145

NATIONAL FLOOD INSURANCE PROGRAM
FEMA MAP COORDINATION CONTRACTOR

OCT 29 2003

Carlos A. Montoya, P.E.
Floodplain Administrator
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

IN REPLY REFER TO:
Case No.: 03-06-833R
Community: City of Albuquerque, Bernalillo County, New Mexico
Community No.: 350002

316-AD

Dear Mr. Montoya:

This is in regard to your January 24, 2003, request that the Federal Emergency Management Agency (FEMA) issue a Conditional Letter of Map Revision for the above-referenced community. In a previous letter, you were informed that additional data might be required to complete our review of the request. The data required to complete our review, which must be submitted within 90 days of the date of this letter, are listed on the enclosed summary.

Please send the required data to us at the address shown at the bottom of this page. Further action on the request has been suspended pending receipt of the required data.

If we do not receive the required data within 90 days, we will suspend the processing of your request. Any data submitted after 90 days will be treated as an original submittal and will be subject to all submittal/payment procedures, including the review and processing fee in effect at the time of the re-submittal as outlined in Paragraph 72.7(a) of the National Flood Insurance Program (NFIP) regulations (44 CFR Parts 59-78). A copy of the notice summarizing the current fee schedule, which was published in the *Federal Register*, is enclosed for your information.

When you write to us about your request, please include the case number referenced above. If you have general questions about your case, FEMA policy, or the NFIP, please call FEMA's toll free map assistance line at 1-877-FEMA MAP (1-877-336-2627). If you have specific questions concerning your request, please contact the Engineer assigned to your case, Saleem Ashraf, P.E., by phone at 1-800-697-7275 Ext. 273, or by e-mail at msashraf@pbsj.com.

Sincerely,

Joseph A. Martinenza, Jr.
Program Manager, Region VI

Enclosures

cc: Tom Rutherford, Chair, Board of County Commissioners, Bernalillo County
Craig W. Hoover, P.E., Bohannan and Huston, Inc.
Douglas H. Collister, High Desert Investment Corp.

NATIONAL FLOOD INSURANCE PROGRAM
FEMA MAP COORDINATION CONTRACTOR

Summary of Additional Information Required to Support a
Conditional Letter of Map Revision

Case No.: 03-06-833R
Community: City of Albuquerque,
Bernalillo County, New Mexico

Requester: Carlos A. Montoya, P.E.
Community No.: 350002

The issues listed below must be addressed before we can continue the review of your request.

1. Our review of your request indicates that unincorporated areas of Bernalillo County, New Mexico are affected by this project. If the area of revision of this request has been annexed by the City of Albuquerque, please submit an annexation agreement indicating that the project site has been annexed by the City of Albuquerque and include an exact map of the entire annexed area, if available. If a portion of the project area affected by this revision is under the jurisdiction of Bernalillo County, please submit the following:

   a. Please provide community acknowledgment in the form of a letter stating that Bernalillo County, New Mexico (Unincorporated Areas) has reviewed the revision request and understands the effects of the revision on flooding conditions in the community; or submit Application/Certification Form 1, titled "Overview and Concurrence Form," signed by a community official from Bernalillo County.

   b. In compliance with Section 65.6 of the National Flood Insurance Program (NFIP) regulations, the community official responsible for floodplain management must provide a statement in writing that a property or structure, existing or proposed, to be removed from the Special Flood Hazard Area (SFHA) meets minimum floodplain management criteria of Section 60.3 of the NFIP regulations and is reasonably safe from flooding. This statement provides FEMA with assurance that the community has reviewed all development plans and has found them to meet the following requirements:

      i. The lowest floor elevations (including basement) of all residential structures built in the area to be removed from the SFHA are at or above the base flood (Paragraph 60.3(b)).

      ii. The area to be removed from the SFHA (including any existing or proposed structures) has been determined to be "reasonably safe from flooding" (Subparagraphs 60.3(a)(3) and 60.3(a)(4), and *Technical Bulletin 10-01*).

      iii. All applicable Federal and State permits have been obtained (Subparagraph 60.3(a)(2)).

      iv. All applicable local permits have been obtained. This includes a local development permit to grade or place fill in the SFHA, and a permit for all existing or proposed construction (Subparagraph 60.3(b)(1)).

      v. Fill has not been placed in the 1% annual chance floodplain (Subparagraph 60.3(c)(10)) that causes a rise in flood elevations associated with the base flood discharge.

   To assist communities in determining if a property or structure, existing or proposed, is reasonably safe from flooding, FEMA has published *Technical Bulletin 10-01*. This bulletin outlines safe building practices that, when followed, reduce the risk of flood damage to a property or structure.

Community Officials interested in obtaining copies of this bulletin should visit our Internet site at http://www.fema.gov/pdf/fima/tb1001.pdf or by calling the FEMA Map Assistance Center toll free at 1-877-FEMA MAP (1-877-336-2627).

2. The Federal Emergency Management Agency (FEMA) requires that when encroachments upon 1% annual chance (100-year) floodplain cause the 1% annual chance flood elevation to increase in excess of those permitted under the NFIP regulations Subparagraph 60.3(c)(10), that the requirements of Section 65.12 be met. Please provide evidence of compliance with the following:

   a. Subparagraph 65.12(a)(2) – Please provide an evaluation of alternatives to this project that would not result in any increases to the 1% annual chance water surface elevations for South Bear Canyon Arroyo 1 (SBC1) and South Bear Canyon Arroyo 2 (SBC2), demonstrating why these alternatives are not feasible. To better ensure timely processing of your request, please have this evaluation directly address one or more of the following issues:

      i. The evaluation indicates that alternatives that do not cause increases are not technically feasible.

      ii. The chosen alternative demonstrates a net reduction of flood hazards. An example of this could be a project involving a proposed dam or detention pond.

      iii. The chosen alternative provides other net public benefits. This benefit cannot be a reduction in construction costs of a planned development or benefit to one property owner or interest.

   b. Subparagraph 65.12(a)(3) – Documentation of individual legal notice to all impacted property owners within and outside of the community, explaining the impact of the proposed action on their property.

   c. Subparagraph 65.12(a)(5) – Certification that no structures are located in areas that would be impacted by the increased 1% annual chance flood elevations.

3. Our computers were unable to read the diskette containing the hydrologic models for SBC1 and SBC2. Please submit the diskette, drainage area map, and backup information related to the hydrologic models for SBC1 and SBC2.

4. Please address the following issues related to the modeling of culverts for SBC1 and SBC2.

   a. Review the geometry of the culvert cross sections. Our review indicates that ground profiles are passing through the flow areas of the culverts for both flooding sources.

   b. The contraction and expansion coefficients for the cross sections for SBC1 and SBC2 are lower than the recommended values. Similarly the culvert coefficient should be 0.2, instead of 0.5. Please revise the hydraulic models using the appropriate coefficient values, or, provide explanations.

5. Please review the geometry of Cross Sections 9990, 10020, and from 10240 to 10360 for SBC1, and 1080 for SBC2 in the HEC-RAS existing and proposed condition models. Our review indicates that the overbank lengths are significantly larger than the channel lengths at these cross sections. Please adjust the lengths in the models, or, provide explanations.

6. Our review indicates discrepancies in the computed floodplain widths and those shown on the submitted work map at numerous cross sections for SBC1 and SBC2. In addition, cross sections were not properly labeled for South Bear Canyon Arroyo on the topographic work map. Please revise the models and/or the topographic work map.

7. Please reflect the above comments on the topographic work map and annotated Flood Insurance Rate Map and submit one copy of each. Please ensure to show the flow line for each flooding source and label the cross sections properly on the topographic work map.

Please send the required data to us at the address shown at the bottom of the first page.

Bohannan Huston INC.

145

Courtyard I
7500 Jefferson St. NE
Albuquerque, NM
87109-4335

www.bhinc.com

voice: 505.823.1000
facsimile: 505.798.7988
toll free: 800.877.5332

August 27, 2003

Saleem Ashraf, P.E.
PBS&J
12101 Indian Creek Court
Beltsville, MD 20705

Re: Case No. 03-06-833R High Desert Tract 13 CLOMR – Response to Additional Verbal Comments

Dear Mr. Ashraf:

In response to your verbal comments from August 25 and 26, 2003 we are providing you the following additional information.

- Rerun HEC-RAS models using the flow rates from the "combined AHYMO model" both hardcopy of the summary output and the digital input files
- A drainage basin map for the South Bear Canyon Arroyos 1 and 2 watersheds
- Supporting calculations for the AHYMO model. Please note that rainfall values and land use treatment values were taken from the approved High Desert Drainage Management Master Plan

As we discussed on the phone on August 26, 2003, the slight changes in the flow rates did not result in an appreciable change in the floodplain width. In fact the maximum water surface elevation change along the South Bear Canyon Arroyo 1 was 0.2' which resulted in a 30.2' decrease in the top width. Since the top width actually decreased slightly, the FIRM map was not revised. The maximum water surface elevation change along the South Bear Canyon Arroyo 2 was a 0.05' increase resulting in a 2.3' increase in the top width. This change is not discernible at the scale of the FIRM. Consequently, we have not revised the FIRM or the Topographic work map submitted initially with the CLOMR.

We believe we have addressed all your comments and look forward to receiving approval of the CLOMR.

If you have any additional questions, or require additional information, please contact me at (505) 823-1000.

Sincerely,

Craig W. Hoover, P.E.
Senior Vice President and Group Manager
Water Resources Group

CWH/cc
Enclosures

cc: Carlos Montoya Floodplain Administrator, COA (w/encls.)
Doug Collister, HDIC (w/encls.)
Jack Eichorn, HDIC (w/encls.)

ENGINEERING
SPATIAL DA
ADVANCED TECHNOLOGIE

P:\030103\Hydro\Corres\CLOMR Ltr3 082703 doc

High Desert - South Bear Canyon Arroyos

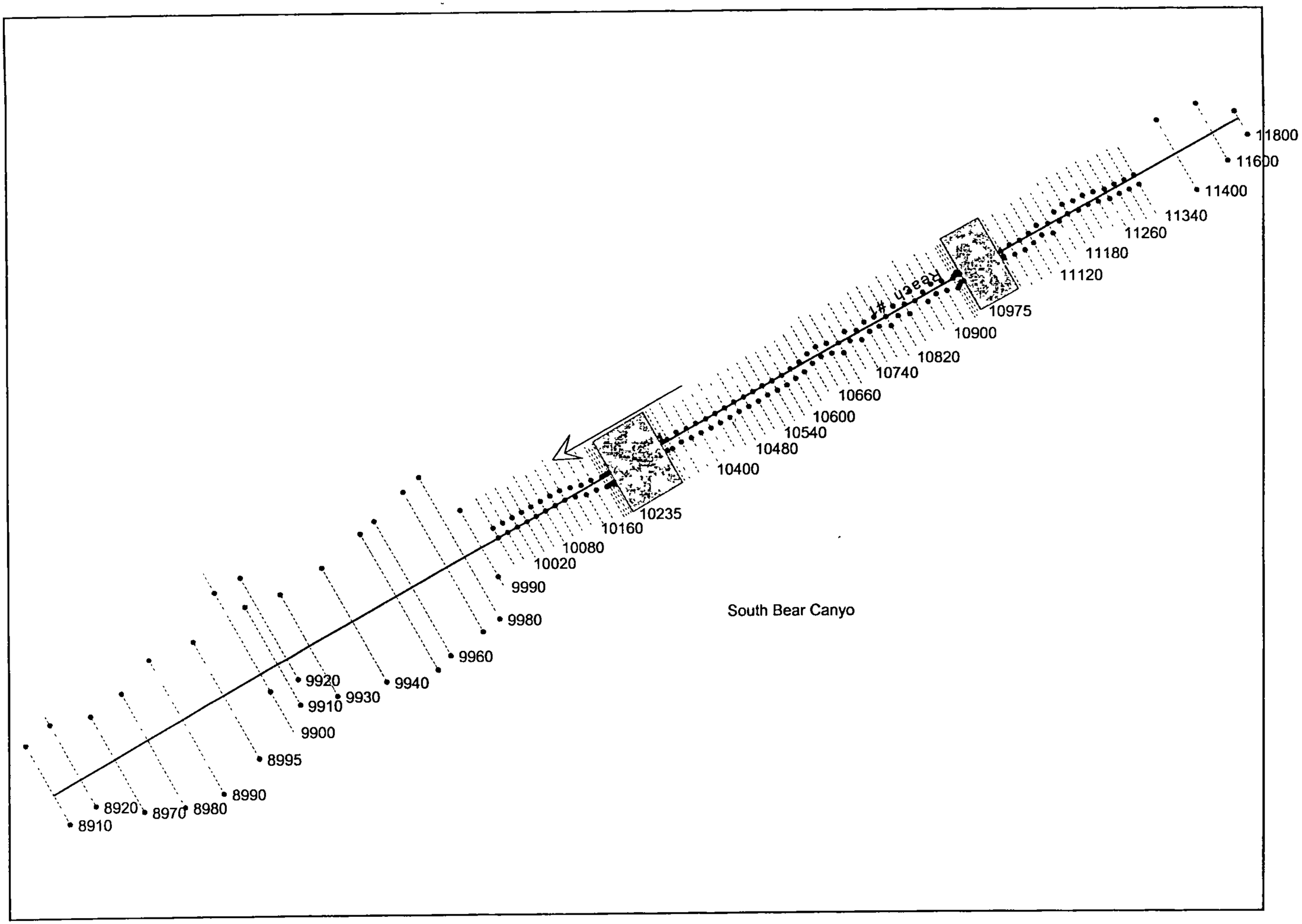
Calculation of Time to Peak

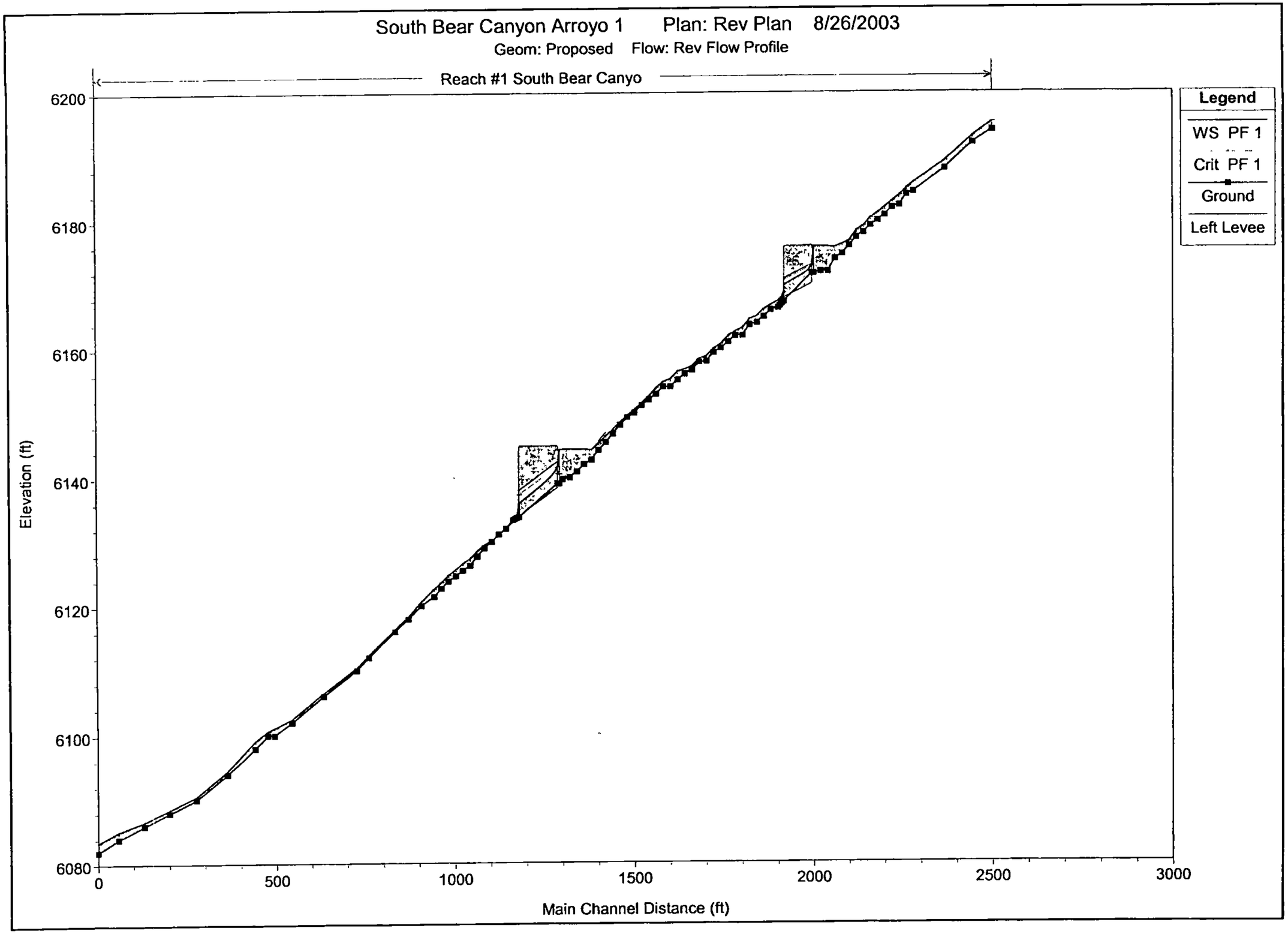
Revised DPM procedure

8/15/2003

Description	Var.	Unit			
Basin			SBCA1-1	SBCA1-2	SBCA2-1
Basin Area		Sq. Miles	0.125	0.145	0.020
Total Reach	L	Feet	4700.0	5020.0	2420.0
Overland Reach	L1	Feet	400.0	400.0	400.0
Overland K	K1		0.7	0.7	0.7
Overland Slope	S1	Percent	31.00	23.25	48.50
Adj. Overland Slope	S1'	Percent	7.219	6.726	8.333
Gully Reach	L2	Feet	1600.0	1600.0	1600.0
Gully K	K2		2.000	2.000	2.000
Gully Slope	S2	Percent	41.880	44.380	24.250
Adj. Gully Slope	S2'	Percent	7.911	8.070	6.790
Arroyo Reach	L3	Feet	2700.0	3020.0	420.0
Arroyo K	K3		3.000	3.000	3.000
Arroyo Slope	S3	Percent	11.890	9.250	5.750
Adj. Arroyo Slope	S3'	Percent	5.992	5.778	5.109
Lca	Lca	Feet	2125.0	2450.0	1200.0
Base Discharge	Qb	cfs	232.0	251.0	39.0
Ground Slope S	S	Percent	23.726	21.562	25.048
Adjusted Slope S'	S'	Percent	6.756	6.619	6.840
K	K		2.003	1.898	1.596
K'	K'		2.119	2.119	1.632
K''	K''		3.097	3.174	2.233
K'''	K'''		2.123	2.175	1.530
Kn	Kn		0.033	0.037	0.033
Orig. TC	TC	Hrs.	0.144	0.179	0.084
Adjusted TC	TC'	Hrs.	0.233	0.258	0.161
Time Lag	Lg	Hrs.	-	-	-
Time to Peak	TP	Hrs.	0.155	0.172	0.133

SBCA1 with Revised Flows
Submittal Run


11800
11600
11400
11340
11260
11180
11120
10975
10900
10820
10740
10660
10600
10540
10480
10400
10235
10160
10080
10020
9990
9980
9960
9940
9930
9920
9910
9900
8995
8990
8980
8970
8920
8910
South Bear Canyo


South Bear Canyon Arroyo 1 Plan: Rev Plan 8/26/2003
Geom: Proposed Flow: Rev Flow Profile
Reach #1 South Bear Canyo
Legend
WS PF 1
Crit PF 1
Ground
Left Levee
Elevation (ft)
6200
6180
6160
6140
6120
6100
6080
0
500
1000
1500
2000
2500
3000
Main Channel Distance (ft)

HEC-RAS Plan. Revised 8-03 River: Reach #1 Reach: South Bear Canyo Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
South Bear Canyo	11800	PF 1	232.00	6194.00	6195.31	6195.31	6195.77	0.019795	5.47	42.42	46.15	1.01
South Bear Canyo	11600	PF 1	232.00	6192.00	6193.07	6193.07	6193.49	0.020820	5.15	45.05	55.89	1.01
South Bear Canyo	11400	PF 1	232.00	6188.00	6189.23	6189.23	6189.65	0.020248	5.21	44.50	53.11	1.00
South Bear Canyo	11340	PF 1	232.00	6184.45	6185.85	6185.85	6186.26	0.019388	5.37	45.88	56.61	1.00
South Bear Canyo	11320	PF 1	232.00	6184.00	6185.04	6185.04	6185.42	0.020358	4.87	47.08	64.11	0.99
South Bear Canyo	11300	PF 1	232.00	6182.31	6183.83	6183.83	6184.25	0.017596	5.37	46.54	60.40	0.96
South Bear Canyo	11280	PF 1	232.00	6182.00	6183.02	6183.02	6183.39	0.017851	5.18	49.21	69.19	0.96
South Bear Canyo	11260	PF 1	232.00	6180.82	6182.03	6182.03	6182.38	0.013751	4.97	53.20	77.69	0.86
South Bear Canyo	11240	PF 1	232.00	6180.00	6181.17	6181.17	6181.52	0.017447	5.02	52.03	79.41	0.94
South Bear Canyo	11220	PF 1	232.00	6179.22	6180.38	6180.38	6180.68	0.018849	4.86	54.49	88.48	0.96
South Bear Canyo	11200	PF 1	232.00	6178.09	6179.16	6179.16	6179.54	0.020922	4.52	47.01	61.56	0.98
South Bear Canyo	11180	PF 1	232.00	6177.35	6178.42	6178.42	6178.72	0.016829	4.80	56.83	91.92	0.92
South Bear Canyo	11160	PF 1	232.00	6176.02	6176.85	6176.85	6177.16	0.020795	4.86	53.12	86.61	1.00
South Bear Canyo	11140	PF 1	232.00	6174.75	6176.30	6176.30	6176.60	0.013957	4.66	58.29	95.75	0.85
South Bear Canyo	11120	PF 1	232.00	6174.00	6175.82		6175.99	0.004694	3.10	71.74	78.89	0.51
South Bear Canyo	11100	PF 1	232.00	6172.00	6175.91		6175.93	0.000335	1.29	207.06	121.92	0.15
South Bear Canyo	11080	PF 1	232.00	6172.00	6175.92		6175.92	0.000081	0.78	348.88	145.79	0.08
South Bear Canyo	11060	PF 1	232.00	6171.75	6175.92	6173.26	6175.92	0.000025	0.50	517.95	158.91	0.05
South Bear Canyo	11017.5		Culvert									
South Bear Canyo	10975	PF 1	232.00	6167.29	6168.76	6168.76	6169.30	0.017119	5.79	39.50	92.01	0.97
South Bear Canyo	10970	PF 1	232.00	6166.98	6168.00	6168.00	6168.33	0.020370	4.90	51.00	78.64	0.99
South Bear Canyo	10965	PF 1	232.00	6166.66	6167.71	6167.71	6168.05	0.020946	4.74	49.94	75.88	0.99
South Bear Canyo	10960	PF 1	232.00	6166.35	6167.45	6167.45	6167.80	0.020895	4.44	49.64	73.58	0.98
South Bear Canyo	10940	PF 1	232.00	6166.00	6166.82	6166.82	6167.15	0.022577	4.70	50.20	76.48	1.02
South Bear Canyo	10920	PF 1	232.00	6164.94	6166.14	6166.14	6166.45	0.016172	4.90	55.04	85.49	0.91
South Bear Canyo	10900	PF 1	232.00	6164.00	6165.04		6165.32	0.014951	4.54	56.30	77.09	0.87
South Bear Canyo	10880	PF 1	232.00	6163.66	6164.63	6164.63	6164.94	0.022537	4.78	52.32	86.42	1.02
South Bear Canyo	10860	PF 1	232.00	6162.00	6163.27	6163.27	6163.62	0.016474	5.04	52.33	75.92	0.92
South Bear Canyo	10840	PF 1	232.00	6162.00	6162.68	6162.68	6162.99	0.022288	4.76	52.09	84.21	1.02
South Bear Canyo	10820	PF 1	232.00	6161.01	6162.02	6162.02	6162.32	0.021795	4.27	53.73	91.04	0.98
South Bear Canyo	10800	PF 1	232.00	6160.00	6160.72	6160.72	6161.04	0.021526	4.86	51.53	80.66	1.01
South Bear Canyo	10780	PF 1	232.00	6159.31	6160.00	6160.00	6160.31	0.017503	3.58	54.46	86.19	0.87
South Bear Canyo	10760	PF 1	232.00	6158.00	6158.80	6158.80	6159.13	0.021583	4.17	51.04	78.49	0.97
South Bear Canyo	10740	PF 1	232.00	6157.88	6158.41	6158.41	6158.70	0.015517	2.96	57.68	92.42	0.79
South Bear Canyo	10720	PF 1	232.00	6156.57	6157.24	6157.24	6157.55	0.016317	3.45	55.15	84.26	0.84
South Bear Canyo	10700	PF 1	232.00	6156.00	6156.74		6156.99	0.015469	4.20	58.74	86.89	0.86
South Bear Canyo	10680	PF 1	232.00	6155.06	6156.40	6156.40	6156.71	0.015846	4.85	55.52	87.33	0.90
South Bear Canyo	10660	PF 1	232.00	6154.00	6155.25	6155.25	6155.65	0.017762	5.25	47.96	63.76	0.96
South Bear Canyo	10640	PF 1	232.00	6154.00	6154.85	6154.85	6155.20	0.022601	4.60	48.97	71.88	1.01

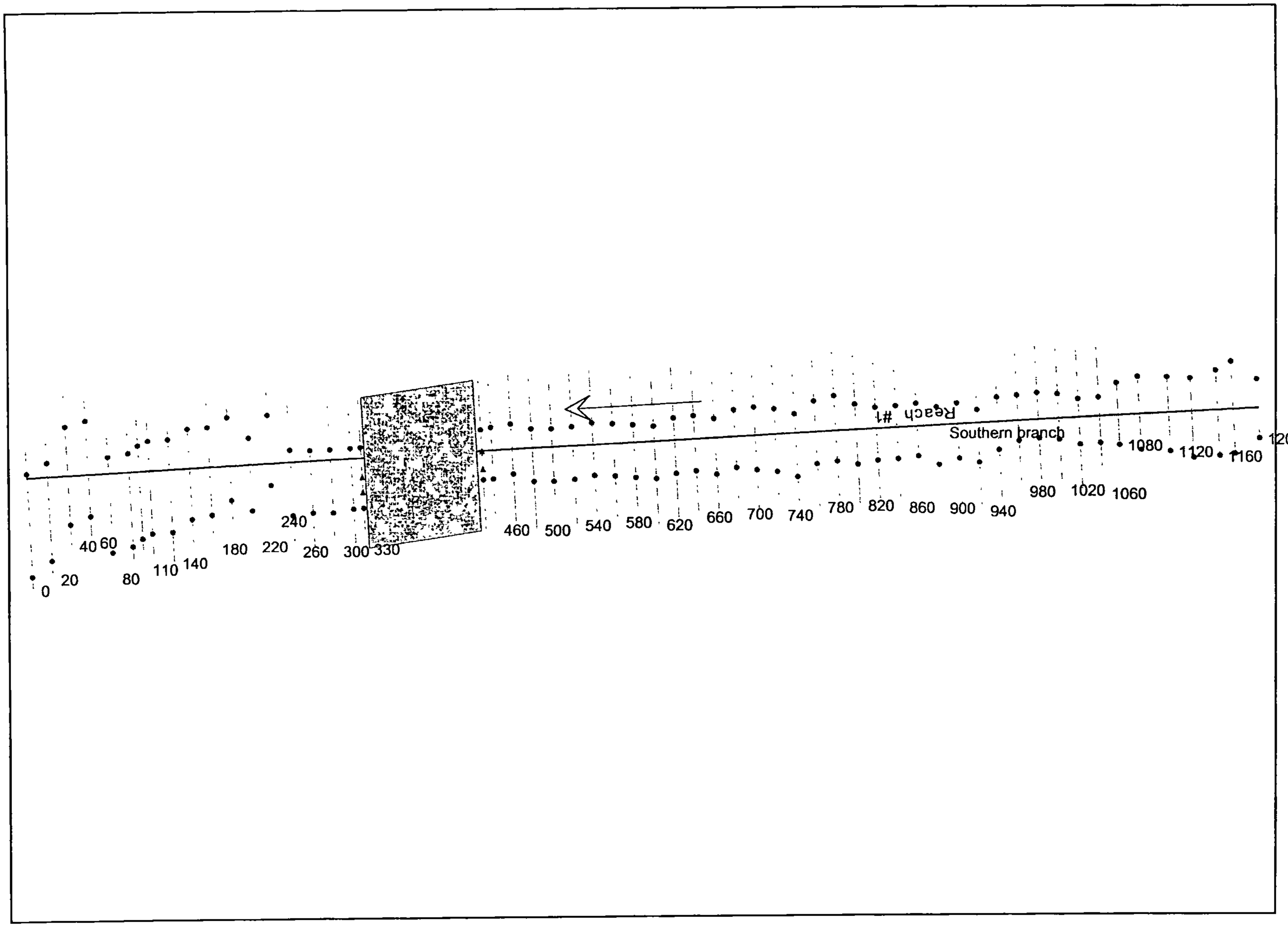
HEC-RAS Plan: Revised 8-03 River: Reach #1 Reach: South Bear Canyo Profile: PF 1 (Continued)

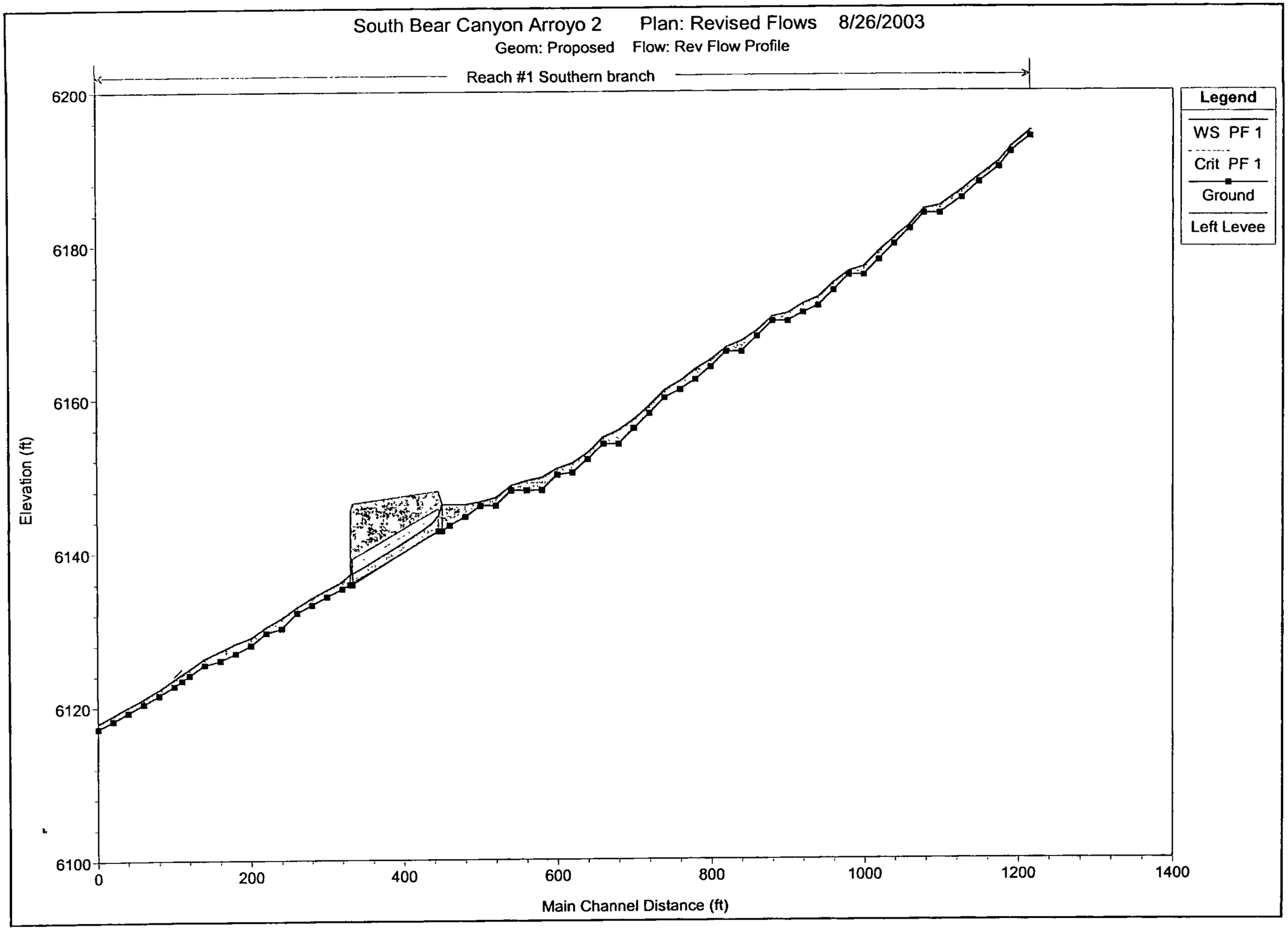
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
South Bear Canyo	10620	PF 1	232.00	6152.85	6153.84	6153.84	6154.19	0.021592	5.24	49.27	70.36	1.03
South Bear Canyo	10600	PF 1	232.00	6151.96	6152.52	6152.52	6152.81	0.023328	3.78	53.80	92.68	0.98
South Bear Canyo	10580	PF 1	232.00	6151.14	6151.51	6151.51	6151.82	0.022578	2.02	52.77	88.14	0.83
South Bear Canyo	10560	PF 1	232.00	6150.00	6150.51	6150.51	6150.81	0.023555	3.47	52.81	88.69	0.96
South Bear Canyo	10540	PF 1	232.00	6149.32	6149.55	6149.55	6149.88	0.022836	1.47	50.12	77.96	0.76
South Bear Canyo	10520	PF 1	232.00	6148 06	6148.56	6148.56	6148.88	0.021459	2.31	52.14	84.67	0.84
South Bear Canyo	10500	PF 1	232.00	6146.74	6147.43	6147.43	6147.74	0.022937	3.32	53.19	90.91	0.94
South Bear Canyo	10480	PF 1	232.00	6145.41	6146.42	6146.42	6146.67	0.021902	4.25	58.47	108.55	0.98
South Bear Canyo	10460	PF 1	232.00	6144.19	6145.33	6145.33	6145.61	0.018512	4.36	54 37	93.18	0.93
South Bear Canyo	10440	PF 1	232.00	6142.66	6144.33		6144.46	0.008227	2.83	85.48	168.90	0.61
South Bear Canyo	10420	PF 1	232.00	6142 00	6144.40		6144.41	0.000169	0.74	338.46	226.82	0.10
South Bear Canyo	10400	PF 1	232.00	6140.88	6144.40		6144.41	0.000028	0.44	602.93	248.90	0.05
South Bear Canyo	10380	PF 1	232.00	6140.00	6144.41		6144.41	0.000008	0.29	944.01	287.69	0.03
South Bear Canyo	10360	PF 1	477.00	6139.69	6144.40		6144.41	0.000014	0.42	1291.06	334.00	0.03
South Bear Canyo	10350	PF 1	477.00	6139.06	6144.36	6140.53	6144.40	0.000165	1.59	306.28	300.00	0.12
South Bear Canyo	10292.5		Culvert									
South Bear Canyo	10235	PF 1	477.00	6133 85	6135.71	6135.71	6136.40	0.015580	6.80	72.29	274.15	0.97
South Bear Canyo	10230	PF 1	477.00	6133.70	6133.52	6133.52	6133.86	0.023459		102.14	154.24	0.00
South Bear Canyo	10225	PF 1	477.00	6133.55	6133.28	6133.28	6133.62	0.023177		102.43	153.93	0.00
South Bear Canyo	10220	PF 1	477.00	6133.40	6133.04	6133.04	6133.38	0.023360		102.35	154.54	0.00
South Bear Canyo	10200	PF 1	477.00	6132.00	6132.04	6132.04	6132.38	0.015401	0.59	111.21	163.69	0.53
South Bear Canyo	10180	PF 1	477.00	6131.13	6130.98	6130.98	6131.33	0.014879		106.09	133.26	0.00
South Bear Canyo	10160	PF 1	477.00	6130.00	6130.15	6130.15	6130.50	0.015252	1.37	108.72	162.47	0.65
South Bear Canyo	10140	PF 1	477.00	6128.96	6129.47	6129.47	6129.85	0.014741	2.28	104.97	140.33	0.72
South Bear Canyo	10120	PF 1	477.00	6127.71	6128.62	6128.62	6129.02	0.013318	2.79	102.95	132.55	0.73
South Bear Canyo	10100	PF 1	477.00	6126.28	6127.41	6127.41	6127.91	0.015554	3.50	88.10	105.84	0.82
South Bear Canyo	10080	PF 1	477.00	6125.49	6126.63	6126.63	6127.00	0.011978	3.57	108.75	153.20	0.75
South Bear Canyo	10060	PF 1	477.00	6124.67	6125.65	6125.65	6126.11	0.013882	3.24	95.62	108.70	0.77
South Bear Canyo	10040	PF 1	477.00	6123.83	6124.84	6124.84	6125.22	0.015438	3.43	104.20	133.77	0.82
South Bear Canyo	10020	PF 1	477.00	6122.70	6123.68	6123.68	6124.14	0.015456	3.67	92.15	101.70	0.83
South Bear Canyo	10000	PF 1	477.00	6121.44	6122.64	6122.64	6123.11	0.016418	3.84	91.40	99.55	0.86
South Bear Canyo	9990	PF 1	477.00	6120.00	6120.65	6120.65	6120.96	0.022340	4.48	106.43	171.84	1.00
South Bear Canyo	9980	PF 1	680.00	6118.00	6118.39	6118.39	6118.58	0.025800	3.51	193.48	501.24	1.00
South Bear Canyo	9970	PF 1	680.00	6116.00	6116.38	6116.38	6116.57	0.025734	3.46	196.34	519.00	0.99
South Bear Canyo	9960	PF 1	680.00	6112.00	6112.42	6112.42	6112.62	0.025600	3.65	186.37	453.77	1.00
South Bear Canyo	9950	PF 1	680.00	6110.00	6110.42	6110.42	6110.63	0.025584	3.67	185.38	447.56	1.00
South Bear Canyo	9940	PF 1	680.00	6106.00	6106.51	6106.51	6106.75	0.023922	3.99	170.28	344.11	1.00
South Bear Canyo	9930	PF 1	680.00	6102.00	6102.55	6102.55	6102.82	0.023545	4.17	163.05	305.09	1.01
South Bear Canyo	9920	PF 1	680.00	6100.00	6101.21	6101.21	6101.58	0.021261	4.85	140.13	193.43	1.00

HEC-RAS Plan: Revised 8-03 River: Reach #1 Reach: South Bear Canyo Profile: PF 1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
South Bear Canyo	9910	PF 1	680.00	6100.00	6100.68	6100.68	6100.99	0.022154	4.53	150.16	237.22	1.00
South Bear Canyo	9900	PF 1	680.00	6098.00	6099.24	6099.24	6099.61	0.021382	4.88	139.28	191.33	1.01
South Bear Canyo	8995	PF 1	680.00	6094.00	6094.56	6094.56	6094.83	0.023535	4.16	163.47	307.01	1.00
South Bear Canyo	8990	PF 1	680.00	6090.00	6090.54	6090.54	6090.80	0.023625	4.11	165.49	317.47	1.00
South Bear Canyo	8980	PF 1	680.00	6088.00	6088.59	6088.59	6088.87	0.022832	4.28	158.80	279.06	1.00
South Bear Canyo	8970	PF 1	680.00	6086.00	6086.69	6086.63	6086.95	0.016619	4.08	166.67	248.16	0.88
South Bear Canyo	8920	PF 1	680.00	6084.00	6085.20	6085.20	6085.60	0.020596	5.08	133.79	168.28	1.00
South Bear Canyo	8910	PF 1	680.00	6082.00	6083.53	6083.53	6083.94	0.020493	5.12	132.88	164.82	1.00

SBCA2 with Revised Flows
Submittal Run


Reach #1
Southern branch
0
20
40
60
80
110
140
180
220
240
260
300
330
460
500
540
580
620
660
700
740
780
820
860
900
940
980
1020
1060
1080
1120
1160
1200


South Bear Canyon Arroyo 2 Plan: Revised Flows 8/26/2003
Geom: Proposed Flow: Rev Flow Profile
Reach #1 Southern branch
Legend
WS PF 1
Crit PF 1
Ground
Left Levee
Elevation (ft)
6200
6180
6160
6140
6120
6100
0
200
400
600
800
1000
1200
1400
Main Channel Distance (ft)

HEC-RAS Plan: Revised 8-03 River: Reach #1 Reach: Southern branch Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Southern branch	1200	PF 1	40.00	6194.00	6194.74	6194.74	6195.04	0.023246	4.41	9.08	15.31	1.01
Southern branch	1180	PF 1	40.00	6192.00	6192.64	6192.64	6192.92	0.023337	4.21	9.49	17.19	1.00
Southern branch	1160	PF 1	40.00	6190.00	6190.75	6190.75	6191.04	0.022534	4.33	9.24	15.66	0.99
Southern branch	1140	PF 1	40.00	6188.00	6188.79	6188.79	6189.09	0.023329	4.38	9.14	15.65	1.01
Southern branch	1120	PF 1	40.00	6186.00	6187.01	6187.01	6187 34	0.022919	4.57	8.75	13.76	1.01
Southern branch	1100	PF 1	40.00	6184.00	6185.00	6184.96	6185.30	0.018640	4.34	9.21	13.39	0.92
Southern branch	1080	PF 1	40.00	6184.00	6184.59	6184.59	6184.85	0.023591	4.09	9.78	18.71	1.00
Southern branch	1060	PF 1	40.00	6182.00	6182.58	6182.58	6182.82	0.024135	3.96	10.11	20.73	1.00
Southern branch	1040	PF 1	40.00	6180.00	6180.86	6180.86	6181.12	0.024036	4.11	9.74	18.81	1.01
Southern branch	1020	PF 1	40.00	6178.00	6179.11	6179.11	6179.40	0.023196	4.34	9.21	15.87	1.00
Southern branch	1000	PF 1	40.00	6176.00	6177.15	6177.15	6177.48	0.023494	4.61	8.68	13.75	1.02
Southern branch	980	PF 1	40.00	6176.00	6176.53	6176.53	6176.76	0.024490	3.85	10.40	22.55	1.00
Southern branch	960	PF 1	40.00	6174.00	6175.04	6175.04	6175.33	0.023880	4.32	9.26	16.47	1.02
Southern branch	940	PF 1	40.00	6172.00	6173.18	6173.18	6173.48	0.023398	4.37	9.16	15.61	1.00
Southern branch	920	PF 1	40.00	6171.09	6172.30	6172.30	6172.59	0.024222	4.33	9.23	16.43	1.02
Southern branch	900	PF 1	40.00	6170.00	6171.04		6171.19	0.009612	3.16	12.65	18.08	0.67
Southern branch	880	PF 1	40.00	6170.00	6170.64	6170.64	6170.89	0.024040	4.04	9.91	19.67	1.00
Southern branch	860	PF 1	40.00	6168.00	6168.77	6168.77	6169.06	0.023163	4.36	9.17	15.68	1.01
Southern branch	840	PF 1	40.00	6166.00	6167.42	6167.42	6167.70	0.023652	4.28	9.34	16.52	1.00
Southern branch	820	PF 1	40.00	6166.00	6166.57	6166.57	6166.82	0.025177	3.98	10.05	21.13	1.02
Southern branch	800	PF 1	40.00	6164.00	6164.94	6164.94	6165.23	0.023585	4.26	9.39	16.82	1.01
Southern branch	780	PF 1	40.00	6162.35	6163.73	6163.73	6164.14	0.021718	5.11	7.83	9.71	1.00
Southern branch	760	PF 1	40.00	6161.06	6162.19	6162.19	6162.39	0.027328	3.62	11.04	28.28	1.02
Southern branch	740	PF 1	40.00	6160.00	6161.02	6161.02	6161.26	0.022915	3.92	10.20	20.09	0.97
Southern branch	720	PF 1	40.00	6158.00	6159.03	6159.03	6159.40	0.022064	4.91	8.14	11.01	1.01
Southern branch	700	PF 1	40.00	6156.05	6157.25	6157.25	6157.61	0.022407	4.82	8.30	11.77	1.01
Southern branch	680	PF 1	40.00	6154.00	6155.85	6155.85	6156.32	0.022673	5.49	7.28	7.88	1.01
Southern branch	660	PF 1	40.00	6154.00	6154.94	6154.94	6155.32	0.022253	4.99	8.01	10.57	1.01
Southern branch	640	PF 1	40.00	6152.00	6152.90	6152.90	6153.24	0.022207	4.65	8.59	12.76	1.00
Southern branch	620	PF 1	40.00	6150.28	6151.57	6151.57	6151.96	0.022349	5.06	7.91	10.27	1.02
Southern branch	600	PF 1	40.00	6150.00	6150.87	6150.87	6151.21	0.022179	4.67	8.57	12.65	1.00
Southern branch	580	PF 1	40.00	6148.04	6149.69		6149.94	0.012742	4.01	9.97	11.97	0.77
Southern branch	560	PF 1	40.00	6148.00	6149.27	6149.27	6149.59	0.023051	4.56	8.77	13.84	1.01
Southern branch	540	PF 1	40.00	6148.00	6148.63	6148.63	6148.91	0.023810	4.22	9.47	17.37	1.01
Southern branch	520	PF 1	40 00	6146.00	6147.09	6147.09	6147.40	0.023307	4.47	8.96	14.83	1.01
Southern branch	500	PF 1	40.00	6146.00	6146.56	6146.56	6146.77	0.025205	3.71	10.78	25.23	1.00
Southern branch	480	PF 1	40.00	6144.58	6146.19		6146.21	0.001123	1.08	37.12	53.86	0.23
Southern branch	460	PF 1	84.00	6143.45	6146.19		6146.20	0.000118	0.61	137.59	89.62	0.09
Southern branch	450	PF 1	84.00	6142.73	6146.17	6144.40	6146.20	0.000327	1.19	70.61	99.24	0.15

HEC-RAS Plan: Revised 8-03 River: Reach #1 Reach: Southern branch Profile: PF 1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Southern branch	390		Culvert									
Southern branch	330	PF 1	84.00	6135.88	6137.18	6137.18	6137.50	0.023562	4.57	18.38	113.39	1.03
Southern branch	320	PF 1	209.00	6135.29	6136.26	6136.26	6136.51	0.024415	3.91	52.65	108.44	1.00
Southern branch	300	PF 1	209.00	6134.28	6135.24	6135.24	6135.50	0.024575	4.03	50.74	99.43	1.01
Southern branch	280	PF 1	209.00	6133.24	6134.14	6134.14	6134.39	0.025269	3.90	52.74	111.85	1.02
Southern branch	260	PF 1	209.00	6132.21	6132.99	6132.99	6133.24	0.023486	4.01	53.09	108.20	0.99
Southern branch	240	PF 1	209.00	6130.19	6131.54	6131.54	6131.78	0.023631	3.99	52.33	104.70	1.00
Southern branch	220	PF 1	209.00	6129.59	6130.44	6130.44	6130.71	0.024565	4.19	49.92	95.81	1.02
Southern branch	200	PF 1	209.00	6128.00	6129.01	6129.01	6129.34	0.022044	4.59	45.58	70.33	1.00
Southern branch	180	PF 1	209.00	6126.95	6128.29	6128.29	6128.58	0.023212	4.35	48.03	83.38	1.01
Southern branch	160	PF 1	209.00	6126.00	6127.32	6127.32	6127.61	0.024310	4.31	48.54	88 62	1.03
Southern branch	140	PF 1	209.00	6125.46	6126.33	6126.33	6126.58	0.021940	3.97	52.68	100.74	0.97
Southern branch	120	PF 1	209.00	6124.08	6124.97	6124.97	6125.22	0.024245	4.04	51.76	103.87	1.01
Southern branch	110	PF 1	209.00	6123.41	6124.31	6124.31	6124.57	0.024453	4.10	51.00	100.76	1.02
Southern branch	100	PF 1	209.00	6122.74	6123.65	6123.65	6123.90	0.024156	4.01	52.07	105.14	1.01
Southern branch	80	PF 1	209.00	6121.53	6122.32	6122.32	6122.53	0.025694	3.65	57.27	139.73	1.00
Southern branch	60	PF 1	209.00	6120.42	6121.14	6121.14	6121.35	0.025359	3.66	57.14	137.61	1.00
Southern branch	40	PF 1	209.00	6119.30	6120.08	6120.08	6120.29	0.027259	3.60	57.99	150.71	1.02
Southern branch	20	PF 1	209.00	6118.23	6118.97	6118.97	6119.22	0.025017	4.01	52.82	112.10	1.02
Southern branch	0	PF 1	209.00	6117.21	6117.97	6117.97	6118.20	0.025513	3.87	54.47	122.03	1.02

Bohannan ▲ Huston INC.

Courtyard I
7500 Jefferson St. NE
Albuquerque, NM
87109-4335

www.bhinc.com

voice: 505.823.1000
facsimile: 505.798.7988
toll free: 800.877.5332

145

August 18, 2003

Saleem Ashraf, P.E.
PBS&J
12101 Indian Creek Court
Beltsville, MD 20705

Re: Case No. 03-06-833R High Desert Tract 13 CLOMR – Response to Additional Verbal Comments

Dear Mr. Ashraf:

In response to your recent verbal comments relating to the hydrologic analysis for the South Bear Canyon Arroyos 1 and 2 we offer the following. Portions of the watershed for these two arroyos were modeled using the Rational Method. To allow us to demonstrate that the 24 hour storm peak flow rates in the arroyos correspond with the flows used in the CLOMR we have prepared an AHYMO model for both arroyos. The model combines the AHYMO model for a portion of South Bear Canyon Arroyo 2 (included in the Tract 13 Drainage Report under Appendix L that was submitted with the CLOMR) with the basins that were previously modeled using the Rational Method. The AHYMO summary output and output files are enclosed with this letter. Flow rates corresponding to the flow rates used in the HEC-RAS analysis of the two arroyos are highlighted on the summary output. As you can see from the AHYMO results, the 100-year 24 hour storm event peak flow rates closely match those used to establish the flood plain. In fact in some locations due to the effects of peak attenuation due to routing the flow rates are slightly less.

The following table summarizes the flow rates at key locations used on the HEC-RAS analysis from the original CLOMR and from the combined AHYMO model being submitted with this letter.

Arroyo	Location	CLOMR Peak Flow Rate (cfs)	Combined AHYMO Model Peak Flow Rate (cfs)
SBCA1	Upstream of 3-36" culverts at Barranca Vista Place	237	232
SBCA1	Upstream of 4-48" culverts at High Desert Street	480	477
SBCA	Upstream of High Desert Street	39	40
SBCA2	Inlet of 2-48" culverts at High Desert Street	83	84
SBCA2	Downstream of 2-48" culverts at High Desert Street	193	209
SBCA1 & SBCA2	Confluence of two arroyos	673	680

Also enclosed is a diskette containing the AHYMO model for the South Bear Canyon Arroyos 1 and 2.

If you have any additional questions, or require additional information, please contact me at (505) 823-1000.

Sincerely,

Craig W. Hoover, P.E.
Senior Vice President and Group Manager
Water Resources Group

CWH/cc
Enclosures

cc: Carlos Montoya Floodplain Administrator, COA (w/encls.)
Doug Collister, HDIC (w/encls.)
Jack Eichorn, HDIC (w/encls.)

AHYMO PROGRAM SUMMARY TABLE (AHYMO_97) - - VERSION: 1997.02c RUN DATE (MON/DAY/YR) =08/17/2003
INPUT FILE = SBCA.HYM USER NO.= AHYMO-S-9702c1BohanHu-AH

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	NOTATION	
*S	HIGH DESERT HYDROLOGY MODEL										
*S	INPUT=SBCA.HYM										
*S	EXISTING CONDTIONS MODEL										
*S	100-YEAR 24 HOUR STORM										
START										TIME=	.00
LOCATION	DEFAULT									PK BF =	1.10
SEDIMENT BULK										RAIN24=	3.650
RAINFALL TYPE= 2											
*S TOTAL FLOW IN SBCA1 AT FIRST CULVERT CROSSING											
COMPUTE NM HYD		1.00	-	1	.12500	232.23	7.751	1.16270	1.533	2.903	PER IMP= 1.00
*S ROUTE FLOW FROM FIRST CULVERT CROSSING TO CULVERT CROSSING AT HIGH DESER											
ROUTE		1.10	1	2	.12500	226.39	7.751	1.16270	1.567	2.830	
COMPUTE NM HYD		3.00	-	3	.14500	250.55	8.991	1.16269	1.533	2.700	PER IMP= 1.00
*s TOTAL FLOW IN THE SBCA1 AT HIGH DESERT STREET											
ADD HYD		4.00	2& 3	4	.27000	476.51	16.743	1.16270	1.567	2.758	
*S ROUTE FLOW FROM HIGH DESERT STREET TO CONFLUENCE WITH SBCA2											
ROUTE	SBCATOTR		4	98	.27000	477.87	16.743	1.16269	1.567	2.765	
*S TOTAL FLOW IN THE SBCA2 AT HIGH DESERT STREET											
COMPUTE NM HYD		3.00	-	99	.02000	40.14	1.240	1.16271	1.500	3.136	PER IMP= 1.00
*S WILDERNESS SUBDIVISION AT HIGH DESERT, UNITS 2 AND 3											
START										TIME=	.00
RAINFALL TYPE= 2										RAIN24=	3.550
*S****WILDERNESS AT HIGH DESERT OFFSITE BASINS											
COMPUTE NM HYD	BASIN01		-	1	.01070	28.56	1.023	1.79195	1.500	4.171	PER IMP= 15.00
COMPUTE NM HYD	BASIN02		-	2	.00280	7.49	.268	1.79197	1.500	4.181	PER IMP= 15.00
COMPUTE NM HYD	BASIN03		-	3	.00100	2.69	.096	1.79201	1.500	4.204	PER IMP= 15.00
COMPUTE NM HYD	BASIN04		-	4	.00280	7.49	.268	1.79197	1.500	4.181	PER IMP= 15.00
COMPUTE NM HYD	BASIN05		-	5	.02420	64.57	2.313	1.79194	1.500	4.169	PER IMP= 15.00
COMPUTE NM HYD	BASIN06		-	6	.00080	2.16	.076	1.79202	1.500	4.213	PER IMP= 15.00
COMPUTE NM HYD	BASIN07		-	7	.00680	18.16	.650	1.79195	1.500	4.173	PER IMP= 15.00
*S****WILDERNESS VILLAGE AT HIGH DESERT (UNIT 2)											
SEDIMENT BULK										PK BF =	1.02
COMPUTE NM HYD	BASIN2A		-	10	.00900	23.50	.959	1.99703	1.500	4.079	PER IMP= 38.00
COMPUTE NM HYD	BASIN2B		-	11	.00750	21.25	.935	2.33664	1.500	4.426	PER IMP= 55.00
COMPUTE NM HYD	BASIN2C		-	12	.00930	26.48	1.170	2.35815	1.500	4.449	PER IMP= 56.00
COMPUTE NM HYD	BASIN2D		-	13	.00520	14.61	.637	2.29736	1.500	4.389	PER IMP= 53.00
COMPUTE NM HYD	BASIN2E		-	14	.00370	9.71	.400	2.02501	1.500	4.099	PER IMP= 40.00
COMPUTE NM HYD	BASIN2F		-	15	.00230	7.55	.371	3.02695	1.500	5.127	PER IMP= 90.00
COMPUTE NM HYD	BASIN2G		-	16	.00050	1.16	.037	1.37655	1.500	3.626	PER IMP= .00
COMPUTE NM HYD	LOT8		-	30	.00070	1.85	.074	1.98372	1.500	4.139	PER IMP= 36.00
COMPUTE NM HYD	LOT9		-	31	.00110	2.71	.100	1.70857	1.500	3.845	PER IMP= 22.00
COMPUTE NM HYD	LOT50		-	32	.00080	1.54	.047	1.09761	1.500	3.003	PER IMP= .00
COMPUTE NM HYD	LOT51		-	33	.00140	3.40	.128	1.72096	1.500	3.799	PER IMP= 25.00
COMPUTE NM HYD	LOT52		-	34	.00110	2.68	.101	1.72097	1.500	3.806	PER IMP= 25.00
*S****ADD UNIT 2 BASINS											
ADD HYD	BASINAB		10&11	40	.01650	44.74	1.893	2.15140	1.500	4.237	
ADD HYD	BASINABC		40&12	42	.02580	71.22	3.063	2.22592	1.500	4.313	
ADD HYD	BASINABCD		42&13	43	.03100	85.83	3.700	2.23790	1.500	4.326	
ADD HYD	BASINGO1		16& 1	44	.01120	29.72	1.059	1.77339	1.500	4.147	

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	NOTATION	
ADD HYD	BASINEO7		14& 7	46	.01050	27.87	1.049	1.87408	1.500	4.147	
*S ROUTE BASINS OS-7 AND 2E THROUGH POND AND SD											
ROUTE RESERVOIR	POND		46	47	.01050	27.25	1.048	1.87197	1.533	4.055	AC-FT= .046
ROUTE	PIPE		47	48	.01050	27.33	1.048	1.87178	1.533	4.066	
*S ROUTE BASINS OS-1 AND 2G THROUGH POND AND SD											

```
                                                          SB      AL.SUM
ROUTE RESERVOIR          POND   44   49        .01120      29.22      1.059      1.77319    1.533    4.076 AC-FT=      .041
ROUTE                    PIPE   49   41        .01120      29.43      1.059      1.77303    1.533    4.106
*S****WILDERNESS COMPOUND AT HIGH DESERT (UNIT 3)
COMPUTE NM HYD        BASIN3A   -    50        .00048       1.05       .033      1.27618    1.500    3.421 PER IMP=     .00
COMPUTE NM HYD        BASIN3B   -    51        .00305       8.47       .364      2.24022    1.500    4.338 PER IMP=   50.00
COMPUTE NM HYD        BASIN3C   -    52        .00086       2.40       .103      2.24029    1.500    4.366 PER IMP=   50.00
COMPUTE NM HYD        BASIN3D   -    53        .00248       6.89       .296      2.24024    1.500    4.341 PER IMP=   50.00
COMPUTE NM HYD        BASIN3E   -    54        .00265       7.36       .317      2.24023    1.500    4.340 PER IMP=   50.00
*S****ADD UNIT 3 AND OFFSITE BASINS
ADD HYD            BASINOS4&5  4& 5  60        .02700      72.06      2.580      1.79195    1.500    4.170
ADD HYD           BASIN3AOS45 50&60  61        .02748      73.11      2.613      1.78293    1.500    4.157
*S ROUTE BASINS 3A, OS-4 AND OS-5 THROUGH POND
ROUTE RESERVOIR          POND   61   62        .02748      71.63      2.612      1.78189    1.533    4.073 AC-FT=      .166
ADD HYD              BASIN3C3 52& 3  63        .00186       5.09       .198      1.99928    1.500    4.279
ADD HYD              BASIN3D2 53& 2  64        .00528      14.38       .564      2.00252    1.500    4.256
ADD HYD            BASIN3C245 63&62  65        .02934      76.53      2.810      1.79567    1.533    4.076
ADD HYD                  3BD2 64&51  66        .00833      22.85       .928      2.08956    1.500    4.286
ADD HYD             3ABCD2345 66&65  68        .03767      98.46      3.738      1.86066    1.533    4.084
*S****ADD UNIT 3 AND UPSTREAM PONDS
ADD HYD                   SD1 48&41  70        .02170      56.76      2.107      1.82081    1.533    4.087
ADD HYD                    W1 68&70  72        .05937     155.22      5.845      1.84609    1.533    4.085
ROUTE                     SUM   72   74        .05937     155.47      5.845      1.84601    1.533    4.092
ADD HYD             BASIN2F3E 15&54  75        .00495      14.91       .688      2.60578    1.500    4.706
ADD HYD                   OUT 74&75  76        .06432     169.70      6.533      1.90449    1.533    4.122
DIVIDE HYD              UPSTRM   76   77        .03921      44.00      3.982      1.90449    1.367    1.753
                        DNSTRM  and   78        .02511     125.70      2.551      1.90449    1.533    7.821
*S TOTAL FLOW IN THE SBCA2 UPSTREAM OF CULVERTS AT HIGH DESERT STREET
ADD HYD                 CULVIN 99&77  79        .05921      84.14      5.223      1.65391    1.500    2.221
ADD HYD               CULVDOWN 78&79  80        .08432     209.01      7.773      1.72854    1.533    3.873
*S      ROUTE FLOW FROM HIGH DESERT STREET TO CONFLUENCE WITH SBCA1
ROUTE                SBCA2TOTR   80   81        .08432     211.53      7.773      1.72838    1.533    3.920
ADD HYD                SBCA1&2 98&81  82        .35432     680.45     24.515      1.29731    1.567    3.001
FINISH
```

```
    AHYMO PROGRAM (AHYMO_97) -                          - Version:  1997.02c
         RUN DATE (MON/DAY/YR) = 08/17/2003
         START TIME (HR:MIN:SEC) = 16:13:54      USER NO.= AHYMO-S-9702c1BohanHu-AH
         INPUT FILE = SBCA.HYM

*S                    HIGH DESERT HYDROLOGY MODEL
*S                          INPUT=SBCA.HYM
*S                        EXISTING CONDTIONS MODEL
*S                            100-YEAR 24 HOUR STORM
*
*
*  BEAR CANYON ARROYO BASIN TAKEN FROM ECI STUDY
*
*  BEAR ARROYO, BEAR TRIBUTARY, SOUTH PINO TRIBUTARY AND PINO ARROYO BASINS
*  UPSTREAM OF HIGH DESERT DEVELOPMENT TAKEN FROM HYMO MODELS FOR THE
*  CONCEPTUAL DRAINAGE MANAGEMENT PLAN.  BASINS WITHIN HIGH DESERT MODIFIED
*  TO FIT DEVELOPMENT PLANS AS PER THE FINAL SECTOR PLAN (MAY 3, 1993)
*  AND FINAL ROAD CONFIGURATION (JULY 1993).
*
*
*
*************************************************************
* SOUTH BEAR CANYON ARROYO (TRIBUTARIES TO THE BEAR CANYON) *
*************************************************************
*
*       TAKEN FROM
*                    FILE: BC_P.IN/OUT
*                    BHI JN'S 8911803, 9123302                    DATE: JAN 6, 1992
*
*
* HYMO ANALYSIS USING NM HYMO, PER CITY DPM APPROVED AUGUST, 1991
* INPUT BASED ON MODIFIED STUDY FOR JOHN ROBERTS DAM, DATED DEC. 1991.
* MODIFICATIONS INCLUDE:   1) INCREASE RAINFALL TO 3.00"/6HR.
*                                          2) ADJUST AREAS USING NEW 1"=200' SCALE MAPS.
*                                          3) MODEL OF EXISITNG CONDITIONS AS OF 1/92
*                                             AND IMPROVEMENTS TO TRAMWAY BLVD.
*                              4) ESTIMATED 40% IMPERVIOUS AREA DEDUCTED
*                                 IN ACCORDANCE WITH THE EXISTING CONDITIONS.
*                                          5) BEAR ARROYO BASINS DO NOT CONTRIBUTE TO
*                                             BEAR CANYON BASINS.
*////////////////////////////////////////////////////////////////////////////
*
*               UPSTREAM OF TRAMWAY BLVD. ON BEAR CANYON ARROYO
*
*
*////////////////////////////////////////////////////////////////////////////
*
*
*
*
*
*
*
START
                                  TIME=0
                                  PUNCH CODE=0
                                  PRINT LINES=6
*
LOCATION                     NAME=ALBUQUERQUE
     Soil infiltration values (LAND FACTORS) for this location are not available.
     The following default values were used.
     Land Treatment     Initial Abstr.(in)    Unif. Infilt.(in/hour)
```

```
          A          0.65                1.67
          B          0.50                1.25
          C          0.35                0.83
          D          0.10                0.04

*
SEDIMENT BULK              CODE=1
                                 BULK FACTOR=1.1
*
RAINFALL                   TYPE=2
                                 RAIN QUARTER=0.0
                                 RAIN ONE=2.23
                                 RAIN SIX=2.90
                                 RAIN DAY=3.65
                                 DT=0.033333

COMPUTED 24-HOUR RAINFALL DISTRIBUTION BASED ON NOAA ATLAS 2 - PEAK AT 1.40 HR.
DT =     .033333 HOURS        END TIME =     19.966470 HOURS
   .0000   .0055   .0110   .0167   .0225   .0284   .0345
   .0406   .0470   .0534   .0600   .0668   .0738   .0809
   .0882   .0958   .1035   .1115   .1198   .1283   .1370
   .1461   .1555   .1653   .1755   .1860   .1971   .2086
   .2207   .2335   .2469   .2531   .2596   .2667   .2819
   .3158   .3679   .4428   .5450   .6793   .8505  1.0637
  1.3239  1.5646  1.6653  1.7504  1.8260  1.8948  1.9582
  2.0171  2.0720  2.1236  2.1721  2.2178  2.2611  2.3020
  2.3407  2.3775  2.4124  2.4455  2.4769  2.4850  2.4928
  2.5002  2.5074  2.5143  2.5210  2.5275  2.5339  2.5400
  2.5460  2.5518  2.5575  2.5631  2.5685  2.5738  2.5790
  2.5841  2.5891  2.5940  2.5989  2.6036  2.6083  2.6129
  2.6174  2.6218  2.6262  2.6305  2.6348  2.6390  2.6431
  2.6472  2.6512  2.6552  2.6591  2.6630  2.6668  2.6706
  2.6744  2.6781  2.6817  2.6854  2.6890  2.6925  2.6960
  2.6995  2.7029  2.7064  2.7097  2.7131  2.7164  2.7197
  2.7230  2.7262  2.7294  2.7326  2.7357  2.7388  2.7419
  2.7450  2.7481  2.7511  2.7541  2.7571  2.7600  2.7630
  2.7659  2.7688  2.7716  2.7745  2.7773  2.7802  2.7829
  2.7857  2.7885  2.7912  2.7939  2.7967  2.7993  2.8020
  2.8047  2.8073  2.8099  2.8125  2.8151  2.8177  2.8203
  2.8228  2.8254  2.8279  2.8304  2.8329  2.8354  2.8378
  2.8403  2.8427  2.8451  2.8476  2.8500  2.8524  2.8547
  2.8571  2.8595  2.8618  2.8641  2.8664  2.8688  2.8711
  2.8733  2.8756  2.8779  2.8801  2.8824  2.8846  2.8868
  2.8891  2.8913  2.8935  2.8957  2.8978  2.9000  2.9021
  2.9042  2.9063  2.9084  2.9105  2.9125  2.9146  2.9167
  2.9187  2.9208  2.9229  2.9249  2.9270  2.9290  2.9310
  2.9331  2.9351  2.9371  2.9391  2.9412  2.9432  2.9452
  2.9472  2.9492  2.9512  2.9532  2.9551  2.9571  2.9591
  2.9611  2.9630  2.9650  2.9670  2.9689  2.9709  2.9728
  2.9747  2.9767  2.9786  2.9805  2.9825  2.9844  2.9863
  2.9882  2.9901  2.9920  2.9939  2.9958  2.9977  2.9996
  3.0015  3.0034  3.0053  3.0072  3.0090  3.0109  3.0128
  3.0146  3.0165  3.0183  3.0202  3.0220  3.0239  3.0257
  3.0275  3.0294  3.0312  3.0330  3.0348  3.0367  3.0385
  3.0403  3.0421  3.0439  3.0457  3.0475  3.0493  3.0511
  3.0529  3.0546  3.0564  3.0582  3.0600  3.0617  3.0635
  3.0653  3.0670  3.0688  3.0705  3.0723  3.0740  3.0758
  3.0775  3.0792  3.0810  3.0827  3.0844  3.0862  3.0879
  3.0896  3.0913  3.0930  3.0947  3.0964  3.0981  3.0998
  3.1015  3.1032  3.1049  3.1066  3.1083  3.1100  3.1116
  3.1133  3.1150  3.1167  3.1183  3.1200  3.1217  3.1233
  3.1250  3.1266  3.1283  3.1299  3.1316  3.1332  3.1348
  3.1365  3.1381  3.1397  3.1414  3.1430  3.1446  3.1462
```

3.1478	3.1494	3.1511	3.1527	3.1543	3.1559	3.1575
3.1591	3.1607	3.1623	3.1638	3.1654	3.1670	3.1686
3.1702	3.1717	3.1733	3.1749	3.1765	3.1780	3.1796
3.1811	3.1827	3.1843	3.1858	3.1874	3.1889	3.1905
3.1920	3.1935	3.1951	3.1966	3.1981	3.1997	3.2012
3.2027	3.2043	3.2058	3.2073	3.2088	3.2103	3.2118
3.2133	3.2149	3.2164	3.2179	3.2194	3.2209	3.2224
3.2238	3.2253	3.2268	3.2283	3.2298	3.2313	3.2328
3.2342	3.2357	3.2372	3.2387	3.2401	3.2416	3.2430
3.2445	3.2460	3.2474	3.2489	3.2503	3.2518	3.2532
3.2547	3.2561	3.2576	3.2590	3.2604	3.2619	3.2633
3.2647	3.2662	3.2676	3.2690	3.2705	3.2719	3.2733
3.2747	3.2761	3.2775	3.2790	3.2804	3.2818	3.2832
3.2846	3.2860	3.2874	3.2888	3.2902	3.2916	3.2930
3.2943	3.2957	3.2971	3.2985	3.2999	3.3013	3.3026
3.3040	3.3054	3.3068	3.3081	3.3095	3.3109	3.3122
3.3136	3.3150	3.3163	3.3177	3.3190	3.3204	3.3217
3.3231	3.3244	3.3258	3.3271	3.3285	3.3298	3.3311
3.3325	3.3338	3.3351	3.3365	3.3378	3.3391	3.3405
3.3418	3.3431	3.3444	3.3457	3.3471	3.3484	3.3497
3.3510	3.3523	3.3536	3.3549	3.3562	3.3575	3.3588
3.3601	3.3614	3.3627	3.3640	3.3653	3.3666	3.3679
3.3692	3.3705	3.3718	3.3731	3.3743	3.3756	3.3769
3.3782	3.3794	3.3807	3.3820	3.3833	3.3845	3.3858
3.3871	3.3883	3.3896	3.3909	3.3921	3.3934	3.3946
3.3959	3.3971	3.3984	3.3996	3.4009	3.4021	3.4034
3.4046	3.4059	3.4071	3.4083	3.4096	3.4108	3.4121
3.4133	3.4145	3.4157	3.4170	3.4182	3.4194	3.4207
3.4219	3.4231	3.4243	3.4255	3.4268	3.4280	3.4292
3.4304	3.4316	3.4328	3.4340	3.4352	3.4364	3.4376
3.4388	3.4400	3.4412	3.4424	3.4436	3.4448	3.4460
3.4472	3.4484	3.4496	3.4508	3.4520	3.4532	3.4543
3.4555	3.4567	3.4579	3.4591	3.4602	3.4614	3.4626
3.4638	3.4649	3.4661	3.4673	3.4685	3.4696	3.4708
3.4719	3.4731	3.4743	3.4754	3.4766	3.4777	3.4789
3.4801	3.4812	3.4824	3.4835	3.4847	3.4858	3.4870
3.4881	3.4893	3.4904	3.4915	3.4927	3.4938	3.4950
3.4961	3.4972	3.4984	3.4995	3.5006	3.5018	3.5029
3.5040	3.5051	3.5063	3.5074	3.5085	3.5096	3.5108
3.5119	3.5130	3.5141	3.5152	3.5163	3.5175	3.5186
3.5197	3.5208	3.5219	3.5230	3.5241		

```
*
*
*      BASIN 1(SBCA1-1)
*
*S TOTAL FLOW IN SBCA1 AT FIRST CULVERT CROSSING
COMPUTE NM HYD              ID=1
                                     HYD NO=1
                                     AREA=0.125 SQ MI
                         PER A=50.0
                                     PER B=12.0
                                     PER C=37.0
                                     PER D=1.0
                                     TP=-0.155 HR
                                     MASS RAIN=-1

     K =    .084895HR    TP =    .155000HR    K/TP RATIO =    .547711     SHAPE CONSTANT, N =  7.061425
     UNIT PEAK =    4.2271    CFS    UNIT VOLUME =     .9973        B =    524.16       P60 = 2.2300
     AREA =       .001250 SQ MI    IA =     .10000 INCHES    INF =     .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333
```

```
K =   .153421HR    TP =   .155000HR    K/TP RATIO =   .989811     SHAPE CONSTANT, N =  3.567128
UNIT PEAK =   259.63    CFS   UNIT VOLUME =    1.000       B =   325.20       P60 = 2.2300
AREA =      .123750 SQ MI    IA =    .51970 INCHES    INF =   1.30515 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.10000 AT PEAK FLOW.

*
PRINT HYD                    ID=1
                                 CODE=10
```

OUTFLOW HYDROGRAPH REACH 1.00

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	4.000	.4	8.000	.0	12.000	.0	16.000	.0
.333	.0	4.333	.2	8.333	.0	12.333	.0	16.333	.0
.667	.1	4.667	.1	8.667	.0	12.667	.0	16.667	.0
1.000	.2	5.000	.1	9.000	.0	13.000	.0	17.000	.0
1.333	22.7	5.333	.1	9.333	.0	13.333	.0	17.333	.0
1.667	156.7	5.667	.1	9.667	.0	13.667	.0	17.666	.0
2.000	30.1	6.000	.1	10.000	.0	14.000	.0	18.000	.0
2.333	12.4	6.333	.1	10.333	.0	14.333	.0	18.333	.0
2.667	6.0	6.667	.1	10.667	.0	14.667	.0	18.666	.0
3.000	2.9	7.000	.1	11.000	.0	15.000	.0	19.000	.0
3.333	1.4	7.333	.1	11.333	.0	15.333	.0	19.333	.0
3.667	.7	7.667	.1	11.667	.0	15.667	.0	19.666	.0

```
RUNOFF VOLUME =     1.16270 INCHES     =       7.7513 ACRE-FEET
PEAK DISCHARGE RATE =     232.23 CFS  AT   1.533 HOURS   BASIN AREA =   .1250 SQ. MI.

*
*
* ROUTE 1
*S      ROUTE FLOW FROM FIRST CULVERT CROSSING TO CULVERT CROSSING AT HIGH DESER
*
*
COMPUTE RATING CURVE       CID=1
                                VS NO=1
                                NSEGS=1
                         MIN ELEV=0
                                MAX ELEV=10.
                         CH SLOPE=.044
                                FP SLOPE=.044
                         N =.035
                                DIST=210
                            DIST  ELEV  DIST   ELEV  DIST  ELEV  DIST  ELEV
                            0.    10.0  55.    0.0   105.  0.0   155.  5.0
                         210.  10.0
```

RATING CURVE VALLEY SECTION 1.0

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS	TOP WIDTH FT
.00	.00	.00	50.00
.53	28.46	157.29	58.16
1.05	61.22	516.14	66.32
1.58	98.27	1050.77	74.47
2.11	139.61	1759.63	82.63
2.63	185.25	2646.93	90.79
3.16	235.18	3719.22	98.95

3.68	289.40	4984.12	107.11
4.21	347.92	6449.78	115.26
4.74	410.73	8124.60	123.42
5.26	477.87	10005.07	131.84
5.79	549.55	12102.10	140.53
6.32	625.80	14437.81	149.21
6.84	706.61	17021.62	157.89
7.37	792.00	19862.76	166.58
7.89	881.96	22970.35	175.26
8.42	976.49	26353.38	183.95
8.95	1075.59	30020.71	192.63
9.47	1179.26	33981.04	201.32
10.00	1287.50	38243.00	210.00

```
*
COMPUTE TRAVEL TIME          ID=2
                                REACH=1
                                NO VS=1
                             L=680
                                SLP=.044
```

TRAVEL TIME TABLE

REACH= 1.0

WATER DEPTH FEET	AVERAGE AREA SQ.FT.	FLOW RATE CFS	TRAVEL TIME HRS
.526	28.463	157.29	.0342
1.053	61.219	516.14	.0224
1.579	98.269	1050.77	.0177
2.105	139.612	1759.63	.0150
2.632	185.249	2646.93	.0132
3.158	235.180	3719.22	.0119
3.684	289.404	4984.12	.0110
4.211	347.922	6449.78	.0102
4.737	410.734	8124.60	.0095
5.263	477.874	10005.07	.0090
5.789	549.550	12102.10	.0086
6.316	625.796	14437.81	.0082
6.842	706.613	17021.62	.0078
7.368	792.001	19862.76	.0075
7.895	881.960	22970.35	.0073
8.421	976.489	26353.38	.0070
8.947	1075.589	30020.71	.0068
9.474	1179.259	33981.04	.0066
10.000	1287.500	38243.00	.0064

```
*
ROUTE                        ID=2
                                HYD=1.1
                                INFLOW ID=1
                                DT=0.0333333333
    Hydrograph incermental time change from DT=   .033333 hours to DT=   .033333 hours
*
PRINT HYD                    ID=2
                                CODE=10
```

OUTFLOW HYDROGRAPH REACH 1.10

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	4.000	.4	8.000	.1	12.000	.0	16.000	.0
.333	.0	4.333	.2	8.333	.0	12.333	.0	16.333	.0
.667	.0	4.667	.1	8.667	.0	12.667	.0	16.667	.0
1.000	.2	5.000	.1	9.000	.0	13.000	.0	17.000	.0

1.333	10.5	5.333	.1	9.333	.0	13.333	.0	17.333	.0
1.667	175.5	5.667	.1	9.667	.0	13.667	.0	17.667	.0
2.000	35.0	6.000	.1	10.000	.0	14.000	.0	18.000	.0
2.333	13.4	6.333	.1	10.333	.0	14.333	.0	18.333	.0
2.667	6.5	6.667	.1	10.667	.0	14.667	.0	18.667	.0
3.000	3.2	7.000	.1	11.000	.0	15.000	.0	19.000	.0
3.333	1.6	7.333	.1	11.333	.0	15.333	.0	19.333	.0
3.667	.8	7.667	.1	11.667	.0	15.667	.0	19.667	.0

```
RUNOFF VOLUME =      1.16270 INCHES     =       7.7513 ACRE-FEET
PEAK DISCHARGE RATE =     226.39 CFS  AT   1.567 HOURS   BASIN AREA =   .1250 SQ. MI.


*
*
*      BASIN 2(SBCA1-2)
*
*
*
COMPUTE NM HYD          ID=3
                                HYD NO=3
                                AREA=0.145 SQ MI
                        PER A=50.0
                                PER B=12.0
                                PER C=37.0
                                PER D=1.0
                        TP=-0.172 HR
                                MASS RAIN=-1
K =   .094356HR    TP =   .172000HR    K/TP RATIO =   .548579     SHAPE CONSTANT, N =  7.047124
UNIT PEAK =   4.4131    CFS   UNIT VOLUME =    .9973       B =   523.48      P60 = 2.2300
AREA =      .001450 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333


K =   .167746HR    TP =   .172000HR    K/TP RATIO =   .975268     SHAPE CONSTANT, N =  3.621368
UNIT PEAK =   274.65    CFS   UNIT VOLUME =    1.000       B =   329.08      P60 = 2.2300
AREA =      .143550 SQ MI    IA =    .51970 INCHES    INF =   1.30515 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.10000 AT PEAK FLOW.

*
PRINT HYD               ID=3
                                CODE=10
                                OUTFLOW HYDROGRAPH REACH     3.00
```

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	4.000	.6	8.000	.1	12.000	.0	16.000	.0
.333	.0	4.333	.4	8.333	.1	12.333	.0	16.333	.0
.667	.1	4.667	.2	8.667	.1	12.667	.0	16.667	.0
1.000	.3	5.000	.1	9.000	.1	13.000	.0	17.000	.0
1.333	20.0	5.333	.1	9.333	.1	13.333	.0	17.333	.0
1.667	190.7	5.667	.1	9.667	.1	13.667	.0	17.666	.0
2.000	38.3	6.000	.1	10.000	.1	14.000	.0	18.000	.0
2.333	15.7	6.333	.1	10.333	.1	14.333	.0	18.333	.0
2.667	8.1	6.667	.1	10.667	.1	14.667	.0	18.666	.0
3.000	4.2	7.000	.1	11.000	.0	15.000	.0	19.000	.0
3.333	2.2	7.333	.1	11.333	.0	15.333	.0	19.333	.0
3.667	1.2	7.667	.1	11.667	.0	15.667	.0	19.666	.0

```
RUNOFF VOLUME =      1.16269 INCHES     =        8.9914 ACRE-FEET
PEAK DISCHARGE RATE =     250.55 CFS  AT   1.533 HOURS   BASIN AREA =   .1450 SQ. MI.


*
*
*      COMBINE HYDROS : 1 & 2
*s TOTAL FLOW IN THE SBCA1 AT HIGH DESERT STREET
*
ADD HYD                    ID=4
                                  HYD=4
                                  ID I=2
                                  ID II=3
*
PRINT HYD                  ID=4
                                  CODE=10
```

OUTFLOW HYDROGRAPH REACH 4.00

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	4.000	1.0	8.000	.1	12.000	.1	16.000	.1
.333	.0	4.333	.6	8.333	.1	12.333	.1	16.333	.1
.667	.1	4.667	.4	8.667	.1	12.667	.1	16.667	.1
1.000	.5	5.000	.2	9.000	.1	13.000	.1	17.000	.1
1.333	30.6	5.333	.2	9.333	.1	13.333	.1	17.333	.1
1.667	366.2	5.667	.1	9.667	.1	13.667	.1	17.667	.1
2.000	73.3	6.000	.1	10.000	.1	14.000	.1	18.000	.1
2.333	29.1	6.333	.1	10.333	.1	14.333	.1	18.333	.1
2.667	14.6	6.667	.1	10.667	.1	14.667	.1	18.667	.1
3.000	7.3	7.000	.1	11.000	.1	15.000	.1	19.000	.1
3.333	3.7	7.333	.1	11.333	.1	15.333	.1	19.333	.1
3.667	1.9	7.667	.1	11.667	.1	15.667	.1	19.667	.1

```
RUNOFF VOLUME =      1.16270 INCHES     =       16.7428 ACRE-FEET
PEAK DISCHARGE RATE =     476.51 CFS  AT   1.567 HOURS   BASIN AREA =   .2700 SQ. MI.


*
* ROUTE 2
*S      ROUTE FLOW FROM HIGH DESERT STREET TO CONFLUENCE WITH SBCA2
*
*
COMPUTE RATING CURVE       CID=1
                                  VS NO=1
                                  NSEGS=1
                           MIN ELEV=0
                                  MAX ELEV=10.
                           CH SLOPE=.052
                                  FP SLOPE=.052
                           N =.035
                                  DIST=210
                              DIST  ELEV  DIST   ELEV  DIST  ELEV  DIST  ELEV
                              0.    10.0  50.    0.0   175.  2.0   210.  10.0
```

RATING CURVE VALLEY SECTION 1.0

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS	TOP WIDTH FT
.00	.00	.00	.00

.53	9.35	37.13	35.53
1.05	37.40	235.77	71.05
1.58	84.14	695.12	106.58
2.11	149.26	1535.92	135.99
2.63	222.13	2908.11	140.92
3.16	297.60	4625.42	145.86
3.68	375.66	6667.25	150.79
4.21	456.33	9020.78	155.72
4.74	539.58	11677.72	160.66
5.26	625.44	14632.72	165.59
5.79	713.89	17882.42	170.53
6.32	804.94	21424.92	175.46
6.84	898.59	25259.38	180.39
7.37	994.83	29385.79	185.33
7.89	1093.67	33804.79	190.26
8.42	1195.11	38517.50	195.20
8.95	1299.14	43525.45	200.13
9.47	1405.77	48830.51	205.07
10.00	1515.00	54434.84	210.00

```
*
COMPUTE TRAVEL TIME        ID=98
                                REACH=1
                                NO VS=1
                           L=420
                                SLP=.052
```

TRAVEL TIME TABLE

REACH= 1.0

WATER DEPTH FEET	AVERAGE AREA SQ.FT.	FLOW RATE CFS	TRAVEL TIME HRS
.526	9.349	37.13	.0294
1.053	37.396	235.77	.0185
1.579	84.141	695.12	.0141
2.105	149.262	1535.92	.0113
2.632	222.133	2908.11	.0089
3.158	297.600	4625.42	.0075
3.684	375.665	6667.25	.0066
4.211	456.326	9020.78	.0059
4.737	539.584	11677.72	.0054
5.263	625.440	14632.72	.0050
5.789	713.892	17882.42	.0047
6.316	804.941	21424.92	.0044
6.842	898.587	25259.38	.0042
7.368	994.830	29385.79	.0039
7.895	1093.670	33804.79	.0038
8.421	1195.107	38517.50	.0036
8.947	1299.141	43525.45	.0035
9.474	1405.772	48830.51	.0034
10.000	1515.000	54434.84	.0032

```
*
ROUTE                      ID=98
                                HYD=SBCATOTR
                                INFLOW ID=4
                                DT=0.0333333333
*
PRINT HYD                  ID=98
                     CODE=10
```

HYDROGRAPH FROM AREA SBCATOTR

TIME	FLOW	TIME	FLOW	TIME	FLOW	TIME	FLOW	TIME	FLOW

HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS	HRS	CFS
.000	.0	4.000	1.1	8.000	.1	12.000	.1	16.000	.1
.333	.0	4.333	.6	8.333	.1	12.333	.1	16.333	.1
.667	.1	4.667	.4	8.667	.1	12.667	.1	16.667	.1
1.000	.5	5.000	.2	9.000	.1	13.000	.1	17.000	.1
1.333	15.2	5.333	.2	9.333	.1	13.333	.1	17.333	.1
1.667	384.7	5.667	.1	9.667	.1	13.667	.1	17.667	.1
2.000	81.0	6.000	.1	10.000	.1	14.000	.1	18.000	.1
2.333	31.1	6.333	.1	10.333	.1	14.333	.1	18.333	.1
2.667	15.5	6.667	.1	10.667	.1	14.667	.1	18.667	.1
3.000	7.8	7.000	.1	11.000	.1	15.000	.1	19.000	.1
3.333	4.0	7.333	.1	11.333	.1	15.333	.1	19.333	.1
3.667	2.1	7.667	.1	11.667	.1	15.667	.1	19.667	.1

```
RUNOFF VOLUME =      1.16269 INCHES     =      16.7426 ACRE-FEET
PEAK DISCHARGE RATE =     477.87 CFS  AT   1.567 HOURS   BASIN AREA =   .2700 SQ. MI.


*
*      BASIN 3(SBCA2-1)
*
*
*
*S TOTAL FLOW IN THE SBCA2 AT HIGH DESERT STREET
COMPUTE NM HYD          ID=99
                                HYD NO=3
                                AREA=0.020 SQ MI
                        PER A=50.0
                                PER B=12.0
                                PER C=37.0
                                PER D=1.0
                      TP=-0.133 HR
                                MASS RAIN=-1

K =   .072485HR    TP =   .133000HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
UNIT PEAK =   .79139    CFS   UNIT VOLUME =     .9842       B =   526.28      P60 = 2.2300
AREA =      .000200 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333


K =   .137689HR    TP =   .133000HR    K/TP RATIO =  1.035259     SHAPE CONSTANT, N =  3.409834
UNIT PEAK =   46.700    CFS   UNIT VOLUME =     .9999       B =   313.69      P60 = 2.2300
AREA =      .019800 SQ MI    IA =    .51970 INCHES    INF =   1.30515 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.10000 AT PEAK FLOW.

*
PRINT HYD               ID=99
                                CODE=10
```

OUTFLOW HYDROGRAPH REACH 3.00

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	4.000	.0	8.000	.0	12.000	.0	16.000	.0
.333	.0	4.333	.0	8.333	.0	12.333	.0	16.333	.0
.667	.0	4.667	.0	8.667	.0	12.667	.0	16.667	.0
1.000	.0	5.000	.0	9.000	.0	13.000	.0	17.000	.0
1.333	5.3	5.333	.0	9.333	.0	13.333	.0	17.333	.0
1.667	22.9	5.667	.0	9.667	.0	13.667	.0	17.666	.0
2.000	4.3	6.000	.0	10.000	.0	14.000	.0	18.000	.0

2.333	1.7	6.333	.0	10.333	.0	14.333	.0	18.333	.0
2.667	.8	6.667	.0	10.667	.0	14.667	.0	18.666	.0
3.000	.4	7.000	.0	11.000	.0	15.000	.0	19.000	.0
3.333	.2	7.333	.0	11.333	.0	15.333	.0	19.333	.0
3.667	.1	7.667	.0	11.667	.0	15.667	.0	19.666	.0

```
RUNOFF VOLUME =      1.16271 INCHES     =       1.2402 ACRE-FEET
PEAK DISCHARGE RATE =      40.14 CFS  AT   1.500 HOURS   BASIN AREA =   .0200 SQ. MI.


*
*
*S WILDERNESS SUBDIVISION AT HIGH DESERT, UNITS 2 AND 3
* 10-21-02
START                RAINFALL BEGINS AT 0.00 HOURS
*                      100 YEAR RETURN PERIOD
*****************************************************************************
*
*      ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
*      ::                        MISC. DATA                                ::
*      ::        RAINFALL RETURN PERIOD_______________  100-YEAR           ::
*      ::        RAINFALL DURATION___________________   6-HOUR                ::
*      ::            ZONE 4                                                      ::
*      ::        RAINFALL DEPTHS: 1 HOUR (P60)___  2.23 INCHES              ::
*      ::        (UNADJUSTED)     6 HOUR (P360)__  2.90 INCHES              ::
*      ::                        24 HOUR (P1440)_  3.65 INCHES              ::
*      ::                                                                   ::
*      ::        RAINFALL DATA TAKEN FROM NOAA.                             ::
*      ::                                                                   ::
*      ::                HYDROGRAPH METHODOLOGY                             ::
*      ::                                                                   ::
*      ::        CITY OF ALBQ. DPM VOL. 2, SECTION 22.2 July, 1997          ::
*      ::        INITIAL ABSTRACTION - INFILTRATION METHOD                  ::
*      ::        Tc CALCULATIONS PER C.O.A. DPM 22.2-B.4                    ::
*      ::        AMAFCA AHYMO VERSION MARCH 20,1992                         ::
*      ::                                                                   ::
*      ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
*                          BEGIN  ANALYSIS
*****************************************************************************
*
RAINFALL             TYPE=2 RAIN QUARTER=0.0 RAIN ONE=2.23
                     RAIN SIX=2.90 RAIN DAY=3.55 DT=0.0333333

                COMPUTED 24-HOUR RAINFALL DISTRIBUTION BASED ON NOAA ATLAS 2 - PEAK AT 1.40 HR.
                DT =     .033333 HOURS       END TIME =     19.966650 HOURS
                   .0000   .0055   .0110   .0167   .0225   .0284   .0345
                   .0406   .0470   .0534   .0600   .0668   .0738   .0809
                   .0882   .0958   .1035   .1115   .1198   .1283   .1370
                   .1461   .1555   .1653   .1755   .1860   .1971   .2086
                   .2207   .2335   .2469   .2531   .2596   .2667   .2819
                   .3158   .3679   .4428   .5450   .6793   .8506  1.0638
                  1.3240  1.5647  1.6654  1.7504  1.8261  1.8949  1.9582
                  2.0171  2.0721  2.1236  2.1721  2.2178  2.2611  2.3020
                  2.3407  2.3775  2.4124  2.4455  2.4769  2.4850  2.4928
                  2.5002  2.5074  2.5143  2.5210  2.5276  2.5339  2.5400
                  2.5460  2.5518  2.5575  2.5631  2.5685  2.5738  2.5790
                  2.5841  2.5891  2.5940  2.5989  2.6036  2.6083  2.6129
                  2.6174  2.6218  2.6262  2.6305  2.6348  2.6390  2.6431
                  2.6472  2.6512  2.6552  2.6591  2.6630  2.6668  2.6706
                  2.6744  2.6781  2.6817  2.6854  2.6890  2.6925  2.6960
                  2.6995  2.7029  2.7064  2.7097  2.7131  2.7164  2.7197
                  2.7230  2.7262  2.7294  2.7326  2.7357  2.7388  2.7419
```

