCTION AND OPERATIONS DIVISION
DRAWER # [redacted]

Skunk Creek Channel & Levees 116
Vicinity of Black Canyon Hwy I-17
DACW09-82-B0004

SAFETY PAYS

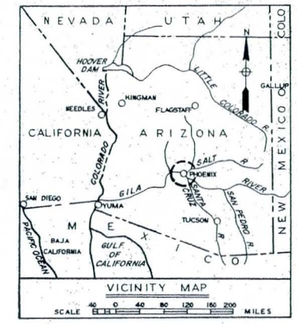
ENVIRONMENTAL ENHANCEMENT THRU ENGINEERING

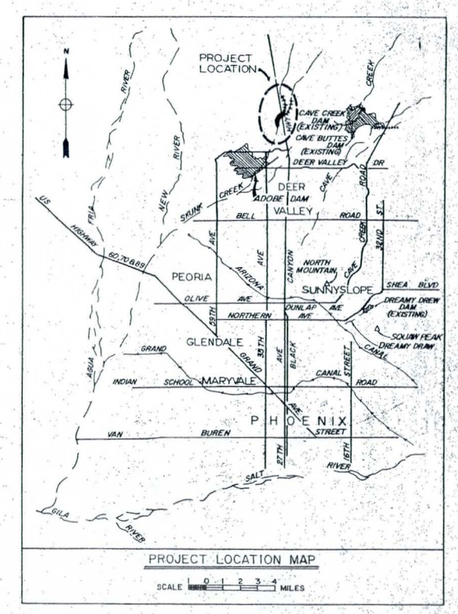


SITE PLAN

SCALE: 1 IN. = 600 FT.

CONTOUR INTERVAL: 2 FT.





DATUM IS MEAN SEA LEVEL

SYMBOL	DESCRIPTIONS	DATE	APPROVAL

REVISIONS

Sverdrup — Sverdrup & Parcel and Associates, Inc. Engineers Architects 1230 West Alameda Drive Tempe, Arizona 85282 602-968-9648

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

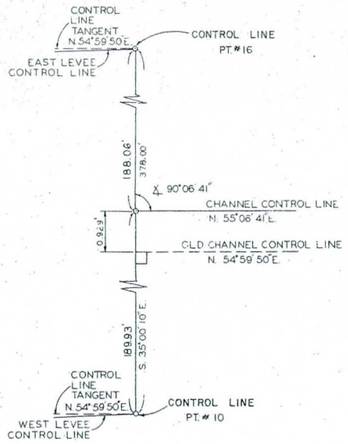
DESIGNED BY: CRB
DRAWN BY: D.A.L.
CHECKED BY: MRS

GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA

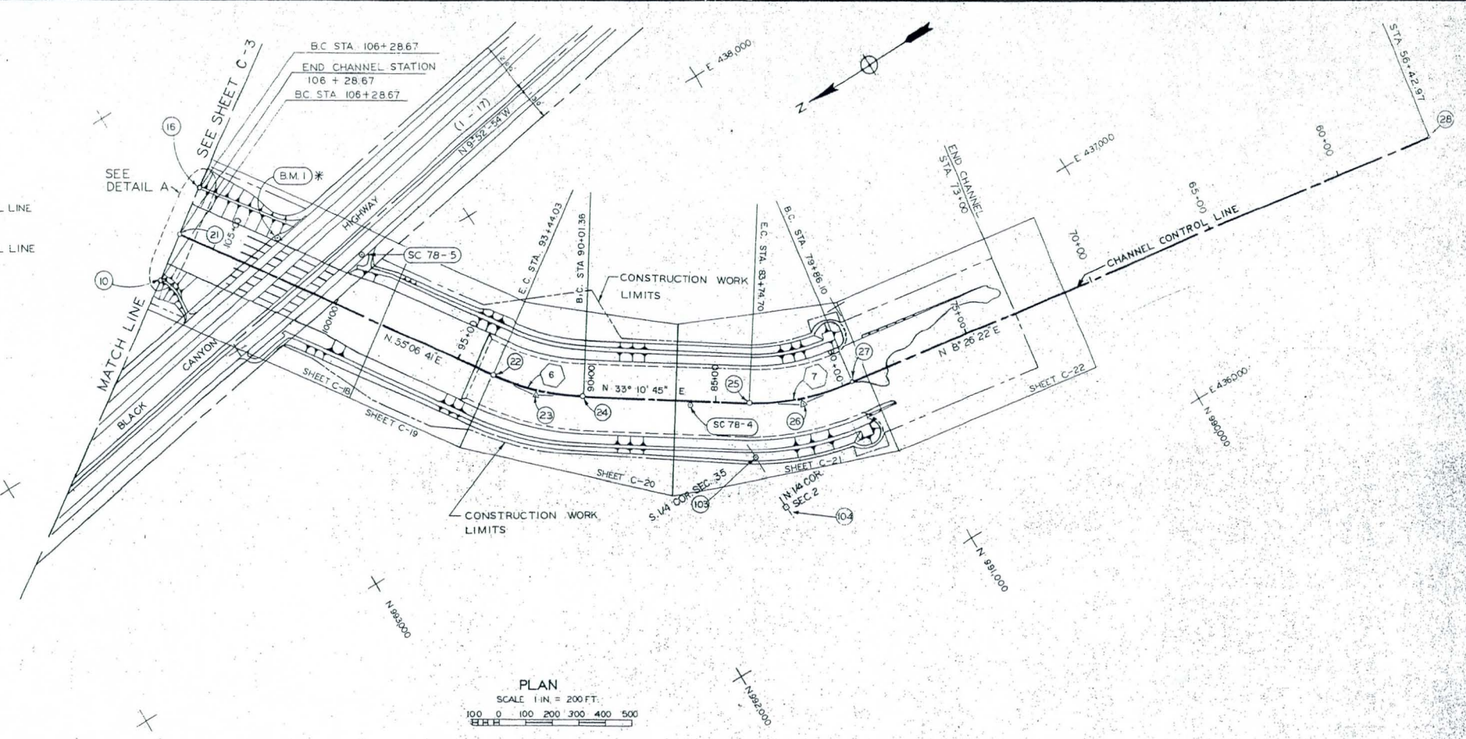
SKUNK CREEK CHANNEL AND LEVEES
VICINITY OF BLACK CANYON HIGHWAY (I-17)

PROJECT LOCATION

SUBMITTED BY: [illegible]
DATE APPROVED: 12 15 81
SPEC. NO. DACW09-82-B-0009
DISTRICT FILE NO. 252/74
SHEET C-2



DETAIL A



PLAN
SCALE 1 IN. = 200 FT.
100 0 100 200 300 400 500

* NOTE
Bench Mark # 1 is stamped with A.D.O.T. Datum Elevation 1475.18. This is not the correct M.S.L. Elevation. Use only the Corps of Engineers Elevation 1474.25. Brass Cap, East Frontage Road, South Bridge Monument, Right Curb.

CONTROL LINE COORDINATES			REFERENCE POINT COORDINATES		
CHANNEL					
Nº	NORTH	EAST	Nº	NORTH	EAST
10	993,116.130	438384.220	103	991,551.29	436692.82
16	992806.510	438601.040	104	991,548.43	436445.56
21	992,960.555	438,493.166	SC 78-5	992408.25	438,084.89
22	992,225.764	437,439.423	SC 78-4	991,673.90	436,973.56
23	992,126.548	437,297.140			
24	991,981.369	437,202.212			
25	991,456.880	436,859.268			
26	991,291.680	436,751.250			
27	991,096.437	436,722.282			
28	988,778.690	436,378.400			

CONTROL LINE CURVE DATA					
Nº	Δ	D_c	R	T	L
6	21°55'56"	6° 24'01"	895.20'	173.46'	342.67'
7	24°44'23"	6° 21'59"	899.99'	197.38'	388.61'

BENCH MARKS		
Nº	ELEV.	DESCRIPTION
* BM 1	* 1474.25	ARIZONA HIGHWAY DEPT. SURVEY MARKER LOCATED ON S.E. CORNER OF EAST FRONTAGE ROAD BRIDGE
SC 78-5	1473.29	COPPERWELD ROD
SC 78-4	1458.81	ALUM. CAP & REBAR

* See Note

DATUM IS MEAN SEA LEVEL

SYMBOL	DESCRIPTIONS	DATE	APPROVAL

REVISIONS

Sverdrup — Sverdrup & Parcel and Associates, Inc. Engineers — Architects — 1550 North Alameda Drive, Tucson, Arizona 85745 — 602-624-9040

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA

SKUNK CREEK CHANNEL AND LEVEES
VICINITY OF BLACK CANYON HIGHWAY (I-17)

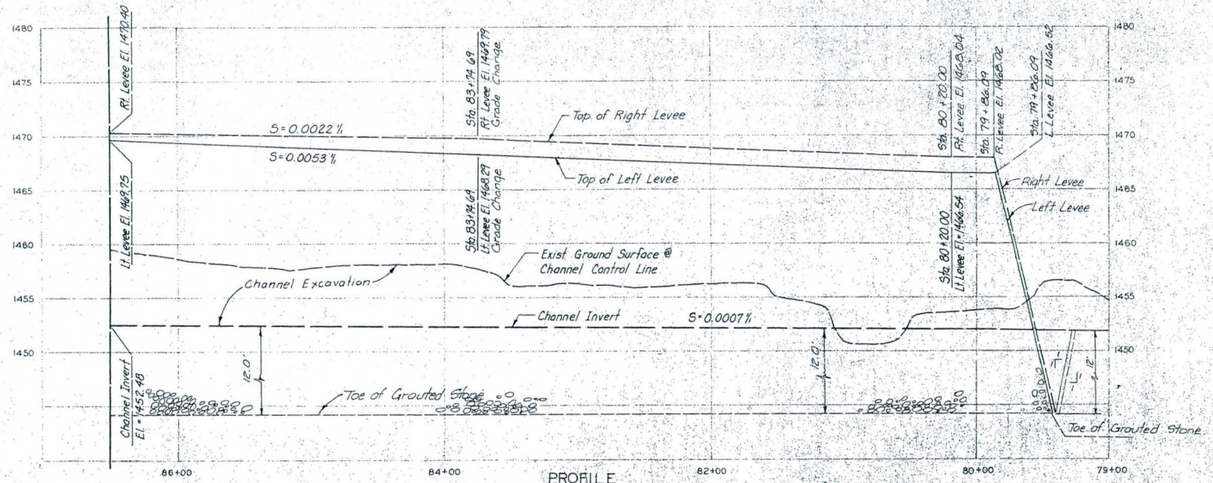
GENERAL PLAN – SHEET 2

DESIGNED BY: C.R.B.
DRAWN BY: D.A.L.
CHECKED BY: M.R.S.

