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ADDENDUM TO:

CAMELBACK RANCH FLOODPLAIN STUDY AND CONDITIONAL LOMR REQUEST

MAY, 1988

Prepared For:

WILLDEN INVESTMENT OPPORTUNITIES, INC.
4520 N. CENTRAL, #500
PHOENIX, AZ 85012

Prepared By:

Coe & Van Loo Consulting Engineers, Inc.
4550 North 12th Street
Phoenix, Arizona 85014
(602) 264-6831

Registered Professional Engineer (Civil)
CERTIFICATE NO. 10512
ASHOK C. PATEL
Date Signed 5/10/88
ARIZONA, U.S.A.

CVL-4-0148

COE & VAN LOO

Planning
Civil Engineering
Landscape Architecture
Hydrology
Sanitary Engineering
Surveying

FOUNDERS
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H.W. VAN LOO, P.E.

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E.H. McDONIE, P.E.
JACK A. LEAVITT, P.E., L.S.

May 10, 1988

Michael Baker, Jr. Inc.
Consulting Engineers
1420 Kings Street, 6th Floor
Alexandria, VA 22314

Attn: Dr. Chandra Pathak

Re: FEMA Case #88-09-25R
IA-RA-RS (316A)(3B)
Camelback Ranch
Conditional LOMR
Maricopa County, AZ (Community 040037)

Gentlemen:

With this letter, we are submitting a copy of an addendum to the report submitted to FEMA in January of 1988. This addendum addresses the items requested by FEMA with a "Data Request Checklist" dated April 18, 1988. To expedite processing, the attached addendum is being sent directly to Michael Baker, Jr., Inc. Consulting Engineers, FEMA's Technical Evaluation Contractor (TEC).

In phone conversations with the TEC, clarification was made about the items requested. Accordingly, this addendum should satisfy the "Required Data" items from the checklist.

The attached addendum includes:

1. Detailed description of the proposed interior drainage system.

2. Engineering analysis that demonstrates that no appreciable erosion of the levee embankment can be expected.

3. Engineering analysis that evaluates the embankment and foundation stability of the proposed levee system.

4. Engineering analysis that assesses future settlement of the levee system.

If you have any questions or comments, please call me or Mr. David Dust of my office at (602) 264-6831.

Very truly yours,

COE & VAN LOO
Consulting Engineers, Inc.

Ashok C. Patel, P.E. L.S
Senior Vice President
ACP/js
CVL-2-0799

Enclosure

cc: Mr. Ray Lenaburg, FEMA Region IX
Mr. William Judkins, FEMA
Mr. Dan Sagramoso, FCDMC
Mr. John Rodriguez, FCDMC
Mr. Paul Kienow, City of Phoenix
Mr. Fred Farr, Willden Invest.

CVL

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1.0 INTRODUCTION

This report is an addendum to the report titled "Camelback Ranch - Floodplain Study and Conditional LOMR Request" (dated January 1988). The above mentioned report was submitted to FEMA in January of 1988. This report is in response to FEMA's "Data Request Checklist" (Case #88-09-25R) dated April 18, 1988. The checklist is included as Appendix I.

2.0 PROPOSED FLOOD CONTROL AND DRAINAGE IMPROVEMENTS

The proposed flood control improvements for Camelback Ranch include the following:

A) A soil cement levee along the Agua Fria River and a soil cement levee with channel improvements along the New River;

B) Interior drainage facilities comprised of a system of retention basins, an open channel, and basin bleed-off systems.

The Flood Control District of Maricopa County is currently in the design phase of a New River channelization project that extends north from approximately Bethany Home Road to Olive Avenue. At approximately Bethany Home Road, the FCDMC channelization project will tie into the proposed Camelback Ranch improvements and the existing Glendale Municipal Airport improvements. The FCDMC channelization project is scheduled to move into the construction phase in September of 1988.

2.1 Interior Drainage Facilities

This section of the report addresses Items 7b and 7f of the checklist. Appendix II includes hydrologic and hydraulic analyses of the proposed interior drainage facilities.

The elevated Camelback Road divides the project site into a north and a south parcel, with respect to drainage. Approximately 175 acres of off-site drainage area contributes to the retention facilities located in the north parcel. However, Camelback Road and the existing R.I.D. Canal along 107th Avenue effectively prevents off-site flows from entering the south parcel (Ref. 1).

The proposed levee system will include interior drainage facilities with a minimum capacity for the 100-year 24-hour event generated on both on-site and adjacent off-site drainage areas. The proposed drainage facilities have been conservatively designed for the worse case scenario; that is, the propopsed interior drainage facilities will have capacity to drain the 100-year interior drainage event into the Agua Fria River, during a coincident 100-year flow event in the adjacent river.

The proposed interior drainage facility configuration for the project is shown in Exhibit A (Appendix V) and involves a system of retention basins, bleed-off systems, and an open channel. Hydrologic and hydraulic analyses for the proposed interior drainage facilities are included as Appendix II.

The hydrologic computer model TR-20 (SCS) was used to evaluate off-site and on-site flows corresponding to the 100

year - 24 hour precipitation event. The model was also used to evaluate the retention basin system. The results of the TR-20 model are summarized in Figure 1 and given in Appendix II.

The hydraulic computer model WSPG (Los Angeles County Flood Control District) was used to model the detention basin bleed-off pipe systems. The results of the WSPG model were used to develop the detention basin storage-discharge curves used in the TR-20 model (See Appendix II).

The proposed detention basin system involves gravity bleed-off lines for the basins north of Camelback Road and pump station for draining the south basin. The gravity bleed-off system for the north basins will not have closures, since the inlet inverts are set above the 100-year water surface elevations at the outlet. However, the pump station discharge line from the south Basin (#4) will include in line check valves (See Exhibit A).

2.2 Levee System

This section of the report addresses Items 7c through 7e of the checklist. Apendices III and IV contain the requested engineering analyses for the proposed levee system.

The proposed levee system is shown schematically in Exhibit A. As indicated in Exhibit A, the proposed levee system is protected by 8-foot thick soil cement bank protection, except along Campbell Road. The portion of the

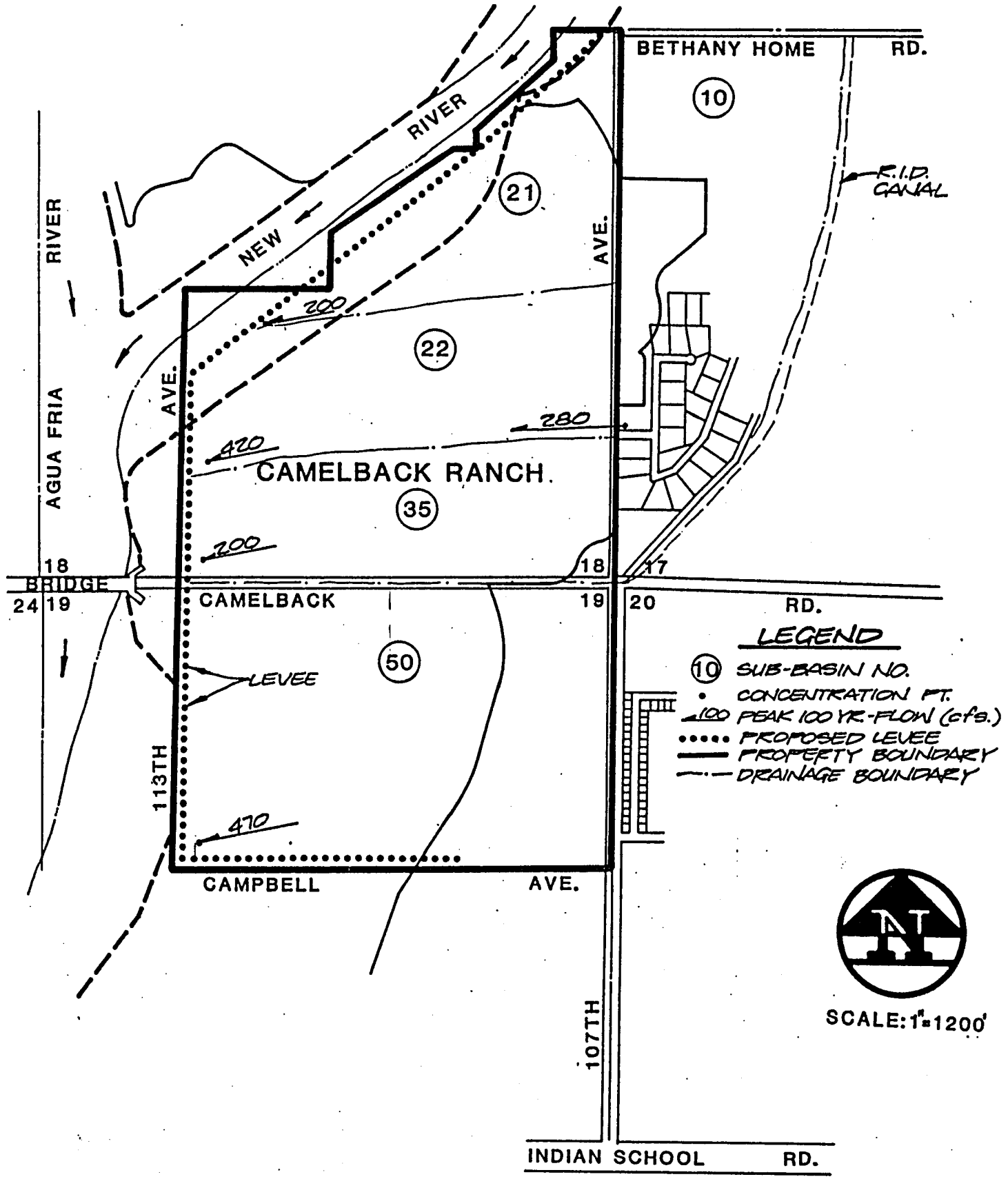

FIGURE 1: DRAINAGE MAP

proposed levee system adjacent to Campbell Road is an earthen embankment without soil cement, since this portion of the levee is in a dead water area and is not subject to high velocities.

Along the Agua Fria River, the proposed levee system is located on the east overbank outside of the designated floodway. This portion of the levee will only be impacted by relatively high magnitude flow events corresponding to releases from the Lake Pleasant Reservoir located approximately 20 miles upstream of the project site.

Along the New River, the proposed improvements include widening the existing main channel from approximately 400 feet to approximately 800 feet and construction of the soil cement levee. As indicated in the hydraulic analyses submitted in the main report (January 1988), the proposed improvements significantly reduces flow depths and velocities.

In response to Item 7c of the checklist, soil cement bank protection is highly resistant to erosion. In addition, the mass of soil cement bank protection and the relatively low permeability of soil cement bank protection enhance the stability of the proposed levee system. In addition, the levee system proposed as part of this project is consistent in design with the existing and future soil cement bank/levee projects (by the corps of Engineers and the FCDMC) upstream and downstream of the project site. Immediately upstream of the project site, the FCDMC is currently in the design phase

of the New River channelization project involving soil cement bank protection. Approximately 0.5 miles downstream of the project site, several miles of the Agua Fria River have been channelized using soil cement bank protection. In support of the toe down depths indicated in the Preliminary Levee Plans (Jan. 1988), local scour computations for the proposed levee system adjacent to the Agua Fria and New Rivers are included as Appendix III.

Included as part of this report is a "Geotechnical Investigation Report" (Appendix IV). The geotechnical report includes engineering analyses that evaluate embankment/foundation stability and the potential for settlement of the proposed levee system. The analyses presented in the "Geotechnical Investigation Report" are in accordance with Section 65.10 (b)(4) and (b)(5) of the NFIP regulations (Ref. 2).

3.0 SUMMARY/CONCLUSIONS

This addendum addresses items request by FEMA with a "Data Request Checklist" (dated April 18, 1988). Items 7b through 7f are requested in the aforementioned FEMA checklist. Items 7c through 7e are addressed in Section 2.2 of this report. Whereas, items 7b and 7f of the checklist are addressed in Section 2.1. In conclusion, the analyses presented in this report are in accordance with Section 65.10 of the NFIP regulations.

4.0 REFERENCES

1. Dooley-Jones & Associates, Inc., "Drainage Study and Conceptual Design, Vicinity of 107th Avenue, RID Canal and Bethany Home Road, FCD 84-32", Flood Control District of Maricopa County, August 14, 1985.
2. Federal Emergency Management Agency, "National Flood Insurance Program and Related Regulations", June, 1987.

APPENDIX I
CORRESPONDENCE

Federal Emergency Management Agency

Washington, D.C. 20472

APR 18 1989

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

IN REPLY REFER TO:
IA-RA-RS (316A) (3B)
Case # 88-09-25R

RE: Agua Fria River/New River
Maricopa County, Arizona

Mr. Ashok Patel, P.E., L.S.
Senior Vice President
Coe & Van Loo Consulting Engineers, Inc.
4550 North 12th Street
Phoenix, Arizona 85014-4291

Dear Mr. Patel:

This is in response to your request for a conditional Letter of Map Revision (LOMR) dated January 20, 1988. Our initial review of your request indicates that additional data are required in order to adequately review your request. The additional data required are listed on the enclosed checklist and should be submitted to us within 60 days of the date of this letter. If we do not receive the requested data within 60 days, your request for a conditional LOMR will be denied due to insufficient data.

You have provided the correct initial fee for this type of request. Please note that the initial fee is the minimum charge for a review of this type; additional costs could be required upon completion of our review and prior to issuance of a conditional LOMR, depending on the complexity of the required review. You will be notified of the estimated total processing cost if it is anticipated that, due to the extent of the review required, the total cost will exceed $1,500. In that situation, our review would be suspended pending written authorization from you to proceed.

If you have any questions concerning Federal Emergency Management Agency (FEMA) policy, or the National Flood Insurance Program in general, please contact our Regional Office staff in San Francisco, California, at (415) 923-7175, or Mr. William Judkins of my staff in Washington, D.C., at (202) 646-3458.

Sincerely,

John L. Matticks
Chief, Risk Studies Division
Federal Insurance Administration

Enclosure

Federal Emergency Management Agency

Washington, D.C. 20472

Case # 88-09-25R

DATA REQUEST CHECKLIST
FOR A CONDITIONAL LETTER OF MAP REVISION

Requestor: Mr. Ashok C. Patel, P.E., L.S. Date: April 18, 1988

The information checked below in Column 1 is required to process your request for a conditional Letter of Map Revision. Information checked in Column 2 has been received and should not be resubmitted unless specifically requested.

Re: Agua Fria River/New River
Maricopa County, Arizona

(1) REQ'D DATA	(2) REC'D DATA	
	X	1. A technical report entitled "Camelback Ranch, Floodplain Study and Conditional LOMR Request, January 1988," prepared by Coe & Van Loo Consulting Engineers, Inc.
	X	2. Printouts from a calibration model that duplicates the hydraulic computer model used to develop the 100-year flood profile along the New River and Agua Fria River, including full input and output listings.
	X	3. Printouts from a calibration model that duplicates the hydraulic computer model used to develop the 100-year floodway boundaries along the New River and Agua Fria River, including full input and output listings.
	X	4. Printouts from a hydraulic computer model representing the proposed 10-, 50-, 100-, and 500-year flood profiles along the New River and Agua Fria River, including full input and output listings and a zone determination. The original model should be modified to include proposed conditions as well as any encroachments that may have occurred since the original model was developed. In addition, the revised hydraulic analysis must be continued upstream and downstream of the revised area until the revised water-surface elevations tie into the existing 10-, 50-, 100-, and 500-year flood profiles.
	X	5. Printouts from a hydraulic computer model representing the proposed 100-year floodway boundaries along the New River and Agua Fria River, including full input and output listings. The original model should be modified to include proposed conditions as well as any encroachments that may have occurred since the original model was developed, with

(1) REQ'D DATA	(2) REC'D DATA	
		all input changes highlighted. The equal-conveyance reduction method should be used to compute the revised floodway limits unless agreements have been made with affected property owners to utilize a different method. The net effect of the proposed modifications, the encroachments made subsequent to the establishment of the original floodway, and the proposed floodway limits must not increase the water-surface elevations by more than 1.0 foot above the elevations computed in Item 2 and also must not exceed 1.0 foot above the new 100-year water-surface elevations computed in Item 4.
	X	6. A map of suitable scale and topographic definition showing:
		a. Delineations of the 100-and 500-year floodplain boundaries.
	X	b. Delineations of the 100-year floodway boundaries.
	X	c. The location and alignment of all cross sections used in the revised hydraulic model.
		The revised delineations must tie into the existing floodplain and floodway boundaries upstream and downstream of the revised reach. This information must be certified by a registered professional engineer.
X		7. Other: The technical report listed in Item 1 indicates a proposed levee system along the east bank of the Agua Fria River and the south bank of the New River. The 100-year water-surface elevations are contained in the channels of the two rivers by the levee system but exceed the elevation of the ground outside of the levee system. Therefore, the levee system must meet the minimum design and maintenance standards outlined in 44 CFR 65.10 of the enclosed National Flood Insurance Program (NFIP) regulations. Specifically, the following items listed below need to be addressed.
	X	a. Evidence must be submitted that shows the levee system meets the minimum freeboard requirements as outlined in Section 65.10(b)(1) of the NFIP regulations.
X		b. If drainage structures through the levee system are included in the overall design, closure devices that are structrual parts of the system during operation must be provided in accordance with Section 65.10(b)(2) of the NFIP regulations.

(1) REQ'D DATA	(2) REC'D DATA	
X		c. An engineering analysis must be submitted that demonstrates that no appreciable erosion of the levee embankment can be expected during the base flood. This analysis must be performed in accordance with Section 65.10(b)(3) of the NFIP regulations.
X		d. An engineering analysis must be prepared that evaluates the embankment and foundation stability of the levee system. This analysis must be performed in accordance with Section 65.10(b)(4) of the NFIP regulations.
X		e. An engineering analysis must be submitted which assesses the potential and magnitude of future losses of freeboard as a result of levee settlement of the proposed levee system. This analysis must be performed in accordance with Section 65.10(b)(5) of the NFIP regulations.
X		f. The proposed levee system creates a condition that prohibits local drainage and overland flow from the land adjacent to the proposed levee (exterior drainage) from entering the Agua Fria River and the New River. Information is required to indicate how the above-mentioned floodwaters will be controlled. This analysis must be performed in accordance with Section 654.10(b)(6) of the NIFP regulations.

APPENDIX II
INTERIOR DRAINAGE ANALYSES

CVL
COE & VAN LOO
ENGINEERING
ARCHITECTURE

Project Camelback Ranch
Project No. 1122-03
Sheet No. A of —
Calculated by DWD Date 5/88
Checked by Date

Appendix II contains:

a) Storage v.s. discharge table and a description of bleedoff system for each of the 4 Retention Basins;

b) Hydraulic analyses for the bleed-off systems for Basins 2 & 3;

c) TR-20 simulation for the 100 year-24 hour precipitation event, under proposed conditions.

NOTE:
The retention basins and bleed-off facilities are shown schematically in Exhibit A.

4550 NORTH 12TH STREET • PHOENIX, ARIZONA 85014 • PHONE (602) 264-6831

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COE & VAN LOO
ENGINEERING • ENGINEERING
LANDSCAPE ARCHITECTURE

Project Camelback Ranch
Project No. 1122-03
Sheet No. 1 of —
Calculated by DWD Date 5/88
Checked by _____ Date _____

Retention Basin # 1: (See Exhibit A for location)

Characteristics

24" • Bleedoff line to Basin #1
a) assuming inlet control
20' wide Broadcrested weir spillway
a) Crest elevation 1025.
b) C = 2.7

Storage Discharge Curve

WSEL	Q(cfs)	Retention Vol.
22.75	0	0.0001
23.75	4.5	1.75
24.75	13.	5.1
25.0	15.	6.0
26.0	74.	13.4

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Project Camelback Ranch
Project No. 1122-03
Sheet No. 2 of –
Calculated by DWD Date 5/88
Checked by _____ Date _____

36" Storm Drain System: Basin 2 to Outlet
(See Exhibit A for locations)

Characteristics:

- Manholes: 8 Pressure manholes:
  maximum spacing 440'
- Grate Inlet: Inv. 1021.0
  $K_e = 0.5$
- Length: 3560'

Rating Curve: from WSPG model (WS = 1019.8 @ outlet)

Inlet W.S.	Q (cfs)	Storage Volume (Basin 2) (Ac-ft)
21.	0	0
21.9	5.	
22.0	7.	4.1
22.2	10.	
22.4	12.	
22.6	15.	
22.7	17.	
22.9	20.	19.8
23.1	22.	
24.2	25.	35.4
25.0	28*	51.1
26.0	30*	66.8
28.	35	

* interpolated

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)

HEADING LINE NO 2 IS -

100 YEAR EVENT WSEL AT OUTLET IS 19.8

HEADING LINE NO 3 IS -

MAY 1988 (SD36A)

WSPG: 36" STORM DRAIN SYSTEM

Basin #2

WATER SURFACE PROFILE - ELEMENT CARD LISTING

```
ELEMENT NO   1 IS A SYSTEM OUTLET      *          *      *
                    U/S DATA   STATION    INVERT   SECT                                W S ELEV
                                 100.00    15.50    2                                   19.80

ELEMENT NO   2 IS A  WALL  EXIT                          *
                    U/S DATA   STATION    INVERT   SECT
                                 100.00    15.50    2

ELEMENT NO   3 IS A REACH              *          *      *
                    U/S DATA   STATION    INVERT   SECT                N                RADIUS  ANGLE  ANG PT  MAN H
                                 150.00    15.58    2                0.012                0.00   0.00   0.00     0

ELEMENT NO   4 IS A REACH              *          *      *
                    U/S DATA   STATION    INVERT   SECT                N                RADIUS  ANGLE  ANG PT  MAN H
                                 160.00    15.60    2                0.012                0.00  45.00   0.00     0

ELEMENT NO   5 IS A REACH              *          *      *
                    U/S DATA   STATION    INVERT   SECT                N                RADIUS  ANGLE  ANG PT  MAN H
                                3660.00    21.00    2                0.012                0.00   0.00   0.00     8

ELEMENT NO   6 IS A  WALL  ENTRANCE                      *
                    U/S DATA   STATION    INVERT   SECT               FP
                                3660.00    21.00    2               0.500

ELEMENT NO   7 IS A SYSTEM HEADWORKS                     *                  *
                    U/S DATA   STATION    INVERT   SECT                                W S ELEV
                                3660.00    21.00    2                                    0.00
NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING
```

CARD CODE	SECT NO	CHN TYPE	NO OF PIERS	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	2	4			3.00														

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
100.00	15.50	4.300	19.800	5.0	0.71	0.008	19.808	0.00	0.700	3.00	0.00	0.00	0	0.00
WALL EXIT												0.00		
100.00	15.50	4.301	19.801	5.0	0.71	0.008	19.809	0.00	0.700	3.00	0.00	0.00	0	0.00
50.00	0.00160					.000048	0.00		0.843			0.00		
150.00	15.58	4.223	19.803	5.0	0.71	0.008	19.811	0.00	0.700	3.00	0.00	0.00	0	0.00
10.00	0.00200					.000048	0.00		0.796			0.00		
160.00	15.60	4.205	19.805	5.0	0.71	0.008	19.813	0.00	0.700	3.00	0.00	0.00	0	0.00
806.42	0.00154					.000047	0.04		0.851			0.00		
966.42	16.84	3.000	19.844	5.0	0.71	0.008	19.852	0.00	0.700	3.00	0.00	0.00	0	0.00
184.93	0.00154					.000044	0.01		0.851			0.00		
1151.35	17.13	2.721	19.851	5.0	0.74	0.009	19.860	0.00	0.700	3.00	0.00	0.00	0	0.00
106.79	0.00154					.000043	0.00		0.851			0.00		
1258.14	17.29	2.560	19.854	5.0	0.78	0.009	19.863	0.00	0.700	3.00	0.00	0.00	0	0.00
88.27	0.00154					.000047	0.00		0.851			0.00		
1346.41	17.43	2.427	19.858	5.0	0.82	0.010	19.868	0.00	0.700	3.00	0.00	0.00	0	0.00
77.76	0.00154					.000051	0.00		0.851			0.00		
1424.17	17.55	2.310	19.861	5.0	0.86	0.011	19.872	0.00	0.700	3.00	0.00	0.00	0	0.00
69.91	0.00154					.000057	0.00		0.851			0.00		
1494.08	17.66	2.205	19.863	5.0	0.90	0.013	19.876	0.00	0.700	3.00	0.00	0.00	0	0.00
64.06	0.00154					.000064	0.00		0.851			0.00		
1558.14	17.76	2.199	19.866	5.0	0.94	0.014	19.880	0.00	0.700	3.00	0.00	0.00	0	0.00
59.55	0.00154					.000072	0.00		0.851			0.00		

