VERTEX

McCune Ranch Subdivision
17480 Meridian Road North
Colorado Springs, Colorado 80924

REQUEST FOR CONDITIONAL LETTER OF MAP REVISION

FOR WEST KIOWA CREEK

COLORADO SPRINGS, COLORADO

NOVEMBER 27, 2018

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1.0 INTRODUCTION

The purpose of this submittal is to request a Conditional Letter of Map Revision (CLOMR) for a flooding source in El Paso County, Colorado known as West Kiowa Creek. This request is requisite for a 760-acre property, known as the proposed McCune Ranch Subdivision. West Kiowa Creek, which flows across the property from west to east, is currently mapped as an approximate Zone A. Stormwater is directed from the contributing basins across the property along an approximate 1.25-mile flow path. The proposed development will affect FIRM map number 080059 panel 0350, effective March 17, 1997. Basin hydrology and hydraulics have been modeled and are included in this study to identify Special Flood Hazard Area (SFHA). The basis of this request is to identify the floodplain boundary for the residential subdivision proposed for the site and to assess the extent of flood risk relative to two proposed bridges.

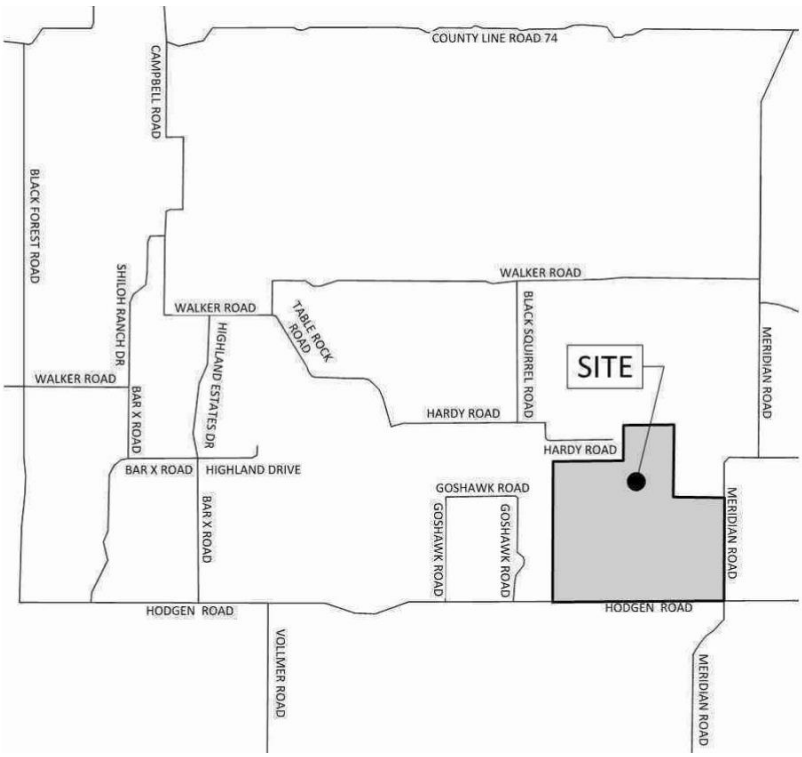
2.0 GENERAL LOCATION AND DESCRIPTION

The following report provides detailed drainage and floodplain information for existing and proposed conditions of the McCune Ranch Subdivision project. The intent of this report is to show the extent of flood risk through the proposed site, and the boundaries of the SFHA, as well as other storm events per FEMA requirements. The information given in this report is intended to provide data resulting from a detailed analysis of stormwater drainage and define the 100-year floodplain. Because the subject reach is currently an approximate Zone A, Base Flood Elevations (BFE's) will be defined. A floodway has not been delineated. This development is in a rural area and will consist of large-lot single family residential parcels, a small commercial area, preserved open space, as well as the roads and required utility infrastructure.

GENERAL LOCATION

The site is located at 17480 Meridian Road North or, more generally, at the northwest corner of Hodgen Road and Meridian Road North in unincorporated El Paso County. The subject property is undeveloped and situated in the West Half of Section 19, Township 11 South, Range 64 West of the 6th P.M., County of El Paso, State of Colorado.

The site is bounded to the south by Hodgen Road, to the east by Meridian Road North, and to the north and west by several parcels zoned primarily as Agricultural and Residential use with some Forest Land. On the east side of Median Road is Forest Green Subdivision, a low-density single-family development. On the south side of Hodgen Road is Bison Meadows Subdivision which is also a low-density single family residential subdivision. The remainder of properties surrounding the site have not yet been formally platted. The site has not been included in any previous drainage study.



DESCRIPTION OF PROPERTY

The existing site contains 766 acres of agricultural grazing land and dry farm land. Ground cover consists mainly of native grasses and shrubs and contains several stands of evergreen trees along its southern and northern boundary. Existing wetlands are present along West Kiowa Creek and its tributaries, wetland boundaries are located roughly 50 feet to either side of the thalweg of West Kiowa Creek and the drainageway way to the south of the creek on the property. There are no existing irrigation canals or ditches on the project site nor are there any major geologic features. The property generally slopes in a northeasterly direction with slopes ranging between 1-16%. Soils consist of Alamosa loam, Brussett loam, Cruckton sandy loam, Elbeth sandy loam, Holderness loam, Kettle gravelly loamy sands, Peyton sandy loam, Peyton-Pring complex, Pring course sandy loam, Tomah-Crowford loamy sands and Tomah-Crowfoot complex. Most of the site has soils classified in Hydrologic Soil Group B; however, the property also contains a mixture of soils from Hydrologic Soils Groups C and D located in the areas in and adjacent to West Kiowa Creek and its tributaries.

PROPOSED DEVELOPMENT

The development of this property will consist of 143 2.5 to 5-acre single family residential lots and the requisite public roads and stormwater infrastructure to serve them. Anticipated construction activities include earthwork and paving associated with the public roads, as well as the installation of culverts and water quality ponds to convey and treat stormwater on the site. The primary access for the site will be from Hodgen Road and Meridian Road. A site plan for the project is included in the appendix.

3.0 PROPOSED DESIGN CONDITIONS

REGULATIONS

The hydrologic calculations in this report comply with the City of Colorado Springs/El Paso County Drainage Criteria Manuals, and FEMA drainage criteria. There are no previous drainage studies that cover this property.

PROPOSED DRAINAGE

In the proposed condition, stormwater runoff will continue to flow from southwest to northeast as it does in the existing condition. The path of the main thalweg is not altered, however 2 new box culverts are proposed at road crossings within the development. All existing drainage patterns will be maintained throughout the site to the extent possible. The proposed stormwater flows exiting the site will be at or below historic levels. Stormwater pond design is still being finalized, but release rates will be controlled such that all flow off the site will be at or below historic averages. With that, historic flow rates are being used for the floodplain model but the proposed drainage plan is included for reference.

PROPOSED BRIDGES

The project includes two double box culverts at points where roads cross the floodplain. The culverts are both sized at 2 – 16’ wide x 6’ high totaling approximately 32’ wide x 6’ high of flow area. In the 100-year storm there is no freeboard remaining in the culvert, but also no overtopping of the road. This condition meets local requirements for this road category. The length of both box culverts is sized to accommodate 2 lanes of traffic, road shoulder, and an 8’ wide pedestrian path on one side. A detail of the proposed culverts is included in the appendix.

The culverts will have flared end sections with a concrete apron that funnels the entering water in and spreads the exiting flow out. A rip-rap bed will be used at the culvert exit points to address potential erosion. The culverts will be installed at grade with 0.5% slope and allow the passage of aquatic life.

HYDROLOGICAL AND HYDRAULIC CRITERIA

a. Topographic mapping was developed from LiDAR and field mapping conducted in 2011, and obtained from the licensed GIS data service of El Paso County.

b. Since this project contains sub-basins over 100 acres, times of concentration and peak runoff values were calculated using the SCS TR-55 Hydrograph method as required by the City of Colorado Springs/El Paso County Drainage Criteria Manuals. The model utilizes the SCS Type II 24-hr rainfall distribution and rain gauge data for the county. A summary of results for the different storm intervals and our 3 design points are shown below:

10 Year

Design Point	Node	Station	Proposed Flow (cfs)
1	Bridge1	55+50	768
2	GHD	35+00	914

50 Year

Design Point	Node	Station	Proposed Flow (cfs)
1	Bridge1	55+50	1754
2	GHD	35+00	2044

100 Year

Design Point	Node	Station	Proposed Flow (cfs)
1	Bridge1	55+50	2228
2	GHD	35+00	2584

500 Year

Design Point	Node	Station	Proposed Flow (cfs)
1	Bridge1	55+50	3689
2	GHD	35+00	4290

c. Hydraulic modeling of the floodplain was performed using HEC-RAS version 5.0.
    - Manning's n-values of 0.013 for in channel areas and 0.05 for overbank areas were used in the model.
    - Contraction and expansion coefficients are 0.1 and 0.3 for all cross sections except for the two box culverts where 0.3 and 0.5 were used.

4.0 HYDRAULIC MODEL RESULTS

A HEC-RAS section analysis was performed to identify the floodplain width for the different storm events. Pertinent model information is included in the appendix. The tables one the following pages outline the results:

Existing Conditions (EC) Versus Proposed Conditions (PC) Base Flood Elevations			
River Station	EC BFEs (feet)	PC BFEs (feet)	Difference [PC-EC] (feet)
7258.36	7338.12	7338.12	0.00
6993.16	7335.75	7335.75	0.00
6787.05	7333.98	7333.98	0.00
6565.94	7331.14	7331.83	0.69
6325.83	7329.14	7332.05	2.91
6156.77	7327.90	7332.16	4.26
5833.82	7325.43	7332.18	6.75
5442.15	7323.59	7332.18	8.59
5431.65	7323.51	7331.86	8.35
5376	Proposed Upstream Bridge		
5321.65	7322.64	7321.91	-0.73
5300.65	7321.75	7321.75	0.00
4866.08	7316.59	7316.59	0.00
4720.61	7316.86	7316.86	0.00
4486	7315.75	7315.75	0.00
4331.01	7314.42	7314.42	0.00
4076.71	7310.91	7310.91	0.00
3774.36	7308.82	7308.83	0.01
3689.36	7307.94	7307.94	0.00
3338.18	7304.82	7304.82	0.00
3071.3	7301.49	7301.49	0.00
2934.46	7300.38	7300.38	0.00
2576.35	7297.47	7297.47	0.00
2373.76	7294.93	7294.93	0.00
2132.45	7292.80	7292.80	0.00
1842.45	7289.60	7291.41	1.81
1634.19	7288.74	7291.68	2.94
1530.98	7286.96	7291.68	4.72
1250.13	7284.26	7291.67	7.41
1240.12	7284.36	7290.58	6.22
1185	Proposed Downstream Bridge		
1131.75	7283.99	7284.07	0.08
1105.72	7283.05	7283.09	0.04
909.01	7281.99	7281.99	0.00
679.18	7278.70	7278.70	0.00
441.15	7276.61	7276.61	0.00

HEC-RAS Plan: Plan EC River: Alignment - (1) Reach: Alignment - (1) Profile: 100-yr

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Top Width	Top Wdth Act	Vel Chnl	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/s)	
Alignment - (1)	7258.36	100-yr	2228.00	7333.54	7338.12	64.91	64.91	10.71	0.96
Alignment - (1)	6993.16	100-yr	2228.00	7330.84	7335.75	71.21	71.21	10.87	0.94
Alignment - (1)	6787.05	100-yr	2228.00	7328.00	7333.98	90.67	90.67	10.16	0.84
Alignment - (1)	6565.94	100-yr	2228.00	7326.00	7331.14	76.99	76.99	10.40	0.95
Alignment - (1)	6325.83	100-yr	2228.00	7324.16	7329.14	95.50	95.50	9.90	0.91
Alignment - (1)	6156.77	100-yr	2228.00	7323.97	7327.90	135.36	135.36	7.48	0.74
Alignment - (1)	5833.82	100-yr	2228.00	7321.68	7325.43	134.65	134.65	8.15	1.01
Alignment - (1)	5442.15	100-yr	2228.00	7318.00	7323.59	176.56	161.29	4.05	0.39
Alignment - (1)	5431.65	100-yr	2228.00	7318.03	7323.51	152.93	151.41	4.49	0.44
Alignment - (1)	5321.65	100-yr	2228.00	7317.99	7322.64	111.41	111.41	7.44	0.69
Alignment - (1)	5300.65	100-yr	2228.00	7317.99	7321.75	79.18	79.18	10.08	0.96
Alignment - (1)	4866.08	100-yr	2228.00	7313.47	7316.59	156.03	95.51	9.15	0.98
Alignment - (1)	4720.61	100-yr	2228.00	7312.00	7316.86	145.81	145.81	4.39	0.40
Alignment - (1)	4486	100-yr	2228.00	7312.00	7315.75	116.67	116.67	7.43	0.70
Alignment - (1)	4331.01	100-yr	2228.00	7311.43	7314.42	115.19	115.19	8.63	1.00
Alignment - (1)	4076.71	100-yr	2228.00	7307.48	7310.91	99.30	99.30	8.72	0.91
Alignment - (1)	3774.36	100-yr	2228.00	7304.64	7308.82	93.39	93.39	8.70	0.84
Alignment - (1)	3689.36	100-yr	2584.00	7303.99	7307.94	103.07	103.07	9.39	1.00
Alignment - (1)	3338.18	100-yr	2584.00	7300.28	7304.82	137.16	111.09	9.60	0.93
Alignment - (1)	3071.3	100-yr	2584.00	7296.87	7301.49	73.86	73.86	10.82	0.97
Alignment - (1)	2934.46	100-yr	2584.00	7296.00	7300.38	76.50	76.50	10.98	0.96
Alignment - (1)	2576.35	100-yr	2584.00	7293.68	7297.47	122.83	122.83	9.33	0.94
Alignment - (1)	2373.76	100-yr	2584.00	7291.32	7294.93	90.98	90.98	10.00	0.98
Alignment - (1)	2132.45	100-yr	2584.00	7289.16	7292.80	100.91	100.91	9.60	0.99
Alignment - (1)	1842.45	100-yr	2584.00	7284.08	7289.60	93.79	93.79	10.15	0.95
Alignment - (1)	1634.19	100-yr	2584.00	7284.00	7288.74	273.70	273.70	6.20	0.61
Alignment - (1)	1530.98	100-yr	2584.00	7282.00	7286.96	169.58	83.90	10.38	0.94
Alignment - (1)	1250.13	100-yr	2584.00	7280.00	7284.26	154.85	154.85	6.86	0.78
Alignment - (1)	1240.12	100-yr	2584.00	7280.00	7284.36	158.14	158.14	5.83	0.60
Alignment - (1)	1131.75	100-yr	2584.00	7280.00	7283.99	130.53	130.53	6.11	0.56
Alignment - (1)	1105.72	100-yr	2584.00	7279.98	7283.05	112.42	112.42	9.23	0.99
Alignment - (1)	909.01	100-yr	2584.00	7277.98	7281.99	243.05	243.05	7.93	0.77
Alignment - (1)	679.18	100-yr	2584.00	7275.60	7278.70	267.72	267.72	5.02	0.59
Alignment - (1)	441.15	100-yr	2584.00	7273.98	7276.61	147.73	147.73	8.46	0.96

HEC-RAS Plan: McCunePC River: Alignment - (1) Reach: Alignment - (1)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Top Width	Top Wdth Act	Vel Chnl	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/s)	
Alignment - (1)	7258.36	100-yr	2228.00	7333.54	7338.12	64.92	64.92	10.70	0.96
Alignment - (1)	7258.36	500-yr	3689.00	7333.54	7339.62	73.99	73.99	12.42	0.94
Alignment - (1)	7258.36	10-yr	768.00	7333.54	7336.24	52.99	52.99	7.30	0.91
Alignment - (1)	7258.36	50-yr	1754.00	7333.54	7337.51	61.08	61.08	10.10	0.98
Alignment - (1)	6993.16	100-yr	2228.00	7330.84	7335.75	71.22	71.22	10.87	0.94
Alignment - (1)	6993.16	500-yr	3689.00	7330.84	7337.39	116.04	93.47	11.99	0.88
Alignment - (1)	6993.16	10-yr	768.00	7330.84	7333.64	48.35	48.35	7.89	0.97
Alignment - (1)	6993.16	50-yr	1754.00	7330.84	7335.13	61.78	61.78	10.23	0.96
Alignment - (1)	6787.05	100-yr	2228.00	7328.00	7333.98	90.70	90.70	10.15	0.84
Alignment - (1)	6787.05	500-yr	3689.00	7328.00	7335.42	108.75	108.75	11.50	0.83
Alignment - (1)	6787.05	10-yr	768.00	7328.00	7331.49	43.48	43.48	8.25	0.98
Alignment - (1)	6787.05	50-yr	1754.00	7328.00	7333.19	72.28	62.91	10.15	0.92
Alignment - (1)	6565.94	100-yr	2228.00	7326.00	7331.83	87.98	87.98	8.59	0.72
Alignment - (1)	6565.94	500-yr	3689.00	7326.00	7332.62	101.45	101.45	11.68	0.90
Alignment - (1)	6565.94	10-yr	768.00	7326.00	7329.25	53.10	53.10	7.34	0.92
Alignment - (1)	6565.94	50-yr	1754.00	7326.00	7331.42	81.78	81.78	7.56	0.67
Alignment - (1)	6325.83	100-yr	2228.00	7324.16	7332.05	199.15	161.91	4.66	0.32
Alignment - (1)	6325.83	500-yr	3689.00	7324.16	7332.78	214.62	214.62	6.53	0.43
Alignment - (1)	6325.83	10-yr	768.00	7324.16	7327.46	60.66	60.66	6.57	0.82
Alignment - (1)	6325.83	50-yr	1754.00	7324.16	7331.58	160.65	144.73	4.05	0.29
Alignment - (1)	6156.77	100-yr	2228.00	7323.97	7332.16	371.69	371.69	2.29	0.15
Alignment - (1)	6156.77	500-yr	3689.00	7323.97	7333.00	391.24	391.24	3.11	0.19
Alignment - (1)	6156.77	10-yr	768.00	7323.97	7326.15	92.84	92.84	6.04	0.90
Alignment - (1)	6156.77	50-yr	1754.00	7323.97	7331.65	354.58	354.58	2.05	0.14
Alignment - (1)	5833.82	100-yr	2228.00	7321.68	7332.18	475.99	475.99	1.00	0.06
Alignment - (1)	5833.82	500-yr	3689.00	7321.68	7333.03	482.38	482.38	1.44	0.08
Alignment - (1)	5833.82	10-yr	768.00	7321.68	7324.68	101.60	101.60	4.18	0.55
Alignment - (1)	5833.82	50-yr	1754.00	7321.68	7331.67	472.20	472.20	0.86	0.05
Alignment - (1)	5442.15 U/S Upper Bridge	100-yr	2228.00	7317.99	7332.18	565.05	565.05	0.81	0.04
Alignment - (1)	5442.15 U/S Upper Bridge	500-yr	3689.00	7317.99	7333.03	586.58	586.58	1.19	0.06
Alignment - (1)	5442.15 U/S Upper Bridge	10-yr	768.00	7317.99	7324.78	222.06	222.06	1.00	0.08
Alignment - (1)	5442.15 U/S Upper Bridge	50-yr	1754.00	7317.99	7331.67	545.83	545.83	0.68	0.04
Alignment - (1)	5431.65 U/S Upper Bridge	100-yr	2228.00	7318.03	7331.86	539.66	271.60	4.16	0.32
Alignment - (1)	5431.65 U/S Upper Bridge	500-yr	3689.00	7318.03	7332.45	558.18	280.56	5.77	0.42
Alignment - (1)	5431.65 U/S Upper Bridge	10-yr	768.00	7318.03	7324.51	223.52	33.00	3.81	0.27
Alignment - (1)	5431.65 U/S Upper Bridge	50-yr	1754.00	7318.03	7331.39	521.47	263.95	3.78	0.31
Alignment - (1)	5376		Culvert						
Alignment - (1)	5321.65 D/S Upper Bridge	100-yr	2228.00	7317.99	7321.91	84.52	66.00	10.32	1.01
Alignment - (1)	5321.65 D/S Upper Bridge	500-yr	3689.00	7317.99	7323.22	137.05	66.00	12.22	1.01
Alignment - (1)	5321.65 D/S Upper Bridge	10-yr	768.00	7317.99	7320.40	70.29	63.05	6.57	0.85
Alignment - (1)	5321.65 D/S Upper Bridge	50-yr	1754.00	7317.99	7321.43	79.95	66.00	9.53	1.01
Alignment - (1)	5300.65 D/S Upper Bridge	100-yr	2228.00	7317.99	7321.75	79.18	79.18	10.08	0.96
Alignment - (1)	5300.65 D/S Upper Bridge	500-yr	3689.00	7317.99	7323.22	121.16	121.16	11.17	0.89
Alignment - (1)	5300.65 D/S Upper Bridge	10-yr	768.00	7317.99	7319.99	63.24	63.24	7.34	1.01
Alignment - (1)	5300.65 D/S Upper Bridge	50-yr	1754.00	7317.99	7321.25	74.68	74.68	9.41	0.97
Alignment - (1)	4866.08	100-yr	2228.00	7313.47	7316.59	156.03	95.51	9.15	0.98
Alignment - (1)	4866.08	500-yr	3689.00	7313.47	7318.29	198.84	198.84	7.07	0.59
Alignment - (1)	4866.08	10-yr	768.00	7313.47	7315.15	105.68	82.82	6.59	0.98

HEC-RAS Plan: McCunePC River: Alignment - (1) Reach: Alignment - (1) (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Top Width	Top Wdth Act	Vel Chnl	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/s)	
Alignment - (1)	4866.08	50-yr	1754.00	7313.47	7316.17	147.61	91.50	8.53	1.00
Alignment - (1)	4720.61	100-yr	2228.00	7312.00	7316.86	145.81	145.81	4.39	0.40
Alignment - (1)	4720.61	500-yr	3689.00	7312.00	7318.16	159.87	159.87	5.36	0.42
Alignment - (1)	4720.61	10-yr	768.00	7312.00	7315.01	129.49	129.49	2.93	0.36
Alignment - (1)	4720.61	50-yr	1754.00	7312.00	7316.35	141.75	141.75	4.00	0.39
Alignment - (1)	4486	100-yr	2228.00	7312.00	7315.75	116.67	116.67	7.43	0.70
Alignment - (1)	4486	500-yr	3689.00	7312.00	7316.69	135.52	135.52	9.36	0.79
Alignment - (1)	4486	10-yr	768.00	7312.00	7314.37	90.71	90.71	4.41	0.54
Alignment - (1)	4486	50-yr	1754.00	7312.00	7315.39	109.79	109.79	6.61	0.66
Alignment - (1)	4331.01	100-yr	2228.00	7311.43	7314.42	115.19	115.19	8.63	1.00
Alignment - (1)	4331.01	500-yr	3689.00	7311.43	7315.36	120.85	120.85	10.11	0.99
Alignment - (1)	4331.01	10-yr	768.00	7311.43	7313.20	103.66	103.66	6.23	1.01
Alignment - (1)	4331.01	50-yr	1754.00	7311.43	7314.07	113.15	113.15	8.01	1.01
Alignment - (1)	4076.71	100-yr	2228.00	7307.48	7310.91	99.30	99.30	8.72	0.91
Alignment - (1)	4076.71	500-yr	3689.00	7307.48	7312.13	116.04	116.04	9.94	0.87
Alignment - (1)	4076.71	10-yr	768.00	7307.48	7309.42	82.61	82.61	6.17	0.89
Alignment - (1)	4076.71	50-yr	1754.00	7307.48	7310.49	93.63	93.63	8.07	0.91
Alignment - (1)	3774.36	100-yr	2228.00	7304.64	7308.83	93.40	93.40	8.70	0.84
Alignment - (1)	3774.36	500-yr	3689.00	7304.64	7309.77	110.29	110.29	10.97	0.94
Alignment - (1)	3774.36	10-yr	768.00	7304.64	7307.21	71.95	71.95	5.84	0.76
Alignment - (1)	3774.36	50-yr	1754.00	7304.64	7308.43	86.40	86.40	7.83	0.81
Alignment - (1)	3689.36	100-yr	2584.00	7303.99	7307.94	103.07	103.07	9.39	1.00
Alignment - (1)	3689.36	500-yr	4290.00	7303.99	7309.24	174.82	174.82	10.26	0.90
Alignment - (1)	3689.36	10-yr	914.00	7303.99	7306.55	82.23	82.23	6.23	0.82
Alignment - (1)	3689.36	50-yr	2044.00	7303.99	7307.55	97.28	97.28	8.63	0.97
Alignment - (1)	3338.18	100-yr	2584.00	7300.28	7304.82	137.23	111.13	9.60	0.93
Alignment - (1)	3338.18	500-yr	4290.00	7300.28	7306.31	479.11	479.11	8.17	0.66
Alignment - (1)	3338.18	10-yr	914.00	7300.28	7303.10	76.68	76.68	7.33	1.01
Alignment - (1)	3338.18	50-yr	2044.00	7300.28	7304.34	118.57	101.17	9.02	0.95
Alignment - (1)	3071.3	100-yr	2584.00	7296.87	7301.49	73.86	73.86	10.82	0.97
Alignment - (1)	3071.3	500-yr	4290.00	7296.87	7303.41	262.30	262.30	9.75	0.71
Alignment - (1)	3071.3	10-yr	914.00	7296.87	7299.52	57.60	57.60	7.80	0.96
Alignment - (1)	3071.3	50-yr	2044.00	7296.87	7301.00	69.45	69.45	9.87	0.95
Alignment - (1)	2934.46	100-yr	2584.00	7296.00	7300.38	76.50	76.50	10.98	0.96
Alignment - (1)	2934.46	500-yr	4290.00	7296.00	7302.49	232.77	232.77	10.05	0.71
Alignment - (1)	2934.46	10-yr	914.00	7296.00	7298.74	60.03	60.03	6.60	0.74
Alignment - (1)	2934.46	50-yr	2044.00	7296.00	7299.78	67.24	67.24	10.27	0.97
Alignment - (1)	2576.35	100-yr	2584.00	7293.68	7297.47	122.83	122.83	9.33	0.94
Alignment - (1)	2576.35	500-yr	4290.00	7293.68	7298.63	153.47	153.47	10.68	0.92
Alignment - (1)	2576.35	10-yr	914.00	7293.68	7295.92	85.62	85.62	7.03	1.01
Alignment - (1)	2576.35	50-yr	2044.00	7293.68	7297.04	115.63	115.63	8.72	0.95
Alignment - (1)	2373.76	100-yr	2584.00	7291.32	7294.93	90.98	90.98	10.00	0.98
Alignment - (1)	2373.76	500-yr	4290.00	7291.32	7296.22	101.09	101.09	11.67	0.97
Alignment - (1)	2373.76	10-yr	914.00	7291.32	7293.57	82.61	82.61	6.21	0.80
Alignment - (1)	2373.76	50-yr	2044.00	7291.32	7294.53	88.62	88.62	9.08	0.95
Alignment - (1)	2132.45	100-yr	2584.00	7289.16	7292.80	100.91	100.91	9.60	0.99
Alignment - (1)	2132.45	500-yr	4290.00	7289.16	7295.69	215.52	215.52	7.41	0.54
Alignment - (1)	2132.45	10-yr	914.00	7289.16	7291.23	82.30	82.30	7.15	1.01

HEC-RAS Plan: McCunePC River: Alignment - (1) Reach: Alignment - (1) (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Top Width	Top Wdth Act	Vel Chnl	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/s)	
Alignment - (1)	2132.45	50-yr	2044.00	7289.16	7292.37	96.35	96.35	8.90	1.00
Alignment - (1)	1842.45	100-yr	2584.00	7284.08	7291.41	132.23	132.23	6.31	0.48
Alignment - (1)	1842.45	500-yr	4290.00	7284.08	7295.88	239.24	239.24	4.34	0.24
Alignment - (1)	1842.45	10-yr	914.00	7284.08	7288.46	75.76	75.76	5.39	0.61
Alignment - (1)	1842.45	50-yr	2044.00	7284.08	7289.06	85.51	85.51	9.58	0.97
Alignment - (1)	1634.19	100-yr	2584.00	7284.00	7291.68	378.54	378.54	2.34	0.17
Alignment - (1)	1634.19	500-yr	4290.00	7284.00	7295.99	464.36	464.36	1.74	0.09
Alignment - (1)	1634.19	10-yr	914.00	7284.00	7286.86	113.76	79.34	7.14	0.99
Alignment - (1)	1634.19	50-yr	2044.00	7284.00	7289.31	295.04	295.04	3.84	0.35
Alignment - (1)	1530.98	100-yr	2584.00	7282.00	7291.68	435.38	435.38	1.78	0.11
Alignment - (1)	1530.98	500-yr	4290.00	7282.00	7295.99	482.46	482.46	1.47	0.07
Alignment - (1)	1530.98	10-yr	914.00	7282.00	7285.03	130.36	63.07	7.69	0.99
Alignment - (1)	1530.98	50-yr	2044.00	7282.00	7289.33	375.24	375.24	2.64	0.19
Alignment - (1)	1250.13 U/S Lower Bridge	100-yr	2584.00	7280.00	7291.67	286.59	286.59	1.40	0.08
Alignment - (1)	1250.13 U/S Lower Bridge	500-yr	4290.00	7280.00	7295.97	594.76	594.76	1.55	0.07
Alignment - (1)	1250.13 U/S Lower Bridge	10-yr	914.00	7280.00	7284.91	168.09	168.09	1.90	0.20
Alignment - (1)	1250.13 U/S Lower Bridge	50-yr	2044.00	7280.00	7289.32	257.88	257.88	1.55	0.10
Alignment - (1)	1240.12 U/S Lower Bridge	100-yr	2584.00	7280.00	7290.58	266.50	33.00	7.45	0.41
Alignment - (1)	1240.12 U/S Lower Bridge	500-yr	4290.00	7280.00	7294.33	332.27	33.00	9.12	0.43
Alignment - (1)	1240.12 U/S Lower Bridge	10-yr	914.00	7280.00	7283.94	149.38	33.00	7.17	0.64
Alignment - (1)	1240.12 U/S Lower Bridge	50-yr	2044.00	7280.00	7288.19	237.95	33.00	7.64	0.47
Alignment - (1)	1185		Culvert						
Alignment - (1)	1131.75 D/S Lower Bridge	100-yr	2584.00	7280.00	7284.07	132.88	65.00	11.02	0.98
Alignment - (1)	1131.75 D/S Lower Bridge	500-yr	4290.00	7280.00	7285.56	182.39	65.00	13.05	0.99
Alignment - (1)	1131.75 D/S Lower Bridge	10-yr	914.00	7280.00	7282.12	114.39	59.82	7.93	1.00
Alignment - (1)	1131.75 D/S Lower Bridge	50-yr	2044.00	7280.00	7283.52	126.96	65.00	10.20	0.98
Alignment - (1)	1105.72 D/S Lower Bridge	100-yr	2584.00	7279.98	7283.09	112.77	112.77	9.09	0.97
Alignment - (1)	1105.72 D/S Lower Bridge	500-yr	4290.00	7279.98	7284.14	131.62	125.66	10.80	0.98
Alignment - (1)	1105.72 D/S Lower Bridge	10-yr	914.00	7279.98	7282.11	103.85	103.85	5.03	0.67
Alignment - (1)	1105.72 D/S Lower Bridge	50-yr	2044.00	7279.98	7283.15	113.30	113.30	7.04	0.74
Alignment - (1)	909.01	100-yr	2584.00	7277.98	7281.99	243.09	243.09	7.93	0.77
Alignment - (1)	909.01	500-yr	4290.00	7277.98	7282.76	256.31	256.31	9.32	0.82
Alignment - (1)	909.01	10-yr	914.00	7277.98	7280.25	90.27	90.27	6.97	0.99
Alignment - (1)	909.01	50-yr	2044.00	7277.98	7281.37	195.10	118.47	8.74	0.95
Alignment - (1)	679.18	100-yr	2584.00	7275.60	7278.70	267.72	267.72	5.02	0.59
Alignment - (1)	679.18	500-yr	4290.00	7275.60	7279.71	275.37	275.37	5.62	0.55
Alignment - (1)	679.18	10-yr	914.00	7275.60	7277.61	232.82	127.85	5.44	0.84
Alignment - (1)	679.18	50-yr	2044.00	7275.60	7278.34	264.98	264.98	4.78	0.61
Alignment - (1)	441.15	100-yr	2584.00	7273.98	7276.61	147.73	147.73	8.46	0.96
Alignment - (1)	441.15	500-yr	4290.00	7273.98	7277.51	157.90	157.90	9.99	0.97
Alignment - (1)	441.15	10-yr	914.00	7273.98	7275.50	124.16	124.16	5.63	0.87
Alignment - (1)	441.15	50-yr	2044.00	7273.98	7276.30	144.05	144.05	7.72	0.94

5.0 SEDIMENT TRANSPORT

After visual observation and examining historical records, there are no indications that sediment or debris transport will impact base flood elevations (BFE). The stream appears to be in a stable state with no evidence that the structure has been recently influenced by sediment deposition, degrading of the bank or stream bed, or vegetative cover in the flow path. Further, the proposed water quality ponds will help address potential sediment before it ever reaches the floodplain area. As a result, sediment transport is not included in this analysis.

6.0 SCOUR ANALYSIS

The potential for scour of the floodway, and the associated impacts on water surface elevations, were considered as a part of this analysis. The two box culverts have been designed with characteristics to help address this in major storm events. At the exit point of the culvert, a combination of flared wing walls, a concrete apron, and a rip-rap bed are proposed to reduce the velocity of the water and the impacts of scour.

7.0 ESA COMPLIANCE

An environmental impact study dated October 1, 2018 has been prepared by Ecosystem Services for this project and is included in the appendix. The study includes a USFWS IPaC report covering any potential endangered wildlife in the area. Based on the research conducted, a determination was made that there is no impact to any federally listed species.

8.0 OPERATION AND MAINTAINANCE REQUIREMENTS

A metropolitan district is being created for the neighborhood that will have responsibility for maintaining drainage facilities and the floodplain area.

9.0 PROPOSED CONDITION BFE INCREASE

The Base (1-percent-annual-chance) Flood Elevation (BFE) increases to greater than 1.0 foot within the current, effective approximate Zone A immediately upstream of each of the two bridges. Fulfillment of the requirements set forth in 44 CFR 65.12 are described below:

a) Certification that no structures are affected by the increased BFE: Please see stamped certification on the next page.
b) Documentation of individual legal notice to all affected property owners, explaining the impact of the proposed action on their property: The only affected property owner is the applicant of this LOMR request, thus the applicant is apprised of the impact of the proposed development, de facto.
c) An evaluation of alternatives that would not result in an increase in BFE has been conducted. To access over half of the project area, the floodplain of this site must be crossed. Other bridge configurations are being considered, but due to the significant expense associated with a bridge of this size, box culverts are currently being specified.

Certification that no structures will be affected by the rises in Base Flood Elevations (BFEs) as a result of the proposed project subject to this request. There are no existing structures currently within the boundary of the project.

Lance P. VanDemark PE, MSCE
VICE PRESIDENT – CIVIL ENGINEERING
O: 303.623.9116 | D: 720.545.0459 | C: 303.263.3102 | VERTEXENG.COM

THE VERTEX COMPANIES, INC.
2420 W. 26TH AVE., SUITE 100-D
DENVER, CO 80211

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

OVERVIEW & CONCURRENCE FORM

O.M.B No. 1660-0016
Expires February 28, 2014

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless it displays a valid OMB control number. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington, VA 20958-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a (NFIP) Flood Insurance Rate Maps (FIRM).

A. REQUESTED RESPONSE FROM DHS-FEMA

This request is for a (check one):

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

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

B. OVERVIEW

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

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
Example: 480301 480287	City of Katy Harris County	TX TX	48473C 48201C	0005D 0220G	02/08/83 09/28/90
080059	El Paso County, Unincorporated Areas	CO	08041C	0350F	03/17/97

2. a. Flooding Source: West Kiowa Creek Drainage Basin (KIKI0200)

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

3. Project Name/Identifier: McCune Subdivision

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

5. Basis for Request and Type of Revision:

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

   ☐ Physical Change ☐ Improved Methodology/Data ☐ Regulatory Floodway Revision ☒ Base Map Changes
   ☐ Coastal Analysis ☒ Hydraulic Analysis ☒ Hydrologic Analysis ☐ Corrections
   ☐ Weir-Dam Changes ☐ Levee Certification ☐ Alluvial Fan Analysis ☐ Natural Changes
   ☐ New Topographic Data ☐ Other (Attach Description)

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

b. The area of revision encompasses the following structures (check all that apply)

Structures: ☐ Channelization ☐ Levee/Floodwall ☒ Bridge/Culvert

☐ Dam ☐ Fill ☐ Other (Attach Description)

6. ☒ Documentation of ESA compliance is submitted (required to initiate CLOMR review). Please refer to the instructions for more information.

C. REVIEW FEE

Has the review fee for the appropriate request category been included? ☒ Yes Fee amount: $6500

☐ No, Attach Explanation

Please see the DHS-FEMA Web site at http://www.fema.gov/plan/prevent/fhm/frm_fees.shtm for Fee Amounts and Exemptions.

D. SIGNATURE

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

Name: Joe DesJardin	Company: PT McCune	
Mailing Address: 1864 Woodmoor Drive, Suite 100 Monument, Colorado 80132	Daytime Telephone No.: 719.476.0800	Fax No.:
	E-Mail Address: JDesJardin@proterraco.com	
Signature of Requester (required):	Date: 11/16/18	

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirements for when fill is placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. For Conditional LOMR requests, the applicant has documented Endangered Species Act (ESA) compliance to FEMA prior to FEMA's review of the Conditional LOMR application. For LOMR requests, I acknowledge that compliance with Sections 9 and 10 of the ESA has been achieved independently of FEMA's process. For actions authorized, funded, or being carried out by Federal or State agencies, documentation from the agency showing its compliance with Section 7(a)(2) of the ESA will be submitted. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title: Keith Curtis	Community Name: El Paso County	
Mailing Address: 2880 International Circle Colorado Springs CO, 80910	Daytime Telephone No.: 719-327-2898	Fax No.:
	E-Mail Address: keith@pprbd.org	
Community Official's Signature (required):	Date: 11-26-18	

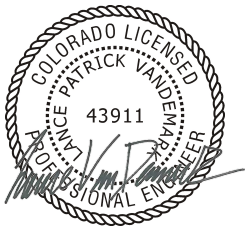
CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.2(b) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name: Lance VanDemark	License No.: 43911	Expiration Date: 10/31/19
Company Name: The Vertex Companies, Inc	Telephone No.: 303.623.9116	Fax No.:
Signature:	Date: 11/16/18	E-Mail Address: lvandemark@vertexeng.com

Ensure the forms that are appropriate to your revision request are included in your submittal.

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



Seal (Optional)

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

RIVERINE HYDROLOGY & HYDRAULICS FORM

O.M.B No. 1660-0016
Expires February 28, 2014

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 3.5 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington VA 20958-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

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DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a NFIP Flood Insurance Rate Maps (FIRM).

Flooding Source: West Kiowa Creek

Note: Fill out one form for each flooding source studied

A. HYDROLOGY

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

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

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

Location	Drainage Area (Sq. Mi.)	Effective/FIS (cfs)	Revised (cfs)
No Existing Analysis			

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

☐ Statistical Analysis of Gage Records ☒ Precipitation/Runoff Model → Specify Model: NRCS Curve Method TR-55
☐ Regional Regression Equations ☐ Other (please attach description)

Please enclose all relevant models in digital format, maps, computations (including computation of parameters), and documentation to support the new analysis.

4. Review/Approval of Analysis

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

5. Impacts of Sediment Transport on Hydrology

Is the hydrology for the revised flooding source(s) affected by sediment transport? ☐ Yes ☒ No

If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation..

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.) Effective	Proposed/Revised
Downstream Limit*	Effective SFHA is Zone A. No BFEs in EC			
Upstream Limit*	PC elev tie into existing within 0.5'			

*Proposed/Revised elevations must tie-into the Effective elevations within 0.5 foot at the downstream and upstream limits of revision.

2. Hydraulic Method/Model Used: HEC-RAS 5.0

3. Pre-Submittal Review of Hydraulic Models*

DHS-FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS.

4.

Models Submitted	Natural Run		Floodway Run		Datum
Duplicate Effective Model*	File Name: N/A	Plan Name:	File Name:	Plan Name:	
Corrected Effective Model*	File Name: N/A	Plan Name:	File Name:	Plan Name:	
Existing or Pre-Project Conditions Model	File Name: McCune EC Fnl	Plan Name:	File Name:	Plan Name:	
Revised or Post-Project Conditions Model	File Name: McCune PC Fnl	Plan Name:	File Name:	Plan Name:	
Other - (attach description)	File Name:	Plan Name:	File Name:	Plan Name:	

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

☒ Digital Models Submitted? (Required)

C. MAPPING REQUIREMENTS

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

☒ Digital Mapping (GIS/CADD) Data Submitted (preferred)

Topographic Information: LiDAR Bare Earth

Source: El Paso County Licensed GIS Date: 2011

Accuracy: 15 centimeters

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

☒ Annotated FIRM and/or FBFM (Required)

D. COMMON REGULATORY REQUIREMENTS*

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

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

      - The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot compared to pre-project conditions.
      - The proposed project encroaches upon a SFHA with or without BFEs established and would result in increases above 1.00 foot compared to pre-project conditions.

   b. Does this LOMR request cause increase in the BFE and/or SFHA compared with the effective BFEs and/or SFHA? ☐ Yes ☒ No

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

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

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

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

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

4. For CLOMR requests, please submit documentation to FEMA and the community to show that you have complied with Sections 9 and 10 of the Endangered Species Act (ESA).

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

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

Additional information to support For MT2-Form 2 - Section D

1. For LOMR/CLOMR requests, do Base Flood Elevations (BFEs) increase? Yes

a. Does this LOMR request cause increase in the BFE and/or SFHA compared with the effective BFEs and/or SFHA? Yes

No effective BFE's have been established. An increase of greater than 1 foot is caused between existing and proposed BFE's. The owner of this proposed development, and of this CLOMR request, is the only property owner affected by the increase in the BFE's.

2. Does the request involve the placement or proposed placement of fill? Yes

Placement of fill is required for construction of two new bridges. No existing or proposed structures will be affected.

4. For CLOMR requests, please submit documentation to FEMA and the community to show that you have complied with Sections 9 and 10 of the Endangered Species Act (ESA).

Please see the attached Environmental Report by Ecosystem Services LLC dated October 1, 2018.

DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

O.M.B. NO. 1660-0016
Expires February 28, 2014

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 7 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington, VA 20598-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program; Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a NFIP Flood Insurance Rate Maps (FIRM).

Flooding Source: West Kiowa Creek

Note**:** Fill out one form for each flooding source studied.

A. GENERAL

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

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

Description Of Modeled Structure

1. Name of Structure: Upstream Bridge

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

   Location of Structure: Southwest side of property @ River Station 1185.

   Downstream Limit/Cross Section: 5321.65

   Upstream Limit/Cross Section: 5431.65

2. Name of Structure: Downstream Bridge

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

   Location of Structure: Northeast side of property @ River Station 1185.

   Downstream Limit/Cross Section: 1131.75

   Upstream Limit/Cross Section: 1240.12

3. Name of Structure: _____

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

   Location of Structure: _____

   Downstream Limit/Cross Section: _____

   Upstream Limit/Cross Section: _____

NOTE: FOR MORE STRUCTURES, ATTACH ADDITIONAL PAGES AS NEEDED.

B. CHANNELIZATION

Flooding Source: _____

Name of Structure: _____

1. Hydraulic Considerations

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

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

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

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

☐ Inlet to channel ☐ Outlet of channel ☐ At Drop Structures ☐ At Transitions

☐ Other locations (specify): _____

2. Channel Design Plans

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

3. Accessory Structures

The channelization includes (check one):

☐ Levees [Attach Section E (Levee/Floodwall)] ☐ Drop structures ☐ Superelevated sections

☐ Transitions in cross sectional geometry ☐ Debris basin/detention basin [Attach Section D (Dam/Basin)] ☐ Energy dissipator

☐ Weir ☐ Other (Describe):

4. Sediment Transport Considerations

Are the hydraulics of the channel affected by sediment transport? ☐ Yes ☐ No

If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation for why sediment transport was not considered.

C. BRIDGE/CULVERT

Flooding Source: West Kiowa Creek

Name of Structure: 1 - Upstream Bridge and 2 - Downstream Bridge

1. This revision reflects (check one):

☒ Bridge/culvert not modeled in the FIS

☐ Modified bridge/culvert previously modeled in the FIS

☐ Revised analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): HEC-RAS 5.0
If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

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

☒ Dimensions (height, width, span, radius, length)

☒ Shape (culverts only)

☒ Material

☐ Beveling or Rounding

☒ Wing Wall Angle

☒ Skew Angle

☒ Distances Between Cross Sections

☒ Erosion Protection

☐ Low Chord Elevations – Upstream and Downstream

☐ Top of Road Elevations – Upstream and Downstream

☒ Structure Invert Elevations – Upstream and Downstream

☒ Stream Invert Elevations – Upstream and Downstream

☒ Cross-Section Locations

4. Sediment Transport Considerations

Are the hydraulics of the structure affected by sediment transport? ☐ Yes ☒ No

If Yes, then fill out Section F (Sediment Transport) of Form 3. If no, then attach an explanation.

D. DAM/BASIN

Flooding Source: _____
Name of Structure: _____

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

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

   Name of the agency or organization: _____

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

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

   Permit or ID number _____ Permitting Agency or Organization _____

   a. ☐ Local Government Dam ☐ Private Dam

   Provided related drawings, specification and supporting design information.

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

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

   Was the dam/basin designed using critical duration storm? (must account for the maximum volume of runoff)

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

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

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

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

6. Does the Base Flood Elevation behind the dam/basin or downstream of the dam/basin change? ☐ Yes ☐ No

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

	Stillwater Elevation Behind the Dam/Basin	
FREQUENCY (% annual chance)	FIS	REVISED
10-year (10%)	_____	_____
50-year (2%)	_____	_____
100-year (1%)	_____	_____
500-year (0.2%)	_____	_____
Normal Pool Elevation	_____	_____

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

E. LEVEE/FLOODWALL

1. System Elements

a. This Levee/Floodwall analysis is based on (check one): ☐ upgrading of an existing levee/floodwall system ☐ a newly constructed levee/floodwall system ☐ reanalysis of an existing levee/floodwall system

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

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

c. Structural Type (check one): ☐ monolithic cast-in place reinforced concrete ☐ reinforced concrete masonry block ☐ sheet piling
☐ Other (describe): _____

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

☐ Yes ☐ No

If Yes, by which agency? _____

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

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

2. Freeboard

a. The minimum freeboard provided above the BFE is:

Riverine

3.0 feet or more at the downstream end and throughout ☐ Yes ☐ No

3.5 feet or more at the upstream end ☐ Yes ☐ No

4.0 feet within 100 feet upstream of all structures and/or constrictions ☐ Yes ☐ No

Coastal

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

2.0 feet above the 1%-annual-chance stillwater surge elevation ☐ Yes ☐ No

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

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

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

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

3. Closures

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

If opening exists, list all closures:

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

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

Note: Geotechnical and geologic data

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

4. Embankment Protection

a. The maximum levee slope land side is: _____

b. The maximum levee slope flood side is: _____

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

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

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

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

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

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

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

Attach engineering analysis to support construction plans.

5. Embankment And Foundation Stability

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

☐ Overall height: Sta.: _____, height _____ ft.

☐ Limiting foundation soil strength:

Strength ϕ = _____ degrees, c = _____ psf

Slope: SS = _____ (h) to _____ (v)

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

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

c. Summary of stability analysis results:

E. LEVEE/FLOODWALL (CONTINUED)

5. Embankment And Foundation Stability (continued)

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

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

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

If Yes, describe methodology used:

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

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

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

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

Attach engineering analysis to support construction plans.

6. Floodwall And Foundation Stability

a. Describe analysis submittal based on Code (check one): ☐ UBC (1988) ☐ Other (specify): _____

b. Stability analysis submitted provides for: ☐ Overturning ☐ Sliding If not, explain: _____

c. Loading included in the analyses were: ☐ Lateral earth @ P_A = _____ psf; P_p = _____ psf

☐ Surcharge-Slope @ _____, ☐ surface _____ psf

☐ Wind @ P_w = _____ psf

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

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

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

d. Summary of Stability Analysis Results: Factors of Safety.
Itemize for each range in site layout dimension and loading condition limitation for each respective reach.

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

(Ref: FEMA 114 Sept 1986; USACE EM 1110-2-2502)
Note: (Extend table on an added sheet as needed and reference)

E. LEVEE/FLOODWALL (CONTINUED)

6. Floodwall And Foundation Stability (continued)

e. Foundation bearing strength for each soil type:

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

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

Attach engineering analysis to support construction plans.

7. Settlement

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

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

c. Settlement of the levee crest is determined to be primarily from : ☐ Foundation consolidation ☐ Embankment compression ☐ Other (Describe): _____

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

Attach engineering analysis to support construction plans.

8. Interior Drainage

a. Specify size of each interior watershed:

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

b. Relationships Established

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

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

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

e. Which flooding conditions were analyzed?

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

If No for any of the above, attach explanation.

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

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

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

E. LEVEE/FLOODWALL (CONTINUED)

8. Interior Drainage (continued)

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

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

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

Will the operation be automatic? ☐ Yes ☐ No

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

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

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

9. Other Design Criteria

a. The following items have been addressed as stated:

Liquefaction ☐ is ☐ is not a problem

Hydrocompaction ☐ is ☐ is not a problem

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

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

Attach supporting documentation

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

d. Sediment Transport Considerations:

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

10. Operational Plan And Criteria

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

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

c. Does the operation plan incorporate all the provisions for interior drainage as required in Paragraph 65.10(c)(2) of the NFIP regulations?
☐ Yes ☐ No If the answer is No to any of the above, please attach supporting documentation.

E. LEVEE/FLOODWALL (CONTINUED)

11. Maintenance Plan

Please attach a copy of the fomal maintenance plan for the levee/floodwall

12. Operations and Maintenance Plan

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

CERTIFICATION OF THE LEVEE DOCUMENTION

This certification is to be signed and sealed by a licensed registered professional engineer authorized by law to certify elevation information data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.10(e) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name: _____ License No.: _____ Expiration Date: _____

Company Name: _____ Telephone No.: _____ Fax No.: _____

Signature: _____ Date: _____ E-Mail Address: _____

F. SEDIMENT TRANSPORT

Flooding Source: _____

Name of Structure: _____

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

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

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

Sediment transport rate _____ (percent concentration by volume)

Method used to estimate sediment transport: _____

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

Method used to estimate scour and/or deposition: _____

Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport: _____

Please note that bulked flows are used to evaluate the performance of a structure during the base flood; however, FEMA does not map BFEs based on bulked flows.

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

FEDERAL EMERGENCY MANAGEMENT AGENCY

PAYMENT INFORMATION FORM

Community Name: El Paso County, Unincorporated Areas

Project Identifier: McCune Subdivision

THIS FORM MUST BE MAILED, ALONG WITH THE APPROPRIATE FEE, TO THE ADDRESS BELOW OR FAXED TO THE FAX NUMBER BELOW.

Please make check or money order payable to the National Flood Insurance Program.

Type of Request:

☐ MT-1 application
☒ MT-2 application

LOMC Clearinghouse
3601 Eisenhower Ave. Suite 500
Alexandria, VA 22304-6426
Attn.: LOMC Manager

☐ EDR application

FEMA Project Library
3601 Eisenhower Ave. Suite 500
Alexandria, VA 22304-6426
FAX (703) 960-9125

Request No. (if known): _____ **Check No.:** 16060 **Amount:** $6,500.00

☐ INITIAL FEE* ☒ FINAL FEE ☐ FEE BALANCE** ☐ MASTER CARD ☐ VISA ☐ CHECK ☐ MONEY ORDER

*Note: Check only for EDR and/or Alluvial Fan requests (as appropriate).

****Note: Check only if submitting a corrected fee for an ongoing request.**

COMPLETE THIS SECTION *ONLY* IF PAYING BY CREDIT CARD

CARD NUMBER EXP. DATE

				–					–					–					–		
1	2	3	4		5	6	7	8		9	10	11	12		13	14	15	16		Month	Year

Date _____ Signature _____

NAME *(AS IT APPEARS ON CARD)*: _____
(please print or type)

ADDRESS: _____
(for your credit card receipt-please print or type) _____

DAYTIME PHONE: _____

FOR SECURITY PURPOSES, THE FACE OF THIS DOCUMENT CONTAINS A COLORED BACKGROUND AND MICROPRINTING IN THE BORDER

ProTerra Investment Holdings, LLC
1864 Woodmoor Dr, Suite100
Monument, CO 80132

Bank of Colorado
421 N. Tejon
C olorado Springs, CO 80903

82-244/1070

MultiCHAX® # 24554DNS-08

CHECK NO. 16060

11/14/2018

National Flood Insurance Program
Six Thousand Five Hundred and 00/100**********

****6,500.00**

PAY TO THE ORDER OF: National Flood Insurance Program

AUTHORIZED SIGNATURE

SECURITY FEATURES INCLUDED. DETAILS ON BACK

⑈016060⑈ ⑆107002448⑆430256 1173⑈

ProTerra Investment Holdings, LLC
National Flood Insurance Program

Date: 11/14/2018 Check #: 16060
11/14/2018

Date	Type	Reference	Original Amt.	Balance Due	Discount	Payment
11/14/2018	Bill	McCune Oct 18	6,500.00	6,500.00		6,500.00
					Check Amount	6,500.00

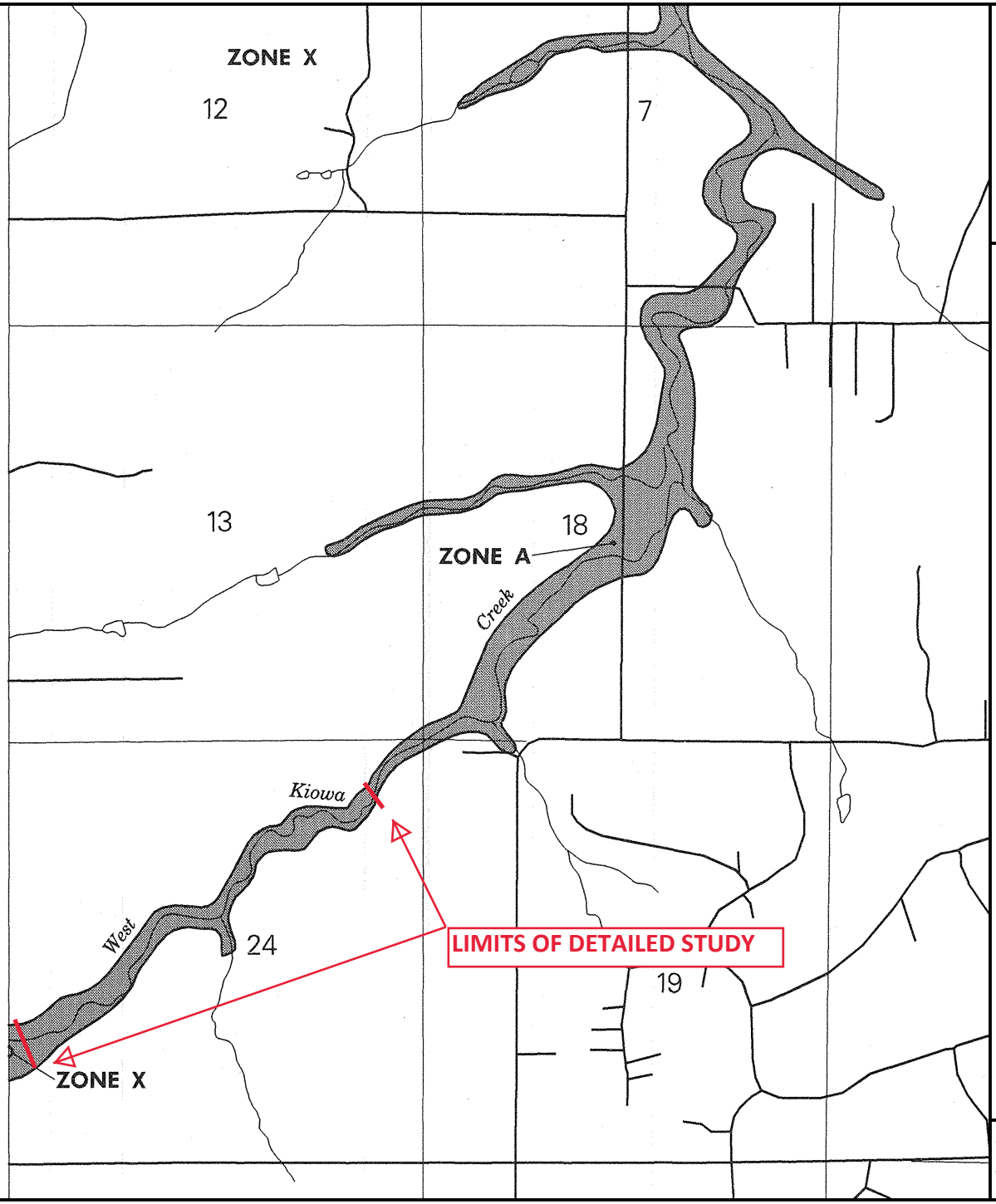
Bank of CO - Checking # 6,500.00

APPENDIX A

REPRESENTATIVE PHOTOGRAPHS

APPENDIX B1

LIMITS OF STUDY MAP



APPROXIMATE SCALE IN FEET

2000 0 2000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 350 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0350	F

MAP NUMBER 08041C0350 F

EFFECTIVE DATE: MARCH 17, 1997

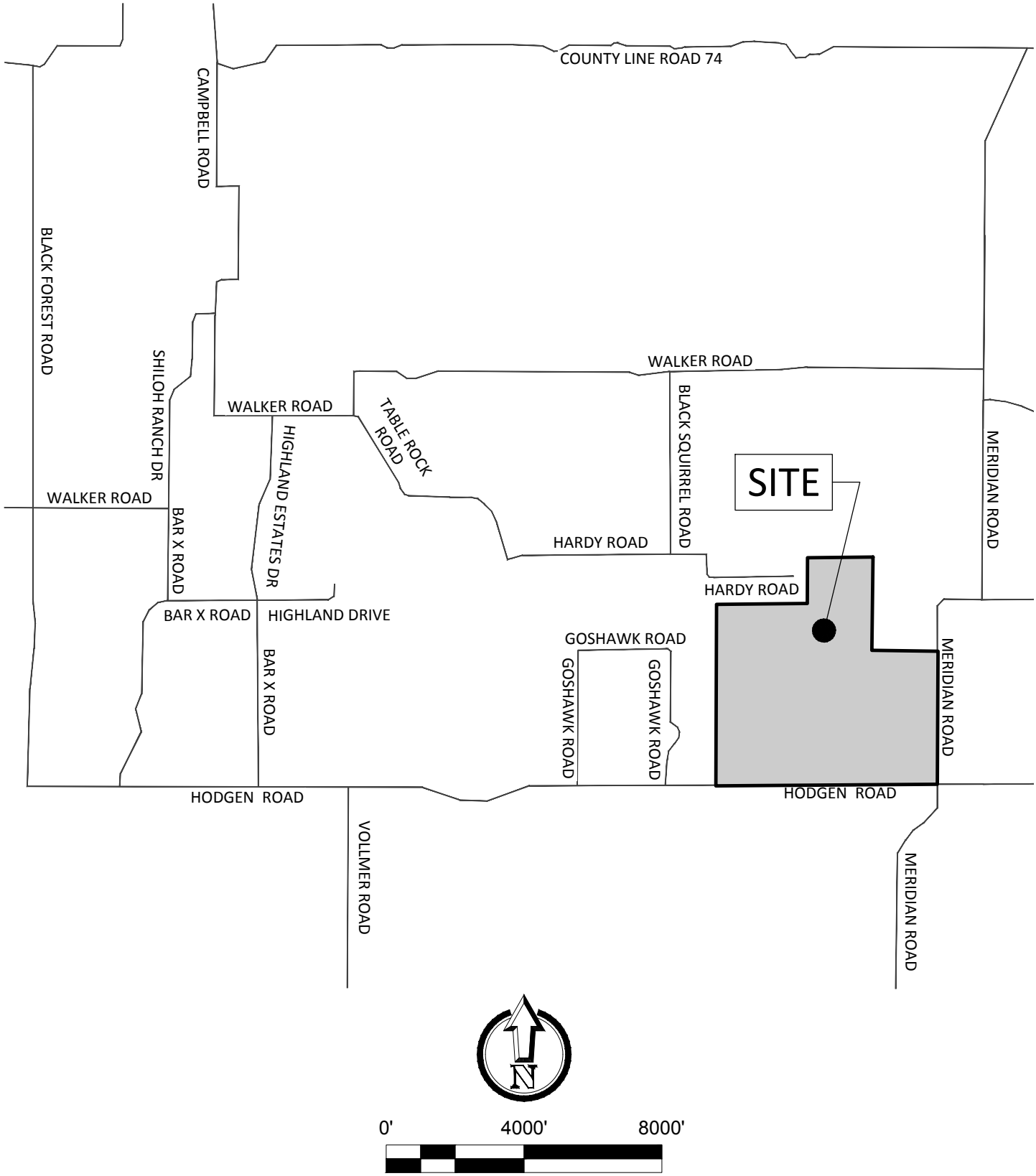
Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

APPENDIX B2

VICINITY MAP

VICINITY MAP



VICINITY MAP			
MCCUNE RANCH SUBDIVISION 17480 MERIDIAN ROAD ELBERT, COLORADO	File No.: Date: 10/04/2018 Drawn: JCP Checked: LPV Job No.: 49388	FIGURE 1	VERTEX®

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Tuesday, October 02, 2018 12:59:57 PM
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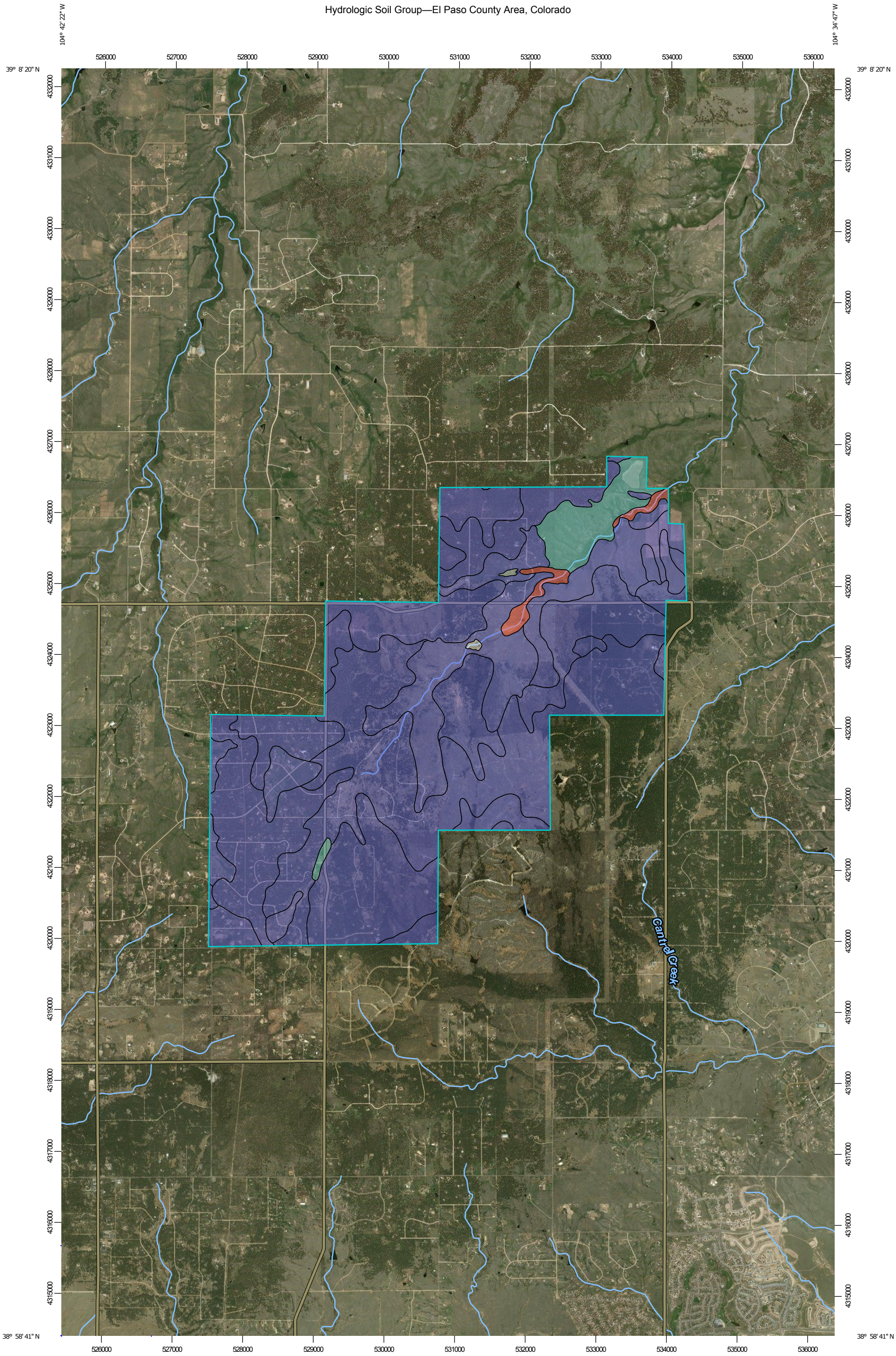
APPENDIX B3

SOILS MAP

Hydrologic Soil Group—El Paso County Area, Colorado



Map Scale: 1:50,000 if printed on B portrait (11" x 17") sheet.

N

Meters: 0 500 1000 2000 3000

Feet: 0 2000 4000 8000 12000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 15, Oct 10, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 22, 2016—Mar 9, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Alamosa loam, 1 to 3 percent slopes	D	80.6	1.2%
15	Brussett loam, 3 to 5 percent slopes	B	6.0	0.1%
21	Cruckton sandy loam, 1 to 9 percent slopes	B	4.7	0.1%
25	Elbeth sandy loam, 3 to 8 percent slopes	B	2,081.3	31.8%
26	Elbeth sandy loam, 8 to 15 percent slopes	B	2,075.9	31.7%
34	Holderness loam, 1 to 5 percent slopes	C	15.5	0.2%
36	Holderness loam, 8 to 15 percent slopes	C	278.7	4.3%
40	Kettle gravelly loamy sand, 3 to 8 percent slopes	B	400.4	6.1%
41	Kettle gravelly loamy sand, 8 to 40 percent slopes	B	265.1	4.0%
67	Peyton sandy loam, 5 to 9 percent slopes	B	36.3	0.6%
68	Peyton-Pring complex, 3 to 8 percent slopes	B	38.1	0.6%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	26.0	0.4%
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	B	661.6	10.1%
93	Tomah-Crowfoot complex, 8 to 15 percent slopes	B	574.4	8.8%
111	Water		10.0	0.2%
Totals for Area of Interest			**6,554.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

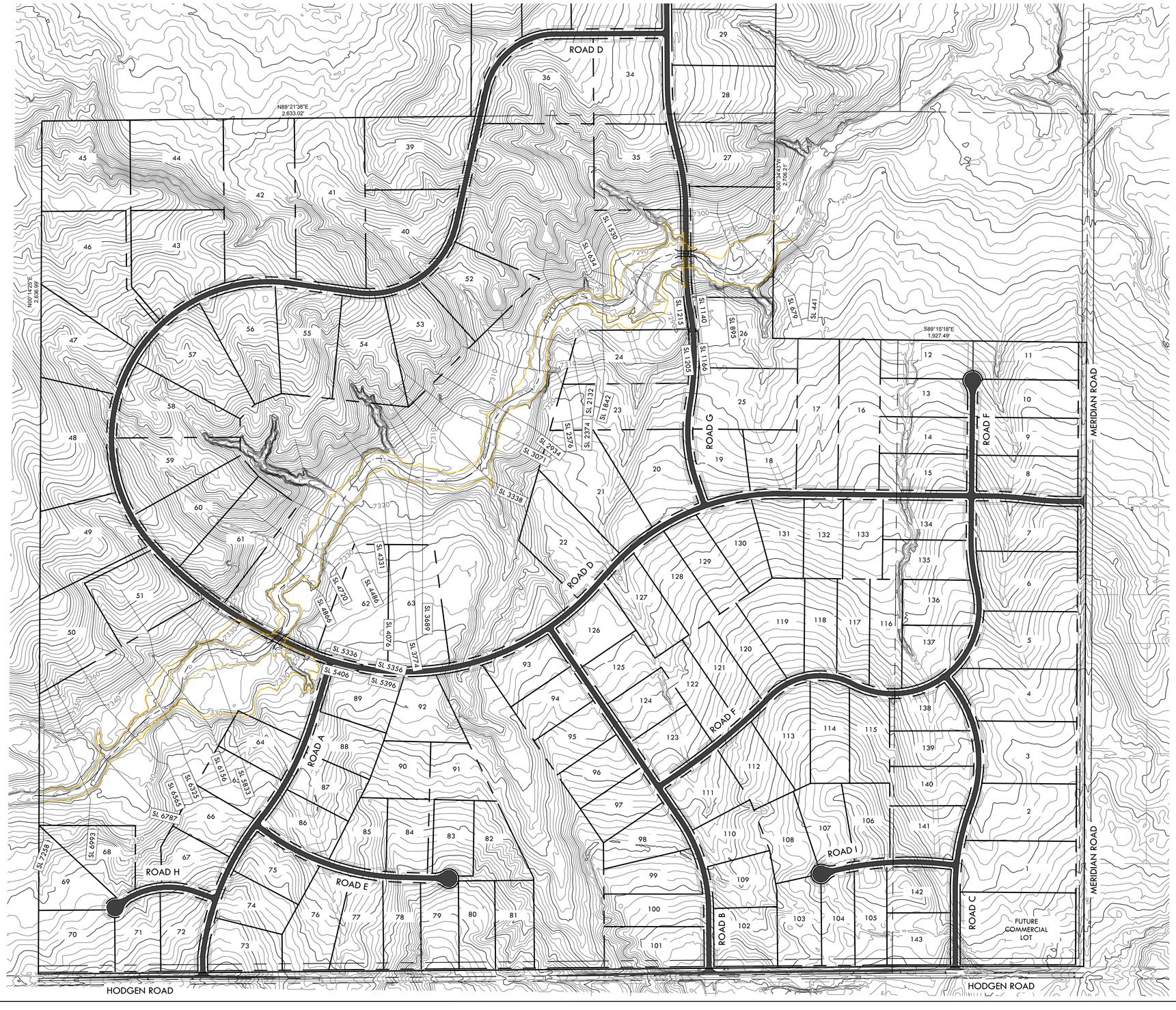
APPENDIX C1

100 YEAR FLOODPLAIN – EXISTING AND PROPOSED CONDITION

FEMA CLOMR SUBMITTAL

MCCUNE RANCH SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO



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MONUMENT, COLORADO 80132

NO.	REVISIONS
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0' 300' 600'

DATE: 11/16/18
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388

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Tuesday, November 20, 2018 4:48:29 PM

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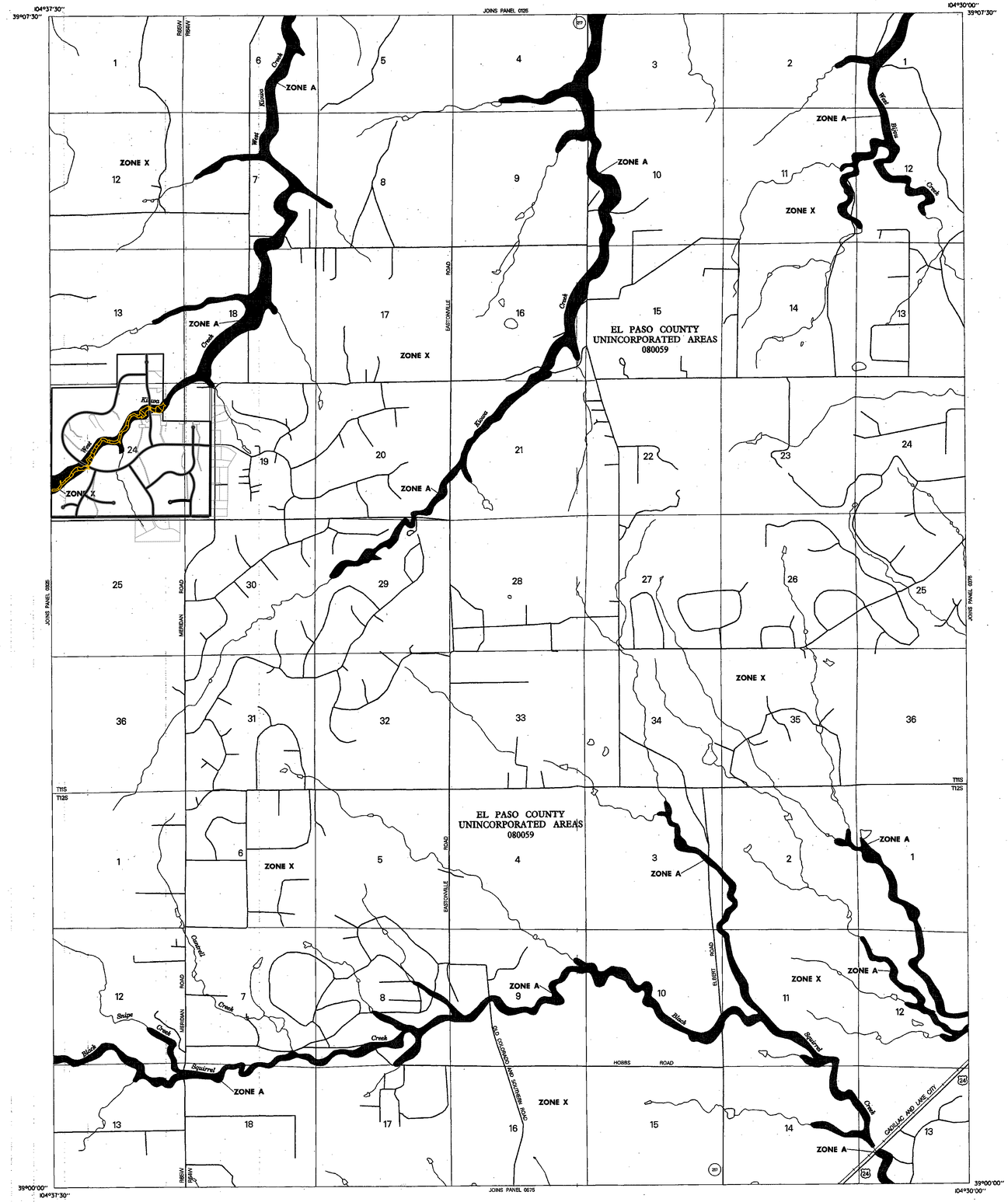
APPENDIX C2

100 YEAR FLOODPLAIN – ANNOTATED FIRMETTE



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 AR/A99 To be protected from 100-year flood by Federal flood protection system under construction; no base 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 1983 | Identified 1990 | Otherwise Protected Areas

Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.

Flood 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 — Cross Section Line

(EL 987) — 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.

Coastal base flood elevations apply only landward of 0.0 NGVD, and include the effects of wave action; these elevations may also differ significantly from those developed by the National Weather Service for hurricane evacuation planning.

Areas of Special Flood Hazard (100-year flood) include Zones A, AE, AH, AO, A99, V, and VE.

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. Floodway widths are provided in the Flood Insurance Study Report.

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).

Corporate limits shown are correct 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.

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.

MAP REPOSITORY
Refer to Repository Listing on Map Index

EFFECTIVE DATE OF
COUNTYWIDE FLOOD INSURANCE RATE MAP:

MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL:

Refer to the FLOOD INSURANCE RATE MAP EFFECTIVE DATE shown on this map to determine when actuarial rates apply to structures in zones where elevations or depths have been established.

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
2000 0 2000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 350 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0350	F

MAP NUMBER
08041C0350 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

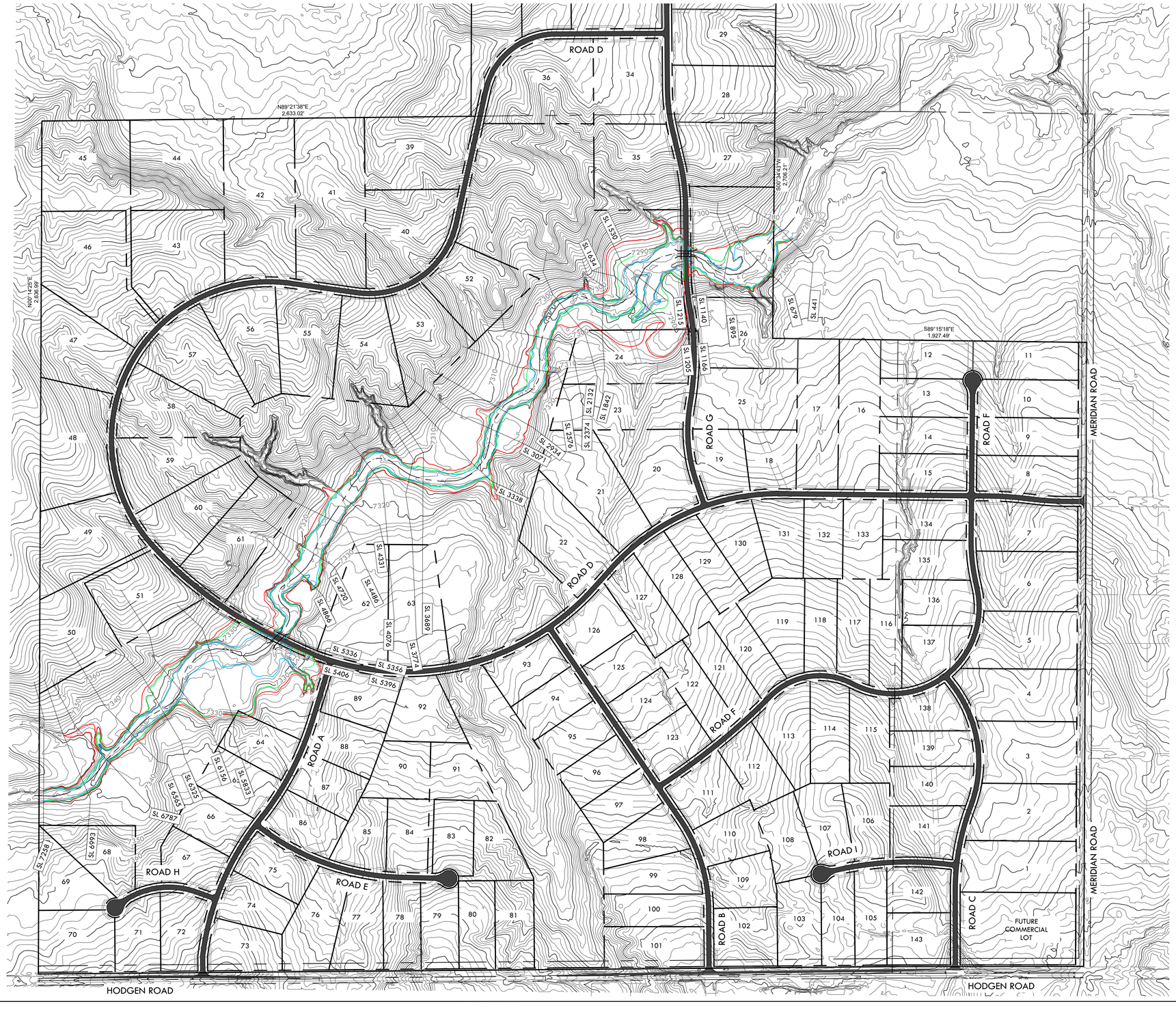
APPENDIX D

10, 50, 500 YEAR FLOODPLAIN – PROPOSED CONDITION

FEMA CLOMR SUBMITTAL

MCCUNE RANCH SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO



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FOR: PT MCCUNE, LLC
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MONUMENT, COLORADO 80132

NO.	REVISIONS
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DATE: 11/16/18
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388

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APPENDIX E

HYDROLOGY - EXISTING CONDITIONS DRAINAGE PLAN

PRELIMINARY PLAN SET

MCCUNE RANCH SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO

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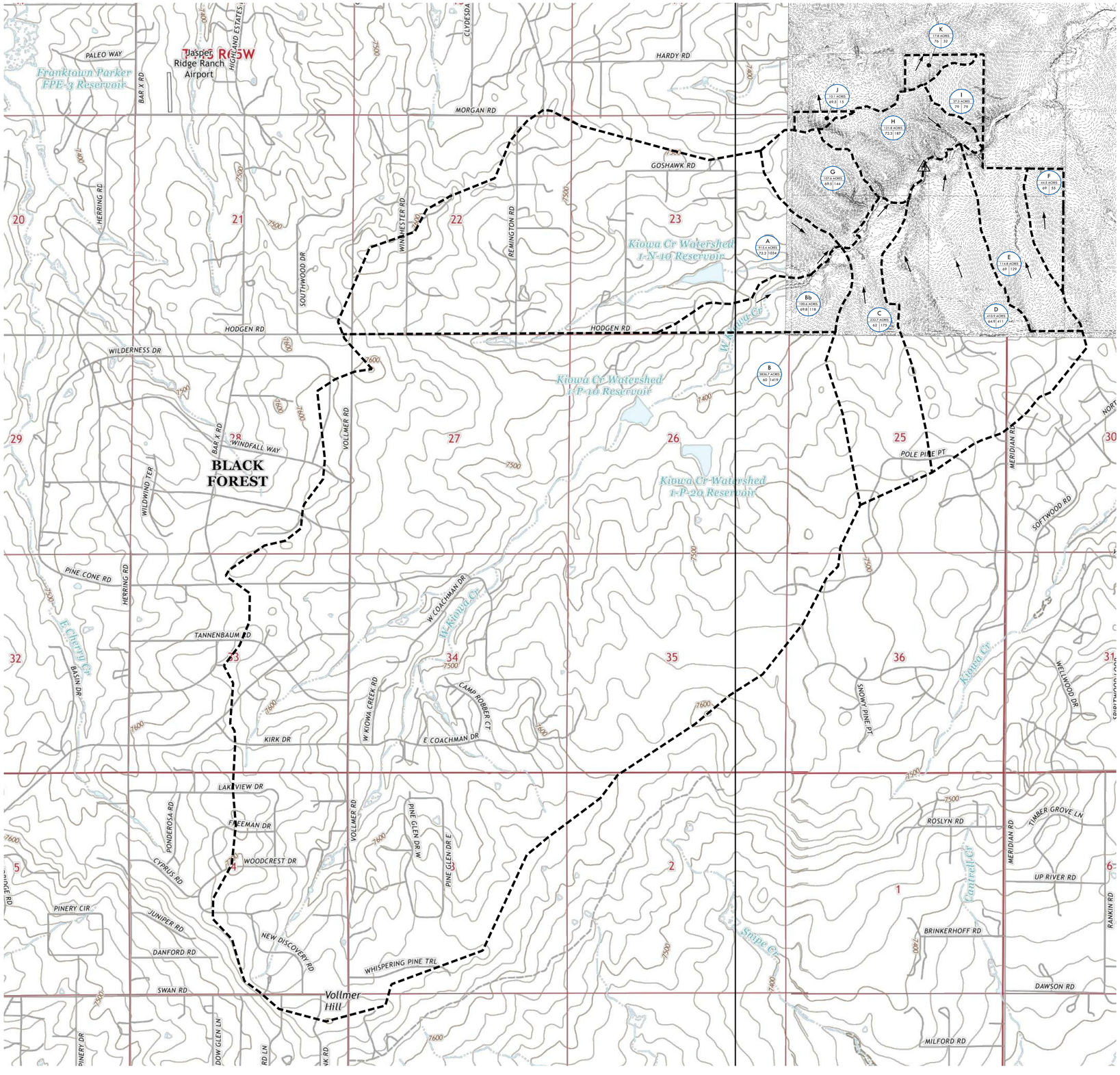

EXISTING STORMWATER RUNOFF TABLE

BASIN	BASIN AREA (ACRES)	T_C	CURVE NUMBER	Q_{100}
A	915.4	52.59	72.2	1034
B	3836.7	88.43	60.0	1419
Bb	100.6	39.85	69.8	118
C	232.7	41.08	62.0	175
D	410.9	44.33	64.9	411
E	114.8	42.34	69.0	129
F	44.5	37.08	69.0	55
G	107.6	33.90	69.5	144
H	121.8	33.64	72.3	187
I	37.5	31.77	79.0	79
J	10.1	29.24	69.5	15
K	17.8	34.56	76.0	32
	5950.4			

LEGEND

- PROPERTY BOUNDARY LINE
- 5540 EXISTING CONTOUR
- DRAINAGE BASIN BOUNDARY

A — BASIN NAME
4.09 ACRES — DRAINAGE BASIN SIZE
4.73 | 14.05 — 100-YEAR RUNOFF | CURVE NUMBER
FLOW ARROWS

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EXISTING DRAINAGE PLAN - OVERALL

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ELBERT, COLORADO 80106

FOR: PT MCCUNE, LLC
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MONUMENT, COLORADO 80132

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DRAWN BY: JCP
CHECKED BY: LPV
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PRELIMINARY PLAN SET

MCCUNE RANCH SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO

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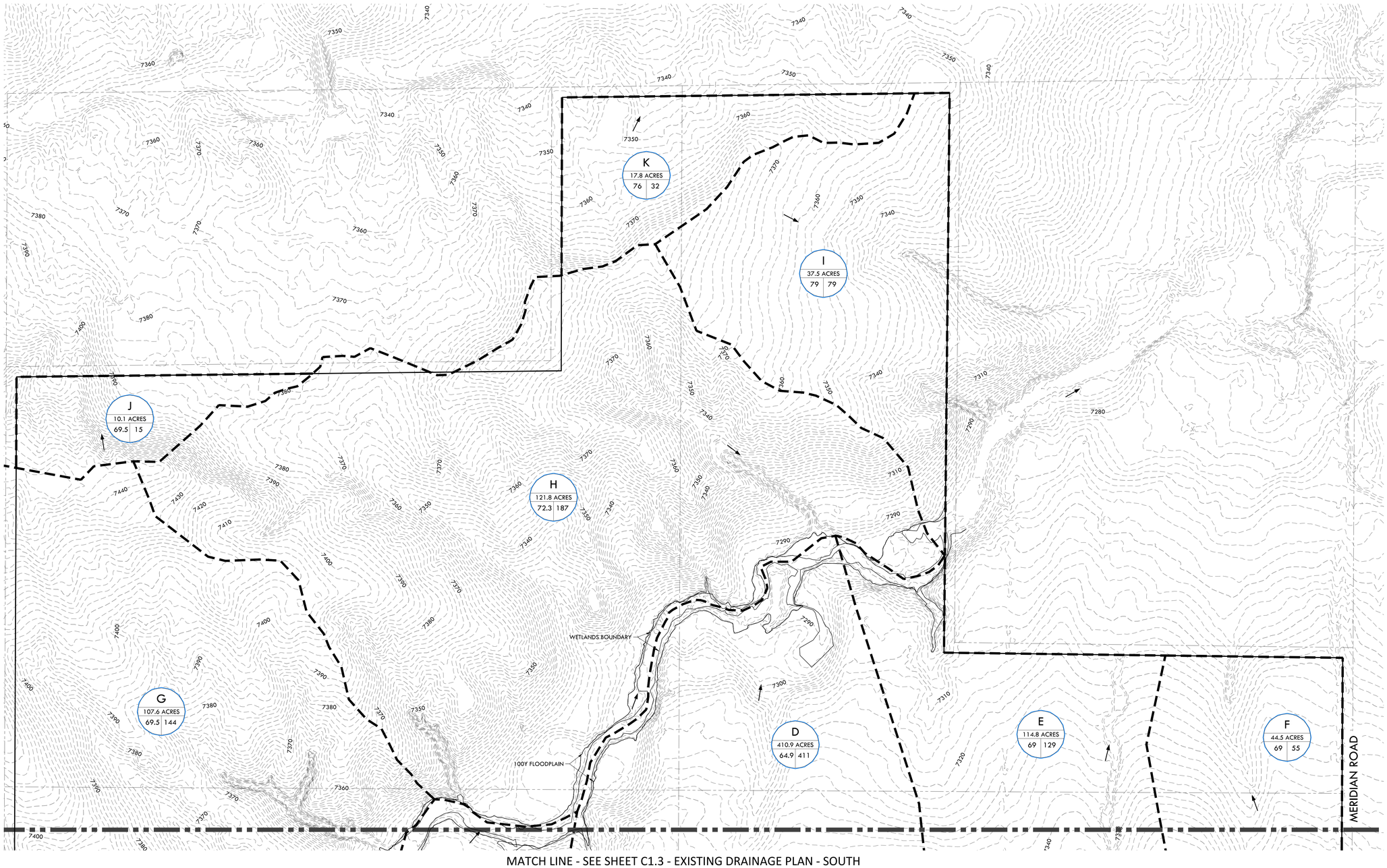

MATCH LINE - SEE SHEET C1.3 - EXISTING DRAINAGE PLAN - SOUTH

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EXISTING DRAINAGE PLAN - NORTH

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CHECKED BY: LPV
JOB #: 49388

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PRELIMINARY PLAN SET

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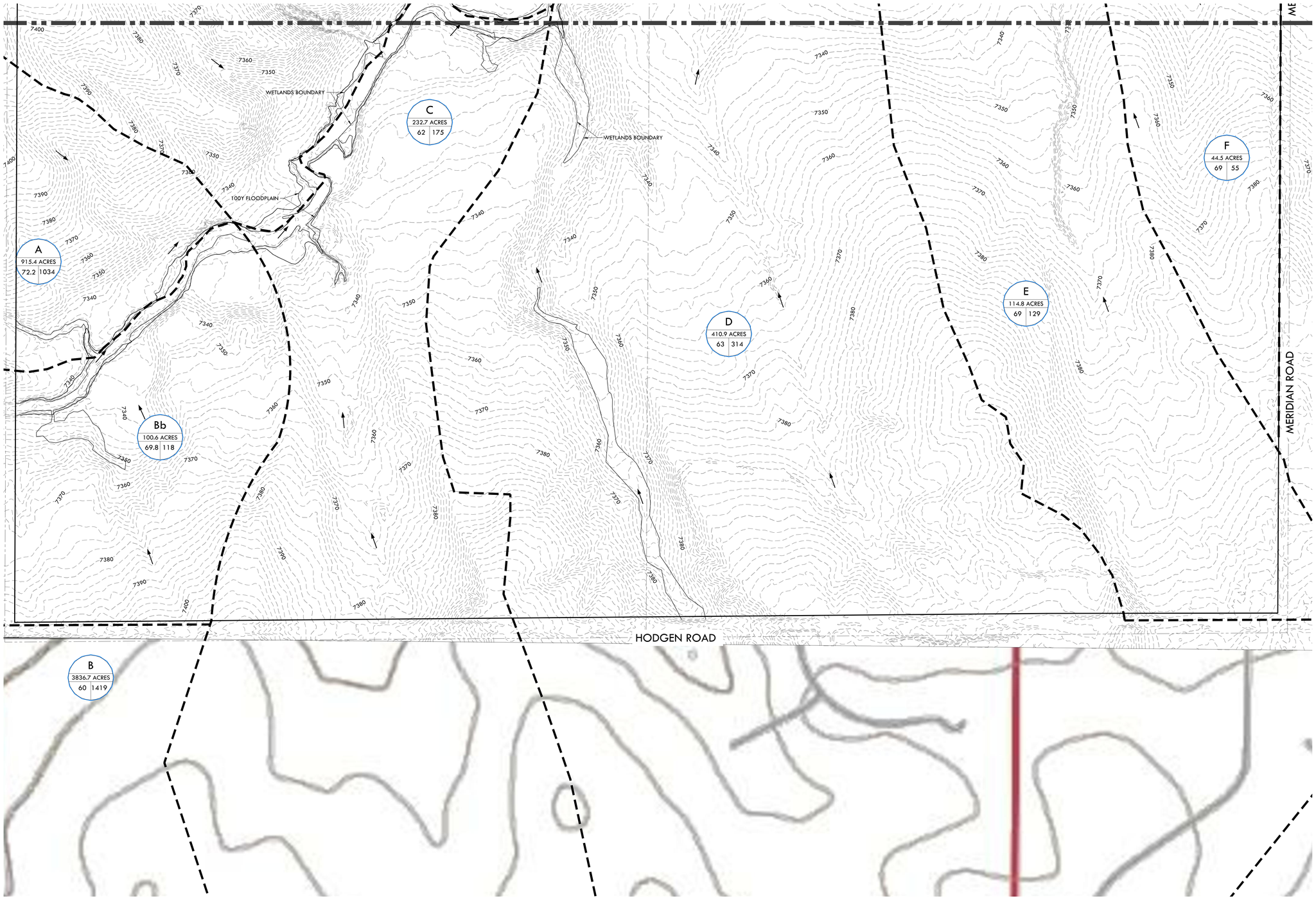
0' 200' 400'

COLORADO 811 KNOW WHAT'S BELOW. CALL BEFORE YOU DIG.

MATCH LINE - SEE SHEET C1.2 - EXISTING DRAINAGE PLAN - NORTH



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JOB #: 49388

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APPENDIX E

HYDROLOGY - PROPOSED CONDITIONS DRAINAGE PLAN

PRELIMINARY PLAN SET

MCCUNE RANCH SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO

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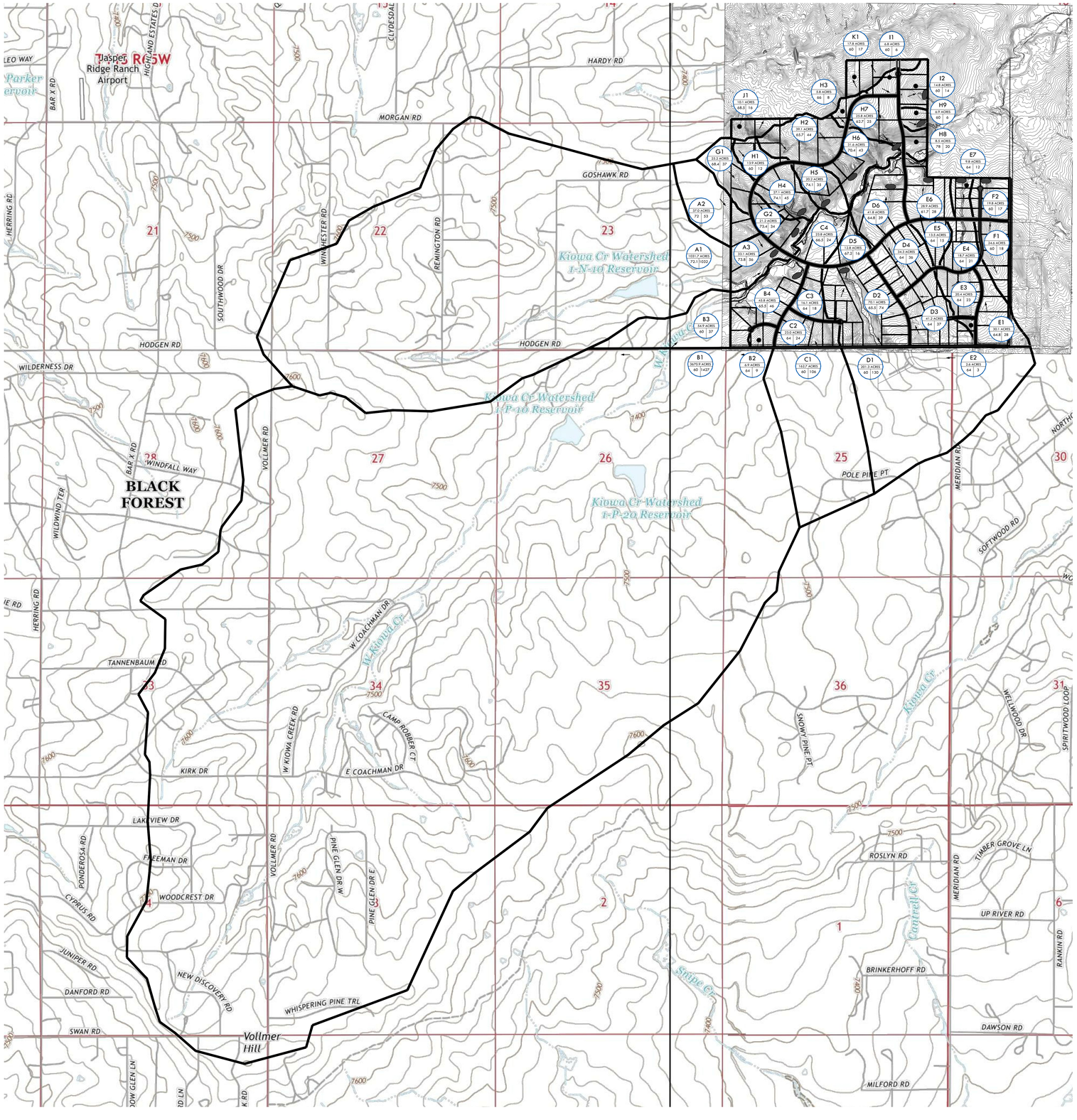

PROPOSED STORMWATER RUNOFF

BASIN	DESIGN POINT	BASIN AREA (ACRES)	T_C	CURVE NUMBER	Q_{100}
A1	1	1031.7	57.1	72.1	1093
A2	2	37.0	37.0	72.0	53
A3	3	33.1	32.5	73.8	56
B1	4	3670.5	82.8	60.0	1427
B2	5	6.9	22.3	64.0	9
B3	6	54.9	38.4	60.0	37
B4	7	45.8	39.8	65.5	44
C1	8	162.7	40.6	60.0	106
C2	9	23.0	31.4	64.0	24
C3	10	16.1	28.2	64.0	18
C4	11	23.8	40.6	66.5	24
D1	12	201.3	41.1	60.0	130
D2	13	70.1	35.0	65.5	74
D3	14	41.2	38.9	64.0	37
D4	15	34.3	30.1	64.0	36
D5	16	12.8	30.3	67.2	16
D6	17	41.8	39.1	64.8	39
E1	18	30.1	39.6	64.8	28
E2	19	2.6	22.2	64.0	3
E3	20	20.4	27.2	64.0	23
E4	21	18.7	28.0	64.0	21
E5	22	13.5	27.0	64.0	15
E6	23	28.9	28.1	61.7	28
E7	24	9.8	24.3	64.0	12
F1	25	24.6	35.6	60.0	18
F2	26	19.8	27.1	60.0	17
G1	27	25.2	26.6	68.4	37
G2	28	21.2	34.1	73.4	34
H1	29	13.9	26.9	60.0	12
H2	30	39.1	32.8	65.7	44
H3	31	5.8	23.9	66.0	8
H4	32	27.1	33.4	74.1	45
H5	33	20.2	32.2	74.1	35
H6	34	31.6	35.2	70.4	43
H7	35	25.8	30.8	62.7	25
H8	36	8.5	25.5	78.0	20
H9	37	6.9	24.0	60.0	6
I1	38	6.8	23.8	60.0	6
I2	39	14.8	23.5	60.0	14
J1	40	10.1	22.9	68.5	16
K1	41	17.8	24.0	60.0	17
		5950.2			

WATER QUALITY POND SUMMARY

POND NUMBER	REQUIRED VOLUME (ACRE-FEET)
1	0.211
2	0.423
3	0.304
4	0.504
5	0.165
6	0.638
7	0.134
8	0.132
9	0.110
10	0.051
11	0.157
12	0.077
13	0.021
14	0.065

LEGEND

- PROPERTY BOUNDARY LINE
- 5540 PROPOSED CONTOUR
- 5540 EXISTING CONTOUR
- DRAINAGE BASIN BOUNDARY

A — BASIN NAME
4.09 ACRES — DRAINAGE BASIN SIZE
4.73 | 14.05 — 100-YEAR RUNOFF
CURVE NUMBER
FLOW ARROWS

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PROPOSED DRAINAGE PLAN - OVERALL

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ELBERT, COLORADO 80106

FOR: PT MCCUNE, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

NO.	REVISIONS
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DATE: 10/12/2018
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388

C2.1

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Friday, October 12, 2018 12:18:50 PM
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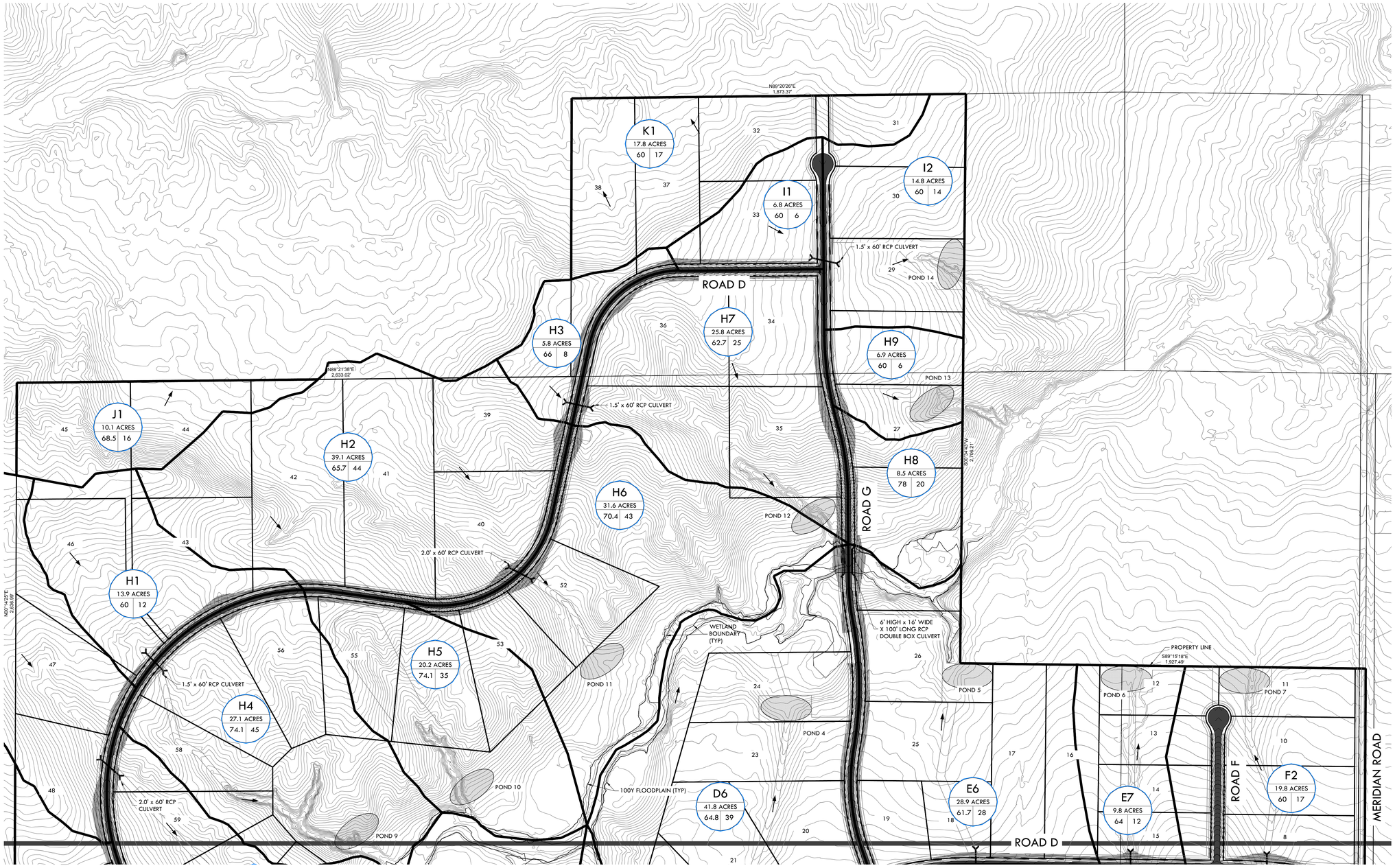
PRELIMINARY PLAN SET

MCCUNE RANCH SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO

0' 200' 400'



MATCH LINE - SEE SHEET C2.3 - PROPOSED DRAINAGE PLAN - SOUTH

VERTEX®
2420 W. 26th Avenue, Suite 100-D | Denver, CO 80211
Main: 303.623.9116 | VERTEXENG.COM

PROPOSED DRAINAGE PLAN - NORTH

SITE: 17480 MERIDIAN ROAD
ELBERT, COLORADO 80106

FOR: PT MCCUNE, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	
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DATE: 10/12/2018
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388

C2.2

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Friday, October 12, 2018 12:19:52 PM
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PRELIMINARY PLAN SET

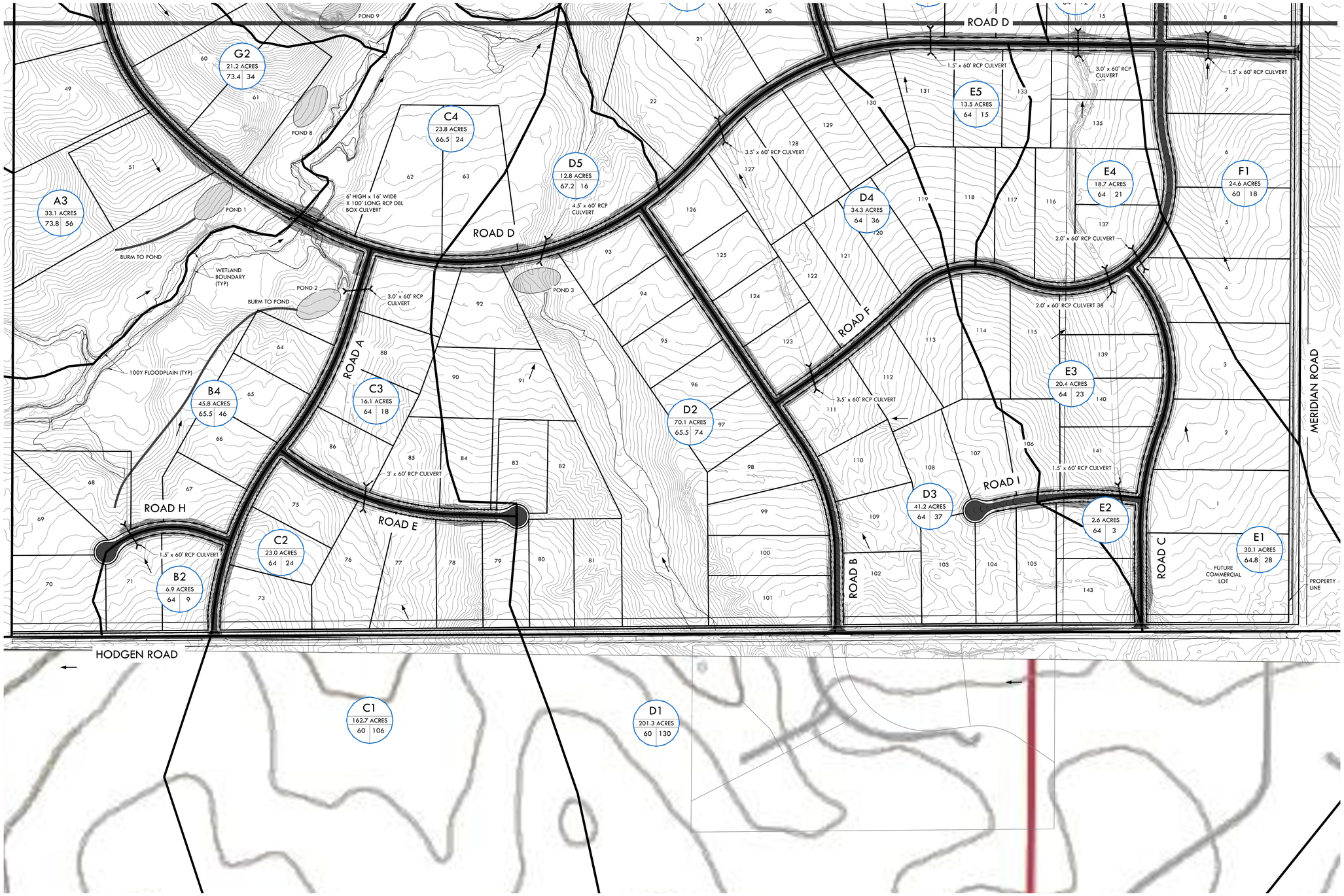
MCCUNE RANCH SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO

0' 200' 400'

COLORADO 811 KNOW WHAT'S BELOW. CALL BEFORE YOU DIG.