SUBMITTED BY:
DATE APPROVED: 12 15 81
SPEC. NO. DACW09-82-B-0004
DISTRICT FILE NO. 252/76
SHEET C-4

ENVIRONMENTAL ENHANCEMENT THRU ENGINEERING

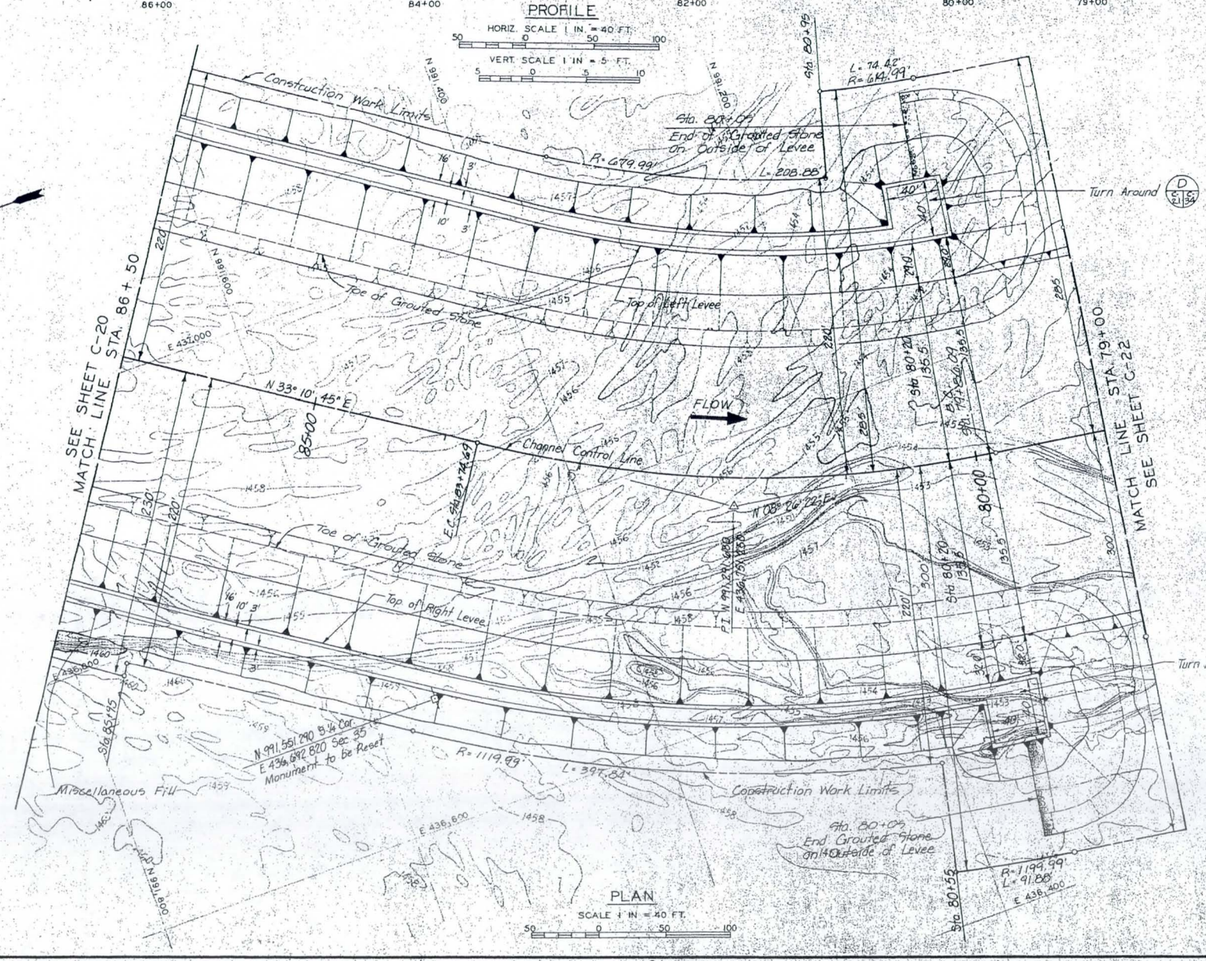
RECORD PRINT OF



PROFILE

HORIZ. SCALE 1 IN. = 40 FT.

VERT. SCALE 1 IN = 5 FT.



PLAN

SCALE 1 IN = 40 FT.

ENVIRONMENTAL ENHANCEMENT THRU ENGINEERING

DATUM IS MEAN SEA LEVEL

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
	REVISIONS		

Sverdrup — Sverdrup & Parcel and Associates, Inc. Engineers Architects 1901 West Pennsylvania Drive Tempe, Arizona 85282 (602) 968-0668

U.S. ARMY ENGINEER DISTRICT LOS ANGELES CORPS OF ENGINEERS

GILA RIVER BASIN NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA

SKUNK CREEK CHANNEL AND LEVEES

VICINITY OF BLACK CANYON HIGHWAY (I-17)

CHANNEL - PLAN AND PROFILE

STA. 86+50 TO 79+00

DESIGNED BY: M.R.S.

DRAWN BY: D.A.L.

CHECKED BY: M.R.S.

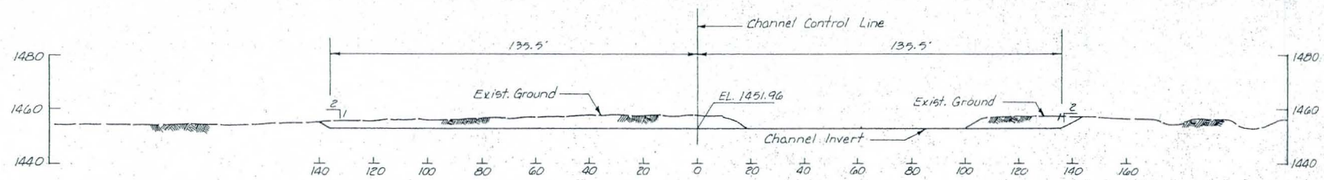
SUBMITTED BY:

DATE APPROVED: 12-15-81

SPEC NO. DACW09-82-B-0004

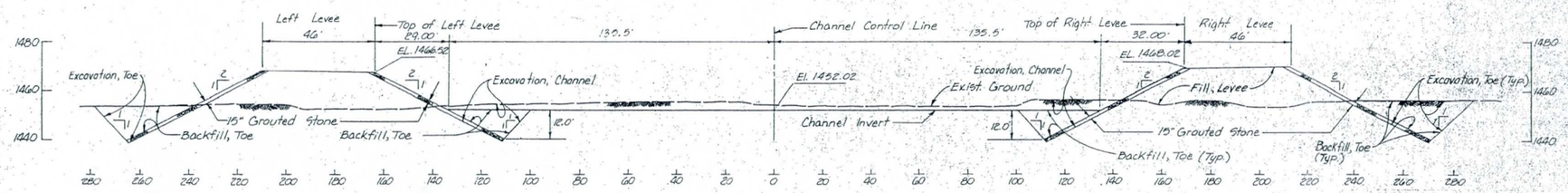
DISTRICT FILE NO. 252/93

SHEET C-21



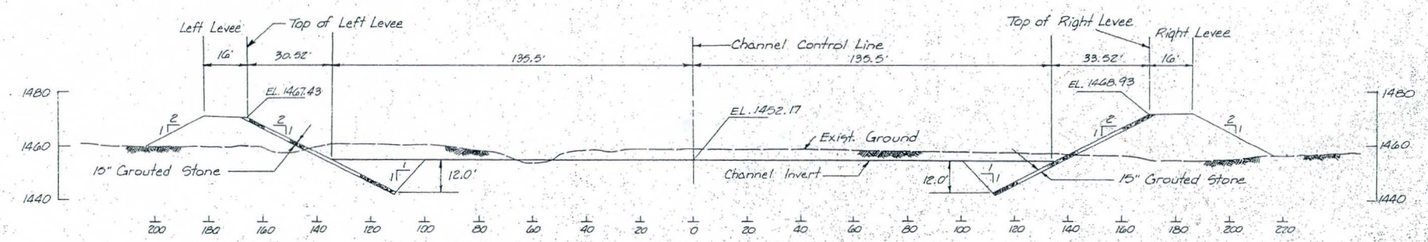
STA. 79+00

Scale: Horiz. 1"=20'
Vert. 1"=20'



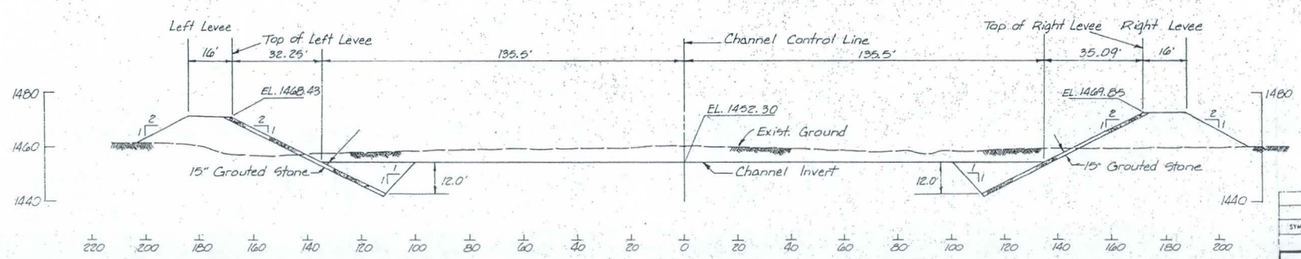
STA. 79+86

Scale: Horiz. 1"=20'
Vert. 1"=20'



STA. 82+00

Scale: Horiz. 1"=20'
Vert. 1"=20'



STA. 84+00

Scale: Horiz. 1"=20'
Vert. 1"=20'

10 0 20 40

NOTE: All sections are drawn looking downstream.

DATUM IS MEAN SEA LEVEL

SYMBOL	DESCRIPTIONS	DATE	APPROVAL

REVISIONS

Sverdrup

Sverdrup & Parcel and Associates, Inc.
Engineers Architects Planners
1950 West Rudkin Drive
Tempe, Arizona 85283 602-968-8668

U. S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

GILA RIVER BASIN
NEW RIVER AND PHOENIX CITY STREAMS, ARIZONA

SKUNK CREEK CHANNEL AND LEVEES
VICINITY OF BLACK CANYON HIGHWAY (I-17)

CHANNEL SECTIONS
STA. 84+00 TO STA. 79+00

DESIGNED BY: M.R.S.
DRAWN BY: K.M.B.
CHECKED BY: M.R.S.
SUBMITTED BY:
DATE APPROVED: 12-15-81
SPEC. NO. DACW09-82-B-0004
DISTRICT FILE NO. 252/101
SHEET C-29

252/101

ENVIRONMENTAL ENHANCEMENT THRU ENGINEERING

APPENDIX H: FEMA FORMS

FEDERAL EMERGENCY MANAGEMENT AGENCY **REVISION REQUESTER AND COMMUNITY OFFICIAL**	O.M.B No. 3067-0148 Expires April 30, 2001

Public reporting burden for this form is estimated to average 2.13 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

1. REQUESTED RESPONSE FROM FEMA

This request is for a:

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

☒ LOMR A letter from FEMA officially revising the current NFIP map to show the changes to floodplains, floodway or flood elevations. LOMRs typically decrease flood hazards. (See 44 CFR Ch. 1 Parts 60 & 65.)