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
1617.69	17.85	2.020	19.869	5.0	0.99	0.015	19.884	0.00	0.700		3.00	0.00	0.00	0	0.00
55.72	0.00154					.000080	0.00			0.851			0.00		
1673.41	17.93	1.937	19.872	5.0	1.04	0.017	19.889	0.00	0.700		3.00	0.00	0.00	0	0.00
52.56	0.00154					.000090	0.00			0.851			0.00		
1725.97	18.02	1.859	19.875	5.0	1.09	0.018	19.893	0.00	0.700		3.00	0.00	0.00	0	0.00
49.39	0.00154					.000102	0.01			0.851			0.00		
1775.36	18.09	1.786	19.879	5.0	1.14	0.020	19.899	0.00	0.700		3.00	0.00	0.00	0	0.00
46.93	0.00154					.000116	0.01			0.851			0.00		
1822.29	18.16	1.717	19.882	5.0	1.19	0.022	19.904	0.00	0.700		3.00	0.00	0.00	0	0.00
44.46	0.00154					.000131	0.01			0.851			0.00		
1866.75	18.23	1.652	19.886	5.0	1.25	0.024	19.910	0.00	0.700		3.00	0.00	0.00	0	0.00
42.71	0.00154					.000148	0.01			0.851			0.00		
1909.46	18.30	1.590	19.889	5.0	1.31	0.027	19.916	0.00	0.700		3.00	0.00	0.00	0	0.00
41.69	0.00154					.000169	0.01			0.851			0.00		
1951.15	18.36	1.530	19.894	5.0	1.38	0.030	19.924	0.00	0.700		3.00	0.00	0.00	0	0.00
39.23	0.00154					.000191	0.01			0.851			0.00		
1990.38	18.42	1.474	19.898	5.0	1.45	0.032	19.930	0.00	0.700		3.00	0.00	0.00	0	0.00
37.51	0.00154					.000217	0.01			0.851			0.00		
2027.89	18.48	1.421	19.903	5.0	1.52	0.036	19.939	0.00	0.700		3.00	0.00	0.00	0	0.00
37.35	0.00154					.000246	0.01			0.851			0.00		
2065.24	18.54	1.369	19.909	5.0	1.59	0.039	19.948	0.00	0.700		3.00	0.00	0.01	0	0.00
35.69	0.00154					.000280	0.01			0.851			0.00		

WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH EASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZP		
2100.93	18.60	1.320	19.915	5.0	1.67	0.043	19.958	0.00	0.700		3.00	0.00	0.00	0	0.00
34.87	0.00154					.000318	0.01			0.851			0.00		
2135.80	18.65	1.273	19.922	5.0	1.75	0.048	19.970	0.00	0.700		3.00	0.00	0.00	0	0.00
34.10	0.00154					.000363	0.01			0.851			0.00		
2169.90	18.70	1.228	19.929	5.0	1.83	0.052	19.981	0.00	0.700		3.00	0.00	0.00	0	0.00
33.45	0.00154					.000413	0.01			0.851			0.00		
2203.35	18.75	1.185	19.938	5.0	1.92	0.058	19.996	0.00	0.700		3.00	0.00	0.00	0	0.00
32.88	0.00154					.000471	0.02			0.851			0.00		
2236.23	18.80	1.144	19.948	5.0	2.02	0.063	20.011	0.00	0.700		3.00	0.00	0.00	0	0.00
33.48	0.00154					.000537	0.02			0.851			0.00		
2269.71	18.86	1.104	19.959	5.0	2.12	0.070	20.029	0.00	0.700		3.00	0.00	0.00	0	0.00
33.37	0.00154					.000613	0.02			0.851			0.00		
2303.08	18.91	1.066	19.973	5.0	2.22	0.077	20.050	0.00	0.700		3.00	0.00	0.00	0	0.00
34.76	0.00154					.000699	0.02			0.851			0.00		
2337.84	18.96	1.029	19.989	5.0	2.33	0.084	20.073	0.00	0.700		3.00	0.00	0.00	0	0.00
35.64	0.00154					.000797	0.03			0.851			0.00		
2373.48	19.02	0.994	20.009	5.0	2.44	0.093	20.102	0.00	0.700		3.00	0.00	0.00	0	0.00
39.09	0.00154					.000910	0.04			0.851			0.00		
2412.57	19.08	0.960	20.036	5.0	2.56	0.102	20.138	0.00	0.700		3.00	0.00	0.00	0	0.00
43.30	0.00154					.001039	0.04			0.851			0.00		
2455.87	19.14	0.928	20.071	5.0	2.69	0.112	20.183	0.00	0.700		3.00	0.00	0.00	0	0.00
58.37	0.00154					.001186	0.07			0.851			0.00		

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
2514.24	19.23	0.896	20.129	5.0	2.82	0.123	20.252	0.00	0.700	3.00	0.00	0.00	0	0.00
94.19	0.00154					.001355	0.13		0.851			0.00		
2608.43	19.38	0.866	20.244	5.0	2.96	0.136	20.380	0.00	0.700	3.00	0.00	0.00	0	0.00
179.93	0.00154					.001498	0.27		0.851			0.00		
2788.36	19.66	0.851	20.507	5.0	3.03	0.143	20.650	0.00	0.700	3.00	0.00	0.00	0	0.00
871.64	0.00154					.001551	1.35		0.851			0.00		
3660.00	21.00	0.851	21.851	5.0	3.03	0.143	21.994	0.00	0.700	3.00	0.00	0.00	0	0.00
WALL ENTRANCE												0.00		
3660.00	21.00	0.852	21.852	5.0	3.02	0.142	21.994	0.00	0.700	3.00	0.00	0.00	0	0.00

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
100.00	15.50	4.300	19.800	7.0	0.99	0.015	19.815	0.00	0.832		3.00	0.00	0.00	0	0.00
WALL EXIT													0.00		
100.00	15.50	4.301	19.801	7.0	0.99	0.015	19.816	0.00	0.832		3.00	0.00	0.00	0	0.00
50.00	0.00160					.000094	0.00			1.004			0.00		
150.00	15.58	4.226	19.806	7.0	0.99	0.015	19.821	0.00	0.832		3.00	0.00	0.00	0	0.00
10.00	0.00200					.000094	0.00			0.950			0.00		
160.00	15.60	4.209	19.809	7.0	0.99	0.015	19.824	0.00	0.832		3.00	0.00	0.00	0	0.00
835.14	0.00154					.000093	0.08			1.014			0.00		
995.14	16.89	3.000	19.889	7.0	0.99	0.015	19.904	0.00	0.832		3.00	0.00	0.00	0	0.00
189.85	0.00154					.000087	0.02			1.014			0.00		
1184.99	17.18	2.721	19.903	7.0	1.04	0.017	19.920	0.00	0.832		3.00	0.00	0.00	0	0.00
109.27	0.00154					.000085	0.01			1.014			0.00		
1294.26	17.35	2.560	19.910	7.0	1.09	0.018	19.928	0.00	0.832		3.00	0.00	0.00	0	0.00
90.39	0.00154					.000092	0.01			1.014			0.00		
1384.65	17.49	2.427	19.917	7.0	1.14	0.020	19.937	0.00	0.832		3.00	0.00	0.00	0	0.00
79.74	0.00154					.000101	0.01			1.014			0.00		
1464.39	17.61	2.310	19.923	7.0	1.20	0.022	19.945	0.00	0.832		3.00	0.00	0.00	0	0.00
71.84	0.00154					.000112	0.01			1.014			0.00		
1536.23	17.72	2.205	19.929	7.0	1.26	0.025	19.954	0.00	0.832		3.00	0.00	0.00	0	0.00
65.98	0.00154					.000125	0.01			1.014			0.00		
1602.21	17.83	2.109	19.934	7.0	1.32	0.027	19.961	0.00	0.832		3.00	0.00	0.00	0	0.00
61.53	0.00154					.000140	0.01			1.014			0.00		

F3515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
1663.74	17.92	2.020	19.940	7.0	1.38	0.030	19.970	0.00	0.832	3.00	0.00	0.00	0	0.00
57.78	0.00154					.000157	0.01		1.014			0.00		
1721.52	18.01	1.937	19.946	7.0	1.45	0.033	19.979	0.00	0.832	3.00	0.00	0.00	0	0.00
54.74	0.00154					.000178	0.01		1.014			0.00		
1776.26	18.09	1.859	19.953	7.0	1.52	0.036	19.989	0.00	0.832	3.00	0.00	0.00	0	0.00
51.70	0.00154					.000200	0.01		1.014			0.00		
1827.96	18.17	1.786	19.960	7.0	1.59	0.039	19.999	0.00	0.832	3.00	0.00	0.00	0	0.00
49.41	0.00154					.000227	0.01		1.014			0.00		
1877.37	18.25	1.717	19.967	7.0	1.67	0.043	20.010	0.00	0.832	3.00	0.00	0.00	0	0.00
47.15	0.00154					.000256	0.01		1.014			0.00		
1924.52	18.32	1.652	19.975	7.0	1.75	0.048	20.023	0.00	0.832	3.00	0.00	0.00	0	0.00
45.69	0.00154					.000290	0.01		1.014			0.00		
1970.21	18.39	1.590	19.983	7.0	1.84	0.053	20.036	0.00	0.832	3.00	0.00	0.00	0	0.00
45.11	0.00154					.000329	0.01		1.014			0.00		
2015.32	18.46	1.530	19.993	7.0	1.93	0.058	20.051	0.00	0.832	3.00	0.00	0.00	0	0.00
42.95	0.00154					.000374	0.02		1.014			0.00		
2058.27	18.53	1.474	20.003	7.0	2.02	0.064	20.067	0.00	0.832	3.00	0.00	0.00	0	0.00
41.71	0.00154					.000425	0.02		1.014			0.00		
2099.98	18.59	1.421	20.014	7.0	2.12	0.070	20.084	0.00	0.832	3.00	0.00	0.00	0	0.00
42.45	0.00154					.000483	0.02		1.014			0.00		
2142.43	18.66	1.369	20.028	7.0	2.23	0.077	20.105	0.00	0.832	3.00	0.00	0.00	0	0.00
41.56	0.00154					.000549	0.02		1.014			0.00		

FC515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
2183.99	18.72	1.320	20.043	7.0	2.33	0.085	20.128	0.00	0.832		3.00	0.00	0.00	0	0.00
41.97	0.00154					.000625	0.03			1.014			0.00		
2225.96	18.79	1.273	20.061	7.0	2.45	0.093	20.154	0.00	0.832		3.00	0.00	0.00	0	0.00
42.91	0.00154					.000711	0.03			1.014			0.00		
2268.87	18.85	1.228	20.082	7.0	2.57	0.102	20.184	0.00	0.832		3.00	0.00	0.00	0	0.00
44.71	0.00154					.000810	0.04			1.014			0.00		
2313.58	18.92	1.185	20.108	7.0	2.69	0.113	20.221	0.00	0.832		3.00	0.00	0.00	0	0.00
48.00	0.00154					.000924	0.04			1.014			0.00		
2361.58	19.00	1.144	20.141	7.0	2.83	0.124	20.265	0.00	0.832		3.00	0.00	0.00	0	0.00
56.31	0.00154					.001053	0.06			1.014			0.00		
2417.89	19.08	1.104	20.188	7.0	2.96	0.136	20.324	0.00	0.832		3.00	0.00	0.00	0	0.00
71.16	0.00154					.001200	0.09			1.014			0.00		
2489.05	19.19	1.066	20.260	7.0	3.11	0.150	20.410	0.00	0.832		3.00	0.00	0.00	0	0.00
126.76	0.00154					.001369	0.17			1.014			0.00		
2615.81	19.39	1.029	20.418	7.0	3.26	0.165	20.583	0.00	0.832		3.00	0.00	0.00	0	0.00
201.20	0.00154					.001503	0.30			1.014			0.00		
2817.01	19.70	1.014	20.714	7.0	3.33	0.172	20.886	0.00	0.832		3.00	0.00	0.00	0	0.00
842.99	0.00154					.001548	1.30			1.014			0.00		
3660.00	21.00	1.014	22.014	7.0	3.33	0.172	22.186	0.00	0.832		3.00	0.00	0.00	0	0.00
WALL ENTRANCE													0.00		
3660.00	21.00	1.015	22.015	7.0	3.33	0.172	22.187	0.00	0.832		3.00	0.00	0.00	0	0.00

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
100.00	15.50	4.300	19.800	10.0	1.41	0.031	19.831	0.00	1.000		3.00	0.00	0.00	0	0.00
WALL EXIT													0.00		
100.00	15.50	4.301	19.801	10.0	1.41	0.031	19.832	0.00	1.000		3.00	0.00	0.00	0	0.00
50.00	0.00160					.000192	0.01			1.216			0.00		
150.00	15.58	4.231	19.811	10.0	1.41	0.031	19.842	0.00	1.000		3.00	0.00	0.00	0	0.00
10.00	0.00200					.000192	0.00			1.144			0.00		
160.00	15.60	4.217	19.817	10.0	1.41	0.031	19.848	0.00	1.000		3.00	0.00	0.00	0	0.00
902.79	0.00154					.000190	0.17			1.230			0.00		
1062.79	16.99	3.000	19.993	10.0	1.41	0.031	20.024	0.00	1.000		3.00	0.00	0.00	0	0.00
201.32	0.00154					.000178	0.04			1.230			0.00		
1264.11	17.30	2.721	20.025	10.0	1.48	0.034	20.059	0.00	1.000		3.00	0.00	0.00	0	0.00
115.06	0.00154					.000174	0.02			1.230			0.00		
1379.17	17.48	2.560	20.041	10.0	1.56	0.038	20.079	0.00	1.000		3.00	0.00	0.00	0	0.00
95.36	0.00154					.000188	0.02			1.230			0.00		
1474.53	17.63	2.427	20.055	10.0	1.63	0.041	20.096	0.00	1.000		3.00	0.00	0.00	0	0.00
84.45	0.00154					.000207	0.02			1.230			0.00		
1558.98	17.76	2.310	20.069	10.0	1.71	0.045	20.114	0.00	1.000		3.00	0.00	0.00	0	0.00
76.45	0.00154					.000229	0.02			1.230			0.00		
1635.43	17.88	2.205	20.082	10.0	1.80	0.050	20.132	0.00	1.000		3.00	0.00	0.00	0	0.00
70.69	0.00154					.000255	0.02			1.230			0.00		
1706.12	17.99	2.109	20.095	10.0	1.88	0.055	20.150	0.00	1.000		3.00	0.00	0.00	0	0.00
66.46	0.00154					.000286	0.02			1.230			0.00		

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
1772.58	18.09	2.020	20.108	10.0	1.97	0.061	20.169	0.00	1.000		3.00	0.00	0.00	0	0.00
63.01	0.00154					.000322	0.02			1.230			0.00		
1835.59	18.18	1.937	20.122	10.0	2.07	0.067	20.189	0.00	1.000		3.00	0.00	0.00	0	0.00
60.44	0.00154					.000362	0.02			1.230			0.00		
1896.03	18.28	1.859	20.138	10.0	2.17	0.073	20.211	0.00	1.000		3.00	0.00	0.00	0	0.00
57.92	0.00154					.000409	0.02			1.230			0.00		
1953.95	18.37	1.786	20.154	10.0	2.28	0.081	20.235	0.00	1.000		3.00	0.00	0.00	0	0.00
56.39	0.00154					.000462	0.03			1.230			0.00		
2010.34	18.45	1.717	20.172	10.0	2.39	0.089	20.261	0.00	1.000		3.00	0.00	0.00	0	0.00
55.06	0.00154					.000523	0.03			1.230			0.00		
2065.40	18.54	1.652	20.192	10.0	2.51	0.098	20.290	0.00	1.000		3.00	0.00	0.00	0	0.00
55.00	0.00154					.000593	0.03			1.230			0.00		
2120.40	18.62	1.590	20.215	10.0	2.63	0.107	20.322	0.00	1.000		3.00	0.00	0.00	0	0.00
56.59	0.00154					.000672	0.04			1.230			0.00		
2176.99	18.71	1.530	20.242	10.0	2.76	0.118	20.360	0.00	1.000		3.00	0.00	0.00	0	0.00
56.67	0.00154					.000764	0.04			1.230			0.00		
2233.66	18.80	1.474	20.274	10.0	2.89	0.130	20.404	0.00	1.000		3.00	0.00	0.00	0	0.00
59.20	0.00154					.000867	0.05			1.230			0.00		
2292.86	18.89	1.421	20.312	10.0	3.03	0.143	20.455	0.00	1.000		3.00	0.00	0.00	0	0.00
67.65	0.00154					.000985	0.07			1.230			0.00		
2360.51	18.99	1.369	20.364	10.0	3.18	0.157	20.521	0.00	1.000		3.00	0.00	0.00	0	0.00
78.82	0.00154					.001120	0.09			1.230			0.00		

FC515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
2439.33	19.12	1.320	20.437	10.0	3.34	0.173	20.610	0.00	1.000	3.00	0.00	0.00	0	0.00
110.98	0.00154					.001275	0.14		1.230			0.00		
2550.31	19.29	1.273	20.561	10.0	3.50	0.190	20.751	0.00	1.000	3.00	0.00	0.00	0	0.00
262.00	0.00154					.001449	0.38		1.230			0.00		
2812.31	19.69	1.230	20.923	10.0	3.66	0.209	21.132	0.00	1.000	3.00	0.00	0.00	0	0.00
847.69	0.00154					.001549	1.31		1.230			0.00		
3660.00	21.00	1.230	22.230	10.0	3.66	0.209	22.439	0.00	1.000	3.00	0.00	0.00	0	0.00
WALL ENTRANCE												0.00		
3660.00	21.00	1.231	22.231	10.0	3.66	0.208	22.439	0.00	1.000	3.00	0.00	0.00	0	0.00

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
100.00	15.50	4.300	19.800	12.0	1.70	0.045	19.845	0.00	1.100		3.00	0.00	0.00	0	0.00
WALL EXIT													0.00		
100.00	15.50	4.301	19.801	12.0	1.70	0.045	19.846	0.00	1.100		3.00	0.00	0.00	0	0.00
50.00	0.00160					.000276	0.01			1.346			0.00		
150.00	15.58	4.235	19.815	12.0	1.70	0.045	19.860	0.00	1.100		3.00	0.00	0.00	0	0.00
10.00	0.00200					.000276	0.00			1.265			0.00		
160.00	15.60	4.224	19.824	12.0	1.70	0.045	19.869	0.00	1.100		3.00	0.00	0.00	0	0.00
969.73	0.00154					.000274	0.27			1.360			0.00		
1129.73	17.10	3.000	20.096	12.0	1.70	0.045	20.141	0.00	1.100		3.00	0.00	0.00	0	0.00
212.52	0.00154					.000256	0.05			1.360			0.00		
1342.25	17.42	2.721	20.145	12.0	1.78	0.049	20.194	0.00	1.100		3.00	0.00	0.00	0	0.00
120.68	0.00154					.000249	0.03			1.360			0.00		
1462.93	17.61	2.560	20.170	12.0	1.87	0.054	20.224	0.00	1.100		3.00	0.00	0.00	0	0.00
100.24	0.00154					.000270	0.03			1.360			0.00		
1563.17	17.77	2.427	20.192	12.0	1.96	0.060	20.252	0.00	1.100		3.00	0.00	0.00	0	0.00
89.15	0.00154					.000297	0.03			1.360			0.00		
1652.32	17.90	2.310	20.213	12.0	2.05	0.066	20.279	0.00	1.100		3.00	0.00	0.00	0	0.00
81.17	0.00154					.000339	0.03			1.360			0.00		
1733.49	18.03	2.205	20.233	12.0	2.15	0.072	20.305	0.00	1.100		3.00	0.00	0.00	0	0.00
75.58	0.00154					.000369	0.03			1.360			0.00		
1809.07	18.14	2.109	20.254	12.0	2.26	0.079	20.333	0.00	1.100		3.00	0.00	0.00	0	0.00
71.73	0.00154					.000412	0.03			1.365			0.00		

WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA / ZR	BASE/ ID NO.	ZL	NO PIER	AVBPR
1880.80	18.26	2.020	20.275	12.0	2.37	0.087	20.362	0.00	1.100	3.00	0.00	0.00	0	0.00
68.82	0.00154					.000463	0.03		1.360			0.00		
1949.62	18.36	1.937	20.298	12.0	2.49	0.096	20.394	0.00	1.100	3.00	0.00	0.00	0	0.00
67.01	0.00154					.000522	0.03		1.360			0.00		
2016.63	18.46	1.859	20.324	12.0	2.61	0.106	20.430	0.00	1.100	3.00	0.00	0.00	0	0.00
65.47	0.00154					.000589	0.04		1.360			0.00		
2082.10	18.57	1.786	20.352	12.0	2.73	0.116	20.468	0.00	1.100	3.00	0.00	0.00	0	0.00
65.43	0.00154					.000666	0.04		1.360			0.00		
2147.53	18.67	1.717	20.384	12.0	2.87	0.128	20.512	0.00	1.100	3.00	0.00	0.00	0	0.00
66.18	0.00154					.000754	0.05		1.360			0.00		
2213.71	18.77	1.652	20.421	12.0	3.01	0.140	20.561	0.00	1.100	3.00	0.00	0.00	0	0.00
69.60	0.00154					.000854	0.06		1.360			0.00		
2283.31	18.88	1.590	20.466	12.0	3.15	0.155	20.621	0.00	1.100	3.00	0.00	0.00	0	0.00
77.51	0.00154					.000968	0.08		1.360			0.00		
2360.82	19.00	1.530	20.526	12.0	3.31	0.170	20.696	0.00	1.100	3.00	0.00	0.00	0	0.00
87.81	0.00154					.001099	0.10		1.360			0.00		
2448.63	19.13	1.474	20.605	12.0	3.47	0.187	20.792	0.00	1.100	3.00	0.00	0.00	0	0.00
116.49	0.00154					.001248	0.15		1.360			0.00		
2565.12	19.31	1.421	20.732	12.0	3.64	0.206	20.938	0.00	1.100	3.00	0.00	0.00	0	0.00
253.63	0.00154					.001419	0.36		1.360			0.00		
2818.75	19.70	1.369	21.071	12.0	3.82	0.226	21.297	0.00	1.100	3.00	0.00	0.00	0	0.00
341.58	0.00154					.001529	0.52		1.360			0.00		

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
3160.33	20.23	1.360	21.590	12.0	3.85	0.230	21.820	0.00	1.100	3.00	0.00	0.00	0	0.00
499.67	0.00154					.001548	0.77		1.360			0.00		
3660.00	21.00	1.360	22.360	12.0	3.85	0.230	22.590	0.00	1.100	3.00	0.00	0.00	0	0.00
WALL ENTRANCE												0.00		
3660.00	21.00	1.361	22.361	12.0	3.85	0.230	22.591	0.00	1.100	3.00	0.00	0.00	0	0.00

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
100.00	15.50	4.300	19.800	15.0	2.12	0.073	19.870	0.00	1.235	3.00	0.00	0.00	0	0.00
WALL EXIT												0.00		
100.00	15.50	4.301	19.801	15.0	2.12	0.070	19.871	0.00	1.235	3.00	0.00	0.00	0	0.00
50.00	0.00160					.000431	0.02		1.532			0.00		
150.00	15.58	4.243	19.823	15.0	2.12	0.070	19.893	0.00	1.235	3.00	0.00	0.00	0	0.00
10.00	0.00200					.000431	0.00		1.435			0.00		
160.00	15.60	4.237	19.837	15.0	2.12	0.070	19.907	0.00	1.235	3.00	0.00	0.00	0	0.00
1120.18	0.00154					.000428	0.48		1.550			0.00		
1280.18	17.33	3.000	20.328	15.0	2.12	0.070	20.398	0.00	1.235	3.00	0.00	0.00	0	0.00
237.14	0.00154					.000400	0.09		1.550			0.00		
1517.32	17.69	2.721	20.415	15.0	2.23	0.077	20.492	0.00	1.235	3.00	0.00	0.00	0	0.00
132.98	0.00154					.000399	0.05		1.550			0.00		
1650.30	17.90	2.560	20.460	15.0	2.33	0.085	20.545	0.00	1.235	3.00	0.00	0.00	0	0.00
111.13	0.00154					.000422	0.05		1.550			0.00		
1761.43	18.07	2.427	20.498	15.0	2.45	0.093	20.591	0.00	1.235	3.00	0.00	0.00	0	0.00
99.87	0.00154					.000464	0.05		1.550			0.00		
1861.30	18.22	2.310	20.535	15.0	2.57	0.102	20.637	0.00	1.235	3.00	0.00	0.00	0	0.00
92.24	0.00154					.000515	0.05		1.550			0.00		
1953.54	18.37	2.205	20.572	15.0	2.69	0.113	20.685	0.00	1.235	3.00	0.00	0.00	0	0.00
87.59	0.00154					.000575	0.05		1.550			0.00		
2041.13	18.50	2.109	20.612	15.0	2.82	0.124	20.736	0.00	1.235	3.00	0.00	0.00	0	0.00
85.29	0.00154					.000645	0.06		1.550			0.00		

