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DESIGN ANALYSIS REPORT
FOR
PIKES PEAK GREENWAY TRAIL
LOW WATER CROSSING AT
FOUNTAIN CREEK

JR ENGINEERING

J·R ENGINEERING
A Subsidiary of Westrian

DESIGN ANALYSIS REPORT
FOR
PIKES PEAK GREENWAY TRAIL
LOW WATER CROSSING AT
FOUNTAIN CREEK

June 2001

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9247.20

DESIGN ANALYSIS REPORT FOR PIKES PEAK GREENWAY TRAIL LOW WATER CROSSING AT FOUNTAIN CREEK

TABLE OF CONTENTS

TABLE OF APPENDICIES

DESIGN ANALYSIS REPORT FOR PIKES PEAK GREENWAY TRAIL LOW WATER CROSSING AT FOUNTAIN CREEK

PURPOSE

The purpose of this project is to enhance and lengthen the popular Pikes Peak Greenway Trail and allow it to continue south of the creek and city.

BACKGROUND

The Pikes Peak Greenway Trail runs along the corridor of Fountain Creek as it travels through the City of Colorado Springs. In 1996, the Parks and Recreation Department built a low water crossing across Fountain Creek along with major trail improvements and additions. After a storm in 1999, the low water crossing was washed out and now lies in a heap along the bank of the creek. A large portion of the northern bank of the creek has also been eroded as an effect of this storm. In addition to the modifications that the Parks and Recreation Department have made to the creek, there have also been large amounts of soil and debris dumped along the banks of the creek.

PREVIOUS REPORTS

In 1994, Muller Engineering Company, Inc. performed a Drainage Basin Planning Study for Fountain Creek. In their report they detailed creek improvements including sloping boulder drops, acquiring property in frequently flooding areas, and adding trails and look-out stations to make the area more aesthetically pleasing. Among other locations, this report suggested the placement of sloped boulder drops at stations 164+00, 154+00, 150+30, and 150+20, which are between the Nevada Street Bridge and the natural confluence with Shooks Run.

There is also information on Fountain Creek in the Federal Emergency Management Act (F.E.M.A.) Flood Insurance Study (F.I.S.) publications. According to the F.I.S., the F.I.S. water surface elevations are based on a study prepared by the United States Army Corp of Engineers (A.C.O.E.) Flood Plain Information study on Fountain Creek in Colorado Springs and Fountain in 1973. Appendix A contains parts of the F.E.M.A. Flood Insurance Rate Map (F.I.R.M.) panels #08041C0729F and #08041C0737F, which

encompass the project location. The proposed project is located in Zone AE as indicated on these F.I.R.M. panels.

GENERAL LOCATION

The project location is just downstream of the Nevada Avenue Bridge over Fountain Creek and just upstream of the natural confluence with Shooks Run. Appendix A contains a map of the project location. As shown on Project Plan Sheet 4 in Appendix D, the proposed low water crossing and trails begin at the existing trail on the north side of the creek, crosses over the creek and continues downstream to an existing trail. The proposed low water crossing is at the same location as the previous one and the additional creek improvements are in close proximity to and resemble those of the Drainage Basin Planning Study by Muller Engineering.

TOPOGRAPHIC INFORMATION

Since there have been numerous studies performed along Fountain Creek, the changes in the bed elevations can be traced. Appendix A contains a contour map with FIMS contours supplemented by JR Engineering contour data and A.C.O.E./F.E.M.A. contours overlaid. According to the contour maps used by the A.C.O.E. for the F.E.M.A. F.I.S. in 1973 and shown in Appendix A, the bed elevation of the creek near the proposed structure was approximately 5886.3 feet. In 1994, Muller Engineering Company reported the bed elevation to be 5887.8 feet and in 2001 the survey data collected by JR Engineering shows the bed elevation to be 5883.1 feet. Appendix B contains two graphs showing the comparison between F.E.M.A. elevations and the most recent survey data. The first is a comparison of elevations for a cross section near the proposed structure. This graph shows the F.E.M.A., F.I.M.S. and JR Engineering elevations, as well as the creek after the proposed project. The second graph shows the channel bed slope according to the different elevation data and for the proposed project. There have been several major storms in Fountain Creek since 1973, which can explain some of the changing bed elevations. Between 1973 and 2001 the creek slope in this area has changed from .63% to a more stable .4%. In 1994, there appeared to be a significant change in elevation (a head cut) just downstream of the confluence with Shooks Run and now, the significant change in bed elevation appears to have moved upstream to be closer to the Nevada Avenue Bridge. Based on the comparison of the 1973 F.E.M.A. contours to current F.I.M.S. contours, supplemented by JR Engineering contour data, it appears

that substantial fill has been added on both sides of the banks in the vicinity of the low water crossing. This can be seen in the contour map in Appendix A.