☐ Other Describe: _____

2. OVERVIEW

1. The basis for this revision request is (are): (check all that apply)

☒ Physical Change ☒ Improved Methodology/Data ☐ Floodway Revision

☐ Other Describe: _____

Note: A photograph is not required, but is very helpful during review.

2. Flooding Source: Buchanan Wash

3. Project Name/Identifier: LOMR Request for Buchanan Wash

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

5. 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	Katy, City	TX	480301	0005D	02/08/83
480287	Harris County	TX	48201C	0220G	09/28/90
040051	Phoenix	AZ	04013	1185G	07/19/01

6. The area of revision encompasses the following types of flooding and structures. Check all that apply.

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

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

4. ENCROACHMENT INFORMATION

1. Does the State have jurisdiction over the floodway or its adoption by communities participating in the NFIP?
☐ Yes ☒ No

If Yes, attach a copy of a letter notifying the appropriate State agency of the floodway revision and documentation of the approval of the revised floodway by the appropriate State agency.

2. Does the development in the floodway cause the 1% annual chance (base) elevation to increase at any location by more than 0.000 feet? ☐ Yes ☒ No ☐ N/A

3. Does the cumulative effect of all development that has occurred since the effective SFHA was originally identified cause the base flood elevation to increase at any location by more than one foot (or other increase limit if community or state has adopted more stringent criteria - even if a floodway has not been delineated by FEMA)? ☒ Yes ☐ No

If the answer to either items is Yes, please attach documentation that all requirements of Section 65.12 of the NFIP regulations have been met, regarding evaluation of alternatives, notice to individual legal property owners, concurrence of CEO, and certification that no insurable structures are impacted.

5. MAINTENANCE RESPONSIBILITY

The community is willing to assume responsibility for ☐ performing ☐ overseeing compliance with the maintenance and operation plans of the Buchanan Wash
(Name)
flood control structure. If not performed promptly by an owner other than the community, the community will provide the necessary services without cost to the Federal government.

Operation and maintenance plans are attached. ☐ **Yes** ☐ **No** ☒ **N/A**

6. REVIEW FEE

The review fee for the appropriate request category has been included. ☒ Yes Fee amount: $4000.00

OR

This request is based on a federally sponsored flood-control project where 50 percent or more of the project's cost is federally sponsored, or the request is based on detailed hydrologic and hydraulic studies conducted by Federal, State, or local agencies to replace approximate studies conducted by FEMA and shown on the effective FIRM; thus the project is fee exempt. ☐ Yes

Please see Instructions for Fee Amounts

7. SIGNATURE

Note: **I understand that my signature indicates that all information submitted in support of this request is correct**

Signature of Revision Requester

Bart S. Bergendahl P.E. Project Manager
Printed Name and Title of Revision Requester

Tetra Tech, Inc.
Company Name

Telephone No.: 602-682-3300 Date: 11-19-01

Note: **Signature indicates that the community understands, from the revision requester, the impacts of the revision on flooding conditions in the community.**

Signature of Community Official

Hasan Mushtaq, P.E. Floodplain Manager
Printed Name and Title of Community Official

City of Phoenix, Arizona
Community Name

Telephone No.: 602-262-4026 Date:

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is in accordance with 44 CFR Ch. 1, Sect 65.2

Signature

Bart S. Bergendahl P.E. Project Manager
Printed Name and Title of Revision Requester

Registr No. 28660 Expires (Date) 3/31/04 State AZ

Type of License/Expertise: Civil Engineer

Check which forms have been included with this request

Form Name and (Number)	Required if .....
☐ **Hydrologic** (3)	new or revised discharges
☒ **Hydraulic** (4)	new or revised water-surface elevations
☒ **Mapping** (5)	floodplain/floodway changes
☐ **Channelization** (6)	channel is modified
☒ **Bridge/Culvert** (7)	addition/revision of bridge/culvert
☐ **Levee/Floodwall** (8)	addition/revision of levee/floodwall
☐ **Coastal** (9)	new or revised coastal elevations
☐ **Coastal Structures** (10)	addition/revision of coastal structure
☐ **Dam** (11)	addition/revision of dam
☐ **Alluvial Fan** (12)	structures proposed on alluvial fan

FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE HYDRAULIC ANALYSIS**	O.M.B No. 3067-0148 Expires April 30, 2001

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 2.25 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Note: Fill out one form for each flooding source studied

Community Name: Phoenix, Arizona

Flooding Source: Buchanan Wash

Project Name/Identifier: LOMR Request for Buchanan Wash

1. REACH TO BE REVISED

Describe the limits of the revision OR submit a copy of the FIRM with the revision area clearly highlighted.
Copy of FIRM(s) attached depicting area of the revision (highlighted, or circled)? ☒ Yes

Downstream Limit: River Mile 0.710

Upstream Limit: River Mile 2.2

2. MODELS SUBMITTED

Requirements: for areas which have detailed flooding:	**for areas which do not have detailed flooding:**
Full input and output listings along with files on diskette for each of the models listed below (items 1-4) and a summary of the source of input parameters used in the models must be provided. The summary must include a description of any changes made from model to model (e.g., Duplicate Effective model to Corrected Effective model). At a minimum, the Duplicate Effective (item 1) and the Revised or Post-Project Conditions (item 4) models must be submitted. See instructions for directions on when other models may be required.	Only the 100-year (Base) flood profile is required. A hydraulic model is not required for areas which do not have detailed flooding; however, BFEs may not be added to the revised FIRM. If a hydraulic model is developed for the area, items 3 and 4 described below must be submitted.

If hydraulic models are not developed, hydraulic analyses (including all calculations) for existing or pre-project conditions and revised or post-project conditions must be submitted.

1. Duplicate Effective Model ☒ **Natural** **File Name** DupRASMode PF#1 ☒ **Floodway** **File Name** DupRASMode PF#2

Copies of the hydraulic analysis used in the effective FIS, referred to as the effective models (10-, 50-, 100-, and 500-year multi-profile runs and the floodway run) must be obtained and then reproduced on the requester's equipment to produce the Duplicate Effective model. This is required to assure that the effective models input data has been transferred correctly to the requester's equipment and to assure that the revised data will be integrated into the effective data to provide a continuous FIS model upstream and downstream of the revised reach.

2. Corrected Effective Model ☐ **Natural** **File Name** _____ ☐ **Floodway** **File Name** _____

The Corrected Effective model is the model that corrects any errors that occur in the Duplicate Effective model, adds any additional cross sections to the Duplicate Effective model, or incorporates more detailed topographic information than that used in the currently effective model. The Corrected Effective model must not reflect any man-made physical changes since the date of the effective model. An error could be a technical error in the modeling procedures, or any construction in the floodplain that occurred prior to the date of the effective model but was not incorporated into the effective model.

3. Existing or Pre-Project Conditions Model ☐ **Natural** **File Name** _____ ☐ **Floodway** **File Name** _____

The Duplicate Effective model or Corrective Effective model is modified to produce the Existing or Pre-Project Conditions model to reflect any modifications that have occurred within the floodplain since the date of the Effective model but prior to the construction of the project for which the revision is being requested. If no modification has occurred since the date of the effective model, then this model would be identical to the Corrected Effective model or Duplicate Effective model.

4. Revised or Post-Project Conditions Model ☒ **Natural** **File Name** Buchanan Wash PF#1 ☒ **Floodway** **File Name** Buchanan Wash PF#2

The Existing or Pre-Project Conditions model (or Duplicate Effective model or Corrected Effective model, as appropriate) is revised to reflect revised or post-project conditions. This model must incorporate any physical changes to the floodplain since the effective model was produced as well as the effects of the project. When the request is for the proposed project this model must reflect proposed conditions.

5. Other – Please attach a sheet describing all other models submitted along with the file names. ☐ **Natural** ☐ **Floodway**

3. STARTING WATER-SURFACE ELEVATIONS

Explain how they were determined. Explanation Attached? ☒ Yes ☐ No

NOTE: If the effective study is an approximate study, the slope/area method is recommended.
For detailed analysis studies, using a known water-surface elevation is recommended.

4. RESULTS (from the model used to revise the 100-year water surface elevations)

If the results indicate any of the following, attach an explanation - to this form, or to the hydraulic model printout- as to the reasonableness of the situation.

☐ Supercritical depth ☐ Critical Depth ☐ Drawdowns ☒ Negative Floodway Surcharges

☐ Floodway Surcharges Greater Than Maximum Allowed by Community/State

☐ Water surface elevations higher than the end points of cross sections.

☐ Floodway discharge is different than the Natural 100-year (base) flood discharge.

☒ Project causes 100-year floodplain or floodway elevations to increase (state if increases are located off the requester's property)

Explanation attached with Form ☒ **Explanation provided on attached printout** ☐

If Hydraulic model used is HEC-2, has it been checked with FEMA'S CHECK-2 computer program? ☐ **Yes** ☐ **No**
(see instructions for information on how to obtain CHECK-2)

5. REVISED FIRM/FBFM AND FLOOD PROFILES

1. Profile Transition

a. 100-Year Water-Surface Elevations - indicate the difference in water surface elevations where the project 100-year elevations tie into the existing 100-year water surface elevations at each end of the project.

Downstream End _____ within _____ (feet) Upstream End _____ within _____ (feet)
Cross-Section # *Cross-Section #*

b. Floodway Elevations - indicate the difference in water surface elevations where the project floodway elevations tie into the existing floodway water surface elevations at each end of the project.

Downstream End _____ within _____ (feet) Upstream End _____ within _____ (feet)
Cross-Section # *Cross-Section #*

c. Floodway widths - indicate the difference in floodway widths where the project floodway widths tie into the existing floodway width at each end of the project.

Downstream End _____ within _____ (feet) Upstream End _____ within _____ (feet)
Cross-Section # *Cross-Section #*

2. Profile Checklist (check box if information has been provided on profile)

The following information (unless in parentheses) must be included at the same scale as the existing profiles for this project:

☒ Stream Name ☒ Community Name ☒ Corporate Limits labeled ☒ Study limits labeled

☒ Confluences labeled ☒ Channel Stationing ☒ Streambed profiled ☒ Cross Sections labeled

☒ Horizontal/Vertical Scales indicated ☒ 100-year elevs profiled*

☒ Road Crossings ☒ Labeled ☒ Low Chord Elevations ☒ Top of Road Elevations

*All recurrence intervals in the effective study must also be profiled.

Floodway Data Table

Attach a Floodway Data Table for each cross section listed in the published Floodway Data table in the FIS report.