F6515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
2126.42	18.63	2.020	20.654	15.0	2.96	0.136	20.790	0.00	1.235	3.00	0.00	0.00	0	0.00
84.75	0.00154					.000724	0.06		1.550			0.00		
2211.17	18.77	1.937	20.702	15.0	3.11	0.150	20.852	0.00	1.235	3.00	0.00	0.00	0	0.00
86.66	0.00154					.000816	0.07		1.550			0.00		
2297.83	18.90	1.859	20.758	15.0	3.26	0.165	20.923	0.00	1.235	3.00	0.00	0.00	0	0.00
90.80	0.00154					.000921	0.08		1.550			0.00		
2388.63	19.04	1.786	20.825	15.0	3.42	0.181	21.006	0.00	1.235	3.00	0.00	0.00	0	0.00
101.22	0.00154					.001040	0.11		1.550			0.00		
2489.85	19.19	1.717	20.912	15.0	3.58	0.199	21.111	0.00	1.235	3.00	0.00	0.00	0	0.00
123.30	0.00154					.001177	0.15		1.550			0.00		
2613.15	19.38	1.652	21.037	15.0	3.76	0.219	21.256	0.00	1.235	3.00	0.00	0.00	0	0.00
192.01	0.00154					.001335	0.26		1.550			0.00		
2805.16	19.68	1.590	21.271	15.0	3.94	0.241	21.512	0.00	1.235	3.00	0.00	0.00	0	0.00
384.28	0.00154					.001480	0.57		1.550			0.00		
3189.44	20.27	1.550	21.824	15.0	4.07	0.257	22.081	0.00	1.235	3.00	0.00	0.00	0	0.00
470.56	0.00154					.001543	0.73		1.550			0.00		
3660.00	21.00	1.550	22.550	15.0	4.07	0.257	22.807	0.00	1.235	3.00	0.00	0.00	0	0.00
WALL ENTRANCE												0.00		
3660.00	21.00	1.551	22.551	15.0	4.07	0.257	22.808	0.00	1.235	3.00	0.00	0.00	0	0.00

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
100.00	15.50	4.300	19.800	17.0	2.40	0.090	19.890	0.00	1.318		3.00	0.00	0.00	0	0.00
WALL EXIT													0.00		
100.00	15.50	4.301	19.801	17.0	2.40	0.090	19.891	0.00	1.318		3.00	0.00	0.00	0	0.00
50.00	0.00160					.000554	0.03			1.653			0.00		
150.00	15.58	4.249	19.829	17.0	2.40	0.090	19.919	0.00	1.318		3.00	0.00	0.00	0	0.00
10.00	0.00200					.000554	0.01			1.545			0.00		
160.00	15.60	4.247	19.847	17.0	2.40	0.090	19.937	0.00	1.318		3.00	0.00	0.00	0	0.00
1273.40	0.00154					.000549	0.70			1.672			0.00		
1433.40	17.57	3.000	20.565	17.0	2.40	0.090	20.655	0.00	1.318		3.00	0.00	0.00	0	0.00
261.47	0.00154					.000514	0.13			1.672			0.00		
1694.87	17.97	2.721	20.689	17.0	2.52	0.099	20.788	0.00	1.318		3.00	0.00	0.00	0	0.00
145.05	0.00154					.000501	0.07			1.672			0.00		
1839.92	18.19	2.560	20.752	17.0	2.65	0.109	20.861	0.00	1.318		3.00	0.00	0.00	0	0.00
122.07	0.00154					.000542	0.07			1.672			0.00		
1961.99	18.38	2.427	20.807	17.0	2.77	0.120	20.927	0.00	1.318		3.00	0.00	0.00	0	0.00
111.02	0.00154					.000597	0.07			1.672			0.00		
2073.01	18.55	2.310	20.862	17.0	2.91	0.131	20.993	0.00	1.318		3.00	0.00	0.00	0	0.00
104.30	0.00154					.000662	0.07			1.672			0.00		
2177.31	18.71	2.205	20.918	17.0	3.05	0.145	21.063	0.00	1.318		3.00	0.00	0.00	0	0.00
101.43	0.00154					.000739	0.08			1.672			0.00		
2278.74	18.87	2.109	20.978	17.0	3.20	0.159	21.137	0.00	1.318		3.00	0.00	0.00	0	0.00
102.25	0.00154					.000828	0.08			1.672			0.00		

FC515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
2380.99	19.03	2.020	21.047	17.0	3.36	0.175	21.222	0.00	1.318		3.00	0.00	0.00	0	0.00
106.94	0.00154					.000931	0.10			1.672			0.00		
2487.93	19.19	1.937	21.129	17.0	3.52	0.193	21.322	0.00	1.318		3.00	0.00	0.00	0	0.00
118.67	0.00154					.001048	0.12			1.672			0.00		
2606.60	19.37	1.859	21.234	17.0	3.69	0.212	21.446	0.00	1.318		3.00	0.00	0.00	0	0.00
143.74	0.00154					.001183	0.17			1.672			0.00		
2750.34	19.60	1.786	21.383	17.0	3.87	0.233	21.616	0.00	1.318		3.00	0.00	0.00	0	0.00
221.28	0.00154					.001337	0.30			1.672			0.00		
2971.62	19.94	1.717	21.655	17.0	4.06	0.256	21.911	0.00	1.318		3.00	0.00	0.00	0	0.00
452.57	0.00154					.001482	0.67			1.672			0.00		
3424.19	20.64	1.672	22.309	17.0	4.20	0.274	22.583	0.00	1.318		3.00	0.00	0.00	0	0.00
235.81	0.00154					.001545	0.36			1.672			0.00		
3660.00	21.00	1.672	22.672	17.0	4.20	0.274	22.946	0.00	1.318		3.00	0.00	0.00	0	0.00
WALL ENTRANCE													0.00		
3660.00	21.00	1.673	22.673	17.0	4.20	0.273	22.946	0.00	1.318		3.00	0.00	0.00	0	0.00

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBFR
100.00	15.50	4.300	19.800	20.0	2.83	0.124	19.924	0.00	1.435	3.00	0.00	0.00	0	0.00
WALL EXIT												0.00		
100.00	15.50	4.301	19.801	20.0	2.83	0.124	19.925	0.00	1.435	3.00	0.00	0.00	0	0.00
50.00	0.00160					.000766	0.04		1.834			0.00		
150.00	15.58	4.259	19.839	20.0	2.83	0.124	19.963	0.00	1.435	3.00	0.00	0.00	0	0.00
10.00	0.00200					.000766	0.01		1.707			0.00		
160.00	15.60	4.265	19.865	20.0	2.83	0.124	19.989	0.00	1.435	3.00	0.00	0.00	0	0.00
1658.08	0.00154					.000760	1.26		1.857			0.00		
1818.08	18.16	3.000	21.158	20.0	2.83	0.124	21.282	0.00	1.435	3.00	0.00	0.00	0	0.00
319.52	0.00154					.000712	0.23		1.857			0.00		
2137.60	18.65	2.721	21.372	20.0	2.97	0.137	21.509	0.00	1.435	3.00	0.00	0.00	0	0.00
173.44	0.00154					.000693	0.12		1.857			0.00		
2311.04	18.92	2.560	21.479	20.0	3.11	0.150	21.629	0.00	1.435	3.00	0.00	0.00	0	0.00
148.91	0.00154					.000751	0.11		1.857			0.00		
2459.95	19.15	2.427	21.576	20.0	3.26	0.165	21.741	0.00	1.435	3.00	0.00	0.00	0	0.00
140.12	0.00154					.000827	0.12		1.857			0.00		
2600.07	19.37	2.310	21.675	20.0	3.42	0.182	21.857	0.00	1.435	3.00	0.00	0.00	0	0.00
138.60	0.00154					.000917	0.13		1.857			0.00		
2738.67	19.58	2.205	21.784	20.0	3.59	0.200	21.984	0.00	1.435	3.00	0.00	0.00	0	0.00
146.14	0.00154					.001023	0.15		1.857			0.00		
2884.81	19.80	2.109	21.913	20.0	3.77	0.220	22.133	0.00	1.435	3.00	0.00	0.00	0	0.00
168.82	0.00154					.001146	0.19		1.857			0.00		

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
3053.63	20.07	2.023	22.085	20.0	3.95	0.242	22.327	0.00	1.435		3.00	0.00	0.00	0	0.00
230.44	0.00154					.001288	0.30			1.857			0.00		
3284.07	20.42	1.937	22.357	20.0	4.14	0.266	22.623	0.00	1.435		3.00	0.00	0.00	0	0.00
375.93	0.00154					.001432	0.54			1.857			0.00		
3660.00	21.00	1.875	22.875	20.0	4.30	0.287	23.162	0.00	1.435		3.00	0.00	0.00	0	0.00
WALL ENTRANCE													0.00		
3660.00	21.00	1.876	22.876	20.0	4.30	0.287	23.163	0.00	1.435		3.00	0.00	0.00	0	0.00

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
100.00	15.50	4.300	19.800	22.0	3.11	0.150	19.950	0.00	1.509	3.00	0.00	0.00	0	0.00
WALL EXIT												0.00		
100.00	15.50	4.301	19.801	22.0	3.11	0.150	19.951	0.00	1.509	3.00	0.00	0.00	0	0.00
50.00	0.00160					.000927	0.05		1.960			0.00		
150.00	15.58	4.267	19.847	22.0	3.11	0.150	19.997	0.00	1.509	3.00	0.00	0.00	0	0.00
10.00	0.00200					.000927	0.01		1.815			0.00		
160.00	15.60	4.278	19.878	22.0	3.11	0.150	20.028	0.00	1.509	3.00	0.00	0.00	0	0.00
2134.14	0.00154					.000920	1.96		1.983			0.00		
2294.14	18.89	3.300	21.893	22.0	3.11	0.150	22.043	0.00	1.509	3.00	0.00	0.00	0	0.00
385.83	0.00154					.000862	0.33		1.983			0.00		
2679.97	19.49	2.721	22.209	22.0	3.26	0.165	22.374	0.00	1.509	3.00	0.00	0.00	0	0.00
205.25	0.00154					.000839	0.17		1.983			0.00		
2885.22	19.81	2.560	22.365	22.0	3.42	0.182	22.547	0.00	1.509	3.00	0.00	0.00	0	0.00
180.94	0.00154					.000908	0.16		1.983			0.00		
3066.16	20.08	2.427	22.511	22.0	3.59	0.200	22.711	0.00	1.509	3.00	0.00	0.00	0	0.00
178.46	0.00154					.000999	0.18		1.983			0.00		
3244.62	20.36	2.310	22.670	22.0	3.77	0.220	22.890	0.00	1.509	3.00	0.00	0.00	0	0.00
191.31	0.00154					.001109	0.21		1.983			0.00		
3435.93	20.65	2.205	22.860	22.0	3.95	0.242	23.102	0.00	1.509	3.00	0.00	0.00	0	0.00
224.07	0.00154					.001235	0.28		1.983			0.00		
3660.00	21.00	2.113	23.113	22.0	4.13	0.265	23.378	0.00	1.509	3.00	0.00	0.00	0	0.00
WALL ENTRANCE												0.00		

FJ515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH EASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZP		
3660.00	21.00	2.114	23.114	22.0	4.13	0.265	23.379	0.00	1.509	3.00	0.00	0.00	0	0.00

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
100.00	15.50	4.300	19.800	25.0	3.54	0.194	19.994	0.00	1.613		3.00	0.00	0.00	0	0.00
WALL EXIT													0.00		
100.00	15.50	4.301	19.801	25.0	3.54	0.194	19.995	0.00	1.613		3.00	0.00	0.00	0	0.00
50.00	0.00160					.001197	0.06			2.153			0.00		
150.00	15.58	4.281	19.861	25.0	3.54	0.194	20.055	0.00	1.613		3.00	0.00	0.00	0	0.00
10.00	0.00200					.001197	0.01			1.980			0.00		
160.00	15.60	4.300	19.900	25.0	3.54	0.194	20.094	0.00	1.613		3.00	0.00	0.00	0	0.00
3500.00	0.00154					.001197	4.19			2.185			0.00		
WALL ENTRANCE													0.00		
3660.00	21.00	3.168	24.168	25.0	3.54	0.194	24.362	0.00	1.613		3.00	0.00	0.00	0	0.00

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH: 36" BLEEDOFF LINE FOR NORTH BASIN(S)
100 YEAR EVENT WSEL AT OUTLET IS 19.8
MAY 1988 (SD36A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
100.00	15.50	4.300	19.800	35.0	4.95	0.381	20.181	0.00	1.923		3.00	0.00	0.00	0	0.00
WALL EXIT													0.00		
100.00	15.50	4.301	19.801	35.0	4.95	0.381	20.182	0.00	1.923		3.00	0.00	0.00	0	0.00
50.00	0.00160					.002346	0.12			3.000			0.00		
150.00	15.58	4.338	19.918	35.0	4.95	0.381	20.299	0.00	1.923		3.00	0.00	0.00	0	0.00
10.00	0.00200					.002346	0.02			3.000			0.00		
160.00	15.60	4.396	19.996	35.0	4.95	0.381	20.377	0.00	1.923		3.00	0.00	0.00	0	0.00
3500.00	0.00154					.002346	8.21			3.000			0.00		
WALL ENTRANCE													0.00		
3660.00	21.00	7.360	28.360	35.0	4.95	0.381	28.741	0.00	1.923		3.00	0.00	0.00	0	0.00

COE & VAN LOO
PLANNING • ENGINEERING
LANDSCAPE ARCHITECTURE

Project Camelback Ranch
Project No. 1122-03
Sheet No. 3 of
Calculated by DWD Date 5/88
Checked by Date

36"/24" Storm Drain System : Basin 3 to Outlet

Characteristics

- Manholes : 8 pressure manholes
  max. spacing 330'
- Grate Inlet : Inv. 1021.0
  Ke 0.5
- Length : 2660' total
  Last 50' is 36"
  2610' of SD. is 24"

Rating Curve : from WSPG model (WS=1019.8 @ Outlet)*

Inlet WS.	Q(cfs)	Vol - Basin #3 (Acft)
21.0	0	0
22.0	5.	2.8
22.2	7.	
23.0	8.1 **	15.0
24.0	9.5 **	27.3
24.4	10.	

* Assumption : 16cfs from pumpsta combines w/ flow from Basin #3 near outlet

** Interpolated

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

CAMELBACK RANCH - 36"/24" BLEEDOFF PIPE SYSTEM

HEADING LINE NO 2 IS -

100YEAR WSEL AT OUTLET IS 19.8

HEADING LINE NO 3 IS -

MAY 1988 (SD24A)

WSPG: 24" STORM DRAIN SYSTEM

Basin #3

WATER SURFACE PROFILE - ELEMENT CARD LISTING

```
ELEMENT NO   1 IS A SYSTEM OUTLET        *          *      *
                    U/S DATA   STATION    INVERT   SECT                                W S ELEV
                               100.00     15.50    1                                    19.80

ELEMENT NO   2 IS A  WALL  EXIT                              *
                    U/S DATA   STATION    INVERT   SECT
                               100.00     15.50    1

ELEMENT NO   3 IS A REACH                *          *      *
                    U/S DATA   STATION    INVERT   SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               140.00     15.58    1               0.012                               0.00    0.00    0.00     0

ELEMENT NO   4 IS A JUNCTION             *          *      *      *                  *                  *                  *
                    U/S DATA   STATION    INVERT   SECT LAT-1 LAT-2   N       Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               140.00     15.58    1      2      0  0.012    16.3     0.0    16.08     0.00    45.00    0.00
THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING
THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING

ELEMENT NO   5 IS A TRANSITION           *          *      *
                    U/S DATA   STATION    INVERT   SECT              N
                               145.00     16.09    2               0.012

ELEMENT NO   6 IS A REACH                *          *      *
                    U/S DATA   STATION    INVERT   SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               150.00     16.10    2               0.012                               0.00    45.00   0.00     0

ELEMENT NO   7 IS A REACH                *          *      *
                    U/S DATA   STATION    INVERT   SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               2760.00    21.00    2               0.012                               0.00    0.00    0.00     8

ELEMENT NO   8 IS A  WALL  ENTRANCE                          *
                    U/S DATA   STATION    INVERT   SECT             FP
                               2760.00    21.00    2               0.500

ELEMENT NO   9 IS A SYSTEM HEADWORKS                         *                  *
                    U/S DATA   STATION    INVERT   SECT                                W S ELEV
                               2760.00    21.00    2                                     0.00
NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING
```

CARD CODE	SECT NO	CHN TYPE	NO OF PIERS	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	4			3.00														
CD	2	4			2.00														

Oxford Oxford Oxford Oxford Oxford

FC515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH - 36"/24" BLEEDOFF PIPE SYSTEM
100YEAR WSEL AT OUTLET IS 19.8
MAY 1988 (SD24A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVRPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
100.00	15.50	4.300	19.800	21.0	2.97	0.137	19.937	0.00	1.472	3.00	0.00	0.00	0	0.00
WALL EXIT												0.00		
100.00	15.50	4.301	19.801	21.0	2.97	0.137	19.938	0.00	1.472	3.00	0.00	0.00	0	0.00
40.00	0.00200					.000845	0.03		1.761			0.00		
140.00	15.58	4.255	19.835	21.0	2.97	0.137	19.972	0.00	1.472	3.00	0.00	0.00	0	0.00
JUNCT STR	0.00000					.000446	0.00					0.00		
140.00	15.58	4.384	19.964	5.0	0.71	0.008	19.972	0.00	0.700	3.00	0.00	0.00	0	0.00
TRANS STR	0.10200					.000232	0.00					0.00		
145.00	16.09	3.850	19.940	5.0	1.59	0.039	19.979	0.00	0.788	2.00	0.00	0.00	0	0.00
5.00	0.00200					.000416	0.00		0.950			0.00		
150.00	16.10	3.848	19.948	5.0	1.59	0.039	19.987	0.00	0.788	2.00	0.00	0.00	0	0.00
1270.07	0.00188					.000412	0.52		0.963			0.00		
1420.07	18.48	2.000	20.484	5.0	1.59	0.039	20.523	0.00	0.788	2.00	0.00	0.00	0	0.00
121.39	0.00188					.000386	0.05		0.963			0.00		
1541.46	18.71	1.814	20.526	5.0	1.67	0.043	20.569	0.00	0.788	2.00	0.00	0.00	0	0.00
69.11	0.00188					.000376	0.03		0.963			0.00		
1610.57	18.84	1.706	20.547	5.0	1.75	0.048	20.595	0.00	0.788	2.00	0.00	0.00	0	0.00
56.66	0.00188					.000407	0.02		0.963			0.00		
1667.23	18.95	1.618	20.566	5.0	1.84	0.052	20.618	0.00	0.788	2.00	0.00	0.00	0	0.00
50.95	0.00188					.000448	0.02		0.963			0.00		
1718.18	19.04	1.540	20.583	5.0	1.93	0.058	20.641	0.00	0.788	2.00	0.00	0.00	0	0.00
46.58	0.00188					.000498	0.02		0.963			0.00		

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH - 36"/24" BLEEDOFF PIPE SYSTEM
100YEAR WSEL AT OUTLET IS 19.8
MAY 1988 (SD24A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
1764.76	19.13	1.470	20.601	5.0	2.02	0.063	20.664	0.00	0.788		2.00	0.00	0.00	0	0.00
43.65	0.00188					.000556	0.02			0.963			0.00		
1808.41	19.21	1.406	20.619	5.0	2.12	0.070	20.689	0.00	0.788		2.00	0.00	0.00	0	0.00
42.28	0.00188					.000622	0.03			0.963			0.00		
1850.69	19.29	1.346	20.638	5.0	2.22	0.077	20.715	0.00	0.788		2.00	0.00	0.00	0	0.00
40.20	0.00188					.000699	0.03			0.963			0.00		
1890.89	19.37	1.291	20.659	5.0	2.33	0.084	20.743	0.00	0.788		2.00	0.00	0.00	0	0.00
40.00	0.00188					.000788	0.03			0.963			0.00		
1930.89	19.44	1.239	20.682	5.0	2.44	0.093	20.775	0.00	0.788		2.00	0.00	0.00	0	0.00
39.21	0.00188					.000889	0.03			0.963			0.00		
1970.10	19.52	1.191	20.707	5.0	2.56	0.102	20.809	0.00	0.788		2.00	0.00	0.00	0	0.00
41.06	0.00188					.001005	0.04			0.963			0.00		
2011.16	19.59	1.145	20.738	5.0	2.69	0.112	20.850	0.00	0.788		2.00	0.00	0.00	0	0.00
44.33	0.00188					.001137	0.05			0.963			0.00		
2055.49	19.68	1.101	20.778	5.0	2.82	0.123	20.901	0.00	0.788		2.00	0.00	0.00	0	0.00
48.71	0.00188					.001289	0.06			0.963			0.00		
2104.20	19.77	1.060	20.828	5.0	2.96	0.136	20.964	0.00	0.788		2.00	0.00	0.00	0	0.00
63.56	0.00188					.001461	0.09			0.963			0.00		
2167.76	19.89	1.020	20.907	5.0	3.10	0.149	21.056	0.00	0.788		2.00	0.00	0.00	0	0.00
101.03	0.00188					.001658	0.17			0.963			0.00		
2268.79	20.08	0.983	21.060	5.0	3.25	0.164	21.224	0.00	0.788		2.00	0.00	0.00	0	0.00
229.17	0.00188					.001828	0.42			0.963			0.00		

FC515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH - 36"/24" BLEEDOFF PIPE SYSTEM
100YEAR WSEL AT OUTLET IS 19.8
MAY 1988 (SD24A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
2497.96	20.51	0.963	21.470	5.0	3.34	0.173	21.643	0.00	0.788	2.00	0.00	0.00	0	0.00
262.04	0.00188					.001893	0.50		0.963			0.00		
2760.00	21.00	0.963	21.963	5.0	3.34	0.173	22.136	0.00	0.788	2.00	0.00	0.00	0	0.00
WALL ENTRANCE												0.00		
2760.00	21.00	0.964	21.964	5.0	3.34	0.173	22.137	0.00	0.788	2.00	0.00	0.00	0	0.00

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH - 36"/24" BLEEDOFF PIPE SYSTEM
100YEAR WSEL AT OUTLET IS 19.8
MAY 1988 (SD24A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVDPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
100.00	15.50	4.300	19.800	23.0	3.25	0.164	19.964	0.00	1.544		3.00	0.00	0.00	0	0.00
WALL EXIT													0.00		
100.00	15.50	4.301	19.801	23.0	3.25	0.164	19.965	0.00	1.544		3.00	0.00	0.00	0	0.00
40.00	0.00200					.001013	0.04			1.870			0.00		
140.00	15.58	4.262	19.842	23.0	3.25	0.164	20.006	0.00	1.544		3.00	0.00	0.00	0	0.00
JUNCT STR	0.00000					.000553	0.00						0.00		
140.00	15.58	4.411	19.991	7.0	0.99	0.015	20.006	0.00	0.832		3.00	0.00	0.00	0	0.00
TRANS STR	0.10200					.000455	0.00						0.00		
145.00	16.09	3.853	19.943	7.0	2.23	0.077	20.020	0.00	0.939		2.00	0.00	0.00	0	0.00
5.00	0.00200					.000816	0.00			1.160			0.00		
150.00	16.10	3.858	19.958	7.0	2.23	0.077	20.035	0.00	0.939		2.00	0.00	0.00	0	0.00
1771.04	0.00188					.000808	1.43			1.183			0.00		
1921.04	19.42	2.000	21.424	7.0	2.23	0.077	21.501	0.00	0.939		2.00	0.00	0.00	0	0.00
158.20	0.00188					.000757	0.12			1.183			0.00		
2079.24	19.72	1.814	21.535	7.0	2.34	0.085	21.620	0.00	0.939		2.00	0.00	0.00	0	0.00
87.41	0.00188					.000738	0.06			1.183			0.00		
2166.65	19.88	1.706	21.591	7.0	2.45	0.093	21.684	0.00	0.939		2.00	0.00	0.00	0	0.00
73.00	0.00188					.000800	0.06			1.183			0.00		
2239.65	20.02	1.618	21.640	7.0	2.57	0.103	21.743	0.00	0.939		2.00	0.00	0.00	0	0.00
67.93	0.00188					.000880	0.06			1.183			0.00		
2307.58	20.15	1.540	21.690	7.0	2.70	0.113	21.803	0.00	0.939		2.00	0.00	0.00	0	0.00
65.18	0.00188					.000976	0.06			1.183			0.00		

FC515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH - 36"/24" BLEEDOFF PIPE SYSTEM
100YEAR WSEL AT OUTLET IS 19.8
MAY 1988 (SD24A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
2372.76	20.27	1.470	21.742	7.0	2.83	0.124	21.866	0.00	0.939		2.00	0.00	0.00	0	0.00
65.50	0.00188					.001089	0.07			1.183			0.00		
2438.26	20.39	1.406	21.801	7.0	2.97	0.137	21.938	0.00	0.939		2.00	0.00	0.00	0	0.00
70.57	0.00188					.001220	0.09			1.183			0.00		
2508.83	20.53	1.346	21.874	7.0	3.11	0.150	22.024	0.00	0.939		2.00	0.00	0.00	0	0.00
79.02	0.00188					.001371	0.11			1.183			0.00		
2587.85	20.68	1.291	21.967	7.0	3.26	0.165	22.132	0.00	0.939		2.00	0.00	0.00	0	0.00
106.59	0.00188					.001544	0.16			1.183			0.00		
2694.44	20.88	1.239	22.115	7.0	3.42	0.182	22.297	0.00	0.939		2.00	0.00	0.00	0	0.00
65.56	0.00188					.001679	0.11			1.183			0.00		
2760.00	21.00	1.219	22.219	7.0	3.49	0.189	22.408	0.00	0.939		2.00	0.00	0.00	0	0.00
WALL ENTRANCE													0.00		
2760.00	21.00	1.220	22.220	7.0	3.49	0.189	22.409	0.00	0.939		2.00	0.00	0.00	0	0.00