MATCH LINE - SEE SHEET C2.2 - PROPOSED DRAINAGE PLAN - NORTH



VERTEX®
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Main: 303.623.9116 | VERTEXENG.COM

PROPOSED DRAINAGE PLAN - SOUTH

SITE: 17480 MERIDIAN ROAD
ELBERT, COLORADO 80106

FOR: PT MCCUNE, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

NO.	REVISIONS
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DATE: 10/12/2018
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388

C2.3

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Friday, October 12, 2018 12:20:20 PM
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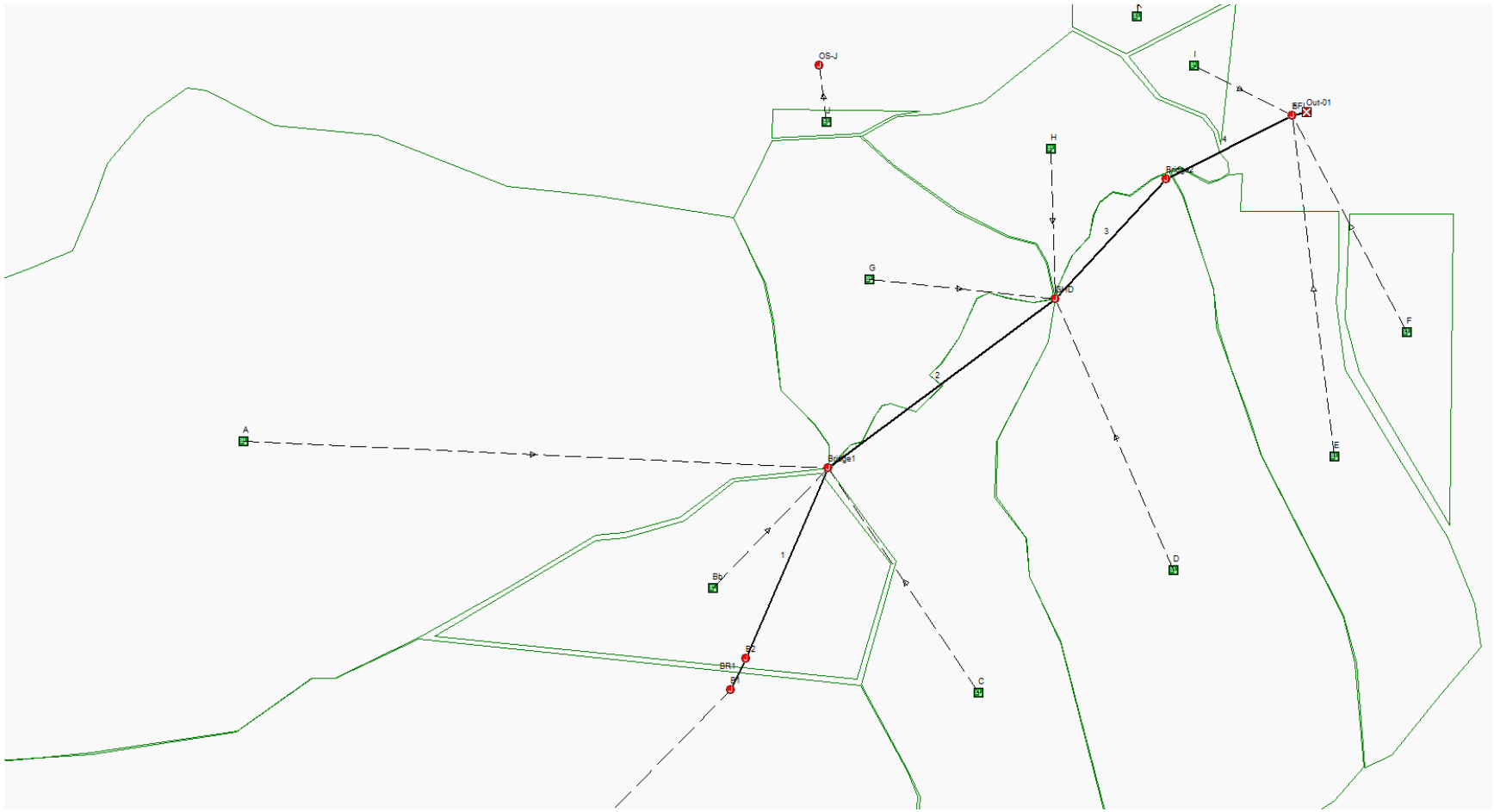
APPENDIX E

HYDROLOGY - STORM MODEL SCHAMATIC



Autodesk Storm and Sanitary Analysis

APPENDIX E

HYDROLOGY 10 YEAR OUTPUTS

SN	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Channel Type	Channel Height (ft)	Channel Width (ft)	Left Overbank Manning's Roughness	Channel Manning's Roughness	Right Overbank Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	Lengthening Factor	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Max Flow Velocity (ft/sec)	Travel Time (min)	Design Flow Capacity (cfs)	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged (min)	Max Flow Depth (ft)	Reported Condition
1	B2	Bridge1	2473.30	7375.00	0.00	7320.00	0.00	55.00	2.2200	Trapezoidal	10.000	100.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	413.00	0 13:12	8.11	5.08	12341.57	0.03	0.19	0.00	1.86	Calculated
2	Bridge1	GHD	2839.57	7320.00	0.00	7300.00	0.00	20.00	0.7000	Trapezoidal	10.000	100.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	765.88	0 12:48	6.48	7.30	6945.70	0.11	0.35	0.00	3.49	Calculated
3	GHD	Bridge2	1717.53	7300.00	0.00	7285.00	0.00	15.00	0.8700	Trapezoidal	10.000	100.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	913.05	0 12:45	7.33	3.91	7734.30	0.12	0.36	0.00	3.62	Calculated
4	Bridge2	EFI	1277.36	7285.00	0.00	7265.00	0.00	20.00	1.5700	Trapezoidal	10.000	100.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	912.53	0 12:47	9.03	2.36	10355.85	0.09	0.31	0.00	3.11	Calculated
5	EFI	Out-01	70.66	7265.00	0.00	7260.00	0.00	5.00	7.0800	Trapezoidal	10.000	100.00	0.0000	0.0320	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	973.84	0 12:45	16.72	0.07	24079.28	0.04	0.21	0.00	2.06	Calculated
6	B1	B2	492.55	7380.00	0.00	7375.00	0.00	5.00	1.0200	Trapezoidal	10.000	100.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	413.14	0 13:10	6.15	1.33	8338.49	0.05	0.23	0.00	2.30	Calculated

SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation	Boundary Type	Flap Gate	Fixed Water Elevation	Peak Inflow	Peak Lateral Inflow	Maximum HGL Depth Attained	Maximum HGL Elevation Attained
					(ft)			(ft)	(cfs)	(cfs)	(ft)	(ft)
1	Out-01	8374.32	12780.61		7260.00	NORMAL	NO		973.84	0.00	2.06	7262.06

SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (ft)	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Maximum HGL Elevation Attained (ft)	Maximum HGL Depth Attained (ft)	Maximum Surcharge Depth Attained (ft)	Minimum Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Maximum HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-inches)	Total Time Flooded (minutes)
1	B1	2605.65	6993.89		7380.00	7390.00	10.00	7380.00	0.00	7390.00	0.00	0.00	0.00	413.10	413.10	7382.30	2.30	0.00	7.70	7380.56	0.56	0 13:10	0 00:00	0.00	0.00
2	B2	2759.22	7305.54		7375.00	7385.00	10.00	7375.00	0.00	7385.00	0.00	0.00	0.00	413.14	0.00	7377.30	2.30	0.00	7.70	7375.56	0.56	0 13:10	0 00:00	0.00	0.00
3	Bridge1	3581.01	9211.93		7320.00	7330.00	10.00	7320.00	0.00	7330.00	0.00	0.00	0.00	768.43	570.54	7323.50	3.50	0.00	6.50	7320.83	0.83	0 12:43	0 00:00	0.00	0.00
4	Bridge2	6966.73	12107.23		7285.00	7295.00	10.00	7285.00	0.00	7295.00	0.00	0.00	0.00	913.05	0.00	7288.62	3.62	0.00	6.38	7285.83	0.83	0 12:45	0 00:00	0.00	0.00
5	EFI	8233.34	12739.61		7265.00	7275.00	10.00	7265.00	0.00	7275.00	0.00	0.00	0.00	973.86	112.40	7268.12	3.12	0.00	6.88	7265.71	0.71	0 12:47	0 00:00	0.00	0.00
6	GHD	5856.17	10910.99		7300.00	7310.00	10.00	7300.00	0.00	7310.00	0.00	0.00	0.00	914.22	239.09	7303.62	3.62	0.00	6.38	7300.84	0.84	0 12:42	0 00:00	0.00	0.00
7	OS-J	3492.52	13241.98		7350.00	7360.00	10.00	7350.00	0.00	7360.00	0.00	0.00	0.00	6.22	6.22	7350.00	0.00	0.00	10.00	7350.00	0.00	0 00:00	0 00:00	0.00	0.00
8	OS-K	6763.12	14398.66		7313.00	7323.00	10.00	7313.00	0.00	7323.00	0.00	0.00	0.00	15.77	15.77	7313.00	0.00	0.00	10.00	7313.00	0.00	0 00:00	0 00:00	0.00	0.00

SN	Element ID	Description	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01		Time Series	TS-01	Cumulative	inches	Colorado	El Paso	10	3.2	SCS Type II 24-hr

SN	Element ID	Description	Area	Drainage Node ID	Weighted Curve Number	Rain Gage ID	Total Precipitation	Total Runoff	Peak Runoff	Time of Concentration
			(acres)				(inches)	(inches)	(cfs)	(days hh:mm:ss)
1	A		915.40	Bridge1	72.24	Rain Gage-01	3.20	0.94	471.73	0 00:52:35
2	B		3836.70	B1	60.00	Rain Gage-01	3.20	0.41	413.10	0 01:28:25
3	Bb		100.60	Bridge1	69.75	Rain Gage-01	3.20	0.82	52.22	0 00:39:51
4	C		232.70	Bridge1	62.00	Rain Gage-01	3.20	0.48	54.29	0 00:41:04
5	D		410.90	GHD	63.38	Rain Gage-01	3.20	0.53	107.10	0 00:44:19
6	E		114.80	EFI	69.00	Rain Gage-01	3.20	0.78	53.60	0 00:42:20
7	F		44.50	EFI	69.00	Rain Gage-01	3.20	0.78	22.85	0 00:37:04
8	G		107.60	GHD	69.50	Rain Gage-01	3.20	0.80	61.22	0 00:33:54
9	H		121.80	GHD	72.00	Rain Gage-01	3.20	0.93	84.44	0 00:33:38
10	I		37.50	EFI	79.00	Rain Gage-01	3.20	1.34	41.86	0 00:31:46
11	J		10.10	OS-J	69.50	Rain Gage-01	3.20	0.80	6.34	0 00:29:14
12	K		17.80	OS-K	76.00	Rain Gage-01	3.20	1.15	15.78	0 00:34:33

APPENDIX E

HYDROLOGY 50 YEAR OUTPUTS

SN	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Channel Type	Channel Height	Channel Width	Left Overbank Manning's Roughness	Channel Manning's Roughness	Right Overbank Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate	Lengthening Factor	Peak Flow	Time of Peak Flow Occurrence	Max Flow Velocity	Travel Time	Design Flow Capacity	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged	Max Flow Depth	Reported Condition
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(ft)	(ft)							(cfs)			(cfs)	(days hh:mm)	(ft/sec)	(min)	(cfs)			(min)	(ft)	
1	B2	Bridge1	2473.30	7375.00	0.00	7320.00	0.00	55.00	2.2200	Trapezoidal	10.000	100.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	1079.89	0 13:03	10.75	3.83	12341.57	0.09	0.31	0.00	3.10	Calculated
2	Bridge1	GHD	2839.57	7320.00	0.00	7300.00	0.00	20.00	0.7000	Trapezoidal	10.000	100.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	1754.14	0 12:48	8.11	5.84	6945.70	0.25	0.53	0.00	5.27	Calculated
3	GHD	Bridge2	1717.53	7300.00	0.00	7285.00	0.00	15.00	0.8700	Trapezoidal	10.000	100.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	2043.48	0 12:44	9.12	3.14	7734.30	0.26	0.54	0.00	5.39	Calculated
4	Bridge2	EFI	1277.36	7285.00	0.00	7265.00	0.00	20.00	1.5700	Trapezoidal	10.000	100.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	2041.75	0 12:46	11.28	1.89	10355.85	0.20	0.47	0.00	4.68	Calculated
5	EFI	Out-01	70.66	7265.00	0.00	7260.00	0.00	5.00	7.0800	Trapezoidal	10.000	100.00	0.0000	0.0320	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	2153.48	0 12:44	21.07	0.06	24079.28	0.09	0.31	0.00	3.14	Calculated
6	B1	B2	492.55	7380.00	0.00	7375.00	0.00	5.00	1.0200	Trapezoidal	10.000	100.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	1081.85	0 13:00	8.10	1.01	8338.49	0.13	0.38	0.00	3.80	Calculated

SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation	Boundary Type	Flap Gate	Fixed Water Elevation	Peak Inflow	Peak Lateral Inflow	Maximum HGL Depth Attained	Maximum HGL Elevation Attained
					(ft)			(ft)	(cfs)	(cfs)	(ft)	(ft)
1	Out-01	8374.32	12780.61		7260.00	NORMAL	NO		2153.48	0.00	3.14	7263.14

SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (ft)	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Maximum HGL Elevation Attained (ft)	Maximum HGL Depth Attained (ft)	Maximum Surcharge Depth Attained (ft)	Minimum Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Maximum HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-inches)	Total Time Flooded (minutes)
1	B1	2605.65	6993.89		7380.00	7390.00	10.00	7380.00	0.00	7390.00	0.00	0.00	0.00	1082.54	1082.54	7383.80	3.80	0.00	6.20	7380.83	0.83	0 13:00	0 00:00	0.00	0.00
2	B2	2759.22	7305.54		7375.00	7385.00	10.00	7375.00	0.00	7385.00	0.00	0.00	0.00	1081.85	0.00	7378.80	3.80	0.00	6.20	7375.83	0.83	0 13:00	0 00:00	0.00	0.00
3	Bridge1	3581.01	9211.93		7320.00	7330.00	10.00	7320.00	0.00	7330.00	0.00	0.00	0.00	1753.62	1086.05	7325.28	5.28	0.00	4.72	7321.18	1.18	0 12:43	0 00:00	0.00	0.00
4	Bridge2	6966.73	12107.23		7285.00	7295.00	10.00	7285.00	0.00	7295.00	0.00	0.00	0.00	2042.48	0.00	7290.39	5.39	0.00	4.61	7286.18	1.18	0 12:44	0 00:00	0.00	0.00
5	EFI	8233.34	12739.61		7265.00	7275.00	10.00	7265.00	0.00	7275.00	0.00	0.00	0.00	2153.48	210.85	7269.68	4.68	0.00	5.32	7266.01	1.01	0 12:46	0 00:00	0.00	0.00
6	GHD	5856.17	10910.99		7300.00	7310.00	10.00	7300.00	0.00	7310.00	0.00	0.00	0.00	2043.84	500.89	7305.40	5.40	0.00	4.60	7301.19	1.19	0 12:42	0 00:00	0.00	0.00
7	OS-J	3492.52	13241.98		7350.00	7360.00	10.00	7350.00	0.00	7360.00	0.00	0.00	0.00	12.15	12.15	7350.00	0.00	0.00	10.00	7350.00	0.00	0 00:00	0 00:00	0.00	0.00
8	OS-K	6763.12	14398.66		7313.00	7323.00	10.00	7313.00	0.00	7323.00	0.00	0.00	0.00	26.71	26.71	7313.00	0.00	0.00	10.00	7313.00	0.00	0 00:00	0 00:00	0.00	0.00

SN	Element ID	Description	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01		Time Series	TS-01	Cumulative	inches	Colorado	El Paso	50	4.2	SCS Type II 24-hr

SN	Element ID	Description	Area	Drainage Node ID	Weighted Curve Number	Rain Gage ID	Total Precipitation	Total Runoff	Peak Runoff	Time of Concentration
			(acres)				(inches)	(inches)	(cfs)	(days hh:mm:ss)
1	A		915.40	Bridge1	72.24	Rain Gage-01	4.20	1.62	864.13	0 00:52:35
2	B		3836.70	B1	60.00	Rain Gage-01	4.20	0.86	1083.98	0 01:28:25
3	Bb		100.60	Bridge1	69.75	Rain Gage-01	4.20	1.45	101.02	0 00:39:51
4	C		232.70	Bridge1	62.00	Rain Gage-01	4.20	0.97	135.73	0 00:41:04
5	D		410.90	GHD	63.38	Rain Gage-01	4.20	1.05	252.85	0 00:44:19
6	E		114.80	EFI	69.00	Rain Gage-01	4.20	1.40	105.90	0 00:42:20
7	F		44.50	EFI	69.00	Rain Gage-01	4.20	1.40	45.02	0 00:37:04
8	G		107.60	GHD	69.50	Rain Gage-01	4.20	1.43	118.88	0 00:33:54
9	H		121.80	GHD	72.00	Rain Gage-01	4.20	1.60	154.65	0 00:33:38
10	I		37.50	EFI	79.00	Rain Gage-01	4.20	2.13	67.77	0 00:31:46
11	J		10.10	OS-J	69.50	Rain Gage-01	4.20	1.43	12.30	0 00:29:14
12	K		17.80	OS-K	76.00	Rain Gage-01	4.20	1.89	26.86	0 00:34:33

APPENDIX E

HYDROLOGY 100 YEAR OUTPUTS

SN	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Channel Type	Channel Height	Channel Width	Left Overbank Manning's Roughness	Channel Manning's Roughness	Right Overbank Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate	Lengthening Factor	Peak Flow	Time of Peak Flow Occurrence	Max Flow Velocity	Travel Time	Design Flow Capacity	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged	Max Flow Depth	Reported Condition
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(ft)	(ft)							(cfs)			(cfs)	(days hh:mm)	(ft/sec)	(min)	(cfs)			(min)	(ft)	
1	B2	Bridge1	2473.30	7375.00	0.00	7320.00	0.00	55.00	2.2200	Trapezoidal	10.000	100.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	1414.90	0 13:02	11.60	3.55	12341.57	0.11	0.36	0.00	3.56	Calculated
2	Bridge1	GHD	2839.57	7320.00	0.00	7300.00	0.00	20.00	0.7000	Trapezoidal	10.000	100.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	2224.57	0 12:48	8.65	5.47	6945.70	0.32	0.59	0.00	5.91	Calculated
3	GHD	Bridge2	1717.53	7300.00	0.00	7285.00	0.00	15.00	0.8700	Trapezoidal	10.000	100.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	2582.92	0 12:44	9.71	2.95	7734.30	0.33	0.60	0.00	6.03	Calculated
4	Bridge2	EFI	1277.36	7285.00	0.00	7265.00	0.00	20.00	1.5700	Trapezoidal	10.000	100.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	2582.47	0 12:45	12.02	1.77	10355.85	0.25	0.52	0.00	5.25	Calculated
5	EFI	Out-01	70.66	7265.00	0.00	7260.00	0.00	5.00	7.0800	Trapezoidal	10.000	100.00	0.0000	0.0320	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	2717.57	0 12:43	22.49	0.05	24079.28	0.11	0.35	0.00	3.54	Calculated
6	B1	B2	492.55	7380.00	0.00	7375.00	0.00	5.00	1.0200	Trapezoidal	10.000	100.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	1416.87	0 13:00	8.72	0.94	8338.49	0.17	0.43	0.00	4.35	Calculated

SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation (ft)	Boundary Type	Flap Gate	Fixed Water Elevation (ft)	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Maximum HGL Depth Attained (ft)	Maximum HGL Elevation Attained (ft)
1	Out-01	8374.32	12780.61		7260.00	NORMAL	NO		2717.57	0.00	3.54	7263.54

SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (ft)	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Maximum HGL Elevation Attained (ft)	Maximum HGL Depth Attained (ft)	Maximum Surcharge Depth Attained (ft)	Minimum Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Maximum HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-inches)	Total Time Flooded (minutes)
1	B1	2605.65	6993.89		7380.00	7390.00	10.00	7380.00	0.00	7390.00	0.00	0.00	0.00	1417.40	1417.40	7384.35	4.35	0.00	5.65	7380.93	0.93	0 13:00	0 00:00	0.00	0.00
2	B2	2759.22	7305.54		7375.00	7385.00	10.00	7375.00	0.00	7385.00	0.00	0.00	0.00	1416.87	0.00	7379.35	4.35	0.00	5.65	7375.93	0.93	0 13:00	0 00:00	0.00	0.00
3	Bridge1	3581.01	9211.93		7320.00	7330.00	10.00	7320.00	0.00	7330.00	0.00	0.00	0.00	2228.19	1311.24	7325.92	5.92	0.00	4.08	7321.31	1.31	0 12:43	0 00:00	0.00	0.00
4	Bridge2	6966.73	12107.23		7285.00	7295.00	10.00	7285.00	0.00	7295.00	0.00	0.00	0.00	2582.92	0.00	7291.04	6.04	0.00	3.96	7286.31	1.31	0 12:44	0 00:00	0.00	0.00
5	EFI	8233.34	12739.61		7265.00	7275.00	10.00	7265.00	0.00	7275.00	0.00	0.00	0.00	2717.56	253.86	7270.25	5.25	0.00	4.75	7266.12	1.12	0 12:45	0 00:00	0.00	0.00
6	GHD	5856.17	10910.99		7300.00	7310.00	10.00	7300.00	0.00	7310.00	0.00	0.00	0.00	2584.13	619.98	7306.04	6.04	0.00	3.96	7301.32	1.32	0 12:42	0 00:00	0.00	0.00
7	OS-J	3492.52	13241.98		7350.00	7360.00	10.00	7350.00	0.00	7360.00	0.00	0.00	0.00	14.79	14.79	7350.00	0.00	0.00	10.00	7350.00	0.00	0 00:00	0 00:00	0.00	0.00
8	OS-K	6763.12	14398.66		7313.00	7323.00	10.00	7313.00	0.00	7323.00	0.00	0.00	0.00	31.42	31.42	7313.00	0.00	0.00	10.00	7313.00	0.00	0 00:00	0 00:00	0.00	0.00

SN	Element ID	Description	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01		Time Series	TS-01	Cumulative	inches	Colorado	El Paso	100	4.6	SCS Type II 24-hr

SN	Element ID	Description	Area	Drainage Node ID	Weighted Curve Number	Rain Gage ID	Total Precipitation	Total Runoff	Peak Runoff	Time of Concentration
			(acres)				(inches)	(inches)	(cfs)	(days hh:mm:ss)
1	A		915.40	Bridge1	72.24	Rain Gage-01	4.60	1.91	1033.95	0 00:52:35
2	B		3836.70	B1	60.00	Rain Gage-01	4.60	1.07	1418.53	0 01:28:25
3	Bb		100.60	Bridge1	69.75	Rain Gage-01	4.60	1.73	122.14	0 00:39:51
4	C		232.70	Bridge1	62.00	Rain Gage-01	4.60	1.20	175.00	0 00:41:04
5	D		410.90	GHD	63.38	Rain Gage-01	4.60	1.29	321.88	0 00:44:19
6	E		114.80	EFI	69.00	Rain Gage-01	4.60	1.67	129.05	0 00:42:20
7	F		44.50	EFI	69.00	Rain Gage-01	4.60	1.67	54.82	0 00:37:04
8	G		107.60	GHD	69.50	Rain Gage-01	4.60	1.71	144.23	0 00:33:54
9	H		121.80	GHD	72.00	Rain Gage-01	4.60	1.90	185.13	0 00:33:38
10	I		37.50	EFI	79.00	Rain Gage-01	4.60	2.46	78.56	0 00:31:46
11	J		10.10	OS-J	69.50	Rain Gage-01	4.60	1.71	14.89	0 00:29:14
12	K		17.80	OS-K	76.00	Rain Gage-01	4.60	2.21	31.51	0 00:34:33

APPENDIX E

HYDROLOGY 500 YEAR OUTPUTS

SN	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Channel Type	Channel Height	Channel Width	Left Overbank Manning's Roughness	Channel Manning's Roughness	Right Overbank Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate	Lengthening Factor	Peak Flow	Time of Peak Flow Occurrence	Max Flow Velocity	Travel Time	Design Flow Capacity	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged	Max Flow Depth	Reported Condition
			(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(ft)	(ft)							(cfs)			(cfs)	(days hh:mm)	(ft/sec)	(min)	(cfs)			(min)	(ft)	
1	B2	ABC	2473.30	7375.00	0.00	7320.00	0.00	55.00	2.2200	Trapezoidal	10.000	100.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	2380.62	0 13:01	13.38	3.08	12341.57	0.19	0.46	0.00	4.63	Calculated
2	Bridge1	GHD	2839.57	7320.00	0.00	7300.00	0.00	20.00	0.7000	Trapezoidal	10.000	100.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	3689.22	0 12:48	9.79	4.83	6945.70	0.52	0.74	0.00	7.39	Calculated
3	GHD	NUL	1717.53	7300.00	0.00	7285.00	0.00	15.00	0.8700	Trapezoidal	10.000	100.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	4290.31	0 12:43	10.97	2.61	7734.30	0.53	0.75	0.00	7.50	Calculated
4	Bridge2	EFI	1277.36	7285.00	0.00	7265.00	0.00	20.00	1.5700	Trapezoidal	10.000	100.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	4116.91	0 12:45	13.60	1.57	10355.85	0.40	0.66	0.00	6.55	Calculated
5	EFI	Out-01	70.66	7265.00	0.00	7260.00	0.00	5.00	7.0800	Trapezoidal	10.000	100.00	0.0000	0.0320	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	4315.11	0 12:42	25.55	0.05	24079.28	0.18	0.45	0.00	4.46	Calculated
6	B1	B2	492.55	7380.00	0.00	7375.00	0.00	5.00	1.0200	Trapezoidal	10.000	100.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	2380.05	0 13:00	10.03	0.82	8338.49	0.29	0.56	0.00	5.60	Calculated

SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation (ft)	Boundary Type	Flap Gate	Fixed Water Elevation (ft)	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Maximum HGL Depth Attained (ft)	Maximum HGL Elevation Attained (ft)
1	Out-01	8374.32	12780.61		7260.00	NORMAL	NO		4315.11	0.00	4.46	7264.46

SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (ft)	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Maximum HGL Elevation Attained (ft)	Maximum HGL Depth Attained (ft)	Maximum Surcharge Depth Attained (ft)	Minimum Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Maximum HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-inches)	Total Time Flooded (minutes)
1	ABC	3581.01	9211.93		7320.00	7330.00	10.00	7320.00	0.00	7330.00	0.00	0.00	0.00	3581.23	1916.62	7327.40	7.40	0.00	2.60	7321.62	1.62	0 12:43	0 00:00	0.00	0.00
2	B1	2605.65	6993.89		7380.00	7390.00	10.00	7380.00	0.00	7390.00	0.00	0.00	0.00	2380.33	2380.33	7385.60	5.60	0.00	4.40	7381.17	1.17	0 13:00	0 00:00	0.00	0.00
3	B2	2759.22	7305.54		7375.00	7385.00	10.00	7375.00	0.00	7385.00	0.00	0.00	0.00	2380.05	0.00	7380.60	5.60	0.00	4.40	7376.17	1.17	0 13:00	0 00:00	0.00	0.00
4	EFI	8233.34	12739.61		7265.00	7275.00	10.00	7265.00	0.00	7275.00	0.00	0.00	0.00	4315.12	368.59	7271.55	6.55	0.00	3.45	7266.39	1.39	0 12:45	0 00:00	0.00	0.00
5	GHD	5856.17	10910.99		7300.00	7310.00	10.00	7300.00	0.00	7310.00	0.00	0.00	0.00	4118.66	950.36	7307.51	7.51	0.00	2.49	7301.64	1.64	0 12:42	0 00:00	0.00	0.00
6	NUL	6966.73	12107.23		7285.00	7295.00	10.00	7285.00	0.00	7295.00	0.00	0.00	0.00	4117.50	0.00	7292.51	7.51	0.00	2.49	7286.62	1.62	0 12:43	0 00:00	0.00	0.00
7	OS-J	3492.52	13241.98		7350.00	7360.00	10.00	7350.00	0.00	7360.00	0.00	0.00	0.00	21.79	21.79	7350.00	0.00	0.00	10.00	7350.00	0.00	0 00:00	0 00:00	0.00	0.00
8	OS-K	6763.12	14398.66		7313.00	7323.00	10.00	7313.00	0.00	7323.00	0.00	0.00	0.00	43.54	43.54	7313.00	0.00	0.00	10.00	7313.00	0.00	0 00:00	0 00:00	0.00	0.00

SN	Element ID	Description	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-01		Time Series	TS-01	Cumulative	inches	Colorado	El Paso	500	5.61	SCS Type II 24-hr

SN	Element ID	Description	Area	Drainage Node ID	Weighted Curve Number	Rain Gage ID	Total Precipitation	Total Runoff	Peak Runoff	Time of Concentration
			(acres)				(inches)	(inches)	(cfs)	(days hh:mm:ss)
1	A		915.40	ABC	72.24	Rain Gage-01	5.61	2.70	1487.63	0 00:52:35
2	B		3836.70	B1	60.00	Rain Gage-01	5.61	1.67	2389.93	0 01:28:25
3	Bb		100.60	ABC	69.75	Rain Gage-01	5.61	2.48	180.26	0 00:39:51
4	C		232.70	ABC	62.00	Rain Gage-01	5.61	1.83	285.17	0 00:41:04
5	D		410.90	GHD	63.38	Rain Gage-01	5.61	1.94	513.33	0 00:44:19
6	E		114.80	EFI	69.00	Rain Gage-01	5.61	2.41	191.52	0 00:42:20
7	F		44.50	EFI	69.00	Rain Gage-01	5.61	2.41	81.20	0 00:37:04
8	G		107.60	GHD	69.50	Rain Gage-01	5.61	2.46	212.54	0 00:33:54
9	H		121.80	GHD	72.00	Rain Gage-01	5.61	2.68	265.85	0 00:33:38
10	I		37.50	EFI	79.00	Rain Gage-01	5.61	3.33	106.93	0 00:31:46
11	J		10.10	OS-J	69.50	Rain Gage-01	5.61	2.46	21.92	0 00:29:14
12	K		17.80	OS-K	76.00	Rain Gage-01	5.61	3.05	43.77	0 00:34:33

APPENDIX F

WEST KIOWA CREEK 100 YEAR PROPOSED CONDITIONS FLOODPLAIN REPORT

```
                    HEC-RAS HEC-RAS 5.0.5 June 2018
                      U.S. Army Corps of Engineers
                     Hydrologic Engineering Center
                           609 Second Street
                           Davis, California


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


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

PROJECT DATA
Project Title: McCune PC Fnl
Project File : McCunePCFnl.prj
Run Date and Time: 11/20/2018 12:50:39 PM

Project in English units

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PLAN DATA

Plan Title: McCunePC
Plan File : C:\Users\wonge\OneDrive\Documents\AWARE, LLC\Projects
2018\Vertex\McCune\10-17-18 Subittal Folder\McCunePCFnl.p02

           Geometry Title: McCunePCFnl
           Geometry File : C:\Users\wonge\OneDrive\Documents\AWARE, LLC\Projects
2018\Vertex\McCune\10-17-18 Subittal Folder\McCunePCFnl.g01

           Flow Title    : McCune PC
           Flow File     : C:\Users\wonge\OneDrive\Documents\AWARE, LLC\Projects
2018\Vertex\McCune\10-17-18 Subittal Folder\McCunePCFnl.f01

Plan Summary Information:
Number of:  Cross Sections =   34    Multiple Openings  =    0
            Culverts       =    2    Inline Structures  =    0
            Bridges        =    0    Lateral Structures =    0

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

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


*******************************************************************************
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FLOW DATA

Flow Title: McCune PC
Flow File : C:\Users\wonge\OneDrive\Documents\AWARE, LLC\Projects 2018\Vertex\McCune\10-17-18 Subittal Folder\McCunePCFnl.f01

Flow Data (cfs)
****

River	Reach	RS	100-yr	500-yr	10-yr	50-yr
Alignment - (1)	Alignment - (1)	7258.36	2228	3689	768	1754
Alignment - (1)	Alignment - (1)	3689.36	2584	4290	914	2044

****

Boundary Conditions
****

River	Reach	Profile	Upstream	Downstream
Alignment - (1)	Alignment - (1)	100-yr	Normal S = 0.009	

****

****

GEOMETRY DATA

Geometry Title: McCunePCFnl
Geometry File : C:\Users\wonge\OneDrive\Documents\AWARE, LLC\Projects 2018\Vertex\McCune\10-17-18 Subittal Folder\McCunePCFnl.g01

CROSS SECTION

RIVER: Alignment - (1)
REACH: Alignment - (1) RS: 7258.36

INPUT
Description:
Station Elevation Data num= 219

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7365.5	3.57	7365.41	5.49	7365.37	7.26	7365.35	10.78	7365.22
14.29	7365.15	17	7365.11	20.36	7365.07	25.91	7365.03	28.98	7365
35.48	7364.92	37.08	7364.98	51.12	7364.75	73.48	7364.37	85.14	7364
91.82	7363.76	92.21	7363.75	93.16	7363.74	97.54	7363.55	101.05	7363.51
104.64	7363.36	108.79	7363.33	110.73	7363.3	114.6	7363.26	119.42	7363.18
122.87	7363.11	131.99	7362.98	144.04	7362.53	157.29	7362	166.34	7361.56
173.8	7361.12	182.14	7360.64	193.13	7360	200.05	7359.35	202.75	7359.03
211.05	7358	224.06	7356.64	229.09	7356	240.93	7354.6	246.28	7354
255.91	7353.05	266.35	7352	293.33	7350.79	311.67	7350	338.06	7348.33
342.95	7348	347.68	7347.56	358.68	7346.52	364.36	7346	370.93	7345.53
388.08	7344.55	395.01	7344.12	397.82	7344	406.89	7343.42	416.03	7342.65
418.82	7342.43	420.89	7342.28	423.93	7342	430.02	7340.54	432.55	7340
433.41	7339.68	438.62	7338	444.29	7336.25	445.07	7336	453.98	7334.27
455.6	7334	455.86	7334	456.8	7333.99	457.51	7333.91	459.27	7333.73

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  459.73 7333.68  459.92 7333.64  459.95  7333.6  468.48 7333.56  474.34 7333.55
  476.67 7333.54  476.99 7333.59  477.58 7333.64  478.56 7333.69     480 7333.75
  483.36 7333.87  486.48    7334  491.17 7334.81  496.52    7336  498.49 7336.59
  502.75    7338  504.74 7338.61   508.7    7340  517.16  7341.8  517.88    7342
  548.66 7343.46  559.93    7344  560.49 7344.08  572.89    7346  578.26  7346.7
  588.23    7348  598.22 7349.21  606.95    7350     610 7350.24  612.13 7350.37
  617.33 7350.44  618.09 7350.46  620.86 7350.53  628.75 7350.42  629.25 7350.43
  632.76 7350.29  633.11 7350.29  637.88 7350.17  638.42 7350.15  642.15    7350
  646.46 7349.85  647.99 7349.75  651.86 7349.54  654.96 7349.36  660.27  7348.9
   662.6 7348.73  664.06 7348.62  671.97    7348  677.91  7347.7  678.93 7347.64
  681.96 7347.46  692.74 7346.85  703.59    7346   713.4 7345.32  730.53 7344.09
  731.09 7344.05  731.79    7344  736.42 7343.69  738.38 7343.73  742.44 7343.78
  746.64 7343.88  749.82    7344  750.93 7344.04  751.11 7344.04  756.25 7344.24
  756.52 7344.24  757.78 7344.25   765.8 7344.56  767.89 7344.56  774.03 7344.75
  779.65 7344.85  781.47 7344.84  785.82 7344.91  792.72    7345  797.44 7345.06
  802.11 7345.12  807.67 7345.23  808.98 7345.25  810.57 7345.26  811.57 7345.27
   814.7 7345.26  816.77 7345.21  818.37 7345.18  822.57 7345.07  830.31 7344.85
  835.28 7344.68  839.18 7344.59  840.99 7344.59  851.02 7344.23  852.21 7344.21
  852.52 7344.22  856.26    7344   859.2 7343.49  868.27    7342  874.19 7340.91
  876.37 7340.96   884.7  7340.3  887.28 7340.68   893.6 7341.41  894.38 7341.41
  896.66 7341.72  897.09 7341.74  897.16 7341.74  898.18    7342  903.52 7343.58
  904.98    7344  905.94 7344.28  911.67    7346   917.7 7347.44  920.35    7348
  924.53 7348.41  933.15  7349.2  935.62 7349.39  937.44 7349.45  938.09 7349.45
   943.1    7350   944.1 7350.09   944.4 7350.12  949.11 7350.54  951.81 7350.88
  952.96 7351.03  956.98 7351.37   960.5    7352  962.17 7352.14  983.76    7354
  990.86 7354.55 1009.95    7356 1026.64 7357.34 1034.55    7358 1047.28 7359.13
  1057.6    7360 1066.54 7360.84 1078.71    7362 1098.57 7363.85 1100.21    7364
 1101.92 7364.15  1106.3 7364.51 1120.51 7365.69 1124.49    7366 1132.84 7366.87
    1144    7368 1153.74  7369.2 1160.46    7370 1164.56 7370.48  1176.9 7371.93
  1177.3 7371.98  1177.5    7372 1177.81 7372.03 1182.62 7372.52

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  444.29     .03  496.52    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        444.29  496.52              255   265.2     301             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
     622 1182.62 7350.73       F

CROSS SECTION OUTPUT  Profile #500-yr
*****************************************************************************************
***********
* E.G. Elev (ft)         * 7341.91  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    2.29  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7339.62  * Reach Len. (ft)        *  255.00  *  265.20  *
 301.00  *
* Crit W.S. (ft)         * 7339.62  * Flow Area (sq ft)      *   18.16  *  281.64  *
  20.47  *
* E.G. Slope (ft/ft)     *0.006732  * Area (sq ft)           *   18.16  *  281.64  *
  20.47  *
* Q Total (cfs)          * 3689.00  * Flow (cfs)             *   87.36  * 3497.86  *
 103.79  *
* Top Width (ft)         *   73.99  * Top Width (ft)         *   10.68  *   52.23  *
  11.08  *
* Vel Total (ft/s)       *   11.52  * Avg. Vel. (ft/s)       *    4.81  *   12.42  *
   5.07  *
* Max Chl Dpth (ft)      *    6.08  * Hydr. Depth (ft)       *    1.70  *    5.39  *
   1.85  *
```

```
* Conv. Total (cfs)      * 44962.7  * Conv. (cfs)            *  1064.8  * 42633.0  *
 1265.0  *
* Length Wtd. (ft)       *  266.45  * Wetted Per. (ft)       *   11.20  *   52.71  *
  11.66  *
* Min Ch El (ft)         * 7333.54  * Shear (lb/sq ft)       *    0.68  *    2.25  *
   0.74  *
* Alpha                  *    1.11  * Stream Power (lb/ft s) *    3.28  *   27.89  *
   3.74  *
* Frctn Loss (ft)        *    1.65  * Cum Volume (acre-ft)   *   48.51  *   92.76  *
  27.49  *
* C & E Loss (ft)        *    0.08  * Cum SA (acres)         *   13.20  *   14.46  *
  11.44  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7337.07  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.83  * Wt. n-Val.             *          *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7336.24  * Reach Len. (ft)        *  255.00  *  265.20  *
 301.00  *
* Crit W.S. (ft)         * 7336.13  * Flow Area (sq ft)      *          *  105.23  *
   0.09  *
* E.G. Slope (ft/ft)     *0.008626  * Area (sq ft)           *          *  105.23  *
   0.09  *
* Q Total (cfs)          *  768.00  * Flow (cfs)             *          *  767.91  *
   0.09  *
* Top Width (ft)         *   52.99  * Top Width (ft)         *          *   52.19  *
   0.79  *
* Vel Total (ft/s)       *    7.29  * Avg. Vel. (ft/s)       *          *    7.30  *
   0.93  *
* Max Chl Dpth (ft)      *    2.70  * Hydr. Depth (ft)       *          *    2.02  *
   0.12  *
* Conv. Total (cfs)      *  8268.9  * Conv. (cfs)            *          *  8268.0  *
    0.9  *
* Length Wtd. (ft)       *  265.20  * Wetted Per. (ft)       *          *   52.67  *
   0.83  *
* Min Ch El (ft)         * 7333.54  * Shear (lb/sq ft)       *          *    1.08  *
   0.06  *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    7.85  *
   0.06  *
* Frctn Loss (ft)        *    2.44  * Cum Volume (acre-ft)   *    1.55  *   25.49  *
   0.09  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *    1.23  *   13.44  *
   0.27  *
*******************************************************************************
```

****

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #50-yr
****

E.G. Elev (ft)	7339.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.57	Wt. n-Val.	0.035	0.030	0.035
W.S. Elev (ft)	7337.51	Reach Len. (ft)	255.00	265.20	301.00
Crit W.S. (ft)	7337.51	Flow Area (sq ft)	2.58	171.85	3.69
E.G. Slope (ft/ft)	0.008594	Area (sq ft)	2.58	171.85	3.69
Q Total (cfs)	1754.00	Flow (cfs)	7.27	1734.88	11.86
Top Width (ft)	61.08	Top Width (ft)	4.09	52.23	4.76
Vel Total (ft/s)	9.85	Avg. Vel. (ft/s)	2.81	10.10	3.22
Max Chl Dpth (ft)	3.97	Hydr. Depth (ft)	0.63	3.29	0.77
Conv. Total (cfs)	18920.1	Conv. (cfs)	78.4	18713.8	127.9
Length Wtd. (ft)	265.37	Wetted Per. (ft)	4.28	52.71	4.99
Min Ch El (ft)	7333.54	Shear (lb/sq ft)	0.32	1.75	0.40
Alpha	1.04	Stream Power (lb/ft s)	0.91	17.66	1.27
Frctn Loss (ft)	2.21	Cum Volume (acre-ft)	20.15	60.09	7.71
C & E Loss (ft)	0.00	Cum SA (acres)	7.51	14.44	4.35

****

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Alignment - (1)
REACH: Alignment - (1) RS: 6993.16

```
INPUT
Description:
Station Elevation Data    num=     227
      Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
        0 7370.33    9.82    7370   13.47 7369.89   14.23 7369.87   16.42  7369.8
    17.99 7369.74   32.89 7369.23   42.76 7368.89   53.82 7368.52   68.34    7368
    79.51  7367.4   82.01 7367.28   89.92 7366.85  109.47 7366.16  113.71    7366
   127.04 7364.93  139.91    7364  142.17 7363.83  143.87 7363.72  150.68 7363.25
   157.54 7362.87  159.69 7362.74  163.54 7362.49  171.22 7362.16  174.46    7362
   180.92  7361.6   182.9  7361.5  185.71 7361.41  187.41 7361.33  191.71 7361.06
   195.23  7360.9  201.13 7360.37  204.67    7360  209.38 7359.58  212.49 7359.35
   218.53 7358.88  224.48 7358.41  228.96    7358  244.77 7356.12  245.78    7356
   245.99 7355.98  246.46 7355.93  254.58 7355.04  264.26 7354.02  264.47    7354
   265.16 7353.92  281.97    7352  283.84 7351.52  285.62 7351.06   289.6    7350
   291.61 7349.78  295.67 7349.37   302.5 7348.86  307.81 7348.62  316.17    7348
   321.98 7347.53  338.81    7346  349.13 7345.09  361.06    7344  366.46 7343.49
      383    7342  391.12  7341.6  392.09  7341.6  393.71 7341.58  395.63 7341.53
    396.1 7341.53  398.79 7341.43  401.91 7341.33  413.48 7340.97  429.72 7340.41
   441.85    7340  442.75 7339.79  445.86 7339.22  450.49 7338.39  452.51    7338
   455.49 7337.37   460.8    7336  466.85  7334.4  468.37    7334  471.17 7333.39
   471.68 7333.27  476.67 7332.09  477.03    7332  478.04 7331.73  478.21 7331.63
   478.79 7331.48  481.09 7331.15  481.38 7331.13  481.42 7331.11  482.87 7330.99
   484.81 7330.84  490.21 7330.88  496.29 7330.95  496.39 7331.04   497.4 7331.06
   498.49 7331.08   500.6  7331.1  501.01 7331.06  501.67 7331.08  501.76 7331.14
   502.61 7331.19  503.96 7331.32  505.92 7331.44  507.38 7331.56  512.92    7332
   513.45 7332.17  515.56 7332.82  518.67 7333.73  519.36 7333.91  519.68    7334
   526.98 7335.33  530.91 7335.65  535.33 7335.87  537.45    7336  542.16 7336.38
   544.09 7336.65   546.9 7337.09  549.84 7337.53  552.98    7338  558.68 7338.86
   564.22    7340  566.27 7340.24  583.46    7342  587.14 7342.11  587.56 7342.11
   588.56 7342.16  589.65 7342.19  591.54 7342.26   600.1 7342.44  604.53 7342.49
    606.3  7342.5  611.77 7342.55  615.18  7342.6  617.41 7342.59  620.82 7342.64
   623.55 7342.73  626.04 7342.83  627.76 7342.93  630.83 7342.99  632.98 7343.01
    634.6 7343.01  636.81 7343.03  638.22 7343.03  640.23 7343.01  645.01 7342.96
   648.95 7342.92  653.73 7342.85  657.47 7342.75   659.2 7342.73  661.51 7342.71
   664.37 7342.65  668.29 7342.56  674.53 7342.46  676.44 7342.45  678.44 7342.44
   680.38 7342.43  682.85 7342.42  693.09 7342.33  695.52 7342.32  697.08 7342.32
   698.85 7342.34  708.43 7342.31  709.41 7342.32   715.3 7342.33  717.19 7342.32
   725.31 7342.35  734.64 7342.41   739.5 7342.42  741.63 7342.42  747.98 7342.39
   754.22 7342.33  762.21 7342.17  771.45 7342.04  774.15    7342  778.03 7341.76
   783.82 7341.35  784.05 7341.35   794.7    7340  799.48 7339.08  806.32    7338
   815.12 7337.47  826.23 7336.84  831.19 7336.83  838.26  7337.2   838.7 7337.31
   839.71 7337.48  842.03 7337.73  842.77 7337.78  844.56    7338  849.45 7338.83
   854.24    7340   861.7 7340.74  868.86 7341.92  869.36    7342  885.17 7343.37
   892.66    7344  898.36 7344.45  915.57    7346   922.5 7346.76  933.29    7348
   941.93 7348.96  951.15    7350  967.65 7351.69  970.55    7352  975.31  7352.4
   994.93    7354 1001.82 7354.38 1028.93    7356 1052.12 7357.36 1063.23    7358
  1085.97 7359.56 1092.32    7360 1095.38 7360.32 1111.03    7362 1118.37 7362.65
  1136.21    7364 1136.78 7364.05 1157.79    7366 1160.86 7366.35 1164.02 7366.69
  1170.84 7367.42 1176.45    7368 1187.97 7369.11 1189.44 7369.23 1197.15    7370
   1201.6 7370.43  1205.8  7370.8

Manning's n Values        num=       3
      Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
        0    .035  471.17     .03  518.67    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         471.17  518.67           185.11  206.11  256.11             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
  639.11  1205.8 7343.15       F
```

```
CROSS SECTION OUTPUT  Profile #500-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7339.42  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    2.04  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7337.39  * Reach Len. (ft)        *  185.11  *  206.11  *
 256.11  *
* Crit W.S. (ft)         * 7337.39  * Flow Area (sq ft)      *   32.14  *  275.22  *
  50.22  *
* E.G. Slope (ft/ft)     *0.005735  * Area (sq ft)           *   32.14  *  275.22  *
  58.29  *
* Q Total (cfs)          * 3689.00  * Flow (cfs)             *  162.73  * 3301.08  *
 225.19  *
* Top Width (ft)         *  116.04  * Top Width (ft)         *   15.76  *   47.50  *
  52.78  *
* Vel Total (ft/s)       *   10.32  * Avg. Vel. (ft/s)       *    5.06  *   11.99  *
   4.48  *
* Max Chl Dpth (ft)      *    6.55  * Hydr. Depth (ft)       *    2.04  *    5.79  *
   1.66  *
* Conv. Total (cfs)      * 48713.3  * Conv. (cfs)            *  2148.8  * 43590.9  *
 2973.6  *
* Length Wtd. (ft)       *  209.14  * Wetted Per. (ft)       *   16.26  *   48.13  *
  30.48  *
* Min Ch El (ft)         * 7330.84  * Shear (lb/sq ft)       *    0.71  *    2.05  *
   0.59  *
* Alpha                  *    1.23  * Stream Power (lb/ft s) *    3.58  *   24.56  *
   2.64  *
* Frctn Loss (ft)        *    1.13  * Cum Volume (acre-ft)   *   48.36  *   91.06  *
  27.22  *
* C & E Loss (ft)        *    0.08  * Cum SA (acres)         *   13.13  *   14.16  *
  11.22  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7334.61  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.97  * Wt. n-Val.             *   0.035  *   0.030  *
         *
* W.S. Elev (ft)         * 7333.64  * Reach Len. (ft)        *  185.11  *  206.11  *
 256.11  *
* Crit W.S. (ft)         * 7333.62  * Flow Area (sq ft)      *    0.14  *   97.31  *
         *
```

```
* E.G. Slope (ft/ft)     *0.009839  * Area (sq ft)           *    0.14  *   97.31  *
          *
* Q Total (cfs)          *  768.00  * Flow (cfs)             *    0.15  *  767.85  *
          *
* Top Width (ft)         *   48.35  * Top Width (ft)         *    1.15  *   47.20  *
          *
* Vel Total (ft/s)       *    7.88  * Avg. Vel. (ft/s)       *    1.04  *    7.89  *
          *
* Max Chl Dpth (ft)      *    2.80  * Hydr. Depth (ft)       *    0.13  *    2.06  *
          *
* Conv. Total (cfs)      *  7742.7  * Conv. (cfs)            *     1.5  *  7741.1  *
          *
* Length Wtd. (ft)       *  206.11  * Wetted Per. (ft)       *    1.18  *   47.81  *
          *
* Min Ch El (ft)         * 7330.84  * Shear (lb/sq ft)       *    0.08  *    1.25  *
          *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *    0.08  *    9.86  *
          *
* Frctn Loss (ft)        *    2.05  * Cum Volume (acre-ft)   *    1.55  *   24.88  *
   0.09  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *    1.23  *   13.14  *
   0.27  *
*******************************************************************************
***********

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7336.72  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.60  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7335.13  * Reach Len. (ft)        *  185.11  *  206.11  *
 256.11  *
* Crit W.S. (ft)         * 7335.13  * Flow Area (sq ft)      *    6.43  *  167.97  *
   4.78  *
* E.G. Slope (ft/ft)     *0.008053  * Area (sq ft)           *    6.43  *  167.97  *
   4.78  *
* Q Total (cfs)          * 1754.00  * Flow (cfs)             *   22.54  * 1717.80  *
  13.66  *
* Top Width (ft)         *   61.78  * Top Width (ft)         *    7.08  *   47.50  *
   7.21  *
* Vel Total (ft/s)       *    9.79  * Avg. Vel. (ft/s)       *    3.50  *   10.23  *
   2.86  *
* Max Chl Dpth (ft)      *    4.29  * Hydr. Depth (ft)       *    0.91  *    3.54  *
   0.66  *
* Conv. Total (cfs)      * 19545.7  * Conv. (cfs)            *   251.2  * 19142.2  *
  152.2  *
* Length Wtd. (ft)       *  206.18  * Wetted Per. (ft)       *    7.29  *   48.13  *
   7.34  *
* Min Ch El (ft)         * 7330.84  * Shear (lb/sq ft)       *    0.44  *    1.75  *
   0.33  *
* Alpha                  *    1.07  * Stream Power (lb/ft s) *    1.55  *   17.94  *
   0.94  *
* Frctn Loss (ft)        *    1.59  * Cum Volume (acre-ft)   *   20.12  *   59.05  *
   7.68  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *    7.48  *   14.14  *
```

4.31 *
****

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Alignment - (1)
REACH: Alignment - (1) RS: 6787.05

INPUT
Description:
Station Elevation Data num= 292

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7360.2	1.96	7360	4.64	7359.71	20.1	7358	21.69	7357.82
37.14	7356	49.36	7354.45	52.82	7354	54.49	7353.78	68.29	7352
78.38	7350.83	85.55	7350	94.77	7348.94	104.46	7348	108.76	7347.58
123.39	7346	131.2	7345.21	141.87	7344	152.93	7343.05	165.1	7342
181.74	7340.88	182.1	7340.86	198.38	7340	212.37	7339.69	215.44	7339.63
222.36	7339.49	230.11	7339.35	240.77	7339.19	244.6	7339.15	251.82	7339.04
257.63	7338.96	263.52	7338.91	267.26	7338.9	272.5	7338.89	278.4	7338.88
280.2	7338.87	281.48	7338.87	283.33	7338.86	284.42	7338.85	287.29	7338.84
290.12	7338.83	290.21	7338.82	294.14	7338.79	297.61	7338.76	299.7	7338.75
302.63	7338.73	306.24	7338.73	310.11	7338.74	313.59	7338.75	317.17	7338.77
321	7338.78	325.83	7338.75	329.44	7338.74	329.71	7338.74	333.75	7338.76
338.11	7338.74	341.29	7338.76	341.93	7338.78	343.47	7338.83	344.61	7338.91
348.15	7338.94	350.43	7338.96	353.49	7338.97	355.09	7338.97	357.05	7338.96
361.56	7338.89	362.55	7338.88	364.62	7338.83	366.08	7338.76	368.46	7338.7
376.6	7338.63	384.9	7338.57	387.23	7338.55	388.45	7338.54	390.65	7338.52
395.47	7338.52	399.56	7338.51	402.5	7338.5	409.61	7338.47	414.22	7338.45
420.32	7338.43	429.34	7338.38	431.11	7338.35	433.39	7338.35	442.83	7338.31
448.28	7338.27	448.78	7338.26	449.62	7338.25	451.25	7338.23	451.85	7338.22
461.79	7338.18	474.15	7338.13	485.83	7338.07	497.59	7338	503.6	7337.92
504.68	7337.88	506.02	7337.83	517.32	7337.54	526.9	7337.35	530.67	7337.21
533.49	7337.09	537.57	7336.9	538.1	7336.87	541.97	7336.58	551.32	7336
553.05	7335.36	557.36	7334	561.6	7333.24	562.09	7333.14	563.24	7332.95
564.13	7332.83	565.52	7332.9	566.05	7332.74	566.18	7332.73	568.61	7332
571.54	7331.29	577.74	7330	582.24	7328.72	584.96	7328	594.95	7328
601.25	7329.07	605.72	7329.81	606.58	7330	607.67	7330.2	616.77	7332
620.21	7332.63	622.01	7332.81	625.86	7333.35	626.85	7333.45	627.71	7333.51
628.52	7333.5	629.1	7333.47	633.39	7333.43	635.64	7333.14	636.9	7333.03
639.97	7332.76	641.44	7332.7	643.51	7333.04	645.01	7333.25	648.22	7334
648.38	7334.03	650.24	7334.43	650.52	7334.41	652.92	7334.58	654.52	7334.76
656.08	7334.79	657.45	7334.87	658.76	7334.91	659.97	7334.99	660.89	7335.22
662.16	7335.57	666.11	7335.95	666.35	7335.98	666.6	7336	677.57	7337.12
679.81	7337.22	687.71	7337.52	690.13	7337.68	695.28	7338	698.84	7338.11
698.96	7338.1	699.05	7338.1	702.65	7338.23	707.81	7338.38	712.3	7338.34
712.76	7338.3	713.45	7338.26	714.12	7338.24	714.94	7338.22	716	7338.23

```
  720.06 7338.27  721.43 7338.29  723.01 7338.34  723.81 7338.38  725.19 7338.44
  734.18 7338.74  738.18 7338.89   743.2 7339.06  745.07 7339.11  745.83 7339.17
  746.91 7339.25  750.27 7339.41  751.63 7339.45  753.43 7339.49     754 7339.47
  762.86  7339.5  764.11 7339.49  765.66 7339.55  767.24 7339.59   767.9  7339.6
  769.64 7339.57  771.82  7339.5  775.56  7339.4  777.06 7339.34  778.82 7339.25
  781.39 7339.08  783.52 7338.93  790.87 7338.22  793.33    7338   800.6 7337.15
  805.66 7336.53  809.92    7336  835.34    7336  835.63 7336.04  835.78 7336.07
  845.58    7338  849.81 7338.65  851.53 7338.69  852.33 7338.69  854.26 7338.74
  866.67 7339.64  872.25    7340  873.15 7340.06  878.48 7340.48  891.76  7341.5
  897.31    7342  902.14 7342.73  910.68    7344  923.19 7345.81  924.46    7346
  926.18 7346.25   938.9    7348  944.52 7348.72  954.53    7350  970.78 7351.83
  972.33    7352  974.61 7352.22  993.38    7354 1025.18 7355.47 1029.64 7355.66
 1031.05 7355.72 1032.16 7355.75 1037.55    7356 1056.34 7357.43 1060.57 7357.75
 1061.22 7357.79 1061.75 7357.81 1062.13 7357.82 1062.61 7357.81 1062.68 7357.81
 1062.84 7357.79 1063.02 7357.76 1063.24  7357.7 1063.66 7357.68 1070.02 7357.38
    1071 7357.24 1073.48 7357.27 1075.04 7357.49 1075.06 7357.65 1076.65  7357.9
 1077.15    7358 1083.67 7358.88 1087.38 7359.34 1091.48 7359.59 1092.52  7359.7
 1093.52 7359.81 1093.78 7359.82 1094.21 7359.84 1094.45 7359.83 1094.72 7359.83
 1096.62 7359.91 1098.19    7360  1103.6 7360.32 1105.09 7360.44 1116.87 7361.19
 1120.21  7361.4 1122.13 7361.52 1123.63 7361.53 1127.39 7361.71 1128.37 7361.71
 1131.37 7361.73 1132.03 7361.74 1133.56 7361.68 1133.91 7361.69 1134.17 7361.54
 1135.42 7361.42 1137.03  7361.3 1138.71 7361.28 1139.24 7361.29 1141.89 7361.49
 1145.02 7361.87 1146.27    7362 1150.58 7362.85 1153.27 7363.29 1155.34 7363.71
 1156.24 7363.82 1158.17    7364 1170.47 7364.63 1172.54 7364.82 1177.29 7365.17
 1182.93 7365.54 1188.66 7365.96

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  571.54     .03  616.77    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        571.54  616.77           221.11  221.11  221.11             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
  628.65 1188.66 7333.51       F

CROSS SECTION OUTPUT  Profile #500-yr
*****************************************************************************************
***********
* E.G. Elev (ft)         * 7337.21  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.79  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7335.42  * Reach Len. (ft)        *  221.11  *  221.11  *
 221.11  *
* Crit W.S. (ft)         * 7335.42  * Flow Area (sq ft)      *   40.74  *  270.34  *
  83.00  *
* E.G. Slope (ft/ft)     *0.005084  * Area (sq ft)           *   40.74  *  270.34  *
  83.00  *
* Q Total (cfs)          * 3689.00  * Flow (cfs)             *  203.58  * 3109.04  *
 376.39  *
* Top Width (ft)         *  108.75  * Top Width (ft)         *   18.66  *   45.23  *
  44.86  *
* Vel Total (ft/s)       *    9.36  * Avg. Vel. (ft/s)       *    5.00  *   11.50  *
   4.53  *
* Max Chl Dpth (ft)      *    7.42  * Hydr. Depth (ft)       *    2.18  *    5.98  *
   1.85  *
* Conv. Total (cfs)      * 51738.9  * Conv. (cfs)            *  2855.2  * 43604.8  *
 5278.9  *
* Length Wtd. (ft)       *  221.11  * Wetted Per. (ft)       *   19.20  *   46.00  *
  45.26  *
* Min Ch El (ft)         * 7328.00  * Shear (lb/sq ft)       *    0.67  *    1.87  *
```

```
  0.58  *
* Alpha                  *    1.31  * Stream Power (lb/ft s) *    3.36  *   21.45  *
  2.64  *
* Frctn Loss (ft)        *    1.25  * Cum Volume (acre-ft)   *   48.20  *   89.77  *
  26.80  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *   13.05  *   13.94  *
  10.94  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7332.55  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.06  * Wt. n-Val.             *   0.035  *   0.030  *
         *
* W.S. Elev (ft)         * 7331.49  * Reach Len. (ft)        *  221.11  *  221.11  *
 221.11  *
* Crit W.S. (ft)         * 7331.49  * Flow Area (sq ft)      *    0.08  *   93.08  *
         *
* E.G. Slope (ft/ft)     *0.010025  * Area (sq ft)           *    0.08  *   93.08  *
         *
* Q Total (cfs)          *  768.00  * Flow (cfs)             *    0.07  *  767.93  *
         *
* Top Width (ft)         *   43.48  * Top Width (ft)         *    0.83  *   42.65  *
         *
* Vel Total (ft/s)       *    8.24  * Avg. Vel. (ft/s)       *    0.90  *    8.25  *
         *
* Max Chl Dpth (ft)      *    3.49  * Hydr. Depth (ft)       *    0.10  *    2.18  *
         *
* Conv. Total (cfs)      *  7670.6  * Conv. (cfs)            *     0.7  *  7669.9  *
         *
* Length Wtd. (ft)       *  221.11  * Wetted Per. (ft)       *    0.85  *   43.37  *
         *
* Min Ch El (ft)         * 7328.00  * Shear (lb/sq ft)       *    0.06  *    1.34  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *    0.05  *   11.08  *
         *
* Frctn Loss (ft)        *    2.10  * Cum Volume (acre-ft)   *    1.55  *   24.43  *
  0.09  *
* C & E Loss (ft)        *    0.07  * Cum SA (acres)         *    1.23  *   12.93  *
  0.27  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
```

```
        the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
        water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
        program defaulted to critical depth.
Note:   Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7334.77  * Element                * Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.57  * Wt. n-Val.             *   0.035 *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7333.19  * Reach Len. (ft)        *  221.11 *  221.11  *
 221.11  *
* Crit W.S. (ft)         * 7333.19  * Flow Area (sq ft)      *    7.71 *  169.43  *
   4.39  *
* E.G. Slope (ft/ft)     *0.007382  * Area (sq ft)           *    7.71 *  169.43  *
   6.89  *
* Q Total (cfs)          * 1754.00  * Flow (cfs)             *   23.70 * 1719.61  *
  10.69  *
* Top Width (ft)         *   72.28  * Top Width (ft)         *    9.71 *   45.23  *
  17.34  *
* Vel Total (ft/s)       *    9.66  * Avg. Vel. (ft/s)       *    3.08 *   10.15  *
   2.43  *
* Max Chl Dpth (ft)      *    5.19  * Hydr. Depth (ft)       *    0.79 *    3.75  *
   0.55  *
* Conv. Total (cfs)      * 20414.7  * Conv. (cfs)            *   275.8 * 20014.4  *
  124.5  *
* Length Wtd. (ft)       *  221.11  * Wetted Per. (ft)       *    9.95 *   46.00  *
   8.06  *
* Min Ch El (ft)         * 7328.00  * Shear (lb/sq ft)       *    0.36 *    1.70  *
   0.25  *
* Alpha                  *    1.08  * Stream Power (lb/ft s) *    1.10 *   17.23  *
   0.61  *
* Frctn Loss (ft)        *    1.13  * Cum Volume (acre-ft)   *   20.09 *   58.25  *
   7.65  *
* C & E Loss (ft)        *    0.21  * Cum SA (acres)         *    7.45 *   13.92  *
   4.23  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
        depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
        sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
        the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
        water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
        program defaulted to critical depth.
Note:   Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.
```

CROSS SECTION

RIVER: Alignment - (1)
REACH: Alignment - (1) RS: 6565.94

INPUT
Description:
Station Elevation Data num= 198

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7360.77	11.92	7360.27	19.07	7360	29.85	7359.47	33.08	7359.3
37.28	7359.08	41.8	7358.82	55.3	7358	65.87	7357.51	90.94	7356.55
105.42	7356	113.07	7355.88	113.49	7355.88	119.11	7355.77	120.69	7355.78
122.9	7355.78	122.93	7355.8	124.48	7355.8	124.95	7355.79	125.02	7355.78
125.64	7355.75	126.18	7355.73	127.61	7355.7	128.22	7355.69	129.88	7355.66
131.11	7355.63	132.89	7355.6	137.21	7355.52	144.43	7355.36	153.63	7355.16
198.25	7354.16	201.52	7354.09	205.39	7354	207.22	7353.88	234.88	7352.37
241.03	7352.03	241.58	7352	245.89	7351.71	255.4	7351.15	259.06	7351.04
264.68	7350.66	275.32	7350.49	280.38	7350.4	283.27	7350.32	285.33	7350.29
286.74	7350.26	288.87	7350.16	292.07	7350	301.34	7348.91	308.69	7348
316.95	7346.79	322.38	7346	324.61	7345.64	334.65	7344	339.79	7343.02
345.09	7342	347.95	7341.47	354.87	7340.48	358.27	7340	367.77	7339.11
374.72	7338.49	377.93	7338.21	379.91	7338	390.66	7336.7	392.4	7336.53
400.76	7336	409.59	7335.64	413.75	7335.5	419.56	7335.33	432.07	7334.98
435.81	7334.9	439.07	7334.82	444.89	7334.75	449.83	7334.69	450.11	7334.73
450.15	7334.75	450.18	7334.76	451.55	7334.77	456.06	7334.73	459.41	7334.7
463.79	7334.65	465.03	7334.64	467.1	7334.63	468.6	7334.62	470.34	7334.67
471.14	7334.69	472.14	7334.73	472.8	7334.75	475.3	7334.8	477.37	7334.72
478.13	7334.73	483.11	7334.59	484.76	7334.51	487.91	7334.52	489.91	7334.46
491.54	7334.45	500.67	7334.39	504.44	7334.17	507.15	7334	511.25	7333.69
516.4	7333.26	530.57	7332	537.77	7331.42	540.07	7331.26	544.73	7330.93
556.71	7330	561.06	7328.63	564.2	7328	567.71	7326.89	570.91	7326
575.98	7326	576.62	7326.05	585.23	7326.7	590.56	7327.11	593.14	7327.28
597.88	7327.55	600.17	7327.71	606.6	7328	613.16	7329.46	614.99	7330
616.99	7330.52	621.19	7332	621.39	7332.03	630.4	7333.49	633.05	7334
643.41	7334.34	651.22	7334.64	656.34	7334.83	660.67	7334.96	663.48	7335.01
665.23	7335.06	667.13	7335.09	671.9	7335.23	672.3	7335.24	673.55	7335.28
674.78	7335.32	676.55	7335.35	685.07	7335.45	698.28	7335.6	712.79	7335.81
723.78	7336	728.9	7336.13	740.84	7336.5	769.22	7337.35	788.14	7338
791.87	7338.2	795.52	7338.38	809.12	7339.09	822.97	7339.74	827.3	7339.96
827.74	7339.98	828.09	7340	843.3	7341.15	853.96	7342	864.09	7342.9
875.97	7344	883.86	7344.9	892.85	7346	897.23	7346.66	906.15	7348
916.24	7349.43	920.17	7350	934.7	7351.93	935.32	7352	942.44	7352.74
954.51	7354	955.57	7354.11	958.58	7354.44	969	7355.56	972.63	7356
985.86	7357.7	988.22	7358	988.92	7358.04	990.66	7358.16	1018.71	7360
1023	7360.39	1041.04	7362	1048.44	7362.63	1065.31	7364	1067.06	7364.13
1068.87	7364.27	1084.45	7365.46	1091.62	7366	1103.46	7366.93	1115.79	7368
1131.12	7369.33	1139.06	7370	1158.64	7371.23	1169.23	7371.86	1171.52	7372
1181.05	7372.66	1200.36	7374	1220.96	7375.59	1226.42	7376	1249.51	7377.74
1253.06	7378	1257.25	7378.31	1274.65	7379.62				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	556.71	.03	613.16	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
556.71	613.16	251.11	240.11	240.11	.1	.3

CROSS SECTION OUTPUT Profile #500-yr
****

```
* E.G. Elev (ft)         * 7334.61  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.99  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7332.62  * Reach Len. (ft)        *  251.11  *  240.11  *
 240.11  *
* Crit W.S. (ft)         * 7332.62  * Flow Area (sq ft)      *   44.60  *  294.12  *
  16.92  *
* E.G. Slope (ft/ft)     *0.006275  * Area (sq ft)           *   44.60  *  294.12  *
  16.92  *
* Q Total (cfs)          * 3689.00  * Flow (cfs)             *  182.53  * 3436.15  *
  70.32  *
* Top Width (ft)         *  101.45  * Top Width (ft)         *   33.12  *   56.45  *
  11.88  *
* Vel Total (ft/s)       *   10.37  * Avg. Vel. (ft/s)       *    4.09  *   11.68  *
   4.16  *
* Max Chl Dpth (ft)      *    6.62  * Hydr. Depth (ft)       *    1.35  *    5.21  *
   1.43  *
* Conv. Total (cfs)      * 46569.6  * Conv. (cfs)            *  2304.2  * 43377.6  *
  887.7  *
* Length Wtd. (ft)       *  240.73  * Wetted Per. (ft)       *   33.22  *   57.24  *
  12.32  *
* Min Ch El (ft)         * 7326.00  * Shear (lb/sq ft)       *    0.53  *    2.01  *
   0.54  *
* Alpha                  *    1.19  * Stream Power (lb/ft s) *    2.15  *   23.52  *
   2.24  *
* Frctn Loss (ft)        *    0.57  * Cum Volume (acre-ft)   *   47.99  *   88.34  *
  26.55  *
* C & E Loss (ft)        *    0.44  * Cum SA (acres)         *   12.92  *   13.68  *
  10.79  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7330.08  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.84  * Wt. n-Val.             *          *   0.030  *
         *
* W.S. Elev (ft)         * 7329.25  * Reach Len. (ft)        *  251.11  *  240.11  *
 240.11  *
* Crit W.S. (ft)         * 7329.13  * Flow Area (sq ft)      *          *  104.66  *
         *
* E.G. Slope (ft/ft)     *0.009027  * Area (sq ft)           *          *  104.66  *
```

```
*
* Q Total (cfs)          *  768.00  * Flow (cfs)            *          *  768.00  *
*
* Top Width (ft)         *   53.10  * Top Width (ft)        *          *   53.10  *
*
* Vel Total (ft/s)       *    7.34  * Avg. Vel. (ft/s)      *          *    7.34  *
*
* Max Chl Dpth (ft)      *    3.25  * Hydr. Depth (ft)      *          *    1.97  *
*
* Conv. Total (cfs)      *  8083.1  * Conv. (cfs)           *          *  8083.1  *
*
* Length Wtd. (ft)       *  240.11  * Wetted Per. (ft)      *          *   53.75  *
*
* Min Ch El (ft)         * 7326.00  * Shear (lb/sq ft)      *          *    1.10  *
*
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    8.05  *
*
* Frctn Loss (ft)        *    1.91  * Cum Volume (acre-ft)   *    1.55  *   23.92  *
   0.09  *
* C & E Loss (ft)        *    0.05  * Cum SA (acres)         *    1.22  *   12.69  *
   0.27  *
*******************************************************************************
***********

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

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7332.29  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.87  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7331.42  * Reach Len. (ft)        *  251.11  *  240.11  *
 240.11  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *   13.15  *  226.37  *
   6.56  *
* E.G. Slope (ft/ft)     *0.003722  * Area (sq ft)           *   13.15  *  226.37  *
   6.56  *
* Q Total (cfs)          * 1754.00  * Flow (cfs)             *   26.64  * 1710.56  *
  16.80  *
* Top Width (ft)         *   81.78  * Top Width (ft)         *   18.95  *   56.45  *
   6.39  *
* Vel Total (ft/s)       *    7.13  * Avg. Vel. (ft/s)       *    2.03  *    7.56  *
   2.56  *
* Max Chl Dpth (ft)      *    5.42  * Hydr. Depth (ft)       *    0.69  *    4.01  *
   1.03  *
* Conv. Total (cfs)      * 28750.5  * Conv. (cfs)            *   436.6  * 28038.5  *
  275.4  *
* Length Wtd. (ft)       *  240.49  * Wetted Per. (ft)       *   19.00  *   57.24  *
   6.68  *
* Min Ch El (ft)         * 7326.00  * Shear (lb/sq ft)       *    0.16  *    0.92  *
   0.23  *
* Alpha                  *    1.10  * Stream Power (lb/ft s) *    0.33  *    6.94  *
   0.58  *
* Frctn Loss (ft)        *    0.30  * Cum Volume (acre-ft)   *   20.04  *   57.25  *
   7.62  *
* C & E Loss (ft)        *    0.19  * Cum SA (acres)         *    7.37  *   13.66  *
   4.17  *
*******************************************************************************
***********
```

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Alignment - (1)
REACH: Alignment - (1) RS: 6325.83

INPUT
Description:
Station Elevation Data num= 231

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7360.51	7.43	7360.18	11.15	7360	20.34	7359.43	44.76	7358
69.29	7356.33	74.13	7356	76.4	7355.89	93.68	7355.04	112.34	7354.13
114.88	7354	115.52	7353.98	124.6	7353.75	133.44	7353.56	133.98	7353.55
134.8	7353.53	141.66	7353.42	148.22	7353.34	151.99	7353.3	156.21	7353.27
160.76	7353.26	169.66	7353.27	179.92	7353.27	183.08	7353.29	185.71	7353.35
188.57	7353.37	193.51	7353.38	200.26	7353.38	201.67	7353.37	204.47	7353.34
208.93	7353.28	209.65	7353.27	212.48	7353.22	216.06	7353.14	221.15	7352.99
227.82	7352.75	235.03	7352.43	245.04	7352	248.09	7351.87	254.76	7351.64
270.87	7351.07	286.06	7350.53	289.68	7350.4	300.96	7350	306.58	7349.68
337.98	7348	345.18	7347.37	345.27	7347.37	361.63	7346	368.31	7345.42
373.25	7344.97	384.53	7344	402.94	7343.74	404.87	7343.72	406.65	7343.7
407.45	7343.68	409.24	7343.66	413.51	7343.62	415.32	7343.6	421.46	7343.52
428.69	7343.42	531.84	7342	538.17	7340.27	539.18	7340	539.41	7339.93
545.09	7338.3	545.99	7338	549.45	7337.04	553.42	7336	554.61	7335.65
559.76	7334	562.77	7332.95	565.49	7332	570.88	7330.11	571.18	7330
572.05	7329.72	573.81	7329.19	577.96	7328	580.1	7327.7	584.61	7327.18
593.11	7326	594.92	7325.78	594.94	7325.81	595.29	7325.79	596.04	7325.74
596.97	7325.65	600.25	7325.1	600.61	7324.95	602.48	7324.79	606.51	7324.48
606.67	7324.46	607.45	7324.42	609.15	7324.34	609.36	7324.33	609.44	7324.32
609.5	7324.31	609.66	7324.27	609.8	7324.25	610.13	7324.22	610.18	7324.21
610.65	7324.18	610.79	7324.18	610.92	7324.17	611.07	7324.17	611.26	7324.16
611.77	7324.16	612.67	7324.18	613.88	7324.21	614.24	7324.23	614.67	7324.25
614.94	7324.25	615.16	7324.27	615.42	7324.29	615.66	7324.34	616	7324.35
616.37	7324.37	616.61	7324.4	618.57	7324.62	619.84	7324.74	620.71	7324.83
622.74	7324.82	624.34	7325	625.88	7325.14	629.4	7325.5	630.93	7325.61
634.43	7326	643.82	7327.62	646.18	7328	648.33	7328.27	650.01	7328.46
652.61	7328.69	654.94	7328.68	655.91	7328.65	656.5	7328.57	659.31	7328.61
661.01	7328.66	664.96	7328.87	668.26	7329.06	682.78	7330	712.99	7331.66
718.52	7332	729.62	7332	731.35	7331.87	732.33	7331.64	733.63	7331.58
734.66	7331.51	736.7	7331.51	742.06	7331.47	747.34	7331.51	755.8	7331.75
761.57	7331.94	763.55	7332	778.52	7332.82	801.31	7334	819.47	7335.95
819.98	7336	820.12	7336.02	834.91	7338	846.5	7339.81	847.53	7339.97
847.73	7340	848.35	7340.11	859.7	7342	860.62	7342.17	871.09	7344
874.48	7344.57	883.05	7346	893.61	7347.49	896.98	7348	902.15	7348.6
914.42	7350	920.34	7350.79	930.29	7352	939.84	7353.46	943.52	7354
947.54	7354.55	958.36	7356	977.66	7357.8	978.36	7357.85	978.71	7357.88
978.96	7357.9	979.14	7357.91	979.39	7357.92	979.55	7357.92	979.65	7357.91
979.72	7357.9	979.87	7357.9	981.24	7358	987.29	7358.31	992.67	7358.54
995.41	7358.78	999.46	7359.01	1005.19	7359.52	1008.71	7359.82	1010.53	7360
1024.75	7361.22	1028.2	7361.5	1030.35	7361.69	1031.54	7361.78	1032.03	7361.81
1032.44	7361.83	1034.14	7362	1047.53	7362.88	1058.17	7363.51	1059.45	7363.57
1064.81	7364	1067.73	7364.2	1084.25	7365.12	1086.99	7365.39	1089.13	7365.5
1091.8	7365.77	1092.52	7365.81	1095.68	7366	1098.34	7366.07	1104.66	7366.19
1118	7366.59	1132.36	7366.96	1135.85	7367.03	1145.18	7367.64	1151.24	7368

```
  1166.1 7368.58 1173.58 7368.86 1178.45 7369.03 1181.22 7369.13 1183.22  7369.2
 1185.52 7369.28 1190.71 7369.41 1199.58 7369.85 1200.63 7369.88 1202.91    7370
 1205.39 7370.12

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  584.61     .03  643.82    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        584.61  643.82           159.06  169.06  189.06             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
  727.25 1205.39 7332.27       F

CROSS SECTION OUTPUT  Profile #500-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7333.32  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.53  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7332.78  * Reach Len. (ft)        *  159.06  *  169.06  *
 189.06  *
* Crit W.S. (ft)         * 7330.49  * Flow Area (sq ft)      *   71.47  *  432.17  *
 267.76  *
* E.G. Slope (ft/ft)     *0.001240  * Area (sq ft)           *   71.47  *  432.17  *
 267.76  *
* Q Total (cfs)          * 3689.00  * Flow (cfs)             *  233.10  * 2821.74  *
 634.16  *
* Top Width (ft)         *  214.62  * Top Width (ft)         *   21.36  *   59.21  *
 134.05  *
* Vel Total (ft/s)       *    4.78  * Avg. Vel. (ft/s)       *    3.26  *    6.53  *
   2.37  *
* Max Chl Dpth (ft)      *    8.62  * Hydr. Depth (ft)       *    3.35  *    7.30  *
   2.00  *
* Conv. Total (cfs)      *104757.3  * Conv. (cfs)            *  6619.4  * 80129.7  *
18008.2  *
* Length Wtd. (ft)       *  170.55  * Wetted Per. (ft)       *   22.18  *   59.67  *
 134.29  *
* Min Ch El (ft)         * 7324.16  * Shear (lb/sq ft)       *    0.25  *    0.56  *
   0.15  *
* Alpha                  *    1.50  * Stream Power (lb/ft s) *    0.81  *    3.66  *
   0.37  *
* Frctn Loss (ft)        *    0.08  * Cum Volume (acre-ft)   *   47.65  *   86.34  *
  25.77  *
* C & E Loss (ft)        *    0.13  * Cum SA (acres)         *   12.76  *   13.36  *
  10.39  *
*******************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7328.13  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.67  * Wt. n-Val.             *   0.035  *   0.030  *
         *
* W.S. Elev (ft)         * 7327.46  * Reach Len. (ft)        *  159.06  *  169.06  *
```

```
 189.06  *
* Crit W.S. (ft)         * 7327.18  * Flow Area (sq ft)      *    0.33  *  116.80  *
         *
* E.G. Slope (ft/ft)     *0.007037  * Area (sq ft)           *    0.33  *  116.80  *
         *
* Q Total (cfs)          *  768.00  * Flow (cfs)             *    0.31  *  767.69  *
         *
* Top Width (ft)         *   60.66  * Top Width (ft)         *    2.40  *   58.26  *
         *
* Vel Total (ft/s)       *    6.56  * Avg. Vel. (ft/s)       *    0.95  *    6.57  *
         *
* Max Chl Dpth (ft)      *    3.30  * Hydr. Depth (ft)       *    0.14  *    2.00  *
         *
* Conv. Total (cfs)      *  9155.0  * Conv. (cfs)            *     3.7  *  9151.3  *
         *
* Length Wtd. (ft)       *  169.06  * Wetted Per. (ft)       *    2.41  *   58.71  *
         *
* Min Ch El (ft)         * 7324.16  * Shear (lb/sq ft)       *    0.06  *    0.87  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *    0.06  *    5.74  *
         *
* Frctn Loss (ft)        *    1.39  * Cum Volume (acre-ft)   *    1.55  *   23.31  *
   0.09  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)         *    1.22  *   12.38  *
   0.27  *
*******************************************************************************
***********

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

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7331.79  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.22  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7331.58  * Reach Len. (ft)        *  159.06  *  169.06  *
 189.06  *
* Crit W.S. (ft)         * 7328.55  * Flow Area (sq ft)      *   47.72  *  360.56  *
 126.12  *
* E.G. Slope (ft/ft)     *0.000608  * Area (sq ft)           *   47.72  *  360.56  *
 127.26  *
* Q Total (cfs)          * 1754.00  * Flow (cfs)             *   93.88  * 1460.44  *
 199.69  *
* Top Width (ft)         *  160.65  * Top Width (ft)         *   17.91  *   59.21  *
  83.53  *
* Vel Total (ft/s)       *    3.28  * Avg. Vel. (ft/s)       *    1.97  *    4.05  *
   1.58  *
* Max Chl Dpth (ft)      *    7.41  * Hydr. Depth (ft)       *    2.66  *    6.09  *
   1.87  *
* Conv. Total (cfs)      * 71155.3  * Conv. (cfs)            *  3808.4  * 59246.2  *
 8100.8  *
* Length Wtd. (ft)       *  170.17  * Wetted Per. (ft)       *   18.52  *   59.67  *
  67.77  *
* Min Ch El (ft)         * 7324.16  * Shear (lb/sq ft)       *    0.10  *    0.23  *
   0.07  *
* Alpha                  *    1.31  * Stream Power (lb/ft s) *    0.19  *    0.93  *
   0.11  *
* Frctn Loss (ft)        *    0.04  * Cum Volume (acre-ft)   *   19.87  *   55.63  *
   7.25  *
```

```
* C & E Loss (ft)        *    0.05  * Cum SA (acres)         *    7.27  *   13.34  *
   3.93  *
*******************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: Alignment - (1)
REACH: Alignment - (1)    RS: 6156.77

INPUT
Description:
Station Elevation Data    num=     296
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0    7358     3.3 7357.93    3.83 7357.92     4.2 7357.91    6.15 7357.85
   38.78 7356.93   56.36 7356.33   65.59    7356   73.43 7355.55   99.06    7354
  121.06  7352.6  131.13    7352   161.2 7350.99  172.58 7350.61  174.38 7350.56
  188.03 7350.23  189.03  7350.2  189.44 7350.18  199.41    7350  200.52 7349.97
  223.05 7349.29  238.49 7348.49   248.2    7348  253.71 7347.41  266.15    7346
  286.68 7344.91   292.2 7344.66  293.31 7344.65  293.61 7344.69  294.16 7344.72
  294.72 7344.74  294.93 7344.74  296.47 7344.71  301.11 7344.56  302.88 7344.44
  303.65 7344.41  304.26 7344.39  308.43    7344  319.14 7343.37  324.43 7343.11
  332.74 7342.84  333.44 7342.83  337.44 7342.27  339.98    7342  346.39 7341.45
  353.11 7340.92  357.03 7340.55  359.33 7340.38  363.83    7340  371.41 7339.31
  374.07 7338.98  378.15 7338.41  379.52 7338.26  380.49 7338.18  382.13    7338
  391.35 7337.06  400.42    7336  401.62 7335.89  403.02 7335.74  410.61 7334.94
  413.53 7334.65  420.07    7334  420.95 7333.93  421.71 7333.86  430.31 7333.19
  433.23 7332.94  437.69 7332.64  446.28    7332  446.67 7331.97  452.36 7331.74
  452.87 7331.71  455.58 7331.63  458.72 7331.48  469.22 7331.06  476.23 7330.77
  480.08 7330.62  491.82 7330.17   492.8 7330.14  493.13 7330.13  498.97 7330.05
     501    7330  503.61 7329.96  503.75 7329.97  515.87  7329.8   524.5 7329.72
  524.87 7329.74  525.41 7329.76  531.04 7329.71  539.73 7329.59   540.6 7329.63
  542.39  7329.7   545.2 7329.66  549.31 7329.63  555.25 7329.64  556.87 7329.64
  559.56 7329.66  566.51 7329.68  575.52 7329.77  576.49 7329.79  577.47 7329.81
  578.38 7329.83  579.32 7329.84  579.81 7329.84   580.4 7329.85  582.88 7329.84
  587.04 7329.85  587.63 7329.86  588.05 7329.87  588.48 7329.88  588.72 7329.89
   588.8 7329.89  588.92  7329.9  589.12  7329.9  589.28 7329.91  589.48 7329.91
  589.61 7329.92  590.69 7329.92  590.86 7329.93  591.38 7329.93   591.4 7329.92
  591.69 7329.93   592.3 7329.92  593.05 7329.91  593.49  7329.9  593.85  7329.9
  594.24 7329.89  594.53 7329.89  594.86 7329.88  595.42 7329.88  596.23 7329.87
  596.69 7329.86  596.99 7329.85   597.2 7329.85  597.56 7329.84  597.65 7329.84
  598.12 7329.83  598.42 7329.82  598.57  7329.8  599.12 7329.78  599.37 7329.76
  599.79 7329.75  600.06 7329.74   601.5 7329.69  602.56 7329.65  602.88 7329.63
  603.25 7329.61   603.4 7329.58  603.58 7329.55  604.39 7329.51  605.98 7329.44
  608.85 7329.28   612.4    7329  621.43 7328.18  624.03    7328  625.72 7327.72
   629.9  7327.6  632.29 7327.61  634.94 7327.25  637.43 7326.99  640.84    7326
  644.08 7325.09  647.81    7324  651.64 7323.99  654.33 7323.98  657.51 7323.97
  659.14 7323.98  663.67 7323.99  667.54    7324  681.18 7324.47  684.09 7324.59
  689.52 7324.77   690.2 7324.79  693.33 7324.89  695.97 7324.95  697.35 7324.98
  699.15 7324.99   702.9 7324.95  706.24 7325.02  708.47 7325.06  710.65 7325.12
  711.09 7325.15  716.16 7325.37  718.59 7325.47  721.06 7325.52  727.96  7325.8
  729.34 7325.87  732.33    7326  733.94 7326.28   737.1 7326.63  738.49 7326.65
  739.23 7326.93  740.32 7327.13  740.88 7327.22  741.67  7327.3   742.6 7327.34
  743.57 7327.37  743.82 7327.37  744.29 7327.32   747.3 7327.23  750.66 7327.16
  753.45 7327.15   755.4 7327.22  760.68    7328  761.68  7328.1  777.78    7330
  778.03 7330.01  778.13 7330.02  795.82 7331.01  798.13 7331.13  800.66 7331.22
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  802.47  7331.3  805.97  7331.4  814.23    7332   819.2 7332.51  824.99 7333.14
  833.49    7334  848.18 7335.45  853.77    7336  868.57 7337.46  874.02    7338
  886.15 7339.26  888.17 7339.49  895.01  7339.8  900.21    7340  901.73 7340.09
  903.38 7340.12  904.31 7340.11  904.94 7340.17   907.6 7340.27  909.69 7340.39
  910.52 7340.44  911.47 7340.52  912.89 7340.45  914.58 7340.23  915.14 7340.21
   916.6    7340  921.12 7339.99  921.47 7339.99  925.16    7340  926.53    7340
  926.64 7340.02  926.69 7340.03  928.81 7340.42  935.54 7341.98   935.6 7341.99
  935.65    7342  944.02 7343.66   945.3    7344  959.28  7345.8  960.93    7346
  961.31 7346.04  978.68    7348  982.86 7348.45  997.46    7350 1001.77 7350.51
 1008.16 7351.26 1012.38 7351.76 1014.45    7352 1026.99 7353.47 1032.14    7354
 1037.67 7354.55 1042.93 7355.07 1048.04 7355.57 1052.41    7356 1068.85 7357.39
 1071.51 7357.61 1075.74    7358 1097.94  7359.3  1111.4    7360 1115.14 7360.16
 1121.05 7360.43 1142.34 7361.37 1155.17    7362    1170 7362.96 1185.99    7364
 1203.97 7365.26 1214.63    7366 1237.12 7367.63 1242.23    7368 1243.34  7368.1
 1250.97 7368.76 1263.11 7369.81 1265.31    7370  1270.3 7370.53 1283.98    7372
 1290.02 7372.61 1304.44    7374 1320.32 7375.14 1330.75    7376  1344.2 7376.73
 1356.82 7377.37 1363.77 7377.72 1365.78 7377.82 1367.09 7377.87 1369.53    7378
 1377.15 7378.32

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  640.84     .03  732.33    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        640.84  732.33           352.95  322.95  252.95             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
  741.77 1377.15 7327.45       F

CROSS SECTION OUTPUT  Profile #500-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7333.11  * Element                * Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.11  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7333.00  * Reach Len. (ft)        *  352.95  *  322.95  *
 252.95  *
* Crit W.S. (ft)         * 7327.45  * Flow Area (sq ft)      *  635.27  *  754.34  *
 314.50  *
* E.G. Slope (ft/ft)     *0.000238  * Area (sq ft)           *  635.27  *  754.34  *
 314.50  *
* Q Total (cfs)          * 3689.00  * Flow (cfs)             *  873.88  * 2347.05  *
 468.06  *
* Top Width (ft)         *  391.24  * Top Width (ft)         *  208.35  *   91.49  *
  91.40  *
* Vel Total (ft/s)       *    2.16  * Avg. Vel. (ft/s)       *    1.38  *    3.11  *
   1.49  *
* Max Chl Dpth (ft)      *    9.03  * Hydr. Depth (ft)       *    3.05  *    8.25  *
   3.44  *
* Conv. Total (cfs)      *239121.1  * Conv. (cfs)            * 56645.1  *152136.0  *
30340.0  *
* Length Wtd. (ft)       *  327.90  * Wetted Per. (ft)       *  208.71  *   91.81  *
  91.82  *
* Min Ch El (ft)         * 7323.97  * Shear (lb/sq ft)       *    0.05  *    0.12  *
   0.05  *
* Alpha                  *    1.47  * Stream Power (lb/ft s) *    0.06  *    0.38  *
   0.08  *
* Frctn Loss (ft)        *    0.03  * Cum Volume (acre-ft)   *   46.36  *   84.04  *
  24.50  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)         *   12.34  *   13.07  *
   9.90  *
```

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

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7326.71  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.57  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7326.15  * Reach Len. (ft)        *  352.95  *  322.95  *
 252.95  *
* Crit W.S. (ft)         * 7326.07  * Flow Area (sq ft)      *    0.04  *  127.05  *
   0.06  *
* E.G. Slope (ft/ft)     *0.009658  * Area (sq ft)           *    0.04  *  127.05  *
   0.06  *
* Q Total (cfs)          *  768.00  * Flow (cfs)             *    0.03  *  767.93  *
   0.04  *
* Top Width (ft)         *   92.84  * Top Width (ft)         *    0.50  *   91.49  *
   0.84  *
* Vel Total (ft/s)       *    6.04  * Avg. Vel. (ft/s)       *    0.71  *    6.04  *
   0.72  *
* Max Chl Dpth (ft)      *    2.18  * Hydr. Depth (ft)       *    0.07  *    1.39  *
   0.07  *
* Conv. Total (cfs)      *  7814.9  * Conv. (cfs)            *     0.3  *  7814.2  *
    0.5  *
* Length Wtd. (ft)       *  322.95  * Wetted Per. (ft)       *    0.53  *   91.81  *
   0.86  *
* Min Ch El (ft)         * 7323.97  * Shear (lb/sq ft)       *    0.04  *    0.83  *
   0.04  *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *    0.03  *    5.04  *
   0.03  *
* Frctn Loss (ft)        *    1.68  * Cum Volume (acre-ft)   *    1.55  *   22.84  *
   0.08  *
* C & E Loss (ft)        *    0.09  * Cum SA (acres)         *    1.21  *   12.09  *
   0.27  *
*******************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7331.70  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.05  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7331.65  * Reach Len. (ft)        *  352.95  *  322.95  *
 252.95  *
* Crit W.S. (ft)         * 7327.05  * Flow Area (sq ft)      *  366.86  *  630.69  *
 199.81  *
```

```
* E.G. Slope (ft/ft)     *0.000131  * Area (sq ft)           *  366.86  *  630.69  *
 199.81  *
* Q Total (cfs)          * 1754.00  * Flow (cfs)             *  279.94  * 1291.51  *
 182.55  *
* Top Width (ft)         *  354.58  * Top Width (ft)         *  185.99  *   91.49  *
  77.10  *
* Vel Total (ft/s)       *    1.46  * Avg. Vel. (ft/s)       *    0.76  *    2.05  *
   0.91  *
* Max Chl Dpth (ft)      *    7.68  * Hydr. Depth (ft)       *    1.97  *    6.89  *
   2.59  *
* Conv. Total (cfs)      *153311.0  * Conv. (cfs)            * 24468.3  *112886.5  *
15956.2  *
* Length Wtd. (ft)       *  326.98  * Wetted Per. (ft)       *  186.31  *   91.81  *
  77.45  *
* Min Ch El (ft)         * 7323.97  * Shear (lb/sq ft)       *    0.02  *    0.06  *
   0.02  *
* Alpha                  *    1.52  * Stream Power (lb/ft s) *    0.01  *    0.11  *
   0.02  *
* Frctn Loss (ft)        *    0.01  * Cum Volume (acre-ft)   *   19.11  *   53.71  *
   6.54  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *    6.89  *   13.05  *
   3.58  *
*******************************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: Alignment - (1)
REACH: Alignment - (1)    RS: 5833.82

INPUT
Description:
Station Elevation Data    num=     284
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 7360.81    3.52 7360.65    8.88 7360.39   17.33    7360    27.1 7359.71
    28.4 7359.66   30.86 7359.58   44.48 7359.16   56.31  7358.8   62.26 7358.61
   80.88 7358.05   81.22 7358.04   82.49    7358   106.7 7357.44  121.42 7357.11
  126.63 7356.94  135.19 7356.75  143.18 7356.54  147.68 7356.43  150.63 7356.36
  158.96 7356.21  166.77    7356  171.61 7355.58   172.7 7355.32  175.81 7355.09
  179.62 7354.92  183.33 7354.88  186.56 7354.87  188.47 7354.95  191.78 7354.94
   197.9 7354.74     201 7354.63  203.24 7354.73   206.4  7354.9   206.5 7354.97
  207.61 7355.14  210.07 7355.09  212.54 7355.08  218.74 7355.11  223.48 7355.02
  224.57 7355.01  230.42 7355.15  234.29 7355.22  235.59 7355.25  237.13 7355.27
  237.99 7355.29  239.49 7355.35  240.16 7355.35  241.52 7355.31  243.38 7355.22
  244.54 7355.15  245.17 7355.09  252.98 7354.57  262.21    7354  290.25 7352.21
  292.39 7352.07  293.53    7352  315.85 7350.44  321.08    7350  329.28 7349.28
  340.76 7348.36  343.95  7348.1  345.54    7348  347.97 7347.87  353.73 7347.68
  361.32 7347.66  366.23 7347.75  371.75 7347.91  374.19    7348  378.57 7348.16
  381.55 7348.29  384.04  7348.4  388.01  7348.6  392.49 7348.81  395.47 7348.92
  397.93 7349.08  401.84 7349.29  403.31 7349.33  406.48 7349.34  409.49 7349.32
  412.34 7349.28   416.2 7349.17  421.25    7349  423.33  7348.9  430.44 7348.66
   431.6 7348.65  440.47 7348.28  444.55 7348.06  445.57    7348  455.11 7346.84
  456.71 7346.64  462.32    7346  472.89  7344.2  473.88    7344  482.14 7342.18
  482.23 7342.16   482.7 7342.07  483.08    7342  494.06 7340.03  494.21    7340
   495.2 7339.77  502.79    7338  504.78 7337.53  510.09    7336  515.43 7334.44
     517    7334  519.74 7333.33  525.08    7332  528.63 7331.31  535.81    7330
  538.32 7329.61  540.92 7329.31  549.61 7328.14  550.26 7328.05  550.63    7328
```

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  558.72 7327.53  563.25 7327.24  564.37 7327.29  570.09 7326.98  571.58 7327.05
  574.93 7326.87  577.39 7326.79  577.76 7326.74  578.04 7326.69  578.64 7326.63
  578.83  7326.6  579.04 7326.54  579.24 7326.52  579.41  7326.5  580.17 7326.47
  581.99 7326.44   583.2 7326.42  584.04 7326.39   589.1 7326.37  593.56 7326.35
  595.26 7326.36  597.18 7326.37  598.23 7326.37  599.73 7326.38  601.89 7326.39
  604.19 7326.41  607.42 7326.44  609.65 7326.46   610.3 7326.47  611.01 7326.48
  612.79 7326.49  615.53 7326.53  617.56 7326.56  623.99 7326.62  628.19 7326.67
  632.05  7326.7  635.98 7326.76  658.99 7327.05  674.27 7327.18  676.63 7327.17
  679.25 7327.17  683.42 7327.19  684.72  7327.2  691.22 7327.23  696.63 7327.25
  699.47 7327.26  701.45 7327.28  707.11  7327.3  712.13 7327.32  714.02 7327.33
  714.78 7327.33  717.34 7327.34  718.34 7327.34   721.5 7327.35  731.47 7327.39
  741.25 7327.44  746.69 7327.47  747.24 7327.49  749.23 7327.53  751.06 7327.54
  755.78 7327.57  758.92 7327.58  760.63  7327.6  763.39 7327.63  766.19 7327.66
  767.45 7327.67  770.07 7327.68  772.53 7327.69   774.7 7327.71  775.56 7327.71
  779.13 7327.66  784.16 7327.59  784.68 7327.57  785.24 7327.54  785.83 7327.51
  786.93 7327.47  788.45 7327.51  789.36  7327.5  790.15 7327.49  791.08 7327.48
  791.48 7327.46   791.7 7327.46  792.08 7327.45  792.87 7327.41  793.16 7327.39
   793.7 7327.34  794.34 7327.31  795.81 7327.21  796.03 7327.12  796.82 7327.07
  800.14 7326.89  801.33 7326.88  812.82  7326.6  816.93 7326.46  825.14    7326
  825.76 7325.98   826.6 7325.96  904.23    7324  913.93 7322.71  919.56    7322
  920.19 7321.96  925.58 7321.68  934.69 7321.75  942.71 7321.83  944.73 7321.85
  947.18 7321.99  947.67    7322  949.74    7322  950.77 7321.99  951.88 7321.96
  952.49 7321.92  955.28 7321.91  960.86 7321.89  965.63    7322  965.81 7322.02
  976.13    7324  980.59 7325.02  984.22    7326  988.55 7327.26  990.69    7328
   992.2  7328.6  995.51    7330  999.48  7331.9  999.68    7332 1000.49 7332.22
 1006.66    7334 1020.93 7335.74 1021.92 7335.85 1022.54 7335.93 1022.62 7335.94
 1022.74 7335.95 1022.86 7335.96 1023.07 7335.96 1023.91    7336 1029.32 7336.27
 1035.13 7336.47 1036.19 7336.56 1040.33 7336.89 1054.52    7338 1055.39 7338.06
 1056.04 7338.11 1066.77 7338.92 1075.33 7339.53 1078.36 7339.76 1081.67    7340
 1086.87 7340.43 1096.51 7341.43 1102.03    7342 1109.35 7342.78  1112.9 7343.13
 1120.64    7344 1126.64 7344.55 1141.61    7346 1152.35 7346.93  1164.2    7348
 1172.81 7348.71 1187.73    7350 1196.75 7350.79 1211.23    7352 1219.29 7352.71
 1234.64    7354 1240.67 7354.58 1255.52 7355.89 1256.34 7355.96 1256.81    7356
 1279.19  7357.8 1282.01    7358 1288.81 7358.46 1296.55    7359

Manning's n Values        num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
**********************************************
       0    .035   826.6     .03  984.22    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         826.6  984.22               240     415     475             .1       .3

CROSS SECTION OUTPUT  Profile #500-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7333.06  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.02  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7333.03  * Reach Len. (ft)        *  240.00  *  415.00  *
 475.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 1732.25  * 1465.12  *
  69.17  *
* E.G. Slope (ft/ft)     *0.000043  * Area (sq ft)           * 1732.25  * 1465.12  *
  69.17  *
* Q Total (cfs)          * 3689.00  * Flow (cfs)             * 1537.72  * 2107.61  *
  43.67  *
* Top Width (ft)         *  482.38  * Top Width (ft)         *  305.67  *  157.62  *
  19.09  *
* Vel Total (ft/s)       *    1.13  * Avg. Vel. (ft/s)       *    0.89  *    1.44  *
   0.63  *
* Max Chl Dpth (ft)      *   11.35  * Hydr. Depth (ft)       *    5.67  *    9.30  *
```

```
  3.62  *
* Conv. Total (cfs)      *560100.1  * Conv. (cfs)            *233472.1  *319997.4  *
 6630.6  *
* Length Wtd. (ft)       *  367.78  * Wetted Per. (ft)       *  306.24  *  158.23  *
  20.39  *
* Min Ch El (ft)         * 7321.68  * Shear (lb/sq ft)       *    0.02  *    0.03  *
   0.01  *
* Alpha                  *    1.19  * Stream Power (lb/ft s) *    0.01  *    0.04  *
   0.01  *
* Frctn Loss (ft)        *    0.01  * Cum Volume (acre-ft)   *   36.77  *   75.81  *
  23.39  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *   10.26  *   12.14  *
   9.58  *
*******************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7324.95  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.27  * Wt. n-Val.             *          *   0.030  *
         *
* W.S. Elev (ft)         * 7324.68  * Reach Len. (ft)        *  240.00  *  415.00  *
 475.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *          *  183.72  *
         *
* E.G. Slope (ft/ft)     *0.003251  * Area (sq ft)           *          *  183.72  *
         *
* Q Total (cfs)          *  768.00  * Flow (cfs)             *          *  768.00  *
         *
* Top Width (ft)         *  101.60  * Top Width (ft)         *          *  101.60  *
         *
* Vel Total (ft/s)       *    4.18  * Avg. Vel. (ft/s)       *          *    4.18  *
         *
* Max Chl Dpth (ft)      *    3.00  * Hydr. Depth (ft)       *          *    1.81  *
         *
* Conv. Total (cfs)      * 13469.6  * Conv. (cfs)            *          * 13469.6  *
         *
* Length Wtd. (ft)       *  413.16  * Wetted Per. (ft)       *          *  102.02  *
         *
* Min Ch El (ft)         * 7321.68  * Shear (lb/sq ft)       *          *    0.37  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    1.53  *
         *
* Frctn Loss (ft)        *    0.07  * Cum Volume (acre-ft)   *    1.55  *   21.69  *
   0.08  *
* C & E Loss (ft)        *    0.08  * Cum SA (acres)         *    1.21  *   11.37  *
   0.26  *
*******************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
```

```
* E.G. Elev (ft)          * 7331.68  * Element                 *  Left OB *  Channel *
Right OB *
* Vel Head (ft)           *    0.01  * Wt. n-Val.              *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)          * 7331.67  * Reach Len. (ft)         *  240.00  *  415.00  *
 475.00  *
* Crit W.S. (ft)          *          * Flow Area (sq ft)       * 1318.60  * 1249.86  *
  46.28  *
* E.G. Slope (ft/ft)      *0.000019  * Area (sq ft)            * 1318.60  * 1249.86  *
  46.28  *
* Q Total (cfs)           * 1754.00  * Flow (cfs)              *  658.86  * 1077.53  *
  17.61  *
* Top Width (ft)          *  472.20  * Top Width (ft)          *  299.81  *  157.62  *
  14.77  *
* Vel Total (ft/s)        *    0.67  * Avg. Vel. (ft/s)        *    0.50  *    0.86  *
   0.38  *
* Max Chl Dpth (ft)       *    9.99  * Hydr. Depth (ft)        *    4.40  *    7.93  *
   3.13  *
* Conv. Total (cfs)       *399690.1  * Conv. (cfs)             *150136.1  *245541.1  *
 4012.9  *
* Length Wtd. (ft)        *  373.15  * Wetted Per. (ft)        *  300.23  *  158.23  *
  15.86  *
* Min Ch El (ft)          * 7321.68  * Shear (lb/sq ft)        *    0.01  *    0.01  *
   0.00  *
* Alpha                   *    1.23  * Stream Power (lb/ft s) *    0.00  *    0.01  *
   0.00  *
* Frctn Loss (ft)         *    0.00  * Cum Volume (acre-ft)    *   12.28  *   46.74  *
   5.82  *
* C & E Loss (ft)         *    0.00  * Cum SA (acres)          *    4.93  *   12.12  *
   3.31  *
*******************************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: Alignment - (1)
REACH: Alignment - (1)    RS: 5442.15

INPUT
Description:
Station Elevation Data    num=     237
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 7343.15    4.72 7343.15   11.09 7343.11    15.6  7343.1    16.8 7343.09
   19.53 7343.07   25.72 7343.06   30.32 7343.03   32.76 7343.03   37.87 7343.01
   42.15    7343   46.67    7343   50.06 7342.99    52.9 7343.03   54.78 7343.08
   56.27 7343.09   58.37  7343.1    60.1  7343.1   62.62 7343.09   64.22 7343.09
   67.75 7343.07   72.77 7343.05   79.93 7343.01   81.82    7343   86.72 7342.98
   91.13 7342.84   96.91 7342.66   99.73 7342.51  101.69 7342.36  105.53 7342.22
  113.71    7342   139.7 7340.17  140.86  7340.1  142.44    7340  146.52 7339.66
  150.63 7339.34  155.84 7338.94  163.23 7338.45  168.44 7338.07   168.8 7338.05
  169.55    7338  181.13 7337.19  182.17 7337.13  192.72  7336.2  193.62 7336.13
   194.9    7336  200.68 7335.43     209 7334.75  214.97    7334  216.92 7333.82
  219.98 7333.52  228.46 7332.76  236.26    7332   237.2 7331.97  253.23 7331.39
  264.05 7331.11  266.85 7331.04  270.04 7330.87  274.79 7330.72  285.46 7330.24
  286.08  7330.2  288.86    7330  291.34 7328.63   292.4    7328  293.01 7327.96
  300.41 7327.37   301.3 7327.28  301.73 7327.25  302.61 7327.22  305.44 7327.18
   310.7 7327.44  315.67    7328  315.94 7328.05  316.04 7328.04  320.83 7328.89
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  322.82 7329.05  322.98 7329.05  323.08 7329.06  323.48 7329.13  323.82 7329.19
  324.02 7329.21  324.49 7329.24  325.41 7329.26  327.16  7329.3  327.68  7329.3
  328.64 7329.31  329.94  7329.3  331.32 7329.28  332.79 7329.25  334.03 7329.23
  334.37 7329.23  335.36 7329.22  339.25 7329.11  340.12 7329.05  341.92 7328.96
  343.76 7328.84  346.85 7328.62  355.64  7328.2     359    7328  360.92 7327.85
  361.19 7327.85  361.43 7327.83  361.78 7327.82   362.1  7327.8  362.67 7327.76
  368.27  7327.3  372.51 7327.06  374.53 7326.94  388.77 7326.29  389.36 7326.25
  389.87 7326.22  396.73 7326.02  397.28    7326  404.23 7325.56  406.22 7325.42
   409.4 7325.14  411.47 7325.03  411.71 7325.03  412.79  7325.1  415.27 7325.01
  418.38 7324.87  425.42 7324.05  425.81    7324  432.09 7322.15  432.24 7322.09
  432.53 7322.06  432.66 7322.04   432.7 7322.05  432.86 7322.05  433.03  7322.1
  433.25 7322.15  437.04 7322.52  438.88  7322.9  443.04  7323.7   443.4 7323.76
  444.35 7323.92  444.44 7323.94  444.49 7323.95  445.25    7324  451.98    7324
  453.21 7323.78  453.73  7323.8  454.03 7323.81  454.36 7323.78  457.31 7323.28
  459.96 7323.16  461.96 7322.93  464.77 7322.74  469.09 7322.38  469.92 7322.29
   472.8    7322  474.19 7321.63  479.47 7320.85  485.83    7320  488.75  7319.9
  489.27 7319.89  490.92 7319.85  495.81 7319.68  497.56 7319.58   503.7 7319.28
   528.8 7318.09  533.61 7317.99  547.22    7318  547.52 7318.02  548.14 7318.06
   571.4 7319.47   580.1    7320  585.54 7320.75  588.71 7321.22  593.58    7322
  602.55 7322.62  606.78 7322.85  608.69 7322.94  609.32 7322.97  610.64 7323.01
  611.88 7323.03  614.58 7323.42  615.94 7323.48  619.88    7324  632.88 7324.49
   633.2  7324.5  651.57 7325.15  658.79 7325.41  671.87    7326  677.95 7326.29
  684.06 7326.57  701.59 7327.35  703.97 7327.45  717.53    7328  722.79  7328.2
  735.25 7328.64  742.06 7328.95  747.71 7329.15  764.38    7330  766.09  7330.1
  769.17 7330.29  796.87    7332  817.54  7333.4  826.87    7334  848.87 7335.25
  861.91    7336  882.25 7337.38  891.93    7338     908 7339.27  915.49 7339.84
  917.62    7340  918.17 7340.03  922.84 7340.32  950.74    7342  958.78 7342.68
  974.44 7343.83  976.13 7343.96   976.8    7344  998.41 7345.67  998.91 7345.71
 1003.26    7346 1012.76 7346.76 1023.22 7347.74 1024.79 7347.87 1026.04    7348
 1034.62 7348.95 1038.26 7349.32 1044.77    7350 1045.19 7350.04 1045.56 7350.08
 1054.49 7350.98 1055.31 7351.04 1057.76 7351.26 1059.29 7351.38 1061.88 7351.58
 1062.74 7351.64 1068.12    7352 1074.29 7352.42 1079.39 7352.76 1085.63 7353.17
 1088.86 7353.39 1096.91 7353.95

Manning's n Values        num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
**********************************************
       0    .035  454.03     .03  619.88    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        454.03  619.88             10.5    10.5    10.5             .3       .5
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
       0  444.28 7324.03       F

CROSS SECTION OUTPUT  Profile #500-yr
*****************************************************************************************
***********
* E.G. Elev (ft)         * 7333.04  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.02  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7333.03  * Reach Len. (ft)        *   10.50  *   10.50  *
  10.50  *
* Crit W.S. (ft)         * 7322.48  * Flow Area (sq ft)      * 1169.80  * 2115.23  *
 959.10  *
* E.G. Slope (ft/ft)     *0.000019  * Area (sq ft)           * 1169.80  * 2115.23  *
 959.10  *
* Q Total (cfs)          * 3689.00  * Flow (cfs)             *  647.96  * 2516.83  *
 524.21  *
* Top Width (ft)         *  586.58  * Top Width (ft)         *  228.56  *  165.85  *
 192.17  *
* Vel Total (ft/s)       *    0.87  * Avg. Vel. (ft/s)       *    0.55  *    1.19  *
```

```
  0.55  *
* Max Chl Dpth (ft)      *   15.04  * Hydr. Depth (ft)       *    5.12  *   12.75  *
   4.99  *
* Conv. Total (cfs)      *836212.0  * Conv. (cfs)            *146878.1  *570506.8
*118827.1  *
* Length Wtd. (ft)       *   10.50  * Wetted Per. (ft)       *  230.00  *  166.46  *
 192.39  *
* Min Ch El (ft)         * 7317.99  * Shear (lb/sq ft)       *    0.01  *    0.02  *
   0.01  *
* Alpha                  *    1.41  * Stream Power (lb/ft s) *    0.00  *    0.02  *
   0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   *   28.78  *   58.75  *
  17.78  *
* C & E Loss (ft)        *    0.13  * Cum SA (acres)         *    8.79  *   10.60  *
   8.43  *
*******************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7324.80  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.02  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7324.78  * Reach Len. (ft)        *   10.50  *   10.50  *
  10.50  *
* Crit W.S. (ft)         * 7320.15  * Flow Area (sq ft)      *   44.90  *  747.77  *
   8.21  *
* E.G. Slope (ft/ft)     *0.000055  * Area (sq ft)           *   44.90  *  747.77  *
   8.21  *
* Q Total (cfs)          *  768.00  * Flow (cfs)             *   16.61  *  750.02  *
   1.37  *
* Top Width (ft)         *  222.06  * Top Width (ft)         *   34.90  *  165.85  *
  21.31  *
* Vel Total (ft/s)       *    0.96  * Avg. Vel. (ft/s)       *    0.37  *    1.00  *
   0.17  *
* Max Chl Dpth (ft)      *    6.79  * Hydr. Depth (ft)       *    1.29  *    4.51  *
   0.39  *
* Conv. Total (cfs)      *103253.3  * Conv. (cfs)            *  2232.7  *100836.1  *
  184.5  *
* Length Wtd. (ft)       *   10.50  * Wetted Per. (ft)       *   35.42  *  166.46  *
  21.33  *
* Min Ch El (ft)         * 7317.99  * Shear (lb/sq ft)       *    0.00  *    0.02  *
   0.00  *
* Alpha                  *    1.07  * Stream Power (lb/ft s) *    0.00  *    0.02  *
   0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   *    1.43  *   17.25  *
   0.04  *
* C & E Loss (ft)        *    0.06  * Cum SA (acres)         *    1.11  *   10.10  *
   0.15  *
*******************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
```