Floodway Data Table Attached ☒ **Yes** ☐ **Not Required**

FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE / COASTAL MAPPING**	O.M.B No. 3067-0148 Expires April 30, 2001

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1.5 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Note: Fill out one form for each flooding source studied

Community Name: City of Phoenix, Arizona

Flooding Source: Buchanan Wash

Project Name/Identifier: LOMR Request for Buchanan Wash

This is a ☒ Manual ☐ Digital submission. *Digital map submissions may be used to update digital FIRMs (DFIRMs). For updating DFIRMs, these submissions must be coordinated with FEMA Headquarters as far in advance as possible.*

1. MAPPING CHANGES

1. A topographic workmap must be submitted showing the following information (check N/A when not applicable):

	Yes	No	N/A
a. Revised approximate 100-year floodplain boundaries (Zone A)	☐	☐	☒
b. Revised detailed 100- and 500-year floodplain boundaries.	☒	☐	☐
c. Revised floodway boundaries	☒	☐	☐
d. Location and alignment of all cross sections with stationing control indicated.	☒	☐	☐
e. Stream alignments, road alignments and dam alignments.	☒	☐	☐
f. Current community boundaries.	☒	☐	☐
g. Effective 100- year floodplain and floodway boundaries from FIRM/FBFM reduced or enlarged to the scale of the topographic workmap	☒	☐	☐
h. Tie-ins between the effective and revised 100-, 500-year and floodway boundaries	☐	☐	☒
i. The requester's property boundaries and community easements	☒	☐	☐
j. The signed certification of a registered professional engineer	☒	☐	☐
k. Location and description of reference marks	☒	☐	☐
l. Vertical datum (example: NGVD, NAVD)	☒	☐	☐
m. Coastal zone designations tie into adjacent areas not being revised	☐	☐	☒
n. Location and alignment of all coastal transects used to revise the coastal analyze	☐	☐	☒
o. V-zone has been delineated to extend landward to the heel of the primary frontal dune	☐	☐	☒

If any items are marked No or N/A please attach an explanation.

2. What is the source and date of the updated topographic information (example: orthophoto maps, July 1985; filed survey, May 1979, beach profile, June 1987 etc.)? _____

3. What is the scale and contour interval of the following workmaps?

Effective FIS Scale 1"=400' Contour Interval 2'

Revision Request Scale 1"=400' Contour Interval 2'

NOTE: Revised topographic information must be of equal or greater detail than effective.

4. Attach an annotated FIRM/FBFM at the scale of the effective FIRM/FBFM showing the revised 100- and 500-year floodplain and the floodway boundaries and how they tie into those shown on the effective FIRM/FBFM downstream and upstream of the revisions or adjacent to the area of revision for coastal studies. **FIRM/FBFM attached?** ☒ **Yes** ☐ **No**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

2. EARTH FILL PLACEMENT

~~berm~~ levee around landfill since effective FIRM ?

1. The fill is: ☒ Existing ☐ Proposed

2. Has fill been/will be placed in the regulatory floodway? ☐ Yes ☒ No
   If Yes, please attach completed Riverine Hydraulic Analysis Form (Form 4).

3. Has fill been/will be placed in floodway fringe (*area between the floodway and 100-year floodplain boundaries*)? ☒ Yes ☐ No

   If Yes, then complete A, B, C, and D below.

   a. Are fill slopes for granular materials steeper than one vertical on one-and-one-half horizontal? ☐ Yes ☒ No

      If Yes, justify steeper slopes _____

   b. Is adequate erosion protection provided for fill slopes exposed to moving flood waters? (*Slopes exposed to flows with velocities of up to 5 feet per second (fps) during the 100-year flood must, at a minimum, be protected by a cover of grass, vines, weeds, or similar vegetation; slopes exposed to flows with velocities greater than 5 fps during the 100-year flood must, at a minimum, be protected by stone or rock riprap.)*

      ☒ Yes ☐ No

      If No, describe erosion protection provided _____

   c. Has all fill placed in revised 100-year floodplain been compacted to 95 percent of the maximum density obtainable with the Standard Proctor Test Method or acceptable equivalent method? ☒ Yes ☐ No

   d. Can structures conceivably be constructed on the fill at any time in the future? ☒ Yes ☐ No

   If Yes, attach certification of fill compaction (item 3c. above) by the community's NFIP permit official, a registered professional engineer, or an accredited soils engineer in accordance with Subparagraph 65.5(a)(6) of the NFIP regulations.

   Fill certification attached ☒ **Yes** ☐ **No**

4. Has fill been/will be placed in a V zone? ☐ Yes ☒ No

   If Yes, is the fill protected from erosion by a flood control structure such as a revetment or seawall?

   ☐ Yes ☐ No

   If Yes, attach the Coastal Structures Form (Form 10).

FEDERAL EMERGENCY MANAGEMENT AGENCY **BRIDGE/CULVERT**	O.M.B. Burden No. 3067-0148 Expires April 30, 2001

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 2 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Community Name: City of Phoenix, Arizona

Flooding Source: Buchanan Wash

Project Name/Identifier: LOMR Request for Buchanan Wash

1. IDENTIFIER

1. Name of structure (roadway, railroad, etc.): Box Culvert under Pinnacle Vista Road

2. Location of bridge/culvert along flooding source (in terms of stream distance or cross-section identifier):

   River Stations 1.326

3. This revision reflects (check one of the following):

   ☒ New bridge/culvert not modeled in the FIS

   ☐ Modified bridge/culvert previously modeled in the FIS

   ☐ New analysis of bridge/culvert previously modeled in the FIS

4. 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 structure(s). *(Attach justification)*

   Justification attached ☐ **Yes** ☐ **No** ☒ **N/A**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

2. DRAWING CHECKLIST

Attach plans of the structure(s) certified by a registered professional engineer. The plan detail and information should include the following (check the boxes if the information has been provided):

- ☒ Dimensions (height, width, span, radius, length)
- ☒ Shape (culverts only)
- ☒ Material
- ☒ Beveling or Rounding
- ☒ Wing Wall Angle
- ☒ 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
- ☒ Skew Angle
- ☒ Cross-Section Locations
- ☒ Distances Between Cross Sections
- ☒ Erosion Protection

3. SEDIMENT TRANSPORT CONSIDERATIONS

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year (base flood) water-surface elevations; and/or based on the stream geomorphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including sewer and deposition) to affect the base flood elevations, then provide the following information **(Check the box if provided):**

- ☐ Estimated sediment load
- ☐ Method used to estimate sediment transport
- ☐ Method used to estimate scour and/or deposition
- ☐ Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport

FEDERAL EMERGENCY MANAGEMENT AGENCY **LEVEE/FLOODWALL SYSTEM ANALYSES**	O.M.B. Burden No. 3067-0148 Expires April 30, 2001

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 3.0 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Community Name: City of Phoenix, Arizona

Flooding Source: Buchanan Wash

Project Name/Identifier: LOMR Request for Buchanan Wash

1. REACH TO BE REVISED

Describe the limits of the revision **OR** submit a copy of the FIRM with the revision area clearly highlighted.
Copy of FIRM(s) attached depicting area of the revision (highlighted, or circled)? ☒ Yes

Downstream Limit: 0.710

Upstream Limit: 2.20

2. LEVEE/FLOODWALL SYSTEM ELEMENTS

1. This Levee/Floodwall analysis is based on:

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

2. Levee elements and locations are:

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

3. Structural Type:

   ☐ monolithic cast-in place reinforced concrete
   ☐ reinforced concrete masonry block
   ☐ sheet piling
   ☒ other (describe): Cement Stabilized Alluvium

4. Has this levee/floodwall system been certified by a Federal agency to provide protection against the 1% annual chance (100-year) flood event? ☐ Yes ☐ No

   If Yes, by which agency? _____

   If Yes, complete only the interior drainage section on pages 7 and 8 of this form and the operation and maintenance section of Revision Requestor and Community Official Form.

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

2. LEVEE/FLOODWALL SYSTEM ELEMENTS (Cont'd)

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

   a. Plan of the levee embankment and floodwall structures. Sheet Numbers 9 of 23

   b. A profile of the levee/floodwall system showing the 100-year water-surface (base flood) elevation, levee and/or wall crest and foundation, and closure locations for the total levee system. Sheet Numbers 9 of 23

   c. A profile of the base flood elevation, closure opening outlet and inlet invert elevations, type and size of opening, and kind of closure device. Sheet Numbers _____

   d. A layout detail for the embankment protection measures. Sheet Numbers _____

   e. Location, layout, and size and shape of the levee embankment features, foundation treatment, floodwall structure, closure structures, and pump stations. Sheet Numbers _____

3. FREEBOARD

1. The minimum freeboard provided above the base flood elevation 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 immediately upstream of all structures and constrictions ☐ Yes ☐ No

   Coastal

   1.0 foot above the height of the one percent wave for the 100-year stillwater surge elevation or maximum wave runup (whichever is greater). ☐ Yes ☐ No

   2.0 feet above 100-year stillwater surge elevation ☐ Yes ☐ No

Please note, occasionally exceptions are made to the minimum freeboard requirement. If an exception is requested, attach documentation addressing Part 65.10(b)(1)(ii) of the National Flood Insurance Program regulations.

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

2. Is there an indication from historical records that ice-jamming can effect the base flood elevation? ☐ Yes ☐ No
   If Yes, provide ice-jam analysis profile and evidence that the minimum freeboard discussed above still exists.

3. Tabulate the elevations at critical locations (tabulate values at each levee crest grade change, and where sediment may accumulate such as along bends in the channel.)

Station	Location	100-year Water Surface Elevation	Levee Crest	Freeboard (ft.)
	Upper end			
	Lower end			

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

4. SEDIMENT TRANSPORT CONSIDERATIONS

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year water-surface (base flood) elevations; and/or based on the stream geomorphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including sewer and deposition) to affect the base flood elevations, then provide the following information:

- ☐ Estimated sediment load
- ☐ Method used to estimate sediment transport
- ☐ Method used to estimate scour and/or deposition
- ☐ Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport

5. CLOSURES

1. Openings through the levee system:

☐ exist ☐ do not exist

If openings exist, 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 detail analysis reports, data obtained during field and laboratory investigations and used in the design analysis for the following levee system features should be submitted in a tabulated summary form. (Reference U.S. Army Corps of Engineers EM-1110-2-1906 Form 2086).

6. EMBANKMENT PROTECTION

1. The maximum levee slope landside is: 2:1
2. The maximum levee slope floodside is: 2:1
3. The range of 100-year (base) riverine flood velocities along the levee? _____ (min.) to _____ (max.)
4. Embankment material is protected by (describe the kind): _____
5. Riprap Design Parameters: (Include references) ☐ Velocity ☐ Tractive stress

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)

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

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

_____

Note: Attach engineering analysis to support construction plans.

7. EMBANKMENT AND FOUNDATION STABILITY

1. 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 Ø = _____ degrees, c = _____ psf

   slope: SS = _____ (h) to _____ (v)

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

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

3. 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: U.S. Army Corps of Engineers (USACE) EM-1110-2-1913 Table 6-1)

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

   If Yes, describe methodology used: _____

5. Was a seepage analysis for the foundation performed: ☐ Yes ☐ No

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

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

8. The duration of 100-year (base) flood hydrograph against the embankment is _____ Hours

Note: Attach engineering analysis to support construction plans.