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH - 36"/24" BLEEDOFF PIPE SYSTEM
100YEAR WSEL AT OUTLET IS 19.8
MAY 1988 (SD24A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVEPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
100.00	15.50	4.300	19.800	26.0	3.68	0.210	20.010	0.00	1.647		3.00	0.00	0.00	0	0.00
WALL EXIT													0.00		
100.00	15.50	4.301	19.801	26.0	3.68	0.210	20.011	0.00	1.647		3.00	0.00	0.00	0	0.00
40.00	0.00200					.001295	0.05			2.037			0.00		
140.00	15.58	4.273	19.853	26.0	3.68	0.210	20.063	0.00	1.647		3.00	0.00	0.00	0	0.00
JUNCT STR	0.00000					.000744	0.00						0.00		
140.00	15.58	4.452	20.032	10.0	1.41	0.031	20.063	0.00	1.000		3.00	0.00	0.00	0	0.00
TRANS STR	0.10200					.000928	0.00						0.00		
145.00	16.09	3.845	19.935	10.0	3.18	0.157	20.092	0.00	1.132		2.00	0.00	0.00	0	0.00
5.00	0.00200					.001665	0.01			1.500			0.00		
150.00	16.10	3.866	19.966	10.0	3.18	0.157	20.123	0.00	1.132		2.00	0.00	0.00	0	0.00
2610.00	0.00188					.001665	4.35			1.540			0.00		
WALL ENTRANCE													0.00		
2760.00	21.00	3.374	24.374	10.0	3.18	0.157	24.531	0.00	1.132		2.00	0.00	0.00	0	0.00

F3515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH - 36"/24" BLEEDOFF PIPE SYSTEM
100YEAR WSEL AT OUTLET IS 19.8
MAY 1988 (SD24A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVEPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
100.00	15.50	4.300	19.800	28.0	3.96	0.244	20.044	0.00	1.712	3.00	0.00	0.00	0	0.00
WALL EXIT												0.00		
100.00	15.50	4.301	19.801	28.0	3.96	0.244	20.045	0.00	1.712	3.00	0.00	0.00	0	0.00
40.00	0.00200					.001502	0.06		2.156			0.00		
140.00	15.58	4.281	19.861	28.0	3.96	0.244	20.105	0.00	1.712	3.00	0.00	0.00	0	0.00
JUNCT STR	0.00000					.000889	0.00					0.00		
140.00	15.58	4.480	20.060	12.0	1.70	0.045	20.105	0.00	1.100	3.00	0.00	0.00	0	0.00
TRANS STR	0.10200					.001337	0.01					0.00		
145.00	16.09	3.831	19.921	12.0	3.82	0.226	20.147	0.00	1.245	2.00	0.00	0.00	0	0.00
5.00	0.00200					.002398	0.01		2.000			0.00		
150.00	16.10	3.865	19.965	12.0	3.82	0.226	20.191	0.00	1.245	2.00	0.00	0.00	0	0.00
2610.00	0.00188					.002398	6.26		2.000			0.00		
WALL ENTRANCE												0.00		
2760.00	21.00	5.313	26.313	12.0	3.82	0.226	26.539	0.00	1.245	2.00	0.00	0.00	0	0.00

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH - 36"/24" BLEEDOFF PIPE SYSTEM
100YEAR WSEL AT OUTLET IS 19.8
MAY 1988 (SD24A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBFR
L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
100.00	15.50	4.300	19.800	31.0	4.39	0.299	20.099	0.00	1.805		3.00	0.00	0.00	0	0.00
WALL EXIT													0.00		
100.00	15.50	4.301	19.801	31.0	4.39	0.299	20.100	0.00	1.805		3.00	0.00	0.00	0	0.00
40.00	0.00200					.001841	0.07			2.354			0.00		
140.00	15.58	4.295	19.875	31.0	4.39	0.299	20.174	0.00	1.805		3.00	0.00	0.00	0	0.00
JUNCT STR	0.00000					.001136	0.00						0.00		
140.00	15.58	4.499	20.079	15.0	2.12	0.070	20.149	0.00	1.235		3.00	0.00	0.00	0	0.00
TRANS STR	0.10200					.002088	0.01						0.00		
145.00	16.09	3.772	19.862	15.0	4.77	0.354	20.216	0.00	1.396		2.00	0.00	0.00	0	0.00
5.00	0.00200					.003746	0.02			2.000			0.00		
150.00	16.10	3.831	19.931	15.0	4.77	0.354	20.285	0.00	1.396		2.00	0.00	0.00	0	0.00
2610.00	0.00188					.003746	9.78			2.000			0.00		
WALL ENTRANCE													0.00		
2760.00	21.00	8.850	29.850	15.0	4.77	0.354	30.204	0.00	1.396		2.00	0.00	0.00	0	0.00

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH - 36"/24" BLEEDOFF PIPE SYSTEM
100YEAR WSEL AT OUTLET IS 19.8
MAY 1988 (SD24A)

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVEPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
100.00	15.50	4.300	19.800	33.0	4.67	0.338	20.138	0.00	1.865	3.00	0.00	0.00	0	0.00
WALL EXIT												0.00		
100.00	15.50	4.301	19.801	33.0	4.67	0.338	20.139	0.00	1.865	3.00	0.00	0.00	0	0.00
40.00	0.00200					.002086	0.08		2.520			0.00		
140.00	15.58	4.304	19.884	33.0	4.67	0.338	20.222	0.00	1.865	3.00	0.00	0.00	0	0.00
JUNCT STR	0.00000					.001320	0.00					0.00		
140.00	15.58	4.549	20.129	17.0	2.40	0.090	20.219	0.00	1.318	3.00	0.00	0.00	0	0.00
TRANS STR	0.10200					.002683	0.01					0.00		
145.00	16.09	3.760	19.850	17.0	5.41	0.455	20.305	0.00	1.486	2.00	0.00	0.00	0	0.00
5.00	0.00200					.004812	0.02		2.000			0.00		
150.00	16.10	3.838	19.938	17.0	5.41	0.455	20.393	0.00	1.486	2.00	0.00	0.00	0	0.00
2610.00	0.00188					.004812	12.56		2.000			0.00		
WALL ENTRANCE												0.00		
2760.00	21.00	11.679	32.679	17.0	5.41	0.455	33.134	0.00	1.486	2.00	0.00	0.00	0	0.00

F0515P
WATER SURFACE PROFILE LISTING
CAMELBACK RANCH - 36"/24" BLEEDOFF PIPE SYSTEM
100YEAR WSEL AT OUTLET IS 19.8
MAY 1988 (SD24A)

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
100.00	15.50	4.300	19.800	36.0	5.09	0.403	20.203	0.00	1.951	3.00	0.00	0.00	0	0.00
WALL EXIT												0.00		
100.00	15.50	4.301	19.801	36.0	5.09	0.403	20.204	0.00	1.951	3.00	0.00	0.00	0	0.00
40.00	0.00200					.002482	0.10		3.000			0.00		
140.00	15.58	4.320	19.900	36.0	5.09	0.403	20.303	0.00	1.951	3.00	0.00	0.00	0	0.00
JUNCT STR	0.00000					.001624	0.00					0.00		
140.00	15.58	4.624	20.204	20.0	2.83	0.124	20.328	0.00	1.435	3.00	0.00	0.00	0	0.00
TRANS STR	0.10200					.003713	0.02					0.00		
145.00	16.09	3.729	19.819	20.0	6.37	0.629	20.448	0.00	1.606	2.00	0.00	0.00	0	0.00
5.00	0.00200					.006660	0.03		2.000			0.00		
150.00	16.10	3.841	19.941	20.0	6.37	0.629	20.570	0.00	1.606	2.00	0.00	0.00	0	0.00
2610.00	0.00188					.006660	17.38		2.000			0.00		
WALL ENTRANCE												0.00		
2760.00	21.00	16.575	37.575	20.0	6.37	0.629	38.204	0.00	1.606	2.00	0.00	0.00	0	0.00

OE & VAN LOO
N NG • ENGINEERING
D APE ARCHITECTURE

Project Camelback Ranch
Project No. 1122-03
Sheet No. 4 of
Calculated by DWD Date 5/88
Checked by Date

Retention Basin # 4 : (See Exhibit A for locations)

Pump Station:
No. of pumps : 3
Design discharge per pump : 3600 GPM = 8cfs

Rating Curve:

WSEL	Q(cfs)	Vol Ret. (Acft)
1008.5	0	0
9.0	1.	1.8
10.5	16.	3.5
15.5	16.	29.
16.0	16	44
16.5	24.	50

TR-20: CAMELBACK RANCH - PROPOSED CONDITIONS

EXECUTIVE CONTROL CARD OPERATION LIST

LISTING OF DATA IN CORE

```
0 CAMELBACK RANCH(ID1122A5A)(3 PUMPS)

                    VELOCITY INCREMENT
1 CTABLE                  0.2000

8          0.0000    0.0800    0.1800    0.2500    0.3200
8          0.3700    0.4100    0.4500    0.4900    0.5100
8          0.5400    0.5700    0.5900    0.6100    0.6300
8          0.6500    0.6600    0.6700    0.6900    0.7000
8          0.7100    0.7200    0.7300    0.7400    0.7500
8          0.7600    0.7700    0.7700    0.7800    0.7900
8          0.7900    0.8000    0.8100    0.8100    0.8200
8          0.8200    0.8300    0.8300    0.8400    0.8400
8          0.8400    0.8500    0.8500    0.8600    0.8600
8          0.8600    0.8600    0.8700    0.8700    0.8700
8          0.8800    0.8800    0.8800    0.8900    0.8900
8          0.8900    0.8900    0.8900    0.8900    0.9000
8          0.9000    0.9000    0.9000    0.9000    0.9100
8          0.9100    0.9100    0.9100    0.9100    0.9100
8          0.9200    0.9200    0.9200    0.9200    0.9200
8          0.9200    0.9200    0.9200    0.9300    0.9300
9 ENDTBL

        STRUCT NO.
3 STRUCT      1
                        ELEVATION   DISCHARGE   STORAGE
8                       1022.7500     0.0000     0.0001
8                       1023.7500     4.5000     1.7500
8                       1024.7500    13.0000     5.1000
8                       1025.0000    15.0000     6.0000
8                       1026.0000    74.0000    13.4000
9 ENDTBL

        STRUCT NO.
3 STRUCT      2
                        ELEVATION   DISCHARGE   STORAGE
8                       1021.0000     0.0000     0.0001
8                       1022.0000     7.0000     4.1000
8                       1023.0000    20.0000    19.8000
8                       1024.0000    25.0000    35.4000
8                       1025.0000    28.0000    51.1000
8                       1026.0000    30.0000    66.8000
9 ENDTBL

        STRUCT NO.
3 STRUCT      3
                        ELEVATION   DISCHARGE   STORAGE
8                       1021.0000     0.0000     0.0001
8                       1022.0000     5.0000     2.8000
```

RETENTION BASIN #1

RETENTION BASIN #2

RETENTION BASIN #3

```
8                    1023.0000     8.1000     15.0000
8                    1024.0000     9.5000     27.3000
9 ENDTBL
```

RETENTION BASIN #3

```
          STRUCT NO.
2 STRUCT      4

                     ELEVATION   DISCHARGE    STORAGE
8                    1008.5000     0.0000      0.0001
8                    1009.0000     1.0000      1.8000
8                    1010.5000    16.0000      3.5000
8                    1015.0000    16.1000     29.0000
8                    1016.0000    17.0000     44.0000
8                    1016.5000    24.0000     50.0000
9 ENDTBL
```

RETENTION BASIN #4

```
                TIME INCREMENT
4 DIMHYD

8          0.0000    0.0300    0.1000    0.1900    0.3100
8          0.4700    0.6600    0.8200    0.9300    0.9900
8          1.0000    0.9900    0.9300    0.8600    0.7800
8          0.6800    0.5600    0.4600    0.3900    0.3300
8          0.2800    0.2410    0.2070    0.1740    0.1470
8          0.1260    0.1070    0.0910    0.0770    0.0660
8          0.0550    0.0470    0.0400    0.0340    0.0290
8          0.0250    0.0210    0.0180    0.0150    0.0130
8          0.0110    0.0090    0.0080    0.0070    0.0060
8          0.0050    0.0040    0.0030    0.0020    0.0010
8          0.0000    0.0000    0.0000    0.0000    0.0000
9 ENDTBL

COMPUTED PEAK K FACTOR =  484.00

                TIME INCREMENT
5 RAINFL 4              0.5000

8          0.0000    0.0040    0.0080    0.0130    0.0180
8          0.0220    0.0260    0.0310    0.0350    0.0400
8          0.0440    0.0480    0.0530    0.0570    0.0620
8          0.0660    0.0710    0.0750    0.0800    0.0930
8          0.1070    0.1200    0.1400    0.1700    0.5000
8          0.8300    0.8600    0.8800    0.8930    0.9070
8          0.9200    0.9240    0.9280    0.9330    0.9370
8          0.9420    0.9470    0.9510    0.9560    0.9600
8          0.9640    0.9690    0.9730    0.9780    0.9820
8          0.9870    0.9910    0.9950    1.0000    1.0000
9 ENDTBL
```

STANDARD CONTROL INSTRUCTIONS

```
6 RUNOFF 1  10       5      0.3100     77.0000     0.63001 0 0 1 0 1
6 REACH  3  15   5   6   3600.0000      0.7500     0.00001 0 0 1 0 1
6 RUNOFF 1  22       5      0.1600     81.0000     0.44001 0 0 1 0 1
6 ADDHYD 4  25   5 6 7                                  1 1 0 1 0 1
6 RUNOFF 1  21       5      0.2100     76.0000     0.54001 0 0 1 0 1
6 RESVOR 2      1 5  6   1022.7500                        1 1 1 1 0 1
6 ADDHYD 4  23   6 7 4                                  1 0 0 1 0 1
6 RESVOR 2      2 4  5   1021.0000                        1 1 1 1 0 1
6 RUNOFF 1  35       7      0.1600     83.0000     0.45001 0 0 1 0 1
6 RESVOR 2      3 7  5   1021.0000                        1 1 1 1 0 1
6 RUNOFF 1  50       6      0.3800     85.0000     0.56001 0 0 1 0 1
6 RESVOR 2      4 6  5    108.5000                        1 1 1 1 0 1
  ENDATA
```

END OF LISTING

PASS= 1

EXECUTIVE CONTROL CARD OPERATION INCREM, MAIN TIME INCREMENT= 0.10
EXECUTIVE CONTROL CARD OPERATION COMPUT, FROM XSECTN/STRUCT 10/ 0 TO XSECTN/STRUCT 0/ 4
STARTING TIME= 0.00 RAIN DEPTH= 4.00 RAIN DURATION= 1.00 RAIN TABLE NO.= 4 SOIL CONDITION= 2
ALTERNATE NO.= 1 STORM NO.= 3

SUBROUTINE RUNOFF CROSS SECTION 10
AREA= 0.31 INPUT RUNOFF CURVE= 77.0 TIME OF CONCENTRATION= 0.63

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
12.63	280.567	(RUNOFF)
16.65	5.746	(RUNOFF)
18.02	6.032	(RUNOFF)
19.15	5.803	(RUNOFF)
20.67	5.788	(RUNOFF)
21.66	5.854	(RUNOFF)
22.66	5.859	(RUNOFF)
24.05	5.695	(RUNOFF)

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 1.8078 CFS-HRS= 361.67 ACRE-FT= 29.89

SUBROUTINE REACH CROSS SECTION 15
LENGTH= 3600.00 INPUT COEFFICIENT= 0.7500 INPUT ROUTINGS= 0.00

AVERAGE WATER VELOCITY= 5.100 AVERAGE ROUTING COEFF= 0.7500 NUMBER OF ROUTINGS= 1.47

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
12.81	272.990	(NULL)
16.83	5.711	(NULL)
18.19	6.018	(NULL)
19.34	5.764	(NULL)
20.86	5.747	(NULL)
21.84	5.812	(NULL)
22.84	5.819	(NULL)
24.20	5.629	(NULL)

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 1.8077 CFS-HRS= 361.66 ACRE-FT= 29.89

SUBROUTINE RUNOFF CROSS SECTION 22
AREA= 0.16 INPUT RUNOFF CURVE= 81.0 TIME OF CONCENTRATION= 0.44

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
12.55	186.828	(RUNOFF)
14.55	9.349	(RUNOFF)
16.57	3.291	(RUNOFF)
17.96	3.403	(RUNOFF)
19.06	3.318	(RUNOFF)
20.57	3.325	(RUNOFF)
21.56	3.338	(RUNOFF)
22.56	3.342	(RUNOFF)
23.99	3.320	(RUNOFF)

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 2.1171 CFS-HRS= 218.61 ACRE-FT= 18.07

SUBROUTINE ADDHYD CROSS SECTION 25
INPUT HYDROGRAPHS= 5,6 OUTPUT HYDROGRAPH= 7

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
12.65	423.247	(NULL)
16.68	8.847	(NULL)
18.07	9.376	(NULL)
19.19	8.908	(NULL)

20.72	8.874	(NULL)
21.70	8.967	(NULL)
22.70	8.985	(NULL)
24.06	8.739	(NULL)

TIME HYDROGRAPH, TZERO= 0.00 DELTA T= 0.10 DRAINAGE AREA= 0.47

0.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.08	0.19	0.34
11.00	DISCHG	0.52	0.75	1.08	1.50	1.97	2.80	6.61	19.58	45.72	82.27
12.00	DISCHG	126.91	177.07	231.18	286.22	338.87	386.47	419.46	419.75	390.92	344.58
13.00	DISCHG	292.78	239.31	188.45	145.83	113.43	90.29	73.71	61.29	51.79	44.55
14.00	DISCHG	39.06	34.87	31.78	29.60	28.16	27.25	26.67	26.25	25.93	25.66
15.00	DISCHG	25.39	24.82	23.49	21.46	19.11	16.75	14.54	12.60	11.07	9.95
16.00	DISCHG	9.19	8.70	8.47	8.44	8.52	8.68	8.81	8.85	8.77	8.62
17.00	DISCHG	8.44	8.29	8.24	8.31	8.46	8.64	8.84	9.02	9.17	9.28
18.00	DISCHG	9.35	9.37	9.28	9.09	8.86	8.62	8.43	8.35	8.40	8.53
19.00	DISCHG	8.71	8.86	8.91	8.84	8.70	8.51	8.32	8.14	8.00	7.89
20.00	DISCHG	7.82	7.81	7.91	8.10	8.33	8.59	8.79	8.87	8.83	8.70
21.00	DISCHG	8.53	8.39	8.35	8.42	8.56	8.75	8.91	8.97	8.91	8.76
22.00	DISCHG	8.58	8.42	8.38	8.45	8.60	8.78	8.93	8.98	8.92	8.78
23.00	DISCHG	8.60	8.41	8.23	8.08	7.98	7.91	7.90	8.00	8.19	8.43
24.00	DISCHG	8.67	8.70	8.27	7.38	6.24	5.01	3.82	2.77	1.93	1.32
25.00	DISCHG	0.90	0.61	0.41	0.27	0.19	0.13	0.08	0.06	0.04	0.02
26.00	DISCHG	0.01	0.00								

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 1.9130 CFS-HRS= 580.27 ACRE-FT= 47.95

SUBROUTINE RUNOFF CROSS SECTION 21
AREA= 0.21 INPUT RUNOFF CURVE= 76.0 TIME OF CONCENTRATION= 0.54

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
12.60	196.300	(RUNOFF)
14.54	11.053	(RUNOFF)
16.61	3.840	(RUNOFF)
17.98	4.020	(RUNOFF)
19.11	3.886	(RUNOFF)
20.62	3.890	(RUNOFF)
21.61	3.920	(RUNOFF)
22.61	3.940	(RUNOFF)
24.01	3.859	(RUNOFF)

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 1.7382 CFS-HRS= 235.57 ACRE-FT= 19.47

SUBROUTINE RESVOR STRUCTURE 1
SURFACE ELEVATION= 1022.75

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
13.15	55.348	1025.68

TIME HYDROGRAPH, TZERO= 0.00 DELTA T= 0.10 DRAINAGE AREA= 0.21

0.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	ELEV	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75
1.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	ELEV	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75
2.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

2.00	ELEV	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75
3.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.00	ELEV	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75
4.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.00	ELEV	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75
5.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	ELEV	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75
6.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.00	ELEV	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75
7.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7.00	ELEV	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75
8.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8.00	ELEV	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75
9.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9.00	ELEV	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75
10.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.00	ELEV	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75
11.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.12	0.41	1.14
11.00	ELEV	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.75	1022.78	1022.84	1022.98
12.00	DISCHG	2.14	3.78	5.94	8.57	11.65	14.83	25.70	36.25	44.81	50.67
12.00	ELEV	1023.23	1023.59	1023.92	1024.23	1024.59	1024.98	1025.18	1025.36	1025.51	1025.60
13.00	DISCHG	53.95	55.25	55.25	54.44	53.11	51.47	49.65	47.76	45.92	43.87
13.00	ELEV	1025.66	1025.68	1025.68	1025.67	1025.65	1025.62	1025.59	1025.56	1025.52	1025.49
14.00	DISCHG	41.93	40.04	38.23	36.50	34.88	33.35	31.93	30.60	29.34	28.16
14.00	ELEV	1025.46	1025.42	1025.39	1025.36	1025.34	1025.31	1025.29	1025.26	1025.24	1025.22
15.00	DISCHG	27.04	25.98	24.95	23.92	22.87	21.80	20.73	19.69	18.69	17.73
15.00	ELEV	1025.20	1025.19	1025.17	1025.15	1025.13	1025.12	1025.10	1025.08	1025.06	1025.05
16.00	DISCHG	16.83	15.97	15.17	14.84	14.63	14.43	14.24	14.05	13.86	13.68
16.00	ELEV	1025.03	1025.02	1025.00	1024.98	1024.95	1024.93	1024.90	1024.88	1024.86	1024.83
17.00	DISCHG	13.49	13.31	13.13	12.95	12.75	12.57	12.39	12.21	12.04	11.87
17.00	ELEV	1024.81	1024.79	1024.77	1024.74	1024.72	1024.70	1024.68	1024.66	1024.64	1024.62
18.00	DISCHG	11.71	11.55	11.39	11.24	11.08	10.92	10.77	10.62	10.47	10.33
18.00	ELEV	1024.60	1024.58	1024.56	1024.54	1024.52	1024.51	1024.49	1024.47	1024.45	1024.44
19.00	DISCHG	10.19	10.06	9.93	9.81	9.68	9.55	9.42	9.30	9.18	9.05
19.00	ELEV	1024.42	1024.40	1024.39	1024.37	1024.36	1024.34	1024.33	1024.31	1024.30	1024.29
20.00	DISCHG	8.93	8.82	8.70	8.60	8.49	8.39	8.30	8.21	8.12	8.02
20.00	ELEV	1024.27	1024.26	1024.24	1024.23	1024.22	1024.21	1024.20	1024.19	1024.18	1024.16
21.00	DISCHG	7.93	7.84	7.75	7.66	7.58	7.50	7.43	7.35	7.28	7.21
21.00	ELEV	1024.15	1024.14	1024.13	1024.12	1024.11	1024.10	1024.09	1024.09	1024.08	1024.07
22.00	DISCHG	7.13	7.06	6.98	6.91	6.84	6.78	6.72	6.66	6.60	6.55
22.00	ELEV	1024.06	1024.05	1024.04	1024.03	1024.03	1024.02	1024.01	1024.00	1024.00	1023.99
23.00	DISCHG	6.48	6.42	6.36	6.30	6.24	6.18	6.12	6.06	6.01	5.96
23.00	ELEV	1023.98	1023.98	1023.97	1023.96	1023.95	1023.95	1023.94	1023.93	1023.93	1023.92
24.00	DISCHG	5.91	5.87	5.82	5.77	5.70	5.61	5.52	5.42	5.31	5.21
24.00	ELEV	1023.92	1023.91	1023.91	1023.90	1023.89	1023.88	1023.87	1023.86	1023.85	1023.83
25.00	DISCHG	5.10	5.00	4.90	4.80	4.70	4.60	4.51	4.41	4.32	4.23
25.00	ELEV	1023.82	1023.81	1023.80	1023.78	1023.77	1023.76	1023.75	1023.73	1023.71	1023.69
26.00	DISCHG	4.14	4.05	3.97	3.88	3.80	3.72	3.64	3.57	3.49	3.42
26.00	ELEV	1023.67	1023.65	1023.63	1023.61	1023.59	1023.58	1023.56	1023.54	1023.53	1023.51
27.00	DISCHG	3.35	3.28	3.21	3.14	3.07	3.01	2.95	2.88	2.82	2.76
27.00	ELEV	1023.49	1023.48	1023.46	1023.45	1023.43	1023.42	1023.40	1023.39	1023.38	1023.36
28.00	DISCHG	2.71	2.65	2.59	2.54	2.48	2.43	2.38	2.33	2.28	2.23
28.00	ELEV	1023.35	1023.34	1023.33	1023.31	1023.30	1023.29	1023.28	1023.27	1023.26	1023.25
29.00	DISCHG	2.19	2.14	2.10	2.05	2.01	1.97	1.93	1.88	1.85	1.81
29.00	ELEV	1023.24	1023.23	1023.22	1023.21	1023.20	1023.19	1023.18	1023.17	1023.16	1023.15