2.7450	2.7481	2.7511	2.7541	2.7571	2.7600	2.7630
2.7659	2.7688	2.7717	2.7745	2.7773	2.7802	2.7830
2.7857	2.7885	2.7912	2.7940	2.7967	2.7993	2.8020
2.8047	2.8073	2.8099	2.8126	2.8151	2.8177	2.8203
2.8228	2.8254	2.8279	2.8304	2.8329	2.8354	2.8378
2.8403	2.8427	2.8452	2.8476	2.8500	2.8524	2.8547
2.8571	2.8595	2.8618	2.8641	2.8665	2.8688	2.8711
2.8733	2.8756	2.8779	2.8801	2.8824	2.8846	2.8869
2.8891	2.8913	2.8935	2.8957	2.8978	2.9000	2.9018
2.9037	2.9055	2.9073	2.9092	2.9110	2.9128	2.9146
2.9164	2.9182	2.9200	2.9218	2.9236	2.9254	2.9271
2.9289	2.9307	2.9325	2.9342	2.9360	2.9377	2.9395
2.9412	2.9430	2.9447	2.9465	2.9482	2.9499	2.9517
2.9534	2.9551	2.9568	2.9585	2.9602	2.9619	2.9636
2.9653	2.9670	2.9687	2.9704	2.9721	2.9738	2.9754
2.9771	2.9788	2.9804	2.9821	2.9837	2.9854	2.9871
2.9887	2.9903	2.9920	2.9936	2.9952	2.9969	2.9985
3.0001	3.0017	3.0034	3.0050	3.0066	3.0082	3.0098
3.0114	3.0130	3.0146	3.0162	3.0178	3.0193	3.0209
3.0225	3.0241	3.0257	3.0272	3.0288	3.0303	3.0319
3.0335	3.0350	3.0366	3.0381	3.0397	3.0412	3.0427
3.0443	3.0458	3.0473	3.0489	3.0504	3.0519	3.0534
3.0549	3.0564	3.0580	3.0595	3.0610	3.0625	3.0640
3.0655	3.0670	3.0684	3.0699	3.0714	3.0729	3.0744
3.0759	3.0773	3.0788	3.0803	3.0817	3.0832	3.0847
3.0861	3.0876	3.0890	3.0905	3.0919	3.0934	3.0948
3.0962	3.0977	3.0991	3.1005	3.1020	3.1034	3.1048
3.1062	3.1077	3.1091	3.1105	3.1119	3.1133	3.1147
3.1161	3.1175	3.1189	3.1203	3.1217	3.1231	3.1245
3.1259	3.1273	3.1287	3.1300	3.1314	3.1328	3.1342
3.1355	3.1369	3.1383	3.1396	3.1410	3.1424	3.1437
3.1451	3.1464	3.1478	3.1491	3.1505	3.1518	3.1532
3.1545	3.1558	3.1572	3.1585	3.1598	3.1612	3.1625
3.1638	3.1651	3.1665	3.1678	3.1691	3.1704	3.1717
3.1730	3.1743	3.1756	3.1769	3.1782	3.1795	3.1808
3.1821	3.1834	3.1847	3.1860	3.1873	3.1886	3.1899
3.1911	3.1924	3.1937	3.1950	3.1963	3.1975	3.1988
3.2001	3.2013	3.2026	3.2039	3.2051	3.2064	3.2076
3.2089	3.2101	3.2114	3.2126	3.2139	3.2151	3.2164
3.2176	3.2188	3.2201	3.2213	3.2226	3.2238	3.2250
3.2262	3.2275	3.2287	3.2299	3.2311	3.2324	3.2336
3.2348	3.2360	3.2372	3.2384	3.2396	3.2408	3.2421
3.2433	3.2445	3.2457	3.2469	3.2481	3.2492	3.2504
3.2516	3.2528	3.2540	3.2552	3.2564	3.2576	3.2587
3.2599	3.2611	3.2623	3.2635	3.2646	3.2658	3.2670
3.2681	3.2693	3.2705	3.2716	3.2728	3.2739	3.2751
3.2763	3.2774	3.2786	3.2797	3.2809	3.2820	3.2832
3.2843	3.2855	3.2866	3.2877	3.2889	3.2900	3.2912
3.2923	3.2934	3.2946	3.2957	3.2968	3.2979	3.2991
3.3002	3.3013	3.3024	3.3036	3.3047	3.3058	3.3069
3.3080	3.3091	3.3103	3.3114	3.3125	3.3136	3.3147
3.3158	3.3169	3.3180	3.3191	3.3202	3.3213	3.3224
3.3235	3.3246	3.3257	3.3267	3.3278	3.3289	3.3300
3.3311	3.3322	3.3333	3.3343	3.3354	3.3365	3.3376
3.3386	3.3397	3.3408	3.3419	3.3429	3.3440	3.3451
3.3461	3.3472	3.3483	3.3493	3.3504	3.3514	3.3525
3.3535	3.3546	3.3557	3.3567	3.3578	3.3588	3.3599
3.3609	3.3619	3.3630	3.3640	3.3651	3.3661	3.3672
3.3682	3.3692	3.3703	3.3713	3.3723	3.3734	3.3744
3.3754	3.3765	3.3775	3.3785	3.3795	3.3806	3.3816
3.3826	3.3836	3.3846	3.3856	3.3867	3.3877	3.3887
3.3897	3.3907	3.3917	3.3927	3.3937	3.3947	3.3958
3.3968	3.3978	3.3988	3.3998	3.4008	3.4018	3.4028

```
3.4038  3.4047  3.4057  3.4067  3.4077  3.4087  3.4097
3.4107  3.4117  3.4127  3.4136  3.4146  3.4156  3.4166
3.4176  3.4186  3.4195  3.4205  3.4215  3.4225  3.4234
3.4244  3.4254  3.4263  3.4273  3.4283  3.4293  3.4302
3.4312  3.4321  3.4331  3.4341  3.4350  3.4360  3.4369
3.4379  3.4389  3.4398  3.4408  3.4417

**********************************************
*S****WILDERNESS AT HIGH DESERT OFFSITE BASINS
**********************************************
**** COMPUTE AND PRINT NM HYD DATA FOR BASIN 01  *********
COMPUTE NM HYD       ID=1 HYD=BASIN01  AREA=0.0107 PER A=0.0 PER B=20.0
                          PER C=65.0 PER D=15.0  TP=.133  RAINFALL=-1

     K =   .072485HR    TP =   .133000HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
     UNIT PEAK =   6.3509    CFS   UNIT VOLUME =    .9977       B =   526.28      P60 = 2.2300
     AREA =      .001605 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333


     K =   .115506HR    TP =   .133000HR    K/TP RATIO =   .868463     SHAPE CONSTANT, N =  4.091263
     UNIT PEAK =   24.701    CFS   UNIT VOLUME =    .9998       B =   361.21      P60 = 2.2300
     AREA =      .009095 SQ MI    IA =    .38529 INCHES    INF =    .92882 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.10000 AT PEAK FLOW.

PRINT HYD                 ID=1   CODE=1

                                   HYDROGRAPH FROM AREA BASIN01

    RUNOFF VOLUME =     1.79195 INCHES     =       1.0226 ACRE-FEET
    PEAK DISCHARGE RATE =      28.56 CFS  AT   1.500 HOURS   BASIN AREA =   .0107 SQ. MI.


*
**** COMPUTE AND PRINT NM HYD DATA FOR BASIN 02  *********
COMPUTE NM HYD       ID=2 HYD=BASIN02  AREA=0.0028 PER A=0.0 PER B=20.0
                          PER C=65.0 PER D=15.0  TP=.133  RAINFALL=-1

     K =   .072485HR    TP =   .133000HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
     UNIT PEAK =   1.6619    CFS   UNIT VOLUME =    .9924       B =   526.28      P60 = 2.2300
     AREA =      .000420 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333


     K =   .115506HR    TP =   .133000HR    K/TP RATIO =   .868463     SHAPE CONSTANT, N =  4.091263
     UNIT PEAK =   6.4637    CFS   UNIT VOLUME =    .9982       B =   361.21      P60 = 2.2300
     AREA =      .002380 SQ MI    IA =    .38529 INCHES    INF =    .92882 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.10000 AT PEAK FLOW.

PRINT HYD                 ID=2   CODE=1

                                   HYDROGRAPH FROM AREA BASIN02


    RUNOFF VOLUME =     1.79197 INCHES     =        .2676 ACRE-FEET
    PEAK DISCHARGE RATE =       7.49 CFS  AT   1.500 HOURS   BASIN AREA =   .0028 SQ. MI.
```

```
*
**** COMPUTE AND PRINT NM HYD DATA FOR BASIN 03  *********
COMPUTE NM HYD        ID=3 HYD=BASIN03  AREA=0.0010 PER A=0.0 PER B=20.0
                                PER C=65.0 PER D=15.0  TP=.133  RAINFALL=-1

     K =   .072485HR    TP =   .133000HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
     UNIT PEAK =   .59354    CFS   UNIT VOLUME =    .9788       B =   526.28      P60 = 2.2300
     AREA =      .000150 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333


     K =   .115506HR    TP =   .133000HR    K/TP RATIO =   .868463     SHAPE CONSTANT, N =  4.091263
     UNIT PEAK =   2.3085    CFS   UNIT VOLUME =    .9948       B =   361.21      P60 = 2.2300
     AREA =      .000850 SQ MI    IA =    .38529 INCHES    INF =    .92882 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.10000 AT PEAK FLOW.

PRINT HYD                  ID=3   CODE=1

                                   HYDROGRAPH FROM AREA BASIN03


    RUNOFF VOLUME =     1.79201 INCHES     =        .0956 ACRE-FEET
    PEAK DISCHARGE RATE =       2.69 CFS  AT   1.500 HOURS   BASIN AREA =   .0010 SQ. MI.


*
**** COMPUTE AND PRINT NM HYD DATA FOR BASIN 04  *********
COMPUTE NM HYD        ID=4 HYD=BASIN04  AREA=0.0028 PER A=0.0 PER B=20.0
                                PER C=65.0 PER D=15.0  TP=.133  RAINFALL=-1

     K =   .072485HR    TP =   .133000HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
     UNIT PEAK =   1.6619    CFS   UNIT VOLUME =    .9924       B =   526.28      P60 = 2.2300
     AREA =      .000420 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333


     K =   .115506HR    TP =   .133000HR    K/TP RATIO =   .868463     SHAPE CONSTANT, N =  4.091263
     UNIT PEAK =   6.4637    CFS   UNIT VOLUME =    .9982       B =   361.21      P60 = 2.2300
     AREA =      .002380 SQ MI    IA =    .38529 INCHES    INF =    .92882 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.10000 AT PEAK FLOW.

PRINT HYD                  ID=4   CODE=1

                                   HYDROGRAPH FROM AREA BASIN04


    RUNOFF VOLUME =     1.79197 INCHES     =        .2676 ACRE-FEET
    PEAK DISCHARGE RATE =       7.49 CFS  AT   1.500 HOURS   BASIN AREA =   .0028 SQ. MI.


*
**** COMPUTE AND PRINT NM HYD DATA FOR BASIN 05  *********
COMPUTE NM HYD        ID=5 HYD=BASIN05  AREA=0.0242 PER A=0.0 PER B=20.0
                                PER C=65.0 PER D=15.0  TP=.133  RAINFALL=-1
```

```
K =   .072485HR    TP =   .133000HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
UNIT PEAK =   14.364    CFS   UNIT VOLUME =    .9986       B =   526.28      P60 = 2.2300
AREA =      .003630 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

K =   .115506HR    TP =   .133000HR    K/TP RATIO =   .868463     SHAPE CONSTANT, N =  4.091263
UNIT PEAK =   55.865    CFS   UNIT VOLUME =    1.000       B =   361.21      P60 = 2.2300
AREA =      .020570 SQ MI    IA =    .38529 INCHES    INF =    .92882 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.10000 AT PEAK FLOW.

PRINT HYD                  ID=5   CODE=1

                                HYDROGRAPH FROM AREA BASIN05

RUNOFF VOLUME =     1.79194 INCHES     =       2.3128 ACRE-FEET
PEAK DISCHARGE RATE =      64.57 CFS  AT   1.500 HOURS   BASIN AREA =   .0242 SQ. MI.


*
**** COMPUTE AND PRINT NM HYD DATA FOR BASIN 06  *********
COMPUTE NM HYD       ID=6 HYD=BASIN06  AREA=0.0008 PER A=0.0 PER B=20.0
                          PER C=65.0 PER D=15.0  TP=.133  RAINFALL=-1

K =   .072485HR    TP =   .133000HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
UNIT PEAK =   .47484    CFS   UNIT VOLUME =    .9754       B =   526.28      P60 = 2.2300
AREA =      .000120 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

K =   .115506HR    TP =   .133000HR    K/TP RATIO =   .868463     SHAPE CONSTANT, N =  4.091263
UNIT PEAK =   1.8468    CFS   UNIT VOLUME =    .9929       B =   361.21      P60 = 2.2300
AREA =      .000680 SQ MI    IA =    .38529 INCHES    INF =    .92882 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.10000 AT PEAK FLOW.

PRINT HYD                  ID=6   CODE=1

                                HYDROGRAPH FROM AREA BASIN06

RUNOFF VOLUME =     1.79202 INCHES     =        .0765 ACRE-FEET
PEAK DISCHARGE RATE =       2.16 CFS  AT   1.500 HOURS   BASIN AREA =   .0008 SQ. MI.


*
**** COMPUTE AND PRINT NM HYD DATA FOR BASIN 07  *********
COMPUTE NM HYD       ID=7 HYD=BASIN07  AREA=0.0068 PER A=0.0 PER B=20.0
                          PER C=65.0 PER D=15.0  TP=.133  RAINFALL=-1

K =   .072485HR    TP =   .133000HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
UNIT PEAK =   4.0361    CFS   UNIT VOLUME =    .9966       B =   526.28      P60 = 2.2300
AREA =      .001020 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

K =   .115506HR    TP =   .133000HR    K/TP RATIO =   .868463     SHAPE CONSTANT, N =  4.091263
```

```
     UNIT PEAK =   15.698    CFS   UNIT VOLUME =    .9995       B =   361.21      P60 = 2.2300
     AREA =      .005780 SQ MI    IA =    .38529 INCHES    INF =    .92882 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.10000 AT PEAK FLOW.

PRINT HYD                  ID=7   CODE=1

                                   HYDROGRAPH FROM AREA BASIN07


    RUNOFF VOLUME =     1.79195 INCHES     =        .6499 ACRE-FEET
    PEAK DISCHARGE RATE =      18.16 CFS  AT   1.500 HOURS   BASIN AREA =   .0068 SQ. MI.


*
*************************************************
*S****WILDERNESS VILLAGE AT HIGH DESERT (UNIT 2)
*************************************************
SEDIMENT BULK              CODE=1
                                BULK FACTOR=1.02
*
**** COMPUTE AND PRINT NM HYD DATA FOR BASIN 2A  *********
COMPUTE NM HYD       ID=10 HYD=BASIN2A  AREA=0.0090 PER A=0.0 PER B=38
                           PER C=24 PER D=38  TP=.133  RAINFALL=-1

     K =   .072485HR    TP =   .133000HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
     UNIT PEAK =   13.533    CFS   UNIT VOLUME =    .9986       B =   526.28      P60 = 2.2300
     AREA =      .003420 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

     K =   .124855HR    TP =   .133000HR    K/TP RATIO =   .938756     SHAPE CONSTANT, N =  3.766917
     UNIT PEAK =   14.236    CFS   UNIT VOLUME =    .9993       B =   339.32      P60 = 2.2300
     AREA =      .005580 SQ MI    IA =    .44194 INCHES    INF =   1.08742 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.02000 AT PEAK FLOW.

PRINT HYD                  ID=10   CODE=1

                                   HYDROGRAPH FROM AREA BASIN2A


    RUNOFF VOLUME =     1.99703 INCHES     =        .9586 ACRE-FEET
    PEAK DISCHARGE RATE =      23.50 CFS  AT   1.500 HOURS   BASIN AREA =   .0090 SQ. MI.


*
**** COMPUTE AND PRINT NM HYD DATA FOR BASIN 2B  *********
COMPUTE NM HYD       ID=11 HYD=BASIN2B  AREA=0.0075 PER A=0.0 PER B=28
                           PER C=17 PER D=55  TP=.133  RAINFALL=-1

     K =   .072485HR    TP =   .133000HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
     UNIT PEAK =   16.322    CFS   UNIT VOLUME =    .9987       B =   526.28      P60 = 2.2300
     AREA =      .004125 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

     K =   .125085HR    TP =   .133000HR    K/TP RATIO =   .940491     SHAPE CONSTANT, N =  3.759680
     UNIT PEAK =   8.5978    CFS   UNIT VOLUME =    .9987       B =   338.82      P60 = 2.2300
```

```
     AREA =       .003375 SQ MI    IA =     .44333 INCHES    INF =   1.09133 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.02000 AT PEAK FLOW.

PRINT HYD                    ID=11   CODE=1

                                        HYDROGRAPH FROM AREA BASIN2B


    RUNOFF VOLUME =      2.33664 INCHES      =         .9346 ACRE-FEET
    PEAK DISCHARGE RATE =       21.25 CFS  AT   1.500 HOURS   BASIN AREA =    .0075 SQ. MI.


*
**** COMPUTE AND PRINT NM HYD DATA FOR BASIN 2C  *********
COMPUTE NM HYD        ID=12 HYD=BASIN2C  AREA=0.0093 PER A=0.0 PER B=27
                                PER C=17 PER D=56  TP=.133  RAINFALL=-1

     K =    .072485HR    TP =    .133000HR    K/TP RATIO =    .545000     SHAPE CONSTANT, N =  7.106420
     UNIT PEAK =   20.608    CFS   UNIT VOLUME =     .9989       B =   526.28      P60 = 2.2300
     AREA =       .005208 SQ MI    IA =     .10000 INCHES    INF =    .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333


     K =    .124873HR    TP =    .133000HR    K/TP RATIO =    .938892     SHAPE CONSTANT, N =  3.766348
     UNIT PEAK =   10.439    CFS   UNIT VOLUME =     .9990       B =   339.28      P60 = 2.2300
     AREA =       .004092 SQ MI    IA =     .44205 INCHES    INF =   1.08773 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.02000 AT PEAK FLOW.

PRINT HYD                    ID=12   CODE=1

                                        HYDROGRAPH FROM AREA BASIN2C


    RUNOFF VOLUME =      2.35815 INCHES      =        1.1696 ACRE-FEET
    PEAK DISCHARGE RATE =       26.48 CFS  AT   1.500 HOURS   BASIN AREA =    .0093 SQ. MI.


*
**** COMPUTE AND PRINT NM HYD DATA FOR BASIN 2D  *********
COMPUTE NM HYD        ID=13 HYD=BASIN2D  AREA=0.0052 PER A=0.0 PER B=29
                                PER C=18 PER D=53  TP=.133  RAINFALL=-1

     K =    .072485HR    TP =    .133000HR    K/TP RATIO =    .545000     SHAPE CONSTANT, N =  7.106420
     UNIT PEAK =   10.905    CFS   UNIT VOLUME =     .9983       B =   526.28      P60 = 2.2300
     AREA =       .002756 SQ MI    IA =     .10000 INCHES    INF =    .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333


     K =    .124957HR    TP =    .133000HR    K/TP RATIO =    .939523     SHAPE CONSTANT, N =  3.763712
     UNIT PEAK =   6.2312    CFS   UNIT VOLUME =     .9981       B =   339.10      P60 = 2.2300
     AREA =       .002444 SQ MI    IA =     .44255 INCHES    INF =   1.08915 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.02000 AT PEAK FLOW.

PRINT HYD                    ID=13   CODE=1
```

```
                    HYDROGRAPH FROM AREA BASIN2D

    RUNOFF VOLUME =      2.29736 INCHES      =         .6371 ACRE-FEET
    PEAK DISCHARGE RATE =       14.61 CFS  AT   1.500 HOURS   BASIN AREA =   .0052 SQ. MI.


*
**** COMPUTE AND PRINT NM HYD DATA FOR BASIN 2E  *********
COMPUTE NM HYD       ID=14 HYD=BASIN2E  AREA=0.0037 PER A=0.0 PER B=40
                           PER C=20 PER D=40  TP=.133  RAINFALL=-1

     K =   .072485HR    TP =   .133000HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
     UNIT PEAK =   5.8563    CFS   UNIT VOLUME =    .9974       B =   526.28      P60 = 2.2300
     AREA =      .001480 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333


     K =   .126186HR    TP =   .133000HR    K/TP RATIO =   .948764     SHAPE CONSTANT, N =  3.725617
     UNIT PEAK =   5.6158    CFS   UNIT VOLUME =    .9978       B =   336.44      P60 = 2.2300
     AREA =      .002220 SQ MI    IA =    .45000 INCHES    INF =   1.11000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.02000 AT PEAK FLOW.

PRINT HYD                 ID=14   CODE=1

                    HYDROGRAPH FROM AREA BASIN2E

    RUNOFF VOLUME =      2.02501 INCHES      =         .3996 ACRE-FEET
    PEAK DISCHARGE RATE =        9.71 CFS  AT   1.500 HOURS   BASIN AREA =   .0037 SQ. MI.


*
**** COMPUTE AND PRINT NM HYD DATA FOR BASIN 2F  *********
COMPUTE NM HYD       ID=15 HYD=BASIN2F  AREA=0.0023 PER A=0.0 PER B=10
                           PER C=0.0 PER D=90  TP=.133  RAINFALL=-1

     K =   .072485HR    TP =   .133000HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
     UNIT PEAK =   8.1909    CFS   UNIT VOLUME =    .9981       B =   526.28      P60 = 2.2300
     AREA =      .002070 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333


     K =   .134438HR    TP =   .133000HR    K/TP RATIO =  1.010815     SHAPE CONSTANT, N =  3.492236
     UNIT PEAK =   .55297    CFS   UNIT VOLUME =    .9750       B =   319.76      P60 = 2.2300
     AREA =      .000230 SQ MI    IA =    .50000 INCHES    INF =   1.25000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.02000 AT PEAK FLOW.

PRINT HYD                 ID=15   CODE=1

                    HYDROGRAPH FROM AREA BASIN2F


    RUNOFF VOLUME =      3.02695 INCHES      =         .3713 ACRE-FEET
    PEAK DISCHARGE RATE =        7.55 CFS  AT   1.500 HOURS   BASIN AREA =   .0023 SQ. MI.
```

```
*
**** COMPUTE AND PRINT NM HYD DATA FOR BASIN 2G  *********
COMPUTE NM HYD        ID=16 HYD=BASIN2G  AREA=0.0005 PER A=0.0 PER B=25.0
                                PER C=75.0 PER D=0.0  TP=.133  RAINFALL=-1

     K =   .115870HR    TP =   .133000HR    K/TP RATIO =   .871201     SHAPE CONSTANT, N =  4.077394
     UNIT PEAK =   1.3545    CFS   UNIT VOLUME =    .9904       B =   360.30      P60 = 2.2300
     AREA =      .000500 SQ MI    IA =    .38750 INCHES    INF =    .93500 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.02000 AT PEAK FLOW.

PRINT HYD                  ID=16   CODE=1

                                   HYDROGRAPH FROM AREA BASIN2G


    RUNOFF VOLUME =      1.37655 INCHES      =        .0367 ACRE-FEET
    PEAK DISCHARGE RATE =       1.16 CFS  AT   1.500 HOURS   BASIN AREA =   .0005 SQ. MI.


*
**** COMPUTE AND PRINT NM HYD DATA FOR LOT 8  *********
COMPUTE NM HYD        ID=30 HYD=LOT8  AREA=0.0007 PER A=0.0 PER B=32
                                PER C=32 PER D=36  TP=.133  RAINFALL=-1

     K =   .072485HR    TP =   .133000HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
     UNIT PEAK =   .99715    CFS   UNIT VOLUME =    .9883       B =   526.28      P60 = 2.2300
     AREA =      .000252 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

     K =   .122059HR    TP =   .133000HR    K/TP RATIO =   .917739     SHAPE CONSTANT, N =  3.857355
     UNIT PEAK =   1.1639    CFS   UNIT VOLUME =    .9883       B =   345.54      P60 = 2.2300
     AREA =      .000448 SQ MI    IA =    .42500 INCHES    INF =   1.04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.02000 AT PEAK FLOW.

PRINT HYD                  ID=30   CODE=1

                                   HYDROGRAPH FROM AREA LOT8


    RUNOFF VOLUME =      1.98372 INCHES      =        .0741 ACRE-FEET
    PEAK DISCHARGE RATE =       1.85 CFS  AT   1.500 HOURS   BASIN AREA =   .0007 SQ. MI.


*
**** COMPUTE AND PRINT NM HYD DATA FOR LOT 9  *********
COMPUTE NM HYD        ID=31 HYD=LOT9  AREA=0.0011 PER A=0.0 PER B=39
                                PER C=39 PER D=22  TP=.133  RAINFALL=-1

     K =   .072485HR    TP =   .133000HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
     UNIT PEAK =   .95758    CFS   UNIT VOLUME =    .9883       B =   526.28      P60 = 2.2300
     AREA =      .000242 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

     K =   .122059HR    TP =   .133000HR    K/TP RATIO =   .917739     SHAPE CONSTANT, N =  3.857355
```

```
UNIT PEAK =   2.2292    CFS   UNIT VOLUME =     .9946        B =   345.54       P60 = 2.2300
AREA =       .000858 SQ MI    IA =     .42500 INCHES    INF =   1.04000 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333

BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.02000 AT PEAK FLOW.

PRINT HYD                    ID=31   CODE=1

                                   HYDROGRAPH FROM AREA LOT9


RUNOFF VOLUME =      1.70857 INCHES      =          .1002 ACRE-FEET
PEAK DISCHARGE RATE =        2.71 CFS  AT   1.500 HOURS   BASIN AREA =    .0011 SQ. MI.


*
**** COMPUTE AND PRINT NM HYD DATA FOR LOT 50  *********
COMPUTE NM HYD        ID=32 HYD=LOT50  AREA=0.0008 PER A=0.0 PER B=100
                              PER C=0.0 PER D=0.0  TP=.133  RAINFALL=-1

K =    .134438HR    TP =    .133000HR    K/TP RATIO =  1.010815     SHAPE CONSTANT, N =  3.492236
UNIT PEAK =   1.9234    CFS   UNIT VOLUME =     .9930        B =   319.76       P60 = 2.2300
AREA =       .000800 SQ MI    IA =     .50000 INCHES    INF =   1.25000 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333

BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.02000 AT PEAK FLOW.

PRINT HYD                    ID=32   CODE=1

                                   HYDROGRAPH FROM AREA LOT50


RUNOFF VOLUME =      1.09761 INCHES      =          .0468 ACRE-FEET
PEAK DISCHARGE RATE =        1.54 CFS  AT   1.500 HOURS   BASIN AREA =    .0008 SQ. MI.


*
**** COMPUTE AND PRINT NM HYD DATA FOR LOT 51  *********
COMPUTE NM HYD        ID=33 HYD=LOT51  AREA=0.0014 PER A=0.0 PER B=50.0
                              PER C=25.0 PER D=25.0  TP=.133  RAINFALL=-1

K =    .072485HR    TP =    .133000HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
UNIT PEAK =   1.3849    CFS   UNIT VOLUME =     .9912        B =   526.28       P60 = 2.2300
AREA =       .000350 SQ MI    IA =     .10000 INCHES    INF =    .04000 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333

K =    .126186HR    TP =    .133000HR    K/TP RATIO =   .948764     SHAPE CONSTANT, N =  3.725617
UNIT PEAK =   2.6561    CFS   UNIT VOLUME =     .9950        B =   336.44       P60 = 2.2300
AREA =       .001050 SQ MI    IA =     .45000 INCHES    INF =   1.11000 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333

BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.02000 AT PEAK FLOW.

PRINT HYD                    ID=33   CODE=1

                                   HYDROGRAPH FROM AREA LOT51


RUNOFF VOLUME =      1.72096 INCHES      =          .1285 ACRE-FEET
PEAK DISCHARGE RATE =        3.40 CFS  AT   1.500 HOURS   BASIN AREA =    .0014 SQ. MI.
```

```
*
**** COMPUTE AND PRINT NM HYD DATA FOR LOT 52  *********
COMPUTE NM HYD        ID=34 HYD=LOT52  AREA=0.0011 PER A=0.0 PER B=50.0
                              PER C=25.0 PER D=25.0  TP=.133  RAINFALL=-1

     K =    .072485HR    TP =    .133000HR    K/TP RATIO =    .545000     SHAPE CONSTANT, N =  7.106420
     UNIT PEAK =    1.0882    CFS   UNIT VOLUME =     .9883       B =   526.28      P60 = 2.2300
     AREA =       .000275 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

     K =    .126186HR    TP =    .133000HR    K/TP RATIO =    .948764     SHAPE CONSTANT, N =  3.725617
     UNIT PEAK =    2.0869    CFS   UNIT VOLUME =     .9935       B =   336.44      P60 = 2.2300
     AREA =       .000825 SQ MI    IA =    .45000 INCHES    INF =   1.11000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.02000 AT PEAK FLOW.

PRINT HYD                   ID=34   CODE=1

                                   HYDROGRAPH FROM AREA LOT52


    RUNOFF VOLUME =      1.72097 INCHES      =        .1010 ACRE-FEET
    PEAK DISCHARGE RATE =        2.68 CFS  AT   1.500 HOURS   BASIN AREA =   .0011 SQ. MI.


*
***********************************
*S****ADD UNIT 2 BASINS
***********************************
ADD HYD                  ID=40 HYD=BASINAB ID I=10 ID II=11
PRINT HYD                   ID=40   CODE=1

                                   HYDROGRAPH FROM AREA BASINAB


    RUNOFF VOLUME =      2.15140 INCHES      =       1.8932 ACRE-FEET
    PEAK DISCHARGE RATE =       44.74 CFS  AT   1.500 HOURS   BASIN AREA =   .0165 SQ. MI.


*
ADD HYD                  ID=42 HYD=BASINABC ID I=40 ID II=12
PRINT HYD                   ID=42   CODE=1

                                   HYDROGRAPH FROM AREA BASINABC


    RUNOFF VOLUME =      2.22592 INCHES      =       3.0628 ACRE-FEET
    PEAK DISCHARGE RATE =       71.22 CFS  AT   1.500 HOURS   BASIN AREA =   .0258 SQ. MI.


*
ADD HYD                  ID=43 HYD=BASINABCD ID I=42 ID II=13
PRINT HYD                   ID=43   CODE=1

                                   HYDROGRAPH FROM AREA BASINABCD
```

```
    RUNOFF VOLUME =      2.23790 INCHES      =        3.7000 ACRE-FEET
    PEAK DISCHARGE RATE =       85.83 CFS  AT   1.500 HOURS   BASIN AREA =   .0310 SQ. MI.


*
ADD HYD                  ID=44 HYD=BASING01 ID I=16 ID II=1
PRINT HYD                   ID=44   CODE=1

                                   HYDROGRAPH FROM AREA BASING01

    RUNOFF VOLUME =      1.77339 INCHES      =        1.0593 ACRE-FEET
    PEAK DISCHARGE RATE =       29.72 CFS  AT   1.500 HOURS   BASIN AREA =   .0112 SQ. MI.


*
ADD HYD                  ID=46 HYD=BASINE07 ID I=14 ID II=7
PRINT HYD                   ID=46   CODE=1

                                   HYDROGRAPH FROM AREA BASINE07

    RUNOFF VOLUME =      1.87408 INCHES      =        1.0495 ACRE-FEET
    PEAK DISCHARGE RATE =       27.87 CFS  AT   1.500 HOURS   BASIN AREA =   .0105 SQ. MI.


*
**********************************************
*S ROUTE BASINS OS-7 AND 2E THROUGH POND AND SD
**********************************************
ROUTE RESERVOIR          ID=47 HYD=POND INFLOW ID=46  CODE=10
                         OUTFLOW (CFS) STORAGE (AC FT) ELEV (FT)
                                  0.00    0.0000   6202
                                  0.01    0.0010   6203
                                  1.34    0.0071   6204
                                 21.12    0.0355   6205
                                 44.68    0.0759   6206

  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
```

TIME (HRS)	INFLOW (CFS)	ELEV (FEET)	VOLUME (AC-FT)	OUTFLOW (CFS)
.00	.00	6202.00	.000	.00
.33	.00	6202.00	.000	.00
.67	.18	6202.69	.001	.01
1.00	.47	6203.31	.003	.43
1.33	6.63	6204.19	.013	5.12
1.67	14.95	6204.75	.029	16.26
2.00	4.87	6204.19	.013	5.14
2.33	1.29	6204.00	.007	1.35
2.67	.54	6203.46	.004	.63
3.00	.28	6203.23	.002	.31
3.33	.18	6203.14	.002	.19
3.67	.13	6203.09	.002	.13
4.00	.11	6203.08	.001	.11
4.33	.11	6203.07	.001	.11
4.67	.11	6203.07	.001	.11

5.00	.11	6203.07	.001	.11
5.33	.11	6203.07	.001	.11
5.67	.11	6203.07	.001	.11
6.00	.11	6203.07	.001	.11
6.33	.09	6203.06	.001	.10
6.67	.09	6203.06	.001	.09
7.00	.09	6203.06	.001	.09
7.33	.09	6203.06	.001	.09
7.67	.08	6203.06	.001	.09
8.00	.08	6203.06	.001	.08
8.33	.08	6203.05	.001	.08
8.67	.08	6203.05	.001	.08
9.00	.08	6203.05	.001	.08
9.33	.08	6203.05	.001	.08
9.67	.08	6203.05	.001	.08
10.00	.07	6203.05	.001	.07
10.33	.07	6203.05	.001	.07
10.67	.07	6203.05	.001	.07
11.00	.07	6203.05	.001	.07
11.33	.07	6203.04	.001	.07
11.67	.07	6203.04	.001	.07
12.00	.07	6203.04	.001	.07
12.33	.07	6203.04	.001	.07
12.67	.06	6203.04	.001	.07
13.00	.06	6203.04	.001	.06
13.33	.06	6203.04	.001	.06
13.67	.06	6203.04	.001	.06
14.00	.06	6203.04	.001	.06
14.33	.06	6203.04	.001	.06
14.67	.06	6203.04	.001	.06
15.00	.06	6203.04	.001	.06
15.33	.06	6203.04	.001	.06
15.67	.06	6203.04	.001	.06
16.00	.06	6203.03	.001	.06
16.33	.06	6203.03	.001	.06
16.67	.05	6203.03	.001	.05
17.00	.05	6203.03	.001	.05
17.33	.05	6203.03	.001	.05
17.67	.05	6203.03	.001	.05
18.00	.05	6203.03	.001	.05
18.33	.05	6203.03	.001	.05

TIME (HRS)	INFLOW (CFS)	ELEV (FEET)	VOLUME (AC-FT)	OUTFLOW (CFS)
18.67	.05	6203.03	.001	.05
19.00	.05	6203.03	.001	.05
19.33	.05	6203.03	.001	.05
19.67	.05	6203.03	.001	.05

PEAK DISCHARGE = 27.249 CFS - PEAK OCCURS AT HOUR 1.53
MAXIMUM WATER SURFACE ELEVATION = 6205.260
MAXIMUM STORAGE = .0460 AC-FT INCREMENTAL TIME= .033333HRS

*
PRINT HYD ID=47 CODE=1

HYDROGRAPH FROM AREA POND

RUNOFF VOLUME = 1.87197 INCHES = 1.0483 ACRE-FEET
PEAK DISCHARGE RATE = 27.25 CFS AT 1.533 HOURS BASIN AREA = .0105 SQ. MI.

```
COMPUTE RATING CURVE  CID=1 VS NO=1 CODE=-1 SLP=0.06
                      DIAM=2.0 FT   N=0.014
```

RATING CURVE PIPE SECTION 1.0

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS	MAX WIDTH FT
.00	.00	.00	.00
.10	.06	.27	.89
.21	.17	1.17	1.22
.31	.31	2.72	1.45
.42	.47	4.90	1.62
.52	.65	7.65	1.76
.63	.84	10.91	1.85
.73	1.04	14.62	1.93
.83	1.24	18.69	1.97
.94	1.45	23.05	2.00
1.04	1.66	27.58	2.00
1.15	1.86	32.20	2.00
1.25	2.07	36.79	2.00
1.35	2.27	41.24	2.00
1.46	2.46	45.40	2.00
1.56	2.63	49.12	2.00
1.67	2.80	52.22	2.00
1.77	2.94	54.44	2.00
1.88	3.06	55.35	2.00
2.00	3.14	55.35	2.00

```
COMPUTE TRAVEL TIME   ID=48   REACH NO=1 NO VS=1 L=400  FT
                              SLOPE=0.06
```

TRAVEL TIME TABLE

REACH= 1.0

WATER DEPTH FEET	AVERAGE AREA SQ.FT.	FLOW RATE CFS	TRAVEL TIME HRS
.104	.062	.27	.0257
.208	.174	1.17	.0165
.313	.314	2.72	.0128
.417	.475	4.90	.0108
.521	.651	7.65	.0095
.625	.839	10.91	.0085
.730	1.037	14.62	.0079
.834	1.240	18.69	.0074
.938	1.447	23.05	.0070
1.042	1.655	27.58	.0067
1.146	1.863	32.20	.0064
1.251	2.067	36.79	.0062
1.355	2.265	41.24	.0061
1.459	2.456	45.40	.0060
1.563	2.635	49.12	.0060
1.668	2.799	52.22	.0060
1.772	2.943	54.44	.0060
1.876	3.061	55.35	.0061
2.000	3.142	55.35	.0063

```
ROUTE                 ID=48   HYD NO=PIPE  INFLOW ID=47
PRINT HYD             ID=48   CODE=1
```

HYDROGRAPH FROM AREA PIPE

RUNOFF VOLUME = 1.87178 INCHES = 1.0482 ACRE-FEET

PEAK DISCHARGE RATE = 27.33 CFS AT 1.533 HOURS BASIN AREA = .0105 SQ. MI.

```
*
************************************************
*S ROUTE BASINS OS-1 AND 2G THROUGH POND AND SD
************************************************
ROUTE RESERVOIR        ID=49 HYD=POND INFLOW ID=44  CODE=10
                       OUTFLOW (CFS) STORAGE (AC FT) ELEV (FT)
                                0.00   0.0000  6182
                                1.51   0.0056  6183
                               29.76   0.0413  6184
                               85.94   0.0905  6185
```

* * * * * * * * * * * * * * * * *

TIME (HRS)	INFLOW (CFS)	ELEV (FEET)	VOLUME (AC-FT)	OUTFLOW (CFS)
.00	.00	6182.00	.000	.00
.33	.00	6182.00	.000	.00
.67	.12	6182.04	.000	.07
1.00	.31	6182.19	.001	.29
1.33	6.88	6183.14	.011	5.43
1.67	16.05	6183.56	.026	17.29
2.00	4.98	6183.13	.010	5.24
2.33	1.31	6182.95	.005	1.44
2.67	.53	6182.40	.002	.60
3.00	.25	6182.18	.001	.27
3.33	.14	6182.10	.001	.15
3.67	.10	6182.07	.000	.10
4.00	.08	6182.05	.000	.08
4.33	.07	6182.05	.000	.07
4.67	.07	6182.05	.000	.07
5.00	.07	6182.05	.000	.07
5.33	.07	6182.05	.000	.07
5.67	.07	6182.05	.000	.07
6.00	.07	6182.05	.000	.07
6.33	.06	6182.04	.000	.06
6.67	.06	6182.04	.000	.06
7.00	.06	6182.04	.000	.06
7.33	.06	6182.04	.000	.06
7.67	.06	6182.04	.000	.06
8.00	.06	6182.04	.000	.06
8.33	.05	6182.04	.000	.05
8.67	.05	6182.04	.000	.05
9.00	.05	6182.03	.000	.05
9.33	.05	6182.03	.000	.05
9.67	.05	6182.03	.000	.05
10.00	.05	6182.03	.000	.05
10.33	.05	6182.03	.000	.05
10.67	.05	6182.03	.000	.05
11.00	.05	6182.03	.000	.05
11.33	.05	6182.03	.000	.05
11.67	.05	6182.03	.000	.05
12.00	.04	6182.03	.000	.04
12.33	.04	6182.03	.000	.04
12.67	.04	6182.03	.000	.04
13.00	.04	6182.03	.000	.04
13.33	.04	6182.03	.000	.04
13.67	.04	6182.03	.000	.04
14.00	.04	6182.03	.000	.04

14.33	.04	6182.03	.000	.04
14.67	.04	6182.03	.000	.04
15.00	.04	6182.03	.000	.04
15.33	.04	6182.03	.000	.04
15.67	.04	6182.03	.000	.04
16.00	.04	6182.02	.000	.04
16.33	.04	6182.02	.000	.04
16.67	.04	6182.02	.000	.04
17.00	.04	6182.02	.000	.04
17.33	.04	6182.02	.000	.04
17.67	.04	6182.02	.000	.04
18.00	.04	6182.02	.000	.04
18.33	.03	6182.02	.000	.03

TIME (HRS)	INFLOW (CFS)	ELEV (FEET)	VOLUME (AC-FT)	OUTFLOW (CFS)
18.67	.03	6182.02	.000	.03
19.00	.03	6182.02	.000	.03
19.33	.03	6182.02	.000	.03
19.67	.03	6182.02	.000	.03

PEAK DISCHARGE = 29.215 CFS - PEAK OCCURS AT HOUR 1.53
MAXIMUM WATER SURFACE ELEVATION = 6183.981
MAXIMUM STORAGE = .0406 AC-FT INCREMENTAL TIME= .033333HRS

*
PRINT HYD ID=49 CODE=1

HYDROGRAPH FROM AREA POND

RUNOFF VOLUME = 1.77319 INCHES = 1.0592 ACRE-FEET
PEAK DISCHARGE RATE = 29.22 CFS AT 1.533 HOURS BASIN AREA = .0112 SQ. MI.

COMPUTE RATING CURVE CID=1 VS NO=1 CODE=-1 SLP=0.08
DIAM=2.0 FT N=0.014

RATING CURVE PIPE SECTION 1.0

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS	MAX WIDTH FT
.00	.00	.00	.00
.10	.06	.31	.89
.21	.17	1.35	1.22
.31	.31	3.15	1.45
.42	.47	5.66	1.62
.52	.65	8.83	1.76
.63	.84	12.60	1.85
.73	1.04	16.88	1.93
.83	1.24	21.59	1.97
.94	1.45	26.61	2.00
1.04	1.66	31.85	2.00
1.15	1.86	37.18	2.00
1.25	2.07	42.48	2.00
1.35	2.27	47.61	2.00
1.46	2.46	52.42	2.00
1.56	2.63	56.72	2.00
1.67	2.80	60.30	2.00
1.77	2.94	62.86	2.00
1.88	3.06	63.91	2.00
2.00	3.14	63.91	2.00

```
COMPUTE TRAVEL TIME    ID=41    REACH NO=1 NO VS=1 L=627   FT
                                SLOPE=0.08

                                TRAVEL TIME TABLE
                                                  REACH=  1.0

                                WATER        AVERAGE      FLOW         TRAVEL
                                DEPTH        AREA         RATE         TIME
                                FEET         SQ.FT.       CFS          HRS
                                   .104          .062          .31        .0349
                                   .208          .174         1.35        .0224
                                   .313          .314         3.15        .0174
                                   .417          .475         5.66        .0146
                                   .521          .651         8.83        .0128
                                   .625          .839        12.60        .0116
                                   .730         1.037        16.88        .0107
                                   .834         1.240        21.59        .0100
                                   .938         1.447        26.61        .0095
                                  1.042         1.655        31.85        .0091
                                  1.146         1.863        37.18        .0087
                                  1.251         2.067        42.48        .0085
                                  1.355         2.265        47.61        .0083
                                  1.459         2.456        52.42        .0082
                                  1.563         2.635        56.72        .0081
                                  1.668         2.799        60.30        .0081
                                  1.772         2.943        62.86        .0082
                                  1.876         3.061        63.91        .0083
                                  2.000         3.142        63.91        .0086
ROUTE                  ID=41  HYD NO=PIPE  INFLOW ID=49
PRINT HYD              ID=41  CODE=1

                                HYDROGRAPH FROM AREA PIPE

    RUNOFF VOLUME =      1.77303 INCHES      =        1.0591 ACRE-FEET
    PEAK DISCHARGE RATE =       29.43 CFS  AT   1.533 HOURS   BASIN AREA =   .0112 SQ. MI.


*
**************************************************
*S****WILDERNESS COMPOUND AT HIGH DESERT (UNIT 3)
**************************************************
**** COMPUTE AND PRINT NM HYD DATA FOR BASIN 3A  *********
COMPUTE NM HYD       ID=50 HYD=BASIN3A  AREA=0.00048 PER A=0.0 PER B=50
                                PER C=50 PER D=0.0  TP=.133  RAINFALL=-1

     K =   .122059HR    TP =   .133000HR    K/TP RATIO =   .917739     SHAPE CONSTANT, N =  3.857355
     UNIT PEAK =   1.2471    CFS   UNIT VOLUME =    .9894       B =   345.54      P60 = 2.2300
     AREA =      .000480 SQ MI    IA =    .42500 INCHES    INF =   1.04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.02000 AT PEAK FLOW.

PRINT HYD                  ID=50   CODE=1

                                HYDROGRAPH FROM AREA BASIN3A


    RUNOFF VOLUME =      1.27618 INCHES      =         .0327 ACRE-FEET
    PEAK DISCHARGE RATE =        1.05 CFS  AT   1.500 HOURS   BASIN AREA =   .0005 SQ. MI.
```

```
*
**** COMPUTE AND PRINT NM HYD DATA FOR BASIN 3B  *********
COMPUTE NM HYD        ID=51 HYD=BASIN3B  AREA=0.00305 PER A=0.0 PER B=30
                              PER C=20 PER D=50  TP=.133  RAINFALL=-1

     K =   .072485HR    TP =   .133000HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
     UNIT PEAK =   6.0344    CFS   UNIT VOLUME =    .9977       B =   526.28      P60 = 2.2300
     AREA =      .001525 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

     K =   .124535HR    TP =   .133000HR    K/TP RATIO =   .936354     SHAPE CONSTANT, N =  3.776996
     UNIT PEAK =   3.8987    CFS   UNIT VOLUME =    .9969       B =   340.02      P60 = 2.2300
     AREA =      .001525 SQ MI    IA =    .44000 INCHES    INF =   1.08200 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.02000 AT PEAK FLOW.

PRINT HYD                  ID=51   CODE=1

                                  HYDROGRAPH FROM AREA BASIN3B

    RUNOFF VOLUME =     2.24022 INCHES     =        .3644 ACRE-FEET
    PEAK DISCHARGE RATE =       8.47 CFS  AT   1.500 HOURS   BASIN AREA =   .0031 SQ. MI.


*
**** COMPUTE AND PRINT NM HYD DATA FOR BASIN 3C  *********
COMPUTE NM HYD        ID=52 HYD=BASIN3C  AREA=0.00086 PER A=0.0 PER B=30
                              PER C=20 PER D=50  TP=.133  RAINFALL=-1

     K =   .072485HR    TP =   .133000HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
     UNIT PEAK =   1.7015    CFS   UNIT VOLUME =    .9924       B =   526.28      P60 = 2.2300
     AREA =      .000430 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

     K =   .124535HR    TP =   .133000HR    K/TP RATIO =   .936354     SHAPE CONSTANT, N =  3.776996
     UNIT PEAK =   1.0993    CFS   UNIT VOLUME =    .9885       B =   340.02      P60 = 2.2300
     AREA =      .000430 SQ MI    IA =    .44000 INCHES    INF =   1.08200 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.02000 AT PEAK FLOW.

PRINT HYD                  ID=52   CODE=1

                                  HYDROGRAPH FROM AREA BASIN3C

    RUNOFF VOLUME =     2.24029 INCHES     =        .1028 ACRE-FEET
    PEAK DISCHARGE RATE =       2.40 CFS  AT   1.500 HOURS   BASIN AREA =   .0009 SQ. MI.


*
**** COMPUTE AND PRINT NM HYD DATA FOR BASIN 3D  *********
COMPUTE NM HYD        ID=53 HYD=BASIN3D  AREA=0.00248 PER A=0.0 PER B=30
                              PER C=20 PER D=50  TP=.133  RAINFALL=-1

     K =   .072485HR    TP =   .133000HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
```

```
UNIT PEAK =   4.9066    CFS   UNIT VOLUME =    .9970       B =   526.28      P60 = 2.2300
AREA =      .001240 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

K =   .124535HR    TP =   .133000HR    K/TP RATIO =   .936354     SHAPE CONSTANT, N =  3.776996
UNIT PEAK =   3.1701    CFS   UNIT VOLUME =    .9959       B =   340.02      P60 = 2.2300
AREA =      .001240 SQ MI    IA =    .44000 INCHES    INF =   1.08200 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.02000 AT PEAK FLOW.

PRINT HYD                    ID=53   CODE=1

                                   HYDROGRAPH FROM AREA BASIN3D

RUNOFF VOLUME =     2.24024 INCHES     =        .2963 ACRE-FEET
PEAK DISCHARGE RATE =       6.89 CFS  AT   1.500 HOURS   BASIN AREA =   .0025 SQ. MI.


*
**** COMPUTE AND PRINT NM HYD DATA FOR BASIN 3E  *********
COMPUTE NM HYD       ID=54 HYD=BASIN3E  AREA=0.00265 PER A=0.0 PER B=30
                          PER C=20 PER D=50  TP=.133  RAINFALL=-1

K =   .072485HR    TP =   .133000HR    K/TP RATIO =   .545000     SHAPE CONSTANT, N =  7.106420
UNIT PEAK =   5.2430    CFS   UNIT VOLUME =    .9974       B =   526.28      P60 = 2.2300
AREA =      .001325 SQ MI    IA =    .10000 INCHES    INF =    .04000 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

K =   .124535HR    TP =   .133000HR    K/TP RATIO =   .936354     SHAPE CONSTANT, N =  3.776996
UNIT PEAK =   3.3874    CFS   UNIT VOLUME =    .9962       B =   340.02      P60 = 2.2300
AREA =      .001325 SQ MI    IA =    .44000 INCHES    INF =   1.08200 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =   .033333

BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.02000 AT PEAK FLOW.

PRINT HYD                    ID=54   CODE=1

                                   HYDROGRAPH FROM AREA BASIN3E

RUNOFF VOLUME =     2.24023 INCHES     =        .3166 ACRE-FEET
PEAK DISCHARGE RATE =       7.36 CFS  AT   1.500 HOURS   BASIN AREA =   .0027 SQ. MI.


*
************************************
*S****ADD UNIT 3 AND OFFSITE BASINS
************************************
ADD HYD                  ID=60 HYD=BASINOS4&5 ID I=4 ID II=5
PRINT HYD                   ID=60   CODE=1

                                   HYDROGRAPH FROM AREA BASINOS4&5

RUNOFF VOLUME =     1.79195 INCHES     =       2.5804 ACRE-FEET
PEAK DISCHARGE RATE =      72.06 CFS  AT   1.500 HOURS   BASIN AREA =   .0270 SQ. MI.
```

```
*
ADD HYD                    ID=61 HYD=BASIN3AOS45 ID I=50 ID II=60
PRINT HYD                     ID=61   CODE=1
```

HYDROGRAPH FROM AREA BASIN3AOS45

```
    RUNOFF VOLUME =      1.78293 INCHES     =       2.6130 ACRE-FEET
    PEAK DISCHARGE RATE =       73.11 CFS  AT   1.500 HOURS   BASIN AREA =   .0275 SQ. MI.


*
************************************************
*S ROUTE BASINS 3A, OS-4 AND OS-5 THROUGH POND
************************************************
ROUTE RESERVOIR        ID=62 HYD=POND INFLOW ID=61  CODE=10
                       OUTFLOW (CFS) STORAGE (AC FT) ELEV (FT)
                                      0.00   0.00000 6177
                                      0.01   0.00100 6178
                                      3.84   0.02865 6179
                                     34.38   0.10516 6180
                                     90.38   0.19603 6181
                                    125.93   0.30227 6182

  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *  *
```

TIME (HRS)	INFLOW (CFS)	ELEV (FEET)	VOLUME (AC-FT)	OUTFLOW (CFS)
.00	.00	6177.00	.000	.00
.33	.00	6177.00	.000	.00
.67	.30	6178.00	.001	.03
1.00	.79	6178.17	.006	.68
1.33	16.94	6179.18	.043	9.39
1.67	39.47	6180.16	.120	43.48
2.00	12.26	6179.32	.053	13.61
2.33	3.21	6178.97	.028	3.71
2.67	1.32	6178.44	.013	1.70
3.00	.62	6178.20	.006	.76
3.33	.35	6178.10	.004	.41
3.67	.25	6178.07	.003	.27
4.00	.20	6178.05	.002	.22
4.33	.18	6178.05	.002	.19
4.67	.18	6178.04	.002	.18
5.00	.18	6178.04	.002	.18
5.33	.18	6178.04	.002	.18
5.67	.18	6178.04	.002	.18
6.00	.18	6178.05	.002	.18
6.33	.16	6178.04	.002	.16
6.67	.15	6178.04	.002	.16
7.00	.15	6178.04	.002	.15
7.33	.15	6178.04	.002	.15
7.67	.14	6178.04	.002	.14
8.00	.14	6178.03	.002	.14
8.33	.14	6178.03	.002	.14
8.67	.14	6178.03	.002	.14
9.00	.13	6178.03	.002	.13
9.33	.13	6178.03	.002	.13
9.67	.13	6178.03	.002	.13
10.00	.13	6178.03	.002	.13

```
10.33        .12   6178.03        .002        .12
10.67        .12   6178.03        .002        .12
11.00        .12   6178.03        .002        .12
11.33        .12   6178.03        .002        .12
11.67        .12   6178.03        .002        .12
12.00        .11   6178.03        .002        .11
12.33        .11   6178.03        .002        .11
12.67        .11   6178.03        .002        .11
13.00        .11   6178.03        .002        .11
13.33        .11   6178.03        .002        .11
13.67        .10   6178.02        .002        .11
14.00        .10   6178.02        .002        .10
14.33        .10   6178.02        .002        .10
14.67        .10   6178.02        .002        .10
15.00        .10   6178.02        .002        .10
15.33        .10   6178.02        .002        .10
15.67        .10   6178.02        .002        .10
16.00        .10   6178.02        .002        .10
16.33        .09   6178.02        .002        .09
16.67        .09   6178.02        .002        .09
17.00        .09   6178.02        .002        .09
17.33        .09   6178.02        .002        .09
17.67        .09   6178.02        .002        .09
18.00        .09   6178.02        .002        .09
18.33        .09   6178.02        .002        .09

TIME       INFLOW     ELEV       VOLUME     OUTFLOW
(HRS)      (CFS)      (FEET)     (AC-FT)    (CFS)

18.67        .09   6178.02        .002        .09
19.00        .09   6178.02        .002        .09
19.33        .08   6178.02        .002        .08
19.67        .08   6178.02        .002        .08
PEAK DISCHARGE =        71.632 CFS - PEAK OCCURS AT HOUR    1.53
MAXIMUM WATER SURFACE ELEVATION =     6180.665
MAXIMUM STORAGE =          .1656 AC-FT      INCREMENTAL TIME=     .033333HRS

*
PRINT HYD                 ID=62      CODE=1

                                HYDROGRAPH FROM AREA POND

    RUNOFF VOLUME =     1.78189 INCHES     =       2.6115 ACRE-FEET
    PEAK DISCHARGE RATE =      71.63 CFS  AT   1.533 HOURS   BASIN AREA =   .0275 SQ. MI.


*
ADD HYD                  ID=63 HYD=BASIN3C3 ID I=52 ID II=3
PRINT HYD                   ID=63   CODE=1

                                HYDROGRAPH FROM AREA BASIN3C3

    RUNOFF VOLUME =     1.99928 INCHES     =        .1983 ACRE-FEET
    PEAK DISCHARGE RATE =       5.09 CFS  AT   1.500 HOURS   BASIN AREA =   .0019 SQ. MI.


*
ADD HYD                  ID=64 HYD=BASIN3D2 ID I=53 ID II=2
PRINT HYD                   ID=64   CODE=1
```

```
                                        HYDROGRAPH FROM AREA BASIN3D2

    RUNOFF VOLUME =      2.00252 INCHES      =         .5639 ACRE-FEET
    PEAK DISCHARGE RATE =       14.38 CFS  AT   1.500 HOURS   BASIN AREA =   .0053 SQ. MI.


*
ADD HYD                  ID=65 HYD=BASIN3C245 ID I=63 ID II=62
PRINT HYD                   ID=65   CODE=1
                                        HYDROGRAPH FROM AREA BASIN3C245

    RUNOFF VOLUME =      1.79567 INCHES      =        2.8099 ACRE-FEET
    PEAK DISCHARGE RATE =       76.53 CFS  AT   1.533 HOURS   BASIN AREA =   .0293 SQ. MI.


*
ADD HYD                  ID=66 HYD=3BD2 ID I=64 ID II=51
PRINT HYD                   ID=66   CODE=1
                                        HYDROGRAPH FROM AREA 3BD2

    RUNOFF VOLUME =      2.08956 INCHES      =         .9283 ACRE-FEET
    PEAK DISCHARGE RATE =       22.85 CFS  AT   1.500 HOURS   BASIN AREA =   .0083 SQ. MI.

*
ADD HYD                  ID=68 HYD=3ABCD2345 ID I=66 ID II=65
PRINT HYD                   ID=68   CODE=1
                                        HYDROGRAPH FROM AREA 3ABCD2345

    RUNOFF VOLUME =      1.86066 INCHES      =        3.7382 ACRE-FEET
    PEAK DISCHARGE RATE =       98.46 CFS  AT   1.533 HOURS   BASIN AREA =   .0377 SQ. MI.


*
************************************
*S****ADD UNIT 3 AND UPSTREAM PONDS
************************************
ADD HYD                  ID=70 HYD=SD1 ID I=48 ID II=41
PRINT HYD                   ID=70   CODE=1
                                        HYDROGRAPH FROM AREA SD1

    RUNOFF VOLUME =      1.82081 INCHES      =        2.1073 ACRE-FEET
    PEAK DISCHARGE RATE =       56.76 CFS  AT   1.533 HOURS   BASIN AREA =   .0217 SQ. MI.


*
ADD HYD                  ID=72 HYD=W1 ID I=68 ID II=70
PRINT HYD                   ID=72   CODE=1
```

HYDROGRAPH FROM AREA W1

RUNOFF VOLUME = 1.84609 INCHES = 5.8454 ACRE-FEET
PEAK DISCHARGE RATE = 155.22 CFS AT 1.533 HOURS BASIN AREA = .0594 SQ. MI.

*
COMPUTE TRAVEL TIME ID=74 REACH NO=1 NO VS=1 L=233 FT
SLOPE=0.04

TRAVEL TIME TABLE
REACH= 1.0

WATER DEPTH FEET	AVERAGE AREA SQ.FT.	FLOW RATE CFS	TRAVEL TIME HRS
.104	.062	.31	.0130
.208	.174	1.35	.0083
.313	.314	3.15	.0065
.417	.475	5.66	.0054
.521	.651	8.83	.0048
.625	.839	12.60	.0043
.730	1.037	16.88	.0040
.834	1.240	21.59	.0037
.938	1.447	26.61	.0035
1.042	1.655	31.85	.0034
1.146	1.863	37.18	.0032
1.251	2.067	42.48	.0031
1.355	2.265	47.61	.0031
1.459	2.456	52.42	.0030
1.563	2.635	56.72	.0030
1.668	2.799	60.30	.0030
1.772	2.943	62.86	.0030
1.876	3.061	63.91	.0031
2.000	3.142	63.91	.0032

ROUTE ID=74 HYD NO=SUM INFLOW ID=72
TRAVEL TIME TABLE EXCEEDED
PRINT HYD ID=74 CODE=1

HYDROGRAPH FROM AREA SUM

RUNOFF VOLUME = 1.84601 INCHES = 5.8452 ACRE-FEET
PEAK DISCHARGE RATE = 155.47 CFS AT 1.533 HOURS BASIN AREA = .0594 SQ. MI.

*
ADD HYD ID=75 HYD=BASIN2F3E ID I=15 ID II=54
PRINT HYD ID=75 CODE=1

HYDROGRAPH FROM AREA BASIN2F3E

RUNOFF VOLUME = 2.60578 INCHES = .6879 ACRE-FEET
PEAK DISCHARGE RATE = 14.91 CFS AT 1.500 HOURS BASIN AREA = .0049 SQ. MI.

*

```
ADD HYD                    ID=76 HYD=OUT ID I=74 ID II=75
PRINT HYD                     ID=76   CODE=1

                                   HYDROGRAPH FROM AREA OUT

    RUNOFF VOLUME =      1.90449 INCHES      =        6.5331 ACRE-FEET
    PEAK DISCHARGE RATE =      169.70 CFS  AT   1.533 HOURS   BASIN AREA =   .0643 SQ. MI.


*
DIVIDE HYD                 ID=76  Q=44.0  ID I=77 HYD=UPSTRM  ID II=78 HYD=DNSTRM
PRINT HYD                     ID=77   CODE=1

                                   HYDROGRAPH FROM AREA UPSTRM

    RUNOFF VOLUME =      1.90449 INCHES      =        3.9825 ACRE-FEET
    PEAK DISCHARGE RATE =       44.00 CFS  AT   1.367 HOURS   BASIN AREA =   .0392 SQ. MI.


*
*S TOTAL FLOW IN THE SBCA2 UPSTREAM OF CULVERTS AT HIGH DESERT STREET
ADD HYD                    ID=79 HYD=CULVIN  ID I=99  ID II=77
PRINT HYD                     ID=79   CODE=1

                                   HYDROGRAPH FROM AREA CULVIN

    RUNOFF VOLUME =      1.65391 INCHES      =        5.2226 ACRE-FEET
    PEAK DISCHARGE RATE =       84.14 CFS  AT   1.500 HOURS   BASIN AREA =   .0592 SQ. MI.


*
ADD HYD                    ID=80 HYD=CULVDOWN  ID I=78  ID II=79
PRINT HYD                     ID=80   CODE=1

                                   HYDROGRAPH FROM AREA CULVDOWN

    RUNOFF VOLUME =      1.72854 INCHES      =        7.7733 ACRE-FEET
    PEAK DISCHARGE RATE =      209.01 CFS  AT   1.533 HOURS   BASIN AREA =   .0843 SQ. MI.


*
* ROUTE 3
*S      ROUTE FLOW FROM HIGH DESERT STREET TO CONFLUENCE WITH SBCA1
*
*
COMPUTE RATING CURVE       CID=1
                                   VS NO=1
                                   NSEGS=1
                           MIN ELEV=0
                                   MAX ELEV=10.
                           CH SLOPE=.06
                                   FP SLOPE=.06
                           N =.035
                                   DIST=210
                              DIST  ELEV  DIST   ELEV  DIST  ELEV  DIST  ELEV
```

0. 10.0 50. 0.0 175. 2.0 210. 10.0

RATING CURVE VALLEY SECTION 1.0

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS	TOP WIDTH FT
.00	.00	.00	.00
.53	9.35	39.89	35.53
1.05	37.40	253.25	71.05
1.58	84.14	746.68	106.58
2.11	149.26	1649.85	135.99
2.63	222.13	3123.81	140.92
3.16	297.60	4968.49	145.86
3.68	375.66	7161.77	150.79
4.21	456.33	9689.87	155.72
4.74	539.58	12543.88	160.66
5.26	625.44	15718.06	165.59
5.79	713.89	19208.80	170.53
6.32	804.94	23014.05	175.46
6.84	898.59	27132.93	180.39
7.37	994.83	31565.41	185.33
7.89	1093.67	36312.17	190.26
8.42	1195.11	41374.43	195.20
8.95	1299.14	46753.84	200.13
9.47	1405.77	52452.39	205.07
10.00	1515.00	58472.39	210.00

*
COMPUTE TRAVEL TIME ID=81
REACH=1
NO VS=1
L=450
SLP=.06

TRAVEL TIME TABLE
REACH= 1.0

WATER DEPTH FEET	AVERAGE AREA SQ.FT.	FLOW RATE CFS	TRAVEL TIME HRS
.526	9.349	39.89	.0293
1.053	37.396	253.25	.0185
1.579	84.141	746.68	.0141
2.105	149.262	1649.85	.0113
2.632	222.133	3123.81	.0089
3.158	297.600	4968.49	.0075
3.684	375.665	7161.77	.0066
4.211	456.326	9689.87	.0059
4.737	539.584	12543.88	.0054
5.263	625.440	15718.06	.0050
5.789	713.892	19208.80	.0046
6.316	804.941	23014.05	.0044
6.842	898.587	27132.93	.0041
7.368	994.830	31565.41	.0039
7.895	1093.670	36312.17	.0038
8.421	1195.107	41374.43	.0036
8.947	1299.141	46753.84	.0035
9.474	1405.772	52452.39	.0034
10.000	1515.000	58472.39	.0032

*
ROUTE ID=81
HYD=SBCA2TOTR
INFLOW ID=80
DT=0.0333333333

```
    Hydrograph incermental time change from DT=   .033333 hours to DT=   .033333 hours
*
PRINT HYD                  ID=81
                     CODE=10
```

HYDROGRAPH FROM AREA SBCA2TOTR

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	4.000	.8	8.000	.5	12.000	.4	16.000	.4
.333	.0	4.333	.7	8.333	.5	12.333	.4	16.333	.3
.667	.3	4.667	.7	8.667	.5	12.667	.4	16.667	.3
1.000	2.6	5.000	.7	9.000	.5	13.000	.4	17.000	.3
1.333	19.3	5.333	.7	9.333	.5	13.333	.4	17.333	.3
1.667	135.2	5.667	.7	9.667	.5	13.667	.4	17.667	.3
2.000	40.8	6.000	.7	10.000	.5	14.000	.4	18.000	.3
2.333	11.5	6.333	.6	10.333	.5	14.333	.4	18.333	.3
2.667	5.1	6.667	.6	10.667	.4	14.667	.4	18.667	.3
3.000	2.5	7.000	.6	11.000	.4	15.000	.4	19.000	.3
3.333	1.4	7.333	.5	11.333	.4	15.333	.4	19.333	.3
3.667	1.0	7.667	.5	11.667	.4	15.667	.4	19.667	.3

```
    RUNOFF VOLUME =      1.72838 INCHES      =       7.7726 ACRE-FEET
    PEAK DISCHARGE RATE =      211.53 CFS  AT   1.533 HOURS   BASIN AREA =   .0843 SQ. MI.


*
ADD HYD                    ID=82 HYD=SBCA1&2  ID I=98  ID II=81
PRINT HYD                     ID=82   CODE=1
```

HYDROGRAPH FROM AREA SBCA1&2

```
    RUNOFF VOLUME =      1.29731 INCHES      =      24.5152 ACRE-FEET
    PEAK DISCHARGE RATE =      680.45 CFS  AT   1.567 HOURS   BASIN AREA =   .3543 SQ. MI.


*

*
FINISH

    NORMAL PROGRAM FINISH          END TIME (HR:MIN:SEC) = 16:13:54
```

Bohannan Huston INC.

Courtyard I
7500 Jefferson St. NE
Albuquerque, NM
87109-4335

www.bhinc.com

voice: 505.823.1000
facsimile: 505.798.7988
toll free: 800.877.5332

June 24, 2003

Saleem Ashraf, P.E.
PBS&J
12101 Indian Creek Court
Beltsville, MD 20705

Re: Case No. 03-06-833R High Desert Tract 13 CLOMR – Response to May 28, 2003 Comments

Dear Mr. Ashraf:

We received a letter from Mr. Joseph A. Martinenza, Jr. dated May 28, 2003 regarding the above referenced project. In response to the comments in that letter we offer the following:

1. We ran the hydrologic model for the 1% annual chance 24-hour duration storm for the Bear Canyon Arroyo and the flow rate did not increase. The hydrologic model input and output for the 6-hour and 24-hour duration storm events are enclosed in both hardcopy and digital formats. Backup information, land treatment and time of peak values, for the hydrologic model for Bear Canyon Arroyo are also included.
2. The South Bear Canyon Arroyos 1 and 2 were analyzed using the Rational Method for the 100 year 24 hour storm event. An AHYMO model was not prepared for these two smaller tributary arroyos. However, had one been prepared, the resultant flow rates in the arroyos and at the culvert crossings would have been smaller since the AHYMO model would have included the effects of attenuation in the flow routing and the reduction in cumulative peak flow due to differences in the time of peak for each sub basin hydrograph as they are routed and added together. A copy of Part C from Chapter 22 of the City of Albuquerque Development Process Manual is included.
3. Copies of relevant portions including the sediment transport sections of the High Desert Drainage Management Master Plan (HDDMMP) are included. The first reference found within the Additional Explanations for Form 3 stating the hydrology used for this CLOMR was obtained from the HDDMMP is in error. A new hydrologic model was prepared as part of this CLOMR (see Item 1).
4. HEC-RAS models for pre-project conditions for the BCA, SBCA 1, and SBCA 2 are included in hardcopy and on CD. (Note: files from CD must be saved onto hard drive in order to run HEC-RAS properly).
5. HEC-RAS models for proposed conditions for SBCA 1 and SBCA 2 are included in hard copy and on CD.
6. HEC-RAS model for proposed conditions model for BCA with the bridge shown is included in hardcopy and on CD.
7. The above comments do not alter in any way the topographic work map and annotated Flood Insurance Rate Map (FIRM) that were submitted with the CLOMR. We have though modified the annotated FIRM to show the proposed bridge and culverts.

If you have any additional questions, or require additional information, please contact me at (505) 823-1000.

Sincerely,

Craig W. Hoover, P.E.
Senior Vice President and Group Manager
Water Resources Group

CWH/cc
Attachments

cc: Carlos Montoya Floodplain Administrator, COA (with attachments)
Doug Collister, HDIC (with attachments)
Jack Eichorn, HDIC (with attachments)

AHYMO PROGRAM SUMMARY TABLE (AHYMO_97) - - VERSION: 1997.02c RUN DATE (MON/DAY/YR) =12/11/2001
INPUT FILE = a.hym USER NO.= AHYMO-S-9702c1BohanHu-AH

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUN VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	NOTATION
START										TIME= .00
LOCATION		DEFAULT								
SEDIMENT BULK										PK BF = 1.10
RAINFALL TYPE= 1										RAIN6= 2.900
COMPUTE NM HYD	1.00	-	1	4.97400	4440.01	399.960	1.50769	2.033	1.395	PER IMP= .00
ROUTE	1.10	1	2	4.97400	4261.04	399.964	1.50771	2.133	1.339	
COMPUTE NM HYD	3.00	-	3	.99860	1468.61	61.562	1.15591	1.633	2.298	PER IMP= 1.00
ADD HYD	4.00	2& 3	4	5.97260	4510.02	461.527	1.44889	2.100	1.180	
FINISH										

```
                    HIGH DESERT HYDROLOGY MODEL
                          INPUT=BCA.HYM
                      EXISTING CONDTIONS MODEL
                          100-YEAR STORM

*********************************************************************
*********************************************************************
 REVISED LAND FACTORS FOR BASINS PA-1 THRU PA-4 TO CORRECT ERROR IN
 INITIAL ABSTRACTION VALUE FOR TREATMENT C.
 REVISED INITIAL ABSTRACTIONS BASED ON TREATMENT C: IA=0.86 FOR FOREST AND
 IA=0.35 FOR ALL OTHER AREAS.  COMPOSITE IA VALUES BASED ON WEIGHTED
 AVERAGES BASED ON AREAS OF FOREST AND AREAS OF OTHER
 REVISED 1/19/94 CWH
*********************************************************************
*********************************************************************

  BEAR CANYON ARROYO BASIN TAKEN FROM ECI STUDY

  BEAR ARROYO, BEAR TRIBUTARY, SOUTH PINO TRIBUTARY AND PINO ARROYO BASINS
  UPSTREAM OF HIGH DESERT DEVELOPMENT TAKEN FROM HYMO MODELS FOR THE
  CONCEPTUAL DRAINAGE MANAGEMENT PLAN.  BASINS WITHIN HIGH DESERT MODIFIED
  TO FIT DEVELOPMENT PLANS AS PER THE FINAL SECTOR PLAN (MAY 3, 1993)
  AND FINAL ROAD CONFIGURATION (JULY 1993).

  JOHN ROBERTS DAM - CONTRIBUTING WATERSHEDS
    1. EMBUDITO ARROYO
    2. BEAR CANYON
    3. SOUTH BEAR ARROYO
    4. MIDDLE BEAR ARROYO
    5. NORTH BEAR ARROYO

*********************************************************************

   THE PURPOSE OF THIS HYMO RUN IS TO EVALUATE THE TRAMWAY
   HYDROLOGY BASED ON THE LATEST VERSION OF THE DPM SECTION
   22.2, DATED JANUARY 1993.

*********************************************************************


************************************
* BEAR CANYON ARROYO *
************************************

       TAKEN FROM
       FILE: BC_P.IN/OUT
       BHI JN'S 8911803, 9123302                    DATE: JAN 6, 1992


* HYMO ANALYSIS USING NM HYMO, PER CITY DPM APPROVED AUGUST, 1991
* INPUT BASED ON MODIFIED STUDY FOR JOHN ROBERTS DAM, DATED DEC. 1991.
* MODIFICATIONS INCLUDE:      1) INCREASE RAINFALL TO 3.00"/6HR.
*                             2) ADJUST AREAS USING NEW 1"=200' SCALE MAPS.
*                             3) MODEL OF EXISITNG CONDITIONS AS OF 1/92
*                                AND IMPROVEMENTS TO TRAMWAY BLVD.
*                               4) ESTIMATED 40% IMPERVIOUS AREA DEDUCTED
*                                  IN ACCORDANCE WITH THE EXISTING CONDITIONS.
*                             5) BEAR ARROYO BASINS DO NOT CONTRIBUTE TO
*                                BEAR CANYON BASINS.
*////////////////////////////////////////////////////////////////////////
*
*               UPSTREAM OF TRAMWAY BLVD. ON BEAR CANYON ARROYO
*
*
*////////////////////////////////////////////////////////////////////////
*
*
*
```

```
TART
                        TIME=0
                        PUNCH CODE=0
                        PRINT LINES=6

OCATION                 NAME=ALBUQUERQUE

EDIMENT BULK            CODE=1
                        BULK FACTOR=1.1

AINFALL                 TYPE=1
                        RAIN QUARTER=0.0
                        RAIN ONE=2.23
                        RAIN SIX=2.90
                        RAIN DAY=3.65
                        DT=0.033333

*
*       BASIN 1(BCA-1)

*
:OMPUTE NM HYD          ID=1
                        HYD NO=1
                        AREA=4.9740 SQ MI
                        PER A=0.0
                        PER B=20.0
                        PER C=80.0
                        PER D=0.0
                        TP=-0.6180 HR
                        MASS RAIN=-1
*
PRINT HYD               ID=1
                        CODE=10
*
*
* ROUTE 1
*       UNLINED NARROW EARTH CHANNEL -- VALLEY SECTION
*
*
COMPUTE RATING CURVE    CID=1
                        VS NO=1
                        NSEGS=1
                         MIN ELEV=0
                        MAX ELEV=15.
                         CH SLOPE=.058
                        FP SLOPE=.058
                         N =.045
                        DIST=410
                        DIST  ELEV  DIST   ELEV  DIST  ELEV  DIST  ELEV
                        0.    15.0  200.   0.0   210.  0.0   410.  10.0
*
COMPUTE TRAVEL TIME     ID=2
                        REACH=1
                        NO VS=1
                        L=5600
                        SLP=.058
*
ROUTE                   ID=2
                        HYD=1.1
                        INFLOW ID=1
                        DT=0.0333333333
*
PRINT HYD               ID=2
                        CODE=10
```

```
BASIN 2A      2A)

OMPUTE NM HYD          ID=3
                      HYD NO=3
                      AREA=.9986 SQ MI
                       PER A=50.0
                      PER B=12.0
                      PER C=37.0
                      PER D=1.0
                       TP=-0.240 HR
                      MASS RAIN=-1

RINT HYD               ID=3
                      CODE=10

      COMBINE HYDROS : 1 & 2A

DD HYD                ID=4
                      HYD=4
                      ID I=2
                      ID II=3

RINT HYD              ID=4
                      CODE=10

INISH
```

```
AH'    PROGRAM (AHYMO_97) -                          -    sion:  1997.02c
       UN DATE (MON/DAY/YR) = 06/09/2003
      START TIME (HR:MIN:SEC) = 17:05:05     USER NO.= AHYMO-S-9702c1BohanHu-AH
      INPUT FILE = bca24hr.hym

*                  HIGH DESERT HYDROLOGY MODEL
*                        INPUT=BCA24hr.HYM
*                     EXISTING CONDTIONS MODEL
*                         24-hr 100-YEAR STORM
*
*********************************************************************
*********************************************************************
* REVISED LAND FACTORS FOR BASINS PA-1 THRU PA-4 TO CORRECT ERROR IN
* INITIAL ABSTRACTION VALUE FOR TREATMENT C.
* REVISED INITIAL ABSTRACTIONS BASED ON TREATMENT C: IA=0.86 FOR FOREST AND
* IA=0.35 FOR ALL OTHER AREAS.  COMPOSITE IA VALUES BASED ON WEIGHTED
* AVERAGES BASED ON AREAS OF FOREST AND AREAS OF OTHER
* REVISED 1/19/94 CWH
*********************************************************************
*********************************************************************
*
*  BEAR CANYON ARROYO BASIN TAKEN FROM ECI STUDY
*
*  BEAR ARROYO, BEAR TRIBUTARY, SOUTH PINO TRIBUTARY AND PINO ARROYO BASINS
*  UPSTREAM OF HIGH DESERT DEVELOPMENT TAKEN FROM HYMO MODELS FOR THE
*  CONCEPTUAL DRAINAGE MANAGEMENT PLAN.  BASINS WITHIN HIGH DESERT MODIFIED
*  TO FIT DEVELOPMENT PLANS AS PER THE FINAL SECTOR PLAN (MAY 3, 1993)
*  AND FINAL ROAD CONFIGURATION (JULY 1993).
*
*  JOHN ROBERTS DAM - CONTRIBUTING WATERSHEDS
*    1. EMBUDITO ARROYO
*    2. BEAR CANYON
*    3. SOUTH BEAR ARROYO
*    4. MIDDLE BEAR ARROYO
*    5. NORTH BEAR ARROYO
*
*********************************************************************
*
*   THE PURPOSE OF THIS HYMO RUN IS TO EVALUATE THE TRAMWAY
*   HYDROLOGY BASED ON THE LATEST VERSION OF THE DPM SECTION
*   22.2, DATED JANUARY 1993.
*
*********************************************************************
*
*
************************************
* BEAR CANYON ARROYO *
************************************
*
*       TAKEN FROM
*                  FILE: BC_P.IN/OUT
*                  BHI JN'S 8911803, 9123302              DATE: JAN 6, 1992
*
*
```

```
* HYMO ANALYSIS USING NM HYMO, PER CITY DPM APPROVED AUGUST, 1991
* INPU    SED ON MODIFIED STUDY FOR JOHN ROBERTS DAM, DA'    DEC. 1991.
* MODI    TIONS INCLUDE:1) INCREASE RAINFALL TO 3.00"/6H]
*                                  2) ADJUST AREAS USING NEW 1"=200' SCALE MAPS.
*                                  3) MODEL OF EXISITNG CONDITIONS AS OF 1/92
*                                     AND IMPROVEMENTS TO TRAMWAY BLVD.
*                               4) ESTIMATED 40% IMPERVIOUS AREA DEDUCTED
*                                  IN ACCORDANCE WITH THE EXISTING CONDITIONS.
*                                  5) BEAR ARROYO BASINS DO NOT CONTRIBUTE TO
*                                     BEAR CANYON BASINS.
*/////////////////////////////////////////////////////////////////////////////
*
*               UPSTREAM OF TRAMWAY BLVD. ON BEAR CANYON ARROYO
*
*
*/////////////////////////////////////////////////////////////////////////////
*
*
*
*
*
*
*
START
                                TIME=0
                                PUNCH CODE=0
                                PRINT LINES=6
*
LOCATION                  NAME=ALBUQUERQUE
     Soil infiltration values (LAND FACTORS) for this location are not available.
     The following default values were used.
     Land Treatment      Initial Abstr.(in)     Unif. Infilt.(in/hour)
          A              0.65                   1.67
          B              0.50                   1.25
          C              0.35                   0.83
          D              0.10                   0.04

*
SEDIMENT BULK             CODE=1
                                BULK FACTOR=1.1
*
RAINFALL                  TYPE=2
                                RAIN QUARTER=0.0
                                RAIN ONE=2.23
                                RAIN SIX=2.90
                                RAIN DAY=3.65
                                DT=0.033333

               COMPUTED 24-HOUR RAINFALL DISTRIBUTION BASED ON NOAA ATLAS 2 - PEAK AT 1.40 HR.
               DT =     .033333 HOURS        END TIME =     19.966470 HOURS
                  .0000   .0055   .0110   .0167   .0225   .0284   .0345
                  .0406   .0470   .0534   .0600   .0668   .0738   .0809
                  .0882   .0958   .1035   .1115   .1198   .1283   .1370
                  .1461   .1555   .1653   .1755   .1860   .1971   .2086
                  .2207   .2335   .2469   .2531   .2596   .2667   .2819
```

.3158	.3679	.4428	.5450	.6793	.8505	1.0637
1.3239	1.5646	1.6653	1.7504	1.8260	948	1.9582
2.0171	2.0720	2.1236	2.1721	2.2178	611	2.3020
2.3407	2.3775	2.4124	2.4455	2.4769	2.4850	2.4928
2.5002	2.5074	2.5143	2.5210	2.5275	2.5339	2.5400
2.5460	2.5518	2.5575	2.5631	2.5685	2.5738	2.5790
2.5841	2.5891	2.5940	2.5989	2.6036	2.6083	2.6129
2.6174	2.6218	2.6262	2.6305	2.6348	2.6390	2.6431
2.6472	2.6512	2.6552	2.6591	2.6630	2.6668	2.6706
2.6744	2.6781	2.6817	2.6854	2.6890	2.6925	2.6960
2.6995	2.7029	2.7064	2.7097	2.7131	2.7164	2.7197
2.7230	2.7262	2.7294	2.7326	2.7357	2.7388	2.7419
2.7450	2.7481	2.7511	2.7541	2.7571	2.7600	2.7630
2.7659	2.7688	2.7716	2.7745	2.7773	2.7802	2.7829
2.7857	2.7885	2.7912	2.7939	2.7967	2.7993	2.8020
2.8047	2.8073	2.8099	2.8125	2.8151	2.8177	2.8203
2.8228	2.8254	2.8279	2.8304	2.8329	2.8354	2.8378
2.8403	2.8427	2.8451	2.8476	2.8500	2.8524	2.8547
2.8571	2.8595	2.8618	2.8641	2.8664	2.8688	2.8711
2.8733	2.8756	2.8779	2.8801	2.8824	2.8846	2.8868
2.8891	2.8913	2.8935	2.8957	2.8978	2.9000	2.9021
2.9042	2.9063	2.9084	2.9105	2.9125	2.9146	2.9167
2.9187	2.9208	2.9229	2.9249	2.9270	2.9290	2.9310
2.9331	2.9351	2.9371	2.9391	2.9412	2.9432	2.9452
2.9472	2.9492	2.9512	2.9532	2.9551	2.9571	2.9591
2.9611	2.9630	2.9650	2.9670	2.9689	2.9709	2.9728
2.9747	2.9767	2.9786	2.9805	2.9825	2.9844	2.9863
2.9882	2.9901	2.9920	2.9939	2.9958	2.9977	2.9996
3.0015	3.0034	3.0053	3.0072	3.0090	3.0109	3.0128
3.0146	3.0165	3.0183	3.0202	3.0220	3.0239	3.0257
3.0275	3.0294	3.0312	3.0330	3.0348	3.0367	3.0385
3.0403	3.0421	3.0439	3.0457	3.0475	3.0493	3.0511
3.0529	3.0546	3.0564	3.0582	3.0600	3.0617	3.0635
3.0653	3.0670	3.0688	3.0705	3.0723	3.0740	3.0758
3.0775	3.0792	3.0810	3.0827	3.0844	3.0862	3.0879
3.0896	3.0913	3.0930	3.0947	3.0964	3.0981	3.0998
3.1015	3.1032	3.1049	3.1066	3.1083	3.1100	3.1116
3.1133	3.1150	3.1167	3.1183	3.1200	3.1217	3.1233
3.1250	3.1266	3.1283	3.1299	3.1316	3.1332	3.1348
3.1365	3.1381	3.1397	3.1414	3.1430	3.1446	3.1462
3.1478	3.1494	3.1511	3.1527	3.1543	3.1559	3.1575
3.1591	3.1607	3.1623	3.1638	3.1654	3.1670	3.1686
3.1702	3.1717	3.1733	3.1749	3.1765	3.1780	3.1796
3.1811	3.1827	3.1843	3.1858	3.1874	3.1889	3.1905
3.1920	3.1935	3.1951	3.1966	3.1981	3.1997	3.2012
3.2027	3.2043	3.2058	3.2073	3.2088	3.2103	3.2118
3.2133	3.2149	3.2164	3.2179	3.2194	3.2209	3.2224
3.2238	3.2253	3.2268	3.2283	3.2298	3.2313	3.2328
3.2342	3.2357	3.2372	3.2387	3.2401	3.2416	3.2430
3.2445	3.2460	3.2474	3.2489	3.2503	3.2518	3.2532
3.2547	3.2561	3.2576	3.2590	3.2604	3.2619	3.2633
3.2647	3.2662	3.2676	3.2690	3.2705	3.2719	3.2733
3.2747	3.2761	3.2775	3.2790	3.2804	3.2818	3.2832
3.2846	3.2860	3.2874	3.2888	3.2902	3.2916	3.2930
3.2943	3.2957	3.2971	3.2985	3.2999	3.3013	3.3026

3.3040	3.3054	3.3068	3.3081	3.3095	3.3109	3.3122
3.3136	3.3150	3.3163	3.3177	3.3190	204	3.3217
3.3231	3.3244	3.3258	3.3271	3.3285	298	3.3311
3.3325	3.3338	3.3351	3.3365	3.3378	3.3391	3.3405
3.3418	3.3431	3.3444	3.3457	3.3471	3.3484	3.3497
3.3510	3.3523	3.3536	3.3549	3.3562	3.3575	3.3588
3.3601	3.3614	3.3627	3.3640	3.3653	3.3666	3.3679
3.3692	3.3705	3.3718	3.3731	3.3743	3.3756	3.3769
3.3782	3.3794	3.3807	3.3820	3.3833	3.3845	3.3858
3.3871	3.3883	3.3896	3.3909	3.3921	3.3934	3.3946
3.3959	3.3971	3.3984	3.3996	3.4009	3.4021	3.4034
3.4046	3.4059	3.4071	3.4083	3.4096	3.4108	3.4121
3.4133	3.4145	3.4157	3.4170	3.4182	3.4194	3.4207
3.4219	3.4231	3.4243	3.4255	3.4268	3.4280	3.4292
3.4304	3.4316	3.4328	3.4340	3.4352	3.4364	3.4376
3.4388	3.4400	3.4412	3.4424	3.4436	3.4448	3.4460
3.4472	3.4484	3.4496	3.4508	3.4520	3.4532	3.4543
3.4555	3.4567	3.4579	3.4591	3.4602	3.4614	3.4626
3.4638	3.4649	3.4661	3.4673	3.4685	3.4696	3.4708
3.4719	3.4731	3.4743	3.4754	3.4766	3.4777	3.4789
3.4801	3.4812	3.4824	3.4835	3.4847	3.4858	3.4870
3.4881	3.4893	3.4904	3.4915	3.4927	3.4938	3.4950
3.4961	3.4972	3.4984	3.4995	3.5006	3.5018	3.5029
3.5040	3.5051	3.5063	3.5074	3.5085	3.5096	3.5108
3.5119	3.5130	3.5141	3.5152	3.5163	3.5175	3.5186
3.5197	3.5208	3.5219	3.5230	3.5241		

```
*
*      BASIN 1(BCA-1)
*
*
COMPUTE NM HYD            ID=1
                               HYD NO=1
                               AREA=4.9740 SQ MI
                               PER A=0.0
                               PER B=20.0
                               PER C=80.0
                               PER D=0.0
                               TP=-0.6180 HR
                               MASS RAIN=-1

     K =    .470576HR    TP =    .618000HR    K/TP RATIO =    .761449     SHAPE CONSTANT, N =  4.735204
     UNIT PEAK =    3231.7    CFS   UNIT VOLUME =    1.000       B =   401.53      P60 = 2.2300
     AREA =     4.974000 SQ MI    IA =    .38000 INCHES    INF =    .91400 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .033333

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.10000 AT PEAK FLOW.

*
PRINT HYD                 ID=1
                               CODE=10

                                       OUTFLOW HYDROGRAPH REACH     1.00
```

TIME	FLOW CFS	TIME HRS	FLOW CFS	TIME	FLOW CFS	TIME HRS	FLOW CFS	TIME HI	FLOW CFS
.	.0	3.667	347.3	7.	25.8	11.000	1.9	14.	.1
.333	.0	4.000	273.4	7.667	20.4	11.333	1.5	15.000	.1
.667	.0	4.333	215.9	8.000	16.1	11.667	1.2	15.333	.1
1.000	.0	4.667	170.5	8.333	12.7	12.000	.9	15.667	.1
1.333	17.4	5.000	134.6	8.667	10.0	12.333	.7	16.000	.1
1.667	2060.2	5.333	106.3	9.000	7.9	12.667	.6	16.333	.0
2.000	4427.5	5.667	84.0	9.333	6.3	13.000	.5	16.667	.0
2.333	3313.0	6.000	66.3	9.667	4.9	13.333	.4	17.000	.0
2.667	1745.6	6.333	52.4	10.000	3.9	13.667	.3	17.333	.0
3.000	862.3	6.667	41.4	10.333	3.1	14.000	.2	17.666	.0
3.333	471.1	7.000	32.7	10.667	2.4	14.333	.2	18.000	.0

RUNOFF VOLUME = 1.50769 INCHES = 399.9578 ACRE-FEET
PEAK DISCHARGE RATE = 4440.01 CFS AT 2.033 HOURS BASIN AREA = 4.9740 SQ. MI.

```
*
*
* ROUTE 1
*      UNLINED NARROW EARTH CHANNEL -- VALLEY SECTION
*
*
COMPUTE RATING CURVE     CID=1
                              VS NO=1
                              NSEGS=1
                        MIN ELEV=0
                              MAX ELEV=15.
                        CH SLOPE=.058
                              FP SLOPE=.058
                        N =.045
                              DIST=410
                         DIST  ELEV  DIST   ELEV  DIST  ELEV  DIST  ELEV
                         0.    15.0  200.   0.0   210.  0.0   410.  10.0
```

RATING CURVE VALLEY SECTION 1.0

WATER SURFACE ELEV	FLOW AREA SQ FT	FLOW RATE CFS	TOP WIDTH FT
.00	.00	.00	10.00
.79	18.28	91.93	36.32
1.58	57.34	429.51	62.63
2.37	117.17	1118.60	88.95
3.16	197.78	2251.91	115.26
3.95	299.17	3913.33	141.58
4.74	421.33	6180.51	167.89
5.53	564.27	9126.39	194.21
6.32	727.98	12820.20	220.53
7.11	912.47	17328.07	246.84
7.89	1117.73	22713.55	273.16
8.68	1343.77	29037.97	299.47
9.47	1590.58	36360.73	325.79
10.26	1857.48	45162.61	346.84

11.05	2135.46	55854.67	357.37
11.84	2421.7	67563.08	367.89
12.63	2716.3	80283.84	378.42
13.42	3019.25	94016.04	388.95
14.21	3330.47	108761.30	399.47
15.00	3650.00	124523.00	410.00

*

COMPUTE TRAVEL TIME ID=2
REACH=1
NO VS=1
L=5600
SLP=.058

TRAVEL TIME TABLE
REACH= 1.0

WATER DEPTH FEET	AVERAGE AREA SQ.FT.	FLOW RATE CFS	TRAVEL TIME HRS
.789	18.283	91.93	.3094
1.579	57.341	429.51	.2077
2.368	117.175	1118.60	.1629
3.158	197.784	2251.91	.1366
3.947	299.169	3913.33	.1189
4.737	421.330	6180.51	.1060
5.526	564.266	9126.39	.0962
6.316	727.978	12820.20	.0883
7.105	912.465	17328.07	.0819
7.895	1117.728	22713.55	.0765
8.684	1343.767	29037.97	.0720
9.474	1590.581	36360.73	.0680
10.263	1857.479	45162.61	.0640
11.053	2135.457	55854.67	.0595
11.842	2421.745	67563.08	.0558
12.632	2716.343	80283.84	.0526
13.421	3019.251	94016.04	.0500
14.211	3330.470	108761.30	.0476
15.000	3649.999	124523.00	.0456

*

ROUTE ID=2
HYD=1.1
INFLOW ID=1
DT=0.0333333333

Hydrograph incermental time change from DT= .033333 hours to DT= .033333 hours

*

PRINT HYD ID=2
CODE=10

OUTFLOW HYDROGRAPH REACH 1.10

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	4.000	307.1	8.000	20.6	12.000	1.2	16.000	.1
.333	.0	4.333	246.5	8.333	16.3	12.333	1.0	16.333	.1
.667	.0	4.667	199.0	8.667	12.8	12.667	.8	16.667	.0

1.000	.0	5.000	160.3	9.000	10.1	13.000	.6	17.000	.0
1	1.5	5.333	128.8	9.	8.0	13.333	.5	17.[illegible]	.0
1.	953.9	5.667	103.5	9.	6.3	13.667	.4	17.[illegible]	.0
2.000	3988.2	6.000	83.2	10.000	5.0	14.000	.3	18.000	.0
2.333	3694.7	6.333	66.5	10.333	3.9	14.333	.2	18.333	.0
2.667	2158.7	6.667	52.8	10.667	3.1	14.667	.2	18.667	.0
3.000	1135.3	7.000	41.8	11.000	2.5	15.000	.1		
3.333	619.1	7.333	33.0	11.333	1.9	15.333	.1		
3.667	408.0	7.667	26.1	11.667	1.5	15.667	.1		