8. FLOODWALL AND FOUNDATION STABILITY

1. Describe analysis submittal based on Code:

   ☐ UBC (1988) or ☐ Other (specify):

2. Stability analysis submitted provides for:

   ☐ Overturning ☐ Sliding; If not, explain: _____

3. 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

   ☐ 100-year significant wave height _____ ft.

   ☐ 100-year significant wave period _____ sec.

4. 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)

5. Foundation bearing strength for each soil type:

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

6. Foundation scour protection ☐ is, ☐ is not provided. Describe if provided:

_____

Note: Attach engineering analysis to support construction plans.

9. SETTLEMENT

1. Has anticipated potential settlement been determined and incorporated into the specified construction elevations to maintain the established freeboard margin? ☐ Yes ☐ No
2. The computed range of settlement is _____ ft. to _____ ft.
3. Settlement of the levee crest is determined to be primarily from:

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

4. Differential settlement of floodwalls

   ☐ has ☐ has not been accommodated in the structural design and construction.

Note: Attach engineering analysis to support construction plans.

10. INTERIOR DRAINAGE

1. Specify size of each interior watershed

   Draining to pressure conduit: _____

   Draining to ponding area: _____

2. Relationships Established

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

3. The river flow duration curve is enclosed ☐ Yes ☐ No
4. Specify the discharge capacity of the head pressure conduit: _____
5. 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, explain why not: _____

6. 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, explain why not: _____

7. The rate of seepage through the levee system for the 100-year (base) flood is _____ cfs

10. INTERIOR DRAINAGE (Cont'd)

8. The length of levee system used to drive this seepage rate in item 7: _____ ft.

9. Will a pumping plant(s) 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 operations be automatic? ☐ Yes ☐ No

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

(Reference: U.S. Army Corps of Engineers EM-1110-2-3101, 3102, 3103, 3104, and 3105)

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

11. OTHER DESIGN CRITERIA

1. 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

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

   _____

3. 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

Note: Attach supporting documentation

12. OPERATIONAL PLAN AND CRITERIA

1. Are the planned/installed works in full compliance with NFIP regulations, Section 44 CFR Ch. 1 1.65.10

   ☐ Yes ☐ No

2. Does the operation plan incorporate all the provisions for closure devices as required in Section 65.10(c)(1), of the NFIP regulations?

   ☐ Yes ☐ No

3. Does the operation plan incorporate all the provisions for interior drainage as required in Section 65.10(c)(2), of the NFIP regulations?

   ☐ Yes ☐ No

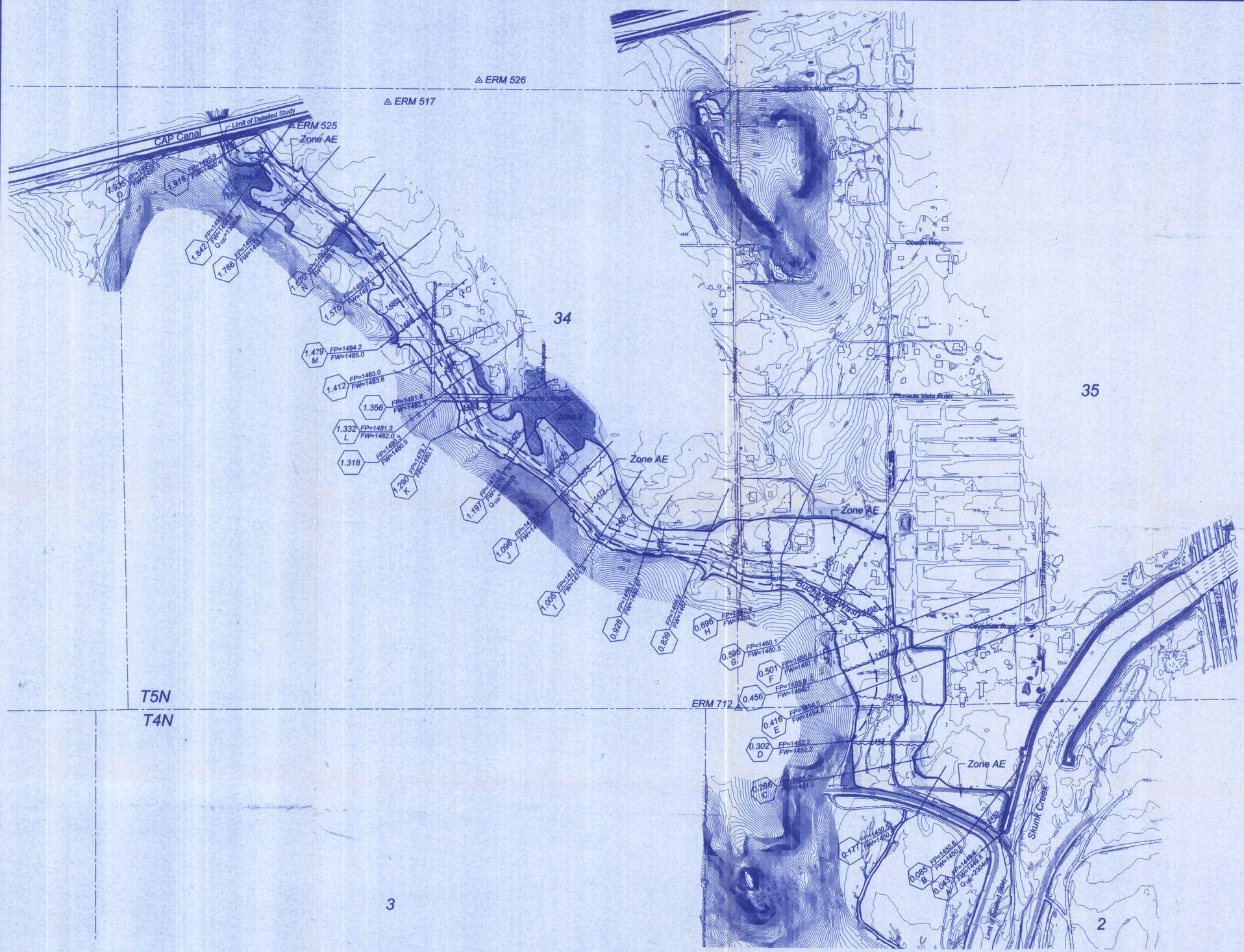
If the answer is No to any of the above, please explain below.

_____

_____

_____

APPENDIX I: FULL-SIZE WORK STUDY MAP



THE BASE TOPOGRAPHIC MAPPING USED TO CONDUCT THIS FLOODPLAIN DELINEATION STUDY WAS PREPARED BY M & B AERIAL MAPPING COMPANY, INC. THIS MAPPING IS BASED ON AERIAL PHOTOGRAPHY TAKEN FEB 11, 2000 AND JAN 24, 2001. PROJECT CONTROL WAS PROVIDED BY MORRISON--MAIERLE, INC. TETRA TECH, INC. ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF THE CONTROL SURVEY OR THE BASE TOPOGRAPHIC MAPPING.

LEGEND

100-YR FLOODPLAIN BOUNDARY

FLOODWAY BOUNDARY

HYDRAULIC BASE LINE

500-YEAR FLOODPLAIN BOUNDARY

CROSS SECTION — 0.10 A (CROSS SECTION RIVER MILE; INDEX CROSS SECTION) — FP= 1483.6 (FLOODPLAIN WATER SURFACE ELEVATION); FW= 1483.0 (FLOODWAY WATER SURFACE ELEVATION)

ELEVATION REFERENCE MARK — ERM XXX

BASE FLOOD ELEVATION — 1462

SFH ZONE DESIGNATION — ZONE AE

AREA BETWEEN 100-YEAR AND 500-YEAR FLOODPLAINS

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929. CONVERSION FACTOR: NGVD 1929 +1.95' = NAVD 1988

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
517	1500.60	FOUND U.S. DEPARTMENT OF INTERIOR BRASS CAP ALONG C.A.P. CANAL. STAMPED POINT #44, STATION 373+41.83 150' RIGHT N: 996,684.42 E: 430,995.55
525	1502.21	FOUND U.S. DEPARTMENT OF INTERIOR BRASS CAP ALONG C.A.P. CANAL. POINT #43 STATION 386+00, 125' RIGHT N: 996,480.99 E: 430,163.65
526	1500.11	FOUND U.S. DEPARTMENT OF INTERIOR BRASS CAP ALONG C.A.P. CANAL. STAMPED POINT #44, STATION 402+67.37 125' RIGHT N: 996,877.09 E: 431,783.43
712	1555.08	FOUND STONE AT THE SOUTHEAST CORNER OF OF SECTION 34 T5N R2E N: 991,520.42 E: 434,056.21

NOTES

1. ADDED 500-YEAR FLOODPLAIN

Shaw™ EMCON/OWT, Inc.

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 27290 GARTH R. BOWERS Date Signed 11/5/01 ARIZONA, U.S.A.

NO.	REVISION	BY	DATE
2			
1			

CITY OF PHOENIX
MARICOPA COUNTY, ARIZONA

BUCHANAN WASH

WORK STUDY MAP

LETTER OF MAP REVISION

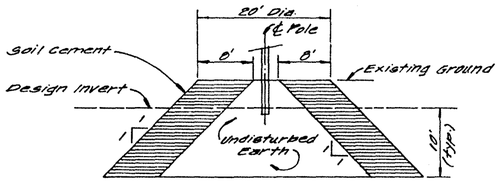
REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 28660 BART S. BERGENDAHL Date Signed 11-1-01 ARIZONA, U.S.A.

TETRA TECH, INC.
INFRASTRUCTURE SOUTHWEST GROUP
4801 East Washington Street, Suite 260, Phoenix, AZ 85034
(602) 685-2002 FAX (602) 244-1164

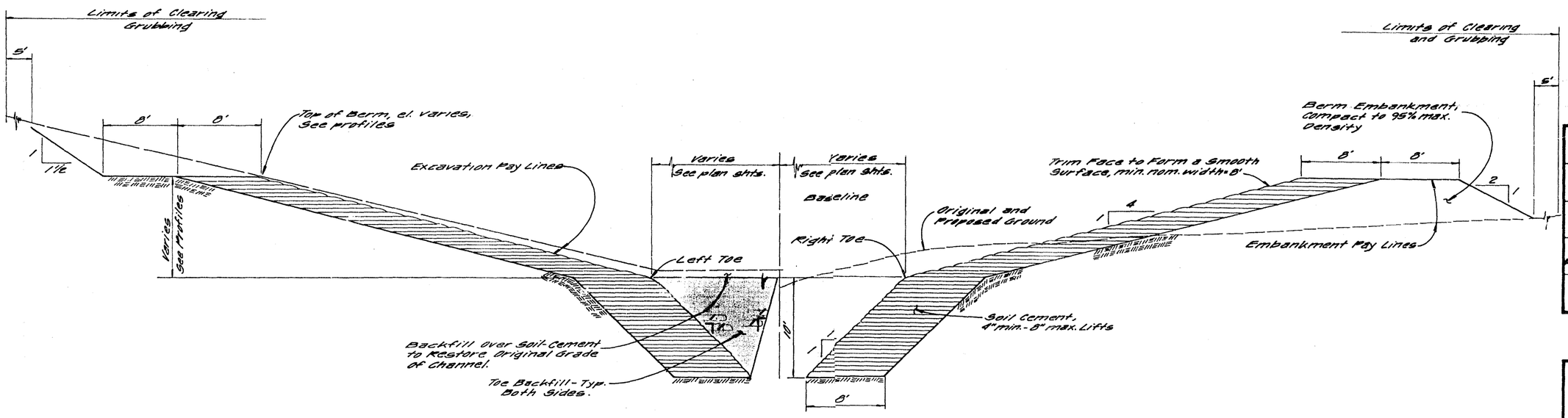
	BY	DATE
DESIGN	DEJ	10/2001
DESIGN CHK.	BSB	10/2001
PLANS	CBC	10/2001
PLANS CHK.	BSB	10/2001

SHEET 01 OF 01

Figure 2



SOIL CEMENT AROUND POLE



TYPICAL SECTION THROUGH CHANNEL
NORTH OF HAPPY VALLEY ROAD
N.T.S.

Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

RECORD DRAWINGS
11-27-96
DATE

138856

MH001385

Revisions	Date

Seal

Designed By: C. MOREA

Drawn By: M. CROSS

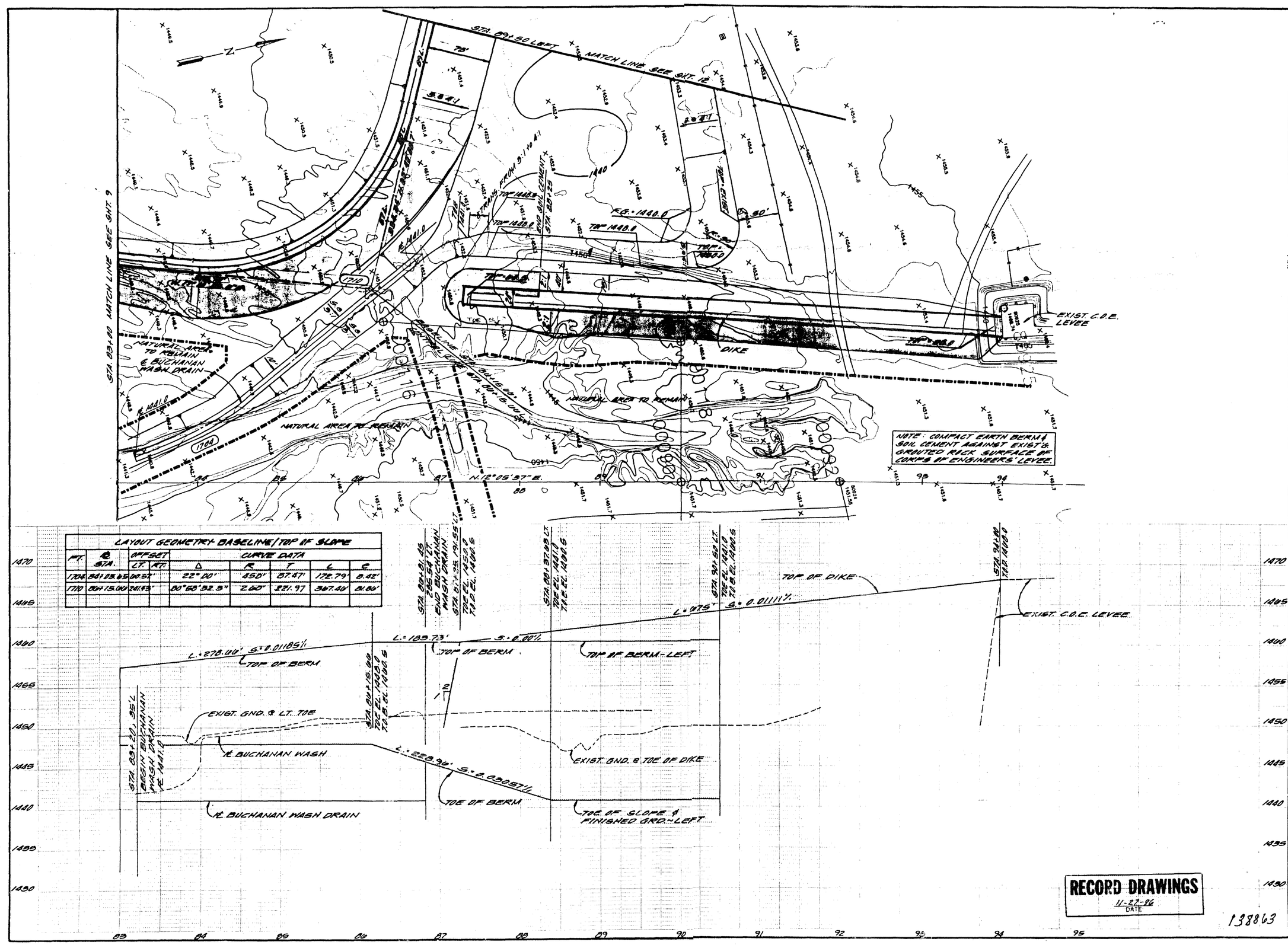
Checked By: C. MOREA

Date: APR. 24, 1992

Title: SKUNK CREEK CHANNEL IMPROVEMENTS INDEX NO. SA-884080

Sheet 3 OF 34

CITY OF PHOENIX • ENGINEERING DEPARTMENT • DESIGN DIVISION



LAYOUT GEOMETRY-BASELINE/TOP OF SLOPE								
PT.	℄ STA.	OFFSET LT.	OFFSET RT.	CURVE DATA Δ	R	T	L	E
1708	B83+03.65	40.52'		22°00'	450'	87.87'	172.79'	8.42'
1710	B84+15.00	241.93'		80°58'32.5"	260'	221.97	367.40'	81.86'

Revisions	Date

Seal

Designed By: C. MOREA

Drawn By: M. CROSS

Checked By: C. MOREA

Date: APR. 24, 1992

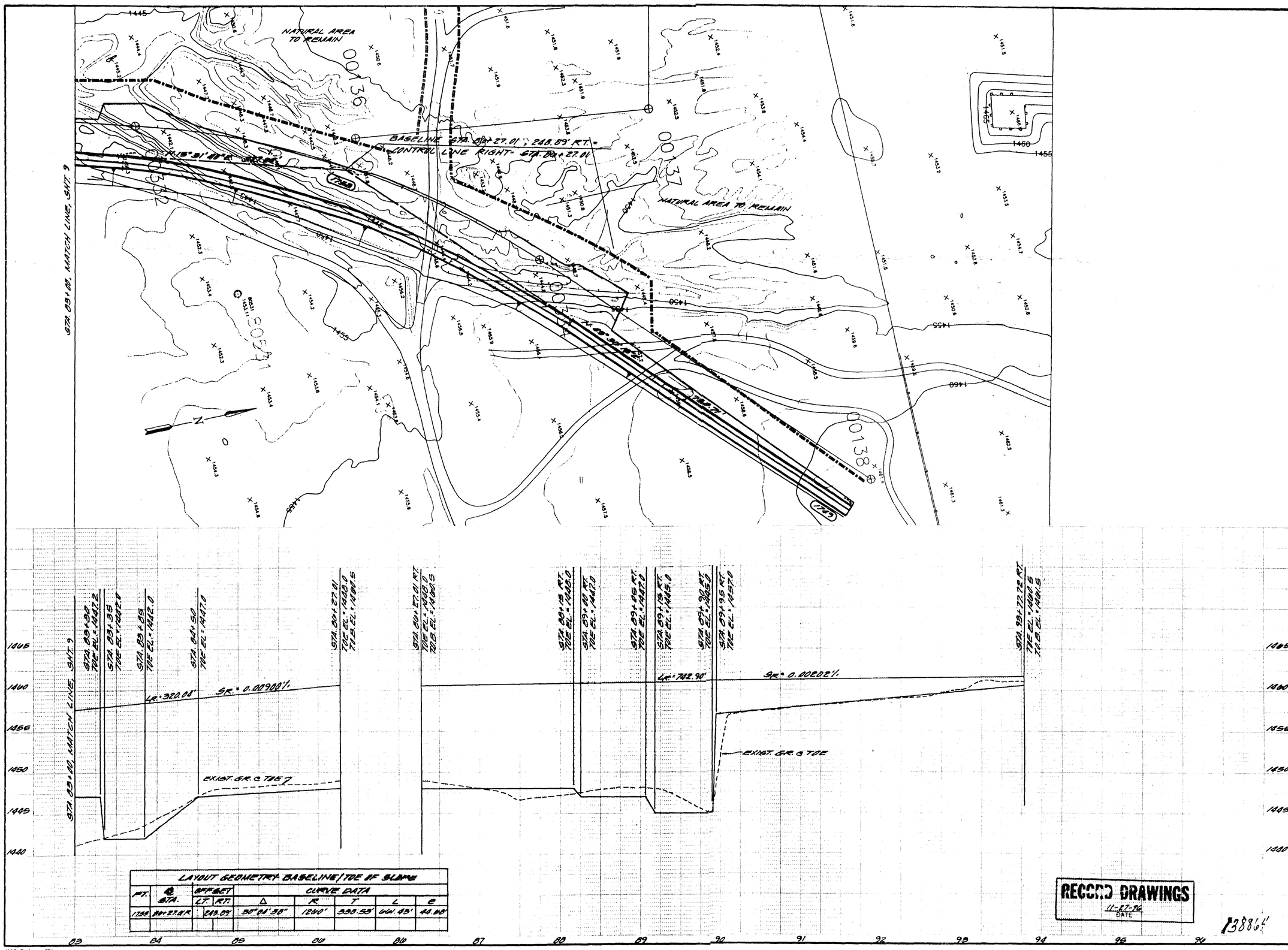
Title: SKUNK CREEK CHANNEL IMPROVEMENTS INDEX NO. SA-884080