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 1.6748 CFS-HRS= 226.99 ACRE-FT= 18.76

SUBROUTINE ADDHYD CROSS SECTION 23

INPUT HYDROGRAPHS= 6,7 OUTPUT HYDROGRAPH= 4

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
12.68	456.353	(NULL)
17.68	21.230	(NULL)
19.07	18.921	(NULL)

20.64	17.130	(NULL)
21.64	16.339	(NULL)
22.65	15.663	(NULL)
24.04	14.600	(NULL)

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 1.8395 CFS-HRS= 807.26 ACRE-FT= 66.71

SUBROUTINE RESVOR STRUCTURE 2
SURFACE ELEVATION= 1021.00

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
15.77	26.816	1024.61

HYDROGRAPH, TZERO= 0.00 DELTA T= 0.10 DRAINAGE AREA= 0.68

TIME											
0.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
1.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
2.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
3.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
4.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
5.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
6.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
7.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
8.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
9.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
10.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
10.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
11.00	DISCHG	0.01	0.02	0.03	0.05	0.07	0.11	0.17	0.35	0.81	1.71
11.00	ELEV	1021.00	1021.00	1021.00	1021.01	1021.01	1021.02	1021.02	1021.05	1021.12	1021.24
12.00	DISCHG	3.17	5.30	7.56	9.32	11.46	13.94	16.74	19.69	21.01	22.05
12.00	ELEV	1021.45	1021.76	1022.04	1022.18	1022.34	1022.53	1022.75	1022.98	1023.20	1023.41
13.00	DISCHG	22.98	23.76	24.41	24.93	25.21	25.41	25.58	25.73	25.85	25.96
13.00	ELEV	1023.59	1023.75	1023.88	1023.99	1024.07	1024.14	1024.19	1024.24	1024.28	1024.32
14.00	DISCHG	26.05	26.13	26.20	26.27	26.33	26.39	26.44	26.49	26.53	26.58
14.00	ELEV	1024.35	1024.38	1024.40	1024.42	1024.44	1024.46	1024.48	1024.50	1024.51	1024.53
15.00	DISCHG	26.62	26.66	26.70	26.73	26.75	26.78	26.79	26.80	26.81	26.81
15.00	ELEV	1024.54	1024.55	1024.56	1024.58	1024.58	1024.59	1024.60	1024.60	1024.60	1024.60
16.00	DISCHG	26.81	26.81	26.81	26.80	26.79	26.79	26.78	26.78	26.77	26.76
16.00	ELEV	1024.60	1024.60	1024.60	1024.60	1024.60	1024.60	1024.59	1024.59	1024.59	1024.59
17.00	DISCHG	26.76	26.75	26.74	26.73	26.72	26.71	26.71	26.70	26.69	26.68
17.00	ELEV	1024.59	1024.58	1024.58	1024.58	1024.57	1024.57	1024.57	1024.57	1024.56	1024.56
18.00	DISCHG	26.67	26.66	26.65	26.64	26.63	26.62	26.61	26.60	26.59	26.57
18.00	ELEV	1024.56	1024.55	1024.55	1024.55	1024.54	1024.54	1024.54	1024.53	1024.53	1024.52
19.00	DISCHG	26.56	26.55	26.54	26.53	26.51	26.50	26.49	26.47	26.46	26.44
19.00	ELEV	1024.52	1024.52	1024.51	1024.51	1024.50	1024.50	1024.50	1024.49	1024.49	1024.48
20.00	DISCHG	26.43	26.41	26.40	26.38	26.37	26.35	26.34	26.32	26.31	26.29
20.00	ELEV	1024.48	1024.47	1024.47	1024.46	1024.46	1024.45	1024.45	1024.44	1024.44	1024.43
21.00	DISCHG	26.28	26.26	26.25	26.23	26.21	26.20	26.18	26.17	26.15	26.14
21.00	ELEV	1024.43	1024.42	1024.42	1024.41	1024.40	1024.40	1024.39	1024.39	1024.38	1024.38
22.00	DISCHG	26.12	26.10	26.09	26.07	26.05	26.04	26.02	26.00	25.99	25.97
22.00	ELEV	1024.37	1024.37	1024.36	1024.36	1024.35	1024.34	1024.34	1024.33	1024.33	1024.32
23.00	DISCHG	25.95	25.93	25.92	25.90	25.88	25.86	25.84	25.83	25.81	25.79
23.00	ELEV	1024.32	1024.31	1024.31	1024.30	1024.29	1024.29	1024.28	1024.27	1024.27	1024.26
24.00	DISCHG	25.77	25.75	25.73	25.72	25.69	25.67	25.65	25.62	25.59	25.56
24.00	ELEV	1024.26	1024.25	1024.24	1024.24	1024.23	1024.22	1024.22	1024.21	1024.20	1024.19
25.00	DISCHG	25.53	25.50	25.47	25.44	25.41	25.37	25.34	25.31	25.27	25.24

25.00	ELEV	1024.18	1024.17	1024.16	1024.15	1024.14	1024.12	1024.11	1024.10	1024.09	1024.08
26.00	DISCHG	25.21	25.17	25.14	25.11	25.07	25.04	25.01	24.96	24.90	24.84
26.00	ELEV	1024.07	1024.06	1024.05	1024.04	1024.02	1024.01	1024.00	1023.99	1023.98	1023.97
27.00	DISCHG	24.79	24.73	24.67	24.61	24.56	24.50	24.44	24.39	24.33	24.27
27.00	ELEV	1023.96	1023.95	1023.93	1023.92	1023.91	1023.90	1023.89	1023.88	1023.87	1023.85
28.00	DISCHG	24.22	24.16	24.10	24.05	23.99	23.93	23.87	23.82	23.76	23.70
28.00	ELEV	1023.84	1023.83	1023.82	1023.81	1023.80	1023.79	1023.77	1023.76	1023.75	1023.74
29.00	DISCHG	23.65	23.59	23.53	23.48	23.42	23.36	23.31	23.25	23.19	23.14
29.00	ELEV	1023.73	1023.72	1023.71	1023.70	1023.68	1023.67	1023.66	1023.65	1023.64	1023.63

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 1.0240 CFS-HRS= 449.39 ACRE-FT= 37.14

SUBROUTINE RUNOFF CROSS SECTION 35
AREA= 0.16 INPUT RUNOFF CURVE= 83.0 TIME OF CONCENTRATION= 0.45

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
12.54	196.242	(RUNOFF)
14.55	9.703	(RUNOFF)
16.57	3.402	(RUNOFF)
17.96	3.522	(RUNOFF)
19.07	3.424	(RUNOFF)
20.58	3.434	(RUNOFF)
21.57	3.447	(RUNOFF)
22.57	3.453	(RUNOFF)
23.99	3.424	(RUNOFF)

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 2.2818 CFS-HRS= 235.61 ACRE-FT= 19.47

SUBROUTINE RESVOR STRUCTURE 3
SURFACE ELEVATION= 1021.00

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
15.18	8.091	1023.00

HYDROGRAPH, TZERO= 0.00 DELTA T= 0.10 DRAINAGE AREA= 0.16

TIME											
0.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
1.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
2.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
3.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
4.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
5.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
6.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
7.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
8.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
9.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00
10.00	DISCHG	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.02	0.04	0.05
10.00	ELEV	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.00	1021.01	1021.01
11.00	DISCHG	0.07	0.09	0.11	0.15	0.19	0.24	0.32	0.55	1.05	1.95
11.00	ELEV	1021.01	1021.02	1021.02	1021.03	1021.04	1021.05	1021.06	1021.11	1021.21	1021.39
12.00	DISCHG	3.26	4.95	5.28	5.61	5.97	6.35	6.74	7.11	7.41	7.61
12.00	ELEV	1021.65	1021.99	1022.09	1022.20	1022.31	1022.44	1022.56	1022.68	1022.78	1022.84
13.00	DISCHG	7.75	7.84	7.90	7.95	7.98	8.00	8.02	8.03	8.04	8.05
13.00	ELEV	1022.89	1022.92	1022.94	1022.95	1022.96	1022.97	1022.97	1022.98	1022.98	1022.98
14.00	DISCHG	8.06	8.06	8.06	8.07	8.07	8.07	8.08	8.08	8.08	8.09

14.00	ELEV	1022.99	1022.99	1022.99	1022.99	1022.99	1022.99	1022.99	1022.99	1022.99	1023.00
15.00	DISCHG	8.09	8.09	8.09	8.09	8.08	8.08	8.07	8.06	8.05	8.04
15.00	ELEV	1023.00	1023.00	1023.00	1023.00	1022.99	1022.99	1022.99	1022.99	1022.98	1022.98
16.00	DISCHG	8.03	8.02	8.00	7.99	7.98	7.97	7.97	7.96	7.95	7.94
16.00	ELEV	1022.98	1022.97	1022.97	1022.97	1022.96	1022.96	1022.96	1022.95	1022.95	1022.95
17.00	DISCHG	7.93	7.91	7.90	7.89	7.88	7.87	7.87	7.86	7.85	7.84
17.00	ELEV	1022.94	1022.94	1022.94	1022.93	1022.93	1022.93	1022.92	1022.92	1022.92	1022.92
18.00	DISCHG	7.83	7.82	7.81	7.80	7.79	7.78	7.77	7.76	7.75	7.74
18.00	ELEV	1022.91	1022.91	1022.91	1022.90	1022.90	1022.90	1022.89	1022.89	1022.89	1022.88
19.00	DISCHG	7.73	7.72	7.71	7.71	7.70	7.69	7.68	7.67	7.66	7.65
19.00	ELEV	1022.88	1022.88	1022.88	1022.87	1022.87	1022.87	1022.86	1022.86	1022.86	1022.85
20.00	DISCHG	7.64	7.63	7.62	7.61	7.60	7.59	7.58	7.57	7.56	7.55
20.00	ELEV	1022.85	1022.85	1022.84	1022.84	1022.84	1022.83	1022.83	1022.83	1022.83	1022.82
21.00	DISCHG	7.54	7.53	7.52	7.51	7.51	7.50	7.49	7.48	7.47	7.46
21.00	ELEV	1022.82	1022.82	1022.81	1022.81	1022.81	1022.81	1022.80	1022.80	1022.80	1022.79
22.00	DISCHG	7.45	7.44	7.43	7.43	7.42	7.41	7.40	7.39	7.38	7.37
22.00	ELEV	1022.79	1022.79	1022.79	1022.78	1022.78	1022.78	1022.77	1022.77	1022.77	1022.77
23.00	DISCHG	7.36	7.36	7.35	7.34	7.33	7.32	7.31	7.30	7.29	7.28
23.00	ELEV	1022.76	1022.76	1022.76	1022.75	1022.75	1022.75	1022.74	1022.74	1022.74	1022.74
24.00	DISCHG	7.27	7.27	7.26	7.25	7.24	7.22	7.21	7.19	7.18	7.16
24.00	ELEV	1022.73	1022.73	1022.73	1022.72	1022.72	1022.72	1022.71	1022.71	1022.70	1022.70
25.00	DISCHG	7.15	7.13	7.12	7.10	7.09	7.07	7.06	7.04	7.03	7.02
25.00	ELEV	1022.69	1022.69	1022.68	1022.68	1022.67	1022.67	1022.66	1022.66	1022.65	1022.65
26.00	DISCHG	7.00	6.99	6.97	6.96	6.94	6.93	6.91	6.90	6.88	6.87
26.00	ELEV	1022.65	1022.64	1022.64	1022.63	1022.63	1022.62	1022.62	1022.61	1022.61	1022.60
27.00	DISCHG	6.86	6.84	6.83	6.81	6.80	6.78	6.77	6.76	6.74	6.73
27.00	ELEV	1022.60	1022.59	1022.59	1022.58	1022.58	1022.58	1022.57	1022.57	1022.56	1022.56
28.00	DISCHG	6.71	6.70	6.68	6.67	6.66	6.64	6.63	6.61	6.60	6.59
28.00	ELEV	1022.55	1022.55	1022.54	1022.54	1022.53	1022.53	1022.53	1022.52	1022.52	1022.51
29.00	DISCHG	6.57	6.56	6.55	6.53	6.52	6.50	6.49	6.48	6.46	6.45
29.00	ELEV	1022.51	1022.50	1022.50	1022.49	1022.49	1022.49	1022.48	1022.48	1022.47	1022.47

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 1.2848 CFS-HRS= 132.67 ACRE-FT= 10.96

SUBROUTINE RUNOFF CROSS SECTION 50

AREA= 0.38 INPUT RUNOFF CURVE= 85.0 TIME OF CONCENTRATION= 0.56

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
12.57	468.741	(RUNOFF)
14.45	23.937	(RUNOFF)
16.62	8.226	(RUNOFF)
17.98	8.582	(RUNOFF)
19.12	8.285	(RUNOFF)
20.63	8.239	(RUNOFF)
21.62	8.323	(RUNOFF)
22.62	8.304	(RUNOFF)
24.03	8.176	(RUNOFF)

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 2.4539 CFS-HRS= 601.78 ACRE-FT= 49.73

SUBROUTINE RESVOR STRUCTURE 4
SURFACE ELEVATION= 108.50

PEAK TIMES	PEAK DISCHARGES	PEAK ELEVATIONS
23.61	16.338	1015.26

TIME HYDROGRAPH, TZERO= 0.00 DELTA T= 0.10 DRAINAGE AREA= 0.39

0.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	ELEV	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50
1.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.00	ELEV	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50
2.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.00	ELEV	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50
3.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.00	ELEV	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50
4.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.00	ELEV	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50
5.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	ELEV	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50
6.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.00	ELEV	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50
7.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7.00	ELEV	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50
8.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8.00	ELEV	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50
9.00	DISCHG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9.00	ELEV	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50	1008.50
10.00	DISCHG	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.07	0.08	0.10
10.00	ELEV	1008.50	1008.51	1008.51	1008.51	1008.52	1008.52	1008.53	1008.53	1008.54	1008.55
11.00	DISCHG	0.12	0.14	0.17	0.21	0.25	0.30	0.37	0.52	0.84	7.43
11.00	ELEV	1008.56	1008.57	1008.59	1008.60	1008.62	1008.65	1008.68	1008.76	1008.92	1009.64
12.00	DISCHG	16.00	16.01	16.02	16.03	16.04	16.06	16.07	16.09	16.10	16.24
12.00	ELEV	1010.59	1010.95	1011.39	1011.91	1012.49	1013.11	1013.76	1014.40	1014.96	1015.16
13.00	DISCHG	16.36	16.44	16.50	16.54	16.57	16.60	16.62	16.63	16.64	16.65
13.00	ELEV	1015.29	1015.38	1015.44	1015.49	1015.53	1015.55	1015.57	1015.59	1015.60	1015.61
14.00	DISCHG	16.66	16.66	16.67	16.67	16.67	16.68	16.68	16.69	16.69	16.69
14.00	ELEV	1015.62	1015.62	1015.63	1015.63	1015.64	1015.64	1015.65	1015.65	1015.65	1015.66
15.00	DISCHG	16.70	16.70	16.70	16.70	16.70	16.70	16.70	16.69	16.69	16.69
15.00	ELEV	1015.66	1015.66	1015.67	1015.67	1015.67	1015.67	1015.66	1015.66	1015.66	1015.65
16.00	DISCHG	16.68	16.68	16.67	16.67	16.66	16.66	16.65	16.65	16.65	16.64
16.00	ELEV	1015.65	1015.64	1015.64	1015.63	1015.63	1015.62	1015.62	1015.61	1015.61	1015.60
17.00	DISCHG	16.64	16.63	16.63	16.62	16.62	16.61	16.61	16.61	16.60	16.60
17.00	ELEV	1015.60	1015.59	1015.59	1015.58	1015.58	1015.57	1015.57	1015.56	1015.56	1015.55
18.00	DISCHG	16.59	16.59	16.59	16.58	16.58	16.57	16.57	16.56	16.56	16.56
18.00	ELEV	1015.55	1015.54	1015.54	1015.54	1015.53	1015.53	1015.52	1015.52	1015.51	1015.51
19.00	DISCHG	16.55	16.55	16.54	16.54	16.53	16.53	16.53	16.52	16.52	16.51
19.00	ELEV	1015.50	1015.50	1015.49	1015.49	1015.48	1015.48	1015.47	1015.47	1015.46	1015.46
20.00	DISCHG	16.51	16.50	16.50	16.49	16.49	16.48	16.48	16.48	16.47	16.47
20.00	ELEV	1015.45	1015.45	1015.44	1015.44	1015.43	1015.43	1015.42	1015.42	1015.41	1015.41
21.00	DISCHG	16.46	16.46	16.45	16.45	16.45	16.44	16.44	16.43	16.43	16.43
21.00	ELEV	1015.40	1015.40	1015.39	1015.39	1015.38	1015.38	1015.37	1015.37	1015.37	1015.36
22.00	DISCHG	16.42	16.42	16.41	16.41	16.40	16.40	16.39	16.39	16.39	16.38
22.00	ELEV	1015.36	1015.35	1015.35	1015.34	1015.34	1015.33	1015.33	1015.32	1015.32	1015.31
23.00	DISCHG	16.38	16.37	16.37	16.36	16.36	16.36	16.35	16.35	16.34	16.34
23.00	ELEV	1015.31	1015.30	1015.30	1015.29	1015.29	1015.28	1015.28	1015.27	1015.27	1015.26
24.00	DISCHG	16.33	16.33	16.33	16.32	16.31	16.31	16.30	16.29	16.29	16.28
24.00	ELEV	1015.26	1015.26	1015.25	1015.24	1015.24	1015.23	1015.22	1015.22	1015.21	1015.20
25.00	DISCHG	16.27	16.26	16.26	16.25	16.24	16.23	16.22	16.22	16.21	16.20
25.00	ELEV	1015.19	1015.18	1015.17	1015.16	1015.15	1015.15	1015.14	1015.13	1015.12	1015.11
26.00	DISCHG	16.19	16.18	16.18	16.17	16.16	16.15	16.14	16.13	16.13	16.12
26.00	ELEV	1015.10	1015.09	1015.08	1015.07	1015.07	1015.06	1015.05	1015.04	1015.03	1015.02
27.00	DISCHG	16.11	16.10	16.10	16.10	16.10	16.10	16.10	16.10	16.10	16.10
27.00	ELEV	1015.01	1015.00	1014.99	1014.96	1014.94	1014.91	1014.89	1014.87	1014.84	1014.82
28.00	DISCHG	16.10	16.09	16.09	16.09	16.09	16.09	16.09	16.09	16.09	16.09
28.00	ELEV	1014.80	1014.77	1014.75	1014.73	1014.70	1014.68	1014.66	1014.63	1014.61	1014.59
29.00	DISCHG	16.09	16.09	16.09	16.09	16.09	16.09	16.09	16.09	16.09	16.09
29.00	ELEV	1014.56	1014.54	1014.52	1014.49	1014.47	1014.45	1014.42	1014.40	1014.37	1014.35

TOTAL WATER, IN INCHES ON DRAINAGE AREA= 1.2041 CFS-HRS= 295.29 ACRE-FT= 24.40

ENDCMP

SUMMARY TABLE 1

ALT	STORM	ID	DA SQ-MI.	RAIN TBLE	AMC	DELTA-T HRS.	TZERO HRS.	PRECIP IN.	PRECIP DURATION	PEAK-Q CFS	PEAK-TIME	PEAK-ELEV	RUNOFF IN.	CSM
1	3	10	0.31	4	2	0.10	0.00	4.00	24.00	280.57	12.63	0.00	1.81	905.06
1	3	15	0.31	4	2	0.10	0.00	4.00	24.00	272.99	12.81	0.00	1.81	880.61
1	3	22	0.16	4	2	0.10	0.00	4.00	24.00	186.83	12.55	0.00	2.12	1167.68
1	3	25	0.47	4	2	0.10	0.00	4.00	24.00	423.25	12.65	0.00	1.91	900.53
1	3	21	0.21	4	2	0.10	0.00	4.00	24.00	196.30	12.60	0.00	1.74	934.76
1	3	-1	0.21	4	2	0.10	0.00	4.00	24.00	55.35	13.15	1025.68	1.67	263.56
1	3	23	0.68	4	2	0.10	0.00	4.00	24.00	456.35	12.68	0.00	1.84	671.11
1	3	-2	0.68	4	2	0.10	0.00	4.00	24.00	26.82	15.77	1024.61	1.02	39.44
1	3	35	0.16	4	2	0.10	0.00	4.00	24.00	196.24	12.54	0.00	2.28	1226.51
1	3	-3	0.16	4	2	0.10	0.00	4.00	24.00	8.09	15.18	1023.00	1.28	50.57
1	3	50	0.38	4	2	0.10	0.00	4.00	24.00	468.74	12.57	0.00	2.45	1233.53
1	3	-4	0.38	4	2	0.10	0.00	4.00	24.00	16.34	23.61	1015.26	1.20	43.09

SUMMARY TABLE 3

	DISCHARGE,CFS									
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
XSEC/STRUC NO. -4 ALTERNATE 1	16.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. -3 ALTERNATE 1	8.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. -2 ALTERNATE 1	26.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. -1 ALTERNATE 1	55.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 10 ALTERNATE 1	280.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 15 ALTERNATE 1	272.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 21 ALTERNATE 1	196.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 22 ALTERNATE 1	186.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 23 ALTERNATE 1	456.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 25 ALTERNATE 1	423.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 35 ALTERNATE 1	196.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
XSEC/STRUC NO. 50 ALTERNATE 1	468.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ENDJOB CARD ENCOUNTERED. END OF JOB.

APPENDIX III
LOCAL SCOUR COMPUTATIONS

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Project Camelback Ranch
Project No. 1122-03
Sheet No. 1 of 3
Calculated by DWD Date 5/88
Checked by _____ Date _____

Local Scour Analyses - Overbank Levee

Theoretical Basis:

Source: Richardson E.V., D.B. Simons, S. Karaki, K. Mahmood, and M.A. Stevens, "Highways in the River Environment, Hydraulic and Environmental Design Considerations, Training and Design Manual" prepared for U.S. Department of Transportation, Federal Highway Administration, May, 1975

Eq(1): $\frac{\Delta Z_{ls}}{Y_h} = 1.1 \left(\frac{a}{Y}\right)^{0.4} Fr^{0.33}$ for $\frac{a}{Y_h} < 25$

Eq(2) $\frac{\Delta Z_{ls}}{Y_h} = 4\, Fr^{0.33}$ for $\frac{a}{Y_h} > 25$

where

ΔZ_{ls} = local scour depth (ft)
Y_h = hydraulic depth (ft)

Fr = Froude No. = $\frac{V}{\sqrt{gY_h}}$

V = Velocity (fps)

a = length of levee encroachment perpendicular to bank

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Project Camelback Ranch
Project No. 1122-03
Sheet No. 2 of 3
Calculated by DWD Date 5/88
Checked by _____ Date _____

• Analyses for Agua Fria and New River Levees

Agua Fria River – X-SEC 9.759

• Longitudinal STA's: 8592 to 9375 ⇒ $a = 783'$
• Hydraulics*
Percent Q = 2.1 ⇒ Q = 1995 cfs ≈ 2000 cfs
Flow Area (A) = 952 sf ⇒ $Y_h = A/a = 2.6'$
Vel = 2.1 fps

• Therefore $Fr = \frac{V}{\sqrt{g Y_h}} = 0.23$

• Since $a/Y_h >> 25$

∴ by Equation (2):

$$\frac{\Delta Z_{ls}}{Y_h} = 4 Fr^{0.33} \Rightarrow \Delta Z_{ls} = 6.4' \text{ (Local Scour)}$$

Recommendation: Minimum of 2·6.4' ≅ 13.' toedown at U/S end of Agua Fria River levee.

Per Prelim. Levee Design Plans (Jan 88), the Proposed toe down at the U/S end of the Agua Fria River levee is 15' to 16' (STA 122+00).

* Note: Hydraulic Parameters from HEC-2 analysis submitted in main Report (Jan 1988).

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Project Camelback Ranch
Project No. 1122-03
Sheet No. 3 of 3
Calculated by DWD Date 5/88
Checked by _____ Date _____

New River - x-sec 59.0

As indicated in the Preliminary Levee Design Plan (Jan 88), the proposed levee ties into the existing bank with minimal encroachment into the existing channel, at the upstream limit of the propose

- From Prelim. Levee Design Plan $a \cong 0$ to $4'$ +/-, say $a = 4'$
- Channel Hydraulics: $Q = 39{,}000$ cfs
  Flow Area = 6052 sf
  Top width = 915'
  Velocity = 6.4 fps

- Hence: $Y_h = A/TW = \frac{6052\,sf}{915'} = 6.6'$

  & $Fr = \frac{V}{\sqrt{gY_h}} = \frac{6.4\,fps}{\sqrt{32.6 \cdot 6.6'}} = 0.43$

- Since $\frac{a}{Y_h} \cong 0.61 < 25$, for $a = 4'$

  $\therefore$ by Eq(1) $\frac{\Delta Z_{ls}}{Y_h} = 1.1\left(\frac{a}{Y_h}\right)^{0.4} Fr^{0.33} \Rightarrow \Delta Z_{ls} = 4.4'$

Recommendation: Minimum of 8 +/- feet toedown at upstream limit of New River Levee.

Per Prelim. Levee Design Plans, the proposed toe down following channel improvements is 8 feet.