RUNOFF VOLUME = 1.50771 INCHES = 399.9619 ACRE-FEET
PEAK DISCHARGE RATE = 4261.04 CFS AT 2.133 HOURS BASIN AREA = 4.9740 SQ. MI.

```
*
*
*      BASIN 2A(BCA-2A)
*
*
*
COMPUTE NM HYD          ID=3
                              HYD NO=3
                              AREA=.9986 SQ MI
                        PER A=50.0
                              PER B=12.0
                              PER C=37.0
                              PER D=1.0
                        TP=-0.240 HR
                              MASS RAIN=-1
```

K = .133403HR TP = .240000HR K/TP RATIO = .555844 SHAPE CONSTANT, N = 6.929753
UNIT PEAK = 21.550 CFS UNIT VOLUME = .9995 B = 517.92 P60 = 2.2300
AREA = .009986 SQ MI IA = .10000 INCHES INF = .04000 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT = .033333

K = .204832HR TP = .240000HR K/TP RATIO = .853466 SHAPE CONSTANT, N = 4.169282
UNIT PEAK = 1508.9 CFS UNIT VOLUME = 1.000 B = 366.30 P60 = 2.2300
AREA = .988614 SQ MI IA = .51970 INCHES INF = 1.30515 INCHES PER HOUR
RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT = .033333

BULKING FACTOR APPLIED TO HYDROGRAPH. FACTOR = 1.10000 AT PEAK FLOW.

```
*
PRINT HYD               ID=3
                              CODE=10
```

OUTFLOW HYDROGRAPH REACH 3.00

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	4.000	8.7	8.000	.4	12.000	.3	16.000	.3
.333	.0	4.333	5.2	8.333	.4	12.333	.3	16.333	.3
.667	.2	4.667	3.2	8.667	.4	12.667	.3	16.667	.3

1.000	1.5	5.000	2.1	9.000	.4	13.000	.3	17.000	.3
1	45.5	5.333	1.4	9.	.4	13.333	.3	17.[illegible]	.3
1	1416.8	5.667	1.0	9.	.4	13.667	.3	17.[illegible]	.3
2.000	409.9	6.000	.8	10.000	.4	14.000	.3	18.000	.3
2.333	131.0	6.333	.6	10.333	.4	14.333	.3	18.333	.3
2.667	73.8	6.667	.5	10.667	.3	14.667	.3	18.666	.2
3.000	43.0	7.000	.5	11.000	.3	15.000	.3	19.000	.2
3.333	25.1	7.333	.5	11.333	.3	15.333	.3	19.333	.2
3.667	14.7	7.667	.4	11.667	.3	15.667	.3	19.666	.2

RUNOFF VOLUME = 1.16265 INCHES = 61.9206 ACRE-FEET
PEAK DISCHARGE RATE = 1468.61 CFS AT 1.633 HOURS BASIN AREA = .9986 SQ. MI.

```
*
*
*      COMBINE HYDROS : 1 & 2A
*
*
ADD HYD                  ID=4
                               HYD=4
                               ID I=2
                               ID II=3
*
PRINT HYD                ID=4
                               CODE=10
```

OUTFLOW HYDROGRAPH REACH 4.00

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	4.000	315.8	8.000	21.0	12.000	1.5	16.000	.3
.333	.0	4.333	251.8	8.333	16.7	12.333	1.3	16.333	.3
.667	.2	4.667	202.2	8.667	13.2	12.667	1.1	16.667	.3
1.000	1.5	5.000	162.4	9.000	10.5	13.000	.9	17.000	.3
1.333	47.0	5.333	130.2	9.333	8.4	13.333	.8	17.333	.3
1.667	2370.7	5.667	104.5	9.667	6.7	13.667	.7	17.667	.3
2.000	4398.2	6.000	84.0	10.000	5.4	14.000	.6	18.000	.3
2.333	3825.7	6.333	67.1	10.333	4.3	14.333	.5	18.333	.3
2.667	2232.6	6.667	53.3	10.667	3.5	14.667	.5	18.667	.3
3.000	1178.2	7.000	42.2	11.000	2.8	15.000	.4	19.000	.2
3.333	644.2	7.333	33.5	11.333	2.3	15.333	.4	19.333	.2
3.667	422.7	7.667	26.5	11.667	1.9	15.667	.4	19.667	.2

RUNOFF VOLUME = 1.45002 INCHES = 461.8831 ACRE-FEET
PEAK DISCHARGE RATE = 4510.02 CFS AT 2.100 HOURS BASIN AREA = 5.9726 SQ. MI.

```
*
FINISH
```

NORMAL PROGRAM FINISH END TIME (HR:MIN:SEC) = 17:05:06

Item # 2

BASIN LAND FULLY DEVELOPED CONDITIONS

BASIN NO.	BASIN NAME	AREA (SQ.MILES)	LAND TREATMENT TYPES (%)				tp
			A	B	C	D	
37	SPT-7A	0.0600	74.85	0.00	8.00	17.15	0.133
38	SPT-7B	0.0460	74.85	0.00	8.00	17.15	0.133
39	SPT-8A	0.0270	75.00	3.00	2.00	20.00	0.143
40	SPT-8B	0.0360	0.00	36.69	12.23	51.08	0.133
41	SPT-9	0.0300	83.32	0.00	5.31	11.37	0.133
42	BCA-2A	0.0186	86.33	7.21	6.46	0.00	0.238
43	BCA-2B	0.0120	44.43	23.92	7.60	24.05	0.133
44	BCA-2C	0.0910	72.52	0.00	8.06	19.47	0.133
45	BCA-2D	0.0160	46.84	13.13	14.12	25.66	0.133
46	BCA-2E	0.0160	34.96	20.96	9.79	32.25	0.133
47	BCA-2F	0.0640	40.02	17.74	7.95	34.29	0.140
48	BCA-2G	0.0050	34.96	20.96	9.79	34.25	0.133
49	EM-1A	0.0180	88.00	4.00	8.00	0.00	0.133
50	EM-1B	0.0224	57.24	7.39	17.45	17.92	0.133
51	EM-1C	0.0186	57.24	7.39	17.45	17.92	0.133
52	EM-2A	0.0470	96.00	2.00	2.00	0.00	0.159
	PA-1	0.2930	0.00	2.00	98.00	0.00	0.136
	PA-2	0.2150	0.00	2.00	98.00	0.00	0.186
	PA-3	0.4060	0.00	3.00	97.00	0.00	0.133
	PA-4	0.5660	0.00	8.00	92.00	0.00	0.173
	PA-5	0.2970	0.00	9.00	91.00	0.00	0.133
	PA-6	0.1140	0.00	15.00	85.00	0.00	0.133
	PA-7	0.1880	0.00	10.00	90.00	0.00	0.133
	PA-8	0.1840	0.00	10.00	90.00	0.00	0.133
	PA-9	0.3190	0.00	10.00	90.00	0.00	0.145
	PA-10	0.1220	0.00	80.00	20.00	0.00	0.170
	PA-11	0.2760	2.00	60.00	38.00	0.00	0.136
	PA-12	0.2500	1.00	34.00	65.00	0.00	0.143
	PA-13	0.1450	4.00	44.00	52.00	0.00	0.162
	PA-14	0.2670	4.00	44.00	52.00	0.00	0.133
	PA-15	0.1310	90.00	9.00	1.00	0.00	0.135
	PA-16	0.1390	90.00	9.00	1.00	0.00	0.133
	PA-17	0.2780	70.00	17.00	7.00	6.00	0.133
	PA-18A	0.0195	66.00	5.00	10.00	19.00	0.133
	PA-18B	0.0208	66.00	5.00	10.00	19.00	0.133
	PA-18C	0.0100	66.00	5.00	10.00	19.00	0.133
	PA-18D	0.0398	66.00	5.00	10.00	19.00	0.133
	PA-18E	0.0240	66.00	5.00	10.00	19.00	0.133
	PA-18F	0.0330	66.00	5.00	10.00	19.00	0.133
	PA-18G	0.0172	66.00	5.00	10.00	19.00	0.133

BASIN TIME OF CONCENTRATION CALCULATIONS

Description	Variable	Unit	Basin SPT-6A	Basin SPT-6B	Basin SPT-7A	Basin SPT-7B	Basin SPT-8A	Basin SPT-8B	Basin SPT-9	Basin BCA-2A	Basin BCA-2C	Basin BCA-2D
Total Reach	L	Feet	4100.0	4650.0	2760.0	3350.0	2400.0	2450.0	2500.0	5900.0	2400.0	1650.0
Overland Reach	L1	Feet	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0
Overland K	K1		0.7	0.7	0.7	0.7	0.7	1	0.7	0.7	0.7	0.7
Overland Slope	S1	Percent	4.60	6.25	6.00	6.50	4.50	4.50	3.50	5.00	8.75	7.50
Adj. Overland Slope	S1'	Percent	4.507	5.275	5.197	5.345	4.434	4.434	3.500	4.760	5.726	5.555
Gully Reach	L2	Feet	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Gully K	K2		2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
Gully Slope	S2	Percent	4.600	5.825	6.063	5.250	3.630	4.000	5.063	4.000	4.438	4.875
Adj. Gully Slope	S2'	Percent	4.507	5.136	5.218	4.892	3.630	4.000	4.795	4.000	4.387	4.687
Arroyo Reach	L3	Feet	2100.0	2650.0	760.0	1350.0	400.0	450.0	150.0	3900.0	400.0	50.0
Arroyo K	K3		3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000
Arroyo Slope	L3	Percent	4.667	5.539	3.816	4.890	2.500	4.000	4.000	5.020	3.500	4.875
Adj. Arroyo Slope	S3'	Percent	4.553	5.024	3.816	4.696	2.500	4.000	4.000	4.772	3.500	4.687
Lca	Lca	Feet	1800.0	2550.0	0.0	0.0	0.0	0.0	0.0	3400.0	0.0	0.0
Base Discharge	Qb	cfs	77.9	234.2	119.5	91.6	50.4	98.7	51.3	207.5	187.6	36.9
Ground Slope S	S	Percent	4.634	5.699	5.435	5.254	3.587	4.082	4.040	4.742	5.000	6.693
Adjusted Slope S'	S'	Percent	4.531	5.089	4.979	4.894	3.587	4.080	4.040	4.603	4.760	5.393
K	K		1.977	2.083	1.721	1.881	1.638	1.828	1.813	2.192	1.666	1.102
K'	K'		1.977	2.070	1.693	1.855	1.634	1.824	1.788	2.188	1.589	1.147
K''	K''		3.107	3.575	3.201	3.078	3.229	3.417	3.052	3.677	3.551	2.490
K'''	K'''		2.130	2.450	2.194	2.110	2.213	2.342	2.092	2.521	2.434	1.707
Kn	Kn		0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042
Orig. TC	TC	Hrs.	0.267	0.270	0.191	0.216	0.215	0.184	0.191	0.377	0.179	0.161
K Value Used	K		2.130	2.450	2.194	2.110	1.638	2.342	2.092	2.521	2.434	1.707
Adjusted TC	TC'	Hrs.	0.252	0.251	0.157	0.199	0.159	0.144	0.165	0.357	0.126	0.116
Time Lag	Lg	Hrs.	-	-	-	-	-	-	-	-	-	-
Time to Peak	TP	Hrs.	0.168	0.167	0.133	0.133	0.143	0.133	0.133	0.238	0.133	0.133

Description	Variable	Unit	Basin BCA-2F	Basin EM-2A	Basin PA-1	sin A-2	Basin PA-3	Basin PA-4	Basin PA-5	Basin PA-6	Basin PA-7	asin A-8
Total Reach	L	Feet	3900.0	3760.0	4600.0	5500.0	4400.0	5500.0	4500.0	3000.0	4000.0	3200.0
Overland Reach	L1	Feet	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0
Overland K	K1		0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Overland Slope	S1	Percent	5.63	6.06	50.00	40.00	32.50	50.00	80.00	25.00	37.50	52.00
Adj. Overland Slope	S1'	Percent	5.060	5.217	8.428	7.792	7.315	8.428	10.337	6.837	7.633	8.555
Gully Reach	L2	Feet	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Gully K	K2		2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
Gully Slope	S2	Percent	5.218	6.250	60.000	53.000	55.000	47.500	75.000	25.000	30.000	40.000
Adj. Gully Slope	S2'	Percent	4.876	5.275	9.064	8.619	8.746	8.269	10.019	6.837	7.156	7.792
Arroyo Reach	L3	Feet	1900.0	1760.0	2600.0	3500.0	2400.0	3500.0	2500.0	1000.0	2000.0	1200.0
Arroyo K	K3		3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000
Arroyo Slope	L3	Percent	5.053	4.090	38.500	31.500	27.000	24.600	30.000	21.000	20.000	17.000
Adj. Arroyo Slope	S3'	Percent	4.790	4.088	7.696	7.251	6.965	6.812	7.156	6.583	6.519	6.328
Lca	Lca	Feet	0.0	0.0	2400.0	2600.0	2400.0	2650.0	2400.0	1900.0	2000.0	1200.0
Base Discharge	Qb	cfs	160.9	64.9	804.9	482.6	1132.4	1356.0	817.5	297.3	503.5	492.3
Ground Slope S	S	Percent	5.179	5.219	46.978	38.373	37.682	33.109	50.444	23.667	25.750	32.875
Adjusted Slope S'	S'	Percent	4.857	4.877	8.236	7.688	7.644	7.353	8.456	6.753	6.885	7.338
K	K		1.963	1.954	2.073	2.176	1.980	2.212	2.054	1.777	2.029	1.843
K'	K'		1.954	1.916	2.068	2.179	2.027	2.200	2.086	1.764	1.987	1.843
K"	K"		3.420	2.898	3.509	3.312	3.873	4.079	3.473	3.239	3.527	3.403
K"'	K"'		2.344	1.987	2.405	2.270	2.655	2.796	2.380	2.220	2.418	2.332
Kn	Kn		0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042
Orig. TC	TC	Hrs.	0.242	0.234	0.114	0.171	0.116	0.179	0.106	0.096	0.108	0.084
K Value Used	K		2.344	1.987	2.405	2.270	2.655	2.796	2.380	2.220	2.418	2.332
Adjusted TC	TC'	Hrs.	0.210	0.238	0.204	0.279	0.182	0.257	0.197	0.144	0.175	0.141
Time Lag	Lg	Hrs.	-	-	-	-	-	-	-	-	-	-
Time to Peak	TP	Hrs.	0.140	0.159	0.136	0.186	0.133	0.171	0.133	0.133	0.133	0.133

Boundary Conditions: Normal Depth Picked for upstream and downstream

Slope taken from MicroStation Drawing

Section	Length	~~Elevation 1~~	~~Elevation 2~~	ΔElevation	Slope
upstream 1	50			2	$\frac{2}{50} = 4\%$
2	39			2	5.1%
3	47			2	4.3%
4	56			2	3.6%
average upstream slope =					4.25%
downstream 1	32			2	6.25%
2	51			2	3.92%
3	42			2	4.76%
4	37			2	5.41%
average downstream slope =					4.94%

Bohannan Huston

PROJECT NAME BCA Bridge SHEET ____ OF ____

PROJECT NO. 020178.002 BY GMM DATE 12/6/01

SUBJECT HEC-RAS Inputs CH'D ____ DATE ____

ENGINEERS PLANNERS PHOTOGRAMMETRISTS SURVEYORS SOFTWARE DEVELOPERS

PART C - PROCEDURE FOR SMALL AND LARGE WATERSHEDS

A unit hydrograph procedure is used for major drainage area analysis and for sub-basins larger than 40 acres. To compute peak discharge the HYMO computer program (Problem-Oriented Computer Language for Hydrologic Modeling, by J.R. Williams and R.W. Hann, Jr., ARS-S-9, 1973) with subsequent modifications by the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) is used. **The PART C procedure may be utilized for small watersheds (40 acres or less) in place of the procedures specified in PART A.**

C.1 THE HYMO COMPUTER PROGRAM

HYMO was developed for rural watersheds exceeding 320 acres. Some modification to HYMO is required for it to be used for small watersheds modeled as components of large watersheds, or for urban watersheds. The following items have been implemented as standard modifications to the HYMO procedures:

1. Employ precipitation and land treatment-specific HYMO recession coefficients, k.

2. Provide a consistent range of peak flows, Q_p for large and small watersheds by adjusting k with sub-basin area.

3. Employ an overland-flow or lag time based time of concentration.

4. Compute runoff by initial abstraction - uniform infiltration methodology. Do not use the standard SCS curve number methodology for computation of runoff.

5. Compute hydrographs by the split watershed method. Compute a hydrograph for the impervious portion of the sub-basin and a separate hydrograph for the pervious portion; then add the pervious and impervious hydrographs to compute the sub-basin hydrograph.

6. Increase hydrograph storage to allow up to 600 hydrograph point values, and increase rainfall storage to allow up to 500 incremental values.

7. Do not automatically adjust Manning's roughness coefficient for depth of flow in channel routing computations.

Extensive enhancements and revisions have been added to the original A.R.S. version of the HYMO program to implement the standard modifications and add new program features. However, the revised HYMO program will execute the original test data from the A.R.S. version of HYMO.

Modifications to the original program FORTRAN source code are required to implement the standard modifications. A PC version (MS-DOS) of the modified program, including FORTRAN source code, is available at the cost of reproduction from the City of Albuquerque, AMAFCA and Bernalillo County. Mini-computer and mainframe computer revisions of the program are available from local engineering consultants.

An enhanced version of the program, titled AHYMO, is also available at nominal cost from AMAFCA. The AHYMO program is distributed subject to AMAFCA's policy for the "Sale and Distribution of AHYMO Software" (Resolution No. 1991-6). The enhanced version (AMAFCA's AHYMO) can store twenty (20) hydrographs; the original and revised version can store six (6) hydrographs. The enhanced version adds the RAINFALL and COMPUTE NM HYD functions, and provides a computation summary table. Both the revised version and the enhanced version can store 600 hydrograph point values. The enhanced version of the program is not required to use the procedures in PART B, although such use may simplify data entry and computation.

C.2 ZONES

The unit hydrograph procedure should not utilize precipitation zones from TABLE A-1 or FIGURE A-1 of PART A. The precipitation amounts are obtained from the NOAA Atlas 2, or figures in PART C and the equations in PART C. Program parameters are obtained based on basin characteristics and precipitation quantities.

C.3 DESIGN STORM

1) The principal design storm for peak flow determination is the 100-year 6-hour event defined by the NOAA Atlas 2, Precipitation - Frequency Atlas of the Western United States, Vol. IV - New Mexico. Storms of other frequencies or durations are required for design or analysis of volume sensitive facilities, when examining sediment transport, and for complex routing conditions. The following statement from the Federal Emergency Management Agency (FEMA) should be used to provide guidance when selecting a storm duration:

> "FEMA's position regarding the duration of rainfall is that the storm must extend for a period long enough to include all rainfall excess when the volume of the runoff hydrograph is an important consideration. This includes conditions when detention storage is involved, when sediment processes are a significant factor, and when combining and routing subbasin hydrographs to obtain watershed runoff. When the peak flow is the primary concern, and it is established that the use of a longer duration storm would not increase the peak flow, shorter duration storms are acceptable."

2) The 100-year six hour, P_{360}, and the 24-hour, P_{1440}, precipitations are obtained from Figures 24 and 30 of NOAA Atlas 2. The one hour precipitation, P_{60}, is computed using the procedures in TABLE 11 of NOAA Atlas 2 and equations a-1 or a-2 herein. Values for P_{60}, P_{360} and P_{1440} in Bernalillo County should be obtained from FIGURES C-1, C-2, and C-3 respectively. Outside of Bernalillo County, NOAA Atlas 2 should be utilized.

3) Compute the depth of cumulative precipitation (also called the mass rainfall or rainfall distribution), P_T, at any time, $t \leq 1440$ minutes, as follows:

$$P_T = 2.334 * (P_{360} - P_{60}) * (1.5^A - (1.5 - t / 60)^A), \qquad 0 \leq t < 60 \qquad \text{(c-1)}$$

$$P_T = P_{T=60} + P_{60} * 0.4754 * (0.5^{0.09} - (1.5 - t / 60)^{0.09}), \qquad 60 \leq t < 67 \qquad \text{(c-2)}$$

$$P_T = P_{T=60} + P_{60} * \{0.0001818182 * (t - 60) + 0.000018338 * (t-60)^{3.2}\},$$

$$67 \leq t < 85.3 \qquad \text{(c-3)}$$

$$P_T = P_{T=60} + P_{60} * \{0.07 * (t - 60) - 1.1886 - 0.0404768 * (t-85)^{1.0985865}\},$$

$$85.3 \leq t < 120 \qquad \text{(c-4)}$$

$$P_T - P_{360} + (P_{T=60} + P_{60} - P_{360}) * (4.4^{(3*A)} - (t / 60 - 1.6)^{(3*A)})$$

$$/ (4.4^{(3*A)} - 0.4^{(3*A)}), \qquad 120 \leq t \leq t\,360 \qquad \text{(c-5)}$$

$$P_T - P_{1440} + (P_{360} - P_{1440}) * (30^B - (t / 60 + 6)^B) / (30^B - 12^B),$$

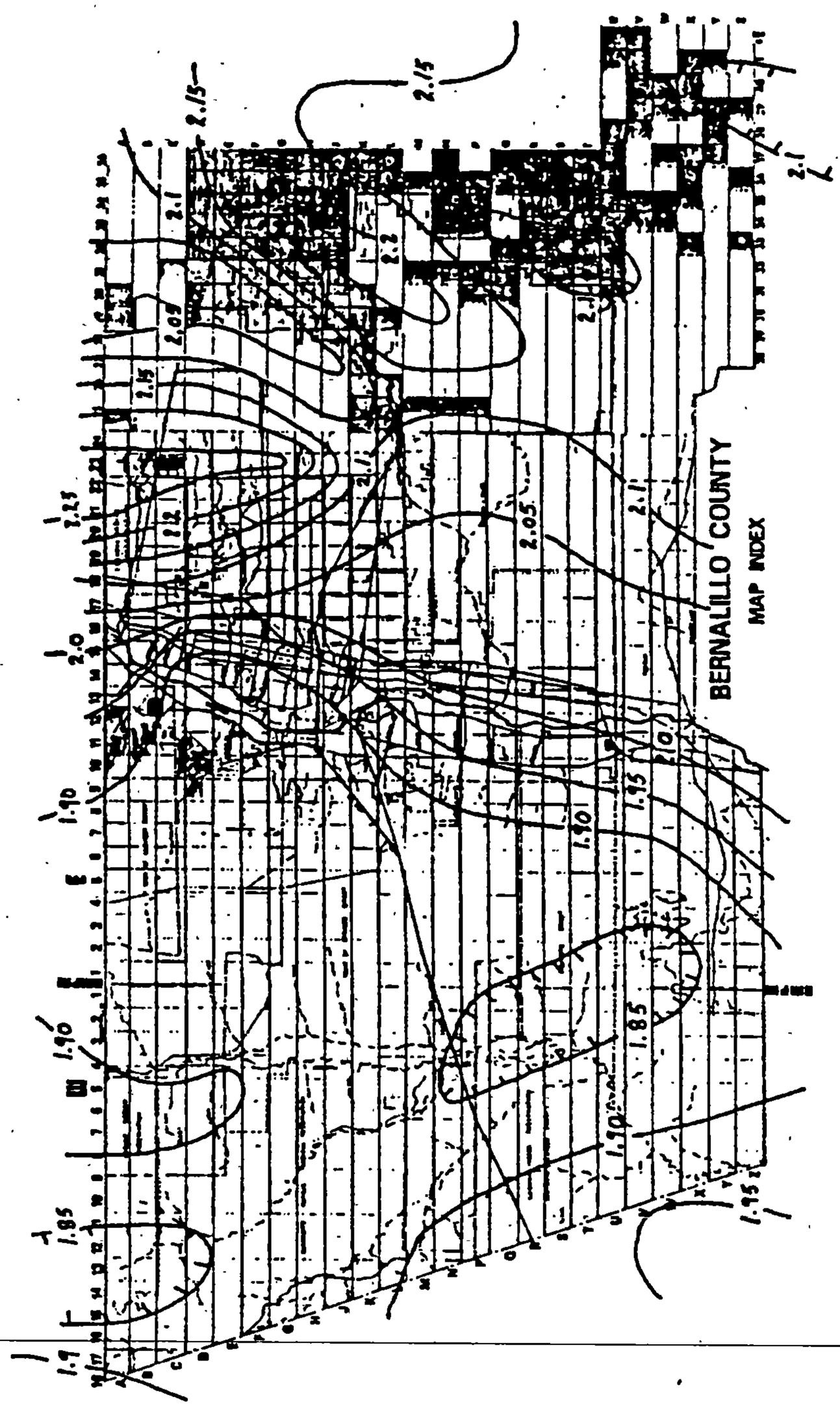
$$360 < t \leq 1440 \qquad \text{(c-6)}$$

where $A = \log_{10}(P_{360} / P_{60}) / \log_{10}(6.0)$

and $B = \log_{10}(P_{1440} / P_{360}) / \log_{10}(4.0)$

Figure C-1 - P_{60}

Isopluvials of 100-year, 1-hour precipitation.



From Figures 24 and 30, *NOAA Atlas 2, Volume IV*, and Y_{100} from equation on Table 11

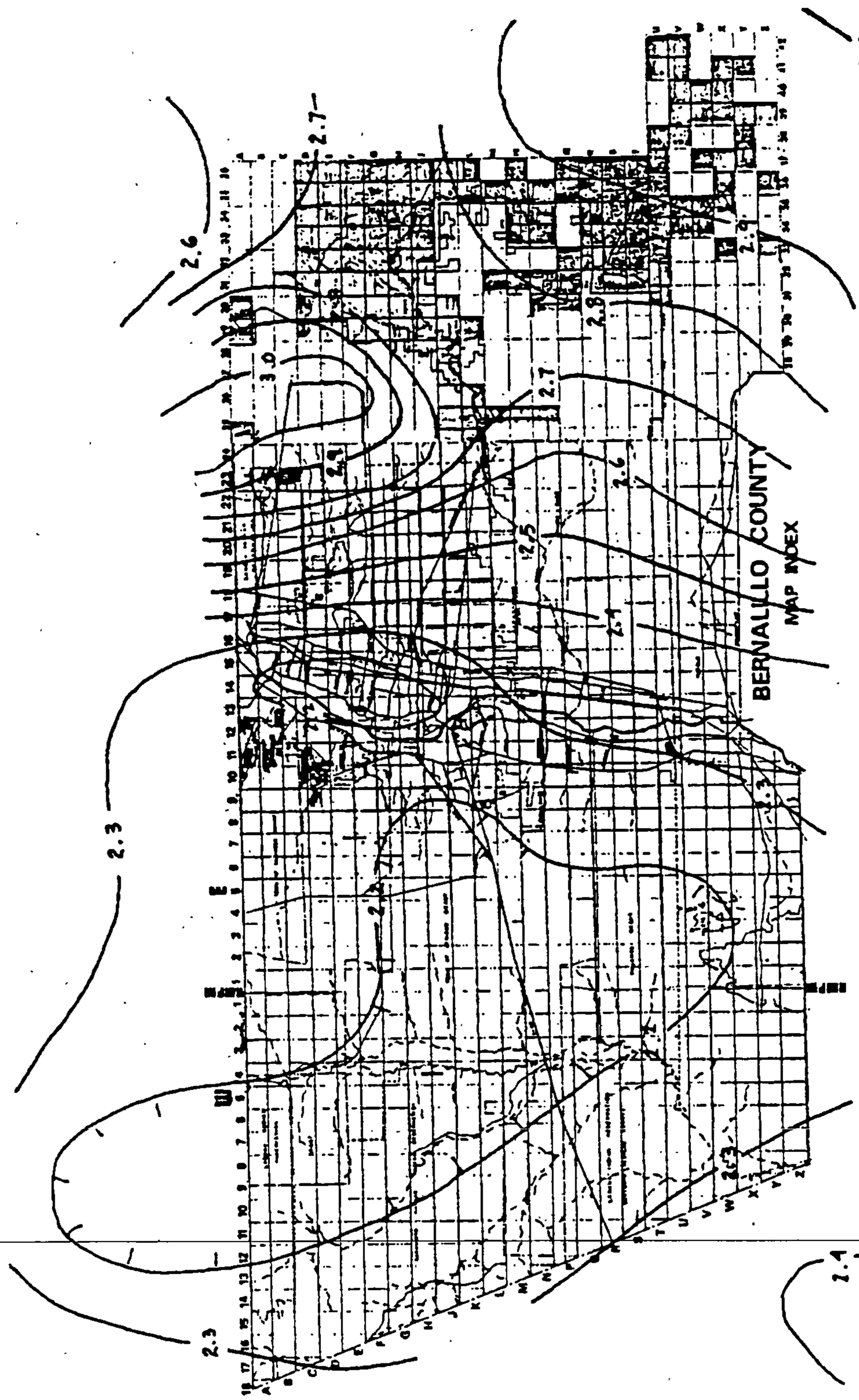


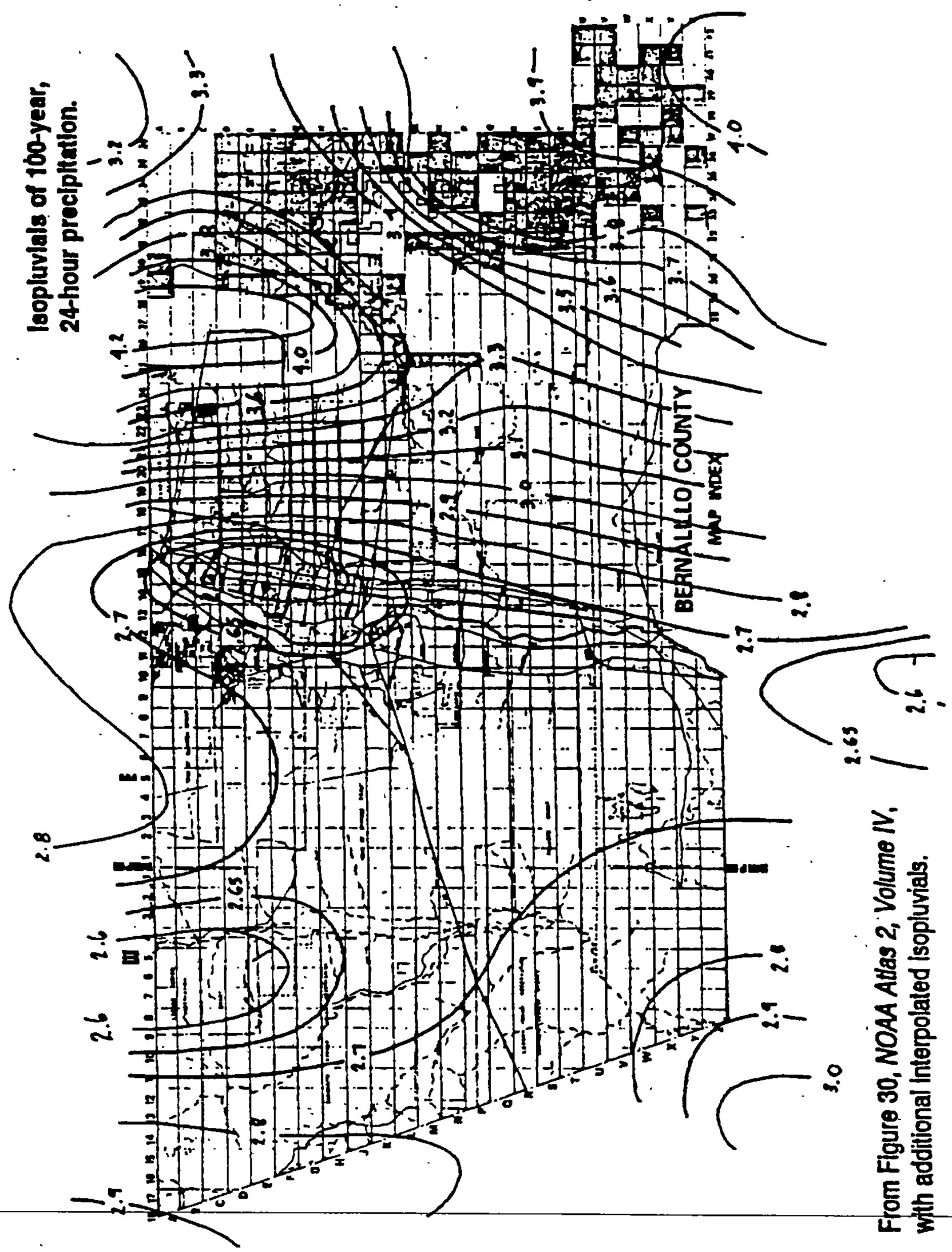
Figure C-2 - P_{360}

Isopluvials of 100-year, 6-hour precipitation.

From Figure 24, *NOAA Atlas 2, Volume IV,* with additional Interpolated Isopluvials.

Figure C-3 - P_{1440}

Isopluvials of 100-year, 24-hour precipitation.



From Figure 30, *NOAA Atlas 2, Volume IV,* with additional interpolated isopluvials.

3) Some applications must consider storms of greater frequency than the 100-year storm. To estimate the 360-minute and 1440-minute precipitation at return periods more frequent than 100-years, use the following formula:

$$P_{N\text{-}YEAR} = \{1 - (\log_{10}(100/year) * 0.333)\} * P_{N\text{-}100}, \qquad 2 \le year < 100 \qquad (c\text{-}7)$$

The return period factors from TABLE A-3 may also be utilized.

To estimate the 60-minute precipitation at return periods more frequent that 100-years, use the following formula:

$$P_{60\text{-}YEAR} = \{0.494 - (\log_{10}(100/year) * 0.505 / \log_{10}(50))\}$$

$$+ \{0.755 + (\log_{10}(100/year) * 0.187 / \log_{10}(50))\}$$

$$* \{1 - (\log_{10}(100/year) * 0.333)\}$$

$$* (P_{360\text{-}100}) * (P_{360\text{-}100}) / (P_{1440\text{-}100}), \qquad 2 \le year < 100 \qquad (c\text{-}8)$$

4) Analysis of retention ponds and detention dams may require storm durations longer than 24-hours. The procedures in S.C.S. TSC Technical Note - Hydrology PO-6 (Rev. 2) may be used to determine precipitation for storm durations between 1 day and 10 days. In Bernalillo County, the following equation may be used in place of the method in PO-6 to determine the 100-year 10-day storm.

$$P_{10days} = 10.0 - (24.9 / (P_{1440})^{1.4}) \qquad (c\text{-}9)$$

The 100-year storm between 1-day and 10-days can be computed with the following equation:

$$P_D = P_{1440} + \{\{(0.469 * \log_{10}(D)) + (0.059 * (D-1))\} * (P_{10days} - P_{1440})\} \qquad (c\text{-}10)$$

where D = duration in days

Example C-1

Determine the 1-hour, 6-hour, 24-hour, 4-day and 10-day precipitation for a 100-year frequency storm at a subbasin located on page E-20 of the Albuquerque/Bernalillo County Zone Atlas. Also determine the 1-hour, 6-hour and 24-hour precipitation for a 10-year frequency storm at this location.

From Figures C-1, C-2, and C-3

$P_{60} = 2.15$ inches $\quad P_{360} = 2.57$ inches $\quad P_{1440} = 3.02$ inches

$P_{10days} = 10.0 - 24.9 / 3.02^{1.4} = 4.70$ inches

$P_{4days} = 3.02 + \{(0.469 * \log_{10}(4) + 0.059 * (4-1))\} * (4.70 - 3.02)$

$= 3.79$ inches

$P_{360\text{-}10yr} = (1 - (\log_{10}(100 / 10) * 0.333)) * 2.57 = 1.71$ inches

$P_{1440\text{-}10yr} = (1 - (\log_{10}(100 / 10) * 0.333)) * 3.02 = 2.01$ inches

$P_{60\text{-}10y} = \{0.494 - (\log_{10}(100 / 10) * 0.505 / \log_{10}(50))\}$

$+ \{.755 + (\log_{10}(100 / 10) * 0.187 / \log_{10}(50))\}$

$* \{1 - (\log_{10}(100 / 10) * 0.333)\} * 2.57 * 2.57 / 3.02$

$= 0.1968 + 0.8651 * 0.667 * 2.57 * 2.57 / 3.02$

$P_{60\text{-}10yr} = 1.46$ inches

5) When evaluating uncontrolled watersheds larger than five (5) square miles, the precipitation amounts may be reduced by multiplying the precipitation amounts from FIGURES C-1, C-2, and C-3 by the "Percent of Point Precipitation" obtained from FIGURE C-4. Uncontrolled watersheds means those areas not controlled by dams, ponds or partial diversions.

For large complex watersheds which include several dams and partial diversions, the method of successive subtraction may provide more detailed modeling of the watershed. The U.S. Bureau of Reclamation computer program SUCSUB, is a useful tool when utilizing this procedure. The user manual for SUCSUB is contained in the U.S. Bureau of Reclamation, Personal Computer Programs. Estimating Probable

Maximum Precipitation and Precipitation Frequency-Duration in the Western United States (1989).

The use of FIGURE C-4 is appropriate for sizing major dams, channels and arroyos but may not be appropriate for sizing channel inlets, side drainage and storm sewers associated with these major facilities. Use of a single "Percent of Point Precipitation" value for large drainage studies may cause flows in the upper reaches of the study area to be under estimated. It may be necessary to evaluate major projects with and without area reduction factors and to establish the capacity of intermediate facilities based on a ratio of the values obtained.

C.4 *HYDROGRAPH COMPUTATION USING HYMO*

The steps which follow contain the procedure for computation of a hydrograph using the HYMO computer program. The original HYMO program developed by A.R.S. must be modified to compute runoff based on initial abstraction/uniform infiltration in order to use this procedure. The procedure described in this section utilizes the COMPUTE HYD function of the standard HYMO computer program.

1) Normally, only the 6-hour storm is input into the HYMO computer program ($t \leq 360$ min). HYMO recession coefficients have been calibrated using a rainfall distribution incremental time of 0.033333 hours (2 minutes). Applications requiring consideration of pond or dam storage, and large watersheds, will likely require use of a 24-hour or longer storm. A rainfall distribution incremental time of 0.05 hours (3 minutes) should be used in 24-hour storm applications. The HYMO recession coefficients are also applicable to a 3 minute incremental time.

2) Determine the areas in each of the pervious land treatments (A, B, and C) and the area of impervious land treatment (D). TABLE A-4 contains a definition of the four treatments. TABLE A-5 may be used to guide the determination of the percentage of treatment D where more specific data is not available. The areas are identified herein as A_A, A_B, A_C, and A_D.

2a) Compute the initial abstraction and infiltration for the pervious treatments (A, B, and C) using the values in TABLE A-6 and TABLE A-7 weighted by the respective areal proportion.

$$\text{IA-Pervious} = (0.65 * A_A + 0.50 * A_B + 0.35 * A_C) / (A_A + A_B + A_C) \quad \text{(c-11)}$$

$$\text{INF-Pervious} = (1.67 * A_A + 1.25 * A_B + 0.83 * A_C) / (A_A + A_B + A_C) \quad \text{(c-12)}$$

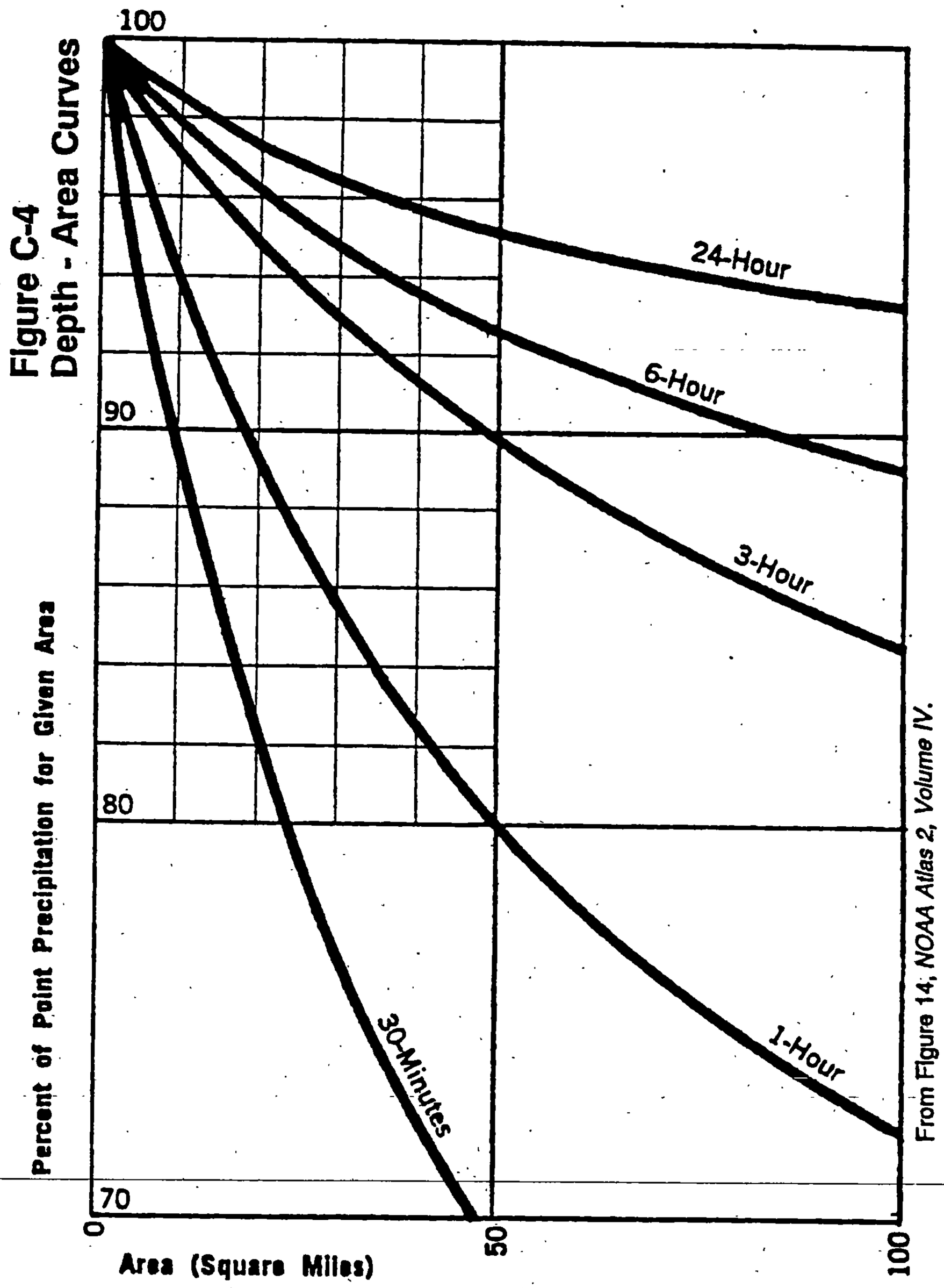


Figure C-4
Depth - Area Curves
Percent of Point Precipitation for Given Area
100
90
80
70
0
50
100
Area (Square Miles)
24-Hour
6-Hour
3-Hour
1-Hour
30-Minutes
From Figure 14; NOAA Atlas 2, Volume IV.

2b) The initial abstraction and infiltration for the impervious areas (land treatment D) are obtained directly from TABLES A-6 and A-7.

IA -	Impervious	=	0.10	
INF -	Impervious	=	0.04	at $0 \le t < 180$ min.
		=	$0.08 - (0.04 * t / 180)$	at $180 \le t < 360$
		=	0.0	at $360 \le t$

The revised version of the HYMO program includes this infiltration rate formulation.

3) Compute the time of concentration, t_c, using equations b-1 and b-2, or equation b-6, or equations b-7 and b-8, and the factors in TABLES B-1 or B-2. A single t_c is computed for the entire (pervious and impervious) watershed.

Consideration should be given to splitting large watersheds into smaller subbasins with reach lengths less than 4000 feet. Smaller subbasins will allow more accurate modeling of channels and basin topography, and should provide for greater modeling accuracy.

4) Set time to peak, t_p, equal to 2/3 t_c, but never less than 0.133333 hours (8.0 minutes.

5) The shape of the unit hydrograph is determined by the t_p and recession constant k. The value of k/t_p is used to calibrate the hydrograph peak flow rate. The value of k/t_p is computed as a function of the sub-basin area, land treatment (IA and INF and precipitation (P_{60})

5a) For a watershed with a total area ($A_A + A_B + A_C + A_D$) between 0 and 40 acres, use the following equation:

$$k/t_{p40} = \text{MAX}\{0, (1.19 + (1.4 * IA) - P_{60})\} * (0.035 + (0.150 * INF))$$
$$+ (1 + INF) * 0.44 + (P_{60} - 2.0) * (0.073 * (0.014 * INF)) \qquad \text{(c-13)}$$

where: MAX(a,b,) = Maximum Value of a or b

and k/t_{p40} (maximum) = 1.35,
and k/t_{p40} (minimum) = 0.545

For the four treatment types, equation c-13 can be reformulated as a set of linear equations as follows:

---

i) Treatment A with: IA = 0.65 INF = 1.67

@ $P_{60} < 2.10$, $k/t_{p40} = 1.58159 - (P_{60} * .18912)$ (c-14)

@ $P_{60} \ge 2.10$, $k/t_{p40} = 0.98204 + (P_{60} * .09638)$ (c-15)

k/t_{p40} (maximum) = 1.35

ii) Treatment B with: IA = 0.50 INF = 1.25

@P_{60} <1.89, $k/t_{p40} = 1.22953 - (P_{60} * .1320)$ (c-16)

@$P_{60} \geq 1.89$, $k/t_{p40} = 0.80900 + (P_{60} * .0905)$ (c-17)

iii) Treatment C with: IA = 0.35 INF = 0.83

@P_{60} <1.68, $k/t_{p40} = 0.90392 - (P_{60} * .07488)$ (c-18)

@$P_{60} \geq 1.68$, $k/t_{p40} = 0.63596 + (P_{60} * .08462)$ (c-19)

iv) Treatment D with: IA = 0.10 INF = 0.04

@$P_{60} < 1.33$, $k/t_{p40} = 0.5450$ (c-20)

@$P_{60} \geq 1.33$, $k/t_{p40} = 0.31048 + (P_{60} * .07356)$ (c-21)

k/t_{p40}(minimum) = 0.545

5b) For a watershed with a total area ($A_A + A_B + A_C + A_D$) larger than 200 acres, use the following equation:

$$k/t_{p200} = 0.52 + 0.20 * INF + (0.18 + 0.24 * INF) * (2^{(2.25 * (1 - P_{60}))}) \quad \text{(c-22)}$$

The value of k/t_{p200} computed by equation c-22 is set to a maximum value of 1.30.

For the four land treatment types, equation c-22 can be reformulated as follows:

i) Treatment A with: INF =1.67

$$k/t_{p200} = 0.854 + 0.5808 * (4.756828^{(1.0 - P_{60})}) \quad \text{(c-23)}$$

ii) Treatment B with: INF = 1.25

$$k/t_{p200} = 0.770 + 0.4800 * (4.756828^{(1.0 - P_{60})}) \quad \text{(c-24)}$$

iii) Treatment C with: INF = 0.83

$$k/t_{p200} = 0.686 + 0.3792 * (4.756828^{(1.0 - P_{60})}) \quad \text{(c-25)}$$

iv) Treatment D with: INF = 0.04

$$k/t_{p200} = 0.528 + 0.1896 * (4.756828^{(1.0 - P_{60})}) \qquad \text{(c-26)}$$

5c) For watershed with a total area smaller than 40 acres or larger than 200 acres, compute the k/t_p for the pervious areas ($A_A + A_B + A_C$) by using equations c-14 through c-19; or c-23, c-24 and c-25 weighted by the respective areal proportion.

$$k/t_p \text{ - pervious} = (k/t_{p@A} * A_A + k/t_{p@B} * A_B + k/t_{p@C} * A_C) / (A_A + A_B + A_C) \qquad \text{(c-27)}$$

The k/t_p for impervious areas is computed from equation c-20, c-21 or c-26 depending of the sub-basin area and P_{60}.

5d) For watersheds between 40 and 200 acres (pervious and impervious), compute the k/t_p as follows:

i) Compute k/t_{p40} for the pervious areas ($A_A + A_B + A_C$) using equation c-27 and equations c-14 through c-19, as applicable.

Computer k/t_{p40} for the impervious area (A_D) using equation c-20 or c-21.

ii) Computer k/t_{p200} for the pervious areas ($A_A + A_B + A_C$) using equation c-27 and equations c-23, c-24 and c-25.

Computer k/t_{p200} for the impervious area (A_D) using equation c-26.

iii) Compute the area-adjusted k/t_p ratio by linear interpolation for the impervious and pervious areas by separate computations using the following equation:

$$k/t_p = k/t_{p40} + \{(A-40) * (k/t_{p200} - k/t_{p40}) / 160\} \qquad \text{(c-28)}$$

where $A = A_A + A_B + A_C + A_D$ (acres)

5e) Compute the k for the pervious and impervious areas separately by multiplying the k/t_p ratio by the t_p computed in step 4, herein.

6) The COMPUTE HYD function of the HYMO computer program is used to compute the watershed hydrograph. Separate hydrographs are computed for the pervious and impervious portions of the watershed, then the two separate hydrographs (pervious and impervious) are added to obtain a combined hydrograph.

6a) The following data for the pervious area hydrograph is input into the COMPUTE HYD function of HYMO:

ID NUMBER	=	Internal storage location (1 to 6)
HYD NUMBER	=	Hydrograph identification number

DT	=	Time increment of mass rainfall input and hydrograph output (Use 0.033333 hrs for a 6-hour storm and 0.05 hrs for a 24-hour storm.)
DRAINAGE AREA	=	$A_A + A_B + A_C$ for the pervious portion of the watershed
IA	=	Initial Abstraction computed by equation c-11 (Input as a negative number.)
INF	=	Uniform Infiltration computed by equation c-12 (Input as a negative number.)
k	=	The recession constant for the pervious area computed by the procedures in Section 5a through 5e (Input as a negative number.)
t_p	=	Time to peak for the entire watershed (hrs) which is equal to 2/3 t_c (Input as a negative number.)
RAINFALL	=	The mass rainfall data computed from equations c-1 through c-5 (using a 2 minute time increment for a 6-hour storm) or equations c-1 through c-6 (using a 3 minute time increment for a 24-hour storm).

6b) The following data for the impervious area hydrograph is input into the COMPUTE HYD function of HYMO:

ID NUMBER	=	Internal storage location (1 to 6, and different from the number used for the pervious area)
HYD NUMBER	=	Hydrograph identification number
DT	=	Time increment (Use the same value as the pervious area)
DRAINAGE AREA	=	A_D, for the impervious portion of the watershed
IA	=	Initial Abstraction or 0.10 for impervious areas. (Input as a **negative** number.)
INF	=	Uniform Infiltration or 0.04 for impervious areas. ~~(Input as a positive number to reduce the impervious~~ infiltration rate after 3.0 hours.)
k	=	The recession constant for the impervious area computed by the procedures in Section 5a through 5e (Input as a **negative** number.)

t_p	=	Time to peak for the entire watershed (hours). (Use the same value as the pervious area, input as a **negative** number.)
RAINFALL	=	The mass rainfall; input a "-1" for this input to indicate use of the previous mass rainfall.

6c) The pervious hydrograph and the impervious hydrograph are added using the ADD HYD function of the HYMO computer program. The hydrograph values are output using the PRINT HYD function.

Example C-2

Find Q_P (100-year storm) for 1120 acres centered at Sheet E-10 of the City/County Zone Atlas. Land treatments are 240 acres of treatment A, 400 acres of treatment B, 160 acres of treatment C, and 320 acres of treatment D. These areas are proportional to the treatments in Example A-5. The flow path is: 600 ft. mountain brush (400 ft. bare ground sheet flow and 200 ft. shallow concentrated flow), s = 0.05 ft/ft; 2000 ft. desert terrain (shallow concentrated flow), s = 0.03 ft/ft; and 6000 ft. medium density urban (streets, and storm sewers), s = 0.02 ft/ft. The watershed centroid is at 55% of the total basin length. Do not adjust t_p for steep slopes with this example.

Pervious portion

Pervious Area = 240 + 400 + 160 = 800 acres = 1.25 sq. mi.

Composite IA = (240 * 0.65 + 400 * 0.50 + 160 * 0.35) / 800 = 0.515 inches

Composite INF.= (240 * 1.67 + 400 * 1.25 + 160 * 0.83) / 800 = 1.292 inches/hour

L = 600 + 2000 + 6000 = 8600 feet

L_{CA}= 0.55 * 8600 = 4730 feet

s = (0.05 * 600 + 0.03 * 2000 + 0.02 * 6000) / 8600 = 0.0244 ft/ft

Use K = 3.0 for portions of basin below first 2000 feet

K = (8600 / √ (0.0244)) / ((400 / (1*√ (0.05))) + (200/(2*√ (0.05))) +

(1400 / (2*√(0.03))) + (600 / (3*√(0.03))) + ((6000/3*√(0.02)))) = 2.552

K_N = (.042 * 600 + .033 * 2000 + .021 * 6000) / 8600 = 0.0253

t_c = ((12000 - 8600) / (72000 * 2.552 * $0.0244^{0.5}$)) + ((8600 - 4000) * 0.0253 * $0.55^{0.33}$ / (552.2 * $0.0244^{0.165}$))
= 0.1185 + 0.3193 = 0.4378 hours

t_p = 2/3 * 0.4378 = 0.292 hours

Since the total area (1120 acres) is greater than 200 acres use equations c-23, c-24 and c-25, to compute the k/t_p for each treatment type.

From FIGURE C-1, the one-hour precipitation, P_{60}, is 1.88 inches.

Example C-2 - Continued

@ Treatment A

$k/t_p = 0.854 + (0.5808 * (4.756828^{(1.0-1.88)})) = 1.0012$

@ Treatment B

$k/t_p = 0.770 + (0.4800 * (4.756828^{(1.0-1.88)})) = 0.8917$

@ Treatment C

$k/t_p = 0.686 + (0.3792 * (4.756828^{(1.0-1.88)})) = 0.7821$

Composite $k/t_p = (1.0012 * 240 + 0.8917 * 400 + 0.7821 * 160) / 800 = 0.9026$

$k = 0.292 * 0.9026 = 0.2636$ hours

The 6-hour precipitation, P_{360}, is obtained from FIGURE C-2

A mass rainfall from equations c-1 through c-5 is obtained for a 2 minute incremental time using:

$P_{60} = 1.88$ inches $\qquad P_{360} = 2.22$ inches

The values for the pervious area are input into the COMPUTE HYD function of HYMO to obtain the following output for the pervious hydrograph:

$Q_p = 906$ cfs @ 1.700 hrs. Volume = 43.4181 Ac Ft

<u>Impervious Portion</u>

Impervious Area = 320 acres = 0.50 sq. mi.

IA = 0.10

INF = 0.04 ($0 < t \leq 180$ min.)

t_p = 0.292 hr (same as for the pervious area)

Example C-2 - Continued

Since the total area (1120 acres) is greater than 200 acres, use equation c-26 to compute k/t_p, P_{60} is equal to 1.88 inches.

$k/t_p = 0.528 + (0.1896 * (4.756828^{(1.0-1.88)})) = 0.5761$

$k = 0.292 * .5761 = .1682$

A "-1" is input as the mass rainfall to utilize the previously input rainfall distribution.

The values for the impervious area are input into the COMPUTE HYD function of HYMO to obtain the following:

Q_p = 924 cfs @ 1.667 hrs Volume = 52.9338 Ac Ft

The impervious and pervious hydrographs are totaled using the ADD HYD function of HYMO to obtain the combined hydrograph for the basin with:

Q_p = 1828 cfs @ 1.667 hrs, Volume = 96.3518 Ac Ft

Example C-3

Find Q_p (100-year storm) for 112 acres in Sheet E-10 of the City/County Zone Atlas. Land treatments are 24 acres of treatment A, 40 acres of treatment B, 16 acres of treatment C, and 32 acres of treatment D. These areas are proportional to the treatments of Example A-5 and Example C-2. The flow path is: 232 ft. bare ground, s = 0.05 ft/ft; 774 ft. shallow concentrated flow, s = 0.03 ft/ft; and 2322 ft. natural channels, s = 0.02 ft/ft.

<u>Pervious portion</u>

Pervious Area = 24 + 40 + 16 = 80 acres = 0.125 sq. mi.

Composite IA = 0.515 (Example C-2)

Composite INF = 1.292 (Example C-2)

$t_c = ((232 / (10 * 1 * \sqrt{0.05})) + (774 / (10 * 2 * \sqrt{0.03}))$

$+ (2322 / (10 * 3 * \sqrt{0.02}))) / 3600 = 0.243$ hour

Example C-3 - Continued

t_p = 2/3 (0.243) = 0.162 hour

The watershed area (112 acres) is greater than 40 acres and less than 200 acres, therefore k/t_{p40} and k/t_{p200} must be computed. P_{60} at location E-10 is 1.88 inches, from FIGURE C-1. Equations c-14, c-16 and c-19 are used to compute k/t_{p40} .

@ Treatment A

$$k/t_{p40} = 1.58159 - ((1.88) * .18912) = 1.2260$$

@ Treatment B

$$k/t_{p40} = 1.22953 - ((1.88) * .13200) = 0.9814$$

@ Treatment C

$$k/t_{p40} = 0.63596 + ((1.88) * .08462) = 0.7950$$

Composite k/t_{p40} = (1.2260 * 24 + 0.9814 * 40 + 0.7950 * 16) / 80 = 1.0175

The k/t_{p200} for treatments A, B and C are computed in Example C-2.

Composite k/t_{p200} = (1.0012 * 24 + 0.8917 * 40 + 0.7821 * 16) /80
= 0.9026

The area adjusted k/t_p, ratio is computed from equation c-28.

k/t_p = 1.0175 + {(112 - 40) * (0.9026 - 1.0175) / 160} = 0.9658

k = 0.162 * 0.9658 = 0.1565 hrs

The 6-hour precipitation, P_{360} = 2.22 inches, is obtained from FIGURE C-2

The mass rainfall is obtained from equations c-1 through c-5.
For this example, it is the same as the mass rainfall used in Example C-2.

The values for the pervious area are input into the COMPUTE HYD function of HYMO to obtain the following:

Q_p = 139.9 cfs @ 1.533 hrs, Volume = 4.3418 Ac Ft

Example C3 - Continued

Impervious Portion

Impervious Area = 32 acres = 0.05 sq. mi.

IA = 0.10 inches

INF = 0.04 inches/hour ($0 < t \leq 180$ min.)

t_p = 0.162 hr (same as for the pervious area)

The k/t_p, ratio is computed by first computing k/t_{p40} and k/t_{p200}. Compute k/t_{p40} from equation c-21.

$k/t_{p40} = 0.31048 + ((1.88) * 0.07356) = 0.4488$

use $k/t_{p40} = 0.545$ (minimum value)

Compute k/t_{p200} from equation c-26.

$k/t_{p200} = 0.528 + (0.1896 * (4.756828^{(1.0-1.88)})) = 0.5761$

The area adjusted k/t_p ratio is computed from equation c-28.

$k/t_p = 0.5450 + \{(112 - 40) * (0.5761 - 0.5450) / 160\} = 0.5590$

$k = 0.162 * 0.5590 = 0.0906$ hrs

A "-1" is input as the mass rainfall to utilize the previously input rainfall distribution.

The values for the impervious area are input into the COMPUTE HYD function of HYMO to obtain the following:

Q_p = 127.9 cfs @ 1.533 hrs, Volume = 5.2934 Ac Ft

The impervious and pervious hydrographs are totaled using the ADD HYD function of HYMO to obtain the combined hydrograph for the watershed with:

Q_p = 267.7 cfs @ 1.533 hrs, Volume = 9.6352 Ac Ft

C.5 SIMPLIFIED INPUT FOR HYDROGRAPH COMPUTATION

The relatively complex procedures described in the previous section can be formulated as a sequence of mathematical operations in a computer program. A new function, labeled COMPUTE NM HYD has been developed for the AHYMO computer program (AMAFCA's enhanced version) to simplify the hydrograph computation and use the procedures outlined in the previous section. A new function, labeled RAINFALL, has been developed for AHYMO to simplify the computation of mass rainfall data. The COMPUTE NM HYD and RAINFALL functions are included only on the enhanced version of HYMO available from AMAFCA (AHYMO) and several local engineering consultants.

1) The steps which follow contain the procedure for use of the RAINFALL function:

1a) Determine the one hour and six hour (P_{60} and P_{360}) precipitation from FIGURES C-1 and C-2. If necessary to utilize more frequent storms, use TABLE A-3 and equations c-7 and c-8. For watersheds larger than five (5) square miles, depth-area adjustment may also be applicable. Before the first COMPUTE NM HYD, the program must compute a rainfall distribution; the one hour precipitation (P_{60}) and six hour precipitation (P_{360}) are required input. The program will compute the rainfall distribution at specified time increments using equations c-1 through c-5. Equation c-6 is added for the 24-hour precipitation. It is recommended that the 24-hour (P_{1440}) precipitation amount be computed to allow for the convenient application of a 24-hour rainfall distribution when dams and ponding are to be considered.

1b) Determine the type of distribution to be used.

For a 6-hour rainfall distribution use "TYPE=1".
For a 24-hour rainfall distribution use "TYPE=2".

1c) Determine the incremental time to be used in the computation. Normally 0.033333 hr. (2 min.) is used for the 6-hour rainfall distribution and 0.05 hr. (3 min.) is used for the 24-hour rainfall distribution.

1d) The following data is input into the RAINFALL function of AHYMO:

RAINFALL TYPE	=	1 for 6-hour rainfall distribution
	=	2 for 24-hour rainfall distribution
QUARTER HOUR PRECIPITATION	=	0.0 for TYPE 1 and 2 distributions
ONE HOUR PRECIPITATION	=	P_{60}

SIX HOUR PRECIPITATION	=	P_{360}
24-HOUR PRECIPITATION	=	P_{1440}
DT	=	Incremental time (hours)

2) The steps which follow contain the procedure for use of the COMPUTE NM HYD function:

2a) Determine the total sub-basin area and the area or percentage of each of the four land treatments (A, B, C and D) using TABLE A-4 and TABLE A-5. Since the COMPUTE NM HYD function reads the total sub-basin area, the land treatments may be computed as ratios of the total area (0 to 1), as percentages of the total area (0 to 100) or as areas in acres or square miles.

2b) Compute the time of concentration, t_c, for the entire sub-basin using equations b-1 and b-2, or equation b-6, or equations b-7 and b-8, and the factors in TABLES B-1 or B-2. Set the time to peak, t_p, equal to 2/3 t_c, but never less than 0.133333 hours (8.0 minutes). The value of t_p, is input into the COMPUTE NM HYD function.

Consideration should be given to splitting large watersheds into smaller subbasins with reach lengths less than 4000 feet. Smaller sub-basins will allow more accurate modeling of channels and basin topography, and should provide for greater modeling accuracy.

2c) The COMPUTE NM HYD function is utilized to compute the sub-basin hydrograph. The computation of k/t_p, ratios, infiltration, initial abstraction, and separate pervious and impervious hydrographs is all performed by the program. The following data is input into the COMPUTE NM HYD function of AHYMO:

ID NUMBER	=	Internal storage location (1 to 20 with AHYMO by AMAFCA)
HYD NUMBER	=	Hydrograph identification number
DRAINAGE AREA	=	The total sub-basin area (in square miles)
AREA OF LAND TREATMENT A,B,C AND D	=	As a percentage of total (0 to 100), as a ratio (0 to 1), or use areas in square miles or acres (four values are input)

t_p = Time to peak for the entire sub-basin (hours) which is equal to 2/3 t_c. (Input as a negative or positive number.)

MASS RAINFALL = if the RAINFALL function was previously used, input a "-1"

The hydrograph values are output using the PRINT HYD function of AHYMO.

Example C-4

Compute the hydrograph using RAINFALL and COMPUTE NM HYD from the data in Example C-3.

From FIGURES C-1, C-2 and C-3 the precipitation at location E-10 is obtained as:

P_{60} = 1.88 in P_{360} = 2.22 in P_{1440} = 2.68 in

Use a TYPE = 1 rainfall distribution and DT = 0.033333 hrs

These values are input into the RAINFALL function of AHYMO.

TOTAL AREA = 24 + 40 + 16 + 32 = 112 acres = 0.175 sq mi

Compute the land treatment percentage:

Percent A = (24/112) * 100 = 21.43

Percent B = (40/112) * 100 = 35.71

Percent C = (16/112) * 100 = 14.29

Percent D = (32/112) * 100 = 28.57

As an alternative, the acreage may also be used as input.

t_c = 0.243 hr t_p, = (2/3) t_c, = (2/3) * 0.243 = 0.162 hr

The above values are input into the COMPUTE NM HYD function of AHYMO to obtain the following:

Q_p = 267.8 cfs @ 1.533 hrs, Volume = 9.6351 Ac Ft

Item # 3

HIGH DESERT
DRAINAGE MANAGEMENT
MASTER PLAN

DECEMBER 1993

HIGH DESERT SUBDIVISION DRAINAGE MANAGEMENT MASTER PLAN

Prepared for:

HIGH DESERT INVESTMENT CORP.
6400 WYOMING BOULEVARD NE
ALBUQUERQUE, NM

Prepared by:

Job No. 93127.40

BOHANNAN-HUSTON INC.
ENGINEERS ARCHITECTS PHOTOGRAMMETRISTS SURVEYORS
COURTYARD I, 7500 JEFFERSON NE ALBUQUERQUE, NM 87109 TEL (505) 823-1000 FAX (505) 821-0892

B. Existing FEMA Floodplains

As previously noted, the property is currently impacted by six floodplains, as identified on Plate 2, enclosed in this report. These floodplains are located in the Pino Arroyo, South Pino Tributary Arroyo, Bear Arroyo Tributary, Bear Arroyo, the Bear Canyon Arroyo, and Embudito Arroyo watersheds.

Of these floodplains, the Bear Arroyo Tributary Floodplain is a "dry" floodplain, because the upstream flows within this arroyo have been diverted by the installation of a training dike to the South Pino Tributary Arroyo. All other floodplains are active.

C. Hydrology

Existing hydrological conditions for each of the six floodplains were analyzed for the 6-hour, 100-year storm. The Master Drainage Basin Map, Plate 1, shows the entire contributing hydrologic basins and the six major arroyos. The six watersheds were sub-divided into drainage basins and land use percentage were estimated as noted in Section II. A summary of the existing conditions basin land use percentages areas and time of peak values is shown in Appendices A and B, while Appendix C provides a summary of the AHYMO 100-year results for these same existing conditions basins. Additionally, the Summary Table on Plate 4 identifies the existing flowrates for the drainage basins of this site.

D. Sediment Analysis - Bulking

It was stated in the Methodology Section of this report that separate sediment and bulking analyses were being prepared for this site. Preliminary results of these analyses indicate bulking factors for undeveloped drainage basins significantly less than 10%, perhaps in the order of 6-8%.

Based on these preliminary results, but choosing to be conservative, a bulking factor of 10% is selected for arroyo and basin flows of High Desert.

The Summary Table of Plate 4 identifies the bulked vs. unbulked flowrates, at key analysis points along Tramway Boulevard.

Modifications to the Existing Training Dikes

As part of the tract development, analysis of the three existing training dikes located on or adjacent to the property is required. The three training dikes are (1) the diversion of the Bear Tributary Arroyo into the South Pino Tributary Arroyo, (2) the diversion of the Bear Arroyo to the Bear Canyon Arroyo and (3) the concrete training dike of the south bank of the Embudito Arroyo, upstream of its confluence with the Bear Canyon Arroyo. Please reference Plates 2 and 3 for locations of these installations. Modifications to upgrade these facilities to newer, more stringent standards may be required.

Operationally, by field inspection, the Bear Tributary Arroyo/South Pino Tributary Arroyo trainer dike appears to be in stable condition. The Bear Arroyo/Bear Canyon Arroyo dike is showing alternating signs of degradation and aggradation along its length. The training dike along the south bank of the Embudito, west of the reservoir site, is showing erosional problems in many areas.

As a result of the discussions described above, modifications to the training dikes to meet FEMA freeboard criteria, may be required prior to development in the watershed downstream of the facility. Design studies for these potential modifications are in process and will be completed and submitted under separate cover in the near future.

H. Sediment Analysis

Semi-urban Residential Areas (Zones 1, 2 and 3, Figure 3)

The proposed development analysis for zones 1, 2, and 3 will continue to use the 10% bulking factor (100-year storm) as used in the existing conditions analysis. This assumption for the preliminary master plan is based on the proposed drainage management schemes outlined previously. Low to moderate density residential areas, with low impervious area, are proposed with controls that minimize ground disturbance and collect and infiltrate runoff from impervious developed surfaces. Thus, there is little impact due to development on the sediment yield in these lower density areas.

Additionally, permanent sedimentation ponds are to be placed at the interface of the low density development with the higher density townhome-apartment development areas. Plate 3 identifies the proposed location of these facilities within the property. Design of these ponds will be provided at the time of storm drain system extension to the site of each pond. The ponds will essentially remove all objectionable sediment from the downstream storm drain piping systems.

Urban Residential Townhome-Apartment Areas (Zone 4, Figure 3)

Sediment yields will be reduced in the higher density area, Zone 4, of the west portion of the property due to the higher ratio of impervious area to pervious land treatments. A bulking factor of 2% was used in these areas.

Impact on the Pino and John Roberts Dams

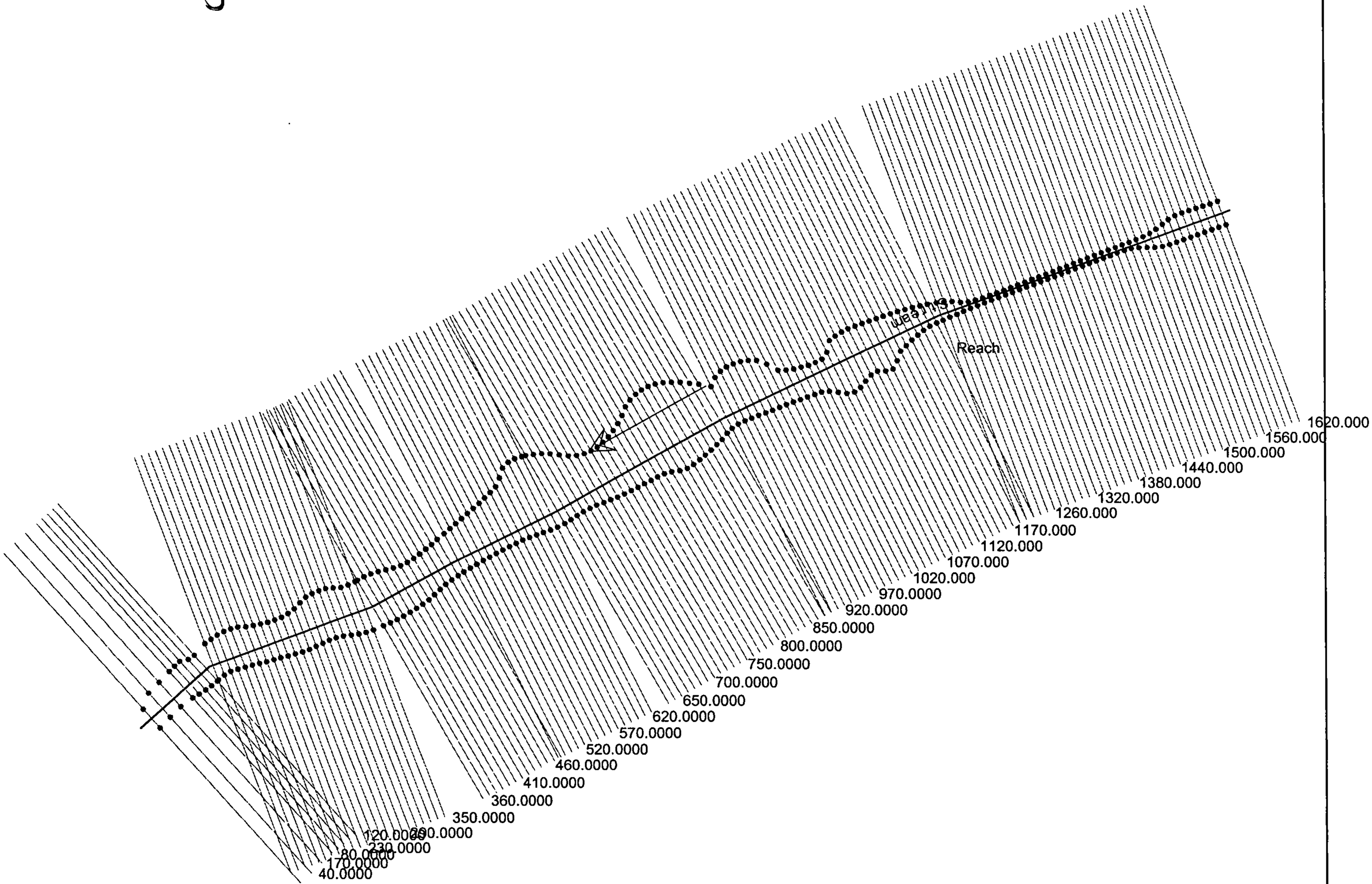
The above findings of no increase and a potential reduction in sediment yield from the property in the developed condition, release the development from further analysis of the dams. As previously stated, the John Roberts Dam has already been identified, by the 1992 ECI report, as being satisfactory in the developed condition analysis. With respect to the Pino Dam, if there is any existing capacity problem with respect to clear water volume or sediment volume, it is a regional problem. Correction of any existing capacity problems is not fairly assessed against High Desert alone because the development has not worsened any pre-existing conditions and has, in fact, significantly reduced sediment transport to the dams from the property.

To verify the capacity of the dam, this report generated data necessary to assess the condition of the Pino Dam under fully-developed conditions in High Desert. The total 100-year, 6-hour storm inflow rate to the dam (assuming no restrictions to dam inflow from Tramway structures) is 5970 cfs and inflow volume is 452 acre/feet (bulked). This volume represents approximately 73% of the design storage capacity of the dam. The spillway elevation is 5980, however, the calculated volume of inflow (412 acre/feet) will only reach an elevation of 5969.4 under existing dam site topography.

Clearly, with these results, no capacity problem exists within the dam.

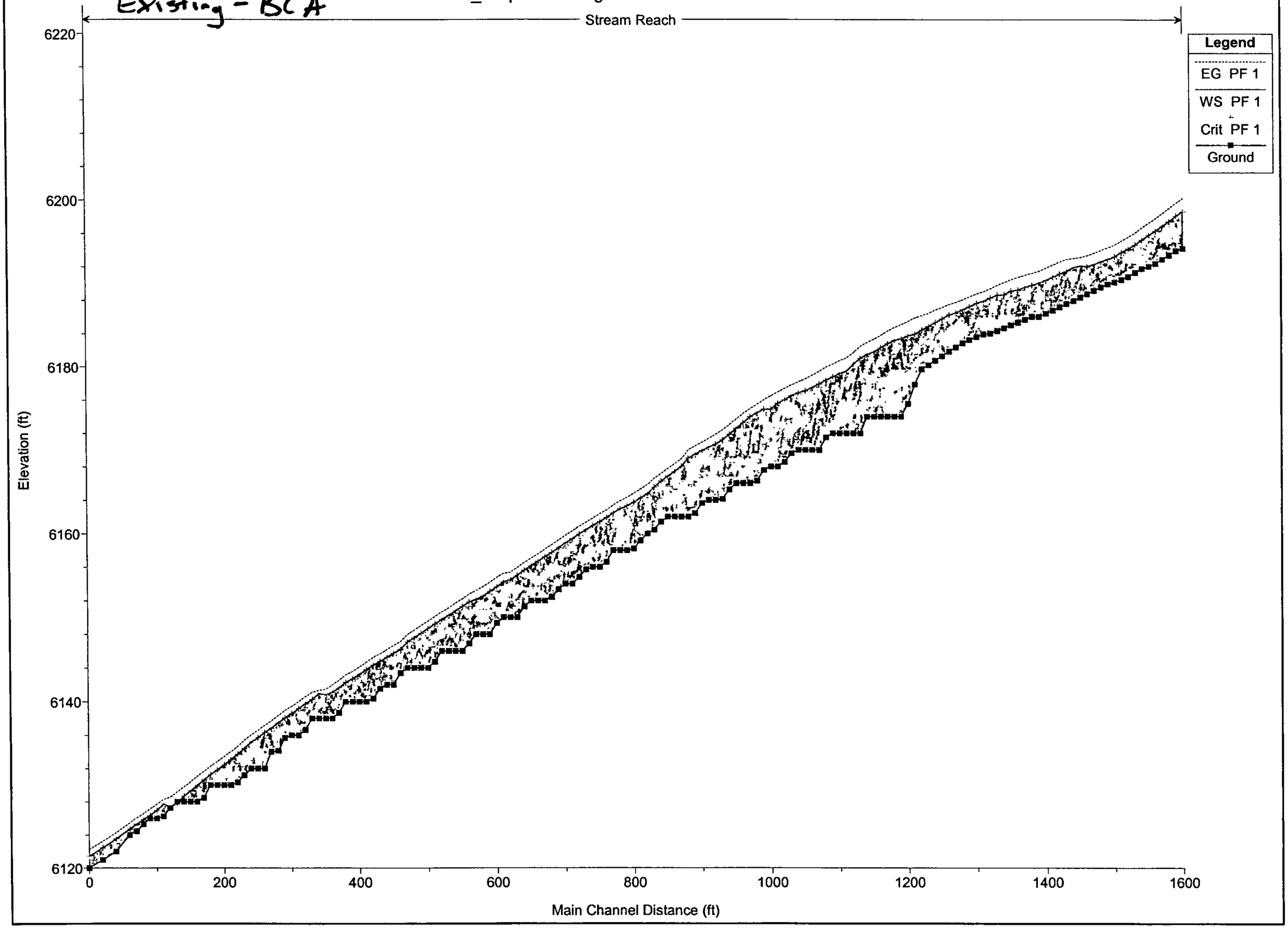
Item # 4

Existing - BCA



Existing - BCA

BCA_Proposed Bridge . lan: Plan 05 6/9/2003



HEC-RAS P.... Existing BCA Bridge

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	1620.000	PF 1	4510.00	6194.16	6198.57	6198.57	6200.15	0.011681	11.73	464.48	147.39	1.00
Reach	1610.000	PF 1	4510.00	6193.87	6198.07	6198.07	6199.58	0.011743	11.60	474.21	157.44	1.00
Reach	1600.000	PF 1	4510.00	6193.36	6197.40	6197.40	6198.92	0.012260	11.50	470.90	156.92	1.01
Reach	1590.000	PF 1	4510.00	6192.85	6196.83	6196.83	6198.32	0.012517	11.40	473.11	160.04	1.02
Reach	1580.000	PF 1	4510.00	6192.33	6196.29	6196.29	6197.75	0.012812	11.31	478.05	166.39	1.03
Reach	1570.000	PF 1	4510.00	6192.00	6195.77	6195.77	6197.18	0.012987	11.13	483.24	171.60	1.03
Reach	1560.000	PF 1	4510.00	6191.74	6195.21	6195.21	6196.60	0.013522	10.75	482.62	174.56	1.03
Reach	1550.000	PF 1	4510.00	6191.26	6194.63	6194.63	6196.00	0.013796	10.60	485.95	179.36	1.04
Reach	1540.000	PF 1	4510.00	6190.78	6194.15	6194.15	6195.51	0.013873	10.48	488.32	182.38	1.04
Reach	1530.000	PF 1	4510.00	6190.41	6193.68	6193.68	6195.05	0.014092	10.33	484.33	179.47	1.04
Reach	1520.000	PF 1	4510.00	6190.12	6193.21	6193.21	6194.58	0.014287	10.12	483.29	179.99	1.04
Reach	1510.000	PF 1	4510.00	6189.90	6192.88	6192.88	6194.24	0.014263	10.13	485.26	182.01	1.04
Reach	1500.000	PF 1	4510.00	6189.51	6192.59	6192.59	6193.93	0.014165	10.38	489.86	185.52	1.04
Reach	1490.000	PF 1	4510.00	6189.11	6192.27	6192.27	6193.59	0.014329	10.62	490.36	186.65	1.05
Reach	1480.000	PF 1	4510.00	6188.71	6192.01	6192.00	6193.31	0.014096	10.85	496.28	189.49	1.05
Reach	1470.000	PF 1	4510.00	6188.30	6192.11		6193.11	0.009505	9.80	564.52	194.55	0.89
Reach	1460.000	PF 1	4510.00	6187.91	6191.91		6193.00	0.010288	10.55	542.68	187.48	0.93
Reach	1450.000	PF 1	4510.00	6187.53	6191.44	6191.44	6192.86	0.013944	12.09	477.18	171.00	1.08
Reach	1440.000	PF 1	4510.00	6187.14	6191.13	6191.13	6192.55	0.013788	12.18	477.98	170.70	1.08
Reach	1430.000	PF 1	4510.00	6186.76	6190.76	6190.76	6192.18	0.013586	12.11	479.58	171.52	1.07
Reach	1420.000	PF 1	4510.00	6186.38	6190.38	6190.38	6191.81	0.013669	12.15	478.75	171.94	1.07
Reach	1410.000	PF 1	4510.00	6186.00	6190.01	6190.01	6191.43	0.013712	12.19	479.59	172.69	1.07
Reach	1400.000	PF 1	4510.00	6185.99	6189.79	6189.79	6191.19	0.013631	11.72	482.53	174.36	1.06
Reach	1390.000	PF 1	4510.00	6185.65	6189.53	6189.53	6190.98	0.013338	11.67	476.88	168.05	1.05
Reach	1380.000	PF 1	4510.00	6185.32	6189.21	6189.21	6190.70	0.013619	11.83	471.59	166.29	1.06
Reach	1370.000	PF 1	4510.00	6184.98	6189.10	6189.10	6190.41	0.011964	11.52	518.24	200.32	1.01
Reach	1360.000	PF 1	4510.00	6184.64	6188.63	6188.63	6190.09	0.014203	12.26	493.81	204.14	1.09
Reach	1350.000	PF 1	4510.00	6184.30	6188.62	6188.62	6189.74	0.010532	11.16	577.94	247.76	0.95
Reach	1340.000	PF 1	4510.00	6184.00	6188.25	6188.25	6189.34	0.010820	11.26	577.15	246.83	0.96
Reach	1330.000	PF 1	4510.00	6183.92	6187.89	6187.89	6189.00	0.011865	11.16	563.75	243.26	0.99
Reach	1320.000	PF 1	4510.00	6183.57	6187.62	6187.62	6188.73	0.011691	11.21	562.85	238.71	0.99
Reach	1310.000	PF 1	4510.00	6183.22	6187.22	6187.22	6188.40	0.012826	11.63	538.34	224.28	1.03
Reach	1300.000	PF 1	4510.00	6182.86	6186.86	6186.86	6188.04	0.012885	11.78	530.24	213.51	1.04
Reach	1290.000	PF 1	4510.00	6182.32	6186.49	6186.49	6187.70	0.012807	12.07	525.12	207.81	1.04
Reach	1280.000	PF 1	4510.00	6181.85	6186.25	6186.25	6187.47	0.012656	12.25	523.84	205.13	1.04
Reach	1270.000	PF 1	4510.00	6181.28	6185.73	6185.73	6187.09	0.012928	12.31	489.90	173.24	1.05
Reach	1260.000	PF 1	4510.00	6180.72	6185.32	6185.32	6186.81	0.013880	12.97	469.48	164.86	1.09
Reach	1250.000	PF 1	4510.00	6180.16	6184.85	6184.85	6186.41	0.013726	12.93	461.06	156.92	1.09
Reach	1240.000	PF 1	4510.00	6179.69	6184.41	6184.41	6186.15	0.014614	13.46	441.86	149.95	1.13
Reach	1230.000	PF 1	4510.00	6177.84	6183.93	6183.93	6185.85	0.012450	14.30	445.79	144.53	1.07
Reach	1220.000	PF 1	4510.00	6175.54	6183.70	6183.70	6185.42	0.007759	13.15	506.92	152.83	0.87
Reach	1210.000	PF 1	4510.00	6174.00	6183.37	6183.37	6185.04	0.008024	12.81	519.97	170.41	0.86

Ex 1/3

HEC-RAS I ..... (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	1200.000	PF 1	4510.00	6174.00	6183.17	6183.17	6184.70	0.008017	12.25	535.52	180.22	0.85
Reach	1190.000	PF 1	4510.00	6174.00	6182.77	6182.77	6184.26	0.008085	11.92	536.65	182.38	0.85
Reach	1180.000	PF 1	4510.00	6174.00	6182.26	6182.26	6183.72	0.007500	11.61	546.15	184.97	0.83
Reach	1170.000	PF 1	4510.00	6174.00	6181.80	6181.80	6183.29	0.007443	11.47	542.39	186.08	0.83
Reach	1160.000	PF 1	4510.00	6174.00	6181.46	6181.46	6182.91	0.007393	11.14	546.27	188.73	0.83
Reach	1150.000	PF 1	4510.00	6172.00	6181.00	6181.00	6182.43	0.007292	10.87	547.64	196.07	0.81
Reach	1140.000	PF 1	4510.00	6172.00	6180.26	6180.26	6181.66	0.007590	10.52	546.51	197.76	0.82
Reach	1130.000	PF 1	4510.00	6172.00	6179.46	6179.46	6181.01	0.008348	10.73	506.35	178.21	0.86
Reach	1120.000	PF 1	4510.00	6172.00	6179.15	6179.15	6180.69	0.008118	10.69	512.11	183.87	0.85
Reach	1110.000	PF 1	4510.00	6172.00	6178.75	6178.75	6180.28	0.007398	10.64	521.81	187.35	0.82
Reach	1100.000	PF 1	4510.00	6171.51	6178.38	6178.38	6179.90	0.007390	10.58	523.02	192.19	0.82
Reach	1090.000	PF 1	4510.00	6170.00	6177.89	6177.89	6179.39	0.007829	10.48	524.13	195.99	0.83
Reach	1080.000	PF 1	4510.00	6170.00	6177.47	6177.47	6178.92	0.007979	10.34	530.57	202.39	0.83
Reach	1070.000	PF 1	4510.00	6170.00	6177.12	6177.12	6178.51	0.007828	10.19	546.48	212.69	0.83
Reach	1060.000	PF 1	4510.00	6170.00	6176.85	6176.85	6178.15	0.006794	10.27	583.74	227.31	0.79
Reach	1050.000	PF 1	4510.00	6169.59	6176.51	6176.51	6177.77	0.006522	10.54	607.20	235.84	0.78
Reach	1040.000	PF 1	4510.00	6168.54	6176.02	6176.02	6177.34	0.006601	11.00	606.21	238.43	0.79
Reach	1030.000	PF 1	4510.00	6168.00	6175.56	6175.56	6176.89	0.006706	11.20	607.27	242.55	0.80
Reach	1020.000	PF 1	4510.00	6168.00	6174.90	6174.90	6176.46	0.007869	11.91	567.45	237.38	0.86
Reach	1010.000	PF 1	4510.00	6167.55	6174.88	6174.88	6175.96	0.005167	10.18	722.01	332.54	0.71
Reach	1000.000	PF 1	4510.00	6166.29	6174.42	6174.42	6175.44	0.004837	9.87	741.02	342.01	0.68
Reach	990.0000	PF 1	4510.00	6166.00	6173.96	6173.96	6174.94	0.004914	9.60	747.31	345.45	0.68
Reach	980.0000	PF 1	4510.00	6166.00	6173.24	6173.24	6174.32	0.005714	9.61	692.74	338.31	0.72
Reach	970.0000	PF 1	4510.00	6166.00	6172.59	6172.59	6173.67	0.005940	9.39	674.25	331.65	0.73
Reach	960.0000	PF 1	4510.00	6165.25	6171.89	6171.89	6173.01	0.006180	9.40	650.23	318.22	0.74
Reach	950.0000	PF 1	4510.00	6164.12	6171.21	6171.21	6172.39	0.006608	9.56	627.62	310.33	0.77
Reach	940.0000	PF 1	4510.00	6164.00	6170.70	6170.70	6171.85	0.006567	9.49	633.89	313.39	0.76
Reach	930.0000	PF 1	4510.00	6164.00	6170.32	6170.32	6171.37	0.006051	9.17	670.75	334.86	0.73
Reach	920.0000	PF 1	4510.00	6163.62	6169.93	6169.93	6170.91	0.006042	9.07	695.35	341.25	0.73
Reach	910.0000	PF 1	4510.00	6162.44	6169.48	6169.48	6170.45	0.006326	9.19	699.23	342.68	0.75
Reach	900.0000	PF 1	4510.00	6162.00	6168.99	6168.99	6169.97	0.006378	9.43	702.49	342.75	0.75
Reach	890.0000	PF 1	4510.00	6162.00	6168.02	6168.02	6168.93	0.006277	8.90	715.53	351.08	0.74
Reach	880.0000	PF 1	4510.00	6162.00	6167.38	6167.38	6168.31	0.006435	8.74	703.89	350.65	0.74
Reach	870.0000	PF 1	4510.00	6162.00	6166.84	6166.84	6167.74	0.006731	8.58	699.16	350.41	0.75
Reach	860.0000	PF 1	4510.00	6161.37	6166.22	6166.22	6167.16	0.007159	8.60	680.97	349.89	0.77
Reach	850.0000	PF 1	4510.00	6160.44	6165.52	6165.52	6166.52	0.007463	8.68	655.83	339.77	0.78
Reach	840.0000	PF 1	4510.00	6160.00	6164.73	6164.73	6165.83	0.007884	8.88	615.86	317.15	0.80
Reach	830.0000	PF 1	4510.00	6159.16	6164.24	6164.24	6165.29	0.008076	8.77	625.73	322.49	0.81
Reach	820.0000	PF 1	4510.00	6158.20	6163.74	6163.74	6164.77	0.008118	8.71	633.86	329.10	0.81
Reach	810.0000	PF 1	4510.00	6158.00	6163.27	6163.27	6164.30	0.008227	8.77	639.66	338.19	0.81
Reach	800.0000	PF 1	4510.00	6158.00	6162.95	6162.95	6163.86	0.007668	8.49	678.83	346.00	0.79
Reach	790.0000	PF 1	4510.00	6158.00	6162.45	6162.45	6163.35	0.007699	8.58	683.31	345.25	0.79