HYDRAULIC ANALYSIS

According to the effective F.E.M.A. Flood Insurance Rate Study (F.I.S.), the 100-year flow rate in the project reach is 44,700 cfs. Using this flow rate and cross section data from F.E.M.A.'s HEC-2 analysis and contour maps, 100-year floodplain and floodway levels were estimated using the HEC River Analysis System (HEC-RAS). All modeled conditions were run in sub-critical flow regime, as were runs in F.E.M.A.'s original flow analysis.

Four cross sections were used to model the section of Fountain Creek near the proposed low water crossing. The most upstream cross section for the models, STA 157+00, is at the same location as F.E.M.A. Flood Insurance Rate Map (F.I.R.M.) cross section "DT." Similarly, the most downstream cross section, STA 144+00, is at the same location as F.E.M.A. F.I.R.M. cross section "DS." The locations of these cross sections can be seen in the contour map in Appendix A. The original HEC-2 input from the F.E.M.A. F.I.R.M. Study was not available from F.E.M.A. so HEC-2 input was obtained locally. This input was used for both cross sections STA 157+00 and STA 144+00 for each of the models.

The first model is a Duplicate Effective. This model has only two cross sections, 157+00 and 144+00, and models the local HEC-2 input in HEC-RAS in order to duplicate the published base flood elevations in the F.E.M.A. F.I.S. Although HEC-2 and HEC-RAS are different versions of the same program, they do have a tendency to give different results due to slightly different methods of calculations. The F.I.S. base flood elevations were matched at the lower cross section without adjustment. At the upper cross section, the "n" values were adjusted to match the F.I.S. base flood elevation.

The second model, the Modified Effective, represents the Duplicate Effective model with cross sections added near the low water crossing. The added cross sections were defined from the contour map used for the original flood study. In the overbank areas, the cross sections were defined to represent an average condition of the general area, as the topography varies considerably within the area. Localized depressions such as Shooks Run were omitted.

The next model shows the pre-project conditions or the present-day conditions. The cross sections at the F.I.S. locations were kept the same as previous models while the cross sections near the proposed low water crossing, STA 152+79 and STA 152+81, were adjusted based on the recent survey data, collected by JR Engineering, for this Pre-Project Model. This model shows that the base flood elevations have increased since the F.E.M.A. F.I.S. This increase is caused by the apparent previously mentioned fill added on both sides of the creek that can be seen in the contour map in Appendix A.

The last of the models is the Post-Project Model which models how the creek will function after the proposed low water crossing, creek improvements and grading have been done. The model indicates that the base flood elevations will decrease from the existing condition base flood elevations with completion of the project.. The chart in Appendix B compares the base flood elevations for the different models. HEC-RAS generated profiles, elevation reports and cross sections for each of the four models are contained in Appendix C. The proposed structure and creek improvements do not impede the original F.E.M.A. creek bed or have an apparent negative affect on the existing 100-year flood elevations as seen in the cross section elevation comparison, bed slope elevation comparison and base flood elevation chart in Appendix B.

SUMMARY OF PROPOSED IMPROVEMENTS

There are several types of proposed improvements along this stretch of Fountain Creek including trails and grading, a low water crossing, a sloped boulder drop, and rip-rap protection along the banks. Plan Sheets 3 through 5, found in Appendix D provide details of the proposed improvements.

Approximately 415 feet of concrete trails will be added to the existing trails along Fountain Creek. The 290 feet of trail on the north side of the creek will begin at the existing trail where it was washed out by previous storms and then turn towards the creek and slope down at 8.3% to the low water crossing. The 125 feet of trail on the south side will begin at the low water crossing and slope up at 4.0%, curve to be parallel to the creek and connect to the existing gravel trail. Some gravel trail on both the north and south sides of the creek will need to be removed and possibly replaced.