* Note: Hydraulic Parameters from HEC-2 analysis submitted in main report (Jan 88).

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APPENDIX IV
GEOTECHNICAL INVESTIGATION REPORT

SERGENT, HAUSKINS & BECKWITH

GEOTECHNICAL INVESTIGATION REPORT

Camelback Ranch Levee Design

Agua Fria River & New River

113th Avenue & Camelback Road

Maricopa County, Arizona

Registered Professional Engineer (Civil)
CERTIFICATE NO. 19669
SUANDAS CHENG
Date Signed
ARIZONA, U.S.A.

SHB Job No. E88-36

Consulting Geotechnical Engineers

PHOENIX • ALBUQUERQUE • SANTA FE • SALT LAKE CITY • EL PASO • TUCSON

SHB

SERGENT, HAUSKINS & BECKWITH CONSULTING GEOTECHNICAL ENGINEERS

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May 3, 1988

Coe and Van Loo
Consulting Engineers, Inc.
4550 North 12th Street
Phoenix, Arizona 85014

SHB Job No. E88-36

Attention: Ashok C. Patel, P.E., R.L.S.

Re: Camelback Ranch Levee Design
Agua Fria River & New River
113th Avenue & Camelback Road
Maricopa County, Arizona

Gentlemen:

Our Geotechnical Investigation Report on the referenced project is herewith submitted. The report includes results of test drilling and laboratory analysis, and recommended criteria for levee design and related earthwork.

Should any questions arise, please do not hesitate to contact us.

Respectfully submitted,
Sergent, Hauskins & Beckwith Engineers

By _____
Suang S. Cheng, P.E.

And _____
Norman H. Wetz, P.E.

Reviewed by _____
Lawrence A. Hansen, Ph.D., P.E.

Copies: Addressee (3)

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SHB Job No. E88-36

Registered Professional Engineer (Civil) CERTIFICATE NO. 19669 SUANG S. CHENG Date Signed ARIZONA, U.S.A.

SERGENT, HAUSKINS & BECKWITH
CONSULTING GEOTECHNICAL ENGINEERS
PHOENIX • TUCSON • ALBUQUERQUE • SANTA FE • SALT LAKE CITY • EL PASO

1. INTRODUCTION

This report is submitted pursuant to a geotechnical investigation made by this firm of the site of the proposed levee alignment for Camelback Ranch to be located south of New River and east of the Agua Fria River in Maricopa County, Arizona. The object of this investigation was to evaluate the physical properties of the subsoils underlying the site to provide recommendations for the design of the levees and related earthwork.

2. PROPOSED CONSTRUCTION

Preliminary details of the project were provided by Ashok C. Patel, P.E., R.L.S., and David W. Dust, P.E., of Coe and Van Loo Consulting Engineers, Inc. It is understood that about 13,000 linear feet of earthen levees are planned for the site. These dikes will provide flood protection from both the New River and the Agua Fria River. The existing channel of the New River will be widened to accept flood waters.

The levees will be about 8 to 10 feet in height. It is proposed that the river side of the embankment be protected against erosion with soil-cement that will extend about 6 to 8 feet below channel grade. Where stabilized levee embankments are planned, 2 1/2:1 (horizontal to

vertical) slopes are planned for the land side and about 1:1 slopes are planned for the river side. Where unprotected levee embankment sections are planned, the upstream and downstream slopes will both be 3:1.

A levee freeboard of 5 feet is anticipated for the 100-year flood. The 100-year flood will result in flows of about 95,000 cubic feet per second (cfs) in the Agua Fria River and 39,000 cfs in the New River. Stream flow velocities are estimated to be about 5 1/2 to 8 1/2 feet per second (fps) in the Agua Fria River and 6 to 7 1/2 fps in the New River. It is further understood that the duration of the 100-year flood in the New River will be less than six hours.

Should details involved in final design vary significantly from those outlined above, this firm should be notified for review and possible revision of recommendations.

3. INVESTIGATION

3.1 Subsurface Exploration

Twenty-two exploratory borings were drilled to depths of 11 to 26 feet below existing grade. All borings were drilled with our CME-55 drill rig advancing 6 5/8-inch O.D. hollow stem auger. Standard penetration testing

and open-end drive sampling were performed at selected intervals in the borings.

The results of the field investigation are presented in Appendix A, which includes a brief description of drilling and sampling equipment and procedures, a site plan showing the boring locations and logs of the test borings. The field investigation was supervised by Roman Y. Jauregui, staff engineer of this firm.

3.2 Laboratory Analysis

The moisture content and dry density of selected samples recovered were determined. The results of these tests are shown on the boring logs in Appendix A. Grain-size analysis, Atterberg limits and direct shear tests were performed on selected samples. The results of these tests are presented in Appendix B.

4. SITE CONDITIONS & GEOTECHNICAL PROFILE

4.1 Site Conditions

The general site area is relatively level and is currently farmland consisting of irrigated fields. No crops were planted at the time of our field investigation, but irrigation ditches are located along the fringes of the irrigated fields. The property does

include some undeveloped areas adjacent to the Agua Fria River and the New River. The land surface generally slopes toward the river channel in these areas and contains a light to moderate growth of grass, brush and some scattered trees. It appeared that some grading had taken place in the northeast portion of the property along the banks of the New River.

4.2 Geotechnical Profile

As indicated by the boring logs, the subsurface profile can generally be described as a two-strata system as follows:

A. From the surface to a depth of 2 to 5 feet, sandy silts and sandy clays of low plasticity were encountered. The plasticity index of these soils varied from 2 to 20. The soils are generally weakly cemented and soft to moderately firm at their present moisture contents.

B. Beneath Stratum A, silty to clayey sands and clean sands with some gravel were encountered to the full depth of the borings. These soils are medium dense to very dense and are generally weakly cemented.

4.3 Groundwater & Soil Moisture Conditions

No free groundwater was encountered in the borings. Soil moisture contents varied from 6 to 20 percent in Stratum A and from 2 to 11 percent in Stratum B.

5. DISCUSSION & RECOMMENDATIONS

5.1 Analysis of Results

As indicated by their index properties, the soils of Stratum A, particularly, are somewhat moisture sensitive. Assuming a volume change on wetting of 5 percent and a 5-foot depth of moisture sensitive soils, a settlement of 3.0 inches is calculated. It is likely that the variation in potential settlement on wetting is 1 to 4 inches, and that differential settlements of 2 to 3 inches could occur over relatively short distances. Because of the potential for settlement and differential settlement, it is recommended that the upper 4 to 5 feet of native soil be removed and recompacted to prevent damage to the proposed soil-cement erosion protection.

Most of the sampled materials are acceptable for use as backfill and soil-cement. Blending and mixing may be required depending on the exact gradation of material generated for embankments. Careful selection and some blending will be required for selection of soils to be used in soil-cement. It is anticipated that material can be mixed during grading operations, at the discretion of the representative of the geotechnical engineer, to provide high quality embankments. Site grading, embankment design and soil-cement design criteria are presented in the following sections.

5.2 Surface Treatment

It is recommended that all vegetation, debris and trash be removed from the site. At the discretion of the representative of the geotechnical engineer, surficial deposits of loose sand and finer grained materials should be overexcavated and removed for use elsewhere on the project site. It appears that 2 to 4 feet of Stratum A soils will require overexcavation.

The upper 6 inches of exposed native soils beneath cut surfaces should be scarified, brought to within 2 percent of the optimum moisture content and compacted to at least 95 percent of maximum dry density as determined by ASTM D698.

5.3 Embankment Fill

All fill required to raise the levee up to design elevation should be free of excessive vegetation, debris and other deleterious materials, and contain no particles larger than 6 inches in diameter. It appears that most of the on-site materials are acceptable for use as embankment fill.

All fill should be compacted to a minimum of 95 percent of maximum dry density as determined in accordance with ASTM D698. The moisture content during compaction

should be maintained within 2 percent of optimum moisture contents.

5.4 Typical Levee Sections

Embankment slopes of 1:1 for soil-cement treated slopes and 3:1 for unprotected upstream slopes are proposed. A 2 1/2:1 downstream slope is proposed for the soil-cement protected portions of the levees and a 3:1 downstream slope is proposed for unprotected portions of the levee. Three typical cross sections were developed for analysis. Figures 1, 2 and 3 in Appendix C illustrate typical levee sections along the New River, the Agua Fria River and the unprotected section, respectively. Shown on these figures are the proposed levee geometry, water surface elevations and freeboard, the assumed maximum phreatic surface that could develop in the levee and the extent of recommended overexcavation of native soils.

It is noted that the location of the phreatic surface within the levee was assumed, and is considered very conservative. Soil-cement typically has a very low coefficient of permeability relative to the native and embankment soils. Thus, seepage below the soil-cement is anticipated prior to seepage through the soil-cement section. The phreatic surface would develop laterally from the river and, considering 6-hour duration of the 100-year flood, would likely not fully develop as shown

in Figures 1, 2 and 3. Full development of the phreatic surface shown, considering the soils that will be utilized in construction, would likely require several days to develop.

5.5 Levee Stability

5.5.1 Analysis Procedure

The slope stability of the levee sections shown in Figures 1 through 3 were analyzed using the computer program STABL developed by Purdue University (Siegel, 1975a, 1975b; Lovell, Sharma and Carpenter, 1984)*. This program (up to and including version STABL4) considers a generalized shear surface utilizing a limiting equilibrium (simplified Janbu or simplified Bishop) method of slices. Irregular trial shear surfaces are generated and analyzed to determine the critical shear surface.

In the simplified Janbu procedure, parallel side shear forces are assumed, and vertical and horizontal force equilibrium of the individual slices are satisfied, but overall moment equilibrium and moment equilibrium of the individual slices are not satisfied. The computed factor of safety is conservative relative to more accurate methods satisfying complete equilibrium.

*References are listed at end of report.

5.5.2 Soil Parameters

Based on the direct shear test results and our general experience with similar soils, the soil strength parameters and unit weights listed in Table 1 were assumed for the analyses. Because of the predominantly granular nature of the soils, the soils were assumed to be cohesionless. The cohesion values assigned to the soil-cement are representative of uniaxial compressive strengths of this material.

5.5.3 Analysis Results

The pertinent results of the stability analyses are listed in Table 2, which presents minimum computed safety factors for both river and land side slopes for several conditions. Three conditions were considered, including end of construction without a phreatic surface, full development of the phreatic surface and sudden drawdown.

Of the three conditions assumed, sudden drawdown subsequent to development of a full phreatic surface results in the minimum computed safety factor for the river side of the embankment. Computed safety factors vary from 1.30 to 1.94 for the three levee sections analyzed, which exceed the recommended minimum of 1.2 for this condition. For all other conditions, computed safety factors exceeded 1.5, indicating the

TABLE 1

Soil Parameters Assumed for Stability Analyses

Material	Unit Weight Total (pcf)	Saturated (pcf)	Friction Angle (degrees)	Cohesion (psf)
Compact fill, dry	115	125	33	0
Compact fill, saturated	115	125	31	0
Native sand, dry	100	108	30	0
Native sand, saturated	100	108	28	0
Soil-cement, dry	130	142	0	5,000
Soil-cement, saturated	130	142	0	3,000

TABLE 2

Results of Stability Analyses

Typical Section	Condition	Slope	Factor of Safety
Figure 1	Case I	River side	3.71
	Case II	River side	1.94
	Case III	River side	2.71
	Case III	Land side	1.55
Figure 2	Case I	River side	3.56
	Case II	River side	1.84
	Case III	River side	2.53
	Case III	Land side	1.58
Figure 3	Case I	River side	1.91
	Case II	River side	1.30
	Case III	River side	1.80
	Case III	Land side	1.82

Note: Case I - End of construction.

Case II - Full phreatic surface subject to sudden drawdown.

Case III - Full phreatic surface at flood stage.

levees should not be subject to slope stability problems once constructed.

5.6 Settlement Analysis

The settlement of the Agua Fria levee section was estimated to determine if the potential settlement of the levees will impact the performance of the levees. The settlement estimate was based on the following assumptions or procedures:

- The depth to an incompressible layer is 30 feet.
- The average standard penetration test (SPT) blow count is 20 blows per foot.
- Deformation modulus is related to SPT blow count as described by Schmertman (Wrench and Nowatzki, 1986).
- Vertical stress due to embankment loading was determined using the influence chart of Osterberg (1957).
- Poisson's ratio for the foundation soils is 0.35.
- Since the finer grained material will be over-excavated, consolidation settlements are ignored.

The results of settlement analysis are shown as a settlement profile in Figure 4 in Appendix C.

A levee having a maximum height of 9 feet was assumed, resulting in a maximum embankment load of 1,125 pounds per square foot (psf). For this loading, a maximum

settlement of 0.28 inch occurring below the midpoint of the crest was computed. As shown on Figure 4, estimated maximum and differential settlements are anticipated to be small. It is further expected that the major component of the settlement will occur during construction, since the predominantly granular foundation soils are not subject to long-term consolidation settlements.

5.7 Erosion Protection

5.7.1 Protection Alternatives

Several alternatives for erosion protection are possible, including gabions, placed riprap and soil-cement. Gabions and riprap would require a graded rock-fill having a mean particle size in the range of 3 to 5 inches. Sources of a significant quantity of this type of aggregate within 5 miles of the project site are limited. Both the haul distance and the grading restriction increase the cost of these options. Placement of the rock-fill on a 2:1 or 3:1 slope would also be difficult, unless a large horizontal thickness were used. Considering the total length of the dike and the above factors, these alternatives are not recommended.

5.7.2 Soil-Cement

Soil-cement is recommended for erosion protection on

the river slope of the levees. The native soils of Stratum B typically contain 10 to 30 percent material finer than the no. 200 sieve, and have a maximum particle size of 1/2 inch or less. The soil-cement protection should be constructed in 6- to 8-inch lifts with a minimum horizontal width of 8 feet.

For estimating purposes, the cement content of soil-cement should be 12 percent. The exact cement content should be determined in accordance with ASTM D558, D559 and D560 using the on-site soil that will be used for the soil-cement treatment. Shrinkage cracks and some maintenance should be expected with soil-cement erosion protection.

5.8 Temporary Slopes During Construction

Temporary slopes during construction will depend upon the soils used to construct the levees and the native soils encountered during excavation. Soils with fines contents on the order of 20 percent or more probably will stand at a slope of 1:1. For the cleaner sands, a temporary allowable cut slope of 1 1/4:1 to 1 1/2:1 will be required to prevent slumping or sloughing of levee materials before the soil-cement section can be constructed. The construction of the soil-cement section, and estimates of the quantity of soil-cement required, should consider that temporary slopes of 1 1/4:1 to 1 1/2:1 may be required.

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APPENDIX A

TEST DRILLING EQUIPMENT & PROCEDURES

Drilling Equipment Truck-mounted CME-55 drill rigs powered with 4 or 6 cylinder Ford industrial engines are used in advancing test borings. The 4 cylinder and 6 cylinder engines are capable of delivering about 4,350 and 6,500 foot/pounds torque to the drill spindle, respectively. The spindle is advanced with twin hydraulic rams capable of exerting 12,000 pounds downward force. Drilling through soil or softer rock is performed with 6 1/2 O.D., 3 1/4 I.D. hollow stem auger or 4 1/2 inch continuous flight auger. Carbide insert teeth are normally used on the auger bits so they can often penetrate rock or very strongly cemented soils which require blasting or very heavy equipment for excavation. Where refusal is experienced in auger drilling, the holes are sometimes advanced with tricone gear bits and NX rods using water or air as a drilling fluid. Where auger and tricone gear bits cannot be used to advance the hole due to cobbles or caving conditions, the ODEX (overburden drilling with the eccentric method) is used. A percussion down-the-hole hammer underreams the hole and 5 inch steel casing is introduced into the hole during drilling. The drill bit is eccentric and can be removed from the center of the casing to allow sampling of the material below the bit penetration depth.

Sampling Procedures Dynamically driven tube samples are usually obtained at selected intervals in the borings by the ASTM D1586 procedure. In many cases, 2" O.D., 1 3/8" I.D. samplers are used to obtain the standard penetration resistance. "Undisturbed" samples of firmer soils are often obtained with 3" O.D. samplers lined with 2.42" I.D. brass rings. The driving energy is generally recorded as the number of blows of a 140 pound 30 inch free fall drop hammer required to advance the samplers in 6 inch increments. However, in stratified soils, driving resistance is sometimes recorded in 2 or 3 inch increments so that soil changes and the presence of scattered gravel or cemented layers can be readily detected and the realistic penetration values obtained for consideration in design. These values are expressed in blows per foot on the logs. "Undisturbed" sampling of softer soils is sometimes performed with thin walled Shelby tubes (ASTM D1587). Where samples of rock are required, they are obtained by NX diamond core drilling (ASTM D2113). Tube samples are labeled and placed in watertight containers to maintain field moisture contents for testing. When necessary for testing, larger bulk samples are taken from auger cuttings.

Continuous Penetration Tests Continuous penetration tests are performed by driving a 2" O.D. blunt nosed penetrometer adjacent to or in the bottom of borings. The penetrometer is attached to 1 5/8" O.D. drill rods to provide clearance to minimize side friction so that penetration values are as nearly as possible a measure of end resistance. Penetration values are recorded as the number of blows of a 140 pound 30 inch free fall drop hammer required to advance the penetrometer in one foot increments or less.

Boring Records Drilling operations are directed by our field engineer or geologist who examines soil recovery and prepares boring logs. Soils are visually classified in accordance with the Unified Soil Classification System (ASTM D2487) with appropriate group symbols being shown on the logs.

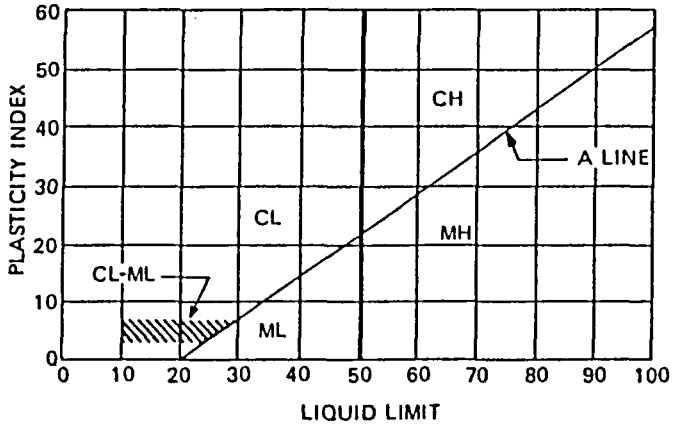
UNIFIED SOIL CLASSIFICATION SYSTEM

Soils are visually classified by the Unified Soil Classification system on the boring logs presented in this report. Grain-size analysis and Atterberg Limits Tests are often performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. For a more detailed description of the system, see "The Unified Soil Classification System" Corp of Engineers, US Army Technical Memorandum No. 3-357 (Revised April 1960) or ASTM Designation: D2487-66T.

MAJOR DIVISIONS				GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (Less than 50% passes No. 200 sieve)	GRAVELS (50% or less of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)			GW	Well graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
					GP	Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		GM	Silty gravels, gravel-sand-silt mixtures.
			Limits plot above "A" line & hatched zone on plasticity chart		GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 seive)			SW	Well graded sands, gravelly sands.
					SP	Poorly graded sands, gravelly sands.
		SANDS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		SM	Silty sands, sand-silt mixtures.
			Limits plot above "A" line & hatched zone on plasticity chart		SC	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS (Limits plot below "A" line & hatched zone on plasticity chart)	SILTS OF LOW PLASTICITY (Liquid Limit Less Than 50)			ML	Inorganic silts, clayey silts with slight plasticity.
		SILTS OF HIGH PLASTICITY (Liquid Limit More Than 50)			MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts.
	CLAYS (Limits plot above "A" line & hatched zone on plasticity chart)	CLAYS OF LOW PLASTICITY (Liquid Limit Less Than 50)			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		CLAYS OF HIGH PLASTICITY (Liquid Limit More Than 50)			CH	Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity.

NOTE: Coarse grained soils with between 5% & 12% passing the No. 200 sieve and fine grained soils with limits plotting in the hatched zone on the plasticity chart to have double symbol.

PLASTICITY CHART



DEFINITIONS OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Cobbles	Above 3 in.
Gravel	3 in. to No. 4 sieve
Coarse gravel	3 in. to ¾ in.
Fine gravel	¾ in. to No. 4 sieve
Sand	No. 4 to No. 200
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Fines (silt or clay)	Below No. 200 sieve

TERMINOLOGY USED TO DESCRIBE THE RELATIVE DENSITY, CONSISTENCY OR FIRMNESS OF SOILS

The terminology used on the boring logs to describe the relative density, consistency or firmness of soils relative to the standard penetration resistance is presented below. The standard penetration resistance (N) in blows per foot is obtained by the ASTM D1586 procedure using 2" O.D., 1 3/8" I.D. samplers.

1. Relative Density. Terms for description of relative density of cohesionless, uncemented sands and sand-gravel mixtures.

N	Relative Density
0-4	Very loose
5-10	Loose
11-30	Medium dense
31-50	Dense
50+	Very dense

2. Relative Consistency. Terms for description of clays which are saturated or near saturation.

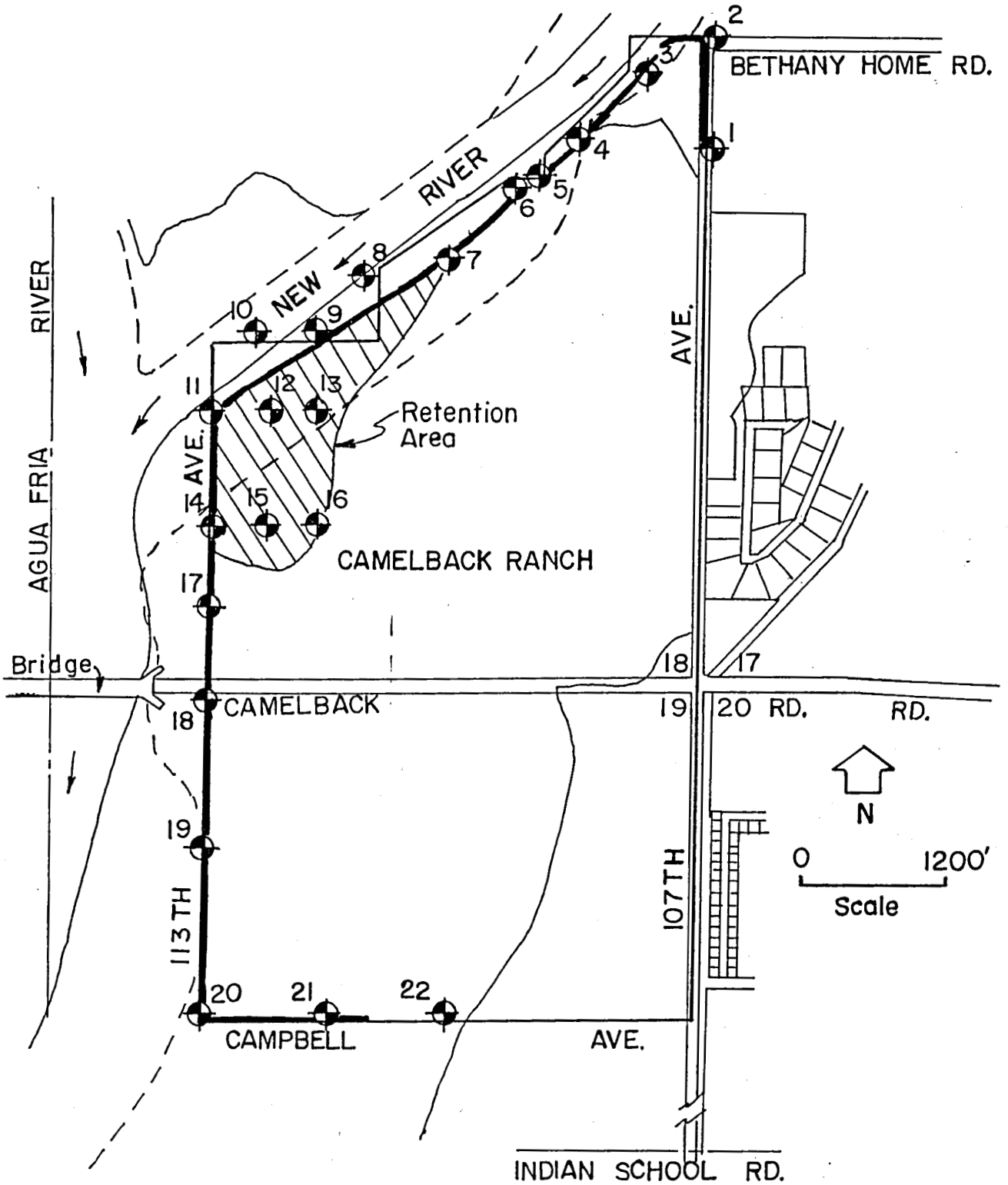
N	Relative Consistency	Remarks
0-2	Very soft	Easily penetrated several inches with fist.
3-4	Soft	Easily penetrated several inches with thumb.
5-8	Medium stiff	Can be penetrated several inches with thumb with moderate effort.
9-15	Stiff	Readily indented with thumb, but penetrated only with great effort.
16-30	Very stiff	Readily indented with thumbnail.
30+	Hard	Indented only with difficulty by thumbnail.