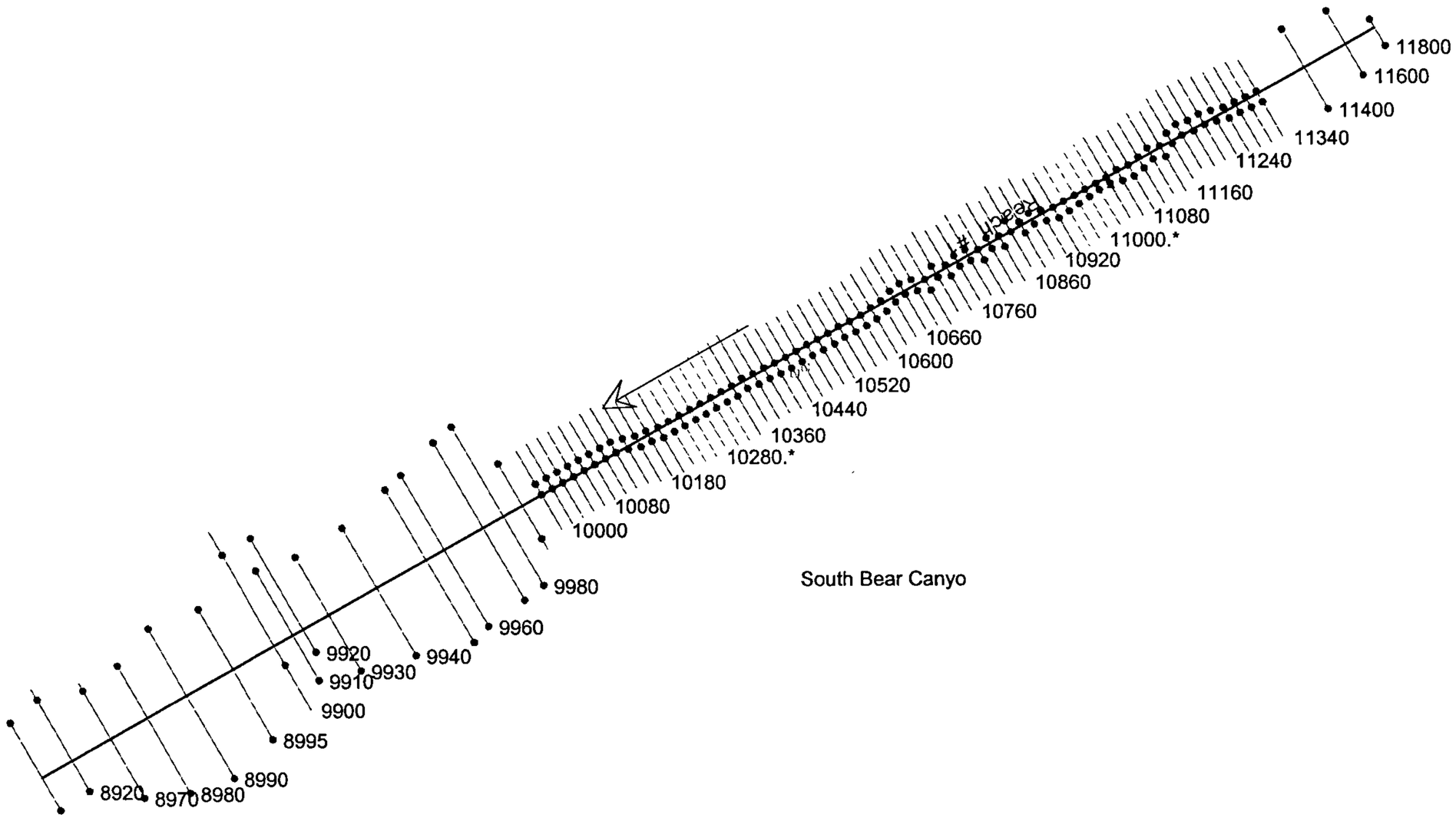
Ex 2/3

HEC-RAS P... (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	780.0000	PF 1	4510.00	6156.59	6161.89	6161.89	6162.80	0.007188	8.65	693.43	347.85	0.77
Reach	770.0000	PF 1	4510.00	6156.00	6161.42	6161.42	6162.32	0.007121	8.77	697.26	348.08	0.77
Reach	760.0000	PF 1	4510.00	6156.00	6160.95	6160.95	6161.83	0.007437	8.83	698.93	346.79	0.79
Reach	750.0000	PF 1	4510.00	6155.68	6160.45	6160.45	6161.33	0.007888	8.94	693.69	344.56	0.81
Reach	740.0000	PF 1	4510.00	6154.81	6159.95	6159.95	6160.84	0.008062	9.06	688.26	342.06	0.82
Reach	730.0000	PF 1	4510.00	6154.00	6159.39	6159.39	6160.29	0.007558	9.09	694.18	340.03	0.80
Reach	720.0000	PF 1	4510.00	6154.00	6158.86	6158.86	6159.76	0.007772	9.12	690.70	337.98	0.80
Reach	710.0000	PF 1	4510.00	6153.32	6158.31	6158.31	6159.21	0.008309	9.18	681.79	336.55	0.83
Reach	700.0000	PF 1	4510.00	6152.42	6157.75	6157.75	6158.65	0.008167	9.12	684.39	336.67	0.82
Reach	690.0000	PF 1	4510.00	6152.00	6157.20	6157.20	6158.10	0.008689	9.10	674.50	336.03	0.84
Reach	680.0000	PF 1	4510.00	6152.00	6156.66	6156.66	6157.56	0.008827	8.98	671.65	335.25	0.84
Reach	670.0000	PF 1	4510.00	6152.00	6156.14	6156.14	6157.03	0.009573	8.90	660.12	333.03	0.87
Reach	660.0000	PF 1	4510.00	6151.29	6155.60	6155.60	6156.51	0.009939	8.89	650.93	330.21	0.88
Reach	650.0000	PF 1	4510.00	6150.00	6155.02	6155.02	6155.92	0.009666	8.79	652.60	329.04	0.87
Reach	640.0000	PF 1	4510.00	6150.00	6154.48	6154.48	6155.37	0.010011	8.71	649.49	328.63	0.88
Reach	630.0000	PF 1	4510.00	6150.00	6154.23	6154.23	6155.25	0.010408	9.11	620.08	313.20	0.90
Reach	620.0000	PF 1	4510.00	6149.29	6153.62	6153.62	6154.75	0.012548	9.62	583.01	307.35	0.98
Reach	610.0000	PF 1	4510.00	6148.00	6153.09	6153.09	6154.17	0.011049	9.37	598.74	302.42	0.92
Reach	600.0000	PF 1	4510.00	6148.00	6152.53	6152.53	6153.65	0.011830	9.59	586.70	296.34	0.95
Reach	590.0000	PF 1	4510.00	6148.00	6152.17	6152.17	6153.21	0.011206	9.51	613.95	323.25	0.93
Reach	580.0000	PF 1	4510.00	6146.89	6151.84	6151.84	6152.74	0.009092	9.05	662.43	327.33	0.85
Reach	570.0000	PF 1	4510.00	6146.00	6151.31	6151.31	6152.22	0.009594	9.18	657.15	329.14	0.87
Reach	560.0000	PF 1	4510.00	6146.00	6150.79	6150.79	6151.69	0.010950	9.20	643.41	330.35	0.92
Reach	550.0000	PF 1	4510.00	6146.00	6150.25	6150.25	6151.14	0.010837	9.22	645.59	329.70	0.91
Reach	540.0000	PF 1	4510.00	6146.00	6149.75	6149.75	6150.64	0.010354	9.26	652.22	329.17	0.90
Reach	530.0000	PF 1	4510.00	6144.72	6149.23	6149.23	6150.12	0.010746	9.33	646.54	329.34	0.91
Reach	520.0000	PF 1	4510.00	6144.00	6148.68	6148.68	6149.56	0.010508	9.37	650.87	330.10	0.91
Reach	510.0000	PF 1	4510.00	6144.00	6148.11	6148.11	6149.01	0.010336	9.50	652.88	332.17	0.91
Reach	500.0000	PF 1	4510.00	6144.00	6147.59	6147.59	6148.48	0.010516	9.49	653.44	334.57	0.91
Reach	490.0000	PF 1	4510.00	6144.00	6147.09	6147.09	6147.98	0.012061	9.43	636.23	335.98	0.96
Reach	480.0000	PF 1	4510.00	6143.40	6146.23	6146.23	6147.13	0.015175	8.96	602.78	334.19	1.03
Reach	470.0000	PF 1	4510.00	6142.00	6145.76	6145.76	6146.66	0.015305	8.80	602.30	335.77	1.03
Reach	460.0000	PF 1	4510.00	6142.00	6145.28	6145.28	6146.18	0.015481	8.57	600.91	335.74	1.03
Reach	450.0000	PF 1	4510.00	6141.54	6144.78	6144.78	6145.68	0.015986	8.46	598.94	340.13	1.04
Reach	440.0000	PF 1	4510.00	6140.34	6144.37	6144.37	6145.25	0.014906	8.79	611.31	344.39	1.02
Reach	430.0000	PF 1	4510.00	6140.00	6143.79	6143.79	6144.68	0.015564	8.51	603.80	345.20	1.02
Reach	420.0000	PF 1	4510.00	6140.00	6143.25	6143.25	6144.13	0.015693	8.16	603.94	347.75	1.02
Reach	410.0000	PF 1	4510.00	6140.00	6142.72	6142.72	6143.60	0.015840	8.13	605.99	353.70	1.02
Reach	400.0000	PF 1	4510.00	6140.00	6142.29	6142.29	6143.16	0.015955	7.72	610.43	361.89	1.01
Reach	390.0000	PF 1	4510.00	6138.65	6141.63	6141.63	6142.51	0.015756	7.38	607.02	355.96	1.00
Reach	380.0000	PF 1	4510.00	6138.00	6141.13	6141.13	6141.99	0.014951	6.96	619.45	362.70	0.96
Reach	370.0000	PF 1	4510.00	6138.00	6140.83		6141.48	0.010642	6.35	708.88	392.04	0.83

Ex 3/3

Exist -SBCA1


11800
11600
11400
11340
11240
11160
11080
11000.*
10920
10860
10760
10660
10600
10520
10440
10360
10280.*
10180
10080
10000
9980
9960
9940
9930
9920
9910
9900
8995
8990
8980
8970
8920
South Bear Canyo

Exist - SBCA 1

HEC-RAS Pla an 02 River: Reach #1 Reach: South Bear Canyo Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
South Bear Canyo	11800	PF 1	237.00	6194.00	6195.32	6195.32	6195.79	0.019826	5.50	43.06	46.43	1.01
South Bear Canyo	11600	PF 1	237.00	6192.00	6192.76	6193.10	6193.81	0.077963	8.22	28.83	47.76	1.86
South Bear Canyo	11400	PF 1	237.00	6188.00	6189.08	6189.25	6189.73	0.036477	6.49	36.51	48.79	1.32
South Bear Canyo	11340	PF 1	237.00	6184.45	6185.64	6185.86	6186.38	0.040985	7.13	35.09	49.17	1.41
South Bear Canyo	11320	PF 1	237.00	6184.00	6184.88	6185.05	6185.51	0.042846	6.06	37.53	58.54	1.38
South Bear Canyo	11300	PF 1	237.00	6182.31	6183.55	6183.85	6184.50	0.055041	8.02	31.11	47.67	1.63
South Bear Canyo	11280	PF 1	237.00	6182.00	6182.85	6183.03	6183.49	0.039266	6.70	38.02	62.63	1.37
South Bear Canyo	11260	PF 1	237.00	6180.82	6181.74	6181.99	6182.59	0.048810	7.54	33.70	60.23	1.53
South Bear Canyo	11240	PF 1	237.00	6180.00	6180.99	6181.19	6181.62	0.042284	6.70	38.47	66.81	1.41
South Bear Canyo	11220	PF 1	237.00	6179.22	6180.25	6180.39	6180.76	0.039776	6.26	43.21	85.27	1.35
South Bear Canyo	11200	PF 1	237.00	6178.09	6178.91	6179.17	6179.75	0.061200	6.44	32.56	53.57	1.60
South Bear Canyo	11180	PF 1	237.00	6177.35	6178.31	6178.43	6178.77	0.031372	5.97	46.80	89.86	1.22
South Bear Canyo	11160	PF 1	237.00	6176.02	6176.58	6176.86	6177.60	0.125596	8.80	30.30	80.73	2.27
South Bear Canyo	11140	PF 1	237.00	6174.75	6176.25	6176.30	6176.62	0.018788	5.19	53.02	95.17	0.97
South Bear Canyo	11120	PF 1	237.00	6174.00	6174.95	6175.27	6175.95	0.051215	7.86	29.64	36.65	1.57
South Bear Canyo	11100	PF 1	237.00	6172.00	6173.46	6173.88	6174.78	0.052297	8.11	26.09	27.48	1.60
South Bear Canyo	11080	PF 1	237.00	6172.00	6173.30	6173.33	6173.83	0.021873	5.81	40.40	41.89	1.06
South Bear Canyo	11060	PF 1	237.00	6171.75	6173.29	6173.29	6173.84	0.015711	5.75	40.90	114.23	0.94
South Bear Canyo	11040.*	PF 1	237.00	6170.67	6170.59	6171.23	6172.86	0.177177		19.60	32.27	0.00
South Bear Canyo	11020.*	PF 1	237.00	6169.59	6170.14	6170.37	6170.86	0.034384	2.66	37.08	58.97	1.04
South Bear Canyo	11000.*	PF 1	237.00	6168.51	6169.20	6169.44	6169.96	0.044330	3.86	36.14	62.73	1.25
South Bear Canyo	10980.*	PF 1	237.00	6167.43	6168.27	6168.46	6168.93	0.044595	4.76	38.19	66.87	1.32
South Bear Canyo	10960	PF 1	237.00	6166.35	6167.29	6167.47	6167.91	0.046792	5.49	38.39	67.49	1.39
South Bear Canyo	10940	PF 1	237.00	6166.00	6166.82	6166.83	6167.17	0.023828	4.82	50.01	76.41	1.05
South Bear Canyo	10920	PF 1	237.00	6164.94	6165.94	6166.15	6166.53	0.039668	6.53	39.56	66.61	1.37
South Bear Canyo	10900	PF 1	237.00	6164.00	6164.75	6164.98	6165.51	0.061856	7.55	34.92	66.92	1.67
South Bear Canyo	10880	PF 1	237.00	6163.66	6164.64	6164.64	6164.95	0.022136	4.79	53.34	86.66	1.02
South Bear Canyo	10860	PF 1	237.00	6162.00	6162.95	6163.28	6164.07	0.089804	8.81	29.04	63.59	2.00
South Bear Canyo	10840	PF 1	237.00	6162.00	6162.68	6162.69	6163.01	0.023316	4.87	52.05	84.20	1.04
South Bear Canyo	10820	PF 1	237.00	6161.01	6161.90	6162.04	6162.41	0.037538	4.82	43.67	83.06	1.24
South Bear Canyo	10800	PF 1	237.00	6160.00	6160.48	6160.73	6161.29	0.088953	7.57	33.16	74.78	1.92
South Bear Canyo	10780	PF 1	237.00	6159.31	6159.93	6160.01	6160.34	0.025488	3.93	48.55	83.10	1.02
South Bear Canyo	10760	PF 1	237.00	6158.00	6158.53	6158.81	6159.44	0.097991	7.01	31.27	68.61	1.95
South Bear Canyo	10740	PF 1	237.00	6157.88	6158.40	6158.42	6158.72	0.017255	3.05	56.42	92.18	0.83
South Bear Canyo	10720	PF 1	237.00	6156.57	6156.92	6157.25	6158.16	0.096483	4.47	29.38	74.34	1.74
South Bear Canyo	10700	PF 1	237.00	6156.00	6156.55	6156.68	6157.04	0.043895	5.82	42.80	83.07	1.38
South Bear Canyo	10680	PF 1	237.00	6155.06	6156.40	6156.40	6156.72	0.016211	4.92	55.90	87.47	0.91
South Bear Canyo	10660	PF 1	237.00	6154.00	6154.92	6155.26	6156.04	0.081141	8.71	28.84	52.44	1.92
South Bear Canyo	10640	PF 1	237.00	6154.00	6154.86	6154.86	6155.21	0.022276	4.61	49.92	72.26	1.01
South Bear Canyo	10620	PF 1	237.00	6152.85	6153.58	6153.85	6154.47	0.087958	8.53	31.78	65.82	1.97
South Bear Canyo	10600	PF 1	237.00	6151.96	6152.34	6152.53	6152.97	0.076997	5.33	37.60	90.04	1.67
South Bear Canyo	10580	PF 1	237.00	6151.14	6151.38	6151.52	6151.90	0.051881	2.27	41.02	84.24	1.16

HEC-RAS Pla . an 02 River: Reach #1 Reach: South Bear Canyo Profile: PF 1 (Continue

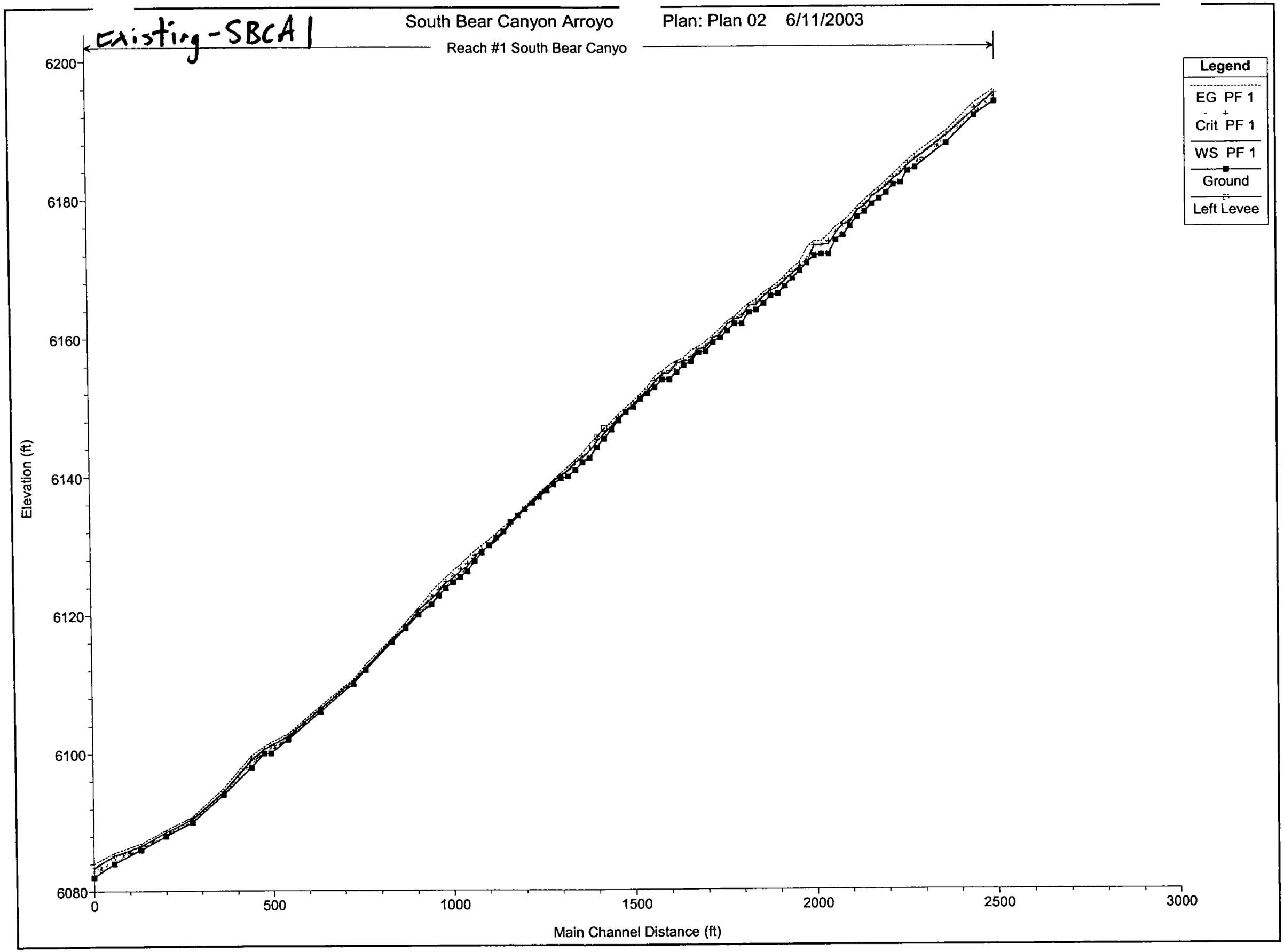
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
South Bear Canyo	10560	PF 1	237.00	6150.00	6150.36	6150.52	6150.91	0.060865	4.66	39.95	87.07	1.47
South Bear Canyo	10540	PF 1	237.00	6149.32	6149.42	6149.56	6149.96	0.046281	1.17	40.14	72.43	0.94
South Bear Canyo	10520	PF 1	237.00	6148.06	6148.40	6148.58	6149.00	0.055171	2.61	38.38	77.23	1.23
South Bear Canyo	10500	PF 1	237.00	6146.74	6147.20	6147.45	6147.93	0.063573	4.39	35.20	68.75	1.48
South Bear Canyo	10480	PF 1	237.00	6145.41	6146.16	6146.42	6146.83	0.054529	5.67	36.30	64.07	1.49
South Bear Canyo	10460	PF 1	237.00	6144.19	6145.05	6145.33	6145.78	0.056503	6.63	34.60	57.70	1.57
South Bear Canyo	10440	PF 1	237.00	6142.66	6143.68	6144.14	6144.64	0.059909	7.72	30.18	42.74	1.66
South Bear Canyo	10420	PF 1	237.00	6142.00	6142.70	6142.95	6143.37	0.058324	6.33	36.98	71.47	1.57
South Bear Canyo	10400	PF 1	237.00	6140.88	6141.98	6142.08	6142.34	0.037451	5.74	51.89	142.32	1.30
South Bear Canyo	10380	PF 1	237.00	6140.00	6140.77	6140.97	6141.36	0.064240	7.24	42.73	139.40	1.68
South Bear Canyo	10360	PF 1	480.00	6139.69	6140.17	6140.20	6140.47	0.031187	3.74	109.83	230.58	1.09
South Bear Canyo	10340.*	PF 1	480.00	6138.79	6139.25	6139.25	6139.50	0.022825	2.92	120.24	232.35	0.91
South Bear Canyo	10320.*	PF 1	480.00	6137.89	6138.27	6138.27	6138.53	0.022193	2.25	119.97	233.39	0.84
South Bear Canyo	10300.*	PF 1	480.00	6136.99	6137.27	6137.27	6137.56	0.023969	1.93	113.81	215.64	0.83
South Bear Canyo	10280.*	PF 1	480.00	6136.10	6136.27	6136.27	6136.56	0.023519	1.28	112.17	205.74	0.75
South Bear Canyo	10260.*	PF 1	480.00	6135.20	6135.21	6135.21	6135.53	0.023543	0.13	105.69	167.62	0.42
South Bear Canyo	10240.*	PF 1	480.00	6134.30	6134.14	6134.14	6134.47	0.023503		103.84	159.51	0.00
South Bear Canyo	10220	PF 1	480.00	6133.40	6133.05	6133.05	6133.38	0.023121		103.18	155.03	0.00
South Bear Canyo	10200	PF 1	480.00	6132.00	6131.69	6131.98	6132.66	0.050334		66.24	107.81	0.00
South Bear Canyo	10180	PF 1	480.00	6131.13	6130.61	6130.98	6131.68	0.045188		63.96	100.37	0.00
South Bear Canyo	10160	PF 1	480.00	6130.00	6129.83	6130.16	6130.80	0.038217		66.48	102.38	0.00
South Bear Canyo	10140	PF 1	480.00	6128.96	6129.25	6129.48	6129.98	0.034283	2.48	76.25	122.83	1.02
South Bear Canyo	10120	PF 1	480.00	6127.71	6128.32	6128.62	6129.22	0.038128	3.59	66.94	105.28	1.16
South Bear Canyo	10100	PF 1	480.00	6126.28	6126.99	6127.41	6128.23	0.060029	5.04	54.54	68.21	1.50
South Bear Canyo	10080	PF 1	480.00	6125.49	6126.30	6126.63	6127.19	0.036810	4.91	65.80	88.94	1.24
South Bear Canyo	10060	PF 1	480.00	6124.67	6125.29	6125.66	6126.37	0.043258	4.12	61.14	83.64	1.26
South Bear Canyo	10040	PF 1	480.00	6123.83	6124.58	6124.85	6125.41	0.043846	4.11	71.50	118.95	1.26
South Bear Canyo	10020	PF 1	480.00	6122.70	6123.33	6123.68	6124.43	0.050671	4.80	59.35	82.37	1.39
South Bear Canyo	10000	PF 1	480.00	6121.44	6122.30	6122.65	6123.38	0.052408	5.58	60.15	83.55	1.46
South Bear Canyo	9990	PF 1	480.00	6120.00	6120.65	6120.65	6120.96	0.022393	4.50	106.77	171.88	1.01
South Bear Canyo	9980	PF 1	673.00	6118.00	6118.22	6118.39	6118.84	0.186080	6.36	105.84	495.90	2.43
South Bear Canyo	9970	PF 1	673.00	6116.00	6116.38	6116.38	6116.56	0.026661	3.49	193.05	518.88	1.01
South Bear Canyo	9960	PF 1	673.00	6112.00	6112.25	6112.41	6112.82	0.140456	6.08	110.72	449.52	2.16
South Bear Canyo	9950	PF 1	673.00	6110.00	6110.38	6110.42	6110.63	0.034720	4.01	167.92	446.33	1.15
South Bear Canyo	9940	PF 1	673.00	6106.00	6106.40	6106.50	6106.79	0.051747	5.03	133.80	341.22	1.42
South Bear Canyo	9930	PF 1	673.00	6102.00	6102.47	6102.54	6102.83	0.037356	4.78	140.77	303.37	1.24
South Bear Canyo	9920	PF 1	673.00	6100.00	6101.12	6101.21	6101.59	0.029472	5.46	123.18	181.83	1.17
South Bear Canyo	9910	PF 1	673.00	6100.00	6100.61	6100.67	6101.00	0.030318	4.98	135.19	234.46	1.16
South Bear Canyo	9900	PF 1	673.00	6098.00	6099.06	6099.24	6099.69	0.043759	6.36	105.90	167.59	1.41
South Bear Canyo	8995	PF 1	673.00	6094.00	6094.39	6094.56	6094.97	0.083263	6.14	109.59	296.00	1.78
South Bear Canyo	8990	PF 1	673.00	6090.00	6090.50	6090.53	6090.80	0.029051	4.36	154.35	316.31	1.10
South Bear Canyo	8980	PF 1	673.00	6088.00	6088.57	6088.58	6088.86	0.024140	4.34	155.12	278.72	1.02

Ex 2/3

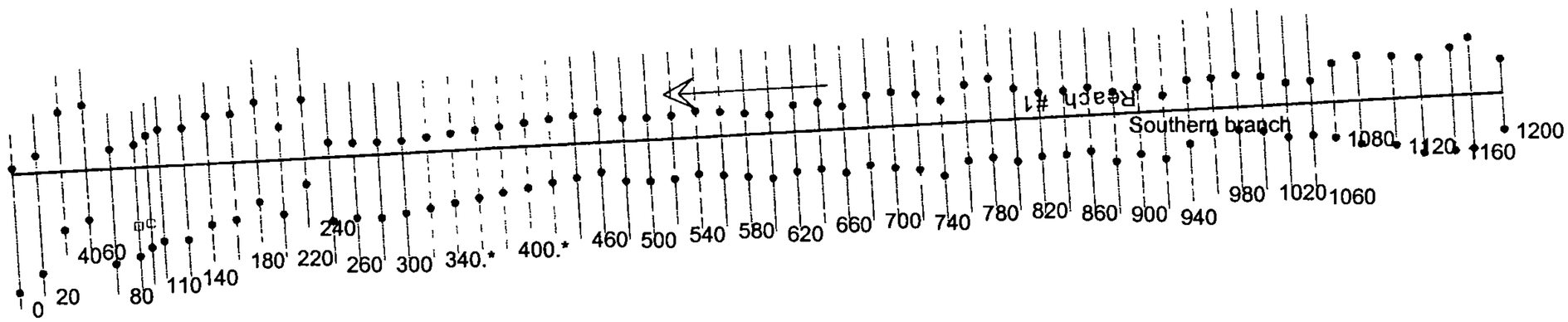
HEC-RAS Pla . an 02 River: Reach #1 Reach: South Bear Canyo Profile: PF 1 (Continue

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
South Bear Canyo	8970	PF 1	673.00	6086.00	6086.57	6086.63	6086.95	0.031211	4.93	136.53	245.59	1.17
South Bear Canyo	8920	PF 1	673.00	6084.00	6085.19	6085.19	6085.59	0.020796	5.09	132.31	167.45	1.01
South Bear Canyo	8910	PF 1	673.00	6082.00	6083.35	6083.53	6083.99	0.037923	6.43	104.70	146.35	1.34

Ex 3/3


Existing-SBCA1
South Bear Canyon Arroyo
Plan: Plan 02 6/11/2003
Reach #1 South Bear Canyo
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Left Levee
Elevation (ft)
6200
6180
6160
6140
6120
6100
6080
0
500
1000
1500
2000
2500
3000
Main Channel Distance (ft)

Ex1 J - SBCA2


Reach #1
Southern branch
0
20
40
60
80
110
140
180
220
240
260
300
340.*
400.*
460
500
540
580
620
660
700
740
780
820
860
900
940
980
1020
1060
1080
1120
1160
1200

Ex ing SBCA 2

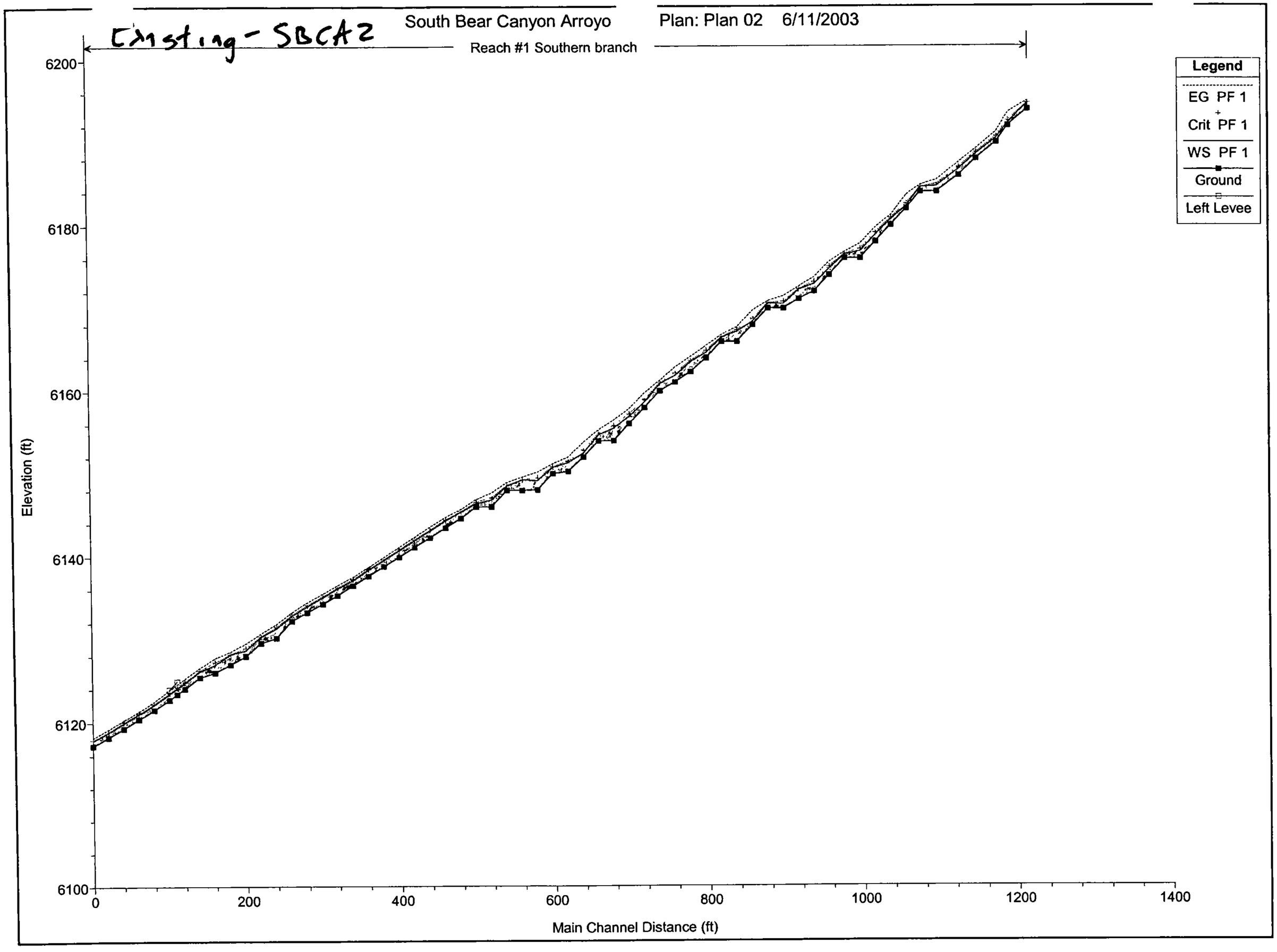
HEC-RAS Pla n 02 River: Reach #1 Reach: Southern branch Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Southern branch	1200	PF 1	39.00	6194.00	6194.73	6194.73	6195.03	0.022799	4.34	8.98	15.26	1.00
Southern branch	1180	PF 1	39.00	6192.00	6192.32	6192.63	6193.58	0.246395	9.02	4.32	14.72	2.93
Southern branch	1160	PF 1	39.00	6190.00	6190.50	6190.73	6191.26	0.093220	6.98	5.59	13.43	1.91
Southern branch	1140	PF 1	39.00	6188.00	6188.59	6188.78	6189.20	0.067217	6.30	6.19	13.57	1.64
Southern branch	1120	PF 1	39.00	6186.00	6186.75	6187.00	6187.55	0.079674	7.18	5.43	11.05	1.81
Southern branch	1100	PF 1	39.00	6184.00	6184.72	6184.94	6185.44	0.067305	6.85	5.70	10.96	1.67
Southern branch	1080	PF 1	39.00	6184.00	6184.58	6184.58	6184.84	0.024596	4.11	9.49	18.59	1.01
Southern branch	1060	PF 1	39.00	6182.00	6182.27	6182.57	6183.61	0.338316	9.31	4.19	17.29	3.33
Southern branch	1040	PF 1	39.00	6180.00	6180.71	6180.85	6181.18	0.052554	5.51	7.08	15.81	1.45
Southern branch	1020	PF 1	39.00	6178.00	6178.83	6179.10	6179.70	0.103823	7.52	5.19	12.08	2.02
Southern branch	1000	PF 1	39.00	6176.00	6176.85	6177.14	6177.75	0.091406	7.61	5.13	10.61	1.93
Southern branch	980	PF 1	39.00	6176.00	6176.47	6176.52	6176.76	0.037526	4.39	8.89	21.77	1.21
Southern branch	960	PF 1	39.00	6174.00	6174.77	6175.03	6175.58	0.095311	7.21	5.41	12.62	1.94
Southern branch	940	PF 1	39.00	6172.00	6172.90	6173.17	6173.72	0.090275	7.26	5.37	11.74	1.89
Southern branch	920	PF 1	39.00	6171.09	6172.24	6172.29	6172.59	0.031596	4.72	8.27	15.83	1.15
Southern branch	900	PF 1	39.00	6170.00	6170.54	6170.82	6171.45	0.113613	7.62	5.12	12.50	2.10
Southern branch	880	PF 1	39.00	6170.00	6170.63	6170.63	6170.88	0.024245	4.02	9.71	19.54	1.00
Southern branch	860	PF 1	39.00	6168.00	6168.42	6168.76	6169.71	0.200306	9.10	4.28	12.30	2.72
Southern branch	840	PF 1	39.00	6166.00	6167.23	6167.40	6167.76	0.047400	5.84	6.68	12.43	1.40
Southern branch	820	PF 1	39.00	6166.00	6166.49	6166.57	6166.83	0.040372	4.63	8.43	20.15	1.26
Southern branch	800	PF 1	39.00	6164.00	6164.69	6164.93	6165.50	0.116593	7.19	5.42	14.74	2.09
Southern branch	780	PF 1	39.00	6162.35	6163.55	6163.71	6164.17	0.039900	6.36	6.13	8.64	1.33
Southern branch	760	PF 1	39.00	6161.06	6161.90	6162.19	6162.91	0.102960	8.08	4.82	9.96	2.05
Southern branch	740	PF 1	39.00	6160.00	6160.89	6161.00	6161.29	0.053118	5.06	7.71	19.49	1.42
Southern branch	720	PF 1	39.00	6158.00	6158.67	6159.02	6159.78	0.103382	8.44	4.62	8.90	2.06
Southern branch	700	PF 1	39.00	6156.05	6156.94	6157.23	6157.87	0.082963	7.75	5.03	9.35	1.86
Southern branch	680	PF 1	39.00	6154.00	6155.53	6155.82	6156.48	0.059470	7.84	4.98	6.51	1.58
Southern branch	660	PF 1	39.00	6154.00	6154.77	6154.93	6155.36	0.043195	6.21	6.28	9.84	1.37
Southern branch	640	PF 1	39.00	6152.00	6152.52	6152.89	6153.81	0.155731	9.11	4.28	10.06	2.46
Southern branch	620	PF 1	39.00	6150.28	6151.35	6151.55	6152.04	0.048460	6.66	5.86	9.03	1.46
Southern branch	600	PF 1	39.00	6150.00	6150.78	6150.86	6151.20	0.030654	5.19	7.52	12.11	1.16
Southern branch	580	PF 1	39.00	6148.04	6149.18	6149.50	6150.19	0.083164	8.08	4.83	8.28	1.86
Southern branch	560	PF 1	39.00	6148.00	6149.26	6149.26	6149.58	0.023357	4.56	8.56	13.67	1.01
Southern branch	540	PF 1	39.00	6148.00	6148.52	6148.62	6148.93	0.045090	5.17	7.54	16.51	1.35
Southern branch	520	PF 1	39.00	6146.00	6146.82	6147.09	6147.66	0.089024	7.35	5.30	11.36	1.90
Southern branch	500	PF 1	39.00	6146.00	6146.39	6146.55	6146.88	0.085098	5.61	6.95	21.82	1.75
Southern branch	480	PF 1	39.00	6144.58	6145.38	6145.46	6145.70	0.040567	4.51	8.65	21.59	1.26
Southern branch	460	PF 1	83.00	6143.45	6144.32	6144.43	6144.75	0.050878	5.26	15.77	37.03	1.42
Southern branch	440.*	PF 1	83.00	6142.28	6143.10	6143.24	6143.58	0.065233	5.57	14.89	38.68	1.58
Southern branch	420.*	PF 1	83.00	6141.12	6141.94	6142.06	6142.35	0.056441	5.13	16.17	42.63	1.47
Southern branch	400.*	PF 1	83.00	6139.95	6140.75	6140.87	6141.16	0.062860	5.15	16.13	45.95	1.53
Southern branch	380.*	PF 1	83.00	6138.79	6139.57	6139.67	6139.93	0.059144	4.81	17.25	51.92	1.47

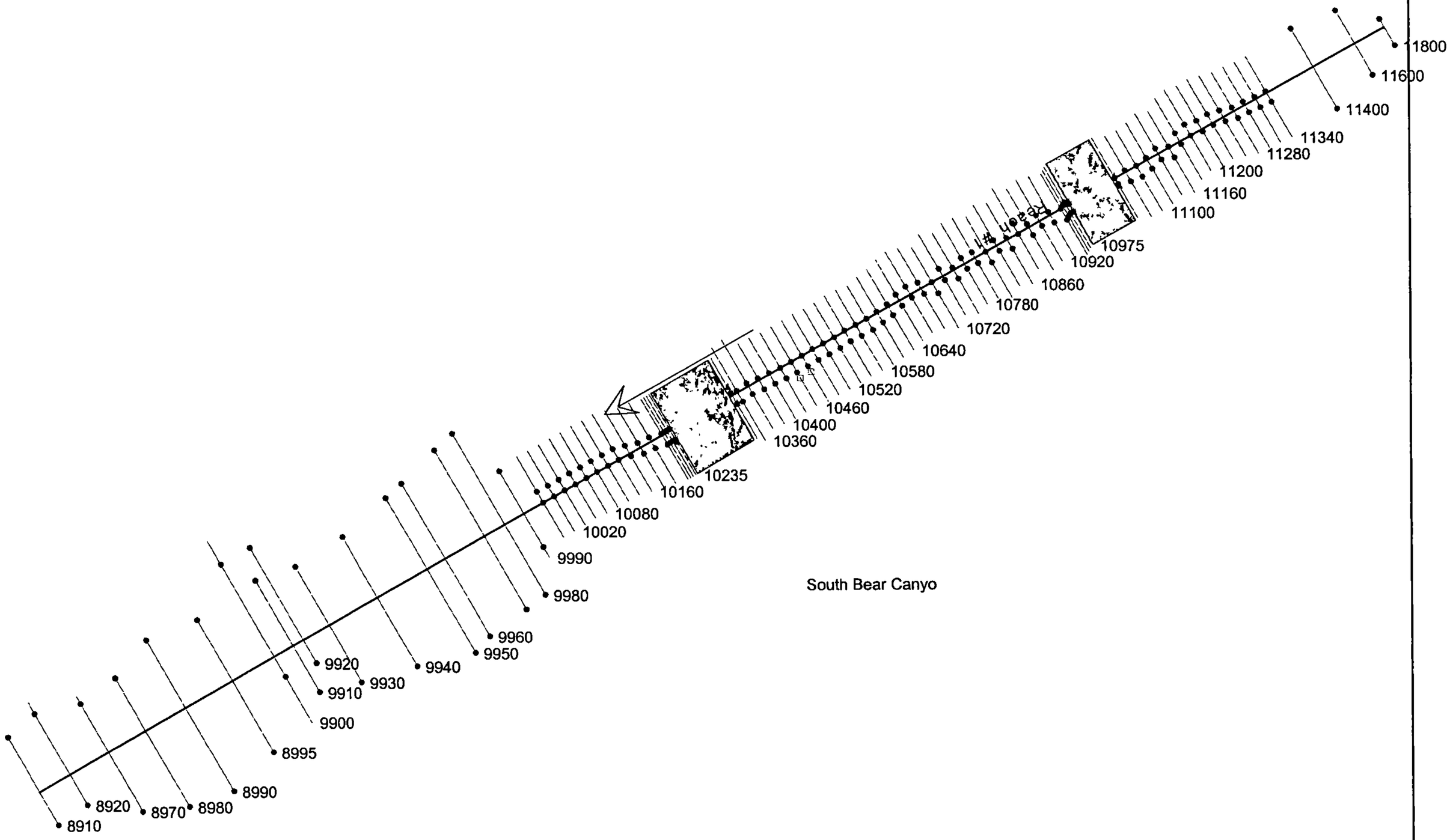
EX 1/2

HEC-RAS Pla an 02 River: Reach #1 Reach: Southern branch Profile: PF 1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Southern branch	360	PF 1	83.00	6137.62	6138.37	6138.47	6138.72	0.061794	4.72	17.60	57.67	1.49
Southern branch	340	PF 1	83.00	6136.46	6137.10	6137.26	6137.53	0.055993	5.36	15.97	43.01	1.48
Southern branch	320	PF 1	193.00	6135.29	6136.15	6136.23	6136.51	0.048203	4.64	40.22	104.48	1.35
Southern branch	300	PF 1	193.00	6134.28	6135.08	6135.21	6135.53	0.052088	5.17	36.34	85.57	1.43
Southern branch	280	PF 1	193.00	6133.24	6133.97	6134.13	6134.46	0.059439	5.57	34.49	82.57	1.53
Southern branch	260	PF 1	193.00	6132.21	6132.84	6132.96	6133.26	0.061855	5.25	37.29	104.10	1.53
Southern branch	240	PF 1	193.00	6130.19	6131.34	6131.51	6131.87	0.079122	5.82	33.19	93.52	1.72
Southern branch	220	PF 1	193.00	6129.59	6130.33	6130.41	6130.70	0.042029	4.85	39.83	91.89	1.30
Southern branch	200	PF 1	193.00	6128.00	6128.73	6128.97	6129.50	0.083612	7.05	27.38	60.24	1.84
Southern branch	180	PF 1	193.00	6126.95	6128.25	6128.25	6128.54	0.024366	4.30	44.84	82.06	1.03
Southern branch	160	PF 1	193.00	6126.00	6126.96	6127.30	6127.77	0.057381	7.22	26.75	42.84	1.61
Southern branch	140	PF 1	193.00	6125.46	6126.19	6126.29	6126.58	0.049127	5.00	38.63	95.70	1.39
Southern branch	120	PF 1	193.00	6124.08	6124.77	6124.93	6125.31	0.082839	5.89	32.77	93.82	1.76
Southern branch	110	PF 1	193.00	6123.41	6124.16	6124.29	6124.60	0.059285	5.32	36.29	94.23	1.51
Southern branch	100	PF 1	193.00	6122.74	6123.48	6123.60	6123.95	0.068864	5.51	35.00	96.31	1.61
Southern branch	80	PF 1	193.00	6121.53	6122.19	6122.29	6122.56	0.067277	4.91	39.28	126.26	1.55
Southern branch	60	PF 1	193.00	6120.42	6121.03	6121.12	6121.36	0.052953	4.57	42.25	126.61	1.39
Southern branch	40	PF 1	193.00	6119.30	6119.96	6120.07	6120.31	0.051119	4.78	40.38	110.11	1.39
Southern branch	20	PF 1	193.00	6118.23	6118.84	6118.95	6119.23	0.056258	5.08	38.43	104.61	1.46
Southern branch	0	PF 1	193.00	6117.21	6117.86	6117.94	6118.19	0.046679	4.63	41.93	112.45	1.33

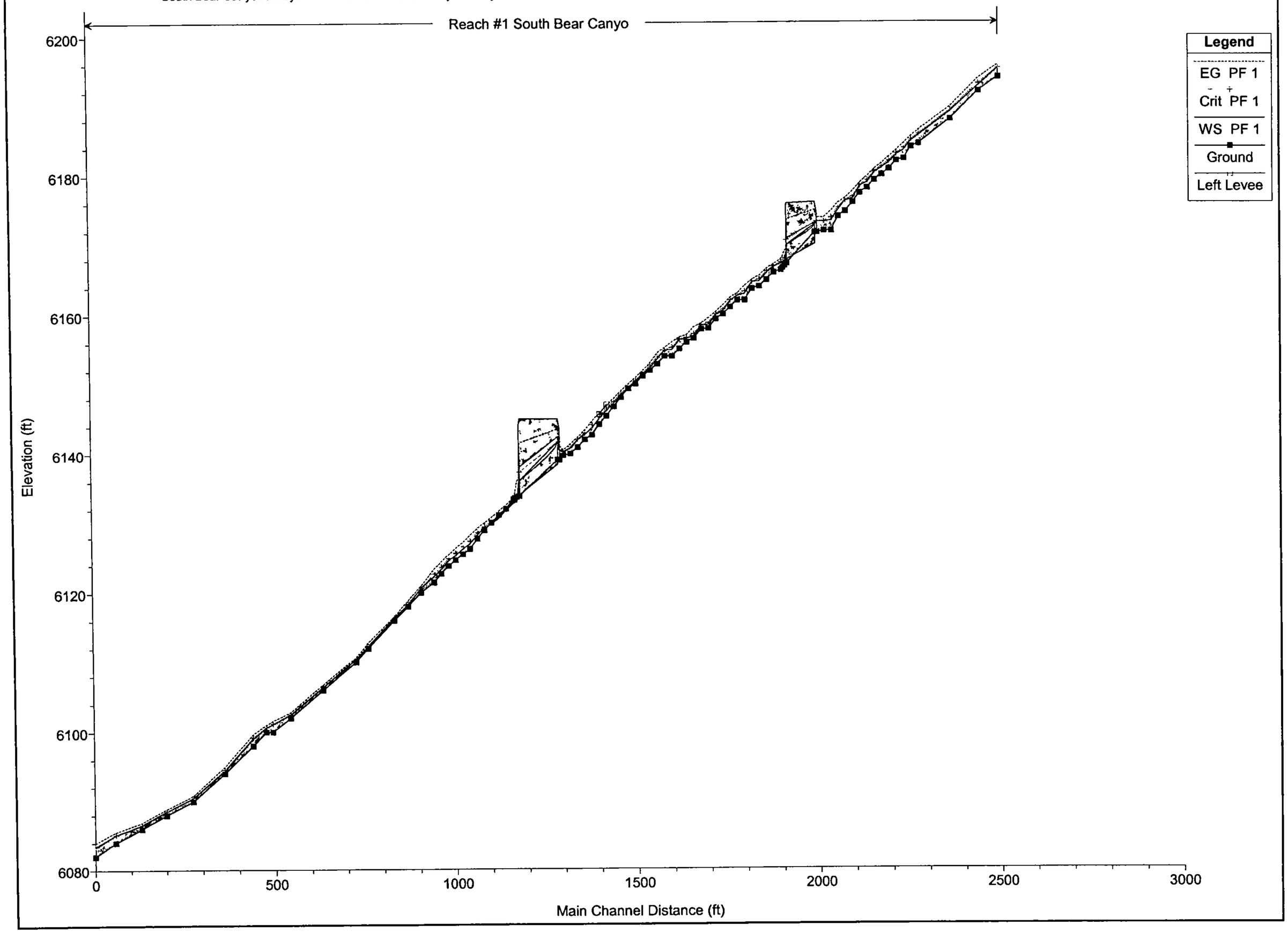

Existing - SBCA2
South Bear Canyon Arroyo
Plan: Plan 02 6/11/2003
Reach #1 Southern branch
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Left Levee
Elevation (ft)
6200
6180
6160
6140
6120
6100
0
200
400
600
800
1000
1200
1400
Main Channel Distance (ft)

Proposed SBCA 1



Pr sed SBCA 1

South Bear Canyon Arroyo 1 Plan: South Bear Canyon Arroyo 1--two sets of culverts ed. Upstream set is 3-36" culverts and downstream set is 4-48 inch culverts. 6/10/2003



Pr red SBCA 1

HEC-RAS Pla an 01 River: Reach #1 Reach: South Bear Canyo Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
South Bear Canyo	11800	PF 1	237.00	6194.00	6195.32	6195.32	6195.79	0.019826	5.50	43.06	46.43	1.01
South Bear Canyo	11600	PF 1	237.00	6192.00	6192.76	6193.10	6193.81	0.077963	8.22	28.83	47.76	1.86
South Bear Canyo	11400	PF 1	237.00	6188.00	6189.08	6189.25	6189.73	0.036477	6.49	36.51	48.79	1.32
South Bear Canyo	11340	PF 1	237.00	6184.45	6185.64	6185.86	6186.38	0.040985	7.13	35.09	49.17	1.41
South Bear Canyo	11320	PF 1	237.00	6184.00	6184.88	6185.05	6185.51	0.042846	6.06	37.53	58.54	1.38
South Bear Canyo	11300	PF 1	237.00	6182.31	6183.55	6183.85	6184.50	0.055041	8.02	31.11	47.67	1.63
South Bear Canyo	11280	PF 1	237.00	6182.00	6182.85	6183.03	6183.49	0.039266	6.70	38.02	62.63	1.37
South Bear Canyo	11260	PF 1	237.00	6180.82	6181.74	6181.99	6182.59	0.048810	7.54	33.70	60.23	1.53
South Bear Canyo	11240	PF 1	237.00	6180.00	6180.99	6181.19	6181.62	0.042284	6.70	38.47	66.81	1.41
South Bear Canyo	11220	PF 1	237.00	6179.22	6180.25	6180.39	6180.76	0.039776	6.26	43.21	85.27	1.35
South Bear Canyo	11200	PF 1	237.00	6178.09	6178.91	6179.17	6179.75	0.061200	6.44	32.56	53.57	1.60
South Bear Canyo	11180	PF 1	237.00	6177.35	6178.31	6178.43	6178.77	0.031372	5.97	46.80	89.86	1.22
South Bear Canyo	11160	PF 1	237.00	6176.02	6176.58	6176.86	6177.60	0.125596	8.80	30.30	80.73	2.27
South Bear Canyo	11140	PF 1	237.00	6174.75	6176.25	6176.30	6176.62	0.018788	5.19	53.02	95.17	0.97
South Bear Canyo	11120	PF 1	237.00	6174.00	6174.95	6175.27	6175.95	0.051215	7.86	29.64	36.65	1.57
South Bear Canyo	11100	PF 1	237.00	6172.00	6173.46	6173.88	6174.78	0.052297	8.11	26.09	27.48	1.60
South Bear Canyo	11080	PF 1	237.00	6172.00	6173.30	6173.33	6173.83	0.021873	5.81	40.40	41.89	1.06
South Bear Canyo	11060	PF 1	237.00	6171.75	6173.29	6173.29	6173.84	0.015711	5.75	40.90	114.23	0.94
South Bear Canyo	11017.5		Culvert									
South Bear Canyo	10975	PF 1	237.00	6167.29	6168.76	6168.76	6169.33	0.017438	5.88	39.79	92.20	0.94
South Bear Canyo	10970	PF 1	237.00	6166.98	6167.64	6168.01	6169.03	0.186406	9.69	25.03	63.71	2.70
South Bear Canyo	10965	PF 1	237.00	6166.66	6167.48	6167.72	6168.27	0.074595	6.85	33.32	66.18	1.75
South Bear Canyo	10960	PF 1	237.00	6166.35	6167.29	6167.47	6167.91	0.047034	5.50	38.32	67.45	1.40
South Bear Canyo	10940	PF 1	237.00	6166.00	6166.82	6166.83	6167.17	0.023775	4.81	50.05	76.42	1.05
South Bear Canyo	10920	PF 1	237.00	6164.94	6165.94	6166.15	6166.53	0.039766	6.53	39.52	66.59	1.37
South Bear Canyo	10900	PF 1	237.00	6164.00	6164.75	6164.98	6165.51	0.061689	7.54	34.95	66.94	1.67
South Bear Canyo	10880	PF 1	237.00	6163.66	6164.64	6164.64	6164.95	0.022136	4.79	53.34	86.66	1.02
South Bear Canyo	10860	PF 1	237.00	6162.00	6162.95	6163.28	6164.07	0.089804	8.81	29.04	63.59	2.00
South Bear Canyo	10840	PF 1	237.00	6162.00	6162.68	6162.69	6163.01	0.023316	4.87	52.05	84.20	1.04
South Bear Canyo	10820	PF 1	237.00	6161.01	6161.90	6162.04	6162.41	0.037538	4.82	43.67	83.06	1.24
South Bear Canyo	10800	PF 1	237.00	6160.00	6160.48	6160.73	6161.29	0.088953	7.57	33.16	74.78	1.92
South Bear Canyo	10780	PF 1	237.00	6159.31	6159.93	6160.01	6160.34	0.025488	3.93	48.55	83.10	1.02
South Bear Canyo	10760	PF 1	237.00	6158.00	6158.53	6158.81	6159.44	0.097991	7.01	31.27	68.61	1.95
South Bear Canyo	10740	PF 1	237.00	6157.88	6158.40	6158.42	6158.72	0.017255	3.05	56.42	92.18	0.83
South Bear Canyo	10720	PF 1	237.00	6156.57	6156.92	6157.25	6158.16	0.096483	4.47	29.38	74.34	1.74
South Bear Canyo	10700	PF 1	237.00	6156.00	6156.55	6156.68	6157.04	0.043895	5.82	42.80	83.07	1.38
South Bear Canyo	10680	PF 1	237.00	6155.06	6156.40	6156.40	6156.72	0.016211	4.92	55.90	87.47	0.91
South Bear Canyo	10660	PF 1	237.00	6154.00	6154.92	6155.26	6156.04	0.081141	8.71	28.84	52.44	1.92
South Bear Canyo	10640	PF 1	237.00	6154.00	6154.86	6154.86	6155.21	0.022276	4.61	49.92	72.26	1.01
South Bear Canyo	10620	PF 1	237.00	6152.85	6153.58	6153.85	6154.47	0.087958	8.53	31.78	65.82	1.97
South Bear Canyo	10600	PF 1	237.00	6151.96	6152.34	6152.53	6152.97	0.076997	5.33	37.60	90.04	1.67
South Bear Canyo	10580	PF 1	237.00	6151.14	6151.38	6151.52	6151.90	0.051881	2.27	41.02	84.24	1.16

HEC-RAS Pla an 01 River: Reach #1 Reach: South Bear Canyo Profile: PF 1 (Continue

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
South Bear Canyo	10560	PF 1	237.00	6150.00	6150.36	6150.52	6150.91	0.060865	4.66	39.95	87.07	1.47
South Bear Canyo	10540	PF 1	237.00	6149.32	6149.42	6149.56	6149.96	0.046281	1.17	40.14	72.43	0.94
South Bear Canyo	10520	PF 1	237.00	6148.06	6148.40	6148.58	6149.00	0.055171	2.61	38.38	77.23	1.23
South Bear Canyo	10500	PF 1	237.00	6146.74	6147.20	6147.45	6147.93	0.063573	4.39	35.20	68.75	1.48
South Bear Canyo	10480	PF 1	237.00	6145.41	6146.16	6146.42	6146.83	0.054529	5.67	36.30	64.07	1.49
South Bear Canyo	10460	PF 1	237.00	6144.19	6145.05	6145.33	6145.78	0.056503	6.63	34.60	57.70	1.57
South Bear Canyo	10440	PF 1	237.00	6142.66	6143.68	6144.14	6144.64	0.059909	7.72	30.18	42.74	1.66
South Bear Canyo	10420	PF 1	237.00	6142.00	6142.70	6142.95	6143.37	0.058324	6.33	36.98	71.47	1.57
South Bear Canyo	10400	PF 1	237.00	6140.88	6141.98	6142.08	6142.34	0.037451	5.74	51.89	142.32	1.30
South Bear Canyo	10380	PF 1	237.00	6140.00	6140.77	6140.97	6141.36	0.064240	7.24	42.73	139.40	1.68
South Bear Canyo	10360	PF 1	480.00	6139.69	6140.17	6140.20	6140.47	0.031187	3.74	109.83	230.58	1.09
South Bear Canyo	10350	PF 1	480.00	6139.06	6140.53	6140.53	6141.15	0.017124	6.56	76.13	250.69	1.00
South Bear Canyo	10292.5		Culvert									
South Bear Canyo	10235	PF 1	480.00	6133.85	6135.70	6135.70	6136.40	0.016207	6.90	71.71	274.05	1.00
South Bear Canyo	10230	PF 1	480.00	6133.70	6132.95	6133.52	6135.95	0.428692		34.54	89.81	0.00
South Bear Canyo	10225	PF 1	480.00	6133.55	6132.88	6133.29	6134.27	0.149529		50.64	106.07	0.00
South Bear Canyo	10220	PF 1	480.00	6133.40	6132.79	6133.05	6133.59	0.071876		66.63	121.64	0.00
South Bear Canyo	10200	PF 1	480.00	6132.00	6131.75	6131.97	6132.54	0.039225		73.50	114.61	0.00
South Bear Canyo	10180	PF 1	480.00	6131.13	6130.62	6130.98	6131.67	0.044374		64.55	100.89	0.00
South Bear Canyo	10160	PF 1	480.00	6130.00	6129.83	6130.16	6130.80	0.038157		66.53	102.44	0.00
South Bear Canyo	10140	PF 1	480.00	6128.96	6129.25	6129.48	6129.97	0.034074	2.48	76.43	122.93	1.01
South Bear Canyo	10120	PF 1	480.00	6127.71	6128.32	6128.62	6129.22	0.038128	3.59	66.94	105.28	1.16
South Bear Canyo	10100	PF 1	480.00	6126.28	6126.99	6127.41	6128.23	0.060029	5.04	54.54	68.21	1.50
South Bear Canyo	10080	PF 1	480.00	6125.49	6126.30	6126.63	6127.19	0.036810	4.91	65.80	88.94	1.24
South Bear Canyo	10060	PF 1	480.00	6124.67	6125.29	6125.66	6126.37	0.043258	4.12	61.14	83.64	1.26
South Bear Canyo	10040	PF 1	480.00	6123.83	6124.58	6124.85	6125.41	0.043846	4.11	71.50	118.95	1.26
South Bear Canyo	10020	PF 1	480.00	6122.70	6123.33	6123.68	6124.43	0.050671	4.80	59.35	82.37	1.39
South Bear Canyo	10000	PF 1	480.00	6121.44	6122.30	6122.65	6123.38	0.052408	5.58	60.15	83.55	1.46
South Bear Canyo	9990	PF 1	480.00	6120.00	6120.65	6120.65	6120.96	0.022393	4.50	106.77	171.88	1.01
South Bear Canyo	9980	PF 1	673.00	6118.00	6118.22	6118.39	6118.84	0.186080	6.36	105.84	495.90	2.43
South Bear Canyo	9970	PF 1	673.00	6116.00	6116.38	6116.38	6116.56	0.026661	3.49	193.05	518.88	1.01
South Bear Canyo	9960	PF 1	673.00	6112.00	6112.25	6112.41	6112.82	0.140456	6.08	110.72	449.52	2.16
South Bear Canyo	9950	PF 1	673.00	6110.00	6110.38	6110.42	6110.63	0.034720	4.01	167.92	446.33	1.15
South Bear Canyo	9940	PF 1	673.00	6106.00	6106.40	6106.50	6106.79	0.051747	5.03	133.80	341.22	1.42
South Bear Canyo	9930	PF 1	673.00	6102.00	6102.47	6102.54	6102.83	0.037356	4.78	140.77	303.37	1.24
South Bear Canyo	9920	PF 1	673.00	6100.00	6101.12	6101.21	6101.59	0.029472	5.46	123.18	181.83	1.17
South Bear Canyo	9910	PF 1	673.00	6100.00	6100.61	6100.67	6101.00	0.030318	4.98	135.19	234.46	1.16
South Bear Canyo	9900	PF 1	673.00	6098.00	6099.06	6099.24	6099.69	0.043759	6.36	105.90	167.59	1.41
South Bear Canyo	8995	PF 1	673.00	6094.00	6094.39	6094.56	6094.97	0.083263	6.14	109.59	296.00	1.78
South Bear Canyo	8990	PF 1	673.00	6090.00	6090.50	6090.53	6090.80	0.029051	4.36	154.35	316.31	1.10
South Bear Canyo	8980	PF 1	673.00	6088.00	6088.57	6088.58	6088.86	0.024140	4.34	155.12	278.72	1.02
South Bear Canyo	8970	PF 1	673.00	6086.00	6086.57	6086.63	6086.95	0.031211	4.93	136.53	245.59	1.17

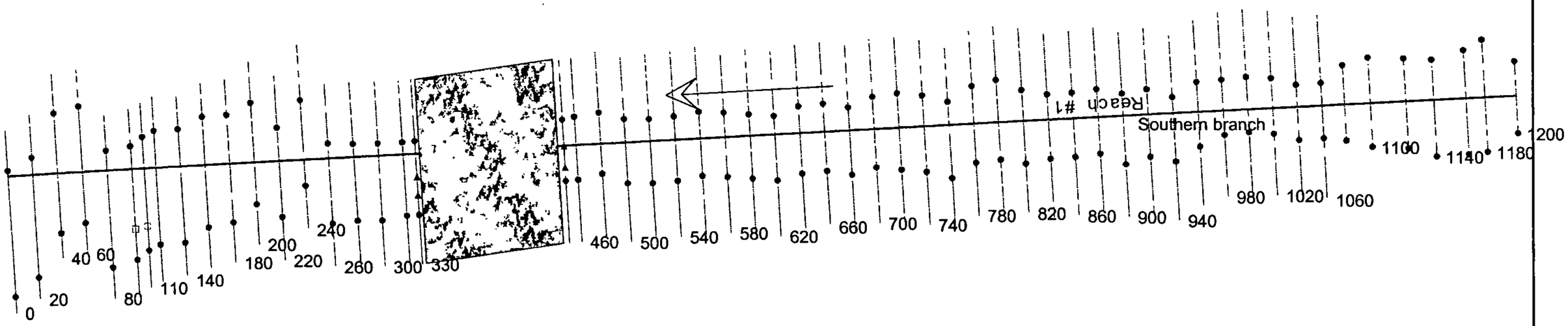
Pro 2/3

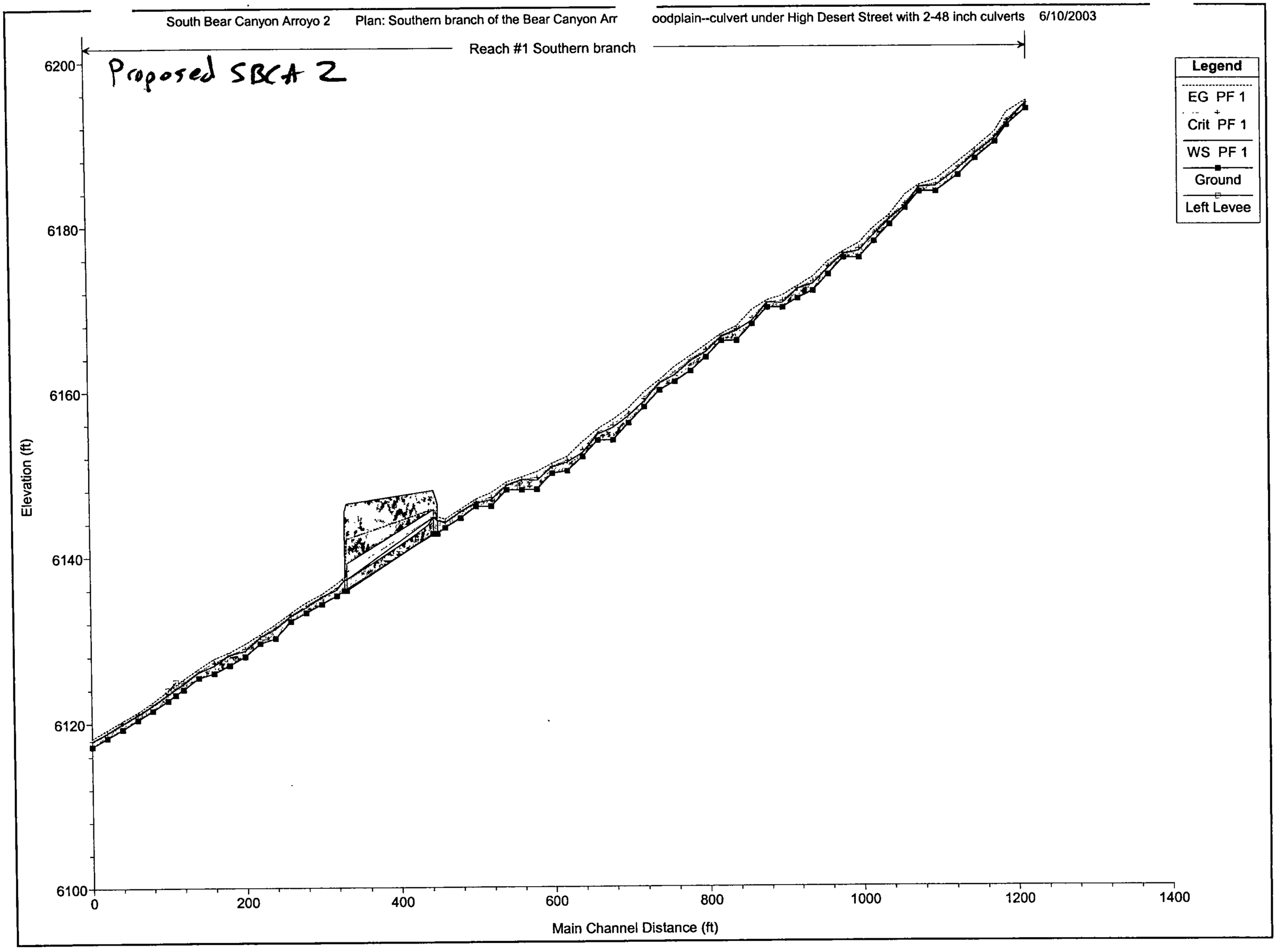
HEC-RAS Pla an 01 River: Reach #1 Reach: South Bear Canyo Profile: PF 1 (Continue

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
South Bear Canyo	8920	PF 1	673.00	6084.00	6085.19	6085.19	6085.59	0.020796	5.09	132.31	167.45	1.01
South Bear Canyo	8910	PF 1	673.00	6082.00	6083.35	6083.53	6083.99	0.037923	6.43	104.70	146.35	1.34

Item # 6

Prop d SBCA 2


Reach #1
Southern branch
0
20
40
60
80
110
140
180
200
220
240
260
300
330
460
500
540
580
620
660
700
740
780
820
860
900
940
980
1020
1060
1100
1140
1180
1200


South Bear Canyon Arroyo 2
Plan: Southern branch of the Bear Canyon Arr
oodplain--culvert under High Desert Street with 2-48 inch culverts
6/10/2003
Reach #1 Southern branch
Proposed SBCA 2
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Left Levee
Elevation (ft)
6200
6180
6160
6140
6120
6100
0
200
400
600
800
1000
1200
1400
Main Channel Distance (ft)

P posed SBCA 2

HEC-RAS Plan. an 01 River: Reach #1 Reach: Southern branch Profile: PF 1

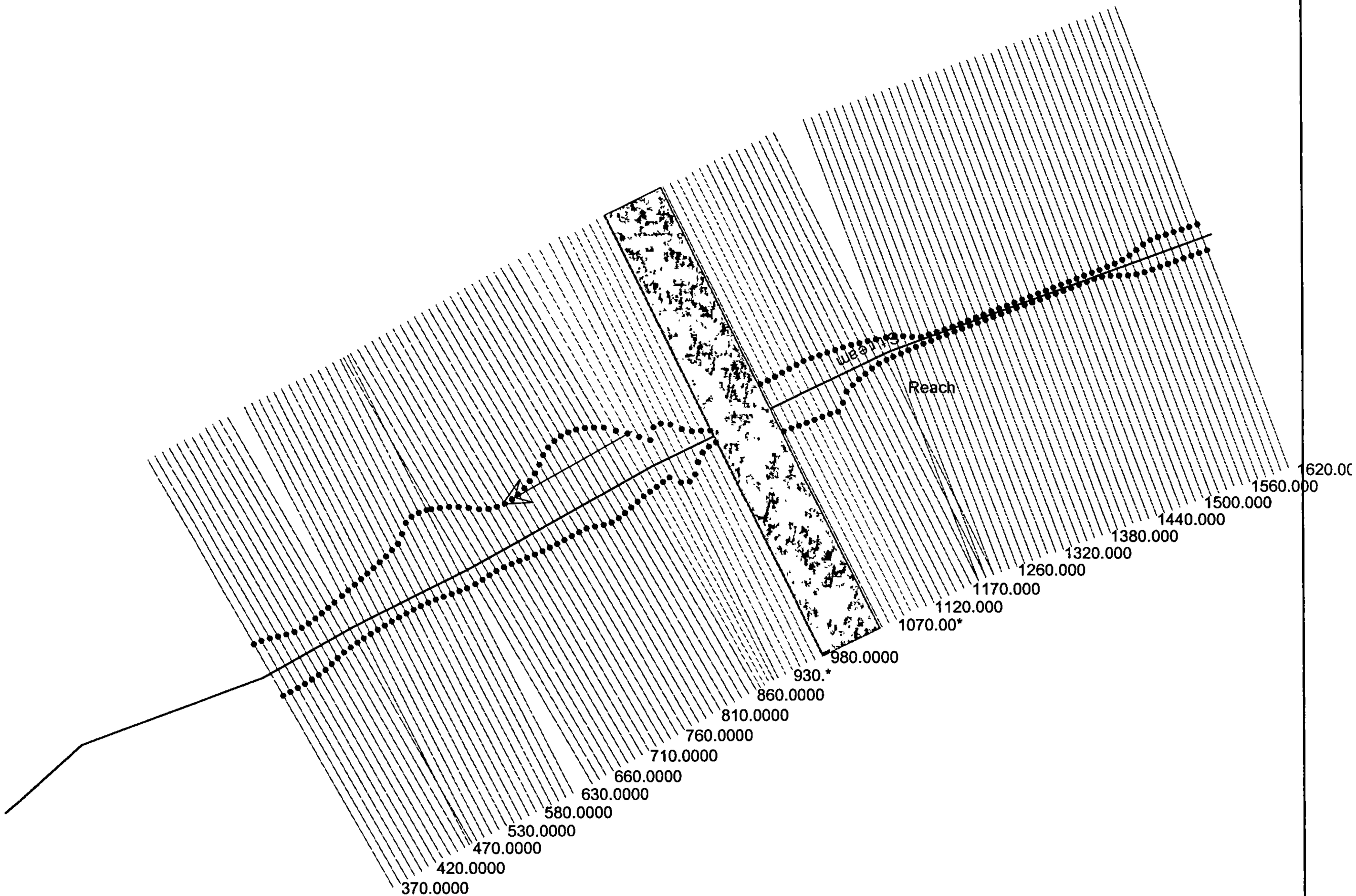
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Southern branch	1200	PF 1	39.00	6194.00	6194.73	6194.73	6195.03	0.022799	4.34	8.98	15.26	1.00
Southern branch	1180	PF 1	39.00	6192.00	6192.32	6192.63	6193.58	0.246395	9.02	4.32	14.72	2.93
Southern branch	1160	PF 1	39.00	6190.00	6190.50	6190.73	6191.26	0.093220	6.98	5.59	13.43	1.91
Southern branch	1140	PF 1	39.00	6188.00	6188.59	6188.78	6189.20	0.067217	6.30	6.19	13.57	1.64
Southern branch	1120	PF 1	39.00	6186.00	6186.75	6187.00	6187.55	0.079674	7.18	5.43	11.05	1.81
Southern branch	1100	PF 1	39.00	6184.00	6184.72	6184.94	6185.44	0.067305	6.85	5.70	10.96	1.67
Southern branch	1080	PF 1	39.00	6184.00	6184.58	6184.58	6184.84	0.024596	4.11	9.49	18.59	1.01
Southern branch	1060	PF 1	39.00	6182.00	6182.27	6182.57	6183.61	0.338316	9.31	4.19	17.29	3.33
Southern branch	1040	PF 1	39.00	6180.00	6180.71	6180.85	6181.18	0.052554	5.51	7.08	15.81	1.45
Southern branch	1020	PF 1	39.00	6178.00	6178.83	6179.10	6179.70	0.103823	7.52	5.19	12.08	2.02
Southern branch	1000	PF 1	39.00	6176.00	6176.85	6177.14	6177.75	0.091406	7.61	5.13	10.61	1.93
Southern branch	980	PF 1	39.00	6176.00	6176.47	6176.52	6176.76	0.037526	4.39	8.89	21.77	1.21
Southern branch	960	PF 1	39.00	6174.00	6174.77	6175.03	6175.58	0.095311	7.21	5.41	12.62	1.94
Southern branch	940	PF 1	39.00	6172.00	6172.90	6173.17	6173.72	0.090275	7.26	5.37	11.74	1.89
Southern branch	920	PF 1	39.00	6171.09	6172.24	6172.29	6172.59	0.031596	4.72	8.27	15.83	1.15
Southern branch	900	PF 1	39.00	6170.00	6170.54	6170.82	6171.45	0.113613	7.62	5.12	12.50	2.10
Southern branch	880	PF 1	39.00	6170.00	6170.63	6170.63	6170.88	0.024245	4.02	9.71	19.54	1.00
Southern branch	860	PF 1	39.00	6168.00	6168.42	6168.76	6169.71	0.200306	9.10	4.28	12.30	2.72
Southern branch	840	PF 1	39.00	6166.00	6167.23	6167.40	6167.76	0.047400	5.84	6.68	12.43	1.40
Southern branch	820	PF 1	39.00	6166.00	6166.49	6166.57	6166.83	0.040372	4.63	8.43	20.15	1.26
Southern branch	800	PF 1	39.00	6164.00	6164.69	6164.93	6165.50	0.116593	7.19	5.42	14.74	2.09
Southern branch	780	PF 1	39.00	6162.35	6163.55	6163.71	6164.17	0.039900	6.36	6.13	8.64	1.33
Southern branch	760	PF 1	39.00	6161.06	6161.90	6162.19	6162.91	0.102960	8.08	4.82	9.96	2.05
Southern branch	740	PF 1	39.00	6160.00	6160.89	6161.00	6161.29	0.053118	5.06	7.71	19.49	1.42
Southern branch	720	PF 1	39.00	6158.00	6158.67	6159.02	6159.78	0.103382	8.44	4.62	8.90	2.06
Southern branch	700	PF 1	39.00	6156.05	6156.94	6157.23	6157.87	0.082963	7.75	5.03	9.35	1.86
Southern branch	680	PF 1	39.00	6154.00	6155.53	6155.82	6156.48	0.059470	7.84	4.98	6.51	1.58
Southern branch	660	PF 1	39.00	6154.00	6154.77	6154.93	6155.36	0.043195	6.21	6.28	9.84	1.37
Southern branch	640	PF 1	39.00	6152.00	6152.52	6152.89	6153.81	0.155731	9.11	4.28	10.06	2.46
Southern branch	620	PF 1	39.00	6150.28	6151.35	6151.55	6152.04	0.048460	6.66	5.86	9.03	1.46
Southern branch	600	PF 1	39.00	6150.00	6150.78	6150.86	6151.20	0.030654	5.19	7.52	12.11	1.16
Southern branch	580	PF 1	39.00	6148.04	6149.18	6149.50	6150.19	0.083164	8.08	4.83	8.28	1.86
Southern branch	560	PF 1	39.00	6148.00	6149.26	6149.26	6149.58	0.023357	4.56	8.56	13.67	1.01
Southern branch	540	PF 1	39.00	6148.00	6148.52	6148.62	6148.93	0.045090	5.17	7.54	16.51	1.35
Southern branch	520	PF 1	39.00	6146.00	6146.82	6147.09	6147.66	0.089024	7.35	5.30	11.36	1.90
Southern branch	500	PF 1	39.00	6146.00	6146.39	6146.55	6146.88	0.085098	5.61	6.95	21.82	1.75
Southern branch	480	PF 1	39.00	6144.58	6145.38	6145.46	6145.70	0.040567	4.51	8.65	21.59	1.26
Southern branch	460	PF 1	39.00	6143.45	6144.07	6144.20	6144.48	0.099304	5.14	7.58	30.44	1.82
Southern branch	450	PF 1	83.00	6142.73	6144.37	6144.37	6144.77	0.022633	5.06	16.41	61.92	1.04
Southern branch	390		Culvert									
Southern branch	330	PF 1	193.00	6135.88	6137.18	6137.18	6137.50	0.124384	4.52	18.38	113.39	1.04
Southern branch	320	PF 1	193.00	6135.29	6136.03	6136.23	6136.78	0.141758	6.34	28.46	100.59	2.19

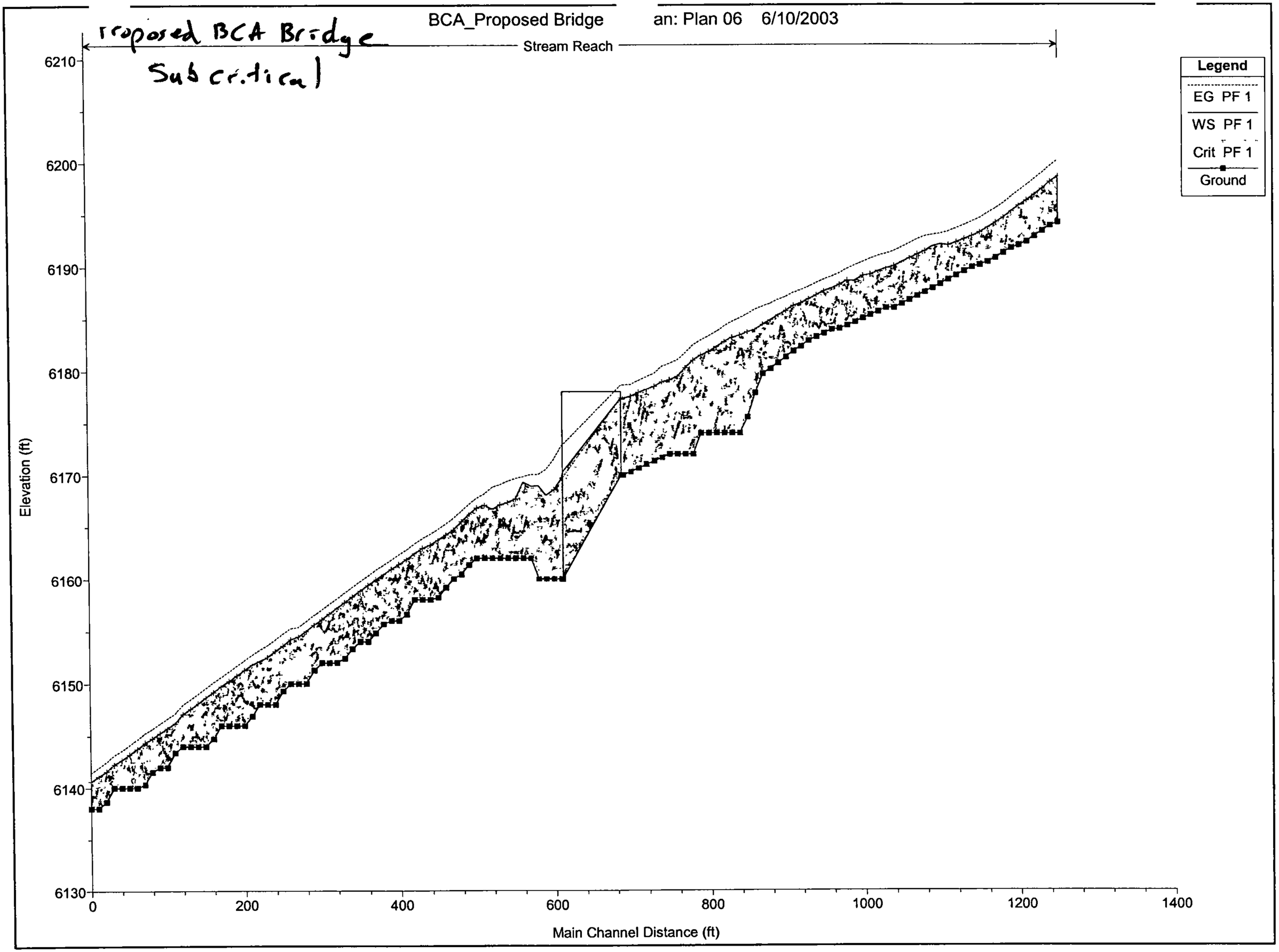
Pro 1/2

HEC-RAS Pl lan 01 River: Reach #1 Reach: Southern branch Profile: PF 1 (Continued

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Southern branch	300	PF 1	193.00	6134.28	6135.15	6135.21	6135.48	0.034333	4.45	42.30	91.44	1.18
Southern branch	280	PF 1	193.00	6133.24	6133.94	6134.13	6134.51	0.074602	6.04	31.83	80.11	1.70
Southern branch	260	PF 1	193.00	6132.21	6132.86	6132.96	6133.24	0.052794	5.00	39.17	104.57	1.42
Southern branch	240	PF 1	193.00	6130.19	6131.33	6131.51	6131.90	0.087829	6.02	32.05	92.70	1.80
Southern branch	220	PF 1	193.00	6129.59	6130.34	6130.41	6130.69	0.040035	4.77	40.46	92.14	1.27
Southern branch	200	PF 1	193.00	6128.00	6128.73	6128.97	6129.52	0.086334	7.13	27.08	60.07	1.87
Southern branch	180	PF 1	193.00	6126.95	6128.25	6128.25	6128.54	0.024366	4.30	44.84	82.06	1.03
Southern branch	160	PF 1	193.00	6126.00	6126.96	6127.30	6127.77	0.057381	7.22	26.75	42.84	1.61
Southern branch	140	PF 1	193.00	6125.46	6126.19	6126.29	6126.58	0.049127	5.00	38.63	95.70	1.39
Southern branch	120	PF 1	193.00	6124.08	6124.77	6124.93	6125.31	0.082839	5.89	32.77	93.82	1.76
Southern branch	110	PF 1	193.00	6123.41	6124.16	6124.29	6124.60	0.059285	5.32	36.29	94.23	1.51
Southern branch	100	PF 1	193.00	6122.74	6123.48	6123.60	6123.95	0.068864	5.51	35.00	96.31	1.61
Southern branch	80	PF 1	193.00	6121.53	6122.19	6122.29	6122.56	0.067277	4.91	39.28	126.26	1.55
Southern branch	60	PF 1	193.00	6120.42	6121.03	6121.12	6121.36	0.052953	4.57	42.25	126.61	1.39
Southern branch	40	PF 1	193.00	6119.30	6119.96	6120.07	6120.31	0.051119	4.78	40.38	110.11	1.39
Southern branch	20	PF 1	193.00	6118.23	6118.84	6118.95	6119.23	0.056258	5.08	38.43	104.61	1.46
Southern branch	0	PF 1	193.00	6117.21	6117.86	6117.94	6118.19	0.046679	4.63	41.93	112.45	1.33

Pro sed BCA Bridge




BCA_Proposed Bridge
an: Plan 06 6/10/2003
Proposed BCA Bridge
Subcritical
Stream Reach
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
6210
6200
6190
6180
6170
6160
6150
6140
6130
0
200
400
600
800
1000
1200
1400
Main Channel Distance (ft)

Proposed BCA Bridge: Subcritical r used from 8+70–9+00

HEC-RAS P.....