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

CROSS SECTION OUTPUT Profile #50-yr
****

E.G. Elev (ft)	7331.67	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.035	0.030	0.035
W.S. Elev (ft)	7331.67	Reach Len. (ft)	10.50	10.50	10.50
Crit W.S. (ft)	7321.09	Flow Area (sq ft)	869.26	1889.29	711.10
E.G. Slope (ft/ft)	0.000007	Area (sq ft)	869.26	1889.29	711.10
Q Total (cfs)	1754.00	Flow (cfs)	258.63	1283.90	211.47
Top Width (ft)	545.83	Top Width (ft)	208.41	165.85	171.57
Vel Total (ft/s)	0.51	Avg. Vel. (ft/s)	0.30	0.68	0.30
Max Chl Dpth (ft)	13.68	Hydr. Depth (ft)	4.17	11.39	4.14
Conv. Total (cfs)	645645.3	Conv. (cfs)	95200.9	472603.1	77841.3
Length Wtd. (ft)	10.50	Wetted Per. (ft)	209.80	166.46	171.75
Min Ch El (ft)	7317.99	Shear (lb/sq ft)	0.00	0.01	0.00
Alpha	1.42	Stream Power (lb/ft s)	0.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	6.25	31.78	1.69
C & E Loss (ft)	0.06	Cum SA (acres)	3.53	10.58	2.29

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Alignment - (1)
REACH: Alignment - (1) RS: 5431.65

INPUT
Description:
Station Elevation Data num= 232

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7343	1.67	7343.01	6.74	7343.01	14.14	7342.96	18.06	7342.96
19.45	7342.95	22.62	7342.92	27.95	7342.91	33.26	7342.88	35.35	7342.88
39.72	7342.86	44.64	7342.85	49.82	7342.85	53.72	7342.84	56.97	7342.89
59.13	7342.94	60.84	7342.95	63.25	7342.96	68.13	7342.96	69.97	7342.95
74.02	7342.93	79.79	7342.91	88.01	7342.86	90.18	7342.85	95.8	7342.83
100.86	7342.67	107.5	7342.46	110.74	7342.28	112.99	7342.12	116.14	7342
126.11	7341.36	128.05	7341.24	136.2	7340.78	138.92	7340.63	142.57	7340.41

```
  145.17 7340.38  152.98    7340  157.75 7339.68  158.83  7339.6  166.59 7339.12
   176.2 7338.46  177.06 7338.42  179.68 7338.26  183.35    7338  187.27 7337.71
  188.28 7337.61  195.63 7337.07  207.45    7336  208.24 7335.94  208.67 7335.88
  210.45 7335.68  219.77 7334.65  223.94    7334  227.33 7333.62  232.01 7333.24
  237.54 7332.71  241.18 7332.47  244.26 7332.21  247.49    7332  252.15 7331.81
  254.86 7331.73  257.11 7331.63  257.24 7331.62  258.79 7331.51  269.43 7331.04
   271.6 7330.91  285.51    7330  286.79 7329.48  292.36    7328  304.63  7326.7
  306.38 7326.52  306.92 7326.49  308.75 7326.34  308.98 7326.32  309.08 7326.31
   309.3  7326.3     310 7326.29  311.31 7326.36  312.65 7326.51  322.29    7328
  322.71 7328.07  326.15 7328.35  326.42 7328.36  326.59 7328.37  327.28  7328.5
  327.88  7328.6  328.22 7328.63  329.04 7328.69  330.63 7328.71  333.65 7328.78
  334.56 7328.79  336.21  7328.8  338.47 7328.78  340.85 7328.75   343.4 7328.71
  345.54 7328.66  346.13 7328.66  347.85 7328.65  354.58 7328.46  356.08 7328.35
  359.19 7328.21  362.38    7328  362.41    7328  366.22 7327.77  369.29 7327.63
  372.64 7327.41  375.57 7327.26  378.41 7327.18  384.47 7326.97  390.88 7326.71
  398.84 7326.34  404.64    7326  405.81 7325.53  410.63    7324  412.29    7324
  414.99 7323.99  419.17 7323.99  419.24 7323.98  423.69 7323.42  425.39 7323.61
  427.55 7323.64  430.92 7323.73  431.86    7324  437.41 7324.03  440.39 7324.03
  442.61 7324.04   443.5 7324.04  445.72 7324.03  448.51 7324.02  452.29    7324
  454.48 7323.81  456.06 7323.67  457.92 7323.48  460.47 7323.23  472.88    7322
  475.21 7321.38  475.62 7321.24  476.56 7320.96  479.75    7320  483.18 7319.79
  484.41 7319.72     492 7319.39  495.53 7319.27  499.41 7319.19  511.84 7318.88
  523.45 7318.47  536.17 7318.03  538.73 7318.17  538.79 7318.17  539.35  7318.2
  539.75 7318.21  540.21 7318.24  542.65  7318.4  545.78 7318.57  548.49  7318.7
  551.66 7318.86  555.72 7319.06  557.63  7319.2  570.81    7320   574.8  7320.5
  577.71  7320.9  581.17 7321.34  585.59    7322  602.74 7323.19  615.75 7323.85
  618.79    7324     638 7324.71  667.37    7326  672.64 7326.31  673.28 7326.32
   675.6  7326.4  679.29 7326.57  684.83 7326.84  696.25 7327.38  709.93    7328
  717.47 7328.31  724.91 7328.61  741.13 7329.23  746.43 7329.42  758.99    7330
  761.29 7330.12  764.54 7330.32  781.95 7331.33   792.9    7332  809.24 7333.11
  822.37    7334  843.59 7335.23  857.22    7336  882.95 7337.54  890.03    7338
  894.04 7338.32  914.59 7339.98  914.87    7340  929.25 7340.88  947.83    7342
  958.28 7342.78  976.58    7344  980.13 7344.27  982.76 7344.46  993.33 7345.17
  999.69  7345.6 1000.68 7345.67 1001.71 7345.72 1002.34 7345.75 1003.04 7345.77
 1005.95    7346 1014.58 7346.72 1018.01 7347.06 1020.83 7347.29 1021.38  7347.3
 1021.84 7347.31 1027.69 7347.93 1027.81 7347.94 1028.43    7348 1033.41 7348.48
 1039.14 7349.07 1044.71 7349.64 1048.52 7349.92 1048.67 7349.93 1049.84    7350
  1052.8 7350.19 1054.87 7350.33 1063.72 7351.03 1066.57 7351.22 1073.61 7351.63
 1075.21  7351.7  1075.7  7351.7 1079.86    7352  1083.7 7352.26 1086.54 7352.46
 1091.56 7352.84 1091.88 7352.86

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  452.29     .03  615.75    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        452.29  615.75              110     110     110             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     519  7334.8       T
     552 1091.88    7331       T

CROSS SECTION OUTPUT  Profile #500-yr
*****************************************************************************************
***********
* E.G. Elev (ft)         * 7332.91  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.46  * Wt. n-Val.             *          *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7332.45  * Reach Len. (ft)        *  110.00  *  110.00  *
 110.00  *
* Crit W.S. (ft)         * 7325.68  * Flow Area (sq ft)      *          *  556.58  *
```

```
 250.62  *
* E.G. Slope (ft/ft)     *0.001323  * Area (sq ft)           * 1026.05  * 1955.88  *
 842.89  *
* Q Total (cfs)          * 3689.00  * Flow (cfs)             *          * 3213.50  *
 475.50  *
* Top Width (ft)         *  558.18  * Top Width (ft)         *  210.90  *  163.46  *
 183.81  *
* Vel Total (ft/s)       *    4.57  * Avg. Vel. (ft/s)       *          *    5.77  *
   1.90  *
* Max Chl Dpth (ft)      *   14.42  * Hydr. Depth (ft)       *          *    5.75  *
   1.36  *
* Conv. Total (cfs)      *101422.6  * Conv. (cfs)            *          * 88349.5  *
13073.1  *
* Length Wtd. (ft)       *  110.00  * Wetted Per. (ft)       *          *   97.01  *
 184.02  *
* Min Ch El (ft)         * 7318.03  * Shear (lb/sq ft)       *          *    0.47  *
   0.11  *
* Alpha                  *    1.41  * Stream Power (lb/ft s) *          *    2.74  *
   0.21  *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *   28.51  *   58.26  *
  17.56  *
* C & E Loss (ft)        *          * Cum SA (acres)         *    8.74  *   10.56  *
   8.38  *
*******************************************************************************
***********

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7324.73  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.23  * Wt. n-Val.             *          *   0.030  *
         *
* W.S. Elev (ft)         * 7324.51  * Reach Len. (ft)        *  110.00  *  110.00  *
 110.00  *
* Crit W.S. (ft)         * 7320.95  * Flow Area (sq ft)      *          *  201.81  *
         *
* E.G. Slope (ft/ft)     *0.000529  * Area (sq ft)           *   25.33  *  657.30  *
   5.27  *
* Q Total (cfs)          *  768.00  * Flow (cfs)             *          *  768.00  *
         *
* Top Width (ft)         *  223.52  * Top Width (ft)         *   43.26  *  163.46  *
  16.79  *
* Vel Total (ft/s)       *    3.81  * Avg. Vel. (ft/s)       *          *    3.81  *
         *
* Max Chl Dpth (ft)      *    6.48  * Hydr. Depth (ft)       *          *    6.12  *
         *
* Conv. Total (cfs)      * 33404.6  * Conv. (cfs)            *          * 33404.6  *
         *
* Length Wtd. (ft)       *  110.00  * Wetted Per. (ft)       *          *   33.03  *
         *
* Min Ch El (ft)         * 7318.03  * Shear (lb/sq ft)       *          *    0.20  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.77  *
         *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *    1.42  *   17.08  *
   0.04  *
* C & E Loss (ft)        *          * Cum SA (acres)         *    1.10  *   10.06  *
   0.14  *
*******************************************************************************
***********

CROSS SECTION OUTPUT  Profile #50-yr
```

```
*******************************************************************************
***********
* E.G. Elev (ft)         * 7331.61  * Element                 *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.22  * Wt. n-Val.              *          *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7331.39  * Reach Len. (ft)         *  110.00  *  110.00  *
 110.00  *
* Crit W.S. (ft)         * 7322.82  * Flow Area (sq ft)       *          *  453.88  *
  64.09  *
* E.G. Slope (ft/ft)     *0.000744  * Area (sq ft)            *  811.71  * 1782.36  *
 656.36  *
* Q Total (cfs)          * 1754.00  * Flow (cfs)              *          * 1714.87  *
  39.13  *
* Top Width (ft)         *  521.47  * Top Width (ft)          *  190.81  *  163.46  *
 167.20  *
* Vel Total (ft/s)       *    3.39  * Avg. Vel. (ft/s)        *          *    3.78  *
   0.61  *
* Max Chl Dpth (ft)      *   13.36  * Hydr. Depth (ft)        *          *    4.69  *
   0.38  *
* Conv. Total (cfs)      * 64321.2  * Conv. (cfs)             *          * 62886.2  *
 1435.0  *
* Length Wtd. (ft)       *  110.00  * Wetted Per. (ft)        *          *   97.01  *
 167.37  *
* Min Ch El (ft)         * 7318.03  * Shear (lb/sq ft)        *          *    0.22  *
   0.02  *
* Alpha                  *    1.22  * Stream Power (lb/ft s) *          *    0.82  *
   0.01  *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)    *    6.05  *   31.34  *
   1.53  *
* C & E Loss (ft)        *          * Cum SA (acres)          *    3.48  *   10.54  *
   2.25  *
*******************************************************************************
***********

CULVERT


RIVER: Alignment - (1)
REACH: Alignment - (1)    RS: 5376

INPUT
Description: Upper Reach Bridge
Distance from Upstream XS =       5
Deck/Roadway Width        =     100
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=      11
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*********************************************************************
   176.2 7338.46             200    7338             300    7336
     500  7332.5             519  7332.1    7324     536  7331.8    7324
     552  7331.5    7324     650    7330             660    7330
     700  7330.1             850    7332

Upstream Bridge Cross Section Data
Station Elevation Data    num=     232
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0    7343    1.67 7343.01    6.74 7343.01   14.14 7342.96   18.06 7342.96
   19.45 7342.95   22.62 7342.92   27.95 7342.91   33.26 7342.88   35.35 7342.88
   39.72 7342.86   44.64 7342.85   49.82 7342.85   53.72 7342.84   56.97 7342.89
   59.13 7342.94   60.84 7342.95   63.25 7342.96   68.13 7342.96   69.97 7342.95
```

```
  74.02 7342.93   79.79 7342.91   88.01 7342.86   90.18 7342.85    95.8 7342.83
 100.86 7342.67   107.5 7342.46  110.74 7342.28  112.99 7342.12  116.14    7342
 126.11 7341.36  128.05 7341.24   136.2 7340.78  138.92 7340.63  142.57 7340.41
 145.17 7340.38  152.98    7340  157.75 7339.68  158.83  7339.6  166.59 7339.12
  176.2 7338.46  177.06 7338.42  179.68 7338.26  183.35    7338  187.27 7337.71
 188.28 7337.61  195.63 7337.07  207.45    7336  208.24 7335.94  208.67 7335.88
 210.45 7335.68  219.77 7334.65  223.94    7334  227.33 7333.62  232.01 7333.24
 237.54 7332.71  241.18 7332.47  244.26 7332.21  247.49    7332  252.15 7331.81
 254.86 7331.73  257.11 7331.63  257.24 7331.62  258.79 7331.51  269.43 7331.04
  271.6 7330.91  285.51    7330  286.79 7329.48  292.36    7328  304.63  7326.7
 306.38 7326.52  306.92 7326.49  308.75 7326.34  308.98 7326.32  309.08 7326.31
  309.3  7326.3     310 7326.29  311.31 7326.36  312.65 7326.51  322.29    7328
 322.71 7328.07  326.15 7328.35  326.42 7328.36  326.59 7328.37  327.28  7328.5
 327.88  7328.6  328.22 7328.63  329.04 7328.69  330.63 7328.71  333.65 7328.78
 334.56 7328.79  336.21  7328.8  338.47 7328.78  340.85 7328.75   343.4 7328.71
 345.54 7328.66  346.13 7328.66  347.85 7328.65  354.58 7328.46  356.08 7328.35
 359.19 7328.21  362.38    7328  362.41    7328  366.22 7327.77  369.29 7327.63
 372.64 7327.41  375.57 7327.26  378.41 7327.18  384.47 7326.97  390.88 7326.71
 398.84 7326.34  404.64    7326  405.81 7325.53  410.63    7324  412.29    7324
 414.99 7323.99  419.17 7323.99  419.24 7323.98  423.69 7323.42  425.39 7323.61
 427.55 7323.64  430.92 7323.73  431.86    7324  437.41 7324.03  440.39 7324.03
 442.61 7324.04   443.5 7324.04  445.72 7324.03  448.51 7324.02  452.29    7324
 454.48 7323.81  456.06 7323.67  457.92 7323.48  460.47 7323.23  472.88    7322
 475.21 7321.38  475.62 7321.24  476.56 7320.96  479.75    7320  483.18 7319.79
 484.41 7319.72     492 7319.39  495.53 7319.27  499.41 7319.19  511.84 7318.88
 523.45 7318.47  536.17 7318.03  538.73 7318.17  538.79 7318.17  539.35  7318.2
 539.75 7318.21  540.21 7318.24  542.65  7318.4  545.78 7318.57  548.49  7318.7
 551.66 7318.86  555.72 7319.06  557.63  7319.2  570.81    7320   574.8  7320.5
 577.71  7320.9  581.17 7321.34  585.59    7322  602.74 7323.19  615.75 7323.85
 618.79    7324     638 7324.71  667.37    7326  672.64 7326.31  673.28 7326.32
  675.6  7326.4  679.29 7326.57  684.83 7326.84  696.25 7327.38  709.93    7328
 717.47 7328.31  724.91 7328.61  741.13 7329.23  746.43 7329.42  758.99    7330
 761.29 7330.12  764.54 7330.32  781.95 7331.33   792.9    7332  809.24 7333.11
 822.37    7334  843.59 7335.23  857.22    7336  882.95 7337.54  890.03    7338
 894.04 7338.32  914.59 7339.98  914.87    7340  929.25 7340.88  947.83    7342
 958.28 7342.78  976.58    7344  980.13 7344.27  982.76 7344.46  993.33 7345.17
 999.69  7345.6 1000.68 7345.67 1001.71 7345.72 1002.34 7345.75 1003.04 7345.77
1005.95    7346 1014.58 7346.72 1018.01 7347.06 1020.83 7347.29 1021.38  7347.3
1021.84 7347.31 1027.69 7347.93 1027.81 7347.94 1028.43    7348 1033.41 7348.48
1039.14 7349.07 1044.71 7349.64 1048.52 7349.92 1048.67 7349.93 1049.84    7350
 1052.8 7350.19 1054.87 7350.33 1063.72 7351.03 1066.57 7351.22 1073.61 7351.63
1075.21  7351.7  1075.7  7351.7 1079.86    7352  1083.7 7352.26 1086.54 7352.46
1091.56 7352.84 1091.88 7352.86

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  452.29     .03  615.75    .035

Bank Sta: Left   Right    Coeff Contr.   Expan.
        452.29  615.75             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     519  7334.8       T
     552 1091.88    7331       T

Downstream  Deck/Roadway Coordinates
    num=      10
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
***********************************************************************
   176.2 7338.46             200    7338             300    7336
     500  7332.5             519  7332.1    7324     536  7331.8    7324
     650    7330             660    7330             700  7330.1
```

```
    850    7332

Downstream Bridge Cross Section Data
Station Elevation Data    num=     233
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 7342.61    4.73 7342.56    7.24 7342.53    11.3 7342.49   14.13 7342.46
   14.85 7342.45   15.07 7342.45   17.34 7342.43   19.76 7342.42   21.85  7342.4
   23.89  7342.4   25.64 7342.39   27.87  7342.4   32.03  7342.4   44.07 7342.32
   45.38 7342.32   47.64 7342.31   52.79 7342.27   54.33 7342.26   62.89 7342.21
   64.44 7342.21   72.27 7342.18   80.55 7342.17    86.8 7342.16   92.03 7342.24
    95.5 7342.31   98.26 7342.33  102.16 7342.35  105.38 7342.35  110.06 7342.34
  113.04 7342.32  119.64 7342.29  129.05 7342.25  142.55 7342.17  146.12 7342.16
  155.42  7342.1  158.79    7342  183.65    7342  194.75 7341.35  211.91    7340
  215.25 7339.65  230.99    7338  234.01 7337.68  237.49  7337.4  243.19 7336.87
  249.59 7336.47  250.39 7336.39  256.22    7336  262.31 7335.56  263.17  7335.5
  269.36 7334.99  276.02 7334.57   283.6    7334  289.23  7333.5   295.1 7332.93
  305.51    7332  311.06 7331.47  313.69 7331.29  320.14 7330.72  322.68 7330.58
  330.97 7330.12  331.46 7330.11  333.45    7330  335.95 7329.56   338.4 7329.03
  338.59 7329.03  339.13 7328.97  341.32    7329  341.83 7328.87  343.69  7328.8
  346.13 7328.44  346.91 7328.47  348.66 7328.42  350.88 7328.32  353.61    7328
  354.08 7327.82  355.41 7327.71  355.69 7327.66  361.45 7326.65  362.06 7326.55
  362.34 7326.53  363.43 7326.49  364.85 7326.53  367.01 7326.59  368.19 7326.65
  369.63  7326.7  371.35 7326.63  376.96  7326.3  377.67 7326.32  381.94 7326.16
  382.62 7326.16  388.45 7326.46  389.17 7326.43   394.6 7326.38  395.07 7326.35
  395.45 7326.32   396.7 7326.52  396.98 7326.68  397.73  7326.9  399.01 7326.96
  400.15    7327   401.6 7327.08  403.41 7327.06  405.54 7326.97  405.72 7326.88
  406.62  7326.7  410.19 7326.27   410.9 7326.19  413.52    7326  419.89  7325.7
  433.32 7325.08  441.94 7324.71  447.65 7324.38   454.3    7324  462.39 7323.04
  471.91    7322  474.04 7321.51  480.45    7320  488.11 7319.35   491.2 7319.17
  493.59 7319.02  507.58    7318  516.43    7318  518.06 7317.99  519.52 7317.99
  526.65    7318  534.05    7318  545.16 7319.76  547.01    7320  557.05 7321.96
  557.17 7321.98  557.19 7321.98  557.29    7322  557.37    7322  566.09  7322.3
   573.2 7322.52  576.44 7322.61  587.15 7322.87  594.41 7323.08  600.91 7323.33
  604.71 7323.49  609.09  7323.6   619.5    7324  627.46 7324.37  632.38 7324.66
  636.94 7324.91  646.04 7325.43  656.94    7326  670.93 7326.77  675.77 7327.07
  683.21 7327.48  691.59    7328  716.75 7328.91  719.75 7329.01  732.87  7329.5
  738.91 7329.71  739.87 7329.74  741.65 7329.81  745.84    7330  752.53 7330.29
  760.68 7330.57  764.73 7330.66  766.36 7330.66  767.29 7330.63  769.55 7330.64
  772.09 7330.66   779.7  7330.8  791.78  7331.5  795.27 7331.66  795.97 7331.69
  801.16    7332  810.74 7332.49   817.3 7332.77  826.72 7333.27  828.14 7333.35
  832.94 7333.57  839.68    7334  849.32 7334.66  857.08 7335.16  869.33    7336
  872.03 7336.17  880.31 7336.66   898.1    7338  918.89  7339.9  919.47 7339.95
  920.05    7340  941.75 7341.99  941.91    7342  949.32 7342.88  960.85    7344
  965.41 7344.48  972.17 7345.13  976.94 7345.61  981.58    7346  988.55 7346.54
  990.27 7346.65  991.87 7346.76   993.5 7346.89  995.76 7347.06  996.78 7347.11
  996.83 7347.11  998.07 7347.16  999.25 7347.19 1010.13 7347.75 1010.93 7347.77
 1011.27 7347.76 1011.65 7347.76 1012.29 7347.74 1015.76    7348 1019.18 7348.19
 1020.28  7348.2 1021.89  7348.3 1030.23 7348.67 1035.07 7348.84 1039.06 7348.98
 1046.67 7349.25 1049.57 7349.32 1051.12 7349.27 1051.77 7349.15  1052.9 7349.09
 1054.72 7349.02 1061.09 7349.46 1061.82 7349.43 1062.56 7349.45 1066.27  7349.5
 1067.32 7349.56 1069.45 7349.64 1069.82 7349.68 1075.08 7349.62 1075.76  7349.7
 1079.79 7349.92 1080.79    7350 1082.74 7350.11

Manning's n Values        num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
*********************************************
       0    .035  474.04     .03  557.05    .035

Bank Sta: Left   Right    Coeff Contr.   Expan.
        474.04  557.05             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
```

```
     0     486    7328       T
   552 1082.74    7328       T

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  1

Culvert Name     Shape      Rise    Span
Culvert #1           Box       6      16
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                 5     100     .011     .011        0                   .2
      1
Upstream   Elevation =  7318
           Centerline Station =  527
Downstream Elevation =  7318
           Centerline Station =  510

CULVERT OUTPUT  Profile #500-yr  Culv Group:  Culvert #1
**********************************************************************
* Q Culv Group (cfs)     * 1997.33  * Culv Full Len (ft)     *  100.00  *
* # Barrels              *       1  * Culv Vel US (ft/s)     *   20.81  *
* Q Barrel (cfs)         * 1997.33  * Culv Vel DS (ft/s)     *   20.81  *
* E.G. US. (ft)          * 7332.91  * Culv Inv El Up (ft)    * 7318.00  *
* W.S. US. (ft)          * 7332.45  * Culv Inv El Dn (ft)    * 7318.00  *
* E.G. DS (ft)           * 7325.54  * Culv Frctn Ls (ft)     *    0.84  *
* W.S. DS (ft)           * 7323.22  * Culv Exit Loss (ft)    *    5.19  *
* Delta EG (ft)          *    7.38  * Culv Entr Loss (ft)    *    1.35  *
* Delta WS (ft)          *    9.24  * Q Weir (cfs)           * 1691.67  *
* E.G. IC (ft)           * 7333.17  * Weir Sta Lft (ft)      *  519.00  *
* E.G. OC (ft)           * 7332.91  * Weir Sta Rgt (ft)      *  806.41  *
* Culvert Control        *  Outlet  * Weir Submerg           *    0.00  *
* Culv WS Inlet (ft)     * 7324.00  * Weir Max Depth (ft)    *    1.92  *
* Culv WS Outlet (ft)    * 7324.00  * Weir Avg Depth (ft)    *    1.70  *
* Culv Nml Depth (ft)    *          * Weir Flow Area (sq ft) *  488.38  *
* Culv Crt Depth (ft)    *    6.00  * Min El Weir Flow (ft)  * 7331.01  *
**********************************************************************

Note:    Culvert critical depth exceeds the height of the culvert.
Note:    During the supercritical calculations a hydraulic jump occurred inside of
the culvert.
Note:    The culvert inlet is submerged and the culvert flows full over part or all
of its length.  Therefore, the culvert inlet
         equations are not valid and the supercritical result has been discarded.
The outlet answer will be used.

CULVERT OUTPUT  Profile #10-yr  Culv Group:  Culvert #1
**********************************************************************
* Q Culv Group (cfs)     *  768.00  * Culv Full Len (ft)     *         *
* # Barrels              *       1  * Culv Vel US (ft/s)     *    9.90  *
* Q Barrel (cfs)         *  768.00  * Culv Vel DS (ft/s)     *   11.56  *
* E.G. US. (ft)          * 7324.74  * Culv Inv El Up (ft)    * 7318.00  *
* W.S. US. (ft)          * 7324.51  * Culv Inv El Dn (ft)    * 7318.00  *
* E.G. DS (ft)           * 7321.07  * Culv Frctn Ls (ft)     *    0.14  *
```

```
* W.S. DS (ft)          * 7320.40  * Culv Exit Loss (ft)    *    3.16  *
* Delta EG (ft)         *    3.67  * Culv Entr Loss (ft)    *    0.37  *
* Delta WS (ft)         *    4.11  * Q Weir (cfs)           *          *
* E.G. IC (ft)          * 7324.74  * Weir Sta Lft (ft)      *          *
* E.G. OC (ft)          * 7324.68  * Weir Sta Rgt (ft)      *          *
* Culvert Control       *   Inlet  * Weir Submerg           *          *
* Culv WS Inlet (ft)    * 7322.85  * Weir Max Depth (ft)    *          *
* Culv WS Outlet (ft)   * 7322.15  * Weir Avg Depth (ft)    *          *
* Culv Nml Depth (ft)   *          * Weir Flow Area (sq ft) *          *
* Culv Crt Depth (ft)   *    4.15  * Min El Weir Flow (ft)  * 7331.01  *
*********************************************************************

CULVERT OUTPUT  Profile #50-yr  Culv Group:  Culvert #1
*********************************************************************
* Q Culv Group (cfs)    * 1498.14  * Culv Full Len (ft)     *          *
* # Barrels             *       1  * Culv Vel US (ft/s)     *   15.61  *
* Q Barrel (cfs)        * 1498.14  * Culv Vel DS (ft/s)     *   22.60  *
* E.G. US. (ft)         * 7331.61  * Culv Inv El Up (ft)    * 7318.00  *
* W.S. US. (ft)         * 7331.39  * Culv Inv El Dn (ft)    * 7318.00  *
* E.G. DS (ft)          * 7322.84  * Culv Frctn Ls (ft)     *    0.77  *
* W.S. DS (ft)          * 7321.43  * Culv Exit Loss (ft)    *    7.24  *
* Delta EG (ft)         *    8.77  * Culv Entr Loss (ft)    *    0.76  *
* Delta WS (ft)         *    9.96  * Q Weir (cfs)           *  255.86  *
* E.G. IC (ft)          * 7331.61  * Weir Sta Lft (ft)      *  546.48  *
* E.G. OC (ft)          * 7329.01  * Weir Sta Rgt (ft)      *  786.42  *
* Culvert Control       *   Inlet  * Weir Submerg           *    0.00  *
* Culv WS Inlet (ft)    * 7324.00  * Weir Max Depth (ft)    *    0.60  *
* Culv WS Outlet (ft)   * 7322.14  * Weir Avg Depth (ft)    *    0.54  *
* Culv Nml Depth (ft)   *          * Weir Flow Area (sq ft) *  130.35  *
* Culv Crt Depth (ft)   *    6.00  * Min El Weir Flow (ft)  * 7331.01  *
*********************************************************************

Warning: During the supercritical analysis, the program could not converge on a
supercritical answer in the downstream cross
         section.  The program used the solution with the least error.
Warning: During the culvert outlet control computations, the program could not
balance the culvert/weir flow.  The reported
         outlet energy grade answer may not be valid.
Note:    Culvert critical depth exceeds the height of the culvert.
Note:    The flow in the culvert is entirely supercritical.

CROSS SECTION


RIVER: Alignment - (1)
REACH: Alignment - (1)    RS: 5321.65

INPUT
Description:
Station Elevation Data    num=     233
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 7342.61    4.73 7342.56    7.24 7342.53    11.3 7342.49   14.13 7342.46
   14.85 7342.45   15.07 7342.45   17.34 7342.43   19.76 7342.42   21.85  7342.4
   23.89  7342.4   25.64 7342.39   27.87  7342.4   32.03  7342.4   44.07 7342.32
   45.38 7342.32   47.64 7342.31   52.79 7342.27   54.33 7342.26   62.89 7342.21
   64.44 7342.21   72.27 7342.18   80.55 7342.17    86.8 7342.16   92.03 7342.24
    95.5 7342.31   98.26 7342.33  102.16 7342.35  105.38 7342.35  110.06 7342.34
  113.04 7342.32  119.64 7342.29  129.05 7342.25  142.55 7342.17  146.12 7342.16
  155.42  7342.1  158.79    7342  183.65    7342  194.75 7341.35  211.91    7340
  215.25 7339.65  230.99    7338  234.01 7337.68  237.49  7337.4  243.19 7336.87
  249.59 7336.47  250.39 7336.39  256.22    7336  262.31 7335.56  263.17  7335.5
  269.36 7334.99  276.02 7334.57   283.6    7334  289.23  7333.5   295.1 7332.93
```

```
  305.51    7332  311.06 7331.47  313.69 7331.29  320.14 7330.72  322.68 7330.58
  330.97 7330.12  331.46 7330.11  333.45    7330  335.95 7329.56   338.4 7329.03
  338.59 7329.03  339.13 7328.97  341.32    7329  341.83 7328.87  343.69  7328.8
  346.13 7328.44  346.91 7328.47  348.66 7328.42  350.88 7328.32  353.61    7328
  354.08 7327.82  355.41 7327.71  355.69 7327.66  361.45 7326.65  362.06 7326.55
  362.34 7326.53  363.43 7326.49  364.85 7326.53  367.01 7326.59  368.19 7326.65
  369.63  7326.7  371.35 7326.63  376.96  7326.3  377.67 7326.32  381.94 7326.16
  382.62 7326.16  388.45 7326.46  389.17 7326.43   394.6 7326.38  395.07 7326.35
  395.45 7326.32   396.7 7326.52  396.98 7326.68  397.73  7326.9  399.01 7326.96
  400.15    7327   401.6 7327.08  403.41 7327.06  405.54 7326.97  405.72 7326.88
  406.62  7326.7  410.19 7326.27   410.9 7326.19  413.52    7326  419.89  7325.7
  433.32 7325.08  441.94 7324.71  447.65 7324.38   454.3    7324  462.39 7323.04
  471.91    7322  474.04 7321.51  480.45    7320  488.11 7319.35   491.2 7319.17
  493.59 7319.02  507.58    7318  516.43    7318  518.06 7317.99  519.52 7317.99
  526.65    7318  534.05    7318  545.16 7319.76  547.01    7320  557.05 7321.96
  557.17 7321.98  557.19 7321.98  557.29    7322  557.37    7322  566.09  7322.3
   573.2 7322.52  576.44 7322.61  587.15 7322.87  594.41 7323.08  600.91 7323.33
  604.71 7323.49  609.09  7323.6   619.5    7324  627.46 7324.37  632.38 7324.66
  636.94 7324.91  646.04 7325.43  656.94    7326  670.93 7326.77  675.77 7327.07
  683.21 7327.48  691.59    7328  716.75 7328.91  719.75 7329.01  732.87  7329.5
  738.91 7329.71  739.87 7329.74  741.65 7329.81  745.84    7330  752.53 7330.29
  760.68 7330.57  764.73 7330.66  766.36 7330.66  767.29 7330.63  769.55 7330.64
  772.09 7330.66   779.7  7330.8  791.78  7331.5  795.27 7331.66  795.97 7331.69
  801.16    7332  810.74 7332.49   817.3 7332.77  826.72 7333.27  828.14 7333.35
  832.94 7333.57  839.68    7334  849.32 7334.66  857.08 7335.16  869.33    7336
  872.03 7336.17  880.31 7336.66   898.1    7338  918.89  7339.9  919.47 7339.95
  920.05    7340  941.75 7341.99  941.91    7342  949.32 7342.88  960.85    7344
  965.41 7344.48  972.17 7345.13  976.94 7345.61  981.58    7346  988.55 7346.54
  990.27 7346.65  991.87 7346.76   993.5 7346.89  995.76 7347.06  996.78 7347.11
  996.83 7347.11  998.07 7347.16  999.25 7347.19 1010.13 7347.75 1010.93 7347.77
 1011.27 7347.76 1011.65 7347.76 1012.29 7347.74 1015.76    7348 1019.18 7348.19
 1020.28  7348.2 1021.89  7348.3 1030.23 7348.67 1035.07 7348.84 1039.06 7348.98
 1046.67 7349.25 1049.57 7349.32 1051.12 7349.27 1051.77 7349.15  1052.9 7349.09
 1054.72 7349.02 1061.09 7349.46 1061.82 7349.43 1062.56 7349.45 1066.27  7349.5
 1067.32 7349.56 1069.45 7349.64 1069.82 7349.68 1075.08 7349.62 1075.76  7349.7
 1079.79 7349.92 1080.79    7350 1082.74 7350.11

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  474.04     .03  557.05    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        474.04  557.05               21      21      21              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0     486    7328       T
     552 1082.74    7328       T

CROSS SECTION OUTPUT  Profile #500-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7325.54  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    2.32  * Wt. n-Val.             *          *   0.030  *
         *
* W.S. Elev (ft)         * 7323.22  * Reach Len. (ft)        *   21.00  *   21.00  *
  21.00  *
* Crit W.S. (ft)         * 7323.22  * Flow Area (sq ft)      *          *  301.99  *
         *
* E.G. Slope (ft/ft)     *0.008057  * Area (sq ft)           *    9.87  *  345.75  *
  24.63  *
* Q Total (cfs)          * 3689.00  * Flow (cfs)             *          * 3689.00  *
```

```
          *
* Top Width (ft)         *  137.05  * Top Width (ft)         *   13.14  *   83.01  *
  40.90  *
* Vel Total (ft/s)       *   12.22  * Avg. Vel. (ft/s)       *          *   12.22  *
          *
* Max Chl Dpth (ft)      *    5.23  * Hydr. Depth (ft)       *          *    4.58  *
          *
* Conv. Total (cfs)      * 41099.0  * Conv. (cfs)            *          * 41099.0  *
          *
* Length Wtd. (ft)       *   21.00  * Wetted Per. (ft)       *          *   66.30  *
          *
* Min Ch El (ft)         * 7317.99  * Shear (lb/sq ft)       *          *    2.29  *
          *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *   27.98  *
          *
* Frctn Loss (ft)        *    0.15  * Cum Volume (acre-ft)   *   28.51  *   56.42  *
  17.56  *
* C & E Loss (ft)        *    0.24  * Cum SA (acres)         *    8.45  *   10.25  *
   8.10  *
*******************************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************************
***********
* E.G. Elev (ft)         * 7321.07  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.67  * Wt. n-Val.             *          *   0.030  *
          *
* W.S. Elev (ft)         * 7320.40  * Reach Len. (ft)        *   21.00  *   21.00  *
  21.00  *
* Crit W.S. (ft)         * 7320.19  * Flow Area (sq ft)      *          *  116.86  *
          *
* E.G. Slope (ft/ft)     *0.007774  * Area (sq ft)           *          *  120.71  *
          *
* Q Total (cfs)          *  768.00  * Flow (cfs)             *          *  768.00  *
          *
* Top Width (ft)         *   70.29  * Top Width (ft)         *          *   70.29  *
          *
* Vel Total (ft/s)       *    6.57  * Avg. Vel. (ft/s)       *          *    6.57  *
          *
* Max Chl Dpth (ft)      *    2.41  * Hydr. Depth (ft)       *          *    1.85  *
          *
* Conv. Total (cfs)      *  8710.2  * Conv. (cfs)            *          *  8710.2  *
          *
* Length Wtd. (ft)       *   21.00  * Wetted Per. (ft)       *          *   63.30  *
          *
* Min Ch El (ft)         * 7317.99  * Shear (lb/sq ft)       *          *    0.90  *
          *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    5.89  *
          *
* Frctn Loss (ft)        *    0.20  * Cum Volume (acre-ft)   *    1.42  *   16.83  *
   0.04  *
* C & E Loss (ft)        *    0.05  * Cum SA (acres)         *    1.05  *    9.76  *
```

```
  0.12  *
*******************************************************************************
***********

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7322.84  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.41  * Wt. n-Val.             *          *   0.030  *
         *
* W.S. Elev (ft)         * 7321.43  * Reach Len. (ft)        *   21.00  *   21.00  *
  21.00  *
* Crit W.S. (ft)         * 7321.43  * Flow Area (sq ft)      *          *  184.07  *
         *
* E.G. Slope (ft/ft)     *0.009486  * Area (sq ft)           *          *  198.18  *
         *
* Q Total (cfs)          * 1754.00  * Flow (cfs)             *          * 1754.00  *
         *
* Top Width (ft)         *   79.95  * Top Width (ft)         *          *   79.95  *
         *
* Vel Total (ft/s)       *    9.53  * Avg. Vel. (ft/s)       *          *    9.53  *
         *
* Max Chl Dpth (ft)      *    3.44  * Hydr. Depth (ft)       *          *    2.79  *
         *
* Conv. Total (cfs)      * 18009.0  * Conv. (cfs)            *          * 18009.0  *
         *
* Length Wtd. (ft)       *   21.00  * Wetted Per. (ft)       *          *   66.30  *
         *
* Min Ch El (ft)         * 7317.99  * Shear (lb/sq ft)       *          *    1.64  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *   15.67  *
         *
* Frctn Loss (ft)        *    0.19  * Cum Volume (acre-ft)   *    6.05  *   30.49  *
   1.53  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *    3.24  *   10.24  *
   2.04  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Alignment - (1)
REACH: Alignment - (1)    RS: 5300.65

INPUT
Description:
Station Elevation Data    num=     208
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 7342.53    4.38 7342.48   23.17 7342.23   25.99  7342.2   28.03 7342.18
   28.83 7342.17   30.11 7342.15   31.01 7342.14   32.02 7342.14   32.78 7342.13
   33.45 7342.13   34.09 7342.12   34.64 7342.12   35.35 7342.13   36.66 7342.13
```

```
  50.78 7342.03   50.91 7342.03   53.55 7342.02   55.73    7342   60.35 7341.93
  70.64 7341.83   78.79 7341.78   86.85 7341.76   92.78 7341.75   99.52 7341.89
 103.23    7342  104.88 7342.04  108.09 7342.06  112.64 7342.07  116.38 7342.08
 121.83 7342.06   125.3 7342.05  132.99 7342.01  135.32    7342  143.03 7341.83
  153.4 7341.59  156.76 7341.54  159.36 7341.49  164.89 7341.36  169.01 7341.38
 171.55  7341.4  173.24  7341.4  177.59 7341.36  181.38  7341.3   186.7 7341.24
 188.08  7341.2  193.48 7341.09  196.76 7341.01  202.36 7340.78  214.27 7340.15
 216.85    7340  219.98 7339.72  242.27    7338  246.37 7337.67  248.56 7337.52
 254.34 7337.12  269.55    7336   274.6 7335.59  293.72    7334  295.48 7333.83
 296.88 7333.72  299.73 7333.55  302.53  7333.3  318.02    7332  329.11 7331.04
 335.82 7330.47  339.34 7330.22  341.43    7330  349.68    7329  353.97 7328.71
 357.09 7328.62  359.39  7328.5     363 7328.59  366.59 7328.48  369.22 7328.55
 372.64 7328.58  378.55 7328.58  380.97 7328.55  382.83  7328.5  384.82 7328.43
 391.72 7328.01  391.83    7328  406.12 7326.98  419.92    7326  420.18 7325.99
 420.29 7325.98  432.58 7325.27   442.5 7324.72  448.31 7324.34  449.83 7324.25
 451.84 7324.14   453.8    7324  455.54 7323.68  465.73    7322  466.12 7321.84
 471.86    7320   473.8 7319.56  475.42  7319.3  477.52 7318.98  480.71 7318.62
 481.96 7318.44   486.9    7318  494.95    7318  495.64 7317.99  518.57 7317.99
 526.04    7318  534.33  7319.8  535.21    7320  538.25 7320.57  542.56 7321.23
 545.72 7321.78  547.75    7322  556.44 7322.35  571.14 7322.92  577.87 7323.17
 579.13 7323.21  580.57 7323.27  587.81  7323.5  591.78  7323.6  594.26 7323.65
 595.01 7323.66  596.82 7323.68  597.86 7323.69  606.32    7324  631.13 7325.22
 645.55    7326  655.86 7326.59  675.78 7327.73  679.51 7327.94  679.74 7327.96
 680.53    7328  682.26 7328.06  699.52 7328.65  714.65 7329.14  715.16 7329.16
 718.19 7329.25  723.63 7329.39  724.44 7329.37  724.88 7329.34  724.93 7329.29
 726.64 7329.28   729.4 7329.25   732.5 7329.23  736.68 7329.23  738.75 7329.27
 741.65 7329.27  743.11 7329.28  746.74 7329.28  748.17 7329.27  750.15 7329.27
 752.18 7329.28   758.2 7329.37  764.59 7329.64  765.98 7329.66  768.47 7329.75
 773.62    7330  774.22 7330.03  782.01 7330.33  784.77 7330.45  791.76 7330.71
 794.47 7330.88  795.59 7330.97  810.21 7331.93  810.75 7331.96  810.87 7331.97
 811.27    7332   826.7 7332.83  835.19 7333.45  842.76    7334  856.75 7335.02
 869.04    7336   875.7 7336.58  879.01 7336.83  887.02 7337.39  895.57    7338
  900.9 7338.47  905.01    7339  913.22    7340  918.39 7340.66  927.81    7342
 933.02 7342.67  943.58    7344  953.34 7345.15  956.39 7345.49  961.22    7346
 972.46 7347.26  978.63 7347.81  979.58 7347.91  980.98    7348  990.09 7348.87
 998.44 7349.71  999.14 7349.78 1001.78    7350 1006.67 7350.35 1008.81 7350.48
 1017.8 7350.76  1022.1 7350.88 1025.26 7350.98  1031.2  7351.2 1040.55 7351.59
1042.89 7351.68 1051.85    7352 1055.86 7352.15  1056.4 7352.17 1056.71 7352.17
1066.29 7352.32 1067.55 7352.32 1076.25 7352.31

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
       0    .035  471.86     .03  535.21    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        471.86  535.21               372  434.57   362.5             .3       .5

CROSS SECTION OUTPUT  Profile #500-yr
*********************************************************************************
***********
* E.G. Elev (ft)         * 7325.05  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.83  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7323.22  * Reach Len. (ft)        *  372.00  *  434.57  *
 362.50  *
* Crit W.S. (ft)         * 7323.22  * Flow Area (sq ft)      *   18.28  *  309.62  *
  46.12  *
* E.G. Slope (ft/ft)     *0.006178  * Area (sq ft)           *   18.28  *  309.62  *
  46.12  *
* Q Total (cfs)          * 3689.00  * Flow (cfs)             *   72.96  * 3458.29  *
 157.75  *
```

```
* Top Width (ft)          *  121.16  * Top Width (ft)          *   13.55  *   63.35  *
  44.26  *
* Vel Total (ft/s)        *    9.86  * Avg. Vel. (ft/s)        *    3.99  *   11.17  *
   3.42  *
* Max Chl Dpth (ft)       *    5.23  * Hydr. Depth (ft)        *    1.35  *    4.89  *
   1.04  *
* Conv. Total (cfs)       * 46932.6  * Conv. (cfs)             *   928.2  * 43997.4  *
 2007.0  *
* Length Wtd. (ft)        *  424.83  * Wetted Per. (ft)        *   13.97  *   63.71  *
  44.45  *
* Min Ch El (ft)          * 7317.99  * Shear (lb/sq ft)        *    0.50  *    1.87  *
   0.40  *
* Alpha                   *    1.21  * Stream Power (lb/ft s) *    2.01  *   20.94  *
   1.37  *
* Frctn Loss (ft)         *    1.72  * Cum Volume (acre-ft)    *   28.50  *   56.26  *
  17.55  *
* C & E Loss (ft)         *    0.59  * Cum SA (acres)          *    8.45  *   10.22  *
   8.08  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)          * 7320.83  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)           *    0.84  * Wt. n-Val.             *          *   0.030  *
         *
* W.S. Elev (ft)          * 7319.99  * Reach Len. (ft)        *  372.00  *  434.57  *
 362.50  *
* Crit W.S. (ft)          * 7319.98  * Flow Area (sq ft)      *          *  104.59  *
         *
* E.G. Slope (ft/ft)      *0.011322  * Area (sq ft)           *          *  104.59  *
         *
* Q Total (cfs)           *  768.00  * Flow (cfs)             *          *  768.00  *
         *
* Top Width (ft)          *   63.24  * Top Width (ft)         *          *   63.24  *
         *
* Vel Total (ft/s)        *    7.34  * Avg. Vel. (ft/s)       *          *    7.34  *
         *
* Max Chl Dpth (ft)       *    2.00  * Hydr. Depth (ft)       *          *    1.65  *
         *
* Conv. Total (cfs)       *  7217.8  * Conv. (cfs)            *          *  7217.8  *
         *
* Length Wtd. (ft)        *  434.57  * Wetted Per. (ft)       *          *   63.60  *
```

```
          *
* Min Ch El (ft)         * 7317.99  * Shear (lb/sq ft)       *          *    1.16  *
          *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    8.53  *
          *
* Frctn Loss (ft)        *    4.92  * Cum Volume (acre-ft)   *    1.42  *   16.77  *
   0.04  *
* C & E Loss (ft)        *    0.08  * Cum SA (acres)         *    1.05  *    9.73  *
   0.12  *
*******************************************************************************
***********

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

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7322.61  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.36  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7321.25  * Reach Len. (ft)        *  372.00  *  434.57  *
 362.50  *
* Crit W.S. (ft)         * 7321.25  * Flow Area (sq ft)      *    2.42  *  184.31  *
   4.41  *
* E.G. Slope (ft/ft)     *0.008763  * Area (sq ft)           *    2.42  *  184.31  *
   4.41  *
* Q Total (cfs)          * 1754.00  * Flow (cfs)             *    6.80  * 1734.93  *
  12.27  *
* Top Width (ft)         *   74.68  * Top Width (ft)         *    3.89  *   63.35  *
   7.44  *
* Vel Total (ft/s)       *    9.18  * Avg. Vel. (ft/s)       *    2.81  *    9.41  *
   2.78  *
* Max Chl Dpth (ft)      *    3.26  * Hydr. Depth (ft)       *    0.62  *    2.91  *
   0.59  *
* Conv. Total (cfs)      * 18737.3  * Conv. (cfs)            *    72.6  * 18533.6  *
  131.1  *
* Length Wtd. (ft)       *  434.19  * Wetted Per. (ft)       *    4.08  *   63.71  *
   7.55  *
* Min Ch El (ft)         * 7317.99  * Shear (lb/sq ft)       *    0.32  *    1.58  *
   0.32  *
* Alpha                  *    1.04  * Stream Power (lb/ft s) *    0.91  *   14.90  *
   0.89  *
* Frctn Loss (ft)        *    4.05  * Cum Volume (acre-ft)   *    6.05  *   30.39  *
   1.53  *
* C & E Loss (ft)        *    0.12  * Cum SA (acres)         *    3.24  *   10.20  *
   2.04  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.
```

CROSS SECTION

RIVER: Alignment - (1)
REACH: Alignment - (1) RS: 4866.08

INPUT
Description:
Station Elevation Data num= 172

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7335.4	2.86	7335.36	4.94	7335.34	10.27	7335.28	12.49	7335.26
23.24	7335.11	35.71	7334.92	51.52	7334.68	66.85	7334.44	83	7334.18
93.53	7334	95.4	7333.9	98.11	7333.74	103.53	7333.27	107.71	7332.9
110.82	7332.62	112.87	7332.43	118.41	7332	125.96	7330.04	126.1	7330
126.13	7330	131.52	7329.55	135.49	7329.25	137.93	7329.15	139.35	7329.12
140.52	7329.05	144.35	7328.95	147.22	7328.8	150.85	7328.59	155.8	7328.47
162.93	7328	164.19	7327.9	169.19	7327.41	174.71	7326.88	183.19	7326
188.73	7325.09	196.84	7324	204.3	7323.13	214.3	7322	215.1	7321.92
223.07	7320.51	225.94	7320	228.01	7319.27	231.58	7318	234.14	7316.85
236.51	7316	246.06	7314.18	246.9	7314	256.14	7314	263.71	7315.14
265.97	7315.31	267.19	7315.44	269.79	7315.49	270.97	7315.5	271.6	7315.54
275.52	7315.46	277.66	7315.46	279.19	7315.59	279.91	7315.69	281.97	7315.76
282.22	7315.82	285.42	7315.84	290.01	7315.96	290.8	7316	295.76	7316.64
297.23	7316.73	298.21	7316.83	299.57	7317.06	301.11	7317.28	303.01	7317.54
305.99	7317.77	311.78	7317.95	311.9	7317.97	311.92	7317.99	312	7317.99
312.02	7317.98	312.05	7317.98	312.17	7317.97	314.98	7317.87	315.18	7317.85
319.79	7317.43	322.47	7317.29	323.09	7317.28	325.97	7316.75	329.44	7316
333.63	7314.16	333.99	7314	335.25	7313.95	340.32	7313.74	341.25	7313.68
356.65	7313.59	363.64	7313.54	383.22	7313.47	385.09	7313.53	386.33	7313.56
388.47	7313.59	397.34	7313.73	400.48	7313.79	402.3	7313.84	404.5	7313.88
406.73	7313.94	407.77	7314	414.48	7315.2	419.44	7316	420.12	7316.17
420.49	7316.23	422.44	7316.64	428.96	7318	431.16	7318.98	433.08	7320
457.1	7321.92	457.5	7321.95	458.08	7322	458.2	7322.01	482.13	7324
482.91	7324.06	485.92	7324.32	501.67	7325.66	505.73	7326	526.93	7327.58
532.38	7328	552.03	7329.3	562.77	7330	582.78	7331.24	595.06	7332
597.79	7332.17	606.88	7332.66	611.79	7332.83	617.89	7332.98	622.48	7333.13
625.11	7333.19	629.53	7333.32	632.33	7333.42	642.59	7333.71	649.75	7334
654.71	7334.32	656.61	7334.39	659.02	7334.52	661.48	7334.75	663.79	7334.96
671.97	7335.82	675.05	7336	677.56	7336.17	679.1	7336.26	681.75	7336.49
685.61	7336.79	692.78	7337.13	697.54	7337.52	703.43	7337.98	703.53	7337.99
703.84	7338	705.98	7338.06	708.14	7338.14	709.49	7338.2	713.96	7338.46
716.62	7338.64	720.22	7338.85	721.71	7338.93	724.33	7338.99	727.99	7339.2
737.2	7339.31	741.77	7339.44	748.61	7339.68	755.45	7340	755.63	7340.01
755.92	7340.01	756.05	7340.02	756.28	7340.03	756.99	7340.05	758.12	7340.08
820.15	7342	856.41	7342						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	329.44	.03	419.44	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
329.44	419.44	137	145.17	161	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	312.5	7318.18	F

CROSS SECTION OUTPUT Profile #500-yr
****
* E.G. Elev (ft) * 7318.93 * Element * Left OB * Channel *

```
Right OB *
* Vel Head (ft)          *    0.64  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7318.29  * Reach Len. (ft)        *  137.00  *  145.17  *
 161.00  *
* Crit W.S. (ft)         * 7317.72  * Flow Area (sq ft)      *  221.97  *  395.95  *
  12.29  *
* E.G. Slope (ft/ft)     *0.002853  * Area (sq ft)           *  221.97  *  395.95  *
  12.29  *
* Q Total (cfs)          * 3689.00  * Flow (cfs)             *  858.13  * 2799.78  *
  31.09  *
* Top Width (ft)         *  198.84  * Top Width (ft)         *   98.67  *   90.00  *
  10.17  *
* Vel Total (ft/s)       *    5.85  * Avg. Vel. (ft/s)       *    3.87  *    7.07  *
   2.53  *
* Max Chl Dpth (ft)      *    4.82  * Hydr. Depth (ft)       *    2.25  *    4.40  *
   1.21  *
* Conv. Total (cfs)      * 69069.4  * Conv. (cfs)            * 16066.8  * 52420.5  *
  582.1  *
* Length Wtd. (ft)       *  144.37  * Wetted Per. (ft)       *   99.71  *   90.61  *
  10.44  *
* Min Ch El (ft)         * 7313.47  * Shear (lb/sq ft)       *    0.40  *    0.78  *
   0.21  *
* Alpha                  *    1.21  * Stream Power (lb/ft s) *    1.53  *    5.50  *
   0.53  *
* Frctn Loss (ft)        *    0.27  * Cum Volume (acre-ft)   *   27.48  *   52.74  *
  17.30  *
* C & E Loss (ft)        *    0.06  * Cum SA (acres)         *    7.97  *    9.45  *
   7.85  *
*******************************************************************************
***********

Warning: Multiple water surfaces were found that could balance the energy equation.
The program selected the water
         surface whose main channel velocity head was the closest to the previously
computed cross section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7315.83  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.68  * Wt. n-Val.             *          *   0.030  *
         *
* W.S. Elev (ft)         * 7315.15  * Reach Len. (ft)        *  137.00  *  145.17  *
 161.00  *
* Crit W.S. (ft)         * 7315.15  * Flow Area (sq ft)      *          *  116.49  *
         *
* E.G. Slope (ft/ft)     *0.011307  * Area (sq ft)           *   18.36  *  116.49  *
         *
* Q Total (cfs)          *  768.00  * Flow (cfs)             *          *  768.00  *
         *
* Top Width (ft)         *  105.68  * Top Width (ft)         *   22.86  *   82.82  *
         *
* Vel Total (ft/s)       *    6.59  * Avg. Vel. (ft/s)       *          *    6.59  *
         *
* Max Chl Dpth (ft)      *    1.68  * Hydr. Depth (ft)       *          *    1.41  *
         *
```

```
* Conv. Total (cfs)      *  7222.4  * Conv. (cfs)            *          *  7222.4  *
         *
* Length Wtd. (ft)       *  145.17  * Wetted Per. (ft)       *          *   83.18  *
         *
* Min Ch El (ft)         * 7313.47  * Shear (lb/sq ft)       *          *    0.99  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    6.52  *
         *
* Frctn Loss (ft)        *    0.44  * Cum Volume (acre-ft)   *    1.34  *   15.67  *
   0.04  *
* C & E Loss (ft)        *    0.16  * Cum SA (acres)         *    0.95  *    9.00  *
   0.12  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7317.30  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.13  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7316.17  * Reach Len. (ft)        *  137.00  *  145.17  *
 161.00  *
* Crit W.S. (ft)         * 7316.17  * Flow Area (sq ft)      *    0.07  *  205.53  *
   0.06  *
* E.G. Slope (ft/ft)     *0.009959  * Area (sq ft)           *   59.75  *  205.53  *
   0.06  *
* Q Total (cfs)          * 1754.00  * Flow (cfs)             *    0.06  * 1753.90  *
   0.05  *
* Top Width (ft)         *  147.61  * Top Width (ft)         *   56.91  *   90.00  *
   0.70  *
* Vel Total (ft/s)       *    8.53  * Avg. Vel. (ft/s)       *    0.82  *    8.53  *
   0.81  *
* Max Chl Dpth (ft)      *    2.70  * Hydr. Depth (ft)       *    0.09  *    2.28  *
   0.09  *
* Conv. Total (cfs)      * 17576.5  * Conv. (cfs)            *     0.6  * 17575.4  *
    0.5  *
* Length Wtd. (ft)       *  145.20  * Wetted Per. (ft)       *    0.82  *   90.61  *
   0.72  *
* Min Ch El (ft)         * 7313.47  * Shear (lb/sq ft)       *    0.05  *    1.41  *
   0.05  *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *    0.04  *   12.03  *
   0.04  *
* Frctn Loss (ft)        *    0.41  * Cum Volume (acre-ft)   *    5.78  *   28.45  *
```

```
  1.51  *
* C & E Loss (ft)        *    0.27  * Cum SA (acres)         *    2.98  *    9.44  *
  2.01  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION


RIVER: Alignment - (1)
REACH: Alignment - (1)    RS: 4720.61

INPUT
Description:
Station Elevation Data    num=     137
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 7333.85    12.5 7333.82   56.08 7333.75   56.83 7333.81    59.6 7333.85
   61.55 7333.89   64.65 7333.92   65.87 7333.95   68.79    7334  156.82    7334
  172.41 7333.29  205.01    7332  215.59 7331.19  217.71 7331.02  221.56 7330.67
  226.45 7330.24  227.72 7330.13  229.02    7330  238.09 7329.36  243.14    7329
  245.67 7328.81  248.03 7328.64  254.74 7328.38   255.7 7328.31  260.55 7328.36
   260.6 7328.48  262.89  7328.5  268.14  7328.5  277.24    7328  285.25 7326.75
  290.57    7326  292.03 7325.69  296.77    7324  301.27 7323.03  302.37 7322.93
  303.87 7322.75  305.67 7322.42  307.33    7322   310.9 7321.02   314.2    7320
  317.15  7319.2  320.41 7318.23   321.2    7318  321.91 7317.77  327.58    7316
  329.66 7315.42  332.29 7314.71  334.65    7314  358.83 7312.61  363.57 7312.35
  371.66    7312  387.87    7312  388.44 7312.02  403.85 7312.52  405.72 7312.58
  412.14  7312.8   412.2 7312.76  423.99 7313.11  452.37    7314  455.48    7314
  458.67 7314.67  460.52 7314.99  466.53    7316  469.63 7316.64  475.38 7317.85
  475.75 7317.93  475.93 7317.95  477.14    7318   482.4 7318.25  482.78 7318.22
  483.07 7318.19  485.35 7318.17  485.88  7318.2  486.24 7318.25  489.13 7318.64
  492.93 7319.54  493.86 7319.77  494.79    7320  504.39 7321.76  505.31 7321.93
  505.57    7322  505.87 7322.03  534.35    7324   535.3 7324.07  537.73 7324.26
  554.55 7325.58  559.34    7326  571.07 7326.91  583.76    7328  601.69 7329.66
  605.45    7330  620.63 7331.73  623.27    7332  635.89 7333.49  638.37 7333.76
  640.53    7334  654.52 7335.69  657.11    7336  662.31 7336.69  672.08    7338
  675.05 7338.42  686.35    7340  696.94 7341.63  698.41 7341.86  699.33    7342
  701.04 7342.28  711.64    7344  719.48 7345.31  723.71    7346  730.88 7347.31
     735    7348  743.17 7349.33  747.41    7350  749.73 7350.28  751.84  7350.5
     759 7351.27  766.09 7351.88  766.59 7351.92  766.64 7351.93  766.79 7351.93
  767.63    7352  769.48 7352.15  775.45 7352.37  776.64 7352.42  784.97 7352.74
  789.77 7352.87  792.75 7352.98  799.21  7353.2  804.52  7353.5  805.84 7353.57
  811.87    7354  813.42 7354.13  816.77 7354.45  828.35 7355.54  832.68    7356
  836.11 7356.35  849.78 7357.97
```

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
       0    .035  329.66     .03  460.52    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        329.66  460.52              218  234.61     245             .1       .3

CROSS SECTION OUTPUT  Profile #500-yr
*********************************************************************************
***********
* E.G. Elev (ft)         * 7318.60  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.44  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7318.16  * Reach Len. (ft)        *  218.00  *  234.61  *
 245.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *   12.57  *  673.59  *
  27.63  *
* E.G. Slope (ft/ft)     *0.001325  * Area (sq ft)           *   12.57  *  673.59  *
  27.63  *
* Q Total (cfs)          * 3689.00  * Flow (cfs)             *   23.54  * 3613.02  *
  52.44  *
* Top Width (ft)         *  159.87  * Top Width (ft)         *    9.01  *  130.86  *
  20.00  *
* Vel Total (ft/s)       *    5.17  * Avg. Vel. (ft/s)       *    1.87  *    5.36  *
   1.90  *
* Max Chl Dpth (ft)      *    6.16  * Hydr. Depth (ft)       *    1.39  *    5.15  *
   1.38  *
* Conv. Total (cfs)      *101351.9  * Conv. (cfs)            *   646.8  * 99264.3  *
 1440.8  *
* Length Wtd. (ft)       *  234.88  * Wetted Per. (ft)       *    9.42  *  131.25  *
  20.29  *
* Min Ch El (ft)         * 7312.00  * Shear (lb/sq ft)       *    0.11  *    0.42  *
   0.11  *
* Alpha                  *    1.06  * Stream Power (lb/ft s) *    0.21  *    2.28  *
   0.21  *
* Frctn Loss (ft)        *    0.54  * Cum Volume (acre-ft)   *   27.11  *   50.96  *
  17.23  *
* C & E Loss (ft)        *    0.08  * Cum SA (acres)         *    7.80  *    9.08  *
   7.80  *
*********************************************************************************
***********

Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #10-yr
*********************************************************************************
***********
* E.G. Elev (ft)         * 7315.15  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.13  * Wt. n-Val.             *          *   0.030  *
  0.000  *
* W.S. Elev (ft)         * 7315.01  * Reach Len. (ft)        *  218.00  *  234.61  *
 245.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *          *  261.96  *
   0.00  *
```

```
* E.G. Slope (ft/ft)     *0.001372  * Area (sq ft)           *          *  261.96  *
   0.00  *
* Q Total (cfs)          *  768.00  * Flow (cfs)             *          *  768.00  *
   0.00  *
* Top Width (ft)         *  129.49  * Top Width (ft)         *          *  129.35  *
   0.13  *
* Vel Total (ft/s)       *    2.93  * Avg. Vel. (ft/s)       *          *    2.93  *
   0.08  *
* Max Chl Dpth (ft)      *    3.01  * Hydr. Depth (ft)       *          *    2.03  *
   0.01  *
* Conv. Total (cfs)      * 20732.7  * Conv. (cfs)            *          * 20732.6  *
    0.0  *
* Length Wtd. (ft)       *  234.61  * Wetted Per. (ft)       *          *  129.69  *
   0.14  *
* Min Ch El (ft)         * 7312.00  * Shear (lb/sq ft)       *          *    0.17  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.51  *
         *
* Frctn Loss (ft)        *    0.46  * Cum Volume (acre-ft)   *    1.31  *   15.04  *
   0.04  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *    0.92  *    8.65  *
   0.12  *
*******************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7316.60  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.25  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7316.35  * Reach Len. (ft)        *  218.00  *  234.61  *
 245.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *    1.52  *  436.41  *
   5.42  *
* E.G. Slope (ft/ft)     *0.001315  * Area (sq ft)           *    1.52  *  436.41  *
   5.42  *
* Q Total (cfs)          * 1754.00  * Flow (cfs)             *    1.39  * 1746.07  *
   6.54  *
* Top Width (ft)         *  141.75  * Top Width (ft)         *    3.20  *  130.86  *
   7.70  *
* Vel Total (ft/s)       *    3.96  * Avg. Vel. (ft/s)       *    0.91  *    4.00  *
   1.21  *
* Max Chl Dpth (ft)      *    4.35  * Hydr. Depth (ft)       *    0.48  *    3.33  *
   0.70  *
* Conv. Total (cfs)      * 48371.3  * Conv. (cfs)            *    38.3  * 48152.7  *
  180.3  *
* Length Wtd. (ft)       *  234.70  * Wetted Per. (ft)       *    3.33  *  131.25  *
   7.82  *
* Min Ch El (ft)         * 7312.00  * Shear (lb/sq ft)       *    0.04  *    0.27  *
   0.06  *
* Alpha                  *    1.02  * Stream Power (lb/ft s) *    0.03  *    1.09  *
   0.07  *
* Frctn Loss (ft)        *    0.50  * Cum Volume (acre-ft)   *    5.69  *   27.38  *
   1.50  *
* C & E Loss (ft)        *    0.04  * Cum SA (acres)         *    2.88  *    9.07  *
   1.99  *
*******************************************************************************
```

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Alignment - (1)
REACH: Alignment - (1) RS: 4486

INPUT
Description:
Station Elevation Data num= 135

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7337.09	15.52	7336	26.25	7335.47	56.88	7334	65.85	7333.78
80.24	7333.56	86.2	7333.44	89.74	7333.41	91.51	7333.39	100.02	7333.23
105.86	7333.19	114.2	7333.13	127.22	7333	144.88	7332.82	165.11	7332.61
203.38	7332.21	224.54	7332	236.32	7331.85	246.02	7331.75	254.44	7331.62
258.67	7331.54	262.34	7331.48	265.37	7331.42	270.12	7331.34	283.6	7330.99
291.1	7330.8	293.97	7330.74	295.3	7330.71	296.79	7330.69	298.98	7330.65
302.63	7330.6	303.84	7330.58	306.13	7330.55	308.71	7330.53	310.45	7330.54
311.12	7330.54	312.13	7330.56	314.85	7330.58	316	7330.6	318.81	7330.6
321.67	7330.55	325.21	7330.49	334.92	7330.29	337.2	7330.23	345.27	7330
355.4	7329.55	387.19	7328	401.48	7327.15	420.66	7326	440.36	7325.31
455.77	7324.89	466.08	7324.56	487.07	7324	507.04	7323.41	520.95	7322.94
521.32	7322.93	532.65	7322.57	538.55	7322.33	545.38	7322.04	546.18	7322
550.71	7321.48	562.7	7320	563.75	7319.68	566.62	7318.85	569.37	7318
570.82	7317.28	573.38	7316	575.16	7315.13	577.45	7314	585.85	7312.1
586.11	7312.03	586.23	7312	645.74	7312	648.58	7312.39	661.26	7314
682.9	7315.3	690.64	7315.76	694.09	7316	708.7	7316.75	721.4	7317.39
734.48	7318	735.46	7318.06	745.24	7318.69	748.19	7318.87	751.19	7319.08
757.48	7319.54	763.39	7320	773.85	7321.36	777.73	7321.85	778.81	7322
780.02	7322.19	791.19	7324	795.81	7324.65	805.02	7326	816.69	7327.99
816.73	7328	816.75	7328	827.61	7330	827.82	7330.04	838.62	7332
839.34	7332.13	849.71	7334	852.41	7334.48	861	7336	866.94	7337.02
872.42	7338	881.53	7339.61	883.54	7340	884.8	7340.27	889.27	7341.23
892.73	7342	898.06	7343.35	900.47	7344	904.5	7345.05	908.09	7346
913.81	7347.52	915.57	7348	922.05	7349.36	925.78	7350	936.57	7351.44
940.58	7352	942.79	7352.43	950.01	7354	950.66	7354.18	951.64	7354.44
955.78	7355.55	956.66	7355.78	956.94	7355.79	957.16	7355.79	958.62	7356
965.74	7356.62	970.07	7356.98	976.09	7358	980.97	7358.51	982.25	7358.63

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	577.45	.03	661.26	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
577.45	661.26	144.99	154.99	165.99	.1	.3

CROSS SECTION OUTPUT Profile #500-yr
****
****

* E.G. Elev (ft)	* 7317.97	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 1.28	* Wt. n-Val.	* 0.035	* 0.030	* 0.035 *
* W.S. Elev (ft)	* 7316.69	* Reach Len. (ft)	* 144.99	* 154.99	* 165.99 *
* Crit W.S. (ft)	* 7316.25	* Flow Area (sq ft)	* 7.34	* 368.48	*

```
  60.53  *
* E.G. Slope (ft/ft)     *0.004981  * Area (sq ft)           *    7.34  *  368.48  *
  60.53  *
* Q Total (cfs)          * 3689.00  * Flow (cfs)             *   24.96  * 3447.29  *
 216.76  *
* Top Width (ft)         *  135.52  * Top Width (ft)         *    5.45  *   83.81  *
  46.26  *
* Vel Total (ft/s)       *    8.45  * Avg. Vel. (ft/s)       *    3.40  *    9.36  *
   3.58  *
* Max Chl Dpth (ft)      *    4.69  * Hydr. Depth (ft)       *    1.35  *    4.40  *
   1.31  *
* Conv. Total (cfs)      * 52268.4  * Conv. (cfs)            *   353.6  * 48843.6  *
 3071.2  *
* Length Wtd. (ft)       *  155.29  * Wetted Per. (ft)       *    6.08  *   84.16  *
  46.34  *
* Min Ch El (ft)         * 7312.00  * Shear (lb/sq ft)       *    0.38  *    1.36  *
   0.41  *
* Alpha                  *    1.16  * Stream Power (lb/ft s) *    1.28  *   12.74  *
   1.45  *
* Frctn Loss (ft)        *    1.01  * Cum Volume (acre-ft)   *   27.06  *   48.15  *
  16.98  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)         *    7.76  *    8.51  *
   7.61  *
*******************************************************************************
***********

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

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7314.67  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.30  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7314.37  * Reach Len. (ft)        *  144.99  *  154.99  *
 165.99  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *    0.14  *  174.05  *
   1.14  *
* E.G. Slope (ft/ft)     *0.003005  * Area (sq ft)           *    0.14  *  174.05  *
   1.14  *
* Q Total (cfs)          *  768.00  * Flow (cfs)             *    0.10  *  767.05  *
   0.86  *
* Top Width (ft)         *   90.71  * Top Width (ft)         *    0.75  *   83.81  *
   6.15  *
* Vel Total (ft/s)       *    4.38  * Avg. Vel. (ft/s)       *    0.70  *    4.41  *
   0.75  *
* Max Chl Dpth (ft)      *    2.37  * Hydr. Depth (ft)       *    0.18  *    2.08  *
   0.18  *
* Conv. Total (cfs)      * 14010.8  * Conv. (cfs)            *     1.8  * 13993.4  *
   15.6  *
* Length Wtd. (ft)       *  155.00  * Wetted Per. (ft)       *    0.84  *   84.16  *
   6.16  *
* Min Ch El (ft)         * 7312.00  * Shear (lb/sq ft)       *    0.03  *    0.39  *
   0.03  *
* Alpha                  *    1.01  * Stream Power (lb/ft s) *    0.02  *    1.71  *
   0.03  *
* Frctn Loss (ft)        *    0.84  * Cum Volume (acre-ft)   *    1.31  *   13.86  *
   0.04  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)         *    0.91  *    8.08  *
   0.10  *
```

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

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7316.06  * Element                * Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.67  * Wt. n-Val.             *   0.035 *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7315.39  * Reach Len. (ft)        * 144.99  *  154.99  *
 165.99  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *    1.96 *  259.58  *
  16.09  *
* E.G. Slope (ft/ft)     *0.003970  * Area (sq ft)           *    1.96 *  259.58  *
  16.09  *
* Q Total (cfs)          * 1754.00  * Flow (cfs)             *    3.82 * 1716.47  *
  33.71  *
* Top Width (ft)         *  109.79  * Top Width (ft)         *    2.82 *   83.81  *
  23.16  *
* Vel Total (ft/s)       *    6.32  * Avg. Vel. (ft/s)       *    1.95 *    6.61  *
   2.10  *
* Max Chl Dpth (ft)      *    3.39  * Hydr. Depth (ft)       *    0.69 *    3.10  *
   0.69  *
* Conv. Total (cfs)      * 27838.1  * Conv. (cfs)            *    60.6 * 27242.4  *
  535.0  *
* Length Wtd. (ft)       *  155.09  * Wetted Per. (ft)       *    3.15 *   84.16  *
  23.20  *
* Min Ch El (ft)         * 7312.00  * Shear (lb/sq ft)       *    0.15 *    0.76  *
   0.17  *
* Alpha                  *    1.07  * Stream Power (lb/ft s) *    0.30 *    5.05  *
   0.36  *
* Frctn Loss (ft)        *    0.95  * Cum Volume (acre-ft)   *    5.68 *   25.51  *
   1.44  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)         *    2.87 *    8.49  *
   1.90  *
*******************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: Alignment - (1)
REACH: Alignment - (1)    RS: 4331.01

INPUT
Description:
Station Elevation Data    num=     354
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 7350.42   10.76 7350.22   12.81 7350.17   14.26 7350.14   18.73 7350.02
   18.98 7350.01   19.25    7350   50.55 7349.14   64.43 7348.76   71.58  7348.6
   81.65 7348.36   84.25  7348.3   90.65 7348.16    91.1 7348.15   98.07    7348
   120.3 7347.41  128.91 7347.11  144.84 7346.54  153.15 7346.28  160.82    7346
  178.83 7345.61  182.04 7345.56   193.4 7345.35  197.74 7345.28  214.51    7345
```

274.83	7344	277.19	7343.95	277.63	7343.94	278.6	7343.91	295.25	7343.44
304.21	7343.16	310.22	7342.94	313.19	7342.83	332.09	7342.36	337.46	7342.22
345.14	7342	346.36	7341.95	351.01	7341.74	367.37	7340.87	380.3	7340.21
384	7340	389.63	7339.76	392.9	7339.62	430.61	7338	470.84	7338
473.82	7338.01	497.85	7338.01	508.05	7338.02	546.34	7338.02	554.73	7338.03
555.23	7338.03	560.37	7338.02	574.21	7338.02	579.99	7338.01	594.04	7338.01
614.92	7338	622.92	7338	633.32	7337.4	641.87	7336.95	652.61	7336.48
655.74	7336.32	663.6	7336	668.31	7335.77	671.2	7335.55	681.03	7334.92
692.06	7334.08	692.54	7334.05	693.32	7334	705.25	7333.81	710.32	7333.74
714.73	7333.69	717.99	7333.65	720.99	7333.62	735.21	7333.4	740.92	7333.32
743.97	7333.25	745.44	7333.22	748.53	7333.14	759.04	7332.99	764.51	7332.85
770.54	7332.67	786.17	7332.18	786.83	7332.17	787.6	7332.15	788.43	7332.14
792.21	7332	817.74	7331.49	836.51	7331.11	880.78	7330.24	888.23	7330.09
893.18	7330	913.21	7329.73	927.28	7329.62	940.29	7329.52	946.93	7329.48
951.26	7329.41	954.8	7329.35	956.62	7329.31	961.89	7329.25	972.27	7329.16
976.07	7329.13	980.45	7329.09	983.69	7329.06	990.57	7328.95	997.5	7328.83
1002.37	7328.73	1010.37	7328.55	1014.05	7328.47	1016.94	7328.43	1018.03	7328.42
1028.9	7328.17	1036.68	7328	1056.62	7326.51	1063.82	7326	1081.34	7324.38
1085.08	7324	1090.29	7323.55	1107.18	7322	1109.53	7321.96	1114.79	7321.89
1125.29	7321.76	1128.52	7321.71	1140.36	7321.55	1151.93	7321.42	1158.33	7321.35
1163.08	7321.31	1170.16	7321.28	1171.59	7321.28	1176.69	7321.26	1180.84	7321.19
1183.18	7321.15	1190.2	7321.04	1191.92	7321.04	1194.87	7321.06	1197.34	7321.12
1201.59	7321.17	1204.55	7321.12	1210.41	7321.13	1215.65	7321.11	1221.16	7321.15
1223.22	7321.16	1226.53	7321.18	1229.59	7321.19	1230.79	7321.2	1234.31	7321.13
1238.55	7321.04	1239.12	7320.99	1243.45	7320.83	1247.89	7320.69	1251.41	7320.68
1255.58	7320.65	1257.54	7320.64	1260.44	7320.63	1264.57	7320.61	1266.93	7320.59
1278.53	7320.52	1284.48	7320.41	1290.44	7320.21	1293.6	7320.12	1297.37	7320
1302.8	7319.3	1312.45	7318	1318.15	7317.05	1323.73	7316	1325.22	7315.48
1328.73	7314	1332.79	7312.44	1334.26	7312.01	1334.3	7312	1335.96	7311.95
1336.54	7311.9	1336.87	7311.84	1337.67	7311.78	1338.85	7311.72	1341.11	7311.67
1346.33	7311.61	1348.36	7311.58	1350.31	7311.54	1351.25	7311.43	1353.9	7311.44
1356.58	7311.44	1357.8	7311.46	1362.74	7311.57	1367.96	7311.59	1372.28	7311.62
1373.75	7311.66	1376.99	7311.73	1381.95	7311.82	1382.26	7311.82	1388.12	7311.92
1394.12	7312	1394.38	7312	1399.45	7312.13	1405.18	7312.27	1417.8	7312.53
1422.31	7312.58	1423.93	7312.46	1426.5	7312.57	1427.08	7312.55	1428.91	7312.67
1430.99	7312.85	1435.43	7313.29	1437.53	7313.33	1440.86	7313.88	1441.47	7314
1442.44	7314.29	1446.64	7315.43	1448.32	7315.91	1448.84	7316	1453.7	7316.5
1460.07	7317.06	1465.35	7318	1466.79	7318.13	1472.21	7318.5	1476.06	7319.02
1480.94	7319.5	1483.01	7319.63	1483.52	7319.65	1485.34	7320	1486.1	7320.05
1490.94	7320.04	1496.56	7320.15	1497.47	7320.32	1501.3	7320.64	1504.22	7320.95
1506.92	7321.71	1508.16	7322	1510.34	7322.15	1515.18	7322.43	1519.95	7322.54
1525.65	7322.6	1527.03	7322.57	1528.11	7322.51	1529.24	7322.34	1530.63	7322.19
1531.09	7322.37	1531.28	7322.33	1531.33	7322.33	1532.73	7322.52	1533.41	7322.69
1534.52	7322.92	1534.68	7322.92	1536.06	7323.21	1539.26	7323.36	1540.81	7323.33
1541.65	7323.33	1546.95	7322.72	1550.69	7322.25	1555.27	7322.14	1555.7	7322.1
1555.94	7322.1	1556.33	7322.24	1557.39	7322.68	1559.98	7323.64	1560.75	7324
1561.67	7324.35	1565.81	7326	1574.83	7327.14	1574.88	7327.15	1577.02	7327.25
1578.02	7327.25	1578.97	7327.26	1581.25	7328	1585.28	7328.61	1587.89	7328.81
1594.01	7329.69	1595.5	7329.81	1596.41	7330	1598.59	7330.2	1600.51	7330.41
1601.56	7330.55	1605.01	7330.98	1605.67	7331.05	1607.52	7331.26	1608.81	7331.36
1609.48	7331.38	1612.66	7331.7	1614.99	7332	1621.88	7332.93	1623.15	7333.21
1624.4	7333.42	1625.09	7333.45	1625.62	7333.48	1628.16	7333.53	1630.61	7334
1638.18	7335.26	1642.69	7336	1644.28	7336.25	1647.9	7336.56	1650.16	7336.55
1651.48	7336.56	1652.82	7336.59	1653.99	7336.67	1655.38	7336.91	1657.52	7337.04
1659.52	7337.43	1661.22	7337.43	1663.3	7337.67	1663.91	7337.65	1665.59	7337.66
1665.97	7337.57	1668.53	7337.35	1669.86	7337.14	1672.77	7337.4	1673.61	7337.28
1674.83	7337.17	1675.89	7337.21	1677.52	7337.35	1678.82	7338	1680.41	7338.34
1681.12	7338.48	1682.46	7338.61	1684.5	7338.4	1686.38	7338.33	1686.71	7338.28
1689.62	7338.33	1689.99	7338.31	1690.76	7338.51	1690.86	7338.52	1690.88	7338.53
1692.02	7338.89	1695.2	7340	1697.36	7340.24	1697.97	7340.33	1708.02	7342
1714.49	7342.89	1722.43	7344	1733.14	7345.26	1739.49	7346	1752.1	7347.65
1754.88	7348	1761.26	7348.91	1768.58	7350	1771.46	7350.39	1772.56	7350.52
1775.99	7350.92	1782.36	7351.51	1783.75	7351.67	1787.08	7352	1788.94	7352.2

```
 1797.68 7353.42 1801.74    7354 1802.87 7354.17 1815.46    7356 1827.17 7357.67
 1829.62    7358 1842.36 7359.84 1843.15 7359.96 1843.45    7360 1844.15 7360.09
 1858.76    7362 1863.26 7362.61 1873.15    7364 1881.17 7364.97

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
       0    .035 1328.73     .03 1440.86    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       1328.73 1440.86            275.3   254.3   220.3             .1       .3

CROSS SECTION OUTPUT  Profile #500-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7316.94  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.58  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7315.36  * Reach Len. (ft)        *  275.30  *  254.30  *
 220.30  *
* Crit W.S. (ft)         * 7315.36  * Flow Area (sq ft)      *    2.18  *  362.87  *
   4.13  *
* E.G. Slope (ft/ft)     *0.008756  * Area (sq ft)           *    2.18  *  362.87  *
   4.13  *
* Q Total (cfs)          * 3689.00  * Flow (cfs)             *    6.32  * 3669.45  *
  13.23  *
* Top Width (ft)         *  120.85  * Top Width (ft)         *    3.21  *  112.13  *
   5.50  *
* Vel Total (ft/s)       *    9.99  * Avg. Vel. (ft/s)       *    2.90  *   10.11  *
   3.20  *
* Max Chl Dpth (ft)      *    3.93  * Hydr. Depth (ft)       *    0.68  *    3.24  *
   0.75  *
* Conv. Total (cfs)      * 39422.6  * Conv. (cfs)            *    67.6  * 39213.7  *
  141.3  *
* Length Wtd. (ft)       *  254.30  * Wetted Per. (ft)       *    3.49  *  112.60  *
   5.70  *
* Min Ch El (ft)         * 7311.43  * Shear (lb/sq ft)       *    0.34  *    1.76  *
   0.40  *
* Alpha                  *    1.02  * Stream Power (lb/ft s) *    0.99  *   17.81  *
   1.27  *
* Frctn Loss (ft)        *    1.86  * Cum Volume (acre-ft)   *   27.04  *   46.85  *
  16.86  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *    7.75  *    8.16  *
   7.51  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
```

```
* E.G. Elev (ft)         * 7313.80  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.60  * Wt. n-Val.             *          *   0.030  *
         *
* W.S. Elev (ft)         * 7313.20  * Reach Len. (ft)        *  275.30  *  254.30  *
 220.30  *
* Crit W.S. (ft)         * 7313.20  * Flow Area (sq ft)      *          *  123.20  *
         *
* E.G. Slope (ft/ft)     *0.012626  * Area (sq ft)           *          *  123.20  *
         *
* Q Total (cfs)          *  768.00  * Flow (cfs)             *          *  768.00  *
         *
* Top Width (ft)         *  103.66  * Top Width (ft)         *          *  103.66  *
         *
* Vel Total (ft/s)       *    6.23  * Avg. Vel. (ft/s)       *          *    6.23  *
         *
* Max Chl Dpth (ft)      *    1.77  * Hydr. Depth (ft)       *          *    1.19  *
         *
* Conv. Total (cfs)      *  6834.8  * Conv. (cfs)            *          *  6834.8  *
         *
* Length Wtd. (ft)       *  254.30  * Wetted Per. (ft)       *          *  103.93  *
         *
* Min Ch El (ft)         * 7311.43  * Shear (lb/sq ft)       *          *    0.93  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    5.83  *
         *
* Frctn Loss (ft)        *    2.70  * Cum Volume (acre-ft)   *    1.31  *   13.33  *
   0.03  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *    0.91  *    7.74  *
   0.09  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7315.07  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.00  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7314.07  * Reach Len. (ft)        *  275.30  *  254.30  *
 220.30  *
* Crit W.S. (ft)         * 7314.07  * Flow Area (sq ft)      *    0.01  *  218.88  *
   0.09  *
* E.G. Slope (ft/ft)     *0.010789  * Area (sq ft)           *    0.01  *  218.88  *
   0.09  *
* Q Total (cfs)          * 1754.00  * Flow (cfs)             *    0.00  * 1753.91  *
   0.09  *
* Top Width (ft)         *  113.15  * Top Width (ft)         *    0.17  *  112.13  *
   0.85  *
* Vel Total (ft/s)       *    8.01  * Avg. Vel. (ft/s)       *    0.45  *    8.01  *
```

```
  0.96  *
* Max Chl Dpth (ft)      *    2.64  * Hydr. Depth (ft)       *    0.04  *    1.95  *
  0.10  *
* Conv. Total (cfs)      * 16886.4  * Conv. (cfs)            *     0.0  * 16885.5  *
   0.8  *
* Length Wtd. (ft)       *  254.30  * Wetted Per. (ft)       *    0.18  *  112.60  *
  0.87  *
* Min Ch El (ft)         * 7311.43  * Shear (lb/sq ft)       *    0.02  *    1.31  *
  0.07  *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *    0.01  *   10.49  *
  0.07  *
* Frctn Loss (ft)        *    2.36  * Cum Volume (acre-ft)   *    5.68  *   24.65  *
  1.41  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *    2.86  *    8.14  *
  1.86  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Alignment - (1)
REACH: Alignment - (1)    RS: 4076.71

INPUT
Description:
Station Elevation Data    num=     176
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 7341.64   54.02    7340   71.93 7339.24   85.09 7338.76  105.36    7338
  193.19    7338  203.27 7338.01   229.4 7338.01  240.78 7338.02  242.61 7338.02
  253.84 7338.01  275.72 7338.01  282.97    7338  304.32    7338   313.5 7337.55
  317.56 7337.37  329.92 7336.78  347.51 7336.13   348.6 7336.09  351.15    7336
  360.84 7335.44  361.61 7335.41  362.08 7335.39  367.98  7335.1  368.96 7335.05
  374.45 7334.79  379.98 7334.46  392.57    7334  398.56  7333.9  399.16 7333.89
  399.85 7333.87  401.79 7333.81  409.58 7333.63  418.21 7333.42  426.91 7333.25
  432.82 7333.03  443.46 7332.65  449.66 7332.46  462.85    7332  463.25 7331.99
  534.16 7330.46  546.36  7330.2  554.48    7330  563.84 7329.88  591.77 7329.52
  602.72 7329.36   617.6 7329.17  631.94 7328.97  640.62  7328.9  648.45 7328.83
  652.37 7328.81  663.21 7328.62  677.78 7328.37  679.66 7328.35  683.16 7328.31
  684.37  7328.3  685.74 7328.28  686.72 7328.27  701.94    7328  702.19    7328
  702.73 7327.96  733.68    7326  742.71 7325.06  748.92 7324.52  755.17    7324
  760.42  7323.6  760.75 7323.57  779.49    7322  800.96 7321.62  840.64 7320.92
  849.81 7320.77  889.08 7320.14  897.75    7320   907.3 7319.84  908.61 7319.82
  919.56 7319.65  937.43 7319.36  996.07 7318.42 1001.93 7318.33 1008.23 7318.23
 1011.42 7318.18 1015.84 7318.11 1022.91 7318.02 1025.17    7318 1028.64 7317.88
 1028.86 7317.87 1031.69 7317.78 1034.59 7317.57 1043.78  7317.1  1045.1 7317.02
 1056.88    7316 1059.72 7315.69 1060.97 7315.56 1062.29 7315.41 1064.49 7315.18
  1070.7 7314.58 1076.35    7314 1077.86 7313.93 1078.45 7313.89 1089.13 7313.34
 1094.87 7313.03 1104.19 7312.39 1105.43 7312.31 1106.09 7312.26 1109.89    7312
 1124.22 7310.49 1127.83    7310 1135.01 7308.36 1136.38    7308 1144.04    7308
```

```
 1162.51 7307.72 1179.51 7307.48 1179.72 7307.48 1180.26 7307.49 1185.39 7307.56
 1188.59 7307.62 1192.33  7307.7 1195.83 7307.78 1197.92 7307.82 1199.94 7307.87
 1203.53 7307.94 1205.68    7308 1209.03 7308.66 1216.02    7310 1216.36  7310.1
 1223.81    7312 1224.58 7312.38 1225.11 7312.57 1227.79 7313.15  1231.6 7313.75
 1232.61 7313.94 1232.63 7313.95 1232.77    7314 1234.87 7315.78 1235.22    7316
 1241.11 7317.96 1241.19    7318 1241.47 7318.12 1246.57    7320 1250.13  7320.6
 1257.86    7322 1267.52 7323.77 1268.82    7324 1271.11 7324.42 1279.61    7326
  1285.7 7327.15 1290.32    7328 1295.72    7329 1301.01    7330 1304.25 7330.65
 1310.87    7332 1316.31 7333.27 1319.62    7334 1321.69 7334.46 1328.85    7336
  1336.9 7337.57 1339.88 7337.98 1340.08    7338 1350.21 7339.35 1352.15 7339.59
 1354.57    7340 1364.48 7341.81 1365.54    7342 1365.72 7342.03 1365.93 7342.06
 1367.69 7342.38 1376.55    7344 1379.46 7344.54 1387.33    7346 1393.39 7347.15
 1397.74    7348 1399.28 7348.43 1406.49    7350 1409.55  7350.8 1411.91    7352
  1415.4 7352.83

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
       0    .035 1127.83     .03 1216.02    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       1127.83 1216.02           350.35  302.35  220.35             .1       .3

CROSS SECTION OUTPUT  Profile #500-yr
*****************************************************************************************
***********
* E.G. Elev (ft)         * 7313.63  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.50  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7312.13  * Reach Len. (ft)        *  350.35  *  302.35  *
 220.35  *
* Crit W.S. (ft)         * 7311.87  * Flow Area (sq ft)      *   19.56  *  361.71  *
   8.75  *
* E.G. Slope (ft/ft)     *0.006171  * Area (sq ft)           *   19.56  *  361.71  *
   8.75  *
* Q Total (cfs)          * 3689.00  * Flow (cfs)             *   64.43  * 3594.42  *
  30.15  *
* Top Width (ft)         *  116.04  * Top Width (ft)         *   19.80  *   88.19  *
   8.05  *
* Vel Total (ft/s)       *    9.46  * Avg. Vel. (ft/s)       *    3.29  *    9.94  *
   3.45  *
* Max Chl Dpth (ft)      *    4.65  * Hydr. Depth (ft)       *    0.99  *    4.10  *
   1.09  *
* Conv. Total (cfs)      * 46960.4  * Conv. (cfs)            *   820.2  * 45756.4  *
  383.8  *
* Length Wtd. (ft)       *  301.79  * Wetted Per. (ft)       *   19.92  *   88.62  *
   8.33  *
* Min Ch El (ft)         * 7307.48  * Shear (lb/sq ft)       *    0.38  *    1.57  *
   0.40  *
* Alpha                  *    1.08  * Stream Power (lb/ft s) *    1.25  *   15.63  *
   1.39  *
* Frctn Loss (ft)        *    2.01  * Cum Volume (acre-ft)   *   26.98  *   44.73  *
  16.83  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)         *    7.68  *    7.57  *
   7.48  *
*****************************************************************************************
***********

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

```
CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7310.01  * Element                * Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.59  * Wt. n-Val.             *         *   0.030  *
         *
* W.S. Elev (ft)         * 7309.42  * Reach Len. (ft)        * 350.35  *  302.35  *
 220.35  *
* Crit W.S. (ft)         * 7309.29  * Flow Area (sq ft)      *         *  124.47  *
         *
* E.G. Slope (ft/ft)     *0.009030  * Area (sq ft)           *         *  124.47  *
         *
* Q Total (cfs)          *  768.00  * Flow (cfs)             *         *  768.00  *
         *
* Top Width (ft)         *   82.61  * Top Width (ft)         *         *   82.61  *
         *
* Vel Total (ft/s)       *    6.17  * Avg. Vel. (ft/s)       *         *    6.17  *
         *
* Max Chl Dpth (ft)      *    1.94  * Hydr. Depth (ft)       *         *    1.51  *
         *
* Conv. Total (cfs)      *  8082.0  * Conv. (cfs)            *         *  8082.0  *
         *
* Length Wtd. (ft)       *  302.35  * Wetted Per. (ft)       *         *   82.93  *
         *
* Min Ch El (ft)         * 7307.48  * Shear (lb/sq ft)       *         *    0.85  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *         *    5.22  *
         *
* Frctn Loss (ft)        *    2.25  * Cum Volume (acre-ft)   *    1.31 *   12.61  *
   0.03  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *    0.91 *    7.20  *
   0.09  *
*******************************************************************************
***********

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

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7311.50  * Element                * Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.01  * Wt. n-Val.             *  0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7310.49  * Reach Len. (ft)        * 350.35  *  302.35  *
 220.35  *
* Crit W.S. (ft)         * 7310.33  * Flow Area (sq ft)      *   0.87  *  216.98  *
   0.44  *
* E.G. Slope (ft/ft)     *0.008054  * Area (sq ft)           *   0.87  *  216.98  *
   0.44  *
* Q Total (cfs)          * 1754.00  * Flow (cfs)             *   1.28  * 1752.09  *
   0.63  *
* Top Width (ft)         *   93.63  * Top Width (ft)         *   3.58  *   88.19  *
   1.85  *
* Vel Total (ft/s)       *    8.04  * Avg. Vel. (ft/s)       *   1.48  *    8.07  *
   1.43  *
* Max Chl Dpth (ft)      *    3.01  * Hydr. Depth (ft)       *   0.24  *    2.46  *
   0.24  *
* Conv. Total (cfs)      * 19544.7  * Conv. (cfs)            *   14.3  * 19523.4  *
    7.0  *
```

```
* Length Wtd. (ft)       *  302.28  * Wetted Per. (ft)       *    3.61  *   88.62  *
   1.92  *
* Min Ch El (ft)         * 7307.48  * Shear (lb/sq ft)       *    0.12  *    1.23  *
   0.12  *
* Alpha                  *    1.01  * Stream Power (lb/ft s) *    0.18  *    9.94  *
   0.17  *
* Frctn Loss (ft)        *    2.11  * Cum Volume (acre-ft)   *    5.67  *   23.38  *
   1.41  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *    2.85  *    7.56  *
   1.85  *
*******************************************************************************
***********

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

CROSS SECTION


RIVER: Alignment - (1)
REACH: Alignment - (1)    RS: 3774.36

INPUT
Description:
Station Elevation Data    num=     197
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 7341.26    7.01 7341.13   17.61 7340.87   47.57 7340.16   50.61 7340.09
   54.37    7340   54.44    7340   66.04 7339.76   68.43 7339.72    69.3 7339.71
   82.97 7339.46   85.91 7339.45   87.85 7339.44   90.57 7339.41   94.09 7339.36
   99.01 7339.28  107.89 7339.14  109.83 7339.13   117.1 7339.01  125.29 7338.96
  134.06 7338.91  141.01  7338.8  145.09 7338.73  151.02 7338.66   154.9 7338.61
  157.36 7338.61  160.68 7338.56  170.24 7338.56  205.88 7338.61  241.22 7338.57
   250.6 7338.48  261.52 7338.38   265.5 7338.35  273.84 7338.28  282.55 7338.21
  288.21 7338.16  307.69 7338.03  312.04    7338  315.31 7337.89  320.17 7337.67
  342.17 7336.81  345.56 7336.66  358.56    7336  386.56 7335.01  419.17    7334
   428.5 7333.72  429.53 7333.69   449.2 7333.09  458.15 7332.85  465.03 7332.64
  480.81 7332.21  488.15    7332  513.37 7331.56  525.81 7331.36  529.69  7331.3
   535.1 7331.22  540.18 7331.11  547.57 7330.98  557.93 7330.76  593.01    7330
  596.56  7329.9  598.03 7329.86  628.34 7329.04  645.41 7328.66  674.01    7328
  675.59 7327.95  679.14 7327.83  684.27 7327.68  687.19 7327.57  698.97 7327.18
  700.78 7327.12  703.03 7327.04  708.05 7326.85  709.85 7326.78  727.27    7326
  744.67 7324.22  746.55    7324  747.98 7323.87  769.19    7322  770.81 7321.87
  776.34 7321.44   791.8 7320.21  796.53    7320  804.34 7319.93  807.98 7319.91
  822.42 7319.81  825.29 7319.81  830.02 7319.78  833.48 7319.68  835.73 7319.65
  859.65 7319.78  883.85 7319.99  889.33    7320   902.3    7320  908.22 7319.67
  911.03 7319.48  931.04    7318  935.56 7317.68  944.46 7317.09  948.78 7316.84
  962.36    7316  977.26 7314.69   985.6    7314  998.82 7312.71 1006.72    7312
 1022.01 7310.45 1026.57    7310 1035.51 7308.54 1037.72 7308.18 1038.77    7308
 1043.03 7306.64 1045.35    7306    1050 7305.67 1051.49 7305.54 1052.64 7305.39
 1055.92 7305.12 1058.01    7305 1060.48 7304.87 1061.98 7304.82 1064.14 7304.78
    1065 7304.77 1066.46 7304.76 1068.27 7304.74 1071.32 7304.72 1071.43 7304.72
 1072.21 7304.71 1074.73 7304.66 1075.71 7304.64 1079.05 7304.67 1082.81 7304.72
 1083.01 7304.76 1083.23 7304.78 1083.77  7304.8 1084.81 7304.83  1085.2 7304.85
 1085.64 7304.87 1085.93 7304.91 1086.31 7304.93 1086.43 7304.96 1086.65 7304.98
 1089.04 7305.18 1089.55 7305.24 1090.46 7305.32 1093.74 7305.44 1095.66 7305.52
 1098.25  7305.6 1104.12  7305.9 1104.33 7305.91 1104.65 7305.92 1106.35    7306
 1115.66 7307.65  1116.1 7307.73 1117.61    7308 1118.62  7308.1 1122.22 7308.39
 1137.02 7309.69 1142.06    7310 1142.95 7310.02 1145.89 7310.09 1150.04 7310.21
 1156.16  7310.3 1159.24 7310.33 1163.79 7310.31 1169.05 7310.25 1169.81 7310.25
  1177.9 7310.46 1185.77 7310.74 1208.47 7311.61 1218.23    7312 1223.83 7312.49
 1241.05    7314 1258.44 7315.72 1261.39    7316  1266.9 7316.54 1281.84    7318
```

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 1288.57 7318.67 1302.15    7320 1314.84 7321.17 1323.86    7322 1339.79 7323.49
 1345.36    7324 1351.43 7324.63  1364.2    7326 1368.53 7326.51  1381.5    7328
 1391.19 7329.18 1397.58    7330 1410.99 7331.89  1411.8    7332 1419.21 7333.46
 1421.97    7334 1422.67 7334.12 1431.78 7335.68 1434.01    7336  1435.6 7336.26
 1440.29 7337.06 1443.35 7337.57

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035 1038.77     .03 1115.66    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       1038.77 1115.66               72      85     105             .1       .3

CROSS SECTION OUTPUT  Profile #500-yr
*****************************************************************************************
***********
* E.G. Elev (ft)         * 7311.59  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.82  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7309.77  * Reach Len. (ft)        *   72.00  *   85.00  *
 105.00  *
* Crit W.S. (ft)         * 7309.77  * Flow Area (sq ft)      *    9.49  *  326.61  *
  21.82  *
* E.G. Slope (ft/ft)     *0.007191  * Area (sq ft)           *    9.49  *  326.61  *
  21.82  *
* Q Total (cfs)          * 3689.00  * Flow (cfs)             *   31.09  * 3581.47  *
  76.44  *
* Top Width (ft)         *  110.29  * Top Width (ft)         *   10.78  *   76.89  *
  22.62  *
* Vel Total (ft/s)       *   10.31  * Avg. Vel. (ft/s)       *    3.28  *   10.97  *
   3.50  *
* Max Chl Dpth (ft)      *    5.13  * Hydr. Depth (ft)       *    0.88  *    4.25  *
   0.96  *
* Conv. Total (cfs)      * 43501.5  * Conv. (cfs)            *   366.6  * 42233.5  *
  901.4  *
* Length Wtd. (ft)       *   85.31  * Wetted Per. (ft)       *   10.92  *   77.43  *
  22.73  *
* Min Ch El (ft)         * 7304.64  * Shear (lb/sq ft)       *    0.39  *    1.89  *
   0.43  *
* Alpha                  *    1.10  * Stream Power (lb/ft s) *    1.28  *   20.77  *
   1.51  *
* Frctn Loss (ft)        *    0.59  * Cum Volume (acre-ft)   *   26.86  *   42.34  *
  16.75  *
* C & E Loss (ft)        *    0.07  * Cum SA (acres)         *    7.55  *    7.00  *
   7.40  *
*****************************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION OUTPUT  Profile #10-yr
*****************************************************************************************
***********
* E.G. Elev (ft)         * 7307.74  * Element                *  Left OB *  Channel *
```

```
Right OB *
* Vel Head (ft)          *    0.53  * Wt. n-Val.             *          *   0.030  *
         *
* W.S. Elev (ft)         * 7307.21  * Reach Len. (ft)        *   72.00  *   85.00  *
 105.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *          *  131.62  *
         *
* E.G. Slope (ft/ft)     *0.006247  * Area (sq ft)           *          *  131.62  *
         *
* Q Total (cfs)          *  768.00  * Flow (cfs)             *          *  768.00  *
         *
* Top Width (ft)         *   71.95  * Top Width (ft)         *          *   71.95  *
         *
* Vel Total (ft/s)       *    5.84  * Avg. Vel. (ft/s)       *          *    5.84  *
         *
* Max Chl Dpth (ft)      *    2.57  * Hydr. Depth (ft)       *          *    1.83  *
         *
* Conv. Total (cfs)      *  9716.9  * Conv. (cfs)            *          *  9716.9  *
         *
* Length Wtd. (ft)       *   85.00  * Wetted Per. (ft)       *          *   72.32  *
         *
* Min Ch El (ft)         * 7304.64  * Shear (lb/sq ft)       *          *    0.71  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    4.14  *
         *
* Frctn Loss (ft)        *    0.58  * Cum Volume (acre-ft)   *    1.31  *   11.72  *
   0.03  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *    0.91  *    6.66  *
   0.09  *
*******************************************************************************************
***********

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************************
***********
* E.G. Elev (ft)         * 7309.38  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.95  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7308.43  * Reach Len. (ft)        *   72.00  *   85.00  *
 105.00  *
* Crit W.S. (ft)         * 7308.04  * Flow Area (sq ft)      *    0.54  *  223.36  *
   2.20  *
* E.G. Slope (ft/ft)     *0.006093  * Area (sq ft)           *    0.54  *  223.36  *
   2.20  *
* Q Total (cfs)          * 1754.00  * Flow (cfs)             *    0.62  * 1750.01  *
   3.37  *
* Top Width (ft)         *   86.40  * Top Width (ft)         *    2.55  *   76.89  *
   6.95  *
* Vel Total (ft/s)       *    7.76  * Avg. Vel. (ft/s)       *    1.16  *    7.83  *
   1.53  *
* Max Chl Dpth (ft)      *    3.78  * Hydr. Depth (ft)       *    0.21  *    2.90  *
   0.32  *
* Conv. Total (cfs)      * 22470.7  * Conv. (cfs)            *     7.9  * 22419.6  *
   43.2  *
* Length Wtd. (ft)       *   85.02  * Wetted Per. (ft)       *    2.59  *   77.43  *
   7.00  *
* Min Ch El (ft)         * 7304.64  * Shear (lb/sq ft)       *    0.08  *    1.10  *
   0.12  *
* Alpha                  *    1.02  * Stream Power (lb/ft s) *    0.09  *    8.60  *
   0.18  *
* Frctn Loss (ft)        *    0.64  * Cum Volume (acre-ft)   *    5.67  *   21.85  *
   1.40  *
```

```
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *    2.83  *    6.98  *
   1.83  *
*******************************************************************************************
***********

CROSS SECTION


RIVER: Alignment - (1)
REACH: Alignment - (1)    RS: 3689.36

INPUT
Description:
Station Elevation Data    num=     197
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0  7339.8     .37 7339.79    2.01 7339.78    3.73 7339.78   16.64 7339.57
   24.33 7339.44    35.6  7339.3   43.07 7339.21   44.42 7339.21   50.88 7339.12
   56.52 7339.13   77.12 7339.17   96.92 7339.16  102.07 7339.11  108.02 7339.06
  110.18 7339.04  114.67    7339  119.33 7338.97  122.33 7338.94  132.58 7338.88
  136.52 7338.85  149.43 7338.77  154.96 7338.73  181.79 7338.54  215.11 7338.28
  234.96 7338.14  246.06 7338.05  252.49    7338  260.63 7337.46  285.18    7336
   311.5 7334.89   331.6    7334  361.94 7332.84  374.99 7332.35  379.96 7332.16
  384.61    7332  390.47 7331.91  411.35 7331.61  431.82 7331.33  446.88 7331.13
  451.68 7331.07  456.59 7331.01  465.14 7330.92  475.32 7330.72  481.73 7330.65
  493.19 7330.44  499.66 7330.32  502.73 7330.28  510.67 7330.14  519.47    7330
  535.19  7329.6  537.17 7329.54  550.75 7329.18  557.77    7329  562.01 7328.88
     568 7328.72   577.4  7328.5  591.43 7328.13  594.55 7328.02  595.05    7328
  600.97 7327.73  612.93 7327.27  624.49 7326.79  634.59 7326.41  637.88 7326.31
  645.63 7326.01  645.86    7326   655.7 7325.33  662.66 7324.82  673.09    7324
  685.64 7322.69  688.49 7322.41   692.2    7322  720.87 7320.23  724.41    7320
  725.29 7319.96  725.62 7319.95  726.38 7319.93  751.71 7319.04  759.83 7318.78
  773.14 7318.39   787.6    7318  788.53 7317.95  794.01 7317.62  796.41 7317.51
  800.32 7317.27  809.29  7316.8  822.24 7316.02  822.32 7316.01   822.5    7316
  824.97 7315.82  838.49 7314.85   848.9    7314  849.73 7313.92  849.84 7313.91
  851.07 7313.82  861.94 7312.88   872.7    7312  873.95  7311.9  874.78 7311.84
  876.31 7311.71  885.73 7310.91  889.44 7310.57  895.38    7310  916.56  7308.2
  917.22 7308.15  918.78    7308  921.17  7307.5   928.5    7306  929.17 7305.84
  936.93    7304  940.88    7304  951.08 7303.99  952.25 7303.99  964.88    7304
  967.21    7304  971.84 7304.28  977.95 7304.62  991.41 7305.41 1002.49    7306
  1021.4 7307.87 1022.41 7307.97 1022.64    7308 1022.95 7308.01 1034.79 7308.28
 1036.89 7308.32 1041.01 7308.41 1048.11 7308.58 1054.64 7308.73 1060.19 7308.84
 1071.61 7309.08 1080.75 7309.28 1113.24 7309.98 1114.33    7310 1120.95 7310.51
 1126.04 7310.83 1129.21 7311.05 1144.31    7312 1150.93 7312.57 1152.42 7312.62
  1153.1 7312.62 1156.32 7312.71 1158.49  7312.8 1161.19 7312.94 1164.72 7313.13
 1171.68 7313.52 1179.48    7314 1180.61 7314.08 1183.09 7314.26 1193.79 7315.02
 1195.83 7315.17 1206.81    7316 1216.29 7316.77 1231.59    7318  1251.8    7320
 1269.98    7322 1280.57 7323.33 1286.12    7324 1291.94 7324.74 1301.76    7326
 1308.68 7326.88 1317.67    7328 1326.37 7329.05 1333.95    7330  1343.3 7331.22
 1349.49    7332 1361.38 7333.78 1362.89    7334 1370.85 7335.29 1375.55    7336
  1385.1 7337.62 1387.51    7338 1392.29  7338.9 1398.05    7340 1401.04 7340.66
 1402.67 7340.92 1405.75 7341.46 1409.63    7342 1415.06 7342.91 1420.27 7343.55
 1423.61    7344 1428.96 7344.86 1430.55 7345.05 1437.19    7346 1440.57 7346.55
    1443  7346.9 1445.97  7347.3 1450.58    7348 1463.12 7349.39 1464.97 7349.63
 1466.24 7349.78 1468.01    7350 1468.26 7350.02 1468.39 7350.04 1468.99 7350.08
 1476.73 7350.46 1479.01 7350.43

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*************************************************
       0    .035  921.17     .03  1021.4    .035

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