RECORD DRAWINGS
11-27-96
DATE

138863

Sheet 10 of 34

CITY OF PHOENIX • ENGINEERING DEPARTMENT • DESIGN DIVISION



Revisions	Date

Seal

Designed By: C. MOREA

Drawn By: M. CROSS

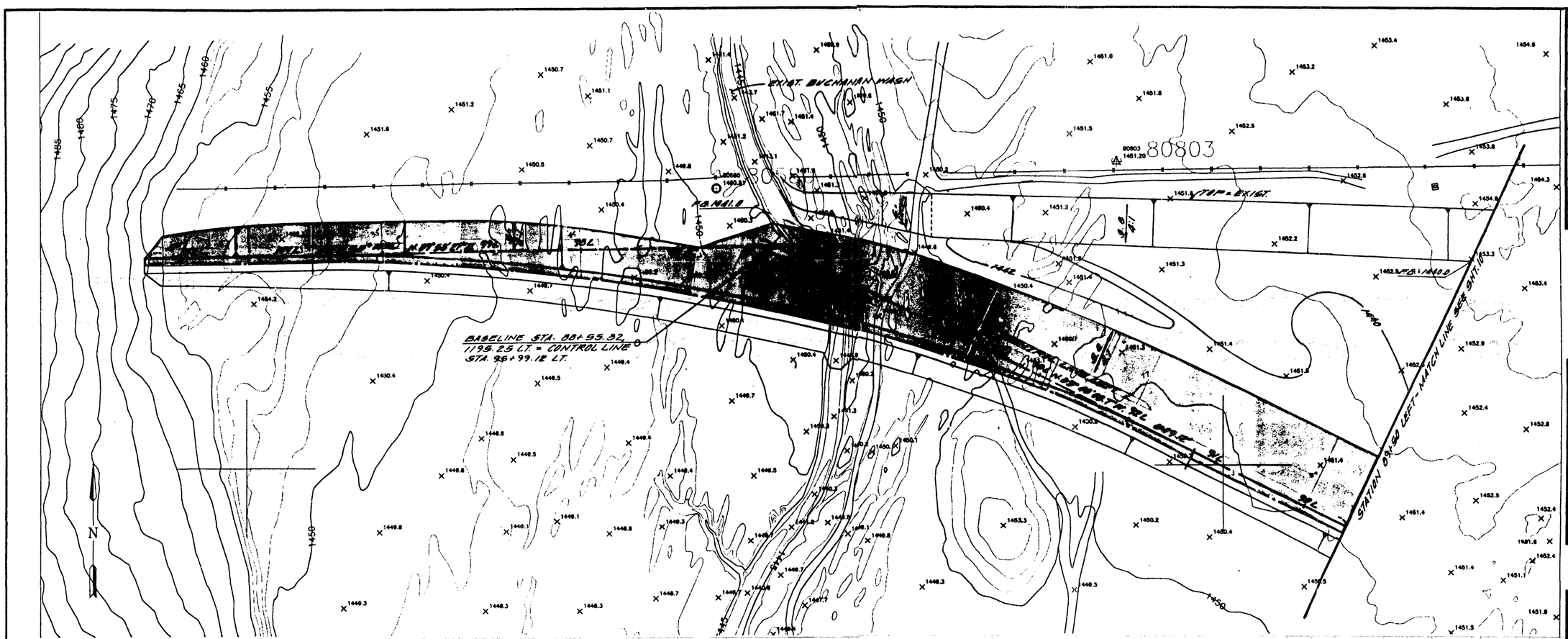
Checked By: C. MOREA

Date: APR. 24, 1995

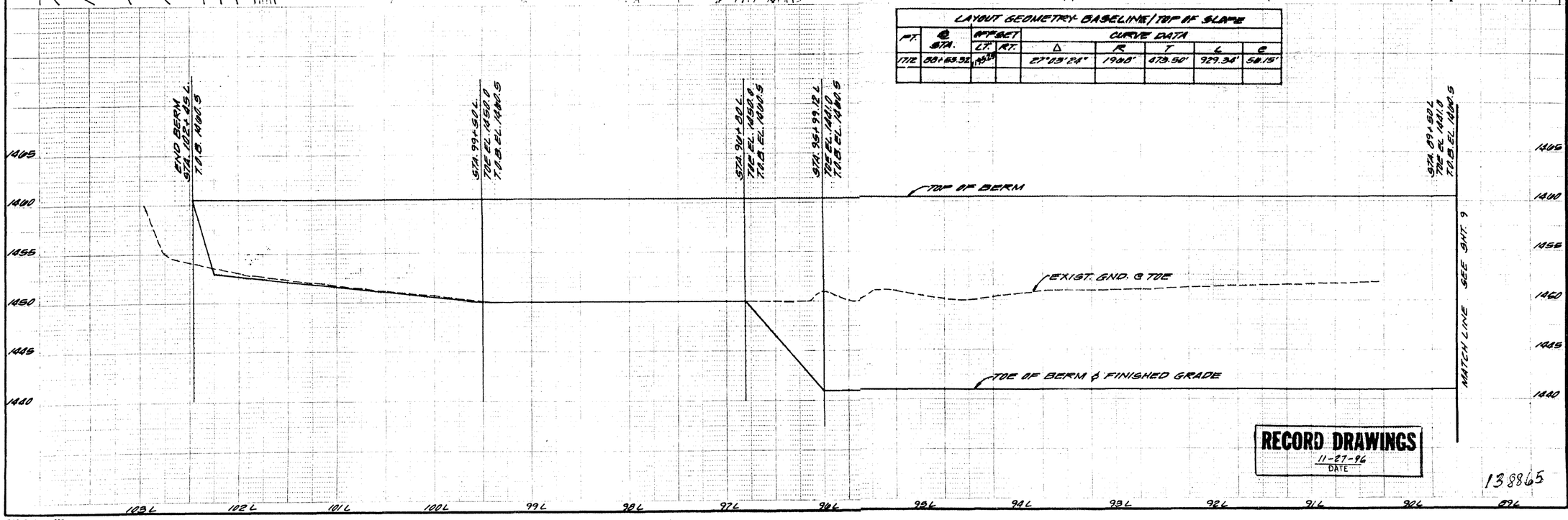
Title: SKUNK CREEK CHANNEL IMPROVEMENTS INDEX NO. SA-884080

Sheet 11 of 34

CITY OF PHOENIX • ENGINEERING DEPARTMENT • DESIGN DIVISION



LAYOUT GEOMETRY - BASELINE/TOP OF SLOPE								
PT.	℄ STA.	OFFSET LT.	OFFSET RT.	CURVE DATA Δ	R	T	L	E
1712	88+55.32	1195.25		27°03'24"	1900'	473.50'	929.34'	58.15'



RECORD DRAWINGS
11-27-96
DATE

138865

Revisions	Date

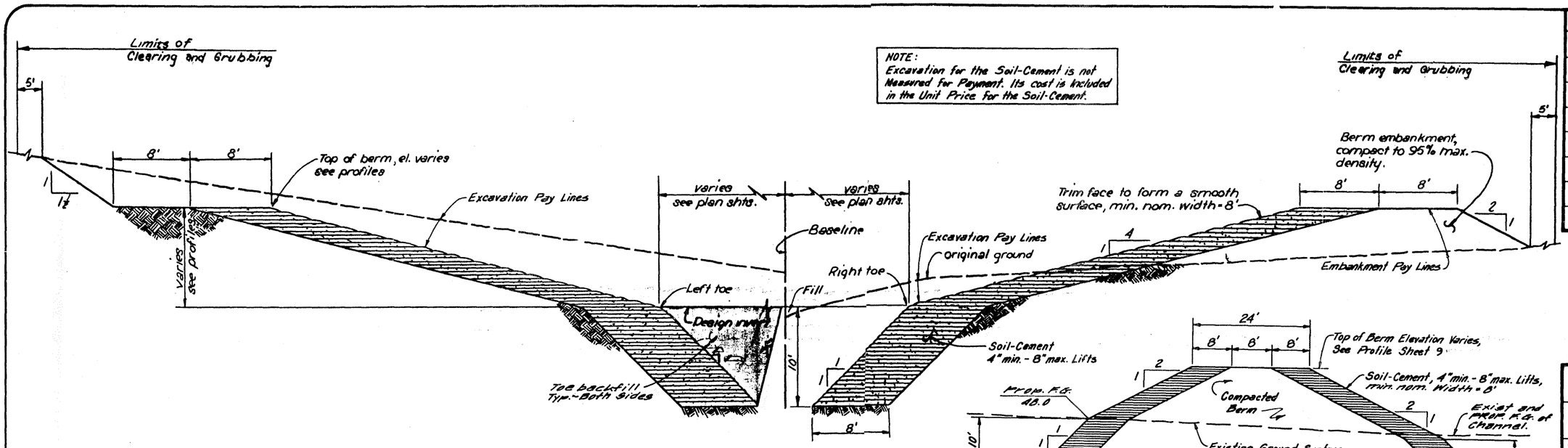
Seal

Designed By: C. MOREA
Drawn By: M. CROSS
Checked By: C. MOREA
Date: APR. 24, 1995

Title: SKUNK CREEK CHANNEL IMPROVEMENTS
INDEX NO. SA-884080

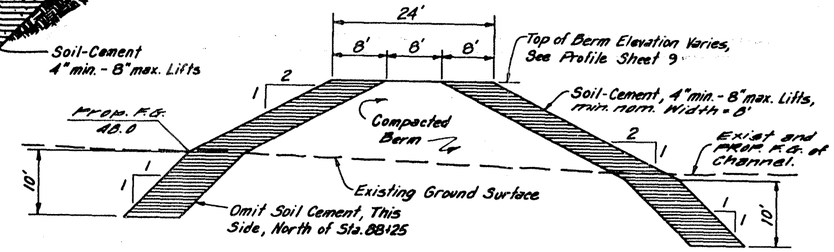
Sheet 12 OF 34

CITY OF PHOENIX • ENGINEERING DEPARTMENT • DESIGN DIVISION

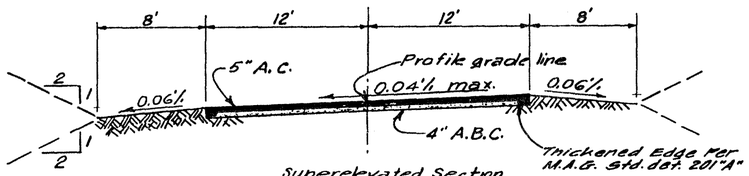


NOTE:
Excavation for the Soil-Cement is not Measured for Payment. Its cost is included in the Unit Price for the Soil-Cement.

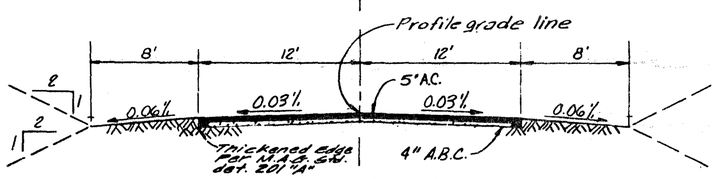
TYPICAL SECTION THROUGH CHANNEL SOUTH OF HAPPY VALLEY ROAD
N.T.S.



TYPICAL SECTION THROUGH SPECIAL BERM LEFT, STA. 87+25 TO CORPS OF ENGINEERS BERM
N.T.S.