3. Relative Firmness. Terms for description of partially saturated and/or cemented soils which commonly occur in the Southwest including clays, cemented granular materials, silts and silty and clayey granular soils.

N	Relative Firmness
0-4	Very soft
5-8	Soft
9-15	Moderately firm
16-30	Firm
31-50	Very firm
50+	Hard

SITE PLAN

SHOWING LOCATIONS OF TEST BORINGS



Reference Drawing: "Camelback Ranch A.L.T.A." by Coe & Van Loo Consulting Engineers, Inc., dated 9/14/87

Camelback Ranch Levee Design
Agua Fria River & New River
113th Avenue & Camelback Road
Maricopa County, Arizona
SHB Job No. E88-36

SERGENT, HAUSKINS & BECKWITH
CONSULTING GEOTECHNICAL ENGINEERS
PHOENIX · TUCSON · ALBUQUERQUE · SANTA FE · SALT LAKE CITY · EL PASO

PROJECT Camelback Ranch Levee Design

JOB NO. E88-36 DATE 2-15-88

LOG OF TEST BORING NO. 1

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1038'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	31			CL-ML	moist very firm to firm	SANDY SILT, some clay, low plasticity, brown
			X	S	17		14			
5			X	S	12			SM	moist medium dense	SILTY SAND, predominantly fine to medium grained, subangular, nonplastic, brown
10			X	S	29 (no recovery)					note: some gravel at 8'
15										Stopped auger at 9'6" Stopped sampler at 11'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E88-36 DATE 2-15-88

LOG OF TEST BORING NO. 2

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1041'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	18				moist firm to moderately firm	Man-made FILL CLAYEY SAND, considerable gravel, poorly graded, subangular, low plasticity to non-plastic, brown
			X	S	23			SC-SM		
5			X	S	13					
10			X	S	70			SP-SM	moist very dense to dense	SILTY SAND, predominantly fine to medium grained, subangular, nonplastic, brown note: considerable gravel from 11' to 14'
15			X	S	37					
20			X	S	50/6"			GP-GM	moist very dense	SILTY SAND & GRAVEL, poorly graded, subrounded, nonplastic, brown
25										Auger refused at 23' on gravel

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E88-36 DATE 2-15-88

LOG OF TEST BORING NO. 3

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1044'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	6		5		moist to dry	SILTY SAND, trace of gravel, predominantly fine to medium grained, subangular, nonplastic, brown
				A			5		very loose to dense	
			X	S	3		4			
5			X	S	4 (no recovery)					note: trace of cobbles from 21'6" to 23'
10			X	S	18		1			
								SM		
15			X	S	13		7			
20			X	U	48	104	3			
25			X	S	50/3½"		12	SC	moist hard	CLAYEY SAND, trace of gravel, predominantly fine to medium grained, subangular to subrounded, weakly to moderately lime cemented, low plasticity, reddish brown
30										Auger refused at 25'6" on gravel & cobbles

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E88-36 DATE 2-15-88

LOG OF TEST BORING NO. 4

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1039'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	25				slightly moist	SANDY SILT, low plasticity to nonplastic, brown
				A			6	ML		
				S	17				firm	
5				U	10	87	10		slightly moist	SANDY CLAY, low plasticity, brown
								CL	soft	
								SP-SM	slightly moist	SAND, considerable gravel, some silt, predominantly fine to medium grained, subangular, nonplastic, brown
10				S	17				medium dense	
15										Stopped auger at 9'6" Stopped sampler at 11'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E88-36 DATE 2-15-88

LOG OF TEST BORING NO. 5

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1036.5'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	13				moist moderately firm	SILTY SAND, predominantly fine grained, low plasticity to non-plastic, brown note: some clay below 4'
				S	14		11			
				A				SM		
5				U	16					
10				S	20				moist medium dense to very dense	SAND, some silt & gravel, predominantly fine to medium grained, sub-angular, nonplastic, light brown
								SP-SM		
15				S	33					
20				S	50/2"					
25										Stopped auger at 19'6" Sampler refused at 20'2"

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E88-36 DATE 2-15-88

LOG OF TEST BORING NO. 6

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1035'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	27			CL	moist firm	SANDY CLAY, low plasticity, brown
			X	S	10		4			
5			X	S	6			SW-SM	moist loose	SAND, considerable silt, well graded, subangular, nonplastic, brown
10			X	S	17			SM-SC	moist firm	SILTY SAND, some clay & gravel, predominantly fine to medium grained, subangular, weakly lime cemented, low plasticity, brown
15										Stopped auger at 9'6" Stopped sampler at 11'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E88-36 DATE 2-15-88

LOG OF TEST BORING NO. 7

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1033.5'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S A	26		8	ML	moist	SANDY SILT, some clay, weakly lime cemented, low plasticity, brown
				S	17		4	SM	firm	
5				U	8	92	4	SP-SC	slightly moist, firm	SILTY SAND, predominantly fine grained, subangular, weakly lime cemented, nonplastic, brown
10				S	30		3	SP-SM	slightly moist, very loose	SAND, some clay, predominantly medium grained, subangular to subrounded, nonplastic, brown
15				S	31 (no recovery)				moist to slightly moist, medium dense to very dense	SAND, some gravel & silt, predominantly fine to medium grained, subangular to subrounded, nonplastic, brown
20				S	50/2" (no recovery)					Stopped auger at 19'6" Sampler refused at 19'8"

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E88-36 DATE 2-15-88

LOG OF TEST BORING NO. 8

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1033'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	9		14		moist	SANDY SILT, low plasticity, brown
			X	S	6			ML	soft to moderately firm	
5			X	S	11					
			X	A			6	SM	moist loose to medium dense	SILTY SAND, trace of gravel, predominantly fine to medium grained, subangular, nonplastic, light brown
10			X	U	16					
										Stopped auger at 9'6" Stopped sampler at 10'6"
15										

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E88-36 DATE 2-16-88

LOG OF TEST BORING NO. 9

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1030.5'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	35			CL	moist	SANDY CLAY, low plasticity, brown
			X	S	20		9		very firm to firm	
5			X	S	15				moist	SAND, some silt, trace of gravel, predominantly fine to medium grained, subangular, nonplastic, brown
									medium dense to very dense	
10			X	S	20			SP-SM		
15			X	S	58					
								SC	moist	CLAYEY SAND, considerable gravel, predominantly fine to medium grained, subangular, weakly lime cemented, low plasticity, reddish brown
20			X	S	50/5"				hard	
25										Stopped auger at 19'6" Sampler refused at 20'5"

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E88-36 DATE 2-16-88

LOG OF TEST BORING NO. 10

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1030'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S A	9		5	SM	slightly moist	SILTY SAND, predominantly fine to medium grained, subangular, nonplastic, brown
			X	S	17		2		moderately firm	
5			X	S	20		2	SP-SM	slightly moist	SAND, trace of silt & gravel, predominantly fine to medium grained, subangular, nonplastic, brown
									medium dense	
10			X	S	22					
										Stopped auger at 9'6" Stopped sampler at 11'
15										

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E88-36 DATE 2-16-88

LOG OF TEST BORING NO. 11

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1028'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	7		4	SM	slightly moist	SILTY SAND, predominantly fine grained, subangular, nonplastic, brown
			X	S	10		3		soft	
5			X	S	10		3		moist	SAND, trace of silt & fine grained gravel, predominantly fine to medium grained, subangular, nonplastic, light brown
								SP-SM	loose to medium dense	
10			X	U	19 (no-recovery)					
								SW-SM	moist	SAND, considerable gravel, trace of silt, well graded, subangular, nonplastic, light brown
15			X	S	50/6"		3		very dense	
20										Auger refused at 16' on gravel

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E88-36 DATE 2-16-88

LOG OF TEST BORING NO. 12

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1027.5'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S A	11		11	SM	moist	SILTY SAND, predominantly fine to medium grained, subangular, nonplastic, brown
			X	S	31				moderately firm	
5			X	S	7			SP-SM	moist loose to dense	SAND, some silt, predominantly medium to fine grained, subangular, nonplastic, light brown
10			X	S	17					note: trace of gravel at 9'
15										Stopped auger at 9'6" Stopped sampler at 11'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E88-36 DATE 2-16-88

LOG OF TEST BORING NO. 13

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1028'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	11			CL	moist	SANDY CLAY, low plasticity, brown
			X	S	4		7		medium firm	
5			X	S	8				moist	SILTY SAND, predominantly fine to medium grained, subangular, nonplastic, light brown
								SM	very loose to medium dense	
10			X	S	13					
15										Stopped auger at 9'6" Stopped sampler at 11'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E88-36 DATE 2-16-88

LOG OF TEST BORING NO. 14

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1025.5'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	6				moist	SANDY CLAY, low plasticity, dark brown
			X	S	4		16	CL	very soft to firm	
5			X	U	36	91	16			
									moist	SAND, trace of silt & gravel, predominantly fine to medium grained, subangular, nonplastic, light brown
10			X	S	8				loose to very dense	
								SP-SM		note: considerable gravel from 12'6" to 20'
15			X	S	50/6"					
20			X	S	40					
										Stopped auger at 19'6" Stopped sampler at 21'
25										

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E88-36 DATE 2-16-88

LOG OF TEST BORING NO. 15

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1026'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	7				moist	SANDY CLAY, low plasticity, dark brown
				A			17	CL	soft to moderately firm	
				S	14					
5				S	8				moist	SAND, trace of silt, predominantly fine to medium grained, subangular, nonplastic, light brown
								SP-SM	loose to medium dense	
10				S	17					note: trace of gravel at 7'6"
15										Stopped auger at 9'6" Stopped sampler at 11'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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PROJECT Camelback Ranch Levee Design

JOB NO. E88-36 DATE 2-16-88

LOG OF TEST BORING NO. 16

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1026'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	18				moist	SANDY CLAY, weakly lime cemented, low plasticity, dark brown
				A				CL	firm to moderately firm	
				S	10					
5				S	7		7		moist	SILTY SAND, trace of gravel, predominantly fine to medium grained, subangular, nonplastic, light brown
								SM	loose to dense	note: considerable gravel at 8'
10				S	37					
15										Stopped auger at 9'6" Stopped sampler at 11'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E88-36 DATE 2-16-88

LOG OF TEST BORING NO. 17

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1024.5'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	6			SM-	moist	SILTY SAND, some clay, predominantly fine grained, subangular, nonplastic, brown
			X	S	7		13	SC	loose	
5			X	S	13				moist medium dense to very dense	SAND, trace of silt, predominantly fine to medium grained, subangular, nonplastic, light brown
10			X	S	54			SP		note: some gravel at 8' & considerable gravel at 12'6"
15			X	S	32					
20										Auger refused at 16' on gravel

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E88-36 DATE 2-17-88

LOG OF TEST BORING NO. 18

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1022'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	28		8	SM-SC	slightly moist firm	SILTY SAND, trace of clay, predominantly fine grained, subangular, weakly lime cemented, low plasticity to nonplastic, brown
			X	S	10		8			
5			X	S	12		4	SM		
10			X	S	16		6		moist medium dense	SILTY SAND, predominantly fine grained, subangular, nonplastic, brown
								SP-SM	moist medium dense to very dense	SAND, some silt, trace of gravel, predominantly fine to medium grained, subangular, nonplastic, light reddish brown note: considerable gravel from 16' to 20'
15			X	S	43		6			
20				S	50/3½" (no recovery)					Stopped auger at 19'6" Sampler refused at 19'9½"

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E88-36 DATE 2-17-88

LOG OF TEST BORING NO. 19

RIG TYPE CME-55
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1019'±
DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	19			CL	moist	SANDY CLAY, weakly lime cemented, low plasticity, brown
			X	U	12	94	2		firm	
5			X	S	42				slightly moist to moist	SAND, trace of silt, predominantly fine grained, subangular, nonplastic, light brown
									medium dense to very dense	note: trace of gravel at 7'6" & considerable gravel from 15' to 20'
10			X	S	15			SP-SM		
15			X	S	47					
20			X	S	50/5½"					
25										Stopped auger at 19'6" Sampler refused at 20'5½"

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E88-36 DATE 2-17-88

LOG OF TEST BORING NO. 20

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1016'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	17		6	SM	moist	SILTY SAND, trace of gravel, predominantly fine to medium grained, subangular, nonplastic, brown
				A					firm to moderately firm	
				S	11		8			
5				S	14		3			
								SP-SM	slightly moist to moist	SAND, trace of silt, predominantly fine to medium grained, subangular, nonplastic, light brown
10				S	22		5		medium dense	note: trace of gravel at 7'6"
15				S	62		7		moist	SILTY SAND, considerable gravel, poorly graded, subangular, weakly lime cemented, nonplastic to low plasticity, light reddish brown
								SM	very dense	
20				S	69		5			
25										Stopped auger at 19'6" Stopped sampler at 21'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E88-36 DATE 2-16-88

LOG OF TEST BORING NO. 21

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1019.5'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0				S	22				moist	SILTY CLAY, some sand, medium plasticity, dark brown
				A					firm to soft	
				S	10		20	CL		
5				S	8					
								SP-SM	moist loose	SAND, trace of silt, predominantly fine to medium grained, sub-angular, nonplastic, light brown
10				S	6					
15										Stopped auger at 9'6" Stopped sampler at 11'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E88-36 DATE 2-16-88

LOG OF TEST BORING NO. 22

RIG TYPE CME-55

BORING TYPE 6 5/8" Hollow Stem Auger

SURFACE ELEV. 1020'±

DATUM Plan & Profile

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	S	9			CL	moist moderately firm	SANDY CLAY, low to medium plasticity, brown
			X	S	9					
5			X	U	11			SC	moist moderately firm	CLAYEY SAND, considerable silt, predominantly fine grained, subangular, low plasticity, light brown
								SP-SM		
10			X	S	47			CL	moist	SAND, some silt, trace of gravel, predominantly fine to medium grained, subangular, nonplastic, light brown
15									moist very firm	SILTY CLAY, some sand, weakly lime cemented, medium plasticity, brown
										Stopped auger at 9'6" Stopped sampler at 11'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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APPENDIX B

LABORATORY TESTING PROCEDURES

Consolidation Tests Soiltest or Clockhouse apparatus of the "floating-ring" type are employed for the one-dimensional consolidation tests. They are designed to receive one inch high 2.5 inch O.D. brass liner rings with soil specimens as secured in the field. Procedures for the tests generally are those outlined in ASTM D2435. Loads are applied in several increments to the upper surface of the test specimen and the resulting deformations are recorded at selected time intervals for each increment. For soils which are essentially saturated, each increment of load is maintained until the deformation versus log of time curve indicates completion of primary consolidation. For partially saturated soils, each increment of load is maintained until the rate of deformation is equal or less than 1/10,000 inch per hour. Applied loads are such that each new increment is equal to the total previously applied loading. Porous stones are placed in contact with the top and bottom of the specimens to permit free addition or expulsion of water. For partially saturated soils, the tests are normally performed at in situ moisture conditions until consolidation is complete under stresses approximately equal to those which will be imposed by the combined overburden and foundation loads. The samples are then submerged to show the effect of moisture increase and the tests continued under higher loadings. Generally, the tests are continued to about twice the anticipated curve due to overburden and structural loads with a rebound curve then being established by releasing loads.

Expansion Tests The same type of consolidometer apparatus described above is used in expansion testing. Undisturbed samples contained in brass liner rings are placed in the consolidometers, subjected to appropriate surcharge loads and submerged. The loads are maintained until the expansion versus log of time curve indicates the completion of "primary swell".

Direct Shear Tests Direct shear tests are run using a Clockhouse or Soiltest apparatus of the strain-control of approximately 0.05 inches per minute. The machine is designed to receive one of the one inch high 2.42 inch diameter specimens obtained by tube sampling. Generally, each sample is sheared under a normal load equivalent to the effective overburden pressure at the point of sampling. In some instances, samples are sheared at several normal loads to obtain the cohesion and angle of internal friction. When necessary, samples are saturated and/or consolidated before shearing in order to approximate the anticipated controlling field loading conditions.

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TABULATION OF TEST RESULTS

Job No. E88-36
W/O 1

HOLE NO	DEPTH	UNIFIED CLASS	L.L.	P.I.	SIEVE ANALYSIS-ACCUM % PASSING #200 .75"	#100 1"	#50 1.5"	#40 2"	#30 2.5"	#16 3"	#10 3.5"	#8 4"	#4 6"	.25" 8"	.375" 10"	.5" 12"	LAB NO
#1	2'6"-4'	CL-ML	26	6	64	75	84	88	91	97	99	99	100				8-36-2
#3	0-4'6"	SM	NV	NP	13	21	39	55	67	86	94	96	100				8-36-10
#4	0-4'6"	ML	21	1	51	66	80	86	92	98	99	99	100				8-36-17
#5	2'6"-4'	SM	NV	NP	37	72	84	92	98	99	99	99	100				8-36-24
#6	2'6"-4'	SW-SM	NV	NP	12	16	27	37	48	69	83	86	92	92	93	96	
					100												8-36-30
#7	4'6"-5'6"	SP-SC	28	9	8.4	9	13	24	45	87	98	99	100				8-36-36
#8	6"-2'	ML	23	2	63	78	91	96	98	99	100						8-36-38
#8	5'-9'	SM	NV	NP	26	34	46	58	71	89	95	96	100				8-36-41
#9	2'6"-4'	CL	31	11	55	69	81	88	93	98	99	100					8-36-44
#10	6"-2'	SM	NV	NP	24	33	48	60	72	90	96	97	100				8-36-50
#10	4'6"-6'	SP-SM	NV	NP	5.4	9	21	37	54	75	84	85	90	90	91	96	
					100												8-36-52
#11	2'6"-4'	SP-SM	NV	NP	5.6	13	34	56	76	94	96	97	98	99	100		8-36-55
#12	6"-2'	SM	NV	NP	39	50	70	81	88	95	97	98	99	99	100		8-36-59
#13	2'6"-4'	SM	NV	NP	21	30	48	62	79	97	99	100					8-36-64
#14	2'6"-4'	CL	28	12	54	66	85	92	96	99							8-36-68

SERGENT, HAUSKINS & BECKWITH

TABULATION OF TEST RESULTS

Job No. E88-36
W/O 1

HOLE NO	DEPTH	UNIFIED CLASS	L.L.	P.I.	SIEVE ANALYSIS-ACCUM % PASSING #200 .75"	#100 1"	#50 1.5"	#40 2"	#30 2.5"	#16 3"	#10 3.5"	#8 4"	#4 6"	.25" 8"	.375" 10"	.5" 12"	LAB NO
#15	0-4'	CL	32	14	52	61	71	75	79	82	83	83	84	85	87	90	
					92	94	97	100									8-36-73
#16	4'6"-6'	SM	NV	NP	15	31	60	74	85	94	96	97	98	98	100		8-36-81
#17	2'6"-4'	SM	NV	NP	39	51	69	81	89	96	99	99	100				8-36-84
#21	2'6"-4'	CL	41	20	79	88	94	96	98	99							8-36-90
#18	2'6"-4'	SM	23	2	47	57	75	85	91	97	98	99	99	100			8-36-98
#19	2'6"-3'6"	SP-SM	NV	NP	6.5	14	42	72	89	98	100						8-36-103
#20	6"-2'	SM	24	2	47	57	71	80	87	94	96	96	97	99	100		8-36-109

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REPORT OF LABORATORY TESTS	DATE	2/29/88
PROJECT: CAMELBACK RANCH	JOB NO.	E88-36
LOCATION:#5 @ 4'6"-5'6"	W.O.NO.	1
	LAB NO.	25

DIRECT SHEAR TEST(SATURATED)ASTM D-3080

POINT NO. 1 (NORMAL STRESS 0.995 KSF)

Initial Moisture Content	17.9%
Dry Density	105.1 LB/CU FT
Moisture at Saturation	21.7%
Maximum Vertical Deformation @ T max.	0.003 IN
Shearing Stress, T max.	0.7 KSF

POINT NO. 2 (NORMAL STRESS 2.059 KSF)

Initial Moisture Content	18.1%
Dry Density	106.0 LB/CU FT
Moisture at Saturation	21.5%
Maximum Vertical Deformation @ T max.	-0.006 IN
Shearing Stress, T max.	1.4 KSF

POINT NO. 3 (NORMAL STRESS 2.998 KSF)

Initial Moisture Content	16.8%
Dry Density	106.4 LB/CU FT
Moisture at Saturation	21.5%
Maximum Vertical Deformation @ T max.	-0.014 IN
Shearing Stress, T max.	1.8 KSF

DIRECT SHEAR

#5 @ 4'6"–5'6"

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REPORT OF LABORATORY TESTS	DATE	2/29/88
PROJECT: CAMELBACK RANCH	JOB NO.	E88-36
LOCATION:#7 @ 4'6"-5'6"	W.O.NO.	1
	LAB NO.	36

DIRECT SHEAR TEST(IN SITU)ASTM D-3080

POINT NO. 1 (NORMAL STRESS 0.995 KSF)

Initial Moisture Content	3.3%
Dry Density	90.5 LB/CU FT
Maximum Vertical Deformation @ T max.	0.009 IN
Shearing Stress, T max.	0.9 KSF

POINT NO. 2 (NORMAL STRESS 2.059 KSF)

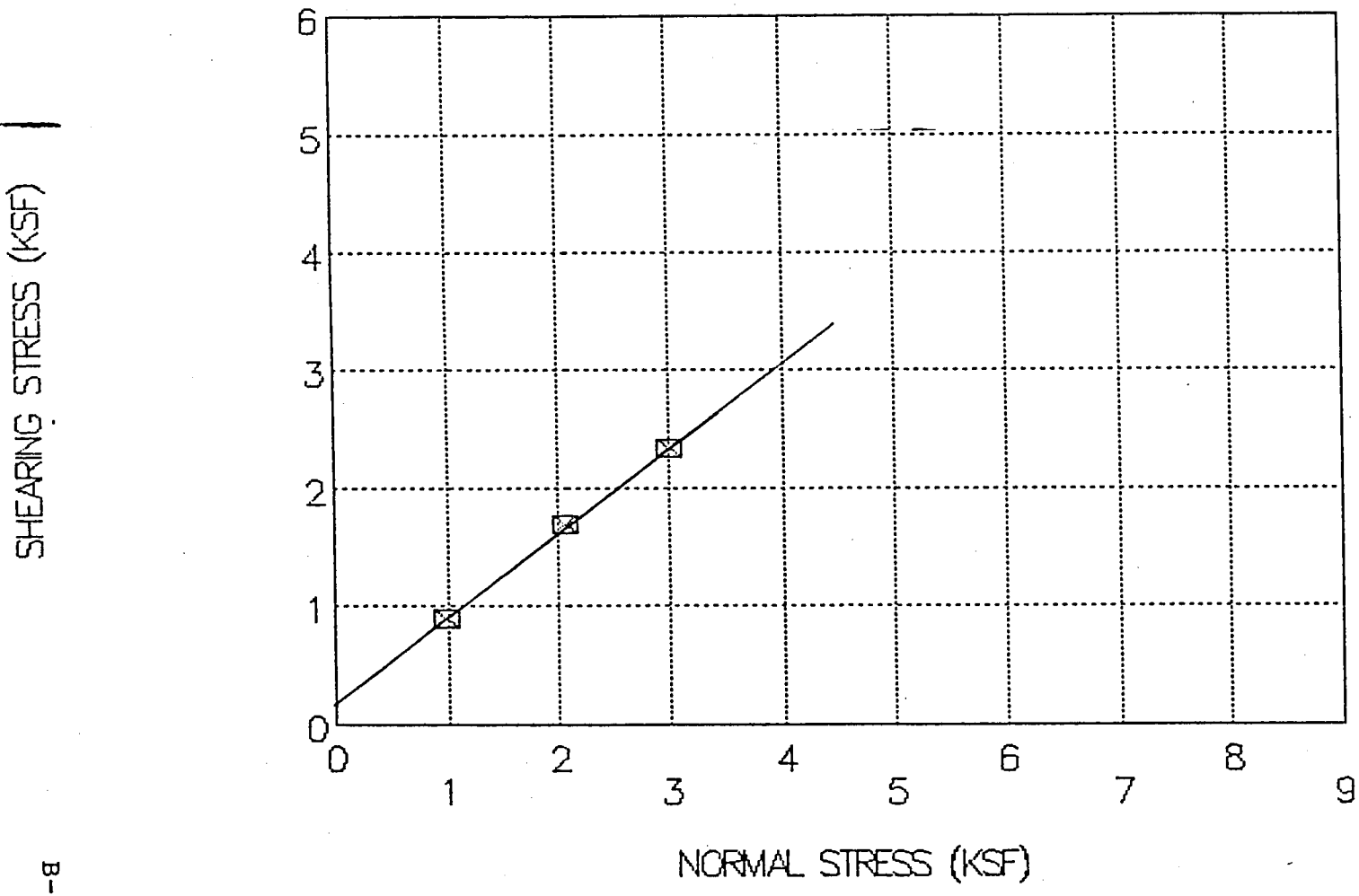
Initial Moisture Content	14.1%
Dry Density	80.2 LB/CU FT
Maximum Vertical Deformation @ T max.	-0.002 IN
Shearing Stress, T max.	1.7 KSF

POINT NO. 3 (NORMAL STRESS 2.998 KSF)