```
      921.17  1021.4           283.18  351.18  535.18             .1       .3

CROSS SECTION OUTPUT  Profile #500-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7310.83  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.59  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7309.24  * Reach Len. (ft)        *  283.18  *  351.18  *
 535.18  *
* Crit W.S. (ft)         * 7309.24  * Flow Area (sq ft)      *   12.50  *  405.66  *
  36.18  *
* E.G. Slope (ft/ft)     *0.006702  * Area (sq ft)           *   12.50  *  405.66  *
  36.18  *
* Q Total (cfs)          * 4290.00  * Flow (cfs)             *   35.42  * 4162.48  *
  92.10  *
* Top Width (ft)         *  174.82  * Top Width (ft)         *   16.89  *  100.23  *
  57.70  *
* Vel Total (ft/s)       *    9.44  * Avg. Vel. (ft/s)       *    2.83  *   10.26  *
   2.55  *
* Max Chl Dpth (ft)      *    5.25  * Hydr. Depth (ft)       *    0.74  *    4.05  *
   0.63  *
* Conv. Total (cfs)      * 52404.8  * Conv. (cfs)            *   432.7  * 50847.1  *
 1125.0  *
* Length Wtd. (ft)       *  367.56  * Wetted Per. (ft)       *   16.99  *  100.77  *
  57.72  *
* Min Ch El (ft)         * 7303.99  * Shear (lb/sq ft)       *    0.31  *    1.68  *
   0.26  *
* Alpha                  *    1.15  * Stream Power (lb/ft s) *    0.87  *   17.28  *
   0.67  *
* Frctn Loss (ft)        *    1.70  * Cum Volume (acre-ft)   *   26.84  *   41.63  *
  16.68  *
* C & E Loss (ft)        *    0.24  * Cum SA (acres)         *    7.53  *    6.83  *
   7.30  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7307.15  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.60  * Wt. n-Val.             *          *   0.030  *
         *
* W.S. Elev (ft)         * 7306.55  * Reach Len. (ft)        *  283.18  *  351.18  *
 535.18  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *          *  146.63  *
```

```
          *
* E.G. Slope (ft/ft)     *0.007368  * Area (sq ft)           *          *  146.63  *
          *
* Q Total (cfs)          *  914.00  * Flow (cfs)             *          *  914.00  *
          *
* Top Width (ft)         *   82.23  * Top Width (ft)         *          *   82.23  *
          *
* Vel Total (ft/s)       *    6.23  * Avg. Vel. (ft/s)       *          *    6.23  *
          *
* Max Chl Dpth (ft)      *    2.56  * Hydr. Depth (ft)       *          *    1.78  *
          *
* Conv. Total (cfs)      * 10647.8  * Conv. (cfs)            *          * 10647.8  *
          *
* Length Wtd. (ft)       *  351.18  * Wetted Per. (ft)       *          *   82.60  *
          *
* Min Ch El (ft)         * 7303.99  * Shear (lb/sq ft)       *          *    0.82  *
          *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    5.09  *
          *
* Frctn Loss (ft)        *    3.20  * Cum Volume (acre-ft)   *    1.31  *   11.45  *
   0.03  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *    0.91  *    6.51  *
   0.09  *
*******************************************************************************
***********

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

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7308.71  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.16  * Wt. n-Val.             *   0.035  *   0.030  *
          *
* W.S. Elev (ft)         * 7307.55  * Reach Len. (ft)        *  283.18  *  351.18  *
 535.18  *
* Crit W.S. (ft)         * 7307.50  * Flow Area (sq ft)      *    0.01  *  236.73  *
          *
* E.G. Slope (ft/ft)     *0.009317  * Area (sq ft)           *    0.01  *  236.73  *
          *
* Q Total (cfs)          * 2044.00  * Flow (cfs)             *    0.00  * 2044.00  *
          *
* Top Width (ft)         *   97.28  * Top Width (ft)         *    0.25  *   97.03  *
          *
* Vel Total (ft/s)       *    8.63  * Avg. Vel. (ft/s)       *    0.36  *    8.63  *
          *
* Max Chl Dpth (ft)      *    3.56  * Hydr. Depth (ft)       *    0.03  *    2.44  *
          *
* Conv. Total (cfs)      * 21175.6  * Conv. (cfs)            *     0.0  * 21175.6  *
          *
* Length Wtd. (ft)       *  352.04  * Wetted Per. (ft)       *    0.26  *   97.54  *
          *
* Min Ch El (ft)         * 7303.99  * Shear (lb/sq ft)       *    0.02  *    1.41  *
          *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *    0.01  *   12.19  *
          *
* Frctn Loss (ft)        *    3.12  * Cum Volume (acre-ft)   *    5.67  *   21.41  *
   1.40  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *    2.82  *    6.81  *
   1.82  *
```

****

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

CROSS SECTION

RIVER: Alignment - (1)
REACH: Alignment - (1) RS: 3338.18

INPUT
Description:
Station Elevation Data num= 271

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7335.78	7.94	7334.85	15.23	7334	15.84	7333.93	19.72	7333.51
33.48	7332	35.41	7331.79	38.15	7331.48	49.64	7330	60.64	7328.44
63.9	7328	74.7	7326.77	81.42	7326	82.33	7325.89	86.3	7325.43
96.27	7324.25	98.3	7324	113.62	7322.18	115.22	7322	121.88	7320.97
128.55	7320	137.82	7318.56	138.67	7318.43	141.24	7318	153.77	7316.56
158.12	7316	168.79	7315.07	180.85	7314	184.59	7313.65	190.81	7313.07
203.29	7312	212.66	7311.09	220.93	7310.27	223.52	7310	231.26	7308.96
238.24	7308	239.24	7307.77	247.98	7306	250.51	7305.36	254.73	7304.39
255.88	7304.13	256.75	7304	259.81	7304	261.2	7303.99	263.53	7303.99
264.55	7303.98	265.21	7303.99	267.56	7303.99	268.23	7304	269.64	7304
272.67	7304.38	275.3	7304.57	276.29	7304.65	282.22	7305.02	290.15	7305.35
290.7	7305.37	291.99	7305.42	292.62	7305.44	293.22	7305.44	294.08	7305.38
294.59	7305.36	299.31	7305.47	301.89	7305.21	305.44	7304.74	309.34	7304
312.91	7303.43	314.08	7303.31	315.23	7303.04	318.52	7302	318.87	7301.97
319.46	7301.95	321.53	7301.86	328.82	7301.48	333.57	7301.27	336.01	7301.15
337.48	7301.13	342.93	7300.83	347.37	7300.62	349.43	7300.52	350.91	7300.43
351.24	7300.42	352.19	7300.39	352.54	7300.38	353.04	7300.37	353.32	7300.36
353.56	7300.34	354.01	7300.3	354.11	7300.28	356.2	7300.3	358.6	7300.32
359.01	7300.33	359.18	7300.34	359.23	7300.35	359.71	7300.4	360.49	7300.48
361.14	7300.54	361.56	7300.57	361.6	7300.58	362.96	7300.72	365.77	7300.96
367.58	7301.17	370.57	7301.61	371.15	7301.6	374.59	7302	381.57	7302.51
382.21	7302.54	393.54	7303.21	395.37	7303.3	403.66	7304	413.91	7304.69
417	7304.88	418.99	7304.92	423.93	7305.19	425.67	7305.17	427.71	7305.12
428.92	7305.11	435.22	7305.13	453.84	7305.95	456.31	7305.96	458.14	7305.95
460.85	7305.96	461.25	7305.95	462.38	7305.96	464.14	7305.92	470.65	7305.68
480.01	7305.58	488.66	7305.49	495.24	7305.43	503.55	7305.36	510.64	7305.32
516.96	7305.29	522	7305.24	523.62	7305.27	524.74	7305.29	526.08	7305.33
526.34	7305.35	526.86	7305.35	527.5	7305.36	528.22	7305.37	529.76	7305.38
530.38	7305.38	530.99	7305.39	531.8	7305.4	535.41	7305.4	536.41	7305.41
539.19	7305.43	540.67	7305.44	541.82	7305.45	542.65	7305.45	542.76	7305.46
543.53	7305.47	544.91	7305.49	545.28	7305.5	546.63	7305.51	548.82	7305.51
552.51	7305.5	555.78	7305.49	558.86	7305.47	561.44	7305.46	563.17	7305.45
564.27	7305.45	565.94	7305.44	566.69	7305.44	571.38	7305.41	573.76	7305.4
574.76	7305.39	576.66	7305.36	577.49	7305.34	579.8	7305.32	581.74	7305.3
583.44	7305.29	592.25	7305.24	600.28	7305.2	602.48	7305.19	611.38	7305.15
613.38	7305.14	617.31	7305.13	621.54	7305.13	623.47	7305.14	625.09	7305.14
627.34	7305.15	629.29	7305.16	634.13	7305.18	644.82	7305.18	651.61	7305.19
659.92	7305.2	667.08	7305.22	668.49	7305.23	672.94	7305.26	674.27	7305.27
680.6	7305.35	686.6	7305.43	691.84	7305.51	697.65	7305.59	706.59	7305.74
715.25	7305.89	721.31	7306	728.09	7306.5	735.8	7307.09	746.98	7308
762.76	7309.94	763.21	7310	763.3	7310.01	778.08	7312	781.42	7312.52
783.54	7312.83	791.04	7314	803.53	7315.96	803.8	7316	804.34	7316.08
816.45	7318	828.75	7319.83	829.91	7320	842.3	7321.67	844.74	7322
845.23	7322.07	859.92	7324	868.94	7325.26	874.29	7326	885.78	7327.67
888.01	7328	889.7	7328.26	900.91	7330	903.1	7330.35	912.56	7332

```
  922.57 7333.51  925.87    7334  935.39 7335.53  938.26    7336  940.84 7336.44
  950.12    7338  956.29 7339.06  961.84    7340  963.65 7340.31  972.65    7342
  982.63 7343.87  983.34    7344  994.09 7345.98  994.27    7346   996.4 7346.44
 1004.13    7348 1005.33  7348.2 1011.62 7349.04 1014.86  7349.4 1016.84 7349.59
 1019.85    7350 1023.16 7350.24 1026.76 7350.29 1027.49 7350.31 1028.33 7350.36
  1028.6 7350.36 1028.85 7350.41 1030.35 7350.62 1039.38    7352 1047.16 7353.58
 1049.13    7354 1051.75 7354.55 1052.98 7354.64 1053.55 7354.65 1055.77 7354.85
 1060.79 7355.36 1066.27    7356 1067.16 7356.29 1073.46    7358 1082.18 7359.68
 1083.97    7360 1095.47 7361.38 1101.77    7362 1118.21 7363.92 1118.81    7364
 1121.37    7364

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
       0    .035  314.08     .03  393.54    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         314.08  393.54           305.88  266.88  239.88             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
       0  292.62 7305.91       F

CROSS SECTION OUTPUT  Profile #500-yr
*****************************************************************************************
***********
* E.G. Elev (ft)         * 7307.10  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.78  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7306.31  * Reach Len. (ft)        *  305.88  *  266.88  *
 239.88  *
* Crit W.S. (ft)         * 7306.31  * Flow Area (sq ft)      *  108.59  *  379.83  *
 331.74  *
* E.G. Slope (ft/ft)     *0.003399  * Area (sq ft)           *  108.59  *  379.83  *
 331.74  *
* Q Total (cfs)          * 4290.00  * Flow (cfs)             *  366.77  * 3102.73  *
 820.50  *
* Top Width (ft)         *  479.11  * Top Width (ft)         *   67.64  *   79.46  *
 332.01  *
* Vel Total (ft/s)       *    5.23  * Avg. Vel. (ft/s)       *    3.38  *    8.17  *
   2.47  *
* Max Chl Dpth (ft)      *    6.03  * Hydr. Depth (ft)       *    1.61  *    4.78  *
   1.00  *
* Conv. Total (cfs)      * 73582.7  * Conv. (cfs)            *  6290.9  * 53218.5  *
14073.3  *
* Length Wtd. (ft)       *  268.78  * Wetted Per. (ft)       *   68.13  *   79.83  *
 332.12  *
* Min Ch El (ft)         * 7300.28  * Shear (lb/sq ft)       *    0.34  *    1.01  *
   0.21  *
* Alpha                  *    1.84  * Stream Power (lb/ft s) *    1.14  *    8.25  *
   0.52  *
* Frctn Loss (ft)        *    0.96  * Cum Volume (acre-ft)   *   26.45  *   38.46  *
  14.42  *
* C & E Loss (ft)        *    0.04  * Cum SA (acres)         *    7.26  *    6.10  *
   4.91  *
*****************************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
```

```
        the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
        water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
        program defaulted to critical depth.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7303.93  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.84  * Wt. n-Val.             *          *   0.030  *
        *
* W.S. Elev (ft)         * 7303.10  * Reach Len. (ft)        *  305.88  *  266.88  *
 239.88  *
* Crit W.S. (ft)         * 7303.10  * Flow Area (sq ft)      *          *  124.66  *
        *
* E.G. Slope (ft/ft)     *0.011533  * Area (sq ft)           *          *  124.66  *
        *
* Q Total (cfs)          *  914.00  * Flow (cfs)             *          *  914.00  *
        *
* Top Width (ft)         *   76.68  * Top Width (ft)         *          *   76.68  *
        *
* Vel Total (ft/s)       *    7.33  * Avg. Vel. (ft/s)       *          *    7.33  *
        *
* Max Chl Dpth (ft)      *    2.82  * Hydr. Depth (ft)       *          *    1.63  *
        *
* Conv. Total (cfs)      *  8511.0  * Conv. (cfs)            *          *  8511.0  *
        *
* Length Wtd. (ft)       *  266.88  * Wetted Per. (ft)       *          *   77.02  *
        *
* Min Ch El (ft)         * 7300.28  * Shear (lb/sq ft)       *          *    1.17  *
        *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    8.54  *
        *
* Frctn Loss (ft)        *    2.83  * Cum Volume (acre-ft)   *    1.31  *   10.36  *
   0.03  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *    0.91  *    5.87  *
   0.09  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
        depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
        the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
        water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
        program defaulted to critical depth.
Note:   Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7305.59  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.24  * Wt. n-Val.             *   0.035  *   0.030  *
```

```
  0.035  *
* W.S. Elev (ft)         * 7304.34  * Reach Len. (ft)        *  305.88  *  266.88  *
 239.88  *
* Crit W.S. (ft)         * 7304.34  * Flow Area (sq ft)      *    3.67  *  223.12  *
   8.57  *
* E.G. Slope (ft/ft)     *0.008416  * Area (sq ft)           *    8.94  *  223.12  *
   8.57  *
* Q Total (cfs)          * 2044.00  * Flow (cfs)             *    9.66  * 2011.58  *
  22.76  *
* Top Width (ft)         *  118.57  * Top Width (ft)         *   23.94  *   79.46  *
  15.18  *
* Vel Total (ft/s)       *    8.68  * Avg. Vel. (ft/s)       *    2.63  *    9.02  *
   2.66  *
* Max Chl Dpth (ft)      *    4.06  * Hydr. Depth (ft)       *    0.56  *    2.81  *
   0.56  *
* Conv. Total (cfs)      * 22280.6  * Conv. (cfs)            *   105.3  * 21927.2  *
  248.1  *
* Length Wtd. (ft)       *  266.80  * Wetted Per. (ft)       *    6.62  *   79.83  *
  15.22  *
* Min Ch El (ft)         * 7300.28  * Shear (lb/sq ft)       *    0.29  *    1.47  *
   0.30  *
* Alpha                  *    1.06  * Stream Power (lb/ft s) *    0.77  *   13.24  *
   0.79  *
* Frctn Loss (ft)        *    2.18  * Cum Volume (acre-ft)   *    5.64  *   19.55  *
   1.34  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)         *    2.74  *    6.10  *
   1.73  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION


RIVER: Alignment - (1)
REACH: Alignment - (1)    RS: 3071.3

INPUT
Description:
Station Elevation Data    num=     176
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*****************************************************************************
       0    7331    5.57 7330.66   12.53 7330.18   14.82    7330   17.98  7329.7
    37.1    7328   47.55 7326.61   51.88    7326    55.5 7325.37   63.81    7324
   76.49 7322.07   76.94    7322   77.46 7321.92   90.74    7320   99.75 7318.72
  104.73    7318  110.67 7317.11  118.15    7316  124.48 7314.99  130.81    7314
  135.28 7313.22  142.52    7312  151.19 7310.55  154.56    7310  157.87 7309.46
  166.78    7308   172.3 7307.09  179.16    7306  188.69 7304.61  192.37 7304.09
  193.01    7304  204.47 7303.12  206.22 7303.07   210.3 7302.91  214.34 7302.77
```

```
  220.83 7302.28  224.31    7302  261.29    7302  294.62 7302.01  337.15 7302.01
  355.98    7302  365.79    7302  369.54 7300.68  371.25    7300  375.38 7298.49
  376.66    7298  376.93 7297.98  379.19 7297.66  379.67 7297.49  380.07 7297.37
  382.34 7297.27  383.55  7297.2  394.78 7296.99  403.04 7296.88  406.87 7296.87
  408.21 7296.88  408.38 7296.89  408.95 7296.93   409.1 7296.94  411.63 7297.09
  411.89  7297.1  414.18 7297.33  414.64 7297.42  416.26  7297.5  418.15 7297.57
  420.82 7297.69  423.02 7297.88  423.62 7297.96  423.97    7298  425.12 7298.24
  432.03    7300  442.34  7301.7  444.52    7302  457.42 7302.99  470.98    7304
   471.5 7304.01     473 7304.03   478.4 7304.09  486.95 7304.14  500.67 7304.16
  512.23 7304.16   522.6 7304.15  530.93 7304.14  536.35 7304.13  539.73 7304.14
  546.99 7304.14  560.37 7304.11  566.85 7304.09  569.52 7304.07  574.48 7304.01
  575.12    7304  580.33 7303.99   590.1 7303.97  591.55 7303.97  598.34 7303.98
   604.5 7303.99  607.23    7304  610.38 7304.17  623.54 7304.96  629.98 7305.14
  633.31 7305.17  635.15 7305.24  646.53 7305.74  651.73    7306  656.87 7306.51
  671.21 7307.94  671.85    7308  678.56 7308.77  689.01    7310  699.61 7311.48
  703.61    7312  716.23 7313.77  718.05    7314  727.41 7314.81  734.17 7315.36
  736.47 7315.46  738.63 7315.54  745.26 7315.92  746.41    7316  746.87  7316.1
  747.63 7316.17  747.81 7316.16  747.86 7316.14  748.45 7316.18   749.6 7316.27
  765.21    7318  772.27 7319.99  772.32    7320  772.49 7320.03   785.6    7322
  794.83 7323.34  799.09    7324  802.94 7324.58  814.25    7326  827.06 7327.85
  828.11    7328  829.03 7328.13  840.99    7330  843.14 7330.35  853.06    7332
  857.49 7332.77  864.43    7334  872.72 7335.48  875.83    7336  887.61 7337.87
  888.58    7338  901.47  7339.8  902.96    7340  912.43 7341.28  917.22    7342
  923.66 7342.96  929.18    7344   934.5 7344.88  941.38    7346  950.54 7347.59
  953.18    7348  958.56 7348.84  963.64 7349.58  966.29    7350  971.55  7350.8
  978.23 7351.79  979.06 7351.91   979.7    7352  990.86 7353.62  993.68    7354
 1003.72 7355.36    1006 7355.65 1008.77    7356 1013.14 7356.53 1016.23 7356.92
 1020.14 7357.35 1026.29    7358 1027.37 7358.11 1027.85 7358.16 1028.78 7358.24
 1038.58 7359.15

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  371.25     .03  432.03    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        371.25  432.03           146.84  136.84  121.84             .1       .3

CROSS SECTION OUTPUT  Profile #500-yr
*****************************************************************************************
***********
* E.G. Elev (ft)         * 7304.62  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.22  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7303.41  * Reach Len. (ft)        *  146.84  *  136.84  *
 121.84  *
* Crit W.S. (ft)         * 7303.41  * Flow Area (sq ft)      *  226.72  *  352.48  *
  42.71  *
* E.G. Slope (ft/ft)     *0.003781  * Area (sq ft)           *  226.72  *  352.48  *
  42.71  *
* Q Total (cfs)          * 4290.00  * Flow (cfs)             *  714.54  * 3438.04  *
 137.43  *
* Top Width (ft)         *  262.30  * Top Width (ft)         *  170.53  *   60.78  *
  31.00  *
* Vel Total (ft/s)       *    6.90  * Avg. Vel. (ft/s)       *    3.15  *    9.75  *
   3.22  *
* Max Chl Dpth (ft)      *    6.54  * Hydr. Depth (ft)       *    1.33  *    5.80  *
   1.38  *
* Conv. Total (cfs)      * 69763.2  * Conv. (cfs)            * 11619.7  * 55908.8  *
 2234.8  *
* Length Wtd. (ft)       *  137.78  * Wetted Per. (ft)       *  170.93  *   61.51  *
  31.21  *
```

```
* Min Ch El (ft)         * 7296.87  * Shear (lb/sq ft)       *    0.31  *    1.35  *
   0.32  *
* Alpha                  *    1.64  * Stream Power (lb/ft s) *    0.99  *   13.20  *
   1.04  *
* Frctn Loss (ft)        *    0.51  * Cum Volume (acre-ft)   *   25.27  *   36.22  *
  13.39  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *    6.42  *    5.67  *
   3.91  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7300.47  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.95  * Wt. n-Val.             *          *   0.030  *
         *
* W.S. Elev (ft)         * 7299.52  * Reach Len. (ft)        *  146.84  *  136.84  *
 121.84  *
* Crit W.S. (ft)         * 7299.46  * Flow Area (sq ft)      *          *  117.13  *
         *
* E.G. Slope (ft/ft)     *0.009766  * Area (sq ft)           *          *  117.13  *
         *
* Q Total (cfs)          *  914.00  * Flow (cfs)             *          *  914.00  *
         *
* Top Width (ft)         *   57.60  * Top Width (ft)         *          *   57.60  *
         *
* Vel Total (ft/s)       *    7.80  * Avg. Vel. (ft/s)       *          *    7.80  *
         *
* Max Chl Dpth (ft)      *    2.65  * Hydr. Depth (ft)       *          *    2.03  *
         *
* Conv. Total (cfs)      *  9248.7  * Conv. (cfs)            *          *  9248.7  *
         *
* Length Wtd. (ft)       *  136.83  * Wetted Per. (ft)       *          *   58.19  *
         *
* Min Ch El (ft)         * 7296.87  * Shear (lb/sq ft)       *          *    1.23  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    9.58  *
         *
* Frctn Loss (ft)        *    0.97  * Cum Volume (acre-ft)   *    1.31  *    9.62  *
   0.03  *
* C & E Loss (ft)        *    0.08  * Cum SA (acres)         *    0.91  *    5.46  *
   0.09  *
*******************************************************************************
***********

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

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
```

```
* E.G. Elev (ft)         * 7302.51  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.51  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7301.00  * Reach Len. (ft)        *  146.84  *  136.84  *
 121.84  *
* Crit W.S. (ft)         * 7300.91  * Flow Area (sq ft)      *    1.27  *  206.05  *
   3.02  *
* E.G. Slope (ft/ft)     *0.007924  * Area (sq ft)           *    1.27  *  206.05  *
   3.02  *
* Q Total (cfs)          * 2044.00  * Flow (cfs)             *    2.83  * 2034.04  *
   7.13  *
* Top Width (ft)         *   69.45  * Top Width (ft)         *    2.61  *   60.78  *
   6.06  *
* Vel Total (ft/s)       *    9.72  * Avg. Vel. (ft/s)       *    2.23  *    9.87  *
   2.36  *
* Max Chl Dpth (ft)      *    4.13  * Hydr. Depth (ft)       *    0.49  *    3.39  *
   0.50  *
* Conv. Total (cfs)      * 22961.7  * Conv. (cfs)            *    31.8  * 22849.8  *
   80.1  *
* Length Wtd. (ft)       *  136.76  * Wetted Per. (ft)       *    2.80  *   61.51  *
   6.14  *
* Min Ch El (ft)         * 7296.87  * Shear (lb/sq ft)       *    0.22  *    1.66  *
   0.24  *
* Alpha                  *    1.03  * Stream Power (lb/ft s) *    0.50  *   16.36  *
   0.57  *
* Frctn Loss (ft)        *    1.10  * Cum Volume (acre-ft)   *    5.60  *   18.24  *
   1.31  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *    2.65  *    5.67  *
   1.67  *
*******************************************************************************
***********

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

CROSS SECTION


RIVER: Alignment - (1)
REACH: Alignment - (1)    RS: 2934.46

INPUT
Description:
Station Elevation Data    num=     191
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 7330.33    1.72 7330.31   11.61 7330.11   12.28  7330.1   16.67    7330
   18.73 7329.94   19.36 7329.92   29.58 7329.59   33.53 7329.45   44.78 7329.06
   53.63 7328.74   57.29  7328.6   59.07 7328.52   71.51 7328.19   72.65 7328.14
   80.43    7328   82.36 7327.95   83.11 7327.89   89.84 7327.58  108.65    7326
   121.2 7324.67  127.92    7324  137.11 7322.95  145.63    7322  147.92 7321.73
  162.65    7320  164.57 7319.76  178.26    7318  178.51 7317.96  193.11    7316
  206.69 7314.15  207.42 7314.06  207.84    7314  218.51 7312.51  222.17    7312
  230.64 7310.76  236.14    7310  246.11 7308.59  250.21    7308  255.86  7307.2
  259.05 7306.71  263.77    7306  268.99 7305.17   276.6    7304  288.93  7302.2
  289.62  7302.1  290.25    7302   291.1 7301.98     302 7301.75  314.25 7301.47
  333.92 7301.35  350.86 7301.26   353.2 7301.31  356.35 7301.34  363.61  7301.4
  363.66 7301.41  363.97 7301.42  372.58 7301.45  373.04 7301.44  381.31 7301.45
  385.57 7301.35  386.58 7301.33   387.7 7301.31  391.28 7301.29  391.99 7301.27
  399.29 7301.24  401.91 7301.19  405.09 7301.17  409.05 7301.12  412.76 7301.05
  414.82    7301  415.86 7300.96  418.07 7300.91  419.72 7300.87  421.21  7300.8
```

```
  423.41 7300.66  424.69 7300.58   429.6 7300.52   430.2 7300.51  430.37 7300.51
  431.93 7300.58  440.97    7300  444.96 7298.26  445.81    7298  447.44  7297.3
   448.2 7296.98  449.18 7296.53  449.77 7296.26  450.48    7296  492.48    7296
  494.26 7296.47  500.84    7298  505.31 7299.09  508.36  7299.7  509.75    7300
  512.61 7300.57  518.61    7302   522.6 7303.76   523.1    7304  524.14 7304.26
   527.6 7305.08  533.81    7306  536.28 7306.26  538.12 7306.57  543.18 7307.31
  547.29    7308  549.17 7308.22  549.58 7308.27  552.98 7308.63  556.48 7308.96
  560.46 7309.16  561.17 7309.23  564.91 7309.46  577.51 7309.72  579.17 7309.78
  580.37  7309.8  585.94    7310  596.65  7310.1  607.14 7310.19  610.36 7310.19
  614.08 7310.21  615.94 7310.28  619.52  7310.4  630.69  7310.6  634.33 7310.65
  637.08 7310.76  641.46 7310.85  647.03 7311.06  655.36 7311.25  659.63 7311.47
  662.93 7311.55   669.4 7311.87  671.48    7312  673.02 7312.08  679.28 7312.33
  684.46 7312.33   686.3 7312.43  691.38 7312.64  696.63 7312.84  708.46 7313.56
  709.87 7313.63   711.6 7313.71  715.65    7314  729.14 7315.06  742.39    7316
   745.9 7316.34  762.49    7318  765.21  7318.3  780.13    7320  785.35 7320.63
   794.8    7322  796.35 7322.22  809.16    7324  817.49 7325.07  825.11    7326
   834.3 7327.06  842.22    7328  852.38 7329.36  857.04    7330  861.05 7330.63
  869.87    7332  873.97 7332.55  884.45    7334  890.55 7334.85  898.12    7336
  904.18 7337.08  910.09    7338  921.59 7339.78  922.93    7340  925.18 7340.35
  926.44 7340.47  932.62 7341.24  933.95 7341.34  935.46 7341.44  937.13 7341.57
  940.66    7342   949.9  7342.8  954.63 7343.21  955.98  7343.3  958.18 7343.42
   961.2  7343.6  966.72    7344  968.18 7344.14   976.5 7344.91  984.22    7346
  995.61 7347.28  999.78 7347.57 1002.18 7347.69  1004.9    7348 1010.47 7348.34
  1013.4 7348.48

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
       0    .035  444.96     .03  500.84    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        444.96  500.84           298.11  358.11  451.11             .1       .3

CROSS SECTION OUTPUT  Profile #500-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7303.80  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.31  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7302.49  * Reach Len. (ft)        *  298.11  *  358.11  *
 451.11  *
* Crit W.S. (ft)         * 7302.49  * Flow Area (sq ft)      *  199.22  *  347.62  *
  44.53  *
* E.G. Slope (ft/ft)     *0.003661  * Area (sq ft)           *  199.22  *  347.62  *
  44.53  *
* Q Total (cfs)          * 4290.00  * Flow (cfs)             *  596.12  * 3495.05  *
 198.84  *
* Top Width (ft)         *  232.77  * Top Width (ft)         *  158.01  *   55.88  *
  18.88  *
* Vel Total (ft/s)       *    7.25  * Avg. Vel. (ft/s)       *    2.99  *   10.05  *
   4.47  *
* Max Chl Dpth (ft)      *    6.49  * Hydr. Depth (ft)       *    1.26  *    6.22  *
   2.36  *
* Conv. Total (cfs)      * 70903.6  * Conv. (cfs)            *  9852.4  * 57764.8  *
 3286.3  *
* Length Wtd. (ft)       *  358.78  * Wetted Per. (ft)       *  158.45  *   56.57  *
  19.43  *
* Min Ch El (ft)         * 7296.00  * Shear (lb/sq ft)       *    0.29  *    1.40  *
   0.52  *
* Alpha                  *    1.61  * Stream Power (lb/ft s) *    0.86  *   14.12  *
   2.34  *
* Frctn Loss (ft)        *    1.76  * Cum Volume (acre-ft)   *   24.55  *   35.12  *
```

```
  13.27  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)         *    5.87  *    5.49  *
   3.84  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7299.42  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.67  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7298.74  * Reach Len. (ft)        *  298.11  *  358.11  *
 451.11  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *    0.27  *  138.26  *
   1.13  *
* E.G. Slope (ft/ft)     *0.005386  * Area (sq ft)           *    0.27  *  138.26  *
   1.13  *
* Q Total (cfs)          *  914.00  * Flow (cfs)             *    0.30  *  911.91  *
   1.78  *
* Top Width (ft)         *   60.03  * Top Width (ft)         *    1.11  *   55.88  *
   3.04  *
* Vel Total (ft/s)       *    6.54  * Avg. Vel. (ft/s)       *    1.14  *    6.60  *
   1.58  *
* Max Chl Dpth (ft)      *    2.74  * Hydr. Depth (ft)       *    0.24  *    2.47  *
   0.37  *
* Conv. Total (cfs)      * 12453.8  * Conv. (cfs)            *     4.1  * 12425.4  *
   24.3  *
* Length Wtd. (ft)       *  358.19  * Wetted Per. (ft)       *    1.21  *   56.57  *
   3.13  *
* Min Ch El (ft)         * 7296.00  * Shear (lb/sq ft)       *    0.07  *    0.82  *
   0.12  *
* Alpha                  *    1.01  * Stream Power (lb/ft s) *    0.08  *    5.42  *
   0.19  *
* Frctn Loss (ft)        *    2.73  * Cum Volume (acre-ft)   *    1.31  *    9.22  *
   0.03  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *    0.91  *    5.28  *
   0.09  *
*******************************************************************************
***********

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

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
```

```
***********
* E.G. Elev (ft)         * 7301.39  * Element                 *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.62  * Wt. n-Val.              *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7299.78  * Reach Len. (ft)         *  298.11  *  358.11  *
 451.11  *
* Crit W.S. (ft)         * 7299.78  * Flow Area (sq ft)       *    2.64  *  196.13  *
   6.69  *
* E.G. Slope (ft/ft)     *0.008185  * Area (sq ft)            *    2.64  *  196.13  *
   6.69  *
* Q Total (cfs)          * 2044.00  * Flow (cfs)              *    7.97  * 2013.36  *
  22.67  *
* Top Width (ft)         *   67.24  * Top Width (ft)          *    3.48  *   55.88  *
   7.88  *
* Vel Total (ft/s)       *    9.95  * Avg. Vel. (ft/s)        *    3.02  *   10.27  *
   3.39  *
* Max Chl Dpth (ft)      *    3.78  * Hydr. Depth (ft)        *    0.76  *    3.51  *
   0.85  *
* Conv. Total (cfs)      * 22592.2  * Conv. (cfs)             *    88.1  * 22253.6  *
  250.6  *
* Length Wtd. (ft)       *  359.47  * Wetted Per. (ft)        *    3.80  *   56.57  *
   8.08  *
* Min Ch El (ft)         * 7296.00  * Shear (lb/sq ft)        *    0.36  *    1.77  *
   0.42  *
* Alpha                  *    1.05  * Stream Power (lb/ft s) *    1.07  *   18.19  *
   1.43  *
* Frctn Loss (ft)        *    3.02  * Cum Volume (acre-ft)    *    5.60  *   17.61  *
   1.30  *
* C & E Loss (ft)        *    0.14  * Cum SA (acres)          *    2.64  *    5.49  *
   1.65  *
*******************************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Alignment - (1)
REACH: Alignment - (1)    RS: 2576.35

INPUT
Description:
Station Elevation Data    num=     146
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 7329.28    4.03 7329.17    19.4 7328.71   27.41 7328.48    34.3 7328.27
    42.7    7328   64.12 7327.15   94.06    7326  109.73 7325.25  133.22  7324.1
  135.23    7324  173.92  7322.6  190.51    7322  228.45 7321.35  242.39 7321.12
  267.16  7320.7  311.46    7320   311.5    7320  318.87 7319.82  338.57 7319.39
  354.56 7319.03  358.07 7318.95  361.64 7318.87  365.08 7318.78  376.77 7318.46
  379.39 7318.39  387.16 7318.21  395.18    7318  414.13 7317.13  435.33    7316
```

```
  444.59 7315.37  464.76    7314  473.03 7313.34  479.32 7312.81  487.56 7312.23
  490.52    7312  491.07 7311.84  492.81 7311.47  493.82 7311.47  495.13 7311.17
  497.12 7310.97  498.97 7310.92   500.7 7310.99  501.88 7310.95  504.05 7310.84
  506.94 7310.61  508.52 7310.46  511.34 7310.29  512.29 7310.19  516.71    7310
  520.08 7309.38  521.94 7309.03  522.28 7308.97  526.36    7308  527.52 7307.72
  528.95 7307.45  532.82 7306.79  535.77    7306  537.07 7305.73  537.99 7305.41
  538.08 7305.39  539.74 7304.69  541.28    7304  545.16 7302.33  545.83    7302
  546.82 7301.56  550.29    7300  554.78 7298.49  556.14    7298  557.44  7297.7
   566.6    7296  570.64 7295.39  580.98    7294   590.3 7293.98  594.42 7293.97
  598.28 7293.97  601.55  7293.9  604.09 7293.86  614.84 7293.68   616.7 7293.79
  620.76 7293.93  624.52    7294  625.63 7294.11  627.86 7294.01   627.9 7294.02
  630.37 7294.31  632.98 7294.59  634.94 7294.71  637.35 7294.87  638.42 7294.92
  640.11 7295.02   643.4 7295.18  650.06  7295.7  651.49  7295.8  653.68    7296
  665.52 7296.27  666.55 7296.32  668.77 7296.43  673.05 7296.74  687.76    7298
  702.51 7298.42  708.37 7298.65  718.83 7299.02  736.22 7299.81  738.96 7299.94
  740.24    7300  741.97 7300.18  758.02    7302  762.97 7302.62  773.71    7304
  785.27 7305.17  793.27    7306  820.47 7307.19  832.99 7307.73  835.93 7307.85
   839.1    7308  843.53 7308.32  868.76    7310  878.01 7310.54  901.63    7312
  931.19 7313.76   935.3    7314  956.02 7315.93  956.82    7316  958.32 7316.15
     977    7318  991.91  7319.7  994.57    7320  1009.4 7321.91 1010.13    7322
 1011.35 7322.17 1024.36    7324 1036.58 7325.96 1036.87    7326 1037.71 7326.15
 1046.61 7327.68 1048.41    7328 1066.86 7329.87 1068.26    7330 1068.94 7330.18
 1076.07    7332 1081.46 7333.49 1083.67    7334 1087.71 7334.85 1093.06    7336
 1100.35 7337.51

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
       0    .035   566.6     .03  653.68    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         566.6  653.68           211.59  202.59  198.59             .1       .3

CROSS SECTION OUTPUT  Profile #500-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7300.27  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.64  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7298.63  * Reach Len. (ft)        *  211.59  *  202.59  *
 198.59  *
* Crit W.S. (ft)         * 7298.63  * Flow Area (sq ft)      *   17.86  *  366.12  *
  70.94  *
* E.G. Slope (ft/ft)     *0.006882  * Area (sq ft)           *   17.86  *  366.12  *
  70.94  *
* Q Total (cfs)          * 4290.00  * Flow (cfs)             *   79.64  * 3911.58  *
 298.78  *
* Top Width (ft)         *  153.47  * Top Width (ft)         *   12.23  *   87.08  *
  54.16  *
* Vel Total (ft/s)       *    9.43  * Avg. Vel. (ft/s)       *    4.46  *   10.68  *
   4.21  *
* Max Chl Dpth (ft)      *    4.95  * Hydr. Depth (ft)       *    1.46  *    4.20  *
   1.31  *
* Conv. Total (cfs)      * 51713.9  * Conv. (cfs)            *   960.0  * 47152.3  *
 3601.6  *
* Length Wtd. (ft)       *  202.55  * Wetted Per. (ft)       *   12.53  *   87.32  *
  54.24  *
* Min Ch El (ft)         * 7293.68  * Shear (lb/sq ft)       *    0.61  *    1.80  *
   0.56  *
* Alpha                  *    1.19  * Stream Power (lb/ft s) *    2.73  *   19.25  *
   2.37  *
* Frctn Loss (ft)        *    1.45  * Cum Volume (acre-ft)   *   23.81  *   32.19  *
```

```
  12.67  *
* C & E Loss (ft)        *    0.04  * Cum SA (acres)         *    5.28  *    4.90  *
   3.46  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7296.69  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.77  * Wt. n-Val.             *          *   0.030  *
         *
* W.S. Elev (ft)         * 7295.92  * Reach Len. (ft)        *  211.59  *  202.59  *
 198.59  *
* Crit W.S. (ft)         * 7295.92  * Flow Area (sq ft)      *          *  130.02  *
         *
* E.G. Slope (ft/ft)     *0.011580  * Area (sq ft)           *          *  130.02  *
         *
* Q Total (cfs)          *  914.00  * Flow (cfs)             *          *  914.00  *
         *
* Top Width (ft)         *   85.62  * Top Width (ft)         *          *   85.62  *
         *
* Vel Total (ft/s)       *    7.03  * Avg. Vel. (ft/s)       *          *    7.03  *
         *
* Max Chl Dpth (ft)      *    2.24  * Hydr. Depth (ft)       *          *    1.52  *
         *
* Conv. Total (cfs)      *  8493.4  * Conv. (cfs)            *          *  8493.4  *
         *
* Length Wtd. (ft)       *  202.57  * Wetted Per. (ft)       *          *   85.85  *
         *
* Min Ch El (ft)         * 7293.68  * Shear (lb/sq ft)       *          *    1.09  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    7.70  *
         *
* Frctn Loss (ft)        *    1.77  * Cum Volume (acre-ft)   *    1.31  *    8.11  *
   0.03  *
* C & E Loss (ft)        *    0.05  * Cum SA (acres)         *    0.91  *    4.70  *
   0.07  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
```

not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION OUTPUT Profile #50-yr
****
****
* E.G. Elev (ft) * 7298.20 * Element * Left OB * Channel *
Right OB *
* Vel Head (ft) * 1.15 * Wt. n-Val. * 0.035 * 0.030 *
0.035 *
* W.S. Elev (ft) * 7297.04 * Reach Len. (ft) * 211.59 * 202.59 *
198.59 *
* Crit W.S. (ft) * 7297.04 * Flow Area (sq ft) * 2.94 * 228.14 *
15.53 *
* E.G. Slope (ft/ft) *0.008613 * Area (sq ft) * 2.94 * 228.14 *
15.53 *
* Q Total (cfs) * 2044.00 * Flow (cfs) * 7.42 * 1989.41 *
47.17 *
* Top Width (ft) * 115.63 * Top Width (ft) * 5.63 * 87.08 *
22.92 *
* Vel Total (ft/s) * 8.29 * Avg. Vel. (ft/s) * 2.53 * 8.72 *
3.04 *
* Max Chl Dpth (ft) * 3.36 * Hydr. Depth (ft) * 0.52 * 2.62 *
0.68 *
* Conv. Total (cfs) * 22024.1 * Conv. (cfs) * 80.0 * 21435.9 *
508.2 *
* Length Wtd. (ft) * 202.55 * Wetted Per. (ft) * 5.72 * 87.32 *
22.95 *
* Min Ch El (ft) * 7293.68 * Shear (lb/sq ft) * 0.28 * 1.40 *
0.36 *
* Alpha * 1.08 * Stream Power (lb/ft s) * 0.70 * 12.25 *
1.10 *
* Frctn Loss (ft) * 1.72 * Cum Volume (acre-ft) * 5.58 * 15.86 *
1.18 *
* C & E Loss (ft) * 0.01 * Cum SA (acres) * 2.61 * 4.90 *
1.49 *
****
****

Warning: The energy equation could not be balanced within the specified number of
iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is
not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Alignment - (1)
REACH: Alignment - (1) RS: 2373.76

INPUT
Description:
Station Elevation Data num= 206
Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev
****
0 7328.62 9.65 7328.33 20.21 7328 25.8 7327.83 28.49 7327.74

```
  45.24 7327.23   57.18 7326.81   65.19 7326.56   78.18 7326.13   79.23 7326.09
  81.93    7326  109.77 7324.99  132.97    7324  176.19 7322.79  208.83    7322
 234.88 7321.14  254.75 7320.69  266.59 7320.35  269.78 7320.26  274.71 7320.19
 276.21 7320.17  285.47 7320.06  291.97    7320  292.07    7320  296.97 7319.93
  306.2  7319.9  307.12    7320  309.15    7320  311.96 7320.01  325.96 7320.01
 331.97 7320.02  333.13 7320.02  335.38 7320.01  343.38 7320.01  349.52    7320
 351.89    7320  357.71 7319.79  372.24 7319.28  408.55    7318  442.61 7316.68
 459.26    7316  481.89 7314.56  490.28    7314  507.68 7312.26   510.4    7312
 515.65 7311.48  530.52    7310  534.35  7309.6  541.24  7308.9  550.83    7308
 560.26 7307.12  566.37 7306.54  569.79 7306.46  572.26  7306.5  578.11 7306.22
 581.68    7306  593.43    7306  602.24 7305.99  602.57 7305.99  602.93    7306
 636.11    7306  641.11 7305.53  644.58 7305.11  647.92 7304.77  654.03    7304
 659.06 7303.42   660.7 7303.34  662.96 7303.25  670.18 7302.94  674.05 7302.81
 675.79 7302.78  683.56  7302.5  686.32 7302.43  688.63 7302.39   690.5  7302.4
 695.33 7302.49  696.78 7302.53  697.91 7302.57     703 7302.78  707.66 7302.73
 715.25 7302.98  717.71    7303  719.87 7303.09  724.07 7303.26  734.27 7303.78
 735.49 7303.83  737.46 7303.91  738.83 7303.88  739.11  7303.9  741.63 7303.81
 742.08 7303.83  742.31 7303.83  742.65 7303.82  743.07  7303.8  743.42 7303.78
 744.06 7303.74  744.42 7303.71  744.48 7303.71  745.81 7303.59  747.57 7303.43
 757.24 7302.69  758.06 7302.66  761.91 7302.27  764.28    7302  766.51 7301.51
 767.46 7301.35  769.59 7300.95  774.22    7300  775.08 7299.76   780.9    7298
 784.48 7296.74  786.43    7296  787.68 7295.35  791.37    7294  794.46 7293.25
 796.87 7292.79  797.08 7292.74  798.42 7292.43  801.91 7292.03  802.13    7292
 804.37 7291.97  806.79 7291.94  808.71  7291.9  809.11 7291.89  809.39 7291.88
 812.23 7291.82  816.09 7291.74  817.37 7291.71  818.01  7291.7  818.45 7291.69
 819.73 7291.59   841.2 7291.42  841.44 7291.42     859 7291.32  862.11 7291.41
 863.48 7291.48  865.01 7291.55  865.41  7291.6  865.83 7291.65  866.09 7291.82
 866.33    7292  871.92    7292  875.99 7293.66  876.85    7294  881.78 7295.56
 885.78    7296  886.03 7296.03  895.74    7298  901.54 7298.36  913.51 7299.14
 917.44 7299.38  928.11    7300  928.82 7300.04  932.56 7300.22  936.75 7300.36
 943.35 7300.53  946.01 7300.59  950.75 7300.81  952.72 7300.92  955.73 7301.03
 957.81 7301.12   960.5 7301.25   963.2 7301.37  964.51  7301.4  965.77 7301.42
 972.54  7301.9  973.67    7302   974.8 7302.12  979.64 7302.48  987.63 7303.08
 999.82    7304 1008.02 7304.94 1017.67    7306 1023.61 7306.59 1030.36 7307.05
1033.77 7307.35 1035.82  7307.5 1037.69 7307.65 1045.04    7308  1048.4 7308.25
1050.38 7308.38 1058.39 7308.93 1068.96 7309.52 1071.68  7309.7 1078.52    7310
1079.69 7310.06 1088.93 7311.13 1095.96    7312 1105.06 7313.27 1110.27    7314
1116.72 7314.98 1123.45    7316 1127.51 7316.66 1135.57    7318 1142.62 7319.25
1146.89    7320 1156.54 7321.77 1157.82    7322 1159.12 7322.24 1168.83    7324
1176.56 7325.51 1179.21    7326 1184.67  7327.1 1189.31    7328 1193.46 7328.89
 1194.3 7329.07

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
       0    .035  794.46     .03  871.92    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        794.46  871.92           168.31  241.31  324.31             .1       .3

CROSS SECTION OUTPUT  Profile #500-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7298.25  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    2.04  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7296.22  * Reach Len. (ft)        *  168.31  *  241.31  *
 324.31  *
* Crit W.S. (ft)         * 7296.22  * Flow Area (sq ft)      *   14.43  *  350.90  *
  24.80  *
* E.G. Slope (ft/ft)     *0.007437  * Area (sq ft)           *   14.43  *  350.90  *
  24.80  *
```

```
* Q Total (cfs)          * 4290.00  * Flow (cfs)             *   71.72  * 4095.18  *
 123.10  *
* Top Width (ft)         *  101.09  * Top Width (ft)         *    8.60  *   77.46  *
  15.03  *
* Vel Total (ft/s)       *   11.00  * Avg. Vel. (ft/s)       *    4.97  *   11.67  *
   4.96  *
* Max Chl Dpth (ft)      *    4.90  * Hydr. Depth (ft)       *    1.68  *    4.53  *
   1.65  *
* Conv. Total (cfs)      * 49744.8  * Conv. (cfs)            *   831.7  * 47485.8  *
 1427.4  *
* Length Wtd. (ft)       *  240.06  * Wetted Per. (ft)       *    9.13  *   77.70  *
  15.71  *
* Min Ch El (ft)         * 7291.32  * Shear (lb/sq ft)       *    0.73  *    2.10  *
   0.73  *
* Alpha                  *    1.08  * Stream Power (lb/ft s) *    3.65  *   24.47  *
   3.64  *
* Frctn Loss (ft)        *    0.88  * Cum Volume (acre-ft)   *   23.73  *   30.52  *
  12.45  *
* C & E Loss (ft)        *    0.37  * Cum SA (acres)         *    5.23  *    4.52  *
   3.30  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7294.16  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.60  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7293.57  * Reach Len. (ft)        *  168.31  *  241.31  *
 324.31  *
* Crit W.S. (ft)         * 7293.30  * Flow Area (sq ft)      *    0.21  *  145.71  *
   3.01  *
* E.G. Slope (ft/ft)     *0.006803  * Area (sq ft)           *    0.21  *  145.71  *
   3.01  *
* Q Total (cfs)          *  914.00  * Flow (cfs)             *    0.21  *  905.28  *
   8.52  *
* Top Width (ft)         *   82.61  * Top Width (ft)         *    1.31  *   77.46  *
   3.84  *
* Vel Total (ft/s)       *    6.14  * Avg. Vel. (ft/s)       *    1.01  *    6.21  *
   2.83  *
* Max Chl Dpth (ft)      *    2.25  * Hydr. Depth (ft)       *    0.16  *    1.88  *
   0.78  *
* Conv. Total (cfs)      * 11081.2  * Conv. (cfs)            *     2.5  * 10975.4  *
```

```
  103.2  *
* Length Wtd. (ft)       *  241.69  * Wetted Per. (ft)       *    1.35  *   77.70  *
   4.15  *
* Min Ch El (ft)         * 7291.32  * Shear (lb/sq ft)       *    0.07  *    0.80  *
   0.31  *
* Alpha                  *    1.02  * Stream Power (lb/ft s) *    0.07  *    4.95  *
   0.87  *
* Frctn Loss (ft)        *    2.11  * Cum Volume (acre-ft)   *    1.31  *    7.47  *
   0.02  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *    0.90  *    4.32  *
   0.06  *
*******************************************************************************
***********

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

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7295.79  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.26  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7294.53  * Reach Len. (ft)        *  168.31  *  241.31  *
 324.31  *
* Crit W.S. (ft)         * 7294.45  * Flow Area (sq ft)      *    3.19  *  220.45  *
   7.98  *
* E.G. Slope (ft/ft)     *0.008361  * Area (sq ft)           *    3.19  *  220.45  *
   7.98  *
* Q Total (cfs)          * 2044.00  * Flow (cfs)             *    9.53  * 2000.94  *
  33.53  *
* Top Width (ft)         *   88.62  * Top Width (ft)         *    4.54  *   77.46  *
   6.61  *
* Vel Total (ft/s)       *    8.82  * Avg. Vel. (ft/s)       *    2.99  *    9.08  *
   4.20  *
* Max Chl Dpth (ft)      *    3.21  * Hydr. Depth (ft)       *    0.70  *    2.85  *
   1.21  *
* Conv. Total (cfs)      * 22354.0  * Conv. (cfs)            *   104.2  * 21883.1  *
  366.7  *
* Length Wtd. (ft)       *  241.81  * Wetted Per. (ft)       *    4.73  *   77.70  *
   7.08  *
* Min Ch El (ft)         * 7291.32  * Shear (lb/sq ft)       *    0.35  *    1.48  *
   0.59  *
* Alpha                  *    1.04  * Stream Power (lb/ft s) *    1.05  *   13.44  *
   2.47  *
* Frctn Loss (ft)        *    2.17  * Cum Volume (acre-ft)   *    5.56  *   14.82  *
   1.13  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *    2.58  *    4.52  *
   1.42  *
*******************************************************************************
***********

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

CROSS SECTION


RIVER: Alignment - (1)
REACH: Alignment - (1)    RS: 2132.45
```

```
INPUT
Description:
Station Elevation Data    num=     179
      Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*****************************************************************************
        0 7321.73    5.12 7321.61   11.86 7321.42   32.17 7320.92   44.51 7320.59
    65.56    7320   68.17 7319.94   68.78 7319.93      69 7319.93   95.54 7319.37
    97.39 7319.33  108.55  7319.1  110.57 7319.07  115.29 7318.92   117.8 7318.82
    120.8 7318.73  122.75 7318.67  123.56 7318.65  124.37 7318.64  128.86 7318.57
   132.46 7318.53  133.74 7318.52  135.61  7318.5  136.98 7318.49  138.39 7318.47
   140.92 7318.45  141.24 7318.48  143.01  7318.5  145.71 7318.52  147.85 7318.52
   153.86 7318.49   161.5 7318.44   171.3 7318.44   175.5 7318.46  182.52 7318.49
   191.29 7318.49  193.72 7318.48  205.23 7318.42  212.69 7318.38   217.2 7318.34
   233.38 7318.17  242.77 7318.06  243.74 7318.05  248.22    7318  257.34 7317.67
   264.04 7317.27  267.52 7317.09  285.29    7316  294.62 7314.96  302.51    7314
   308.45 7313.27  318.93    7312  327.78  7310.9  335.09    7310  343.96 7308.95
    351.9    7308  369.09 7306.12  370.28    7306  411.07 7305.07  427.64 7304.72
   435.15 7304.58  461.78    7304  464.82 7303.87  469.36 7303.71  470.75 7303.67
   479.32  7303.4  481.23 7303.33  485.38 7303.18  488.35 7303.06   494.4 7302.85
   497.83 7302.73   502.3 7302.54  511.59 7302.09   513.4    7302  515.45 7301.82
   523.46 7301.21  531.94 7300.47  534.73 7300.24  537.34    7300  548.67 7298.92
   558.39    7298  560.24 7297.83  579.36    7296  580.69 7295.91  581.25  7295.9
   590.59 7295.39  595.54 7295.14  597.76  7295.2  598.07 7295.22  612.61 7295.15
   631.45 7294.99  640.06 7294.82  661.58 7294.39  681.22    7294  686.88 7293.35
   697.87    7292  709.52 7290.71  713.42 7290.42  718.77    7290  719.81 7289.95
   721.09  7289.8  724.98 7289.59  726.57 7289.48  727.29 7289.45  727.34 7289.37
   737.25 7289.24  745.63 7289.16  748.33 7289.21  752.43 7289.26  752.44 7289.21
   753.51 7289.19  755.26 7289.18  759.12 7289.25  760.87 7289.29  761.38  7289.3
   761.85 7289.31  764.63 7289.37  765.58  7289.4  768.15 7289.44  770.03 7289.49
   772.92 7289.59   777.6 7289.78  782.78    7290  787.54 7291.35  790.19    7292
    793.4 7293.22   795.3    7294  798.93 7295.17   801.6    7296  820.02 7297.51
   822.11 7297.68  823.24 7297.76  826.26    7298  829.49 7298.27  842.58 7299.25
   850.53    7300  857.39 7300.89  865.57    7302  870.86 7302.74  879.83    7304
   887.62 7305.07  894.27    7306  902.07 7307.12  908.33    7308  912.83 7308.67
   921.97    7310  929.96 7311.06  936.48    7312  944.07 7313.16  949.87    7314
    954.7 7314.72  962.81    7316  972.26 7317.39  976.56    7318  981.86 7318.76
   984.46 7319.11  991.05    7320  999.66 7321.18 1005.42    7322 1012.79 7323.12
  1018.78    7324 1025.19 7325.04 1030.78    7326 1039.14 7327.36 1042.91    7328
   1044.8 7328.37 1054.44    7330 1056.96 7330.58 1063.58    7332 1066.96 7332.77
  1072.64    7334 1079.24 7335.28 1083.71    7336 1083.94 7336.04 1085.02 7336.23
  1093.59 7337.73 1093.64 7337.74 1095.31    7338 1100.02 7338.81

Manning's n Values        num=       3
      Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
        0    .035  697.87     .03  790.19    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         697.87  790.19               290     290     332              .1       .3

CROSS SECTION OUTPUT  Profile #500-yr
*****************************************************************************************
***********
* E.G. Elev (ft)         * 7296.49  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.79  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7295.69  * Reach Len. (ft)        *  290.00  *  290.00  *
 332.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *  127.31  *  535.60  *
  18.29  *
* E.G. Slope (ft/ft)     *0.002161  * Area (sq ft)           *  127.31  *  535.60  *
```

```
  18.29  *
* Q Total (cfs)          * 4290.00  * Flow (cfs)            *  272.12  * 3967.40  *
  50.48  *
* Top Width (ft)         *  215.52  * Top Width (ft)         *  112.78  *   92.32  *
  10.41  *
* Vel Total (ft/s)       *    6.30  * Avg. Vel. (ft/s)       *    2.14  *    7.41  *
   2.76  *
* Max Chl Dpth (ft)      *    6.53  * Hydr. Depth (ft)       *    1.13  *    5.80  *
   1.76  *
* Conv. Total (cfs)      * 92295.3  * Conv. (cfs)            *  5854.4  * 85354.8  *
 1086.1  *
* Length Wtd. (ft)       *  292.01  * Wetted Per. (ft)       *  112.93  *   92.81  *
  11.06  *
* Min Ch El (ft)         * 7289.16  * Shear (lb/sq ft)       *    0.15  *    0.78  *
   0.22  *
* Alpha                  *    1.29  * Stream Power (lb/ft s) *    0.33  *    5.77  *
   0.62  *
* Frctn Loss (ft)        *    0.22  * Cum Volume (acre-ft)   *   23.46  *   28.06  *
  12.29  *
* C & E Loss (ft)        *    0.17  * Cum SA (acres)         *    5.00  *    4.05  *
   3.21  *
*******************************************************************************
***********

Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7292.03  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.80  * Wt. n-Val.             *          *   0.030  *
         *
* W.S. Elev (ft)         * 7291.23  * Reach Len. (ft)        *  290.00  *  290.00  *
 332.00  *
* Crit W.S. (ft)         * 7291.23  * Flow Area (sq ft)      *          *  127.78  *
         *
* E.G. Slope (ft/ft)     *0.011668  * Area (sq ft)           *          *  127.78  *
         *
* Q Total (cfs)          *  914.00  * Flow (cfs)             *          *  914.00  *
         *
* Top Width (ft)         *   82.30  * Top Width (ft)         *          *   82.30  *
         *
* Vel Total (ft/s)       *    7.15  * Avg. Vel. (ft/s)       *          *    7.15  *
         *
* Max Chl Dpth (ft)      *    2.07  * Hydr. Depth (ft)       *          *    1.55  *
         *
* Conv. Total (cfs)      *  8461.6  * Conv. (cfs)            *          *  8461.6  *
         *
* Length Wtd. (ft)       *  290.02  * Wetted Per. (ft)       *          *   82.65  *
         *
* Min Ch El (ft)         * 7289.16  * Shear (lb/sq ft)       *          *    1.13  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    8.06  *
         *
* Frctn Loss (ft)        *    1.75  * Cum Volume (acre-ft)   *    1.31  *    6.71  *
   0.01  *
* C & E Loss (ft)        *    0.10  * Cum SA (acres)         *    0.90  *    3.88  *
```

```
   0.05  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7293.61  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.23  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7292.37  * Reach Len. (ft)        *  290.00  *  290.00  *
 332.00  *
* Crit W.S. (ft)         * 7292.37  * Flow Area (sq ft)      *    0.57  *  229.43  *
   0.18  *
* E.G. Slope (ft/ft)     *0.009669  * Area (sq ft)           *    0.57  *  229.43  *
   0.18  *
* Q Total (cfs)          * 2044.00  * Flow (cfs)             *    0.77  * 2042.99  *
   0.24  *
* Top Width (ft)         *   96.35  * Top Width (ft)         *    3.04  *   92.32  *
   0.98  *
* Vel Total (ft/s)       *    8.88  * Avg. Vel. (ft/s)       *    1.36  *    8.90  *
   1.31  *
* Max Chl Dpth (ft)      *    3.21  * Hydr. Depth (ft)       *    0.19  *    2.49  *
   0.19  *
* Conv. Total (cfs)      * 20787.1  * Conv. (cfs)            *     7.9  * 20776.8  *
    2.4  *
* Length Wtd. (ft)       *  290.11  * Wetted Per. (ft)       *    3.07  *   92.81  *
   1.05  *
* Min Ch El (ft)         * 7289.16  * Shear (lb/sq ft)       *    0.11  *    1.49  *
   0.11  *
* Alpha                  *    1.01  * Stream Power (lb/ft s) *    0.15  *   13.29  *
   0.14  *
* Frctn Loss (ft)        *    2.65  * Cum Volume (acre-ft)   *    5.55  *   13.57  *
   1.10  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *    2.57  *    4.05  *
   1.39  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
```

water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Alignment - (1)
REACH: Alignment - (1) RS: 1842.45

INPUT
Description:
Station Elevation Data num= 237

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7321.8	18.03	7321.5	34.78	7321.2	46.1	7320.9	53.22	7320.75
77.94	7320.12	80.03	7320.08	82.94	7320	126.65	7318.97	152.55	7318.36
155.52	7318.3	161.23	7318.17	161.78	7318.15	163.13	7318.12	163.91	7318.11
169.29	7318	184.26	7317.63	193.56	7317.42	195.68	7317.37	198.12	7317.32
200.14	7317.28	205.64	7317.24	211.94	7317.19	219.21	7317.21	222.62	7317.24
228.99	7317.3	232.8	7317.26	240.11	7317.29	242	7317.28	244.73	7317.29
246.45	7317.29	253.77	7317.22	257.56	7317.23	261.5	7317.18	267.47	7317.16
269.63	7317.13	271.37	7317.12	273.92	7317.09	278.15	7317.04	281.49	7316.98
287.9	7316.81	298.47	7316.61	300.68	7316.55	307.23	7316.37	315.13	7316.13
315.82	7316.11	318.93	7316	327.13	7315.31	333.37	7314.74	341.2	7314
357.84	7312.23	360	7312	365.99	7311.44	380.7	7310	383.2	7309.74
384.08	7309.65	385.12	7309.54	398.51	7308	406.67	7307.05	415.38	7306
430.2	7304.33	433.09	7304	434.71	7303.82	435.11	7303.79	445.07	7302.72
446.86	7302.53	447.59	7302.45	448.44	7302.41	448.89	7302.4	449.57	7302.35
450.2	7302.36	450.7	7302.35	451.88	7302.36	459.8	7302.21	462.44	7302.08
462.6	7302.09	462.71	7302.09	465.37	7302	467.03	7301.94	467.67	7301.9
477.85	7301.33	478	7301.32	485.44	7300.9	491.49	7300.55	497.37	7300.29
501.84	7300	501.99	7299.99	502.24	7299.96	514.22	7298.76	518.64	7298.35
522.31	7298	536.34	7296.86	544.1	7296.21	546.39	7296	553.65	7295.4
562.88	7294.7	565.75	7294.48	568.65	7294.23	572.47	7294	583.5	7293.26
588.4	7292.95	597.16	7292.46	599.8	7292.28	601.02	7292.19	608.28	7292
610.79	7291.94	615.95	7291.87	616.26	7291.86	619.34	7291.75	620.69	7291.73
624.28	7291.64	628.91	7291.46	631.77	7291.45	632.44	7291.45	634.09	7291.44
636.07	7291.39	637.12	7291.35	638.7	7291.28	641.01	7291.18	645.5	7290.94
650.91	7290.72	663.48	7290	665.67	7289.65	670.64	7289.05	677.52	7288.15
681.65	7288.09	683.51	7288	686.67	7287.77	688.15	7287.55	692.17	7287.01
692.7	7286.93	696.59	7286	703.51	7284.4	703.99	7284.3	704.59	7284.2
705	7284.14	705.11	7284.12	705.16	7284.1	705.23	7284.09	705.35	7284.08
706.43	7284.08	706.61	7284.09	706.73	7284.1	706.74	7284.1	706.96	7284.12
707.15	7284.13	707.45	7284.15	708.2	7284.19	712.71	7284.48	716.48	7284.73
719.66	7284.94	735.28	7286	737.94	7286.56	747.06	7288	747.27	7288.03
747.46	7288.04	754.65	7288.93	756.77	7289.13	761.57	7289.86	762.38	7290
767.23	7291.3	769.91	7292	774.76	7293.45	776.97	7294	780.98	7294.65
787.76	7296	788.35	7296.07	795.15	7296.76	798.79	7297.32	803.03	7298
807.29	7298.39	815.42	7299.02	816.02	7299.05	816.23	7299.07	816.39	7299.07
817.89	7299.13	819.18	7299.14	821.26	7299.14	822.35	7299.19	823.84	7299.29
824.14	7299.3	824.54	7299.3	826.53	7299.37	830.06	7299.35	832.01	7299.36
832.31	7299.39	835.72	7299.68	839.37	7300	849.35	7300.76	852.6	7300.99
862.19	7302	868.51	7302.67	870.78	7302.93	875.88	7303.45	880.73	7304
895.21	7305.22	904.16	7306	908.35	7306.48	913.26	7306.85	913.52	7306.86
913.77	7306.87	917.57	7306.89	920.03	7307.18	923.14	7307.31	924.35	7307.38
928.72	7308	936.76	7308.66	941.4	7309.05	944.28	7309.29	945.98	7309.41
946.77	7309.42	947.61	7309.49	947.74	7309.5	947.87	7309.5	951.8	7310
962.06	7310.94	968.98	7311.55	970.69	7311.66	970.86	7311.67	971.04	7311.68
971.39	7311.69	971.87	7311.66	973.82	7312	977.67	7312.36	984.1	7312.97
988.52	7313.39	991.83	7313.71	993.76	7313.88	993.89	7313.89	993.91	7313.89
994.83	7314	1012.97	7315.9	1013.88	7316	1014.1	7316.02	1034.02	7318
1049.34	7319.53	1050.28	7319.63						

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
       0    .035  677.52     .03  747.46    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        677.52  747.46              147  208.26     348             .1       .3

CROSS SECTION OUTPUT  Profile #500-yr
*********************************************************************************
***********
* E.G. Elev (ft)         * 7296.10  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.22  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7295.88  * Reach Len. (ft)        *  147.00  *  208.26  *
 348.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *  484.20  *  687.94  *
 169.78  *
* E.G. Slope (ft/ft)     *0.000368  * Area (sq ft)           *  484.20  *  687.94  *
 169.78  *
* Q Total (cfs)          * 4290.00  * Flow (cfs)             *  947.87  * 2982.77  *
 359.37  *
* Top Width (ft)         *  239.24  * Top Width (ft)         *  129.62  *   69.94  *
  39.67  *
* Vel Total (ft/s)       *    3.20  * Avg. Vel. (ft/s)       *    1.96  *    4.34  *
   2.12  *
* Max Chl Dpth (ft)      *   11.80  * Hydr. Depth (ft)       *    3.74  *    9.84  *
   4.28  *
* Conv. Total (cfs)      *223640.1  * Conv. (cfs)            * 49412.8  *155493.3  *
18734.1  *
* Length Wtd. (ft)       *  210.30  * Wetted Per. (ft)       *  129.92  *   70.57  *
  40.52  *
* Min Ch El (ft)         * 7284.08  * Shear (lb/sq ft)       *    0.09  *    0.22  *
   0.10  *
* Alpha                  *    1.40  * Stream Power (lb/ft s) *    0.17  *    0.97  *
   0.20  *
* Frctn Loss (ft)        *    0.02  * Cum Volume (acre-ft)   *   21.42  *   23.99  *
  11.57  *
* C & E Loss (ft)        *    0.06  * Cum SA (acres)         *    4.19  *    3.51  *
   3.02  *
*********************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #10-yr
*********************************************************************************
***********
* E.G. Elev (ft)         * 7288.91  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.45  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7288.46  * Reach Len. (ft)        *  147.00  *  208.26  *
 348.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *    0.38  *  169.53  *
   0.72  *
* E.G. Slope (ft/ft)     *0.003675  * Area (sq ft)           *    0.38  *  169.53  *
   0.72  *
* Q Total (cfs)          *  914.00  * Flow (cfs)             *    0.28  *  913.06  *
```

```
  0.66  *
* Top Width (ft)         *   75.76  * Top Width (ft)         *    2.40  *   69.94  *
  3.42  *
* Vel Total (ft/s)       *    5.36  * Avg. Vel. (ft/s)       *    0.74  *    5.39  *
  0.91  *
* Max Chl Dpth (ft)      *    4.38  * Hydr. Depth (ft)       *    0.16  *    2.42  *
  0.21  *
* Conv. Total (cfs)      * 15077.7  * Conv. (cfs)            *     4.6  * 15062.2  *
  10.9  *
* Length Wtd. (ft)       *  208.30  * Wetted Per. (ft)       *    2.42  *   70.57  *
  3.45  *
* Min Ch El (ft)         * 7284.08  * Shear (lb/sq ft)       *    0.04  *    0.55  *
  0.05  *
* Alpha                  *    1.01  * Stream Power (lb/ft s) *    0.03  *    2.97  *
  0.04  *
* Frctn Loss (ft)        *    1.23  * Cum Volume (acre-ft)   *    1.31  *    5.72  *
  0.00  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)         *    0.89  *    3.37  *
  0.04  *
*******************************************************************************
***********

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

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7290.48  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.42  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7289.06  * Reach Len. (ft)        *  147.00  *  208.26  *
 348.00  *
* Crit W.S. (ft)         * 7289.06  * Flow Area (sq ft)      *    3.18  *  211.40  *
  4.24  *
* E.G. Slope (ft/ft)     *0.008671  * Area (sq ft)           *    3.18  *  211.40  *
  4.24  *
* Q Total (cfs)          * 2044.00  * Flow (cfs)             *    7.40  * 2026.18  *
  10.42  *
* Top Width (ft)         *   85.51  * Top Width (ft)         *    6.98  *   69.94  *
  8.59  *
* Vel Total (ft/s)       *    9.34  * Avg. Vel. (ft/s)       *    2.33  *    9.58  *
  2.46  *
* Max Chl Dpth (ft)      *    4.98  * Hydr. Depth (ft)       *    0.46  *    3.02  *
  0.49  *
* Conv. Total (cfs)      * 21950.7  * Conv. (cfs)            *    79.5  * 21759.3  *
  111.9  *
* Length Wtd. (ft)       *  204.30  * Wetted Per. (ft)       *    7.04  *   70.57  *
  8.65  *
* Min Ch El (ft)         * 7284.08  * Shear (lb/sq ft)       *    0.24  *    1.62  *
  0.27  *
* Alpha                  *    1.04  * Stream Power (lb/ft s) *    0.57  *   15.54  *
  0.65  *
* Frctn Loss (ft)        *    0.46  * Cum Volume (acre-ft)   *    5.54  *   12.10  *
  1.08  *
* C & E Loss (ft)        *    0.37  * Cum SA (acres)         *    2.54  *    3.51  *
  1.36  *
*******************************************************************************
```

****

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross
sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION

RIVER: Alignment - (1)
REACH: Alignment - (1)   RS: 1634.19

INPUT
Description:
Station Elevation Data   num=   146

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7292.82	4.27	7293.04	6.34	7293.13	6.76	7293.15	7.15	7293.15
8.12	7293.17	8.75	7293.18	9.9	7293.22	14.62	7293.45	15.58	7293.52
16.94	7293.55	17.9	7293.58	18.54	7293.58	19.14	7293.59	20.31	7293.57
21.53	7293.54	24.17	7293.56	24.97	7293.54	27.06	7293.44	29.03	7293.35
30.61	7293.26	32.66	7293.15	39.49	7292.71	42.39	7292.53	43.08	7292.49
49.63	7292	53.03	7291.81	55.53	7291.65	67.22	7290.91	74.42	7290.4
76.55	7290.27	80.02	7290	98.27	7288.92	107.76	7288.27	110.26	7288.14
111.86	7288	117.38	7286.93	122.31	7286.03	122.43	7286	122.46	7286
128.72	7284.16	130.1	7284	132.13	7284	133.09	7283.99	133.51	7283.99
134.83	7284	145.17	7285.51	147.85	7286	148.63	7286.22	150.06	7286.48
153.26	7287.05	154.6	7287.25	159.92	7287.94	160.04	7287.96	160.1	7287.96
160.18	7287.95	161.25	7288	163.1	7288.01	166.82	7288	166.84	7288
170.63	7287.46	173.31	7287.85	173.53	7287.87	174.7	7288	177.42	7288.03
180.31	7288.11	183.57	7288.01	184.46	7288.01	191.81	7288.02	193.88	7288.03
198.15	7288.03	203.21	7288.02	206.65	7288.01	210.3	7288.01	211.69	7288
219.92	7288	223.17	7287.64	225.04	7287.31	235.13	7286.13	235.2	7286.12
235.96	7286	236.79	7285.88	247.33	7284	270.57	7284	284.63	7285.77
286.45	7286	291.61	7286.26	295.1	7286.43	299.34	7286.59	304.59	7286.77
307.53	7286.82	310.89	7287.01	317	7287.15	319.62	7287.19	323.56	7287.35
324.48	7287.37	326.14	7287.4	335.9	7287.64	337.34	7287.71	342.84	7287.89
346.45	7287.98	346.82	7288	347.49	7288.02	348.19	7288.02	356.12	7288.16
356.71	7288.18	359.78	7288.22	361.02	7288.27	362.42	7288.33	368.57	7288.47
372.3	7288.66	377.3	7288.83	383.2	7289.13	385.79	7289.25	388.31	7289.39
389.43	7289.46	391.18	7289.55	393.58	7289.65	403.63	7289.84	409.65	7290
411.64	7290.08	414.73	7290.3	417.38	7290.41	422.49	7290.8	425.46	7290.97
437.42	7292	440.68	7292.47	452.22	7294	454.55	7294.36	459.64	7295.2
463.11	7295.78	464.44	7296	471.57	7297.24	475.9	7298	484.54	7299.42
488.22	7300	498.6	7301.54	501.41	7302	508.15	7303.05	514.77	7304
519.94	7304.72	529.1	7306	538.47	7307.33	542.91	7308	553.75	7309.65
554.13	7309.71								

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	225.04	.03	317	.035

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        225.04     317           103.21  103.21  103.21             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
       0  180.31 7288.11       F

CROSS SECTION OUTPUT  Profile #500-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7296.02  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.03  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7295.99  * Reach Len. (ft)        *  103.21  *  103.21  *
 103.21  *
* Crit W.S. (ft)         * 7288.96  * Flow Area (sq ft)      * 1526.92  *  965.04  *
 890.66  *
* E.G. Slope (ft/ft)     *0.000054  * Area (sq ft)           * 1526.92  *  965.04  *
 890.66  *
* Q Total (cfs)          * 4290.00  * Flow (cfs)             * 1688.00  * 1680.70  *
 921.30  *
* Top Width (ft)         *  464.36  * Top Width (ft)         *  225.04  *   91.96  *
 147.36  *
* Vel Total (ft/s)       *    1.27  * Avg. Vel. (ft/s)       *    1.11  *    1.74  *
   1.03  *
* Max Chl Dpth (ft)      *   12.00  * Hydr. Depth (ft)       *    6.79  *   10.49  *
   6.04  *
* Conv. Total (cfs)      *583113.4  * Conv. (cfs)            *229439.7  *228446.7
*125227.0  *
* Length Wtd. (ft)       *  103.21  * Wetted Per. (ft)       *  229.31  *   92.36  *
 147.78  *
* Min Ch El (ft)         * 7284.00  * Shear (lb/sq ft)       *    0.02  *    0.04  *
   0.02  *
* Alpha                  *    1.18  * Stream Power (lb/ft s) *    0.02  *    0.06  *
   0.02  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   *   18.03  *   20.04  *
   7.34  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *    3.59  *    3.12  *
   2.27  *
*******************************************************************************
***********

Warning: The cross-section end points had to be extended vertically for the computed
water surface.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7287.65  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.79  * Wt. n-Val.             *          *   0.030  *
         *
* W.S. Elev (ft)         * 7286.86  * Reach Len. (ft)        *  103.21  *  103.21  *
 103.21  *
* Crit W.S. (ft)         * 7286.86  * Flow Area (sq ft)      *          *  128.10  *
         *
* E.G. Slope (ft/ft)     *0.011024  * Area (sq ft)           *   56.96  *  128.10  *
         *
* Q Total (cfs)          *  914.00  * Flow (cfs)             *          *  914.00  *
         *
* Top Width (ft)         *  113.76  * Top Width (ft)         *   34.42  *   79.34  *
         *
```

```
* Vel Total (ft/s)       *    7.14  * Avg. Vel. (ft/s)       *          *    7.14  *
          *
* Max Chl Dpth (ft)      *    2.87  * Hydr. Depth (ft)       *          *    1.61  *
          *
* Conv. Total (cfs)      *  8705.3  * Conv. (cfs)            *          *  8705.3  *
          *
* Length Wtd. (ft)       *  103.21  * Wetted Per. (ft)       *          *   79.71  *
          *
* Min Ch El (ft)         * 7284.00  * Shear (lb/sq ft)       *          *    1.11  *
          *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    7.89  *
          *
* Frctn Loss (ft)        *    1.11  * Cum Volume (acre-ft)   *    1.21  *    5.01  *
   0.00  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *    0.83  *    3.01  *
   0.02  *
*******************************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************************
***********
* E.G. Elev (ft)         * 7289.48  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.17  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7289.31  * Reach Len. (ft)        *  103.21  *  103.21  *
 103.21  *
* Crit W.S. (ft)         * 7288.12  * Flow Area (sq ft)      *  267.20  *  350.64  *
  83.66  *
* E.G. Slope (ft/ft)     *0.001013  * Area (sq ft)           *  267.20  *  350.64  *
  83.66  *
* Q Total (cfs)          * 2044.00  * Flow (cfs)             *  571.30  * 1345.18  *
 127.52  *
* Top Width (ft)         *  295.04  * Top Width (ft)         *  133.29  *   91.96  *
  69.79  *
* Vel Total (ft/s)       *    2.91  * Avg. Vel. (ft/s)       *    2.14  *    3.84  *
   1.52  *
* Max Chl Dpth (ft)      *    5.32  * Hydr. Depth (ft)       *    2.00  *    3.81  *
   1.20  *
* Conv. Total (cfs)      * 64222.5  * Conv. (cfs)            * 17950.4  * 42265.4  *
 4006.7  *
* Length Wtd. (ft)       *  103.21  * Wetted Per. (ft)       *  134.24  *   92.36  *
  69.83  *
* Min Ch El (ft)         * 7284.00  * Shear (lb/sq ft)       *    0.13  *    0.24  *
   0.08  *
* Alpha                  *    1.31  * Stream Power (lb/ft s) *    0.27  *    0.92  *
   0.12  *
```

```
* Frctn Loss (ft)        *    0.05  * Cum Volume (acre-ft)   *    5.09  *   10.76  *
   0.73  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)         *    2.30  *    3.12  *
   1.04  *
*******************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: Alignment - (1)
REACH: Alignment - (1)    RS: 1530.98

INPUT
Description:
Station Elevation Data    num=     144
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 7288.56     .93 7288.55     2.1 7288.56    2.76 7288.57    4.42 7288.51
    5.29 7288.47    6.85 7288.43    7.48 7288.42    8.67 7288.39   10.46 7288.36
   11.25 7288.35   12.78 7288.33   14.22 7288.31   15.85 7288.28   19.95 7288.21
   20.93  7288.2   21.91 7288.19   22.81  7288.2   27.59 7288.18   30.28 7288.19
   31.49 7288.19   35.05 7288.22   36.21 7288.23   38.87  7288.3   41.71 7288.36
   42.93 7288.35   44.78 7288.44   48.05 7288.68   50.61 7288.73   52.11 7288.77
   53.96 7288.83   57.65 7288.83   58.39 7288.84   60.06 7288.88    61.7  7288.9
   62.18  7288.9   62.64 7288.89   63.43 7288.87   64.55 7288.81   65.38 7288.64
   71.33 7288.61   74.45 7288.58   76.82 7288.49   78.39 7288.36   79.32 7288.25
   81.39 7288.16   82.81 7288.08    83.9    7288   88.08 7287.33   95.69    7286
  101.21 7284.59  103.89    7284  106.02 7283.63  107.84 7283.59  114.13 7282.89
  115.95 7282.72  116.47 7282.68  118.91 7282.52   119.6 7282.44  120.11 7282.37
  120.28 7282.29  123.27 7282.18  124.66 7282.14  125.26 7282.14  125.48 7282.15
  125.53 7282.15  125.77 7282.16  126.36 7282.19  126.67 7282.21  126.83 7282.21
  126.87 7282.22   127.2 7282.23  127.37 7282.25   127.7 7282.25  130.68 7282.26
  131.63 7282.27  131.77 7282.28  132.18 7282.29  132.61  7282.3  133.01 7282.32
  133.33 7282.35  133.69 7282.37  136.77 7282.39  137.42 7282.42  138.11 7282.46
  138.22 7282.47  138.39 7282.48  138.91 7282.52  139.83 7282.59  144.24 7282.61
  146.68 7282.79  154.25 7282.79  158.27 7283.46   161.9    7284   169.4 7285.59
  171.31    7286  171.77  7286.1   175.7 7286.93  179.69  7287.8  180.61    7288
   235.1    7288  240.03 7287.32  241.84 7287.21  243.56 7287.16  244.73 7287.14
  246.42 7287.11  247.58 7287.07  248.64 7287.04   251.4 7286.72  253.83 7286.38
  256.16    7286  263.95 7285.04  273.69    7284  292.66 7282.61   297.8 7282.18
   300.4    7282  311.43    7282  315.35 7282.67  323.63    7284  328.08 7285.33
  330.46    7286     336 7287.95  336.14    7288  352.43 7288.57  367.16 7289.07
   368.1  7289.1  373.57 7289.28  388.73 7289.75  390.78 7289.81  392.72 7289.86
  393.24 7289.88  393.72 7289.89  398.25    7290  399.56 7290.04   405.7 7290.25
  408.15 7290.35  411.74 7290.52  436.53 7291.74   441.8    7292  444.05 7292.19
  465.21    7294  468.08 7294.33  482.55    7296  497.19    7298

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0    .035  263.95     .03  328.08    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        263.95  328.08           280.85  280.85  280.85             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
       0  236.17 7287.97       F
```

```
CROSS SECTION OUTPUT  Profile #500-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7296.01  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.02  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7295.99  * Reach Len. (ft)        *  280.85  *  280.85  *
 280.85  *
* Crit W.S. (ft)         * 7287.98  * Flow Area (sq ft)      * 2486.48  *  821.34  *
 813.65  *
* E.G. Slope (ft/ft)     *0.000030  * Area (sq ft)           * 2486.48  *  821.34  *
 813.65  *
* Q Total (cfs)          * 4290.00  * Flow (cfs)             * 2512.79  * 1208.40  *
 568.81  *
* Top Width (ft)         *  482.46  * Top Width (ft)         *  263.95  *   64.13  *
 154.38  *
* Vel Total (ft/s)       *    1.04  * Avg. Vel. (ft/s)       *    1.01  *    1.47  *
   0.70  *
* Max Chl Dpth (ft)      *   13.99  * Hydr. Depth (ft)       *    9.42  *   12.81  *
   5.27  *
* Conv. Total (cfs)      *786606.6  * Conv. (cfs)            *460740.3  *221570.2
*104296.1  *
* Length Wtd. (ft)       *  280.85  * Wetted Per. (ft)       *  272.69  *   64.62  *
 155.09  *
* Min Ch El (ft)         * 7282.00  * Shear (lb/sq ft)       *    0.02  *    0.02  *
   0.01  *
* Alpha                  *    1.17  * Stream Power (lb/ft s) *    0.02  *    0.03  *
   0.01  *
* Frctn Loss (ft)        *    0.01  * Cum Volume (acre-ft)   *   13.27  *   17.92  *
   5.32  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *    3.01  *    2.94  *
   1.91  *
*******************************************************************************
***********

Warning: The cross-section end points had to be extended vertically for the computed
water surface.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7285.95  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.92  * Wt. n-Val.             *          *   0.030  *
         *
* W.S. Elev (ft)         * 7285.03  * Reach Len. (ft)        *  280.85  *  280.85  *
 280.85  *
* Crit W.S. (ft)         * 7285.03  * Flow Area (sq ft)      *          *  118.85  *
         *
* E.G. Slope (ft/ft)     *0.010455  * Area (sq ft)           *  135.40  *  118.85  *
         *
* Q Total (cfs)          *  914.00  * Flow (cfs)             *          *  914.00  *
         *
* Top Width (ft)         *  130.36  * Top Width (ft)         *   67.30  *   63.07  *
         *
* Vel Total (ft/s)       *    7.69  * Avg. Vel. (ft/s)       *          *    7.69  *
         *
* Max Chl Dpth (ft)      *    3.03  * Hydr. Depth (ft)       *          *    1.88  *
         *
* Conv. Total (cfs)      *  8938.9  * Conv. (cfs)            *          *  8938.9  *
         *
* Length Wtd. (ft)       *  280.85  * Wetted Per. (ft)       *          *   63.51  *
```

```
*
* Min Ch El (ft)         * 7282.00  * Shear (lb/sq ft)       *          *    1.22  *
*
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    9.39  *
*
* Frctn Loss (ft)        *    0.29  * Cum Volume (acre-ft)   *    0.98  *    4.72  *
   0.00  *
* C & E Loss (ft)        *    0.26  * Cum SA (acres)         *    0.71  *    2.85  *
   0.02  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7289.40  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.07  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7289.33  * Reach Len. (ft)        *  280.85  *  280.85  *
 280.85  *
* Crit W.S. (ft)         * 7286.41  * Flow Area (sq ft)      *  729.17  *  394.38  *
  47.61  *
* E.G. Slope (ft/ft)     *0.000255  * Area (sq ft)           *  729.17  *  394.38  *
  47.61  *
* Q Total (cfs)          * 2044.00  * Flow (cfs)             *  969.03  * 1042.67  *
  32.30  *
* Top Width (ft)         *  375.24  * Top Width (ft)         *  263.95  *   64.13  *
  47.16  *
* Vel Total (ft/s)       *    1.75  * Avg. Vel. (ft/s)       *    1.33  *    2.64  *
   0.68  *
* Max Chl Dpth (ft)      *    7.33  * Hydr. Depth (ft)       *    2.76  *    6.15  *
   1.01  *
* Conv. Total (cfs)      *127889.1  * Conv. (cfs)            * 60630.2  * 65237.9  *
 2021.0  *
* Length Wtd. (ft)       *  280.85  * Wetted Per. (ft)       *  266.03  *   64.62  *
  47.62  *
* Min Ch El (ft)         * 7282.00  * Shear (lb/sq ft)       *    0.04  *    0.10  *
   0.02  *
* Alpha                  *    1.45  * Stream Power (lb/ft s) *    0.06  *    0.26  *
   0.01  *
* Frctn Loss (ft)        *    0.03  * Cum Volume (acre-ft)   *    3.90  *    9.88  *
   0.58  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *    1.83  *    2.94  *
   0.91  *
```

****

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Alignment - (1)
REACH: Alignment - (1) RS: 1250.13

INPUT
Description:
Station Elevation Data num= 152

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7296.73	5.43	7296.49	8.45	7296.37	14.77	7296.06	16.27	7296
27.64	7295.55	31.03	7295.43	40.1	7295.09	44.32	7294.96	50.94	7294.84
54.95	7294.73	56.68	7294.71	58.78	7294.75	64.39	7294.78	67.79	7294.88
70.45	7295.03	72.47	7295.07	74.74	7295.15	76.79	7295.13	84.21	7295.11
90.63	7294.9	97.02	7294.89	99.29	7294.83	101.81	7294.88	106.98	7295.03
112.96	7295.26	119.53	7295.19	121.52	7295.23	123.62	7295.24	128.72	7295.22
133.87	7295.33	142.74	7295.48	146.17	7295.55	156.65	7295.79	163.65	7295.89
164.32	7295.9	170.78	7295.89	171.19	7295.9	179.03	7295.84	179.72	7295.84
186.52	7295.76	187.42	7295.77	194.15	7295.67	195.48	7295.66	202.71	7295.48
205.25	7295.47	206.4	7295.44	210.29	7295.29	213.2	7295.17	216.78	7295.09
218.93	7294.97	222.49	7294.93	222.78	7294.91	223.24	7294.89	224.2	7294.81
228	7294.84	229.3	7294.87	231.74	7294.86	234.32	7294.74	241.27	7294.32
245.95	7294	258.64	7292.89	270.31	7292	280.22	7290.74	287.5	7290
296.39	7289.03	298.59	7288.81	306.55	7288	313.29	7287.48	317.08	7287.21
319.19	7287.07	325.47	7286.64	337.19	7286	339.36	7285.94	339.6	7285.93
339.73	7285.92	340.3	7285.89	341.13	7285.85	359.4	7285.09	375.04	7284.02
375.33	7284	375.69	7283.89	381.24	7282	382.54	7281.68	389.15	7280
404.55	7280	405.51	7280.05	422.9	7280.87	427.76	7281.08	429.16	7281.1
430.87	7281.11	432.3	7281.02	433.53	7280.99	441.65	7281.6	443.63	7281.67
444.51	7281.71	448.89	7281.99	448.9	7282	448.98	7282	455.14	7282.11
463.69	7282.26	471.78	7282.39	476.36	7282.41	478.2	7282.4	480.11	7282.41
483.66	7282.4	488.01	7282.42	492.13	7282.44	492.64	7282.44	493.96	7282.42
495.21	7282.38	496.9	7282.44	501.57	7282.49	502.22	7282.47	504.84	7282.47
505.87	7282.48	506.98	7282.51	507.86	7282.55	508.66	7282.6	509.95	7282.7
514.52	7283.18	516.19	7283.23	521.29	7283.63	525.17	7284	527.76	7284.58
537.58	7286	539.49	7286.61	541.18	7287.13	542.14	7287.35	542.78	7287.58
545.75	7288	548.81	7288.68	551.17	7289.21	554.25	7290	555.7	7290.35
556.96	7290.73	560.4	7292	565.53	7292.54	569.05	7293.07	570.74	7293.31
574.97	7294	579.76	7294.27	584.77	7294.5	603.35	7295.5	612.45	7296
628.55	7296.81	651.86	7298	669.37	7298.97	687.71	7300	694.16	7300.44
717.8	7302	737.83	7303.43						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	359.4	.03	527.76	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
359.4	527.76	10.01	10.01	10.01	.3	.5

CROSS SECTION OUTPUT Profile #500-yr

```
*******************************************************************************
***********
* E.G. Elev (ft)         * 7296.00  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.03  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7295.97  * Reach Len. (ft)        *   10.01  *   10.01  *
  10.01  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *  965.41  * 2342.15  *
 348.60  *
* E.G. Slope (ft/ft)     *0.000030  * Area (sq ft)           *  965.41  * 2342.15  *
 348.60  *
* Q Total (cfs)          * 4290.00  * Flow (cfs)             *  444.74  * 3639.29  *
 205.97  *
* Top Width (ft)         *  594.76  * Top Width (ft)         *  342.30  *  168.36  *
  84.09  *
* Vel Total (ft/s)       *    1.17  * Avg. Vel. (ft/s)       *    0.46  *    1.55  *
   0.59  *
* Max Chl Dpth (ft)      *   15.97  * Hydr. Depth (ft)       *    2.82  *   13.91  *
   4.15  *
* Conv. Total (cfs)      *788454.3  * Conv. (cfs)            * 81739.1  *668860.2  *
37855.1  *
* Length Wtd. (ft)       *   10.01  * Wetted Per. (ft)       *  342.79  *  169.18  *
  85.22  *
* Min Ch El (ft)         * 7280.00  * Shear (lb/sq ft)       *    0.01  *    0.03  *
   0.01  *
* Alpha                  *    1.52  * Stream Power (lb/ft s) *    0.00  *    0.04  *
   0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   *    2.14  *    7.73  *
   1.57  *
* C & E Loss (ft)        *    0.38  * Cum SA (acres)         *    1.06  *    2.19  *
   1.15  *
*******************************************************************************
***********

Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7284.97  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.06  * Wt. n-Val.             *          *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7284.91  * Reach Len. (ft)        *   10.01  *   10.01  *
  10.01  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *          *  481.37  *
   0.38  *
* E.G. Slope (ft/ft)     *0.000357  * Area (sq ft)           *          *  481.37  *
   0.38  *
* Q Total (cfs)          *  914.00  * Flow (cfs)             *          *  913.91  *
   0.09  *
* Top Width (ft)         *  168.09  * Top Width (ft)         *          *  165.78  *
   2.31  *
* Vel Total (ft/s)       *    1.90  * Avg. Vel. (ft/s)       *          *    1.90  *
   0.24  *
* Max Chl Dpth (ft)      *    4.91  * Hydr. Depth (ft)       *          *    2.90  *
   0.17  *
```

```
* Conv. Total (cfs)      * 48374.0  * Conv. (cfs)            *          * 48369.1  *
   4.9  *
* Length Wtd. (ft)       *   10.01  * Wetted Per. (ft)       *          *  166.60  *
   2.33  *
* Min Ch El (ft)         * 7280.00  * Shear (lb/sq ft)       *          *    0.06  *
   0.00  *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.12  *
   0.00  *
* Frctn Loss (ft)        *    0.01  * Cum Volume (acre-ft)   *    0.54  *    2.79  *
   0.00  *
* C & E Loss (ft)        *    0.22  * Cum SA (acres)         *    0.49  *    2.11  *
   0.01  *
*******************************************************************************
***********

Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7289.36  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.04  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7289.32  * Reach Len. (ft)        *   10.01  *   10.01  *
  10.01  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *  165.65  * 1223.15  *
  61.13  *
* E.G. Slope (ft/ft)     *0.000070  * Area (sq ft)           *  165.65  * 1223.15  *
  61.13  *
* Q Total (cfs)          * 2044.00  * Flow (cfs)             *  108.85  * 1895.06  *
  40.09  *
* Top Width (ft)         *  257.88  * Top Width (ft)         *   65.68  *  168.36  *
  23.84  *
* Vel Total (ft/s)       *    1.41  * Avg. Vel. (ft/s)       *    0.66  *    1.55  *
   0.66  *
* Max Chl Dpth (ft)      *    9.32  * Hydr. Depth (ft)       *    2.52  *    7.27  *
   2.56  *
* Conv. Total (cfs)      *244323.9  * Conv. (cfs)            * 13010.5  *226521.1  *
 4792.3  *
* Length Wtd. (ft)       *   10.01  * Wetted Per. (ft)       *   65.83  *  169.18  *
  24.36  *
* Min Ch El (ft)         * 7280.00  * Shear (lb/sq ft)       *    0.01  *    0.03  *
   0.01  *
* Alpha                  *    1.14  * Stream Power (lb/ft s) *    0.01  *    0.05  *
   0.01  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   *    1.02  *    4.66  *
   0.23  *
* C & E Loss (ft)        *    0.26  * Cum SA (acres)         *    0.77  *    2.19  *
   0.68  *
*******************************************************************************
***********

Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
```

1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Alignment - (1)
REACH: Alignment - (1)   RS: 1240.12

INPUT
Description:
Station Elevation Data   num=   153

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7298.67	2.95	7298.54	15.42	7298.04	15.67	7298.03	16.51	7298
28.6	7297.54	32.54	7297.39	41.5	7297.17	48.74	7297.01	55.77	7296.91
61.47	7296.87	69.67	7296.92	71.59	7296.98	78.81	7296.98	85.59	7296.97
92.67	7297.03	99.64	7297.02	106.74	7297.01	111.77	7297.14	116.21	7297.08
121.3	7297.02	125.43	7297.01	132.19	7296.91	133.44	7296.9	140.07	7297.02
146.68	7297.08	152.17	7297.21	161.06	7297.34	163.44	7297.37	169.37	7297.39
171.46	7297.38	174.13	7297.36	180.29	7297.27	183.16	7297.23	187.92	7297.1
191.62	7297.04	195.27	7296.89	200.99	7296.74	203.21	7296.61	207.33	7296.43
212.73	7296.3	213.88	7296.22	218.49	7296.02	218.8	7296	219.15	7295.98
220.15	7295.93	222.26	7295.76	223.03	7295.76	223.3	7295.77	223.8	7295.77
224.32	7295.74	225.74	7295.66	228.03	7295.5	234.61	7295.02	243.08	7294.33
246.93	7294	248.91	7293.81	254.19	7293.29	266.9	7292	277.08	7290.64
282.13	7290	290.09	7289.08	299.98	7288	307.05	7287.4	310.62	7287.11
318.45	7286.51	325.68	7286	329.42	7285.89	329.9	7285.87	330.62	7285.84
335.76	7285.69	339.13	7285.6	351.02	7285.24	356.26	7284.98	363.83	7284.58
374.3	7284	374.61	7283.89	380.62	7282	382.89	7281.51	389.27	7280
407.52	7280	412.36	7280.21	415.08	7280.25	418.42	7280.26	421.19	7280.1
423.58	7280.04	423.93	7280.07	433.53	7280.4	437.77	7280.6	439.31	7280.7
441.96	7280.88	444.63	7281.04	451.85	7281.45	454.02	7281.57	455.42	7281.65
461.72	7281.93	467.04	7282	467.25	7282	469.57	7281.97	471.9	7281.99
476.31	7281.98	476.42	7281.98	479.9	7282	481.82	7282.01	487.01	7282.04
487.65	7282.04	489.31	7282.01	489.58	7282	490.46	7281.94	495.81	7282
496.83	7282.01	497.11	7282	497.44	7281.98	499.8	7281.97	501.47	7282
503.79	7282.07	504.08	7282.09	504.69	7282.15	509.85	7282.56	515.36	7283.07
524.46	7284	527.71	7284.8	531.26	7286	533.28	7287.03	535.75	7288
536.46	7288.27	541.8	7290	542.6	7290.17	543.4	7290.38	545.59	7291.07
547.63	7291.66	548.75	7292	551.57	7292.26	554.62	7292.52	558.37	7292.74
559.32	7292.79	565.86	7293.63	569.14	7294	571.05	7294.09	571.79	7294.13
572.14	7294.15	583.16	7294.75	588.69	7295.07	608.24	7295.95	609.19	7296
644.91	7297.75	649.84	7298	654.68	7298.27	686.72	7300	708.85	7301.43
717.84	7302	732.15	7303.02	736.89	7303.36				

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	374.61	.03	524.46	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
374.61	524.46	109	109	109	.3	.5

Ineffective Flow   num=   2

Sta L	Sta R	Elev	Permanent
0	389.27	7295	T
422.27	736.89	7296	T

CROSS SECTION OUTPUT Profile #500-yr
****
****
* E.G. Elev (ft) * 7295.62 * Element * Left OB * Channel *
Right OB *
* Vel Head (ft) * 1.29 * Wt. n-Val. * * 0.030 *

```
          *
* W.S. Elev (ft)         * 7294.33  * Reach Len. (ft)        *  109.00  *  109.00  *
 109.00  *
* Crit W.S. (ft)         * 7288.14  * Flow Area (sq ft)      *          *  470.20  *
          *
* E.G. Slope (ft/ft)     *0.000983  * Area (sq ft)           *  811.94  * 1936.33  *
 182.02  *
* Q Total (cfs)          * 4290.00  * Flow (cfs)             *          * 4290.00  *
          *
* Top Width (ft)         *  332.27  * Top Width (ft)         *  131.49  *  149.85  *
  50.93  *
* Vel Total (ft/s)       *    9.12  * Avg. Vel. (ft/s)       *          *    9.12  *
          *
* Max Chl Dpth (ft)      *   14.33  * Hydr. Depth (ft)       *          *   14.25  *
          *
* Conv. Total (cfs)      *136853.1  * Conv. (cfs)            *          *136853.1  *
          *
* Length Wtd. (ft)       *  109.00  * Wetted Per. (ft)       *          *   33.01  *
          *
* Min Ch El (ft)         * 7280.00  * Shear (lb/sq ft)       *          *    0.87  *
          *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    7.97  *
          *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *    1.94  *    7.23  *
   1.51  *
* C & E Loss (ft)        *          * Cum SA (acres)         *    1.00  *    2.15  *
   1.13  *
*******************************************************************************************
***********

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************************
***********
* E.G. Elev (ft)         * 7284.74  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.80  * Wt. n-Val.             *          *   0.030  *
          *
* W.S. Elev (ft)         * 7283.94  * Reach Len. (ft)        *  109.00  *  109.00  *
 109.00  *
* Crit W.S. (ft)         * 7282.95  * Flow Area (sq ft)      *          *  127.39  *
          *
* E.G. Slope (ft/ft)     *0.003466  * Area (sq ft)           *    0.00  *  379.68  *
          *
* Q Total (cfs)          *  914.00  * Flow (cfs)             *          *  914.00  *
          *
* Top Width (ft)         *  149.38  * Top Width (ft)         *    0.14  *  149.25  *
          *
* Vel Total (ft/s)       *    7.17  * Avg. Vel. (ft/s)       *          *    7.17  *
          *
* Max Chl Dpth (ft)      *    3.94  * Hydr. Depth (ft)       *          *    3.86  *
          *
* Conv. Total (cfs)      * 15524.6  * Conv. (cfs)            *          * 15524.6  *
          *
* Length Wtd. (ft)       *  109.00  * Wetted Per. (ft)       *          *   33.01  *
          *
* Min Ch El (ft)         * 7280.00  * Shear (lb/sq ft)       *          *    0.84  *
          *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    5.99  *
          *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *    0.54  *    2.69  *
   0.00  *
* C & E Loss (ft)        *          * Cum SA (acres)         *    0.49  *    2.07  *
   0.01  *
```

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

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7289.09  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.91  * Wt. n-Val.             *          *   0.030  *
         *
* W.S. Elev (ft)         * 7288.19  * Reach Len. (ft)        *  109.00  *  109.00  *
 109.00  *
* Crit W.S. (ft)         * 7284.99  * Flow Area (sq ft)      *          *  267.53  *
         *
* E.G. Slope (ft/ft)     *0.001462  * Area (sq ft)           *  180.65  * 1016.01  *
  27.26  *
* Q Total (cfs)          * 2044.00  * Flow (cfs)             *          * 2044.00  *
         *
* Top Width (ft)         *  237.95  * Top Width (ft)         *   76.32  *  149.85  *
  11.78  *
* Vel Total (ft/s)       *    7.64  * Avg. Vel. (ft/s)       *          *    7.64  *
         *
* Max Chl Dpth (ft)      *    8.19  * Hydr. Depth (ft)       *          *    8.11  *
         *
* Conv. Total (cfs)      * 53464.7  * Conv. (cfs)            *          * 53464.7  *
         *
* Length Wtd. (ft)       *  109.00  * Wetted Per. (ft)       *          *   33.01  *
         *
* Min Ch El (ft)         * 7280.00  * Shear (lb/sq ft)       *          *    0.74  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    5.65  *
         *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *    0.98  *    4.41  *
   0.22  *
* C & E Loss (ft)        *          * Cum SA (acres)         *    0.75  *    2.15  *
   0.67  *
*******************************************************************************
***********

CULVERT


RIVER: Alignment - (1)
REACH: Alignment - (1)    RS: 1185

INPUT
Description: Lower Reach Bridge
Distance from Upstream XS =       5
Deck/Roadway Width        =     100
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=      10
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*********************************************************************
     219    7297             289    7295          389.27    7295    7286
  422.27    7296    7286     439  7296.3             489  7297.5
     589    7302             700    7309             850    7320
     900    7323

Upstream Bridge Cross Section Data
Station Elevation Data    num=     153
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
```

```
       0 7298.67    2.95 7298.54   15.42 7298.04   15.67 7298.03   16.51    7298
    28.6 7297.54   32.54 7297.39    41.5 7297.17   48.74 7297.01   55.77 7296.91
   61.47 7296.87   69.67 7296.92   71.59 7296.98   78.81 7296.98   85.59 7296.97
   92.67 7297.03   99.64 7297.02  106.74 7297.01  111.77 7297.14  116.21 7297.08
   121.3 7297.02  125.43 7297.01  132.19 7296.91  133.44  7296.9  140.07 7297.02
  146.68 7297.08  152.17 7297.21  161.06 7297.34  163.44 7297.37  169.37 7297.39
  171.46 7297.38  174.13 7297.36  180.29 7297.27  183.16 7297.23  187.92  7297.1
  191.62 7297.04  195.27 7296.89  200.99 7296.74  203.21 7296.61  207.33 7296.43
  212.73  7296.3  213.88 7296.22  218.49 7296.02   218.8    7296  219.15 7295.98
  220.15 7295.93  222.26 7295.76  223.03 7295.76   223.3 7295.77   223.8 7295.77
  224.32 7295.74  225.74 7295.66  228.03  7295.5  234.61 7295.02  243.08 7294.33
  246.93    7294  248.91 7293.81  254.19 7293.29   266.9    7292  277.08 7290.64
  282.13    7290  290.09 7289.08  299.98    7288  307.05  7287.4  310.62 7287.11
  318.45 7286.51  325.68    7286  329.42 7285.89   329.9 7285.87  330.62 7285.84
  335.76 7285.69  339.13  7285.6  351.02 7285.24  356.26 7284.98  363.83 7284.58
   374.3    7284  374.61 7283.89  380.62    7282  382.89 7281.51  389.27    7280
  407.52    7280  412.36 7280.21  415.08 7280.25  418.42 7280.26  421.19  7280.1
  423.58 7280.04  423.93 7280.07  433.53  7280.4  437.77  7280.6  439.31  7280.7
  441.96 7280.88  444.63 7281.04  451.85 7281.45  454.02 7281.57  455.42 7281.65
  461.72 7281.93  467.04    7282  467.25    7282  469.57 7281.97   471.9 7281.99
  476.31 7281.98  476.42 7281.98   479.9    7282  481.82 7282.01  487.01 7282.04
  487.65 7282.04  489.31 7282.01  489.58    7282  490.46 7281.94  495.81    7282
  496.83 7282.01  497.11    7282  497.44 7281.98   499.8 7281.97  501.47    7282
  503.79 7282.07  504.08 7282.09  504.69 7282.15  509.85 7282.56  515.36 7283.07
  524.46    7284  527.71  7284.8  531.26    7286  533.28 7287.03  535.75    7288
  536.46 7288.27   541.8    7290   542.6 7290.17   543.4 7290.38  545.59 7291.07
  547.63 7291.66  548.75    7292  551.57 7292.26  554.62 7292.52  558.37 7292.74
  559.32 7292.79  565.86 7293.63  569.14    7294  571.05 7294.09  571.79 7294.13
  572.14 7294.15  583.16 7294.75  588.69 7295.07  608.24 7295.95  609.19    7296
  644.91 7297.75  649.84    7298  654.68 7298.27  686.72    7300  708.85 7301.43
  717.84    7302  732.15 7303.02  736.89 7303.36

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
       0    .035  374.61     .03  524.46    .035

Bank Sta: Left   Right    Coeff Contr.   Expan.
        374.61  524.46             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  389.27    7295       T
  422.27  736.89    7296       T

Downstream  Deck/Roadway Coordinates
    num=      10
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
**********************************************************************
     219    7297             289    7295          389.27    7295    7286
  422.27    7296    7286     439  7296.3             489  7297.5
     589    7302             700    7309             850    7320
     900    7323

Downstream Bridge Cross Section Data
Station Elevation Data    num=     138
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
**************************************************************************
       0  7305.8    1.14 7305.74    2.52 7305.68   10.94 7305.31   11.84 7305.28
   12.97 7305.26   15.75 7305.18   17.89 7305.11   19.71 7305.03   20.25 7305.06
   21.31 7305.03    22.4 7304.99    23.6 7304.95   27.98 7304.85   31.34 7304.79
   33.42 7304.77   37.92 7304.67   42.15 7304.68   45.39 7304.65   48.43 7304.61
   50.34 7304.58   51.82 7304.58   53.92 7304.59   55.31 7304.57   58.26  7304.6
   63.11  7304.7   67.99 7304.71   76.02 7304.57   78.08 7304.59   79.29 7304.57
```

```
  85.39 7304.45   86.04 7304.46   86.86 7304.44   87.36 7304.41   97.78 7304.61
 103.26 7304.47  106.11 7304.34  110.98 7304.19   111.4 7304.18   111.6 7304.17
 113.56 7304.15  114.34 7304.14  125.21    7304  127.57 7303.96  127.81 7303.95
 127.96 7303.94  139.24 7303.78  140.12 7303.75  141.61  7303.7  147.89 7303.73
 148.38 7303.74  148.87 7303.75  151.23 7303.73  153.59 7303.65  156.12 7303.62
 161.34 7303.34  162.72 7303.24  167.57 7303.12  171.29 7302.85   178.9 7302.47
 179.71 7302.41  185.65    7302   188.4 7301.76  190.46 7301.54  196.38 7300.91
 203.77    7300  207.75 7299.45   217.1    7298  224.16 7296.84  230.12    7296
 233.74 7295.42  242.96    7294  248.31 7293.18  256.51    7292  262.95 7291.35
 274.73    7290   287.2 7288.52  291.62    7288  302.76 7286.83  311.18    7286
 320.57 7285.52   320.6 7285.56     321  7285.6  321.33 7285.63  322.64 7285.58
 328.62  7285.4  333.63 7285.22  337.61 7285.08  338.84 7285.04  350.85 7284.61
 360.81 7284.25  368.01    7284  370.11  7283.5  378.39    7282  384.22 7280.85
 388.54    7280  411.63    7280  418.12 7280.01  418.88 7280.01   426.3    7280
 466.17    7280  490.11 7281.86  491.81    7282  492.14 7282.13  493.06  7282.4
 496.25 7283.31  497.29 7283.62  498.63    7284  506.03 7285.83  506.73    7286
 507.01 7286.07  508.81 7286.57  513.55 7287.89  513.93    7288  520.32  7289.1
 524.09 7289.83  524.47 7289.91  524.65 7289.94  524.84    7290  532.13 7291.12
 537.89    7292  538.66 7292.07   561.6    7294  571.97    7295  584.24    7296
 593.78 7296.81  606.54 7297.93   607.1 7297.98   607.4    7298  638.16    7298
 642.49  7298.2   655.3 7298.78   658.5 7298.78  683.93    7300  704.39 7301.29
 716.02    7302  732.39 7303.15  735.37 7303.37

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
       0    .035  378.39     .03  492.14    .035

Bank Sta: Left   Right    Coeff Contr.   Expan.
        378.39  492.14             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  372.54    7290       T
  437.54  735.37  7291.3       T

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  1

Culvert Name     Shape      Rise    Span
Culvert #1           Box       6      16
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef
Exit Loss Coef
                  5     100     .011     .011        0                   .2
      1
Number of Barrels =  2
Upstream   Elevation =  7280
Centerline Stations
    Sta.    Sta.
  397.27  414.27
Downstream Elevation =  7280
Centerline Stations
    Sta.    Sta.
  396.54  413.54
```

```
CULVERT OUTPUT  Profile #500-yr  Culv Group:  Culvert #1
**************************************************************************
* Q Culv Group (cfs)     * 4150.61  * Culv Full Len (ft)     *  100.00  *
* # Barrels              *       2  * Culv Vel US (ft/s)     *   21.62  *
* Q Barrel (cfs)         * 2075.31  * Culv Vel DS (ft/s)     *   21.62  *
* E.G. US. (ft)          * 7295.62  * Culv Inv El Up (ft)    * 7280.00  *
* W.S. US. (ft)          * 7294.33  * Culv Inv El Dn (ft)    * 7280.00  *
* E.G. DS (ft)           * 7288.15  * Culv Frctn Ls (ft)     *    0.91  *
* W.S. DS (ft)           * 7285.56  * Culv Exit Loss (ft)    *    5.11  *
* Delta EG (ft)          *    7.47  * Culv Entr Loss (ft)    *    1.45  *
* Delta WS (ft)          *    8.77  * Q Weir (cfs)           *  139.39  *
* E.G. IC (ft)           * 7296.33  * Weir Sta Lft (ft)      *  267.93  *
* E.G. OC (ft)           * 7295.62  * Weir Sta Rgt (ft)      *  409.14  *
* Culvert Control        *  Outlet  * Weir Submerg           *    0.00  *
* Culv WS Inlet (ft)     * 7286.00  * Weir Max Depth (ft)    *    0.60  *
* Culv WS Outlet (ft)    * 7286.00  * Weir Avg Depth (ft)    *    0.51  *
* Culv Nml Depth (ft)    *          * Weir Flow Area (sq ft) *   72.70  *
* Culv Crt Depth (ft)    *    6.00  * Min El Weir Flow (ft)  * 7295.01  *
**************************************************************************

Warning: During the culvert inlet control computations, the program could not
balance the culvert/weir flow.  The reported
         inlet energy grade answer may not be valid.
Note:    Culvert critical depth exceeds the height of the culvert.
Note:    During the supercritical calculations a hydraulic jump occurred inside of
the culvert.
Note:    The culvert inlet is submerged and the culvert flows full over part or all
of its length.  Therefore, the culvert inlet
         equations are not valid and the supercritical result has been discarded.
The outlet answer will be used.

CULVERT OUTPUT  Profile #10-yr  Culv Group:  Culvert #1
**************************************************************************
* Q Culv Group (cfs)     *  914.00  * Culv Full Len (ft)     *          *
* # Barrels              *       2  * Culv Vel US (ft/s)     *    8.14  *
* Q Barrel (cfs)         *  457.00  * Culv Vel DS (ft/s)     *    9.72  *
* E.G. US. (ft)          * 7284.74  * Culv Inv El Up (ft)    * 7280.00  *
* W.S. US. (ft)          * 7283.94  * Culv Inv El Dn (ft)    * 7280.00  *
* E.G. DS (ft)           * 7283.10  * Culv Frctn Ls (ft)     *    0.13  *
* W.S. DS (ft)           * 7282.12  * Culv Exit Loss (ft)    *    1.31  *
* Delta EG (ft)          *    1.65  * Culv Entr Loss (ft)    *    0.21  *
* Delta WS (ft)          *    1.82  * Q Weir (cfs)           *          *
* E.G. IC (ft)           * 7284.71  * Weir Sta Lft (ft)      *          *
* E.G. OC (ft)           * 7284.74  * Weir Sta Rgt (ft)      *          *
* Culvert Control        *  Outlet  * Weir Submerg           *          *
* Culv WS Inlet (ft)     * 7283.51  * Weir Max Depth (ft)    *          *
* Culv WS Outlet (ft)    * 7282.94  * Weir Avg Depth (ft)    *          *
* Culv Nml Depth (ft)    *          * Weir Flow Area (sq ft) *          *
* Culv Crt Depth (ft)    *    2.94  * Min El Weir Flow (ft)  * 7295.01  *
**************************************************************************

CULVERT OUTPUT  Profile #50-yr  Culv Group:  Culvert #1
**************************************************************************
* Q Culv Group (cfs)     * 2044.00  * Culv Full Len (ft)     *          *
* # Barrels              *       2  * Culv Vel US (ft/s)     *   10.65  *
* Q Barrel (cfs)         * 1022.00  * Culv Vel DS (ft/s)     *   17.01  *
* E.G. US. (ft)          * 7289.09  * Culv Inv El Up (ft)    * 7280.00  *
* W.S. US. (ft)          * 7288.19  * Culv Inv El Dn (ft)    * 7280.00  *
* E.G. DS (ft)           * 7285.13  * Culv Frctn Ls (ft)     *    0.49  *
* W.S. DS (ft)           * 7283.52  * Culv Exit Loss (ft)    *    3.13  *
* Delta EG (ft)          *    3.97  * Culv Entr Loss (ft)    *    0.35  *
* Delta WS (ft)          *    4.66  * Q Weir (cfs)           *          *
```

```
* E.G. IC (ft)           * 7289.09  * Weir Sta Lft (ft)      *          *
* E.G. OC (ft)           * 7288.06  * Weir Sta Rgt (ft)      *          *
* Culvert Control        *   Inlet  * Weir Submerg           *          *
* Culv WS Inlet (ft)     * 7286.00  * Weir Max Depth (ft)    *          *
* Culv WS Outlet (ft)    * 7283.75  * Weir Avg Depth (ft)    *          *
* Culv Nml Depth (ft)    *          * Weir Flow Area (sq ft) *          *
* Culv Crt Depth (ft)    *    5.02  * Min El Weir Flow (ft)  * 7295.01  *
*********************************************************************
```

Note: The flow in the culvert is entirely supercritical.