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	1620.000	PF 1	4510.00	6194.16	6198.57	6198.57	6200.15	0.011681	11.73	464.48	147.39	1.00
Reach	1610.000	PF 1	4510.00	6193.87	6198.07	6198.07	6199.58	0.011743	11.60	474.21	157.44	1.00
Reach	1600.000	PF 1	4510.00	6193.36	6197.40	6197.40	6198.92	0.012260	11.50	470.90	156.92	1.01
Reach	1590.000	PF 1	4510.00	6192.85	6196.83	6196.83	6198.32	0.012517	11.40	473.11	160.04	1.02
Reach	1580.000	PF 1	4510.00	6192.33	6196.29	6196.29	6197.75	0.012812	11.31	478.05	166.39	1.03
Reach	1570.000	PF 1	4510.00	6192.00	6195.77	6195.77	6197.18	0.012987	11.13	483.24	171.60	1.03
Reach	1560.000	PF 1	4510.00	6191.74	6195.21	6195.21	6196.60	0.013522	10.75	482.62	174.56	1.03
Reach	1550.000	PF 1	4510.00	6191.26	6194.63	6194.63	6196.00	0.013796	10.60	485.95	179.36	1.04
Reach	1540.000	PF 1	4510.00	6190.78	6194.15	6194.15	6195.51	0.013873	10.48	488.32	182.38	1.04
Reach	1530.000	PF 1	4510.00	6190.41	6193.68	6193.68	6195.05	0.014092	10.33	484.33	179.47	1.04
Reach	1520.000	PF 1	4510.00	6190.12	6193.21	6193.21	6194.58	0.014287	10.12	483.29	179.99	1.04
Reach	1510.000	PF 1	4510.00	6189.90	6192.88	6192.88	6194.24	0.014263	10.13	485.26	182.01	1.04
Reach	1500.000	PF 1	4510.00	6189.51	6192.59	6192.59	6193.93	0.014165	10.38	489.86	185.52	1.04
Reach	1490.000	PF 1	4510.00	6189.11	6192.27	6192.27	6193.59	0.014329	10.62	490.36	186.65	1.05
Reach	1480.000	PF 1	4510.00	6188.71	6192.01	6192.00	6193.31	0.014096	10.85	496.28	189.49	1.05
Reach	1470.000	PF 1	4510.00	6188.30	6192.11		6193.11	0.009505	9.80	564.52	194.55	0.89
Reach	1460.000	PF 1	4510.00	6187.91	6191.91		6193.00	0.010288	10.55	542.68	187.48	0.93
Reach	1450.000	PF 1	4510.00	6187.53	6191.44	6191.44	6192.86	0.013944	12.09	477.18	171.00	1.08
Reach	1440.000	PF 1	4510.00	6187.14	6191.13	6191.13	6192.55	0.013788	12.18	477.98	170.70	1.08
Reach	1430.000	PF 1	4510.00	6186.76	6190.76	6190.76	6192.18	0.013586	12.11	479.58	171.52	1.07
Reach	1420.000	PF 1	4510.00	6186.38	6190.38	6190.38	6191.81	0.013669	12.15	478.75	171.94	1.07
Reach	1410.000	PF 1	4510.00	6186.00	6190.01	6190.01	6191.43	0.013712	12.19	479.59	172.69	1.07
Reach	1400.000	PF 1	4510.00	6185.99	6189.79	6189.79	6191.19	0.013631	11.72	482.53	174.36	1.06
Reach	1390.000	PF 1	4510.00	6185.65	6189.53	6189.53	6190.98	0.013338	11.67	476.88	168.05	1.05
Reach	1380.000	PF 1	4510.00	6185.32	6189.21	6189.21	6190.70	0.013619	11.83	471.59	166.29	1.06
Reach	1370.000	PF 1	4510.00	6184.98	6189.10	6189.10	6190.41	0.011964	11.52	518.24	200.32	1.01
Reach	1360.000	PF 1	4510.00	6184.64	6188.63	6188.63	6190.09	0.014203	12.26	493.81	204.14	1.09
Reach	1350.000	PF 1	4510.00	6184.30	6188.62	6188.62	6189.74	0.010532	11.16	577.94	247.76	0.95
Reach	1340.000	PF 1	4510.00	6184.00	6188.25	6188.25	6189.34	0.010820	11.26	577.15	246.83	0.96
Reach	1330.000	PF 1	4510.00	6183.92	6187.89	6187.89	6189.00	0.011865	11.16	563.75	243.26	0.99
Reach	1320.000	PF 1	4510.00	6183.57	6187.62	6187.62	6188.73	0.011691	11.21	562.85	238.71	0.99
Reach	1310.000	PF 1	4510.00	6183.22	6187.22	6187.22	6188.40	0.012826	11.63	538.34	224.28	1.03
Reach	1300.000	PF 1	4510.00	6182.86	6186.86	6186.86	6188.04	0.012885	11.78	530.24	213.51	1.04
Reach	1290.000	PF 1	4510.00	6182.32	6186.49	6186.49	6187.70	0.012807	12.07	525.12	207.81	1.04
Reach	1280.000	PF 1	4510.00	6181.85	6186.25	6186.25	6187.47	0.012656	12.25	523.84	205.13	1.04
Reach	1270.000	PF 1	4510.00	6181.28	6185.73	6185.73	6187.09	0.012928	12.31	489.90	173.24	1.05
Reach	1260.000	PF 1	4510.00	6180.72	6185.32	6185.32	6186.81	0.013880	12.97	469.48	164.86	1.09
Reach	1250.000	PF 1	4510.00	6180.16	6184.85	6184.85	6186.41	0.013726	12.93	461.06	156.92	1.09
Reach	1240.000	PF 1	4510.00	6179.69	6184.41	6184.41	6186.15	0.014614	13.46	441.86	149.95	1.13
Reach	1230.000	PF 1	4510.00	6177.84	6183.93	6183.93	6185.85	0.012450	14.30	445.79	144.53	1.07
Reach	1220.000	PF 1	4510.00	6175.54	6183.70	6183.70	6185.42	0.007759	13.15	506.92	152.83	0.87
Reach	1210.000	PF 1	4510.00	6174.00	6183.37	6183.37	6185.04	0.008024	12.81	519.97	170.41	0.86

Sub 1/3

HEC-RAS Plan: (Continued)

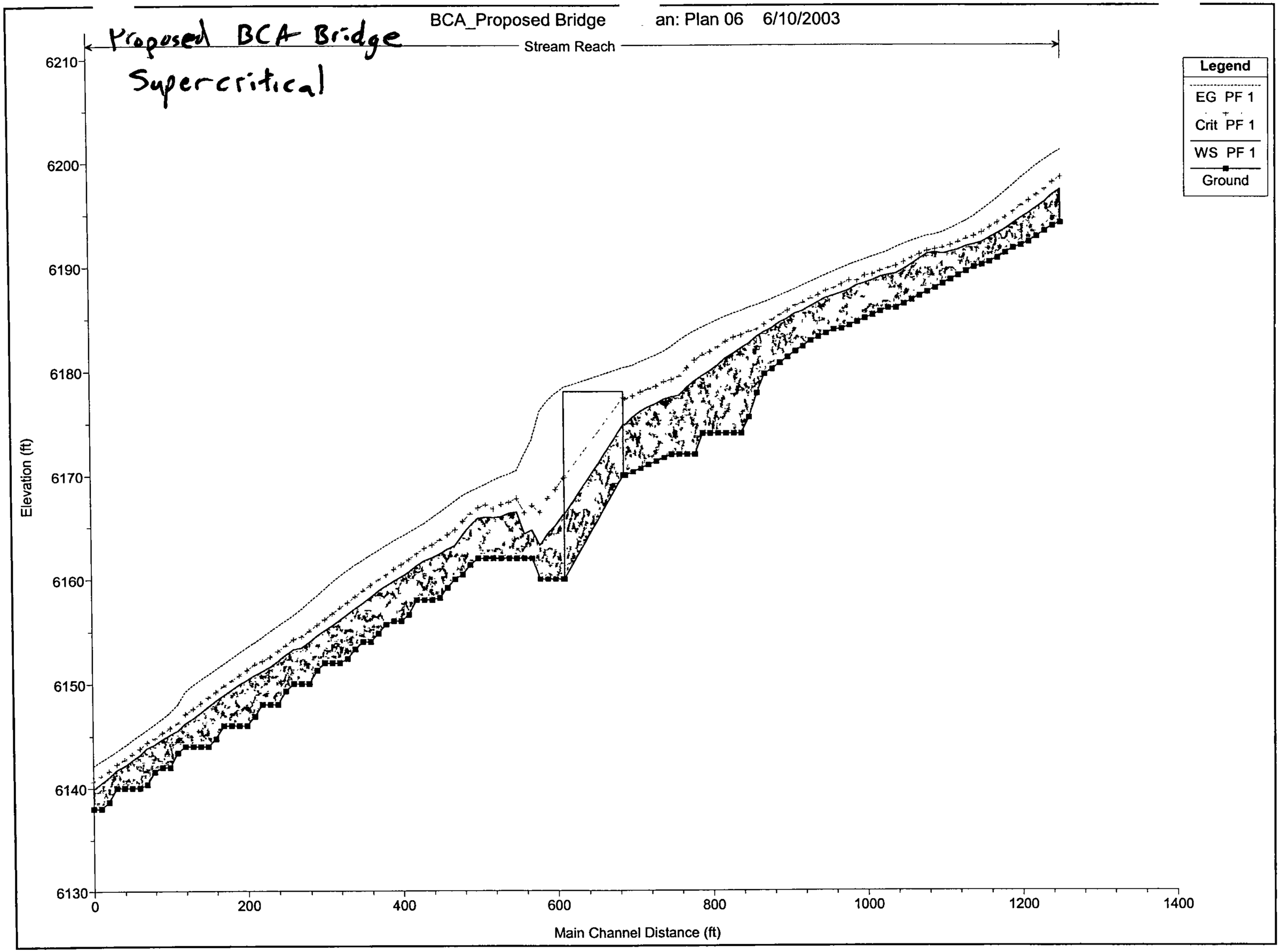
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	1200.000	PF 1	4510.00	6174.00	6183.17	6183.17	6184.70	0.008017	12.25	535.52	180.22	0.85
Reach	1190.000	PF 1	4510.00	6174.00	6182.77	6182.77	6184.26	0.008085	11.92	536.65	182.38	0.85
Reach	1180.000	PF 1	4510.00	6174.00	6182.26	6182.26	6183.72	0.007500	11.61	546.15	184.97	0.83
Reach	1170.000	PF 1	4510.00	6174.00	6181.80	6181.80	6183.29	0.007443	11.47	542.39	186.08	0.83
Reach	1160.000	PF 1	4510.00	6174.00	6181.46	6181.46	6182.91	0.007393	11.14	546.27	188.73	0.83
Reach	1150.000	PF 1	4510.00	6172.00	6181.00	6181.00	6182.43	0.007292	10.87	547.64	196.07	0.81
Reach	1140.000	PF 1	4510.00	6172.00	6180.26	6180.26	6181.66	0.007590	10.52	546.51	197.76	0.82
Reach	1130.000	PF 1	4510.00	6172.00	6179.46	6179.46	6181.01	0.008348	10.73	506.35	178.21	0.86
Reach	1120.000	PF 1	4510.00	6172.00	6179.15	6179.15	6180.69	0.008118	10.69	512.11	183.87	0.85
Reach	1110.00*	PF 1	4510.00	6171.67	6178.93	6178.93	6180.41	0.007341	10.47	531.79	197.29	0.81
Reach	1100.00*	PF 1	4510.00	6171.33	6178.50	6178.50	6179.75	0.005985	9.49	514.38	201.40	0.73
Reach	1090.00*	PF 1	4510.00	6171.00	6178.20	6178.20	6179.41	0.005598	9.40	527.85	213.74	0.71
Reach	1080.00*	PF 1	4510.00	6170.67	6177.92	6177.92	6179.06	0.005051	9.17	549.00	227.92	0.68
Reach	1070.00*	PF 1	4510.00	6170.33	6177.57	6177.57	6178.69	0.004821	9.13	557.91	236.90	0.66
Reach	1060.002	PF 1	4510.00	6170.00	6177.39	6177.28	6178.63	0.001242	9.60	613.32	255.98	0.68
Reach	1000		Bridge									
Reach	980.0000	PF 1	4510.00	6160.00	6169.69	6169.69	6172.80	0.005275	9.81	342.64	54.75	0.56
Reach	970.*	PF 1	4510.00	6160.00	6168.60	6168.60	6171.51	0.005939	9.61	358.73	61.42	0.58
Reach	960.*	PF 1	4510.00	6160.00	6168.07		6170.54	0.005739	9.06	392.82	68.31	0.56
Reach	950.*	PF 1	4510.00	6160.00	6168.98		6170.09	0.002521	6.45	583.62	85.00	0.38
Reach	940.*	PF 1	4510.00	6162.00	6168.95		6170.06	0.004231	7.04	575.26	97.54	0.47
Reach	930.*	PF 1	4510.00	6162.00	6169.34		6169.86	0.001427	5.89	799.01	190.42	0.38
Reach	920.0000	PF 1	4510.00	6162.00	6167.72	6167.72	6169.68	0.009348	11.49	425.86	121.47	0.91
Reach	910.*	PF 1	4510.00	6162.00	6167.36	6167.36	6169.41	0.010128	12.63	435.95	130.77	0.97
Reach	900.*	PF 1	4510.00	6162.00	6167.14	6167.14	6169.06	0.009956	11.95	453.35	150.38	0.95
Reach	890.*	PF 1	4510.00	6162.00	6166.71	6166.71	6168.82	0.012561	12.29	427.95	160.07	1.04
Reach	880.*	PF 1	4510.00	6162.00	6167.12	6167.12	6168.18	0.006521	9.13	662.77	333.20	0.76
Reach	870.0000	PF 1	4510.00	6162.00	6166.84	6166.84	6167.74	0.006731	8.58	699.16	350.41	0.75
Reach	860.0000	PF 1	4510.00	6161.37	6166.22	6166.22	6167.16	0.007159	8.60	680.97	349.89	0.77
Reach	850.0000	PF 1	4510.00	6160.44	6165.52	6165.52	6166.52	0.007463	8.68	655.83	339.77	0.78
Reach	840.0000	PF 1	4510.00	6160.00	6164.73	6164.73	6165.83	0.007884	8.88	615.86	317.15	0.80
Reach	830.0000	PF 1	4510.00	6159.16	6164.24	6164.24	6165.29	0.008076	8.77	625.73	322.49	0.81
Reach	820.0000	PF 1	4510.00	6158.20	6163.74	6163.74	6164.77	0.008118	8.71	633.86	329.10	0.81
Reach	810.0000	PF 1	4510.00	6158.00	6163.27	6163.27	6164.30	0.008227	8.77	639.66	338.19	0.81
Reach	800.0000	PF 1	4510.00	6158.00	6162.95	6162.95	6163.86	0.007668	8.49	678.83	346.00	0.79
Reach	790.0000	PF 1	4510.00	6158.00	6162.45	6162.45	6163.35	0.007699	8.58	683.31	345.25	0.79
Reach	780.0000	PF 1	4510.00	6156.59	6161.89	6161.89	6162.80	0.007188	8.65	693.43	347.85	0.77
Reach	770.0000	PF 1	4510.00	6156.00	6161.42	6161.42	6162.32	0.007121	8.77	697.26	348.08	0.77
Reach	760.0000	PF 1	4510.00	6156.00	6160.95	6160.95	6161.83	0.007437	8.83	698.93	346.79	0.79
Reach	750.0000	PF 1	4510.00	6155.68	6160.45	6160.45	6161.33	0.007888	8.94	693.69	344.56	0.81
Reach	740.0000	PF 1	4510.00	6154.81	6159.95	6159.95	6160.84	0.008062	9.06	688.26	342.06	0.82
Reach	730.0000	PF 1	4510.00	6154.00	6159.39	6159.39	6160.29	0.007558	9.09	694.18	340.03	0.80

Sub 2/3

HEC-RAS Plan: (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	720.0000	PF 1	4510.00	6154.00	6158.86	6158.86	6159.76	0.007772	9.12	690.70	337.98	0.80
Reach	710.0000	PF 1	4510.00	6153.32	6158.31	6158.31	6159.21	0.008309	9.18	681.79	336.55	0.83
Reach	700.0000	PF 1	4510.00	6152.42	6157.75	6157.75	6158.65	0.008167	9.12	684.39	336.67	0.82
Reach	690.0000	PF 1	4510.00	6152.00	6157.20	6157.20	6158.10	0.008689	9.10	674.50	336.03	0.84
Reach	680.0000	PF 1	4510.00	6152.00	6156.66	6156.66	6157.56	0.008827	8.98	671.65	335.25	0.84
Reach	670.0000	PF 1	4510.00	6152.00	6156.14	6156.14	6157.03	0.009573	8.90	660.12	333.03	0.87
Reach	660.0000	PF 1	4510.00	6151.29	6155.60	6155.60	6156.51	0.009939	8.89	650.93	330.21	0.88
Reach	650.0000	PF 1	4510.00	6150.00	6155.02	6155.02	6155.92	0.009666	8.79	652.60	329.04	0.87
Reach	640.0000	PF 1	4510.00	6150.00	6154.48	6154.48	6155.37	0.010011	8.71	649.49	328.63	0.88
Reach	630.0000	PF 1	4510.00	6150.00	6154.23	6154.23	6155.25	0.010408	9.11	620.08	313.20	0.90
Reach	620.0000	PF 1	4510.00	6149.29	6153.62	6153.62	6154.75	0.012548	9.62	583.01	307.35	0.98
Reach	610.0000	PF 1	4510.00	6148.00	6153.09	6153.09	6154.17	0.011049	9.37	598.74	302.42	0.92
Reach	600.0000	PF 1	4510.00	6148.00	6152.53	6152.53	6153.65	0.011830	9.59	586.70	296.34	0.95
Reach	590.0000	PF 1	4510.00	6148.00	6152.17	6152.17	6153.21	0.011206	9.51	613.95	323.25	0.93
Reach	580.0000	PF 1	4510.00	6146.89	6151.84	6151.84	6152.74	0.009092	9.05	662.43	327.33	0.85
Reach	570.0000	PF 1	4510.00	6146.00	6151.31	6151.31	6152.22	0.009594	9.18	657.15	329.14	0.87
Reach	560.0000	PF 1	4510.00	6146.00	6150.79	6150.79	6151.69	0.010950	9.20	643.41	330.35	0.92
Reach	550.0000	PF 1	4510.00	6146.00	6150.25	6150.25	6151.14	0.010837	9.22	645.59	329.70	0.91
Reach	540.0000	PF 1	4510.00	6146.00	6149.75	6149.75	6150.64	0.010354	9.26	652.22	329.17	0.90
Reach	530.0000	PF 1	4510.00	6144.72	6149.23	6149.23	6150.12	0.010746	9.33	646.54	329.34	0.91
Reach	520.0000	PF 1	4510.00	6144.00	6148.68	6148.68	6149.56	0.010508	9.37	650.87	330.10	0.91
Reach	510.0000	PF 1	4510.00	6144.00	6148.11	6148.11	6149.01	0.010336	9.50	652.88	332.17	0.91
Reach	500.0000	PF 1	4510.00	6144.00	6147.59	6147.59	6148.48	0.010516	9.49	653.44	334.57	0.91
Reach	490.0000	PF 1	4510.00	6144.00	6147.09	6147.09	6147.98	0.012061	9.43	636.23	335.98	0.96
Reach	480.0000	PF 1	4510.00	6143.40	6146.23	6146.23	6147.13	0.015175	8.96	602.78	334.19	1.03
Reach	470.0000	PF 1	4510.00	6142.00	6145.76	6145.76	6146.66	0.015305	8.80	602.30	335.77	1.03
Reach	460.0000	PF 1	4510.00	6142.00	6145.28	6145.28	6146.18	0.015481	8.57	600.91	335.74	1.03
Reach	450.0000	PF 1	4510.00	6141.54	6144.78	6144.78	6145.68	0.015986	8.46	598.94	340.13	1.04
Reach	440.0000	PF 1	4510.00	6140.34	6144.37	6144.37	6145.25	0.014906	8.79	611.31	344.39	1.02
Reach	430.0000	PF 1	4510.00	6140.00	6143.79	6143.79	6144.68	0.015564	8.51	603.80	345.20	1.02
Reach	420.0000	PF 1	4510.00	6140.00	6143.25	6143.25	6144.13	0.015693	8.16	603.94	347.75	1.02
Reach	410.0000	PF 1	4510.00	6140.00	6142.72	6142.72	6143.60	0.015840	8.13	605.99	353.70	1.02
Reach	400.0000	PF 1	4510.00	6140.00	6142.29	6142.29	6143.16	0.015955	7.72	610.43	361.89	1.01
Reach	390.0000	PF 1	4510.00	6138.65	6141.63	6141.63	6142.51	0.015756	7.38	607.02	355.96	1.00
Reach	380.0000	PF 1	4510.00	6138.00	6141.13	6141.13	6141.99	0.014951	6.96	619.45	362.70	0.96
Reach	370.0000	PF 1	4510.00	6138.00	6140.62	6140.62	6141.45	0.014767	6.89	628.40	374.08	0.96

Sub 3/3


BCA_Proposed Bridge an: Plan 06 6/10/2003
Proposed BCA Bridge
Supercritical
Stream Reach
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Elevation (ft)
6210
6200
6190
6180
6170
6160
6150
6140
6130
0
200
400
600
800
1000
1200
1400
Main Channel Distance (ft)

Proposed BCA Bridge: Supercritical ^ used from 9+00 – 12+50

HEC-RAS Pl...

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	1620.000	PF 1	4510.00	6194.16	6197.38	6198.57	6201.18	0.042511	18.00	299.36	129.90	1.81
Reach	1610.000	PF 1	4510.00	6193.87	6196.85	6198.07	6200.73	0.046600	18.38	296.49	135.21	1.88
Reach	1600.000	PF 1	4510.00	6193.36	6196.17	6197.40	6200.21	0.052763	18.68	289.01	138.37	1.98
Reach	1590.000	PF 1	4510.00	6192.85	6195.61	6196.83	6199.67	0.056454	18.81	287.61	143.01	2.03
Reach	1580.000	PF 1	4510.00	6192.33	6195.10	6196.29	6199.07	0.057895	18.67	290.22	148.51	2.05
Reach	1570.000	PF 1	4510.00	6192.00	6194.60	6195.77	6198.45	0.059031	18.34	293.62	154.06	2.06
Reach	1560.000	PF 1	4510.00	6191.74	6194.10	6195.21	6197.80	0.060824	17.48	297.13	161.11	2.05
Reach	1550.000	PF 1	4510.00	6191.26	6193.56	6194.63	6197.15	0.061900	17.15	300.03	165.95	2.06
Reach	1540.000	PF 1	4510.00	6190.78	6193.14	6194.15	6196.48	0.056976	16.44	310.28	168.90	1.97
Reach	1530.000	PF 1	4510.00	6190.41	6192.72	6193.68	6195.88	0.052588	15.53	317.63	167.43	1.89
Reach	1520.000	PF 1	4510.00	6190.12	6192.30	6193.21	6195.32	0.049446	14.68	324.27	168.14	1.82
Reach	1510.000	PF 1	4510.00	6189.90	6192.09	6192.88	6194.78	0.041313	14.00	345.02	172.37	1.68
Reach	1500.000	PF 1	4510.00	6189.51	6191.90	6192.59	6194.32	0.035440	13.86	364.59	176.59	1.58
Reach	1490.000	PF 1	4510.00	6189.11	6191.59	6192.27	6193.96	0.035287	14.20	367.66	178.86	1.59
Reach	1480.000	PF 1	4510.00	6188.71	6191.39	6192.00	6193.58	0.031228	14.07	382.32	179.42	1.51
Reach	1470.000	PF 1	4510.00	6188.30	6191.19	6191.73	6193.25	0.027615	13.90	394.17	176.59	1.44
Reach	1460.000	PF 1	4510.00	6187.91	6191.33	6191.61	6193.01	0.019413	13.03	436.34	175.03	1.24
Reach	1450.000	PF 1	4510.00	6187.53	6191.19	6191.44	6192.89	0.018089	13.17	434.75	164.63	1.21
Reach	1440.000	PF 1	4510.00	6187.14	6190.71	6191.13	6192.66	0.022169	14.33	406.92	163.09	1.34
Reach	1430.000	PF 1	4510.00	6186.76	6190.19	6190.76	6192.39	0.025793	15.05	384.68	159.86	1.43
Reach	1420.000	PF 1	4510.00	6186.38	6189.72	6190.38	6192.10	0.028636	15.59	370.34	157.30	1.50
Reach	1410.000	PF 1	4510.00	6186.00	6189.29	6190.01	6191.79	0.030887	16.03	361.11	156.12	1.56
Reach	1400.000	PF 1	4510.00	6185.99	6189.17	6189.79	6191.44	0.026410	14.48	379.05	157.02	1.43
Reach	1390.000	PF 1	4510.00	6185.65	6189.00	6189.53	6191.16	0.023819	14.12	390.25	157.24	1.37
Reach	1380.000	PF 1	4510.00	6185.32	6188.67	6189.21	6190.90	0.024500	14.35	384.87	155.46	1.39
Reach	1370.000	PF 1	4510.00	6184.98	6188.39	6189.10	6190.64	0.024736	14.58	386.17	161.12	1.40
Reach	1360.000	PF 1	4510.00	6184.64	6188.19	6188.63	6190.39	0.024435	14.86	406.72	193.06	1.40
Reach	1350.000	PF 1	4510.00	6184.30	6187.72	6188.62	6190.10	0.027803	15.50	378.55	189.80	1.49
Reach	1340.000	PF 1	4510.00	6184.00	6187.44	6188.25	6189.80	0.029106	16.05	391.44	197.30	1.52
Reach	1330.000	PF 1	4510.00	6183.92	6187.21	6187.89	6189.47	0.030695	15.79	403.45	223.91	1.55
Reach	1320.000	PF 1	4510.00	6183.57	6186.97	6187.62	6189.15	0.028754	15.59	411.48	223.29	1.51
Reach	1310.000	PF 1	4510.00	6183.22	6186.56	6187.22	6188.84	0.031855	16.21	394.66	210.05	1.58
Reach	1300.000	PF 1	4510.00	6182.86	6186.16	6186.86	6188.50	0.033879	16.81	385.45	203.85	1.63
Reach	1290.000	PF 1	4510.00	6182.32	6185.74	6186.49	6188.16	0.033003	16.99	377.38	188.49	1.62
Reach	1280.000	PF 1	4510.00	6181.85	6185.50	6186.25	6187.81	0.030126	16.64	381.92	179.12	1.56
Reach	1270.000	PF 1	4510.00	6181.28	6184.99	6185.73	6187.48	0.031408	16.89	365.40	163.80	1.59
Reach	1260.000	PF 1	4510.00	6180.72	6184.64	6185.32	6187.17	0.029584	16.91	361.51	152.14	1.55
Reach	1250.000	PF 1	4510.00	6180.16	6184.09	6184.85	6186.85	0.030946	17.11	347.40	142.67	1.58
Reach	1240.000	PF 1	4510.00	6179.69	6183.71	6184.41	6186.54	0.027961	16.60	343.39	129.26	1.51
Reach	1230.000	PF 1	4510.00	6177.84	6183.27	6183.93	6186.28	0.022232	17.55	355.54	127.30	1.40
Reach	1220.000	PF 1	4510.00	6175.54	6182.59	6183.70	6186.03	0.018018	17.89	356.58	122.08	1.29
Reach	1210.000	PF 1	4510.00	6174.00	6182.15	6183.37	6185.71	0.020222	17.84	345.02	121.52	1.33

Super 1/3

HEC-RAS ..... (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	1200.000	PF 1	4510.00	6174.00	6181.65	6183.17	6185.47	0.025328	18.19	318.14	111.12	1.45
Reach	1190.000	PF 1	4510.00	6174.00	6181.21	6182.77	6185.18	0.028475	18.35	309.44	113.59	1.52
Reach	1180.000	PF 1	4510.00	6174.00	6180.55	6182.26	6184.85	0.030515	18.74	299.21	112.74	1.59
Reach	1170.000	PF 1	4510.00	6174.00	6179.99	6181.80	6184.52	0.032401	18.74	284.46	101.38	1.63
Reach	1160.000	PF 1	4510.00	6174.00	6179.55	6181.46	6184.17	0.036091	18.70	275.78	98.65	1.70
Reach	1150.000	PF 1	4510.00	6172.00	6179.03	6181.00	6183.78	0.038395	18.68	270.20	96.13	1.73
Reach	1140.000	PF 1	4510.00	6172.00	6178.41	6180.26	6183.35	0.043819	18.70	265.91	109.73	1.83
Reach	1130.000	PF 1	4510.00	6172.00	6177.62	6179.46	6182.86	0.048648	18.88	254.02	100.91	1.91
Reach	1120.000	PF 1	4510.00	6172.00	6177.49	6179.15	6182.28	0.039726	18.00	268.82	106.30	1.75
Reach	1110.00*	PF 1	4510.00	6171.67	6177.26	6178.93	6181.86	0.034603	17.52	274.91	105.87	1.65
Reach	1100.00*	PF 1	4510.00	6171.33	6176.84	6178.50	6181.50	0.034071	17.55	263.30	97.72	1.64
Reach	1090.00*	PF 1	4510.00	6171.00	6176.52	6178.20	6181.17	0.031565	17.43	264.03	91.78	1.59
Reach	1080.00*	PF 1	4510.00	6170.67	6176.13	6177.92	6180.86	0.030133	17.48	259.99	79.60	1.56
Reach	1070.00*	PF 1	4510.00	6170.33	6175.56	6177.57	6180.53	0.030646	17.89	252.15	62.87	1.57
Reach	1060.002	PF 1	4510.00	6170.00	6174.83	6177.28	6180.33	0.008487	18.82	239.69	59.31	1.65
Reach	1000		Bridge									
Reach	980.0000	PF 1	4510.00	6160.00	6166.18	6169.69	6178.33	0.040873	20.23	175.23	40.72	1.43
Reach	970.*	PF 1	4510.00	6160.00	6165.13	6168.60	6177.79	0.057661	21.23	173.19	45.51	1.65
Reach	960.*	PF 1	4510.00	6160.00	6164.36	6167.73	6177.11	0.078504	22.21	172.52	50.21	1.88
Reach	950.*	PF 1	4510.00	6160.00	6163.22	6166.38	6176.05	0.145561	24.70	167.72	59.32	2.43
Reach	940.*	PF 1	4510.00	6162.00	6164.71	6167.04	6173.37	0.139171	21.53	199.57	79.50	2.31
Reach	930.*	PF 1	4510.00	6162.00	6164.34	6166.36	6171.97	0.087611	21.56	204.84	95.80	2.48
Reach	920.0000	PF 1	4510.00	6162.00	6166.43	6167.72	6170.44	0.027639	16.16	288.33	97.04	1.49
Reach	910.*	PF 1	4510.00	6162.00	6166.31	6167.36	6170.11	0.024057	16.80	313.38	107.12	1.44
Reach	900.*	PF 1	4510.00	6162.00	6166.00	6167.14	6169.84	0.027039	16.52	307.93	112.80	1.49
Reach	890.*	PF 1	4510.00	6162.00	6165.89	6166.71	6169.49	0.027388	15.78	316.00	123.62	1.48
Reach	880.*	PF 1	4510.00	6162.00	6165.93	6167.12	6169.10	0.025409	14.70	335.75	139.19	1.42
Reach	870.0000	PF 1	4510.00	6162.00	6165.84	6166.84	6168.75	0.026742	14.16	379.92	287.89	1.43
Reach	860.0000	PF 1	4510.00	6161.37	6165.13	6166.22	6168.42	0.032724	14.79	343.31	277.94	1.56
Reach	850.0000	PF 1	4510.00	6160.44	6164.28	6165.52	6168.00	0.040392	15.51	298.85	179.88	1.71
Reach	840.0000	PF 1	4510.00	6160.00	6163.24	6164.73	6167.49	0.051121	16.56	272.49	115.95	1.89
Reach	830.0000	PF 1	4510.00	6159.16	6162.88	6164.24	6166.92	0.050699	16.13	279.86	126.17	1.88
Reach	820.0000	PF 1	4510.00	6158.20	6162.44	6163.74	6166.40	0.049485	15.97	284.33	140.44	1.85
Reach	810.0000	PF 1	4510.00	6158.00	6162.07	6163.27	6165.87	0.045335	15.69	298.73	221.31	1.79
Reach	800.0000	PF 1	4510.00	6158.00	6161.80	6162.95	6165.34	0.042658	15.48	328.02	252.39	1.74
Reach	790.0000	PF 1	4510.00	6158.00	6161.31	6162.45	6164.91	0.042856	15.79	333.86	259.38	1.75
Reach	780.0000	PF 1	4510.00	6156.59	6160.70	6161.89	6164.48	0.040768	16.14	328.38	253.05	1.73
Reach	770.0000	PF 1	4510.00	6156.00	6160.24	6161.42	6164.07	0.039418	16.37	331.54	254.14	1.71
Reach	760.0000	PF 1	4510.00	6156.00	6159.81	6160.95	6163.66	0.042277	16.77	336.88	257.81	1.77
Reach	750.0000	PF 1	4510.00	6155.68	6159.35	6160.45	6163.22	0.046036	17.18	338.93	263.18	1.84
Reach	740.0000	PF 1	4510.00	6154.81	6158.86	6159.95	6162.75	0.045920	17.34	341.09	267.31	1.84
Reach	730.0000	PF 1	4510.00	6154.00	6158.25	6159.39	6162.29	0.043491	17.48	335.62	257.39	1.80

Super 2/3

HEC-RAS Plan: (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	720.0000	PF 1	4510.00	6154.00	6157.71	6158.86	6161.83	0.046717	17.82	332.49	257.55	1.86
Reach	710.0000	PF 1	4510.00	6153.32	6157.19	6158.31	6161.34	0.051153	18.10	331.11	263.64	1.94
Reach	700.0000	PF 1	4510.00	6152.42	6156.62	6157.75	6160.82	0.050957	18.07	329.30	265.05	1.93
Reach	690.0000	PF 1	4510.00	6152.00	6156.09	6157.20	6160.28	0.055734	18.11	325.96	266.54	2.00
Reach	680.0000	PF 1	4510.00	6152.00	6155.55	6156.66	6159.71	0.057878	17.89	324.26	268.87	2.03
Reach	670.0000	PF 1	4510.00	6152.00	6155.09	6156.14	6159.06	0.062822	17.60	327.19	279.04	2.08
Reach	660.0000	PF 1	4510.00	6151.29	6154.58	6155.60	6158.38	0.061789	17.13	331.33	280.25	2.05
Reach	650.0000	PF 1	4510.00	6150.00	6153.97	6155.02	6157.76	0.060704	16.90	329.07	274.29	2.03
Reach	640.0000	PF 1	4510.00	6150.00	6153.44	6154.48	6157.10	0.064002	16.71	330.21	273.14	2.07
Reach	630.0000	PF 1	4510.00	6150.00	6153.28	6154.23	6156.51	0.048051	15.48	348.39	251.05	1.82
Reach	620.0000	PF 1	4510.00	6149.29	6152.78	6153.62	6156.01	0.051012	15.59	345.57	251.22	1.86
Reach	610.0000	PF 1	4510.00	6148.00	6152.15	6153.09	6155.49	0.049700	15.73	340.39	242.27	1.85
Reach	600.0000	PF 1	4510.00	6148.00	6151.62	6152.53	6154.99	0.052071	15.98	338.88	241.38	1.89
Reach	590.0000	PF 1	4510.00	6148.00	6151.22	6152.17	6154.43	0.050406	15.99	348.71	247.08	1.86
Reach	580.0000	PF 1	4510.00	6146.89	6150.82	6151.84	6153.92	0.044282	15.90	362.19	253.75	1.77
Reach	570.0000	PF 1	4510.00	6146.00	6150.34	6151.31	6153.47	0.046261	16.18	361.94	259.15	1.81
Reach	560.0000	PF 1	4510.00	6146.00	6149.91	6150.79	6152.94	0.053852	16.39	363.32	280.19	1.92
Reach	550.0000	PF 1	4510.00	6146.00	6149.39	6150.25	6152.41	0.053216	16.52	369.39	294.03	1.92
Reach	540.0000	PF 1	4510.00	6146.00	6148.90	6149.75	6151.89	0.049286	16.52	377.34	300.43	1.87
Reach	530.0000	PF 1	4510.00	6144.72	6148.38	6149.23	6151.39	0.051593	16.70	374.64	302.04	1.90
Reach	520.0000	PF 1	4510.00	6144.00	6147.81	6148.68	6150.88	0.051093	16.88	373.72	299.25	1.90
Reach	510.0000	PF 1	4510.00	6144.00	6147.23	6148.11	6150.37	0.049856	17.08	372.23	294.72	1.89
Reach	500.0000	PF 1	4510.00	6144.00	6146.69	6147.59	6149.85	0.053067	17.30	367.79	293.92	1.95
Reach	490.0000	PF 1	4510.00	6144.00	6146.23	6147.09	6149.22	0.062816	17.15	360.22	293.87	2.07
Reach	480.0000	PF 1	4510.00	6143.40	6145.51	6146.23	6148.01	0.072235	15.30	367.10	315.47	2.12
Reach	470.0000	PF 1	4510.00	6142.00	6145.13	6145.76	6147.26	0.058196	13.80	393.64	317.09	1.90
Reach	460.0000	PF 1	4510.00	6142.00	6144.68	6145.28	6146.65	0.052994	12.78	405.20	314.87	1.80
Reach	450.0000	PF 1	4510.00	6141.54	6144.21	6144.78	6146.11	0.051340	12.24	411.23	317.34	1.76
Reach	440.0000	PF 1	4510.00	6140.34	6143.85	6144.37	6145.59	0.042481	12.51	434.96	325.12	1.64
Reach	430.0000	PF 1	4510.00	6140.00	6143.20	6143.79	6145.12	0.051267	12.50	410.55	318.55	1.76
Reach	420.0000	PF 1	4510.00	6140.00	6142.65	6143.25	6144.59	0.053451	11.86	404.96	318.80	1.77
Reach	410.0000	PF 1	4510.00	6140.00	6142.14	6142.72	6144.05	0.052278	11.72	410.30	325.84	1.75
Reach	400.0000	PF 1	4510.00	6140.00	6141.76	6142.29	6143.54	0.041498	9.91	427.69	332.08	1.54
Reach	390.0000	PF 1	4510.00	6138.65	6141.02	6141.63	6143.06	0.046782	9.43	400.52	303.43	1.59
Reach	380.0000	PF 1	4510.00	6138.00	6140.47	6141.13	6142.59	0.045816	8.57	397.21	294.99	1.54
Reach	370.0000	PF 1	4510.00	6138.00	6139.91	6140.62	6142.14	0.044684	8.17	390.62	282.45	1.51

Super 3/3

Proposed SBCA 1

HEC-RAS Plan: Plan 01 River: SBCA1 Reach: SBCA1 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SBCA1	1340.000	PF 1	237.00	6184.45	6185.86	6185.86	6186.28	0.019464	5.41	46.46	56.91	1.00
SBCA1	1320.000	PF 1	237.00	6184.00	6185.05	6185.05	6185.44	0.020288	4.91	47.80	64.46	0.99
SBCA1	1300.000	PF 1	237.00	6182.31	6183.85	6183.85	6184.27	0.017181	5.38	47.64	61.39	0.95
SBCA1	1280.000	PF 1	237.00	6182.00	6183.03	6183.03	6183.41	0.017812	5.22	49.99	69.63	0.96
SBCA1	1260.000	PF 1	237.00	6180.82	6182.04	6182.04	6182.40	0.013818	5.02	53.96	78.03	0.86
SBCA1	1240.000	PF 1	237.00	6180.00	6181.18	6181.18	6181.53	0.017445	5.06	52.81	79.72	0.94
SBCA1	1220.000	PF 1	237.00	6179.22	6180.38	6180.38	6180.70	0.019021	4.91	55.10	88.65	0.97
SBCA1	1200.000	PF 1	237.00	6178.09	6179.17	6179.17	6179.56	0.020848	4.55	47.80	61.97	0.98
SBCA1	1180.000	PF 1	237.00	6177.35	6178.43	6178.43	6178.73	0.016950	4.85	57.50	92.05	0.92
SBCA1	1160.000	PF 1	237.00	6176.02	6176.86	6176.86	6177.17	0.020499	4.88	54.09	86.82	0.99
SBCA1	1140.000	PF 1	237.00	6174.75	6176.30	6176.30	6176.61	0.014407	4.74	58.52	95.77	0.86
SBCA1	1120.000	PF 1	237.00	6174.00	6176.02		6176.14	0.002968	2.73	89.99	109.05	0.42
SBCA1	1100.000	PF 1	237.00	6172.00	6176.08		6176.10	0.000267	1.21	227.70	124.51	0.14
SBCA1	1080.000	PF 1	237.00	6172.00	6176.08		6176.09	0.000069	0.75	373.28	148.17	0.07
SBCA1	1060.000	PF 1	237.00	6170.34	6176.08	6173.27	6176.09	0.000022	0.53	544.45	161.14	0.04
SBCA1	1018		Culvert									
SBCA1	975	PF 1	237.00	6167.29	6168.76	6168.76	6169.33	0.017438	6.29	39.69	92.13	1.00
SBCA1	970	PF 1	237.00	6166.98	6168.01	6168.01	6168.35	0.020231	4.92	51.84	78.94	0.99
SBCA1	965	PF 1	237.00	6166.66	6167.72	6167.72	6168.07	0.020830	4.78	50.75	76.30	0.99
SBCA1	960.0000	PF 1	237.00	6166.35	6167.47	6167.47	6167.81	0.020680	4.47	50.54	74.01	0.97
SBCA1	940.0000	PF 1	237.00	6166.00	6166.83	6166.83	6167.17	0.022480	4.72	50.98	76.75	1.02
SBCA1	920.0000	PF 1	237.00	6164.94	6166.15	6166.15	6166.47	0.016108	4.93	55.92	85.70	0.91
SBCA1	900.0000	PF 1	237.00	6164.00	6165.05	6164.99	6165.33	0.015007	4.57	57.06	77.35	0.87
SBCA1	880.0000	PF 1	237.00	6163.66	6164.63	6164.63	6164.95	0.022528	4.81	53.04	86.59	1.02
SBCA1	860.0000	PF 1	237.00	6162.00	6163.28	6163.28	6163.63	0.016423	5.07	53.15	76.13	0.92
SBCA1	840.0000	PF 1	237.00	6162.00	6162.69	6162.69	6163.01	0.022037	4.78	53.00	84.45	1.01
SBCA1	820.0000	PF 1	237.00	6161.01	6162.04	6162.04	6162.33	0.020872	4.25	55.24	91.35	0.97
SBCA1	800.0000	PF 1	237.00	6160.00	6160.73	6160.73	6161.06	0.021584	4.90	52.20	80.87	1.01
SBCA1	780.0000	PF 1	237.00	6159.31	6160.01	6160.01	6160.32	0.017780	3.63	54.97	86.33	0.87
SBCA1	760.0000	PF 1	237.00	6158.00	6158.82	6158.82	6159.14	0.021223	4.19	52.00	78.93	0.97
SBCA1	740.0000	PF 1	237.00	6157.88	6158.42	6158.42	6158.71	0.015588	3.00	58.45	92.57	0.79
SBCA1	720.0000	PF 1	237.00	6156.57	6157.25	6157.25	6157.56	0.016309	3.49	55.97	84.39	0.84
SBCA1	700.0000	PF 1	237.00	6156.00	6156.75		6157.00	0.015192	4.21	59.88	87.16	0.86
SBCA1	680.0000	PF 1	237.00	6155.06	6156.40	6156.40	6156.72	0.016140	4.92	55.99	87.50	0.91
SBCA1	660.0000	PF 1	237.00	6154.00	6155.27	6155.27	6155.66	0.017682	5.29	48.74	64.17	0.96
SBCA1	640.0000	PF 1	237.00	6154.00	6154.86	6154.86	6155.21	0.022512	4.62	49.75	72.19	1.01
SBCA1	620.0000	PF 1	237.00	6152.85	6153.85	6153.85	6154.20	0.021227	5.25	50.24	70.60	1.02
SBCA1	600.0000	PF 1	237.00	6151.96	6152.53	6152.53	6152.82	0.023261	3.81	54.57	92.80	0.98
SBCA1	580.0000	PF 1	237.00	6151.14	6151.52	6151.52	6151.83	0.022743	2.06	53.37	88.34	0.83
SBCA1	560.0000	PF 1	237.00	6150.00	6150.52	6150.52	6150.82	0.023143	3.47	53.80	88.85	0.95
SBCA1	540.0000	PF 1	237.00	6149.32	6149.56	6149.56	6149.90	0.022294	1.51	51.27	78.57	0.76
SBCA1	520.0000	PF 1	237.00	6148.06	6148.57	6148.57	6148.90	0.021463	2.34	52.89	85.07	0.84

Pro 1/2

HEC-RAS Plan: Plan 01 River: SBCA1 Reach: SBCA1 Profile: PF 1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SBCA1	500.0000	PF 1	237.00	6146.74	6147.45	6147.45	6147.75	0.022154	3.30	54.67	91.87	0.93
SBCA1	480.0000	PF 1	237.00	6145.41	6146.42	6146.42	6146.68	0.022617	4.32	58.68	108.67	1.00
SBCA1	460.0000	PF 1	237.00	6144.19	6145.33	6145.33	6145.62	0.019216	4.40	54.69	94.14	0.94
SBCA1	440.0000	PF 1	237.00	6142.66	6144.37		6144.48	0.008608	2.85	92.61	177.65	0.63
SBCA1	420.0000	PF 1	237.00	6142.00	6144.43		6144.44	0.000165	0.75	345.22	227.19	0.10
SBCA1	400.0000	PF 1	237.00	6140.88	6144.43		6144.44	0.000028	0.44	610.35	249.36	0.05
SBCA1	380.0000	PF 1	237.00	6140.00	6144.44		6144.44	0.000007	0.29	944.18	271.53	0.02
SBCA1	360.0000	PF 1	480.00	6139.69	6144.43		6144.44	0.000013	0.42	1258.44	300.00	0.03
SBCA1	350.	PF 1	480.00	6139.06	6144.39	6140.53	6144.43	0.000164	1.59	308.07	300.00	0.12
SBCA1	292		Culvert									
SBCA1	235.	PF 1	480.00	6133.85	6135.70	6135.70	6136.40	0.016207	6.90	71.71	274.05	0.99
SBCA1	230.	PF 1	480.00	6133.70	6133.52	6133.52	6133.86	0.023247		102.97	154.87	0.00
SBCA1	225.	PF 1	480.00	6133.55	6133.29	6133.29	6133.62	0.022998		103.18	154.41	0.00
SBCA1	220.0000	PF 1	480.00	6133.40	6133.05	6133.05	6133.38	0.023265		102.95	154.90	0.00
SBCA1	200.0000	PF 1	480.00	6132.00	6132.05	6132.05	6132.39	0.015371	0.62	112.01	164.72	0.53
SBCA1	180.0000	PF 1	480.00	6131.13	6130.98	6130.98	6131.34	0.014908		106.68	133.79	0.00
SBCA1	160.0000	PF 1	480.00	6130.00	6130.16	6130.16	6130.51	0.015240	1.39	109.28	162.71	0.65
SBCA1	140.0000	PF 1	480.00	6128.96	6129.48	6129.48	6129.86	0.014674	2.29	105.66	140.70	0.72
SBCA1	120.0000	PF 1	480.00	6127.71	6128.62	6128.62	6129.02	0.013381	2.80	103.27	132.72	0.74
SBCA1	100.0000	PF 1	480.00	6126.28	6127.41	6127.41	6127.91	0.015577	3.52	88.51	106.32	0.82
SBCA1	80.0000	PF 1	480.00	6125.49	6126.63	6126.63	6127.00	0.011881	3.57	109.73	153.83	0.75
SBCA1	60.0000	PF 1	480.00	6124.67	6125.66	6125.66	6126.11	0.013742	3.24	96.47	109.10	0.77
SBCA1	40.0000	PF 1	480.00	6123.83	6124.85	6124.85	6125.22	0.015416	3.44	104.72	133.97	0.82
SBCA1	20.0000	PF 1	480.00	6122.70	6123.68	6123.68	6124.15	0.015403	3.68	92.70	101.91	0.83
SBCA1	-0.0000	PF 1	480.00	6121.44	6122.65	6122.65	6123.11	0.016145	3.82	92.38	99.92	0.85

posed SBCA 2

HEC-RAS Plan: Plan 01 River: SBCA2 Reach: SBCA2 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SBCA2	1060.000	PF 1	39.00	6182.00	6182.57	6182.57	6182.81	0.024218	3.93	9.93	20.64	1.00
SBCA2	1040.000	PF 1	39.00	6180.00	6180.85	6180.85	6181.11	0.024070	4.08	9.55	18.61	1.01
SBCA2	1020.000	PF 1	39.00	6178.00	6179.10	6179.10	6179.39	0.023473	4.33	9.00	15.71	1.01
SBCA2	1000.000	PF 1	39.00	6176.00	6177.14	6177.14	6177.46	0.023184	4.55	8.56	13.66	1.01
SBCA2	980.0000	PF 1	39.00	6176.00	6176.52	6176.52	6176.75	0.024832	3.83	10.18	22.44	1.00
SBCA2	960.0000	PF 1	39.00	6174.00	6175.03	6175.03	6175.31	0.023951	4.30	9.08	16.31	1.02
SBCA2	940.0000	PF 1	39.00	6172.00	6173.17	6173.17	6173.46	0.023571	4.35	8.96	15.41	1.01
SBCA2	920.0000	PF 1	39.00	6171.09	6172.29	6172.29	6172.58	0.024153	4.30	9.08	16.34	1.02
SBCA2	900.0000	PF 1	39.00	6170.00	6171.03		6171.18	0.009514	3.13	12.47	17.97	0.66
SBCA2	880.0000	PF 1	39.00	6170.00	6170.63	6170.63	6170.88	0.024245	4.02	9.71	19.54	1.00
SBCA2	860.0000	PF 1	39.00	6168.00	6168.76	6168.76	6169.05	0.023625	4.36	8.95	15.55	1.01
SBCA2	840.0000	PF 1	39.00	6166.00	6167.40	6167.40	6167.69	0.024175	4.31	9.06	16.13	1.01
SBCA2	820.0000	PF 1	39.00	6166.00	6166.57	6166.57	6166.81	0.024080	3.89	10.03	21.11	0.99
SBCA2	800.0000	PF 1	39.00	6164.00	6164.93	6164.93	6165.21	0.024253	4.27	9.14	16.70	1.02
SBCA2	780.0000	PF 1	39.00	6162.35	6163.71	6163.71	6164.12	0.022409	5.13	7.60	9.57	1.02
SBCA2	760.0000	PF 1	39.00	6161.06	6162.19	6162.19	6162.38	0.024780	3.48	11.20	28.33	0.98
SBCA2	740.0000	PF 1	39.00	6160.00	6161.00	6161.00	6161.24	0.025129	4.00	9.75	19.98	1.01
SBCA2	720.0000	PF 1	39.00	6158.00	6159.01	6159.01	6159.38	0.021926	4.87	8.01	10.94	1.00
SBCA2	700.0000	PF 1	39.00	6156.05	6157.23	6157.23	6157.59	0.022856	4.82	8.09	11.63	1.02
SBCA2	680.0000	PF 1	39.00	6154.00	6155.82	6155.82	6156.29	0.023169	5.50	7.09	7.77	1.02
SBCA2	660.0000	PF 1	39.00	6154.00	6154.93	6154.93	6155.30	0.021963	4.93	7.91	10.52	1.00
SBCA2	640.0000	PF 1	39.00	6152.00	6152.88	6152.88	6153.22	0.022928	4.67	8.35	12.62	1.01
SBCA2	620.0000	PF 1	39.00	6150.28	6151.55	6151.55	6151.94	0.022348	5.02	7.76	10.18	1.01
SBCA2	600.0000	PF 1	39.00	6150.00	6150.86	6150.86	6151.19	0.022162	4.63	8.42	12.57	1.00
SBCA2	580.0000	PF 1	39.00	6148.04	6149.68		6149.92	0.012572	3.97	9.83	11.88	0.77
SBCA2	560.0000	PF 1	39.00	6148.00	6149.26	6149.26	6149.58	0.023213	4.55	8.58	13.68	1.01
SBCA2	540.0000	PF 1	39.00	6148.00	6148.63	6148.63	6148.90	0.023510	4.17	9.35	17.31	1.00
SBCA2	520.0000	PF 1	39.00	6146.00	6147.09	6147.09	6147.39	0.022981	4.41	8.84	14.75	1.00
SBCA2	500.0000	PF 1	39.00	6146.00	6146.55	6146.55	6146.76	0.025255	3.69	10.58	25.06	1.00
SBCA2	480.0000	PF 1	39.00	6144.58	6146.16		6146.18	0.001203	1.10	35.59	52.99	0.24
SBCA2	460.0000	PF 1	83.00	6143.45	6146.17		6146.17	0.000122	0.62	135.06	89.23	0.09
SBCA2	450.	PF 1	83.00	6142.73	6146.15	6144.37	6146.17	0.000335	1.19	69.62	98.82	0.15
SBCA2	389		Culvert									
SBCA2	330.	PF 1	83.00	6135.88	6137.18	6137.18	6137.50	0.023004	4.52	18.38	113.39	1.02
SBCA2	320.0000	PF 1	193.00	6135.29	6136.23	6136.23	6136.47	0.024919	3.81	49.69	107.51	1.00
SBCA2	300.0000	PF 1	193.00	6134.28	6135.21	6135.21	6135.46	0.024483	3.94	47.91	96.83	1.01
SBCA2	280.0000	PF 1	193.00	6133.24	6134.13	6134.13	6134.35	0.024470	3.74	50.66	111.39	0.99
SBCA2	260.0000	PF 1	193.00	6132.21	6132.96	6132.96	6133.20	0.024564	3.94	49.77	107.29	1.01
SBCA2	240.0000	PF 1	193.00	6130.19	6131.51	6131.51	6131.75	0.023580	3.88	49.79	103.98	0.99
SBCA2	220.0000	PF 1	193.00	6129.59	6130.42	6130.42	6130.67	0.024186	4.05	47.63	94.93	1.01
SBCA2	200.0000	PF 1	193.00	6128.00	6128.97	6128.97	6129.29	0.022613	4.51	42.76	68.87	1.01
SBCA2	180.0000	PF 1	193.00	6126.95	6128.25	6128.25	6128.54	0.023717	4.27	45.24	82.23	1.01

Pro 1/2

HEC-RAS , ...: Plan 01 River: SBCA2 Reach: SBCA2 Profile: PF 1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SBCA2	160.0000	PF 1	193.00	6126.00	6127.29	6127.29	6127.56	0.025090	4.23	45.58	87.36	1.03
SBCA2	140.0000	PF 1	193.00	6125.46	6126.29	6126.29	6126.54	0.024489	4.00	48.29	99.17	1.01
SBCA2	120.0000	PF 1	193.00	6124.08	6124.93	6124.93	6125.18	0.026081	4.04	47.76	101.15	1.04
SBCA2	110	PF 1	193.00	6123.41	6124.29	6124.29	6124.53	0.023283	3.92	49.19	99.98	0.99
SBCA2	100.0000	PF 1	193.00	6122.74	6123.60	6123.60	6123.86	0.027169	4.06	47.50	102.85	1.05
SBCA2	80.0000	PF 1	193.00	6121.53	6122.30	6122.30	6122.50	0.026024	3.57	54.02	137.39	1.00
SBCA2	60.0000	PF 1	193.00	6120.42	6121.12	6121.12	6121.32	0.026256	3.60	53.54	135.28	1.01
SBCA2	40.0000	PF 1	193.00	6119.30	6120.07	6120.07	6120.26	0.026256	3.46	55.86	150.37	1.00
SBCA2	20.0000	PF 1	193.00	6118.23	6118.95	6118.95	6119.18	0.025200	3.91	49.99	110.67	1.01
SBCA2	0.0000	PF 1	193.00	6117.21	6117.94	6117.94	6118.16	0.026176	3.81	51.11	119.53	1.02

Pro 2/2

NATIONAL FLOOD INSURANCE PROGRAM

FEMA MAP COORDINATION CONTRACTOR

MAY 28 2003

MAYOR'S OFFICE
03 MAY 30 AM 8:33

Carlos A. Montoya, P.E.
Floodplain Administrator
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

IN REPLY REFER TO:
Case No.: 03-06-833R
Community: City of Albuquerque, Bernalillo County, New Mexico
Community No.: 350002

316-AD

Dear Mr. Montoya:

This is in regard to your January 24, 2003, request that the Federal Emergency Management Agency (FEMA) issue a Conditional Letter of Map Revision for the above-referenced community. In a previous letter, you were informed that additional data might be required to complete our review of the request. The data required to complete our review, which must be submitted within 90 days of the date of this letter, are listed on the enclosed summary.

Please send the required data to us at the address shown at the bottom of this page. Further action on the request has been suspended pending receipt of the required data.

If we do not receive the required data within 90 days, we will suspend the processing of your request. Any data submitted after 90 days will be treated as an original submittal and will be subject to all submittal/payment procedures, including the review and processing fee in effect at the time of the re-submittal as outlined in Paragraph 72.7(a) of the National Flood Insurance Program (NFIP) regulations (44 CFR Parts 59-78). A copy of the notice summarizing the current fee schedule, which was published in the *Federal Register*, is enclosed for your information.

When you write to us about your request, please include the case number referenced above. If you have general questions about your case, FEMA policy, or the NFIP, please call FEMA's toll free map assistance line at 1-877-FEMA MAP (1-877-336-2627). If you have specific questions concerning your request, please contact the Engineer assigned to your case, Saleem Ashraf, P.E., by phone at 1-800-697-7275 Ext. 273, or by e-mail at msashraf@pbsj.com.

Sincerely,

Joseph A. Martinenza, Jr.
Program Manager, Region VI

Enclosures

cc: The Honorable Martin Chavez, Mayor, City of Albuquerque
Craig W. Hoover, P.E., Vice President and Water Resources Group Manager, Bohannan and Huston, Inc.
Douglas H. Collister, President, High Desert Investment Corp.

12101 Indian Creek Court, Beltsville, MD 20705 • Phone: 1-800-697-7275 • Fax: 301-210-5157

NATIONAL FLOOD INSURANCE PROGRAM
FEMA MAP COORDINATION CONTRACTOR

Summary of Additional Information Required to Support a
Conditional Letter of Map Revision

Case No.: 03-06-833R
Community: City of Albuquerque,
Bernalillo County, New Mexico

Requester: Carlos A. Montoya, P.E.
Community No.: 350002

The issues listed below must be addressed before we can continue the review of your request.

1. Our review indicates that the 1% annual chance (100-year) storm with 6-hour duration is used to compute discharge values for Bear Canyon Arroyo. Please use 1% annual chance with 24-hour duration to simulate discharge values to be used in the hydraulic models. In addition, please provide the back up information and justifications for the parameters used in the hydrologic model for Bear Canyon Arroyo.

2. Please provide calculations for the discharge values relating to South Bear Canyon Arroyo 1 and South Bear Canyon Arroyo 2. Please ensure that the 1% annual chance storm with 24-hour duration is used in the computations. Please include a copy of the relevant chapters of the City of Albuquerque's *Development Process Manual* to facilitate the technical review and reasonableness of the assumptions made in your hydrologic and hydraulic analyses.

3. A number of references have been made to previous studies such as *High Desert Drainage Management Master Plan* in your submittal. Please provide copies of the relevant portions of the reports mentioned in your submittal for our review. We would like to emphasize that Federal Emergency Management Agency (FEMA) conducts its own independent hydrologic and hydraulic engineering review in conjunction with the National Flood Insurance Program regulation criteria for a map revision request.

4. Please submit paper and electronic copies of the pre-project conditions hydraulic models for Bear Canyon Arroyo, South Bear Canyon Arroyo 1, and South Bear Canyon Arroyo 2 using one of the FEMA acceptable hydraulic models. The list of FEMA's acceptable models can be accessed at http://www.fema.gov/mit/tsd/en_modl.htm.

5. Our computers were unable to read the proposed conditions models for South Bear Canyon Arroyo 1 and South Bear Canyon Arroyo 2. Please resubmit the hydraulic models using one of the FEMA's acceptable software programs. Please ensure that the proposed culverts along South Bear Canyon Arroyo 1 and South Bear Canyon Arroyo 2 are included in the proposed conditions hydraulic models.

6. Our review of the proposed conditions hydraulic model for Bear Canyon Arroyo indicates that the proposed bridge is not included in the hydraulic model. Please revise the hydraulic model to include the proposed bridge, and submit paper and electronic copies of the model.

7. Please reflect above comments on the topographic work map and annotated Flood Insurance Rate Map (FIRM), and submit one copy of each. Please ensure that proposed bridge and culverts are shown on the annotated FIRM.

Please send the required data to us at the address shown at the bottom of this page.

12101 Indian Creek Court, Beltsville, MD 20705 • Phone: 1-800-697-7275 • Fax: 301-210-5157

vcd 3-3-03
8-

NATIONAL FLOOD INSURANCE PROGRAM
FEMA MAP COORDINATION CONTRACTOR

FEB 21 2003

Carlos A. Montoya, P.E.
Floodplain Administrator
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

IN REPLY REFER TO:
Case No.: 03-06-833R
Community: City of Albuquerque, Bernalillo County, New Mexico
Community No.: 350002

316-ACK.FRQ

MAYOR'S OFFICE
03 FEB 26 AM 8:39

Dear Mr. Montoya:

This responds to your request, dated January 24, 2003, that the Federal Emergency Management Agency (FEMA) issue a conditional revision to the Flood Insurance Rate Map (FIRM) for the above-referenced community. Pertinent information about the request is listed below.

Identifier:	High Desert Tract 13
Flooding Sources:	Bear Canyon Arroyo, South Bear Canyon Arroyo 1, and South Bear Canyon Arroyo 2
FIRM Panel Affected:	Bernalillo County, New Mexico and Incorporated Areas, FIRM number 35001C0163 E, dated April 2, 2002

We have completed an inventory of the items that you submitted. The items identified below are required before we can begin a detailed review of your request.

- In compliance with Section 65.5 of the National Flood Insurance Program (NFIP) regulations, the community official responsible for floodplain management must provide in writing a statement that a property or structure, existing or proposed, to be removed from the Special Flood Hazard Area (SFHA) meets minimum floodplain management criteria of Section 60.3 of the NFIP regulations and is reasonably safe from flooding. This statement provides FEMA with assurance that the community has reviewed all development plans and has found them to meet the following requirements:

  a. The lowest floor elevations (including basement) of all residential structures built in the area to be removed from the SFHA are at or above the base flood (Paragraph 60.3(b)).

  b. The area to be removed from the SFHA (including any existing or proposed structures) has been determined to be "reasonably safe from flooding" (Subparagraphs 60.3(a)(3) and 60.3(a)(4), and *Technical Bulletin 10-01*).

  c. All applicable Federal and State permits have been obtained (Subparagraph 60.3(a)(2)).

  d. All applicable local permits have been obtained. This includes a local development permit to grade or place fill in the SFHA, and a permit for all existing or proposed construction (Subparagraph 60.3(b)(1)).

e. Fill has not been placed in a floodway (Subparagraph 60.3(d)(3)) that causes a rise in flood elevations associated with the base flood discharge.

To assist communities in determining if a property or structure, existing or proposed, is reasonably safe from flooding, FEMA has published *Technical Bulletin 10-01*. This bulletin outlines safe building practices that, when followed, reduce the risk of flood damage to a property or structure. Community Officials interested in obtaining copies of this bulletin should visit our Internet site at http://www.fema.gov/pdf/fima/tb1001.pdf or by calling the FEMA Map Assistance Center toll free at 1-877-FEMA MAP (1-877-336-2627).

Please send the required data to us at the address shown at the bottom of the first page. If all required items are not submitted within 90 days of the date of this letter, FEMA will treat any subsequent request as an original submittal, and it will be subject to all submittal/payment procedures as outlined in Paragraph 72.7(a) of the NFIP regulations (44 CFR Parts 59-78).

If you are unable to meet the 90-day deadline for submittal of required items and would like FEMA to continue processing your request, you must request an extension of the deadline. This request must be submitted to us in writing and must provide (1) the reason why the data cannot be submitted within the requested timeframe and (2) a new date for the submittal of the data. FEMA receives a very large volume of requests and cannot maintain inactive requests for an indefinite period of time. Therefore, the fees will be forfeited for any request for which neither the requested data nor a written extension request is received within 90 days.

When you write to us about your request, please include the case number referenced above in your letter. If you have general questions about your case, FEMA policy, or the NFIP, please call FEMA's toll free map assistance line at 1-877-FEMA MAP (1-877-336-2627). If you have specific questions concerning your request, please contact the Engineer assigned to your case, Mr. Saleem Ashraf, P.E., by phone at 1-800-697-7275 Ext. 273, or by e-mail at msashraf@pbsj.com.

Sincerely,

Michael DePue for

Joseph A. Martinenza, Jr.
Program Manager, Region VI

cc: The Honorable Martin Chavez, Mayor, City of Albuquerque
Craig W. Hoover, P.E., Vice President and Water Resources Group Manager, Bohannan and Huston, Inc.
Douglas H. Collister, President, High Desert Investment Corp.

NATIONAL FLOOD INSURANCE PROGRAM
FEMA MAP COORDINATION CONTRACTOR

145

FEB 21 2003

Carlos A. Montoya, P.E.
Floodplain Administrator
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

IN REPLY REFER TO:
Case No.: 03-06-833R
Community: City of Albuquerque, Bernalillo County, New Mexico
Community No.: 350002

316-ACK.FRQ

Dear Mr. Montoya:

This responds to your request, dated January 24, 2003, that the Federal Emergency Management Agency (FEMA) issue a conditional revision to the Flood Insurance Rate Map (FIRM) for the above-referenced community. Pertinent information about the request is listed below.

Identifier:	High Desert Tract 13
Flooding Sources:	Bear Canyon Arroyo, South Bear Canyon Arroyo 1, and South Bear Canyon Arroyo 2
FIRM Panel Affected:	Bernalillo County, New Mexico and Incorporated Areas, FIRM number 35001C0163 E, dated April 2, 2002

We have completed an inventory of the items that you submitted. The items identified below are required before we can begin a detailed review of your request.

- In compliance with Section 65.5 of the National Flood Insurance Program (NFIP) regulations, the community official responsible for floodplain management must provide in writing a statement that a property or structure, existing or proposed, to be removed from the Special Flood Hazard Area (SFHA) meets minimum floodplain management criteria of Section 60.3 of the NFIP regulations and is reasonably safe from flooding. This statement provides FEMA with assurance that the community has reviewed all development plans and has found them to meet the following requirements:

  a. The lowest floor elevations (including basement) of all residential structures built in the area to be removed from the SFHA are at or above the base flood (Paragraph 60.3(b)).

  b. The area to be removed from the SFHA (including any existing or proposed structures) has been determined to be "reasonably safe from flooding" (Subparagraphs 60.3(a)(3) and 60.3(a)(4), and *Technical Bulletin 10-01*).

  c. All applicable Federal and State permits have been obtained (Subparagraph 60.3(a)(2)).

  d. All applicable local permits have been obtained. This includes a local development permit to grade or place fill in the SFHA, and a permit for all existing or proposed construction (Subparagraph 60.3(b)(1)).

e. Fill has not been placed in a floodway (Subparagraph 60.3(d)(3)) that causes a rise in flood elevations associated with the base flood discharge.

To assist communities in determining if a property or structure, existing or proposed, is reasonably safe from flooding, FEMA has published *Technical Bulletin 10-01*. This bulletin outlines safe building practices that, when followed, reduce the risk of flood damage to a property or structure. Community Officials interested in obtaining copies of this bulletin should visit our Internet site at http://www.fema.gov/pdf/fima/tb1001.pdf or by calling the FEMA Map Assistance Center toll free at 1-877-FEMA MAP (1-877-336-2627).

Please send the required data to us at the address shown at the bottom of the first page. If all required items are not submitted within 90 days of the date of this letter, FEMA will treat any subsequent request as an original submittal, and it will be subject to all submittal/payment procedures as outlined in Paragraph 72.7(a) of the NFIP regulations (44 CFR Parts 59-78).

If you are unable to meet the 90-day deadline for submittal of required items and would like FEMA to continue processing your request, you must request an extension of the deadline. This request must be submitted to us in writing and must provide (1) the reason why the data cannot be submitted within the requested timeframe and (2) a new date for the submittal of the data. FEMA receives a very large volume of requests and cannot maintain inactive requests for an indefinite period of time. Therefore, the fees will be forfeited for any request for which neither the requested data nor a written extension request is received within 90 days.

When you write to us about your request, please include the case number referenced above in your letter. If you have general questions about your case, FEMA policy, or the NFIP, please call FEMA's toll free map assistance line at 1-877-FEMA MAP (1-877-336-2627). If you have specific questions concerning your request, please contact the Engineer assigned to your case, Mr. Saleem Ashraf, P.E., by phone at 1-800-697-7275 Ext. 273, or by e-mail at msashraf@pbsj.com.

Sincerely,

Michael DePue FOR

Joseph A. Martinenza, Jr.
Program Manager, Region VI

cc: The Honorable Martin Chavez, Mayor, City of Albuquerque
Craig W. Hoover, P.E., Vice President and Water Resources Group Manager, Bohannan and Huston, Inc.
Douglas H. Collister, President, High Desert Investment Corp.

#119

Federal Emergency Management Agency

Washington, D.C. 20472

FEB 03 2004

The Honorable Martin J. Chavez
Mayor, City of Albuquerque
City/County Building, 11th Floor
One Civic Plaza NW, P.O. Box 1293
Albuquerque, NM 87103

IN REPLY REFER TO:
Case Number: 03-06-833R

Community: City of Albuquerque, Bernalillo County, New Mexico
Community No.: 350002

104

Dear Mayor Chavez:

This is in reference to a letter, dated January 24, 2003, from Carlos A. Montoya, P.E., City Floodplain Administrator, City of Albuquerque, requesting a Conditional Letter of Map Revision (CLOMR) from the Federal Emergency Management Agency (FEMA) for the proposed High Desert Tract 13 project. The proposed project will be located along the Bear Canyon Arroyo, from approximately 2,375 feet upstream of the confluence with an unnamed tributary to the Bear Canyon Arroyo, hereafter referred to as South Bear Canyon Arroyo 1, to approximately 1,125 feet upstream of the confluence with South Bear Canyon Arroyo 1. Furthermore, the project will affect two unnamed tributaries to the Bear Canyon Arroyo, hereafter referred to as South Bear Canyon Arroyo 1 and South Bear Canyon Arroyo 2. The project will affect South Bear Canyon Arroyo 1, from approximately 2,350 feet upstream of the confluence with Bear Canyon Arroyo to approximately 875 feet upstream of the confluence with Bear Canyon Arroyo. The project will affect South Bear Canyon 2, from approximately 1,000 feet upstream of the confluence with South Bear canyon Arroyo 1 to approximately 125 feet upstream of South Bear Canyon Arroyo 1. The project will consist of the channelization of portions of the Bear Canyon Arroyo, the construction of a bridge at High Desert Place, and the placement of fill in the 1% annual chance (100-year) floodplain for each flooding source. Revisions along the tributaries will consist of the placement of fill in the 1% annual chance floodplain, as well as the construction of culverts at several locations along both flooding sources. The area of the proposed project is shown on Flood Insurance Rate Map (FIRM) number 35001C0163F, dated November 19, 2003. Portions of the subject area are shown to be within the unincorporated areas of Bernalillo County; however, the City of Albuquerque has annexed these areas.

We received the following data, prepared by Craig W. Hoover, P.E., of Bohannan-Huston, Inc., in support of this request:

- HEC-1 hydrologic analysis, dated December 11, 2001, of the 1% annual chance flood, representing the existing conditions for the Bear Canyon Arroyo, South Bear Canyon Arroyo 1, and South Bear Canyon Arroyo 2;

- HEC-RAS hydraulic models, dated June 11, 2003, of the 1% annual chance flood, representing the existing and proposed conditions for the Bear Canyon Arroyo;

- HEC-RAS hydraulic models, dated December 10, 2003, of the 1% annual chance flood, representing the existing and proposed conditions for South Bear Canyon Arroyo 1 and South Bear Canyon Arroyo 2;

- a certified topographic work map, dated October 10, 2002, titled *High Desert Tract 13 CLOMR,* at a scale of 1 inch = 100 feet, with a contour interval of 2 feet, representing the existing and proposed conditions along the Bear Canyon Arroyo, South Bear Canyon Arroyo 1, and South Bear Canyon Arroyo 2;

- a copy of Bernalillo County, New Mexico and Incorporated Areas FIRM number 35001C0163 E, dated April 2, 2002, annotated to reflect proposed conditions; and

- completed application/certification forms, including community concurrence with the proposed project and property owner notification.

We received all of the data required to perform a technical review of the CLOMR request as of December 11, 2003.

We have reviewed the submitted data and determined that the proposed project meets the minimum floodplain management criteria of the National Flood Insurance Program (NFIP). If the project is built as proposed, a revision to the FIRM for your community will be warranted. This revision will show the following effects, as shown by the data submitted to support the request:

Zone AO Stillwater Elevation

When we compared the proposed conditions with the effective conditions, it was determined that the effective stillwater elevation would remain unchanged for the left overbank areas of the Bear Canyon Arroyo.

When we compared the proposed conditions with the effective conditions, it was determined that the effective stillwater elevation would remain unchanged for the shared Zone AO floodplain of South Bear Canyon Arroyo 1 and South Bear Canyon Arroyo 2.

1% Annual Chance Floodplain

When we compared the proposed conditions with the effective conditions, it was determined that increases and decreases in the 1% annual chance floodplain would occur for the Bear Canyon Arroyo. A maximum increase of 50 feet would occur approximately 1,125 feet upstream of the confluence with South Bear Canyon Arroyo 1, and a maximum decrease of 350 feet would occur approximately 2,250 feet upstream of the confluence with South Bear Canyon Arroyo 1.

When we compared the proposed conditions with the effective conditions, it was determined that increases and decreases in the 1% annual chance floodplain would occur for South Bear Canyon Arroyo 1. A maximum increase of 60 feet would occur approximately 2,350 feet upstream of the confluence with the Bear Canyon Arroyo, and a maximum decrease of 210 feet would occur approximately 1,500 feet upstream of the confluence with the Bear Canyon Arroyo.

When we compared the proposed conditions with the effective conditions, it was determined that increases and decreases in the 1% annual chance floodplain would occur for South Bear Canyon Arroyo 2. The upstream limit of the Special Flood Hazard Area (SFHA) would be extended 540 feet upstream of its current limit, and a maximum decrease of 50 feet would occur approximately 625 feet upstream of the confluence with South Bear Canyon Arroyo 1.

Future revisions to the Flood Insurance Study, FIRM, or restudies of the flood hazards in this area could modify this determination.

We based this determination on the 1% annual chance discharges computed in the submitted hydrologic model for the Bear Canyon Arroyo, South Bear Canyon Arroyo 1, and South Bear Canyon Arroyo 2. Future development of projects upstream may increase discharges, which may increase flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on discharges and, therefore, could establish greater flood hazards in this area.

Your community must approve all proposed floodplain development, including this proposed project, and ensure that permits required by other Federal agencies and/or State and local agencies have been obtained. State and/or community officials may set standards for construction that are more restrictive than the minimum NFIP standards or may limit development in floodplains, based on knowledge of local conditions and in the interest of safety. If the State and/or the community have adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

The submitted data demonstrated compliance with NFIP regulations Paragraph 65.12(a), which is necessary when a community proposes to permit encroachments upon an adopted floodway that will result in any increase in Base (1% annual chance) Flood Elevations (BFEs) within the community. Upon completion of the project, we will require evidence of compliance with NFIP regulations Paragraphs 65.12(b) and (c) before revising your community's FIRM.

Channel modifications and culverts will fail to function as designed without proper maintenance, such as the regular clearing of the channelized stream and culvert. To avoid such failures, we require participating communities to ensure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained according to NFIP regulations Subparagraph 60.3(b)(7). Therefore, upon completion of the project, your community must submit documentation ensuring that the modified channel and culverts will be maintained to preserve their design function. We may request that your community submit a description and schedule of its channel and culvert maintenance, as outlined in Subparagraph 65.6(a)(12) of the NFIP regulations.

If fill is placed in your community to raise the ground surface to or above the BFE, your community must meet the criteria of NFIP regulations Sections 60.3 and 65.5, which require that the community's NFIP permit official certify that proposed or existing structures to be removed from the SFHA be "reasonably safe from flooding." "Reasonably safe from flooding" means base flood waters will not inundate the land or damage structures to be removed from the SFHA and that any subsurface waters related to the base flood will not damage existing or proposed buildings. The community and engineers should review and use *FEMA Technical Bulletin 10-01, Ensuring That Structures Built on Fill In or Near Special Flood Hazard Areas Are Reasonably Safe From Flooding*, which may be downloaded directly from the FEMA website at http://www.fema.gov/pdf/fima/tb1001.pdf.

Upon completion of the proposed project, your community should request a revision to the FIRM to assure that the physical change to the flooding conditions is used for flood insurance rating and floodplain management purposes. The revision request should be submitted to our Regional Office in Denton, Texas, at (940) 898-5399 and include the data listed below.

1. Evidence of compliance with NFIP regulations Paragraph 65.4(b), which states that "all requests for changes to effective maps...must be made in writing by the community's Chief Executive Officer (CEO) or an official designated by the CEO."

2. As-built plans of all relevant project elements as well as a statement declaring that the project was built as proposed, both of which must be certified by a Professional Engineer. If the project is not

built as proposed, please provide a description of the changes in design that have occurred since the issuance of the CLOMR.

3. Detailed application and certification forms may be required if as-built conditions differ from the proposed plans. If required, please submit new forms or annotated copies of the previously submitted forms showing the revised information.

4. Hydrologic analysis, for the existing conditions of the 1% annual chance flood for the Bear Canyon Arroyo, South Bear Canyon Arroyo 1, and South Bear Canyon Arroyo 2.

5. Hydraulic analyses, for as-built conditions, of the 1% annual chance flood for the Bear Canyon Arroyo, South Bear Canyon Arroyo 1, and South Bear Canyon Arroyo 2.

6. A certified topographic work map, delineating the 1% annual chance floodplain for the Bear Canyon Arroyo, South Bear Canyon Arroyo 1, and South Bear Canyon Arroyo 2, including the locations and alignments of the cross sections and flow lines used in the hydraulic model, representing the as-built conditions.

   a. Please show this information on a map of suitable scale and topographic definition to provide reasonable accuracy.

   b. Please label all items for easy cross-referencing to the hydraulic model and summary data.

   c. Please submit this information in both paper and electronic format, if available.

7. Copy of Bernalillo County, New Mexico and Incorporated Areas FIRM number 35001C0163F, dated November 19, 2003, annotated to reflect proposed conditions.

8. Documentation of individual legal notices that were sent to property owners who are adversely impacted by any increases in and/or shifting of the 1% annual chance floodplain for the Bear Canyon Arroyo, South Bear Canyon Arroyo 1, and South Bear Canyon Arroyo 2. Legal notice may take the form of certified mailing receipts or certification that all property owners have been notified, with an accompanying mailing list and copy of letter sent. Examples of individual notices can be found on Pages 12 through 17 of the MT-2 instructions, which can be accessed at http://www.fema.gov/pdf/fhm/mt2_inst.pdf.

   a. If you submit notification and acceptance from the adversely impacted property owners, FEMA can issue a Letter of Map Revision (LOMR) effective the date of issuance.

   b. If you submit notification of, but not acceptance by, the adversely impacted property owners, FEMA may issue a LOMR effective one month after the date of issuance.

9. Evidence of compliance with NFIP regulations Subparagraph 65.6(a)(12) regarding maintenance, and Section 65.5 regarding fill placement.

If the project is built as proposed in the data submitted in support of this request, you do not have to resubmit items 3 through 6 listed above; otherwise, please resubmit them.

We have enclosed a copy of our application/certification forms for your reference. The application/certification forms package may be downloaded directly from the FEMA website at http://www.fema.gov/fhm/en_main.shtm or copies may be obtained by contacting the FEMA Map

Assistance Center, toll free, at 1-877-FEMA MAP (1-877-336-2627). Typically, we do not require all of these forms if the project is completed as proposed in the data submitted in support of this request. The enclosed document, titled *Requirements for Submitting Application/ Certification Forms to Support Requests for NFIP Map Revisions*, describes in detail the circumstances under which the forms are required.

We recover costs associated with reviewing and processing requests for modifications to published FIRMs to minimize the financial burden on the policyholders. The fee for an as-built Letter of Map Revision request in follow-up to this CLOMR is $3,800, which we must receive before we can begin processing. This fee represents the fee schedule effective September 1, 2002. However, the fee schedule is subject to change, and the requester is required to submit the fee in effect at the time of the submission. Your payment must be a check or money order made payable to the National Flood Insurance Program and should be forwarded to:

Federal Emergency Management Agency
Fee Charge System Administrator
P.O. Box 3173
Merrifield, Virginia 22216

Once we receive the processing fee and the items listed above, complete our review, and verify that the completed project meets all applicable NFIP standards, we will revise your community's FIRM to incorporate the effects of the completed project, as appropriate.

Part 65 of the enclosed NFIP regulations further describes the data needed to support a request to revise the FIRM. Your compliance with the criteria outlined in the NFIP regulations will streamline our review, allowing us to expeditiously revise your community's FIRM.

If you have any questions regarding this CLOMR, please contact the FEMA Map Assistance Center, toll free, at 1-877-FEMA MAP (1-877-336-2627).

Sincerely,

Kevin C. Long

Kevin C. Long, CFM, Project Engineer
Hazard Identification Section
Mitigation Division
Emergency Preparedness
and Response Directorate

For: Doug Bellomo, P.E., CFM, Acting Chief
Hazard Identification Section
Mitigation Division
Emergency Preparedness
and Response Directorate

Enclosures

cc: Brad Bingham, Floodplain Administrator, City of Albuquerque
Brian Kent, Floodplain Administrator, Bernalillo County
Craig W. Hoover, P.E., Vice President, Bohannan-Huston, Inc.
Douglas H. Collister, President, High Desert Investment Corporation

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

January 24, 2003

Joseph A. Martinenza
PBS&J
12101 Indian Creek Court
Beltsville, Maryland 20705

RE: Request for a Conditional Letter of Map Revision for High Desert Tract 13

City of Albuquerque, New Mexico, Community No. 350002, FIRM Panel 35001C0163 E Effective Date April 2, 2003

Dear Mr. Martinenza,

The purpose of this submittal is to convey the documents in order to request a Conditional Letter of Map Revision based on a proposed construction of a bridge and three culvert crossings to revise the 100-year floodplain.

Enclosed with this letter is the construction drawings for the structures, Hec-Ras computer runs, a Drainage Report for Tract 13 at High Desert, and a check in the amount of $4,000.00.

As the City Floodplain Administrator, I have reviewed the response provided with this submittal. Our Community would greatly appreciate your prompt response and approval for this Conditional Letter of Map Revision.

THE CITY OF ALBUQUERQUE IS AN EQUAL OPPORTUNITY/REASONABLE ACCOMMODATION EMPLOYER

If you have any questions, you can contact me at (505) 924-3982.

Sincerely,

Carlos A. Montoya
City Floodplain Administrator

C: Bill Blanton, Federal Emergency Management Agency Headquarters
Jack Quarles, FEMA Region VI
Craig W. Hoover, Bohannan Huston
Lynn Mazur, AMAFCA
Susan Calongne, Bernalillo County Floodplain Administrator

Bohannan ^ Huston INC.

Courtyard I
7500 Jefferson St. NE
Albuquerque, NM
87109-4335

www.bhinc.com

voice: 505.823.1000
facsimile: 505.798.7988
toll free: 800.877.5332

January 22, 2003

Carlos Montoya, P.E.
City of Albuquerque
600 2nd St., NW
Albuquerque, NM 87103

Re: High Desert Tract 13 – CLOMR

Dear Mr. Montoya:

We are submitting the revisions to this CLOMR per comments from yourself, AMAFCA and our client. Please remove and replace from your copy the following:

- Form 3, page 1 – change to Section 4 Bear Canyon Arroyo Revised (cfs) 4.510 to 4,510
- Form 5 – figures 5.1, 5.2 and 5.3 have been updated
- Appendix A – AMAFCA Operation and Maintenance Plan updated to current edition
- Appendix C – HEC-RAS output information reprinted
- Appendix C – Bank Protection Plan Sheet 37 of 45 revised

One (1) additional set of the Conditional Letter of Map Revision (CLOMR) with a binder of the High Desert Tract 13 Drainage Report referenced in Appendix B. Please review these changes and sign Page 2 of Form 1 where indicated. We are enclosing a check in the amount of $4,000.00 for the review fee to be sent to FEMA with the CLOMR.

Thank you for your attention to this matter. If you have any questions or require additional information, please call me at 823-1000.

Sincerely,

Craig W. Hoover, P.E.
Senior Vice President and Group Manager
Water Resources Group

CWH/cc
Enclosures

cc: Lynn Mazur, P.E., AMAFCA

TABLE OF CONTENTS

TABLE OF CONTENTS

Form 1: Revision Requestor and Community Official Form

Figure 1.1 Regional Vicinity Map

Figure 1.2 Project Vicinity Map

Figure 1.3 Tract 13 Map

Form 3: Hydrologic Analysis Form

Form 4: Reverine Hydraulic Analysis Form

Form 4.1: Bear Canyon Arroyo

Figure 4.1.1 Bear Canyon Arroyo

Form 4.2: South Bear Canyon Arroyo 1

Figure 4.2.1 South Bear Canyon Arroyo 1 and 2

Form 4.3: South Bear Canyon Arroyo 2

Form 5: Riverine Mapping Form

Figure 5.1 Existing FIRM Map (35001C0163D)

Figure 5.2 Topographic Work Map

Figure 5.3 Annotated FIRM Map

Form 6: Channelization Form

Form 7: Bridge/Culvert Form

Form 7.1: High Desert Street Bridge crossing Bear Canyon Arroyo

Form 7.2: Culverts for South Bear Canyon Arroyo 1

Form 7.3: Culverts for South Bear Canyon Arroyo 2

APPENDICES

APPENDIX A OPERATION AND MAINTENCE PLANS

AMAFCA Operation and Maintenance Plan

City of Albuquerque Operation and Maintenance Plan

Maintenance Levels 1-4 for the High Desert Residential Owners Association

APPENDIX B FORM 3 – HYDROLOGIC ANALYSIS – BACK-UP DATA

AHYMO information for the Bear Canyon Arroyo Bridge

Approval letter from the City of Albuquerque for the Bear Canyon Arroyo bridge hydrology

Diskette with AHYMO model files for Bear Canyon Arroyo

Sections of the High Desert Tract 13 Drainage Report

Approval letter from the City of Albuquerque for the Drainage Report for Tract 13

APPENDIX C BEAR CANYON ARROYO / HIGH DESERT STREET BRIDGE DATA AND DRAWINGS (FORMS 4.1, 6.1, AND 7.1)

HEC-RAS output information for Bear Canyon Arroyo Bridge

RiverCAD output information for Bear Canyon Arroyo

CD with HEC-RAS and RiverCAD files for all Arroyos

Bank protection plan sheets

Bridge plan sheets

APPENDIX D SOUTH BEAR CANYON ARROYO 1 CULVERT DATA AND DRAWINGS (FORMS 4.2 AND 7.2)

RiverCAD output information for South Bear Canyon Arroyo 1 culverts

Culvert drawings

~~APPENDIX E SOUTH BEAR CANYON ARROYO 2 CULVERT DATA AND DRAWINGS (FORMS 4.3 AND 7.3)~~

RiverCAD output information for South Bear Canyon Arroyo 1 culverts

Culvert drawings (See Appendix D)

FORM 1

FEDERAL EMERGENCY MANAGEMENT AGENCY **REVISION REQUESTER AND COMMUNITY OFFICIAL**	O.M.B No. 3067-0148 Expires April 30, 2001

Public reporting burden for this form is estimated to average 2.13 hours per response. The burden estimate includes the ıe for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and mpleting and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

1. REQUESTED RESPONSE FROM FEMA

This request is for a:

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

☐ LOMR A letter from FEMA officially revising the current NFIP map to show the changes to floodplains, floodway or flood elevations. LOMRs typically decrease flood hazards. (See 44 CFR Ch. 1 Parts 60 & 65.)

☐ Other Describe: _____

2. OVERVIEW

1. The basis for this revision request is (are): (check all that apply)

☒ Physical Change ☒ Improved Methodology/Data ☐ Floodway Revision

☐ Other Describe: See additional Explanation 1.1
Note: A photograph is not required, but is very helpful during review.

Flooding Source: Bear Canyon Arroyo

3. Project Name/Identifier: High Desert Tract 13 CLOMR

4. FEMA zone designations affected: AO (depths between 1 and 2 feet)
(example: A, AH, AO, A1-A30, A99, AE, V, V1-V30, VE, B, C, D, X)

5. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
Ex: 480301 480287	Katy, City Harris County	TX TX	480301 48201C	0005D 0220G	02/08/83 09/28/90
350002	Albuquerque, City	NM	35001C	0163D	9/20/96
350001	Bernalillo, County	NM	35001C	0163D	9/20/96

6. The area of revision encompasses the following types of flooding and structures. Check all that apply.

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

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

4. ENCROACHMENT INFORMATION

1. Does the State have jurisdiction over the floodway or its adoption by communities participating in the NFIP?
   ☐ Yes ☒ No

Yes, attach a copy of a letter notifying the appropriate State agency of the floodway revision and documentation of the approval of the revised floodway by the appropriate State agency.

2. Does the development in the floodway cause the 1% annual chance (base) elevation to increase at any location by more than 0.000 feet? ☐ Yes ☒ No ☐ N/A

3. Does the cumulative effect of all development that has occurred since the effective SFHA was originally identified cause the base flood elevation to increase at any location by more than one foot (or other increase limit if community or state has adopted more stringent criteria - even if a floodway has not been delineated by FEMA)? ☐ Yes ☒ No

If the answer to either items is Yes, please attach documentation that all requirements of Section 65.12 of the NFIP regulations have been met, regarding evaluation of alternatives, notice to individual legal property owners, concurrence of CEO, and certification that no insurable structures are impacted.

5. MAINTENANCE RESPONSIBILITY

The community is willing to assume responsibility for ☐ performing ☒ overseeing compliance with the maintenance and operation plans of the Bear Canyon Arroyo See additional explanation 1.2
(Name)
flood control structure. If not performed promptly by an owner other than the community, the community will provide the necessary services without cost to the Federal government.

Operation and maintenance plans are attached. ☒ **Yes** ☐ **No** ☐ **N/A** See Appendix A

6. REVIEW FEE

The review fee for the appropriate request category has been included. ☒ Yes Fee amount: $4,000

OR

This request is based on a federally sponsored flood-control project where 50 percent or more of the project's cost is federally sponsored, or the request is based on detailed hydrologic and hydraulic studies conducted by Federal, State, or local agencies to replace approximate studies conducted by FEMA and shown on the effective FIRM; thus the project is fee exempt.
☐ Yes

Please see Instructions for Fee Amounts

7. SIGNATURE

Note: **I understand that my signature indicates that all information submitted in support of this request is correct**

Signature of Revision Requester

Douglas H. Collister, President
Printed Name and Title of Revision Requester

High Desert Investment Corp.
Company Name

Telephone No.: 505-823-9360 Date: ____

Note: **Signature indicates that the community understands, from the revision requester, the impacts of the revision on flooding conditions in the community.**

Signature of Community Official

Carlos Montoya, P.E., City/County Floodplain Administrator
Printed Name and Title of Community Official

City of Albuquerque
Community Name

Telephone No.: 505-924-3982 Date: 1-24-03

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is in accordance with 44 CFR Ch. 1, Sect 65.2

Signature

Craig W. Hoover, P.E., Vice President and Group Manager, Water Resources Group
Printed Name and Title of Revision Requester

Registr No. 11848 Expires (Date) 12/31/02 State NM

Type of License/Expertise: Civil Engineering/hydrology, hydraulics

Check which forms have been included with this request

Form Name and (Number)	Required if .....
☒ **Hydrologic** (3)	new or revised discharges
☒ **Hydraulic** (4)	new or revised water-surface elevations
☒ **Mapping** (5)	floodplain/floodway changes
☒ **Channelization** (6)	channel is modified
☒ **Bridge/Culvert** (7)	addition/revision of bridge/culvert
☐ **Levee/Floodwall** (8)	addition/revision of levee/floodwall
☐ **Coastal** (9)	new or revised coastal elevations
☐ **Coastal Structures** (10)	addition/revision of coastal structure
☐ **Dam** (11)	addition/revision of dam
☐ **Alluvial Fan** (12)	structures proposed on alluvial fan

Additional Explanations for Form 1 – Revision Requester and Community Official Form

Basis for Revision Request

1.1 The general area considered for this Conditional Letter of Map Revision (CLOMR) is Tract 13 of the High Desert Subdivision. The High Desert Subdivision is located in the northeast area of Albuquerque. High Desert Subdivision is bounded on the west by Tramway Boulevard, on the north by Elena Gallegos Land Grant (Simms Park Road), on the south by existing residences (Glenwood Hills Subdivision), and on the east by the Cibola National Forest (refer to Figure 1.1). Tract 13 is located in the southeastern section of High Desert, between the Bear Canyon and the Embudito arroyos (refer to Figure 1.2).

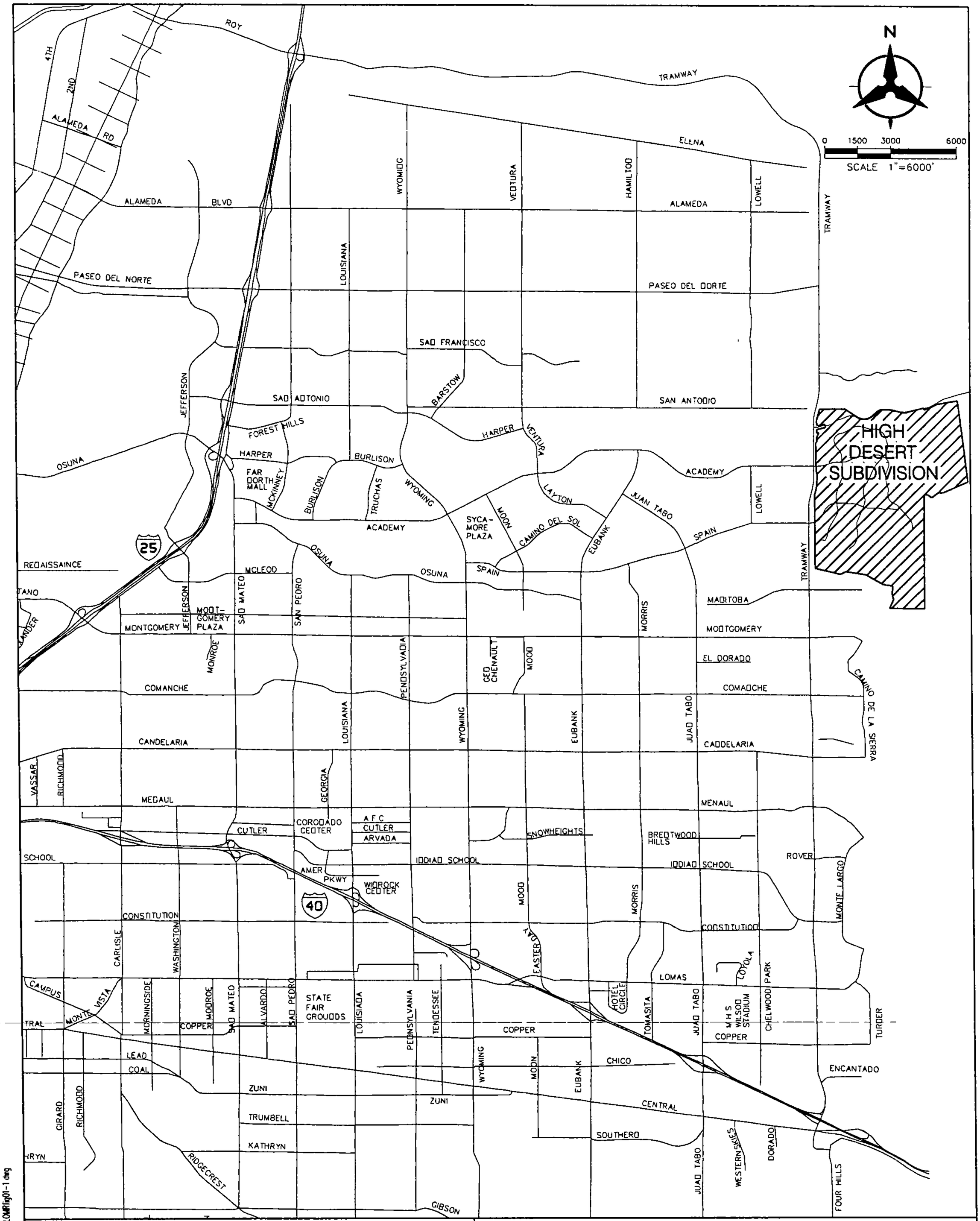
This CLOMR proposes physical changes to the Bear Canyon Arroyo in the vicinity of Tract 13. The changes are described below and general locations are shown in Figure 1.3. Details on the described changes are provided in this CLOMR.

Bear Canyon Arroyo has three tributaries of floodplain within the Tract 13 area. The main arroyo (which will be designated as BCA) forms the northern boundary of Tract 13. High Desert Place will cross the arroyo to provide access to Tract 13 from the north. A bridge and bank protection, both upstream and downstream of the bridge, is proposed for this arroyo crossing.

The two southern tributaries of the Bear Canyon Arroyo floodplain will be referred to as South Bear Canyon Arroyo 1 (SBCA 1) and South Bear Canyon Arroyo 2 (SBCA 2). Streets crossing these arroyos with culverts are proposed in three locations (refer to Figure 1.3 for locations).

Maintenance Responsibility

1.2 The bridge and the culverts will be the City of Albuquerque's to maintain since they are within City right-of-way. The bank protection associated with the BCA crossing will be maintained by the High Desert Residential Owners Association for Level 1 and 2 maintenance and by AMAFCA for Level 3 and 4 maintenance. Refer to Appendix A for operation and maintenance plans and a description of maintenance levels 1-4.



Bohannan ▲ Huston INC.

Courtyard I 7500 Jefferson St. NE Albuquerque, NM 87109-4335

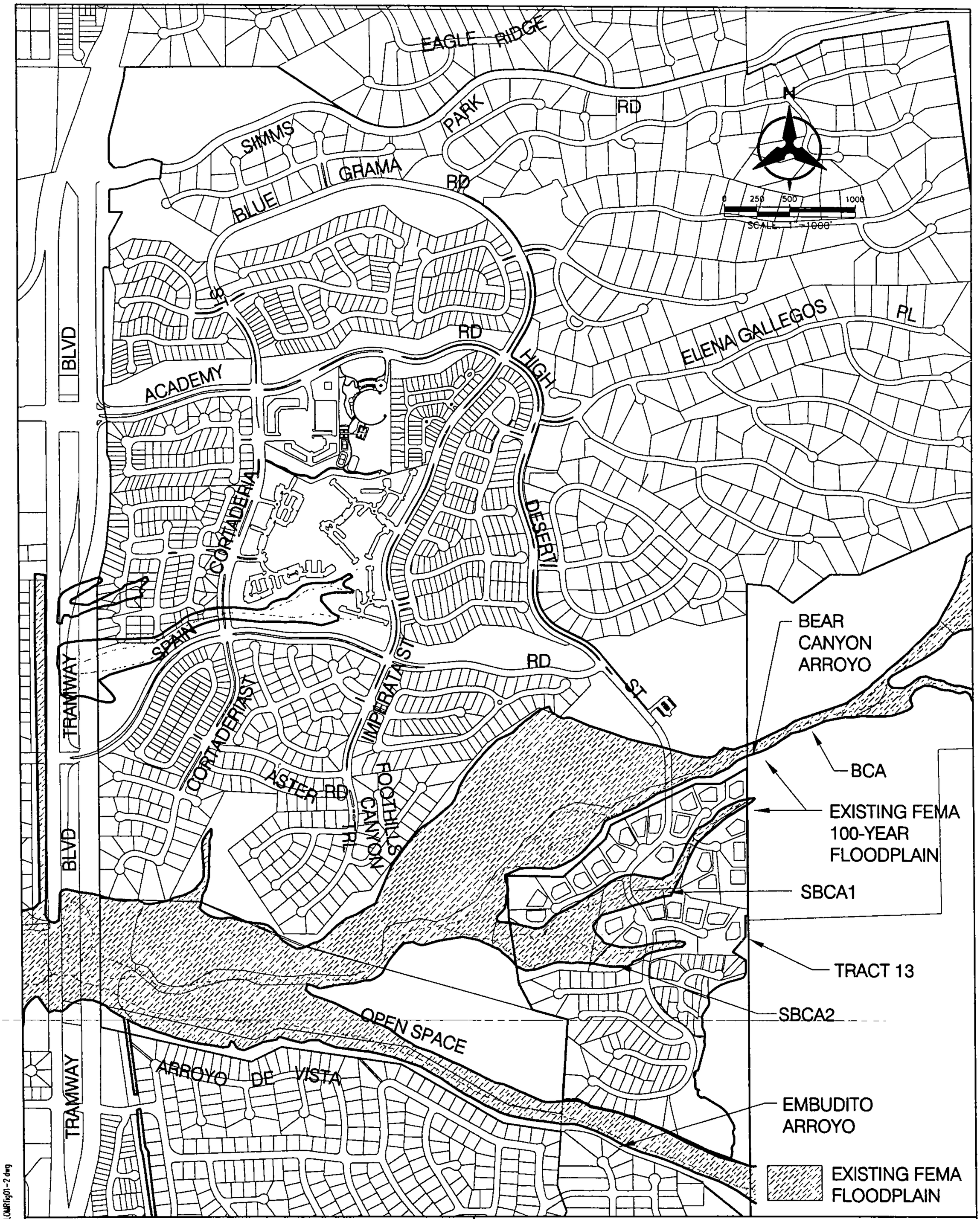
ENGINEERING ▲ SPATIAL DATA ▲ ADVANCED TECHNOLOGIES

HIGH DESERT TRACT 13 CLOMR

REGIONAL VICINITY MAP FIGURE 1.1

DRAWN BY S.F.G.	DATE 10.29.02
CHECKED BY S.J.G./C.W.H.	PROJECT NO 030103.006.CWH

P:\030103\Hydro\HD Tr13 CLOMR\030103.006\Fig01-1.dwg
Dec 09, 2002 - 4:02pm



Bohannan ▲ Huston INC.