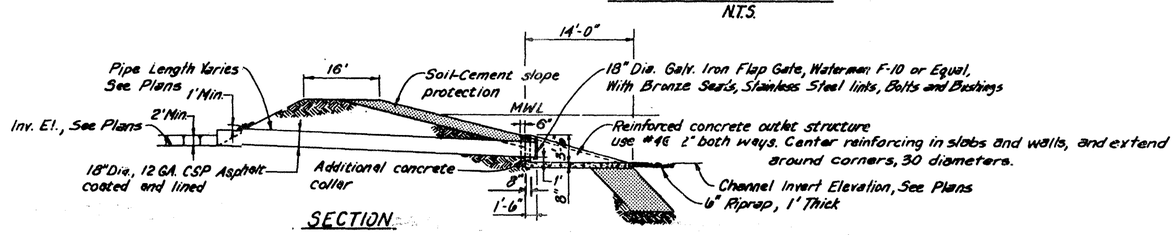


Superelevated Section

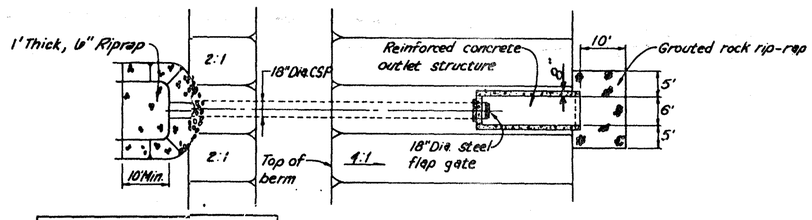


Tangent Section

CROSS SECTION OF HAPPY VALLEY RD.
Scale: 1" = 5'



SECTION



See Plan Sheets for Locations for These Inlets

PLAN
CROSS DRAIN
N.T.S.

SHEET INDEX

BENCH MARK: "Skunk," Elev. 1468.90 Brass cap at N 19,991.92, E 9,783.24 227.4 Ft. East of the ℄ of the I-17 E. Frontage Rd., along the N. Line of TWP. 4 N. 0.15 Mi. S. of S. end of the bridge over Skunk Creek

RECORD DRAWINGS
11-27-96
DATE

SHEET INDEX

No.	Title
1	TITLE SHEET
2-3	TYPICAL CROSS SECTIONS & DETAILS
4-12	PLAN & PROFILES
13-14	HAPPY VALLEY ROAD IMPROVEMENTS
15-22	CHANNEL CROSS SECTIONS
23	ROCK EXCAVATION PLAN
24-28	PLANTING PLANS
29-33	IRRIGATION PLANS
34	ELECTRICAL PLAN

138855

NH021384

Revisions	Date

Seal

Designed By: C. MOREA
Drawn By: M. CROSS
Checked By: C. MOREA
Date: APR. 24, 1992

Title: SKUNK CREEK CHANNEL IMPROVEMENTS INDEX NO. SA-884080

Sheet 2 of 34

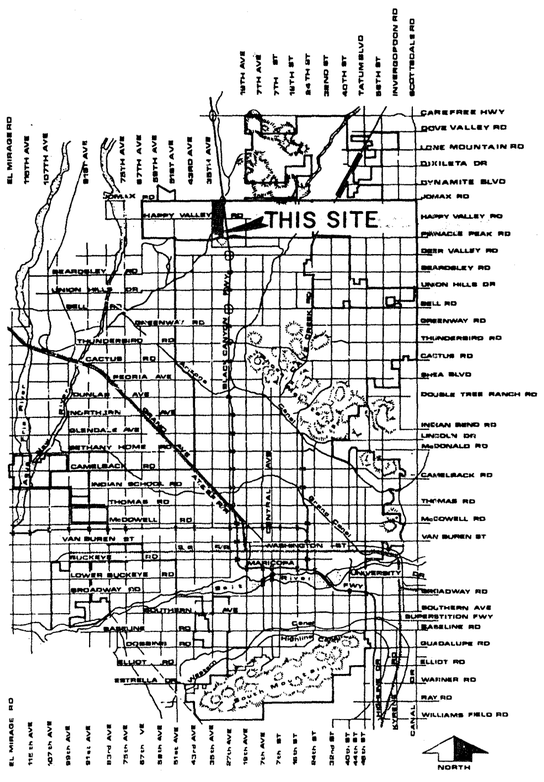
CITY OF PHOENIX • ENGINEERING DEPARTMENT • DESIGN DIVISION

CITY OF PHOENIX

ENGINEERING & ARCHITECTURAL SERVICES
PROJECT MANAGEMENT

SKUNK CREEK CHANNEL IMPROVEMENTS
INDEX NUMBER SA-884080

1992



Vicinity Map

MAYOR

PAUL JOHNSON

CITY COUNCIL

DISTRICT NO. 1 THELDA WILLIAMS	DISTRICT NO. 5 JOHN NELSON
DISTRICT NO. 2 FRANCES BARWOOD	DISTRICT NO. 6 KATHY DUBS
DISTRICT NO. 3 SKIP RIMSZA	DISTRICT NO. 7 MARY ROSE WILCOX
DISTRICT NO. 4 CRAIG TRIBKEN	DISTRICT NO. 8 CALVIN C. GOODE

CITY MANAGER - FRANK FAIRBANKS

CITY ENGINEER - KENNY HARRIS, P.E.

APPROVALS

ENGINEERING SUPERVISOR — DATE 9/21/92

PUBLIC WORKS DIRECTOR — DATE

RECORD DRAWINGS
11-27-96
DATE

138154

MHC01383

MOREA·HALL engineering, inc.
1820 W. Maricopa Freeway
Phoenix, Arizona 85007
Phone: 602-258-4428
CIVIL • SANITARY • STRUCTURAL • SURVEY

EASI FILE CORP. IRVINE, CA | EFH 34

50-20

Kenney Aerial Mapping
1130 West Fillmore
Phoenix, AZ 85007
Phone: (602) 258-6471
Fax: (602) 340-1877

PHOTO DATE

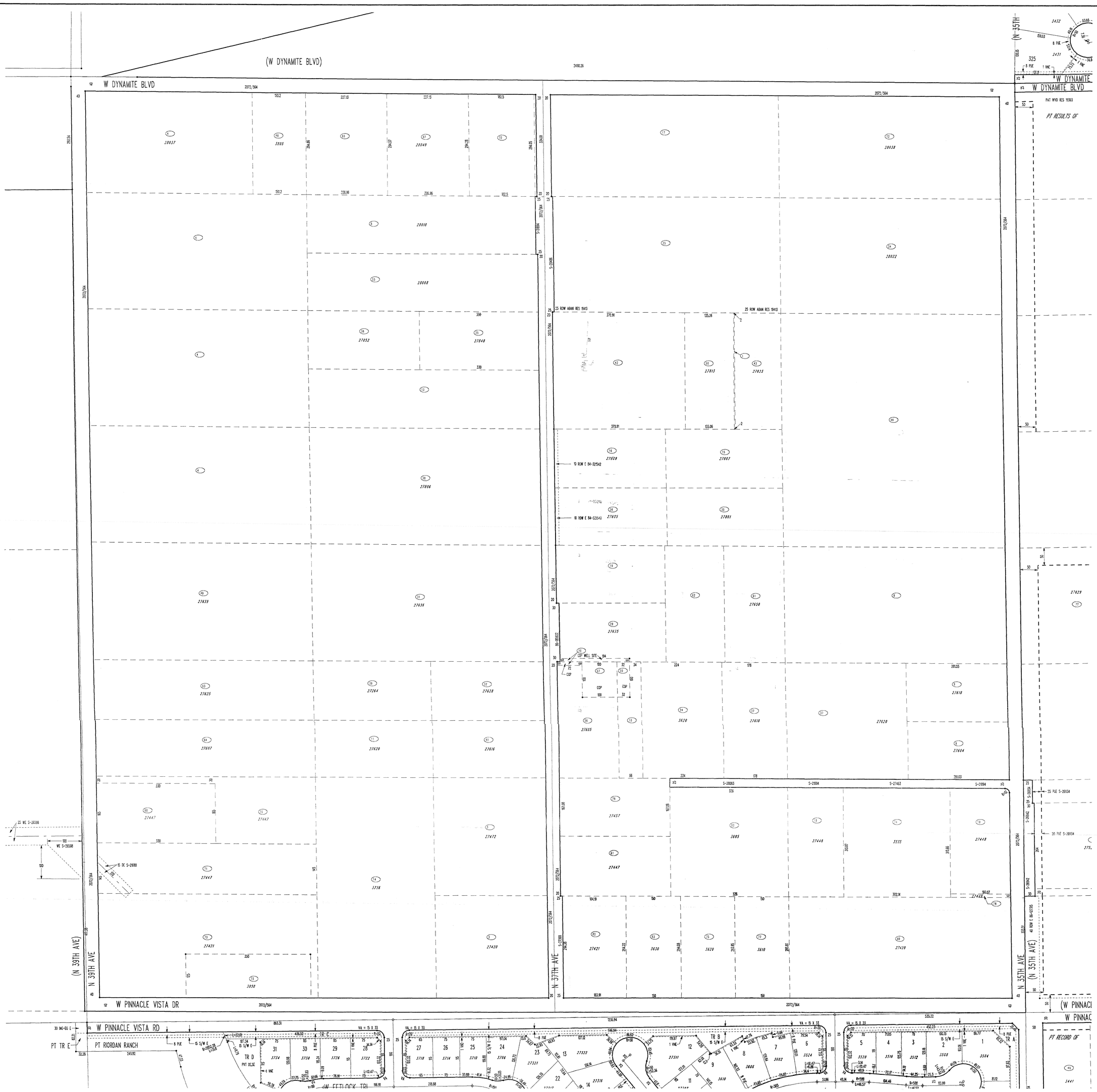
2-24-99

City of Phoenix

SCALE 1" = 100'

QUARTER SECTION NUMBER

50-20



NOTE:
THIS MAP IS TO BE USED FOR REFERENCE PURPOSES ONLY (DO NOT SCALE). THE CITY OF PHOENIX ACCEPTS NO LIABILITY FOR INFORMATION CONTAINED ON THIS MAP.
CITY OF PHOENIX GIS PRODUCT.

UNAPPROVED PROPERTY SPLIT
PARCEL IN SCALLOPED STREET PROGRAM
MAPPING SECTION FILE NUMBER
Z PARCELS THAT WERE COMBINED INTO ONE
HL DESIGNATION FOR HILLSIDE LOT
U.S. PATENT RESERVE EASEMENT 33' WIDE AROUND 5 ACRE PARCELS
U.S. PATENT RESERVE EASEMENT OTHER THAN 33' WIDE AROUND 5 ACRE PARCELS
RESUBDIVIDED LOT, DEDICATION OR RECORDING DATA CHANGED
SUBSTANDARD WIDTH OF A PRIVATE STREET DEDICATED TO THE PUBLIC
ABANDONED 3' PUE= WITHIN A SUBDIVISION
PROPERTY OWNED BY A.D.O.T
SURVEY MONUMENT SHOWN ON A SUBPLOT
SURVEY MONUMENT INSTALLED BY A CONSTRUCTION PROJECT
COP PROPERTY OWNED BY THE CITY OF PHOENIX

N 1/4 COR | GLO LOTS IN THIS Q.S. NONE | NE CORNER
CENTER | E 1/4 COR

ENGINEERING & ARCHITECTURAL SERVICES DEPARTMENT
QUARTER SECTION MAP SHOWING RIGHT OF WAY, PROPERTY & ADDRESSES
NE1/4 SEC.34,T.5N,R.2E., G & S.R.B. & M.
SCALE: 1" = 100'
PLOTTED: Jul 10 , 2002

No. 50-20

City of Phoenix