CROSS SECTION

RIVER: Alignment - (1)
REACH: Alignment - (1) RS: 1131.75

INPUT
Description:
Station Elevation Data num= 138

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	7305.8	1.14	7305.74	2.52	7305.68	10.94	7305.31	11.84	7305.28
12.97	7305.26	15.75	7305.18	17.89	7305.11	19.71	7305.03	20.25	7305.06
21.31	7305.03	22.4	7304.99	23.6	7304.95	27.98	7304.85	31.34	7304.79
33.42	7304.77	37.92	7304.67	42.15	7304.68	45.39	7304.65	48.43	7304.61
50.34	7304.58	51.82	7304.58	53.92	7304.59	55.31	7304.57	58.26	7304.6
63.11	7304.7	67.99	7304.71	76.02	7304.57	78.08	7304.59	79.29	7304.57
85.39	7304.45	86.04	7304.46	86.86	7304.44	87.36	7304.41	97.78	7304.61
103.26	7304.47	106.11	7304.34	110.98	7304.19	111.4	7304.18	111.6	7304.17
113.56	7304.15	114.34	7304.14	125.21	7304	127.57	7303.96	127.81	7303.95
127.96	7303.94	139.24	7303.78	140.12	7303.75	141.61	7303.7	147.89	7303.73
148.38	7303.74	148.87	7303.75	151.23	7303.73	153.59	7303.65	156.12	7303.62
161.34	7303.34	162.72	7303.24	167.57	7303.12	171.29	7302.85	178.9	7302.47
179.71	7302.41	185.65	7302	188.4	7301.76	190.46	7301.54	196.38	7300.91
203.77	7300	207.75	7299.45	217.1	7298	224.16	7296.84	230.12	7296
233.74	7295.42	242.96	7294	248.31	7293.18	256.51	7292	262.95	7291.35
274.73	7290	287.2	7288.52	291.62	7288	302.76	7286.83	311.18	7286
320.57	7285.52	320.6	7285.56	321	7285.6	321.33	7285.63	322.64	7285.58
328.62	7285.4	333.63	7285.22	337.61	7285.08	338.84	7285.04	350.85	7284.61
360.81	7284.25	368.01	7284	370.11	7283.5	378.39	7282	384.22	7280.85
388.54	7280	411.63	7280	418.12	7280.01	418.88	7280.01	426.3	7280
466.17	7280	490.11	7281.86	491.81	7282	492.14	7282.13	493.06	7282.4
496.25	7283.31	497.29	7283.62	498.63	7284	506.03	7285.83	506.73	7286
507.01	7286.07	508.81	7286.57	513.55	7287.89	513.93	7288	520.32	7289.1
524.09	7289.83	524.47	7289.91	524.65	7289.94	524.84	7290	532.13	7291.12
537.89	7292	538.66	7292.07	561.6	7294	571.97	7295	584.24	7296
593.78	7296.81	606.54	7297.93	607.1	7297.98	607.4	7298	638.16	7298
642.49	7298.2	655.3	7298.78	658.5	7298.78	683.93	7300	704.39	7301.29
716.02	7302	732.39	7303.15	735.37	7303.37				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	378.39	.03	492.14	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
378.39	492.14	26.03	26.03	26.03	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	372.54	7290	T
437.54	735.37	7291.3	T

```
CROSS SECTION OUTPUT  Profile #500-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7288.15  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    2.59  * Wt. n-Val.             *   0.035  *   0.030  *
         *
* W.S. Elev (ft)         * 7285.56  * Reach Len. (ft)        *   26.03  *   26.03  *
  26.03  *
* Crit W.S. (ft)         * 7285.56  * Flow Area (sq ft)      *   17.72  *  318.60  *
         *
* E.G. Slope (ft/ft)     *0.007379  * Area (sq ft)           *   61.37  *  595.90  *
  21.09  *
* Q Total (cfs)          * 4290.00  * Flow (cfs)             *  133.86  * 4156.14  *
         *
* Top Width (ft)         *  182.39  * Top Width (ft)         *   55.85  *  113.75  *
  12.79  *
* Vel Total (ft/s)       *   12.76  * Avg. Vel. (ft/s)       *    7.55  *   13.05  *
         *
* Max Chl Dpth (ft)      *    5.56  * Hydr. Depth (ft)       *    3.03  *    5.39  *
         *
* Conv. Total (cfs)      * 49941.4  * Conv. (cfs)            *  1558.3  * 48383.1  *
         *
* Length Wtd. (ft)       *   26.03  * Wetted Per. (ft)       *    5.95  *   59.35  *
         *
* Min Ch El (ft)         * 7280.00  * Shear (lb/sq ft)       *    1.37  *    2.47  *
         *
* Alpha                  *    1.02  * Stream Power (lb/ft s) *   10.37  *   32.26  *
         *
* Frctn Loss (ft)        *    0.20  * Cum Volume (acre-ft)   *    1.94  *    6.49  *
   1.51  *
* C & E Loss (ft)        *    0.40  * Cum SA (acres)         *    0.77  *    1.82  *
   1.05  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7283.10  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.98  * Wt. n-Val.             *   0.035  *   0.030  *
         *
* W.S. Elev (ft)         * 7282.12  * Reach Len. (ft)        *   26.03  *   26.03  *
  26.03  *
* Crit W.S. (ft)         * 7282.12  * Flow Area (sq ft)      *    0.04  *  115.21  *
         *
```

```
* E.G. Slope (ft/ft)     *0.010591  * Area (sq ft)           *    0.04  *  204.77  *
        *
* Q Total (cfs)          *  914.00  * Flow (cfs)             *    0.03  *  913.97  *
        *
* Top Width (ft)         *  114.39  * Top Width (ft)         *    0.67  *  113.73  *
        *
* Vel Total (ft/s)       *    7.93  * Avg. Vel. (ft/s)       *    0.66  *    7.93  *
        *
* Max Chl Dpth (ft)      *    2.12  * Hydr. Depth (ft)       *    0.06  *    1.95  *
        *
* Conv. Total (cfs)      *  8881.2  * Conv. (cfs)            *     0.3  *  8881.0  *
        *
* Length Wtd. (ft)       *   26.03  * Wetted Per. (ft)       *    0.68  *   59.35  *
        *
* Min Ch El (ft)         * 7280.00  * Shear (lb/sq ft)       *    0.04  *    1.28  *
        *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *    0.03  *   10.18  *
        *
* Frctn Loss (ft)        *    0.18  * Cum Volume (acre-ft)   *    0.54  *    2.51  *
   0.00  *
* C & E Loss (ft)        *    0.29  * Cum SA (acres)         *    0.49  *    1.74  *
   0.01  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7285.13  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.60  * Wt. n-Val.             *   0.035  *   0.030  *
        *
* W.S. Elev (ft)         * 7283.52  * Reach Len. (ft)        *   26.03  *   26.03  *
  26.03  *
* Crit W.S. (ft)         * 7283.52  * Flow Area (sq ft)      *    5.82  *  198.25  *
        *
* E.G. Slope (ft/ft)     *0.008487  * Area (sq ft)           *    6.41  *  364.46  *
   3.37  *
* Q Total (cfs)          * 2044.00  * Flow (cfs)             *   22.43  * 2021.57  *
        *
* Top Width (ft)         *  126.96  * Top Width (ft)         *    8.38  *  113.75  *
   4.83  *
* Vel Total (ft/s)       *   10.02  * Avg. Vel. (ft/s)       *    3.86  *   10.20  *
        *
* Max Chl Dpth (ft)      *    3.52  * Hydr. Depth (ft)       *    0.99  *    3.35  *
        *
* Conv. Total (cfs)      * 22186.9  * Conv. (cfs)            *   243.5  * 21943.4  *
        *
```

```
* Length Wtd. (ft)       *   26.03  * Wetted Per. (ft)       *    5.95  *   59.35  *
        *
* Min Ch El (ft)         * 7280.00  * Shear (lb/sq ft)       *    0.52  *    1.77  *
        *
* Alpha                  *    1.03  * Stream Power (lb/ft s) *    2.00  *   18.05  *
        *
* Frctn Loss (ft)        *    0.17  * Cum Volume (acre-ft)   *    0.98  *    4.11  *
   0.22  *
* C & E Loss (ft)        *    0.42  * Cum SA (acres)         *    0.64  *    1.82  *
   0.65  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION


RIVER: Alignment - (1)
REACH: Alignment - (1)    RS: 1105.72

INPUT
Description:
Station Elevation Data    num=     141
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0  7307.7    5.58  7307.4    7.07 7307.37    8.29 7307.33   15.67 7307.19
   19.83 7307.12   27.36 7307.04   28.61 7307.02   30.84 7307.08   36.66 7306.99
   38.24 7306.99    42.8 7306.96   47.78  7306.9    49.7 7306.86   53.73 7306.89
   56.89 7306.85   60.88 7306.93   68.29 7307.04   73.04  7307.1   76.25 7307.12
   78.74 7307.12   80.63  7307.1   82.21  7307.1   83.51 7307.12   85.22 7307.09
   86.52 7307.06   89.77 7306.99   97.24  7306.7   99.41  7306.6  102.87 7306.47
  104.95 7306.42  106.77 7306.36  107.63 7306.35  117.08 7306.21  117.71 7306.18
  125.94 7306.03  126.06 7306.02  126.96    7306   136.4 7305.74  136.62 7305.74
  141.16 7305.59  143.21 7305.59  143.87 7305.58  145.53 7305.53  147.17 7305.47
  147.94 7305.44  150.83 7305.31  152.45 7305.23   161.2 7304.92  173.74 7304.05
  173.97 7304.04   174.5    7304  188.45 7302.63  193.25    7302  195.38 7301.63
  204.82    7300  214.27 7298.35  216.32    7298  217.75 7297.73  227.02    7296
  235.45 7294.43   237.8    7294  240.78  7293.5  250.57    7292  263.16 7290.38
  266.44    7290  271.37 7289.54  287.89    7288  303.57 7286.61  313.83 7286.02
  314.29    7286  329.96  7285.1  336.29 7284.63  337.76 7284.54  342.03 7284.04
  342.49    7284  345.83    7284  345.85 7284.02  347.87  7284.2  349.57 7284.33
  356.43 7284.07  358.68    7284  362.18 7283.27  368.59    7282  377.15 7281.18
  380.71 7280.85  392.14 7280.04  392.41 7280.02  392.48 7280.02  392.95    7280
  396.93    7280  403.37 7280.03  405.24 7280.04  410.15 7280.04  416.65 7280.06
  420.53 7280.05  434.71 7280.02  436.58 7280.02  438.84 7280.01  440.75    7280
  442.61    7280  450.26 7279.99  451.88 7279.99  459.86 7279.98  460.07    7280
   460.7 7280.14  461.18 7280.24  471.46    7282  479.21 7283.92  479.62    7284
  480.08 7284.09  489.36    7286  499.02 7287.91  499.38 7287.97  499.57    7288
  500.37 7288.11   515.2    7290  523.55 7290.85  526.71 7291.13  535.11    7292
```

```
  554.94 7293.95  555.26 7293.98  555.45    7294  555.59 7294.02  575.43    7296
  589.76 7296.95  592.89    7297  595.04 7297.01  596.16 7296.88  598.13 7296.89
  600.16 7296.91  603.76 7297.04  609.04 7297.24  621.68 7297.68  630.88    7298
   670.1 7299.57  680.73    7300   686.6 7300.35  714.16    7302  726.58 7302.89
  732.73 7303.32

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
       0    .035  368.59     .03  471.46    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        368.59  471.46              210  196.71   152.5             .3       .5
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
       0   349.9 7284.35       F

CROSS SECTION OUTPUT  Profile #500-yr
*****************************************************************************************
***********
* E.G. Elev (ft)         * 7285.92  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.78  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7284.14  * Reach Len. (ft)        *  210.00  *  196.71  *
 152.50  *
* Crit W.S. (ft)         * 7284.14  * Flow Area (sq ft)      *   11.68  *  390.32  *
   9.24  *
* E.G. Slope (ft/ft)     *0.008060  * Area (sq ft)           *   12.31  *  390.32  *
   9.24  *
* Q Total (cfs)          * 4290.00  * Flow (cfs)             *   39.18  * 4215.23  *
  35.59  *
* Top Width (ft)         *  131.62  * Top Width (ft)         *   19.90  *  102.87  *
   8.85  *
* Vel Total (ft/s)       *   10.43  * Avg. Vel. (ft/s)       *    3.36  *   10.80  *
   3.85  *
* Max Chl Dpth (ft)      *    4.16  * Hydr. Depth (ft)       *    0.84  *    3.79  *
   1.04  *
* Conv. Total (cfs)      * 47784.5  * Conv. (cfs)            *   436.4  * 46951.6  *
  396.4  *
* Length Wtd. (ft)       *  192.20  * Wetted Per. (ft)       *   14.14  *  103.13  *
   9.11  *
* Min Ch El (ft)         * 7279.98  * Shear (lb/sq ft)       *    0.42  *    1.90  *
   0.51  *
* Alpha                  *    1.06  * Stream Power (lb/ft s) *    1.39  *   20.57  *
   1.97  *
* Frctn Loss (ft)        *    1.27  * Cum Volume (acre-ft)   *    1.92  *    6.20  *
   1.50  *
* C & E Loss (ft)        *    0.35  * Cum SA (acres)         *    0.75  *    1.76  *
   1.04  *
*****************************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
```

```
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is
not a valid subcritical answer.  The
         program defaulted to critical depth.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7282.50  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.39  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7282.11  * Reach Len. (ft)        *  210.00  *  196.71  *
 152.50  *
* Crit W.S. (ft)         * 7281.67  * Flow Area (sq ft)      *    0.03  *  181.62  *
   0.02  *
* E.G. Slope (ft/ft)     *0.004854  * Area (sq ft)           *    0.03  *  181.62  *
   0.02  *
* Q Total (cfs)          *  914.00  * Flow (cfs)             *    0.01  *  913.98  *
   0.01  *
* Top Width (ft)         *  103.85  * Top Width (ft)         *    0.55  *  102.87  *
   0.44  *
* Vel Total (ft/s)       *    5.03  * Avg. Vel. (ft/s)       *    0.42  *    5.03  *
   0.42  *
* Max Chl Dpth (ft)      *    2.13  * Hydr. Depth (ft)       *    0.05  *    1.77  *
   0.05  *
* Conv. Total (cfs)      * 13118.6  * Conv. (cfs)            *     0.2  * 13118.2  *
    0.1  *
* Length Wtd. (ft)       *  196.71  * Wetted Per. (ft)       *    0.56  *  103.13  *
   0.45  *
* Min Ch El (ft)         * 7279.98  * Shear (lb/sq ft)       *    0.02  *    0.53  *
   0.02  *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *    0.01  *    2.69  *
   0.01  *
* Frctn Loss (ft)        *    1.39  * Cum Volume (acre-ft)   *    0.54  *    2.40  *
   0.00  *
* C & E Loss (ft)        *    0.11  * Cum SA (acres)         *    0.49  *    1.68  *
   0.01  *
*******************************************************************************
***********

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

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7283.91  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.77  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7283.15  * Reach Len. (ft)        *  210.00  *  196.71  *
 152.50  *
* Crit W.S. (ft)         * 7282.68  * Flow Area (sq ft)      *    3.33  *  288.61  *
   2.66  *
* E.G. Slope (ft/ft)     *0.005122  * Area (sq ft)           *    3.33  *  288.61  *
   2.66  *
* Q Total (cfs)          * 2044.00  * Flow (cfs)             *    6.90  * 2031.63  *
```

```
  5.48  *
* Top Width (ft)         *  113.30  * Top Width (ft)         *    5.80  *  102.87  *
  4.64  *
* Vel Total (ft/s)       *    6.94  * Avg. Vel. (ft/s)       *    2.07  *    7.04  *
  2.06  *
* Max Chl Dpth (ft)      *    3.17  * Hydr. Depth (ft)       *    0.57  *    2.81  *
  0.57  *
* Conv. Total (cfs)      * 28560.2  * Conv. (cfs)            *    96.4  * 28387.2  *
  76.5  *
* Length Wtd. (ft)       *  196.40  * Wetted Per. (ft)       *    5.91  *  103.13  *
  4.78  *
* Min Ch El (ft)         * 7279.98  * Shear (lb/sq ft)       *    0.18  *    0.89  *
  0.18  *
* Alpha                  *    1.02  * Stream Power (lb/ft s) *    0.37  *    6.30  *
  0.37  *
* Frctn Loss (ft)        *    1.28  * Cum Volume (acre-ft)   *    0.98  *    3.92  *
  0.21  *
* C & E Loss (ft)        *    0.12  * Cum SA (acres)         *    0.64  *    1.76  *
  0.65  *
*******************************************************************************
***********

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

CROSS SECTION


RIVER: Alignment - (1)
REACH: Alignment - (1)    RS: 909.01

INPUT
Description:
Station Elevation Data    num=     182
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 7310.54    7.06 7310.26   13.84    7310   41.18 7309.44   45.51 7309.35
   70.69 7308.83    92.1 7308.37   96.15 7308.28  100.38 7308.19  101.42 7308.18
  110.84 7308.04  111.07 7308.03  111.38 7308.03  111.46 7308.02  111.85 7308.02
  113.64    7308  135.71    7308  171.94 7307.27  190.82 7306.89  194.31 7306.88
  196.37 7306.86  200.25 7306.79  206.07 7306.72  212.47 7306.64  217.37 7306.58
  221.29 7306.54  221.91 7306.54  224.17 7306.52  225.28 7306.51  226.95 7306.49
  229.45 7306.47   231.7  7306.5   234.3 7306.54  234.47 7306.56  239.08 7306.47
  241.07 7306.46  252.49  7306.4  259.08 7306.34  273.56 7306.12  278.65 7306.03
   279.8    7306  287.56 7305.25  290.41 7304.98  299.47    7304  300.63 7303.84
  306.99 7303.13  311.31 7302.69  318.05    7302  322.89 7301.51   334.8    7300
   335.1 7299.95   335.4  7299.9  336.03 7299.77  342.95 7298.61  344.73    7298
  344.94 7297.87  346.14 7297.11     349    7296   350.9 7294.53  351.61    7294
  353.18 7292.86  354.31    7292  355.18 7291.61  359.59    7290  359.71 7289.96
  364.22    7288  366.58 7286.96  368.81    7286  372.92 7284.12  373.22    7284
  374.41 7283.69  374.54 7283.65   380.7    7282  401.72 7280.04  401.77 7280.04
   402.1 7280.01   402.2    7280  422.21  7278.2  424.48    7278  430.97 7277.99
  433.26 7277.99   440.3 7277.98  440.71 7277.98  448.19 7277.99  449.68 7277.99
  455.03    7278   462.3  7278.7  469.87 7279.14  483.93    7280  487.64 7280.18
  488.27  7280.2  489.42 7280.23  494.58 7280.58  496.73 7280.72  498.55 7280.85
  502.64 7281.11  503.86 7281.19  505.52 7281.33  506.17 7281.38  507.71 7281.48
   508.6 7281.51  510.67 7281.58   511.5  7281.6  513.09 7281.62  516.86 7281.55
  522.78 7281.41  529.61 7281.46  530.62 7281.45  532.66  7281.4  538.66 7281.38
  539.45 7281.37  542.29 7281.34  547.26  7281.3  548.45 7281.28  554.46 7281.24
  556.55 7281.22  559.15 7281.21  561.29  7281.2  565.38 7281.23  567.54 7281.22
  570.75 7281.27  573.79 7281.23   574.7 7281.19  575.79 7281.17  577.55  7281.1
  578.96 7280.99  581.24 7280.87  586.44 7281.04   587.5 7280.99  589.32 7280.98
```

```
591.51  7280.9  593.46 7280.96  595.48 7280.93  596.31 7280.83  598.31 7280.87
 599.5 7280.87  604.18 7281.04  607.76 7280.99  612.71 7281.26  614.58 7281.27
616.24 7281.34  623.75 7281.99     624    7282  625.64 7282.03  625.67 7282.03
627.83 7282.22  636.76 7282.98  640.61 7283.28  648.69    7284  659.41 7285.16
667.22    7286  671.82 7286.59  682.84    7288  695.27 7289.64  698.65    7290
   704 7290.56  707.78 7290.93  720.65    7292   724.2 7292.25   726.1 7292.34
733.56 7292.83  740.38 7293.13  755.66    7294   755.7    7294   787.3    7296
787.56 7296.02  787.92 7296.04  802.72 7297.09  816.45    7298  826.71 7298.79
843.26    7300  843.89 7300.06  851.07 7300.87  860.96    7302  872.13 7303.38
877.26    7304  881.13 7304.54   891.5    7306  900.95 7307.57  903.54    7308
905.09 7308.28  911.15 7309.36

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
       0    .035  401.72     .03  487.64    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        401.72  487.64              168  229.83     383             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
  513.41  911.15 7281.72       F

CROSS SECTION OUTPUT  Profile #500-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7283.84  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.08  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7282.76  * Reach Len. (ft)        *  168.00  *  229.83  *
 383.00  *
* Crit W.S. (ft)         * 7282.76  * Flow Area (sq ft)      *   37.65  *  346.73  *
 218.52  *
* E.G. Slope (ft/ft)     *0.005522  * Area (sq ft)           *   37.65  *  346.73  *
 218.52  *
* Q Total (cfs)          * 4290.00  * Flow (cfs)             *  160.13  * 3230.57  *
 899.29  *
* Top Width (ft)         *  256.31  * Top Width (ft)         *   23.86  *   85.92  *
 146.53  *
* Vel Total (ft/s)       *    7.12  * Avg. Vel. (ft/s)       *    4.25  *    9.32  *
   4.12  *
* Max Chl Dpth (ft)      *    4.78  * Hydr. Depth (ft)       *    1.58  *    4.04  *
   1.49  *
* Conv. Total (cfs)      * 57730.0  * Conv. (cfs)            *  2154.9  * 43473.4  *
12101.7  *
* Length Wtd. (ft)       *  232.91  * Wetted Per. (ft)       *   24.05  *   86.09  *
 146.68  *
* Min Ch El (ft)         * 7277.98  * Shear (lb/sq ft)       *    0.54  *    1.39  *
   0.51  *
* Alpha                  *    1.37  * Stream Power (lb/ft s) *    2.30  *   12.94  *
   2.11  *
* Frctn Loss (ft)        *    0.86  * Cum Volume (acre-ft)   *    1.80  *    4.53  *
   1.10  *
* C & E Loss (ft)        *    0.20  * Cum SA (acres)         *    0.64  *    1.33  *
   0.77  *
*******************************************************************************
***********

Warning: The energy equation could not be balanced within the specified number of
iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
```

indicate the need for additional cross
sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.

CROSS SECTION OUTPUT Profile #10-yr
****

E.G. Elev (ft)	7281.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.75	Wt. n-Val.	0.035	0.030	0.035
W.S. Elev (ft)	7280.25	Reach Len. (ft)	168.00	229.83	383.00
Crit W.S. (ft)	7280.25	Flow Area (sq ft)	0.24	131.17	0.08
E.G. Slope (ft/ft)	0.011281	Area (sq ft)	0.24	131.17	0.08
Q Total (cfs)	914.00	Flow (cfs)	0.24	913.72	0.04
Top Width (ft)	90.27	Top Width (ft)	2.26	85.92	2.09
Vel Total (ft/s)	6.95	Avg. Vel. (ft/s)	1.00	6.97	0.52
Max Chl Dpth (ft)	2.27	Hydr. Depth (ft)	0.11	1.53	0.04
Conv. Total (cfs)	8605.6	Conv. (cfs)	2.3	8602.9	0.4
Length Wtd. (ft)	229.83	Wetted Per. (ft)	2.27	86.09	2.09
Min Ch El (ft)	7277.98	Shear (lb/sq ft)	0.07	1.07	0.03
Alpha	1.00	Stream Power (lb/ft s)	0.07	7.47	0.01
Frctn Loss (ft)	2.22	Cum Volume (acre-ft)	0.54	1.69	0.00
C & E Loss (ft)	0.09	Cum SA (acres)	0.49	1.25	0.01

****

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #50-yr
****
****

E.G. Elev (ft)	7282.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.15	Wt. n-Val.	0.035	0.030	0.035
W.S. Elev (ft)	7281.37	Reach Len. (ft)	168.00	229.83	383.00
Crit W.S. (ft)	7281.37	Flow Area (sq ft)	9.42	226.91	11.63
E.G. Slope (ft/ft)	0.008545	Area (sq ft)	9.42	226.91	29.97
Q Total (cfs)	2044.00	Flow (cfs)	28.01	1982.34	33.65
Top Width (ft)	195.10	Top Width (ft)	14.21	85.92	94.96
Vel Total (ft/s)	8.24	Avg. Vel. (ft/s)	2.97	8.74	2.89
Max Chl Dpth (ft)	3.39	Hydr. Depth (ft)	0.66	2.64	0.63
Conv. Total (cfs)	22112.2	Conv. (cfs)	303.0	21445.2	364.0
Length Wtd. (ft)	219.19	Wetted Per. (ft)	14.27	86.09	18.38
Min Ch El (ft)	7277.98	Shear (lb/sq ft)	0.35	1.41	0.34
Alpha	1.09	Stream Power (lb/ft s)	1.05	12.28	0.98
Frctn Loss (ft)	1.24	Cum Volume (acre-ft)	0.95	2.76	0.16
C & E Loss (ft)	0.25	Cum SA (acres)	0.59	1.33	0.48

****
****

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical
depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross
sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The
program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Alignment - (1)
REACH: Alignment - (1) RS: 679.18

```
INPUT
Description:
Station Elevation Data    num=     150
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 7309.79   13.39 7309.45   71.34    7308   74.89 7307.88   82.29 7307.64
   99.37  7307.2   99.93 7307.19  106.55 7307.02  118.61 7306.77  128.76 7306.55
  132.96 7306.44  145.47 7306.18   149.6 7306.09  152.79    7306  167.53 7305.51
  212.09    7304  232.38 7303.02  254.06    7302  263.96 7301.27   282.1    7300
  292.82 7298.55   296.7    7298  305.22 7296.91  312.45    7296  312.46    7296
  316.86    7294  317.98 7293.35  319.29  7292.6  320.67    7292  324.05 7290.21
  324.46    7290  324.71 7289.85  327.92 7288.27  328.38    7288  329.52 7287.33
  332.04    7286  334.11  7284.9  335.71    7284   338.8 7282.45  339.76    7282
  343.29 7280.81  344.23 7280.47  345.18    7280  347.14 7279.44  352.34    7278
  355.71 7277.25  357.76 7276.84  361.67    7276  372.62 7275.97  373.06 7275.97
  377.48 7275.98  385.15    7276  386.38 7276.06  392.91 7276.29  394.67 7276.38
  397.46  7276.5  403.98 7276.61  405.56 7276.63  410.47 7276.68  414.45 7276.72
  417.01 7276.64  419.37 7276.51   424.3 7276.28  425.39 7276.25  425.63 7276.24
  425.81 7276.23  425.94 7276.21  426.24 7276.18  426.36 7276.17  426.47 7276.17
  426.99 7276.15  427.44 7276.14  428.16 7276.15  428.98 7276.16     429 7276.16
  429.21 7276.17  429.43 7276.18  429.84  7276.2  430.29 7276.21  430.62 7276.21
  434.07 7276.34   462.5 7277.79  464.25 7277.87     465    7278  472.25    7278
  497.51 7277.18  502.08 7276.98  510.19 7276.69  513.46 7276.56  520.88 7276.23
  525.72    7276  526.47 7275.97  527.59 7275.92  528.19 7275.88  528.76 7275.84
  535.25 7275.66  535.39 7275.61  536.83  7275.6  539.17 7275.66  546.25  7275.8
  548.41 7275.83  552.94 7275.83  563.77 7275.79  566.37 7275.79  568.63  7275.8
  573.22 7275.84  583.17  7275.9  587.63 7275.93  589.53    7276  592.76    7276
  594.36 7276.13  599.99 7276.73  601.59 7276.73  602.98  7276.7   604.5 7276.75
  606.04 7276.86  606.31 7276.88   606.4 7276.89  607.25 7276.99  610.35 7277.38
  614.73    7278  614.76    7278  622.21 7279.88  622.66    7280  623.09 7280.12
   623.2 7280.15  623.37  7280.2  628.31 7281.52  629.92    7282  638.71 7283.01
  647.26    7284  658.86 7285.33  664.53    7286  665.62 7286.18  677.79    7288
  679.51 7288.21  696.91    7290  703.52 7290.44  715.83  7291.5  719.38 7291.79
  721.66    7292  731.62 7292.86  744.71    7294  748.06 7294.26  770.17    7296
  770.38 7296.02  770.91 7296.06  794.97    7298  804.14 7299.01  807.89 7299.42

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0    .035  472.25     .03  614.76    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        472.25  614.76              232  238.03     248             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
       0  467.21 7278.07       F

CROSS SECTION OUTPUT  Profile #500-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7280.14  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.42  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7279.71  * Reach Len. (ft)        *  232.00  *  238.03  *
 248.00  *
* Crit W.S. (ft)         * 7278.62  * Flow Area (sq ft)      *  371.56  *  464.69  *
   5.82  *
* E.G. Slope (ft/ft)     *0.002664  * Area (sq ft)           *  371.56  *  464.69  *
   5.82  *
* Q Total (cfs)          * 4290.00  * Flow (cfs)             * 1668.87  * 2609.85  *
  11.28  *
```

```
* Top Width (ft)          *  275.37  * Top Width (ft)          *  126.07  *  142.51  *
   6.79  *
* Vel Total (ft/s)        *    5.09  * Avg. Vel. (ft/s)        *    4.49  *    5.62  *
   1.94  *
* Max Chl Dpth (ft)       *    4.11  * Hydr. Depth (ft)        *    2.95  *    3.26  *
   0.86  *
* Conv. Total (cfs)       * 83124.4  * Conv. (cfs)             * 32336.6  * 50569.3  *
  218.6  *
* Length Wtd. (ft)        *  237.03  * Wetted Per. (ft)        *  126.60  *  142.69  *
   7.01  *
* Min Ch El (ft)          * 7275.60  * Shear (lb/sq ft)        *    0.49  *    0.54  *
   0.14  *
* Alpha                   *    1.04  * Stream Power (lb/ft s) *    2.19  *    3.04  *
   0.27  *
* Frctn Loss (ft)         *    1.03  * Cum Volume (acre-ft)    *    1.01  *    2.39  *
   0.12  *
* C & E Loss (ft)         *    0.11  * Cum SA (acres)          *    0.35  *    0.73  *
   0.10  *
*******************************************************************************
***********

Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)          * 7278.07  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)           *    0.46  * Wt. n-Val.              *          *   0.030  *
         *
* W.S. Elev (ft)          * 7277.61  * Reach Len. (ft)        *  232.00  *  238.03  *
 248.00  *
* Crit W.S. (ft)          * 7277.42  * Flow Area (sq ft)      *          *  168.17  *
         *
* E.G. Slope (ft/ft)      *0.008367  * Area (sq ft)           *  118.44  *  168.17  *
         *
* Q Total (cfs)           *  914.00  * Flow (cfs)             *          *  914.00  *
         *
* Top Width (ft)          *  232.82  * Top Width (ft)         *  104.97  *  127.85  *
         *
* Vel Total (ft/s)        *    5.44  * Avg. Vel. (ft/s)        *          *    5.44  *
         *
* Max Chl Dpth (ft)       *    2.01  * Hydr. Depth (ft)        *          *    1.32  *
         *
* Conv. Total (cfs)       *  9992.1  * Conv. (cfs)             *          *  9992.1  *
         *
* Length Wtd. (ft)        *  238.03  * Wetted Per. (ft)        *          *  127.99  *
         *
* Min Ch El (ft)          * 7275.60  * Shear (lb/sq ft)        *          *    0.69  *
         *
* Alpha                   *    1.00  * Stream Power (lb/ft s) *          *    3.73  *
         *
* Frctn Loss (ft)         *    2.07  * Cum Volume (acre-ft)    *    0.32  *    0.90  *
   0.00  *
* C & E Loss (ft)         *    0.00  * Cum SA (acres)          *    0.28  *    0.69  *
```

```
  0.00  *
*******************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7278.64  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.31  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7278.34  * Reach Len. (ft)        *  232.00  *  238.03  *
 248.00  *
* Crit W.S. (ft)         * 7278.08  * Flow Area (sq ft)      *  201.41  *  268.53  *
   0.23  *
* E.G. Slope (ft/ft)     *0.004016  * Area (sq ft)           *  201.41  *  268.53  *
   0.23  *
* Q Total (cfs)          * 2044.00  * Flow (cfs)             *  759.11  * 1284.71  *
   0.18  *
* Top Width (ft)         *  264.98  * Top Width (ft)         *  121.13  *  142.51  *
   1.34  *
* Vel Total (ft/s)       *    4.35  * Avg. Vel. (ft/s)       *    3.77  *    4.78  *
   0.81  *
* Max Chl Dpth (ft)      *    2.74  * Hydr. Depth (ft)       *    1.66  *    1.88  *
   0.17  *
* Conv. Total (cfs)      * 32255.7  * Conv. (cfs)            * 11979.2  * 20273.6  *
    2.9  *
* Length Wtd. (ft)       *  236.96  * Wetted Per. (ft)       *  121.47  *  142.69  *
   1.38  *
* Min Ch El (ft)         * 7275.60  * Shear (lb/sq ft)       *    0.42  *    0.47  *
   0.04  *
* Alpha                  *    1.04  * Stream Power (lb/ft s) *    1.57  *    2.26  *
   0.03  *
* Frctn Loss (ft)        *    1.37  * Cum Volume (acre-ft)   *    0.54  *    1.45  *
   0.02  *
* C & E Loss (ft)        *    0.06  * Cum SA (acres)         *    0.33  *    0.73  *
   0.05  *
*******************************************************************************
***********

Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.

CROSS SECTION


RIVER: Alignment - (1)
REACH: Alignment - (1)    RS: 441.15
```

```
INPUT
Description:
Station Elevation Data    num=     120
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*****************************************************************************
       0 7310.32      10 7310.13   15.76    7310   69.44 7308.79  105.48    7308
  163.71 7306.85  192.22 7306.28  197.99 7306.17  200.82 7306.12  207.66    7306
   281.4 7304.38  293.38 7304.12  298.26    7304  303.49 7303.83  308.02 7303.68
  352.16 7302.27  358.96 7302.11  363.12    7302  367.38 7301.79  370.66 7301.59
  381.11 7301.08  384.28 7300.89  398.84 7300.08  399.37 7300.05  399.53 7300.05
  399.64 7300.04  399.83 7300.04  400.83    7300  402.67 7299.94  406.63 7299.83
  416.35 7299.65  417.36  7299.6  422.44 7299.55  425.74 7299.36  431.44 7299.19
  432.87 7299.12  435.12 7298.98  439.36 7298.56  444.48    7298   452.4 7297.01
  454.42 7296.77  460.33    7296  470.71 7294.48  473.43    7294  476.55 7293.14
  480.97    7292   484.5 7290.91  487.15    7290  489.67 7289.19   493.3    7288
  498.06 7286.56  500.15    7286     504 7285.05  508.25    7284  512.88 7283.15
  518.64    7282   526.5 7281.14  536.76    7280  546.02 7278.47  548.99    7278
  550.71 7277.42  552.74 7276.68  554.68    7276  555.41 7275.82  557.01 7275.48
  560.43 7274.75  562.01 7274.43  564.42    7274  595.51    7274  598.55 7274.01
  599.71 7274.01   608.2 7274.02  614.28 7274.01  621.39 7274.01  622.72 7274.02
  625.49 7274.01  631.95 7274.01  634.51    7274  638.23    7274  640.62 7273.98
  644.47 7273.99  651.56    7274  658.68    7274  659.24 7274.05  659.73 7274.08
  674.64 7275.22  677.51 7275.36  680.09 7275.47  680.93  7275.5  693.43 7275.94
  693.82 7275.96  694.76    7276  697.93 7276.31  701.95 7276.75  712.53    7278
  724.26  7279.4  729.26    7280  730.94 7280.21  745.47    7282  754.67 7283.14
  761.83    7284  766.17  7284.5  779.33    7286  780.21  7286.1  782.71 7286.38
  796.88    7288  802.62 7288.64  814.64    7290  832.17 7291.39  839.88    7292
  847.83 7292.73  860.04    7294  868.19 7294.78  881.63    7296  885.81 7296.46
  894.82 7297.38  898.63 7297.79  900.78    7298  908.53 7298.84  909.46 7298.95

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  557.01     .03  680.93    .035

Bank Sta: Left   Right    Coeff Contr.   Expan.
        557.01  680.93             .1       .3

CROSS SECTION OUTPUT  Profile #500-yr
*****************************************************************************************
***********
* E.G. Elev (ft)         * 7279.00  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.50  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7277.51  * Reach Len. (ft)        *          *          *
         *
* Crit W.S. (ft)         * 7277.51  * Flow Area (sq ft)      *    7.34  *  410.57  *
  35.00  *
* E.G. Slope (ft/ft)     *0.008255  * Area (sq ft)           *    7.34  *  410.57  *
  35.00  *
* Q Total (cfs)          * 4290.00  * Flow (cfs)             *   29.55  * 4101.94  *
 158.51  *
* Top Width (ft)         *  157.90  * Top Width (ft)         *    6.56  *  123.92  *
  27.42  *
* Vel Total (ft/s)       *    9.47  * Avg. Vel. (ft/s)       *    4.03  *    9.99  *
   4.53  *
* Max Chl Dpth (ft)      *    3.53  * Hydr. Depth (ft)       *    1.12  *    3.31  *
   1.28  *
* Conv. Total (cfs)      * 47216.1  * Conv. (cfs)            *   325.2  * 45146.4  *
 1744.6  *
* Length Wtd. (ft)       *          * Wetted Per. (ft)       *    6.87  *  124.12  *
  27.51  *
```

```
* Min Ch El (ft)         * 7273.98  * Shear (lb/sq ft)       *    0.55  *    1.70  *
   0.66  *
* Alpha                  *    1.07  * Stream Power (lb/ft s) *    2.22  *   17.03  *
   2.97  *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *          *          *
         *
* C & E Loss (ft)        *          * Cum SA (acres)         *          *          *
         *
*******************************************************************************
***********

Warning: Slope too steep for slope area to converge during supercritical flow
calculations (normal depth is below critical
         depth). Water surface set to critical depth.

CROSS SECTION OUTPUT  Profile #10-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7276.00  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.49  * Wt. n-Val.             *   0.000  *   0.030  *
  0.000  *
* W.S. Elev (ft)         * 7275.50  * Reach Len. (ft)        *          *          *
         *
* Crit W.S. (ft)         * 7275.37  * Flow Area (sq ft)      *    0.00  *  162.49  *
   0.00  *
* E.G. Slope (ft/ft)     *0.009006  * Area (sq ft)           *    0.00  *  162.49  *
   0.00  *
* Q Total (cfs)          *  914.00  * Flow (cfs)             *    0.00  *  914.00  *
   0.00  *
* Top Width (ft)         *  124.16  * Top Width (ft)         *    0.11  *  123.92  *
   0.12  *
* Vel Total (ft/s)       *    5.63  * Avg. Vel. (ft/s)       *    0.21  *    5.63  *
   0.07  *
* Max Chl Dpth (ft)      *    1.52  * Hydr. Depth (ft)       *    0.01  *    1.31  *
   0.00  *
* Conv. Total (cfs)      *  9631.1  * Conv. (cfs)            *     0.0  *  9631.1  *
    0.0  *
* Length Wtd. (ft)       *          * Wetted Per. (ft)       *    0.12  *  124.12  *
   0.12  *
* Min Ch El (ft)         * 7273.98  * Shear (lb/sq ft)       *          *    0.74  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    4.14  *
         *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *          *          *
         *
* C & E Loss (ft)        *          * Cum SA (acres)         *          *          *
         *
*******************************************************************************
***********

CROSS SECTION OUTPUT  Profile #50-yr
*******************************************************************************
***********
* E.G. Elev (ft)         * 7277.22  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.92  * Wt. n-Val.             *   0.035  *   0.030  *
  0.035  *
* W.S. Elev (ft)         * 7276.30  * Reach Len. (ft)        *          *          *
         *
* Crit W.S. (ft)         * 7276.26  * Flow Area (sq ft)      *    1.47  *  261.54  *
   8.21  *
* E.G. Slope (ft/ft)     *0.009003  * Area (sq ft)           *    1.47  *  261.54  *
```

```
  8.21  *
* Q Total (cfs)          * 2044.00  * Flow (cfs)            *    3.43  * 2020.18  *
  20.39  *
* Top Width (ft)         *  144.05  * Top Width (ft)        *    3.20  *  123.92  *
  16.94  *
* Vel Total (ft/s)       *    7.54  * Avg. Vel. (ft/s)      *    2.34  *    7.72  *
   2.48  *
* Max Chl Dpth (ft)      *    2.32  * Hydr. Depth (ft)      *    0.46  *    2.11  *
   0.48  *
* Conv. Total (cfs)      * 21542.5  * Conv. (cfs)           *    36.2  * 21291.4  *
  214.9  *
* Length Wtd. (ft)       *          * Wetted Per. (ft)      *    3.31  *  124.12  *
  16.96  *
* Min Ch El (ft)         * 7273.98  * Shear (lb/sq ft)      *    0.25  *    1.18  *
   0.27  *
* Alpha                  *    1.04  * Stream Power (lb/ft s) *    0.58  *    9.15  *
   0.68  *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)  *          *          *
         *
* C & E Loss (ft)        *          * Cum SA (acres)        *          *          *
         *
*******************************************************************************
***********

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

SUMMARY OF MANNING'S N VALUES

River:Alignment - (1)
*****************************************************************
*     Reach      *   River Sta.   *   n1    *   n2    *   n3    *
*****************************************************************
*Alignment - (1) *    7258.36     *     .035*      .03*     .035*
*Alignment - (1) *    6993.16     *     .035*      .03*     .035*
*Alignment - (1) *    6787.05     *     .035*      .03*     .035*
*Alignment - (1) *    6565.94     *     .035*      .03*     .035*
*Alignment - (1) *    6325.83     *     .035*      .03*     .035*
*Alignment - (1) *    6156.77     *     .035*      .03*     .035*
*Alignment - (1) *    5833.82     *     .035*      .03*     .035*
*Alignment - (1) *    5442.15     *     .035*      .03*     .035*
*Alignment - (1) *    5431.65     *     .035*      .03*     .035*
*Alignment - (1) *    5376        *Culvert  *        *        *
*Alignment - (1) *    5321.65     *     .035*      .03*     .035*
*Alignment - (1) *    5300.65     *     .035*      .03*     .035*
*Alignment - (1) *    4866.08     *     .035*      .03*     .035*
*Alignment - (1) *    4720.61     *     .035*      .03*     .035*
*Alignment - (1) *    4486        *     .035*      .03*     .035*
*Alignment - (1) *    4331.01     *     .035*      .03*     .035*
*Alignment - (1) *    4076.71     *     .035*      .03*     .035*
*Alignment - (1) *    3774.36     *     .035*      .03*     .035*
*Alignment - (1) *    3689.36     *     .035*      .03*     .035*
*Alignment - (1) *    3338.18     *     .035*      .03*     .035*
*Alignment - (1) *    3071.3      *     .035*      .03*     .035*
*Alignment - (1) *    2934.46     *     .035*      .03*     .035*
*Alignment - (1) *    2576.35     *     .035*      .03*     .035*
*Alignment - (1) *    2373.76     *     .035*      .03*     .035*
*Alignment - (1) *    2132.45     *     .035*      .03*     .035*
*Alignment - (1) *    1842.45     *     .035*      .03*     .035*
*Alignment - (1) *    1634.19     *     .035*      .03*     .035*
*Alignment - (1) *    1530.98     *     .035*      .03*     .035*
*Alignment - (1) *    1250.13     *     .035*      .03*     .035*
*Alignment - (1) *    1240.12     *     .035*      .03*     .035*
*Alignment - (1) *    1185        *Culvert  *        *        *
```

```
*Alignment - (1) *    1131.75     *     .035*      .03*     .035*
*Alignment - (1) *    1105.72     *     .035*      .03*     .035*
*Alignment - (1) *    909.01      *     .035*      .03*     .035*
*Alignment - (1) *    679.18      *     .035*      .03*     .035*
*Alignment - (1) *    441.15      *     .035*      .03*     .035*
*****************************************************************

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

SUMMARY OF REACH LENGTHS

River: Alignment - (1)
*****************************************************************
*     Reach      *   River Sta.   *  Left   * Channel *  Right  *
*****************************************************************
*Alignment - (1) *    7258.36     *      255*    265.2*      301*
*Alignment - (1) *    6993.16     *   185.11*   206.11*   256.11*
*Alignment - (1) *    6787.05     *   221.11*   221.11*   221.11*
*Alignment - (1) *    6565.94     *   251.11*   240.11*   240.11*
*Alignment - (1) *    6325.83     *   159.06*   169.06*   189.06*
*Alignment - (1) *    6156.77     *   352.95*   322.95*   252.95*
*Alignment - (1) *    5833.82     *      240*      415*      475*
*Alignment - (1) *    5442.15     *     10.5*     10.5*     10.5*
*Alignment - (1) *    5431.65     *      110*      110*      110*
*Alignment - (1) *    5376        *Culvert  *         *         *
*Alignment - (1) *    5321.65     *       21*       21*       21*
*Alignment - (1) *    5300.65     *      372*   434.57*    362.5*
*Alignment - (1) *    4866.08     *      137*   145.17*      161*
*Alignment - (1) *    4720.61     *      218*   234.61*      245*
*Alignment - (1) *    4486        *   144.99*   154.99*   165.99*
*Alignment - (1) *    4331.01     *    275.3*    254.3*    220.3*
*Alignment - (1) *    4076.71     *   350.35*   302.35*   220.35*
*Alignment - (1) *    3774.36     *       72*       85*      105*
*Alignment - (1) *    3689.36     *   283.18*   351.18*   535.18*
*Alignment - (1) *    3338.18     *   305.88*   266.88*   239.88*
*Alignment - (1) *    3071.3      *   146.84*   136.84*   121.84*
*Alignment - (1) *    2934.46     *   298.11*   358.11*   451.11*
*Alignment - (1) *    2576.35     *   211.59*   202.59*   198.59*
*Alignment - (1) *    2373.76     *   168.31*   241.31*   324.31*
*Alignment - (1) *    2132.45     *      290*      290*      332*
*Alignment - (1) *    1842.45     *      147*   208.26*      348*
*Alignment - (1) *    1634.19     *   103.21*   103.21*   103.21*
*Alignment - (1) *    1530.98     *   280.85*   280.85*   280.85*
*Alignment - (1) *    1250.13     *    10.01*    10.01*    10.01*
*Alignment - (1) *    1240.12     *      109*      109*      109*
*Alignment - (1) *    1185        *Culvert  *         *         *
*Alignment - (1) *    1131.75     *    26.03*    26.03*    26.03*
*Alignment - (1) *    1105.72     *      210*   196.71*    152.5*
*Alignment - (1) *    909.01      *      168*   229.83*      383*
*Alignment - (1) *    679.18      *      232*   238.03*      248*
*Alignment - (1) *    441.15      *         *         *         *
*****************************************************************

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

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Alignment - (1)

*******************************************************
*     Reach      *   River Sta.   * Contr.  * Expan.  *
*******************************************************
*Alignment - (1) *    7258.36 *       .1*       .3*
*Alignment - (1) *    6993.16 *       .1*       .3*
```

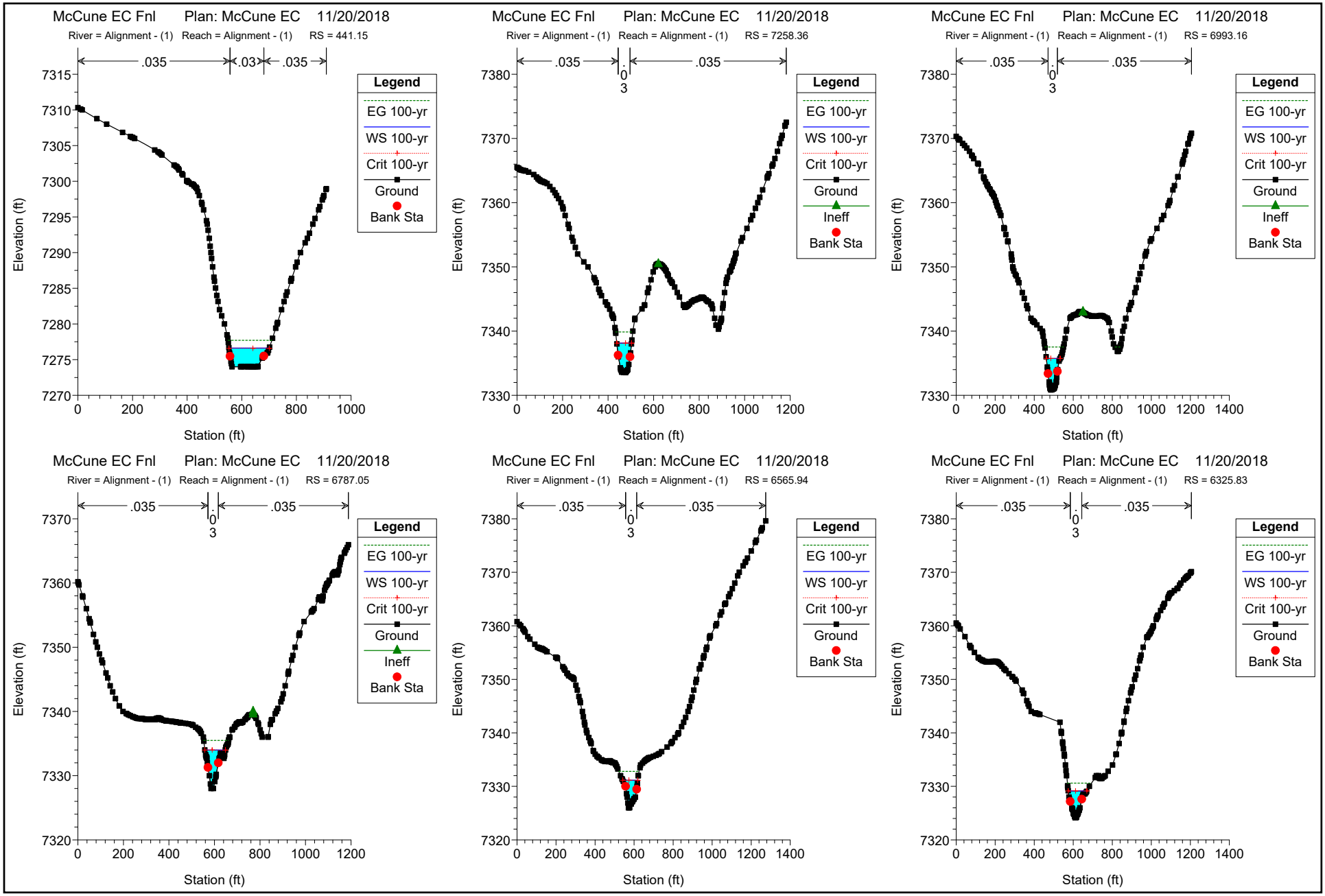
```
*Alignment - (1) *    6787.05 *       .1*       .3*
*Alignment - (1) *    6565.94 *       .1*       .3*
*Alignment - (1) *    6325.83 *       .1*       .3*
*Alignment - (1) *    6156.77 *       .1*       .3*
*Alignment - (1) *    5833.82 *       .1*       .3*
*Alignment - (1) *    5442.15 *       .3*       .5*
*Alignment - (1) *    5431.65 *       .3*       .5*
*Alignment - (1) *    5376    *Culvert  *         *
*Alignment - (1) *    5321.65 *       .3*       .5*
*Alignment - (1) *    5300.65 *       .3*       .5*
*Alignment - (1) *    4866.08 *       .1*       .3*
*Alignment - (1) *    4720.61 *       .1*       .3*
*Alignment - (1) *    4486    *       .1*       .3*
*Alignment - (1) *    4331.01 *       .1*       .3*
*Alignment - (1) *    4076.71 *       .1*       .3*
*Alignment - (1) *    3774.36 *       .1*       .3*
*Alignment - (1) *    3689.36 *       .1*       .3*
*Alignment - (1) *    3338.18 *       .1*       .3*
*Alignment - (1) *    3071.3  *       .1*       .3*
*Alignment - (1) *    2934.46 *       .1*       .3*
*Alignment - (1) *    2576.35 *       .1*       .3*
*Alignment - (1) *    2373.76 *       .1*       .3*
*Alignment - (1) *    2132.45 *       .1*       .3*
*Alignment - (1) *    1842.45 *       .1*       .3*
*Alignment - (1) *    1634.19 *       .1*       .3*
*Alignment - (1) *    1530.98 *       .1*       .3*
*Alignment - (1) *    1250.13 *       .3*       .5*
*Alignment - (1) *    1240.12 *       .3*       .5*
*Alignment - (1) *    1185    *Culvert  *         *
*Alignment - (1) *    1131.75 *       .3*       .5*
*Alignment - (1) *    1105.72 *       .3*       .5*
*Alignment - (1) *    909.01  *       .1*       .3*
*Alignment - (1) *    679.18  *       .1*       .3*
*Alignment - (1) *    441.15  *       .1*       .3*
*****************************************************

Profile Output Table - Four XS Culvert
*******************************************************************************
*************************************************************************
* Reach           * River Sta                 * Profile * E.G. Elev * W.S. Elev *
Vel Head * Frctn Loss * C & E Loss * Q Left * Q Channel * Q Right * Top Width *
*                 *                           *         *       (ft) *      (ft) *
 (ft) *       (ft) *       (ft) *  (cfs) *     (cfs) *   (cfs) *      (ft) *
*******************************************************************************
*************************************************************************
* Alignment - (1) * 5442.15  U/S Upper Bridge * 500-yr  *   7333.04 *   7333.03 *
 0.02 *       0.00 *       0.13 * 647.96 *   2516.83 *  524.21 *    586.58 *
* Alignment - (1) * 5442.15  U/S Upper Bridge * 10-yr   *   7324.80 *   7324.78 *
 0.02 *       0.00 *       0.06 *  16.61 *    750.02 *    1.37 *    222.06 *
* Alignment - (1) * 5442.15  U/S Upper Bridge * 50-yr   *   7331.67 *   7331.67 *
 0.01 *       0.00 *       0.06 * 258.63 *   1283.90 *  211.47 *    545.83 *
*                 *                           *         *         *          *
      *            *            *        *           *         *          *
* Alignment - (1) * 5431.65  U/S Upper Bridge * 500-yr  *   7332.91 *   7332.45 *
 0.46 *            *            *        *   3213.50 *  475.50 *    558.18 *
* Alignment - (1) * 5431.65  U/S Upper Bridge * 10-yr   *   7324.73 *   7324.51 *
 0.23 *            *            *        *    768.00 *         *    223.52 *
* Alignment - (1) * 5431.65  U/S Upper Bridge * 50-yr   *   7331.61 *   7331.39 *
 0.22 *            *            *        *   1714.87 *   39.13 *    521.47 *
*                 *                           *         *         *          *
      *            *            *        *           *         *          *
* Alignment - (1) * 5376                      *         *   Culvert *          *
      *            *            *        *           *         *          *
```

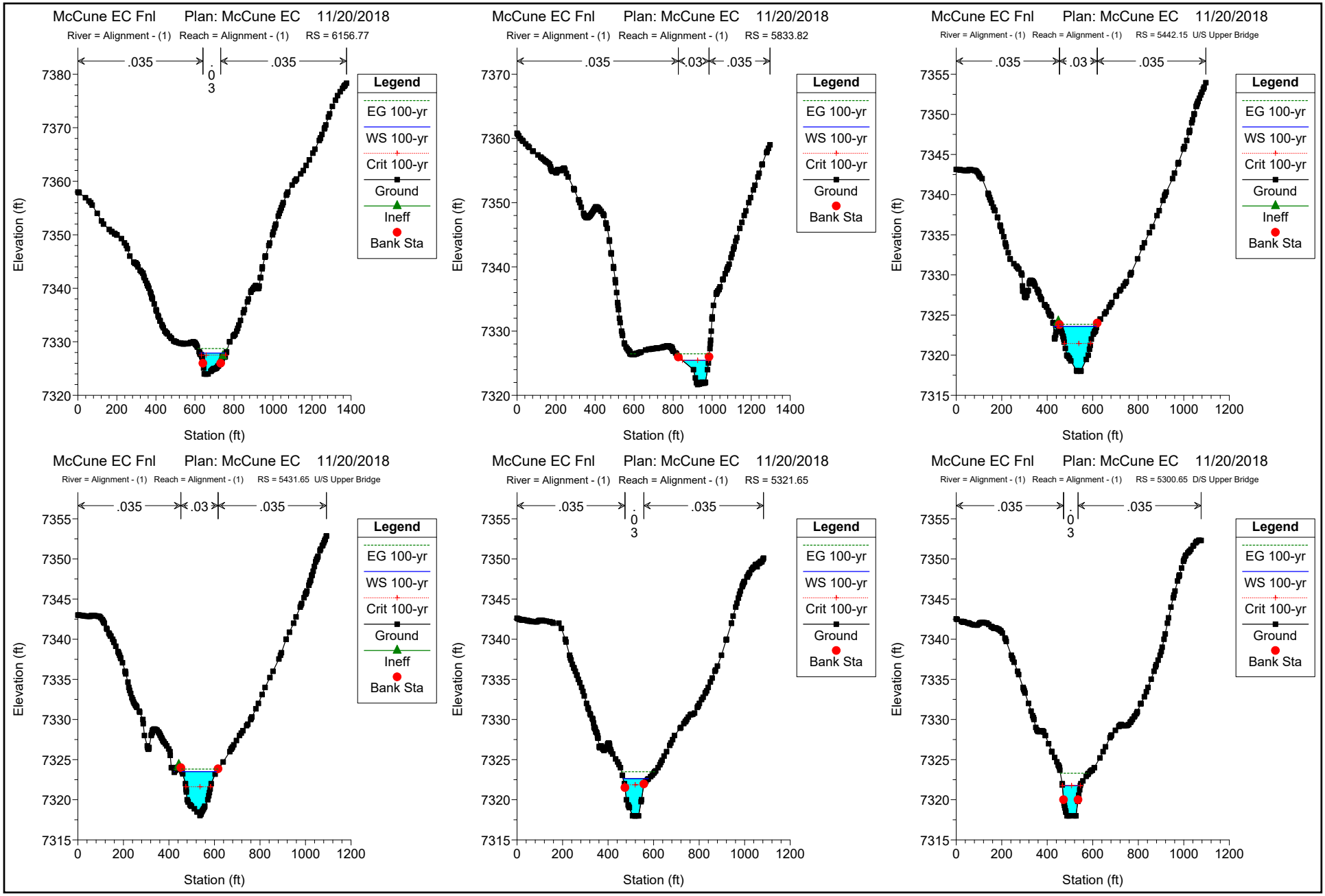
```
*                 *                             *         *            *           *
      *            *             *        *         *         *          *
* Alignment - (1) * 5321.65  D/S Upper Bridge * 500-yr  *   7325.54 *   7323.22 *
 2.32 *       0.15 *       0.24 *        *   3689.00 *        *    137.05 *
* Alignment - (1) * 5321.65  D/S Upper Bridge * 10-yr   *   7321.07 *   7320.40 *
 0.67 *       0.20 *       0.05 *        *    768.00 *        *     70.29 *
* Alignment - (1) * 5321.65  D/S Upper Bridge * 50-yr   *   7322.84 *   7321.43 *
 1.41 *       0.19 *       0.02 *        *   1754.00 *        *     79.95 *
*                 *                             *         *            *           *
      *            *             *        *         *         *          *
* Alignment - (1) * 5300.65  D/S Upper Bridge * 500-yr  *   7325.05 *   7323.22 *
 1.83 *       1.72 *       0.59 *  72.96 *   3458.29 *  157.75 *    121.16 *
* Alignment - (1) * 5300.65  D/S Upper Bridge * 10-yr   *   7320.83 *   7319.99 *
 0.84 *       4.92 *       0.08 *        *    768.00 *        *     63.24 *
* Alignment - (1) * 5300.65  D/S Upper Bridge * 50-yr   *   7322.61 *   7321.25 *
 1.36 *       4.05 *       0.12 *   6.80 *   1734.93 *   12.27 *     74.68 *
*                 *                             *         *            *           *
      *            *             *        *         *         *          *
*                 *                             *         *            *           *
      *            *             *        *         *         *          *
* Alignment - (1) * 1250.13  U/S Lower Bridge * 500-yr  *   7296.00 *   7295.97 *
 0.03 *       0.00 *       0.38 * 444.74 *   3639.29 *  205.97 *    594.76 *
* Alignment - (1) * 1250.13  U/S Lower Bridge * 10-yr   *   7284.97 *   7284.91 *
 0.06 *       0.01 *       0.22 *        *    913.91 *    0.09 *    168.09 *
* Alignment - (1) * 1250.13  U/S Lower Bridge * 50-yr   *   7289.36 *   7289.32 *
 0.04 *       0.00 *       0.26 * 108.85 *   1895.06 *   40.09 *    257.88 *
*                 *                             *         *            *           *
      *            *             *        *         *         *          *
* Alignment - (1) * 1240.12  U/S Lower Bridge * 500-yr  *   7295.62 *   7294.33 *
 1.29 *            *             *        *   4290.00 *        *    332.27 *
* Alignment - (1) * 1240.12  U/S Lower Bridge * 10-yr   *   7284.74 *   7283.94 *
 0.80 *            *             *        *    914.00 *        *    149.38 *
* Alignment - (1) * 1240.12  U/S Lower Bridge * 50-yr   *   7289.09 *   7288.19 *
 0.91 *            *             *        *   2044.00 *        *    237.95 *
*                 *                             *         *            *           *
      *            *             *        *         *         *          *
* Alignment - (1) * 1185                          *         *   Culvert *           *
      *            *             *        *         *         *          *
*                 *                             *         *            *           *
      *            *             *        *         *         *          *
* Alignment - (1) * 1131.75  D/S Lower Bridge * 500-yr  *   7288.15 *   7285.56 *
 2.59 *       0.20 *       0.40 * 133.86 *   4156.14 *        *    182.39 *
* Alignment - (1) * 1131.75  D/S Lower Bridge * 10-yr   *   7283.10 *   7282.12 *
 0.98 *       0.18 *       0.29 *   0.03 *    913.97 *        *    114.39 *
* Alignment - (1) * 1131.75  D/S Lower Bridge * 50-yr   *   7285.13 *   7283.52 *
 1.60 *       0.17 *       0.42 *  22.43 *   2021.57 *        *    126.96 *
*                 *                             *         *            *           *
      *            *             *        *         *         *          *
* Alignment - (1) * 1105.72  D/S Lower Bridge * 500-yr  *   7285.92 *   7284.14 *
 1.78 *       1.27 *       0.35 *  39.18 *   4215.23 *   35.59 *    131.62 *
* Alignment - (1) * 1105.72  D/S Lower Bridge * 10-yr   *   7282.50 *   7282.11 *
 0.39 *       1.39 *       0.11 *   0.01 *    913.98 *    0.01 *    103.85 *
* Alignment - (1) * 1105.72  D/S Lower Bridge * 50-yr   *   7283.91 *   7283.15 *
 0.77 *       1.28 *       0.12 *   6.90 *   2031.63 *    5.48 *    113.30 *
*******************************************************************************
*******************************************************************************

Profile Output Table - Bridge Only
*******************************************************************************
*******************************************************************************
* Reach       * River Sta   * Profile * E.G. US. * Min El Prs * BR Open Area * Prs O
WS * Q Total * Min El Weir Flow * Q Weir * Delta EG * BR Sluice Coef *
*             *             *         *     (ft) *      (ft) *      (sq ft) *
```

```
(ft) *   (cfs) *             (ft) *  (cfs) *     (ft) *                 *
*****************************************************************************************
*****************************************************************************
*              *              *         *          *            *              *
   *          *                  *         *           *                  *
*****************************************************************************************
*****************************************************************************
```

APPENDIX F

EXISTING CONDITIONS 100 YEAR FLOODPLAIN CROSS SECTIONS


McCune EC Fnl Plan: McCune EC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 441.15
.035 .03 .035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
McCune EC Fnl Plan: McCune EC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 7258.36
.035 .03 .035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
McCune EC Fnl Plan: McCune EC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 6993.16
.035 .03 .035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
McCune EC Fnl Plan: McCune EC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 6787.05
.035 .03 .035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
McCune EC Fnl Plan: McCune EC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 6565.94
.035 .03 .035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
McCune EC Fnl Plan: McCune EC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 6325.83
.035 .03 .035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


McCune EC Fnl Plan: McCune EC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 6156.77
.035 .03 .035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
McCune EC Fnl Plan: McCune EC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 5833.82
.035 .03 .035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
McCune EC Fnl Plan: McCune EC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 5442.15 U/S Upper Bridge
.035 .03 .035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
McCune EC Fnl Plan: McCune EC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 5431.65 U/S Upper Bridge
.035 .03 .035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
McCune EC Fnl Plan: McCune EC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 5321.65
.035 .03 .035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
McCune EC Fnl Plan: McCune EC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 5300.65 D/S Upper Bridge
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Crit 100-yr
Ground
Bank Sta
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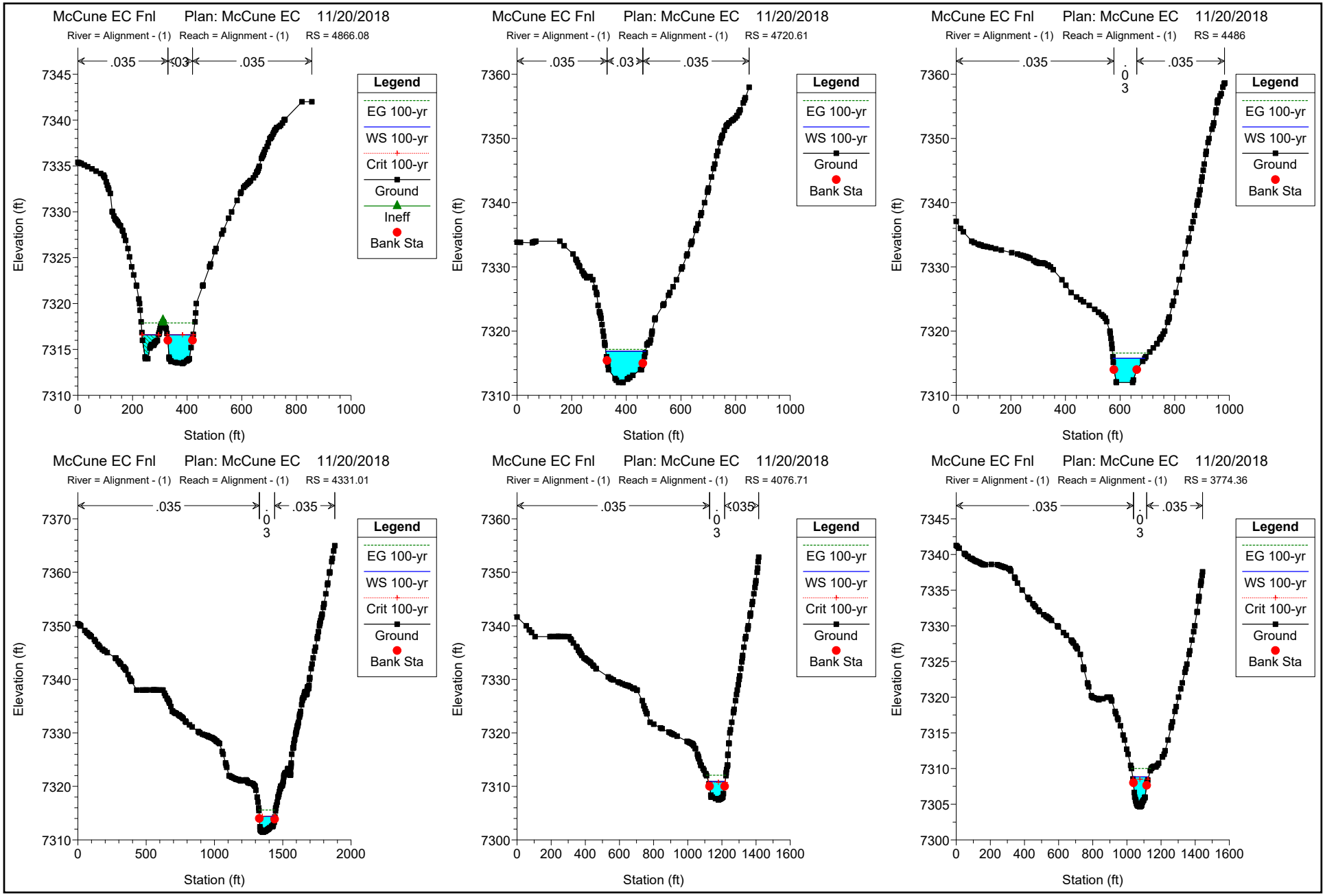
Station (ft)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River = Alignment - (1) Reach = Alignment - (1) RS = 4866.08
.035 .03 .035
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EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
McCune EC Fnl Plan: McCune EC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 4720.61
.035 .03 .035
Legend
EG 100-yr
WS 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
McCune EC Fnl Plan: McCune EC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 4486
.035 .03 .035
Legend
EG 100-yr
WS 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
McCune EC Fnl Plan: McCune EC 11/20/2018
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WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
McCune EC Fnl Plan: McCune EC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 4076.71
.035 .03 .035
Legend
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WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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River = Alignment - (1) Reach = Alignment - (1) RS = 3774.36
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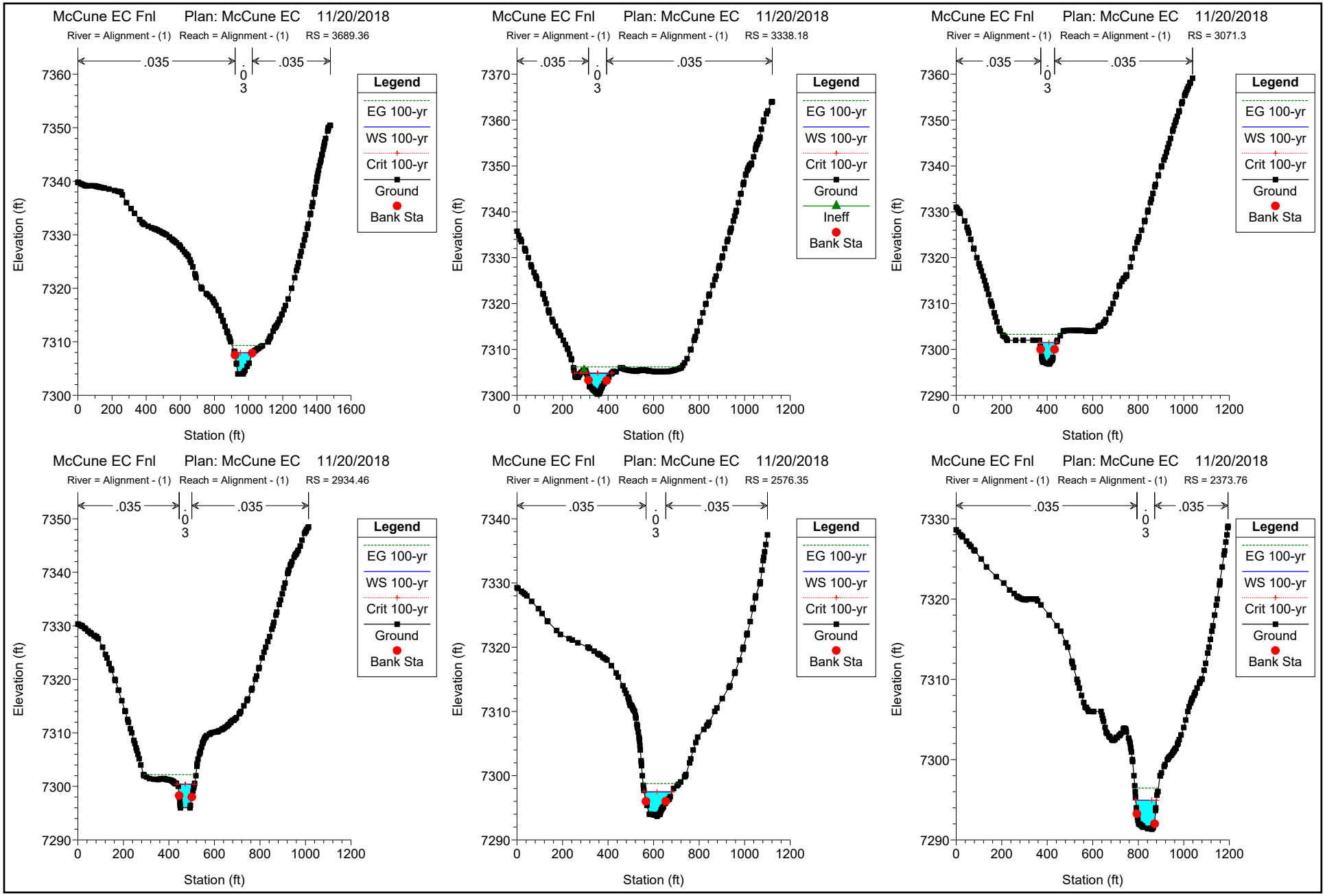
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
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River = Alignment - (1) Reach = Alignment - (1) RS = 3071.3
.035
.03
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WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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River = Alignment - (1) Reach = Alignment - (1) RS = 2934.46
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.03
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WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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River = Alignment - (1) Reach = Alignment - (1) RS = 2576.35
.035
.03
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Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
McCune EC Fnl Plan: McCune EC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 2373.76
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WS 100-yr
Crit 100-yr
Ground
Bank Sta
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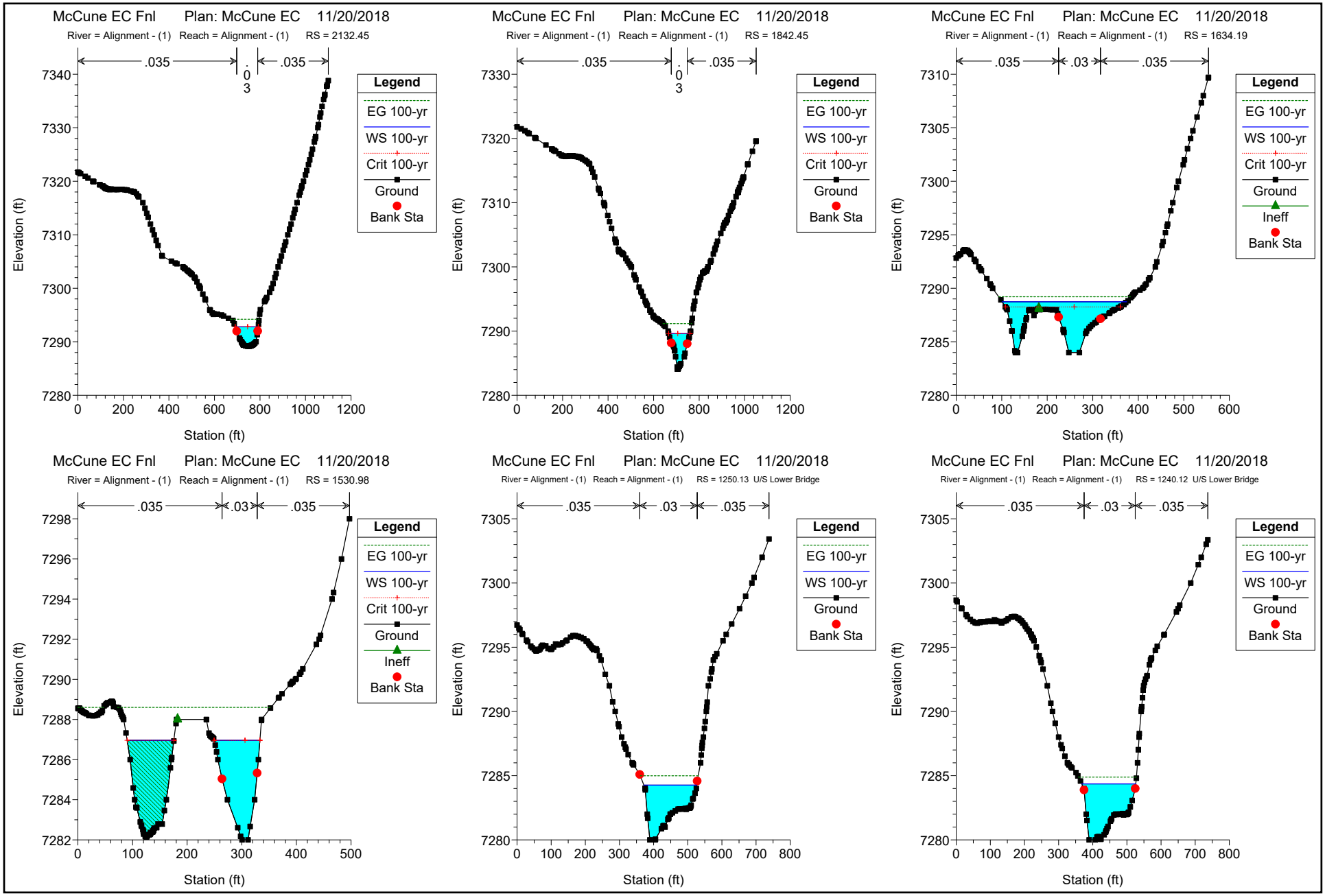
Station (ft)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WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
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.035
.03
.035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
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River = Alignment - (1) Reach = Alignment - (1) RS = 1250.13 U/S Lower Bridge
.035
.03
.035
Legend
EG 100-yr
WS 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
McCune EC Fnl Plan: McCune EC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 1240.12 U/S Lower Bridge
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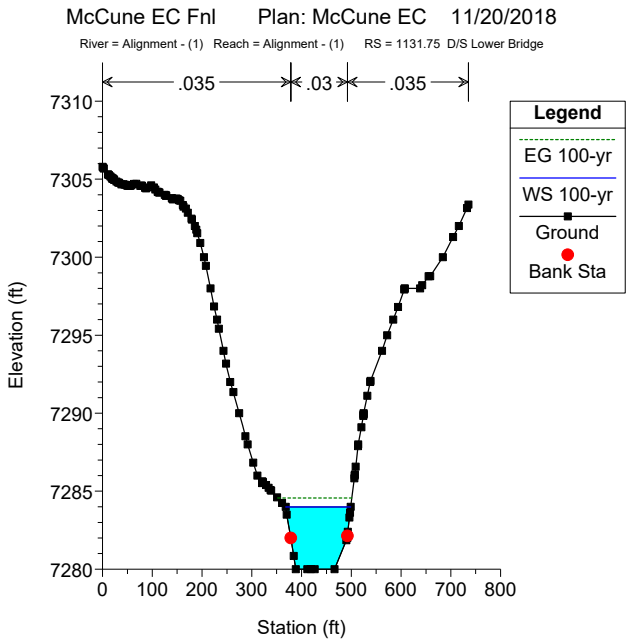
WS 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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River = Alignment - (1) Reach = Alignment - (1) RS = 1131.75 D/S Lower Bridge
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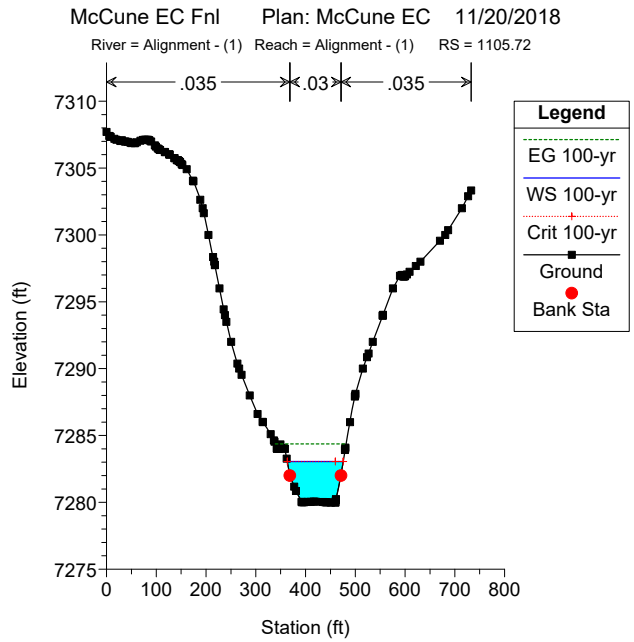
WS 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


McCune EC Fnl Plan: McCune EC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 1105.72
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Legend
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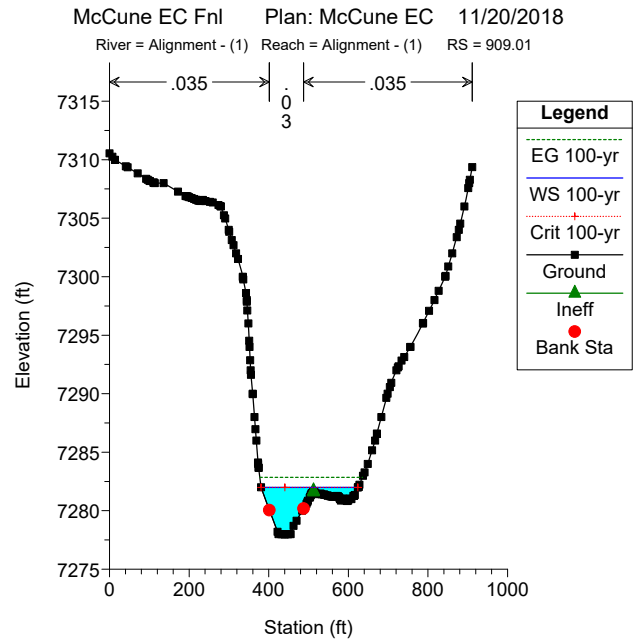
WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


McCune EC Fnl Plan: McCune EC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 909.01
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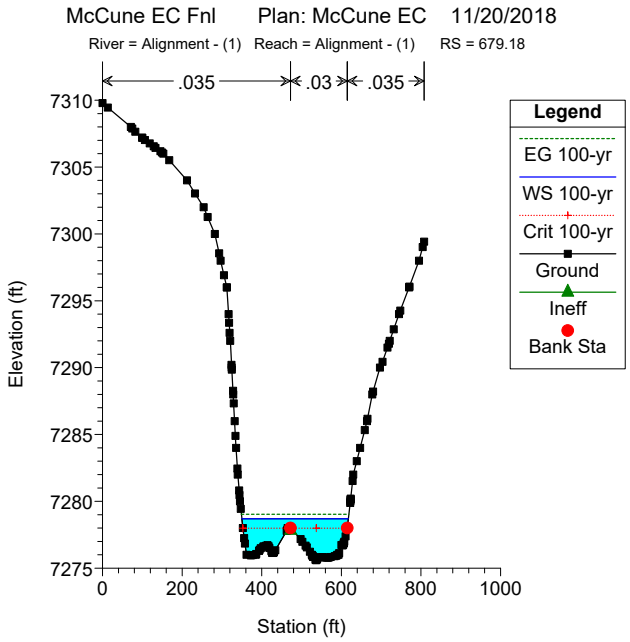
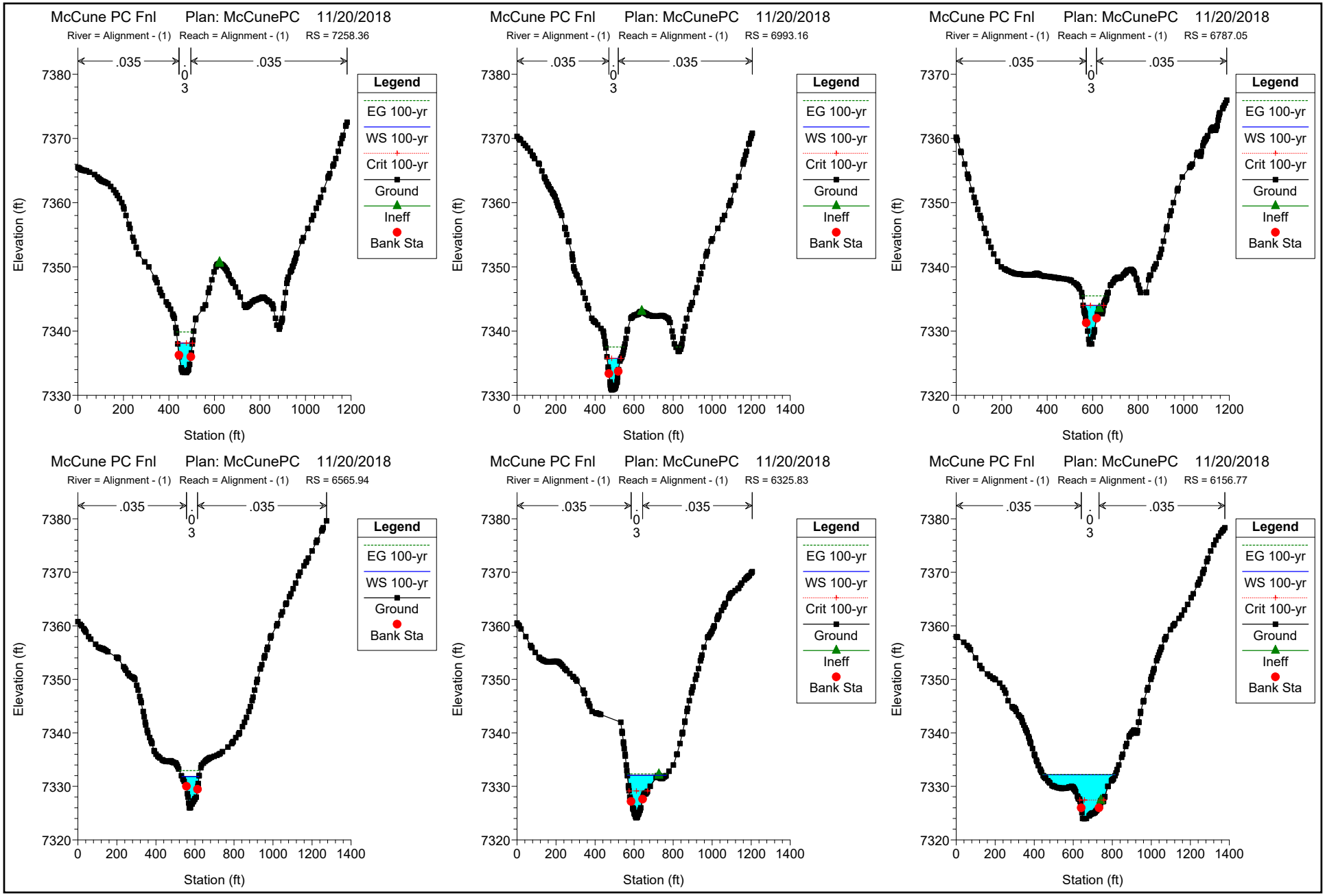
.035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


McCune EC Fnl Plan: McCune EC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 679.18
.035
.03
.035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

APPENDIX F

PROPOSED CONDITIONS 100 YEAR FLOODPLAIN CROSS SECTIONS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McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 6993.16
McCune PC Fnl Plan: McCunePC 11/20/2018
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McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 6565.94
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 6325.83
McCune PC Fnl Plan: McCunePC 11/20/2018
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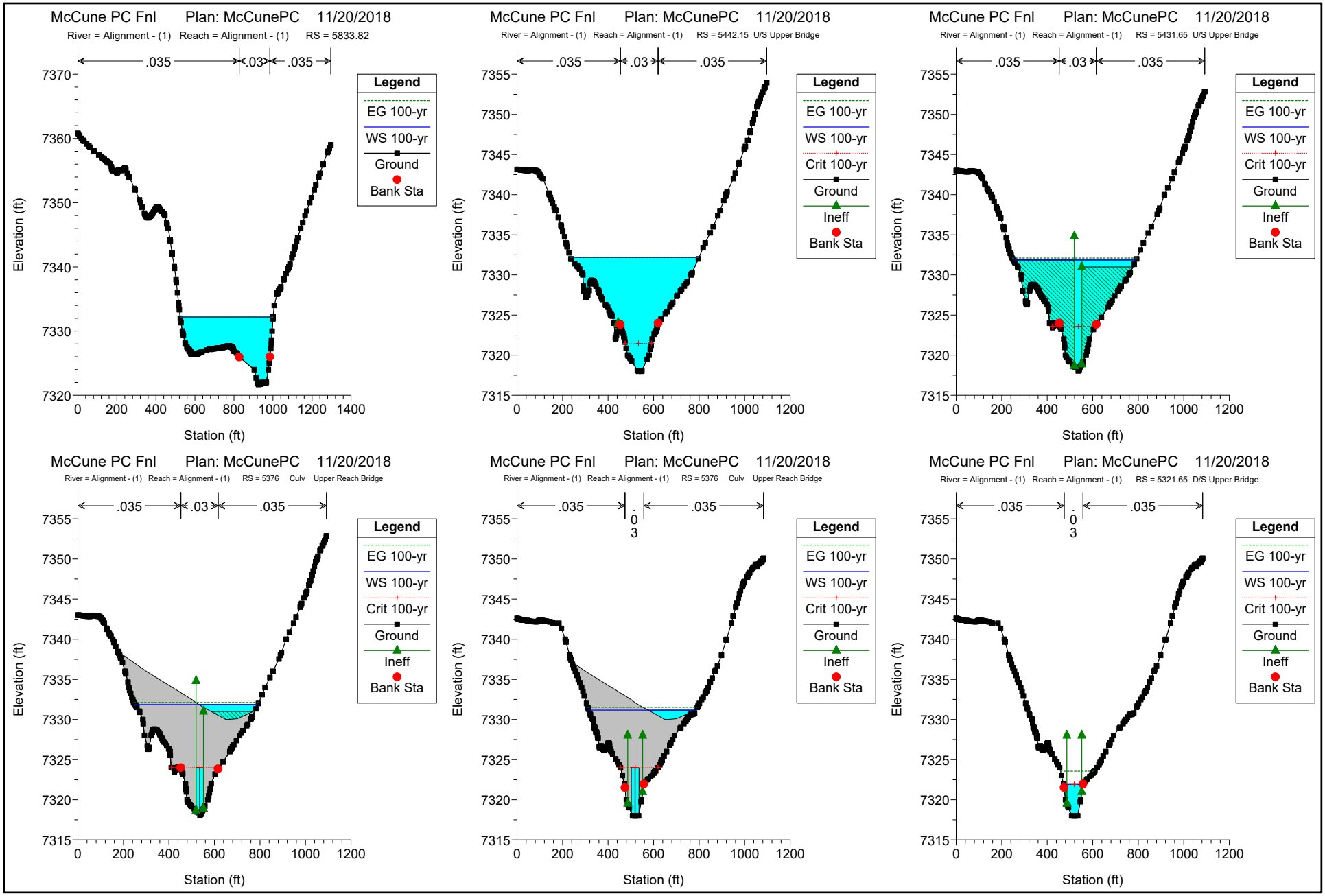
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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.035 .03 .035
Legend
EG 100-yr
WS 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 5442.15 U/S Upper Bridge
.035 .03 .035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
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Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 5376 Culv Upper Reach Bridge
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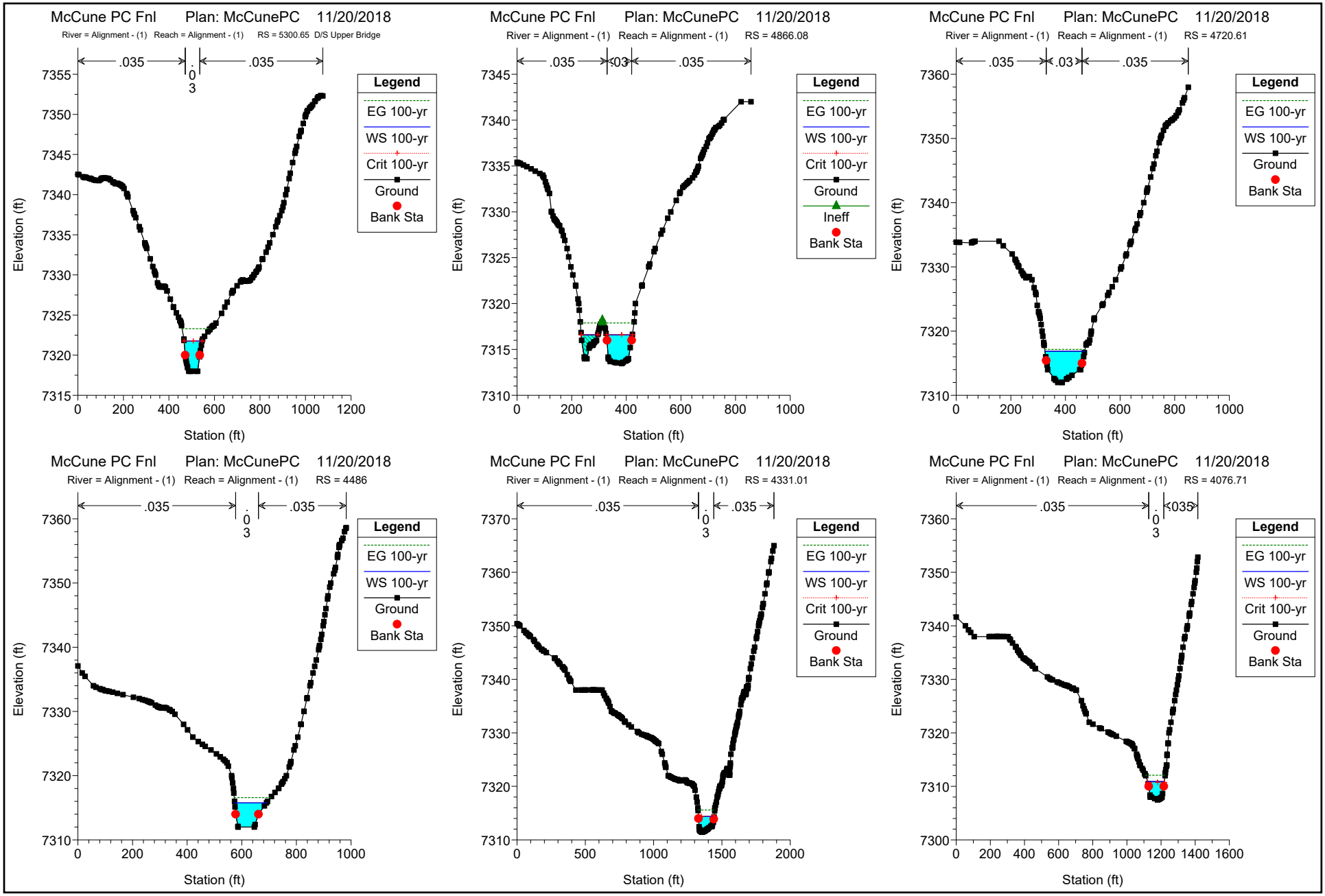
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 5376 Culv Upper Reach Bridge
.035 .03 .035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 5321.65 D/S Upper Bridge
.035 .03 .035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 5300.65 D/S Upper Bridge
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.035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 4866.08
.035
.03
.035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 4720.61
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.03
.035
Legend
EG 100-yr
WS 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 4486
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.03
.035
Legend
EG 100-yr
WS 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 4331.01
.035
.03
.035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 4076.71
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.035
Legend
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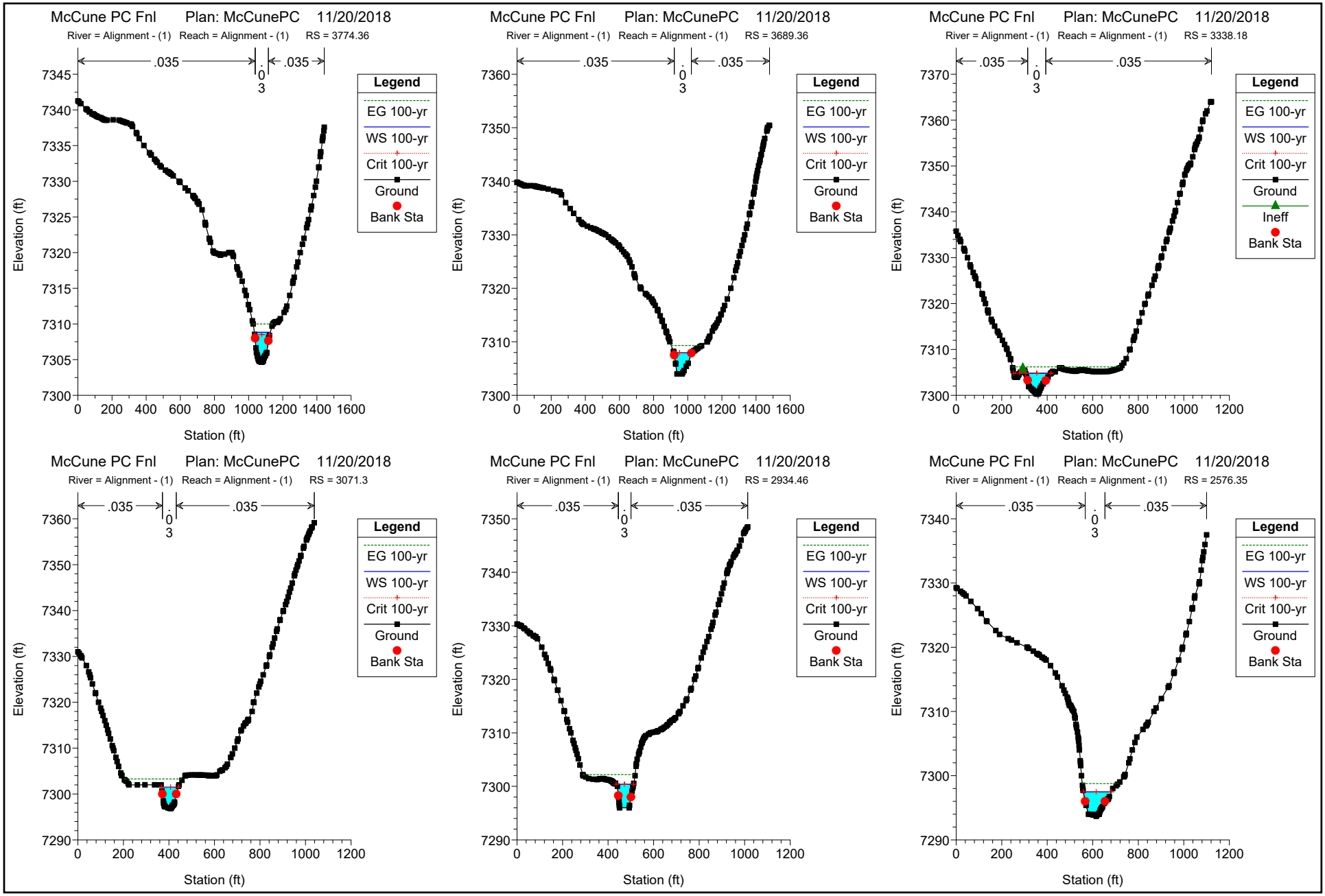
WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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River = Alignment - (1) Reach = Alignment - (1) RS = 3689.36
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Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 3338.18
.035
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Legend
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WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
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Legend
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WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 2934.46
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WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
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Legend
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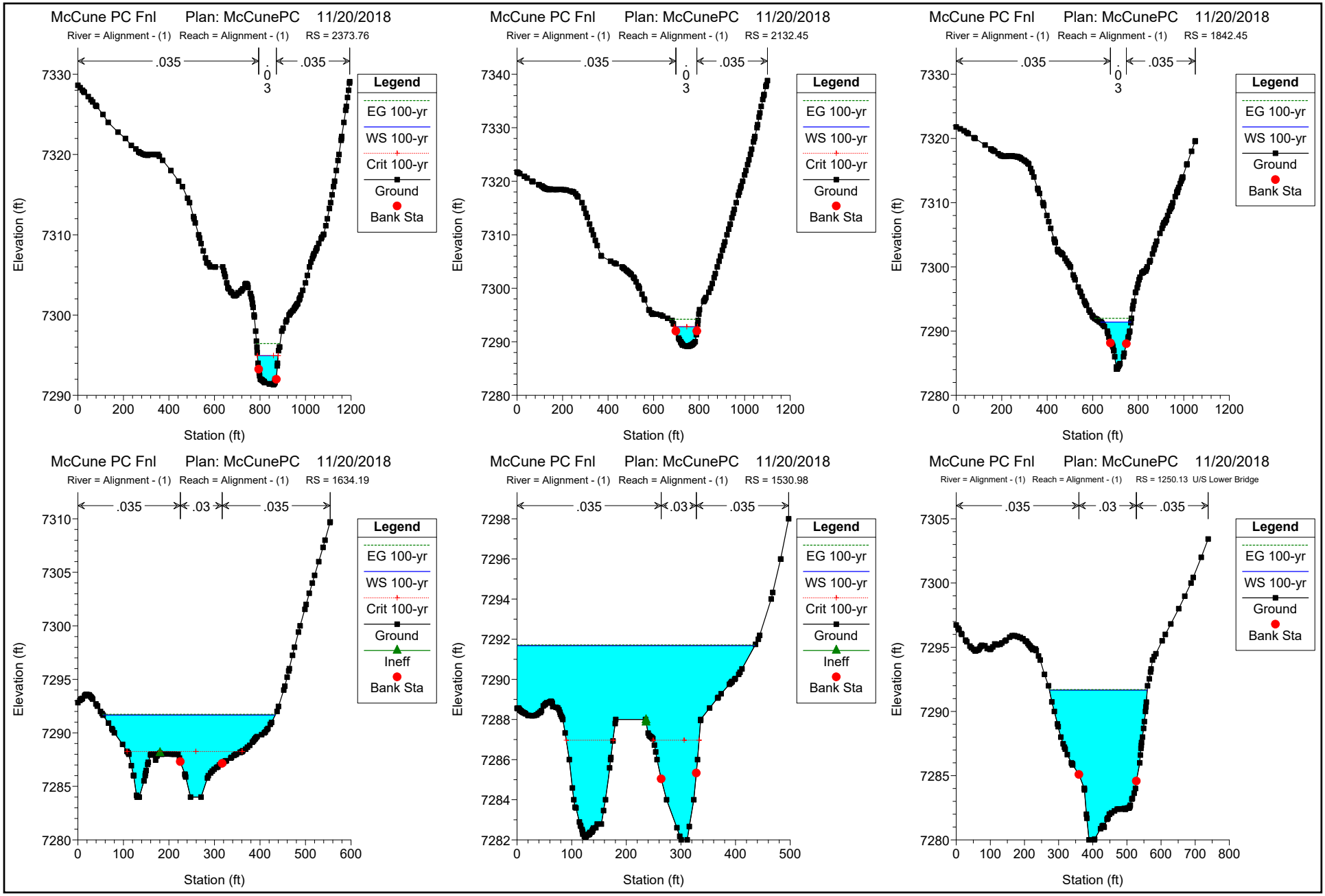
WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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Legend
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WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 2132.45
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Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 1842.45
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.03
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Legend
EG 100-yr
WS 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 1634.19
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Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 1530.98
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.035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 1250.13 U/S Lower Bridge
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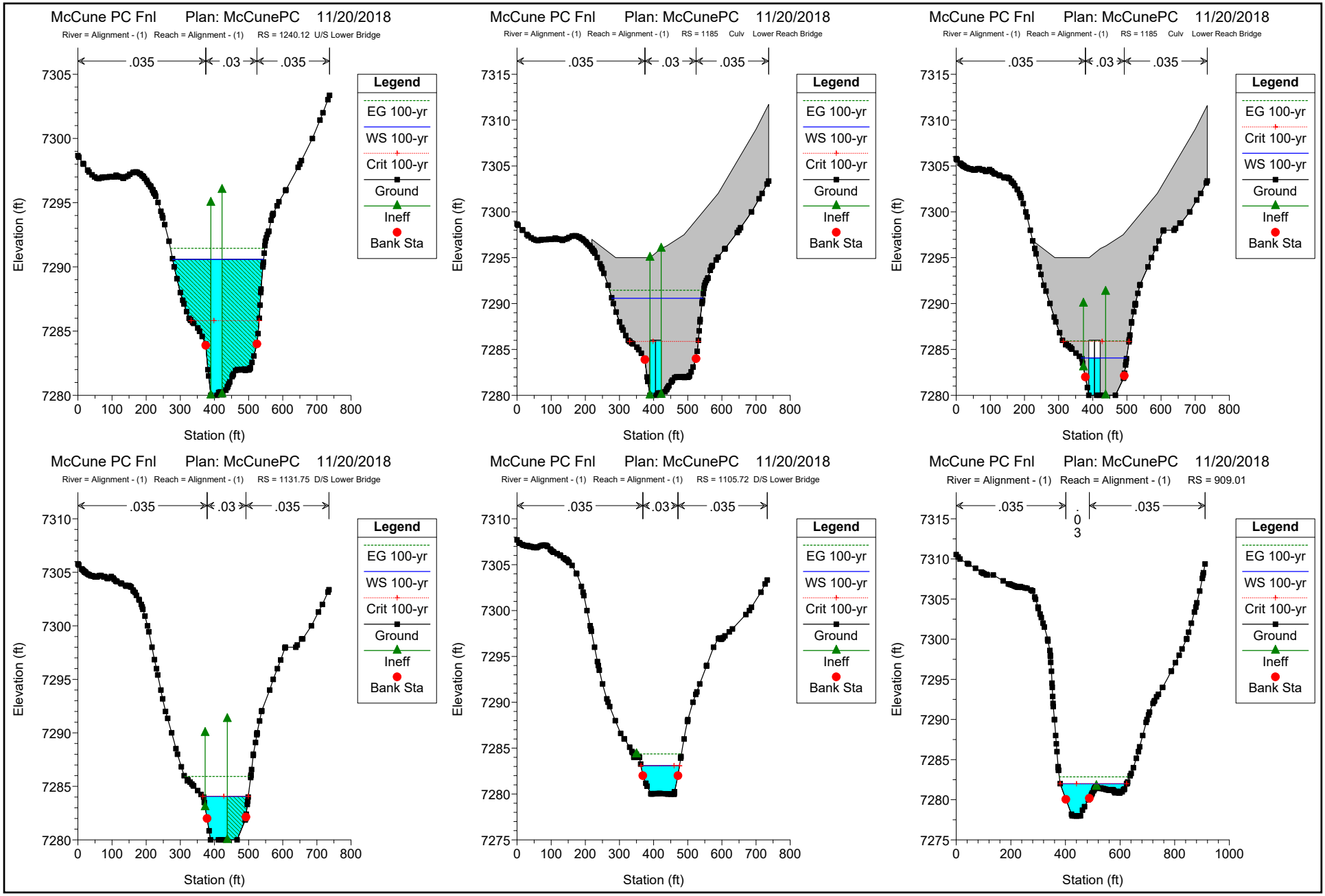
EG 100-yr
WS 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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River = Alignment - (1) Reach = Alignment - (1) RS = 1240.12 U/S Lower Bridge
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Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
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WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 1185 Culv Lower Reach Bridge
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Legend
EG 100-yr
Crit 100-yr
WS 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 1131.75 D/S Lower Bridge
.035 .03 .035
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 1105.72 D/S Lower Bridge
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Legend
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WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 909.01
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Legend
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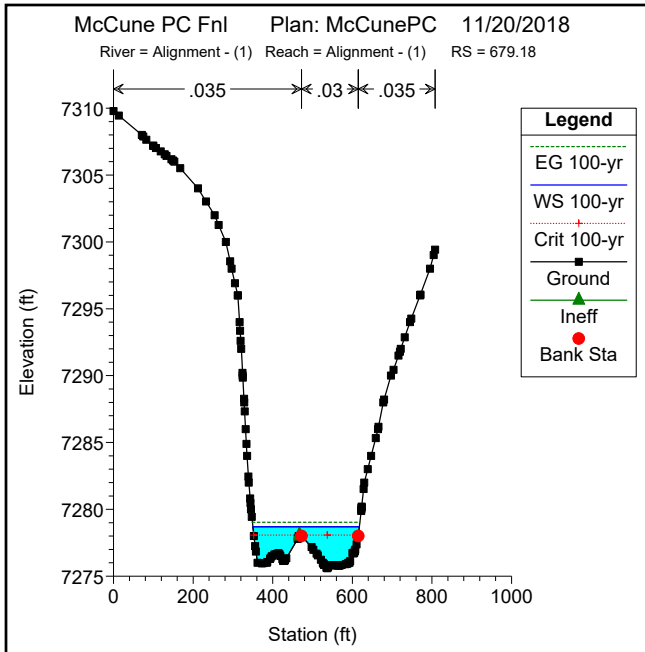
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