Initial Moisture Content	3.7%
Dry Density	92.5 LB/CU FT
Maximum Vertical Deformation @ T max.	-0.003 IN
Shearing Stress, T max.	2.3 KSF

DIRECT SHEAR

#7 @ 4'6"–5'6"



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REPORT OF LABORATORY TESTS	DATE	2/29/88
PROJECT: CAMELBACK RANCH	JOB NO.	E88-36
LOCATION: #8 @ 9'6"-10'6"	W.O.NO.	1
	LAB NO.	42

DIRECT SHEAR TEST(IN SITU)ASTM D-3080

POINT NO. 1 (NORMAL STRESS 0.995 KSF)

Initial Moisture Content	3.5%
Dry Density	97.4 LB/CU FT
Maximum Vertical Deformation @ T max.	0.007 IN
Shearing Stress, T max.	0.8 KSF

POINT NO. 2 (NORMAL STRESS 2.059 KSF)

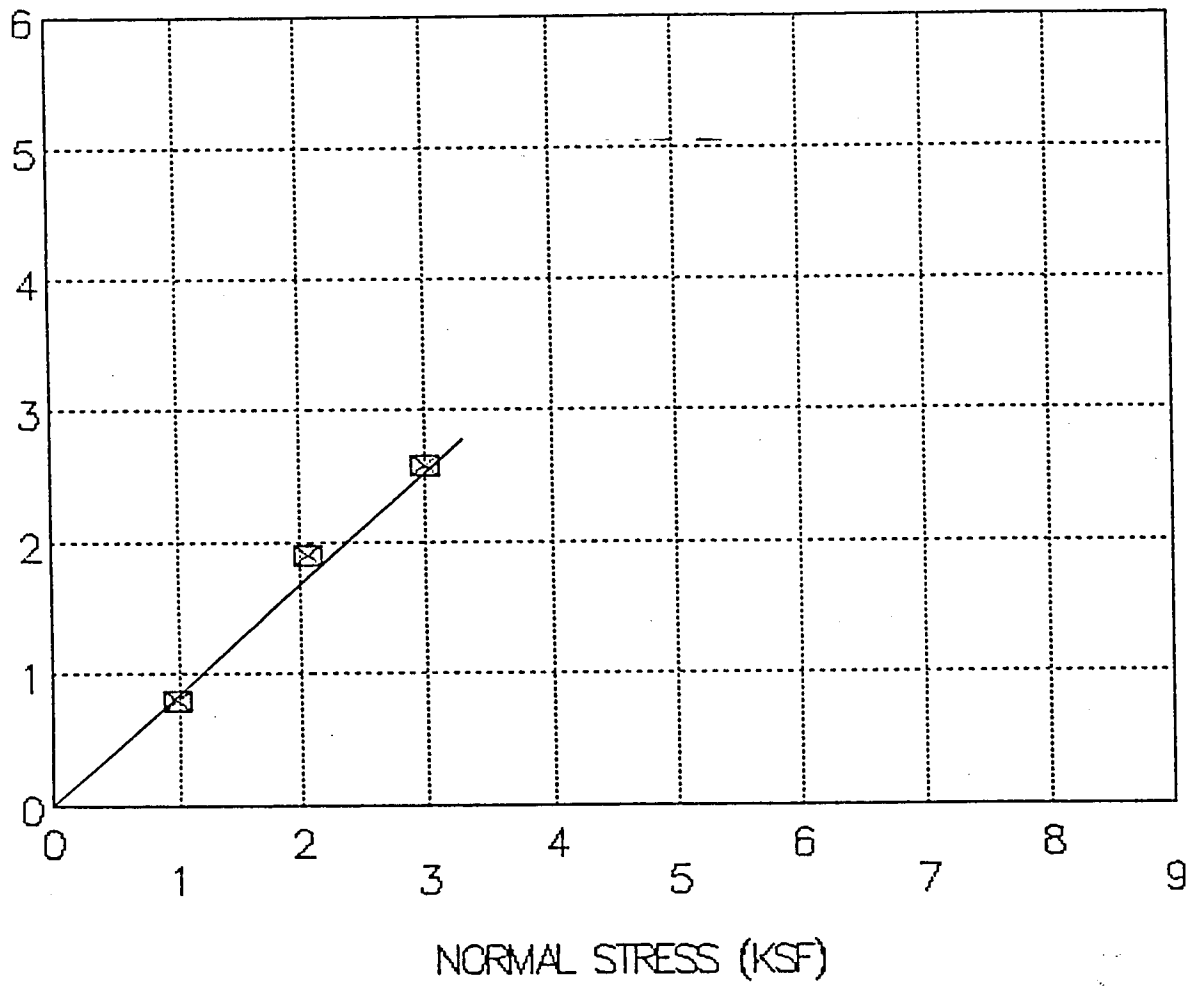
Initial Moisture Content	2.2%
Dry Density	94.6 LB/CU FT
Maximum Vertical Deformation @ T max.	0.014 IN
Shearing Stress, T max.	1.9 KSF

POINT NO. 3 (NORMAL STRESS 2.998 KSF)

Initial Moisture Content	3.1%
Dry Density	98.8 LB/CU FT
Maximum Vertical Deformation @ T max.	0.014 IN
Shearing Stress, T max.	2.6 KSF

DIRECT SHEAR

#8 @ 9'6"–10'6"



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REPORT OF LABORATORY TESTS	DATE	2/29/88
PROJECT: CAMELBACK RANCH	JOB NO.	E88-36
LOCATION:#19 @ 2'6"-3'6"	W.O.NO.	1
	LAB NO.	103

DIRECT SHEAR TEST(IN SITU)ASTM D-3080

POINT NO. 1 (NORMAL STRESS 0.995 KSF)

Initial Moisture Content	2.4%
Dry Density	94.5 LB/CU FT
Maximum Vertical Deformation @ T max.	0.012 IN
Shearing Stress, T max.	0.9 KSF

POINT NO. 2 (NORMAL STRESS 2.059 KSF)

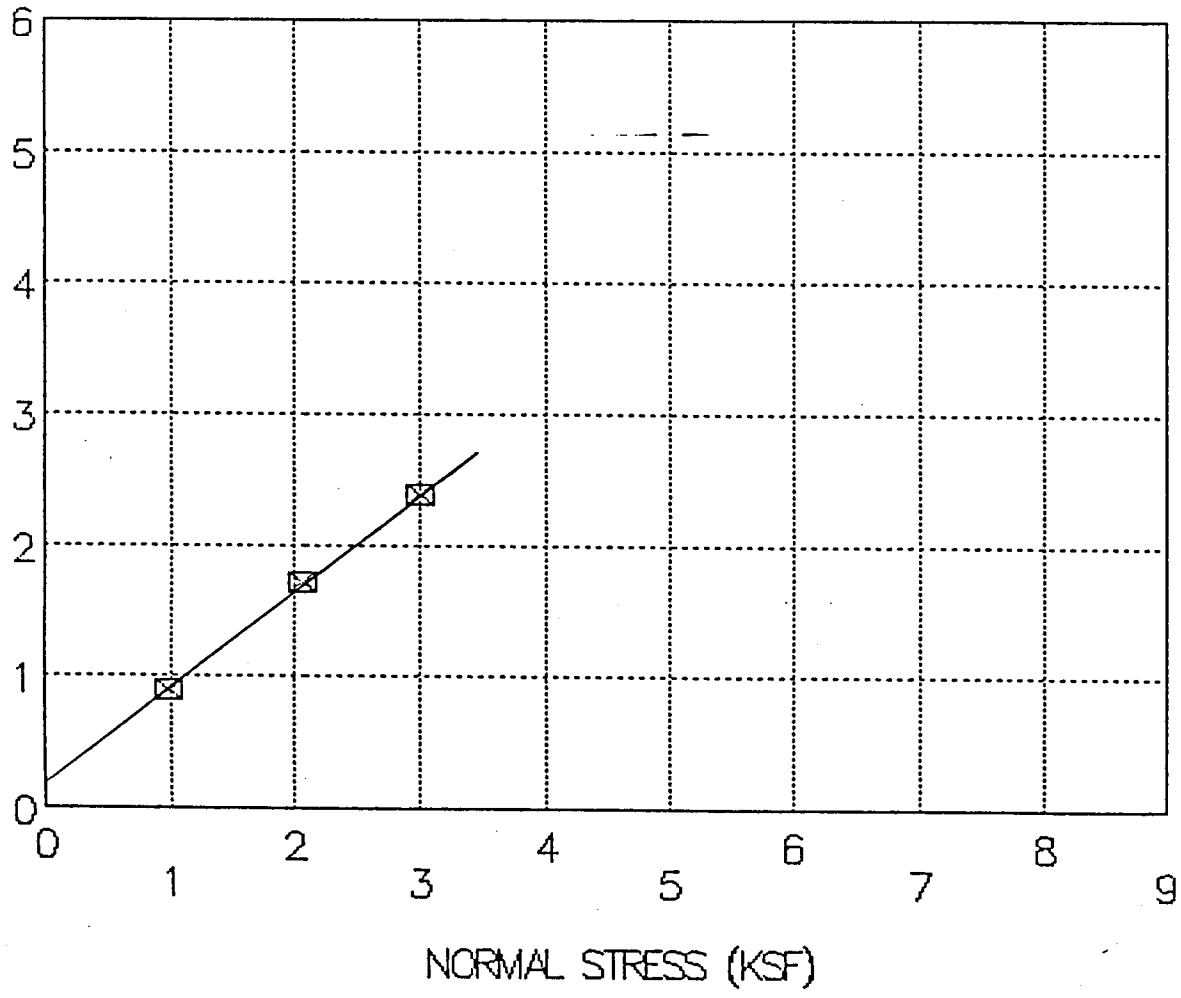
Initial Moisture Content	2.4%
Dry Density	93.9 LB/CU FT
Maximum Vertical Deformation @ T max.	0.013 IN
Shearing Stress, T max.	1.7 KSF

POINT NO. 3 (NORMAL STRESS 2.998 KSF)

Initial Moisture Content	2.3%
Dry Density	93.4 LB/CU FT
Maximum Vertical Deformation @ T max.	0.01 IN
Shearing Stress, T max.	2.4 KSF

DIRECT SHEAR

#19 @ 2'6"–3'6"



APPENDIX C

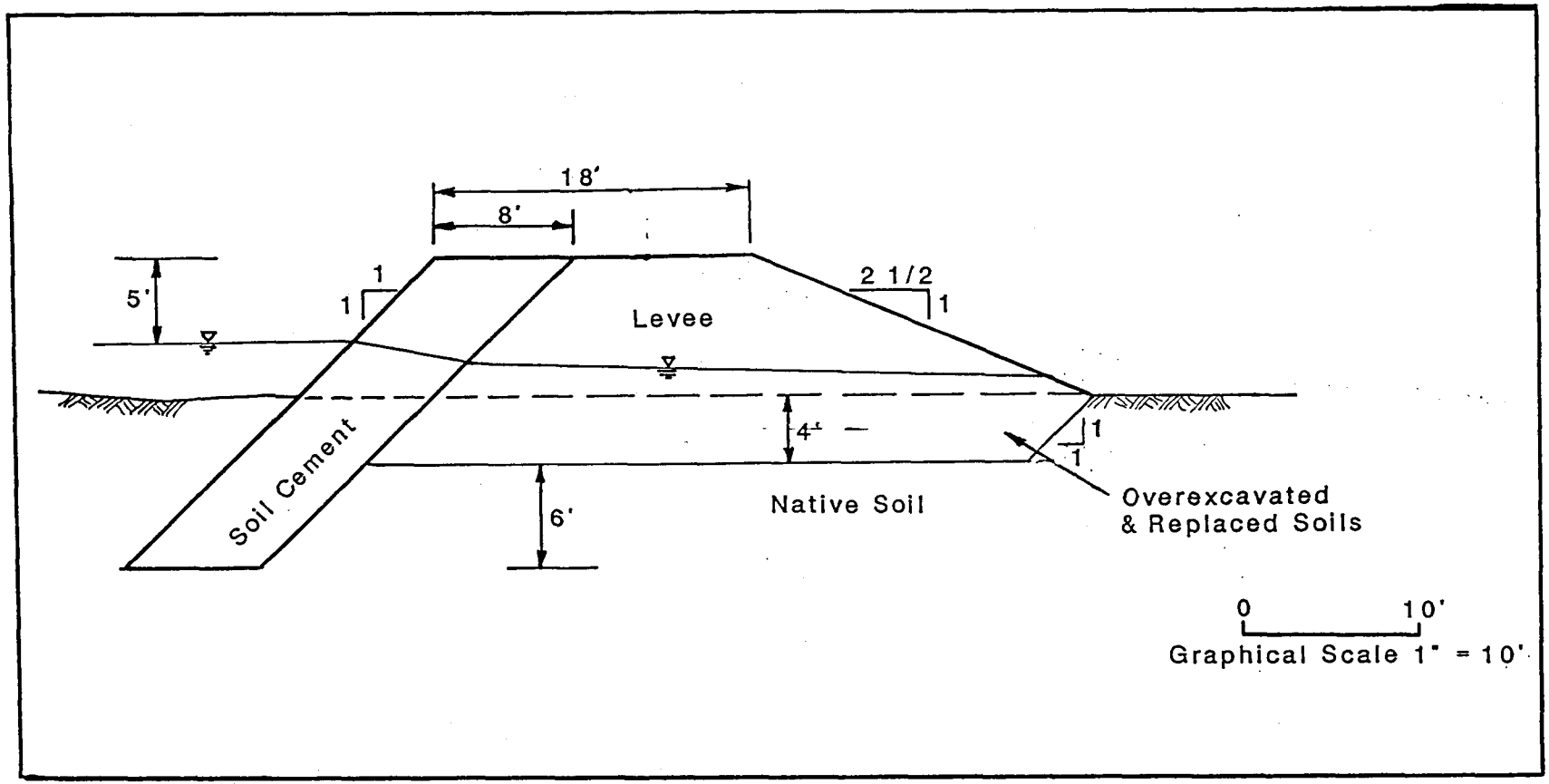


FIGURE 1

Typical Levee Section At New River

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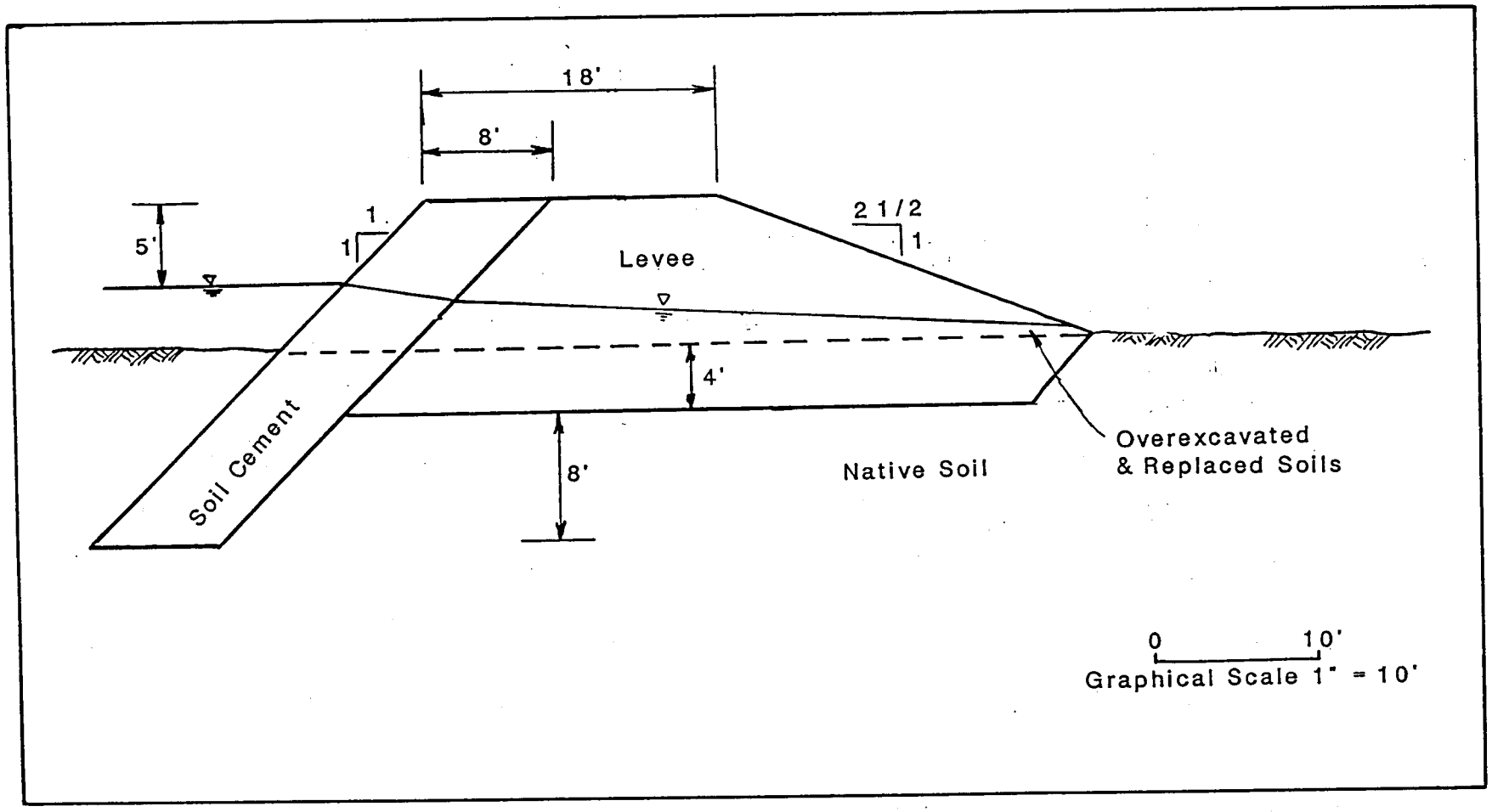

FIGURE 2

Typical Levee Section At Aqua Fria River

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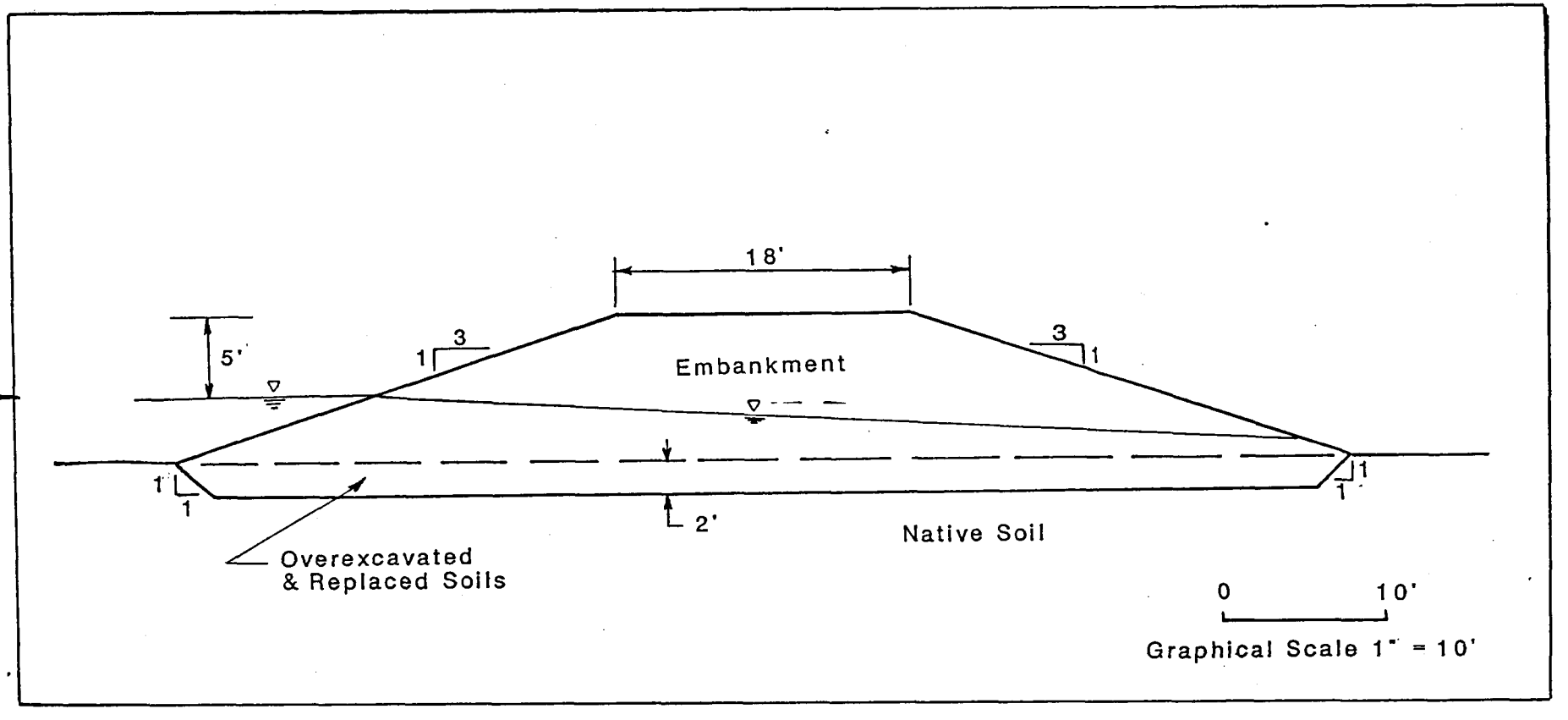

FIGURE 3

Typical Unprotected Levee Section

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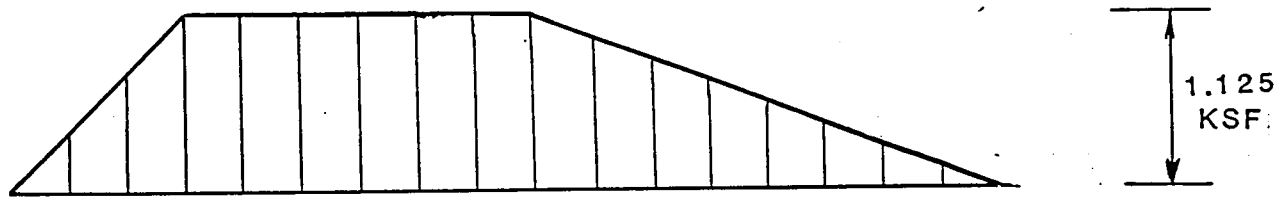
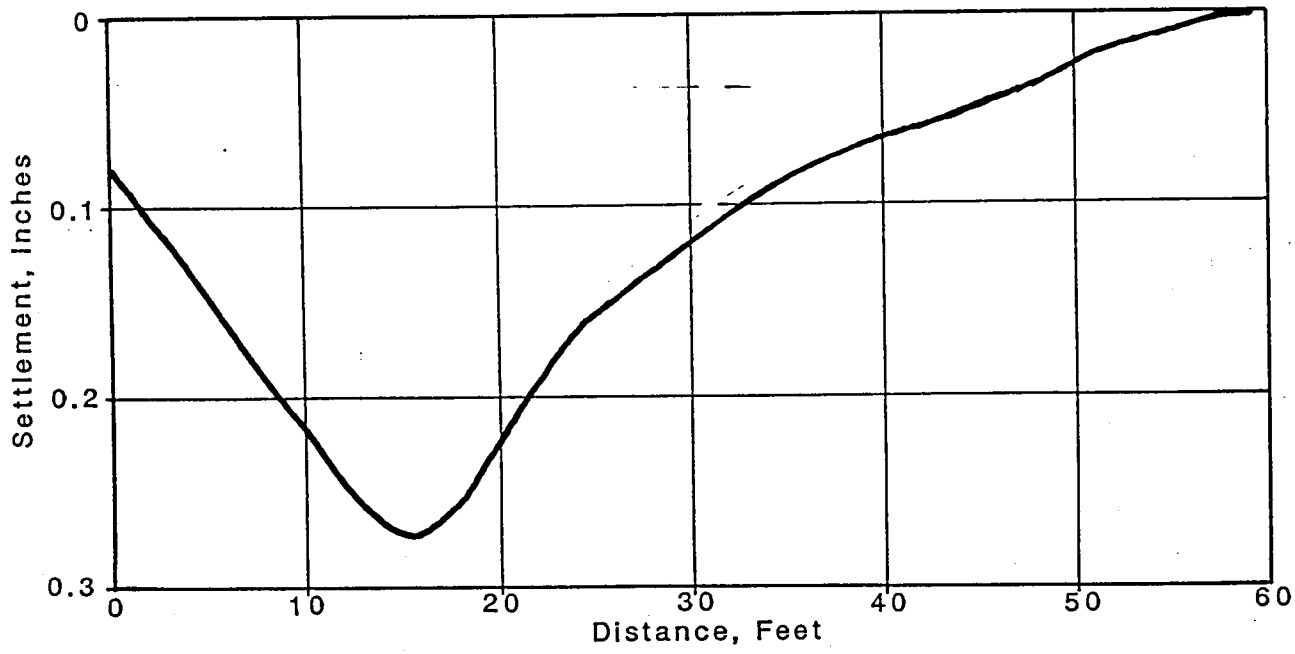


(a) LOADING DUE TO LEVEE



(b) SETTLEMENT PROFILE

FIGURE 4

Settlement Profile For Typical Aqua Fria Levee Section

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