Courtyard I 7500 Jefferson St. NE Albuquerque, NM 87109-4335

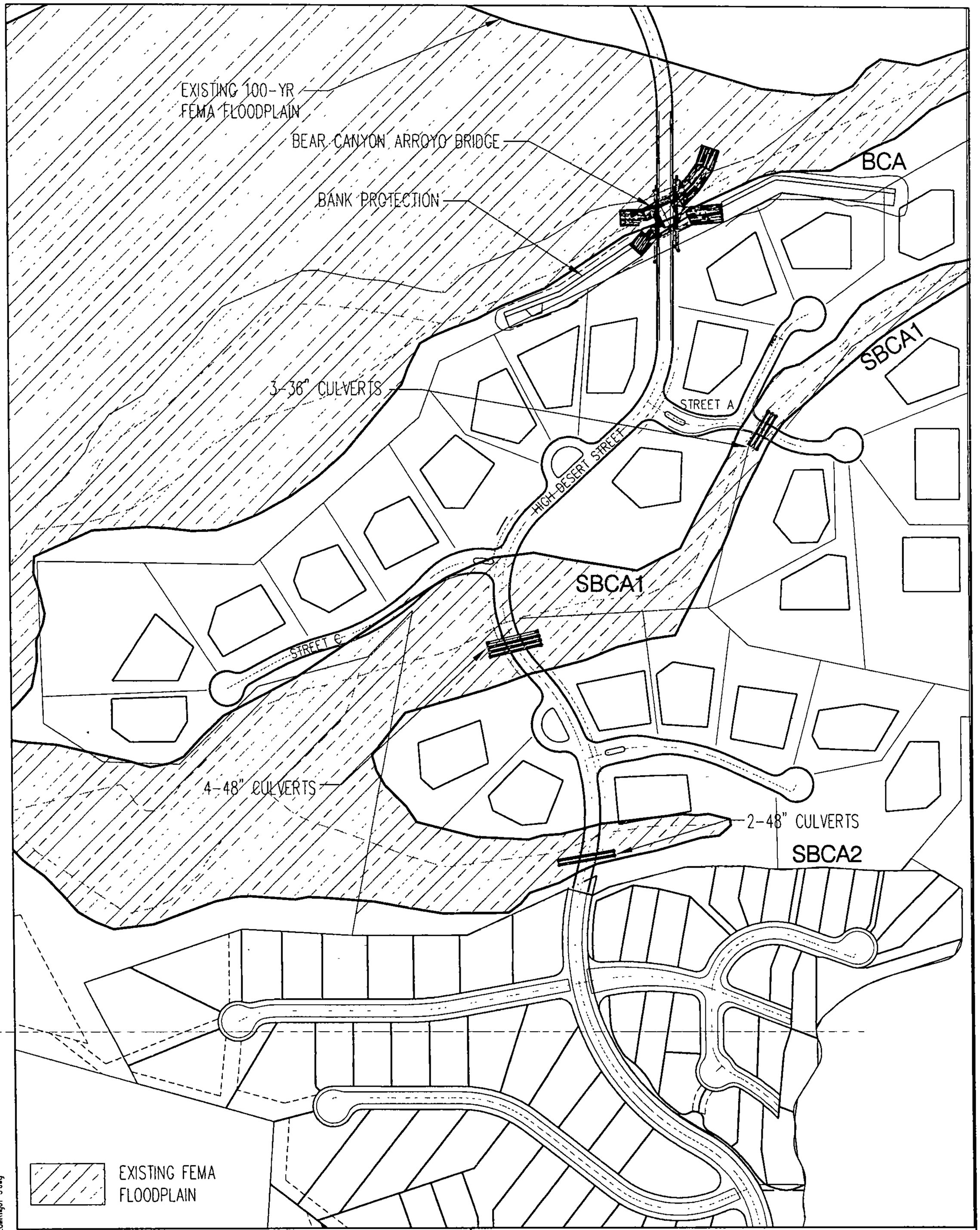
ENGINEERING ▲ SPATIAL DATA ▲ ADVANCED TECHNOLOGIES

HIGH DESERT TRACT 13
CLOMR

PROJECT VICINITY MAP
FIGURE 1.2

DRAWN BY	S.F.G.	DATE	10.29.02
CHECKED BY	S.J.G.	PROJECT NO	030103.006.CWH

P:\030103\Hydro\HD Tr13 CLOMR\030103CLOMRfig01-2.dwg
Dec 09, 2002 - 4:02pm



Bohannan ▲ Huston INC.

Courtyard I 7500 Jefferson St. NE Albuquerque, NM 87109-4335

ENGINEERING ▲ SPATIAL DATA ▲ ADVANCED TECHNOLOGIES

HIGH DESERT TRACT 13 CLOMR

TRACT 13 MAP
FIGURE 1.3

DRAWN BY	S F.G.	DATE	10.29.02
CHECKED BY	S J.G.	PROJECT NO	030103.006 CWH

P:\030103\Hydro\HD 1r13 CLOMR\030103LOMRfig01-3.dwg
Dec 09, 2002 - 4:03pm

FORM 3

FEDERAL EMERGENCY MANAGEMENT AGENCY **HYDROLOGIC ANALYSIS**	O.M.B No. 3067-0148 Expires April 30, 2001

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average **3.67** hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Note: Fill out one form for each flooding source studied

Community Name: City of Albuquerque, Bernalillo County

Flooding Source: Bear Canyon Arroyo

Project Name/Identifier: High Desert Tract 13 CLOMR

1. REASON FOR NEW HYDROLOGIC ANALYSIS

☐ No existing analysis ☐ Improved data ☒ Changed physical condition of watershed

☒ Alternative methodology ☐ Proposed Conditions (CLOMR) ☐ Other

See Additional Explanation 3.1 and 3.2

For the reason stated above, please attach a detailed explanation. If a computer program/model was used in revising the hydrologic analysis, **please provide a diskette with the input files** for the same flood recurrence intervals contained in the FIS for that stream; and at least for the 1% annual chance (base) flood where no detailed study exists.

Explanation provided: ☒ Yes ☐ No **Diskettes provided:** ☒ Yes ☐ No See Additional Explanation 3.3

2. METHODOLOGY FOR NEW ANALYSIS

Indicate Method	Required Data	Data Included
☐ Statistical Analysis of Gage Records	Form 3 - Attachment A	☐ Yes ☐ No
☐ Regional Regression Equations	Form 3 - Attachment C	☐ Yes ☐ No
☒ Precipitation/Runoff Model	Form 3 - Attachment D	☒ Yes ☐ No
☐ Other	Back-up computations and supporting data	☐ Yes ☐ No

3. APPROVAL OF ANALYSIS

The hydrologic analysis has already been approved by a local, state, or Federal Agency. ☒ Yes ☐ No ☐ Not Required

If Yes, attach evidence of approval. ☒ **Approval attached.** If No, attach explanation. ☐ **Explanation attached.**

4. COMPARISON OF BASE FLOOD DISCHARGES

Location:	Drainage Area (SqMi)	FIS(cfs)	Revised (cfs)
Bear Canyon Arroyo (BCA)	5.97	N/A	4,510
South Bear Canyon Arroyo 1 (SBCA1) at Street A	0.15	N/A	237
South Bear Canyon Arroyo 1 (SBCA1) at High Desert St.	0.27	N/A	480
South Bear Canyon Arroyo 2 (SBCA2)	*	N/A	83

Note: When revised discharges are not significantly different than the FIS discharges, FEMA may require a confidence limits analysis (see attachment B) at a later date to complete the review.

If only a portion of a detailed study area was revised please attach an explanation describing the transition from the proposed discharges to the effective discharges. ☒ **Explanation Included** ☐ **Explanation Not Required**

See Additional Explanation 3.5

5. HISTORICAL FLOODING INFORMATION

If historical data are available for the flooding source please provide: Location, peak discharges/water-surface elevations and dates, and source of information. ☐ **Data Attached** ☒ **Data Not Available**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

* Off-site drainage basins as well as an off-site storm drain contribute flow to this analysis point, therfore the total contributing drainage area was not determined for this specific hydrologic study.

ATTACHMENT A: STATISTICAL ANALYSIS OF GAGE RECORDS

aging Station: N/A

Gage Location (latitude and longitude): _____

		FIS:		Revised:	
1.	Number of years of data	_____		_____	
	Systematic	_____		_____	
	Historical	_____		_____	
2.	Homogeneous data	☐ Yes	☐ No	☐ Yes	☐ No
3.	Data adjustments	☐ Yes	☐ No	☐ Yes	☐ No
4.	Number of high outliers	_____		_____	
	Low outliers	_____		_____	
	Zero events	_____		_____	
5.	Generalized skew	_____		_____	
6.	Station skew	_____		_____	
7.	Adopted skew	_____		_____	
8.	Probability distribution used (justify if log-Pearson III was not used)	_____		_____	
9.	Transfer equations to ungaged sites			☐ Yes	☐ No
	If Yes, specify method				
10.	Expected probability*			☐ Yes	☐ No
11.	Comparison of results with other analyses			☐ Yes	☐ No
	If Yes, describe comparison				
12.	**Attach analysis including plot of flood-frequency curve. Analysis Attached?**			☐ Yes	☐ No

*FEMA does not accept expected probability analyses for the purpose of reflecting flood hazard information in a FIS.

If any data are not available, indicate by N/A.

ATTACHMENT B: CONFIDENCE LIMITS EVALUATION

Stream: N/A

Select one location for Confidence Limits Evaluation (*describe location*): _____

1. Discharges for selected location:

Exceedence Probability		FIS:	Revised:
10%	(10-year)	_____ cfs	_____ cfs
2%	(50-year)	_____ cfs	_____ cfs
1%	(100-year)	_____ cfs	_____ cfs
0.2%	(500-year)	_____ cfs	_____ cfs

2. 1% Annual Chance (Base) Flood Confidence Intervals

90% Confidence Interval:	5% limit	_____ cfs
	95% limit	_____ cfs
50% Confidence Interval:	25% limit	_____ cfs
	75% limit	_____ cfs

3. If the discharge of the base flood in the FIS is beyond the 50% confidence interval but within the 90% confidence interval, does the base flood elevation change by 1.0 foot or more? ☐ Yes ☐ No

An example of confidence limits analysis can be found in Appendix 9 of Bulletin 17B.

4. **Confidence Limits Analysis Attached?** ☐ Yes ☐ No

ATTACHMENT C: REGIONAL REGRESSION EQUATIONS N/A

. Bibliographical Reference:

_____

_____

_____

(Attach a copy of title page, table of contents, and pertinent pages including equations.)

2. Gaged or ungaged stream: _____

3. Hydrologic region(s): _____
Attach backup map.

4. Provide parameters, values, and source of data used to define parameters.

_____

_____

_____

		FIS:		Revised:	
5.	Urbanized conditions calculations	☐ Yes	☐ No	☐ Yes	☐ No
6.	Percent of watershed urbanization	_____		_____	
.	Is the watershed controlled?	☐ Yes	☐ No	☐ Yes	☐ No
8.	Comparison with other analyses	☐ Yes	☐ No	☐ Yes	☐ No

If the answer to 5, 7, or 8 is Yes, explain methdology below. If data are not available, indicate with N/A.

Comments

_____

9. **Attach computation and supporting maps, delineating the watershed boundary and drainage area divides.**

Computation and Supporting Maps provided? ☐ Yes ☐ No

ATTACHMENT D: PRECIPITATION/RUNOFF MODEL

		FIS:		Revised:	
	Method or model used:	_____		HYMO	
	Version:	_____		AHYMO 97	
	Date:	_____		1994	
2.	Source of rainfall depth:	_____		DPM Ch 22-2 *	
3.	Source of rainfall distribution:	_____		DPM Ch 22-2 *	
4.	Rainfall duration:	_____		24-hr	
5.	Areal adjustment to precipitation (%):	_____		N/A	
6.	Maximum overland flow length	_____		400 feet	
7.	Hydrograph development method:	_____		Unit Hyd.	
8.	Loss rate method:	_____		IA/INF	
	Source of soils information:	_____		SCS	
	Source of land use information:	_____		Field / Aerial Photo	
9.	Channel routing method:	_____		Variable storage method	
10.	Reservoir routing:	☐ Yes	☐ No	☒ Yes	☐ No
11.	Baseflow considerations: **If Yes, explain below how baseflow was determined:** _____	☐ Yes	☐ No	☐ Yes	☒ No
12.	Snowmelt considerations:	☐ Yes	☐ No	☐ Yes	☒ No
13.	Model calibration: **If Yes, explain below how calibration was performed** _____	☐ Yes	☐ No	☐ Yes	☒ No
14.	Future land use condition: **If Yes, explain why below** _____	☐ Yes	☐ No	☐ Yes	☒ No

15. **Attach precipitation/runoff model, hydrologic model schematic, curve number calculations, time of concentration calculations, and supporting maps, delineating the watershed boundary and drainage area divides.**

Information and Maps provided? ☒ Yes ☐ No See Appendix B

NOTE: FEMA policy is to base flooding on existing conditions.

* DPM Ch 22-2: City of Albuquerque Development Process Manual, Chapter 22-2 Hydrology, July 1997

Additional Explanations for Form 3—Hydrologic Analysis

Reason for new Hydrologic Analysis—Alternative Methodology and Proposed Conditions (CLOMR)

3.1 Changed Physical Conditions in the Watershed

This CLOMR proposes physical changes to the watershed. These changes include:

- Construction of a bridge crossing the Bear Canyon Arroyo (BCA) including associated bank protection and channel lining,
- Two roadway crossings of the South Bear Canyon Arroyo 1 (SBCA1) utilizing culverts to convey the flow under the roadway and
- One roadway crossing of the South Bear Canyon Arroyo 2 (SBCA2) utilizing culverts to convey the flow under the roadway.

These changes will reduce the width of the floodplain at the crossing locations.

3.2 For the main Bear Canyon Arroyo (BCA), the AHYMO computer modeling program was used in accordance with the City of Albuquerque Design Process manual (DPM) and conforms to the High Desert Drainage Management Master Plan (Dec. 1993). The drainage master plan model was used although the basins were further subdivided in order to obtain a flow rate at the proposed bridge location. The model information is included in Appendix B. The City approved the hydrology and the approval letter is included in Appendix B.

The flow rates for the southern tributaries of the Bear Canyon Arroyo floodplain were determined using the modified rational method from the City of Albuquerque's Development Process Manual (DPM). The basin map for this area is included in Appendix B. This area is Unit 1 of Tract 13. The site conditions were analyzed for the 100-year, 6-hour storm event in accordance with the DPM.

Computer Model Diskettes

3.3 The AHYMO model for the High Desert Master Drainage Plan has been previously approved (reference the High Desert Subdivision LOMR, effective date, July 13, 2000, Case No.: 99-06-1119P). Therefore, the High Desert Master Drainage Plan AHYMO model is not included in this CLOMR. A diskette containing the revised AHYMO model for the BCA Bridge is included in Appendix B.

Approval of Hydrologic Analysis

3.4 FEMA has accepted the City of Albuquerque Development Process Manual (DPM) in a letter dated November 14, 1991 to Gilbert Aldaz, City/County Floodplain Administrator. In addition, the Albuquerque Metropolitan Area Flood Control Authority (AMAFCA) has approved the use of the AHYMO computer model.

City approval for the BCA bridge hydrology and the Tract 13 Drainage Report is included in Appendix B.

Comparison of Base Flood Discharges

3.5 The effective FIS study for Albuquerque was completed in 1982. The source for the FIS discharges for the Bear Canyon Arroyo is the Northeast Heights Drainage Management Plan, Leonard Rice, April 1975. The hydrology used for this CLOMR was obtained from the High Desert Drainage Master Plan, Bohannan Huston, December 1993.

The discharges provided in the FIS for the Bear Canyon Arroyo is downstream of the High Desert Subdivision and therefore there are no locations for direct comparisons of base flows for this arroyo. The table below summarizes the flows used in this CLOMR:

Location	Drainage Area (Sq. Mi.)	100-year flow (cfs)
Bear Canyon Arroyo at High Desert Place Bridge	5.97	4510
South Bear Canyon Arroyo 1 at culvert crossing under Street A	0.15	237
South Bear Canyon Arroyo 1 at culvert crossing High Desert Place	0.27	480
South Bear Canyon Arroyo 2 at culvert crossing under High Desert Place	*	83

*Off-site drainage basins as well as an off-site storm drain contribute flow to this analysis point, therefore the total contributing drainage area was not determined for this specific hydrologic study.

Only a portion of arroyos' floodplain was studied as it relates to Tract 13 of the High Desert Subdivision. The floodplain transitions from the proposed discharges to the effective discharges are shown in Figure 5.3.

FORM 4.1

FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE HYDRAULIC ANALYSIS**	O.M.B No. 3067-0148 Expires April 30, 2001

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 2.25 hours per response. The burden estimate includes the time for viewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the m. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Note: Fill out one form for each flooding source studied

Community Name: City of Albuquerque, Bernalillo County

Flooding Source: Bear Canyon Arroyo (BCA)

Project Name/Identifier: High Desert Tract 13 CLOMR

1. REACH TO BE REVISED

Describe the limits of the revision OR submit a copy of the FIRM with the revision area clearly highlighted.
Copy of FIRM(s) attached depicting area of the revision (highlighted, or circled)? ☐ Yes

Downstream Limit: Approximately 1000 feet downstream of High Desert Place

Upstream Limit: Approximately 300 feet upstream of High Desert Place

2. MODELS SUBMITTED

Requirements: for areas which have detailed flooding:
Full input and output listings along with files on diskette for each of the models listed below (items 1-4) and a summary of the source of input parameters used in the models must be provided. The summary must include a description of any changes made from model to model (e.g., Duplicate Effective model to Corrected Effective model). At a minimum, the Duplicate Effective (item 1) and the Revised or Post-Project Conditions (item 4) models must be submitted. See instructions for directions on when other models may be required.

for areas which do not have detailed flooding:
Only the 100-year (Base) flood profile is required. A hydraulic model is not required for areas which do not have detailed flooding; however, BFEs may not be added to the revised FIRM. If a hydraulic model is developed for the area, items 3 and 4 described below must be submitted.

hydraulic models are not developed, hydraulic analyses (including all calculations) for existing or pre-project conditions and revised or post-project conditions must be submitted.

1. Duplicate Effective Model ☐ **Natural** **File Name** _____ ☐ **Floodway** **File Name** N/A
Copies of the hydraulic analysis used in the effective FIS, referred to as the effective models (10-, 50-, 100-, and 500-year multi-profile runs and the floodway run) must be obtained and then reproduced on the requester's equipment to produce the Duplicate Effective model. This is required to assure that the effective models input data has been transferred correctly to the requester's equipment and to assure that the revised data will be integrated into the effective data to provide a continuous FIS model upstream and downstream of the revised reach.

2. Corrected Effective Model ☐ **Natural** **File Name** _____ ☐ **Floodway** **File Name** N/A
The Corrected Effective model is the model that corrects any errors that occur in the Duplicate Effective model, adds any additional cross sections to the Duplicate Effective model, or incorporates more detailed topographic information than that used in the currently effective model. The Correctly Effective model must not reflect any man-made physical changes since the date of the effective model. An error could be a technical error in the modeling procedures, or any construction in the floodplain that occurred prior to the date of the effective model but was not incorporated into the effective model.

3. Existing or Pre-Project Conditions Model ☐ **Natural** **File Name** _____ ☐ **Floodway** **File Name** N/A
The Duplicate Effective model or Corrective Effective model is modified to produce the Existing or Pre-Project Conditions model to reflect any modifications that have occurred within the floodplain since the date of the Effective model but prior to the construction of the project for which the revision is being requested. If no modification has occurred since the date of the effective model, then this model would be identical to the Corrected Effective model or Duplicate Effective model.

4. Revised or Post-Project Conditions Model ☒ **Natural** **File Name** final.prj & northern-branch7.flx ☐ **Floodway** **File Name** _____
The Existing or Pre-Project Conditions model (or Duplicate Effective model or Corrected Effective model, as appropriate) is revised to reflect revised or post-project conditions. This model must incorporate any physical changes to the floodplain since the effective model was produced as well as the effects of the project. When the request is for the proposed project this model must reflect proposed conditions. See Additional Explanation 4.1.1

5. Other – Please attach a sheet describing all other models submitted along with the file names. ☐ **Natural** ☐ **Floodway**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

3. STARTING WATER-SURFACE ELEVATIONS

Explain how they were determined. Explanation Attached? ☒ Yes ☐ No

NOTE: If the effective study is an approximate study, the slope/area method is recommended.
For detailed analysis studies, using a known water-surface elevation is recommended.

4. RESULTS (from the model used to revise the 100-year water surface elevations)

If the results indicate any of the following, attach an explanation - to this form, or to the hydraulic model printout- as to the reasonableness of the situation.

☒ Supercritical depth ☒ Critical Depth ☐ Drawdowns ☐ Negative Floodway Surcharges

☐ Floodway Surcharges Greater Than Maximum Allowed by Community/State

☐ Water surface elevations higher than the end points of cross sections.

☐ Floodway discharge is different than the Natural 100-year (base) flood discharge.

☐ Project causes 100-year floodplain or floodway elevations to increase (state if increases are located off the requester's property)

Explanation attached with Form ☒ **Explanation provided on attached printout** ☐

If Hydraulic model used is HEC-2, has it been checked with FEMA'S CHECK-2 computer program? ☐ **Yes** ☐ **No**
(see instructions for information on how to obtain CHECK-2) N/A

5. REVISED FIRM/FBFM AND FLOOD PROFILES

1. **Profile Transition** N/A See Additional Explanation 4.1.1

a. 100-Year Water-Surface Elevations - indicate the difference in water surface elevations where the project 100-year elevations tie into the existing 100-year water surface elevations at each end of the project.

Downstream End _____ within _____ (feet) Upstream End _____ within _____ (feet)
Cross-Section # *Cross-Section #*

b. Floodway Elevations - indicate the difference in water surface elevations where the project floodway elevations tie into the existing floodway water surface elevations at each end of the project.

Downstream End _____ within _____ (feet) Upstream End _____ within _____ (feet)
Cross-Section # *Cross-Section #*

c. Floodway widths - indicate the difference in floodway widths where the project floodway widths tie into the existing floodway width at each end of the project.

Downstream End _____ within _____ (feet) Upstream End _____ within _____ (feet)
Cross-Section # *Cross-Section #*

2. **Profile Checklist (check box if information has been provided on profile)**

The following information (unless in parentheses) must be included at the same scale as the existing profiles for this project:

☐ Stream Name ☐ Community Name ☐ Corporate Limits labeled ☐ Study limits labeled

☐ Confluences labeled ☐ Channel Stationing ☐ Streambed profiled ☐ Cross Sections labeled

☐ Horizontal/Vertical Scales indicated ☐ 100-year elevs profiled*

☐ Road Crossings ☐ Labeled ☐ Low Chord Elevations ☐ Top of Road Elevations

*All recurrence intervals in the effective study must also be profiled.

Floodway Data Table

Attach a Floodway Data Table for each cross section listed in the published Floodway Data table in the FIS report.

Floodway Data Table Attached ☐ **Yes** ☒ **Not Required**

Additional Explanations for Form 4.1 – Riverine Hydraulic Analysis - Bear Canyon Arroyo (BCA)

Revised or Post-Project Conditions Model

4.1.1 The post-project conditions hydraulic model simulates approximately 1,600 feet of the Bear Canyon Arroyo in the vicinity of the proposed High Desert Place Bridge. The model includes the proposed bridge and associated bank protection and channel lining.

Bank protection will also be constructed on the south side of the arroyo. Buried, wire-tied riprap will be used for the embankment protection. The riprap will be constructed and the natural arroyo sides, bottom and materials will be restored over the riprap. The embankment protection will extend approximately 400 feet upstream of the bridge and 350 feet downstream of the bridge. Details on the embankment protection are provided in Appendix C.

Figure 4.1.1 shows the bridge and embankment protection in reference to the arroyo stationing used in the HEC-RAS model.

Starting Water Surface Elevations

4.1.2 A mixed flow model was run in HEC-RAS. The starting water surface elevations for the model were taken as normal depth, both at the upstream and downstream ends, as calculated by the HEC-RAS model. The model was started far enough upstream and downstream of the project area to assure that the starting water surface elevation did not effect the model results in the vicinity of the bridge.

In addition, a RiverCAD model was used to map the floodplain upstream and downstream of the HEC-RAS model.

Explanation of HEC-RAS Model Results

4.1.3 The results of the HEC-RAS model for the proposed bridge and embankment protection are included in Appendix C. This form requests an explanation of the results and the reasonableness of the situation. The following occur and an explanation for each follows: supercritical depth and critical depth.

Supercritical Depth:
The flow in the Bear Canyon Arroyo is supercritical flow. This is expected in a natural arroyo located in this area of Albuquerque. In a natural arroyo, the supercritical flow in the arroyo may pass through critical at various and varying positions along the length of the channel. The model results show that the computed water surface elevation at most of the cross sections is supercritical. The wire-tied riprap embankment protection was designed to handle the supercritical flow velocities.

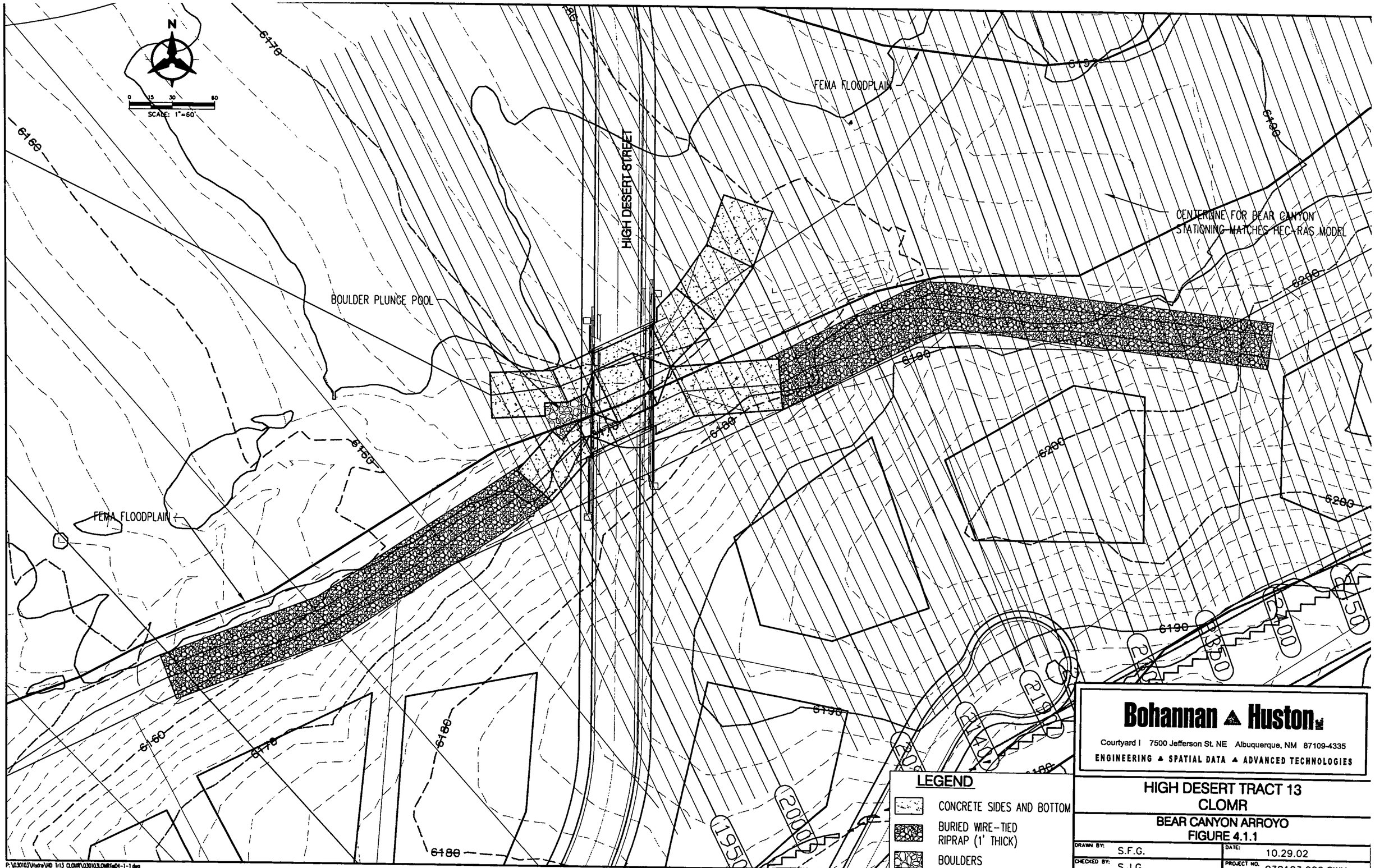
Critical Depth:
The natural arroyo bottom and sides will be restored once construction is competed. The wire-tied riprap protection will be buried by natural material. Because of the natural arroyo, the supercritical flow in the arroyo may pass through critical at various and varying positions along the length of the channel. In the profile provided, several small jumps from supercritical to subcritical flow are shown, due to the varying, natural arroyo. The arroyo has ample freeboard, even with the flow at critical depth, and also for subcritical flow.

The flow in the arroyo spreads out into several divided sections at the downstream end of the model (station 20 to 120). The HEC-RAS profile in this area is not smooth for this reason, and the summary table shows the top width of the arroyo widening significantly. This area of the model does not effect the floodplain changes being modeled upstream.

Revised FIRM Profiles

4.1.4 The FIRM map has been revised to reflect the results of the hydraulic analysis presented in this form. The existing floodplain in this area was studied by approximate methods in the effective FIS. Since only approximate methods were used to determine water surface elevations, flood profiles and floodway data tables for the Bear Canyon Arroyo floodplain do not exist.

The upstream limit of the revised section of the floodplain is 400 feet upstream (northeast) of the High Desert Place Bridge. The downstream limit of the revised section of the floodplain ties into the existing floodplain approximately 350 feet downstream of the High Desert Place Bridge.


N
0 15 30 60
SCALE: 1"=60'
6170
6160
6150
6140
6130
6120
6110
6100
6090
6080
6070
6060
6050
6040
6030
6020
6010
6000
5990
5980
5970
5960
5950
5940
5930
5920
5910
5900
5890
5880
5870
5860
5850
5840
5830
5820
5810
5800
5790
5780
5770
5760
5750
5740
5730
5720
5710
5700
5690
5680
5670
5660
5650
5640
5630
5620
5610
5600
5590
5580
5570
5560
5550
5540
5530
5520
5510
5500
5490
5480
5470
5460
5450
5440
5430
5420
5410
5400
5390
5380
5370
5360
5350
5340
5330
5320
5310
5300
5290
5280
5270
5260
5250
5240
5230
5220
5210
5200
5190
5180
5170
5160
5150
5140
5130
5120
5110
5100
5090
5080
5070
5060
5050
5040
5030
5020
5010
5000
4990
4980
4970
4960
4950
4940
4930
4920
4910
4900
4890
4880
4870
4860
4850
4840
4830
4820
4810
4800
4790
4780
4770
4760
4750
4740
4730
4720
4710
4700
4690
4680
4670
4660
4650
4640
4630
4620
4610
4600
4590
4580
4570
4560
4550
4540
4530
4520
4510
4500
4490
4480
4470
4460
4450
4440
4430
4420
4410
4400
4390
4380
4370
4360
4350
4340
4330
4320
4310
4300
4290
4280
4270
4260
4250
4240
4230
4220
4210
4200
4190
4180
4170
4160
4150
4140
4130
4120
4110
4100
4090
4080
4070
4060
4050
4040
4030
4020
4010
4000
3990
3980
3970
3960
3950
3940
3930
3920
3910
3900
3890
3880
3870
3860
3850
3840
3830
3820
3810
3800
3790
3780
3770
3760
3750
3740
3730
3720
3710
3700
3690
3680
3670
3660
3650
3640
3630
3620
3610
3600
3590
3580
3570
3560
3550
3540
3530
3520
3510
3500
3490
3480
3470
3460
3450
3440
3430
3420
3410
3400
3390
3380
3370
3360
3350
3340
3330
3320
3310
3300
3290
3280
3270
3260
3250
3240
3230
3220
3210
3200
3190
3180
3170
3160
3150
3140
3130
3120
3110
3100
3090
3080
3070
3060
3050
3040
3030
3020
3010
3000
2990
2980
2970
2960
2950
2940
2930
2920
2910
2900
2890
2880
2870
2860
2850
2840
2830
2820
2810
2800
2790
2780
2770
2760
2750
2740
2730
2720
2710
2700
2690
2680
2670
2660
2650
2640
2630
2620
2610
2600
2590
2580
2570
2560
2550
2540
2530
2520
2510
2500
2490
2480
2470
2460
2450
2440
2430
2420
2410
2400
2390
2380
2370
2360
2350
2340
2330
2320
2310
2300
2290
2280
2270
2260
2250
2240
2230
2220
2210
2200
2190
2180
2170
2160
2150
2140
2130
2120
2110
2100
2090
2080
2070
2060
2050
2040
2030
2020
2010
2000
1990
1980
1970
1960
1950
1940
1930
1920
1910
1900
1890
1880
1870
1860
1850
1840
1830
1820
1810
1800
1790
1780
1770
1760
1750
1740
1730
1720
1710
1700
1690
1680
1670
1660
1650
1640
1630
1620
1610
1600
1590
1580
1570
1560
1550
1540
1530
1520
1510
1500
1490
1480
1470
1460
1450
1440
1430
1420
1410
1400
1390
1380
1370
1360
1350
1340
1330
1320
1310
1300
1290
1280
1270
1260
1250
1240
1230
1220
1210
1200
1190
1180
1170
1160
1150
1140
1130
1120
1110
1100
1090
1080
1070
1060
1050
1040
1030
1020
1010
1000
990
980
970
960
950
940
930
920
910
900
890
880
870
860
850
840
830
820
810
800
790
780
770
760
750
740
730
720
710
700
690
680
670
660
650
640
630
620
610
600
590
580
570
560
550
540
530
520
510
500
490
480
470
460
450
440
430
420
410
400
390
380
370
360
350
340
330
320
310
300
290
280
270
260
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
HIGH DESERT STREET
FEMA FLOODPLAIN
BOULDER PLUNGE POOL
CENTERLINE FOR BEAR CANYON
STATIONING MATCHES HEC-RAS MODEL
LEGEND
CONCRETE SIDES AND BOTTOM
BURIED WIRE-TIED
RIPRAP (1' THICK)
BOULDERS
Bohannan ▲ Huston INC.
Courtyard I 7500 Jefferson St. NE Albuquerque, NM 87109-4335
ENGINEERING ▲ SPATIAL DATA ▲ ADVANCED TECHNOLOGIES
HIGH DESERT TRACT 13
CLOMR
BEAR CANYON ARROYO
FIGURE 4.1.1
DRAWN BY: S.F.G.
DATE: 10.29.02
CHECKED BY: S.J.G.
PROJECT NO. 030103.006.CWH
P:\030103\Hydro\HD Tr13 CLOMR\030103.CLOMRfig04-1-1.dwg
Dec 12, 2002 - 9:03am

FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE HYDRAULIC ANALYSIS**	O.M.B No. 3067-0148 Expires April 30, 2001

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 2.25 hours per response. The burden estimate includes the time for --viewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the m. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information ollections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Note: Fill out one form for each flooding source studied

Community Name: City of Albuquerque, Bernalillo County

Flooding Source: South Bear Canyon Arroyo 1 (SBCA1)

Project Name/Identifier: High Desert Tract 13 CLOMR

1. REACH TO BE REVISED

Describe the limits of the revision OR submit a copy of the FIRM with the revision area clearly highlighted.
Copy of FIRM(s) attached depicting area of the revision (highlighted, or circled)? ☐ Yes

Downstream Limit: 500 feet downstream of High Desert Place

Upstream Limit: 550 feet upstream of Steet A

2. MODELS SUBMITTED

Requirements: for areas which have detailed flooding:	**for areas which do not have detailed flooding**:
Full input and output listings along with files on diskette for each of the models listed below (items 1-4) and a summary of the source of input parameters used in the models must be provided. The summary must include a description of any changes made from model to model (e.g., Duplicate Effective model to Corrected Effective model). At a minimum, the Duplicate Effective (item 1) and the Revised or Post-Project Conditions (item 4) models must be submitted. See instructions for directions on when other models may be required.	Only the 100-year (Base) flood profile is required. A hydraulic model is not required for areas which do not have detailed flooding; however, BFEs may not be added to the revised FIRM. If a hydraulic model is developed for the area, items 3 and 4 described below must be submitted.

hydraulic models are not developed, hydraulic analyses (including all calculations) for existing or pre-project conditions and revised or post-project conditions must be submitted.

1. Duplicate Effective Model ☐ **Natural** **File Name** _____ ☐ **Floodway** **File Name** N/A
Copies of the hydraulic analysis used in the effective FIS, referred to as the effective models (10-, 50-, 100-, and 500-year multi-profile runs and the floodway run) must be obtained and then reproduced on the requester's equipment to produce the Duplicate Effective model. This is required to assure that the effective models input data has been transferred correctly to the requester's equipment and to assure that the revised data will be integrated into the effective data to provide a continuous FIS model upstream and downstream of the revised reach.

2. Corrected Effective Model ☐ **Natural** **File Name** _____ ☐ **Floodway** **File Name** N/A
The Corrected Effective model is the model that corrects any errors that occur in the Duplicate Effective model, adds any additional cross sections to the Duplicate Effective model, or incorporates more detailed topographic information than that used in the currently effective model. The Correctly Effective model must not reflect any man-made physical changes since the date of the effective model. An error could be a technical error in the modeling procedures, or any construction in the floodplain that occurred prior to the date of the effective model but was not incorporated into the effective model.

3. Existing or Pre-Project Conditions Model ☐ **Natural** **File Name** _____ ☐ **Floodway** **File Name** N/A
The Duplicate Effective model or Corrective Effective model is modified to produce the Existing or Pre-Project Conditions model to reflect any modifications that have occurred within the floodplain since the date of the Effective model but prior to the construction of the project for which the revision is being requested. If no modification has occurred since the date of the effective model, then this model would be identical to the Corrected Effective model or Duplicate Effective model.

4. Revised or Post-Project Conditions Model ☒ **Natural** **File Name** comb-mid-south.flx ☐ **Floodway** **File Name** _____
The Existing or Pre-Project Conditions model (or Duplicate Effective model or Corrected Effective model, as appropriate) is revised to reflect revised or post-project conditions. This model must incorporate any physical changes to the floodplain since the effective model was produced as well as the effects of the project. When the request is for the proposed project this model must reflect proposed conditions. See Additional Explanation 4.2.1

5. Other – Please attach a sheet describing all other models submitted along with the file names. ☐ **Natural** ☐ **Floodway**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

4.2 South Bear Canyon Arroyo 1

3. STARTING WATER-SURFACE ELEVATIONS

Explain how they were determined. Explanation Attached? ☒ Yes ☐ No

See Additional Explanation 4.2.2

NOTE: If the effective study is an approximate study, the slope/area method is recommended. For detailed analysis studies, using a known water-surface elevation is recommended.

4. RESULTS (from the model used to revise the 100-year water surface elevations)

If the results indicate any of the following, attach an explanation - to this form, or to the hydraulic model printout- as to the reasonableness of the situation.

☒ Supercritical depth ☒ Critical Depth ☐ Drawdowns ☐ Negative Floodway Surcharges

☐ Floodway Surcharges Greater Than Maximum Allowed by Community/State See Additional Explanation 4.2.3

☐ Water surface elevations higher than the end points of cross sections.

☐ Floodway discharge is different than the Natural 100-year (base) flood discharge.

☐ Project causes 100-year floodplain or floodway elevations to increase (state if increases are located off the requester's property)

Explanation attached with Form ☒ **Explanation provided on attached printout** ☐

If Hydraulic model used is HEC-2, has it been checked with FEMA'S CHECK-2 computer program? ☐ **Yes** ☐ **No**
(see instructions for information on how to obtain CHECK-2)

5. REVISED FIRM/FBFM AND FLOOD PROFILES

1. **Profile Transition** N/A See Additional Explanation 4.2.4

a. 100-Year Water-Surface Elevations - indicate the difference in water surface elevations where the project 100-year elevations tie into the existing 100-year water surface elevations at each end of the project.

Downstream End _____ within _____ (feet) Upstream End _____ within _____ (feet)
Cross-Section # *Cross-Section #*

b. Floodway Elevations - indicate the difference in water surface elevations where the project floodway elevations tie into the existing floodway water surface elevations at each end of the project.

Downstream End _____ within _____ (feet) Upstream End _____ within _____ (feet)
Cross-Section # *Cross-Section #*

c. Floodway widths - indicate the difference in floodway widths where the project floodway widths tie into the existing floodway width at each end of the project.

Downstream End _____ within _____ (feet) Upstream End _____ within _____ (feet)
Cross-Section # *Cross-Section #*

2. **Profile Checklist (check box if information has been provided on profile)**

The following information (unless in parentheses) must be included at the same scale as the existing profiles for this project:

☐ Stream Name ☐ Community Name ☐ Corporate Limits labeled ☐ Study limits labeled

☐ Confluences labeled ☐ Channel Stationing ☐ Streambed profiled ☐ Cross Sections labeled

☐ Horizontal/Vertical Scales indicated ☐ 100-year elevs profiled*

☐ Road Crossings ☐ Labeled ☐ Low Chord Elevations ☐ Top of Road Elevations

*All recurrence intervals in the effective study must also be profiled.

Floodway Data Table

Attach a Floodway Data Table for each cross section listed in the published Floodway Data table in the FIS report.

Floodway Data Table Attached ☐ **Yes** ☒ **Not Required**

Additional Explanations for Form 4.2 – Riverine Hydraulic Analysis South Bear Canyon Arroyo 1 (SBCA1)

Revised or Post-Project Conditions Model

4.2.1 The post-project conditions hydraulic model simulates 1,340 feet of the South Bear Canyon Arroyo 1 in the vicinity of the proposed culverts under Street A and High Desert Place. The model includes the proposed culverts.

Figure 4.2.1 shows the culvert locations and sizes in reference to the stationing used for the model and the Tract 13 layout.

Starting Water Surface Elevations

4.2.2 A mixed flow model was run in RiverCAD. The starting water surface elevations for the model were taken as critical depth, both at the upstream and downstream ends, as calculated by the model. The model was started far enough upstream and downstream of the project area to assure that the starting water surface elevation did not effect the model results in the vicinity of the proposed culverts.

Explanation of Model Results

4.2.3 The results of the model for the proposed culverts are included in Appendix D. This form requests an explanation of the results and the reasonableness of the situation. The following occur and an explanation for each follows: supercritical depth, critical depth, and water surface elevation higher than the end points of the cross section.

Supercritical Depth:
The flow in the South Bear Canyon Arroyo 1 is supercritical flow. This is expected in a natural arroyo located in this area of Albuquerque. The model results show that the computed water surface elevation at most of the cross sections is supercritical.

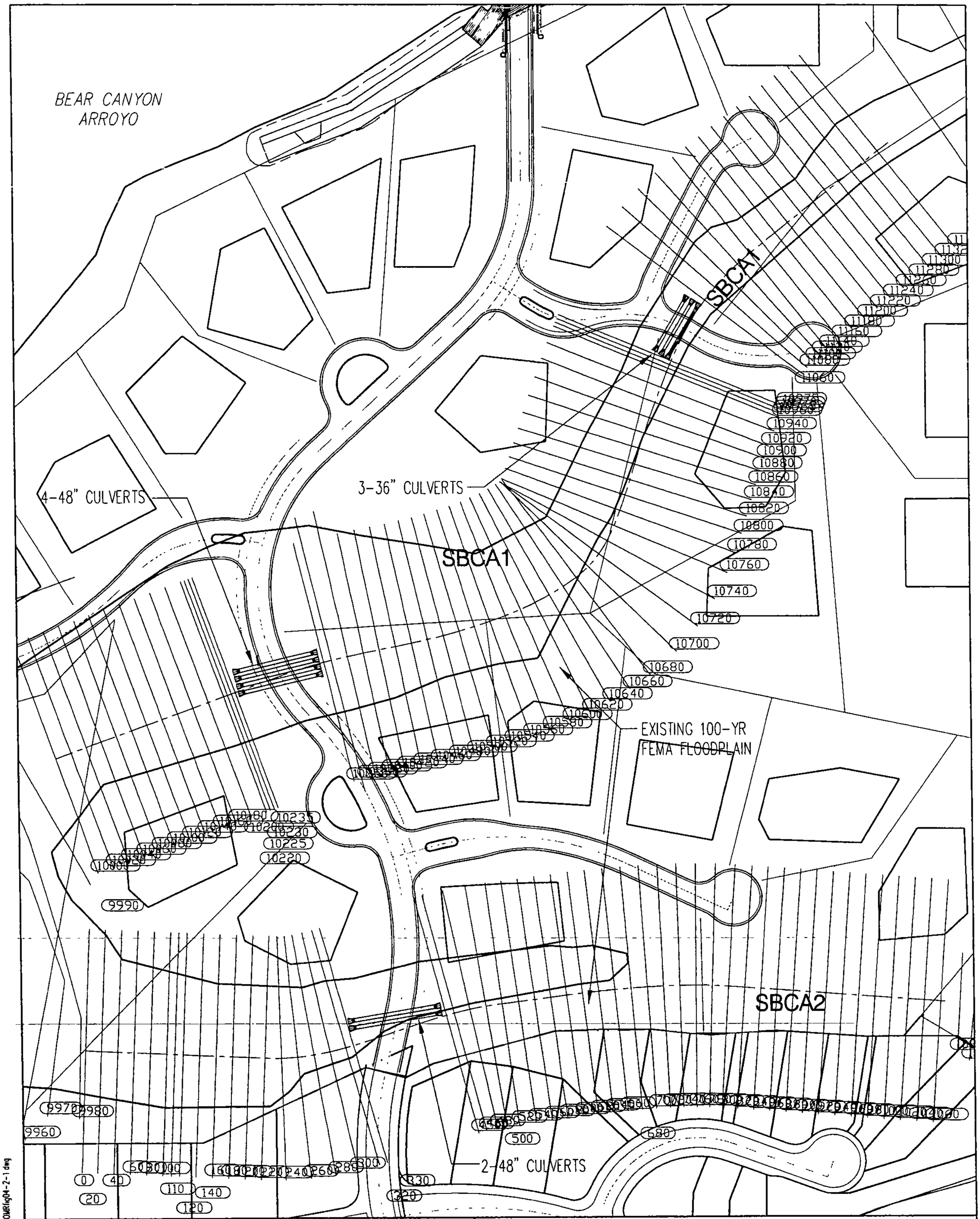
Critical Depth:
Supercritical flow in a natural arroyo may pass through critical at various and varying positions along the length of the channel. In the profile provided, several small jumps from supercritical to subcritical flow are shown, due to the varying, natural arroyo. The arroyo has ample freeboard, even with the flow at critical depth, and also for subcritical flow.

The flow becomes subritical upstream of the proposed culverts as the water backs up before passing through the culverts. This is shown as a widening of the floodplain in the area upstream of the culverts.

Revised FIRM Profiles

4.2.4 The FIRM map has been revised to reflect the results of the hydraulic analysis presented in this form. The existing floodplain in this area was studied by approximate methods in the effective FIS. Since only approximate methods were used to determine water surface elevations, flood profiles and floodway data tables for the Bear Canyon Arroyo floodplain do not exist.

The upstream limit of the revised section of the floodplain is 550 feet upstream of Street A. This location is the eastern property boundary for High Desert. East of this location is land owned by the United States Forest Service and City of Albuquerque Open Space Division. This land will never be developed and therefore a floodplain is not required beyond this point. The downstream limit of the revised section of the floodplain ties into the existing floodplain approximately 500 feet downstream of the High Desert Place culverts.



Bohannan ▲ Huston INC.

Courtyard I 7500 Jefferson St. NE Albuquerque, NM 87109-4335

ENGINEERING ▲ SPATIAL DATA ▲ ADVANCED TECHNOLOGIES

HIGH DESERT TRACT 13 CLOMR

TRACT 13 MAP
FIGURE 4.2.1

DRAWN BY	S F.G.	DATE	10 29.02
CHECKED BY	S.J.G.	PROJECT NO	030103.006.CWH

P:\030103\Hydro\HD Tr13 CLOMR\030103LOMRfig04-2-1.dwg
Dec 09, 2002 - 2:57pm

FORM 4.3

FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE HYDRAULIC ANALYSIS**	O.M.B No. 3067-0148 Expires April 30, 2001

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 2.25 hours per response. The burden estimate includes the time for viewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the m. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information ollections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Note: Fill out one form for each flooding source studied

Community Name: City of Albuquerque, Bernalillo County

Flooding Source: South Bear Canyon Arroyo 2 (SBCA 2)

Project Name/Identifier: High Desert Tract 13 CLOMR

1. REACH TO BE REVISED

Describe the limits of the revision OR submit a copy of the FIRM with the revision area clearly highlighted.
Copy of FIRM(s) attached depicting area of the revision (highlighted, or circled)? ☐ Yes

Downstream Limit: 500 feet downstream of High Desert Place

Upstream Limit: 800 feet upstream of High Desert Place

2. MODELS SUBMITTED

Requirements: for areas which have detailed flooding:	**for areas which do not have detailed flooding**:
Full input and output listings along with files on diskette for each of the models listed below (items 1-4) and a summary of the source of input parameters used in the models must be provided. The summary must include a description of any changes made from model to model (e.g., Duplicate Effective model to Corrected Effective model). At a minimum, the Duplicate Effective (item 1) and the Revised or Post-Project Conditions (item 4) models must be submitted. See instructions for directions on when other models may be required.	Only the 100-year (Base) flood profile is required. A hydraulic model is not required for areas which do not have detailed flooding; however, BFEs may not be added to the revised FIRM. If a hydraulic model is developed for the area, items 3 and 4 described below must be submitted.

hydraulic models are not developed, hydraulic analyses (including all calculations) for existing or pre-project conditions and revised or post-project conditions must be submitted.

1. Duplicate Effective Model ☐ **Natural** **File Name** _____ ☐ **Floodway** **File Name** N/A
Copies of the hydraulic analysis used in the effective FIS, referred to as the effective models (10-, 50-, 100-, and 500-year multi-profile runs and the floodway run) must be obtained and then reproduced on the requester's equipment to produce the Duplicate Effective model. This is required to assure that the effective models input data has been transferred correctly to the requester's equipment and to assure that the revised data will be integrated into the effective data to provide a continuous FIS model upstream and downstream of the revised reach.

2. Corrected Effective Model ☐ **Natural** **File Name** _____ ☐ **Floodway** **File Name** N/A
The Corrected Effective model is the model that corrects any errors that occur in the Duplicate Effective model, adds any additional cross sections to the Duplicate Effective model, or incorporates more detailed topographic information than that used in the currently effective model. The Correctly Effective model must not reflect any man-made physical changes since the date of the effective model. An error could be a technical error in the modeling procedures, or any construction in the floodplain that occurred prior to the date of the effective model but was not incorporated into the effective model.

3. Existing or Pre-Project Conditions Model ☐ **Natural** **File Name** _____ ☐ **Floodway** **File Name** N/A
The Duplicate Effective model or Corrective Effective model is modified to produce the Existing or Pre-Project Conditions model to reflect any modifications that have occurred within the floodplain since the date of the Effective model but prior to the construction of the project for which the revision is being requested. If no modification has occurred since the date of the effective model, then this model would be identical to the Corrected Effective model or Duplicate Effective model.

4. Revised or Post-Project Conditions Model ☒ **Natural** **File Name** southern-branch6.flx ☐ **Floodway** **File Name** _____
The Existing or Pre-Project Conditions model (or Duplicate Effective model or Corrected Effective model, as appropriate) is revised to reflect revised or post-project conditions. This model must incorporate any physical changes to the floodplain since the effective model was produced as well as the effects of the project. When the request is for the proposed project this model must reflect proposed conditions. See Additional Explanation 4.3.1

. **Other** – Please attach a sheet describing all other models submitted along with the file names. ☐ **Natural** ☐ **Floodway**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

4.3 South Bear Canyon Arroyo 2

3. STARTING WATER-SURFACE ELEVATIONS

Explain how they were determined. Explanation Attached? ☒ Yes ☐ No

See Additional Explanation 4.3.2

NOTE: If the effective study is an approximate study, the slope/area method is recommended. For detailed analysis studies, using a known water-surface elevation is recommended.

4. RESULTS (from the model used to revise the 100-year water surface elevations)

If the results indicate any of the following, attach an explanation - to this form, or to the hydraulic model printout- as to the reasonableness of the situation. See Additional Explanation 4.3.3

☒ Supercritical depth ☒ Critical Depth ☐ Drawdowns ☐ Negative Floodway Surcharges

☐ Floodway Surcharges Greater Than Maximum Allowed by Community/State

☐ Water surface elevations higher than the end points of cross sections.

☐ Floodway discharge is different than the Natural 100-year (base) flood discharge.

☐ Project causes 100-year floodplain or floodway elevations to increase (state if increases are located off the requester's property)

Explanation attached with Form ☒ **Explanation provided on attached printout** ☐

If Hydraulic model used is HEC-2, has it been checked with FEMA'S CHECK-2 computer program? ☐ **Yes** ☐ **No**
(see instructions for information on how to obtain CHECK-2)

5. REVISED FIRM/FBFM AND FLOOD PROFILES

1. **Profile Transition** N/A See Additional Explanation 4.3.4

a. 100-Year Water-Surface Elevations - indicate the difference in water surface elevations where the project 100-year elevations tie into the existing 100-year water surface elevations at each end of the project.

Downstream End _____ within _____ (feet) Upstream End _____ within _____ (feet)
Cross-Section # *Cross-Section #*

b. Floodway Elevations - indicate the difference in water surface elevations where the project floodway elevations tie into the existing floodway water surface elevations at each end of the project.

Downstream End _____ within _____ (feet) Upstream End _____ within _____ (feet)
Cross-Section # *Cross-Section #*

c. Floodway widths - indicate the difference in floodway widths where the project floodway widths tie into the existing floodway width at each end of the project.

Downstream End _____ within _____ (feet) Upstream End _____ within _____ (feet)
Cross-Section # *Cross-Section #*

2. **Profile Checklist (check box if information has been provided on profile)**

The following information (unless in parentheses) must be included at the same scale as the existing profiles for this project:

☐ Stream Name ☐ Community Name ☐ Corporate Limits labeled ☐ Study limits labeled

☐ Confluences labeled ☐ Channel Stationing ☐ Streambed profiled ☐ Cross Sections labeled

☐ Horizontal/Vertical Scales indicated ☐ 100-year elevs profiled*

☐ Road Crossings ☐ Labeled ☐ Low Chord Elevations ☐ Top of Road Elevations

*All recurrence intervals in the effective study must also be profiled.

Floodway Data Table

Attach a Floodway Data Table for each cross section listed in the published Floodway Data table in the FIS report.

Floodway Data Table Attached ☐ **Yes** ☒ **Not Required**

Additional Explanations for Form 4.3 – Riverine Hydraulic Analysis South Bear Canyon Arroyo 2 (SBCA2)

Revised or Post-Project Conditions Model

4.3.1 The post-project conditions hydraulic model simulates 1,060 feet of the South Bear Canyon Arroyo 2 in the vicinity of the proposed culverts under High Desert Place. The model includes the proposed culverts.

Figure 4.2.1 shows the culvert locations and sizes in reference to the stationing used for the HEC-RAS model and the Tract 13 layout.

Starting Water Surface Elevations

4.3.2 A mixed flow model was run in RiverCAD. The starting water surface elevations for the model were taken as critical depth, both at the upstream and downstream ends, as calculated by the model. The model was started far enough upstream and downstream of the project area to assure that the starting water surface elevation did not effect the model results in the vicinity of the proposed culverts.

Explanation of Model Results

4.3.3 The results of the model for the proposed culverts are included in Appendix E. This form requests an explanation of the results and the reasonableness of the situation. The following occur and an explanation for each follows: supercritical depth and critical depth.

Supercritical Depth:
The flow in the South Bear Canyon Arroyo 2 is supercritical flow. This is expected in a natural arroyo located in this area of Albuquerque. The model results show that the computed water surface elevation at most of the cross sections is supercritical.

Critical Depth:
Supercritical flow in a natural arroyo may pass through critical at various and varying positions along the length of the channel. In the profile provided, several small jumps from supercritical to subcritical flow are shown, due to the varying, natural arroyo. The arroyo has ample freeboard, even with the flow at critical depth, and also for subcritical flow.

The flow becomes subritical upstream of the proposed culverts as the water backs up before passing through the culverts. This is shown as a widening of the floodplain in the area upstream of the culverts.

Revised FIRM Profiles

4.3.4 The FIRM map has been revised to reflect the results of the hydraulic analysis presented in this form. The existing floodplain in this area was studied by approximate methods in the effective FIS.

Since only approximate methods were used to determine water surface elevations, flood profiles and floodway data tables for the Bear Canyon Arroyo floodplain do not exist.

The upstream limit of the revised section of the floodplain is 800 feet upstream of High Desert Place. This location is the eastern property boundary for High Desert. East of this location is land owned by the United States Forest Service and City of Albuquerque Open Space Division. This land will never be developed and therefore a floodplain is not required beyond this point. The downstream limit of the revised section of the floodplain ties into the existing floodplain approximately 500 feet downstream of the High Desert Place culverts.

FORM 5

FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE / COASTAL MAPPING**	O.M.B No. 3067-0148 Expires April 30, 2001

PUBLIC BURDEN DISCLOSURE NOTICE

ublic reporting burden for this form is estimated to average 1.5 hours per response. The burden estimate includes the me for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Note: Fill out one form for each flooding source studied

Community Name: City of Albuquerque, Bernalillo County

Flooding Source: Bear Canyon Arroyo

Project Name/Identifier: High Desert Tract 13 CLOMR

This is a ☒ Manual ☐ Digital submission. *Digital map submissions may be used to update digital FIRMs (DFIRMs). For updating DFIRMs, these submissions must be coordinated with FEMA Headquarters as far in advance as possible.*

1. MAPPING CHANGES

1. A topographic workmap must be submitted showing the following information (check N/A when not applicable):

a. Revised approximate 100-year floodplain boundaries (Zone A)	☐ Yes	☐ No	☒ N/A
b. Revised detailed 100- and 500-year floodplain boundaries.	☒ Yes	☐ No	☐ N/A
c. Revised floodway boundaries	☐ Yes	☐ No	☒ N/A
d. Location and alignment of all cross sections with stationing control indicated.	☐ Yes	☐ No	☒ N/A
e. Stream alignments, road alignments and dam alignments.	☒ Yes	☐ No	☐ N/A
f. Current community boundaries.	☒ Yes	☐ No	☐ N/A
. Effective 100- year floodplain and floodway boundaries from FIRM/FBFM reduced or enlarged to the scale of the topographic workmap	☒ Yes	☐ No	☐ N/A
... Tie-ins between the effective and revised 100-, 500-year and floodway boundaries	☒ Yes	☐ No	☐ N/A
i. The requester's property boundaries and community easements	☒ Yes	☐ No	☐ N/A
j. The signed certification of a registered professional engineer	☒ Yes	☐ No	☐ N/A
k. Location and description of reference marks	☒ Yes	☐ No	☐ N/A
l. Vertical datum (example: NGVD, NAVD)	☒ Yes	☐ No	☐ N/A
m. Coastal zone designations tie into adjacent areas not being revised	☐ Yes	☐ No	☒ N/A
n. Location and alignment of all coastal transects used to revise the coastal analyze	☐ Yes	☐ No	☒ N/A
o. V-zone has been delineated to extend landward to the heel of the primary frontal dune	☐ Yes	☐ No	☒ N/A

If any items are marked No or N/A please attach an explanation. See Additional Explanation 5.1

2. What is the source and date of the updated topographic information (example: orthophoto maps, July 1985; filed survey, May 1979, beach profile, June 1987 etc.)? _____

3. What is the scale and contour interval of the following workmaps?

Effective FIS Scale 1" = 500' Contour Interval 2'

Revision Request Scale 1" = 200' Contour Interval 2'

NOTE: Revised topographic information must be of equal or greater detail than effective.

4. Attach an annotated FIRM/FBFM at the scale of the effective FIRM/FBFM showing the revised 100- and 500-year floodplain and the floodway boundaries and how they tie into those shown on the effective FIRM/FBFM downstream and upstream of the revisions or adjacent to the area of revision for coastal studies. **FIRM/FBFM attached?** ☒ **Yes** ☐ **No** See Figure 5.3

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

2. EARTH FILL PLACEMENT

The fill is: ☐ Existing ☐ Proposed See Additional Explanation 5.2

2. Has fill been/will be placed in the regulatory floodway? ☐ Yes ☒ No
If Yes, please attach completed Riverine Hydraulic Analysis Form (Form 4).

3. Has fill been/will be placed in floodway fringe (*area between the floodway and 100-year floodplain boundaries*)? ☐ Yes ☒ No

If Yes, then complete A, B, C, and D below.

a. Are fill slopes for granular materials steeper than one vertical on one-and-one-half horizontal? ☐ Yes ☐ No

If Yes, justify steeper slopes _____

b. Is adequate erosion protection provided for fill slopes exposed to moving flood waters? (*Slopes exposed to flows with velocities of up to 5 feet per second (fps) during the 100-year flood must, at a minimum, be protected by a cover of grass, vines, weeds, or similar vegetation; slopes exposed to flows with velocities greater than 5 fps during the 100-year flood must, at a minimum, be protected by stone or rock riprap.)*

☐ Yes ☐ No

If No, describe erosion protection provided _____

c. Has all fill placed in revised 100-year floodplain been compacted to 95 percent of the maximum density obtainable with the Standard Proctor Test Method or acceptable equivalent method? ☐ Yes ☐ No

d. Can structures conceivably be constructed on the fill at any time in the future? ☐ Yes ☐ No

If Yes, attach certification of fill compaction (item 3c. above) by the community's NFIP permit official, a registered professional engineer, or an accredited soils engineer in accordance with Subparagraph 65.5(a)(6) of the NFIP regulations.

Fill certification attached ☐ **Yes** ☐ **No**

4. Has fill been/will be placed in a V zone? ☐ Yes ☐ No

If Yes, is the fill protected from erosion by a flood control structure such as a revetment or seawall?

☐ Yes ☐ No

If Yes, attach the Coastal Structures Form (Form 10).

Additional Explanations for Form 5 – Riverine / Coastal Mapping

Mapping Changes

5.1 A. There is no zone A floodplain within the project boundaries.
C. There is no floodway within the project boundaries.
D. There were no cross sections used to delineate the revised floodplain. Cross sections and stationing related to the HEC-RAS model are provided in Appendix C.
M. No coastal zones present within the project boundaries.
N. No coastal zones present within the project boundaries.
O. No coastal zones present within the project boundaries.

Earth Fill Placement

5.2 Engineered earth fill will be placed in the Bear Canyon Arroyo (BCA) and the South Bear Canyon Arroyos 1 and 2 (SBCA1 and SBCA2) to facilitate construction of the roadway crossings. For the BCA flow upstream of the bridge crossing will be directed to the lined channel section under the bridge by lined wing dikes. The northeast wing dike will be lined with concrete slope paving while the southeast wing dike will be lined with wire tied riprap. For SBCA1 and SBCA2 the culverts will include end sections on the upstream and downstream ends. The upstream roadway embankment will be protected with dumped riprap. The roadway side slopes at all the crossing locations will be 3:1 (horizontal to vertical) or flatter.

FORM 6

FEDERAL EMERGENCY MANAGEMENT AGENCY **CHANNELIZATION**	O.M.B. Burden No. 3067-0148 Expires April 30, 2001

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1.75 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Community Name: City of Albuquerque, Bernalillo County

Flooding Source: Bear Canyon Arroyo (BCA)

Project Name/Identifier: High Desert Tract 13 CLOMR

1. REACH TO BE REVISED

Describe the limits of the revision **OR** submit a copy of the FIRM with the revision area clearly highlighted.
Copy of FIRM(s) attached depicting area of the revision (highlighted, or circled)? ☐ Yes

Downstream Limit: Approximately 350 feet downstream of High Desert Place

Upstream Limit: Approximately 400 feet upstream of High Desert Place

2. CHANNEL DESCRIPTION

Attach the following information about the channel (check box if information has been provided):

☒ Description of the inlet and outlet See Additional Explanation 6.1

☒ Description of the shape of the channel *(both cross sectional and planimetric configuration)* and its lining *(channel bottom and sides)*:

3. ACCESSORY STRUCTURES

The channelization includes:

- ☐ Levees *(Attach Levee/Floodwall System Analysis Form - Form 8)*
- ☐ Drop structures
- ☐ Superelevated sections
- ☒ Transitions in cross sectional geometry
- ☐ Debris basin/detention basin
- ☒ Energy dissipater
- ☐ Other (Describe):

4. DRAWING CHECKLIST

Attach the plans of the channelization certified by a registered professional engineer. The plan detail and information should include (check box if information has been provided):

☒ Channel alignment and locations of inlet, outlet, and accessory structures

☒ Channel lining

☒ Typical cross sections and profiles of channel banks and invert See Figures in Appendix C

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

5. HYDRAULIC CONSIDERATIONS

1. The channel was designed to carry 4510 (cfs) and/or the 100-year flood.

. The design elevation in the channel based on:

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

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

Inlet to channel?	☐ Yes
Outlet of channel?	☒ Yes
At Drop Structures?	☐ Yes
At Transitions?	☐ Yes
Other locations?	☐ Yes

Explanation Attached? ☒ **Yes** ☐ **No** ☐ **N/A** See Additional Explanation 6.2

6. SEDIMENT TRANSPORT CONSIDERATIONS

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year (base flood) water-surface elevations; and/or based on the stream geomorphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including sewer and deposition) to affect the base flood water-surface elevations, then provide the following information **(Check the box if provided):**

- ☐ Estimated sediment load
- ☐ Method used to estimate sediment transport
- ☐ Method used to estimate scour and/or deposition
- ☒ Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport

See Additional Explanation 6.3

Additional Explanations for Form 6 – Channelization Form
Bear Canyon Arroyo (BCA)

Arroyo Description

6.1 Wire-tied riprap will be constructed on the south bank of the Bear Canyon Arroyo for erosion protection. The riprap will be placed at the same side slope as the existing side slope. The riprap will be buried with natural materials after construction, so the arroyo will appear in its natural state. Details on the wire-tied riprap are shown in Figures in Appendix C.

The wire-tied riprap will begin approximately 400 feet upstream of the proposed bridge over High Desert Place and end approximately 350 feet downstream of the bridge. The arroyo will be concrete slope paving under the bridge. The extent of the wire-tied riprap is shown in Figure 4.1.1.

Boulders will be placed immediately downstream of the bridge, on the arroyo bottom. The boulder plunge pool will be roughly 40 foot wide by 60 foot long. The plunge pool will drop the flow two feet vertically to account for long-term scour. The plunge pool also creates a hydraulic jump downstream of the bridge thereby reducing the water velocity in the reach.

Hydraulic Considerations

6.2 Downstream of the bridge the intent of the design is dissipate the flow's energy and reduce its velocity by creating a hydraulic jump. This jump is created through the geometry of the boulder plunge pool located approximately 40' downstream of the bridge. The plunge pool increases in width moving downstream and includes a 2 feet tall sill at the downstream end. This configuration combines to force a hydraulic jump. The HEC RAS model includes these proposed improvements and verifies the presence and location of the hydraulic jump. The sill will control the location of the jump, keeping the jump well downstream of the bridge crossing. See Appendix C for design information.

Sediment Transport Considerations

6.2 The High Desert Drainage Management Plan, December 1993, is the source of information on sediment transport for the Bear Canyon Arroyo.

<u>Method Used to Revise the Hydrologic Analysis to Account for Sediment Transport:</u>
Sediment transport is usually a consideration when hydrologic studies are conducted in Albuquerque. The AHYMO program has a sediment bulking factor that is applied to clean water flows to account for sediment in the runoff.

Sediment yield data was used to determine sediment bulking factors for the AHYMO model for the area. The 100-year sediment bulking factor for arroyo and basin flows of High Desert is 10 percent.

FORM 7.1

※※※※※

FEDERAL EMERGENCY MANAGEMENT AGENCY **BRIDGE/CULVERT**	O.M.B. Burden No. 3067-0148 Expires April 30, 2001

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 2 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Community Name: City of Albquerque, Bernalillo County

Flooding Source: Bear Canyon Arroyo (BCA)

Project Name/Identifier: High Desert Tract 13 CLOMR

1. IDENTIFIER

1. Name of structure (roadway, railroad, etc.): High Desert Place Bridge

2. Location of bridge/culvert along flooding source (in terms of stream distance or cross-section identifier):

   Station 9+80 to 10+60 for modeling purposes

3. This revision reflects (check one of the following):

   ☒ New bridge/culvert not modeled in the FIS

   ☐ Modified bridge/culvert previously modeled in the FIS

   ☐ New analysis of bridge/culvert previously modeled in the FIS

4. Hydraulic model used to analyze the structure *(e.g., HEC-2 with special bridge routine, WSPRO, HY8)*

   HEC-RAS

   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structure(s). *(Attach justification)*

   Justification attached ☐ **Yes** ☐ **No** ☒ **N/A**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

7.1 Bear Canyon Arroyo Bridge

2. DRAWING CHECKLIST

Attach plans of the structure(s) certified by a registered professional engineer. The plan detail and information should include the following (check the boxes if the information has been provided):

- ☒ Dimensions (height, width, span, radius, length)
- ☐ Shape (culverts only)
- ☒ Material — See Figures in Appendix C
- ☐ Beveling or Rounding
- ☒ Wing Wall Angle — See Additional Explanation 7.1.1
- ☒ Low Chord Elevations - Upstream and Downstream
- ☒ Top of Road Elevations - Upstream and Downstream
- ☒ Structure Invert Elevations - Upstream and Downstream
- ☒ Stream Invert Elevations - Upstream and Downstream
- ☒ Skew Angle
- ☒ Cross-Section Locations
- ☒ Distances Between Cross Sections 10 feet See Figure 4.1.1
- ☒ Erosion Protection

3. SEDIMENT TRANSPORT CONSIDERATIONS

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year (base flood) water-surface elevations; and/or based on the stream geomorphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including sewer and deposition) to affect the base flood elevations, then provide the following information **(Check the box if provided):**

- ☐ Estimated sediment load
- ☐ Method used to estimate sediment transport
- ☐ Method used to estimate scour and/or deposition
- ☒ Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport

See Additional Explanation 7.1.2

Additional Explanations for Form 7.1 – Bridge / Culvert Form
High Desert Place Bridge-Bear Canyon Arroyo

Bridge Description

7.1.1 The High Desert Place Bridge over the Bear Canyon Arroyo is shown in detail in Appendix C. The arroyo under the bridge will be concrete lined. The lined arroyo will have a 5 percent slope under the bridge. The arroyo will be trapezoidal in shape with a 40 foot bottom, 2 to 1 side slopes, and then vertical abutments. The total span of the bridge over the arroyo will be 73 feet. A minimum of 3 feet of freeboard from the water surface to the low chord of the bridge is provided.

Sediment Transport Considerations

7.1.2 The High Desert Drainage Management Plan, December 1993, is the source of information on sediment transport for the Bear Canyon Arroyo.

Method Used to Revise the Hydrologic Analysis to Account for Sediment Transport:
Sediment transport is usually a consideration when hydrologic studies are conducted in Albuquerque. The AHYMO program has a sediment bulking factor that is applied to clean water flows to account for sediment in the runoff.

Sediment yield data was used to determine sediment bulking factors for the AHYMO model for the area. The 100-year sediment bulking factor for arroyo and basin flows of High Desert is 10 percent.

FORM 7.2

*****

FEDERAL EMERGENCY MANAGEMENT AGENCY **BRIDGE/CULVERT**	O.M.B. Burden No. 3067-0148 Expires April 30, 2001

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 2 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Community Name: City of Albuquerque, Bernalillo County

Flooding Source: South Bear Canyon 1 (SBCA1)

Project Name/Identifier: High Desert Tract 13 CLOMR

1. IDENTIFIER

1. Name of structure (roadway, railroad, etc.): Culverts

2. Location of bridge/culvert along flooding source (in terms of stream distance or cross-section identifier):

   3 - 36" culverts under Street A and 4 - 48" culverts under High Desert Place, just south of Steet C

3. This revision reflects (check one of the following):

   ☒ New bridge/culvert not modeled in the FIS

   ☐ Modified bridge/culvert previously modeled in the FIS

   ☐ New analysis of bridge/culvert previously modeled in the FIS

4. Hydraulic model used to analyze the structure *(e.g., HEC-2 with special bridge routine, WSPRO, HY8)*

   HEC-RAS

   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structure(s). *(Attach justification)*

   Justification attached ☐ **Yes** ☐ **No** ☒ **N/A**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

7.2 South Bear Canyon 1

2. DRAWING CHECKLIST

Attach plans of the structure(s) certified by a registered professional engineer. The plan detail and information should include the following (check the boxes if the information has been provided):

- ☒ Dimensions (height, width, span, radius, length)
- ☒ Shape (culverts only)
- ☒ Material — See Figures in Appendix D
- ☒ Beveling or Rounding
- ☐ Wing Wall Angle — See Additional Explanation 7.2.1
- ☐ Low Chord Elevations - Upstream and Downstream
- ☒ Top of Road Elevations - Upstream and Downstream
- ☐ Structure Invert Elevations - Upstream and Downstream
- ☒ Stream Invert Elevations - Upstream and Downstream
- ☒ Skew Angle
- ☒ Cross-Section Locations — See Figure 4.2.1
- ☒ Distances Between Cross Sections
- ☐ Erosion Protection

3. SEDIMENT TRANSPORT CONSIDERATIONS

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year (base flood) water-surface elevations; and/or based on the stream geomorphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including sewer and deposition) to affect the base flood elevations, then provide the following information **(Check the box if provided):**

- ☐ Estimated sediment load
- ☐ Method used to estimate sediment transport
- ☐ Method used to estimate scour and/or deposition
- ☒ Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport

See Additional Explanation 7.2.2

Additional Explanations for Form 7.2 – Bridge / Culvert Form – Culverts-South Bear Canyon Arroyo 1 (SBCA1)

Culvert Description

7.2.1 There are two sets of culverts on this section of the Bear Canyon Arroyo floodplain. For purposes of this CLOMR, this section of the floodplain will be referred to as South Bear Canyon Arroyo 1 (SBCA1). The east set of culverts cross under Street A. Three 36-inch culverts are proposed for this crossing. The west set of culverts cross under High Desert Place, just south of Street C. Four 48-inch culverts are proposed for this crossing.

Sediment Transport Considerations

7.2.2 A sediment bulking factor of 10 percent, taken from the High Desert Drainage Management Plan, was used for all areas.

FORM 7.3

FEDERAL EMERGENCY MANAGEMENT AGENCY **BRIDGE/CULVERT**	O.M.B. Burden No. 3067-0148 Expires April 30, 2001

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 2 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing and reviewing the form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, S.W., Washington, DC 20472; and to the Office of Management and Budget, Paperwork Reduction Project (3067-0148), Washington, DC 20503.

You are not required to respond to this collection of information unless a valid OMB Control Number is displayed in the upper right corner of this form.

Community Name: City of Albuquerque, Bernalillo County

Flooding Source: South Bear Canyon Arroyo 2 (SBCA2)

Project Name/Identifier: High Desert Tract 13 CLOMR

1. IDENTIFIER

1. Name of structure (roadway, railroad, etc.): Culverts

2. Location of bridge/culvert along flooding source (in terms of stream distance or cross-section identifier):

   2 - 48' culverts under High Desert Place

3. This revision reflects (check one of the following):

   ☒ New bridge/culvert not modeled in the FIS

   ☐ Modified bridge/culvert previously modeled in the FIS

   ☐ New analysis of bridge/culvert previously modeled in the FIS

4. Hydraulic model used to analyze the structure *(e.g., HEC-2 with special bridge routine, WSPRO, HY8)*

   HEC-RAS

   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structure(s). *(Attach justification)*

   Justification attached ☐ **Yes** ☐ **No** ☒ **N/A**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

7.3 South Bear Canyon 2

2. DRAWING CHECKLIST

Attach plans of the structure(s) certified by a registered professional engineer. The plan detail and information should include the following (check the boxes if the information has been provided):

- ☒ Dimensions (height, width, span, radius, length)
- ☒ Shape (culverts only)
- ☒ Material — See Figures in Appendix E
- ☒ Beveling or Rounding
- ☐ Wing Wall Angle — See Additional Explanation 7.3.1
- ☐ Low Chord Elevations - Upstream and Downstream
- ☒ Top of Road Elevations - Upstream and Downstream
- ☒ Structure Invert Elevations - Upstream and Downstream
- ☒ Stream Invert Elevations - Upstream and Downstream
- ☒ Skew Angle
- ☒ Cross-Section Locations — See Figure 4.2.1
- ☒ Distances Between Cross Sections
- ☐ Erosion Protection

3. SEDIMENT TRANSPORT CONSIDERATIONS

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year (base flood) water-surface elevations; and/or based on the stream geomorphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including sewer and deposition) to affect the base flood elevations, then provide the following information **(Check the box if provided):**

- ☐ Estimated sediment load
- ☐ Method used to estimate sediment transport
- ☐ Method used to estimate scour and/or deposition
- ☒ Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport
  See Additional Explanation 7.3.2

Additional Explanations for Form 7.3 – Bridge / Culvert Culverts-South Bear Canyon Arroyo 2 (SBCA2)

Culvert Description

7.3.1 For purposes of this CLOMR, this section of the floodplain will be referred to as South Bear Canyon Arroyo 2 (SBCA2). Two 48-inch culverts are proposed under High Desert Place, just south of Street D.

Sediment Transport Considerations

7.3.2 A sediment bulking factor of 10 percent, taken from the High Desert Drainage Management Plan, was used for all areas.

APPENDIX A

APPENDIX A
OPERATION AND MAINTENANCE PLANS

- AMAFCA Operation and Maintenance Plan
- City of Albuquerque Operations and Maintenance Plan
- Maintenance Levels 1-4 for the High Desert Residential Owners Association

Albuquerque Metropolitan Arroyo Flood Control Authority

PROJECT MAINTENANCE

Plan No. 3,
December, 1999

1. **Definition:** Maintenance is defined as all measures taken to ensure that each facility will operate as intended by design, and includes repairs, improvements, and all measures taken to assure that public welfare and safety are protected.

2. General:

Maintenance and repairs will be accomplished by the most expeditious and cost-effective means. Both in-house forces and contractors may be used.

A. Priority of effort will be:

1. Correction of problems which could lead to failure and subsequent loss of life or major property damage (e.g., concrete channel repairs, blockages of outlets and channels).

2. Installation or repair of features to protect public safety (e.g., guardrails, traffic barriers, reflectors, delineators).

3. Repairs which are necessary to prevent deterioration to a condition which could lead to failure (e.g., serious erosion, gabion repairs).

4. Work to maintain stormwater capacity (e.g., sediment, vegetation, and trash removal).

5. Routine maintenance (e.g., normal erosion. replacement or riprap, concrete joint repairs).

6. Minor/esthetic maintenance (e.g., minor sediment graffiti).

3. Guidelines for allocation of effort:

A. In-house crew

1. Emergencies

2. Safety - installation of new safety features; maintenance and upgrade of existing

3. Inspection

4. Concrete repair, except large jobs

5. Jobs for which crew has experience, (e.g., silt removal in sensitive locations (Alameda Outlet Structure, NDC)

6. Routine and repetitive tasks

7. Short duration jobs (2 or less weeks duration)

B. Contractors

1. Production jobs, (e.g., larger dirt or silt moving)

2. Specialized tasks for which we lack in-house expertise and/or equipment

3. Appropriate backlog tasks which cannot be scheduled in a timely manner by Maintenance Crew

C. Other

1. Contractors and others may remove sediment from AMAFCA facilities, in accordance with Resolution 1991-10. Permits may be issued by the Business Manager after appropriate approval by other the Executive Engineer, Field Engineer, and/or Maintenance Superintendent.

4. <u>Administration and Records</u>

A. The Field Engineer and Maintenance Superintendent will develop annual and monthly maintenance (including safety) schedules.

B. Insofar as possible, records of maintenance work (written, photographic, costs) will be kept in each project OMI folder.

C. Field Engineer and Maintenance Superintendent will brief Executive Engineer monthly on accomplishments, schedule(s), safety, and other matters of interest.

Adopted: John P. Kelly Date: 2-16-99

John P. Kelly
Executive Engineer

Albuquerque Metropolitan Arroyo Flood Control Authority

PROJECT OPERATIONS

Plan No.3,
December, 1999

1. Definitions:

   A. **Operations**
   Within the context of "Operations, Maintenance, and Inspection", Operations is defined as the functioning of a flood control facility during or immediately after a storm. It includes the opening/closing of gates, valves, outlet works (if the facility has them) and may also involve hasty or emergency measures, if necessary to ensure proper functioning of the facility.

   B. **Emergency Operations**
   See Emergency Operations Plan No. 5, dated December, 1999.

2. General: During rainstorms, AMAFCA personnel, as needed or directed, will observe and monitor flood control facilities to ensure their proper operation.

3. Specific Instructions:

   A. As weather conditions dictate, AMAFCA personnel will travel to affected areas or flood control facilities, with radio-equipped vehicles. This procedure will be in effect during both on and off duty hours.

   B. Through communications, facilities affected will be identified, and closely monitored for proper operation and safety. Additional Authority forces will be called out, as required.

   C. Photographs will be taken, where possible.

   D. Flow or detention dam stages (depths) and times will be recorded.

   E. Notes of project operation characteristics will be made, particularly where unusual conditions may be noted.

   F. If necessary, assist police and rescue forces, as needed in opening gates, giving location instructions, etc. AMAFCA employees will not attempt rescue of victims in channels.

   G. Following storms, project OMI folders will be updated with information gathered during the operation and any remedial actions immediately planned and executed.

H. After a facility has functioned from stormwater, at the first opportunity, a detailed inspection will be made by an Authority engineer. Use of checklist is recommended.

4. Preparatory Instructions:

A. Before each flood season, the following will be accomplished:

1. Stock adequate supplies of film (Maintenance Superintendent)

2. Ensure vehicles, radios, lights, etc., are in good condition (Maintenance Superintendent).

3. Repaint, as needed, depth gauges (Maintenance Superintendent)

4. Ensure all gates, valves, outlet works function properly, and keep wheels and cranks property stored (Field Engineer, Maintenance Superintendent).

5. Keep cameras, flashlights, spray paint, rescue equipment available in vehicles (Field Engineer, Maintenance Superintendent).

B. During the flood season, the following applies:

1. Vacations and absences will be limited and controlled. (All, especially field personnel).

2. A daily assessment of storm potential will be made, and plans for response discussed (Field Engineer, Drainage Engineer, Maintenance Superintendent).

3. Maintenance Superintendent will take home a radio-equipped Authority vehicle.

4. Continuous inspections of Authority flood control facilities will be made. Secondary, incidental inspections may be made of facilities owner/operated by other to ensure complementary safe operation.

Adopted: John P Kelly Date: 12-16-99

John P. Kelly
Executive Engineer

Albuquerque Metropolitan Arroyo Flood Control Authority

PROJECT INSPECTIONS

Plan No. 3,
December 1999

1. **Definitions:**

A. Inspection. Examination of an Authority facility to ensure its proper operation and to identify needed maintenance and repairs.

2. **Procedures**

A. Intervals

1. A detailed, formal inspection of each Authority facility will be made at least once per year, normally in the spring before flood season. This inspection will be accomplished using a check list (See Inspection Guides and Checklist file). Certain facilities (e.g., NDC and SDC) require more frequent inspections.

2. An inspection will be conducted after each major sto rm event which affects a flood control facility, with the primary objective being to identify immediate measures needed to restore the facility's ability to function as designed.

3. An informal inspection of each facility will be conducted, normally in the fall. The formal checklist is not required, but written record may be made.

4. Principal spillway conduits at Dams will be inspected via remote camera ever four years. Conduits will be visually inspected during each annual inspection from the ends with lights. Physical inspection will be done if needed, in accordance with confined space entry procedures.

5. Dam crests will be surveyed for settlement every four years. Mylar drawings will be updated with the elevation information. with copies furnished to the New Mexico State Engineer Office.

a. Records

1. Formal checklists will be completed. reviewed by the Field Engineer and Executive Engineer, and filed in the project's OMI folder.

2. Sheet G-2 (required Maintenance/Repairs) will be duplicated, with a copy of

the Maintenance Superintendent, to serve as a work directive.

3. Results of informal inspections will be reported by informal notes, or in briefings to the Field Engineer.

4. The Field Engineer is responsible for developing inspection schedules.

5. Progress on inspections will be reported monthly to the Executive Engineer.

3. As a matter of professional courtesy, and when convenient, AMAFCA personnel will informally inspect drainage facilities owned by other public agencies, and advise them of problems.

Adopted: Date: 12-16-99

John P. Kelly

John P. Kelly
Executive Engineer

Albuquerque Metropolitan Arroyo Flood Control Authority

Emergency Operations Plan for Flood Emergencies

Plan No. 5
December, 1999

I **Purpose:**

This plan provides a framework for action in the event of a major flood emergency.

II **Mission:**

A. Operate AMAFCA projects to minimize loss of life and property damage.

B. Restore damaged flood control facilities to operation as soon as possible.

C. Assist other agencies as needed.

III **Procedures:**

A. During rainstorms, AMAFCA personnel, as needed or directed, will observe and monitor flood control facilities to ensure their proper operation. Any AMAFCA personnel have the authority to request additional assistance from AMAFCA staff and to implement this Emergency Operations Plan as needed. Initiation of this plan may also be at request of other agencies.

IV **Specific Instructions:**

A. **Executive Engineer**

1. Direct AMAFCA activities.

2. Coordinate acivities with other agencies.

3. Request State and Federal assistance.

4. Execute and administer contracts for emergency work.

4. Call for Emergency Board Meeting, if needed.

B. **Field Engineer**

1. Keep Executive Engineer informed

2. Direct field activities

3. Inspect or cause to be inspected all affected AMAFCA facilities.

4. Provide Maintenance Superintendent with prioriteis and technical guidance.

5. Recommend emergency actions to Executive Engineer. If Executive Engineer is not available, take action.

6. As time permits, inspect impacted flood control facilities managed by other agencies.

C. **Drainage Engineer**

1. Keep Executive Engineer informed

2. Establish and organize AMAFCA office as an Emergency Operations Center

3. Retrieve as built drawings, innundation maps, and technical reports as necessary to assist and relay information to field forces.

4. Recommend emergency actions to Field Engineer and Executive Engineer. If they are not available, take action.

5. Contact volunteer rainfall observers, USGS and National Weather Service for event information. Relay such to others.

6. Assist in inspection of affected facilities.

D. **Development Review Engineer**

1. Keep Executive Engineer informed

2. Assist in inspection of affected facilities.

3. Provide Maintenance Superintendent with priorities and technical guidance.

4. As time permits, inspect impacted flood control facilities managed by other agencies.

5. Arrange for aerial photographic coverage of flooding and flood damage.

E. **Real Estate Manager**

1. Report to City of Albuquerque Emergency Operations Center as AMAFCA's representative. EOC is in Basement of Police Building.

2. Act as liaison and communications link between AMAFCA and other agencies.

3. Assist Executive Engineer as directed.

F. **Maintenance Superintendent**

1. Call in necessary crew to respond.

2. Deploy men and equipment to ensure that affected AMAFCA dams,. Channels and other projects are inspected as soon as possible.

3. Assemble men and equipment at projects of concern.

4. Advise Field Engineer where problems might exist.

5. Maintain communication with AMAFCA office.

6. Assess need for outside support, and take action if necessary.

G. **Maintenance Crew**

1. Report to office. If delayed, phone in.

2. Activate radios, warm up equipment and trucks, load equipment on transport vehicles.

3. Follow instructions of Maintenance Superintendent or Field Engineer.

H. **Business Manager**

1. Manage AMAFCA office as an Emergency Operations Center

2. Maintain radio and telephone contact with Executive Engineer and field personnel.

3. Keep Board of Directors informed. As directed by Executive Engineer, poll Board to authorize emergency purchases, contacts and other activities.

4. Provide information to press.

5. Assist Executive Engineer in preparing and executing emergency contracts.

I. **Executive Secretary**

1. Operate communication equipment

2. Provide support to Emergency Operations Center

3. Keep records of communications and actions. Use speaker phone and tape recorder, if necessary.

V. Communications and Control

A. AMAFCA

1.	Office Telephone		(505) 884-2215
2.	Emergency Pager		(505) 251-4342
3.	Home and mobile telephones		attached
4.	Radio	High Band:	Receive 453.625 MHz Transmit 458.625 MHZ
5.	AMAFCA Fax		(505) 884-0214

B. Field and mobile units to maintain radio or periodic telephone contact with AMAFCA office.

C. All personnel advise Executive Engineer and Field Engineer of severe flooding, predicted severe flooding, or other severe circumstances.

D. Normal chain of command applies.

Adopted: John P Kelly Date: 12-16-99

John P. Kelly
Executive Engineer

CITY OF
Albuquerque

Federal Emergency Management Agency
Hazard Identification & Risk Assessment Division
500 C Street SW, Room 422
Washington, D.C. 20472

Community: City of Albuquerque,
New Mexico

Community No.: 350002

The City of Albuquerque, Public Works Department, Storm Drainage Maintenance Division, is responsible for the operation and maintenance of storm drainage systems in the City. The Storm Drainage Maintenance Division has 25 full-time employees, and is equipped to perform maintenance operations for all types of storm drainage facilities. Maintenance operations include sediment removal, pipe cleaning and flushing, pipeline, manhole, inlet repair and construction, concrete channel repair, and vegetation control.

Storm drainage maintenance activities are on-going throughout the year. Drainage system components are maintained per the following schedule:

System Component	*Inspection*	*Maintenance*
Pipes, Manholes, Inlets	Annual and following Complaints	Pipes, Manholes - Biannual Inlets - Annual
Channels, Arroyos	Annual	Annual, As Required
Detention Basins	Annual and following Complaints	Mowing - Annual Sediment Removal - As Req.

The Storm Drainage Maintenance Division is supervised by Mr. Glenn Jurgensen, Storm Drainage Superintendent.

Sincerely,

Larry A. Blair, P.E., Director
Public Works Department

93128205

3894

EASEMENT TO AMAFCA AND OWNERS ASSOCIATION
(Bear Canyon)

ALBUQUERQUE ACADEMY, INC., a New Mexico nonprofit corporation ("Grantor"), the ALBUQUERQUE METROPOLITAN ARROYO FLOOD CONTROL AUTHORITY, a political subdivision of the State of New Mexico ("AMAFCA") and the HIGH DESERT RESIDENTIAL OWNERS ASSOCIATION, INC., a New Mexico nonprofit corporation (the "Owners Association") agree:

1. Recitals

A. Grantor is the sole owner in fee simple of certain real property in Bernalillo County, New Mexico, more fully described in the attached Exhibit A (the "Property").

B. Grantor desires to grant a drainage easement to AMAFCA over the Property for surface storm water drainage.

C. The Owners Association was established for the administration of certain obligations pertaining to homes to be located adjacent to and in the vicinity of the Property.

D. The Property possesses arroyos which are paths for storm water drainage, but also possesses open space values that are of great importance.

E. Grantor desires that to the extent possible, without restricting the rights of AMAFCA granted pursuant to this easement, the Property be preserved for drainage and open space and that the primary function of the arroyos, which is for drainage, be consistent, in as much as possible, with the natural open space nature of the Property.

STATE OF NEW MEXICO
COUNTY OF BERNALILLO
FILED FOR RECORD
93 NOV 12 PM 3:34
93:32 3894-3918

2. Definitions. The following terms have the following meanings:

A. Level One Maintenance means:

i. removal from the Property of garbage and debris including but not limited to paper, cans and bottles;

ii. pruning of vegetation, removal of dead and dying plant material and thinning of vegetation to prevent choking or congestion of the arroyos situated on the Property;

iii. enhancement of vegetation through the addition of specimens native to the vicinity of the Property, provided however, that, the addition of such native specimens will not be in such a manner which reduces or restricts arroyo flows, or redirects arroyo flows to cause damage. In general, most specimens, especially woody varieties, will only be allowed along arroyo banks, or in vegetated "islands" in the middle of the arroyo which will not impair arroyo flows or induce bank erosion;

iv. the installation and maintenance of water harvesting devices in any situation or at any time the Owners Association determines necessary or desirable, subject to prior approval of AMAFCA, such approval not to be unreasonably withheld;

v. removal and control of pests and rodents; and

vi. other measures intended primarily to preserve or enhance the aesthetic values of the Property, without restricting arroyo flows.

B. Level Two Maintenance means:

i. repair of minor erosion of arroyo banks (generally three feet high or less) by hand or machine grading, in order to:

a. fill in steep banks which are enticements for digging by children or others;

b. correct hazardous bank conditions which could lead to unexpected falls and injury; and

c. arrest the potential for a significant change of course by the arroyo;

ii. cleaning of culverts and culvert entrances;

iii. construction of minor erosion control measures, using primarily native materials, along arroyo banks, at drainage outfalls to the arroyo, at water harvesting structures, below culverts and road crossings, at utility crossings of arroyos, and at any other place where continued neglect could or would lead to Level Three Maintenance or higher;

iv. reseeding of disturbed areas, using native seed mix and/or native plants/bushes. Provided however, that, plantings will not be made which obstruct arroyo flows or direct arroyo flows in a manner or direction which can cause harmful erosion or damage; and

v. other measures intended to preserve the capacity and flow path of the Property's arroyo, and to correct safety hazards.