McCune PC Fnl Plan: McCunePC 11/20/2018
River = Alignment - (1) Reach = Alignment - (1) RS = 679.18
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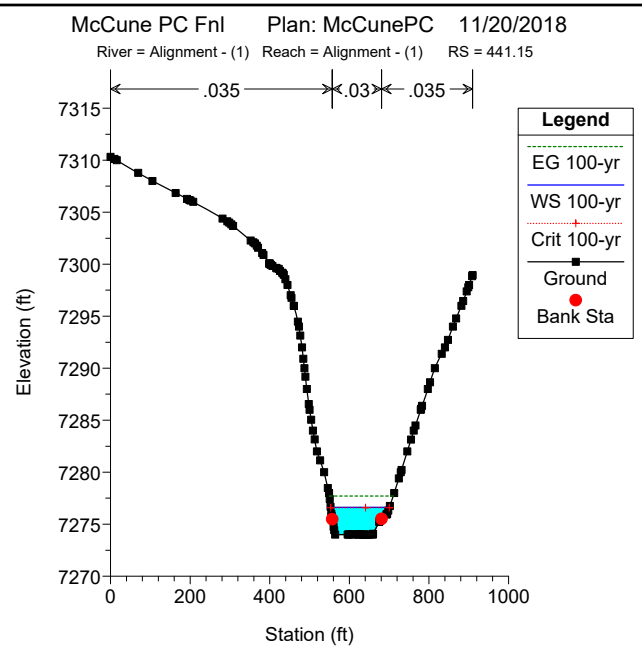
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


McCune PC Fnl Plan: McCunePC 11/20/2018
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Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

APPENDIX F

COMPARATIVE EXISTING VS PROPOSED BFE DATA

Existing Conditions (EC) Versus Proposed Conditions (PC) Base Flood Elevations			
River Station	EC BFEs (feet)	PC BFEs (feet)	Difference [PC-EC] (feet)
7258.36	7338.12	7338.12	0.00
6993.16	7335.75	7335.75	0.00
6787.05	7333.98	7333.98	0.00
6565.94	7331.14	7331.83	0.69
6325.83	7329.14	7332.05	2.91
6156.77	7327.90	7332.16	4.26
5833.82	7325.43	7332.18	6.75
5442.15	7323.59	7332.18	8.59
5431.65	7323.51	7331.86	8.35
5376	Proposed Upstream Bridge		
5321.65	7322.64	7321.91	-0.73
5300.65	7321.75	7321.75	0.00
4866.08	7316.59	7316.59	0.00
4720.61	7316.86	7316.86	0.00
4486	7315.75	7315.75	0.00
4331.01	7314.42	7314.42	0.00
4076.71	7310.91	7310.91	0.00
3774.36	7308.82	7308.83	0.01
3689.36	7307.94	7307.94	0.00
3338.18	7304.82	7304.82	0.00
3071.3	7301.49	7301.49	0.00
2934.46	7300.38	7300.38	0.00
2576.35	7297.47	7297.47	0.00
2373.76	7294.93	7294.93	0.00
2132.45	7292.80	7292.80	0.00
1842.45	7289.60	7291.41	1.81
1634.19	7288.74	7291.68	2.94
1530.98	7286.96	7291.68	4.72
1250.13	7284.26	7291.67	7.41
1240.12	7284.36	7290.58	6.22
1185	Proposed Downstream Bridge		
1131.75	7283.99	7284.07	0.08
1105.72	7283.05	7283.09	0.04
909.01	7281.99	7281.99	0.00
679.18	7278.70	7278.70	0.00
441.15	7276.61	7276.61	0.00

APPENDIX F

EXISTING CONDITIONS 100 YEAR FLOODPLAIN DATA

HEC-RAS Plan: Plan EC River: Alignment - (1) Reach: Alignment - (1) Profile: 100-yr

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Top Width	Top Wdth Act	Vel Chnl	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/s)	
Alignment - (1)	7258.36	100-yr	2228.00	7333.54	7338.12	64.91	64.91	10.71	0.96
Alignment - (1)	6993.16	100-yr	2228.00	7330.84	7335.75	71.21	71.21	10.87	0.94
Alignment - (1)	6787.05	100-yr	2228.00	7328.00	7333.98	90.67	90.67	10.16	0.84
Alignment - (1)	6565.94	100-yr	2228.00	7326.00	7331.14	76.99	76.99	10.40	0.95
Alignment - (1)	6325.83	100-yr	2228.00	7324.16	7329.14	95.50	95.50	9.90	0.91
Alignment - (1)	6156.77	100-yr	2228.00	7323.97	7327.90	135.36	135.36	7.48	0.74
Alignment - (1)	5833.82	100-yr	2228.00	7321.68	7325.43	134.65	134.65	8.15	1.01
Alignment - (1)	5442.15	100-yr	2228.00	7318.00	7323.59	176.56	161.29	4.05	0.39
Alignment - (1)	5431.65	100-yr	2228.00	7318.03	7323.51	152.93	151.41	4.49	0.44
Alignment - (1)	5321.65	100-yr	2228.00	7317.99	7322.64	111.41	111.41	7.44	0.69
Alignment - (1)	5300.65	100-yr	2228.00	7317.99	7321.75	79.18	79.18	10.08	0.96
Alignment - (1)	4866.08	100-yr	2228.00	7313.47	7316.59	156.03	95.51	9.15	0.98
Alignment - (1)	4720.61	100-yr	2228.00	7312.00	7316.86	145.81	145.81	4.39	0.40
Alignment - (1)	4486	100-yr	2228.00	7312.00	7315.75	116.67	116.67	7.43	0.70
Alignment - (1)	4331.01	100-yr	2228.00	7311.43	7314.42	115.19	115.19	8.63	1.00
Alignment - (1)	4076.71	100-yr	2228.00	7307.48	7310.91	99.30	99.30	8.72	0.91
Alignment - (1)	3774.36	100-yr	2228.00	7304.64	7308.82	93.39	93.39	8.70	0.84
Alignment - (1)	3689.36	100-yr	2584.00	7303.99	7307.94	103.07	103.07	9.39	1.00
Alignment - (1)	3338.18	100-yr	2584.00	7300.28	7304.82	137.16	111.09	9.60	0.93
Alignment - (1)	3071.3	100-yr	2584.00	7296.87	7301.49	73.86	73.86	10.82	0.97
Alignment - (1)	2934.46	100-yr	2584.00	7296.00	7300.38	76.50	76.50	10.98	0.96
Alignment - (1)	2576.35	100-yr	2584.00	7293.68	7297.47	122.83	122.83	9.33	0.94
Alignment - (1)	2373.76	100-yr	2584.00	7291.32	7294.93	90.98	90.98	10.00	0.98
Alignment - (1)	2132.45	100-yr	2584.00	7289.16	7292.80	100.91	100.91	9.60	0.99
Alignment - (1)	1842.45	100-yr	2584.00	7284.08	7289.60	93.79	93.79	10.15	0.95
Alignment - (1)	1634.19	100-yr	2584.00	7284.00	7288.74	273.70	273.70	6.20	0.61
Alignment - (1)	1530.98	100-yr	2584.00	7282.00	7286.96	169.58	83.90	10.38	0.94
Alignment - (1)	1250.13	100-yr	2584.00	7280.00	7284.26	154.85	154.85	6.86	0.78
Alignment - (1)	1240.12	100-yr	2584.00	7280.00	7284.36	158.14	158.14	5.83	0.60
Alignment - (1)	1131.75	100-yr	2584.00	7280.00	7283.99	130.53	130.53	6.11	0.56
Alignment - (1)	1105.72	100-yr	2584.00	7279.98	7283.05	112.42	112.42	9.23	0.99
Alignment - (1)	909.01	100-yr	2584.00	7277.98	7281.99	243.05	243.05	7.93	0.77
Alignment - (1)	679.18	100-yr	2584.00	7275.60	7278.70	267.72	267.72	5.02	0.59
Alignment - (1)	441.15	100-yr	2584.00	7273.98	7276.61	147.73	147.73	8.46	0.96

APPENDIX F

PROPOSED CONDITIONS 100 YEAR FLOODPLAIN DATA

HEC-RAS Plan: McCunePC River: Alignment - (1) Reach: Alignment - (1) Profile: 100-yr

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Top Width	Top Wdth Act	Vel Chnl	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/s)	
Alignment - (1)	7258.36	100-yr	2228.00	7333.54	7338.12	64.92	64.92	10.70	0.96
Alignment - (1)	6993.16	100-yr	2228.00	7330.84	7335.75	71.22	71.22	10.87	0.94
Alignment - (1)	6787.05	100-yr	2228.00	7328.00	7333.98	90.70	90.70	10.15	0.84
Alignment - (1)	6565.94	100-yr	2228.00	7326.00	7331.83	87.98	87.98	8.59	0.72
Alignment - (1)	6325.83	100-yr	2228.00	7324.16	7332.05	199.15	161.91	4.66	0.32
Alignment - (1)	6156.77	100-yr	2228.00	7323.97	7332.16	371.69	371.69	2.29	0.15
Alignment - (1)	5833.82	100-yr	2228.00	7321.68	7332.18	475.99	475.99	1.00	0.06
Alignment - (1)	5442.15 U/S Upper Bridge	100-yr	2228.00	7317.99	7332.18	565.05	565.05	0.81	0.04
Alignment - (1)	5431.65 U/S Upper Bridge	100-yr	2228.00	7318.03	7331.86	539.66	271.60	4.16	0.32
Alignment - (1)	5376		Culvert						
Alignment - (1)	5321.65 D/S Upper Bridge	100-yr	2228.00	7317.99	7321.91	84.52	66.00	10.32	1.01
Alignment - (1)	5300.65 D/S Upper Bridge	100-yr	2228.00	7317.99	7321.75	79.18	79.18	10.08	0.96
Alignment - (1)	4866.08	100-yr	2228.00	7313.47	7316.59	156.03	95.51	9.15	0.98
Alignment - (1)	4720.61	100-yr	2228.00	7312.00	7316.86	145.81	145.81	4.39	0.40
Alignment - (1)	4486	100-yr	2228.00	7312.00	7315.75	116.67	116.67	7.43	0.70
Alignment - (1)	4331.01	100-yr	2228.00	7311.43	7314.42	115.19	115.19	8.63	1.00
Alignment - (1)	4076.71	100-yr	2228.00	7307.48	7310.91	99.30	99.30	8.72	0.91
Alignment - (1)	3774.36	100-yr	2228.00	7304.64	7308.83	93.40	93.40	8.70	0.84
Alignment - (1)	3689.36	100-yr	2584.00	7303.99	7307.94	103.07	103.07	9.39	1.00
Alignment - (1)	3338.18	100-yr	2584.00	7300.28	7304.82	137.23	111.13	9.60	0.93
Alignment - (1)	3071.3	100-yr	2584.00	7296.87	7301.49	73.86	73.86	10.82	0.97
Alignment - (1)	2934.46	100-yr	2584.00	7296.00	7300.38	76.50	76.50	10.98	0.96
Alignment - (1)	2576.35	100-yr	2584.00	7293.68	7297.47	122.83	122.83	9.33	0.94
Alignment - (1)	2373.76	100-yr	2584.00	7291.32	7294.93	90.98	90.98	10.00	0.98
Alignment - (1)	2132.45	100-yr	2584.00	7289.16	7292.80	100.91	100.91	9.60	0.99
Alignment - (1)	1842.45	100-yr	2584.00	7284.08	7291.41	132.23	132.23	6.31	0.48
Alignment - (1)	1634.19	100-yr	2584.00	7284.00	7291.68	378.54	378.54	2.34	0.17
Alignment - (1)	1530.98	100-yr	2584.00	7282.00	7291.68	435.38	435.38	1.78	0.11
Alignment - (1)	1250.13 U/S Lower Bridge	100-yr	2584.00	7280.00	7291.67	286.59	286.59	1.40	0.08
Alignment - (1)	1240.12 U/S Lower Bridge	100-yr	2584.00	7280.00	7290.58	266.50	33.00	7.45	0.41
Alignment - (1)	1185		Culvert						
Alignment - (1)	1131.75 D/S Lower Bridge	100-yr	2584.00	7280.00	7284.07	132.88	65.00	11.02	0.98
Alignment - (1)	1105.72 D/S Lower Bridge	100-yr	2584.00	7279.98	7283.09	112.77	112.77	9.09	0.97
Alignment - (1)	909.01	100-yr	2584.00	7277.98	7281.99	243.09	243.09	7.93	0.77
Alignment - (1)	679.18	100-yr	2584.00	7275.60	7278.70	267.72	267.72	5.02	0.59
Alignment - (1)	441.15	100-yr	2584.00	7273.98	7276.61	147.73	147.73	8.46	0.96

APPENDIX F

PROPOSED CONDITIONS 10, 50, 500 YEAR FLOODPLAIN DATA

HEC-RAS Plan: McCunePC River: Alignment - (1) Reach: Alignment - (1)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Top Width	Top Wdth Act	Vel Chnl	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/s)	
Alignment - (1)	7258.36	500-yr	3689.00	7333.54	7339.62	73.99	73.99	12.42	0.94
Alignment - (1)	7258.36	10-yr	768.00	7333.54	7336.24	52.99	52.99	7.30	0.91
Alignment - (1)	7258.36	50-yr	1754.00	7333.54	7337.51	61.08	61.08	10.10	0.98
Alignment - (1)	6993.16	500-yr	3689.00	7330.84	7337.39	116.04	93.47	11.99	0.88
Alignment - (1)	6993.16	10-yr	768.00	7330.84	7333.64	48.35	48.35	7.89	0.97
Alignment - (1)	6993.16	50-yr	1754.00	7330.84	7335.13	61.78	61.78	10.23	0.96
Alignment - (1)	6787.05	500-yr	3689.00	7328.00	7335.42	108.75	108.75	11.50	0.83
Alignment - (1)	6787.05	10-yr	768.00	7328.00	7331.49	43.48	43.48	8.25	0.98
Alignment - (1)	6787.05	50-yr	1754.00	7328.00	7333.19	72.28	62.91	10.15	0.92
Alignment - (1)	6565.94	500-yr	3689.00	7326.00	7332.62	101.45	101.45	11.68	0.90
Alignment - (1)	6565.94	10-yr	768.00	7326.00	7329.25	53.10	53.10	7.34	0.92
Alignment - (1)	6565.94	50-yr	1754.00	7326.00	7331.42	81.78	81.78	7.56	0.67
Alignment - (1)	6325.83	500-yr	3689.00	7324.16	7332.78	214.62	214.62	6.53	0.43
Alignment - (1)	6325.83	10-yr	768.00	7324.16	7327.46	60.66	60.66	6.57	0.82
Alignment - (1)	6325.83	50-yr	1754.00	7324.16	7331.58	160.65	144.73	4.05	0.29
Alignment - (1)	6156.77	500-yr	3689.00	7323.97	7333.00	391.24	391.24	3.11	0.19
Alignment - (1)	6156.77	10-yr	768.00	7323.97	7326.15	92.84	92.84	6.04	0.90
Alignment - (1)	6156.77	50-yr	1754.00	7323.97	7331.65	354.58	354.58	2.05	0.14
Alignment - (1)	5833.82	500-yr	3689.00	7321.68	7333.03	482.38	482.38	1.44	0.08
Alignment - (1)	5833.82	10-yr	768.00	7321.68	7324.68	101.60	101.60	4.18	0.55
Alignment - (1)	5833.82	50-yr	1754.00	7321.68	7331.67	472.20	472.20	0.86	0.05
Alignment - (1)	5442.15 U/S Upper Bridge	500-yr	3689.00	7317.99	7333.03	586.58	586.58	1.19	0.06
Alignment - (1)	5442.15 U/S Upper Bridge	10-yr	768.00	7317.99	7324.78	222.06	222.06	1.00	0.08
Alignment - (1)	5442.15 U/S Upper Bridge	50-yr	1754.00	7317.99	7331.67	545.83	545.83	0.68	0.04
Alignment - (1)	5431.65 U/S Upper Bridge	500-yr	3689.00	7318.03	7332.45	558.18	280.56	5.77	0.42
Alignment - (1)	5431.65 U/S Upper Bridge	10-yr	768.00	7318.03	7324.51	223.52	33.00	3.81	0.27
Alignment - (1)	5431.65 U/S Upper Bridge	50-yr	1754.00	7318.03	7331.39	521.47	263.95	3.78	0.31
Alignment - (1)	5376		Culvert						
Alignment - (1)	5321.65 D/S Upper Bridge	500-yr	3689.00	7317.99	7323.22	137.05	66.00	12.22	1.01
Alignment - (1)	5321.65 D/S Upper Bridge	10-yr	768.00	7317.99	7320.40	70.29	63.05	6.57	0.85
Alignment - (1)	5321.65 D/S Upper Bridge	50-yr	1754.00	7317.99	7321.43	79.95	66.00	9.53	1.01
Alignment - (1)	5300.65 D/S Upper Bridge	500-yr	3689.00	7317.99	7323.22	121.16	121.16	11.17	0.89
Alignment - (1)	5300.65 D/S Upper Bridge	10-yr	768.00	7317.99	7319.99	63.24	63.24	7.34	1.01
Alignment - (1)	5300.65 D/S Upper Bridge	50-yr	1754.00	7317.99	7321.25	74.68	74.68	9.41	0.97
Alignment - (1)	4866.08	500-yr	3689.00	7313.47	7318.29	198.84	198.84	7.07	0.59
Alignment - (1)	4866.08	10-yr	768.00	7313.47	7315.15	105.68	82.82	6.59	0.98
Alignment - (1)	4866.08	50-yr	1754.00	7313.47	7316.17	147.61	91.50	8.53	1.00
Alignment - (1)	4720.61	500-yr	3689.00	7312.00	7318.16	159.87	159.87	5.36	0.42
Alignment - (1)	4720.61	10-yr	768.00	7312.00	7315.01	129.49	129.49	2.93	0.36
Alignment - (1)	4720.61	50-yr	1754.00	7312.00	7316.35	141.75	141.75	4.00	0.39
Alignment - (1)	4486	500-yr	3689.00	7312.00	7316.69	135.52	135.52	9.36	0.79
Alignment - (1)	4486	10-yr	768.00	7312.00	7314.37	90.71	90.71	4.41	0.54
Alignment - (1)	4486	50-yr	1754.00	7312.00	7315.39	109.79	109.79	6.61	0.66
Alignment - (1)	4331.01	500-yr	3689.00	7311.43	7315.36	120.85	120.85	10.11	0.99
Alignment - (1)	4331.01	10-yr	768.00	7311.43	7313.20	103.66	103.66	6.23	1.01

HEC-RAS Plan: McCunePC River: Alignment - (1) Reach: Alignment - (1) (Continued)

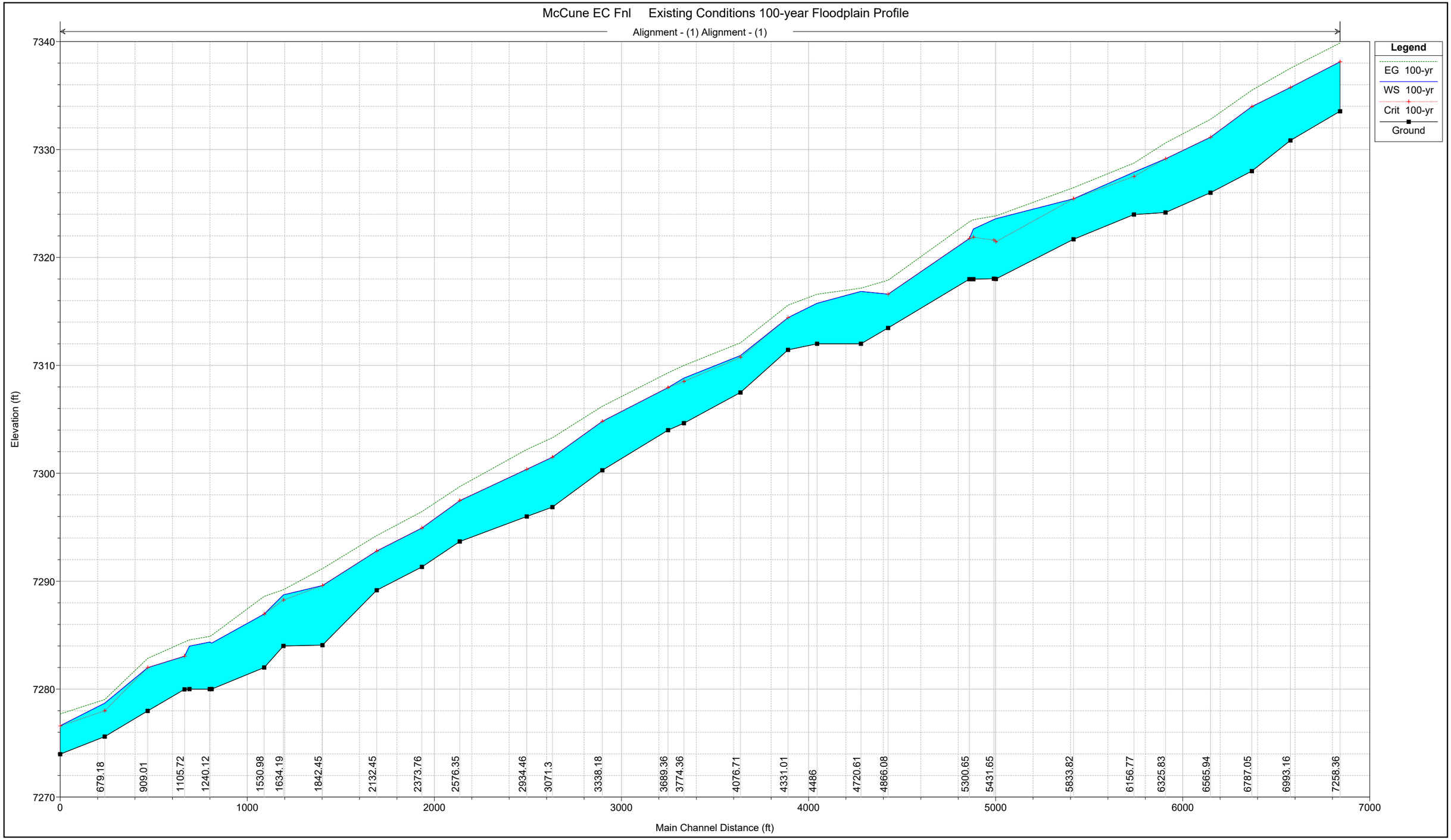
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Top Width	Top Wdth Act	Vel Chnl	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/s)	
Alignment - (1)	4331.01	50-yr	1754.00	7311.43	7314.07	113.15	113.15	8.01	1.01
Alignment - (1)	4076.71	500-yr	3689.00	7307.48	7312.13	116.04	116.04	9.94	0.87
Alignment - (1)	4076.71	10-yr	768.00	7307.48	7309.42	82.61	82.61	6.17	0.89
Alignment - (1)	4076.71	50-yr	1754.00	7307.48	7310.49	93.63	93.63	8.07	0.91
Alignment - (1)	3774.36	500-yr	3689.00	7304.64	7309.77	110.29	110.29	10.97	0.94
Alignment - (1)	3774.36	10-yr	768.00	7304.64	7307.21	71.95	71.95	5.84	0.76
Alignment - (1)	3774.36	50-yr	1754.00	7304.64	7308.43	86.40	86.40	7.83	0.81
Alignment - (1)	3689.36	500-yr	4290.00	7303.99	7309.24	174.82	174.82	10.26	0.90
Alignment - (1)	3689.36	10-yr	914.00	7303.99	7306.55	82.23	82.23	6.23	0.82
Alignment - (1)	3689.36	50-yr	2044.00	7303.99	7307.55	97.28	97.28	8.63	0.97
Alignment - (1)	3338.18	500-yr	4290.00	7300.28	7306.31	479.11	479.11	8.17	0.66
Alignment - (1)	3338.18	10-yr	914.00	7300.28	7303.10	76.68	76.68	7.33	1.01
Alignment - (1)	3338.18	50-yr	2044.00	7300.28	7304.34	118.57	101.17	9.02	0.95
Alignment - (1)	3071.3	500-yr	4290.00	7296.87	7303.41	262.30	262.30	9.75	0.71
Alignment - (1)	3071.3	10-yr	914.00	7296.87	7299.52	57.60	57.60	7.80	0.96
Alignment - (1)	3071.3	50-yr	2044.00	7296.87	7301.00	69.45	69.45	9.87	0.95
Alignment - (1)	2934.46	500-yr	4290.00	7296.00	7302.49	232.77	232.77	10.05	0.71
Alignment - (1)	2934.46	10-yr	914.00	7296.00	7298.74	60.03	60.03	6.60	0.74
Alignment - (1)	2934.46	50-yr	2044.00	7296.00	7299.78	67.24	67.24	10.27	0.97
Alignment - (1)	2576.35	500-yr	4290.00	7293.68	7298.63	153.47	153.47	10.68	0.92
Alignment - (1)	2576.35	10-yr	914.00	7293.68	7295.92	85.62	85.62	7.03	1.01
Alignment - (1)	2576.35	50-yr	2044.00	7293.68	7297.04	115.63	115.63	8.72	0.95
Alignment - (1)	2373.76	500-yr	4290.00	7291.32	7296.22	101.09	101.09	11.67	0.97
Alignment - (1)	2373.76	10-yr	914.00	7291.32	7293.57	82.61	82.61	6.21	0.80
Alignment - (1)	2373.76	50-yr	2044.00	7291.32	7294.53	88.62	88.62	9.08	0.95
Alignment - (1)	2132.45	500-yr	4290.00	7289.16	7295.69	215.52	215.52	7.41	0.54
Alignment - (1)	2132.45	10-yr	914.00	7289.16	7291.23	82.30	82.30	7.15	1.01
Alignment - (1)	2132.45	50-yr	2044.00	7289.16	7292.37	96.35	96.35	8.90	1.00
Alignment - (1)	1842.45	500-yr	4290.00	7284.08	7295.88	239.24	239.24	4.34	0.24
Alignment - (1)	1842.45	10-yr	914.00	7284.08	7288.46	75.76	75.76	5.39	0.61
Alignment - (1)	1842.45	50-yr	2044.00	7284.08	7289.06	85.51	85.51	9.58	0.97
Alignment - (1)	1634.19	500-yr	4290.00	7284.00	7295.99	464.36	464.36	1.74	0.09
Alignment - (1)	1634.19	10-yr	914.00	7284.00	7286.86	113.76	79.34	7.14	0.99
Alignment - (1)	1634.19	50-yr	2044.00	7284.00	7289.31	295.04	295.04	3.84	0.35
Alignment - (1)	1530.98	500-yr	4290.00	7282.00	7295.99	482.46	482.46	1.47	0.07
Alignment - (1)	1530.98	10-yr	914.00	7282.00	7285.03	130.36	63.07	7.69	0.99
Alignment - (1)	1530.98	50-yr	2044.00	7282.00	7289.33	375.24	375.24	2.64	0.19
Alignment - (1)	1250.13 U/S Lower Bridge	500-yr	4290.00	7280.00	7295.97	594.76	594.76	1.55	0.07
Alignment - (1)	1250.13 U/S Lower Bridge	10-yr	914.00	7280.00	7284.91	168.09	168.09	1.90	0.20
Alignment - (1)	1250.13 U/S Lower Bridge	50-yr	2044.00	7280.00	7289.32	257.88	257.88	1.55	0.10
Alignment - (1)	1240.12 U/S Lower Bridge	500-yr	4290.00	7280.00	7294.33	332.27	33.00	9.12	0.43
Alignment - (1)	1240.12 U/S Lower Bridge	10-yr	914.00	7280.00	7283.94	149.38	33.00	7.17	0.64
Alignment - (1)	1240.12 U/S Lower Bridge	50-yr	2044.00	7280.00	7288.19	237.95	33.00	7.64	0.47
Alignment - (1)	1185		Culvert						

HEC-RAS Plan: McCunePC River: Alignment - (1) Reach: Alignment - (1) (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Top Width	Top Wdth Act	Vel Chnl	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/s)	
Alignment - (1)	1131.75 D/S Lower Bridge	500-yr	4290.00	7280.00	7285.56	182.39	65.00	13.05	0.99
Alignment - (1)	1131.75 D/S Lower Bridge	10-yr	914.00	7280.00	7282.12	114.39	59.82	7.93	1.00
Alignment - (1)	1131.75 D/S Lower Bridge	50-yr	2044.00	7280.00	7283.52	126.96	65.00	10.20	0.98
Alignment - (1)	1105.72 D/S Lower Bridge	500-yr	4290.00	7279.98	7284.14	131.62	125.66	10.80	0.98
Alignment - (1)	1105.72 D/S Lower Bridge	10-yr	914.00	7279.98	7282.11	103.85	103.85	5.03	0.67
Alignment - (1)	1105.72 D/S Lower Bridge	50-yr	2044.00	7279.98	7283.15	113.30	113.30	7.04	0.74
Alignment - (1)	909.01	500-yr	4290.00	7277.98	7282.76	256.31	256.31	9.32	0.82
Alignment - (1)	909.01	10-yr	914.00	7277.98	7280.25	90.27	90.27	6.97	0.99
Alignment - (1)	909.01	50-yr	2044.00	7277.98	7281.37	195.10	118.47	8.74	0.95
Alignment - (1)	679.18	500-yr	4290.00	7275.60	7279.71	275.37	275.37	5.62	0.55
Alignment - (1)	679.18	10-yr	914.00	7275.60	7277.61	232.82	127.85	5.44	0.84
Alignment - (1)	679.18	50-yr	2044.00	7275.60	7278.34	264.98	264.98	4.78	0.61
Alignment - (1)	441.15	500-yr	4290.00	7273.98	7277.51	157.90	157.90	9.99	0.97
Alignment - (1)	441.15	10-yr	914.00	7273.98	7275.50	124.16	124.16	5.63	0.87
Alignment - (1)	441.15	50-yr	2044.00	7273.98	7276.30	144.05	144.05	7.72	0.94

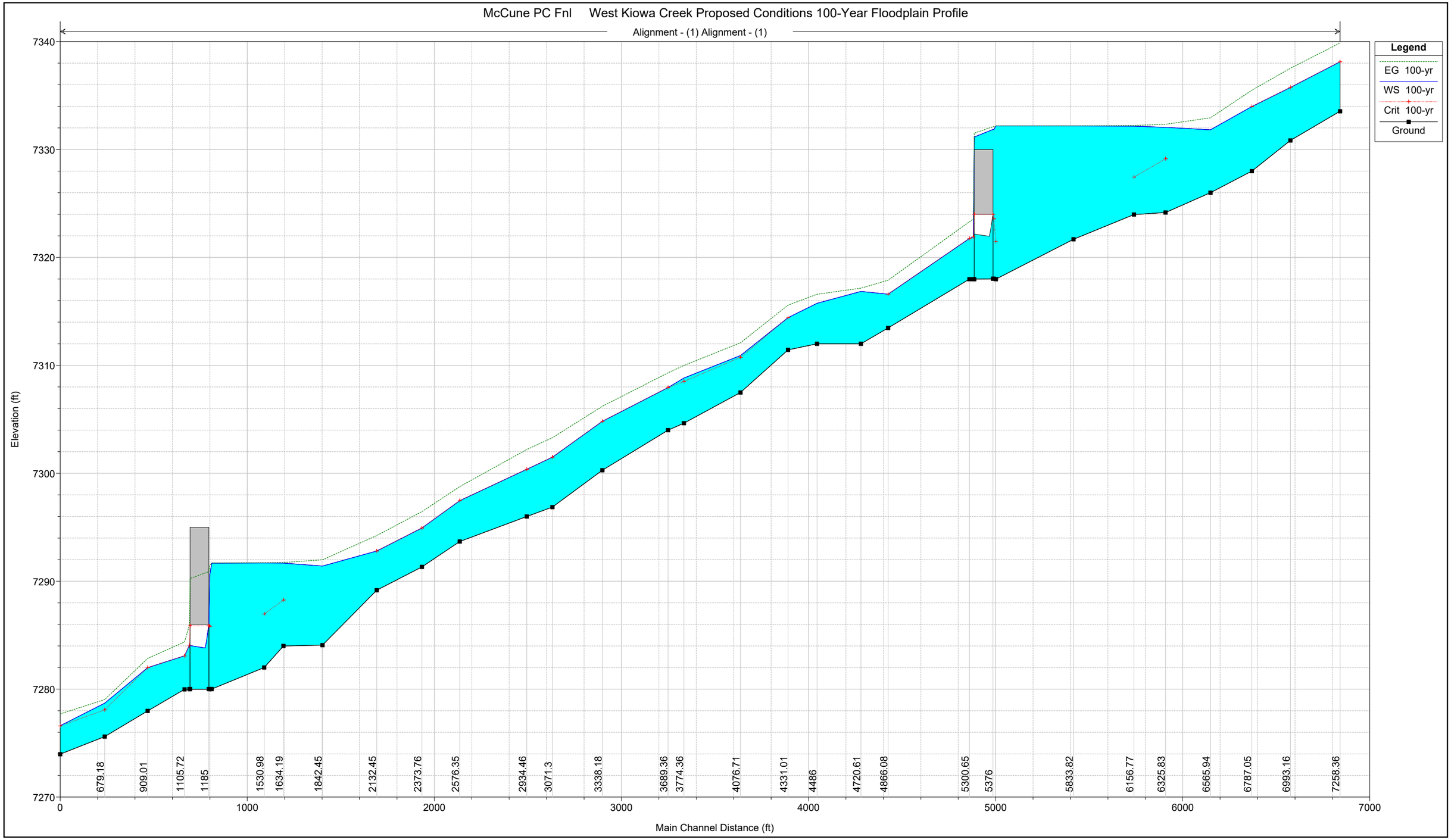
APPENDIX F

EXISTING CONDITIONS 100 YEAR FLOODPLAIN PROFILE


McCune EC Fnl Existing Conditions 100-year Floodplain Profile
Alignment - (1) Alignment - (1)
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Elevation (ft)
7340
7330
7320
7310
7300
7290
7280
7270
0
1000
2000
3000
4000
5000
6000
7000
Main Channel Distance (ft)
679.18
909.01
1105.72
1240.12
1530.98
1634.19
1842.45
2132.45
2373.76
2576.35
2934.46
3071.3
3338.18
3689.36
3774.36
4076.71
4331.01
4486
4720.61
4866.08
5300.65
5431.65
5833.82
6156.77
6325.83
6565.94
6787.05
6993.16
7258.36

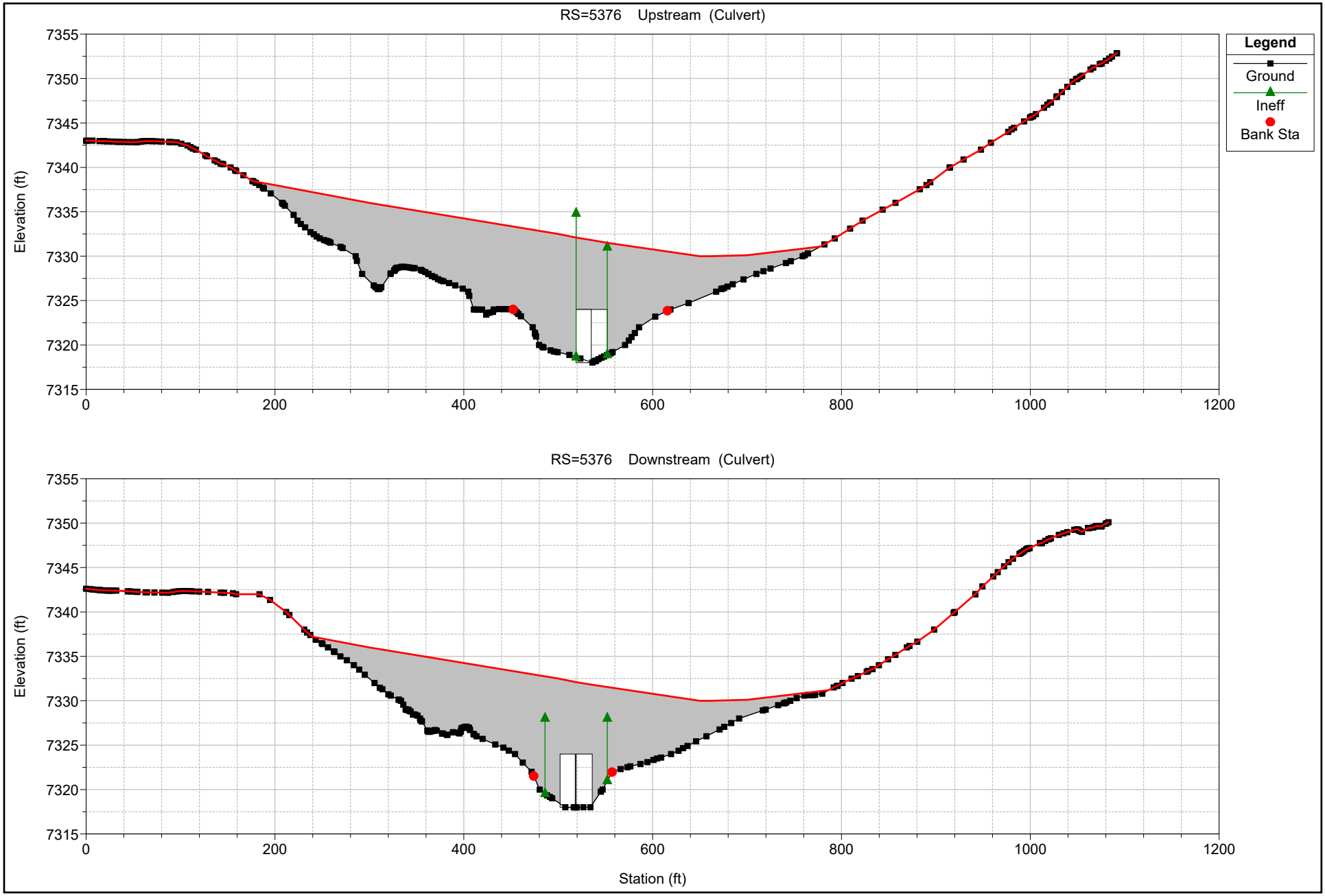
APPENDIX F

PROPOSED CONDITIONS 100 YEAR FLOODPLAIN PROFILE


McCune PC Fnl West Kiowa Creek Proposed Conditions 100-Year Floodplain Profile
Alignment - (1) Alignment - (1)
Legend
EG 100-yr
WS 100-yr
Crit 100-yr
Ground
Elevation (ft)
7340
7330
7320
7310
7300
7290
7280
7270
0
1000
2000
3000
4000
5000
6000
7000
Main Channel Distance (ft)
679.18
909.01
1105.72
1185
1530.98
1634.19
1842.45
2132.45
2373.76
2576.35
2934.46
3071.3
3338.18
3689.36
3774.36
4076.71
4331.01
4486
4720.61
4866.08
5300.65
5376
5833.82
6156.77
6325.83
6565.94
6787.05
6993.16
7258.36

APPENDIX F

PROPOSED UPPER AND LOWER BRIDGES


RS=5376 Upstream (Culvert)
Legend
Ground
Ineff
Bank Sta
Elevation (ft)
7355
7350
7345
7340
7335
7330
7325
7320
7315
0
200
400
600
800
1000
1200
RS=5376 Downstream (Culvert)
Elevation (ft)
Station (ft)

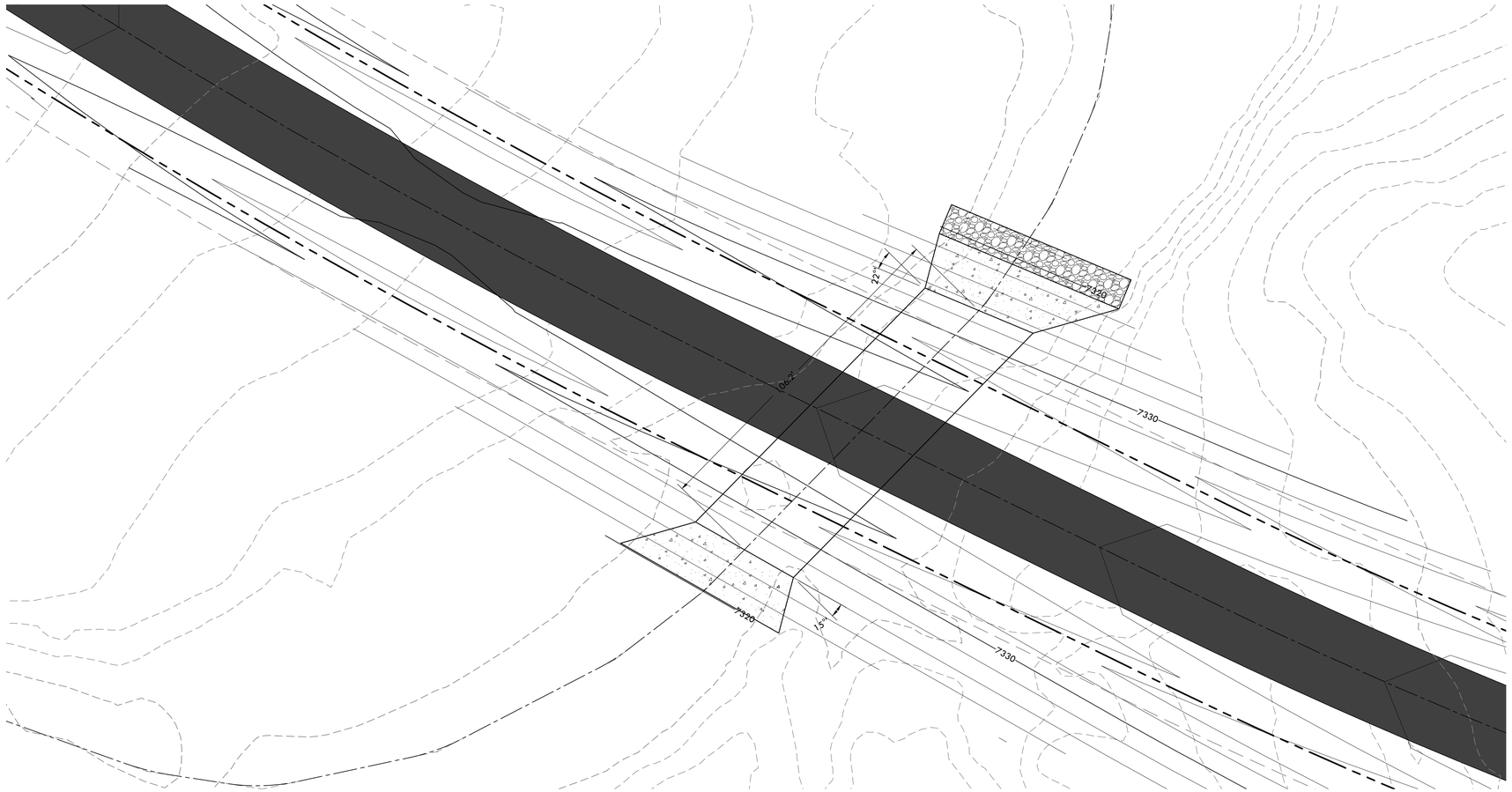
APPENDIX F

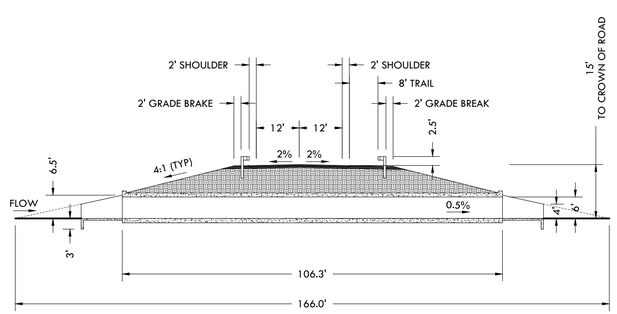
PROPOSED BRIDGE DETAILS

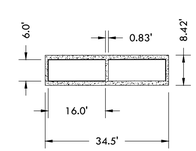
PRELIMINARY PLAN SET

MCCUNE RANCH SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO







0' 20' 40'

VERTEX®

2420 W. 26th Avenue, Suite 100-D | Denver, CO 80211
Main: 303.623.9116 | VERTEXENG.COM

BOX CULVERT 1 (UPSTREAM) DETAIL

SITE: 1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

FOR: PT MCCUNE, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

DATE: 11/12/18
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388

1

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Tuesday, November 27, 2018 1:36:52 PM
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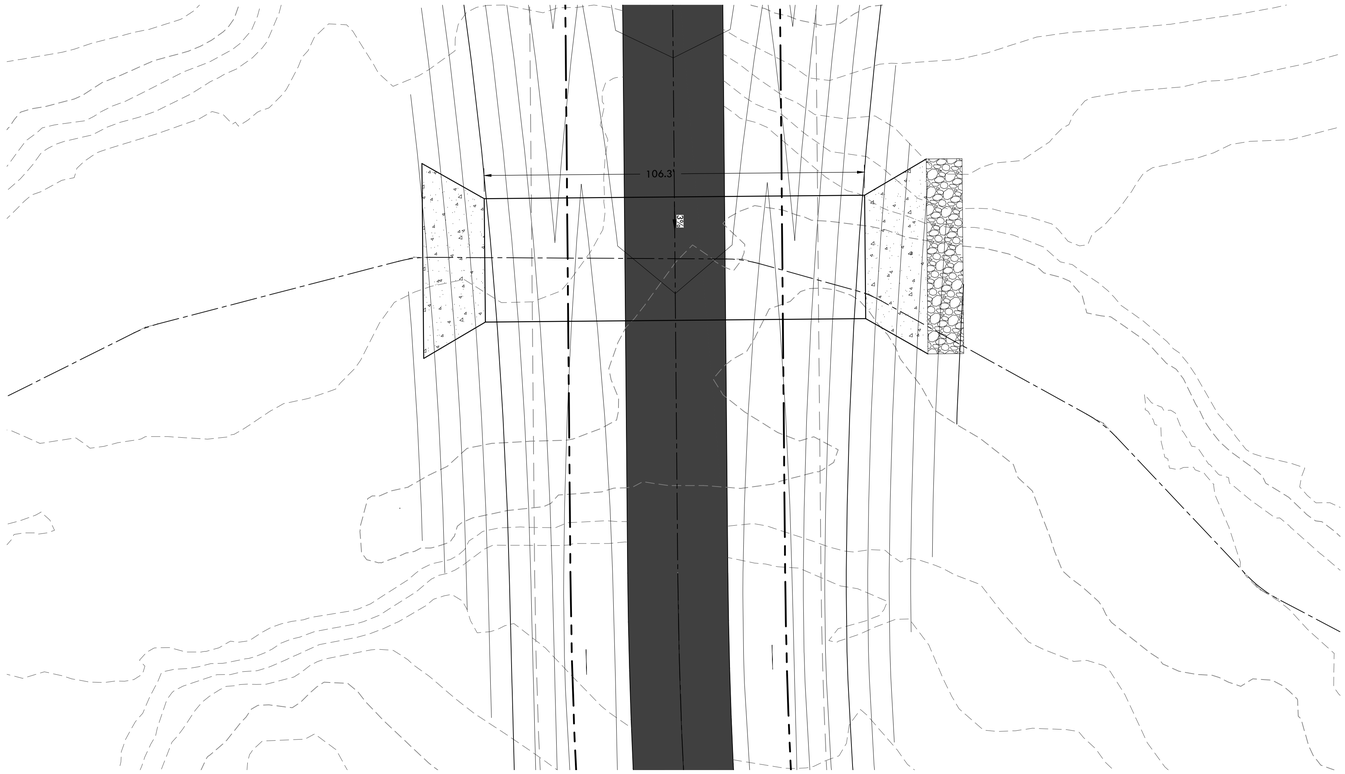
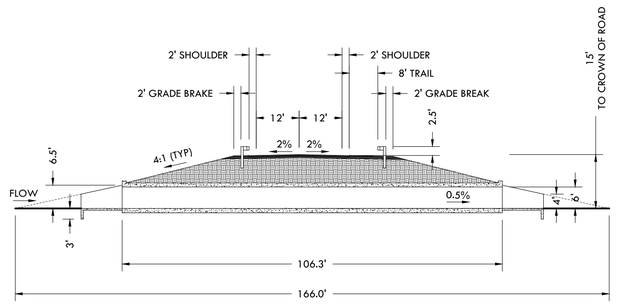
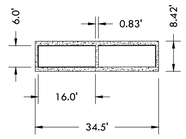
PRELIMINARY PLAN SET

MCCUNE RANCH SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO







0' 20' 40'

VERTEX®
2420 W. 26th Avenue, Suite 100-D | Denver, CO 80211
Main: 303.623.9116 | VERTEXENG.COM

BOX CULVERT 2 (DOWNSTREAM) DETAIL

SITE: 1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

FOR: PT MCCUNE, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

NO.	REVISIONS
1	
2	
3	
4	
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6	
7	
8	
9	
10	

DATE: 11/12/18
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388

2

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Tuesday, November 27, 2018 1:40:27 PM
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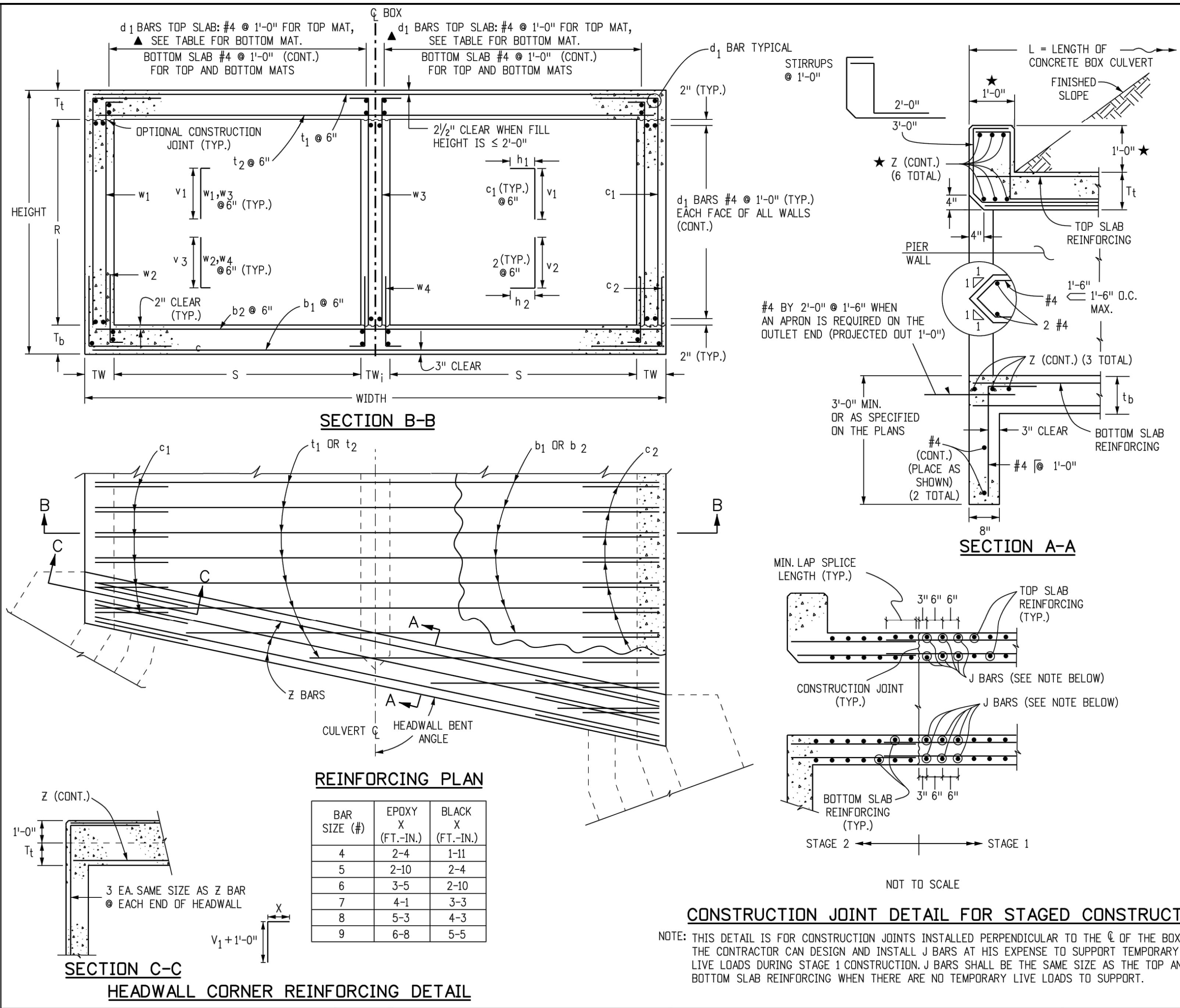
PRELIMINARY PLAN SET

MCCUNE RANCH SUBDIVISION

A PARCEL OF PROPERTY LOCATED IN SECTIONS 13 & 24, TOWNSHIP 11 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AND IN THE WEST HALF
OF THE WEST HALF OF SECTION 19, TOWNSHIP 11 SOUTH, RANGE 64 WEST OF THE 6TH P.M., COUNTY OF EL PASO, STATE OF COLORADO



BAR SIZE (#)	EPOXY X (FT.-IN.)	BLACK X (FT.-IN.)
4	2-4	1-11
5	2-10	2-4
6	3-5	2-10
7	4-1	3-3
8	5-3	4-3
9	6-8	5-5

NOTE: THIS DETAIL IS FOR CONSTRUCTION JOINTS INSTALLED PERPENDICULAR TO THE ℄ OF THE BOX ONLY. THE CONTRACTOR CAN DESIGN AND INSTALL J BARS AT HIS EXPENSE TO SUPPORT TEMPORARY LIVE LOADS DURING STAGE 1 CONSTRUCTION. J BARS SHALL BE THE SAME SIZE AS THE TOP AND BOTTOM SLAB REINFORCING WHEN THERE ARE NO TEMPORARY LIVE LOADS TO SUPPORT.

GENERAL NOTES

1. ALL CONCRETE SHALL BE CLASS D (BOX CULVERT).
2. ALL CONSTRUCTION JOINTS SHALL BE THOROUGHLY CLEANED BEFORE FRESH CONCRETE IS PLACED.
3. ALL CONSTRUCTION JOINTS NOT SHOWN ON THE PLANS SHALL BE CONSTRUCTED ONLY IF APPROVED BY THE ENGINEER.
4. THE CONTRACTOR SHALL MAINTAIN THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION.
5. STRUCTURE EXCAVATION AND BACKFILL SHALL BE IN ACCORDANCE WITH STANDARD PLAN M-206-1.
6. FOR ANY CULVERT SPAN 20 FT. OR GREATER, A FOUNDATION INVESTIGATION AND REPORT ARE REQUIRED.
7. BACKFILL SHALL NOT BEGIN UNTIL TOP SLAB HAS REACHED DESIGN STRENGTH, f'_c.
8. SPLICE QUANTITIES FOR LONGITUDINAL AND TRANSVERSE BARS ARE NOT INCLUDED.
9. REINFORCING STEEL SHALL BE GRADE 60.
10. THE MINIMUM LAP SPLICE LENGTH FOR EPOXY COATED REINFORCING BARS SHALL BE:

BAR SIZE:	#4	#5	#6	#7	#8	#9	#10	#11
SPLICE LENGTH:	1'-3"	1'-7"	2'-5"	2'-10"	3'-8"	4'-8"	5'-11"	7'-3"

THE MINIMUM LAP SPLICE LENGTH FOR BLACK REINFORCING BARS SHALL BE:

BAR SIZE:	#4	#5	#6	#7	#8	#9	#10	#11
SPLICE LENGTH:	1'-1"	1'-4"	1'-7"	1'-11"	2'-6"	3'-1"	3'-11"	4'-10"

THE ABOVE SPLICE LENGTHS ARE FOR CLASS B SPLICES.

11. ALL DIMENSIONS ARE PERPENDICULAR TO THE CENTERLINE OF THE BOX.
12. WINGWALLS SHALL BE TIED TO CONCRETE BOX CULVERT IN ACCORDANCE WITH STANDARD PLAN M-601-20.
13. ALL TRANSVERSE REINFORCING SHALL BE NORMAL TO THE CENTERLINE OF THE BOX.
14. THE FILL HEIGHT IS THE DISTANCE MEASURED FROM THE TOP OF THE TOP SLAB TO THE TOP OF PAVEMENT.
15. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾".
16. FOR FILL HEIGHTS LESS THAN 2 FT, A WATERPROOFING MEMBRANE SHALL BE PROVIDED FOR THE TOP OF THE TOP SLAB AND 18" DOWN ALONG THE TOPS OF THE EXTERIOR WALLS.

▲ 17. FOR FILL HIEGHTS LESS THAN 2 FT, THE d_1 BARS FOR THE BOTTOM MAT OF THE TOP SLAB SHALL BE AS FOLLOWS:

S	6, 8	10, 12, 16	14, 18	20
BAR SIZE:	#4	#5	#6	#7
SPACING	0'-6"	1'-0"	1'-2"	1'-2"

DESIGN DATA: 7TH EDITION, 2014, OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS
RATING DATA: 2ND EDITION, 2011, OF THE AASHTO MANUAL FOR BRIDGE EVALUATION

LOADING DATA: $f_y = 60{,}000$ psi., $f'_c = 4{,}500$ psi.,

LIVE LOAD = AASHTO LRFD, HL-93 TRUCK, HL-93 TANDEM, COLORADO PERMIT TRUCK AND NRL

DEAD LOAD CASE 1: VERTICAL EARTH LOAD = 120 LBS./CU. FT.
HORIZONTAL EARTH LOAD = 30 LBS./CU.FT.

DEAD LOAD CASE 2: VERTICAL EARTH LOAD = 120 LBS./CU. FT.
HORIZONTAL EARTH LOAD = 60 LBS./CU. FT.

WEARING SURFACE - 12 IN. THICK CONCRETE PAVEMENT.
DEAD LOAD - TYPE 7 BARRIER.
THRUST IS NOT CONSIDERED IN THIS STANDARD, I.E. THRUST = 0.
EXTREME HEADWATER TO DEPTH RATIO IS IN ACCORDANCE WITH THE CDOT DRAINAGE MANUAL.
EXTREME HEADWATER TO DEPTH RATIO WAS INCLUDED IN THE CULVERT DESIGNS BUT EXCLUDED FROM THE RATINGS AS PER THE AASHTO MANUAL FOR BRIDGE EVALUATION.
LIVE LOAD SURCHARGE ON EXTERIOR WALLS = 2 FT. OF EARTH

★ IF HEADWALL MOUNT GUARDRAIL IS USED (SEE STANDARD PLAN M-606-1, SHEET 19) AND THE NOTES BELOW:
- ALL REINFORCING STEEL SHALL BE ACCORDING TO THIS BOX CULVERT PLAN.
- ANY SPECIAL DESIGN FOR STIRRUPS WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
- HEADWALL DIMENSION AND CONCRETE QUANTITY SHALL BE ACCORDING TO STANDARD PLAN M-606-1, SHEET 19.
- POST ANCHORS SHALL BE PROVIDED ACCORDING TO STANDARD PLAN M-606-1, SHEET 19.
- POST ANCHORS AND CONCRETE FOR HEADWALL MOUNT OF GUARDRAIL WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE WORK.
- POST ANCHORS WHEN REQUIRED AND ENCASED IN HEADWALL CONCRETE, SHALL CONFORM TO ASTM A 36 OR AASHTO M 169 STEEL.

Computer File Information
Creation Date: 07/04/12 Initials: DD
Last Modification Date: 11/25/15 Initials: JBE
Full Path: www.codot.gov/business/designsupport
Drawing File Name: 601020102.dgn
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English

	Sheet Revisions	
	Date:	Comments
(R-1)	08/27/13	LRFD Design
(R-2)	08/01/15	Analysis Program Updates

Colorado Department of Transportation
4201 East Arkansas Avenue
CDOT HQ, 4th Floor
Denver, CO 80222
Phone: 303-757-9021 FAX: 303-757-9868
Division of Project Support DDG/Bridge

DOUBLE CONCRETE BOX CULVERT
Issued By: Project Development Branch July 4, 2012
STANDARD PLAN NO. M-601-2
Sheet No. 1 of 2

DOUBLE CONCRETE BOX CULVERT DIMENSIONS, QUANTITIES & RATING FACTORS (EXCLUDING HEADWALL & TOEWALL QUANTITIES)

BOX SIZE				FILL HEIGHT ALLOWED	SLAB & WALL THICKNESS (INHES)			BAR SIZES									DIMENSIONS					QUANTITIES			RATING FACTORS			
S	R	HT.	WIDTH					t_1*	t_2	b_1	b_2	w_1* & w_2	w_3* & w_4	c_1*	c_2	d_1▲	h_1	h_2	v_1	v_2	v_3	CONCRETE	REBAR STL	MEMBRANE	HL-93 INVENTORY	HL-93 OPERATING	COLORADO PERMIT	NRL VEHICLE
FT	FT	FT-IN	FT-IN	FT-FT	T_t	T_b	TW & TW_i	#	#	#	#	#	#	#	#	NO.	FT-IN	FT-IN	FT-IN	FT-IN	FT-IN	CY/LF	LBS/LF	CY/LF				
6	6	7-9	14-6	< 2	11	10	10	5	6	5	6	4	4	5	5	114	3-5	2-4	6-8	3-1	1-11	1.495	338	1.944	1.27	1.65	2.09	2.05
		7-7.5	14-6	2 TO 10	10	9.5	10	5	5	5	5	4	4	5	5	102	2-6	2-4	6-8	3-1	1-11	1.428	300		1.81	2.35	2.90	2.82
		7-7.5	14-6	10 TO 12.8	10	9.5	10	4	4	4	4	4	4	5	5	102	2-6	2-4	6-8	3-1	1-11	1.428	258		4.53	5.88	6.42	7.36
		7-8	14-6	12.8 TO 20	10	10	10	4	4	4	4	4	4	5	5	102	2-6	2-4	6-8	3-1	1-11	1.451	258		◆	◆	◆	◆
	8	9-9	14-6	< 2	11	10	10	5	6	5	6	4	4	5	5	126	3-5	2-4	8-8	3-1	1-11	1.681	365	1.944	1.28	1.66	2.10	2.05
		9-7.5	14-6	2 TO 10	10	9.5	10	5	5	5	5	4	4	5	5	114	2-6	2-4	8-8	3-1	1-11	1.613	327		1.82	2.36	2.85	2.77
		9-7.5	14-6	10 TO 12.8	10	9.5	10	4	4	4	4	4	4	5	5	114	2-6	2-4	8-8	3-1	1-11	1.613	285		4.66	6.04	6.82	5.08
		9-8	14-6	12.8 TO 20	10	10	10	4	5	5	5	4	4	5	5	114	2-6	2-4	8-8	3-1	1-11	1.636	317		◆	◆	◆	◆
	10	11-9	14-6	< 2	11	10	10	5	6	5	6	4	4	5	5	138	3-5	2-4	10-8	3-1	1-11	1.866	392	1.944	1.28	1.67	1.00	2.06
		11-7.5	14-6	2 TO 10	10	9.5	10	5	5	5	5	4	4	5	5	126	2-6	2-4	10-8	3-1	1-11	1.799	354		1.83	2.38	1.00	2.78
		11-7.5	14-6	10 TO 12.8	10	9.5	10	4	4	4	4	4	4	5	5	126	2-6	2-4	10-8	3-1	1-11	1.799	312		2.22	2.88	2.79	1.96
		11-8.5	14-10.5	12.8 TO 20	10	10.5	11.5	4	5	4	5	4	4	5	5	126	2-6	2-4	10-8	3-2	2-0	2.006	336		◆	◆	◆	◆
8	6	7-10.5	18-6	< 2	12.5	10	10	5	6	5	6	4	4	5	5	134	3-5	2-4	6-10	3-1	1-11	1.840	394	2.389	1.20	1.56	1.76	1.65
		7-8	18-6	2 TO 10	10	10	10	5	5	5	5	4	4	5	5	118	2-6	2-4	6-8	3-1	1-11	1.698	344		1.47	1.90	2.19	2.15
		7-10	18-6	10 TO 15	10	12	10	5	4	5	5	4	4	5	5	118	2-6	2-4	6-8	3-3	2-1	1.812	332		2.89	3.74	4.00	4.38
		7-11	18-9	15 TO 16.8	10.5	12.5	11	5	4	5	5	4	4	5	5	118	2-6	2-5	6-8	3-4	2-2	1.942	335		3.37	4.37	4.60	4.86
		7-11	18-9	16.8 TO 20	10.5	12.5	11	5	4	5	5	4	4	5	5	118	2-6	2-4	6-8	3-4	2-2	1.942	335		◆	◆	◆	◆
	8	9-10.5	18-6	< 2	12.5	10	10	5	6	5	6	4	4	5	5	146	3-5	2-4	8-10	3-1	1-11	2.025	421	2.389	1.21	1.57	1.71	1.61
		9-8	18-6	2 TO 10	10	10	10	5	5	5	5	4	4	5	5	130	2-6	2-4	8-8	3-1	1-11	1.883	371		1.46	1.89	2.18	2.13
		9-10	18-6	10 TO 15	10	12	10	5	4	5	5	4	4	5	5	130	2-6	2-4	8-8	3-3	2-1	1.997	359		2.96	3.83	4.10	4.37
		9-11	18-9	15 TO 16.8	10.5	12.5	11	5	4	5	5	4	4	5	5	130	2-6	2-5	8-8	3-4	2-2	2.146	362		3.44	4.46	4.70	4.96
		9-11	18-9	16.8 TO 20	10.5	12.5	11	5	4	5	5	4	4	5	5	130	2-6	2-5	8-8	3-4	2-2	2.146	362		◆	◆	◆	◆
10	6	8-0.5	22-6	< 2	13.5	11	10	5	6	5	6	4	4	5	5	134	3-5	2-4	6-11	3-2	2-0	2.257	444	2.833	1.15	1.49	1.65	1.49
		8-1.5	22-6	2 TO 5	13	12.5	10	5	6	5	6	4	4	5	5	134	2-6	2-4	6-11	3-4	2-2	2.326	434		1.52	1.98	1.82	1.84
		8-2	22-6	5 TO 10	13	13	10	5	4	6	6	4	4	5	5	134	2-6	2-4	6-11	3-5	2-2	2.361	417		1.77	2.29	2.65	3.77
		8-2.5	22-9	10 TO 15	13	13.5	11	6	5	6	6	5	5	5	5	134	2-6	2-5	6-11	3-5	2-7	2.472	495		3.57	4.63	4.62	5.05
		8-5.5	23-0	15 TO 20	14	15.5	12	6	5	6	6	5	5	5	5	134	2-6	2-6	7-0	3-7	2-9	2.761	501		3.36	4.36	4.38	4.52
	8	10-1	22-6	< 2	14	11	10	5	6	5	6	4	4	5	5	146	3-5	2-5	8-11	3-2	2-0	2.477	472	2.833	1.22	1.58	1.60	1.44
		10-1.5	22-6	2 TO 5	13	12.5	10	5	6	5	6	4	4	5	5	146	2-6	2-4	8-11	3-4	2-2	2.512	461		1.52	1.97	1.79	1.79
		10-3	22-6	5 TO 10	13	14	10	5	4	5	6	4	4	5	5	146	2-6	2-4	8-11	3-5	2-3	2.616	425		1.74	2.25	2.61	3.53
		10-3	22-9	10 TO 15	13	14	11	6	5	6	5	5	5	5	5	146	2-6	2-5	8-11	3-5	2-7	2.711	508		3.95	5.12	5.26	5.69
		10-5.5	23-0	15 TO 20	14	15.5	12	6	5	6	6	6	6	5	5	146	2-6	2-6	9-0	3-7	2-9	2.983	588		3.46	4.48	4.51	4.64
	10	12-2	22-6	< 2	14	12	10	5	6	5	6	4	4	5	5	158	3-5	2-5	10-11	3-3	2-1	2.731	499	2.833	1.24	1.60	1.79	1.61
		12-2	22-6	2 TO 5	13	13	10	5	6	5	6	4	4	5	5	158	2-6	2-4	10-11	3-4	2-2	2.731	488		1.64	2.12	1.89	1.88
		12-3	22-6	5 TO 10	13	14	10	5	4	5	6	4	4	5	5	158	2-6	2-4	10-11	3-5	2-3	2.801	452		1.72	2.23	2.58	2.74
		12-5.5	22-9	10 TO 15	14	15.5	11	5	6	6	4	5	5	5	5	158	2-6	2-5	11-0	3-7	2-9	3.090	527		2.42	3.14	3.18	2.25
		12-5.5	23-0	15 TO 20	14	15.5	12	6	5	6	6	5	5	5	5	158	2-6	2-5	11-0	3-7	2-9	3.205	567		2.11	2.73	2.64	1.86
12	6	8-3.5	26-6	< 2	14.5	13	10	5	6	5	6	4	4	5	5	150	3-5	2-5	7-0	3-4	2-2	2.805	500	3.278	1.16	1.51	1.51	1.59
		8-5	26-6	2 TO 5	14	15	10	5	6	6	6	4	4	5	5	150	2-6	2-4	7-0	3-6	2-4	2.927	512		1.22	1.59	1.43	1.54
		8-5.5	26-6	5 TO 10	14	15.5	10	6	5	6	6	4	4	5	5	150	2-6	2-4	7-0	3-6	2-5	2.968	488		2.10	2.72	3.13	3.89
		8-6.5	26-9	10 TO 15	15	15.5	11	6	6	7	6	5	5	5	5	150	3-3	2-5	7-1	3-7	2-9	3.129	610		1.86	2.42	2.36	2.53
	8	10-4	26-6	< 2	14.5	13.5	10	5	6	5	6	4	4	5	5	162	3-5	2-5	9-0	3-5	2-3	3.031	528	3.278	1.16	1.51	1.56	1.59
		10-5.5	26-6	2 TO 5	14	15.5	10	5	6	5	6	4	4	5	5	162	2-6	2-4	9-0	3-7	2-5	3.154	515		1.22	1.58	1.43	1.51
		10-7.5	26-6	5 TO 10	16	15.5	10	5	6	6	6	4	4	5	5	162	3-3	2-4	9-2	3-7	2-5	3.317	544		1.70	2.21	2.16	2.39
		10-7.5	26-9	10 TO 15	16	15.5	11	6	6	7	6	5	5	5	5	162	3-3	2-5	9-2	3-7	2-9	3.416	644		2.83	3.67	3.54	3.80
	10	12-5	26-6	< 2	15	14	10	5	6	5	6	4	4	5	5	174	3-9	2-5	11-0	3-5	2-3	3.298	556	3.278	1.23	1.60	1.66	1.69
		12-5.5	26-6	2 TO 5	14	15.5	10	5	6	5	6	4	4	5	5	174	2-6	2-5	11-0	3-7	2-5	3.339	543		1.22	1.58	1.43	1.52
		12-7.5	26-6	5 TO 10	16	15.5	10	5	6	6	6	4	4	5	5	174	3-3	2-4	11-2	3-7	2-5	3.502	571		1.82	2.36	2.31	2.56
		12-7.5	26-9	10 TO 15	16	15.5	11	6	6	7	6	5	5	5	5	174	3-3	2-5	11-2	3-7	2-9	3.619	678		2.33	3.02	2.92	2.08
14	6	8-5.5	30-6	< 2	15.5	14	10	6	7	6	7	5	5	6	6	166	4-4	2-9	7-1	3-9	2-7	3.333	766	3.722	1.15	1.49	1.54	1.53
		8-4.5	30-6	2 TO 5	14	14.5	10	6	7	6	7	5	5	6	6	166	2-10	2-8	7-0	3-10	2-8	3.238	731		1.28	1.66	1.41	1.50
		8-6.5	30-6	5 TO 10	15.5	15	10	6	7	7	7	5	5	6	6	166	3-8	2-8	7-1	3-10	2-8	3.427	770		1.37	1.78	1.65	1.83
		8-8	30-6	10 TO 12	16	16	10	7	6	7	7	5	5	6	6	166	3-8	2-9	7-2	3-11	2-9	3.568	773		2.27	2.95	2.50	2.66
	8	10-5.5	30-6	< 2	15.5	14	10	6	7	6	7	5	5	6	6	178	4-4	2-9	9-1	3-9	2-7	3.518	803	3.722	1.15	1.49	1.49	1.50
		10-4.5	30-6	2 TO 5	14	14.5	10	6	7	6	7	5	5	6	6	178	2-10	2-8	9-0	3-10	2-8	3.424	768		1.26	1.64	1.38	1.46
		10-6.5	30-6	5 TO 10	15.5	15	10	6	7	7	7	5	5	6	6	178	3-8	2-8	9-1	3-10	2-8	3.612	807		1.37	1.77	1.65	1.83
		10-8.5	30-6	10 TO 12	16	16.5	10	7	5	7	7	5	5	6	6	178	3-8	2-8	9-2	4-0	2-10	3.800	783		1.46	1.90	2.09	2.27
	10	12-5.5	30-6	< 2	15.5	14	10	6	7	6	7	5	5	6	6	190	4-4	2-9	11-1	3-9	2-7	3.703	839	3.722	1.15	1.50	1.46	1.48
		12-5	30-9	2 TO 5	14	15	11	6	7	6	7	5	5	6	6	190	2-10	2-9	11-0	3-10	2-8	3.771	809		1.30	1.69	1.42	1.57
		12-6.5	30-6	5 TO 7	15.5	15	10	6	5	7	7	5	5	6	6	190	3-8	2-8	11-1	3-10	2-8	3.797	783		1.49	1.93	2.18	2.78
		12-8.5	30-6	7 TO 12	16	16.5	10	7	5	7	7	5	5	6	6	190	3-8	2-8	11-2	4-0	2-10	3.985	820		1.47	1.91	2.11	2.02
16	6	8-6.5	34-9	< 2	16	14.5	11	6	7	6	7	5	5	6	6	182	4-4	2-9	7-1	3-9	2-8	3.882	825	4.194	1.12	1.46	1.44	1.44
		8-5	34-6	2 TO 5	14	15	10	7	6	6	7	5	5	6	6	182	2-10	2-8	7-0	3-10	2-8	3.644	799		1.00	1.29	1.09	1.02
		8-6	34-6	5 TO 7	14	16	10	7	6	7	6	5	5	6	6	182	2-10	2-8	7-0	3-11	2-9	3.750	800		1.66	2.16	1.94	2.21
		8-7.5	34-9	7 TO 10	15.5	16	11	7	6	8	6	5	5	6	6	182	3-8	2-9	7-1	3-11	2-9	3.990	853		1.64	2.13	1.89	2.06
	8	10-7.5	34-9	< 2	16.5	15	11	6	7	6	7	5	5	6	6	194	4-4	2-9	9-2	3-10	2-8	4.193	864	4.194	1.18	1.54	1.45	1.46
		10-6	34-6	2 TO 5	15	15	10	8	6	7	6	5	5	6	6	194	2-10	2-8	9-1	3-10	2-8	3.935	880		1.02	1.32	1.42	1.36
		10-7	34-6	5 TO 7	15	16	10	8	6	7	6	5	5	6	6	194	2-10	2-8	9-1	3-11	2-9	4.042	881		1.72	2.23	2.23	2.13
		10-8	34-9	7 TO 10	15.5	16.5	11	7	6	8	6	5	5	6	6	194	3-8	2-9	9-1	4-0	2-10	4.247	891		1.60	2.07	1.84	2.00
	10	12-7.5	34-9	< 2	16.5	15	11	6	7	6	7	5	5	6	6	206	4-4	2-9	11-2	3-10	2-8	4.397	901	4.194	1.19	1.54	1.41	1.42
		12-6.5	34-6	2 TO 5	15.5	15	10	8	6	7	6	5	5	6	6	206	2-10	2-8	11-1	3-10	2-8	4.174	916		1.02	1.33	1.43	1.37
		12-7.5	34-6	5 TO 7	15.5	16	10	8	6	7	6	5	5	6	6	206	2-10	2-8	11-1	3-11	2-9	4.280	918		1.74	2.26	2.23	2.12
18	6	8-8	38-9	< 2	17	15	11	7	8	7	8	5	5	6	6	198	4-4	2-10	7-2	3-10	2-9	4.438	1094	4.639	1.14	1.47	1.27	1.32
		8-6.5	38-9	2 TO 5	15	15.5	11	8	8	8	8	5	5	6	6	198	3-8	2-9	7-1	3-11	2-9	4.259	1153		1.32	1.71	1.73	1.65
		8-7.5	38-9	5 TO 7	15.5	16	11	8	8	8	8	5	5	6	6	198	3-8	2-9	7-1	3-11	2-9	4.378	1153		2.23	2.89	2.57	2.58
	8	10-9	38-9	< 2	17.5	15.5	11	7	8	7	8	5	5	6	6	210	4-4	2-9	9-3	3-10	2-9	4.762	1132	4.639	1.19	1.55	1.28	1.33
		10-7	38-9	2 TO 5	15	16	11	8	9	8	9	5	5	6	6	210	3-8	2-9	9-1	3-11	2-9	4.522	1302		1.47	1.90	1.80	1.83
		10-7	38-9	5 TO 7	15	16	11	8	9	8	9	5	5	6	6	210	3-8	2-9	9-1	3-11	2-9	4.522	1302		2.20	2.85	2.45	2.46
	10	12-9	38-9	< 2	17.5	15.5	11	7	8	7	8	5	5	6	6	222	4-4	2-9	11-3	3-10	2-9	4.965	1168	4.639	1.16	1.51	1.24	1.29
		12-7	38-9	2 TO 5	15	16	11	8	9	8	9	6	6	6	6	222	3-8	2-9	11-1	3-11	3-1	4.726	1404		1.53	1.98	1.78	1.88
		12-7	38-9	5 TO 7	15	16	11	8	9	8	9	6	6	6	6	222	3-8	2-9	11-1	3-11	3-1	4.726	1404		2.20	2.85	2.39	2.39
20	6	8-10	43-0	< 2	18	16	12	8	9	8	9	6	6	7	7	214	5-0	3-3	7-3	4-3	3-1	5.179	1546	5.111	1.16	1.51	1.22	1.31
		8-7.5	43-0	2 TO 5	15.5	16	12	8	9	8	9	6	6	7	7	214	4-3	3-3	7-1	4-4	3-1	4.847	1480		1.48	1.91	1.51	1.70
	8	10-10	43-0	< 2	18	16	12	8	9	8	9	6	6	7	7	226	5-0	3-3	9-3	4-4	3-1	5.401	1595	5.111	1.14	1.48	1.16	1.24
		10-7.5	43-0	2 TO 5	15.5	16	12	8	9	8	9	6	6	7	7	226	4-3	3-3	9-1	4-4	3-1	5.069	1528		1.52	1.97	1.46	1.68
	10	12-10.5	43-0	< 2	18	16.5	12	8	9	8	9	6	6	7	7	238	5-0	3-3	11-3	4-4	3-2	5.690	1645	5.111	1.16	1.50	1.20	1.28
		12-7.5	43-0	2 TO 5	15.5	16	12	8	9	8	9	6	6	7	7	238	5-4	3-3	11-1	4-4	3-1	5.292	1585		1.52	1.97	1.43	1.64

HEADWALL AND TOEWALL QUANTITIES

HEADWALL BENT ANGLE	90° TO 75°			74° TO 60°			59° TO 45°		
CLEAR SPAN (S)	Z	STIRRUPS	REBAR QUANT.	Z	STIRRUPS	REBAR QUANT.	Z	STIRRUPS	REBAR QUANT.
	#	#	LBS/LF	#	#	LBS/LF	#	#	LBS/LF
6	4	4	20.8	4	4	20.4	6	4	31.2
8	4	4	19.9	5	4	24.3	7	4	36.2
10	5	4	25.0	6	4	30.6	9	4■	57.8
12	6	4	30.0	6	4	29.6	9	5■	61.3
14	6	4	29.7	7	4	35.7	★	★	★
16	6	4	29.0	8	5	46.7	★	★	★
18	7	4	35.0	9	5	54.9	★	★	★
20	7	4	34.4	★	★	★	★	★	★
CONCRETE QUANTITY = 0.086 CY/LF									

NOTES

■ 1. SIX INCH SPACING AT EACH END OF THE SPAN FOR A DISTANCE OF 1/4 OF THE SPAN LENGTH; 12 INCH SPACING ELSEWHERE.

2. QUANTITIES ARE GIVEN FOR ONE HEADWALL AND ONE TOEWALL AND ARE BASED ON PER LINEAR FOOT OF HEADWALL. STEEL QUANTITIES INCLUDE ALL REINFORCING. QUANTITIES SHALL BE PAID FOR AS SHOWN ON THE PLANS.

★ 3. SKEWED HEADWALLS ARE NOT RECOMMENDED FOR THESE SPANS. A SPECIAL DESIGN IS REQUIRED.

4. FOR HEADWALL AND TOEWALL DETAILS SEE M-601-2, SHEET 1 OF 2.

5. WHEN THE FILL HEIGHTS ARE LESS THAN OR EQUAL TO 2 FT, ALL REINFORCING BARS IN THE HEADWALL, ALL REINFORCING BARS DESIGNATED BY AN ASTERISK (*), AND THE d_1 BARS IN THE TOP MAT OF THE TOP SLAB SHALL BE EPOXY COATED.

6. REINFORCING QUANTITIES INCLUDE BOTH EPOXY-COATED AND UNCOATED BARS.

7. WHEN A (RISE) R OF LESS THAN 6 FT IS REQUIRED, USE THE BAR SIZES AND THE SLAB AND WALL THICKNESSES FOR THE 6 FT RISE (IF AVAILABLE ON THE TABLE).

▲ 8. FOR SIZE AND SPACING OF THE BOTTOM MAT BARS IN THE TOP SLAB SEE TABLE ON M-601-2, SHEET 1 OF 2. ALL OTHER d_1 BARS ARE #4's AT 1'-0" SPACING. THE NUMBER OF BARS REQUIRED IS LISTED ON THIS SHEET AND INCLUDES BOTH #4 BARS AND THOSE FROM THE TABLE.

◆ 9. LIVE LOAD IS NEGLECTED AS PER AASHTO LRFD SECTION 3.6.1.2.6. FOR THESE STRUCTURES REFER TO THE CDOT RATING MANUAL.

10. FOR ALL NEW CULVERT DESIGNS, A RATING IS REQUIRED. THE RATING SUMMARY SHEET SHOULD BE PRINTED FROM THE CDOT EXTERNAL WEBSITE AND SUBMITTED TO THE BRIDGE RATING UNIT OR INCLUDED AS PART OF A LARGER DESIGN PACKAGE. FOR ADDITIONAL INFORMATION, SEE THE CDOT RATING MANUAL.

Computer File Information
Creation Date: 07/04/12 Initials: JBE
Last Modification Date: 11/25/15 Initials: JBE
Full Path: www.codot.gov/business/designsupport
Drawing File Name: 601020202.dgn
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English

	Sheet Revisions	
	Date:	Comments
(R-1)	08/27/13	LRFD Design
(R-2)	08/01/15	Analysis Program Updates

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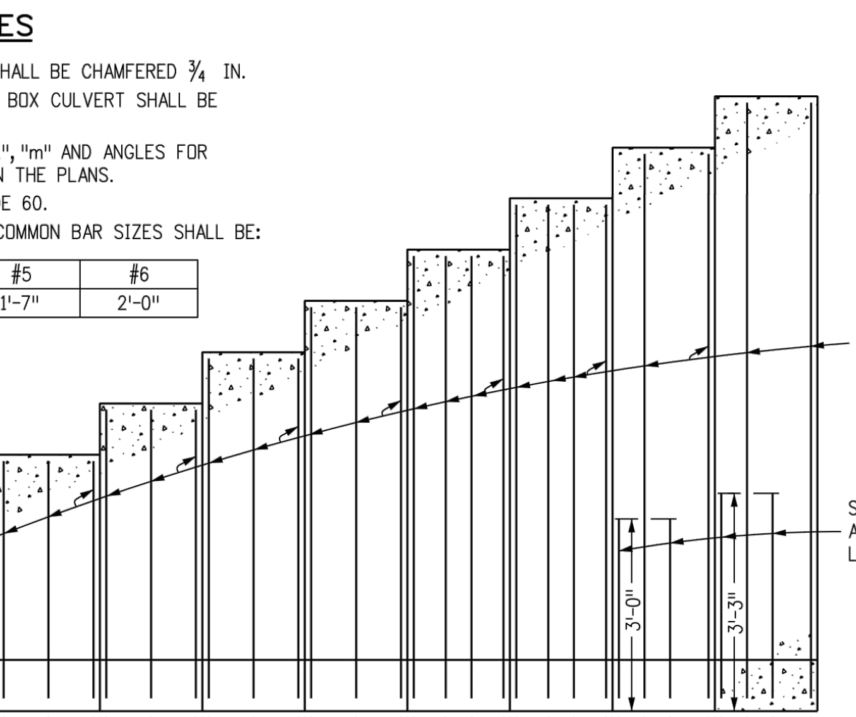
Division of Project Support DDG/Bridge

DOUBLE CONCRETE BOX CULVERT
Issued By: Project Development Branch July 4, 2012
STANDARD PLAN NO. M-601-2
Sheet No. 2 of 2

GENERAL NOTES

1. ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED ¾ IN.
2. WINGWALL FOOTINGS AND FLOOR OF BOX CULVERT SHALL BE PLACED MONOLITHICALLY.
3. DIMENSIONS "h", "Ba", "RISE", "k", "L", "m" AND ANGLES FOR WINGWALLS SHALL BE AS SHOWN ON THE PLANS.
4. REINFORCING STEEL SHALL BE GRADE 60.
5. THE MINIMUM SPLICE LENGTH FOR COMMON BAR SIZES SHALL BE:

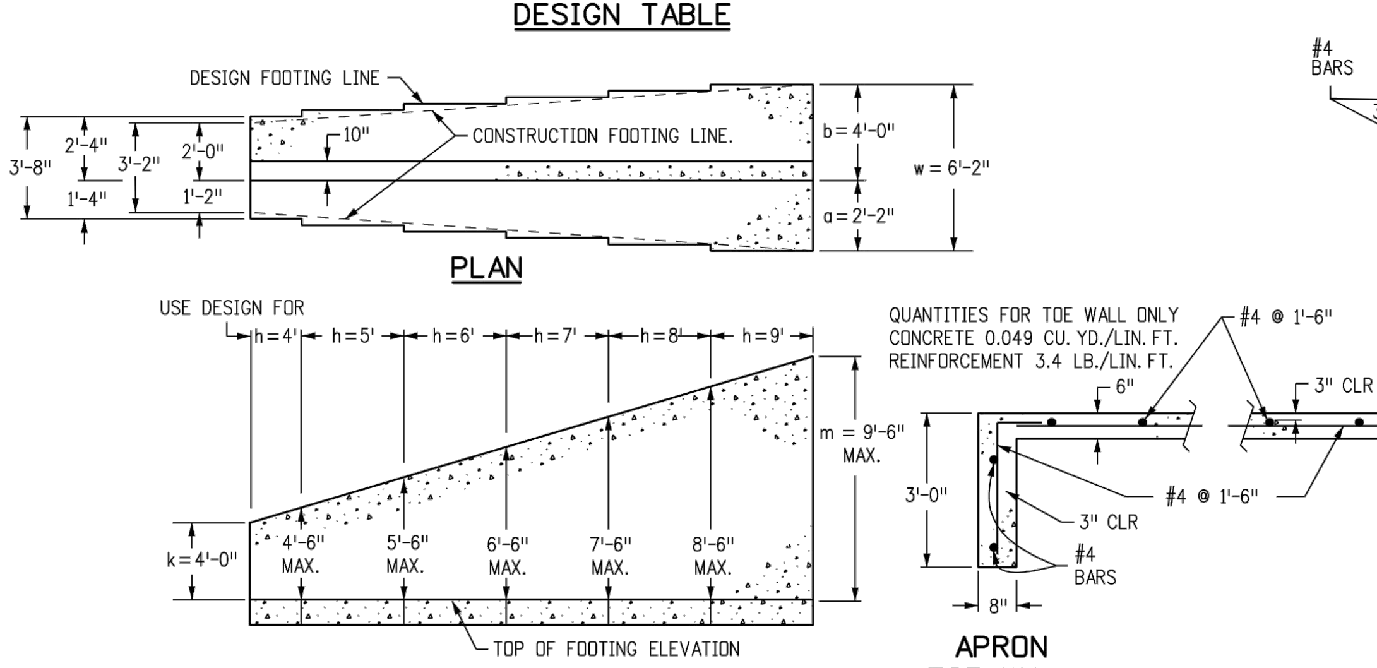
BAR	#4	#5	#6
SPLICE LENGTH	1'-3"	1'-7"	2'-0"

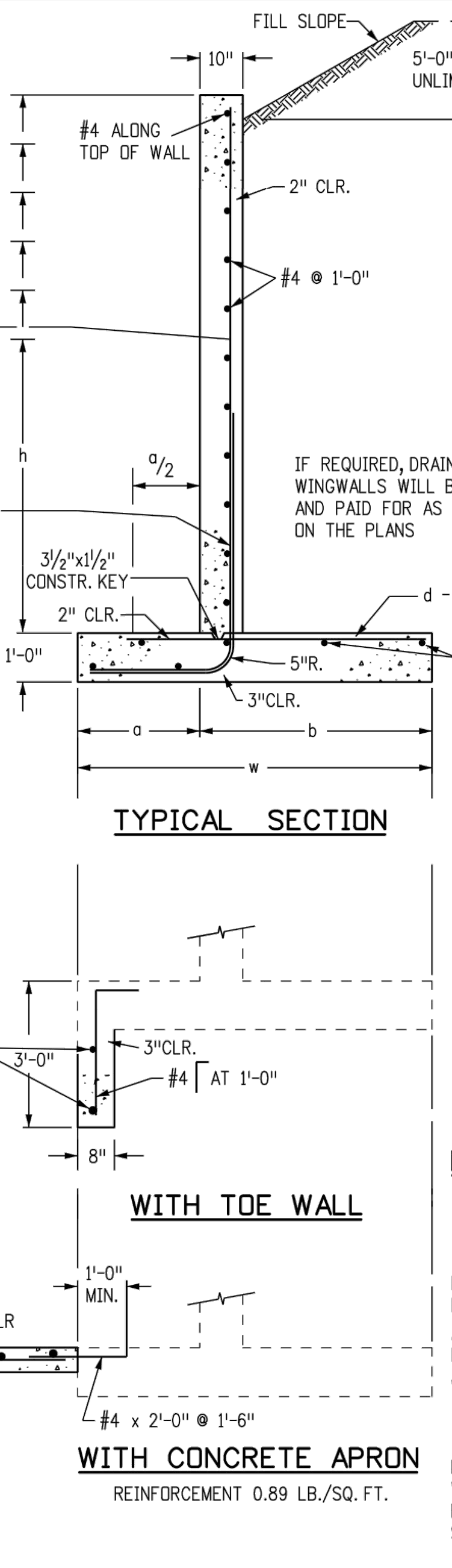


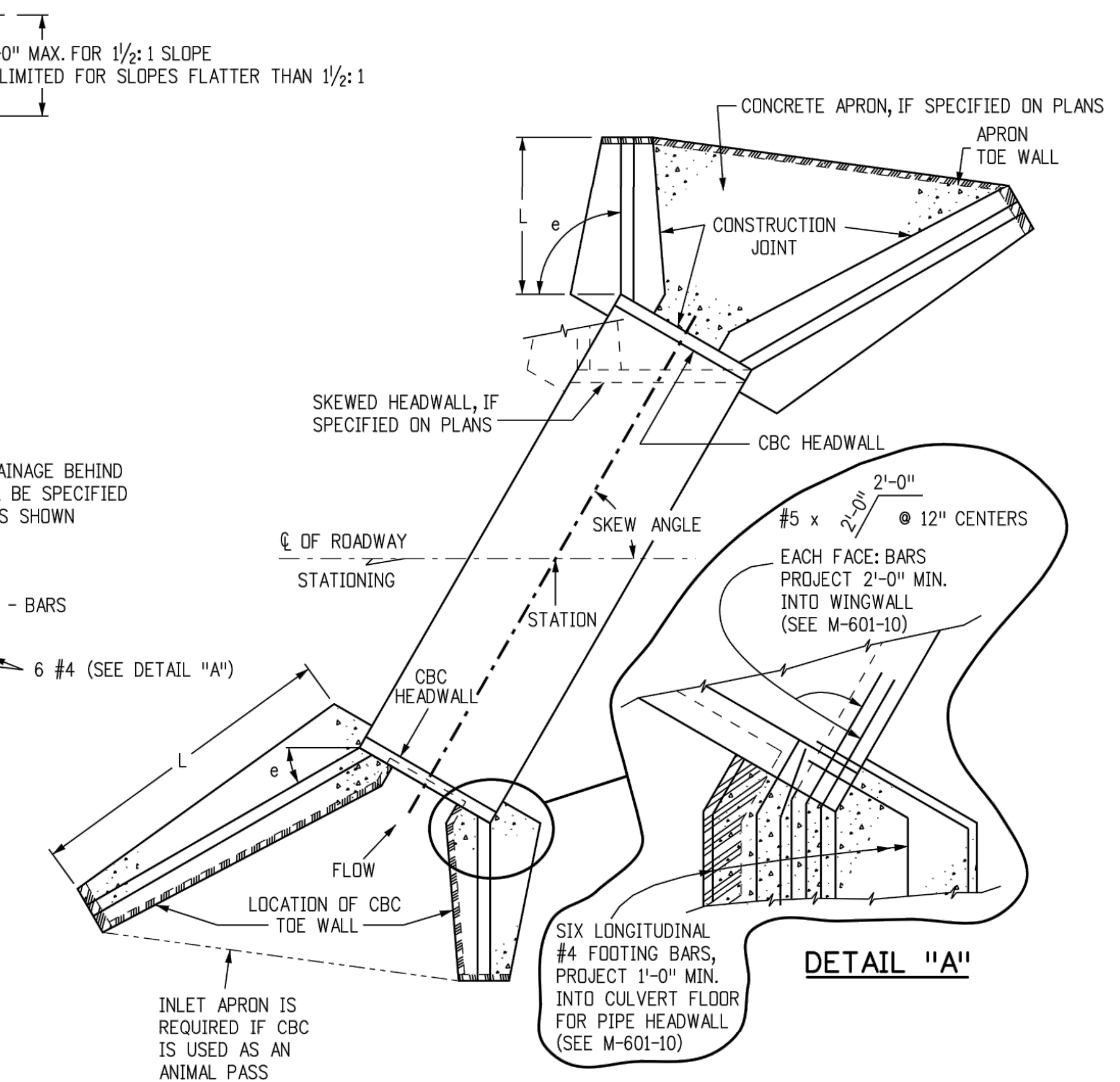
e =	1'-6"	1'-6"	1'-6"	1'-6"	1'-6"	1'-4"	1'-3"	11"	9"	7"	CTRS.
h =	2'	3'	4'	5'	6'	7'	8'	9'	10'	11'	
a =	1'-0"	1'-2"	1'-4"	1'-6"	1'-8"	1'-10"	2'-0"	2'-2"	2'-4"	2'-6"	
b =	1'-8"	2'-0"	2'-4"	2'-8"	3'-0"	3'-4"	3'-8"	4'-0"	4'-4"	4'-8"	
w =	2'-8"	3'-2"	3'-8"	4'-2"	4'-8"	5'-2"	5'-8"	6'-2"	6'-8"	7'-2"	
c & d BARS	#4@1'-6"	#4@1'-6"	#4@1'-6"	#4@1'-6"	#4@1'-6"	#4@1'-4"	#5@1'-3"	#5@11"	#6@9"	#6@7"	CTRS.
* CONC.CU.YD./L.F.	0.161	0.210	0.259	0.308	0.358	0.407	0.457	0.506	0.556	0.604	
* REINF. LB./L.F.	8.0	9.3	10.7	12.1	14.3	16.4	23.0	28.6	41.8	54.6	

* DOES NOT INCLUDE TOE WALL QUANTITIES

DESIGN TABLE







DESIGN DATA:

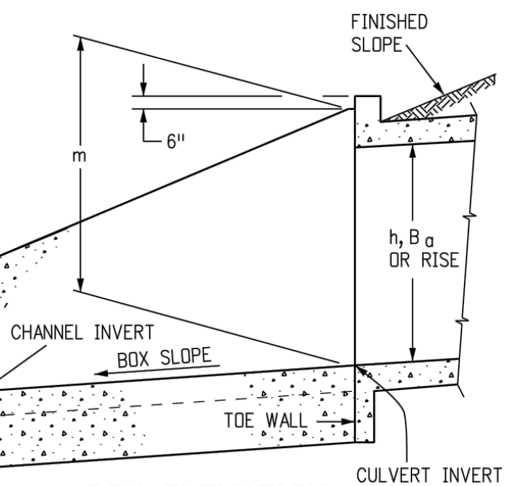
UNIT STRESSES: $f_s = 24{,}000$ PSI
$f_c = 1{,}200$ PSI
$n = 9$

EQUIVALENT FLUID PRESSURE = 36 LBS./CU. FT.
MAXIMUM TOE PRESSURE = 1 TON/SQ. FT.

ALL CONSTRUCTION JOINTS SHALL BE THOROUGHLY CLEANED BEFORE CONCRETE IS POURED.

WINGWALL AND APRON CONCRETE SHALL BE:
CONCRETE CLASS B, OR D (BOX CULVERT) FOR CBC's.
CONCRETE CLASS B, OR D (WALL) FOR PIPES.

LIVE LOAD SURCHARGE HAS NOT BEEN CONSIDERED. WALLS WITHIN h/2 OF THE EDGE OF THE ROADWAY SHOULDER WILL REQUIRE A SPECIAL DESIGN IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES.



BOX ELEVATION
$m = h, B_a$ OR RISE + (1'-4")
UNLESS OTHERWISE SHOWN ON PLANS

Computer File Information
Creation Date: 07/04/12 Initials: DD
Last Modification Date: 07/04/12 Initials: LTA
Full Path: www.coloradodot.info/business/designsupport
Drawing File Name: 6010200101.dgn
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English

	Sheet Revisions	
	Date:	Comments
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(R-X)		
(R-X)		

Colorado Department of Transportation
4201 East Arkansas Avenue
Denver, Colorado 80222
Phone: (303) 757-9083
Fax: (303) 757-9820
Project Development Branch DD/LTA

WINGWALLS FOR PIPE OR BOX CULVERTS
Issued By: Project Development Branch July 4, 2012
STANDARD PLAN NO. M-601-20
Sheet No. 1 of 1

NO.	REVISIONS
1	
2	
3	
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8	
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BOX CULVERT SPECIFICATION DETAILS

SITE: 1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

FOR: PT MCCUNE, LLC
1864 WOODMORE DR, SUITE 100
MONUMENT, COLORADO 80132

VERTEX®
2420 W. 26th Avenue, Suite 100-D | Denver, CO 80211
Main: 303.623.9116 | VERTEXENG.COM

DATE: 11/12/18
DRAWN BY: JCP
CHECKED BY: LPV
JOB #: 49388

APPENDIX G

ENVIRONMENTAL REPORT

Natural Features and Wetland Report for the McCune Ranch Property in El Paso County, Colorado

October 1, 2018

Prepared for:

ProTerra Properties, LLC
2475 Waynoka Place
Colorado Springs, Colorado 80915

Prepared by:

ecos ecosystem services LLC

1455 Washburn Street
Erie, Colorado 80516
(p): 970-812-3267

Project Number: 2018-10-1

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LIST OF ACROYNMS AND ABBREVIATIONS

AMSL	above mean sea level
Applicant	Proterra Properties, LLC
CCRs	Codes, Covenants and Restrictions
CDA	Colorado Department of Agriculture
CNHP	Colorado Natural Heritage Program
COGCC	Colorado Oil and Gas Conservation Commission
CPW	Colorado Parks and Wildlife
Creek	West Kiowa Creek
CWA	Clean Water Act
Ecos or ecos	Ecosystem Services, LLC
JD	jurisdictional under the Clean Water Act
Non-JD	non- jurisdictional under the Clean Water Act
PMJM	Preble's meadow jumping mouse
Report	Natural Features and Wetland Report
Site	McCune Ranch
NRCS	Natural Resource Conservation Service
NTCHS	National Technical Committee for Hydric Soils
NWI	National Wetland Inventory
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WOUS	Waters of the United States

1.0 INTRODUCTION

Ecosystem Services, LLC (Ecos or ecos) was retained by Proterra Properties, LLC (Applicant) to perform a natural resource assessment for the proposed McCune Ranch Development (Site) and to prepare this Natural Features and Wetland Report (Report).

The contact information for the Applicant and ecos representatives for this Report is provided below:

Applicant

Charlie Williams
PT McCune, LLC
1864 Woodmoor Drive, Suite 100
Monument, Colorado 80132
Phone: 719-492-1993
williams@proterraco.com

Agent

Grant E. Gurnée, P.W.S.
Ecosystem Services, LLC
1455 Washburn Street
Erie, Colorado 80516
Phone: (970) 812-6167
grant@ecologicalbenefits.com

1.1 Purpose

The purpose of this Report is to identify and document the natural resources, ecological characteristics and existing conditions of the Site; identify potential ecological impacts associated with Site development; and provide current regulatory guidance related to potential development-related impacts to natural resources. The specific resources and issues of concern addressed in this Report are in conformance with the El Paso County requirements (refer to Section 2.0), and include:

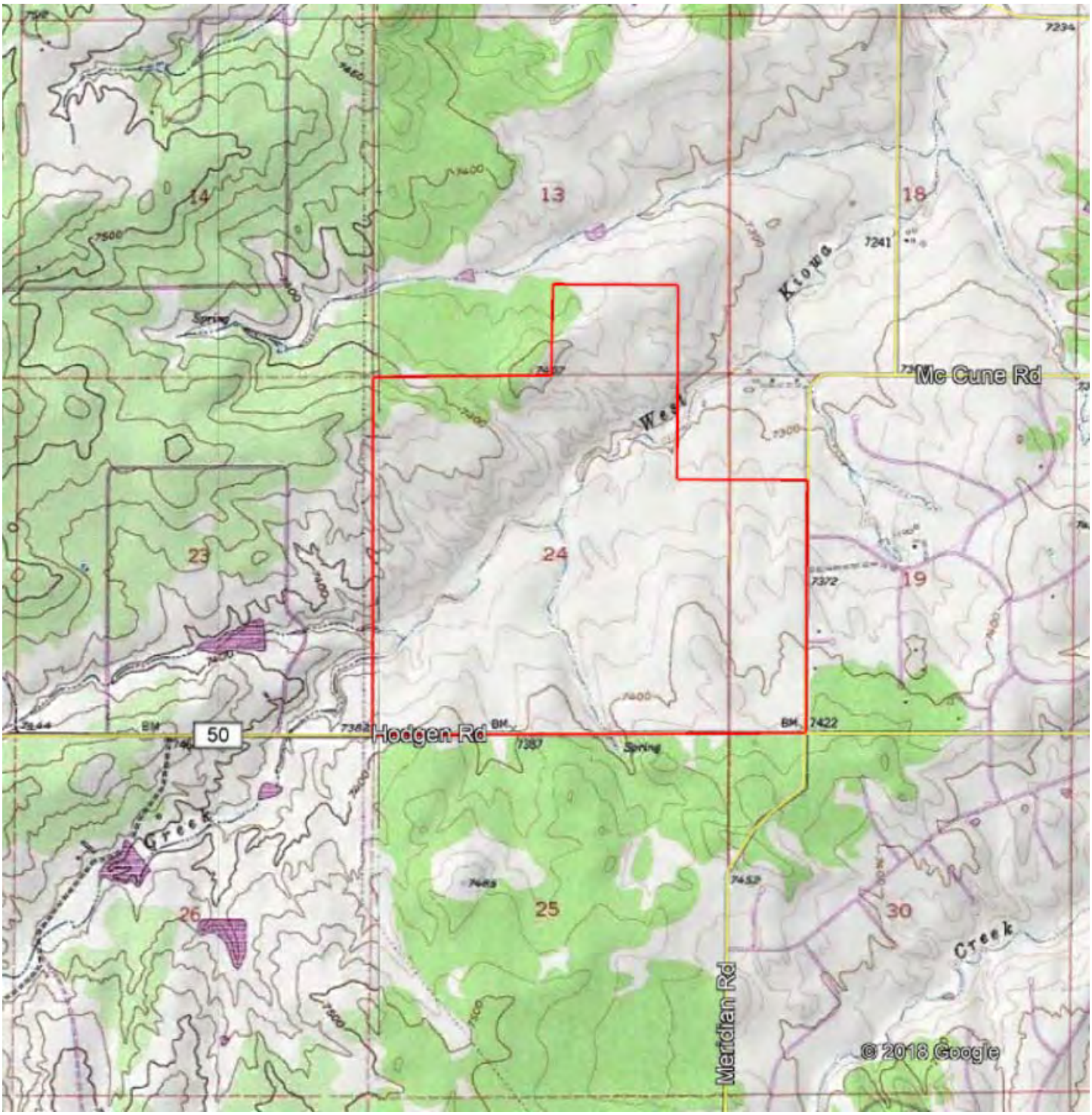
- Mineral and Natural Resource Extraction;
- Vegetation;
- Wetland Habitat and Waters of the U.S.
- Weeds;
- Wildfire Hazard;
- Wildlife;
- Federal and State Listed Candidate, Threatened and Endangered Species; and
- Raptors and Migratory Birds.