C. Level Three Maintenance means:

i. repair of major erosion of arroyo banks (over three feet high) by machine grading or filling, including the hauling in and placing of fill against the banks and including the temporary (90 days or less) storage of sediment within the limits of the Prudent Lines (defined below) or in other areas as may be approved by the Owners Association;

ii. stabilization of arroyo horizontal or vertical migration by installation of permanent grade control structures or permanent bank stabilization structures (Permanent Improvements) (defined below), in particular in situations in which the Prudent Line (defined below) is threatened,

iii. installation of permanent scour protection below culverts, dip crossings, or other points where flow has been concentrated;

iv. protection of utility crossings of arroyos by installation of permanent erosion protection (Permanent Improvements);

v. other measures intended to preserve and protect the 100 Year Design Storm Capacity (defined below) of the arroyos and/or any of its improvements.

D. Level Four Maintenance means:

i. measures taken to protect public safety and prevent property damage, generally immediately after a significant flood event, when such measures clearly dominate over such considerations as aesthetics and preservation of flora and fauna. This includes the temporary storage of sediment within the limits of the Prudent Lines, and if necessary, in such areas outside the Prudent Lines as would be mutually agreeable to AMAFCA and the Owners Association;

ii. restoration or preservation of the Prudent Line, both by short term or permanent measures using Permanent Improvements;

iii. restoration or repair of any Permanent Improvements; and

iv. any measures deemed by AMAFCA to be urgent or an emergency, intended to restore the 100 Year Design Storm (defined below) capacity of the arroyo and which, if not performed, are likely to lead to threats to life or property.

E. Prudent Line (or Erosion Limit Line) is defined as that line which will not be disturbed by erosion, scour, or meandering of a natural (unlined) arroyo, channel or watercourse over a period of thirty (30) years and which will not be disturbed by a 100 Year Design Storm occurring at any time during the 30 year period. The Prudent Line shall be so located as to include all free board required to contain the wave action of the 100 Year Design Storm. The engineering costs of defining or

redefining the Prudent Line will not be borne by AMAFCA. It is understood that AMAFCA's maintenance responsibilities will not extend beyond the limits of this Drainage Easement until such time as the Prudent Line is established and an additional easement to the Prudent Line has been granted to AMAFCA, at which time the maintenance responsibilities of AMAFCA will extend to the Prudent Line.

F. Permanent Improvement is defined as a flood control facility which has been analyzed and designed by a competent engineer using acceptable engineering standards, and which is constructed of materials expected to have a design life of 50 years or more before replacement or major rehabilitation is required. Within this Drainage Easement, any Permanent Improvement will, to the extent possible, be constructed of soil cement, concrete, rip rap, or other materials of equivalent durability, stability, and longevity. Rip rap will be covered with an earth layer sufficient to sustain plant growth and discourage rodents. Other materials will be covered, to the extent possible, with a similar earth layer. Structural concrete, if exposed, will be treated to make its color similar to the surrounding earth, either by concrete additives, or by appropriate surface treatment. Texturing of the structural concrete will also be considered. The construction of reinforced concrete channels will be permitted only when other permanent measures have been tried and have failed, or are deemed

unacceptable to AMAFCA for reasons of high maintenance or poor performance.

3. Grant of Drainage Easement; Purpose; Reserved Rights. Grantor grants to AMAFCA and to its successors and assigns, a drainage easement over the Property for the primary purpose of surface storm drainage and gives AMAFCA the right to construct, operate, maintain, reconstruct, temporarily store sediment and perform other functions necessary for drainage and flood control as specified herein (the "Drainage Easement"). Grantor reserves to itself, and to its personal representatives, heirs, successors and assigns, all rights accruing from the ownership of the Property, including the right to engage in or permit or invite others to engage in all uses of and activities at the Property that are not expressly prohibited by or inconsistent with the purpose of the Drainage Easement, as such purposes are defined herein. Without limiting the foregoing, the Grantor will have and expressly reserves the following rights and easements to be exercised at the discretion of the Grantor, except as otherwise provided:

A. The right to grant subservient easements over portions of the Property to the appropriate parties as necessary for underground utilities including but not limited to water, sewer, gas, electricity and cable t.v., subject to prior approval from AMAFCA, such approval not to be unreasonably withheld, and issuance of an encroachment license by AMAFCA;

B. The right to use and maintain, and grant subservient easements to use and maintain, the Property consistent with the purpose of the Drainage Easement and permitted uses within the scope of the Drainage Easement, subject to prior approval from AMAFCA, such approval not to be unreasonably withheld, and issuance of an encroachment license by AMAFCA;

C. The right to establish hiking, biking and equestrian trails, the right to maintain such trails, and the right to grant trail and other path easements, all subject to prior approval from AMAFCA, such approval not to be unreasonably withheld, and issuance of an encroachment license by AMAFCA;

D. The right to dedicate to the City of Albuquerque portions of the Property as rights-of-way for public streets, subject to prior approval from AMAFCA, such approval not to be unreasonably withheld;

E. The right to install and maintain water harvesting devices;

F. The right to plat lots over this Drainage Easement; and

G. The right to develop, construct and transact with third parties and grant certain rights in the Property in connection with the development and use of the Property, or a portion thereof, as a golf course, provided that such development and use will be covered by a separate document which addresses, in specific terms, the rights and obligations of each party.

4. Term of Drainage Easement. The Drainage Easement will remain in effect so long as AMAFCA continues to use the Drainage Easement for the designated purpose. Whenever AMAFCA abandons, vacates or ceases to use the Drainage Easement, then ownership of the Drainage Easement will revert to and revest in Grantor, and its successors and assigns, without any action on the part of Grantor, as fully and completely as if the grant of the Drainage Easement had never been executed by Grantor and the Drainage Easement will then become void. Abandonment action will occur by the AMAFCA Board of Directors, conveying the Drainage Easement to Grantor by quitclaim deed.

5. Maintenance Obligations of AMAFCA. Level Three and Level Four Maintenance for the Drainage Easement will be the responsibility of AMAFCA. AMAFCA will bear all costs, responsibilities and liabilities related to such maintenance, except as otherwise stated herein. These obligations to maintain will remain in full force and effect as long as this Drainage Easement exists and may only be assigned to and assumed by a person or entity capable of performing such obligations. Such assignment will not be made without prior approval of the Owners Association, such approval not to be unreasonably withheld. Grantor will have no responsibility whatsoever relating to such maintenance of the Drainage Easement.

6. Easement; Maintenance Obligations of the Owners Association. Grantor grants to the Owners Association an easement for, and the Owners Association will be responsible for,

Level One and Level Two Maintenance for the Drainage Easement. The Owners Association will bear all costs, responsibilities and liabilities related to such maintenance. Should the Owners Association desire to undertake measures outlined under Level Three or Level Four Maintenance, it may do so at its own expense, subject to prior written approval from AMAFCA of both the engineering aspects and the financial ability to finance such measures, such approval not to be unreasonably withheld. Grantor will have no responsibility whatsoever relating to such maintenance of the Drainage Easement.

7. Default in Maintenance Obligations.

A. Non-Emergency Situation Defaults. If AMAFCA or the Owners Association believes the other has defaulted in its obligations to maintain the Drainage Easement, except in flood emergency situations as set forth in Section 7(B), the "non-defaulting party" will give the "defaulting party" written notice of such default. Within 10 working days of such notice the "defaulting party" will respond, in writing, setting forth its intended action to cure the default. If the intended action is not satisfactory to the "non-defaulting party", it will appeal to the AMAFCA Board of Directors. If the nature of the default is of a technical nature, either party may, as an intermediate step before appeal to the AMAFCA Board, appeal to the Technical Standards Committee of AMAFCA (the "Technical Standards Committee"). If the decision of the Technical Standards Committee is not satisfactory to either party, either party may

appeal to the AMAFCA Board of Directors. If the decision of the AMAFCA Board of Directors is not satisfactory to either party, either party may proceed to arbitration under the provisions of the New Mexico Uniform Arbitration Act. If a claim of default in maintenance obligations is arbitrated, the prevailing party will be entitled to reasonable attorney fees and costs.

B. Emergency Situation Defaults. During or immediately following a flood emergency, if AMAFCA or the Owners Association believes the other is in default of its maintenance obligations, the "non-defaulting party" has the option of seeking immediate judicial relief in the form of an injunction, or it can unilaterally, without notice, take whatever reasonable steps it believes are necessary to mitigate damage from the emergency situation. Following such mitigation efforts, the party taking such steps may seek reimbursement of its reasonable expenses from the "defaulting party" through arbitration under the procedures of the New Mexico Uniform Arbitration Act. If such a claim for reimbursement is arbitrated, the prevailing party will be entitled to reasonable attorney fees and costs.

C. Liens. If AMAFCA is awarded monetary compensation (including attorney fees and costs) against the Owners Association through arbitration, AMAFCA may take whatever steps are necessary to enforce and collect such monetary award, including the placing of a lien against the assets of the Owners Association. The Owners Association agrees to enforce the provisions of all documents governing the Owners Association and

its members regarding members' financial contributions to the Owners Association, so that sufficient funds and other assets are available to satisfy any arbitration or judicial award.

8. Operation, Maintenance and Inspection: Procedures and Records.

A. An operation, maintenance and inspection file (the "File") will be created and maintained by AMAFCA, but will be available for review by the Owners Association at any time. The File will include, at a minimum, the following:

i. copy of this Drainage Easement and any modification;

ii. copy of any easement documents;

iii. photographs of the Property's arroyo in its condition contemporaneous with the date of this Drainage Easement, such photographs to be taken by AMAFCA. These photographs will comprise a visual baseline for evaluating appropriateness of planned maintenance measures, and for ensuring the flood-carrying capacity of the arroyo is not diminished;

iv. operation, maintenance and inspection records, as outlined below;

v. correspondence; and

vi. other records deemed appropriate or necessary.

B. Operation records of the Property's arroyos will be kept as follows:

i. operation records of flood events, that may have any degree of formality, and that may include such records as telephonic reports of rainfall, floods and visual observations, photographs, video recordings, measurements of depth and width of flows, and engineering estimates of flow will be maintained.

ii. Owners Association will endeavor to notify AMAFCA during or after significant storm events, that create a need for Level Two Maintenance or higher, and to provide as much information as possible for purposes of maintaining operating records.

iii. Any engineering analyses regarding flow events will be the responsibility of AMAFCA.

C. Maintenance records of the Property's arroyo will be maintained as follows:

i. Reports of maintenance performed, with an associated estimate of costs will be maintained.

ii. Both AMAFCA and the Owners Association will provide reports to the AMAFCA file, immediately after maintenance is performed.

iii. Reports will include information on what maintenance was performed, location of maintenance activities, and estimated costs. Photographs and sketches may be added, as appropriate.

D. Inspection records of the Property's arroyos will be maintained as follows:

i. The Owners Association will cause the arroyo to be inspected at least once annually, during the period October 1 to March 31, and after each significant storm event which creates a need for Level Two Maintenance or higher. The primary purposes of the inspection are to identify problems needing correction and to serve as a work order for maintenance.

ii. Inspections will be performed by a person or team with sufficient knowledge and experience to determine when and what maintenance is required. AMAFCA will, to the extent possible, participate in the inspection, at mutually agreed upon times.

iii. Reports of each inspection will be made on a form developed by AMAFCA, in consultation with the Owners Association.

9. Liability and Responsibility; Insurance; Contingency Reserve.

A. Each party will be responsible and liable for its actions, according to New Mexico state law.

B. Owners Association will carry general liability insurance in the amount of not less than $500,000, naming AMAFCA as additional named insured and with a copy of the policy provided to AMAFCA annually, or upon each renewal.

E. Owners Association will, within ten years of the date of this Drainage Easement, establish a contingency reserve (the "Reserve"), dedicated solely to extraordinary drainage maintenance and repair.

i. The Reserve will be funded to an amount equal to the costs incurred for Levels One and Two Maintenance, for the five years during the first ten years after the date of this Drainage Easement in which such costs were the highest, or $50,000, whichever is greater.

ii. The Reserve will be maintained in a financial institution selected by the Owners Association.

iii. The Reserve will be used by the Owners Association solely for (i) Level One or Level Two Maintenance types of activities, following Level Three or Level Four Maintenance activities by AMAFCA, (ii) Level One or Level Two Maintenance activities at any time when mutually agreed upon by AMAFCA and the Owners Association, or (iii) Level Three or Level Four Maintenance activities performed by the Owners Association when mutually agreed upon by AMAFCA and the Owners Association. The Reserve may not be used for other purposes without the prior written approval of AMAFCA. If the Reserve is depleted, it will be restored within an amount of time proportional to the amount of depletion up to a five year period (e.g. 20% depletion replaced in one year; 100% depletion replaced in five years).

iv. The amount of the reserve may be modified after the tenth year by mutual agreement, based upon accumulated experience.

10. Connection to Drainage. Any developer of immediately adjacent properties will convey its drainage to this Drainage Easement or to construct facilities in a manner

satisfactory to, and approved in advance, by AMAFCA, such approval not to be unreasonably withheld.

11. Other Easements. AMAFCA accepts the Drainage Easement subject to other easements of record to which the Property is subject.

12. Recordation. Grantor will timely record this Drainage Easement in the real estate records of Bernalillo County, New Mexico and any other place of recordation AMAFCA or the Owners Association deems is necessary to preserve its rights.

13. Notice. Any notice required under this Drainage Easement will be sent by first class mail, postage prepaid:

If to Grantor:	Albuquerque Academy, Inc. 6400 Wyoming Blvd., N.E. Albuquerque, New Mexico 87109
If to AMAFCA:	Albuquerque Metropolitan Arroyo Flood Control Authority 2600 Prospect Avenue, N.E. Albuquerque, New Mexico 87107
If to Owners Association:	High Desert Residential Owners Association, Inc. P.O. Box 91976 Albuquerque, New Mexico 87199

14. Binding Effect. This Drainage Easement will inure to the benefit of and bind the heirs, devisees, personal representative, mortgagees, lessees, tenants, successors and assigns of Grantor, AMAFCA and the Owners Association and will continue as a servitude running in perpetuity with the Property.

15. Governing Law. This Drainage Easement will be governed by and interpreted in accordance with the laws of the State of New Mexico.

16. Amendment. This Drainage Easement may be amended or modified by the mutual agreement in writing of Grantor, AMAFCA and the Owners Association or their successors or assigns. Such writing will be filed for public record with reference to this Drainage Easement and previous amendments thereto, if any.

17. Liberal Construction and Interpretation. This Drainage Easement will be liberally construed. If any provision of this Drainage Easement is found to be ambiguous, an interpretation consistent with the purpose of this Drainage Easement that would render the provision valid will be favored over an interpretation that would render it invalid. If any provision of this Drainage Easement is determined by a court of competent jurisdiction to be void, invalid, illegal or unenforceable, that portion will be severed from this Drainage Easement and the remaining parts will remain in full force as though the invalid, illegal, or unenforceable portion had never been a part of this Drainage Easement.

18. Integration. This Drainage Easement contains or expressly incorporates by reference the entire agreement of the parties with respect to the matters contemplated by this Drainage Easement and supersedes all prior negotiations.

19. No Forfeiture. Nothing contained herein will result in a forfeiture or reversion of Grantor's title in any respect.

20. No Rights Granted or Conferred. This Drainage Easement is not intended to and does not grant or confer rights

to any utilities or the public except those rights specifically granted and conferred herein.

21. Flood Control Standards; Future Easements. It is understood and the parties agree that:

A. the community standard in Albuquerque, New Mexico for flood protection is the 100 Year Design Storm as defined in the City of Albuquerque and Bernalillo County Drainage Ordinances as of the date of this Easement and that damage resulting from a storm exceeding the 100 Year Design Storm will not be attributed to any party to this Drainage Easement, nor will any such party be liable for such damage;

B. this Drainage Easement granted is based, primarily, on a flood plain defined by the 100 Year Design Storm, and delineated on maps prepared by the Federal Emergency Arrangement Agency ("FEMA"), and that all parties will work to preserve and protect the ability of the easement area to convey said storm;

C. following delineation of the Prudent Line, any necessary and appropriate additional easements will be granted to AMAFCA to permit AMAFCA to meet its Level Three and Level Four Maintenance Obligations, however, such additional easements for maintenance will not exceed the limits of the Prudent Line; and

D. Permanent Improvements will be designed and built to withstand the 100 Year Design Storm, unless otherwise approved by AMAFCA.

22. Resolution of Disputes and Appeals.

A. Matters of a technical nature may be appealed by any party to the Technical Standards Committee, under provisions of AMAFCA Resolution 1980-15.

B. Except as otherwise provided herein, non-technical decisions made by the AMAFCA staff may be appealed to the AMAFCA Board of Directors. If satisfactory resolution is not achieved, any party will refer the matter to arbitration under the provisions of the New Mexico Uniform Arbitration Act, except as otherwise provided herein.

C. The sole remedy for all disputes arising under this Drainage Easement, with the exception of injunctive relief as set forth in Section 7(B), will be arbitration under the provisions of the New Mexico Uniform Arbitration Act.

23. Albuquerque Academy, Inc. The obligations and liabilities of Albuquerque Academy, Inc. as Grantor or otherwise will cease upon the transfer or conveyance of the Property by Albuquerque Academy, Inc. to a subsequent owner. Upon such transfer or conveyance, Albuquerque Academy, Inc. is and will be released and discharged from any obligation or liability under this Drainage Easement.

24. Miscellaneous. The headings used in this Drainage Easement are for convenience only and will be disregarded in interpreting the substantive provisions of this

Drainage Easement. Time is of the essence of each term of this Drainage Easement.

Dated Nov. 11, 1993.

ALBUQUERQUE ACADEMY, INC., a New Mexico nonprofit corporation

By _____
Its President

HIGH DESERT RESIDENTIAL OWNERS ASSOCIATION, INC., a New Mexico nonprofit corporation

By Pamela G Searles
Its PRESIDENT

ALBUQUERQUE METROPOLITAN ARROYO FLOOD CONTROL AUTHORITY

By _____
Its Chairman

By _____
Its Secretary

STATE OF NEW MEXICO)
) ss.
COUNTY OF BERNALILLO)

This instrument was acknowledged before me on November 11, 1993, by Robert L Bournette, PRESIDENT of Albuquerque Academy, Inc., a New Mexico nonprofit corporation, on behalf of the corporation.

Nancy L Parker
Notary Public

My commission expires:
5-21-94

OFFICIAL SEAL
NANCY L. PARKER
NOTARY PUBLIC STATE OF NEW MEXICO
Notary Bond Filed with Secretary of State
My Commission Expires 5-21-94

STATE OF NEW MEXICO)
) ss.
COUNTY OF BERNALILLO)

This instrument was acknowledged before me on November 11, 1993, by Pamela G Scanlon, PRESIDENT of High Desert Residential Owners Association, Inc., a New Mexico nonprofit corporation, on behalf of the corporation.

Nancy L Parker
Notary Public

My commission expires:
5 21-94

OFFICIAL SEAL
NANCY L. PARKER
NOTARY PUBLIC STATE OF NEW MEXICO
Notary Bond Filed with Secretary of State
My Commission Expires 5-21-94

STATE OF NEW MEXICO)
) ss.
COUNTY OF BERNALILLO)

This instrument was acknowledged before me on November 9, 1993, by Daniel W. Cook, Chairman of the Albuquerque Metropolitan Arroyo Flood Control Authority, a political subdivision of the State of New Mexico, on behalf of the subdivision.

Irene B. Griffin
Notary Public

My commission expires:
May 22, 1995

STATE OF NEW MEXICO)
) ss.
COUNTY OF BERNALILLO)

This instrument was acknowledged before me on November 9, 1993, by Ronald D. Brown, Secretary of the Albuquerque Metropolitan Arroyo Flood Control Authority, a political subdivision of the State of New Mexico, on behalf of the subdivision.

Irene B. Griffin
Notary Public

My commission expires:
May 22, 1995

73307

BEAR CANYON ARROYO
DESCRIPTION

A certain tract of land situate within the Elena Gallegos Grant in projected Sections 26 and 35, Township 11 North, Range 4 East, New Mexico Principal Meridian, Bernalillo County, New Mexico, said tract being a southerly portion of Tract I-2 of Plat of Tracts G-1, H-1, I-1, I-2, and L, Elena Gallegos Grant as the same is shown and designated on the Plat filed in the office of the County Clerk of Bernalillo County, New Mexico on April 2, 1990 in Volume 90C, Folio 96 and being more particularly described by New Mexico State Plane grid bearings (Central Zone) and ground distances as follows:

BEGINNING at the southwest corner of the tract herein described, a point on the northerly boundary line of Open Space Unit 1, Glenwood Hills North as the same is shown and designated on the plat filed in the office of the County Clerk of Bernallilo County, New Mexico on July 18, 1978 in Volume D8, Folio 166 and also being a point on the southerly boundary line of said Tract I-2 whence the NGS/ACS Station "Tumble", a standard USC&GS Brass Tablet set in concrete (having New Mexico State Plane Coordinates, Central Zone:
X =425,465.55 and Y=1,513,470.01) bears N12°06'14"W, a distance of 6592.48 feet and from said point of beginning running thence along the westerly boundary line of the tract herein described,
N27°39"34"E, a distance of 960.00 feet to the northwest corner of the tract herein described; thence,
S86°46'14"E, a distance of 408.00 feet to a point; thence,
S03°13'46"W, a distance of 140.00 feet to a point, thence,
S52°05'37"W, a distance of 480.00 feet to a point; thence,
S33°07'39"E, a distance of 770.00 feet to a point; thence,
S89°00'50"E, a distance of 257.00 feet to a point; thence,
N40°01'59"E, a distance of 417.19 feet to a point; thence,
N81°23'26"E, a distance of 140.02 feet to a point; thence,
N37°49'41"E, a distance of 1050.00 feet to a point; thence,
N41°01'36"E, a distance of 403.92 feet to a point; thence,
N56°01'53"E, a distance of 483.10 feet to a point; thence,
S68°12'17"E, a distance of 177.34 feet to a point; thence,
S68°43'43"E, a distance of 474.27 feet to a point; thence,
S77°43'31"E, a distance of 617.62 feet to a point; thence,
N66°09'41"E, a distance of 410.91 feet to the northeast corner of the tract herein described, a point on the easterly boundary line of said Tract I-2 and also being a point on the projected Section line of projected Sections 25 and 26, Township 11 North, Range 4 East, N.M.P.M., thence running along the easterly boundary line of said Tract I-2 and also along said projected Section line,
S00°17'37"W, a distance of 190.00 feet to the projected Section corner common to Sections 25, 26, 35, and 36, Township 11 North, Range 4 East, N.M.P.M., thence running along the easterly boundary line of said Tract I-2 and also along the projected Section line common to said projected Sections 35 and 36,
S00°03'21"W, a distance of 70.00 feet to the southeast corner of the tract herein described, thence leaving the easterly boundary line of said Tract I-2 and also said projected Section line and running thence along the southerly boundary line of the tract herein described,
S59°42'45"W, a distance of 237.54 feet to a point; thence,
N89°56'39"W, a distance of 185.00 feet to a point; thence,
S64°02'12"W, a distance of 728.87 feet to a point; thence,
S20°02'20"W, a distance of 117.05 feet to a point; thence,
S48°25'04"W, a distance of 438.43 feet to a point; thence,
N89°02'29"W, a distance of 429.09 feet to a point; thence,
S01°39'57"E, a distance of 320.00 feet to a point, thence,
S57°11'44"E, a distance of 140.00 feet to a point; thence,
S88°04'11"E, a distance of 150.21 feet to a point; thence,
N45°44'08"E, a distance of 219.54 feet to a point; thence,
N75°08'14"E, a distance of 226.38 feet to a point; thence,
N44°10'41"E, a distance of 127.07 feet to a point; thence,
N53°49'48"E, a distance of 198.25 feet to a point; thence,
N87°01'31"E, a distance of 340.48 feet to a point; thence,

N19°42'34"E, a distance of 193.26 feet to a point; thence,
N43°17'19"E, a distance of 291.99 feet to a point; thence,
N60°14'14"E, a distance of 386.12 feet to a point on the easterly boundary line of said Tract I-2 and also being a point on the projected Section line common to said projected Sections 35 and 36, thence running along the easterly boundary line of said Tract I-2 and also along said projected Section line,
S00°03'21"W, a distance of 70.00 feet to the southeast corner of the tract herein descibed; thence,
S60°07'27"W, a distance of 190.39 feet to a point; thence,
S37°17'27"W, a distance of 338.79 feet to a point; thence,
S17°13'54"W, a distance of 287.84 feet to a point; thence,
S50°26'42"W, a distance of 188.22 feet to a point; thence,
S79°33'51"W, a distance of 164.75 feet to a point; thence,
S73°13'11"W, a distance of 405.12 feet to a point; thence,
S11°06'21"W, a distance of 150.00 feet to a point; thence,
S76°02'07"E, a distance of 189.05 feet to a point; thence,
N85°06'59"E, a distance of 406.51 feet to a point; thence,
S76°56'59"E, a distance of 133.42 feet to a point; thence,
S76°08'12"W, a distance of 236.96 feet to a point; thence,
S65°17'32"W, a distance of 341.39 feet to a point; thence,
N89°56'52"W, a distance of 225.47 feet to a point; thence,
N86°42'00"W, a distance of 218.70 feet to a point; thence,
S71°11'03"W, a distance of 330.00 feet to a point; thence,
N50°49'13"W, a distance of 438.50 feet to a point; thence,
S87°59'29"W, a distance of 543.43 feet to a point; thence,
S37°28'06"W, a distance of 188.48 feet to a point on the southerly boundary line of said Tract I-2 and also being a point on the northerly boundary line of said Open Space Unit 1, thence running along the southerly boundary of said Tract I-2 and also along the northerly boundary line of said Open Space Unit 1,
N74°19'59"W, a distance of 710.72 feet to a point; thence,
N66°20'00"W, a distance of 829.99 feet to a point; thence,
N87°50'00"W, a distance of 245.93 feet to the point and place of beginning.

3917

Tract contains 87.7844 acres, more or less.

Bohannan-Huston Inc.
Courtyard I
7500 Jefferson Street NE
Albuquerque, NM 87109

A. Dwain Weaver
A. Dwain Weaver
N.M.P.S. No. 6544

August 5, 1993
Date

DWAIN WEAVER NEW MEXICO 6544 REGISTERED PROFESSIONAL LAND SURVEYOR

Job No. 93125.89

BEAR CANYON

EXHIBIT A
(Page 2 of 3)

TANGENT DATA

NUMBER	BEARING	DISTANCE	NUMBER	BEARING	DISTANCE	NUMBER	BEARING	DISTANCE	NUMBER	BEARING	DISTANCE
T1	N27°39'34"E	960.00	T16	S77°43'31"E	149.27	T31	N45°44'08"E	219.54	T46	S76°02'07"E	189.05
T2	S86°46'14"E	408.00	T17	N66°09'41"E	410.91	T32	N75°08'14"E	226.38	T47	N85°06'59"E	406.51
T3	S03°13'46"W	140.00	T18	S00°17'37"W	190.00	T33	N44°10'41"E	127.07	T48	S76°56'59"E	133.42
T4	S52°05'37"W	480.00	T19	S00°03'21"W	70.00	T34	N53°49'48"E	198.25	T49	S76°08'12"W	236.96
T5	S33°07'39"E	770.00	T20	S59°42'45"W	237.54	T35	N87°01'31"E	340.48	T50	S65°17'32"W	341.39
T6	S89°00'50"E	257.00	T21	N89°56'39"W	185.00	T36	N19°42'34"E	93.26	T51	N89°56'52"W	225.47
T7	N40°01'59"E	417.19	T22	S64°02'12"W	109.08	T37	N43°17'19"E	291.99	T52	N86°42'00"W	218.70
T8	N81°23'26"E	140.02	T23	S64°02'12"W	62.36	T38	N60°14'14"E	386.12	T53	S71°11'03"W	330.00
T9	N37°49'41"E	1050.00	T24	S64°02'12"W	557.43	T39	S60°07'27"W	190.39	T54	N50°49'13"W	438.50
T10	N41°01'36"E	403.92	T25	S20°02'20"W	117.05	T40	S37°17'27"W	338.79	T55	S87°59'29"W	543.43
T11	N56°01'53"E	483.10	T26	S48°25'04"W	438.43	T41	S17°13'54"W	287.84	T56	S37°28'06"W	188.48
T12	S68°12'17"E	177.34	T27	N89°02'29"W	429.09	T42	S50°26'42"W	188.22	T57	N74°19'59"W	710.72
T13	S68°43'43"E	474.27	T28	S01°39'57"E	320.00	T43	S79°33'51"W	164.75	T58	N66°20'00"W	829.99
T14	S77°43'31"E	398.96	T29	S57°11'44"E	140.00	T44	S73°13'11"W	405.12	T59	N87°50'00"W	245.93
T15	S77°43'31"E	69.39	T30	S88°04'11"E	150.21	T45	S11°06'21"W	150.00			

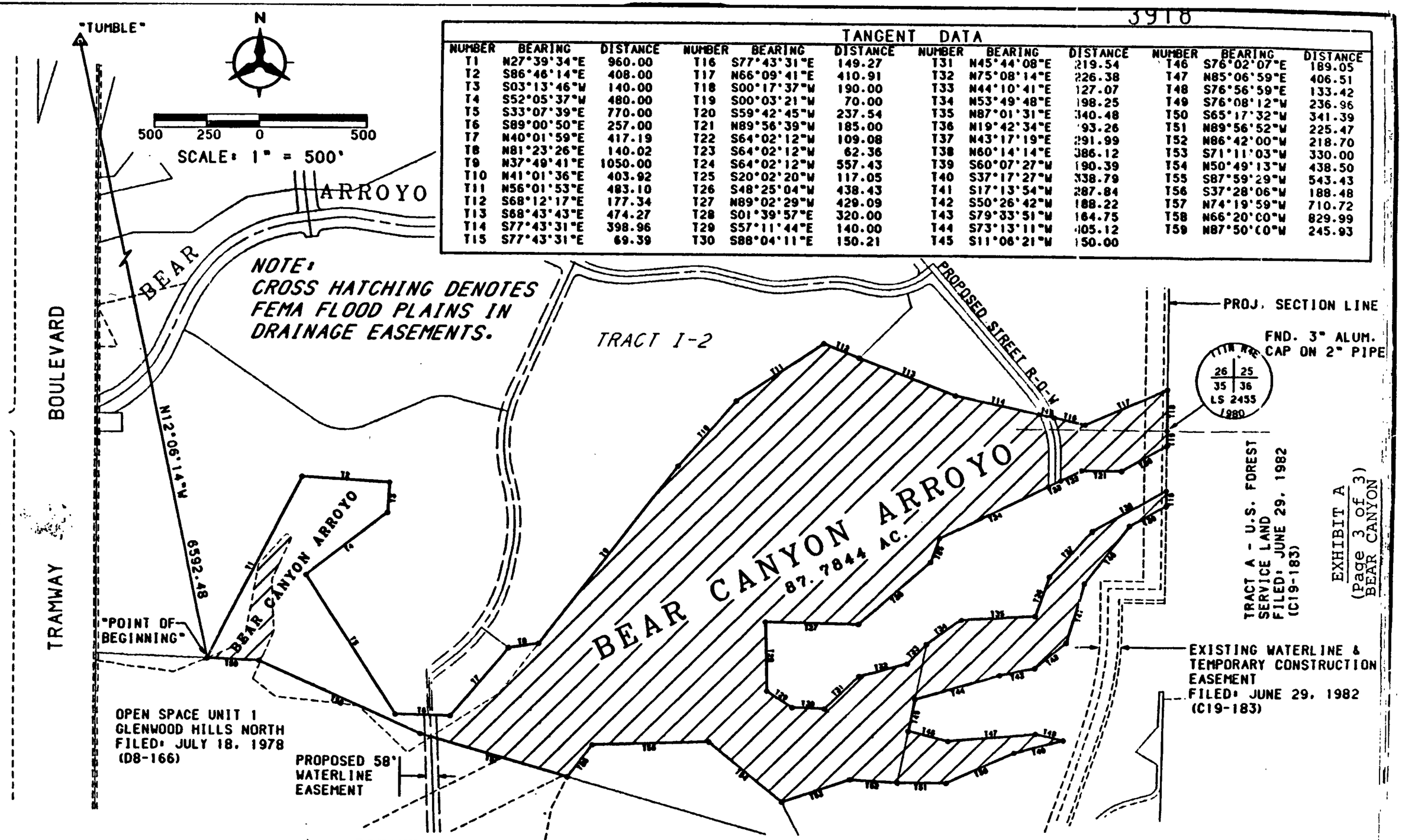


EXHIBIT A
(Page 3 of 3)
BEAR CANYON

BOHANNAN-HUSTON, INC. ALBUQUERQUE NEW MEXICO JOB NO. 3125.89

APPENDIX B

*****

APPENDIX B

FORM 3 – HYDROLOGIC ANALYSIS – BACK-UP DATA

- AHYMO information for the Bear Canyon Arroyo Bridge
- Approval letter from the City of Albuquerque for the Bear Canyon Arroyo Bridge hydrology
- Diskette with AHYMO model files for Bear Canyon Arroyo
- Sections of the High Desert Tract 13 Drainage Report
- Approval letter from the City of Albuquerque for the High Desert Tract 13 Drainage Report

BCA.SUM

AHYMO PROGRAM SUMMARY TABLE (AHYMO_97) - - VERSION: 1997.02c
RUN DATE (MON/DAY/YR) =12/11/2001
INPUT FILE = bca.hym
USER NO.= AHYMO-S-9702c1BohanHu-AH

TIME TO PEAK (HOURS)	CFS PER ACRE	PAGE = 1 HYDROGRAPH IDENTIFICATION NOTATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)
		START TIME= .00						
		LOCATION	DEFAULT					
		SEDIMENT BULK PK BF = 1.10	(10% sediment bulking factor)					
		RAINFALL TYPE= 1 RAIN6= 2.900						
		COMPUTE NM HYD 1.00	-	1	4.97400	4440.01	399.960	1.50769
2.033	1.395	PER IMP= .00						
		ROUTE 1.10	1	2	4.97400	4261.04	399.964	1.50771
2.133	1.339							
		COMPUTE NM HYD 3.00	-	3	.99860	1468.61	61.562	1.15591
1.633	2.298	PER IMP= 1.00						
		ADD HYD 4.00	2& 3	4	5.97260	4510.02	461.527	1.44889
2.100	1.180							
		FINISH						

- ANYMO model for the Bear Canyon Arroyo (BCA) floodplain in the vicinity of the High Desert Street Bridge. Modified from the High Desert Drainage Master Plan in order to have flow rates in the vicinity of the proposed bridge.

0201'18

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

July 5, 2002

Craig Hoover
Bohannan-Huston Inc.
7500 Jefferson NE
Courtyard One
Albuquerque, New Mexico 87111

RE: Drainage Report for Bear Canyon Crossing (E23-D11) Dated February 22, 2002 and Letter Dated May 28, 2002 with Attachments

Dear Mr. Hover:

The above referenced drainage report received June 3, 2002 is approved. We will be reviewing your construction plans at DRC.

If you have any questions please call me at 924-3982.

Sincerely,

Carlos A. Montoya
City Floodplain Administrator

C: Lynn Mazur, AMAFCA

THE CITY OF ALBUQUERQUE IS AN EQUAL OPPORTUNITY/REASONABLE ACCOMMODATION EMPLOYER

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

November 27, 2002

Kevin Patton, PE
Bohannan Huston, Inc
7500 Jefferson NE
Albuquerque, NM 87109

Re: The Wilderness at High Desert (Tract 13) Subdivision Drainage Report
Engineer Stamp dated 10-25-02 (F23/D10)

Dear Mr. Patton,

Based upon the information provided in your submittal dated 10-25-02, the above referenced report is approved for Preliminary Plat action by the DRB.

If you have any questions, you can contact me at 924-3986.

Sincerely,

Bradley L. Bingham, PE
Sr. Engineer, Planning Dept.
Development and Building Services

C: file

THE CITY OF ALBUQUERQUE IS AN EQUAL OPPORTUNITY/REASONABLE ACCOMMODATION EMPLOYER

APPENDIX C

APPENDIX C
BEAR CANYON ARROYO / HIGH DESERT STREET BRIDGE DATA AND DRAWINGS (FORMS 4.1, 6.1, AND 7.1)

- HEC-RAS output information for Bear Canyon Arroyo Bridge
- RiverCAD output information for Bear Canyon Arroyo
- Diskette with HEC-RAS and RiverCAD files
- Bank protection plan sheets
- Bridge plan sheets

Sub critical run used from 8+70 to 9+00

HEC-RAS Plan: boulders02 River: Stream Reach: Reach Profile: PF 1

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	1620.000	4510.00	6194.16	6198.57	6198.57	6200.15	0.011681	11.73	464.48	147.39	1.00
Reach	1610.000	4510.00	6193.87	6198.07	6198.07	6199.58	0.011743	11.60	474.21	157.44	1.00
Reach	1600.000	4510.00	6193.36	6197.40	6197.40	6198.92	0.012260	11.50	470.90	156.92	1.01
Reach	1590.000	4510.00	6192.85	6196.83	6196.83	6198.32	0.012517	11.40	473.11	160.04	1.02
Reach	1580.000	4510.00	6192.33	6196.29	6196.29	6197.75	0.012812	11.31	478.05	166.39	1.03
Reach	1570.000	4510.00	6192.00	6195.77	6195.77	6197.18	0.012987	11.13	483.24	171.60	1.03
Reach	1560.000	4510.00	6191.74	6195.21	6195.21	6196.60	0.013522	10.75	482.62	174.56	1.03
Reach	1550.000	4510.00	6191.26	6194.63	6194.63	6196.00	0.013796	10.60	485.95	179.36	1.04
Reach	1540.000	4510.00	6190.78	6194.15	6194.15	6195.51	0.013873	10.48	488.32	182.38	1.04
Reach	1530.000	4510.00	6190.41	6193.68	6193.68	6195.05	0.014092	10.33	484.33	179.47	1.04
Reach	1520.000	4510.00	6190.12	6193.21	6193.21	6194.58	0.014287	10.12	483.29	179.99	1.04
Reach	1510.000	4510.00	6189.90	6192.88	6192.88	6194.24	0.014263	10.13	485.26	182.01	1.04
Reach	1500.000	4510.00	6189.51	6192.59	6192.59	6193.93	0.014165	10.38	489.86	185.52	1.04
Reach	1490.000	4510.00	6189.11	6192.27	6192.27	6193.59	0.014329	10.62	490.36	186.65	1.05
Reach	1480.000	4510.00	6188.71	6192.04	6192.00	6193.31	0.013607	10.73	501.93	189.83	1.04
Reach	1470.000	4510.00	6188.30	6192.12		6193.11	0.009391	9.76	566.71	194.67	0.88
Reach	1460.000	4510.00	6187.91	6191.91		6193.00	0.010354	10.57	541.49	187.34	0.93
Reach	1450.000	4510.00	6187.53	6191.44	6191.44	6192.86	0.013944	12.09	477.18	171.00	1.08
Reach	1440.000	4510.00	6187.14	6191.13	6191.13	6192.55	0.013788	12.18	477.98	170.70	1.08
Reach	1430.000	4510.00	6186.76	6190.76	6190.76	6192.18	0.013586	12.11	479.58	171.52	1.07
Reach	1420.000	4510.00	6186.38	6190.38	6190.38	6191.81	0.013669	12.15	478.75	171.94	1.07
Reach	1410.000	4510.00	6186.00	6190.01	6190.01	6191.43	0.013712	12.19	479.59	172.69	1.07
Reach	1400.000	4510.00	6185.99	6189.79	6189.79	6191.19	0.013631	11.72	482.53	174.36	1.06
Reach	1390.000	4510.00	6185.65	6189.53	6189.53	6190.98	0.013338	11.67	476.88	168.05	1.05
Reach	1380.000	4510.00	6185.32	6189.21	6189.21	6190.70	0.013619	11.83	471.59	166.29	1.06
Reach	1370.000	4510.00	6184.98	6189.10	6189.10	6190.41	0.011964	11.52	518.24	200.32	1.01
Reach	1360.000	4510.00	6184.64	6188.63	6188.63	6190.09	0.014203	12.26	493.81	204.14	1.09
Reach	1350.000	4510.00	6184.30	6188.62	6188.62	6189.74	0.010532	11.16	577.94	247.76	0.95
Reach	1340.000	4510.00	6184.00	6188.25	6188.25	6189.34	0.010820	11.26	577.15	246.83	0.96
Reach	1330.000	4510.00	6183.92	6187.89	6187.89	6189.00	0.011865	11.16	563.75	243.26	0.99
Reach	1320.000	4510.00	6183.57	6187.62	6187.62	6188.73	0.011691	11.21	562.85	238.71	0.99
Reach	1310.000	4510.00	6183.22	6187.22	6187.22	6188.40	0.012826	11.63	538.34	224.28	1.03
Reach	1300.000	4510.00	6182.86	6186.86	6186.86	6188.04	0.012885	11.78	530.24	213.51	1.04
Reach	1290.000	4510.00	6182.32	6186.49	6186.49	6187.70	0.012807	12.07	525.12	207.81	1.04
Reach	1280.000	4510.00	6181.85	6186.25	6186.25	6187.47	0.012656	12.25	523.84	205.13	1.04
Reach	1270.000	4510.00	6181.28	6185 73	6185.73	6187.09	0.012928	12.31	489.90	173.24	1.05

HEC-RAS Plan: boulders02 River: Stream Reach: Reach Profile: PF 1 (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	1260.000	4510.00	6180.72	6185.32	6185.32	6186.81	0.013880	12.97	469.48	164.86	1.09
Reach	1250.000	4510.00	6180.16	6184.85	6184.85	6186.41	0.013726	12.93	461.06	156.92	1.09
Reach	1240.000	4510.00	6179.69	6184.41	6184.41	6186.15	0.014614	13.46	441.86	149.95	1.13
Reach	1230.000	4510.00	6177.84	6183.93	6183.93	6185.85	0.012450	14.30	445.79	144.53	1.07
Reach	1220.000	4510.00	6175.54	6183.70	6183.70	6185.42	0.007759	13.15	506.92	152.83	0.87
Reach	1210.000	4510.00	6174.00	6183.37	6183.37	6185.04	0.008024	12.81	519.97	170.41	0.86
Reach	1200.000	4510.00	6174.00	6183.17	6183.17	6184.70	0.008017	12.25	535.52	180.22	0.85
Reach	1190.000	4510.00	6174.00	6182.77	6182.77	6184.26	0.008085	11.92	536.65	182.38	0.85
Reach	1180.000	4510.00	6174.00	6182.26	6182.26	6183.72	0.007500	11.61	546.15	184.97	0.83
Reach	1170.000	4510.00	6174.00	6181.80	6181.80	6183.29	0.007443	11.47	542.39	186.08	0.83
Reach	1160.000	4510.00	6174.00	6181.46	6181.46	6182.91	0.007393	11.14	546.27	188.73	0.83
Reach	1150.000	4510.00	6172.00	6181.00	6181.00	6182.43	0.007292	10.87	547.64	196.07	0.81
Reach	1140.000	4510.00	6172.00	6180.26	6180.26	6181.66	0.007590	10.52	546.51	197.76	0.82
Reach	1130.000	4510.00	6172.00	6179.46	6179.46	6181.01	0.008348	10.73	506.35	178.21	0.86
Reach	1120.000	4510.00	6172.00	6179.15	6179.15	6180.69	0.008118	10.69	512.11	183.87	0.85
Reach	1110.00*	4510.00	6171.67	6178.93	6178.93	6180.41	0.007341	10.47	531.79	197.29	0.81
Reach	1100.00*	4510.00	6171.33	6178.50	6178.50	6179.75	0.005985	9.49	514.38	201.40	0.73
Reach	1090.00*	4510.00	6171.00	6178.20	6178.20	6179.41	0.005598	9.40	527.85	213.74	0.71
Reach	1080.00*	4510.00	6170.67	6177.92	6177.92	6179.06	0.005051	9.17	549.00	227.92	0.68
Reach	1070.00*	4510.00	6170.33	6177.73	6177.57	6178.70	0.004067	8.53	596.04	245.35	0.61
Reach	1060.002	4510.00	6170.00	6177.28	6177.28	6178.63	0.001359	9.93	586.20	249.51	0.71
Reach	1010	4510.00	6167.50	6174.12	6174.12	6174.95	0.005526	7.79	626.25	353.97	0.53
Reach	1000	4510.00	6163.50	6173.17	6173.17	6174.10	0.002775	7.10	607.78	311.85	0.40
Reach	990	4510.00	6161.50	6170.56	6170.56	6173.60	0.005894	9.91	349.17	57.10	0.58
Reach	980.0000	4510.00	6160.00	6169.69	6169.69	6172.80	0.005275	9.81	342.64	54.75	0.56
Reach	970.*	4510.00	6160.00	6168.60	6168.60	6171.51	0.005939	9.61	358.73	61.42	0.58
Reach	960.*	4510.00	6160.00	6168.10		6170.54	0.005665	9.02	394.45	68.43	0.56
Reach	950.*	4510.00	6160.00	6168.99		6170.10	0.002509	6.44	584.50	85.04	0.38
Reach	940.*	4510.00	6162.00	6168.95		6170.06	0.004224	7.04	575.55	97.55	0.47
Reach	930.*	4510.00	6162.00	6169.34		6169.86	0.001427	5.89	798.83	190.32	0.38
Reach	920.0000	4510.00	6162.00	6167.72	6167.72	6169.68	0.009348	11.49	425.86	121.47	0.91
Reach	910.*	4510.00	6162.00	6167.36	6167.36	6169.41	0.010128	12.63	435.95	130.77	0.97
Reach	900.*	4510.00	6162.00	6167.14	6167.14	6169.06	0.009956	11.95	453.35	150.38	0.95
Reach	890.*	4510.00	6162.00	6166.71	6166.71	6168.82	0.012561	12.29	427.95	160.07	1.04
Reach	880.*	4510.00	6162.00	6167.12	6167.12	6168.18	0.006521	9.13	662.77	333.20	0.76
Reach	870.0000	4510.00	6162.00	6166.84	6166.84	6167.74	0.006731	8.58	699.16	350.41	0.75

HEC-RAS Plan: boulders02 River: Stream Reach: Reach Profile: PF 1 (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev.	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	860.0000	4510.00	6161.37	6166.22	6166.22	6167.16	0.007159	8.60	680.97	349.89	0.77
Reach	850.0000	4510.00	6160.44	6165.52	6165.52	6166.52	0.007463	8.68	655.83	339.77	0.78
Reach	840.0000	4510.00	6160.00	6164.73	6164.73	6165.83	0.007884	8.88	615.86	317.15	0.80
Reach	830.0000	4510.00	6159.16	6164.24	6164.24	6165.29	0.008076	8.77	625.73	322.49	0.81
Reach	820.0000	4510.00	6158.20	6163.74	6163.74	6164.77	0.008118	8.71	633.86	329.10	0.81
Reach	810.0000	4510.00	6158.00	6163.27	6163.27	6164.30	0.008227	8.77	639.66	338.19	0.81
Reach	800.0000	4510.00	6158.00	6162.95	6162.95	6163.86	0.007668	8.49	678.83	346.00	0.79
Reach	790.0000	4510.00	6158.00	6162.45	6162.45	6163.35	0.007699	8.58	683.31	345.25	0.79
Reach	780.0000	4510.00	6156.59	6161.89	6161.89	6162.80	0.007188	8.65	693.43	347.85	0.77
Reach	770.0000	4510.00	6156.00	6161.42	6161.42	6162.32	0.007121	8.77	697.26	348.08	0.77
Reach	760.0000	4510.00	6156.00	6160.95	6160.95	6161.83	0.007437	8.83	698.93	346.79	0.79
Reach	750.0000	4510.00	6155.68	6160.45	6160.45	6161.33	0.007888	8.94	693.69	344.56	0.81
Reach	740.0000	4510.00	6154.81	6159.95	6159.95	6160.84	0.008062	9.06	688.26	342.06	0.82
Reach	730.0000	4510.00	6154.00	6159.39	6159.39	6160.29	0.007558	9.09	694.18	340.03	0.80
Reach	720.0000	4510.00	6154.00	6158.86	6158.86	6159.76	0.007772	9.12	690.70	337.98	0.80
Reach	710.0000	4510.00	6153.32	6158.31	6158.31	6159.21	0.008309	9.18	681.79	336.55	0.83
Reach	700.0000	4510.00	6152.42	6157.75	6157.75	6158.65	0.008167	9.12	684.39	336.67	0.82
Reach	690.0000	4510.00	6152.00	6157.20	6157.20	6158.10	0.008689	9.10	674.50	336.03	0.84
Reach	680.0000	4510.00	6152.00	6156.66	6156.66	6157.56	0.008827	8.98	671.65	335.25	0.84
Reach	670.0000	4510.00	6152.00	6156.14	6156.14	6157.03	0.009573	8.90	660.12	333.03	0.87
Reach	660.0000	4510.00	6151.29	6155.60	6155.60	6156.51	0.009939	8.89	650.93	330.21	0.88
Reach	650.0000	4510.00	6150.00	6155.02	6155.02	6155.92	0.009666	8.79	652.60	329.04	0.87
Reach	640.0000	4510.00	6150.00	6154.48	6154.48	6155.37	0.010011	8.71	649.49	328.63	0.88
Reach	630.0000	4510.00	6150.00	6154.23	6154.23	6155.25	0.010408	9.11	620.08	313.20	0.90
Reach	620.0000	4510.00	6149.29	6153.62	6153.62	6154.75	0.012548	9.62	583.01	307.35	0.98
Reach	610.0000	4510.00	6148.00	6153.09	6153.09	6154.17	0.011049	9.37	598.74	302.42	0.92
Reach	600.0000	4510.00	6148.00	6152.53	6152.53	6153.65	0.011830	9.59	586.70	296.34	0.95
Reach	590.0000	4510.00	6148.00	6152.17	6152.17	6153.21	0.011206	9.51	613.95	323.25	0.93
Reach	580.0000	4510.00	6146.89	6151.84	6151.84	6152.74	0.009092	9.05	662.43	327.33	0.85
Reach	570.0000	4510.00	6146.00	6151.31	6151.31	6152.22	0.009594	9.18	657.15	329.14	0.87
Reach	560.0000	4510.00	6146.00	6150.79	6150.79	6151.69	0.010950	9.20	643.41	330.35	0.92
Reach	550.0000	4510.00	6146.00	6150.25	6150.25	6151.14	0.010837	9.22	645.59	329.70	0.91
Reach	540.0000	4510.00	6146.00	6149.75	6149.75	6150.64	0.010354	9.26	652.22	329.17	0.90
Reach	530.0000	4510.00	6144.72	6149.23	6149.23	6150.12	0.010746	9.33	646.54	329.34	0.91
Reach	520.0000	4510.00	6144.00	6148.68	6148.68	6149.56	0.010508	9.37	650.87	330.10	0.91
Reach	510.0000	4510.00	6144.00	6148.11	6148.11	6149.01	0.010336	9.50	652.88	332.17	0.91

HEC-RAS Plan: boulders02 River: Stream Reach: Reach Profile: PF 1 (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	500.0000	4510.00	6144.00	6147.59	6147.59	6148.48	0.010516	9.49	653.44	334.57	0.91
Reach	490.0000	4510.00	6144.00	6147.09	6147.09	6147.98	0.012061	9.43	636.23	335.98	0.96
Reach	480.0000	4510.00	6143.40	6146.23	6146.23	6147.13	0.015175	8.96	602.78	334.19	1.03
Reach	470.0000	4510.00	6142.00	6145.76	6145.76	6146.66	0.015305	8.80	602.30	335.77	1.03
Reach	460.0000	4510.00	6142.00	6145.28	6145.28	6146.18	0.015481	8.57	600.91	335.74	1.03
Reach	450.0000	4510.00	6141.54	6144.78	6144.78	6145.68	0.015986	8.46	598.94	340.13	1.04
Reach	440.0000	4510.00	6140.34	6144.37	6144.37	6145.25	0.014906	8.79	611.31	344.39	1.02
Reach	430.0000	4510.00	6140.00	6143.79	6143.79	6144.68	0.015564	8.51	603.80	345.20	1.02
Reach	420.0000	4510.00	6140.00	6143.25	6143.25	6144.13	0.015693	8.16	603.94	347.75	1.02
Reach	410.0000	4510.00	6140.00	6142.72	6142.72	6143.60	0.015840	8.13	605.99	353.70	1.02
Reach	400.0000	4510.00	6140.00	6142.29	6142.29	6143.16	0.015955	7.72	610.43	361.89	1.01
Reach	390.0000	4510.00	6138.65	6141.63	6141.63	6142.51	0.015756	7.38	607.02	355.96	1.00
Reach	380.0000	4510.00	6138.00	6141.13	6141.13	6141.99	0.014951	6.96	619.45	362.70	0.96
Reach	370.0000	4510.00	6138.00	6140.62	6140.62	6141.45	0.014767	6.89	628.40	374.08	0.96

Super critical run used from 9+00 to 12+50

HEC-RAS Plan: boulders02 River: Stream Reach: Reach Profile: PF 1

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	1620.000	4510.00	6194.16	6197.38	6198.57	6201.18	0.042511	18.00	299.36	129.90	1.81
Reach	1610.000	4510.00	6193.87	6196.85	6198.07	6200.72	0.046447	18.36	296.82	135.25	1.88
Reach	1600.000	4510.00	6193.36	6196.17	6197.40	6200.21	0.052689	18.67	289.15	138.38	1.98
Reach	1590.000	4510.00	6192.85	6195.61	6196.83	6199.67	0.056289	18.80	287.89	143.04	2.03
Reach	1580.000	4510.00	6192.33	6195.10	6196.29	6199.07	0.057807	18.66	290.36	148.52	2.05
Reach	1570.000	4510.00	6192.00	6194.60	6195.77	6198.45	0.059078	18.34	293.54	154.05	2.06
Reach	1560.000	4510.00	6191.74	6194.11	6195.21	6197.80	0.060625	17.46	297.45	161.14	2.05
Reach	1550.000	4510.00	6191.26	6193.56	6194.63	6197.15	0.061900	17.15	300.03	165.95	2.06
Reach	1540.000	4510.00	6190.78	6193.14	6194.15	6196.48	0.057166	16.46	309.95	168.87	1.98
Reach	1530.000	4510.00	6190.41	6192.72	6193.68	6195.88	0.052759	15.54	317.31	167.41	1.89
Reach	1520.000	4510.00	6190.12	6192.29	6193.21	6195.33	0.049761	14.71	323.61	168.09	1.82
Reach	1510.000	4510.00	6189.90	6192.09	6192.88	6194.77	0.041187	13.98	345.36	172.39	1.68
Reach	1500.000	4510.00	6189.51	6191.91	6192.59	6194.31	0.034976	13.80	366.15	176.73	1.57
Reach	1490.000	4510.00	6189.11	6191.62	6192.27	6193.93	0.034125	14.05	371.59	179.11	1.57
Reach	1480.000	4510.00	6188.71	6191.41	6192.00	6193.56	0.030493	13.96	385.30	179.69	1.50
Reach	1470.000	4510.00	6188.30	6191.21	6191.73	6193.23	0.027065	13.81	396.85	176.90	1.43
Reach	1460.000	4510.00	6187.91	6191.43	6191.61	6192.98	0.017247	12.53	454.49	177.34	1.18
Reach	1450.000	4510.00	6187.53	6191.33	6191.44	6192.86	0.015693	12.57	457.32	167.98	1.14
Reach	1440.000	4510.00	6187.14	6190.73	6191.13	6192.65	0.021513	14.18	411.07	163.54	1.32
Reach	1430.000	4510.00	6186.76	6190.19	6190.76	6192.39	0.025686	15.03	385.23	159.93	1.43
Reach	1420.000	4510.00	6186.38	6189.73	6190.38	6192.10	0.028566	15.58	370.65	157.35	1.50
Reach	1410.000	4510.00	6186.00	6189.29	6190.01	6191.79	0.031000	16.05	360.65	156.06	1.56
Reach	1400.000	4510.00	6185.99	6189.16	6189.79	6191.44	0.026602	14.51	378.06	156.85	1.44
Reach	1390.000	4510.00	6185.65	6189.04	6189.53	6191.13	0.022720	13.90	396.64	158.05	1.34
Reach	1380.000	4510.00	6185.32	6188.72	6189.21	6190.87	0.023303	14.11	391.57	156.32	1.36
Reach	1370.000	4510.00	6184.98	6188.42	6189.10	6190.62	0.024118	14.47	389.89	163.28	1.38
Reach	1360.000	4510.00	6184.64	6188.19	6188.63	6190.39	0 024340	14.84	407.28	193.13	1.40
Reach	1350.000	4510.00	6184.30	6187.72	6188.62	6190.10	0.027889	15.51	378.09	189.66	1.49
Reach	1340.000	4510.00	6184.00	6187.43	6188.25	6189.82	0.029568	16.14	389.23	196.96	1.54
Reach	1330.000	4510.00	6183.92	6187.20	6187.89	6189.48	0.030983	15.84	402.03	223.55	1.56
Reach	1320.000	4510.00	6183.57	6186.97	6187.62	6189.15	0.028754	15.59	411.48	223.29	1.51
Reach	1310.000	4510.00	6183.22	6186.56	6187.22	6188.83	0.031806	16.20	394.86	210.07	1.58
Reach	1300.000	4510.00	6182.86	6186.16	6186.86	6188.50	0.033879	16.81	385.45	203.85	1 63
Reach	1290.000	4510.00	6182.32	6185.75	6186.49	6188.16	0.032838	16.96	378.03	188.56	1.62
Reach	1280.000	4510.00	6181.85	6185.50	6186.25	6187.81	0.030044	16.62	382.27	179.15	1.56
Reach	1270.000	4510.00	6181.28	6185.00	6185.73	6187.48	0.031304	16.87	365.80	163.83	1.58

HEC-RAS Plan: boulders02 River: Stream Reach: Reach Profile: PF 1 (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	1260.000	4510.00	6180.72	6184.64	6185.32	6187.17	0.029548	16.90	361.66	152.16	1.55
Reach	1250.000	4510.00	6180.16	6184.10	6184.85	6186.84	0.030856	17.09	347.75	142.72	1.58
Reach	1240.000	4510.00	6179.69	6183.70	6184.41	6186.54	0.028038	16.62	343.08	129.22	1.51
Reach	1230.000	4510.00	6177.84	6183.27	6183.93	6186.28	0.022242	17.55	355.47	127.29	1.40
Reach	1220.000	4510.00	6175.54	6182.59	6183.70	6186.03	0.018026	17.89	356.52	122.07	1.29
Reach	1210.000	4510.00	6174.00	6182.15	6183.37	6185.72	0.020296	17.86	344.49	121.39	1.33
Reach	1200.000	4510.00	6174.00	6181.65	6183.17	6185.47	0.025328	18.19	318.14	111.12	1.45
Reach	1190.000	4510.00	6174.00	6181.21	6182.77	6185.19	0.028500	18.36	309.33	113.56	1.52
Reach	1180.000	4510.00	6174.00	6180.55	6182.26	6184.86	0.030558	18.74	299.05	112.70	1.59
Reach	1170.000	4510.00	6174.00	6179.99	6181.80	6184.52	0.032498	18.76	284.16	101.35	1.63
Reach	1160.000	4510.00	6174.00	6179.54	6181.46	6184.17	0.036165	18.71	275.59	98.63	1.70
Reach	1150.000	4510.00	6172.00	6179.03	6181.00	6183.79	0.038435	18.68	270.11	96.12	1.73
Reach	1140.000	4510.00	6172.00	6178.41	6180.26	6183.36	0.043944	18.72	265.64	109.67	1.83
Reach	1130.000	4510.00	6172.00	6177.62	6179.46	6182.87	0.048756	18.89	253.82	100.86	1.92
Reach	1120.000	4510.00	6172.00	6177.48	6179.15	6182.31	0.040204	18.06	267.63	105.83	1.76
Reach	1110.00*	4510.00	6171.67	6177.24	6178.93	6181.88	0.035114	17.60	273.37	105.07	1.66
Reach	1100.00*	4510.00	6171.33	6176.83	6178.50	6181.53	0.034502	17.62	262.16	97.33	1.65
Reach	1090.00*	4510.00	6171.00	6176.51	6178.20	6181.20	0.031963	17.50	262.87	91.23	1.60
Reach	1080.00*	4510.00	6170.67	6176.11	6177.92	6180.88	0.030475	17.54	258.90	79.10	1.57
Reach	1070.00*	4510.00	6170.33	6175.54	6177.57	6180.55	0.030991	17.96	251.16	62.78	1.58
Reach	1060.002	4510.00	6170.00	6174.81	6177.28	6180.35	0.008575	18.88	238.85	59.25	1.66
Reach	1010	4510.00	6167.50	6172.09	6174.12	6179.33	0.048579	18.10	224.25	57.66	1.49
Reach	1000	4510.00	6163.50	6169.43	6173.17	6178.73	0.032633	17.58	201.82	48.11	1.27
Reach	990	4510.00	6161.50	6167.32	6170.56	6178.21	0.041744	19.65	185.84	43.84	1.44
Reach	980.0000	4510.00	6160.00	6166.31	6169.69	6177.76	0.037309	19.60	180.47	41.23	1.38
Reach	970.*	4510.00	6160.00	6165.23	6168.60	6177.27	0.053259	20.66	177.59	45.96	1.59
Reach	960.*	4510.00	6160.00	6164.44	6167.73	6176.62	0.072896	21.66	176.53	50.60	1.81
Reach	950.*	4510.00	6160.00	6163.27	6166.38	6175.63	0.136484	24.19	171.03	59.57	2.36
Reach	940.*	4510.00	6162.00	6164.76	6167.04	6173.08	0.129883	21.07	203.77	79.72	2.24
Reach	930.*	4510.00	6162.00	6164.38	6166.36	6171.78	0.083448	21.23	207.93	96.03	2.43
Reach	920.0000	4510.00	6162.00	6166.56	6167.72	6170.26	0.024424	15.55	301.05	98.79	1.41
Reach	910.*	4510.00	6162.00	6166.40	6167.36	6169.99	0.022181	16.35	322.86	108.48	1.38
Reach	900.*	4510.00	6162.00	6166.07	6167.14	6169.74	0.025258	16.17	316.00	115.02	1.45
Reach	890.*	4510.00	6162.00	6165.94	6166.71	6169.42	0.026147	15.55	321.39	124.59	1.45
Reach	880.*	4510.00	6162.00	6165.96	6167.12	6169.05	0.024439	14.52	340.66	140.47	1.39
Reach	870.0000	4510.00	6162.00	6165.85	6166.84	6168.73	0.026467	14.11	381.89	288.31	1.42

HEC-RAS Plan: boulders02 River: Stream Reach: Reach Profile: PF 1 (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	860.0000	4510.00	6161.37	6165.14	6166.22	6168.41	0.032554	14.76	344.26	278.15	1.56
Reach	850.0000	4510.00	6160.44	6164.28	6165.52	6168.00	0.040392	15.51	298.85	179.88	1.71
Reach	840.0000	4510.00	6160.00	6163.24	6164.73	6167.49	0.051019	16.55	272.66	115.96	1.89
Reach	830.0000	4510.00	6159.16	6162.88	6164.24	6166.92	0.050627	16.13	279.98	126.20	1.88
Reach	820.0000	4510.00	6158.20	6162.44	6163.74	6166.40	0.049687	15.99	283.92	139.58	1.86
Reach	810.0000	4510.00	6158.00	6162.06	6163.27	6165.88	0.045739	15.73	297.44	219.38	1.79
Reach	800.0000	4510.00	6158.00	6161.79	6162.95	6165.37	0.043179	15.54	326.18	251.22	1.75
Reach	790.0000	4510.00	6158.00	6161.31	6162.45	6164.93	0.043260	15.84	332.47	259.12	1.76
Reach	780.0000	4510.00	6156.59	6160.69	6161.89	6164.49	0.041032	16.18	327.39	252.84	1.73
Reach	770.0000	4510.00	6156.00	6160.24	6161.42	6164.08	0.039639	16.40	330.67	253.95	1.72
Reach	760.0000	4510.00	6156.00	6159.81	6160.95	6163.67	0.042493	16.80	336.12	257.65	1.77
Reach	750.0000	4510.00	6155.68	6159.35	6160.45	6163.22	0.046116	17.19	338.67	263.07	1.84
Reach	740.0000	4510.00	6154.81	6158.86	6159.95	6162.76	0.046037	17.36	340.70	267.11	1.84
Reach	730.0000	4510.00	6154.00	6158.25	6159.39	6162.29	0.043491	17.48	335.62	257.39	1.80
Reach	720.0000	4510.00	6154.00	6157.71	6158.86	6161.83	0.046637	17.81	332.74	257.64	1.86
Reach	710.0000	4510.00	6153.32	6157.19	6158.31	6161.34	0.051153	18.10	331.11	263.64	1.94
Reach	700.0000	4510.00	6152.42	6156.62	6157.75	6160.82	0.050866	18.06	329.56	265.15	1.93
Reach	690.0000	4510.00	6152.00	6156.08	6157.20	6160.29	0.055890	18.12	325.57	266.39	2.00
Reach	680.0000	4510.00	6152.00	6155.55	6156.66	6159.71	0.057986	17.90	324.00	268.74	2.03
Reach	670.0000	4510.00	6152.00	6155.09	6156.14	6159.05	0.062691	17.59	327.47	279.11	2.08
Reach	660.0000	4510.00	6151.29	6154.58	6155.60	6158.37	0.061530	17.11	331.88	280.39	2.05
Reach	650.0000	4510.00	6150.00	6153.97	6155.02	6157.75	0.060457	16.88	329.60	274.45	2.03
Reach	640.0000	4510.00	6150.00	6153.44	6154.48	6157.09	0.063866	16.70	330.48	273.22	2.06
Reach	630.0000	4510.00	6150.00	6153.28	6154.23	6156.50	0.047962	15.47	348.63	251.11	1.82
Reach	620.0000	4510.00	6149.29	6152.77	6153.62	6156.01	0.051110	15.60	345.33	251.16	1.87
Reach	610.0000	4510.00	6148.00	6152.15	6153.09	6155.49	0.049700	15.73	340.39	242.27	1.85
Reach	600.0000	4510.00	6148.00	6151.62	6152.53	6154.99	0.052023	15.98	339.00	241.41	1.89
Reach	590.0000	4510.00	6148.00	6151.22	6152.17	6154.43	0.050358	15.99	348.83	247.11	1.86
Reach	580.0000	4510.00	6146.89	6150.82	6151.84	6153.91	0.044203	15.89	362.43	253.82	1.77
Reach	570.0000	4510.00	6146.00	6150.34	6151.31	6153.46	0.046052	16.15	362.57	259.35	1.81
Reach	560.0000	4510.00	6146.00	6149.92	6150.79	6152.93	0.053695	16.37	363.87	280.78	1.92
Reach	550.0000	4510.00	6146.00	6149.40	6150.25	6152.40	0.052942	16.49	370.11	294.23	1.92
Reach	540.0000	4510.00	6146.00	6148.90	6149.75	6151.89	0.049236	16.51	377.49	300.47	1.87
Reach	530.0000	4510.00	6144.72	6148.38	6149.23	6151.39	0.051378	16.68	375.23	302.19	1.90
Reach	520.0000	4510.00	6144.00	6147.81	6148.68	6150.87	0.050988	16.87	374.01	299.33	1.90
Reach	510.0000	4510.00	6144.00	6147.23	6148.11	6150.36	0.049658	17.06	372.80	294.89	1.89

HEC-RAS Plan: boulders02 River: Stream Reach: Reach Profile: PF 1 (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	500.0000	4510.00	6144.00	6146.69	6147.59	6149.85	0.052954	17.29	368.08	293.96	1.94
Reach	490.0000	4510.00	6144.00	6146.23	6147.09	6149.23	0.063030	17.17	359.79	293.78	2.07
Reach	480.0000	4510.00	6143.40	6145.51	6146.23	6148.00	0.071866	15.28	367.72	315.57	2.11
Reach	470.0000	4510.00	6142.00	6145.13	6145.76	6147.25	0.057697	13.76	394.72	317.21	1.89
Reach	460.0000	4510.00	6142.00	6144.69	6145.28	6146.64	0.052367	12.73	406.74	315.05	1.79
Reach	450.0000	4510.00	6141.54	6144.21	6144.78	6146.11	0.051522	12.25	410.76	317.28	1.76
Reach	440.0000	4510.00	6140.34	6143.84	6144.37	6145.61	0.043112	12.57	432.90	324.87	1.65
Reach	430.0000	4510.00	6140.00	6143.20	6143.79	6145.12	0.051703	12.53	409.46	318.44	1.77
Reach	420.0000	4510.00	6140.00	6142.65	6143.25	6144.59	0.053582	11.87	404.65	318.77	1.77
Reach	410.0000	4510.00	6140.00	6142.14	6142.72	6144.06	0.052720	11.75	409.19	325.68	1.76
Reach	400.0000	4510.00	6140.00	6141.76	6142.29	6143.55	0.042080	9.94	425.59	331.32	1.55
Reach	390.0000	4510.00	6138.65	6141.01	6141.63	6143.07	0.047229	9.45	399.19	303.01	1.60
Reach	380.0000	4510.00	6138.00	6140.46	6141.13	6142.60	0.046193	8.59	396.06	294.57	1.55
Reach	370.0000	4510.00	6138.00	6139.91	6140.62	6142.13	0.044642	8.17	390.76	282.51	1.51

Bear Canyon Arroyo RiverCAD output
Submerged Data

Profile Output - Standard Table 1

River Sta.	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
2620	4510.00	6194.16	6198.57	6198.57	6200.15	0.011686	11.73	464.41	147.38	1.00
2610	4510.00	6193.87	6198.07	6198.07	6199.58	0.011749	11.60	474.14	157.44	1.00
2600	4510.00	6193.36	6197.40	6197.40	6198.92	0.012225	11.49	471.36	156.96	1.01
2590	4510.00	6192.85	6196.83	6196.83	6198.32	0.012530	11.40	472.96	160.03	1.02
2580	4510.00	6192.33	6196.29	6196.29	6197.75	0.012819	11.32	477.97	166.38	1.03
2570	4510.00	6192.00	6195.77	6195.77	6197.18	0.012967	11.12	483.49	171.62	1.03
2560	4510.00	6191.74	6195.21	6195.21	6196.60	0.013493	10.74	482.96	174.58	1.03
2550	4510.00	6191.26	6194.63	6194.63	6196.00	0.013866	10.61	485.16	179.31	1.04
2540	4510.00	6190.78	6194.15	6194.15	6195.51	0.013889	10.49	488.14	182.37	1.04
2530	4510.00	6190.30	6193.68	6193.68	6195.05	0.014100	10.34	484.24	179.47	1.04
2520	4510.00	6190.00	6193.21	6193.21	6194.58	0.014303	10.12	483.12	179.97	1.04
2510	4510.00	6189.62	6192.88	6192.88	6194.24	0.014247	10.13	485.44	182.02	1.04
2500	4510.00	6189.24	6192.59	6192.59	6193.93	0.014198	10.39	489.50	185.50	1.04
2490	4510.00	6188.85	6192.27	6192.27	6193.59	0.014320	10.61	490.45	186.66	1.05
2480	4510.00	6188.47	6192.01	6192.00	6193.31	0.014088	10.85	496.37	189.50	1.05
2470	4510.00	6188.09	6192.11		6193.11	0.009505	9.80	564.52	194.55	0.89
2460	4510.00	6187.90	6191.91		6193.00	0.010288	10.55	542.68	187.48	0.93
2450	4510.00	6187.51	6191.44	6191.44	6192.86	0.013951	12.10	477.10	170.99	1.08
2440	4510.00	6187.13	6191.13	6191.13	6192.55	0.013767	12.18	478.23	170.73	1.07
2430	4510.00	6186.74	6190.76	6190.76	6192.18	0.013531	12.09	480.25	171.60	1.07
2420	4510.00	6186.35	6190.38	6190.38	6191.81	0.013655	12.15	478.91	171.96	1.07
2410	4510.00	6186.00	6190.01	6190.01	6191.43	0.013685	12.18	479.93	172.74	1.07
2400	4510.00	6185.83	6189.79	6189.79	6191.19	0.013631	11.72	482.53	174.36	1.06
2390	4510.00	6185.52	6189.53	6189.53	6190.98	0.013312	11.66	477.20	168.09	1.05
2380	4510.00	6185.22	6189.21	6189.21	6190.70	0.013673	11.84	470.95	166.21	1.06
2370	4510.00	6184.91	6189.10	6189.10	6190.41	0.012003	11.53	517.66	200.26	1.01
2360	4510.00	6184.60	6188.75	6188.75	6190.08	0.012542	11.77	521.31	228.33	1.03

2350	4510.00	6184.30	6188.63	6188.63	6189.73	0.010507	11.15	578.42	247.81	0.95
2340	4510.00	6184.00	6188.27	6188.27	6189.34	0.010616	11.19	581.00	247.16	0.95
2330	4510.00	6183.70	6187.89	6187.89	6189.00	0.011837	11.15	564.22	243.31	0.99
2320	4510.00	6183.31	6187.62	6187.62	6188.73	0.011698	11.21	562.73	238.70	0.99
2310	4510.00	6182.92	6187.24	6187.24	6188.39	0.012591	11.55	541.74	224.61	1.03
2300	4510.00	6182.53	6186.85	6186.85	6188.04	0.012900	11.78	530.03	213.49	1.04
2290	4510.00	6182.15	6186.48	6186.48	6187.70	0.012947	12.12	523.20	207.65	1.05
2280	4510.00	6181.85	6186.24	6186.24	6187.47	0.012678	12.26	523.54	205.10	1.04
2270	4510.00	6181.28	6185.73	6185.73	6187.09	0.012908	12.30	490.15	173.26	1.05
2260	4510.00	6180.72	6185.31	6185.31	6186.81	0.013942	12.99	468.75	164.78	1.10
2250	4510.00	6180.16	6184.85	6184.85	6186.41	0.013798	12.96	460.22	156.82	1.09
2240	4510.00	6179.69	6184.43	6184.43	6186.14	0.014314	13.37	445.09	150.34	1.11
2230	4510.00	6177.84	6183.94	6183.94	6185.85	0.012364	14.27	446.99	144.74	1.07
2220	4510.00	6175.54	6183.71	6183.71	6185.42	0.007702	13.12	508.49	153.13	0.87
2210	4510.00	6174.00	6183.41	6183.41	6185.04	0.007841	12.71	525.58	172.08	0.85
2200	4510.00	6174.00	6183.17	6183.17	6184.70	0.008014	12.25	535.61	180.24	0.85
2190	4510.00	6174.00	6182.77	6182.77	6184.25	0.008062	11.91	537.27	182.50	0.85
2180	4510.00	6174.00	6182.25	6182.25	6183.72	0.007592	11.66	543.45	184.48	0.84
2170	4510.00	6174.00	6181.81	6181.81	6183.29	0.007392	11.44	543.93	186.37	0.83
2160	4510.00	6174.00	6181.47	6181.47	6182.91	0.007340	11.11	547.84	188.98	0.82
2150	4510.00	6172.00	6181.00	6181.00	6182.43	0.007286	10.87	547.83	196.11	0.81
2140	4510.00	6172.00	6180.26	6180.26	6181.66	0.007614	10.53	545.83	197.66	0.82
2130	4510.00	6172.00	6179.47	6179.47	6181.01	0.008272	10.69	508.27	178.65	0.85
2120	4510.00	6172.00	6179.14	6179.14	6180.69	0.008128	10.69	511.84	183.80	0.85
2110	4510.00	6171.67	6178.93	6178.93	6180.41	0.007337	10.46	531.89	197.32	0.81
2100	4510.00	6171.33	6178.50	6178.50	6179.75	0.005960	9.48	515.17	201.59	0.73
2090	4510.00	6171.00	6178.20	6178.20	6179.41	0.005618	9.42	527.12	213.55	0.71
2080	4510.00	6170.67	6177.92	6177.92	6179.06	0.005059	9.18	548.67	227.84	0.68
2070	4510.00	6170.33	6177.63	6177.58	6178.69	0.004521	8.90	571.99	239.90	0.64

2060	4510.00	6170.00	6177.27	6177.27	6178.63	0.001368	9.95	584.14	249.06	0.71
2010	4510.00	6167.50	6174.12	6174.12	6174.95	0.005508	7.78	626.94	353.98	0.53
2000	4510.00	6163.50	6173.16	6173.16	6174.10	0.002796	7.13	605.05	310.49	0.40
1990	4510.00	6161.50	6170.58	6170.58	6173.60	0.005834	9.88	350.34	57.18	0.58
1980	4510.00	6160.00	6169.69	6169.69	6172.80	0.005265	9.80	342.86	54.76	0.55
1970	4510.00	6160.00	6168.61	6168.61	6171.51	0.005924	9.61	359.03	61.44	0.58
1960	4510.00	6160.00	6168.08		6170.54	0.005732	9.06	392.98	68.33	0.56
1950	4510.00	6160.00	6168.98		6170.09	0.002519	6.44	583.79	85.01	0.38
1940	4510.00	6162.00	6168.95		6170.06	0.004229	7.04	575.31	97.54	0.47
1930	4510.00	6162.00	6169.34		6169.86	0.001427	5.89	799.01	190.42	0.38
1920	4510.00	6162.00	6167.72	6167.72	6169.68	0.009348	11.49	425.86	121.47	0.91
1810.92	4510.00	6160.07	6163.65	6163.65	6164.16	0.010094	7.52	933.81	885.43	0.83
1710	4510.00	6154.77	6157.60	6157.60	6158.09	0.019006	6.79	809.62	810.35	1.02
1610	4510.00	6148.89	6151.99	6151.99	6152.50	0.022555	5.20	785.31	850.17	1.02
1510	4510.00	6142.00	6145.52	6145.52	6146.02	0.015578		789.62	748.35	0.00
1010	4510.00	6118.64	6121.64	6121.64	6122.35	0.017648	6.43	669.17	480.59	0.98
910	4510.00	6115.11	6117.74	6117.74	6118.43	0.015130	7.34	691.64	518.04	0.96
810	4510.00	6110.00	6113.64	6113.64	6114.28	0.010134	5.29	710.87	523.02	0.76
710	4510.00	6104.00	6107.58	6107.58	6108.24	0.013995	5.26	697.53	505.36	0.86
610	4510.00	6095.91	6099.92	6099.92	6100.87	0.015958		576.40	300.79	0.00
510	4510.00	6092.00	6096.25	6096.25	6097.11	0.013696	2.22	620.61	387.36	0.69
410	4510.00	6087.95	6091.46	6091.46	6092.48	0.015971	5.02	571.89	312.60	0.89
310	4510.00	6084.00	6088.08	6088.08	6088.93	0.014474	3.09	626.28	369.30	0.76
270	4510.00	6082.79	6086.85	6086.85	6087.67	0.015614	3.50	629.22	384.17	0.81

APPENDIX D

*****

APPENIDX D
SOUTH BEAR CANYON ARROYO 1 CULVERT DATA AND DRAWINGS (FORMS 4.2 AND 7.2)

- RiverCAD output information for South Bear Canyon Arroyo 1 culverts
- Culvert drawings

[nb-mid-soth.tlx]

Final - Mid Branch (+ southern trib)

Profile Output - Standard Table 1

River Sta.	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
11800	237.00	6194.00	6195.33	6195.33	6195.79	0.019596	5.48	43.24	46.52	1.00
11600	237.00	6192.00	6192.76	6193.09	6193.81	0.077599	8.21	28.88	47.78	1.86
11400	237.00	6188.00	6189.07	6189.24	6189.73	0.036875	6.52	36.37	48.71	1.33
11340	237.00	6184.45	6185.64	6185.86	6186.38	0.041135	7.14	35.04	49.14	1.42
11320	237.00	6184.00	6184.88	6185.05	6185.51	0.042950	6.07	37.50	58.52	1.38
11300	237.00	6182.31	6183.55	6183.85	6184.51	0.055740	8.06	30.95	47.51	1.64
11280	237.00	6182.00	6182.84	6183.03	6183.49	0.039266	6.70	38.02	62.63	1.37
11260	237.00	6180.82	6181.74	6182.04	6182.60	0.049283	7.56	33.58	60.15	1.54
11240	237.00	6180.00	6180.99	6181.19	6181.62	0.042387	6.70	38.44	66.78	1.41
11220	237.00	6179.22	6180.25	6180.38	6180.76	0.040009	6.28	43.12	85.25	1.36
11200	237.00	6178.00	6178.91	6179.17	6179.74	0.060511	6.42	32.69	53.65	1.59
11180	237.00	6177.35	6178.31	6178.43	6178.78	0.031635	5.99	46.67	89.84	1.23
11160	237.00	6176.02	6176.58	6176.86	6177.59	0.125093	8.79	30.34	80.75	2.27
11140	237.00	6174.75	6176.25	6176.30	6176.62	0.018658	5.17	53.16	95.18	0.97
11120	237.00	6174.00	6176.02	6175.26	6176.14	0.002964	2.73	90.04	109.06	0.42
11100	237.00	6172.00	6176.08		6176.10	0.000267	1.21	227.70	124.51	0.14
11080	237.00	6172.00	6176.08		6176.09	0.000069	0.75	373.28	148.17	0.07
11060	237.00	6170.33	6176.08	6173.27	6176.09	0.000023	0.49	544.45	161.14	0.04
11017.5	Culvert									
10975	237.00	6167.29	6168.78	6168.78	6169.32	0.016694	5.80	40.32	92.55	0.96
10970	237.00	6166.98	6167.64	6168.01	6169.03	0.185729	9.68	25.06	63.73	2.69
10965	237.00	6166.66	6167.48	6167.72	6168.28	0.076197	6.89	33.09	66.02	1.77
10960	237.00	6166.26	6167.29	6167.47	6167.91	0.047400	5.51	38.22	67.38	1.40
10940	237.00	6166.00	6166.82	6166.83	6167.17	0.023775	4.81	50.05	76.42	1.05
10920	237.00	6164.94	6165.94	6166.15	6166.53	0.039864	6.54	39.49	66.58	1.37
10900	237.00	6164.00	6164.75	6164.99	6165.51	0.061357	7.53	35.02	66.98	1.67
10880	237.00	6163.66	6164.64	6164.64	6164.95	0.022025	4.78	53.42	86.68	1.01

10860	237.00	6162.00	6162.94	6163.28	6164.08	0.091678	8.87	28.83	63.22	2.02
10840	237.00	6162.00	6162.67	6162.69	6163.01	0.023724	4.89	51.76	84.12	1.05
10820	237.00	6160.81	6161.90	6162.03	6162.41	0.037337	4.82	43.75	83.09	1.24
10800	237.00	6159.98	6160.48	6160.73	6161.30	0.089885	7.59	33.05	74.74	1.93
10780	237.00	6158.75	6159.93	6160.01	6160.34	0.025989	3.94	48.23	82.93	1.03
10760	237.00	6157.95	6158.54	6158.82	6159.43	0.096427	6.97	31.44	68.70	1.94
10740	237.00	6156.88	6158.39	6158.42	6158.72	0.017453	3.06	56.19	92.14	0.83
10720	237.00	6156.00	6156.92	6157.25	6158.16	0.095871	4.47	29.45	74.37	1.73
10700	237.00	6156.00	6156.55	6156.68	6157.04	0.043631	5.81	42.88	83.09	1.38
10680	237.00	6155.06	6156.40	6156.40	6156.72	0.016176	4.92	55.94	87.49	0.91
10660	237.00	6154.00	6154.92	6155.26	6156.04	0.080736	8.69	28.89	52.47	1.92
10640	237.00	6154.00	6154.86	6154.86	6155.21	0.022654	4.63	49.64	72.15	1.02
10620	237.00	6152.85	6153.58	6153.85	6154.46	0.087128	8.50	31.88	65.85	1.96
10600	237.00	6151.76	6152.34	6152.53	6152.97	0.076708	5.33	37.65	90.05	1.66
10580	237.00	6150.60	6151.38	6151.52	6151.90	0.052544	2.27	40.86	84.18	1.17
10560	237.00	6149.79	6150.36	6150.51	6150.91	0.060654	4.66	39.99	87.07	1.47
10540	237.00	6148.65	6149.42	6149.56	6149.96	0.046404	1.17	40.10	72.41	0.94
10520	237.00	6147.40	6148.39	6148.58	6149.01	0.055968	2.61	38.19	77.11	1.24
10500	237.00	6146.04	6147.20	6147.45	6147.93	0.063241	4.38	35.27	68.80	1.47
10480	237.00	6145.21	6146.16	6146.42	6146.83	0.054783	5.68	36.24	64.01	1.49
10460	237.00	6144.00	6145.05	6145.33	6145.79	0.056873	6.64	34.51	57.63	1.57
10440	237.00	6142.66	6143.68	6144.14	6144.64	0.059792	7.72	30.20	42.76	1.66
10420	237.00	6142.00	6144.43	6142.95	6144.44	0.000165	0.75	345.11	227.18	0.10
10400	237.00	6140.88	6144.43		6144.44	0.000028	0.44	610.23	249.35	0.05
10380	237.00	6140.00	6144.43		6144.44	0.000008	0.29	952.59	288.43	0.03
10360	480.00	6139.33	6144.43		6144.44	0.000013	0.42	1301.01	334.60	0.03
10350	480.00	6138.68	6144.39	6140.52	6144.43	0.000164	1.59	308.07	300.00	0.12
10292.5	Culvert									
10235	480.00	6132.50	6135.71	6135.71	6136.40	0.015636	6.83	72.49	274.18	0.98

10230	480.00	6132.33	6132.94	6133.53	6135.98	0.436380		34.32	89.58	0.00
10225	480.00	6132.06	6132.88	6133.29	6134.28	0.151230		50.43	105.89	0.00
10220	480.00	6131.76	6132.78	6133.05	6133.59	0.072399		66.45	121.49	0.00
10200	480.00	6130.00	6131.75	6132.05	6132.54	0.039225		73.50	114.61	0.00
10180	480.00	6128.05	6130.62	6130.98	6131.67	0.044374		64.55	100.89	0.00
10160	480.00	6128.00	6129.83	6130.16	6130.79	0.038157		66.53	102.44	0.00
10140	480.00	6128.00	6129.26	6129.48	6129.97	0.033730	2.48	76.73	123.10	1.01
10120	480.00	6127.03	6128.31	6128.62	6129.22	0.038548	3.59	66.63	104.97	1.16
10100	480.00	6125.87	6126.99	6127.41	6128.23	0.059699	5.03	54.64	68.24	1.49
10080	480.00	6124.94	6126.30	6126.63	6127.19	0.036999	4.91	65.67	88.76	1.24
10060	480.00	6124.00	6125.29	6125.66	6126.37	0.043332	4.12	61.10	83.61	1.26
10040	480.00	6123.22	6124.58	6124.84	6125.41	0.043941	4.11	71.44	118.91	1.27
10020	480.00	6122.00	6123.33	6123.68	6124.43	0.050391	4.80	59.47	82.48	1.38
10000	480.00	6121.07	6122.30	6122.65	6123.38	0.052607	5.59	60.06	83.51	1.46
9990	480.00	6120.00	6120.65	6120.65	6120.96	0.022111	4.48	107.19	171.93	1.00
9980	673.00	6118.00	6118.21	6118.39	6118.84	0.186080	6.36	105.84	495.90	2.43
9970	673.00	6116.00	6116.37	6116.38	6116.56	0.027370	3.51	191.53	518.83	1.02
9960	673.00	6112.00	6112.26	6112.41	6112.78	0.119645	5.79	116.21	449.83	2.01
9950	673.00	6110.00	6110.37	6110.42	6110.63	0.037535	4.10	164.00	446.05	1.19
9940	673.00	6106.00	6106.41	6106.50	6106.78	0.045680	4.84	138.97	341.63	1.34
9930	673.00	6102.00	6102.45	6102.54	6102.84	0.042713	4.98	135.14	302.93	1.31
9920	673.00	6100.00	6101.21	6101.21	6101.57	0.021131	4.83	139.37	192.93	1.00
9910	673.00	6100.00	6100.57	6100.67	6101.02	0.039471	5.41	124.48	232.46	1.30
9900	673.00	6098.00	6099.10	6099.24	6099.65	0.037074	5.98	112.62	172.64	1.30
8995	673.00	6094.00	6094.36	6094.56	6095.03	0.103750	6.57	102.38	294.49	1.96
8990	673.00	6090.00	6090.51	6090.53	6090.79	0.027056	4.27	157.75	316.67	1.07
8980	673.00	6088.00	6088.57	6088.58	6088.86	0.024845	4.38	153.76	278.59	1.04
8970	673.00	6086.00	6086.57	6086.63	6086.95	0.030855	4.91	137.01	245.64	1.16
8920	673.00	6084.00	6085.19	6085.19	6085.59	0.020448	5.06	133.13	167.92	1.00
8910	673.00	6082.00	6083.35	6083.52	6084.00	0.038833	6.49	103.77	145.71	1.35

APPENDIX E

APPENDIX E
SOUTH BEAR CANYON ARROYO 2 CULVERT DATA AND DRAWINGS (FORMS 4.3 AND 7.3)

- RiverCAD output information for South Bear Canyon Arroyo 2 culverts
- Culvert drawings (See Appendix D)

south -branch6.flx

Final - South Branch 6 Saturday 12/7/02

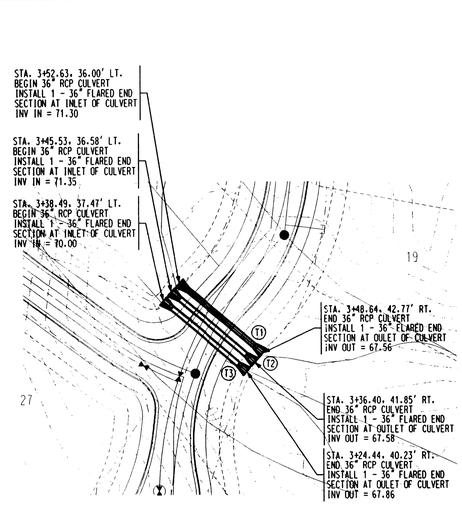
Profile Output - Standard Table 1

River Sta.	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1200	39.00	6194.00	6194.73	6194.73	6195.03	0.022854	4.35	8.97	15.26	1.00
1180	39.00	6192.00	6192.63	6192.63	6192.91	0.024305	4.24	9.21	17.07	1.02
1160	39.00	6190.00	6190.73	6190.73	6191.03	0.023419	4.35	8.96	15.50	1.01
1140	39.00	6188.00	6188.77	6188.77	6189.07	0.023644	4.36	8.94	15.52	1.01
1120	39.00	6186.00	6187.01	6187.01	6187.32	0.022479	4.51	8.65	13.68	1.00
1100	39.00	6184.00	6184.99	6184.94	6185.28	0.018537	4.30	9.06	13.29	0.92
1080	39.00	6184.00	6184.58	6184.58	6184.84	0.023683	4.06	9.61	18.64	1.00
1060	39.00	6182.00	6182.56	6182.56	6182.81	0.024889	3.96	9.84	20.59	1.01
1040	39.00	6180.00	6180.85	6180.85	6181.11	0.024070	4.08	9.55	18.61	1.01
1020	39.00	6178.00	6179.10	6179.10	6179.39	0.023310	4.32	9.03	15.73	1.01
1000	39.00	6176.00	6177.14	6177.14	6177.46	0.022566	4.51	8.65	13.73	1.00
980	39.00	6176.00	6176.52	6176.52	6176.75	0.024913	3.83	10.17	22.43	1.00
960	39.00	6174.00	6175.03	6175.03	6175.31	0.023839	4.29	9.09	16.32	1.01
940	39.00	6172.00	6173.16	6173.16	6173.46	0.023879	4.38	8.91	15.37	1.01
920	39.00	6171.09	6172.29	6172.29	6172.58	0.024460	4.32	9.04	16.31	1.02
900	39.00	6170.00	6171.03	6170.82	6171.18	0.009405	3.12	12.52	18.00	0.66
880	39.00	6170.00	6170.62	6170.62	6170.88	0.024944	4.06	9.61	19.48	1.02
860	39.00	6168.00	6168.75	6168.75	6169.05	0.023741	4.37	8.93	15.54	1.01
840	39.00	6166.00	6167.40	6167.40	6167.69	0.024078	4.30	9.07	16.15	1.01
820	39.00	6166.00	6166.57	6166.57	6166.81	0.024750	3.92	9.94	21.06	1.01
800	39.00	6164.00	6164.94	6164.94	6165.21	0.023560	4.23	9.23	16.74	1.00
780	39.00	6162.35	6163.71	6163.71	6164.12	0.022261	5.12	7.62	9.58	1.01
760	39.00	6161.06	6162.19	6162.19	6162.38	0.024877	3.49	11.19	28.33	0.98
740	39.00	6160.00	6161.00	6161.00	6161.24	0.024970	3.99	9.77	19.98	1.01
720	39.00	6158.00	6159.01	6159.01	6159.38	0.022007	4.87	8.00	10.93	1.00
700	39.00	6156.05	6157.23	6157.23	6157.59	0.022682	4.81	8.11	11.65	1.01
680	39.00	6154.00	6155.82	6155.82	6156.29	0.023269	5.51	7.08	7.77	1.02

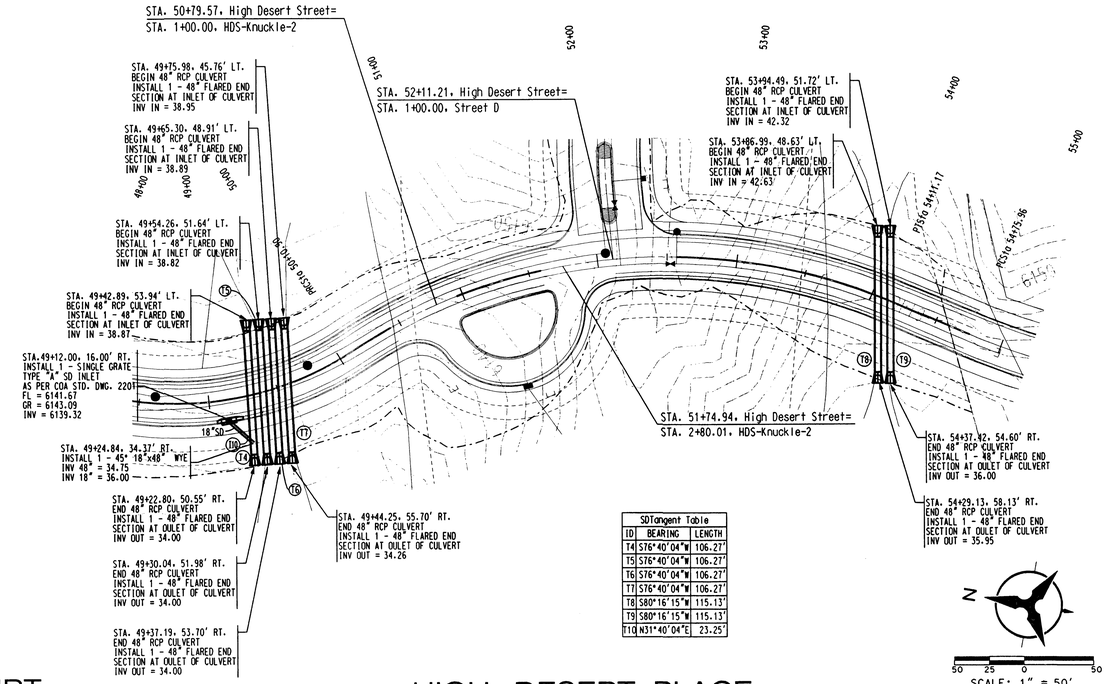
660	39.00	6154.00	6154.92	6154.92	6155.30	0.022087	4.94	7.90	10.52	1.00
640	39.00	6152.00	6152.88	6152.88	6153.22	0.022975	4.68	8.34	12.61	1.01
620	39.00	6150.28	6151.55	6151.55	6151.94	0.022387	5.03	7.76	10.18	1.01
600	39.00	6150.00	6150.85	6150.85	6151.19	0.022255	4.64	8.41	12.57	1.00
580	39.00	6148.04	6149.68		6149.92	0.012513	3.96	9.85	11.89	0.77
560	39.00	6148.00	6149.25	6149.25	6149.58	0.023405	4.56	8.55	13.66	1.02
540	39.00	6148.00	6148.62	6148.62	6148.90	0.023638	4.18	9.33	17.31	1.00
520	39.00	6146.00	6147.08	6147.08	6147.39	0.023462	4.44	8.78	14.71	1.01
500	39.00	6146.00	6146.54	6146.54	6146.76	0.026196	3.73	10.45	24.95	1.02
480	39.00	6144.58	6146.16		6146.18	0.001207	1.10	35.53	52.96	0.24
460	39.00	6143.45	6146.17		6146.17	0.000027	0.29	135.45	89.29	0.04
450	83.00	6142.73	6146.15	6144.38	6146.17	0.000335	1.19	69.62	98.82	0.15
390	Culvert									
330	193.00	6135.88	6137.66	6137.66	6138.20	0.017793	5.86	32.94	127.52	0.99
320	193.00	6135.29	6136.23	6136.23	6136.47	0.025084	3.82	49.59	107.48	1.01
300	193.00	6134.28	6135.21	6135.21	6135.46	0.024614	3.94	47.81	96.74	1.01
280	193.00	6133.24	6134.12	6134.12	6134.35	0.024554	3.74	50.61	111.38	0.99
260	193.00	6132.21	6132.96	6132.96	6133.20	0.025063	3.97	49.46	107.20	1.02
240	193.00	6130.19	6131.52	6131.52	6131.75	0.022549	3.82	50.50	104.18	0.97
220	193.00	6129.59	6130.41	6130.41	6130.67	0.024775	4.08	47.26	94.79	1.02
200	193.00	6128.00	6128.97	6128.97	6129.29	0.022358	4.50	42.93	68.95	1.00
180	193.00	6126.95	6128.25	6128.25	6128.54	0.023974	4.28	45.08	82.16	1.02
160	193.00	6126.00	6127.30	6127.30	6127.56	0.023000	4.11	46.91	87.92	0.99
140	193.00	6125.46	6126.29	6126.29	6126.54	0.024796	4.01	48.10	99.10	1.02
120	193.00	6124.08	6124.93	6124.93	6125.18	0.025121	3.99	48.35	101.43	1.02
110	193.00	6123.41	6124.29	6124.29	6124.53	0.022797	3.90	49.53	100.13	0.98
100	193.00	6122.74	6123.61	6123.61	6123.86	0.026486	4.03	47.90	103.05	1.04
80	193.00	6121.53	6122.30	6122.30	6122.50	0.026120	3.58	53.95	137.34	1.01
60	193.00	6120.42	6121.12	6121.12	6121.32	0.025683	3.58	53.94	135.54	1.00

40	193.00	6119.30	6120.07	6120.07	6120.26	0.025922	3.44	56.08	150.41	0.99
20	193.00	6118.23	6118.95	6118.95	6119.18	0.024872	3.89	50.21	110.78	1.01
0	193.00	6117.21	6117.93	6117.93	6118.16	0.027064	3.85	50.53	119.10	1.04

SD Tangent Table		
ID	BEARING	LENGTH
T1	N30°42'04"E	78.86'
T2	N30°42'04"E	78.91'
T3	N30°42'04"E	78.86'



STORM DRAIN FLOW TABLE						
NUMBER	Q(cfs)	V(cfs)	DEPTH	LENGTH	SIZE	SLOPE
T1	79.00	20.98	18.92"	78.86'	36"	4.74%
T2	79.00	18.71	20.76"	78.91'	36"	3.51%
T3	79.00	16.91	22.60"	78.86'	36"	2.71%
T4	120.0	22.96	20.82"	106.27'	48"	4.58%
T5	120.0	22.89	20.87"	106.27'	48"	4.54%
T6	120.0	23.00	20.80"	106.27'	48"	4.60%
T7	120.0	22.67	21.02"	106.27'	48"	4.42%
T8	104.5	24.13	18.08"	115.13'	48"	5.81%
T9	104.5	23.64	18.36"	115.13'	48"	5.49%
T10	16.17	22.12	7.78"	13.22'	48"	15.79%



SDTangent Table		
ID	BEARING	LENGTH
T4	S76°40'04"W	106.27'
T5	S76°40'04"W	106.27'
T6	S76°40'04"W	106.27'
T7	S76°40'04"W	106.27'
T8	S80°16'15"W	115.13'
T9	S80°16'15"W	115.13'
T10	N31°40'04"E	23.25'

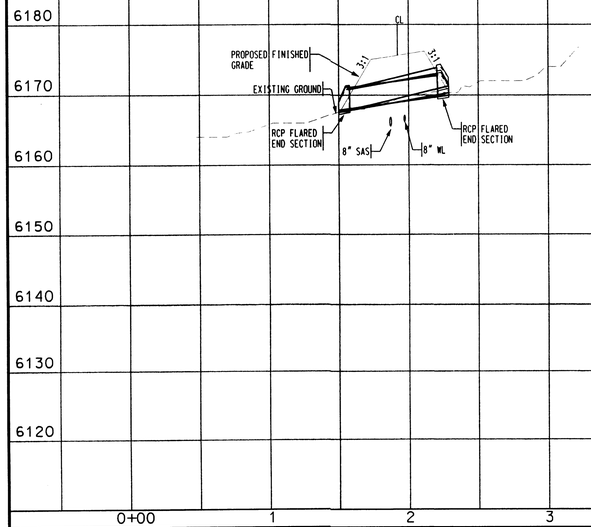
BARRANCA OSO COURT

HIGH DESERT PLACE

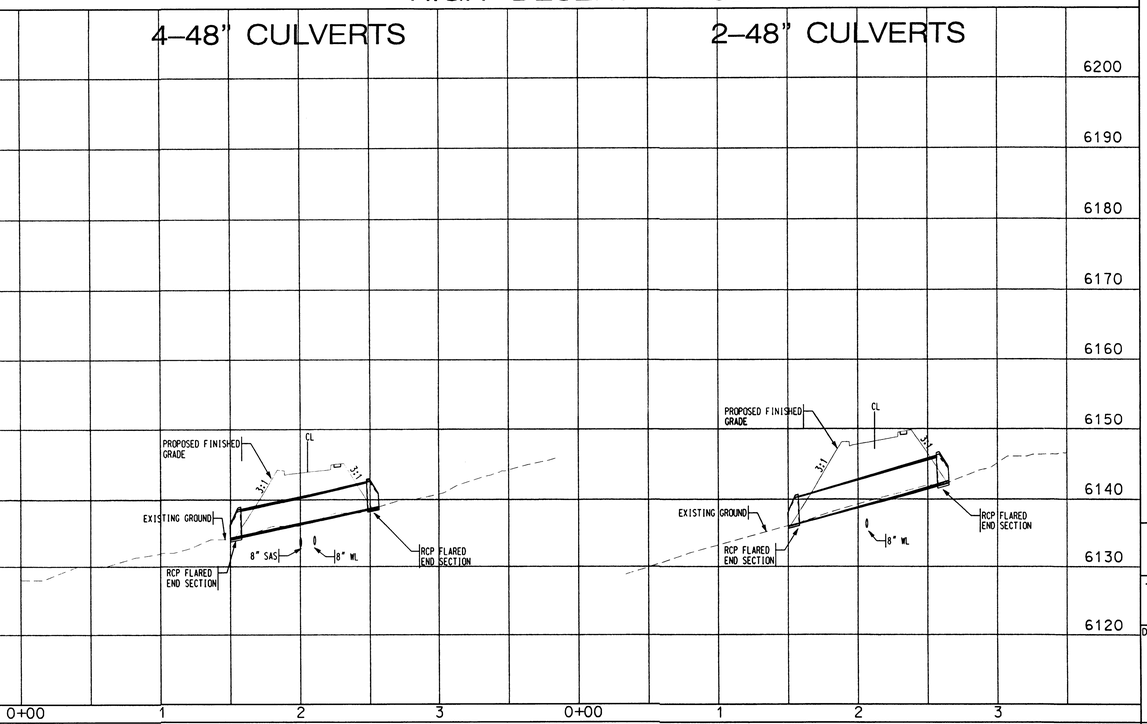
NOTES

1. THE CONTRACTOR SHALL FIELD VERIFY ALL EXISTING UTILITY LOCATIONS AND NOTIFY THE ENGINEER IMMEDIATELY OF OF ANY DISCREPANCIES.
2. ALL CURB RETURN RADII SHALL BE 25' UNLESS OTHERWISE SPECIFIED.
3. ALL CURVE DATA AND DIMENSIONS REFER TO FACE OF CURB UNLESS OTHERWISE SPECIFIED.
4. GRADE ELEVATIONS, WHERE NOTED, ARE ALONG FLOWLINE OF STANDARD CURB UNLESS OTHERWISE SPECIFIED.
5. CONTRACTOR IS TO INSTALL A 4" X 4" X 5' POST AND EMD AT THE END OF EACH SANITARY SEWER SERVICE.
6. CONTRACTOR IS RESPONSIBLE FOR REPAIR AND/OR REPLACEMENT OF ALL UTILITY CONDUITS AND EXISTING LINES.
7. ANY ADDITIONAL GRADING REQUIRED TO MATCH PROPOSED STREET GRADES SHALL BE INCIDENTAL TO PAVING ITEMS.
8. CONTRACTOR SHALL PROVIDE THE INSPECTORS, (CITY AND PRIVATE) WITH THE PROPOSED HYDROSTATIC TESTING PLAN. THE PLAN MUST BE APPROVED BEFORE TESTING OPERATIONS BEGIN.
9. CONTRACTOR SHALL PARK EQUIPMENT AND VEHICLES AS NOT TO INTERFERE WITH NORMAL ACTIVITIES OF RESIDENTS OR OTHER CONTRACTORS ON SITE.
10. ANY DAMAGE TO THE EXISTING FACILITIES (CURB & GUTTER), PAVEMENT, CONDUITS, LANDSCAPING, UTILITY LINES, ETC.) DURING CONSTRUCTION SHALL BE REPLACED AT THE CONTRACTORS' EXPENSE.
11. REMOVAL OF THE EXISTING CURB AND GUTTER SHALL BE AS PER COA STD. DWG. 2415 (SAWCUT ONLY).
12. WHEELCHAIR RAMPS SHALL BE CONSTRUCTED PRIOR TO ACCEPTANCE OFCURB & GUTTER.
13. ALL EXCAVATION, TRENCHING AND SHORING ACTIVITIES MUST BE CARRIED-OUT IN ACCORDANCE WITH OSHA 29 CFR 1926.650 SUBPART P.

3-36" CULVERTS



4-48" CULVERTS



2-48" CULVERTS

SCALE: 1" = 50' (HORIZ.)
1" = 10' (VERT.)

BHI JOB NO. 030103

P:\ 030103\CDP\PNP\ 030103sdPpnp01

p:\030103\cdp\pnp\030103sdpnp01.dgn
09-DEC-2002
16:16

AS-BUILT INFORMATION

CONTRACTOR

STAKED BY	
INSPECTOR'S ACCEPTANCE BY	DATE
FIELD VERIFICATION BY	DATE
AS-BUILT INDICATED CORRECTED BY	DATE

MICRO-FILM INFORMATION

RECORDED BY	DATE
NO.	

BENCH MARKS

STATION IS A STANDARD USC & GS BRASS

GEOLOGICAL SURVEY BENCH MARK. TOP	
TABLET STAMPED "TUMBLE 1969" SET IN	DATE
CONCRETE PROJECTING 0.2 FEET ABOVE	
GROUND. LOCATED 489 FEET WEST OF	DATE
THE INTERSECTION OF SAN ANTONIO	DATE
DRIVE AND TENNYSON STREET, AND 35	DATE
FEET NORTH OF RIGHT-OF-WAY LINE	
OF SAN ANTONIO DR. ELEV.= 6009.155	

ENGINEER'S SEAL

KEVIN G. PATTON
NEW MEXICO
13685
REGISTERED PROFESSIONAL ENGINEER

SURVEY INFORMATION

FIELD NOTES

NO.	DATE	BY

NO.	DATE	REMARKS	BY
		REVISIONS	
		DESIGN	

DESIGNED BY	YOP	DATE 09/2002
DRAWN BY	DLM	DATE 09/2002
CHECKED BY	KGP	DATE 09/2002

Bohannan ▲ Huston

Courtyard I 7500 Jefferson St. NE Albuquerque, NM 87109-4335

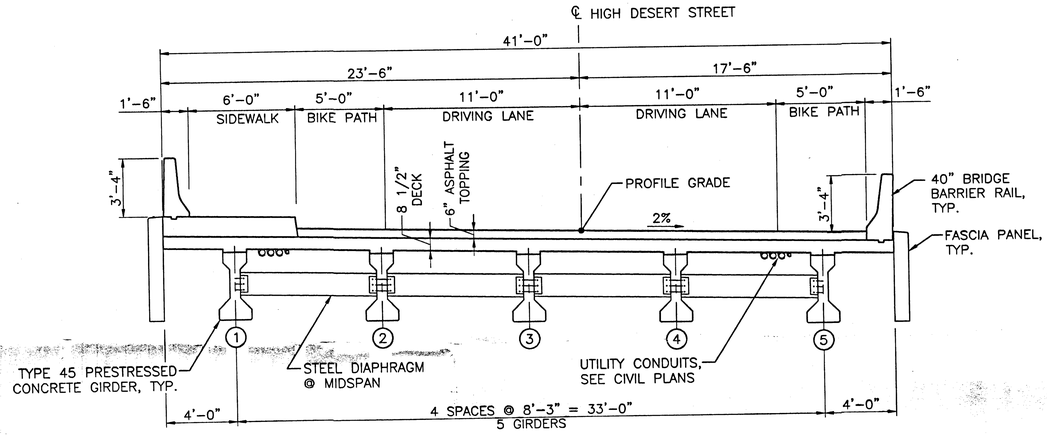
ENGINEERING ▲ SPATIAL DATA ▲ ADVANCED TECHNOLOGIES

CITY OF ALBUQUERQUE
PUBLIC WORKS DEPARTMENT
ENGINEERING DEVELOPMENT GROUP

THE WILDERNESS ESTATES SUBDIVISION AT HIGH DESERT
CULVERT PLAN & PROFILE
BARRANCA OSO COURT /HIGH DESERT PLACE

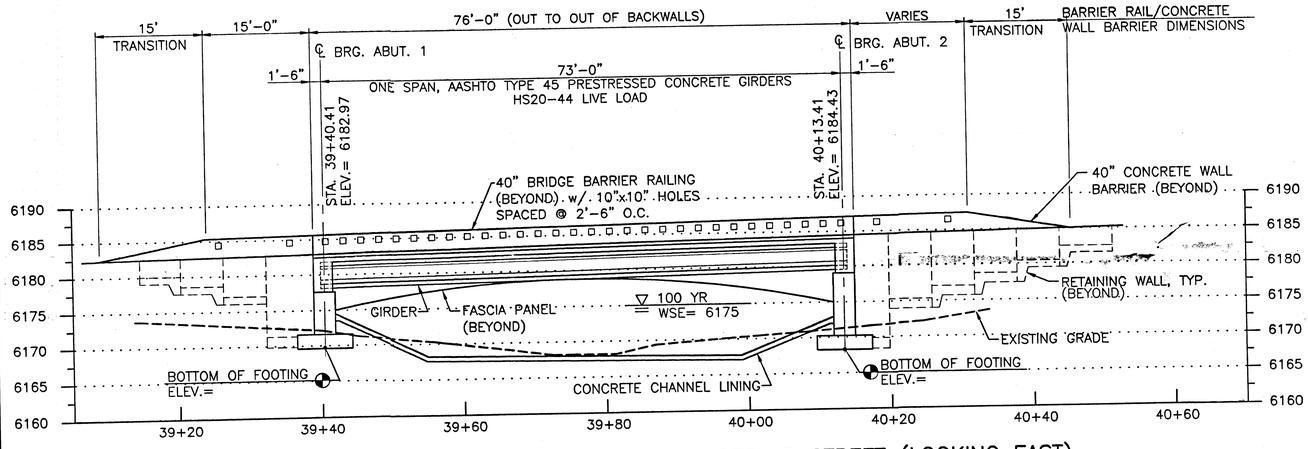
DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL	LAST DESIGN UPDATE	MO./DAY/YR.	MO./DAY/YR.

CITY PROJECT NO.	ZONE MAP NO.	SHEET	OF
	F-23	20	45



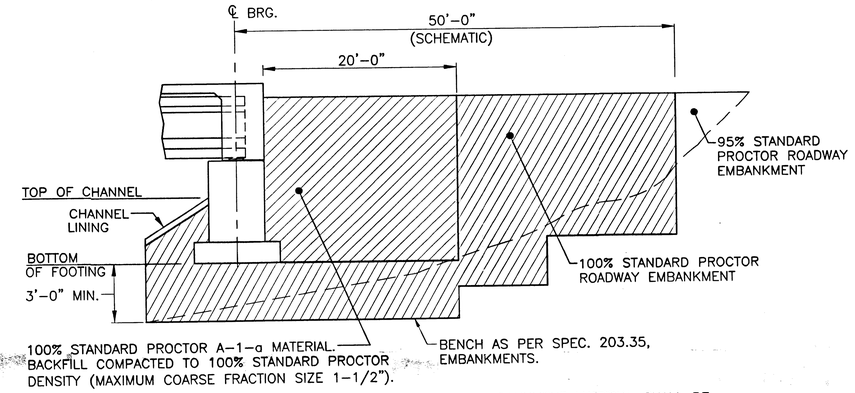
TYPICAL SECTION (LOOKING SOUTH)

SCALE: 1/4" = 1'-0"



BRIDGE PROFILE @ CENTERLINE OF HIGH DESERT STREET (LOOKING EAST)

SCALE: 1" = 10'



NOTE: PROCTOR CURVES OF BACKFILL & NORMAL EMBANKMENT MATERIAL SHALL BE SUBMITTED TO THE OWNER'S REPRESENTATIVE. FIELD DENSITY TEST REPORTS SHALL ALSO BE SUBMITTED TO THE OWNER'S REPRESENTATIVE OF 100% STANDARD PROCTOR ZONES.

EXCAVATION AND BACKFILL NOTES

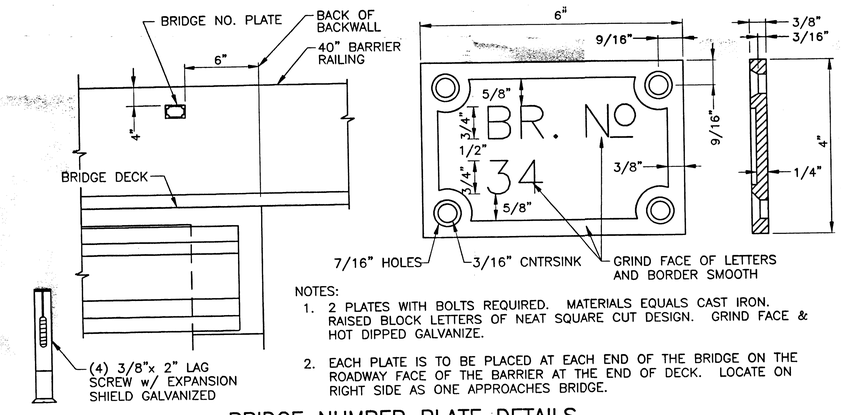
1. FOUNDATION CONSTRUCTION SHALL BE IN CONFORMANCE WITH THE PROJECT GEOTECHNICAL REPORT AS PREPARED BY GEO-TEST, JOB No. 1-00904 DATED NOVEMBER 20, 2000. THE CONTRACTOR SHALL OBTAIN A COPY OF THE REPORT FROM THE OWNER.
2. ALL BACKFILL SOILS AND STRUCTURAL FILL SHALL BE NON-EXPANSIVE, FREE OF VEGETATION AND DEBRIS, AND CONTAIN NO ROCKS LARGER THAN 6". GRADATION SHALL BE ACCORDING TO ASTM D-422 AS FOLLOWS:

SIEVE SIZE	PERCENT PASSING
3 INCH	90-100
NO 4	60-100
NO 200	0-45

3. A REGISTERED SOILS ENGINEER SHALL INSPECT THE EXCAVATION AND BACKFILL.

BACKFILL COMPACTION DETAIL

NO SCALE



NOTES:
1. 2 PLATES WITH BOLTS REQUIRED. MATERIALS EQUALS CAST IRON. RAISED BLOCK LETTERS OF NEAT SQUARE CUT DESIGN. GRIND FACE & HOT DIPPED GALVANIZE.
2. EACH PLATE IS TO BE PLACED AT EACH END OF THE BRIDGE ON THE ROADWAY FACE OF THE BARRIER AT THE END OF DECK. LOCATE ON RIGHT SIDE AS ONE APPROACHES BRIDGE.

BRIDGE NUMBER PLATE DETAILS

NO SCALE

GENERAL NOTES

1. WORKMANSHIP AND MATERIALS SHALL CONFORM TO THE NEW MEXICO STATE HIGHWAY AND TRANSPORTATION DEPARTMENT'S STANDARD SPECIFICATION FOR HIGHWAY AND BRIDGE CONSTRUCTION, 2000 EDITION. ALL REFERENCES TO 'THE DEPARTMENT' SHALL MEAN 'THE CITY' UNLESS OTHERWISE NOTED.
2. STRUCTURAL CAST-IN-PLACE CONCRETE SHALL BE CLASS AA IN ACCORDANCE WITH SPEC. 510, PORTLAND CEMENT CONCRETE. CHAMFER ALL EXPOSED EDGES OF STRUCTURES 3/4" UNLESS OTHERWISE NOTED.
3. SUPERSTRUCTURE CONCRETE SHALL BE PLACED ACCORDING TO SPEC. 512, SUPERSTRUCTURE CONCRETE EXCEPT GROOVING OF HARDENED CONCRETE ON DECK IS NOT REQUIRED.
4. STRUCTURAL STEEL SHALL BE CARBON STEEL CONFORMING TO SPEC. 541, STEEL STRUCTURES.
5. PRECAST MEMBERS SHALL CONFORM TO SPEC. 518, PRESTRESSED CONCRETE MEMBERS.
6. A WATER PROOFING MEMBRANE SHALL BE APPLIED TO THE TOP OF THE BRIDGE DECK ACCORDING TO SPEC. 531, LAYERED BRIDGE DECK SEALING. THE SYSTEM IS INCIDENTAL TO BRIDGE CONSTRUCTION AND MUST BE APPROVED BY THE ENGINEER.
7. THE BACK SIDES OF ABUTMENT BACKWALLS AND RETAINING WALLS SHALL BE PROTECTED BY WATERPROOFING ACCORDING TO LIMITS AND APPROVED PRODUCTS SHOWN ON THE PLANS. WATERPROOFING IS INCIDENTAL TO BRIDGE CONSTRUCTION.
8. REINFORCING STEEL IN THE BRIDGE DECK AND ABUTMENT DIAPHRAGMS SHALL BE EPOXY COATED.
9. ALL EXPOSED CONCRETE SURFACES, EXCEPT FOR THE TOP SURFACE OF THE BRIDGE DECK, SHALL RECEIVE A PENETRATING WATER REPELLENT TREATMENT PER SPEC. 511.386. THE BRIDGE DECK SHALL RECEIVE HMWM SEALING BY FLOODING THE ENTIRE DECK PER SPEC. 535, CRACK SEALING USING HIGH MOLECULAR WEIGHT METHACRYLATE, PRIOR TO APPLICATION OF THE MEMBRANE. WATER REPELLENT AND HMWM TREATMENTS ARE INCIDENTAL TO BRIDGE CONSTRUCTION.
10. ALL EXPOSED CONCRETE SURFACES SHALL RECEIVE A CLASS 4 SPECIAL SURFACE FINISH PER SPEC. 511.385. COLOR WILL BE AS SPECIFIED BY THE OWNER AND IS INCIDENTAL TO BRIDGE CONSTRUCTION.
11. ALL EXPOSED CONCRETE SURFACES SHALL RECEIVE ANTI-GRAFITTI COATING PER SPEC. PROV 532-A.

DESIGN DATA

DESIGN IS IN ACCORDANCE WITH AASHTO SPECIFICATIONS 1996 EDITION. DESIGN STRESSES: STRUCTURAL STEEL-ASTM A-36, Fy= 36,000psi
PRECAST CONCRETE, F'c= 6500psi AT 28 DAYS
CAST-IN-PLACE CONCRETE F'c= 4000psi AT 28 DAYS
REINFORCING STEEL, Fy= 60,000psi GRADE 60
LOADS INCLUDE 6" ASPHALT TOPPING
NO ALLOWANCE FOR FUTURE OVERLAY
ALLOWANCE FOR STEEL DECK FORMS =15 psf
LIVE LOAD: HS 20-44

FOUNDATION DATA

ACTIVE EARTH PRESURE.....35pcf
EARTH PRESSURE AT REST.....60pcf
PASSIVE EARTH PRESSURE.....325pcf
ALLOWABLE SOIL BEARING PRESSURE
ABUTMENT FOOTINGS.....2500psf
RETAINING WALL FOOTINGS.....2500psf
COEFFICIENT OF FRICTION.....0.4
SOIL UNIT WEIGHT.....110pcf

STANDARD DRAWINGS REQUIRED

THE FOLLOWING NEW MEXICO STATE HIGHWAY AND TRANSPORTATION DEPARTMENT STANDARD DRAWINGS ARE REQUIRED AND ARE INCLUDED BY REFERENCE AS PART OF THIS CONTRACT. THE CONTRACTOR IS REQUIRED TO OBTAIN A COPY OF THESE DRAWINGS FROM THE NMSH&TD.

DRAWING 040 SHEETS 1,2 & 5 40" BARRIER RAILING

INCIDENTAL WORK AND MATERIALS

1. WATER REPELLENT ON CONCRETE SURFACES
2. HMWM ON DECK
3. WATERPROOFING MEMBRANE ON DECK
4. WATERPROOFING BEHIND ABUTMENTS AND RETAINING WALLS
5. CLASS 4 SPECIAL FINISH ON CONCRETE SURFACES
6. JOINTS ON SIDEWALK
7. ELASTOMERIC BEARING PADS
8. ANCHORS FOR FASCIA PANELS
9. NP-1
10. JOINT FILLER, BOND BREAKER AND STYROFOAM BLOCKOUTS
11. BRIDGE PLATES
12. APPERTENANCES FOR STEEL DIAPHRAGMS
13. FOOTING & REBAR FOR CONCRETE WALL BARRIER
14. EXISTING WALL WEEPHOLES

ITEMS LISTED ABOVE ARE ONLY A GENERAL DESCRIPTION OF THE REQUIRED WORK AND MATERIALS, AND MAY NOT BE COMPLETE. PARAGRAPH 104.01 OF THE STANDARD SPECS APPLIES. THIS LIST DOES NOT INCLUDE ANY INCIDENTAL WORK OR MATERIAL REQUIRED BY SPECIAL PROVISIONS, SERIALS, SUPPLEMENTAL SPECIFICATIONS, OR THE STANDARD SPECIFICATIONS.

AS-BUILT INFORMATION
CONTRACTOR — DATE
WORK STAKED BY — DATE
INSPECTOR'S ACCEPTANCE BY — DATE
FIELD VERIFICATION BY — DATE
DRAWINGS CORRECTED BY — DATE
MICRO-FILM INFORMATION
RECORDED BY — DATE
NO.

BENCH MARKS
STATION IS A STANDARD UCC & GS BRASS
GEOLOGICAL SURVEY BENCH MARK. TOP TABLET STAMPED "TUMBLE 1969" SET IN CONCRETE PROJECTING 0.2 FEET ABOVE GROUND. LOCATED 489 FEET WEST OF THE INTERSECTION OF SAN ANTONIO DRIVE AND TENNYSON STREET, AND 35 FEET NORTH OF RIGHT-OF-WAY LINE OF SAN ANTONIO DR.
ELEV.=6009.155

SURVEY INFORMATION
FIELD NOTES
NO. | BY | DATE

ENGINEER'S SEAL

No.	Date	REMARKS	By
		REVISIONS	
		DESIGN	

Designed By: MYS — DATE: 10/08/02
Drawn By: ED — DATE: 10/08/02
Checked By: DMB — DATE: 10/08/02

Bohannan ▲ Huston
Courtyard I 7500 Jefferson St. NE Albuquerque, NM 87109-4335
ENGINEERING ▲ SPATIAL DATA ▲ ADVANCED TECHNOLOGIES

CITY OF ALBUQUERQUE
PUBLIC WORKS DEPARTMENT

HIGH DESERT / BEAR CANYON BRIDGE
BRIDGE PROFILE / TYPICAL SECTION & NOTES

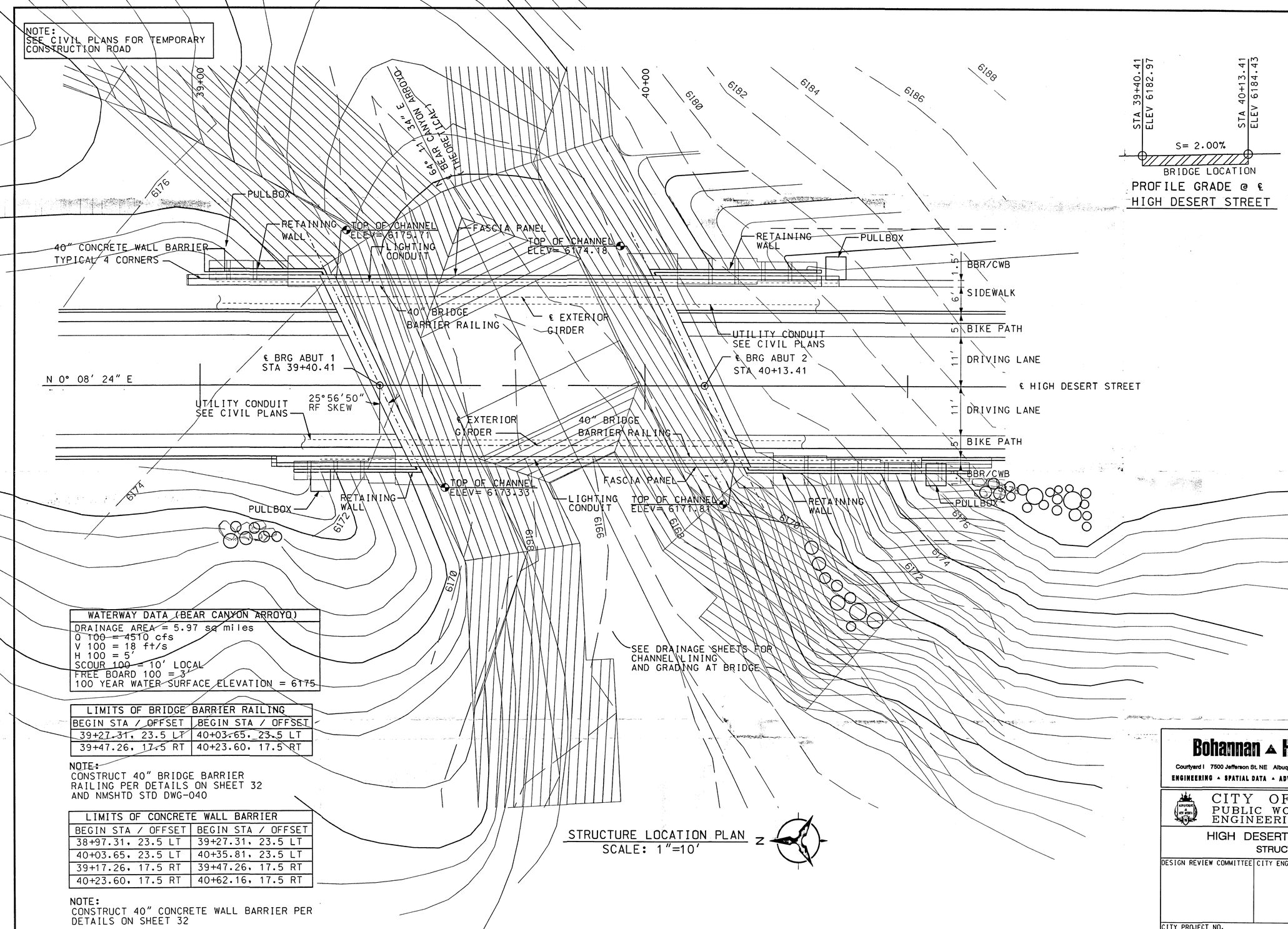
Design Review Committee	City Engineer Approval	Last Design Update	Mo./Day/Yr.	Mo./Day/Yr.

City Project No.	Zone Map No.	Sheet	Of
.....	F-23	23	45

BHI JOB NO. 030103

P:\030103\struct\drawings\030103-Tsection.dwg
November 05, 2002 - 12:13 PM
SECTION & PROFILE

NOTE:
SEE CIVIL PLANS FOR TEMPORARY CONSTRUCTION ROAD



WATERWAY DATA (BEAR CANYON ARROYO)
DRAINAGE AREA = 5.97 sq miles
Q 100 = 4510 cfs
V 100 = 18 ft/s
H 100 = 5'
SCOUR 100 = 10' LOCAL
FREE BOARD 100 = 3'
100 YEAR WATER SURFACE ELEVATION = 6175

LIMITS OF BRIDGE BARRIER RAILING	
BEGIN STA / OFFSET	BEGIN STA / OFFSET
39+27.31, 23.5 LT	40+03.65, 23.5 LT
39+47.26, 17.5 RT	40+23.60, 17.5 RT

NOTE:
CONSTRUCT 40" BRIDGE BARRIER RAILING PER DETAILS ON SHEET 32 AND NMSHTD STD DWG-040

LIMITS OF CONCRETE WALL BARRIER	
BEGIN STA / OFFSET	BEGIN STA / OFFSET
38+97.31, 23.5 LT	39+27.31, 23.5 LT
40+03.65, 23.5 LT	40+35.81, 23.5 LT
39+17.26, 17.5 RT	39+47.26, 17.5 RT
40+23.60, 17.5 RT	40+62.16, 17.5 RT

NOTE:
CONSTRUCT 40" CONCRETE WALL BARRIER PER DETAILS ON SHEET 32

STRUCTURE LOCATION PLAN
SCALE: 1"=10'

N

P:\ P:\030103\struct\drawings\plan01.dgn
10-DEC-2002
07:53

BHI JOB NO. 030103

AS-BUILT INFORMATION
CONTRACTOR
WORK STAKED BY
INSPECTOR'S ACCEPTANCE BY DATE
FIELD LOCATION BY DATE
DRAWINGS CORRECTED BY DATE
MICRO-FILM INFORMATION
RECORDED BY DATE
NO.

BENCH MARKS
STATION IS A STANDARD USC & GS BRASS GEOLOGICAL SURVEY BENCH MARK. TOP TABLET STAMPED "TUMBLE 1969" SET IN CONCRETE PROJECTING 0.2 FEET ABOVE GROUND. LOCATED 489 FEET WEST OF THE INTERSECTION OF SAN ANTONIO DRIVE AND TENNYSON STREET, AND 35 FEET NORTH OF RIGHT-OF-WAY LINE OF SAN ANTONIO DR. ELEV.= 6009.155

ENGINEER'S SEAL SURVEY INFORMATION
FIELD NOTES

NO.	BY	DATE

NO.	DATE	REMARKS	BY
		REVISIONS	
		DESIGN	

DESIGNED BY MVS DATE 10/2002
DRAWN BY LAE DATE 10/2002
CHECKED BY DWB DATE 10/2002

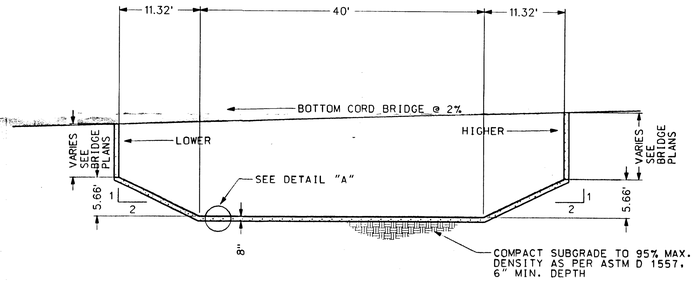
Bohannan ▲ Huston
Courtyard I 7500 Jefferson St. NE Albuquerque, NM 87109-4335
ENGINEERING ▲ SPATIAL DATA ▲ ADVANCED TECHNOLOGIES

CITY OF ALBUQUERQUE
PUBLIC WORKS DEPARTMENT
ENGINEERING DEVELOPMENT GROUP

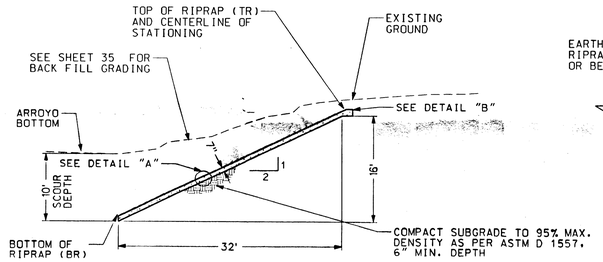
HIGH DESERT /BEAR CANYON BRIDGE
STRUCTURE LOCATION PLAN

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL	LAST DESIGN UPDATE	MO./DAY/YR.	MO./DAY/YR.

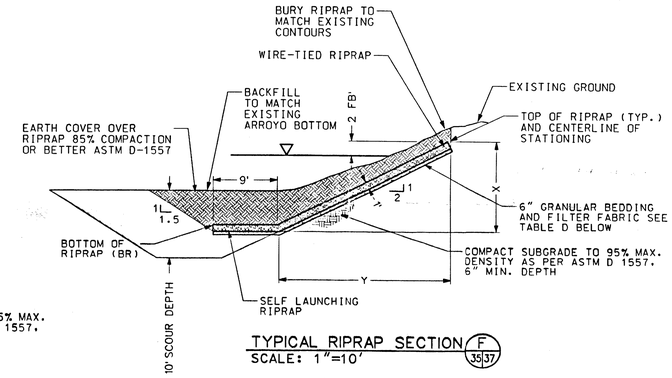
CITY PROJECT NO. | ZONE MAP NO. F-23 | SHEET 22 OF 45



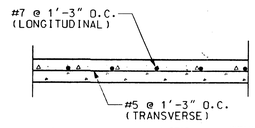
SECTION A-A - TYPICAL CHANNEL SECTION (A 35|37)
SCALE: 1"=10'



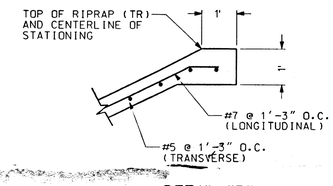
SECTION B-B - TYPICAL WEST CHANNEL SECTION (B 35|37)
SCALE: 1"=10'



TYPICAL RIPRAP SECTION (F 35|37)
SCALE: 1"=10'



DETAIL "A"
N.T.S.



DETAIL "B"
N.T.S.

SOUTHWEST RIPRAP SECTIONS

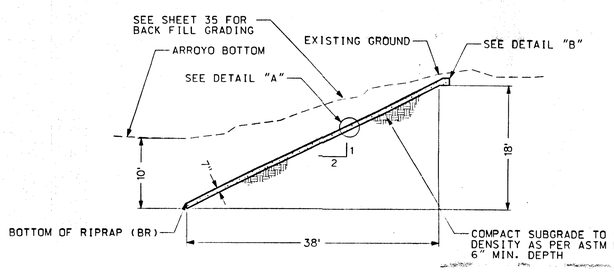
STATIONS	X	Y
0+00 TO 0+40	12'	24' (2:1)
0+40 TO 0+50	12'	24' TO 18' TRANSITION 2:1 TO 1.5:1
0+50 TO 0+70	12'	18' (1.5:1 SEE DETAIL "A" SHEET 34)
0+70 TO 0+80	12'	18' TO 24' TRANSITION 1.5:1 TO 2.1
0+80 TO 3+00	12'	24' (2:1)

SOUTHEAST RIPRAP SECTIONS

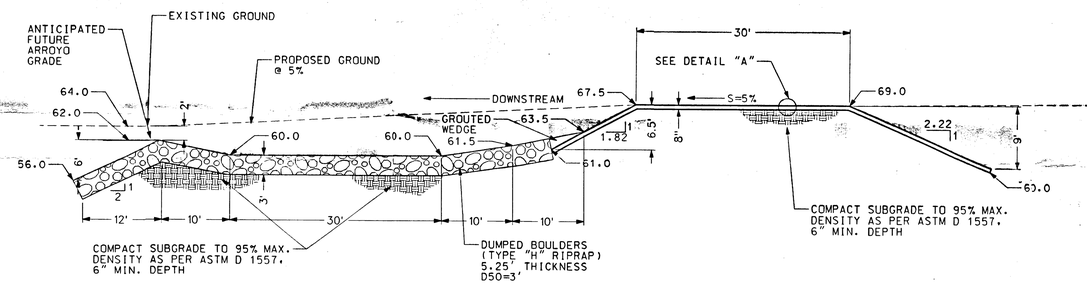
STATIONS	X	Y
0+00 TO 1+29.16	14'	28' (2:1)
1+29.16 TO 3+50	12'	24' (2:1)

TABLE D

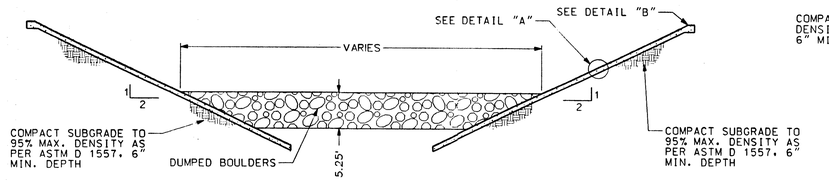
GRANULAR BEDDING GRADATION	
U.S. STANDARD SIEVE SIZE	% PASSING BY WEIGHT
3/8"	100
#4	95-100
#16	45-90
#50	10-30
#100	2-10
#200	0-2



SECTION C-C - TYPICAL WEST CHANNEL SECTION (C 35|37)
SCALE: 1"=10'



SECTION D-D - RIPRAP BOULDER PLUNGE POOL (D 35|37)
SCALE: 1"=10'



SECTION E-E - TYPICAL BOULDER SECTION (E 35|37)
SCALE: 1"=10'

P:\
01=030103\Hydro\Bear Canyon\Design\Plans\030103hd01.dgn
01-28-2003
09:12

BHI JOB NO. 030103

ENGINEER'S SEAL

SURVEY INFORMATION

FIELD NOTES

NO.	BY	DATE

BENCH MARKS

STATION IS A STANDARD USC & GS BRASS
GEOLOGICAL SURVEY BENCH MARK. TOP
TABLET STAMPED "TUMBLE 1969" SET IN
CONCRETE PROJECTING 0.2 FEET ABOVE
GROUND. LOCATED 489 FEET WEST OF
THE INTERSECTION OF SAN ANTONIO
DRIVE AND TENNYSON STREET, AND 35
FEET NORTH OF RIGHT-OF-WAY LINE
OF SAN ANTONIO DR. ELEV.= 6009.155

AS-BUILT INFORMATION

CONTRACTOR	
WORK STAKED BY	
INSPECTOR'S ACCEPTANCE BY	DATE
FIELD VERIFICATION BY	DATE
DRAWINGS CORRECTED BY	DATE

MICRO-FILM INFORMATION

RECORDED BY	DATE
NO.	

NO.	DATE	REMARKS	BY
		REVISIONS	
		DESIGN	

DESIGNED BY	G.M.	DATE 10/2002
DRAWN BY	S.F.G.	DATE 10/2002
CHECKED BY	G.M./C.H.	DATE 10/2002

Bohannan ▲ Huston
Courtyard I 7500 Jefferson St. NE Albuquerque, NM 87109-4335
ENGINEERING ▲ SPATIAL DATA ▲ ADVANCED TECHNOLOGIES

CITY OF ALBUQUERQUE
PUBLIC WORKS DEPARTMENT
ENGINEERING DEVELOPMENT GROUP

THE WILDERNESS ESTATES SUBDIVISION AT HIGH DESERT
BEAR CANYON BANK PROTECTION
AND CROSSING STRUCTURE DETAILS

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL	LAST DESIGN UPDATE	MO./DAY/YR.	MO./DAY/YR.

CITY PROJECT NO.	ZONE MAP NO.	SHEET	OF
XXXXXX	F-23	37	45

CROSSING STRUCTURE POINTS			
◯	NORTHING	EASTING	ELEVATION
1	1508402.89	430809.29	6169.91
2	1508437.20	430839.43	6172.45
3	1508437.84	430840.77	6172.52
4	1508439.51	430840.77	6171.81
5	1508460.16	430883.48	6174.18
6	1508458.50	430883.48	6174.90
7	1508459.14	430884.82	6174.97
8	1508452.83	430884.80	6177.67
9	1508467.39	430914.91	6179.34
10	1508472.04	430974.82	6179.92
11	1508507.93	430972.03	6161.92
12	1508502.61	430903.53	6161.26
13	1508504.33	430902.86	6160.00
14	1508505.93	430902.24	6161.22
15	1508562.08	430954.27	6161.86
16	1508612.90	430973.16	6162.94
17	1508625.45	430939.42	6180.94
18	1508581.31	430923.01	6180.00
19	1508540.30	430885.01	6179.54
20	1508532.16	430885.03	6176.68
21	1508531.50	430883.66	6176.49
22	1508529.83	430883.65	6175.71
23	1508509.17	430840.94	6173.33
24	1508510.84	430840.95	6174.12
25	1508500.52	430819.53	6172.95
26	1508497.67	430763.46	6169.93
27	1508465.71	430765.08	6153.93
28	1508467.34	430797.04	6155.65
29	1508473.43	430796.73	6158.70
30	1508474.79	430823.40	6160.14
31	1508481.44	430837.16	6160.90
32	1508497.47	430842.74	6167.50
33	1508510.53	430869.74	6169.00
34	1508501.23	430896.46	6160.00
35	1508474.52	430887.16	6169.00
36	1508461.46	430860.15	6167.50
37	1508467.04	430844.12	6160.90
38	1508456.18	430821.68	6159.65
39	1508444.00	430810.98	6158.78
40	1508448.05	430806.37	6155.71
41	1508424.01	430785.25	6153.99

Tangent Table		
ID	BEARING	LENGTH
T1	N48°42'07"W	32.00'
T2	N41°17'53"E	45.67'
T3	S64°11'34"W	1.49'
T4	S00°08'24"W	1.67'
T5	S64°11'34"W	47.44'
T6	S00°08'24"W	1.67'
T7	N64°11'34"E	1.49'
T8	S00°08'24"W	6.31'
T9	N64°11'34"E	33.44'
T10	N85°33'54"E	60.09'
T11	N04°26'06"W	36.00'
T12	N85°33'54"E	68.71'
T13	S21°12'26"E	1.84'
T14	S21°12'26"E	1.72'
T15	N42°49'14"E	76.54'
T16	N20°23'52"E	54.22'
T17	S69°36'08"E	36.00'
T18	N20°23'52"E	47.09'
T19	N42°49'14"E	55.91'
T20	S00°07'55"E	8.15'
T21	S64°11'34"W	1.52'
T22	S00°08'25"W	1.67'
T23	N64°11'34"E	47.44'
T24	S00°08'24"W	1.66'
T25	N64°16'37"E	23.77'
T26	N87°05'15"E	56.15'
T27	N02°54'45"W	32.00'
T28	N87°05'15"E	32.00'
T29	N02°54'45"W	6.10'
T30	N87°05'15"E	26.70'
T31	S64°11'34"W	15.28'
T32	N25°48'26"W	16.00'
T33	N64°11'34"E	24.93'
T34	N41°17'53"E	16.22'
T35	S48°42'07"E	6.13'
T36	N41°17'53"E	32.00'
T37	S43°04'18"E	25.99'
T38	N08°32'35"W	26.02'
T39	S19°11'34"W	16.97'
T40	N70°48'26"W	16.97'
T41	N64°11'34"E	30.00'
T42	N64°11'34"E	30.00'
T43	S70°48'26"E	28.28'
T44	N19°11'34"E	28.28'
T45	N64°11'34"E	7.11'
T46	S17°54'35"E	37.02'
T47	S32°23'20"E	32.14'
T48	S58°23'27"E	36.70'

AS-BUILT INFORMATION

BENCH MARKS

STATION IS A STANDARD USC & GS BRASS GEOLOGICAL SURVEY BENCH MARK. TOP TABLET STAMPED "TUMBLE 1969" SET IN CONCRETE PROJECTING 0.2 FEET ABOVE GROUND. LOCATED 489 FEET WEST OF THE INTERSECTION OF SAN ANTONIO DRIVE AND TENNYSON STREET, AND 35 FEET NORTH OF RIGHT-OF-WAY LINE OF SAN ANTONIO DR. ELEV.= 6009.155

CONTRACTOR WORK WORKED BY
INSPECTOR'S ACCEPTANCE BY — DATE
FIELD VERIFICATION BY — DATE
DRAWINGS CORRECTED BY — DATE

MICRO-FILM INFORMATION
RECORDED BY — DATE
NO.

ENGINEER'S SEAL

SURVEY INFORMATION
FIELD NOTES

NO.	BY	DATE

NO.	DATE	REMARKS	BY
		REVISIONS	
		DESIGN	

DESIGNED BY G.M.M. DATE 10/2002
DRAWN BY S.F.G. DATE 10/2002
CHECKED BY G.M.M./C.W DATE 10/2002

Bohannan ▲ Huston
Courtyard I 7500 Jefferson St. NE Albuquerque, NM 87109-4335
ENGINEERING ▲ SPATIAL DATA ▲ ADVANCED TECHNOLOGIES

CITY OF ALBUQUERQUE
PUBLIC WORKS DEPARTMENT
ENGINEERING DEVELOPMENT GROUP

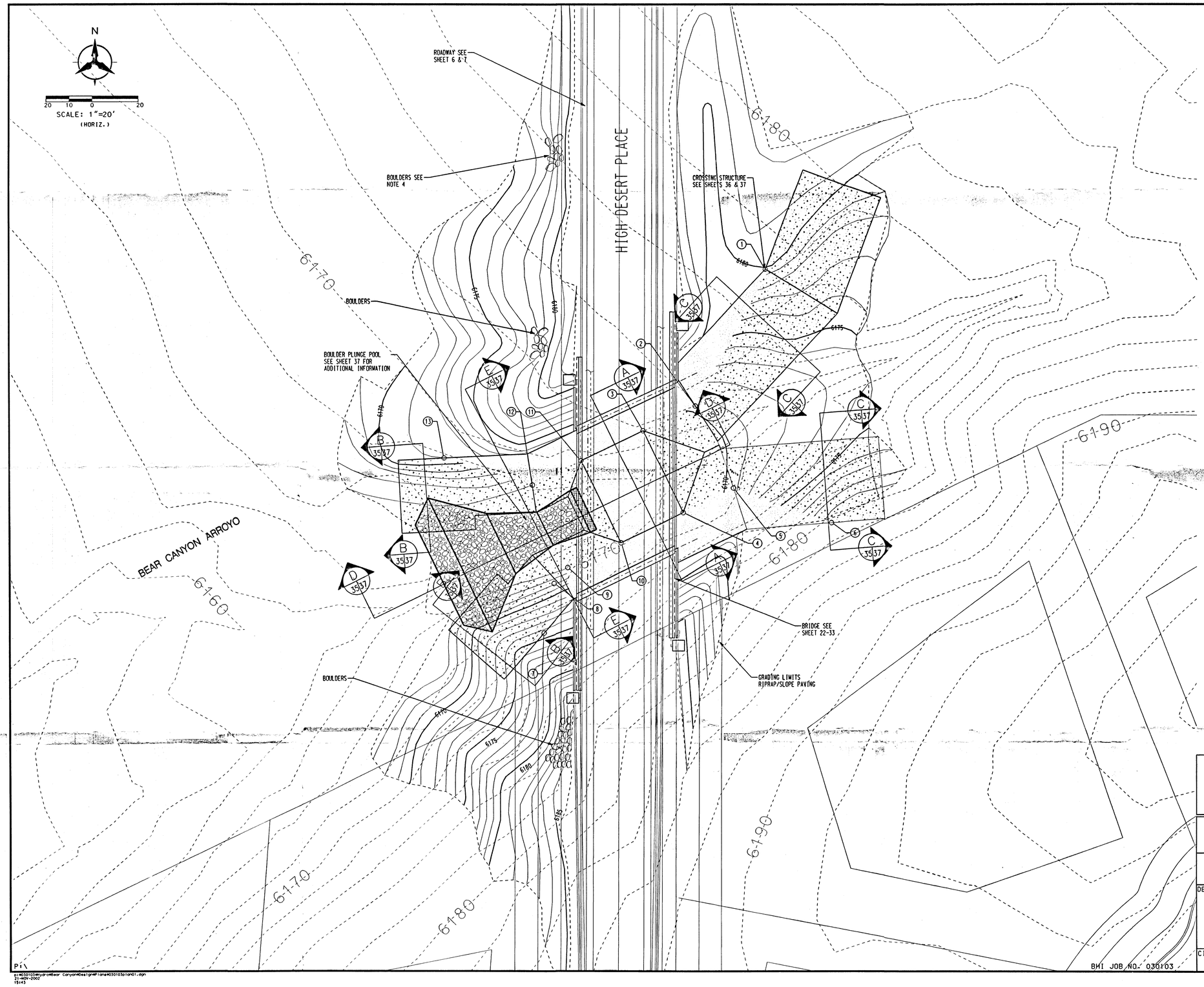
THE WILDERNESS ESTATES SUBDIVISION AT HIGH DESERT
BEAR CANYON CROSSING STRUCTURE LAYOUT PLAN

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL	LAST DESIGN UPDATE	MO./DAY/YR.	MO./DAY/YR.

CITY PROJECT NO.	ZONE MAP NO.	SHEET	OF
XXXXXX	F-23	36	45

BHI JOB NO. 030103

P:\
p:\030103\Hydro\Bear Canyon\Design\Plans\030103plan02.dgn
29-NOV-2002
10:59



NOTES:

1. ANY EXPOSED SLOPE PAVING SHALL BE TINTED PER THE SPECIFICATIONS.
2. CONTRACTOR IS RESPONSIBLE FOR PROTECTING ALL TREES LOCATED NEAR THE GRADING LIMITS FROM DAMAGE.
3. ALL TREES NOT IDENTIFIED ON THESE PLANS BUT LOCATED WITHIN LIMITS OF GRADING SHALL BE REPLANTED PER THE DIRECTION OF THE CONSTRUCTION OBSERVER.
4. BOULDERS TO BE PLACED AS DIRECTED BY THE CONSTRUCTION INSPECTOR
5. THE CONTRACTOR SHALL INSTALL TEMPORARY FENCING ENCLOSING THE WORK AREA WITHING THE GRADING LIMITS. ALL WORK SHALL BE CONFINED TO WITHIN THE FENCED AREA.
6. THE CONTRACTOR SHALL STOCKPILE THE TOPSOIL, FROM CLEAR AND GRUBBING OPERATIONS, AS DIRECTED BY THE CONSTRUCTION OBSERVER.

ERECT 40 LF OF 6' TALL TEMPORARY FENCE WITH 4 POSTS

DETAIL B: PROTECTIVE TREE FENCE

TINTED CONCRETE SLOPE PAVING POINT TABLE

	EASTING	NORTHING
1	430923.01	1508581.31
2	430892.38	1508521.47
3	430869.74	1508510.53
4	430887.16	1508474.52
5	430909.17	1508485.16
6	430951.74	1508470.25
7	430826.70	1508422.71
8	430831.01	1508444.06
9	430836.98	1508450.76
10	430860.15	1508461.46
11	430842.74	1508497.47
12	430821.69	1508486.56
13	430783.35	1508498.68

LEGEND

- TINTED CONCRETE SLOPE PAVING
- BURIED TINTED CONCRETE SLOPE PAVING
- GROUTED WEDGE
- GRADING LIMITS

AS-BUILT INFORMATION

CONTRACTOR WORK STAKED BY — DATE
INSPECTOR'S ACCEPTANCE BY — DATE
FIELD VERIFICATION BY — DATE
DRAWINGS CORRECTED BY — DATE

MICRO-FILM INFORMATION

RECORDED BY — DATE
NO.

BENCH MARKS

STATION IS A STANDARD USC & GS BRASS GEODLOGICAL SURVEY BENCH MARK. TOP TABLET STAMPED "TUMBLE 1969" SET IN CONCRETE PROJECTING 0.2 FEET ABOVE GROUND. LOCATED 489 FEET WEST OF THE INTERSECTION OF SAN ANTONIO DRIVE AND TENNYSON STREET, AND 35 FEET NORTH OF RIGHT-OF-WAY LINE OF SAN ANTONIO DR. ELEV.= 6009.155

SURVEY INFORMATION
FIELD NOTES

NO.	BY	DATE

ENGINEER'S SEAL

NO.	DATE	REMARKS	BY
		REVISIONS	
		DESIGN	

DESIGNED BY G.M. DATE 10/2002
DRAWN BY S.F.G. DATE 10/2002
CHECKED BY G.M./C.H. DATE 10/2002

Bohannan ▲ Huston

Courtyard I 7500 Jefferson St. NE Albuquerque, NM 87109-4335

ENGINEERING ▲ SPATIAL DATA ▲ ADVANCED TECHNOLOGIES

CITY OF ALBUQUERQUE
PUBLIC WORKS DEPARTMENT
ENGINEERING DEVELOPMENT GROUP

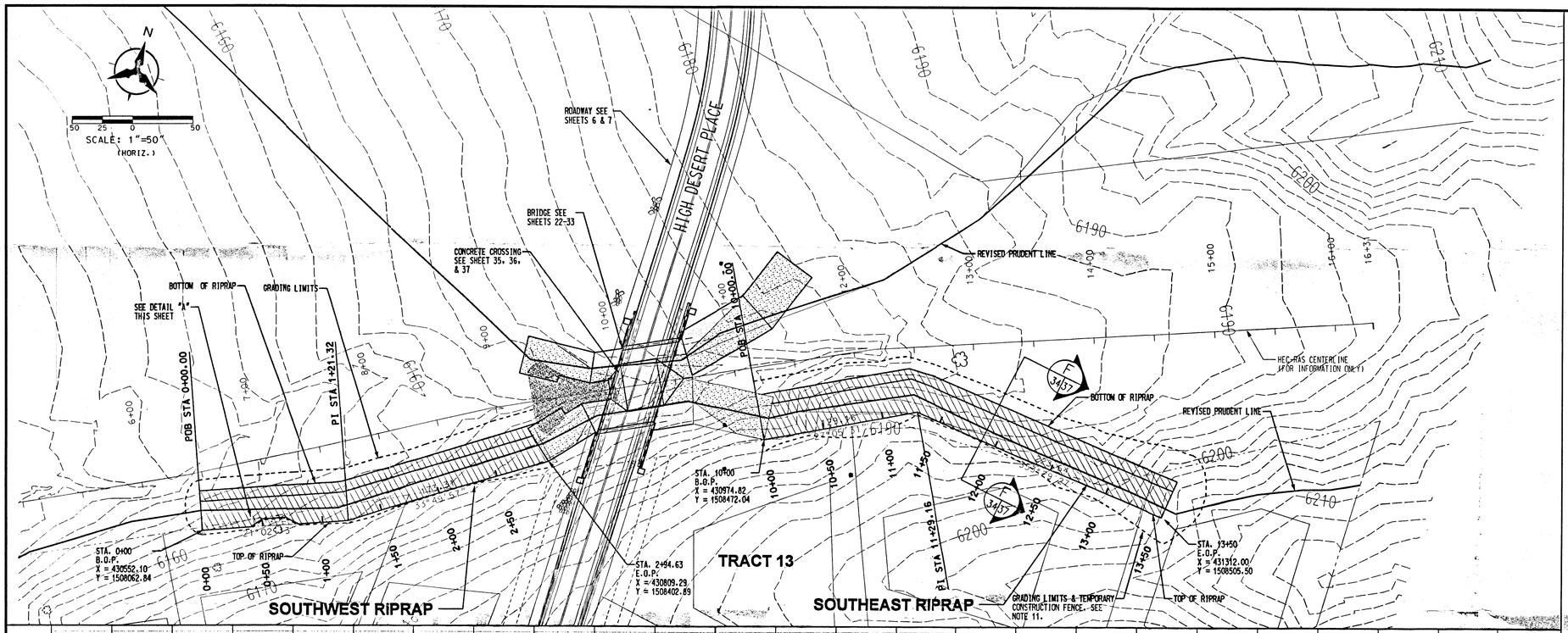
THE WILDERNESS ESTATES SUBDIVISION AT HIGH DESERT
BEAR CANYON CROSSING GRADING PLAN

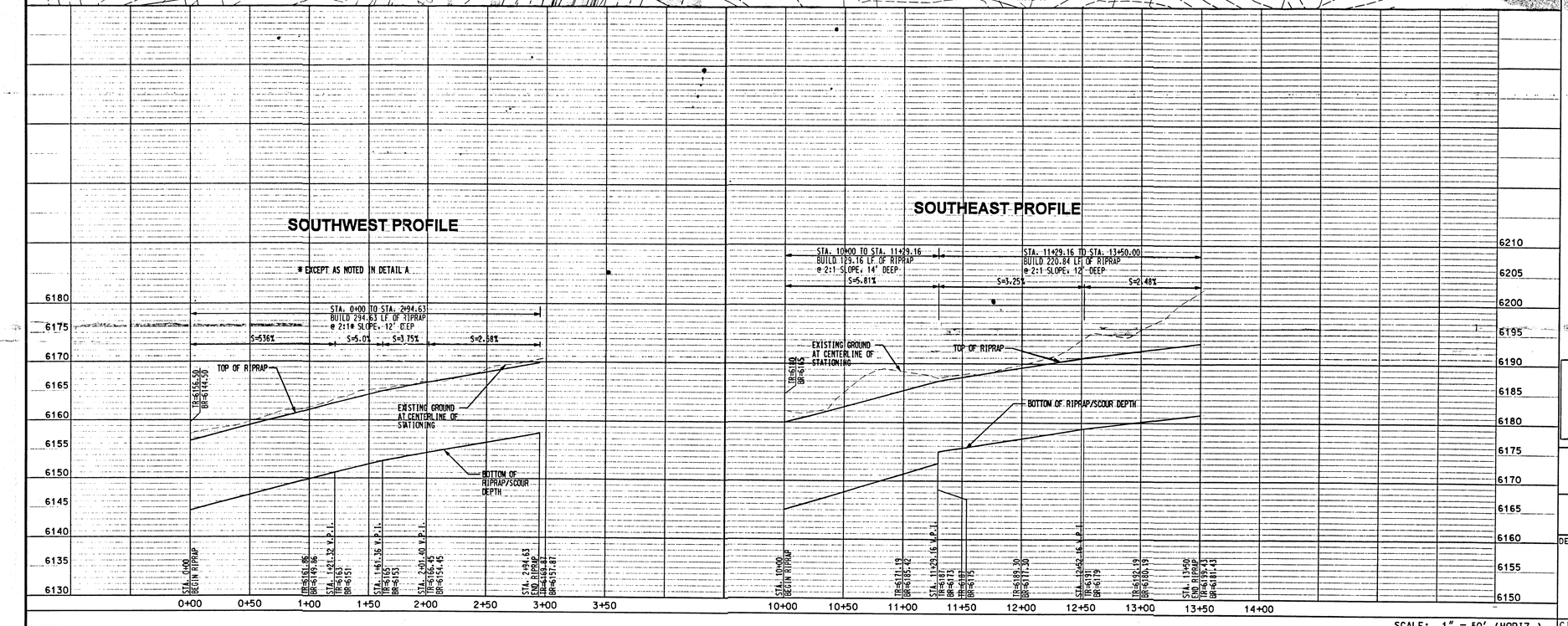
DESIGN REVIEW COMMITTEE | CITY ENGINEER APPROVAL | LAST DESIGN UPDATE | MO./DAY/YR. | MO./DAY/YR.

CITY PROJECT NO. XXXXXX | ZONE MAP NO. F-23 | SHEET 35 OF 45

BHI JOB NO. 030103

P:\
b:\030103\hydro\Bear Canyon\Design\Plans\030103p1on01.dgn
21-NOV-2002
15:43



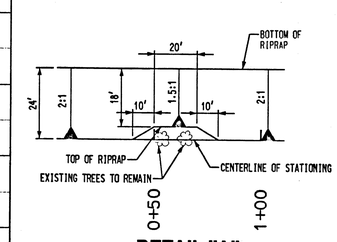


NOTES

1. CENTERLINE OF STATIONING CORRESPONDS TO THE TOP OF RIPRAP, EXCEPT AS NOTED IN DETAIL "A". SEE TYPICAL RIPRAP SECTION SHEET 37.
2. THE CONTRACTOR SHALL FIELD VERIFY ALL EXISTING UTILITY LOCATIONS AND NOTIFY THE ENGINEER IMMEDIATELY OF OF ANY DISCREPANCIES.
3. CONTRACTOR IS RESPONSIBLE FOR REPAIR AND/OR REPLACEMENT OF ALL UTILITY CONDUITS AND EXISTING LINES.
4. CONTRACTOR SHALL PARK EQUIPMENT AND VEHICLES AS NOT TO INTERFERE WITH NORMAL ACTIVITIES OF RESIDENTS OR OTHER CONTRACTORS ON SITE.
5. ANY DAMAGE TO THE EXISTING FACILITIES (CURB & GUTTER, PAVEMENT, CONDUITS, LANDSCAPING, UTILITY LINES, ETC.) DURING CONSTRUCTION SHALL BE REPLACED AT THE CONTRACTORS' EXPENSE.
6. ALL RIPRAP SHALL BE COVERED WITH SOIL TO A MINIMUM OF THICKNESS OF 12".
7. AREA SHALL BE GRADED TO MATCH EXISTING GROUND
8. ALL TREES NOT IDENTIFIED ON THESE PLANS BUT LOCATED WITHIN LIMITS OF GRADING SHALL BE REPLANTED PER THE DIRECTION OF THE CONSTRUCTION OBSERVER.
9. CONTRACTOR RESPONSIBLE FOR PROTECTING ALL TREES LOCATED NEAR GRADING LIMITS FROM DAMAGE.
10. ALL DISTURBED AREAS, EXCEPT FOR THE AREA OF EXPOSED CONCRETE SLOPE PAVING, SHALL BE RESEEDED.
11. THE CONTRACTOR SHALL INSTALL TEMPORARY FENCING ENCLOSING THE WORK AREA WITHIN THE GRADING LIMITS. ALL WORK SHALL BE CONFINED TO WITHIN THE FENCED AREA.
12. THE CONTRACTOR SHALL STOCKPILE THE TOPSOIL, FROM CLEAR AND GRUBBING OPERATIONS, AS DIRECTED BY THE CONSTRUCTION OBSERVER.
13. TINTED CONCRETE SHALL BE COLORED SAN DIEGO BUFF.

LEGEND

- TINTED CONCRETE EXPOSED SLOPE PAVING (SEE NOTE 13)
- BURIED CONCRETE SLOPE PAVING
- BURIED WIRE TIED RIPRAP BANK PROTECTION
- GRADING LIMITS
- BR = BOTTOM OF RIPRAP
- TR = TOP OF RIPRAP



DETAIL "A"
NOT TO SCALE

Bohannan ▲ Huston
Courtyard I 7500 Jefferson St. NE Albuquerque, NM 87109-4335
ENGINEERING ▲ SPATIAL DATA ▲ ADVANCED TECHNOLOGIES

AS-BUILT INFORMATION

CONTRACTOR	
WORK STAKED BY	DATE
INSPECTOR'S ACCEPTANCE BY	DATE
FIELD LOCATION BY	DATE
DRAWINGS CORRECTED BY	DATE

MICRO-FILM INFORMATION

RECORDED BY	DATE
NO.	

BENCH MARKS

STATION IS A STANDARD USC & GS BRASS TABLET STAMPED "TUMBLE 1969" SET IN CONCRETE PROJECTING 0.2 FEET ABOVE GROUND. LOCATED 489 FEET WEST OF THE INTERSECTION OF SAN ANTONIO DRIVE AND TENNYSON STREET, AND 35 FEET NORTH OF RIGHT-OF-WAY LINE OF SAN ANTONIO DR. ELEV.= 6009.155

SURVEY INFORMATION
FIELD NOTES

NO.	BY	DATE

ENGINEER'S SEAL

NO.	DATE	REMARKS	BY
		REVISIONS	
		DESIGN	

		DATE
DESIGNED BY	G.M.M.	10/2002
DRAWN BY	S.F.G.	10/2002
CHECKED BY	G.M./C.H.	10/2002

CITY OF ALBUQUERQUE
PUBLIC WORKS DEPARTMENT
ENGINEERING DEVELOPMENT GROUP

THE WILDERNESS ESTATES SUBDIVISION AT HIGH DESERT
BEAR CANYON BANK PROTECTION PLAN & PROFILE

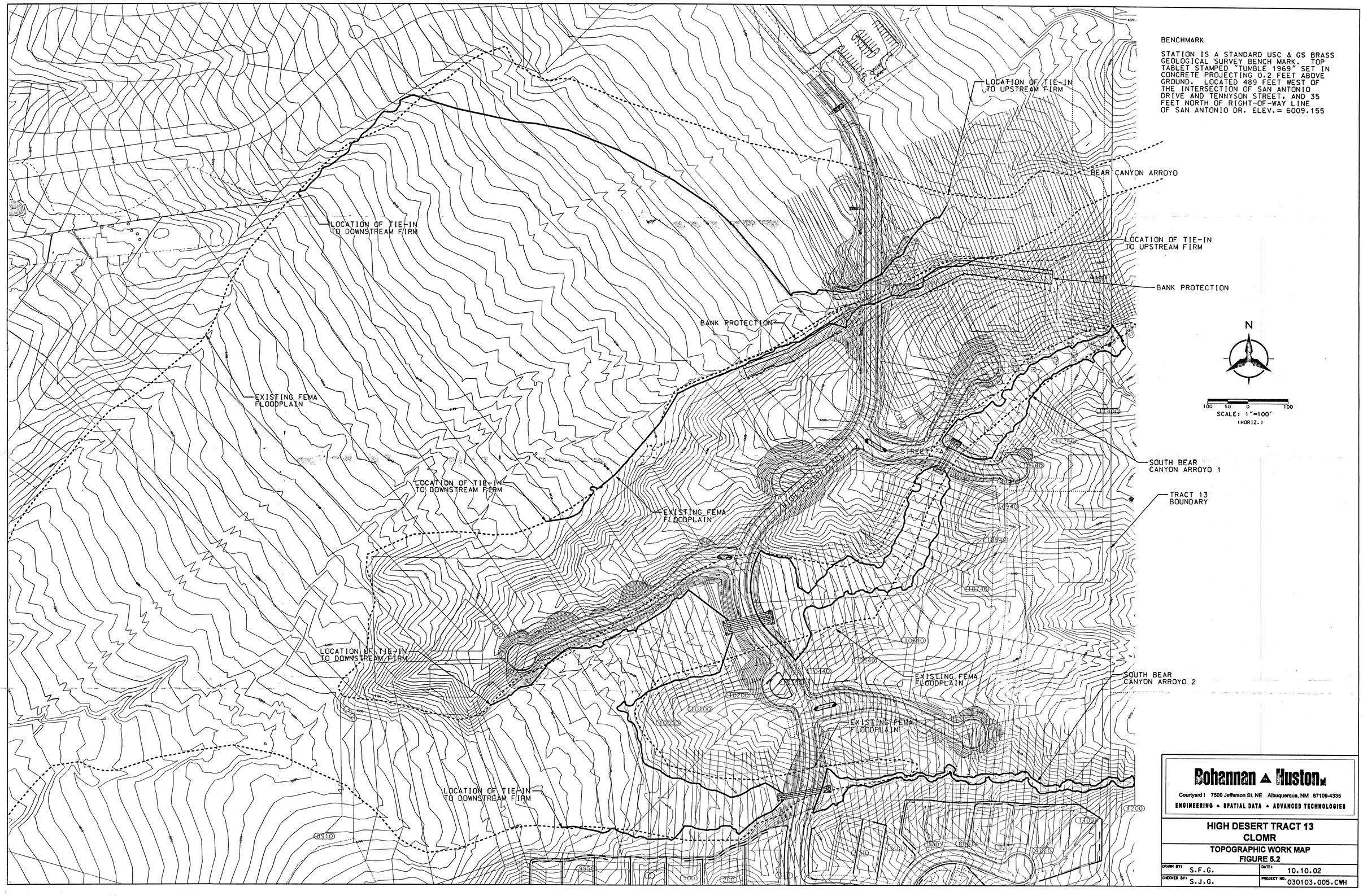
DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL	LAST DESIGN UPDATE	MO./DAY/YR.	MO./DAY/YR.

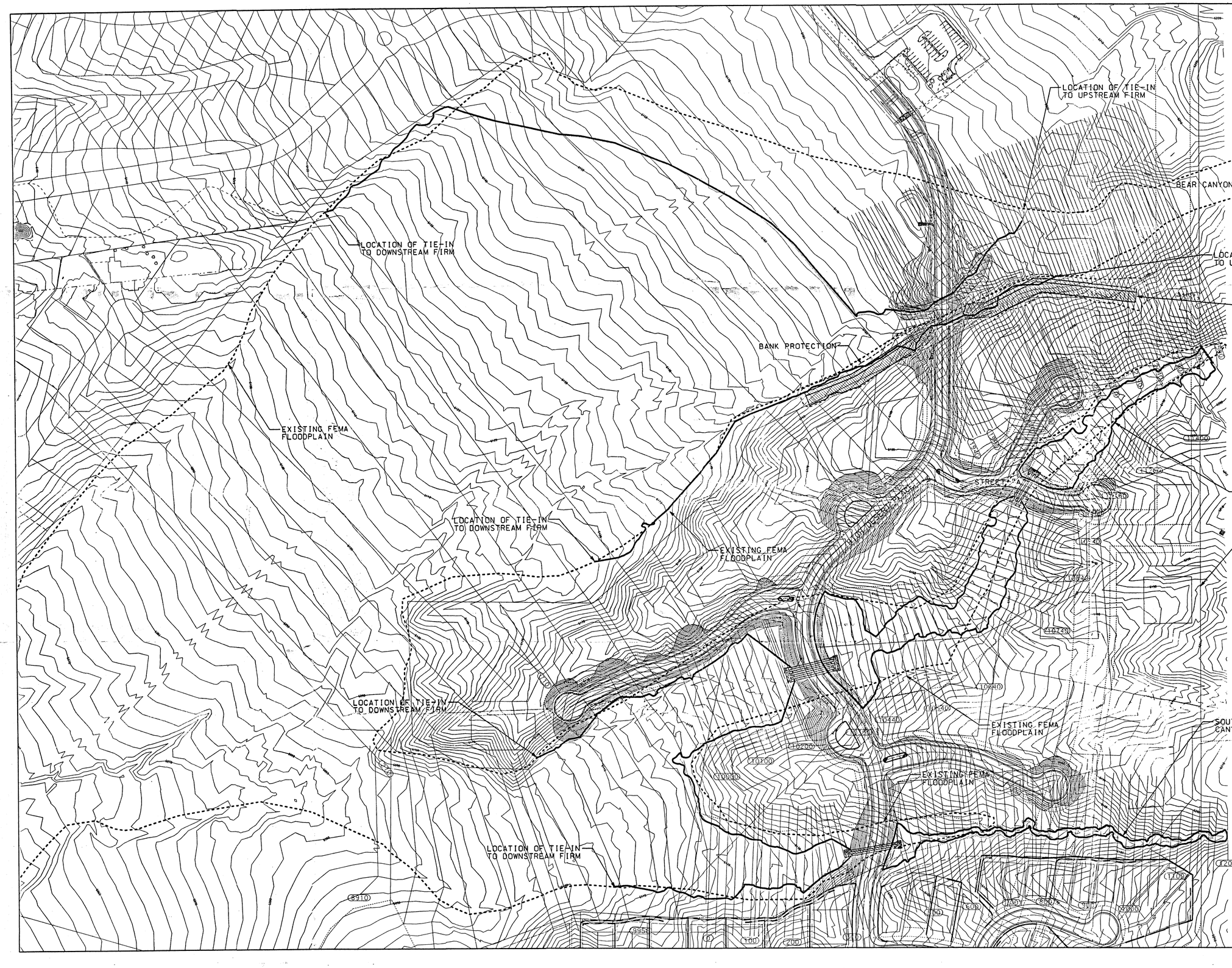
CITY PROJECT NO.	ZONE MAP NO.	SHEET	OF
XXXXXX	F-23	34	45

21-NOV-2002
P:\020103\Wilde\Bear Canyon\Design\Plans\030103smp01.dgn

BHI JOB NO. 020199

SCALE: 1" = 50' (HORIZ.)
1" = 10' (VERT.)


BENCHMARK
STATION IS A STANDARD USC & GS BRASS GEOLOGICAL SURVEY BENCH MARK. TOP TABLET STAMPED "TUMBLE 1969" SET IN CONCRETE PROJECTING 0.2 FEET ABOVE GROUND. LOCATED 489 FEET WEST OF THE INTERSECTION OF SAN ANTONIO DRIVE AND TENNYSON STREET, AND 35 FEET NORTH OF RIGHT-OF-WAY LINE OF SAN ANTONIO DR. ELEV.= 6009.155
LOCATION OF TIE-IN TO UPSTREAM FIRM
BEAR CANYON ARROYO
LOCATION OF TIE-IN TO DOWNSTREAM FIRM
LOCATION OF TIE-IN TO UPSTREAM FIRM
BANK PROTECTION
BANK PROTECTION
N
EXISTING FEMA FLOODPLAIN
SCALE: 1"=100'
(HORIZ.)
STREET "A"
SOUTH BEAR CANYON ARROYO 1
LOCATION OF TIE-IN TO DOWNSTREAM FIRM
TRACT 13 BOUNDARY
EXISTING FEMA FLOODPLAIN
LOCATION OF TIE-IN TO DOWNSTREAM FIRM
EXISTING FEMA FLOODPLAIN
SOUTH BEAR CANYON ARROYO 2
EXISTING FEMA FLOODPLAIN
LOCATION OF TIE-IN TO DOWNSTREAM FIRM
Bohannan ▲ Huston
Courtyard I 7500 Jefferson St. NE Albuquerque, NM 87109-4335
ENGINEERING ▲ SPATIAL DATA ▲ ADVANCED TECHNOLOGIES
HIGH DESERT TRACT 13
CLOMR
TOPOGRAPHIC WORK MAP
FIGURE 5.2
DRAWN BY: S.F.G.
DATE: 10.10.02
CHECKED BY: S.J.G.
PROJECT NO. 030103.005.CWH



BENCHMARK

STATION IS A STANDARD USC & GS BRASS GEOLOGICAL SURVEY BENCH MARK. TOP TABLET STAMPED "TUMBLE 1969" SET IN CONCRETE PROJECTING 0.2 FEET ABOVE GROUND. LOCATED 489 FEET WEST OF THE INTERSECTION OF SAN ANTONIO DRIVE AND TENNYSON STREET, AND 35 FEET NORTH OF RIGHT-OF-WAY LINE OF SAN ANTONIO DR. ELEV.= 6009.155

Bohannan ▲ Huston

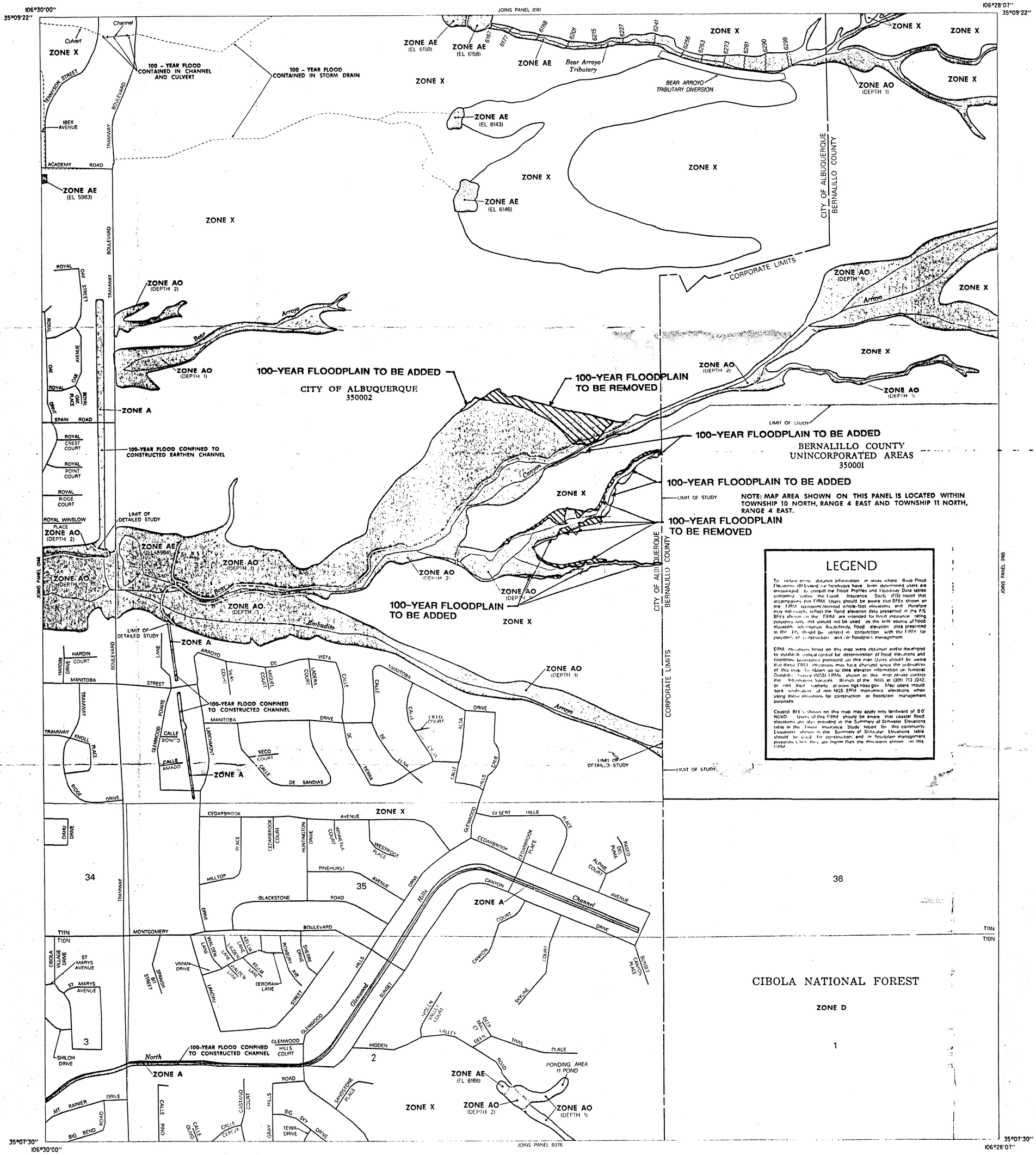
Courtyard I 7500 Jefferson St. NE Albuquerque, NM 87109-4335

ENGINEERING ▲ SPATIAL DATA ▲ ADVANCED TECHNOLOGIES

HIGH DESERT TRACT 13
CLOMR

TOPOGRAPHIC WORK MAP
FIGURE 5.2

DRAWN BY:	S.F.G.	DATE:	10.10.02
CHECKED BY:	S.J.G.	PROJECT NO.	030103.005.CWH



LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** No base flood elevations determined.
- **ZONE AE** Base flood elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** To be protected from 100-year flood by Federal flood protection system under construction ; no base flood elevations determined.
- **ZONE V** Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- **ZONE X** Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside 500-year floodplain.
- **ZONE D** Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Identified 1981 | Identified 1990 | Otherwise Protected Areas

Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain Boundary
- Floodway Boundary
- Zone D Boundary
- Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.
- 513 — Base Flood Elevation Line; Elevation in Feet. See Map Index for Elevation Datum.
- D — D (EL 987) — Cross Section Line; Base Flood Elevation in Feet Where Uniform Within Zone. See Map Index for Elevation Datum.
- RM7 × — Elevation Reference Mark
- • M2 — River Mile
- 97°07'30", 32°22'30" — Horizontal Coordinates Based on North American Datum of 1927 (NAD 27) Projection.

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas. The community map repository should be consulted for more detailed data on BFE's, and for any information on floodway delineations, prior to use of this map for property purchase or construction purposes.

Areas of Special Flood Hazard (100-year flood) include Zones A, AE, A1-A30, AH, AO, A99, V, VE and V1-V30

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at 1/20 inch.

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map

This map may incorporate approximate boundaries of Coastal Barrier Resource System Units and /or Otherwise Protected Areas established under the Coastal Barrier Improvement Act of 1990 (PL 101-591).

For community map revision history prior to countywide mapping, see Section 6.0 of the Flood Insurance Study Report.

For adjoining map panels and base map source see separately printed Map Index.

LEGEND

To obtain more detailed information in areas where Base Flood Elevations (BFEs) and/or floodways have been determined, users are encouraged to consult the Flood Profiles and Floodway Data tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations, and therefore may not exactly reflect the flood elevation data presented in the FIS. BFEs shown on the FIRM are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

FIRM elevations listed on this map were obtained and/or developed to establish vertical control for determination of flood elevations and floodplain boundaries portrayed on this map. Users should be aware that these FIRM elevations may have changed since the publication of this map. To obtain up-to-date elevation information on National Geodetic Survey (NGS) FIRMs shown on this map please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their website at www.ngs.noaa.gov. Map users should seek verification of non-NGS FIRM monument elevations when using these elevations for construction or floodplain management purposes.

Coastal BFEs shown on this map may apply only landward of 0.0' NGVD. Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this community. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

MAP REPOSITORY
Refer to Repository Listing on Map Index

EFFECTIVE DATE OF
COUNTYWIDE FLOOD INSURANCE RATE MAP:
SEPTEMBER 20, 1996

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL:

Map revised April 2, 2002 to update corporate limits, to change base flood elevations, to change special flood hazard areas, to add road and road names, to reflect updated topographic information, and to incorporate previously issued letters of map revision.
To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE IN FEET
500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

BERNALILLO COUNTY, NEW MEXICO AND INCORPORATED AREAS

PANEL 163 OF 825
(SEE MAP INDEX FOR PANELS NOT PRINTED)

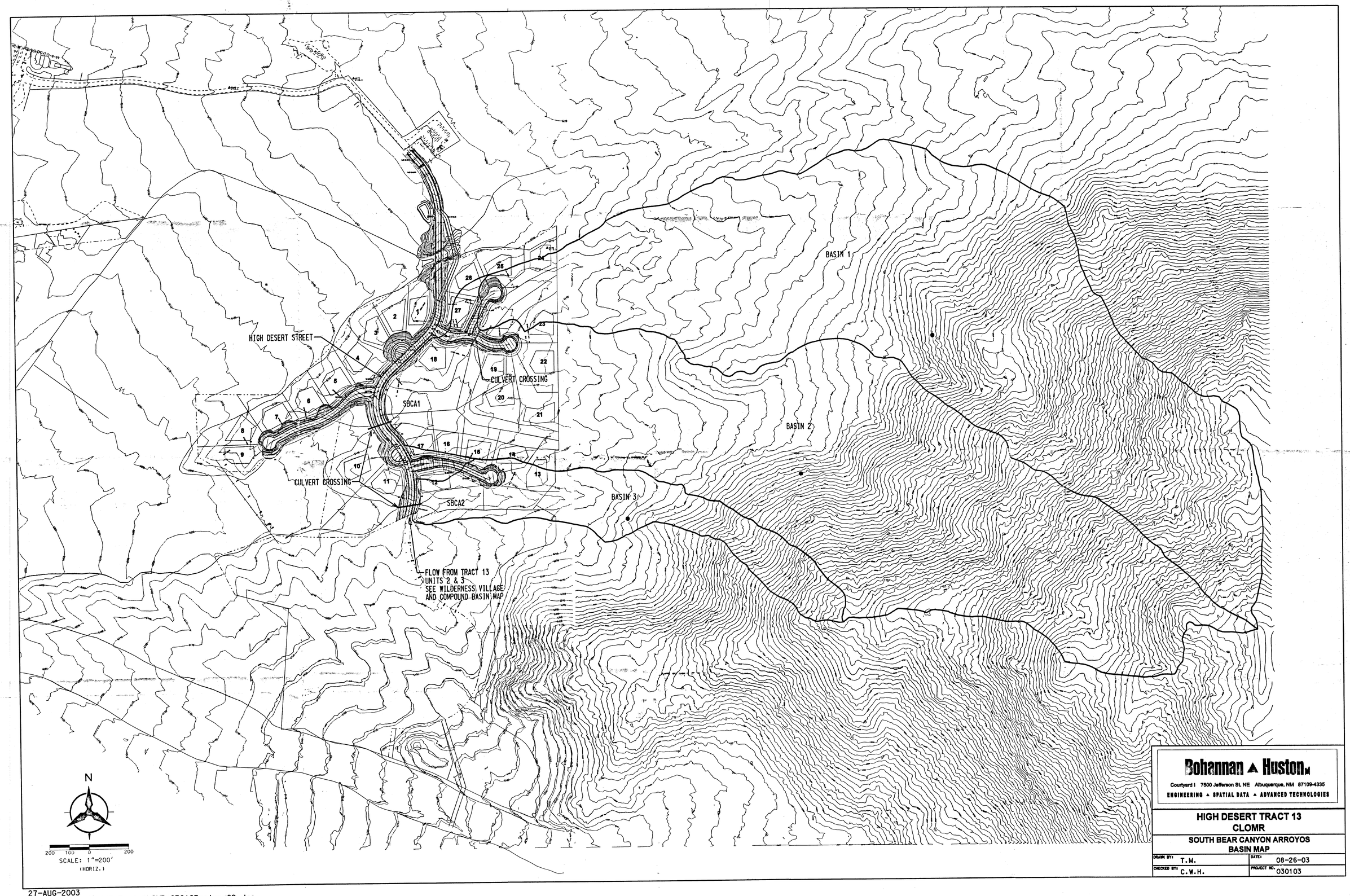
CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
ALBUQUERQUE, CITY OF	350002	0163	E
BERNALILLO COUNTY, UNINCORPORATED AREAS	350001	0163	E

REVISED FIRM MAP
FIGURE 5.3

MAP NUMBER
35001C0163 E

MAP REVISED:
APRIL 2, 2002

Federal Emergency Management Agency



Bohannan ▲ Huston

Courtyard I 7500 Jefferson St. NE Albuquerque, NM 87109-4335

ENGINEERING ▲ SPATIAL DATA ▲ ADVANCED TECHNOLOGIES

HIGH DESERT TRACT 13
CLOMR

SOUTH BEAR CANYON ARROYOS
BASIN MAP

DRAWN BY:	T.M.	DATE:	08-26-03
CHECKED BY:	C.W.H.	PROJECT NO.	030103

27-AUG-2003
P:*030103*Hydro*HD Tr13 CLOMR*030103gclomr02.dgn