1.2 Project Description and Site Location

The Applicant proposes to form a metropolitan district within El Paso County and develop the 765-acre Site as a residential community consisting of 5-acre and 2.5 acre single-family detached rural-residential lots and one commercial lot, including trails, utilities, and streets and cul-de-sacs that provide access to each lot; and preserve 148.6 acres of open space along West Kiowa Creek.

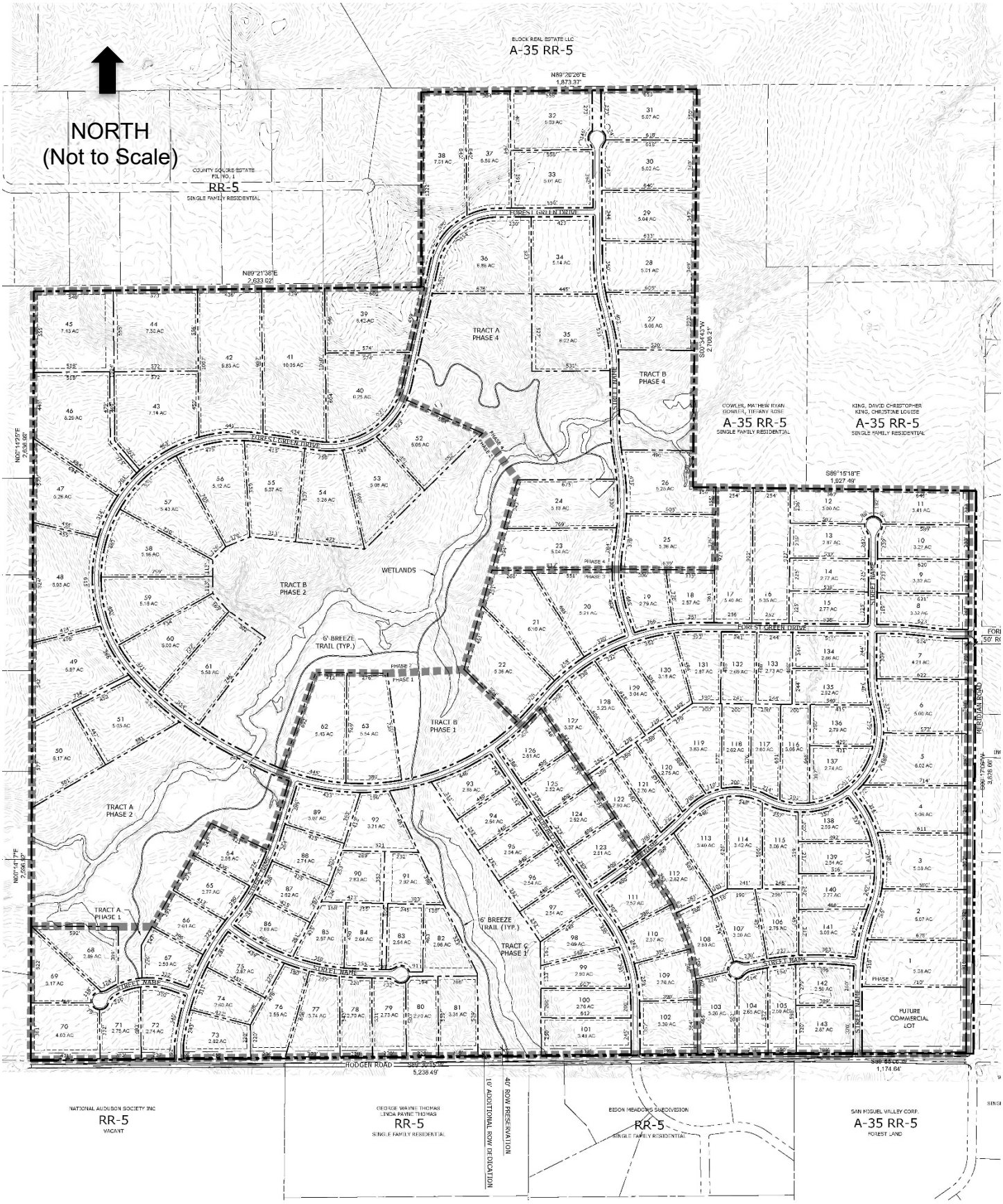
The Site is located in the northeastern corner of the Black Forest approximately 12.5 miles east of Monument and 7.3 miles east of Highway 83, in El Paso County, Colorado. The Site is located in the northwest corner of Hodgen and Meridian Roads. The Site is specifically located within Section 24, the south ¼ of Section 13, and the west ½ of

Section 19, Township 11 South, Range 65 West in El Paso County, Colorado (refer to Figures 1 and 2).



USGS 7.5 min. Quad: Eastonville
Latitude: 39.078344°N
Longitude: -104.614832°W
Section 24, Township 11 South, Range 65 West

Figure 1 USGS SITE LOCATION MAP



SOURCE: NES Land Planning, 10-1-18

Figure 2 SITE PLAN

2.0 METHODOLOGY

Ecos performed an office assessment in which available databases, resources, literature and field guides on local flora and fauna were reviewed to gather background information on the environmental setting of the Site. We consulted several organizations, agencies, and their databases, including:

- Colorado Department of Agriculture (CDA) Noxious Weed List;
- Colorado Natural Heritage Program (CNHP);
- Colorado Oil and Gas Conservation Commission (COGCC) GIS Online;
- Colorado Parks and Wildlife (CPW);
- El Paso County Black Forest Preservation Plan Update;
- Google Earth current and historic aerial imagery;
- CNHP Survey of Critical Biological Resources, El Paso County, Colorado;
- CNHP Survey of Critical Wetlands and Riparian Areas in EI Paso and Pueblo Counties, Colorado;
- U.S. Fish and Wildlife Service (USFWS) Region 6;
- USFWS National Wetland Inventory (NWI); and
- U.S. Geological Survey (USGS).

Ecos reviewed, and incorporated the requirements of the following regulations into, this Report:

1) Historic El Paso County Land Development Code (circa 1991 – 1995, updated on June 29, 2000) – The county still utilizes this old version as they have not yet updated current codes. Applicable Sections include:
    a. Chapter IV, Section 35.13 – Development Requirements for Mineral and Natural Resource Extraction Operations: The developer must include a statement that no resource extraction will occur during the development of the Project;
    b. Chapter V, Section 51.5 – Wildfire Hazard and Vegetation Reports; and
    c. Chapter V, Section 51.6 – Streams, Lakes, Physical Features and Wildlife Habitats

    (Note: Sections 51.5 and 51.6 information must both be addressed in assessment and reporting).
2) Current El Paso County Land Development Code (available on their website). Applicable Sections include:
    a. Chapter 6 General Development Standards, Section 6.3 Environmental Standards:
        i. 6.3.3 – Fire Protection and Wildfire Mitigation;
        ii. 6.3.7 – Noxious Weeds
        iii. 6.3.8 – Wetlands; and
        iv. 6.3.9 – Wildlife.
    b. Chapter 8 Subdivision Design, Improvements and Dedications:

i. Section 8.4.2 Environmental Considerations, Item A.4. – Threatened and Endangered Species Compliance.

3) El Paso County, Draft Procedures Manual (unpublished, provided by El Paso County). Applicable Sections include:
    a. Procedure # R-RE-002-08 – Wetlands Analysis Report; and
    b. Procedure # R-RE-004-08 – Wildlife Report.
4) El Paso County Master Plan: Pertinent Maps and Descriptors to append all of the topics, regulations and guidance referenced above, including:
    a. Wetland Habitat Maps and descriptors; and
    b. Wildlife Habitat Maps and descriptors.

Following the collection and review of existing data and background information, ecos conducted a field assessment of the Site on September 5, 2018 to identify any potential impacts to natural resources associated with the Project. Field reconnaissance concentrated on identification of wetland habitat, waters of the U.S. and on the presence of habitat suitable to support threatened and endangered wildlife. Ecos conducted a follow-up field assessment on September 20, 2018 to conduct a noxious weed inventory and wildfire assessment. Wetland habitat and waters of the U.S. boundaries, wildlife habitat, and major weed stands were sketched on topographic and aerial base maps and located using a hand-held Global Positioning System as deemed necessary. Representative photographs were taken to assist in describing and documenting Site conditions and potential ecological impacts.

The office and onsite assessment data, the pertinent El Paso County regulations outlined above, and Natural Resource Assessment and Wetland report examples used in previous County land development review submittals (provided by El Paso County) were used in the preparation of the Report.

3.0 ENVIRONMENTAL SETTING

A review of the El Paso County Master Plan revealed that the Site is within the Black Forest Preservation Area. The Site contains no Colorado Natural Heritage Conservation Areas or Potential Conservation Areas according to the CNHP (CNHP, 2018), and no Wildlife Refuges or Hatcheries according to the USFWS IPaC Trust Resources Report (USFWS, 2016a).

3.1 Topography

The Site is generally characterized by rolling hills and valleys with some deep ravines draining to the West Kiowa Creek (Creek). The topography of the Site trends gently downward from the southwest to the northeast with north facing and south facing slopes tilting toward the Creek. Topography ranges from high elevations of 7448 feet above mean sea level (AMSL) in the northwestern corner and 7426 feet in the southeast corner to 7276 feet where the Creek exits the site on the east boundary, a total elevation drop of 172 feet. The Creek enters the site at the west boundary at an elevation of 7336 and drops 60 feet before flowing off of the Site. Naturally undulating

and intermittent drainage swales drain toward the Creek that contain wetlands in low areas and dry areas where alluvial deposits have formed.

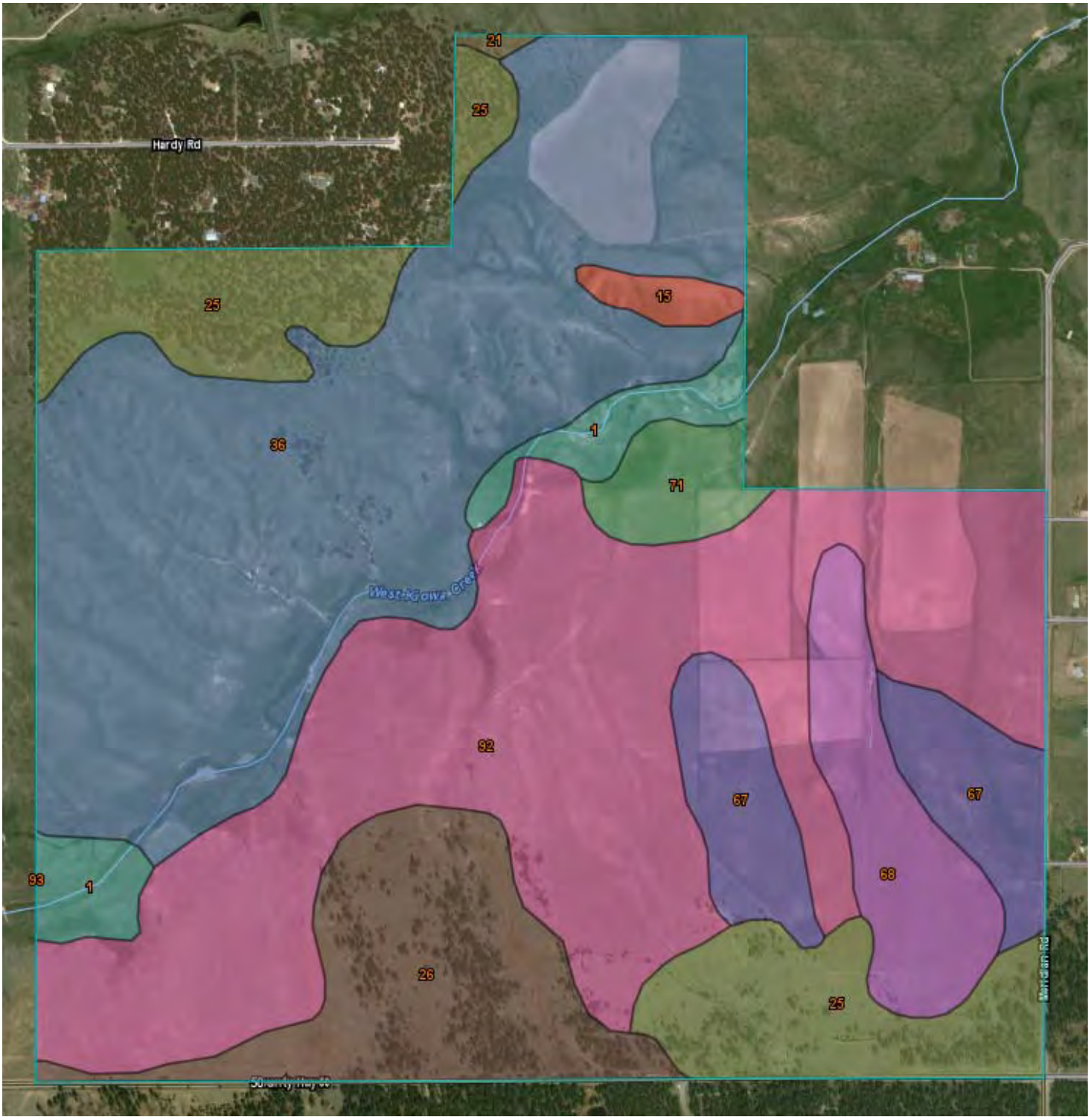
3.2 Soils

Ecos utilized the U.S. Department of Agriculture, Natural Resource Conservation Service Web Soil Survey (USDA, NRCS, 2016) to determine if hydric soils are present within the Site, as this data assist in informing the presence/absence of potential wetland habitat regulated under the Clean Water Act. The soils data were also utilized to supplement the field observations of vegetation, as the USDA provides correlation of native vegetation species by soils types. Please refer to Figure 3, NRCS Soil Map and Appendix A for additional USFWS wetland information.

Alamosa loam (Map Unit #1) is listed by the NRCS as a hydric soil with a rating of 85 on a scale of 1 to 100 with 100 having the major hydric components. Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS, 1994) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. Under natural conditions, these soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in *Field Indicators of Hydric Soils in the United States* (USDA, NRCS, 2010).

Additional, detailed soil data for the Project are presented in the Soils & Geology Report that will be included in the Project submittal.



Summary by Map Unit — El Paso County Area, Colorado (CO625)

Summary by Map Unit — El Paso County Area, Colorado (CO625)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Alamosa loam, 1 to 3 percent slopes	Alamosa loam, 1 to 3 percent slopes	22.9	3.0%
15	Brussett loam, 3 to 5 percent slopes	Brussett loam, 3 to 5 percent slopes	5.9	0.8%
21	Cruckton sandy loam, 1 to 9 percent slopes	Cruckton sandy loam, 1 to 9 percent slopes	1.1	0.1%
25	Elbeth sandy loam, 3 to 8 percent slopes	Elbeth sandy loam, 3 to 8 percent slopes	86.3	11.3%
26	Elbeth sandy loam, 8 to 15 percent slopes	Elbeth sandy loam, 8 to 15 percent slopes	67.3	8.8%
36	Holderness loam, 8 to 15 percent slopes	Holderness loam, 8 to 15 percent slopes	250.4	32.7%
67	Peyton sandy loam, 5 to 9 percent slopes	Peyton sandy loam, 5 to 9 percent slopes	45.2	5.9%
68	Peyton-Pring complex, 3 to 8 percent slopes	Peyton-Pring complex, 3 to 8 percent slopes	38.3	5.0%
71	Pring coarse sandy loam, 3 to 8 percent slopes	Pring coarse sandy loam, 3 to 8 percent slopes	15.0	2.0%
92	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	Tomah-Crowfoot loamy sands, 3 to 8 percent slopes	233.8	30.5%
93	Tomah-Crowfoot complex, 8 to 15 percent slopes	Tomah-Crowfoot complex, 8 to 15 percent slopes	0.0	0.0%
Totals for Area of Interest			**766.1**	**100.0%**

Figure 3

NRCS SOIL SURVEY MAP

3.3 Vegetation

The Site is located in the Black Forest. The Black Forest region includes a mix of ponderosa pine (*Pinus ponderosa*) woodlands and native grassland. In addition to shortgrass prairie, there are also relict eastern American prairie and woodland plant communities with species otherwise unknown in Colorado except for some protected canyons in the outer Front Range (Weber, 2012). Well-developed riparian communities occur along drainages that support plains cottonwood (*Populus deltoides*), narrowleaf cottonwood (*Populus angustifolia*), crack willow (*Salix fragilis*) and sandbar willow (*Salix exigua*), sedges, rushes and grasses. The area has historically been used for rangeland; however, residential development is increasing.

3.3.1 Ponderosa Pine Forest

Ponderosa pine forest on Site is present along the southern edge and in the northwest corner. There are also ponderosa pine patches and individual trees scattered throughout the shortgrass prairie. Most of the forest areas have been heavily grazed, but still have a relatively diverse herbaceous understory. Mountain muhly (*Muhlenbergia montana*) is the most common grass species. Other grass species include junegrass (*Koeleria macrantha*), Canada wild rye (*Elymus canadensis*), and squirreltail (*E. elymoides*). Forbs include wild tarragon (*Oligosporus (Artemisia) dracunculus*), yarrow (*Achilla lanulosa*), harebell (*Campanula rotundifolia*), and Fendler's sandwort (*Arenaria fendleri*). Yellow toadflax, a noxious weed, is common in the forested areas in the northwest corner/south of Hardy Road.

The ponderosa pine forest in the northernmost portion of the Site appears to have been minimally grazed and the herbaceous vegetation is much taller and denser here. Two unique plant communities are present here:

1) Ponderosa Pine/Sun Sedge Woodland is present in the western half of this area. This community is comprised of a dense overstory of large ponderosa pine, and the dominant understory species is sun sedge (*Carex inops* ssp. *heliophila*). Mountain muhly and smooth brome are also common.

2) Ponderosa Pine/Little Bluestem Woodland occurs to the east. The ponderosa pines here are smaller and sparser, with only 10 to 30% cover. The understory consists of tall, dense grasses with three dominant species: little bluestem (*Schizachyrium scoparium*), mountain muhly, and blue grama. Hairy false goldenaster (*Heterotheca villosa*) is also common.

3.3.2 Shortgrass Prairie

The majority of the Site is vegetated with shortgrass prairie and the dominant species in almost all of these prairie areas is blue grama (*Bouteloua gracilis*) (Figure 4). The other most common species are hairy false goldenaster and fringed sage (*Artemisia frigida*). Other species include broom snakeweed (*Gutierrezia sarothrae*), wavy-leaf thistle (*Cirsium undulatum*), and green-needle grass (*Nassella viridula*). The prairie south of the

Creek is heavily grazed and there are scattered weeds throughout, primarily knapweed and common mullein. The prairie north of the Creek is on a drier, south facing slope, and this area appears to have been less impacted by grazing and weeds are limited to the lower areas.

Two subtypes of shortgrass prairie were mapped by ecos:

1) The moister portions of the shortgrass prairie tend to be weedy (See Section 3.5 for additional detail) and are mapped as "**shortgrass prairie-weedy"** (Figure 4). Most of the lower areas along the Creek have dense cover of common knapweed, which extends far into the adjacent uplands, especially along drainage swales and in areas disturbed by grazing.
2) Based on observed vegetation and aerial photographs, the easternmost and northernmost portions of the Site appear to have been occasionally plowed in the past and therefore are mapped as **"shortgrass prairie – disturbed"** (Figure 4). Past disturbance is evidenced by the presence of introduced pasture species, including smooth brome (20-30%) with minor amounts of alfalfa and crested wheatgrass. There is also decreased cover of blue grama and increased areas of bare ground. Weeds are generally low density, but scattered throughout and include common mullein, knapweed, and pigweed (*Amaranthus retroflexus*). Native forbs tend to be weedy and include fringed sage, hairy false golden aster, wild tarragon, white prairie aster (*Symphyotrichum falcatum*), and winged buckwheat (*Eriogonum alatum*).

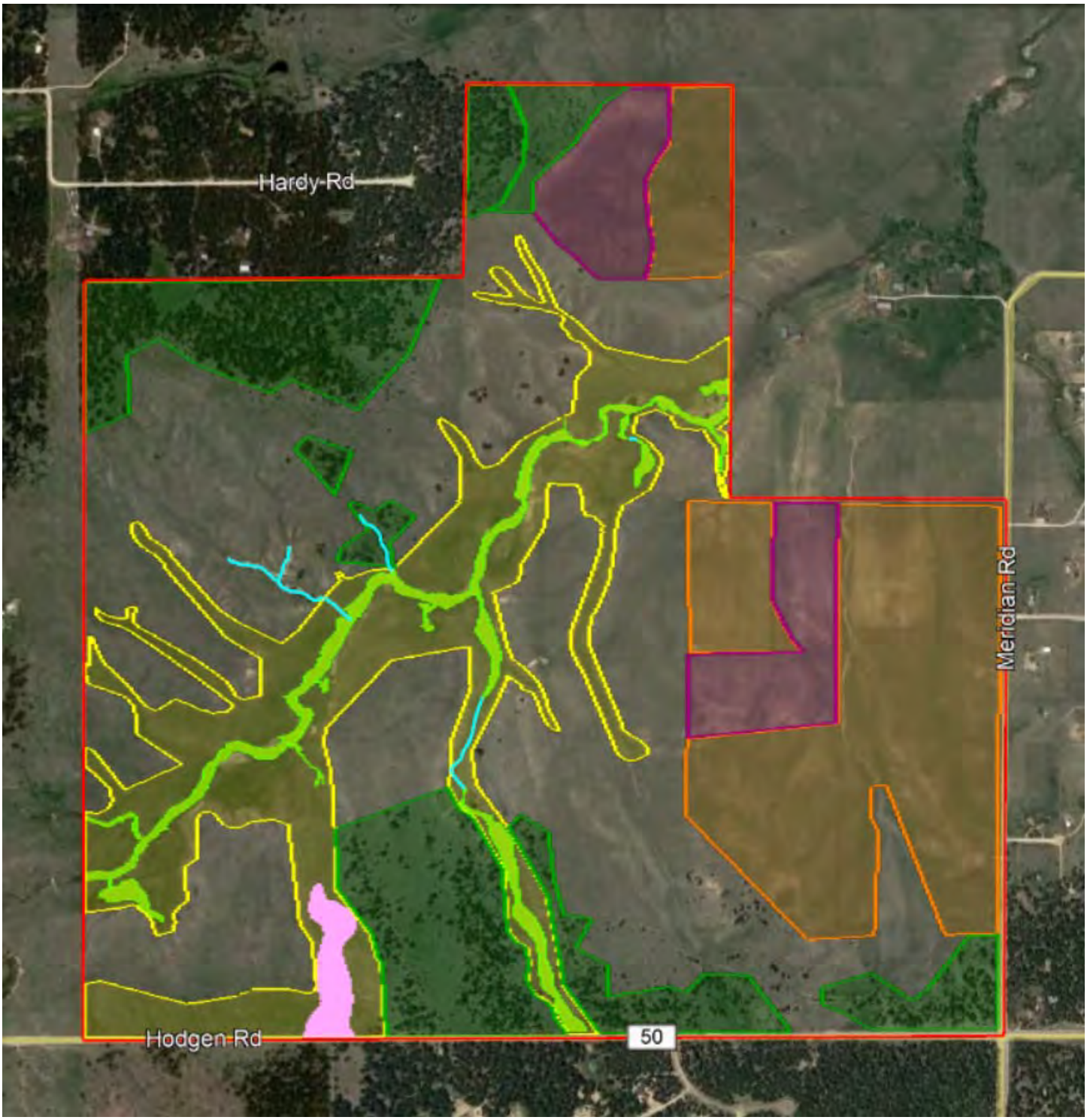
3.3.3 Plowed Fields

There are currently three recently plowed fields where bare ground is approximately 75%. Smooth brome (10%) is the most common species in these areas. Alfalfa (3%) was observed in the northern field. Knapweed (3%) was present in the eastern field. These three fields are all located within the areas mapped as shortgrass prairie – disturbed.

3.3.4 CNHP Vegetation Communities

Ecos reviewed the CNHP database and sorted the data for the Eastonville, Colorado 7.5-minute quadrangle, as that quadrangle includes the Site. We reviewed the Eastonville quadrangle data to determine the probability of the presence/absence of significant natural communities, rare plant areas, or riparian corridors that may be within the range of, and/or within the Site as summarized them in Table 1 below. Based on this data and our onsite assessment, ecos has provided our professional opinion regarding the probability that these species may occur within the Site and their probability of being impacted by the Project.

TABLE 1 – CNHP VEGETATION COMMUNITIES POTENTIALLY IMPACTED BY THE PROJECT			
Species	**Status**	**Presence and Location**	**Probability of Impact by Project**
PLANT COMMUNITIES			
Pinus ponderosa/Carex inops ssp. heliophila Woodland	State Rank: S3 (Vulnerable)	In the Black Hills region, occurs in relatively mesic, open savanna habitats, on gentle to moderate south- and west-facing slopes. Present in the northernmost portion of the Site (see Section 3.3.1).	High. Development is planned for the area where this community occurs.
Salix amygdaloides Riparian Woodland	State Rank: S1 (Critically imperiled)	Backwater areas and overflow channels of large rivers, on narrow floodplains of small creeks, and on the edges of ponds and lakes. Often in small isolated clumps. Present along the Creek (see Section 3.4.2 and Figure 7, Wetland A)	Low. The existing riparian woodland has been degraded by grazing. Woody vegetation is limited to scattered trees and tattered saplings. This habitat will be preserved as open space. Thus, the riparian habitat should improve once grazing stops, if stormwater and weeds are managed appropriately.
Schizachyrium scoparium - Bouteloua curtipendula Western Great Plains Grassland	State Rank: S2 (Imperiled)	Shallow sandy or rocky soil, usually on level or gently sloping terrain, mid grasses with tall and short grasses present to abundant. This community is not present.	None. This community is not present.



SOURCE: Plant Community Inventory, Ecosystem Services, LLC, 2018

Legend:

	Ponderosa Pine Forest		**Wetland - Palustrine Emergent**
	Shortgrass Prairie		**Wetland – Isolated**
	Shortgrass Prairie - Weedy		**Waters/Channel**
	Shortgrass Prairie - Disturbed		
	Shortgrass Prairie - Plowed		

Note: Shortgrass prairie is shown in natural color of aerial photograph.

Figure 4 VEGETATION COMMUNITY MAP

3.4 Wetland Habitat and Waters of the U.S.

3.4.1 Methodology

Ecos utilized the National Wetland Inventory (NWI) Wetlands Mapper (USFWS 2016); the Survey of Critical Biological Resources, El Paso County, Colorado (CNHP, 2001b); the Survey of Critical Wetlands and Riparian Areas in EI Paso and Pueblo Counties, Colorado (CNHP, 2001c); Colorado Wetland Inventory Mapping Tool (CNHP, 2018); historic and current Google Earth aerial photography; USGS 7.5-minute topographic mapping; and detailed Project topographic mapping to screen the Site for potential wetland habitat and waters of the U.S. Additionally, ecos performed a jurisdictional delineation to identify the Waters of the United States (WOUS), including wetlands. The Site contains no Wetland and Riparian Conservation Areas or Potential Wetland and Riparian Conservation Areas according to the CNHP, however, the site is directly north of and adjacent to the Pineries at Black Forest (CNHP, 2001b).

The mapping data above were proofed during the filed assessment and a wetland delineation was conducted to determine the presence/absence of potential WOUS, including wetland habitat. Once a feature was verified to be present, ecos determined whether it is a jurisdictional wetland/waters under the Clean Water Act. The U.S. Army Corps of Engineers (USACE), wetland delineation methodology was employed to document the 3 field indicators (parameters) of wetland habitat (i.e., wetland hydrology, hydric soils and a predominance of hydrophytic vegetation as explained in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory, 1987) and supplemented by the Regional Supplement to the *Corps of Engineers Wetlands Delineation Manual: Western Mountains, Valleys and Coats region (Version 2)* (USACE, 2010). The wetland delineation was surveyed by the project team surveyor

Consistent with the NWI and Colorado Wetland Inventory Mapping Tool, the wetland/waters delineation revealed the presence of palustrine emergent wetland habitat and perennial waters along West Kiowa Creek as well as an intermittent tributary draining to West Kiowa Creek from the south. Smaller intermittent drainages/ravines were also found to be connected with West Kiowa Creek. Other wetlands identified on the CNPH Colorado Wetland Inventory were investigated during the field assessment and we found to be upland swales, did not exhibit defined bed or bank, or were isolated and not connected with West Kiowa Creek. Please refer to Figure 4, National Wetland Inventory, Figure 5, CNHP Wetland and Riparian Areas Map, and Figure 6, ECOS Wetland and Waters Sketch Map. Project Plans illustrate the wetland and waters delineation in detail.

3.4.2 Field Assessment Findings

The results of the onsite assessment for each potential wetland and waters area is summarized below, with an explanation of the field indicators (parameters) of wetland habitat/waters that were observed, and an explanation as to whether ecos determined

each feature was jurisdictional or non- jurisdictional under Section 404 of the Clean Water Act. Jurisdictional features are mapped on Figure 5.

1) Jurisdictional wetland habitat and waters of the U.S. – West Kiowa Creek (Area A) and adjacent and connected waters and associated wetlands (Areas B – F), share similar vegetation, soil and hydrologic characteristics and consist of the following wetland types:
    a. PEMC1 Wetland Habitat – Wetland Area A is classified as a Palustrine Emergent, Persistent, Seasonally Flooded wetland (PEMC1). This area occupies the floodplain along West Kiowa Creek. Wetland Area A is dominated by Nebraska sedge, beaked sedge, redtop, water mint, Baltic rush, with small or immature patches of crack willow, peachleaf willow, sandbar willow, plains cottonwood, and narrowleaf cottonwood present. Soil samples indicate the presence of field indicators of hydric soils (10YR2.5/1 silty clay 0- 14 inches & 10YR2.5/1 silty sand from 14-18+ inches). Sustaining hydrology was evident as flowing water is present within a defined channel and saturated soils are present throughout the floodplain, including groundwater driven side-slope seepage. This area meets all 3 parameters for jurisdictional wetland habitat.
    b. PEMC1 Wetland Habitat – Wetland Areas B – E are classified as a Palustrine Emergent, Persistent, Seasonally Flooded wetlands (PEMC1). These tributary wetlands are connected to West Kiowa Creek at their confluence. These wetlands are located at the lower end of numerous channels/swales that are tributary to West Kiowa Creek. Wetland Areas B – E are dominated by Nebraska sedge, beaked sedge, redtop, water mint, and Baltic rush with no tree or shrub component. Soil samples indicate the presence of field indicators of hydric soils (10YR2.5/1 silty clay 0- 14 inches & 10YR2.5/1 silty sand from 14-18+ inches). Sustaining hydrology from groundwater seepage was evident as saturated soil is present at or within 12 inches of the ground surface. These areas meet all 3 parameters for jurisdictional wetland habitat.
    c. PEMC1 Wetland Habitat – Wetland Area F is classified as a Palustrine Emergent, Persistent, Seasonally Flooded wetlands (PEMC1), a tributary wetland in the upper reach of the southern drainage. This wetland exhibits the same characteristics of Wetland Areas B – E and meets all 3 parameters for jurisdictional wetland habitat. Unlike the other wetlands, this area is not contiguous with downstream wetlands but connected by tributary waters via an upland swale/channel within a defined valley.
    d. R4SB2 Intermittent Ravines - Two intermittent ravines draining into West Kiowa Creek from the north are classified as Riverine, Intermittent, Streambed, Sand creek (R4SB2). These deeply incised sandy bottom channels support upland vegetation dominated by Ponderosa pine with small, insignificant patches of wetland and upland herbs. These channels meet the criterion for a WOUS as they are directly connected with West Kiowa Creek.

2) Isolated Wetland - A large patch of PEMC1 Wetland exists in the southwest corner of the site. This is a functional wetland that exhibits the same characteristics of other wetlands on site and meets all 3 parameters for jurisdictional wetland habitat. However, this wetland is clearly disconnected from West Kiowa Creek by uplands that do not exhibit a defined bed or bank. This area is clearly isolated and therefore not delineated.

3) Upland Swales – Numerous upland swales drain toward West Kiowa Creek which can be seen as dark green drainage signatures on aerial photography. Refer to Figure 6. These upland swales are ephemeral and may only flow during discrete rainfall events. These areas do not meet all 3 parameters for jurisdictional wetland habitat and do not meet the requirements to be deemed navigable waters and therefore are considered non-jurisdictional.

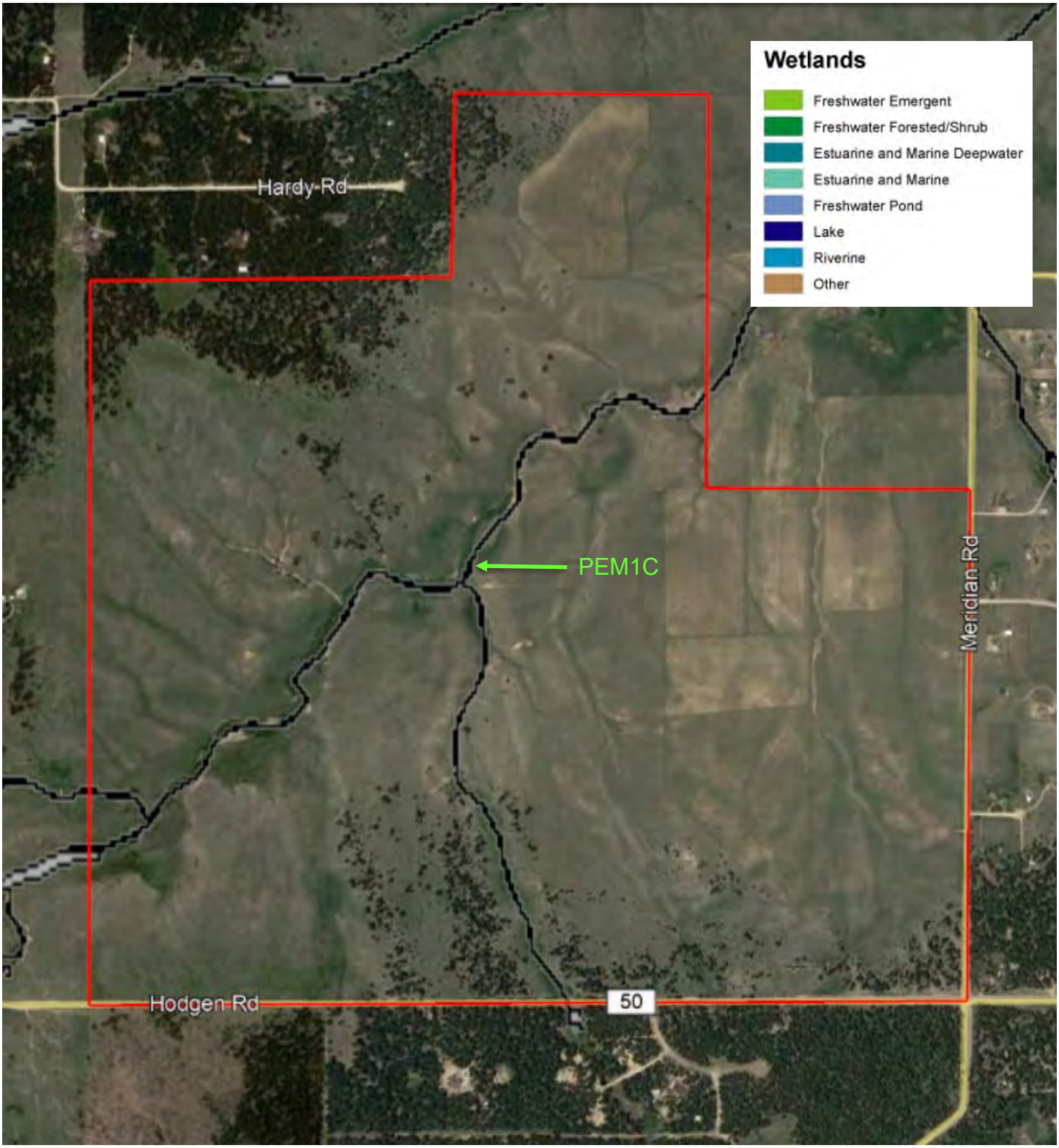
3.4.3 Summary of Jurisdictional and Non-Jurisdictional Wetlands and Waters

Jurisdictional Habitat – Wetland Areas A – F and Intermittent Tributary Waters and Ravines (refer to Figure 6) are jurisdictional wetland habitat and WOUS as they are tributary to the jurisdictional habitat in West Kiowa Creek. These natural features meet the criteria that the USACE uses to assert jurisdiction, as they are:

- Non-navigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months); and
- Wetlands that directly abut such tributaries.

Non-Jurisdictional Areas – Pursuant to verification by the USACE, the Isolated Wetland in the southwest corner of the site and typical Upland Swales (generically labeled on Figure 6) present throughout the site are all considered non-jurisdictional. They do not meet the criteria that the Corps uses to assert jurisdiction, as they are not:

- Traditional navigable waters;
- Wetlands adjacent to traditional navigable waters;
- Non-navigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months); and
- Wetlands that directly abut such tributaries.

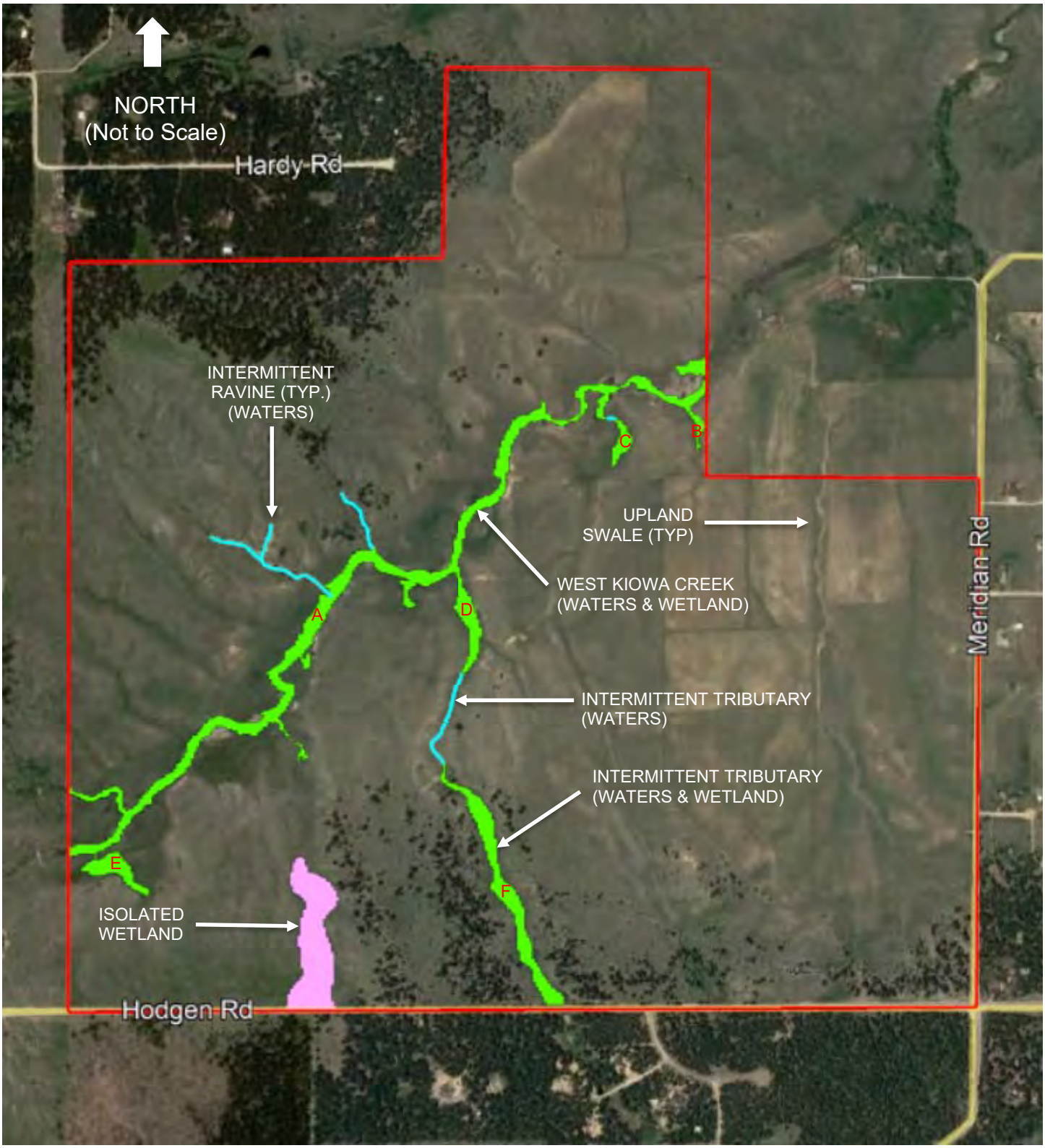


SOURCE: USFWS, National Wetland Inventory

Key: PEMC1 = Palustrine Emergent, Persistent, Seasonally Flooded

SOURCE: CNHP, Colorado Wetland Inventory

Figure 6 CNHP WETLAND & RIPARIAN AREA MAP



SOURCE: Google Earth Aerial, 6-9-17 and ECOS On-site Wetland and Waters Delineation.

Figure 7 ECOS WETLAND AND WATERS SKETCH MAP

3.5 Weeds

3.5.1 Regulatory Background

The Colorado Department of Agriculture maintains a list of noxious weed species (CDA, 2018a) and works with counties to manage noxious weeds. Weed management on Site must follow County requirements, including the "El Paso County Noxious Weeds and Control Methods" report (El Paso County, 2015b).

There are four CDA categories of noxious weeds:

- List A: Rare noxious that are designated for eradication statewide.
- List B: Discretely distributed noxious weeds that must be eradicated, contained, or suppressed, depending on their location, to stop their continued spread.
- List C. These species are well-established in Colorado. Species management plans are designed to support the efforts of local governing bodies to facilitate more effective integrated weed management. The goal of such plans is not to stop the continued spread of these species, but to provide additional education, research, and biological control resources to jurisdictions that choose to require management of List C species.
- Watch List Species are those may pose a potential threat to the agricultural productivity and environmental values. The Watch List is intended to serve advisory and educational purposes only. Its purpose is to encourage the identification and reporting of these species to the Commissioner in order to assist in determining which species should be designated as noxious weeds.

3.5.2 Noxious Weed Survey Results

No noxious weed species on the Colorado Department of Agriculture List A or the Watch List (CDA, 2018a) were observed on the Site.

Five List B noxious weed species (CDA, 2018a) were observed on the Site (listed in order of abundance):

- knapweed (two species and a hybrid between them occur in mixed stands);
    - diffuse knapweed (*Centaurea diffusa*),
    - spotted knapweed (*C. stoebe*), and
    - hybrid knapweed (*C. x psammogena*);
- musk thistle (*Carduus nutans*);
- Canada thistle (*Cirsium arvense*); and
- yellow toadflax (*Linaria vulgaris*).

Three List C noxious weed species (CDA, 2018a) were observed on Site (listed in order of abundance):

- common mullein (*Verbascum thapsus*);
- downy brome (cheatgrass) (*Bromus tectorum*); and
- field bindweed (*Convolvulus arvensis*).

Knapweed species are by far the most abundant noxious weed, with density ranging from 5-30% across large areas. Three species typically occur together on the Site: spotted knapweed, diffuse knapweed, and hybrid knapweed (Figure 4). They have similar management requirements and were mapped together. Common mullein is the second most common noxious weed and is present on much more of the Site than knapweed, but at lower densities (typically 1-5%). Yellow toadflax (*Linaria vulgaris*) is the third most abundant noxious weed, as multiple dense patches were observed in the northwest forest and scattered individuals are mixed with knapweed along the Creek. The other noxious weed species were present in limited areas and low densities.

The uplands adjacent to the Creek are the weediest areas. Knapweed species are dominant in most of the transitional areas between the wetlands and the adjacent upland. In many areas, there is a 100 to 200' wide swath of dense (20-30% cover) knapweed along the Creek. Knapweed continues up the slopes, with density gradually decreasing as conditions become drier. Common mullein is also present, but at lower density (2-5%) and extending farther into the uplands than the knapweed. All the other noxious weed species, except for field bindweed, were also observed along the Creek. They are mixed in with the dense knapweed, but only in limited areas and typically with less than one percent cover.

Noxious weeds are also present in most of the drainage swales and the forested areas, but at much lower density (1-5% cover) than along the Creek. Common mullein is present throughout most of the drainage swales and forested areas. Knapweed was present in limited patches within some swales and in the southeast forest. There are multiple patches of yellow toadflax in the northwest forest.

There are fields on the Site that have been recently plowed or appear to have been plowed in the past. They are all located on the east side of the Site, except for one recently plowed field in the northernmost section of the Site. All of the noxious weeds were seen in these areas, but typically with less than 5% total cover. Field bindweed was only observed in one location in the northernmost parcel, east of the plowed field, and 100 feet southwest of the large trees in trees in the drainage swale.

There are scattered noxious weeds within the shortgrass prairie south of the Creek, including knapweed, common mullein, and musk thistle. Few weeds were observed in the dry short grass prairie on the upper slopes north of the Creek, and in the forested northernmost part of the Site where there appeared to have been no recent cattle grazing.

3.5.3 Noxious Weed Management Plan

All of the List B species on the Site are designated for suppression (CCR, 2018). The Colorado Noxious Weed Act defines suppression as "*reducing the vigor of noxious weed populations within an infested region, decreasing the propensity of noxious weed species to spread to surrounding lands, and mitigating the negative effects of noxious weed populations on infested lands*." Suppression efforts may employ a wide variety of integrated management techniques. Per the El Paso County Noxious Weed and Control

Methods document (El Paso County, 2018a): "*The most effective way to control noxious weeds is through Integrated Pest Management (IPM). IPM incorporates weed biology, environmental information, and available management techniques to create a management plan that prevents unacceptable damage from pests, such as weeds, and poses the least risk to people and the environment. IPM is a combination of treatment options that, when used together, provide optimum control for noxious weeds; however, IPM does not necessarily imply that multiple control techniques have to be used or that chemical control options should be avoided.*

- *Prevention: The most effective, economical, and ecologically sound management technique. The spread of noxious weeds can be prevented by cleaning equipment, vehicles, clothing, and shoes before moving to weed free areas; using weed-free sand, soil, and gravel; and using certified weed free seed and feed.*
- *Cultural: Promoting and maintaining healthy native or other desirable vegetation. Methods include proper grazing management (prevention of overgrazing), re-vegetating or re-seeding, fertilizing, and irrigation.*
- *Biological: The use of an organism such as insects, diseases, and grazing animals to control noxious weeds; useful for large, heavily infested areas. Not an effective method when eradication is the objective but can be used to reduce the impact and dominance of noxious weeds.*
- *Mechanical: Manual or mechanical means to remove, kill, injure, or alter growing conditions of unwanted plants. Methods include mowing, hand pulling, tilling, mulching, cutting, and clipping seed heads.*
- *Chemical: The use of herbicides to suppress or kill noxious weeds by disrupting biochemical processes unique to plants."*

The areas to be preserved as open space (i.e., the uplands adjacent to the Creek and the large southern tributary) are the weediest portions of the Site. Knapweed is the most abundant noxious weed in these areas. Common mullein is also prevalent, albeit at lower densities. If possible, weed control efforts in Open Space areas should begin prior to construction.

The following information provides general measures to prevent introducing new weeds and spreading existing weeds during construction:

<u>Prior to Construction</u>:

1. Create a native habitat restoration and weed control plan for the Open Space areas. Since there is such dense knapweed mixed with other weeds along the Creek, total re-vegetation of some areas may be necessary. One option in the weediest areas would be to remove the top three to six inches of topsoil and replace it with topsoil from the non-weedy short grass prairie north of the Creek that will be developed. If topsoil can be transferred directly, or is only briefly stockpiled, then re-seeding may not be needed. Planning topsoil management

ahead of construction may decrease costs for weed control, restoration, and grading.

2. Biological control is a low cost and non-invasive way to begin controlling weeds. Optimum results take 3-5 years. Contact the Colorado Department of Agriculture Request-A-Bug program at 970-464-7916 to reserve insects, determine the species/quantity needed, and discuss release schedules (CDA, 2018b). At a minimum, species should be introduced to control the knapweed. Biological control may also be available for yellow toadflax, musk thistle, and Canada thistle; with the dense patches of yellow toadflax in the northwest corner of the Site being the highest priority of these three.
3. Reduce grazing overall. Eliminate cattle grazing in knapweed-infested areas, unless using grazing for weed control. Cattle will eat young knapweed prior to bolting but avoid it once the plant matures and develops spines. Thus, targeted grazing can reduce knapweed, but prolonged heavy grazing increases it. Cattle grazing in areas of diffuse knapweed twice in spring may decrease seed by 50%. If cattle are being used for weed control, grazing should consist of two, 10-day intervals in the spring when diffuse knapweed is bolting and about 6 to 12 inches tall (see CSU, 2013). Grazing may reduce the efficacy of biological control.
4. Develop a mowing program to control weeds. This will be most effective for the large areas of common mullein, but may also be used for Canada thistle, musk thistle, and cheatgrass. Mowing in the knapweed areas may reduce the efficacy of biological control for this species.

<u>During construction staging</u>:

1. Fence off all the open space areas to prevent vehicles from driving through them and spreading knapweed, etc. to new areas (Note: fencing will also prevent unpermitted wetland impacts and likely be required by the stormwater management plan).
2. Designate a minimal number of vehicle crossings of the Open Space areas. Construct crossings with weed free soil so that noxious weed seeds are not tracked into new areas.

<u>During construction</u>:

1. Prior to any grading of the non-weedy areas on the slopes north of the Creek, salvage the top six inches of topsoil so that it can be used to construct vehicle crossings and for re-vegetation of natural areas. If possible, immediately move soil to re-vegetation areas. If soil must be stockpiled, minimize the time in order to maintain native seed viability. Excess topsoil may be used for development areas.
2. Do not move weedy soil to new areas within the Site or import weedy soil from other Sites.

3. Control weeds within staging areas and along construction access roads on an ongoing basis.
4. Noxious weeds are most likely to become established in areas where the native vegetation and soil have been disturbed by construction. Thus, maintaining and then quickly re-establishing desirable vegetation post-construction will minimize weed infestations. Desirable vegetation may consist of native plant communities or landscaped areas.

The Site development plan should include measures to prevent introducing new weeds and spreading existing weeds during construction (including prevention measures above). Following construction, the Homeowner's Association (HOA) will be responsible for weed control. Weed management recommendations for the species observed on the Site are summarized in Table 2. Refer to the El Paso County "Noxious Weed and Control Methods" booklet for additional detail (El Paso County, 2018a).

TABLE 2 – NOXIOUS WEED MANAGEMENT SUMMARY

Species	Occurrence	Management[1,2,3]
LIST B[4]		
Canada thistle (*Cirsium arvense*)	Uncommon. Two patches noted, both in uplands near the Creek. Likely present in additional areas.	Mowing combined with herbicide treatment. Mow every 10 to 21 days during the growing season to prevent seeding. Spot treatment with herbicide will likely be needed in open space areas.
knapweeds (*Centaurea diffusa, C. stoebe, and C. x psammagena*)	Abundant. Many large patches throughout, generally in relatively moist areas along the Creek. Approximately 20 acres where cover exceeds 20%, plus additional areas with lower cover.	Biological control is available; this takes 3 to 5 years but is recommended as an initial step due to the abundance of these species in future open space. Reduce or eliminate cattle grazing, unless it is being specifically used to reduce flowering prior to plants bolting. Mowing may reduce production but is not recommended in conjunction with biological control. Some herbicide treatment is typically required for total control. Native seeding may be necessary in areas with dense knapweed.

TABLE 2 – NOXIOUS WEED MANAGEMENT SUMMARY		
Species	**Occurrence**	**Management[1,2,3]**
Musk thistle (*Carduus nutans*)	Uncommon. Individual plants are scattered throughout areas disturbed by heavy grazing or plowing. Mostly south of the Creek. Cover is less than 1%.	Severing the root below the soil surface is effective. Mowing is most effective at full bloom, but flowering plant parts must be disposed of properly to prevent seed development. Spring herbicide treatment is also effective and may be necessary in open space.
Yellow toadflax (*Linaria vulgaris*)	Common in the forest in the northwest corner of the Site where there are multiple dense patches (~2% cover over 23 acres). Uncommon along the Creek where there are scattered individuals (less than 1% cover).	Difficult to control; control when infestations are small. Biological control is available and recommended, particularly in the northwest corner where this species is most abundant. Spot treatment with herbicide will likely be needed in open space areas.
LIST C		
Common mullein (*Verbascum thapsus*)	Common. Present along the Creek, in almost every drainage swale, in the northwest and southeast forested areas, and scattered throughout much of the southern fields. Cover is typically 5% or less, but the species is present on at least 200 acres.	Reduce grazing to increase density of other vegetation. Mow in the bolting to early flowering stage to reduce seed production. Use herbicide to kill existing rosettes. Hand-pulling is effective, but likely not feasible for such large areas. Establish other vegetation and minimize disturbance to prevent existing seeds from sprouting in bare soil.
Downy brome (cheatgrass) (*Bromus tectorum*)	Uncommon. Only observed in low, sandy area near the Creek on the east edge of the Site.	The key to control is to prevent seed production and/or spread of this annual plant. Grazing two times in early in spring may reduce populations. Hand-pulling and bagging the seeds is effective for managing small patches. Herbicide treatment is also effective.

TABLE 2 – NOXIOUS WEED MANAGEMENT SUMMARY		
Species	**Occurrence**	**Management[1,2,3]**
Field bindweed (*Convolvulus arvensis*)	Uncommon. Only observed in one location; in the northernmost parcel, east of the plowed field, and 100 feet southwest of the large trees in trees in the drainage swale.	Do not spread soils where this species occurs to other parts of the Site. Herbicide treatment after full bloom and/or in fall. Early and aggressive control is recommended to prevent this tenacious species from spreading.

[1]Refer to the El Paso County "Noxious Weed and Control Methods" booklet for additional detail (CDA, 2018a).

[2]When using herbicides, always read and follow the product label to ensure proper use and application.

[3]If near water or wetlands, only use herbicides and formulations approved for use near water.

[4]All of the List B species on the Site are designated for suppression (CCR, 2018).

3.6 Wildfire Hazard

The following sections are based on the information available at the drafting of this Report based on the current stage of development planning and design (i.e., road and lot layout plan, no landscape plan, no CCRs, and no layout plan for home or ancillary structure locations within each lot). Once design and CCRs have progressed, the information in these sections may be incorporated into a "Wildland Fire and Hazard Mitigation Plan" that will be updated and "tailored to the stage of development application and the stage of subdivision-related construction" (per County Code). It is expected that individual lot owners/home builders would be responsible for completing their own "Wildland Fire Risk and Hazard Severity Analysis". Section 3.6.1 generally meets the requirements for a Fire Protection Report per County Code.

The stated purpose and intent of the 2018 El Paso County Development Standards" for "Fire Protection and Wildfire Mitigation" is to ensure that proposed development is reviewed for wildfire risks and adequate fire protection. No permit or approval associated with development, construction or occupancy shall be approved or issued until the provisions of these standards are satisfied.

Fire hazard was evaluated using two resources, the Colorado State Forest Service (CSFS) online Wildfire Risk Assessment Portal (WRAP) (CSFS, 2018) and the El Paso County Wildfire Hazard Map (El Paso County, 2007) (Figure 8).

The CSFS WRAP estimates potential wildfire intensity based on a 2-mile buffer and classifies potential fire intensity on most of the Site as being moderate to high.

- Moderate: Flames up to 8 feet in length; short-range spotting is possible. Trained firefighters will find these fires difficult to suppress without support from aircraft or engines, but dozer and plows are generally effective.
- High: Large Flames, up to 30 feet in length; short-range spotting common; medium range spotting possible. Direct attack by trained firefighters, engines, and dozers is generally ineffective, indirect attack may be effective.

The El Paso County Wildfire Hazard Map is based only on the existing vegetation and classifies the forested areas and scattered trees on the Site as High Hazard. Most of the Site consists of grassland areas that are classified as low wildfire hazard. [Note: the Vegetation Map required to be referenced in the current Land Development Code is not available.] “Wildland areas” include land shown as forested (high hazard) or areas identified as such in the “Wildland Fire Risk and Hazard Mitigation Plan.” Since the Site includes forested (high hazard) areas, it is subject to the wildland areas requirements. Additionally, once the “Wildland Fire and Hazard Mitigation Plan” is completed for the Project; additional areas may be identified that must comply with the wildland area requirements.

3.6.1 Fire Protection

The Site is located within the jurisdiction and boundaries of the Falcon Fire Protection District (FFPD). The Falcon Fire Department (Fire Department) has provided a letter dated September 20, 2018 to confirm its commitment to provide fire suppression, fire prevention, emergency rescue, ambulance, hazardous materials and emergency medical services (collectively, "Emergency Services") to the property, subject to the following conditions:

- All new construction, renovations or developments within the Fire Department’s jurisdiction must comply with the applicable fire code and nationally recognized life-safety standards adopted by the El Paso County Board of County Commissioners and the FFPD’s Board of Directors, as amended from time to time;
- All development, water and construction plans must be reviewed and approved by the Fire Department for compliance with the applicable fire code and nationally recognized life-safety standards prior to final plat or construction permit being issued; and,
- All development or construction projects shall meet the fire code and nationally recognized standards' pertaining to fire protection water. Please note that approved and inspected fire cisterns are permitted by the Fire Department in an attempt to help the property owner/developer meet these requirements (Appendix B).

The three staffed FFPD stations are:

- Station 1, 12072 Royal County Down Road, Peyton (7.6 miles from Site)
- Station 3, 7030 Old Meridian Road, Peyton (9.7 miles from Site)
- Station 4, 2710 Capital Drive, Colorado Springs, CO (17 miles from Site)

The closest station to the Site entrance is Station 2 located at 14450 Meridian Road and 2.6 miles south of the Site. Since Station 2 is unstaffed, response usually comes from Station 1 and the estimated response time is 12 minutes (per phone conversation with Fire Chief T. Harwig on September 28, 2018). Equipment at Station 1 includes an engine, a water tender (water truck), a brush truck, an AMR ambulance, a utility truck, and a command vehicle (FFPD, 2018). Equipment at Station 2 includes a 4-wheel drive engine, a water tender, and a brush truck.

In a developed area, firefighting water supplies are typically available through hydrant systems. However, rural areas are dependent on cisterns. The project would construct a 30,000 gallon cistern to serve the Site. The cistern would be operated and maintained by Fire Department staff. All residential properties within 5 road miles of any FFPD station have an ISO insurance rating of Class 3.

3.6.2 General Design Standards

The 2018 County Development Standards for Fire Protection and Wildfire Mitigation must be followed for the common areas and all newly constructed buildings. Common area standards include water supply, roads, bridges, and access gates. Lot development standards include those for buildings, driveways, propane tanks, and gates.

3.6.3 Wildfire Hazard Reduction

Based on information provided by the previous property owners, wildfire hazard reduction was completed for 62 acres of the Site between 2013 and 2015 (Appendix C). Although approximately 100 acres of the Site is forested, tree density is low in many areas (which would explain why only 62 acres were mitigated). Wildfire hazards were reduced by reducing tree densities, removing ladder fuels and modifying stand structure. Additionally, overall forest health was improved by removing trees that were suppressed, poorly formed, insect and disease infested, or storm damaged in order to reduce competition and improve growing space for residual trees. Additional wildfire hazard reduction may be necessary to meet County standards; however, this will be largely dependent on the location of new buildings.

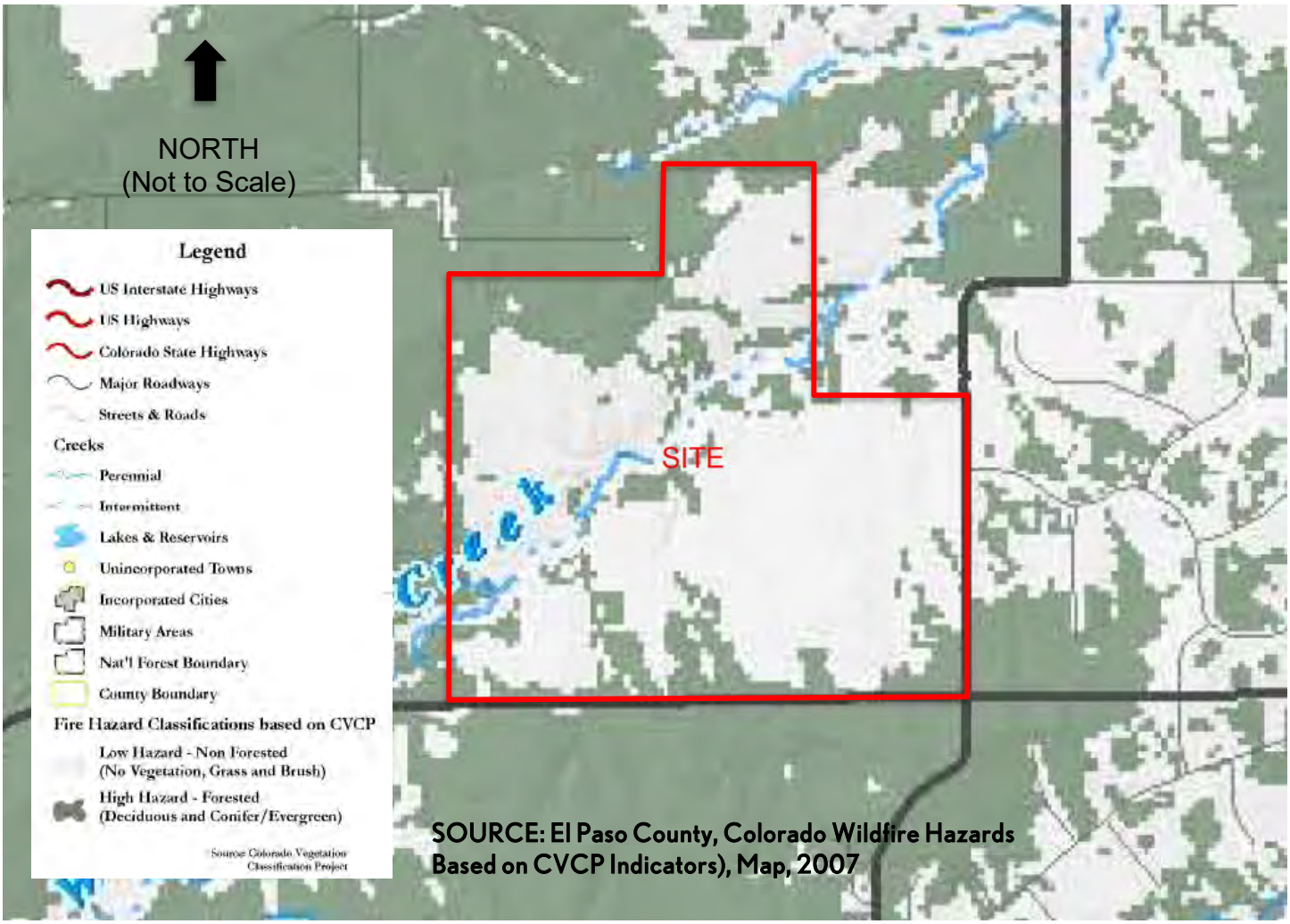
3.6.4 Construction in Wildland Fire Areas

Since the Site includes high hazard areas, a “Wildland Fire Risk and Hazard Mitigation Plan” must be prepared by a qualified professional and shall be tailored to the stage of development application and the stage of subdivision-related construction. A higher level of plan may be submitted at any stage of the process so long as it is implemented at the final stage of development. Plans shall utilize the Colorado State University (CSU)

Guidelines and National Fire Protection (NFPA) standards, as applicable. Additional fire precaution measures may be required because of fire hazard in the following areas:

- Forested areas;
- Areas rated as fire hazards by the CSFS;
- Where slopes in or adjacent to proposed development are in excess of 20%; or
- Where the local fire protection agency identifies a specific fire danger.

All structures potentially threatened by wildland fire shall be designed, located, constructed, and maintained per the County Development Code for Construction in Wildland Fire Areas. The wildland fire area requirements should be incorporated into the Covenants, Conditions, and Restrictions (CC&R). Prior to building permit authorization in high hazard areas, a "Risk and Hazard Rating Analysis" shall be performed to determine the level of the wildland fire threat, unless completed as part of the "Wildland Fire and Hazard Mitigation Plan."



SOURCE: El Paso County, Colorado Wildfire Hazards Based on CVCP Indicators), Map, 2007

Colorado Vegetation Classification Project (CVCP) Indicator Groupings

Low Hazard - Non Forested

No Vegetation:
(1) Urban/Built Up
(6) Barren Land
(8) Riparian
(9) Water
(11) Residential
(12) Commercial
(61) Rock
(6101) Talus Slopes & Rock Outcroppings
(62) Soil

Grass:
(21) Dryland Agriculture
(22) Irrigated Agriculture
(3102) Grassland
(3104) Grass/Forb Mix
(3111) Sparse Grass/Blowouts
(3304) Grass/Misc. Cactus Mix
(3307) Grass/Yucca Mix
(7102) Alpine Grass Dominated
(7103) Alpine Grass/Forb Mix
(7401) Subalpine Grass/Forb Mix
(83) Herbaceous Riparian

Brush:
(3201) Sagebrush Community
(3202) Slatbrush Community
(3203) Greasewood
(33) Shrub/Grass/Forb Mix
(3301) Sagebrush/Grass Mix
(3302) Rabbitbrush/Grass Mix
(4202) Xeric Mountain Shrub Mix
(4203) Mesic Mountain Shrub Mix
(4205) Upland Willow/Shrub Mix
(72) Subalpine Shrub Community
(82) Shrub Riparian
(8201) Willow

High Hazard - Forested

Deciduous:
(4201) Gambel Oak
(5101) Aspen
(5102) Aspen/Mesic Mountain Shrub Mix
(81) Forested Riparian
(8101) Cottonwood

Conifer/Evergreen:
(4101) Pinyon-Juniper
(4102) Juniper
(4301) PJ-Oak Mix
(4303) PJ-MNT Shrub Mix
(4304) Sparse PJ/Shrub/Rock Mix
(4305) Sparse Juniper/Shrub/Rock Mix
(5201) Ponderosa Pine
(5202) Engelmann Spruce/Fir Mix
(5203) Douglas Fir
(5204) Lodgepole Pine
(5207) Spruce/Lodgepole Pine Mix
(5208) Bristlecone Pine
(5209) Ponderosa Pine/Douglas Fir Mix
(5211) Limber Pine
(5213) Lodgepole/Spruce/Fir Mix
(5214) Fir/Lodgepole Pine Mix
(5215) Douglas Fir/Engelmann Spruce Mix
(5301) Spruce/Fir/Aspen Mix
(5302) P. Pine/Gambel Oak Mix
(5303) Ponderosa Pine/Aspen Mix
(5304) Douglas Fir/Aspen Mix
(5306)Lodgepole Pine/Aspen Mix
(5307) Spruce/Fir/Lodgepole/Aspen Mix
(5308) P. Pine/Mountain Shrub Mix
(5309) P. Pine/Aspen/Mesic Mountain Shrub Mix

Figure 8 EL PASO COUNTY WILDFIRE HAZARDS MAP

3.7 Wildlife Communities

The stated purpose and intent of the "El Paso County Development Standards" section on wildlife is to ensure that proposed development is reviewed in consideration of the impacts on wildlife and wildlife habitat, and to implement the provisions of the Master Plan (El Paso County, 2018b). Ecos has determined that the wildlife impact potential for development of the Site is expected to be low to moderate.

The Site currently provides good habitat for wildlife. There are multiple vegetation types, including shortgrass prairie, ponderosa pine woodland, and wetlands along West Kiowa Creek. Portions of the Site along the Creek and to the south have been heavily impacted by grazing. This is most significant along the Creek where most of the adjacent uplands are dominated by knapweed and woody vegetation along the channel is limited to scattered large trees and small willow saplings. Overall, there is high diversity of plants within all of the vegetation communities. The northern portion of the Site is more lightly grazed; most of the short grass prairie and pine forest here are in good to excellent condition.

The project would develop all of the woodlands and most of the shortgrass prairie. The Creek, one main tributary, and some steep short grass prairie would be preserved as Open Space. Wide upland buffers would be preserved along the Creek and the tributary. Eliminating cattle grazing from the Site would allow for more woody vegetation to grow along the Creek, thus improving habitat for many wildlife species. A noxious weed management plan will be implemented per State and County requirements to improve wildlife habitat; and a native plant re-vegetation plan for the Open Space is recommended to provide additional benefit to wildlife habitat.

Birds were the most common wildlife observed by ecos during the Site visit. The habitat preferences of the observed species are reflective of the habitat types on Site. Three species of birds were observed that typically occur in open habitats, such as short-grassed prairie: western bluebirds (*Sialia mexicana*), vesper sparrows (*Pooecetes gramineus*), and a red-tailed hawk (*Buteo jamaicensis*). Five species were observed that are typically associated with coniferous forests: Steller's jays (*Cyanocitta stelleri*), mountain chickadees (*Poecile gambeli*), yellow-rumped warblers (*Setophaga coronata*), ruby-crowned kinglets (*Regulus calendula*), and pygmy nuthatches (*Sitta pygmaea*). The remaining species are considered generalists and included mourning doves (*Zenaida macroura*), American crows (*Corvus brachyrhynchos*) and American robins (*Turdus migratorius*). The Site provides potential nesting habitat for raptors; however, no existing nest sites for any raptors were noted during the Site visit.

The Site provides habitat for mammals including rodents, deer, and carnivores. Two Abert's squirrels (*Sciurus aberti*), ponderosa pine specialists, were seen in northwest corner of the Site. The area is suitable year-round range for mule deer (*Odocoileus hemionus*) and one was seen grazing in a forest opening. The site also provides foraging and breeding habitat for predators such as coyote and fox. Two coyotes were observed resting together in one of the small ravines to be preserved on the north side of the

Creek; both appeared to have severe mange. An abandoned den was observed near the crest of the hill in the northeast corner of the Site. This is a potential swift fox (*Vulpes velox*) den, based on the surrounding short grass prairie habitat, location near the hillcrest, entrance width (~8”), and proximity to a farm.

The Site also provides good habitat for reptiles and amphibians. Numerous leopard frogs (*Rana pipiens*) were seen along the Creek. No other species were observed by ecos during our field assessment.

4.0 STATE, CNHP AND FEDERAL LISTED SPECIES

A number of species that occur in El Paso County are listed as candidate, threatened or endangered by the USFWS (USFWS, 2018) and the CPW (CPW, 2018). Ecos compiled the special status species for the Site in Table 2 based on the data sources listed above, as well as the Site-specific, USFWS IPaC Trust Resources Report we ran for the Project (Appendix A); the CNHP data we compiled for the Eastonville, Colorado 7.5-minute quadrangle (CNHP, 2018); and our onsite assessment. Ecos has provided our professional opinion regarding the probability that these species may occur within the Site and their probability of being impacted by the Project.

The likelihood that the Project would impact any of the species listed below is low to none. Most are not expected occur in the project area and no downstream impacts are expected. The Preble's mouse is discussed in more detail below because there is USFWS designated Critical Habitat in the County.

TABLE 2 - STATE AND FEDERAL PROTECTED SPECIES POTENTIALLY IMPACTED BY THE PROJECT

Species	Status	Habitat Requirements and Presence	Probability of Impact by Project
FISH			
Greenback cutthroat trout (*Oncorhynchus clarki stomias*)	Federal: Threatened State: Threatened	Cold, clear, gravely headwater streams and mountain lakes that provide an abundant food supply of insects.	None. Suitable habitat does not exist on the Site.
Pallid sturgeon (*Scaphirhynchus albus*)	Federal: Endangered	Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.	None. The proposed project is not in the watershed for any of the listed river basins.
REPTILES AND AMPHIBIANS			

TABLE 2 - STATE AND FEDERAL PROTECTED SPECIES POTENTIALLY IMPACTED BY THE PROJECT			
Species	**Status**	**Habitat Requirements and Presence**	**Probability of Impact by Project**
Northern leopard frog (*Rana pipiens*)	State: Special concern State Rank: Vulnerable to Extirpation (S3)	Wet meadows and the banks and shallows of marshes, ponds, glacial kettle ponds, beaver ponds, lakes, reservoirs, streams, and irrigation ditches. Observed on Site, abundant along West Kiowa Creek.	Moderate. The proposed project would avoid direct impacts to most of Kiowa Creek. However, residential development is likely to have a negative impact on water quality by increasing stormwater runoff and the use herbicides and pesticides.
BIRDS			
Least tern (*Sternula antillarum*)	Federal: Endangered State: Endangered	Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.	None. The proposed project is not in the watershed for any of the listed river basins.
Mexican spotted owl (*Strix occidentalis lucida*)	Federal: Threatened State: Threatened	Mature, old-growth forests of white pine, Douglas fir, and ponderosa pine; steep slopes and canyons with rocky cliffs. The closest USFWS designated Critical habitat is over 15 miles southwest of the Site in mountainous terrain (USFWS, 2018).	None. Suitable habitat does not exist on the Site.
Piping plover (*Charadrius melodus*)	Federal: Threatened State: Threatened	Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.	None. The proposed project is not in the watershed for any of the listed river basins.

TABLE 2 - STATE AND FEDERAL PROTECTED SPECIES POTENTIALLY IMPACTED BY THE PROJECT			
Species	**Status**	**Habitat Requirements and Presence**	**Probability of Impact by Project**
Whooping crane (*Grus americana*)	Federal: Endangered State: Endangered	Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska.	None. The proposed project is not in the watershed for any of the listed river basins.
MAMMALS			
North American Wolverine (*Gulo gulo luscus*)	Proposed Threatened	Occur in select high elevation areas that are cold and receive enough winter precipitation to reliably maintain deep persistent snow late into the warm season.	None. Suitable habitat does not exist on the Site.
Preble's meadow jumping mouse (*Zapus hudsonius preblei*)	Federal: Threatened State: Threatened State Rank: Critically Imperiled (S1)	Inhabits well-developed riparian habitat with adjacent, relatively undisturbed grassland communities, and a nearby water source. Well-developed riparian habitat includes a dense combination of grasses, forbs and shrubs; a taller shrub and tree canopy may be present. Has been found to regularly use uplands at least as far out as 100 meters beyond the 100-year floodplain. The Site is 6.5 northeast of the nearest critical habitat and 7.5 miles northeast of the closest occupied habitat, both along Black Squirrel Creek.	Very low. Unlikely to occur on Site due to distance from known populations. The closest mapped Occupied Habitat is 2.5 miles northwest of the Site
PLANTS			
Crawe sedge (*Carex crawei*)	State Rank: S1 (Critically imperiled)	Found in high quality, wet calcareous areas; usually associated with flat limestone outcrops or gravels.	Low. Suitable habitat is not present and wetland impacts would be minimal.
Gay-feather or Rocky mountain blazing star (*Liatris ligulistylis*)	State Rank: Imperiled (S2)	Wet meadows. The wetlands on Site are suitable habitat.	Low. May occur, but habitat impacts will be minimal.

TABLE 2 - STATE AND FEDERAL PROTECTED SPECIES POTENTIALLY IMPACTED BY THE PROJECT			
Species	**Status**	**Habitat Requirements and Presence**	**Probability of Impact by Project**
Hall's milkweed (*Asclepias hallii*)	State Rank: S3 (Vulnerable)	Sloping creek banks on the plains. Suitable habitat is present but degraded by knapweed.	Low. Unlikely to occur and impacts to suitable habitat would be limited.
Lesser bladderpod (*Utricularia minor*)	State Rank: S1 (Critically imperiled)	This species typically occurs in shallow standing water in acid habitats in peat bogs, peaty swamps, mountain lakes, pond edges and occasionally in swampy pastures.	Low. Unlikely to occur and impacts to suitable habitat would be limited.
Plains frostweed (*Crocanthemum bicknellii*)	State Rank: Critically Imperiled (S1)	Infrequent or rare at the base of the outer foothills of the Front Range and Black Forest. Dry pine forests and open meadows, sometimes in hotly burned areas that are no longer forested. Soil texture is generally rocky, gravelly, and sandy. Not seen and habitat does not appear to be suitable.	Low. Unlikely to occur due to absence of suitable habitat.
Prairie goldenrod (*Oligoneuron album*)	State Rank: Critically Imperiled (S1)	Wet to dry, open prairies, forest clearings, or montane meadows. Elevation 5,558 - 9,967 feet. Not seen, but suitable habitat is present.	Moderate due to impacts to suitable habitat.
Prairie violet (*Viola pedatifida*)	State Rank: Imperiled (S2)	Prairies, open woodlands, and forest openings; rocky sites, outwash mesas. Elevation 5800-8800 feet. Not seen, but suitable habitat is present.	Moderate due to impacts to suitable habitat.
Richardson's alum-root (*Heuchera richardsonii*)	State Rank: S1 (Critically imperiled)	In Colorado, found only in the ponderosa pine woodlands of the Black Forest. Elevation 6942 - 7611 feet. Not seen, but suitable habitat is present.	Moderate due to impacts to suitable habitat.
Small-headed rush (*Juncus brachycephalus*)	State Rank: Critically Imperiled (S1)	Wetlands within relict tall grass prairie communities in the Black Forest region. Not seen, but suitable habitat is present.	Low. Unlikely to occur and suitable habitat would not be impacted.

TABLE 2 - STATE AND FEDERAL PROTECTED SPECIES POTENTIALLY IMPACTED BY THE PROJECT			
Species	**Status**	**Habitat Requirements and Presence**	**Probability of Impact by Project**
Two flowered dwarf dandelion (*Krigia biflora*)	State Rank: Critically Imperiled (S1)	Very rare, occurs in moist meadows in the Black Forest. Not seen, but suitable habitat is present.	Low. Unlikely to occur and suitable habitat would not be impacted.
Ute ladies'-tresses orchid (*Spiranthes diluvialis*)	Federal: Threatened	Primarily occurs along seasonally flooded river terraces, sub-irrigated or spring-fed abandoned stream channels or valleys, and lakeshores. May also occur along irrigation canals, berms, levees, irrigated meadows, excavated gravel pits, roadside borrow pits, reservoirs, and other human-modified wetlands. All of the wetlands on Site are suitable habitat, but this species is not known to occur in the Black Forest area.	Low. Unlikely to occur and wetland impacts will be minimal. However, ULTO surveys should be implemented during the blooming period (i.e., August) for all wetland areas to be impacted by road crossings.
Yellow stargrass (*Hypoxis hirsuta*)	State Rank: Critically Imperiled (S1)	Wetlands within relict tall grass prairie communities.	Low. Unlikely to occur and suitable habitat would not be impacted.
Western prairie fringed orchid (*Platanthera praeclara*)	Federal: Threatened	Occurs in tallgrass prairie in Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and Oklahoma. Upstream depletions to the Platte River system in Colorado and Wyoming may affect the species in Nebraska.	None. The proposed project will not alter or deplete flows to the South Platte.

4.1 Preble's meadow jumping mouse

4.1.1 Natural History

The Preble's meadow jumping mouse (PMJM) is a small mammal approximately 9-inches in length with large hind feet adapted for jumping, a long bicolor tail (which accounts for 60% of its length), and a distinct dark stripe down the middle of its back, bordered on either side by gray to orange-brown fur (USFWS, 2016d). This largely nocturnal mouse lives primarily in the foothills of southeastern Wyoming, and south to Colorado Springs, along the eastern edge of the Front Range of Colorado. PMJM are true

hibernators. They usually enter into hibernation in September or October and emerge in May of the following spring.

The preferred habitat of the PMJM is well-developed plains riparian vegetation with a nearby water source. These riparian areas include a relatively dense combination of grasses, forbs, and shrubs. PMJM regularly range into adjacent uplands to feed, hibernate, and avoid flooding. Therefore, the riparian habitat needs to be in close proximity to relatively undisturbed upland communities. PMJM typically prefers grassy upland habitats with scattered trees and shrubs.

4.1.2 Threats

Threats to PMJM and their habitat include habitat alteration, degradation, loss, and fragmentation resulting from human land uses including urban development, flood control, water development, and agriculture. Habitat destruction may impact individual PMJM directly or by destroying nest sites, food resources, and hibernation sites; by disrupting behavior; or by forming a barrier to movement. Invasive non-native and noxious weeds can alter habitat and decrease its value.

4.1.3 Critical Habitat

Critical habitat is specific areas identified by the USFWS as being essential to the conservation of PMJM (USFWS, 2016d). In determining which areas to designate as critical habitat, the USFWS must use the best scientific and commercial data available and consider physical and biological features (primary, constituent elements) that are essential to conservation of the species, and that may require special management consideration and protection. The primary constituent elements for the PMJM include those habitat components essential for the biological needs of reproducing, rearing of young, foraging, sheltering, hibernation, dispersal, and genetic exchange. Thus, critical habitat includes riparian areas located within grassland, shrub land, forest, and mixed vegetation types where dense herbaceous or woody vegetation occurs near the ground level, where available open water exists during their active season, and where there are ample upland habitats of sufficient width and quality for foraging, hibernation, and refugia from catastrophic flooding events. Section 7 of the Endangered Species Act prohibits destruction or adverse modification of a critical habitat by any activity funded, authorized, or carried out by any Federal agency, and Federal Agencies proposing actions affecting areas designated as critical habitat must consult with the USFWS on the effects of their proposed actions, pursuant to Section 7(a)(2) of the Act.

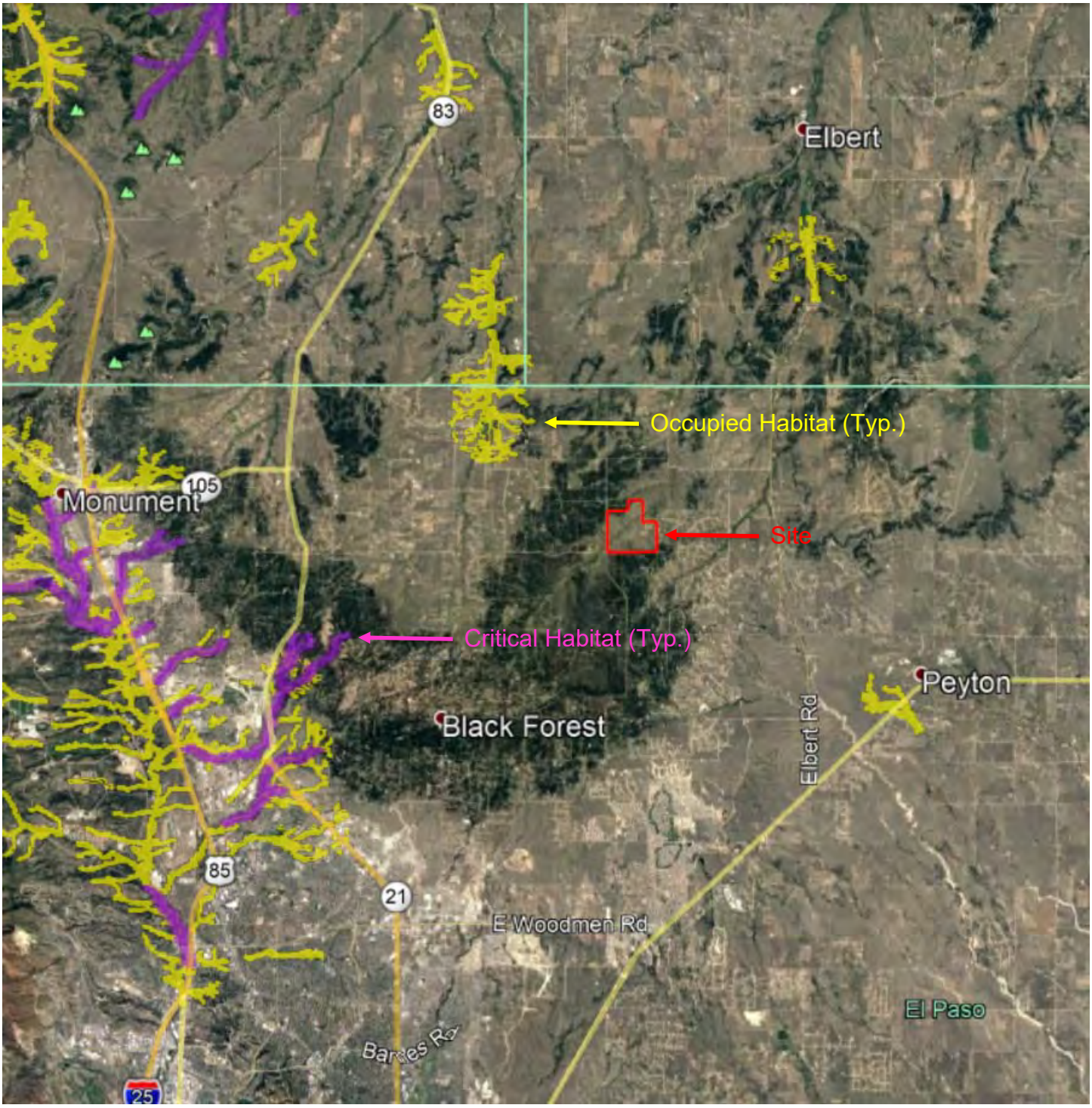
The closest Critical Habitat is 6.5 miles southwest of the Site along Black Squirrel Creek in Colorado Springs, a completely separate watershed, and therefore is not a factor or Project constraint. Refer to Figure 9, PMJM Habitat Map.

4.1.4 Occupied Range

In addition to the USFWS Critical Habitat, Colorado Parks and Wildlife (CPW) mapped areas of PMJM occupied range (CPW, 2005). The occupied range mapping is based on

known occurrences of PMJM (i.e., trapping data) and mapped riparian vegetation (i.e., potential habitat that was not necessarily trapped or verified). For each known PMJM location, a one-mile buffer is applied to riparian areas both upstream and downstream. This includes both the main channel and side channels. Additionally, a 100-meter lateral buffer is applied which, in general, represents foraging and hibernaculum habitat. This buffer serves as a general guideline. Site specific topographic and vegetative features may increase or decrease the area considered locally as foraging and hibernaculum habitat. Where riparian vegetation maps don't exist, the stream centerline is buffered laterally by 100 meters.

The closest Occupied Habitat is 2.5 miles northwest of the Site along East Cherry Creek, a completely separate watershed which drains in to Douglas County and therefore is not a factor or Project constraint. Refer to Figure 9, PMJM Habitat Map.



SOURCE: USFWS & CPW Google Earth PMJM Critical Habitat & Occupied Range Data, 2005 and 2007

5.0 RAPTORS AND MIGRATORY BIRDS

Raptors and most birds are protected by the Colorado Nongame Wildlife Regulations, as well as by the federal Migratory Bird Treaty Act. No raptor nests have been mapped within one mile of the Site (COGCC, 2018). No raptors nests were observed during the site visit. The ponderosa pine forests, short grass prairie, riparian, and wetlands habitats are all valuable nesting habitat for birds.

6.0 SUMMARY OF IMPACTS

6.1 Mineral and Natural Resource Extraction

The El Paso County Master Plan for Mineral Extraction (El Paso County, 1996) shows, Floodplain Deposits with sand and gravel with minor amounts of silt and clay deposited in the floodplain; Valley Fill with sand and gravel with silt and clay deposited in valleys; and Upland Deposits with sand and gravel with silt and clay on topographic high points south of West Kiowa Creek.

Proterra Properties, LLC researched the records of the El Paso County Clerk and Recorder and established that there is not a mineral estate owner on the Site (Appendix D). As such, Mineral or Natural Resource Extraction will not occur as a part of this Project.

6.2 Vegetation

There are three main types of vegetation on Site; wetlands, short-grass prairie, and ponderosa pine forest. Heavy cattle grazing has degraded vegetation by increasing weeds in many areas and severely reducing woody riparian vegetation along the Creek. Direct negative impacts to vegetation will result from the construction of roads, trails, and homes. However, since the development is low density, most negative impacts will be indirect such as spreading weeds to new areas, overgrazing of limited areas by horses, or alteration of wetland hydrology. Since the project will preserve a large area as open space and properties will be kept in a mostly natural condition (per pending CCRs), there is also the potential to improve vegetation, particularly in the Open Space areas. The following recommendations are intended to minimize negative impacts and increase positive impacts:

1. Create a habitat restoration and management plan for the Open Space areas that begins as soon as possible, continues through construction, and is taken over and implemented by the Metropolitan District following construction.
2. Increase native vegetation in the plowed fields and disturbed shortgrass prairie areas by seeding with native species. Another option would be to spread ~1” of salvaged topsoil obtained/stockpiled from any non-weedy shortgrass prairie that

would be impacted by infrastructure construction, such as roads and associated disturbances.

3. Minimize trail impacts to the non-weedy shortgrass prairie northwest of the Creek by locating trails on this side of the Creek either in the weedy shortgrass prairie areas or near roads.
4. The ponderosa pine forest in the northernmost portion of the Site includes diverse herbaceous vegetation. Protect as much of this habitat as possible by designating specific building envelopes in the three overlapping lots and designating the reminder of these lots as non-buildable.
5. Include requirements in the CCRs to preserve native vegetation and minimize non-native landscaping and irrigation.
6. Include requirements in the CCRs to minimize tree removal by siting homes, ancillary structures and defensible space buffers in non-forested portions of the lot. Based on the preliminary development plan, most of the lots have non-forested areas located near planned roads. Clearing limitations could be specified for groups of lots, with more tree removal permitted on the few heavily forested lots. Limiting tree clearing could be incentivized in the CCRs by requiring landowners to plant trees of the same species to replace any they remove.
7. Implement a stormwater management system that does not significantly increase flows into wetlands and the Creek.

6.3 Wetland Habitat and Waters of the U.S.

West Kiowa Creek and associated and connected wetlands and intermittent tributaries are jurisdictional WOUS, including wetlands. Lot layout has been planned to avoid wetlands and waters to the extent feasible. A majority of the wetlands and waters on Site will be set aside and included in Open Space. Site-wide over-lot grading is not proposed. Any site grading necessary to prepare a lot for home construction will be the responsibility of the lot owner where impacts to wetlands or waters will be prohibited without a Clean Water Act (CWA) Section 404 Permit. Any proposed impacts to wetlands or waters resulting from road or utility crossings and associated grading operations implemented by the Developer will be avoided or minimized to the extent possible. If impacts cannot be avoided or minimized, the Developer will obtain authorization from the U.S. Army Corps of Engineers (USACE) prior to construction. Any wetlands or waters that occur within private lots will be protected by easements, codes, covenants and restrictions (CCR's) and therefore impacts by private land owners will be prohibited.

An isolated, non-jurisdictional wetland area (to be confirmed by the USACE) in the southwest corner of the Site will be impacted by development. Refer to Figure 6. If deemed non-jurisdictional, no CWA 404 Permit will be required.

6.4 Weeds

Weeds observed on Site included five List B noxious weed species and three List C noxious weed species (CDA, 2018a). Suppression is required for all List B species. Knapweed is the most problematic weed on the Site, and two species and a hybrid between tend to occur altogether in dense patches within the proposed Open Space area. Site development typically causes weeds to increase due to increased earth disturbance and new weeds being brought in (on vehicles, on shoes, in fill material, in landscaping supplies, etc.). The following recommendations are intended to minimize negative impacts and increase positive impacts:

1. Introduce biological control agents for weed control as soon as possible.
2. Implement an integrated noxious weed management plan that begins as soon as possible, continues through construction, and is taken over and implemented by the Metropolitan District following construction. Control of List B species should be the highest priority, particularly knapweed.
3. Include requirements in the CCRs that landowners manage weeds on their property per the Colorado Noxious Weed Act and El Paso County guidelines.
4. Include requirements in the CCRs to minimize livestock grazing impacts, such as requiring weed free hay and limiting the number of animals per acre of fenced pasture to a sustainable level.
5. Prohibit importation of fill dirt and landscaping material from other locations unless it is certified as weed free.

6.5 Wildfire Hazard

The forested areas and scattered trees on the Site are mapped as High Hazard (El Paso County, 2007) (Figure 8). Since the Site includes high hazard areas, a "Wildland Fire Risk and Hazard Mitigation Plan" must be prepared and will more accurately map the areas of high wildfire hazard on the Site. Wildfire hazard reduction was recently completed for much of the forested portions of the Site and should reduce the overall wildfire risk. The site development plan must conform to County Development Standards for Fire Protection. Construction on each lot must comply with the County Development Standards and this should be referenced in the CCRs. Buildings should be sited away from trees in order to reduce fire risk and minimize clearing.

6.6 Wildlife Communities

The impact to wildlife is similar to that for vegetation. Species that occur in wetland and riparian habitat are expected to benefit from Open Space protection and an expected increase in woody riparian vegetation once cattle are removed. Implementation of the stormwater management plan will assist in protecting water quality in the Creek, to ameliorate development impacts on aquatic wildlife species, such as leopard frogs. Minor impacts to forest species are expected due to tree clearing for home construction and wildfire hazard reduction. Many shortgrass prairie specialist species avoid areas with buildings, overhead powerlines, and trees; thus, the project is expected to have the

most significant negative impact on these species. The following, additional recommendations are intended to reduce impacts to wildlife:

1. Limit the use of herbicides, pesticides, and fertilizers as they can negatively impact aquatic wildlife species.
2. Minimize the installation of fencing. When fencing is needed, use wildlife friendly fences or include specific wildlife crossings along fence lines. Pronghorn are of particular concern because they do not jump over fences and can be injured by barbed-wire fences.
3. Road crossings over the Creek should be designed to enable wildlife underpass and allow use the Creek as a movement corridor to reduce collisions with vehicles.
4. Dogs should be kept in fenced pens and be leashed when on walks. At least one designated off-leash area for dogs should be provided, as this will increase compliance with leash rules in other areas.
5. Cats should no be allowed outdoors because they kill birds and native rodents. Cats may also be eaten by foxes and coyotes.

6.7 State, CNHP and Federal Listed Species

6.7.1 State T&E Species and Species of Concern

T&E species within Colorado are identified on the Colorado Parks and Wildlife's list of Threatened and Endangered Species (CPW, 2018). The CPW's T&E Species list also includes Species of Concern as summarized in Section 4.0, Table 2 of this Report. The state-listed species that may be affected by the Project are summarized in Table 2.

6.7.2 CNHP Rare Species

The Black Forest area includes many plant communities that are typically found only in prairies much farther east; and the CNHP list of rare plants reflects this. Due to the generally degraded nature of the onsite vegetation, few of these species are expected to occur. Since much of the wetlands would be preserved as Open Space, the project would have an overall positive impact on species associated with this habitat. If weeds are controlled, then the project may also have a positive impact on the shortgrass prairie species.

6.7.3 Federal T&E Species

The Site is not located within any officially designated occupied or critical habitat for federally designated threatened or endangered species, including the Preble's meadow jumping mouse. Therefore, no impacts to federally designated threatened or endangered species are expected and there is and no need to initiate consultation with the USFWS under the ESA. However, to ensure impact avoidance, Ute ladies'-tresses orchid (*Spiranthes diluvialis*) surveys should be implemented during the blooming period

(i.e., August) for all wetland areas to be impacted, including road and trail crossings, utility installation areas, and stormwater outfalls.

6.8 Raptors and Migratory Birds

The Project is expected to have mixed impacts on raptors and migratory birds. Preservation of Open Space along the Creek and an expected increase in woody riparian vegetation once cattle are removed will likely have a positive impact on the birds that use this habitat. The project is expected to have slight negative impact on forest birds and shortgrass prairie birds due to habitat alteration and increased disturbance by people, dogs, and cats. Negative impacts can be minimized by following the recommendations in the vegetation and wildlife sections.

7.0 REGULATIONS AND RECOMMENDATIONS

7.1 Clean Water Act

Section 404 of the Clean Water Act prohibits the discharge of dredged or fill material into waters of the U.S. (including wetland habitat) protected by the Act without a valid permit. Ecos identified jurisdictional wetland habitat and WOUS along West Kiowa Creek and its connected and adjacent wetlands and tributaries. The applicant is proposing box culverts and fill at several crossings of West Kiowa Creek. It is assumed that these activities can be authorized under Nationwide Permit 14 for Linear Transportation Projects. The current site plan indicates that impacts to other jurisdictional wetlands and waters will be avoided. Refer to Figure 2. If Site plan is revised and impacts to any wetlands or waters not currently contemplated are deemed unavoidable after impact minimization efforts, a different Nationwide Permit or Individual Permit may be required depending on the total acreage and lineal footage of impacts proposed. No construction may commence without USACE authorization.

<u>Clarification of Jurisdictional vs. Non-Jurisdictional Waters of the U.S.</u>

The USACE and U.S. Environmental Protection Agency (EPA) prepared a guidance memorandum, *Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in Rapanos v. United States & Carabell v. United States*. This memorandum provides guidance to EPA regions and Corps districts implementing the Supreme Court's decision in the consolidated Rapanos and Carabell cases which address the jurisdiction over waters of the United States under the Clean Water Act. The key points of the memorandum, which apply to the determinations made in the field by ecos for the Project are summarized below:

The agencies will assert jurisdiction over the following waters:

- Traditional navigable waters;
- Wetlands adjacent to traditional navigable waters;

- Non-navigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months); and
- Wetlands that directly abut such tributaries.

The agencies generally will not assert jurisdiction over the following features:

- Upland swales or erosional features (e.g., gullies, small washes characterized by low volume, infrequent, or short duration flow); and
- Ditches (including roadside ditches) excavated wholly in and draining only uplands and that do not carry a relatively permanent flow of water.

7.2 Endangered Species Act

The Site is not located within any officially designated occupied or critical habitat for federally designated threatened or endangered species, including the Preble's meadow jumping mouse. However, to ensure impact avoidance, Ute ladies'-tresses orchid (*Spiranthes diluvialis*) surveys should be implemented during the blooming period (i.e., August) for all wetland areas to be impacted, including road and trail crossings, utility installation areas, and stormwater outfalls.

7.3 Migratory Bird Treaty Act & Bald and Golden Eagle Protection Act

No raptor nests have been mapped within one mile of the Site (COGCC, 2018) and no migratory bird nests were observed within the Site. However, given the transitory nature of these species ecos recommends a nesting bird inventory immediately prior to construction to identify any new nests within the Site or within the CPW recommended buffers of the Site. If these species are found to be present, construction activities should be restricted during the breeding season near any newly identified nests.

7.4 Colorado Noxious Weed Act

In order to ensure Project compliance with the Act, the Noxious Weed Management Plan referenced in Section 3.5.3 of this Report should be implemented, and further site-specific weed management should be implemented on an ongoing basis, starting as soon as feasible.

8.0 REFERENCES

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Appendix A

USFWS IPaC Trust Resources Report

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

NOT FOR CONSULTATION

Location

El Paso County, Colorado

Map of project location

Local office

Colorado Ecological Services Field Office

(303) 236-4773
(303) 236-4005

MAILING ADDRESS
Denver Federal Center
P.O. Box 25486
Denver, CO 80225-0486

PHYSICAL ADDRESS
134 Union Boulevard, Suite 670
Lakewood, CO 80228-1807

http://www.fws.gov/coloradoES
http://www.fws.gov/platteriver

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population, even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information.
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS

NOT FOR CONSULTATION

North American Wolverine Gulo gulo luscus — Proposed Threatened

No critical habitat has been designated for this species.
https://ecos.fws.gov/ecp/species/5123

Preble's Meadow Jumping Mouse Zapus hudsonius preblei — Threatened

There is **final** critical habitat for this species. Your location is outside the critical habitat.
https://ecos.fws.gov/ecp/species/4090

Birds

NAME	STATUS
Least Tern Sterna antillarum This species only needs to be considered if the following condition applies: • Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska. No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/8505	Endangered
Mexican Spotted Owl Strix occidentalis lucida There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/8196	Threatened
Piping Plover Charadrius melodus This species only needs to be considered if the following condition applies: • Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska. There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/6039	Threatened
Whooping Crane Grus americana This species only needs to be considered if the following condition applies: • Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska. There is **final** critical habitat for this species. Your location is outside the critical habitat. https://ecos.fws.gov/ecp/species/758	Endangered

Fishes

NAME	STATUS

NOT FOR CONSULTATION

Greenback Cutthroat Trout *Oncorhynchus clarkii stomias* No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2775	Threatened
Pallid Sturgeon *Scaphirhynchus albus* This species only needs to be considered if the following condition applies: • Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska. No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7162	Endangered

Flowering Plants

NAME	STATUS
Ute Ladies'-tresses *Spiranthes diluvialis* No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2159	Threatened
Western Prairie Fringed Orchid *Platanthera praeclara* This species only needs to be considered if the following condition applies: • Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska. No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/1669	Threatened

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Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.

2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Measures for avoiding and minimizing impacts to birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Nationwide conservation measures for birds http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

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NAME	BREEDING SEASON (IF A BREEDING SEASON IS INDICATED FOR A BIRD ON YOUR LIST, THE BIRD MAY BREED IN YOUR PROJECT AREA SOMETIME WITHIN THE TIMEFRAME SPECIFIED, WHICH IS A VERY LIBERAL ESTIMATE OF THE DATES INSIDE WHICH THE BIRD BREEDS ACROSS ITS ENTIRE RANGE. "BREEDS ELSEWHERE" INDICATES THAT THE BIRD DOES NOT LIKELY BREED IN YOUR PROJECT AREA.)
Lark Bunting *Calamospiza melanocorys* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds May 10 to Aug 15

Willow Flycatcher *Empidonax traillii* Breeds May 20 to Aug 31

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/3482

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

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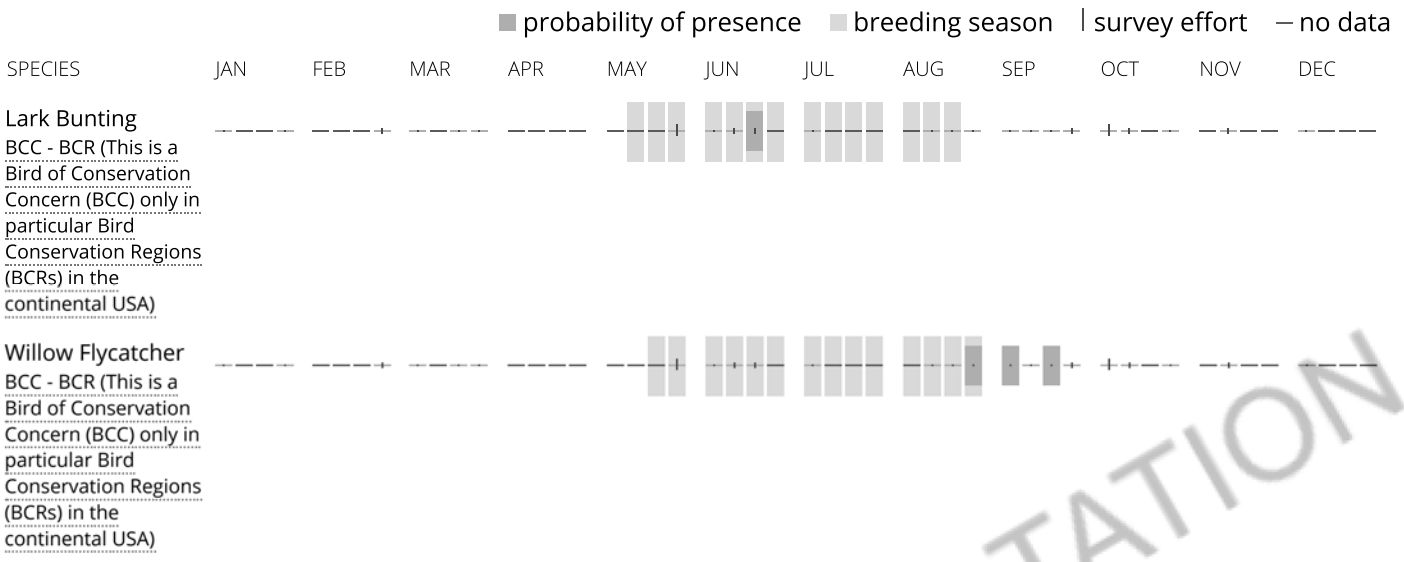
Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



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Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures and/or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the E-bird Explore Data Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets .

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: The Cornell Lab of Ornithology All About Birds Bird Guide, or (if you are unsuccessful in locating the bird of interest there), the Cornell Lab of Ornithology Neotropical Birds guide. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ “What does IPaC use to generate the migratory birds potentially occurring in my specified location”. Please be aware this report provides the “probability of presence” of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look

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carefully at the survey effort (indicated by the black vertical bar) and for the existence of the “no data” indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ “Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds” at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER EMERGENT WETLAND

- PEM1C

RIVERINE

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R4SBC

A full description for each wetland code can be found at the National Wetlands Inventory website

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

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Appendix B

Commitment Letter to Provide Fire and Emergency Services

FALCON FIRE PROTECTION DISTRICT

Administration Office
7030 Old Meridian Road
Falcon, Colorado 80831
Business Number: 719-495-4050 Business Fax: 719-495-3112

September 20, 2018

Charlie Williams
Proterra Properties
1864 Woodmoor drive, suite #100
Monument, Colorado 80132

Re: Conditional Commitment to Provide Emergency Services
Property: McCune Ranch

Douglas,

Based upon the information you have provided, the above-referenced real property is located within the jurisdiction and boundaries of the Falcon Fire Protection District ("Fire Department"). By this letter, the Fire Department confirms its commitment to provide fire suppression, fire prevention, emergency rescue, ambulance, hazardous materials and emergency medical services (collectively, "Emergency Services") to the property, subject to the following conditions:

- ☒ All new construction, renovations or developments within the Fire Department's jurisdiction must comply with the applicable fire code and nationally recognized life-safety standards adopted by the El Paso County Board of County Commissioners and the Fire Department's Board of Directors, as amended from time to time;
- ☒ All development, water and construction plans must be reviewed and approved by the Fire Department for compliance with the applicable fire code and nationally recognized life-safety standards prior to final plat or construction permit being issued; and,
- ☒ All development or construction projects shall meet the fire code and nationally recognized standards' pertaining to fire protection water. Please note that approved and inspected fire cisterns are permitted by the Fire Department in an attempt to help the property owner/developer meet these requirements.

Please do not hesitate to call the fire administration office or me for further information between 9:00 am and 4:00 pm, Monday through Friday.

Sincerely,
Trent Harwig
Fire Chief/Administrator

Appendix C

Liss Wildfire Hazard Reduction Scope And Payment Application

Scope of Work

Liss Property EQIP_2013-2015

Purpose:

Perform Forest Stand Improvement and Forest Slash Treatments that will:

- Reduce wildfire hazards by reducing tree densities, removing ladder fuels and modifying stand structure.
- Improve overall forest health by removing suppressed, poorly formed, insect and disease infested trees and storm damaged trees. Reduce competition and improve growing space for residual trees.

Location and General Description of Work:

The Liss property is located in portions of the NE¼, NW ¼, S ½, SE ¼, and W ½ of Sections 13, 19 and 24, Township 11 South, Range 65 West in El Paso County, Colorado. The project area consists of one private property parcel located off of Meridian Road and Highway 83. The Colorado State Forest Service (CSFS-Franktown District) Forester will be the Technical Service Provider (TSP) and a Service Agreement is in place with the landowner for this project.

Work involves Timber Stand Improvement and Forest Slash Treatment activities in a dominant ponderosa pine forest. Both activities will follow the EQIP requirements and standards for each activity (descriptions of both are attached to Scope of Work).

Unit Description:

The Liss Project area is one (1) management unit consisting of two blocks. The entire treatment area has a gross acreage of approximately 62 acres. Ponderosa pine trees are the dominant species in both blocks with intermittent Gambel oak throughout.

The management unit and fields (blocks) are shown on the attached maps and is described in the following table:

Unit Number	Field numbers	Land Ownership	Acreage	Treatment Period
1	1-6	Private Private Private	5 acres 34 acres 7 acres 10.5 acres 5.5 acres	Sept. 2013 Dec. 2015
Total			62 acres	

project.

Slope Distribution (Based on DEM maps)

Field numbers	0-30% (acres)	31-45% (acres)	46% +	Total Acres
1-3	62 *** majority of acres fall in the 0-8% slope range	0	0	62
Total Acres	62	0	0	62

Project Boundary Marking

Unit Number	Field Numbers:	East, West, North and South Boundary Designation
1	1, 2 and 3	fence line, natural meadows and pink flagging

Forest Management Treatments:

- The project will involve performing timber stand improvement and forest slash treatments of forested areas (ponderosa pine and Gambel oak). Thinning shall be accomplished via mechanical mastication and handwork with chainsaws

- Where possible landowner will harvest trees for firewood to help reduce depth of material on the ground. Slash disposal shall be by means mastication.

- Use of equipment that is comparable to a rubber tired Bobcat with a Fecon head mulching attachment for mastication will be used by the landowner on this project. Other equipment such as an ATV, Trailers, pruning loppers and chainsaws will also be used.

- Trees and oak will be thoroughly mulched/masticated. Chips and chunks will be well distributed across the project area with a desired average of 3-inches or less. All tops and slash must be processed on site via mechanical mastication.

Prescriptions:

- Masticate whole trees concentrating on sizes of 7 inches and less dbh to achieve 70-80ft^2/acre of basal area. Goal is to treat all ponderosa pine acting as ladder fuels and that are overtopped, poorly formed (bent, broken topped, forked), damaged, diseased (bark beetle, severe mistletoe) and excessive (dense clumps). Thin all trees to create a10-foot spacing between tree crowns.

- Trees will be thoroughly masticated to reduce the amount of large woody fuels as possible. Chips and chunks will be well-distributed across the project area with a desired average depth of 3-inches or less. Any tops or other large material left following the mulching must be less than 18" in height. ***If necessary, such material may need to be lopped with chainsaws and scattered by hand.***

- Large pockets of ponderosa pine seedlings and saplings (0-4” dbh) should be hand thinned out and whole trees masticated. Landowner should focus on retaining trees that have a full, healthy crown, straight main stem/trunk (no forks or cracks) and free of all insect and disease. Tree spacing for residual trees should be a minimum of 5-10 feet.

    - Thicker clumps growing underneath the dripline of the mature overstory trees should be all masticated to remove ladder fuels, decrease competition for water, sunlight and nutrients and increase growing space for the residual trees.

- Small, healthy widely dispersed pockets of ponderosa pine seedling/sapling trees can be retained only if they are not considered ladder fuels and will grow as single trees in the stand. If there are individual isolated trees in the 8 inch dbh and less range they can be retained if they are located at a minimum of 30 feet (stem spacing) from other remaining trees.

- Trees 7” in dbh and greater are recommended to target as harvest trees (trees removed, limbed and topped, skidded and decked to an area landowner can access). This will help to reduce the depth of woody debris on the ground and produce a wood product for the landowner to use, sale or trade for services.

- In areas where Gambel oak is present, priority will be to remove old, dead, decadent patches, especially those with significant top kill. A variety of oak heights and widths will be chosen for the remaining clumps. In areas where there are continuous oak thickets, irregular shaped openings will be cut to create a mosaic.

    - Throughout the oak there are isolated conifers or pockets of conifers (> 8”). All oak that is acting as ladder fuels underneath residual trees and within 20 feet of the dripline of those residual trees will be masticated.
    - Priority is to retain mature, healthy open clumps of oak to help maintain diversity and provide for important wildlife corridors.

- All down and dead, damaged, poor formed and wind thrown trees that are on the ground which are 8 inches and less dbh will be treated via mastication.
-

- Retain 2-3 snags per acre with a minimum diameter of 8 inches.

- All stumps will be 6 inches or less in height as measured on the uphill side.

Additional Performance Standards:

- The landowner should follow the outlined Scope of Work in this document as well as the EQIP requirement and standard sheets for Forest Stand Improvement and Forest Slash Treatment activities.
- In areas where machines have used a path repeatedly waterbars should installed if the TSP and landowner deem necessary.
- Gates, fences, or signs damaged by the landowner will be repaired to a like or better condition, or replaced at the discretion of the Landowner.
- The TSP may recommend to landowner to suspend or limit operations if excess damage is occurring due to mud, snow, extreme fire danger, etc.
- Any soil contaminated by loss of fuel, oil, grease, hydraulic fluid, coolant or other fluids should be removed and placed in covered drums or other acceptable containers for proper disposal by the contractor.
- Areas with excessive rutting caused by the turning of tracked equipment, should be raked smooth to the original slope of the ground.
- Grasses and understory should recover nicely after treatment. Where soils slow or prohibit recovery re-seeding with native a native grass mix for the area is recommended.

US DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

NRCS-CPA-1245
6/2012

PRACTICE APPROVAL AND PAYMENT APPLICATION

Information is needed from the Conservation Plan Schedule of Operations to complete this form.

Penalty for false statement or entries.

Participant	Program and Contract Number
JASON J LISS	EQIP 2008 748B05122PQ
County and State	**Fund Code**
EL PASO County, CO	Drought 2012 All Lands (All Field Offices)
Watershed	**Payment Application Number**
Headwaters Kiowa Creek	1

1. CONSERVATION PRACTICES PERFORMED

Contract Item	Practice	Inspection Date	Practice Completion	Planned Amount	Applied Amount	Units	Cost Per Unit	Cost Share % Method	Payment Cap	Amount Earned
1	Forest Stand Improvement (666)	10/28/2013	Completed	34.00	10.00	ac	$1,400.00 00	PR[1]	N/A	$14,000.00
2	Woody Residue Treatment (384)	10/28/2013	Completed	34.00	10.00	ac	$300.0000	PR[1]	N/A	$3,000.00

Total Amount Earned: **$17,000.00**

Notes

[1] 1, 2 Payment Rates define the unit cost rate of compensation to be received by the participant.

Practice Certification

Practice(s) have been performed to the extent shown above and meet the program requirements. If the practice(s) does (do) not meet practice specifications, or if additional work is required, see explanation in Performance Report below.

Performance Report	Certification By	Date
CIN 1, 2 This practice meets NRCS standards and specifications.	LANA ARMON USDA electronic signature; manual signature not required.	10/28/2013

2. PARTICIPANT CERTIFICATION AND SIGNATURE

CERTIFICATION BY PARTICIPANT(s): I certify that the above information is true and correct. I further certify that the entry in Column Practice Extent and Units shows that the practice(s) was (were) performed in accordance with the practice specifications and other program requirements. I hereby apply for payment to the extent that the NRCS Approving Official has determined that the practice(s) has (have) been performed and further certify that this payment is not a duplicate of any other earned by me through another USDA program. Any payment that has or will be received from other sources has been disclosed to the NRCS Approving Official. I agree to maintain this (these) practice(s) for at least the practice service life beginning with the date the practice was completed. I agree to refund all or part of the cost-share/incentive assistance paid to me, as determined by the NRCS Approving Official, if before expiration of the practice service life, I (a) destroy the practice installed, or (b) voluntarily relinquish control or title to the land on which the installed practice has been established and the new owner and/or operator of the land does not agree in writing to properly maintain the practice for the remainder of its specified lifespan.

Participant Name, Address, Telephone	
JASON J LISS PO BOX 36 ELBERT CO 80106	**Signature**
	Date

3. NRCS APPROVING OFFICIAL CERTIFICATION

US DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

NRCS-CPA-1245
6/2012

PRACTICE APPROVAL AND PAYMENT APPLICATION	Participant	Program and Contract Number
	JASON J LISS	EQIP 2008 748B05122PQ
Information is needed from the Conservation Plan Schedule of Operations to complete this form.	County and State	Fund Code
	EL PASO County, CO	Drought 2012 All Lands (All Field Offices)
Penalty for false statement or entries.	Watershed	Payment Application Number
	Headwaters Kiowa Creek	1

Pursuant to authority vested in me, I certify that the items listed herein are correct and hereby approved for payment from the fund designated on supporting data records

NRCS Approving Official	Date

4. PAYMENT SUMMARY

Participants with 0% payment shares are not listed.

Payees	Payee Type	SSN or Tax ID	Account	Participant Payment Share	Payment Reductions	Payment Amount
JASON J LISS	P	*****5205	***4241	100.0000%	$0.00	$17,000.00
			Total	100.0000%	$0.00	$17,000.00

5. PAYMENT ASSIGNMENTS

Participants with active payment assignments on this contract are listed.

PRIVACY ACT STATEMENT

The following statements are made in accordance with the Privacy Act of 1974 (U.S.C. 522a). Furnishing this information is voluntary; however, failure to furnish correct, complete information will result in the withholding or withdrawal of such technical or financial assistance. The information may be furnished to other USDA agencies, the Internal Revenue Service, the Department of Justice, or other state or federal law enforcement agencies, or in response to orders of a court, magistrate, or administrative tribunal.

This information collection is exempted from the Paperwork Reduction Act, as it is required for administration of the Food, Conservation, and Energy Act of 2008 (Pub.L. 110-236)

NONDISCRIMINATION STATEMENT

The U.S. Department of Agriculture (USDA) prohibits discrimination in all of its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex (including gender identity and expression), marital status, familial status, parental status, religion, sexual orientation, political beliefs, genetic information, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

Appendix D

McCune Ranch Mineral Estate Owner Certification

CERTIFICATION:

I, *Erin Ganaway*, researched the records of the El Paso County Clerk and Recorder and established that there **was not** a mineral estate owner(s) on the real property known as McCune Ranch. An initial public hearing on _____, which is the subject of the hearing, is scheduled for _____, 20____.

Pursuant to §24-65.5-103(4), C.R.S., I certify that a Notice of an initial public hearing was mailed to the mineral estate owner(s) (if established above) and a copy was mailed to the El Paso County Planning Department on _____, 20___.

Dated this 25 day of September, 2018.

STATE OF COLORADO)
) s.s.
COUNTY OF EL PASO)

The foregoing certification was acknowledged before me this 25 day of September, 20 18, by Erin Ganaway.

Witness my hand and official seal.

My Commission Expires: June 17, 2022

Carol E. Smith

Notary Public

CAROL E SMITH
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 19874188481
MY COMMISSION EXPIRES JUNE 17, 2022

Appendix E

Professional Qualifications

ecos ecosystem services LLC

RESUME

Grant E. Gurnée, P.W.S.

Owner/Manager
Senior Restoration Ecologist
Fisheries and Wildlife Biologist
Wetland Ecologist

AREAS OF EXPERTISE:

- Project Management for Complex, Environmental Regulatory and Restoration Projects
- Habitat Assessment, Surveys, Planning, Permitting, Restoration Design, Construction Oversight & Monitoring for:
  - Aquatic, Wetland and Riparian Habitat, and Wildlife Habitat
  - Threatened & Endangered Species, Special Status Species, and Species of Concern
  - Nesting Birds, Raptors and Burrowing Owls
  - Natural Areas, Open Space, Trails and Environmental Education Facilities
  - Conservation and Resource Mitigation Banks
- Natural Resources/Environmental Regulatory Compliance
- Grant Funding Support for Conservation and Restoration Projects
- Expert Witness Testimony

EDUCATION:

- MCRP, Environmental Planning and Law Program, Rutgers University, 1994
- Bachelor of Science, Biology, Richard Stockton College of N.J., 1984

EMPLOYMENT HISTORY:

- 2008-Current: Owner, Managing Partner and Senior Restoration Ecologist
  Ecosystem Services, LLC, Erie, Colorado
- 2010-2011: Director Ecological Solutions and Natural Systems Group
  Walsh Environmental Scientists and Engineers, LLC, Boulder, Colorado
- 1999-2010: Ecological Restoration Group Manager
  Walsh Environmental Scientists and Engineers, LLC, Boulder, Colorado
- 1994-1999: Vice President and Consulting Division Manager
  Aquatic and Wetland Company, Boulder, Colorado
- 1987-1994: Ecological Assessment Group Manager
  Killam Associates, Millburn, New Jersey
- 1989 – 1994: Owner and Ecologist, Westhill Environmental, Colonia, NJ
- 1986-1987: Project Manager, Connolly Environmental, Denville, New Jersey
- 1985-1986: Biological Technician/Team Lead, EA Engineering Science and Technology, Forked River Field Station, New Jersey

CONTINUING EDUCATION:

- Stream Functions Pyramid Workshop, Denver, CO - 2014
- Colorado Natural Heritage Program, Wetland Plant Identification - 2014
- Colorado Natural Heritage Program, Ecological Integrity Assessment for Colorado Wetlands - 2013
- FACWet – Functional Assessment of Colorado Wetlands - 2010, 2012 and 2013
- Natural Treatment System Design and Implementation, Southwest Wetlands, Phoenix, AZ - 1995
- Continuing Education in Coastal and Wetland Ecology, Rutgers University, 1985 – 1994

REGISTRATIONS and CERTIFICATIONS:

- Professional Wetland Scientist, Certification (#559), Society of Wetland Scientists Certification Program, 1995
- Certified Wetland Delineator, Army Corps of Engineers Wetland Delineator Certification Program, 1993
- Wetland Mitigation Planning and Design Certification, Environmental Concern, Sparks, MD, 1992
- Certified Ornithologist, Marine Biologist, Aquatic Biologist and Ecologist for the preparation and certification of Environmentally Sensitive Areas Protection Plans, N.J. Dept. of Environmental Protection and Energy, 1988
- Wetland Delineation and Regulatory Certification, National Wetland Science Training Institute, 1988

PROTECTED SPECIES SURVEYS AND HABITAT ASSESSMENTS:

- Ute-ladies' tresses orchid and Colorado butterfly plant
- Preble's meadow jumping mouse
- Nesting raptors, including burrowing owls
- Swift fox and bobcat
- Boreal toad
- Pine Barrens and grey tree frogs
- Freshwater, estuarine and marine surveys for native fish
- Western Tiger Salamander
- Terrestrial and sea turtles

EXPERIENCE SUMMARY:

Mr. Gurnée is a founder and managing partner of Ecosystem Services, LLC (ecos), a small design-build firm that is the culmination of his life's work and passion for restoring and conserving the natural world. Grant is a certified Professional Wetland Scientist with over 33 years of experience in wetland ecology, restoration ecology, wildlife and fisheries biology, environmental planning, and regulatory compliance. Prior to ecos Grant established the Ecological Restoration Group at Walsh Environmental and was the Vice President in charge of the Consulting & Design Division for Aquatic and Wetland Company, the first design-build-grow firm in Colorado. Mr. Gurnée utilizes his diverse field assessment and hands-on experience to bring a unique and pragmatic, big-picture perspective to projects from conceptual planning through implementation. Grant's environmental planning and law education combined with his regulatory compliance experience make him one of the leading experts in the Intermountain West in Clean Water Act and Endangered Species Act issues. He enjoys teaching and furthering the science and art that comprise the field of restoration ecology. As such, Grant has published and presented papers and technical manuals, and lectured nationally and internationally at educational programs that further the understanding of aquatic, wetland, riparian and T&E species habitat assessment and restoration. Mr. Gurnée has also been called upon to provide expert reports, expert witness testimony and liaison representation in complex regulatory compliance matters.

RELEVANT PROJECT EXPERIENCE:

Habitat Assessment and Regulatory Compliance

- **Bellvue Pipeline Project, Larimer County, CO** – ecos was retained by the City of Greeley as Best Management Practices (BMP) Facilitators to provide pre-construction documentation post-construction oversight of pipeline reclamation processes. Essential responsibilities include meeting with landowners prior to construction to facilitate project understanding and post-construction outcomes; to document landowner needs and wants relative to project goals and land use; and to document and monitor pre- and post-construction reclamation and maintenance requirements.
- **Georgetown Lake, Georgetown, CO** –ecos was hired to perform an onsite assessment of ecological resources and prepare a summary report to describe the physical/ecological characteristics of the Project area and evaluate the potential effects of the construction of a loop trail project on environmental issues and species of concern to support a GOCO grant application. Items evaluated and documented, include site location/ownership, general site characteristics, current land use, proposed impacts, possible effects on Federal– and State-listed T&E animal and plant species, unique or important wildlife, water quality, water bodies, wetlands, and floodplains, stormwater runoff, sedimentation, soil erosion, and invasive species. The assessment report also included mitigation measures, project benefits, and environmental compliance recommendations under applicable regulatory programs.

- **Site Assessments for General Vegetation Cover and T&E Species Presence/Absence** – ecos was retained by JADE Consulting, LLC to perform the assessment of two future development sites located in Lafayette and Yuma, Colorado. We performed a desk-top assessment to identify existing site characteristics and screen the potential presence/absence of federally-listed threatened and endangered (T&E) species and followed up with onsite assessments to verify our preliminary findings. Our findings and recommendations were summarized in a Technical Memorandum in which we determined that no further assessment or regulatory compliance actions are required.
- **The Cove Assessment & Regulatory Compliance Report, El Paso County, CO** - ecos was retained by Lake Woodmoor Development, Inc.to perform a natural resource assessment for The Cove development, and to prepare a Natural Features Wetland, Wildfire, Noxious Weeds & Wildlife Report (Report) pursuant to El Paso County environmental review regulations. The purpose of the project was to identify and document the natural resources, ecological characteristics and existing conditions of the Site; identify potential ecological impacts associated with Site development; and provide current regulatory guidance related to potential development-related impacts to natural resources, including: Mineral and Natural Resource Extraction; Vegetation; Wetland Habitat and Waters of the U.S.; Noxious Weeds; Wildfire Hazard; Wildlife; Federal and State Listed Candidate, Threatened and Endangered Species; and Raptors and Migratory Birds.
- **Jurisdictional Determination Request for Banning Lewis Ranch, Villages 1 and 2 Residential Development, El Paso County, CO** - ecos was retained by Oakwood Homes, LLC to review a 2014 Jurisdictional Boundary Delineation and determine if a portion of the wetlands and waters within the site could be deemed non-jurisdictional under the Clean Water Act (CWA) based on their "isolated" status. Following data review, ecos arranged a field assessment with the U.S. Army Corps of Engineers (Corps) to review site conditions, and potential offsite, downstream connections to waters of the U.S. (WOUS), and particularly the presence of a Significant Nexus to Traditional Navigable Waters TNW). Ecos and the Corps agreed that several of the intermittent drainages on the suite are not jurisdictional under the CWA, as they are not: 1) a TNW or wetland adjacent to a TNW; 2) a Relatively Permanent Water (RPW) or a wetland directly abutting an RPW with perennial or seasonal flow; 3) a tributary to a TNW; or 4) a direct tributary to a downstream WOUS as the feature loses it bed and banks. The Corps submitted ecos' findings to the U.S. Environmental Protection Agency (EPA) and they concurred and issued an Approved Jurisdictional Determination stating that the drainages were indeed "isolated" features exempt from the CWA.
- **Bellvue Pipeline Project, Larimer County, CO** – ecos was retained by the City of Greeley to provide regulatory and technical support for the preparation and submittal of the CWA, Supplement Pre-Construction Notification (PCN) for the Bellvue Pipeline Project (Project). Ecos scope includes reviewing the Project CWA permitting and review data and history, assessing wetland and riparian habitat within the Project reach of the Cache la Poudre River, preparing a Resources Impact Assessment Report, and assisting the City with discussions and presentations to the Corps during their review and processing of a Minimal Effects Determination for the Project.
- **Appraisal Support Documentation Report for the 1st Bank Parcel, Colorado Springs, CO** - ecos was retained by 1st Bank Holding Company to perform a Preble's meadow jumping mouse (PMJM) habitat assessment, mitigation cost analysis and conceptual lot layout for the approximate 9.4-acre 1st Bank Parcel (Site) situated south of the Gleneagle residential development and north of the current Northgate Open Space along Smith Creek in Colorado Springs, Colorado.
- **South Boulder Canon Ditch Maintenance, Clean Water Act (CWA) Exemption Determination, Erie, CO** – ecos assisted the Town of Erie in exempting their proposed ditch maintenance project by performing an assessment of site conditions, submitting the assessment report to the Corps, and verifying that said project is exempt pursuant to Section 404(f) of the CWA.
- **Endangered Species Act (ESA) Compliance Documentation for the Pinon Lake tributary CLOMR Application, Forest Lakes Filing 2B in El Paso County, Colorado** – ecos performed an assessment to document the absence of federally-listed T&E species and their habitat and prepared a report for FEMA that documents that the proposed CLOMR action will not result in a "take" of T&E species.
- **Gleneagle Infill Development Assessment & Regulatory Compliance Report, El Paso County, CO** - ecos was retained by G & S Development, Inc. to perform a natural resource assessment for the proposed Gleneagle Infill Development at the former Gleneagle Golf Course, and to prepare a Natural Features and Wetland Report (Report) pursuant to El Paso County environmental review regulations. The purpose of the project was to identify and document the natural resources, ecological characteristics and existing conditions of the Site; identify potential ecological impacts associated with Site development; and provide current regulatory guidance related to potential development-

related impacts to natural resources, including: Mineral and Natural Resource Extraction; Vegetation; Wetland Habitat and Waters of the U.S.; Weeds; Wildfire Hazard; Wildlife; Federal and State Listed Candidate, Threatened and Endangered Species; and Raptors and Migratory Birds. As part of the Project, ecos obtained an Approved Jurisdictional Determination from the Corps.

- **North Fork at Briargate Habitat Evaluation and ESA Compliance, Colorado Springs, CO** - ecos performed a habitat evaluation on behalf of High Valley Land Co., Inc. and La Plata Communities to support informal consultation with the U.S. Fish and Wildlife Service (FWS) under the ESA for potential effects to the Federally-listed, threatened PMJM from the proposed North Fork development, Filings 3 through 7 at Briargate.
- **C Lazy U Preserves Natural Resource Inventory and Conservation Easement Documentation, Grand County, CO** – ecos is assisting the C Lazy U Preserves in assessing and documenting the conservation values of the 980-acre site known as C Lazy U Preserves near Granby, CO such that the site may be protected under Conservation Easements (CE's) held by The Nature Conservancy. The purpose of the CE's is the long-term preservation of the scenic, open space, agricultural, significant natural habitat, native vegetation, rare plant communities, riparian, and wetland values of the Property. ecos staff completed the Easement Documentation Reports Phase 1 of the CE's in 2006, Phase 2 in 2007, and Phase 3 in 2015.
- **Bellvue Transmission Line Project, CWA and ESA Regulatory Negotiation -** Mr. Gurnée assisted the City of Greeley in their negotiations with the Corps to facilitate review and verification of the Northern Segment of the Project under CWA, Nationwide Permit12. Grant aided the City during Corps meetings, field visits and teleconferences; in coordinating with the Corps and the technical experts on the Corps Common Technical Platform (CTP) team; and in utilizing the CTP Poudre watershed data to assess the probability of Project-specific impacts. Mr. Gurnée also assisted Greeley in their negotiations with the FWS to facilitate review and consultation for the Northern Segment of the Project under Section 7 of the ESA. Grant led the field assessment with FWS, identification and prioritization of potential PMJM habitat mitigation sites, development of a conceptual design for the selected PMJM habitat mitigation sites, and preparation of the Biological Assessment Addendum and Habitat Mitigation Plan. Grant also aided the City during agency review and approval of the FWS Biological Opinion by utilizing his relationships with the FWS, and extensive experience of ESA regulations, policies and precedents.
- **Seaman Water Management Project, Riparian-Wetland Technical Support -** Mr. Gurnée is supporting Greeley in the NEPA EIS process by reviewing riparian and wetland technical reports prepared by the Corps CTP team, and providing comments to assist the City in their formal review and response to the Corps. He is also providing technical and regulatory support for CWA and ESA (PMJM habitat) assessment, consultation, and compensatory mitigation planning and design.
- **ARCO Clark Fork River Basin Anaconda Smelter Superfund Site, Anaconda, MT** – Grant and his Team performed wetland delineation, functional assessments, and impact analysis over a 200 square mile area affected by historic mining practices and current remedial actions required by an EPA consent decree.
- **ARCO Clark Fork River Basin Milltown Reservoir Superfund Site, Missoula, MT** – Mr. Gurnée and his Team performed wetland delineation, functional assessments, and impact analysis of proposed remedial actions that will remove metal laden sediments from the site prior to dam removal.
- **C-Lazy-U and Horn Ranch Environmental Assessments, Granby, CO** – Mr. Gurnée and his Team performed an assessment of ecological opportunities and constraints in the aquatic, riparian, wetland and threatened and endangered species habitat along the Colorado River for the development and enhancement of fishing/resort ranch amenities.
- **Village at Avon, Avon, CO** – Grant and his Team performed a wetland delineation and prepared CWA Section 404 permitting for the town center expansion and low-density ranchette development.

Protected Species Surveys and Habitat Assessments

- **Golden Eagle Monitoring at Meadow Park in Lyons, CO** - ecos was retained by the Town of Lyons (Town) to perform the monthly monitoring of the Golden Eagle (*Aquila chrysaetos*) nest sites at Meadow Park, to prepare monthly Monitoring Summary Memorandum following each event, and to prepare and submit annual reporting to the U.S. Fish and Wildlife Service (USFWS) associated with the *Lyons Federal Fish and Wildlife Permit #MB82833B-0, Eagle Take Associated With But Not The Purpose Of An Activity* (Take Permit).
- **Nesting Birds, Raptors and Burrowing Owls** – Grant has completed over 100 pre-construction nesting surveys and numerous monitoring surveys for raptors and burrowing owls. His projects include pipeline rights-of-way, housing

and commercial development projects, stream and river restoration projects, wind and solar farm projects, and oil and gas projects along the Front Range of Colorado, as well as projects in the Pine Barrens of southern New Jersey. His avian experience includes golden eagle nest monitoring; barred owl roost and nest monitoring, and call playback inventory; and multi-species raptor surveys.

- **Native Plants** - Grant has completed numerous pre-construction and monitoring surveys for Ute ladies' tresses orchid and Colorado butterfly plant since 1994. His projects include pipeline rights-of way, mined land reclamation projects, housing and commercial development projects, stream and river restoration projects, wind and solar farm projects, and oil and gas projects along the Front Range of Colorado.
- **Threatened, Endangered and Candidate Species** – Grant trained with the leading expert, Robert Stoecker, PhD, in 1994 and 1995 to gain an understanding of the newly listed, federally-threatened species, the Preble's meadow jumping mouse; and since that time, he has completed numerous surveys, habitat assessments, and ESA consultations. He has also performed night-time Swift fox surveys at windfarm sites in southern CO and Boreal toad surveys in northern CO. Prior to relocating to CO Grant performed numerous surveys in N.J., including bobcat surveys to assist in protecting the Pyramid Rock Natural Area; Pine Barrens and gray tree frog surveys, and native Pine Barrens fish surveys with his mentor, Dr. Rudy Arndt; and Eastern box turtle surveys. He also assessed migration routes and alternative mitigation measures for sea turtles that were being impacted by the Garden State Parkway.

Wetland Mitigation and Habitat Restoration

- **Front Range Mitigation and Habitat Conservation Bank –** ecos is assisting Restoration Systems, LLC (RS), the Bank Sponsor, with the assessment, planning and design of the Front Range Umbrella Bank for Aquatic Resource Mitigation & Habitat Conservation (Bank). This "umbrella" Bank is intended to provide habitat mitigation for projects along the entire Front Range of Colorado. The **ecos**/RS Team is in the process of securing viable sites in the major watersheds along the Front Range; and recently submitted the Draft Prospectus for the establishment of the Bank to the U.S. Army Corps of Engineers, Albuquerque District, Southern Colorado Regulatory Office and Omaha District, Denver Regulatory Office.
- **Lions Park Poudre River CWA and ESA Mitigation Site** - ecos assisted Greeley in developing and constructing an advance river and wetland mitigation site at Lions Park in LaPorte, Colorado that may be used for future CWA impacts in the Poudre River watershed. We also prepared a conceptual design for Preble's meadow jumping mouse habitat that will be used to support ESA consultation. ecos assessed the site, prepared the designs, and coordinated review with Greeley, Colorado Department of Parks and Wildlife, Larimer County Parks and Open Lands and Larimer County Engineering Department. The mitigation site provides compensatory mitigation for impacts to wetland and waters of the U.S. under the CWA and will also provide compensation for PMJM habitat under the ESA. This mitigation project entails development of mitigation measures including bioengineered streambank stabilization, fishery habitat enhancement, riparian and wetland habitat restoration and PMJM habitat enhancement.
- **Bellvue Transmission Line Project, Preliminary Compensatory Mitigation Plan (PCMP) -** Mr. Gurnée was the Project Manager for the preparation of the Preliminary Compensatory Mitigation Plan (PCMP) for the Bellvue Transmission Line Project. Built upon preferred strategies in the 2008 Corps Compensatory Mitigation Rules, the PCMP leverages a broad strategy to ensure mitigation success and employs a watershed approach to select and prioritize compensatory mitigation (CM) measures that will best mitigate adverse environmental effects. It is intended to support a Corps determination of minimal adverse effect and allow verification of the Northern Segment of the Project under Nationwide Permit 12. Grant led the Team during the watershed assessment of the Poudre River, identification and prioritization of potential CM and preservation sites, development of a Pilot Watershed Plan, and conceptual design of priority CM sites. The PCMP has been submitted to the Corps for review and approval.
- **Flatirons Parcel Riparian and Wetland Habitat Restoration Project** – Grant assisted Greeley in developing a multiple use project at the Flatirons Parcel, a gravel quarry site in Greeley, Colorado. The site is being decommissioned over the next decade and offers great potential to create a system of ponds connected via a naturalized stream that discharges into the Poudre. The concept design incorporates recreation opportunities that are tied into the Poudre River Trail, a passive park, and the development of wetland, riparian and wildlife habitat.
- **Ruby Pipeline Wetland, Riparian and Waterbody Mitigation and Restoration Plan, WY, UT, NV AND OR -** Mr. Gurnée was the lead restoration ecologist and wetland scientist for the 675-mile, Ruby Pipeline; a natural gas pipeline traversing four states. He was the lead for the preparation of Wetland Mitigation, Riparian and Waterbody Restoration Plans under the CWA, BLM regulations and state equivalent programs. The plans included regulatory

guidelines, requirements, and processes; and ecoregion specific restoration plans. The plans detailed specifications for the basis of design, construction, and revegetation; outlined performance criteria, maintenance and monitoring methods for the restoration of approximately 460 acres of temporary wetland impacts.

- **River Point, Sheridan, CO -** Mr. Gurnée was the project manager and lead restoration ecologist for the team that assessed, permitted and designed the natural and aesthetic features of this Brownfields project. The project included a naturalized water quality swale and riverfront improvements which complement the aesthetics and ecology of the South Platte River corridor. The swale was designed to mimic the form and function of a tributary stream, providing passive water treatment with native wetland and riparian vegetation, as well as flood attenuation with instream structures and grade control. The project utilized natural, "bio-engineering" and "bio-technical" techniques to repair and maintain channel and stream bank stability, and native vegetation to enhance and restore habitat. This project also addressed the interface of proposed restaurants, a regional greenway trail, and the river through planning and design of nature trails, interpretive nodes and overlooks/access features that will function to both stabilize banks and help connect people with the river.
- **Caribou Peat Bog Restoration, Nederland, CO –** Grant performed the impact assessment, prepared native plant community design, planting cost estimate, and on-the-ground oversight of restoration volunteers to restore a high-altitude peat bog disturbed by an illegal off-road-vehicle "mudfest".
- **Opportunity Ponds Operational Unit, Anaconda, MT -** Mr. Gurnée was the project manager and lead restoration ecologist providing technical support to Atlantic Richfield/British Petroleum at a Superfund site in the Upper Clark Fork River basin in Montana between 1995 and 2008. Services included wetland delineation and functional assessment of over 3,000 acres of wetland, stream and pond habitat; design of stream and wetland habitat mitigation projects; and permitting/compliance services. The largest project within the Superfund site was the Opportunity Ponds, a 908-acre wetland, stream and wildlife habitat creation project. The project will result in the largest freshwater mitigation project in the U.S; and is intended to mitigate for historic wetland/waters impacts from Anaconda Mining Company operations and current impacts resulting from remedial actions associated with the Superfund cleanup process.
- **The Club at Flying Horse Golf Course, Colorado Springs, CO –** On behalf of Classic Communities, Grant and his Team assessed wetland habitat, recommended impact avoidance and minimization measures, and prepared the Section 404, CWA permit for a 1500-acre mixed use development and Weiskopf golf course. The project aesthetic and mitigation measures included the design of native prairie roughs, meandering stream channels and native wetland meadows within the golf course. Extra wetland mitigation was created to serve as a private mitigation bank for the client.
- **Maloit Park, Minturn, CO -** Grant was the project manager and restoration ecologist for the Maloit Park Restoration Project, which was necessitated by the accidental release of mine slurry that contaminated the soils and vegetation of critical wetland habitat at the confluence of Cross Creek and the Eagle River. The project included the assessment of the site, the collection of native wetland seed (that was adapted to site conditions); the selection of appropriate replacement soil; the design of the restoration grading and planting plans; and oversight during the soil replacement, grading and planting phases. Mr. Gurnée also provided follow-up monitoring and reporting to ensure the successful establishment of the wetland habitat.
- **Department of Energy, Private Mitigation Bank, Westminster, CO -** Mr. Gurnée provided the project assessment, design, permitting, mitigation banking instrument negotiation with the Corps and EPA, and construction supervision of a 12-acre wetland mitigation bank for the Department of Energy in Westminster, CO. The project provides compensatory mitigation for impacts associated with the Rocky Flats clean-up and remediation project. It should be noted that this was the first private mitigation bank negotiated in Colorado, and as such it assisted in setting the precedent for future negotiations.
- **Wetland Mitigation for the Stanley Lake Protection Project, Westminster, CO -** Grant and his Team provided assessment, design, permitting, and construction supervision of an 11-acre wetland and wildlife habitat mitigation project in Westminster, Colorado. The project provides compensatory mitigation for impacts associated with the construction of the Stanley Lake Protection Project.
- **Saudi Arabia Coastal Wetland Restoration -** Mr. Gurnée assisted in the restoration planning for 67 square kilometers (41 square miles) of high salt marsh (sabhka) impacted by Gulf War oil spills.

Aquatic, Wetland, and Riparian Habitat Design

- **Saint Vrain Creek Breaches Restoration, Boulder County, CO** - ecos is part of the Design Team assisting Boulder County Parks & Open Space (BCPOS) with the restoration, repair and enhancement of the reach of the Saint Vrain Creek from Highway 36 downstream to Hygiene Road in rural Boulder County, which was damaged by the 2013 floods. Our role on the project includes: 1) desktop and field assessment to inventory and document the characteristics of the stream reach and riparian corridor (e.g. stream/in-stream features, vegetation, wildlife habitat); identify and locate significant habitat features within the areas of proposed construction; identify potential sources of native plant materials for restoration; and identify areas of opportunity within the breach repair work areas for native vegetation, wetland, PMJM, leopard frog and fishery habitat restoration; and delineate wetland habitat and waters of the U.S. in all areas of proposed/potential construction-related impact; 2) vegetation community and wildlife habitat restoration design; 3) permitting and compliance under the CWA, ESA and NHPA; 4) construction oversight for restoration construction; and 5) monitoring and reporting project success/establishment to BCPOS, stakeholders, the Corps, FWS and the State of Colorado Department of Local Affairs (DOLA) under the (the Grant funding agency under the Community Development Block Grant Disaster Recovery (CDBGDR) Resilience Planning Program grant.
- **Bohn Park Flood Recovery Design, Town of Lyons, CO** – ecos is part of the Design Team assisting the Town with the restoration, repair and enhancement of Bohn Park in Lyons, which was damaged by the 2013 floods. Ecos roles is to assess and design the natural restoration of the vegetation communities and habitat along St. Vrain Creek and riparian corridor; and to support the project design by acquiring permits/approvals and maintaining regulatory compliance under the CWA, ESA and National Historic Preservation Act (NHPA). The final design will address goals and priorities associated with the Parks Flood Recovery Planning Process, FEMA Project Worksheets and Project Scopes, the Lyons Recovery Action Plan (LRAP), associated Program Development Guides (PDG's), existing Town master plans, comprehensive plans and other relevant documentation and studies.
- **James Creek Post-Flood Restoration, Lefthand Watershed Oversight Group (LWOG), Jamestown, CO** – ecos was part of the LWOG and Boulder County Department of Transportation Team responsible for preparing the 30-60% design package for James Creek Reach 16 as identified in the Left Hand Creek Watershed Master Plan. ecos performed pre- and post-flood plant community assessment; developed revegetation goals and objectives, the basis of design, monitoring protocols, and revegetation plans in accordance with Colorado Department of Local Affairs (DOLA), Community Development Block Grant – Disaster Recovery (CDBG-DR) 30% Guidelines. Specific resources and issues of concern addressed by ecos, included federal and state listed candidate, threatened and endangered species, wildlife species of concern (including raptors), fisheries and fish passage, native plant communities, and management of noxious weeds, all in concert with geomorphic, hydrology and hydraulic analysis and design prepared by other team members.
- **Saint Vrain Creek Restoration and Floodplain Resiliency Plan, Lyons, CO** – ecos is part of the design-build team intent on restoring the St. Vrain Creek corridor in the Town of Lyons that was damaged during the September 2013 flood event. The goal of the project is to create a more resilient floodplain and natural channel condition that will alleviate future threats to the community, reestablish floodplain connectivity, stabilize banks, and restore aquatic, wetland and riparian habitat that was wiped out during the flood. Grant is responsible for CWA, ESA, Migratory Bird Treaty Act and Bald and Golden Eagle Protection Act permitting; as well as developing the plant communities and revegetation strategies needed to restore aquatic and riparian structure and functions within the corridor that support fish, wildlife, recreation, and help the town regain the ecological benefits and economic value they receive from outdoor enthusiasts.
- **Bellvue Raw Water Ponds Riverbank Restoration, Bellvue, CO –** The 2013 flood on the Poudre River altered the course of the river and severely eroded a bank nearly causing a breach of the City of Greeley's raw water ponds – their main municipal water supply. The goal of the project was to stabilize the bank to protect the ponds and to create riparian habitat for the Preble's meadow jumping mouse, a federally listed threatened and endangered species. Jon was responsible for preparing bioengineering design plans and specifications that include soil/cobble encapsulated lifts, stream barbs to deflect flows away from the bank, and harder, biotechnical design of soil/riprap and stream bed scour protection measures to prevent erosion and further undermining and sloughing of the bank. Design plans included specification of native plant materials and various techniques to restore cottonwood forest and willow habitat to further stabilize the bank.

- **Poudre River Pipeline Crossing at Kodak, Windsor, CO –** ecos role on the project was to assess restoration potential, techniques, and prepare design plans and performance specifications to reclaim a pipeline corridor across the lower Poudre River where the City of Greely had to replace 3 major water supply lines. ecos also provided oversight during the construction of site and riverbank stabilization and restoration measures following installation of the pipelines.
- **Lions Park Poudre River Restoration Plan, Laporte, CO –** ecos role on the project was to assess habitat conditions; gather, compile and analyze field survey data; and to prepare the mapping and mitigation design plans for the Lions Park PMJM habitat and the Poudre River Bank Stabilization Plans. We designed and executed the technical drawings for the structural components of the habitat, ensuring that the proposed riparian plant community, habitat structures (brush piles), and bioengineered streambank stabilization measures will create the conditions that alleviate the current habitat fragmentation; support the life requisites of the PMJM; and enhance the overall health of the Poudre River fishery.
- **C Lazy U Ranch, Willow Creek Fishery Enhancement Plan, Granby, CO -** Mr. Gurnée was the lead fisheries biologist and wetland ecologist for the assessment and design of this project. The project entailed 2 miles of instream and riparian cover habitat aimed at enhancing water quality through increased bank stability, improving aquatic habitat and angling opportunities, and providing long-term stability to the reach given existing land-use constraints, and ongoing ranching activities. Bank-side improvements included wetland mitigation design to support ranch impacts, detailed seeding and planting plans indicating site-specific plant and seed locations, life zones, and species palettes according to hydrologic, soil, and aspect conditions. Grant was the regulatory lead, consulting with the Corps under Section 404 of the CWA.
- **Edwards Eagle River Restoration Project, Edwards, CO –** Grant was the senior wetland ecologist and fisheries biologist for the Edwards Eagle River Restoration Project (Project); which is roughly 1.5 miles long covering an area of 168 acres of floodplain along the Eagle River in the heart of the Edwards community. The project utilized indigenous materials and methods to naturally integrate habitat structure in the landscape context. He provided grant funding support; stream, riparian, wetland and fisheries habitat assessment, planning and design; and construction oversight services to the Eagle River Watershed Council for the Project. He assisted the ERWC in facilitating the public process associated with developing stakeholder support and gaining funding through the Eagle Mine Natural Resources Damage Fund. The Project was awarded over $2,000,000 in grant funding; $1,400,000 of which was from the Eagle Mine NRDF. The total project cost is projected at $4,300,000.
- **Gypsum Creek Fisheries Enhancement, Gypsum, CO -** Mr. Gurnée was the lead fisheries biologist and restoration ecologist for the instream and riparian habitat assessment, design, permitting and implementation of habitat improvements along Gypsum Creek. Project treatments included both instream and bankside treatments. Instream treatments served to improve deep-water habitat, create flow separation or concentration zones, increase low flow sinuosity, provide instream cover, improve adult fish habitat, create nursery areas, and enhance spawning opportunities. Bankside treatments for aquatic habitat improvements included creation or enhancement of overhead cover; provision of protective cover; and enhancing shading, cooling, and nutrient cycling functions. Bank protection treatments served to correct localized bank instabilities and reduce bank erosion and the potential for sediment deposition downstream. The Colorado Division of Wildlife (CDOW) commented that, "The Gypsum Creek project was implemented in such a low impact manner that you cannot tell that construction had occurred in the area."
- **Cache La Poudre River Removal Action, Fort Collins, CO -** On behalf of the City of Fort Collins, Mr. Gurnée led negotiations between the EPA, stakeholders and the City regarding riverine, riparian and wetland regulatory and restoration design standards during the removal and remediation of a contaminated reach of the Poudre River. He also provided design review and revision, as well as construction oversight to ensure successful implementation of the instream and streambank restoration along the 0.50 mile, highly visible reach of the river near downtown Fort Collins.
- **TZ Ranch, Elk Hollow Creek Fishery Habitat Enhancement Plan, Saratoga, WY -** ecos performed the assessment and design of the Elk Hollow Creek Project, which included instream and riparian habitat improvements aimed at increasing bank stability, improving aquatic habitat and angling opportunities, and providing long-term stability to the reach. Instream improvements included drop structures, plunge pools, deep pools, riffles and spawning habitat. Bank improvements included seeding and planting plans for native wetland and riparian species. Grant was the

regulatory lead, consulting with the Corps under Section 404 of the CWA and the Wyoming Department of Fish and Game. ecos also provided construction oversight and native plant installation services to ensure the successful implementation of the Project.

- **Brush Creek Fishery Enhancement Plans, Saratoga, WY –** Grant assisted in the preparation of access and staging plans, design plans and details, and performed on-site construction oversight of instream and riparian habitat enhancements and bioengineered bank stabilization for a 3-mile reach of Brush Creek. The purpose of the project is to enhance fish, bird and wildlife habitat and use these resources to facilitate education and improve the recreational experience of Ranch guests.
- **Brush Creek Ranch Pond Creation Plans, Saratoga, WY –** ecos provided design-build services including site optimization selection; excavation, grading, drainage and revegetation plans; and construction oversight for a 0.30-acre fishing pond. The pond design included an innovative undercut bank design incorporating a framework of trees supporting transplanted, native sod; which provided excellent fish habitat.
- **Boulder Creek Fishery Enhancement and Pond Creation Project, Boulder, CO -** Grant was the lead fisheries biologist and restoration ecologist for this project along a private reach of South Boulder Creek adjacent to City of Boulder, Eldorado Canyon Open Space. His tasks included instream and riparian habitat assessment, design of instream and pond fishery habitat and riparian enhancement measures and permitting and consultation. Grant was also the regulatory lead, consulting with the FWS regarding PMJM habitat and with the Corps under Section 404 of the CWA.
- **Stream and Floodplain Restoration at A.T. Massey Coal Mining Facility, KY -** Grant was the Project Manager, fisheries biologist and restoration ecologist for the technical team tasked with assessment and restoration of 26 miles of stream corridor following the accidental release of 250 million gallons of coal slurry into two separate drainages in eastern Kentucky. He was the first ecologist to respond after the spill to ensure that fisheries, stream and riparian habitat restoration objectives were incorporated into the selected cleanup measures. As such, Grant devised a "triage" categorization and remediation system for all affected reaches that minimized impacts to sensitive aquatic and riparian habitat based on the site-specific level of cleanup and remediation required. In addition to instream and bank restoration and stabilization, comprehensive riparian corridor restoration was a major component of the project. Grant was the regulatory and permitting lead and coordinated permits and approval with EPA, Corps and State agencies.
- **Roaring Fork Golf and Fishing Club, Basalt, CO -** Mr. Gurnée was the lead fisheries biologist and restoration ecologist for the assessment, design, permitting and construction supervision of a native trout stream (1 mile) with associated wetland complexes (3 acres). The trout stream was created as an amenity and functional fly-fishing challenge for this fishing component of the Roaring Fork Club; and the associated wetland and riparian habitat were created to naturalize the stream and provide compensatory mitigation for impacts associated with the development of the club facilities. Grant was the regulatory and permitting lead and coordinated permits and approval with Corps and CDOW.
- **Spring Creek Wetland Mitigation, Colorado Springs, CO** – Grant and his team generated wetland and creek creation plans that integrated required mitigation into a high density, "new urban" development. The design emphasized re-utilization of urban storm water to sustain wetlands, use of indigenous plants, construction materials, and natural geomorphic relationships.
- **Tobacco Island Project, Kansas City, MO -** Grant was the lead fisheries biologist and restoration ecologist for the Corps, Tobacco Island Project - a portion of the Missouri River Bank Stabilization and Navigation, Fish and Wildlife Mitigation Project. Project tasks included assessment and conceptual design of measures aimed at reconnecting floodplain and riparian habitat to a reach of the Missouri River near Kansas City. He prepared preliminary designs of channel and backwater wetlands; provided regulatory analysis under Section 404 of the CWA; and assisted in the preparation of an Environmental Impact Statement.
- **San Miguel River Corridor Restoration Plan -** Mr. Gurnée was the lead restoration ecologist, planner and designer for phase 1 of the San Miguel River Corridor Restoration Plan, which included a 1-mile reach through Town. He and his team assisted the Town of Telluride in applying for and winning approximately $500,000 in Natural Resource Damage Assessment Fund money from the State of Colorado. The money, along with other funding, was utilized for final design and construction of the project which included instream habitat, streambank restoration, riparian and wetland restoration, trails and parks. Grant was responsible for leading all public meetings, regulatory negotiation and permitting; assisted the Town with grant funding; and provided construction oversight services.

- **High Altitude Stream Restoration at Copper Mountain Resort, CO -** Grant was the lead ecologist for the restoration of an alpine stream and enhancement of associated wetland and riparian habitat situated within tundra habitat atop Union Peak at Copper Mountain Resort. Grant performed the assessment, design, permitting, and construction oversight for one of the highest altitude stream restoration and wetland mitigation projects in Colorado (approximately 11,500 feet above sea level). Innovative bioengineering and construction techniques were designed and adapted to this sensitive environment to minimize construction-related impacts and maximize environmental benefits.

Threatened & Endangered Species Consultation & Habitat Restoration

- **The Farm (formerly Allison Valley Ranch), Colorado Springs, CO –** Mr. Gurnée performed the habitat assessment and mapping; and prepared ESA, Section 7 and CWA, Section 404 consultation documents as required by the FWS and Corps, including mitigation construction documents, specifications, on-site layout of plant communities and construction supervision aimed at restoring wetland and riparian habitat occupied by Preble's meadow jumping mouse. Ecos is currently assisting the owner with construction oversight for habitat restoration and native planting.
- **Advance Mitigation for PMJM Habitat** – ecos is assisting a private client in identifying, assessing, prioritizing and designing advance mitigation sites for PMJM habitat in the North Fork and main stem of the Cache la Poudre River.
- **TriView Metropolitan District ESA and CWA Permit Resolution, Monument, CO -** Mr. Gurnée represented the TriView Metropolitan District (TriView) and Phoenix Bell as the lead consultant to resolve outstanding compliance issues related to a joint ESA, Section 7 Consultation and CWA, Section 404 Permit. Grant lead negotiations amongst the various landowners, TriView and the Town to resolve compliance issues related to PMJM and wetland habitat, such that development may proceed in this core area of the town. Upon resolution and agreement of the stakeholders, he lead the negotiations with the FWS and Corps to formally amend the Biological Opinion and 404 Permit. Once the approvals were amended, Grant lead the planning and design of PMJM and wetland habitat to meet mitigation requirements under the ESA and CWA.
- **Bernardi Residential Property, Eldorado Canyon, Boulder, CO –** ecos consulted with the Corps and FWS to document and fulfill regulatory requirements for a residential home construction project in PMJM, wetland and riparian habitat. Mr. Gurnée coordinated with the FWS and Corps and obtained approvals under ESA, Section 7 and CWA, Section 404. He prepared all consultation documents, including the Biological Assessment, mitigation plan, and construction documents and specifications. Grant is leading the on-site layout of plant communities and construction supervision, aimed at restoring wetland and riparian habitat occupied by the PMJM.
- **Northgate Boulevard Realignment, Colorado Springs, CO –** Mr. Gurnée performed the habitat assessment and mapping; and coordinated and prepared ESA, Section 7 and CWA, Section 404 consultation documents as required by the FWS and Corps, including mitigation construction documents, specifications, on-site layout of plant communities and construction supervision aimed at restoring wetland and riparian habitat occupied by Preble's meadow jumping mouse.
- **Jefferson County Highways and Transportation Department Gunbarrel Bridge Replacement, Oxyoke, CO -** ecos staff consulted with the Corps, FWS, CDOT, and the FHWA to document regulatory requirements for a bridge replacement project in PMJM, wetland and riparian habitat. He and his Team produced a CDOT Wetland Finding Report, Biological Assessment, acquired a Section 404 Permit and Biological Opinion (Section 7 of the ESA), and then implemented habitat mitigation improvements at the site.
- **Northgate Project, Colorado Springs, CO -** As project manager, Mr. Gurnée led the team in the assessment, permitting and regulatory negotiation (Section 404 of the CWA and Section 7 of the ESA) for the project which included the planning, design and construction supervision of a precedent setting, "joint" mitigation plan for 60 acres of wetland, riparian and PMJM habitat.

Ecological Master Planning

- **Sundance Trail Guest Ranch, Larimer County,** CO – ecos is currently assisting a local guest ranch in the assessment of natural resources and site features, and the development of site plans to balance natural habitat and aesthetic values with the expansion of guest facilities and services.

- **Sand Creek Channel Improvements Stability Analysis at Indigo Ranch, Colorado Springs, CO** - ecos was retained to perform an analysis of channel stability under proposed development conditions for a 1.17-mile reach of Sand Creek. Ecos utilized existing vegetation composition data, density and height within the Project reach as a basis; and compared the 10-year and 100-year storm event modelling data (specifically flow velocity, flow depth and shear stress) to reference literature to provide a professional opinion regarding the future stability of the channel under developed conditions. The analysis of channel stability for the proposed Project assumes a bioengineering and biotechnical approach that preserves and enhances the existing vegetation, as well as substrate cohesion and stability, within the channel and its streambanks. The Stability Analysis will likely serve as a benchmark study for the City of Colorado Springs to use to preserve other naturally stable channels.
- **Uncompahgre River Corridor Master Plan, Montrose, CO –** Grant and his Team assessed the character, condition and quality of aquatic, wetland and riparian habitat along a 10-mile rural and urban corridor of the Uncompahgre River through the City of Montrose. Habitats were then rated, ranked, prioritized and master planned for their preservation potential and integration in to the parks, recreation and trail system. The master plans form the foundation for the City to focus environmental stewardship, tourism and generate riverfront economic development with a focus on the river – the major asset of the Community.
- **Brush Creek Stewardship and Enhancement Plan, Saratoga, WY –** Mr. Gurnée managed the assessment of a 12,000-acre, private ranch near Saratoga, Wyoming and the preparation of the Ranch Stewardship Plan (Plan). The Plan includes land and resource stewardship goals, objectives, and implementation action items; including ranch-wide master planning of the trail and recreational systems, design of the Brush Creek riparian corridor trail, and restoration/fisheries habitat enhancement of Brush Creek. Trail and recreation planning and design focused on universal access, habitat sensitivity, environmental education, and wildlife observation opportunities and unique landscape experiences.

Environmental Assessment and Impact Studies

- **NEPA EA for Eagle County Airport Runway Expansion, Eagle County, CO -** Grant was project manager and senior ecologist for an Environmental Assessment (EA) under the National Environmental Policy Act (NEPA) for a proposed 1000-foot runway expansion and ILS installation at the Eagle County Airport, west of Vail, Colorado. Critical issues addressed included noise, ecological, and public opinion considerations. Grant conducted the work under FAA guidance requirements for EAs.
- **NEPA EA for the Avon Interstate 70 Interchange -** Mr. Gurnée was project manager and senior ecologist for this NEPA EA. He performed environmental assessment and data compilation work for construction of a new CDOT interchange and associated development on Interstate 70. This included evaluating T&E Species; a wetlands inventory; a cultural/archeological resources survey; noise and air pollution modeling and studies; and reviewing soils, meteorology, geologic hazards, and other impacts.
- **Raritan River Wetland Inundation Impact Study, N.J. -** Grant's work on the preparation and processing of the first Individual Permit under the New Jersey Freshwater Wetlands Protection Act of 1987 included a precedent setting wetland inundation study. This study shaped the N.J. Department of Environmental Protection's policy regarding the need to assess hydrologic impacts during wetland permit reviews.

Construction Oversight and Plant Installation

- **2013 Flood and 2014 Runoff Events, Damage Restoration, Cache la Poudre River, CO** - ecos performed the construction oversight of 3 flood and runoff damage restoration projects along the Cache la Poudre River.
- **Lions Park CWA and ESA Mitigation Site** - ecos performed the construction oversight for an advance river and wetland mitigation site at Lions Park in LaPorte, Colorado.
- **TZ Ranch, Elk Hollow Creek Fishery Habitat Enhancement Plan, Saratoga, WY -** ecos performed the construction oversight for the Elk Hollow Creek Project.
- **Brush Creek Ranch Fishery Enhancement Plans, Saratoga, WY –** Mr. Gurnée assisted in the construction oversight for a 3-mile reach of Brush Creek to improve fisheries and outdoor recreation experiences for guests of the Ranch.
- **C Lazy U Ranch, Willow Creek Fishery Enhancement Plan, Granby, CO -** Grant assisted in the construction oversight for this fishery habitat, channel stabilization and streambank restoration project.

- **Standley Lake Protection Project, Westminster, CO –** Mr. Gurnée performed construction oversight of a 12-acre created emergent wetland that he and his Team designed to fulfill CWA mitigation requirements and bring closure to the City's drinking water protection project.
- **Caribou Peat Bog Restoration, Nederland, CO –** Grant prepared native plant community design, planting cost estimate, and on-the-ground oversight of volunteers to restore a high-altitude peat bog disturbed by an illegal four-wheel drive "mudfest".
- **Department of Energy Wetland Mitigation Bank, Westminster, CO –** Mr. Gurnée provided construction supervision of the grading and planting of a 12-acre wetland mitigation bank that he and his Team designed for the Department of Energy.
- **ARCO Lower Area One and Butte Reduction Works, Butte, MT –** Grant performed construction observation and supervision of temporary labor crews to plant a passive treatment wetland designed to absorb heavy metals from groundwater.

Natural Treatment System Design

- **Natural Treatment Wetlands, Butte, MT -** Mr. Gurnée and his Team performed the assessment and design of the ARCO Lower Area One and Butte Reduction Works passive treatment wetlands. These natural treatment systems were situated within two units of a reclaimed superfund site to treat heavy metals in surface and groundwater.
- **Natural Treatment Wetlands, Avondale, AZ –** Grant and his Team performed the assessment and design of a constructed wetland system to treat surface water and inject/recharge the municipal well system for the City of Avondale, AZ. This system successfully alleviated a well moratorium necessitated by a contaminated groundwater aquifer.

PUBLICATIONS:

Giordanengo, John H., Randy Mandel, William Spitz, Matthew Bossler, Michael Blazewicz, Steven Yochum, Katie Yagt, William LaBarre, Grant Gurnée, Robert Humphries and Kelly Uhing. 2016. Living Streambanks, A Manual of Bioengineering Treatments for Colorado Streams. Submitted to the State of Colorado, Colorado Water Conservation Board Denver, Colorado. Submitted by AloTerra Restoration Services, LLC, and Golder Associates, Inc.

Gurnée, Grant E. 1998. Wetland Revegetation Techniques chapter in Native Plant Revegetation Guide for Colorado, Caring for the Land Series, Volume III; a joint publication of the Colorado Natural Areas Program, Colorado State Parks, and Colorado Department of Natural Resources. Denver, Colorado.

Gurnée, Grant E. 1995. Optimizing Water Reclamation, Remediation and Reuse with Constructed Wetlands. Environmental Concern Wetland Journal, Summer 1995 Issue. Environmental Concern, Inc. St. Michaels, Maryland.

PRESENTATIONS:

Gurnée, Grant E., 2016. Clean Water Act, Section 404 Permits for Flood Recovery Projects. Presented at the Colorado Stream Restoration Network (CSRN) conference in Longmont, CO on March 23, 2016.

Gurnée, Grant E., 2016. Endangered Species Act Consultation for Flood Recovery Projects. Presented at the Colorado Stream Restoration Network (CSRN) conference in Longmont, CO on March 23, 2016.

Gurnée, Grant E., 2010. Stream Corridor/Bioengineering Round Table. Presented at the Colorado Riparian Association (CRA) Sustaining Colorado Watersheds Conference on October 5 - 7, 2010 in Vail, Colorado.

Gurnée, Grant E. and Greg A. Fenchel, 2009. Stream Corridor/Bioengineering Workshop. Presented at the Colorado Riparian Association (CRA) Sustaining Colorado Watersheds Conference, October 7 - 9, 2009 in Vail, Colorado.

Gurnée, Grant E. and Scott J. Franklin, 2008. Section 404 Individual Permits: Negotiating the Application and Follow-up Process. Presented at the CLE International, Colorado Wetlands Conference, May 8 – 9, 2008 in Denver, Colorado.

Gurnée, Grant E. and Julie, E. Ash, P.E., 2007. Edwards Eagle River Restoration Project. Presented at the Colorado Riparian Association (CRA) Sustaining Colorado Watersheds Conference, October 5 - 7, 2009 in Breckinridge, Colorado.

Gurnée, Grant E. 2000. Natural Treatment Alternatives for Surface Discharges, Surface Runoff, and Mined Land Reclamation. Presented at the International Mining Technology Seminar, September 13 – 15, 2000 in Belo Horizonte, Minas Gerais, Brazil.

Gurnée, Grant E. 1999. Wetland Mitigation: Considering Mitigation Requirements in the Project Planning Process. Presented at the Continuing Legal Education (CLE) Wetlands & Mitigation Banking Conference, October 21 & 22, 1999 in Denver, Colorado.

Hoag, Chris, Hollis Allen, Craig Fisheneck and Grant Gurnée. Bioengineering Workshop sponsored by the U.S. Army Corps of Engineers Waterways Experiment Station and the U.S. Department of Agriculture – Aberdeen Plant Materials Center. Presented September 1998 in Carson City, Nevada.

Hoag, Chris and Grant Gurnée. 1998 Glancy Riparian Demonstration Project. Assistant instructor for a hands-on bioengineering workshop on the Carson River. September 1998 near Dayton, Nevada.

Gurnée, Grant E. 1998. Stream and Wetland Restoration Successes and Failures: The Good, the Bad, and the Ugly. Presented at the Colorado Riparian Association (CRA) Restoring the Greenline Conference. October 16, 1998. Salida, Colorado.

Gurnée, Grant E. 1998. Save Our Streams, Wetland Conservation and Sustainability Workshop. Lead Instructor of wetland assessment and restoration course presented with the Izaak Walton League. April 21 & 22, 1998. Boulder, Colorado.

Windell, Jay, and Grant Gurnée. 1998. Creation of a Stream, Riparian and Wetland Ecosystem: Tributary to the Roaring Fork River, Basalt, Colorado. Presented at the American Society of Civil Engineers, Wetlands Engineering & River Restoration Conference, March 23 – 27, 1998 in Denver, Colorado.

Gurnée, Grant E. 1998 A Case Study: Department of Energy's Wetland Mitigation Bank at Standley Lake. Presented at the Continuing Legal Education (CLE) International, Colorado Wetlands Conference, January 27 – 29, 1998 in Denver, Colorado.

Gurnée, Grant E. 1997. Wetland Mitigation: Design and Implementation via the Design/Build/Grow Process. Presented at the International Erosion Control Association, Erosion & Sediment Control Workshop, November 19, 1997 in Northglenn, Colorado.

Gurnée, Grant E. 1997. Wetland Mitigation: Design and Implementation via the Design/Build/Grow Process. Presented at the International Erosion Control Association, Erosion & Sediment Control Workshop. November 19, 1997. Northglenn, Colorado.

Gurnée, Grant E. and Gary Bentrup. 1996. Wetland and Riparian Protection Strategies. Presented at the Sierra Club, Regional Growth Strategies Conference, "New Perspectives and Strategies to Preserve Mountain Communities." February 16 – 17, 1996. Glenwood Springs, Colorado.

Gurnée, Grant E. 1994. How to Recognize and Deal with Wetland Regulation Issues. Presented at the Continuing Legal Education (CLE) International, 3rd Annual Western Agricultural and Rural Law Roundup. June 23-25, 1994. Fort Collins, Colorado.

AWARDS:

- Colorado Landscape Contractors Award, Sand Creek Enhancement Project – 2000

PROFESSIONAL ASSOCIATIONS:

- Association of State Wetland Managers (ASWM)
- Society of Wetland Scientists (SWS)
- Environmental Concern (EC)

ecos ecosystem services LLC

RESUME

Jon Dauzvardis, M.L.A, P.W.S.

Owner/Managing Partner
Senior Restoration Ecologist
Landscape Architect
Wetland Ecologist

AREAS OF EXPERTISE:

- Vegetation Inventories and Mapping
- Habitat Assessment, Functional Assessment and Wetland Delineation
- Aquatic, Wetland, and Riparian Restoration Ecology, Planning and Design
- Landscape Ecology, Planning and Landscape Architecture
- Conservation and Resource Mitigation Bank Support Services
- Grant Funding Support for Conservation and Restoration Projects
- Open Space and Trail Planning, Design and Habitat Management
- Construction Oversight & Best Management Practices
- AutoCAD, Mapping, Presentation Graphics

EDUCATION:

- Master of Landscape Architecture, Texas A&M University, College Station, Texas, 1995
- Bachelor of Science, Environmental Design, University of Missouri, Columbia, 1991
- Architecture Study, Harvard University Graduate School of Design, Cambridge, Massachusetts, 1989

EMPLOYMENT HISTORY:

- 2008-Present, Owner/Manager and Senior Restoration Ecologist, Ecosystem Services, LLC, Erie Colorado
- 2000 – 2011, Senior Restoration Ecologist, Walsh Environmental Scientists and Engineers, LLC, Boulder, Colorado
- 1997 – 2000, Restoration Ecologist, Construction Supervisor, Aquatic and Wetland Company, Boulder, Colorado
- 1996-1997, Landscape Architect, Design Studios West, Denver, Colorado
- 1995-1996, Landscape Architect, Wenk Associates, Denver, Colorado
- 1994-1995, Graduate Researcher, ALCOA – Texas A&M University, College Station, Texas
- 1994, Johnson County Parks and Recreation Department, Shawnee Mission, Kansas
- 1992-1994, Grounds Maintenance Superintendent, Brazos County, Texas

CONTINUING EDUCATION:

- Stream Functions Pyramid Workshop, Denver, CO - 2014
- Colorado Natural Heritage Program, Wetland Plant Identification - 2014
- Colorado Natural Heritage Program, Ecological Integrity Assessment for Colorado Wetlands - 2013
- FACWet – Functional Assessment of Colorado Wetlands - 2010, 2012 and 2013
- ESRI, ARC View Geographic Information System (GIS) Training, 1996
- Bicycle Planning and Facilities Training, 1994
- AutoCAD Drafting and Design, Self-taught, 1991

CERTIFICATIONS:

- Professional Wetland Scientist Certification (# 1699), Society of Wetland Scientists Certification Program, 2004

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EXPERIENCE SUMMARY:

Mr. Dauzvardis is a founder and managing partner of Ecosystem Services, LLC (**ecos**), a small, ecological planning and design business dedicated to the restoration, enhancement and creation of aquatic, wetland and riparian habitat. Jon is a certified Professional Wetland Scientist with over 23 years of experience working in the fields of landscape architecture, ecological restoration, and wetland science in Colorado, Wyoming, Texas, Kansas and the Intermountain West. Jon's academic, professional and work history in housing design, community planning, architecture, landscape architecture, ecological planning and restoration is unique and makes him a valuable asset to his company, clients and their projects. His diverse knowledge and skills in landscape planning, habitat design, bioengineering, and hands-on experience demonstrate that he can easily negotiate between art and science, man-made and natural systems, generalities and detail, and concepts and landscape construction. Jon takes a practical and realistic approach to generating ideas that solve problems, concentrating on broad scale ecological master planning simultaneously with fine scale design of aquatic, wetland, riparian and terrestrial habitats. As a restoration ecologist, Jon specializes in restoring and enriching habitat structure, stability and health and how to manage landscapes and natural systems so that they function, change, and respond positively over time. Jon's strengths are rooted in his understanding of natural and landscape processes; finding design solutions that integrate the needs of people, wildlife, and visual quality; sustaining ecosystem goods and services; and integration of nature-based recreation and environmental education programs and facilities.

RELEVANT PROJECT EXPERIENCE:

Habitat Assessment and Regulatory Compliance

Mr. Dauzvardis routinely performs ecological site and resource impacts assessments, jurisdictional wetland determinations and functional assessments to assist clients in site planning, design, and permitting processes. Assessment methods established by the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and Colorado Department of Transportation among others are used to assess habitat elements and screen sites for threatened and endangered plants and animals, wetlands, migratory birds and other wildlife. Jon stresses habitat impact avoidance and minimization to preserve a site's ecological benefits and to minimize regulatory constraints, timing and permitting costs. Jon has performed a multitude of site assessments, delineations and prepared permits, including but not limited to the following notable projects as well as others listed throughout this resume:

- **Bellvue Pipeline Project, Larimer County, CO** – ecos was retained by the City of Greeley as Best Management Practices (BMP) Facilitators to provide pre-construction documentation post-construction oversight of pipeline reclamation processes. Essential responsibilities include meeting with landowners prior to construction to facilitate project understanding and post-construction outcomes; to document landowner needs and wants relative to project goals and land use; and to document and monitor pre- and post-construction reclamation and maintenance requirements.
- **Georgetown Lake, Georgetown, CO –**ecos was hired to prepare an office level assessment report of ecological resources to describe the physical/ecological characteristics of the Project area and evaluate the potential effects of the construction of a loop trail project on environmental issues and species of concern to support a GOCO grant application. Items evaluated and documented, include site location/ownership, general site characteristics, current land use, proposed impacts, possible effects on Federal– and State-listed T&E animal and plant species, unique or important wildlife, water quality, water bodies, wetlands, and floodplains, stormwater runoff, sedimentation, soil erosion, and invasive species. The assessment report also included mitigation measures, project benefits, and environmental compliance recommendations under applicable regulatory programs.
- **Appraisal Support Documentation Report for the 1st Bank Parcel, Colorado Springs, CO** - ecos was retained by 1st Bank Holding Company to perform a Preble's meadow jumping mouse (PMJM) habitat assessment, mitigation cost analysis, and conceptual lot layout for the approximate 9.4-acre Parcel located adjacent to the Northgate Open Space along Smith Creek. Jon was responsible for preparing the lot layout, existing habitat aerial photo interpretation/delineation, proposed conceptual mitigation, and quantification of impacts and associated mitigation to ascertain appraisal value of the site if it were to be developed.
- **Encana Oil and Gas (USA), Denver Julesburg Basin, CO** – Encana hired ecos to assess their ecological constraints, recommend means and methods to avoid, minimize and permit impacts; and to mitigate,

restore and prepare ecological management plans for their drilling and pipeline operations in the Denver Julesburg basin. Jon's role on the team is to perform site assessments, research background data, and prepare assessment reports and mapping data that can be utilized by Encana's project managers and geographic information systems (GIS) department to proactively track ecological resources before issues arise. In addition to client consultation, Jon is responsible for tracking drill site schedules, constraints, restoration and management efforts in a data base and reporting said information to Encana's project manager on a regular basis.

- **Tollgate Creek Riparian and Wetland Habitat Assessment, Aurora, CO** – Jon performed high level aerial photo interpretation and delineation of riparian and wetland habitat along Toll Gate Creek and East Toll Gate Creek from confluence with Sand Creek upstream to East Hampden Avenue. The delineation was performed in Google Earth and imported into AutoCAD by digitizing riparian and wetland habitat zones. Once complete, the data was turned over to the project engineer to incorporate into a Drainage Master Plan for the Urban Drainage and Flood Control District (UDFCD).
- **Eagle River Meadows Ecological Inventory and Strategic Wetland Action Plan, Edwards, CO** – Mr. Dauzvardis delineated, assessed, and provided an analysis of potential adverse effects to wetlands within a complex site adjacent to the Eagle River. Jon also developed a strategic process and decision making tool to determine avoidance, minimization, low impact development (LID), and mitigation measures in support of a County Sketch Plan application for a Multi-use Health Care Community.
- **Mesa County Colorado Riverfront Trail, Grand Junction, CO** – Jon performed wetland delineation, jurisdictional determination, Section 404 Permitting; and prepared wetland mitigation plans to construct approximately two miles of regional trail along the north side of the Colorado River between the James M. Robb and the Colorado River State Park at Corn Lake.
- **ARCO Upper Clark Fork River Basin Superfund Site Functional Wetland Assessment, MT** – Between 2000 and 2008, Jon managed the assessment team and performed extensive wetland delineation, GPS surveying, functional assessments, and impact mapping and analysis covering a 200 square mile Superfund Site affected by historic mining practices. Assessments we done in preparation for soil remediation of heavy metals, capping of tailings ponds, sediment and dam removal, and implementation of compensatory wetland mitigation plans required under a consent decree. Assessment areas included the Anaconda Smelter, Old Works, Opportunity Ponds, and Milltown Reservoir.
- **Jefferson County Highways & Transportation Department Gunbarrel Bridge Replacement, Oxyoke, CO** – Jon consulted with the USACE, USFWS, CDOT, and the FHWA to document regulatory requirements. Produced a CDOT Wetland Finding Report, Biological Assessment, Preble's meadow jumping mouse and wetland mitigation plans, and helped acquire a Section 404 Permit and Biological Opinion.
- **Pole Canyon Wind Farm, Babcock and Brown, Huerfano County,** CO – Assessed and prepared critical issues analysis and County 1041 Permit application for a 125-megawatt wind farm and associated transmission lines located on a 5,800-acre site. The project included detailed site assessments to document the presence or absence of potential development constraints and site-specific ecological conditions as well as preparation of permit maps, plot plans, and environmental analyses, alternatives analysis, and mitigation measures.
- **Dalton Property Wetland Assessment, Longmont, CO** – Provided site assessment, regulatory analyses, and developed a restoration plan for critical riparian and wetland habitat along Left Hand Creek in Boulder County, CO.
- **Colowyo Coal Mine Wetland Delineation, Meeker,** CO – Delineated 1.5 miles of jurisdictional waters and wetlands in preparation for wetland mitigation design along West New Goodspring Creek.
- **Lafarge Northbank Resources Gravel Pit Wetland Assessment, Rifle, CO** – Delineated and acquired a jurisdictional determination from the USACE for complex tailwater and riparian wetlands along the Colorado River. Prepared gravel pit reclamation plans aimed at providing suitable shallow-water lake edge wetlands to serve as compensatory wetland mitigation.
- **Jefferson County Highways & Transportation Department Highway 73 Expansion, Conifer,** CO – Performed presence/absence study, habitat assessment and documentation of wetlands, Migratory Birds, State Species of Concern, and federally listed T&E Species including Bald eagle, Preble's meadow jumping mouse, the Pawnee montane skipper butterfly and Colorado butterfly plant along a one-mile corridor of highway.

- **Flying Horse Ranch and the Club at Flying Horse Golf Course, Colorado Springs, CO** – Conducted an assessment of wetland habitat, impact avoidance and minimization and Section 404 of the Clean Water Act permitting for a 1500-acre mixed use development and Weiskopf golf course design being implemented by Neiber Golf.
- **C-Lazy-U and Horn Ranch Environmental Assessments, Granby, CO** – Performed site assessment of ecological opportunities and constraints of aquatic, riparian, wetland and threatened and endangered species habitat along the Colorado River for the development and enhancement of fishing/resort ranch amenities.
- **Village at Avon, Avon, CO** – Delineated wetlands and prepared a Section 404 Permit for the town center expansion and low-density ranchette development.
- **Residential Developers and Realtors** – Performed numerous wetland and T&E species habitat ecological assessments, wetland delineations, and prepared Clean Water Act Section 404 Permits and mitigation plans for residential developers and realtors, including: Equinox Land Group, DR Horton, Melody Homes, Standard Pacific Homes, Gateway American Properties, Zephyr Real Estate Company, Lowell Development Partners, and Palmer-McAlister, Classic Communities, Stoll Properties, Karen Bernardi, Colorado Commercial Builders, Terra Visions, Smith Creek Holdings, Picolan, Realty Development Services, Northgate Properties.
- **Commercial and Industrial Developers** - Performed numerous wetland and T&E species habitat ecological assessments, wetland delineations, and prepared Clean Water Act Section 404 Permits and mitigation plans for commercial and industrial developers, including: Atira Group, Leadership Circle, Ridgeway Valley Enterprises, Morley Companies, HF Holdings, Regency Centers, Miller-Weingarten, Gulf Coast Commercial Development, Traer Creek, Mountain Property Associates, Morley Golf, Executive Consulting, Inc.
- **Architectural and Engineering Companies** - Performed numerous wetland and T&E species habitat ecological assessments, wetland delineations, and prepared Clean Water Act Section 404 Permits and mitigation plans for A&E firms, including: Classic Consulting Engineers, Del-Mont Consultants, JW Nakai and Associates, Nolte and Associates, JR Engineering, Hyrdosphere, Executive Consulting Engineers, Muller Engineering, Farnsworth Group.
- **Counties, Municipalities, Metro Districts and Quasi-Public Institutions** – Mr. Dauzvardis has performed numerous wetland and T&E species habitat ecological assessments, wetland delineations, and prepared Clean Water Act Section 404 Permits and mitigation plans for counties, municipalities, and quasi-public institutions, including: City of Louisville Highway 42 and 96th Street realignment, City of Westminster Jim Baker Reservoir and Standley Lake Protection Projects, Jefferson County Highway 73 and 67 Improvement Projects, Todd Creek Village Metro District, Town of Monument/Triview Metro District, Boulder Community Hospital, and City of Fort Collins Regulatory Fact Sheets Preparation Project, Todd Creek Village Metro District on-call consultant, Three-lakes Water and Sanitation District, City of Greeley,
- **Educational Institutions** – Performed numerous wetland and T&E species habitat ecological assessments, wetland delineations, and prepared Clean Water Act Section 404 Permits and mitigation plans for educational institutions, including: Colorado Mountain College - Steamboat Springs, The Classical Academy – Colorado Springs, and Coal Ridge High School – Rifle.
- **Wind Energy Developers** – Performed numerous wetland and T&E species habitat ecological assessments, wetland delineations, and critical issues analyses for wind development projects, including: Cedar Creek Windfarm – Weld County, CO, Wheatland Windfarm – Platte County, WY, Silver Mountain Windfarm – Huerfano County, CO, Pole Canyon Windfarm, Huerfano Count, CO.
- **Mining Companies** – Performed wetland and T&E species habitat ecological assessments, wetland delineations, and critical issues analyses for mining companies, including: Lafarge and Kennecott Coal.

Ecological Master Planning

- **Front Range Umbrella Mitigation Bank, CO –** ecos was retained by Restoration Systems, a nationally renowned wetland mitigation banking firm, to help identify and prepare conceptual design plans for mitigation banking sites to establish the Front Range Umbrella Mitigation Bank (Bank). The purpose of the Bank is to provide compensatory mitigation credits for unavoidable, permitted impacts to aquatic, wetland, riparian, upland, wildlife, and threatened and endangered (T&E) species habitat regulated under the Clean Water and Endangered Species Acts; and to restore, enhance and preserve valuable

natural resource functions at degraded mitigation sites within multiple watersheds along Colorado's Front Range. Currently, the Bank is developing banks sites that serve the Cache la Poudre, St. Vrain, Upper South Platte, Fountain and Upper Arkansas watersheds. Jon's primary role on the team is to perform functional habitat assessments; prepare mapping and graphics of baseline and future conditions; grading and plant community design based on hydrologic, hydraulic, and geomorphic modelling and engineering; and communicate with landowners and stakeholders regarding the process, technicalities, and outcomes.

- **Sand Creek Channel Improvements Stability Analysis at Indigo Ranch, Colorado Springs, CO** - ecos was retained to perform an analysis of channel stability under proposed development conditions for a 1.17 mile reach of Sand Creek. Ecos utilized existing vegetation composition data, density and height within the Project reach as a basis; and compared the 10-year and 100-year storm event modelling data (specifically flow velocity, flow depth and shear stress) to reference literature to provide a professional opinion regarding the future stability of the channel under developed conditions. The analysis of channel stability for the proposed Project assumes a bioengineering and biotechnical approach that preserves and enhances the existing vegetation, as well as substrate cohesion and stability, within the channel and its streambanks. The Stability Analysis will likely serve as a benchmark study for the City of Colorado Springs to use to preserve other naturally stable channels.
- **Brush Creek Ranch Stewardship Plan, Saratoga, WY** – Brush Creek Ranch Stewardship Plan, Fishery Enhancement and Bank Stabilization, Saratoga, WY – Mr. Dauzvardis managed the organization, generation and graphic design of the Ranch Stewardship Plan. Jon assessed and prepared stewardship goals, objectives, and implementation action items, including ranch-wide master planning of the trail and recreational systems and design of the Brush Creek riparian corridor trail. Trail and recreation planning and design focused on universal access, habitat sensitivity, environmental education, wildlife observation opportunities and unique landscape experiences. Simultaneously with the master plan, Jon developed revegetation plans to support geomorphic stream alterations and bank stabilization to enhance the creek fishery. Jon was responsible for the design and supervised construction of a cold-water pond to be used by novice anglers to learn the art and experience the pleasure of catching trout.
- **Town of Erie, Comprehensive Plan, Parks Recreation Open Space and Trails Master Plan, and Natural Areas Inventory, Erie, CO -** As a former 8-year Member, Chair, and Vice Chair of the Town Erie Open Space and Trails Advisory Board (OSTAB) and an Erie resident and small business owner, Jon has an intimate knowledge of Erie's political and physical landscape and public processes. During his tenure on OSTAB, Jon actively participated in the writing and development of the Town's guiding documents. Jon authored the Open Space Chapter of the Comprehensive Plan which eventually was codified in the Town's Unified Development Code (UDC). Jon was the key commenter on the content, analysis and synthesis of the of the Open Space and Trail Chapters and Mapping that was adopted with the Town's first Parks Recreation Open Space and Trails Master Plan (PROST). Jon guided the process used in the development of the Erie Natural Areas Inventory (ENAI) to identify and design a habitat condition, quality and restoration rating and ranking system of significant natural areas throughout the Town's 49-square mile planning area.
- **Uncompahgre River Corridor Master Plan, Montrose, CO** – Jon was responsible for the development of an ecological master plan focusing on the Uncompahgre River as a natural asset for eco-tourism and the generation of riverfront economic development. Mr. Dauzvardis was responsible for assessing the character, condition and quality of aquatic, wetland and riparian habitat; and developing a rating, ranking, land acquisition prioritization system, and associated mapping aimed at the preservation and integration of open space and habitat within the City's parks, recreation and trail system.
- **Ruby Pipeline Wetland, Riparian and Waterbody Mitigation and Restoration Plan, WY, UT, NV and OR** – Jon was responsible for assisting with the generation of a Comprehensive Wetland Mitigation Plan outlining Clean Water Act regulatory guidelines, requirements, and processes. Jon developed an eco-region specific restoration plan for a 675-mile natural gas pipeline specifying the basis of design, construction, revegetation, maintenance, performance criteria, and monitoring means and methods for restoring approximately 460 acres of temporarily impacted riparian and wetland habitat.
- **Dry Creek Regional Urbanization Area, Weld County, CO** – Mr. Dauzvardis performed an ecological inventory and prepared the assessment report for a 6,000-acre Regional Urbanization Area (RUA); and a1000-acre multi-use site development in un-incorporated Weld County. Subsequent phases included

establishing ecological policy, goals, and objectives for the study area that will assist the County in the refining their first ever Comprehensive Plan.

- **City of Broomfield I-25 Subarea Environmental Guidelines, Broomfield, CO** – Jon drafted development sensitivity design and ecological sustainability standards.
- **McStain Development Corporation, Mountain Village III Master Plan, Loveland, CO** – Conducted concept planning for recreational and environmental interpretation facilities focusing on lake and wetland habitat features of the community.
- **Estes Park Comprehensive Land Use Plan, Estes Park, Larimer County, CO** – Teamed with town planning staff in producing a county-wide land use plan using GIS as a public involvement/participation tool.
- **San Miguel River Park Corridor Master Plan, Telluride, CO** – Prepared park, trail, wetland and riparian corridor master plan and design for the San Miguel River Park Corridor. Jon prepared illustrative plan graphics that assisted the Town in applying for and winning approximately $500,000 in Natural Resource Damage Assessment Fund money from the State of Colorado, which was used for final design and implementation.
- **South Platte River Wildlife and Recreation Corridor Plan, Denver, CO** – Designed the Zuni Riverfront Park and planned the wildlife and recreation corridor between I-25 and 8th Street near Mile High Stadium. Prepared, steered and presented graphics that the City and County of Denver Mayor's Commission (Wellington Webb) and the Urban Drainage and Flood Control District used to help sell the project to the public and federal funding sources in Washington D.C.
- **Historic Arkansas River Walk, Pueblo, CO** – Coordinated and steered the design and presentation of riparian, aquatic, and palustrine wetlands in the HARP Natural Area. Designed environmental Education Park to include outdoor classroom, access, and multi-thematic interpretive nodes.
- **Pueblo Natural Resources and Environmental Education Council Plan, Pueblo, CO** – Designed the identity and jointly produced strategic natural resource based environmental education plan for Pueblo County (PNREEC). The plan helped build consensus among multiple private and governmental agencies and stakeholders on funding, conservation, restoration, and enhancement priorities throughout the County.
- **Aluminum Company of America (ALCOA) Huisache Cove Master and Design Plan Master of Landscape Architecture Thesis, Port Lavaca, TX** – Served as environmental consultant in researching and generating wildlife habitat restoration plan and multi-functional landfill cap redesign incorporating coastal prairie, lacustrine, palustrine, estuarine wetlands, passive recreation, bird watching and ecological interpretation facilities on an industrial superfund clean-up site.

Aquatic, Wetland, and Riparian Habitat Design:

- **Saint Vrain Creek Breaches Restoration, Boulder County, CO** - ecos is part of the Design Team assisting Boulder County Parks & Open Space (BCPOS) with the restoration, repair and enhancement of the reach of the Saint Vrain Creek from Highway 36 downstream to Hygiene Road in rural Boulder County, which was damaged by the 2013 floods. Our role on the project includes: 1) desktop and field assessment to inventory and document the characteristics of the stream reach and riparian corridor (e.g. stream/in-stream features, vegetation, wildlife habitat); identify and locate significant habitat features within the areas of proposed construction; identify potential sources of native plant materials for restoration; and identify areas of opportunity within the breach repair work areas for native vegetation, wetland, PMJM, leopard frog and fishery habitat restoration; and delineate wetland habitat and waters of the U.S. in all areas of proposed/potential construction-related impact; 2) vegetation community and wildlife habitat restoration design; 3) permitting and compliance under the CWA, ESA and NHPA; 4) construction oversight for restoration construction; and 5) monitoring and reporting project success/establishment to BCPOS, stakeholders, the Corps, FWS and the State of Colorado Department of Local Affairs (DOLA) under the (the Grant funding agency under the Community Development Block Grant Disaster Recovery (CDBGDR) Resilience Planning Program grant.
- **Bohn Park Flood Recovery Design, Town of Lyons, CO** – ecos is part of the Design Team assisting the Town with the restoration, enhancement and stabilization of Bohn Park which was damaged by the 2013 floods. Ecos role is to assess, design, and prepare design-bid-build specifications for the natural restoration of the vegetation communities and habitat along South St. Vrain Creek and riparian corridor in collaboration with the landscape architect designing the parks and recreation facilities and the water

resource engineer designing instream hydraulic and fish habitat structures. ecos is also; supporting the project design by acquiring permits/approvals and maintaining regulatory compliance under the CWA, ESA and National Historic Preservation Act (NHPA).

- **James Creek Post-flood Restoration, Lefthand Watershed Oversight Group (LWOG), Jamestown, CO –** ecos was part of the LWOG and Boulder County Department of Transportation Team responsible for preparing the 30-60% design package for James Creek Reach 16 as identified in the Left Hand Creek Watershed Master Plan. ecos performed pre- and post-flood plant community assessment; developed revegetation goals and objectives, the basis of design, monitoring protocols, and revegetation plans in accordance with Colorado Department of Local Affairs (DOLA), Community Development Block Grant – Disaster Recovery (CDBG-DR) 30% Guidelines. Specific resources and issues of concern addressed by ecos, included federal and state listed candidate, threatened and endangered species, wildlife species of concern (including raptors), fisheries and fish passage, native plant communities, and management of noxious weeds, all in concert with geomorphic, hydrology and hydraulic analysis and design prepared by other team members.
- **Saint Vrain Creek Restoration and Floodplain Resiliency Plan, Town of Lyons, CO –** ecos is part of a design-build team tasked with restoring the St. Vrain Creek corridor in the Town of Lyons that was damaged during the September 2013 flood event. The goal of the project is to work with the Town and affected land-owners to create a more resilient floodplain and natural channel condition that will help alleviate future threats to the community, reestablish floodplain connectivity, stabilize banks, and restore aquatic, wetland and riparian habitat that was wiped out during the flood. Mr. Dauzvardis is responsible for developing the plant communities and revegetation strategies needed to restore aquatic and riparian structure and functions within the corridor that support fish, wildlife, recreation, and help the Town regain the ecological benefits and economic value they receive from outdoor enthusiasts.
- **Plum Creek Mitigation Bank, Sedalia, CO –** ecos was retained by Restoration Systems to prepare conceptual design plans for the Plum Creek Mitigation Bank Site that is currently under consideration by the Chatfield Reservoir Mitigation Company (CRMC). The purpose of the Site is to provide compensatory mitigation credits for unavoidable, permitted impacts to wetland, PMJM and bird (target resources) habitat regulated under the CWA and ESA; and to restore, enhance and preserve natural resource functions. Jon has guided agency and CRMC staff on tours of the Site; performed plant community mapping, baseline EFU assessment for PMJM, and FACWet assessment of wetlands. Jon was responsible for mapping, interpretation, and quantification of historic and existing habitat on the site. Jon prepared Conceptual Design Plans for resource mitigation including channel geomorphology, PMJM and wetland habitat setting the stage for post-mitigation calculations of EFU's.
- **Bellvue Raw Water Ponds Riverbank Restoration, Bellvue, CO –** The 2013 flood on the Poudre River altered the course of the river and severely eroded a bank nearly causing a breach of the City of Greeley's raw water ponds – their main municipal water supply. The goal of the project was to stabilize the bank to protect the ponds and to create riparian habitat for the Preble's meadow jumping mouse, a federally listed threatened and endangered species. Jon was responsible for preparing bioengineering design plans and specifications that include soil/cobble encapsulated lifts, stream barbs to deflect flows away from the bank, and harder, biotechnical design of soil/riprap and stream bed scour protection measures to prevent erosion and further undermining and sloughing of the bank. Design plans included specification of native plant materials and various techniques to restore cottonwood forest and willow habitat to further stabilize the bank.
- **Poudre River Pipeline Crossing at Kodak, Windsor, CO –** Jon's role on the ecos team was to assess restoration potential, techniques, and prepare design plans and performance specifications to reclaim a pipeline corridor across the lower Poudre River where the City of

Greely had to replace 3 major water supply lines. Flooding on the Poudre River in 2013 and 2014 temporarily suspended construction of the pipeline. Jon will oversee site stabilization and restoration measures once all 3 pipelines have been installed.

- **Lions Park Poudre River Restoration Plan, Laporte, CO –** Jon's role on the ecos team was to assess habitat conditions; gather, compile and analyze field survey data; and to prepare the mapping and mitigation design plans for the Lions Park PMJM habitat and the Poudre River Bank Stabilization Plans. Jon simultaneously designed and executed the technical drawings for the structural components of the habitat, ensuring that the proposed riparian plant community, habitat structures (brush piles), and bioengineered streambank stabilization measures will create the conditions that alleviate the current habitat fragmentation; support the life requisites of the PMJM; and enhance the overall health of the Poudre River fishery.
- **St. Vrain River Riparian Corridor Enhancement, Lyons, CO –** Jon designed, managed and led the construction of the Preble's Meadow Jumping Mouse Habitat (PMJM) enhancement project along the St. Vrain River. Jon worked in coordination with the project sponsor and Director of the Town of Lyons, Parks, Recreation and Cultural Events Department to implement required mitigation within a passive greenway park along the St. Vrain. Jon's role included riparian/PMJM mitigation site identification and habitat assessment; and design; and implementation of riverbank stabilization and riparian habitat enhancement measures.
- **Brush Creek Fishery Enhancement Plan, Saratoga, WY** – Prepared access, staging and design plans, details and performed on-site construction oversight of instream and riparian habitat enhancements and bioengineered bank stabilization along a 3-mile reach of Brush Creek. The purpose of the project is to enhance fish, bird and wildlife habitat and use these resources to facilitate education and improve the recreational experience of Ranch guests. Access routes were planned so that they can be easily converted to trails to avoid repetitive impacts to high quality habitat and productive pastures.
- **St. Vrain River Riparian Corridor Enhancement, Lyons, CO** – Jon is the lead Landscape Architect for the restoration and enhancement of Preble's Meadow Jumping Mouse Habitat (PMJM) along the St. Vrain River. Jon and ecos are working in coordination with the Town of Lyons, Parks, Recreation and Cultural Events team to implement this restoration project within a passive park area along the St. Vrain. Jon's tasks include riparian/PMJM habitat assessment; PMJM site location and habitat design; and implementation of riverbank stabilization and riparian habitat enhancement measures.
- **Brush Creek Ranch Pond Creation Plan, Saratoga, WY** – Prepared below grade pond excavation, grading, drainage and revegetation plan for a 0.30-acre fishing pond, followed by on-site field layout and surveying, wetland sod transplanting, submerged aquatic habitat and construction support of heavy equipment operators. The pond was designed to be a self-sustaining, cold water fishery that supports all components of the aquatic food-chain and incorporates all necessary life requisites for trout; and provide fishing opportunities during high water in Brush Creek.
- **Edwards Eagle River Restoration Project, Edwards, CO** – Assessment, planning, native plant community design and construction oversight of aquatic, wetland, riparian habitat along 1.5 mile reach and 168-acres of floodplain along the Eagle River utilizing indigenous materials and methods that naturally integrate habitat structure in the landscape context. Planning and design included trails, boat launch, boardwalks, overlooks, and interpretive sign systems and thematic content.
- **Boone Property, Boulder Creek Fishery Enhancement Project, Boulder, CO** – Performed site assessment and identified instream and overhead cover habitat to enhance fish habitat along a short reach of Boulder Creek adjacent to City of Boulder, Eldorado Canyon Open Space.
- **C-Lazy-U Ranch Willow Creek Fishery Enhancement Plan, Granby, CO** – Assessed and prepared design plans for 2 miles of instream and overhead cover habitat aimed at enhancing water quality through increased bank stability, improving aquatic habitat and angling opportunities, and providing long-term stability to the reach influenced ongoing ranching activities. Bank-side improvements include detailed seeding and planting plans indicating site-specific plant and seed locations, life zones, and species palettes according to hydrologic, soil, and aspect conditions.
- **Colowyo Coal Mine Wetland Creation Plan, Meeker, CO** – Performed wetland mitigation site feasibility assessment and design of 2.2-acres of created wetland benches along a 1.5-mile reach of the West New Goodspring Creek.

- **Uncompahgre River Wetland Creation and Streambank Stabilization, Montrose, CO** – Mr. Dauzvardis developed a Clean Water Act Individual Section 404, alternatives analysis and mitigation plans that successfully defrayed public descent and offset unavoidable impacts related to the River Landing Retail Development Project. Once approved by the USACE, the project turned a degraded, gravel-mined portion of the floodplain into functional and aesthetic riparian habitat that is now enjoyed by the public via a segment of trail that Mr. Dauzvardis designed. Two acres of riparian and "backwater" wetland habitat were strategically created along the Uncompahgre River to ensure reliable hydrologic connectivity and support of the designed wetland plant community. Nearly 350 lineal feet of severely degraded stream bank was stabilized using a naturalized bio-engineering approach that incorporated soil, native seed, erosion control blanket, shrubs, trees, and strategically located river boulders and logs to restore the riparian habitat, create fish habitat and redirect scouring flows away from the once barren bank.
- **River Point at Sheridan Brownfield Redevelopment, Sheridan, CO** – Designed and oversaw the construction of a "bio-engineered" and "bio-technical" vegetative landfill cap system and water quality swale that drains to the South Platte River. Jon was responsible for integrating the swale in to the River Point at Sheridan commercial redevelopment and the City of Englewood Golf Course renewal – renamed to the Broken Tee Golf Course.
- **Broken Tee Golf Course Flood Protection, City of Englewood, CO –** Oversaw the construction of a biotechnical subsurface stabilization and flood protection system (under-armor) designed to ensure that the woodland golf course tees, fairways and greens in the South Platte River floodplain are not compromised by flood scour. Designed and implemented bioengineered bank stabilization and under-armor on Bear Creek that was essential for protecting tees and greens. Jon was responsible for disproving the jurisdictional status of artificially supported wetlands via a groundwater monitoring system.
- **Lafarge Northbank Resources Gravel Pit Wetland Design, Rifle, CO** – Jon asses DMG requirements and prepared gravel pit reclamation plans aimed at providing suitable shallow-water wetlands and islands within the pit closure area to serve as compensatory mitigation for wetland impacts associated with mine operations adjacent to the Colorado River.
- **Leach Creek Stream Enhancement, Grand Junction, CO** – Designed stream corridor enhancements for a ½-mile section of Leach Creek that was channelized and used as an irrigation canal. Enhancements were designed to restore natural channel form and function, improve the aquatic environment, and provide mitigation for jurisdictional impacts permitted under the Nationwide Permit program. This project is being used as a model and replicated along other reaches of Leach Creek
- **Castro Property Wetlands and Wildlife Ponds, Beulah, CO** – Performed the site assessment, feasibility analysis, water resource and minor dam design, native plant design, landscape architecture, and supported the water rights application needed to create shallow water wetland habitat for amphibians, waterfowl, migrating bird and ungulates, and deep water habitat for trout at a sub-alpine elevation of 9000 feet. Project included development of a spring, creation of a creek and a mechanical water circulation and aeration system to support the aquatic, wetland, and riparian ecosystem. Organized, supervised and participated in a volunteer planting effort.
- **Jefferson County Gunbarrel Bridge Replacement, Oxyoke, CO** – Developed construction plans and specifications and oversaw construction of wetland and Preble's mouse habitat mitigation to enhance weedy and degraded wetland and Preble's mouse habitat along Gunbarrel Creek, a tributary to the upper South Platte River near Deckers, CO.
- **Coal Creek Bank Stabilization, Erie, CO** – Assessed, permitted, designed and performed construction oversight of bio-engineered/bio-technical bank stabilization and wetland creation associated with the Vista Parkway bridge crossing over Coal Creek in Erie, CO. The project involved pulling back vertical banks and restoring native wetland, riparian, and short grass prairie habitat.
- **Spring Creek Wetland Mitigation, Colorado Springs, CO** – Generated wetland and creek creation plans that integrated required mitigation into a high density, "new urban" development. The design emphasized re-utilization of urban storm water to sustain wetlands, use of indigenous plants, construction materials, and natural geomorphic relationships.

- **Sulphur Gulch, Parker, CO** – Developed a naturalized sculpted concrete drop structure design, planting and bio-engineering plans for a highly visible, urbanizing reach of a sandy creek through the center of the Town of Parker.
- **Skylark Creek Restoration Plan, Kremmling, CO** – Designed and performed construction oversight of aquatic, wetland and riparian plant community, and trail system along a historic side channel of the Upper Colorado River on a private fishing ranch.
- **ARCO Opportunity Ponds Wetland Mitigation Design, Anaconda, MT –** Jon generated the design of a 908-acre complex of wetlands and terrestrial habitat required to meet the Consent Decree and the functional assessment criteria established during the wetland assessment process mentioned previously. The design is currently being implemented. Once complete, the grading, drainage, hydrology, and revegetation strategy used to create wetlands from massive soil borrow pits will potentially be the largest inland, freshwater wetland mitigation project in the United States.
- **Northgate Boulevard Realignment, Colorado Springs, CO** – Coordinated and prepared ESA Section 7 and CWA Section 404 consultation documents as required by the USFWS and USACE, including mitigation construction documents, specifications, on-site layout of plant communities and construction supervision aimed at restoring wetland and riparian habitat occupied by Preble's meadow jumping mouse.
- **Northgate PMJM and Wetland Mitigation Plan, Colorado Springs, CO** – Mr. Dauzvardis was an instrumental member of multidisciplinary team responsible for delineating wetlands, preparing ESA Section 7 and CWA Section 404 assessment, impact analysis and consultation documents as required by the USFWS and USACE. As the lead designer, Jon was responsible for the design of over 80 acres of wetland, riparian, and grassland habitat utilized as primary and secondary habitat for Preble's Meadow Jumping Mouse, a Federally-listed threatened species. Jon prepared mitigation construction documents, specifications, onsite layout of plant communities and supervised construction for this precedent setting mitigation plan designed to offset impacts to critical habitat over a 1200-acre site.
- **Martin County Coal Corporation, Inez, KY** – Mr. Dauzvardis bioengineered and performed on-the-ground triage of two stream corridors, consisting of 26 miles, impacted by a coal slurry spill that originated from a mountaintop mine reservoir used to hold liquefied coal dust. Jon identified and documented critically imperiled stream banks and human settlements, and then designed, coordinated, led and supervised local crews during the implementation of specified floodplain, bioengineered bank stabilization, and reforestation efforts.
- **Uncompahgre River Restoration and Park Corridor, Ouray, CO** – Jon designed and performed construction oversight of the restoration and reclamation of one mile of upland, riparian and wetland habitat left barren by historic placer mining. The major challenge presented by this project was a lack of soil, organic matter and nutrients to sustain vegetation. This constraint was addressed by amending the soil with humate and planting and seeding riparian vegetation to initiate natural succession and bioaccumulation of matter, assisted by an irrigation system that injected organic fertilizer and microbes (mycorrhizea) in to the substrate.
- **Burlington Mine Remediation, Jamestown, CO** – Preparation and management of specification package, best management practices (BMPs), and revegetation design for mine waste capping and closure.
- **Powder River Coal Company – Porcupine Creek Restoration, Douglas, WY** – Designed and supervised the construction of this post mine wetland/creek restoration project. Following the pit closure, reclamation specialists reestablished the original location and geomorphic relationships of the creek using historic aerial photography using a trapezoidal channel cross-section design. Jon adapted the design creating grading and wetland planting plans that mimic the landform, natural lateral and longitudinal channel tilt, and plant communities that are indigenous to ephemeral creeks in the shortgrass prairie landscapes of eastern Wyoming.
- **Sand Creek Corridor Habitat Enhancement at Bluff Lake, Denver, CO** – Prepared plant community, bioengineering and bank stabilization design. Prepared visualization graphics to present and receive design approval.
- **Intrawest Resort Development, West Ten Mile Creek, Copper Mountain Village, CO** – Prepared vegetation community and village base streamside amenity concept design.

Construction Oversight and Plant Installation:

- **St. Vrain River Riparian Corridor Enhancement, Lyons, CO –** Jon managed construction and implementation of the restoration and enhancement of 0.60-acre of riparian Preble's Meadow Jumping Mouse Habitat (PMJM)

along the St. Vrain River.

- **Standley Lake Protection Project, Westminster, CO** – Designed and performed construction oversight of a 0.50-acre created emergent wetland to fulfill final mitigation requirements of the USACE and bring closure to the City's drinking water protection project.
- **Caribou Peat Bog Restoration, Nederland, CO** –Prepared native plant community design, planting cost estimate, and on-the-ground oversight of volunteers to restore a high altitude peat bog disturbed by an illegal four-wheel drive "mudfest".
- **Department of Energy (DOE) Wetland Mitigation Bank, Westminster, CO** – Construction supervision of grading and planting plans of a 12-acre wetland mitigation bank design for the Department of Energy.
- **ARCO Lower Area One and Butte Reduction Works, Butte, MT** – Performed construction observation and supervision of temporary labor crews to plant a passive treatment wetland designed to absorb heavy metals from groundwater.
- **Colorado Department of Transportation Mitigation Bank, Limon, CO** – Performed in-field planting design and supervised local labor to complete a 10 acre wetland mitigation bank designed by CDOT to offset future wetland impacts in the transportation region.
- **Irvine Ranch Water District – San Joaquin Wetland Treatment System, Irvine, CA** – Planting superintendent of a wetland designed to be a used as tertiary wastewater treatment facility and waterfowl refuge.

PRESENTATIONS:

Dauzvardis, Jonathan B. 2008. Preserving the Ecological Services of Willow Cuttings. Research presented at the Colorado Riparian Association (CRA) Sustaining Colorado Watersheds Conference. October 2, 2008. Vail, Colorado.

Dauzvardis, Jonathan B. 2004. Wetland and Wildlife Habitat Restoration, Opportunity Ponds, Anaconda, Montana. Poster Presentation at Ecological Restoration Conference. October, 2003. Orlando, Florida.

Dauzvardis, Jonathan B. 2003. Application of Landscape Ecology Principles to Mine Remediation and Wetland Creation: An Ecological Restoration Seminar using a Case Study of the Opportunity Ponds Wetlands Plan, Anaconda, Montana. Presented at the University of Colorado, Denver. November, 2003. Denver, Colorado.

Dauzvardis, Jonathan B. 2000. Endangered Species Act Issues: Incorporating the ESA into Mitigation Projects. Presented at the Continuing Legal Education (CLE, International) Colorado Wetlands Conference. September 18, 2000. Denver, Colorado.

AWARDS:

- Colorado Landscape Contractors Award, Sand Creek Enhancement Project – 2000
- Colorado Landscape Contractors Award, Skylark Creek Restoration Project – 1998
- Colorado American Society of Landscape Architects, Research, and Communications – 1997
- Texas American Society of Landscape Architects Honor Award – 1995
- Texas A&M Landscape Architecture Faculty Award – 1995

PROFESSIONAL ASSOCIATIONS:

- Town of Erie, Colorado Open Space and Trails Advisory Board (OSTAB) - As a former member and chair of the Town of Erie Open Space and Trails Advisory Board (OSTAB), Mr. Dauzvardis routinely collaborated with Town Administrator, Community Planning, Public Works, and Parks and Recreation Directors and Staff, and advised the Board of Trustees on all matters related to the goals, objectives, prioritization, acquisition, conservation, and the management of open space and trails throughout a 49-square mile planning area. Jon's 8-year experience on the OSTAB translates to an intimate knowledge of public processes.
- Society of Wetland Scientists (SWS)

ecos ecosystem services LLC

RESUME – Sub Consultant

Julia Auckland

Wildlife Biologist
Plant Ecologist
Wetland Ecologist

AREAS OF EXPERTISE:

- Field Ornithology
- Butterfly Surveys
- Threatened and Endangered Species
- Habitat mapping and Wetland Delineation
- Noxious Weed surveys wetlands
- Environmental Permitting and Consultation

EDUCATION:

- Bachelor of Science, Fisheries and Wildlife Science, North Carolina State University
- Master of Science, Ecology and Evolutionary Biology, Iowa State University

CONTINUING EDUCATION:

- 38 Hour U.S. Army Corps Wetland Delineation Training
- FACWet – Functional Assessment of Colorado Wetlands, CDOT
- Stormwater Management and Erosion Control, CETC #150
- ACEC Future Leaders Supervisory Skills Workshop

PROTECTED SPECIES SURVEYS:

- Ute-ladies' tresses orchid and Colorado butterfly plant
- Preble's meadow jumping mouse
- Nesting raptors including burrowing owls

EXPERIENCE SUMMARY:

Julia Auckland is a wildlife biologist and environmental consultant who has worked on, and managed, projects throughout the United States for over 15 years. She is a valued subcontractor for ecos and has been since 2013. She has worked as a sole proprietor since 2012. Her areas of expertise include field ornithology, butterfly surveys, threatened and endangered species, habitat mapping, noxious weed surveys, wetlands, and permitting. She has worked on a wide variety of infrastructure and development projects. Ms. Auckland customizes each project approach based on the client's goals, resource constraints, regulations, budget, and schedule.

Raptor & Nesting Bird Surveys:

Ms. Auckland has completed pre-construction surveys for nesting birds (raptors, burrowing owls and/or songbirds) on three pipelines, ten transportation projects, and almost 100 oil and gas drilling sites. Her avian experience also includes bald eagle nest monitoring, multi-species surveys, long-term population monitoring, trapping, banding, and behavioral studies in 12 states, Mexico, and Australia for university research projects, endangered species management on military bases, agricultural operations, and environmental impact studies.

T**hreatened and Endangered Species Surveys**:

Ms. Auckland has substantial experience surveying for threatened and endangered species. She has completed multiple Preble's mouse habitat assessments and surveys for Ute ladies'-tresses orchid and Colorado butterfly plant.

Wetlands Delineation and Permitting:
Ms. Auckland has been completing wetlands delineations, permitting, and mitigation since 1993. She has completed more than 50 wetlands projects including delineations, permitting, mitigation monitoring, and mitigation design.

Noxious Weed Surveys:
Ms. Auckland has completed noxious weed surveys on projects ranging from small transportation improvements to a 1,000+ acre wind farm. She has also completed noxious weed management plans for multiple sites in Colorado.

NEPA:
Ms. Auckland has been the environmental manager on more than 40 transportation projects requiring National Environmental Policy Act (NEPA) compliance (Categorical Exclusion, EA, EIS, and PEL). She has been the technical lead for sections on wetlands, wildlife, vegetation, water quality, and air quality. She has managed staff and sub-consultants in the areas of hazardous materials, archaeology, paleontology, history, Section 4(f), stormwater management, socioeconomics, and land use.

Wildfire Hazard Assessment and Mitigation:
Ms. Auckland has worked with Ecosystem Services, LLC (Ecos) to complete Natural Features, Wetland, Wildfire, Noxious Weeds & Wildlife Reports per El Paso County land development code for three new residential development projects;

- Gleneagle Infill Development at the former Gleneagle Golf course for G&S Development, Inc. (2016),
- North Bay at Lake Woodmoor in Monument for Woodmoor Lake Development, Inc. (2016), and
- The Beach and South Beach at Woodmoor in Monument for Woodmoor Lake Development, Inc. (2017)

RELEVANT PROJECT EXPERIENCE:

<u>Wetlands</u>

Environmental Permitting for Transportation Projects: Environmental compliance project manager on more than 40 Colorado transportation projects requiring wetlands delineations and permitting. Completed the majority of the wetland delineations for these projects. Wrote or reviewed all of the delineation reports and permit applications. Prepared on-site mitigation plans and monitored wetland mitigation sites.

Metro Wastewater Reclamation District: Wetland delineation and biological constraints assessment for an effluent pump back force-main (11 miles) and interceptor (6.8 miles) to serve the Northern Treatment Plant. Adams County, Colorado

Xcel Energy: Project manager for an environmental constraints analysis of two 2,500+ parcels. Mapped habitat types and completed a wetland delineation in conformance with Army Corps of Engineers requirements. Assessed each site for the potential occurrence of species listed as endangered, threatened, candidate, and/or rare by the USFWS and the Colorado Division of Wildlife. Prepared summary reports. Brush and Las Animas, CO.

Mc Gonigle Canyon: Coordination and monitoring of a 29-acre wetland restoration project including grading, erosion control, gabion construction, native plant salvage, non-native plant removal, irrigation installation, and planting, San Diego County, CA.

<u>Threatened and Endangered Species</u>

SWCA Environmental Consultants: Completed surveys for the federally-threatened Dakota skipper (*Hesperia dacotae*) on multiple sites in western North Dakota in 2017 and 2018.

Denver Water: Monitored riparian habitat restoration completed as mitigation for impacts to Preble's meadow jumping mouse habitat (Zapus hudsonius preblei), Littleton, CO.

Colorado Springs Utilities Preble's Mouse Surveys: Conducted surveys for Preble's mouse habitat for a sewer line rehabilitation project in Colorado Springs along Sand Creek. Survey area included over 30 stream crossings, Colorado Springs, CO.

US Army Corps of Engineers: Surveyed Chatfield State Park for the federally threatened Ute ladies'-tresses orchid (Spiranthes diluvialis), Littleton, CO.

Clark County Butterfly Surveys: Contracted with Clark County to complete multiple surveys over two summers for the Mt. Charleston blue and the Spring Mountains acastus checkerspot as required by the USFWS and USFS, Mt Charleston, NV.

Whooping Crane Surveys for the Platte River Endangered Species Partnership: Assistant project manager and field crew coordinator for fall Whooping Crane migration surveys. Coordinated a 10-person field crew to fly survey routes over an eighty-mile section of the central Platte River in Nebraska for 30 consecutive days. Conducted aerial whooping crane surveys and surveyed river cross-sections (topography, water depth, substrate, and vegetation).

Additional Avian and Wildlife Experience

Buckley Air Force Base: Conducted a survey of prairie dogs and burrowing owls at Buckley Air Force Base. Assisted with mapping approximately 600 acres of prairie dogs at the 3,500-acre base. Prairie dog population estimates and burrowing owl nest mapping was also performed. Helped established permanent and temporary transects, sampled for various vegetation and wildlife, identified species of concern, and monitored site conditions. Summarized findings in a report to help guide in future development plans at the base. Aurora, CO.

Preconstruction Bird Surveys (2005 – present): Completed multiple surveys for nesting songbirds, nesting raptors and burrowing owls. Projects have primarily been for residential development, transportation projects, pipeline work, and oil & gas.

Nesting Bird Monitoring on CDOT Region 6 Bridges: Worked with CDOT Region 6 environmental staff to develop standard protocols for bridge construction project that would prevent violations of the Migratory Bird Treaty Act. Twice a week, bridges scheduled for construction during the nesting season were surveyed for nests so that nests could be removed prior to egg-laying. Evaluated the cost and effectiveness of different nest exclusion and removal methods. Prepared a detailed summary report. Denver, CO.

Biodiversity Surveys of the Greater Yellowstone Ecosystem for Iowa State University (1998-2001): Two years as the project manager and one year as the assistant project manager for a study of the efficacy of using satellite imagery to predict biodiversity in the Greater Yellowstone Ecosystem. Managed a complex research project in a remote area that required moving between a northern and southern study area every two weeks. Conducted point counts for birds and surveyed butterflies for three field seasons. Hired trained, and supervised field assistants for two field seasons. Coordinated with botany and GIS field crews. Designed and implemented a mark-recapture study of *Parnassius clodius* butterflies to estimate populations, mobility, and survival rates.

Red-cockaded woodpecker research, monitoring, and management (1991-1996): Worked on multiple red-cockaded woodpeckers (RCW) (federally endangered species) projects over six years beginning as a university field research assistant and culminating as the project manager on the 250,000 acre Eglin Air Force Base in Florida.