The proposed low water crossing is a reinforced concrete bridge structure that will span the distance between banks of the creek allowing normal flows to pass below the path while limiting the amount of mass blocking the creek during larger flows. With an opening of 1.5 feet, an estimated flow of approximately 380 cfs will flow under the deck of the structure without over topping it. A table of the results of various methodologies used to estimate the low flow conveyance capacity is in Appendix B. The table indicates flow rates yielding a maximum elevation of 5885, the bottom of the crossing slab, and 5886, the top of the crossing slab. The calculations that produced the data contained in the summary table are also contained in Appendix B. It is estimated that a flow greater than the capacity of the opening of the structure will occur 2-3 times every year. This estimation is based on the past 25 years worth of peak flow rates through the creek measured from U.S.G.S. at gage 07105500 near the Tejon and Nevada Street Bridges. A graph of these peak daily flows is contained in Appendix B. It was determined from the data on the graph that if the capacity of the low water crossing is 380 cfs, it would be usable, on average, for 97% of the days in a given year which is only 10 days of being over topped. A table of low flows through Fountain Creek, located in Appendix B, provides more detail to these historic flow rates. Project Plan Sheets 6 and 7 show the structural details of the low water crossing.

The proposed sloped boulder drop begins at STA 153+16.88 and continues to STA 152+63.68. This is approximately 115 feet downstream from the proposed location of a drop structure in the Fountain Creek Drainage Basin Planning Study (D.B.P.S.) and does not interfere with the other proposed drop locations. Appendix B contains a diagram showing the locations of these drop structures as proposed in the D.B.P.S. The proposed drop for this project will have a 1:5 slope and a drop of 2.5 feet. Boulders with a minimum diameter of 3-feet grouted-in-place along with several hard point grade control structures have been included in the design to maintain the integrity of the drop. The D.B.P.S. specified 24" diameter boulders and no hard point grade control structures. Plan Sheets 8 and 9 show details of the sloped boulder drop.

Because the water and soil in the creek are constantly moving, bank protection is needed to help stabilize the trail and crossing. Rip rap with a d_{50} = 24" to be grouted in place, is proposed on both sides of the creek and trails. In addition to the permanent rip-rap, reinforcement matting will be placed along the trail and some graded areas to facilitate vegetation re-growth. Plan Sheet 3 shows the location of the proposed reinforcement matting and Sheet 4 shows the location of the rip rap.

CONCLUSION

Currently, Fountain Creek between the Nevada Avenue Bridge and Shooks Run is an eyesore. Parts of the banks are washed out, the existing trail ends abruptly, and there is a pile of concrete rubble from the remains of the last low water crossing. This proposed project will reconnect the currently segmented trail. The project calls for removal of the rubble pile, removal of the old gravel and broken asphalt trail, and the addition of 415 feet of new concrete trail. Not only will this project enhance the Pikes Peak Greenway Trail, but it will also help to stabilize Fountain Creek. The proposed drop structure will create a more stable creek bed and the rip rap bank protection will reduce the erosive effects of future storms. Also, the low water crossing is proposed to be five feet lower than the previous one allowing large storms to freely overtop it. Moreover, the fact that the low water crossing is constructed on caissons that are approximately 18' long, and the low water crossing is tied to the drop structure which is secured to bedrock gives it additional stability. The Fountain Creek D.B.P.S. prepared in 1994 suggested additional trails, creek improvements, and the acquisition of property adjacent to the creek in this section of Fountain Creek. This project is the first step to making the Fountain Creek floodplain a safer place to be and fulfilling the suggestions of the Fountain Creek D.B.P.S.

PREPARED BY:

JR Engineering

Julie Anne Wildschut

Julie Anne Wildschut, E.I.,
Design Engineer I

/kd/9247.20/Greenway Report

ENGINEER'S STATEMENT:

The above letter, report and attachments were prepared under my direction and supervision and are correct to the best of my knowledge and belief. The evaluation performed for this report indicates that no significant increase to the existing flood elevation will occur as a result of the construction of the proposed improvements.

COLORADO REGISTERED CYNTHIA MEINEN BLEVINS 34484 PROFESSIONAL ENGINEER

Cynthia M. Blevins, P.E. #34484
For and On Behalf of JR Engineering

7-03-01
Date

BIBLIOGRAPHY:

1. Federal Emergency Management Agency 1990. Flood Insurance Study for the City of Colorado Springs. Washington, D.C.

2. Federal Emergency Management Agency 1997. Flood Insurance Rate Map, El Paso County, Colorado and Incorporated Areas, Panels #08041C0 729F and 737F. Washington, D.C.

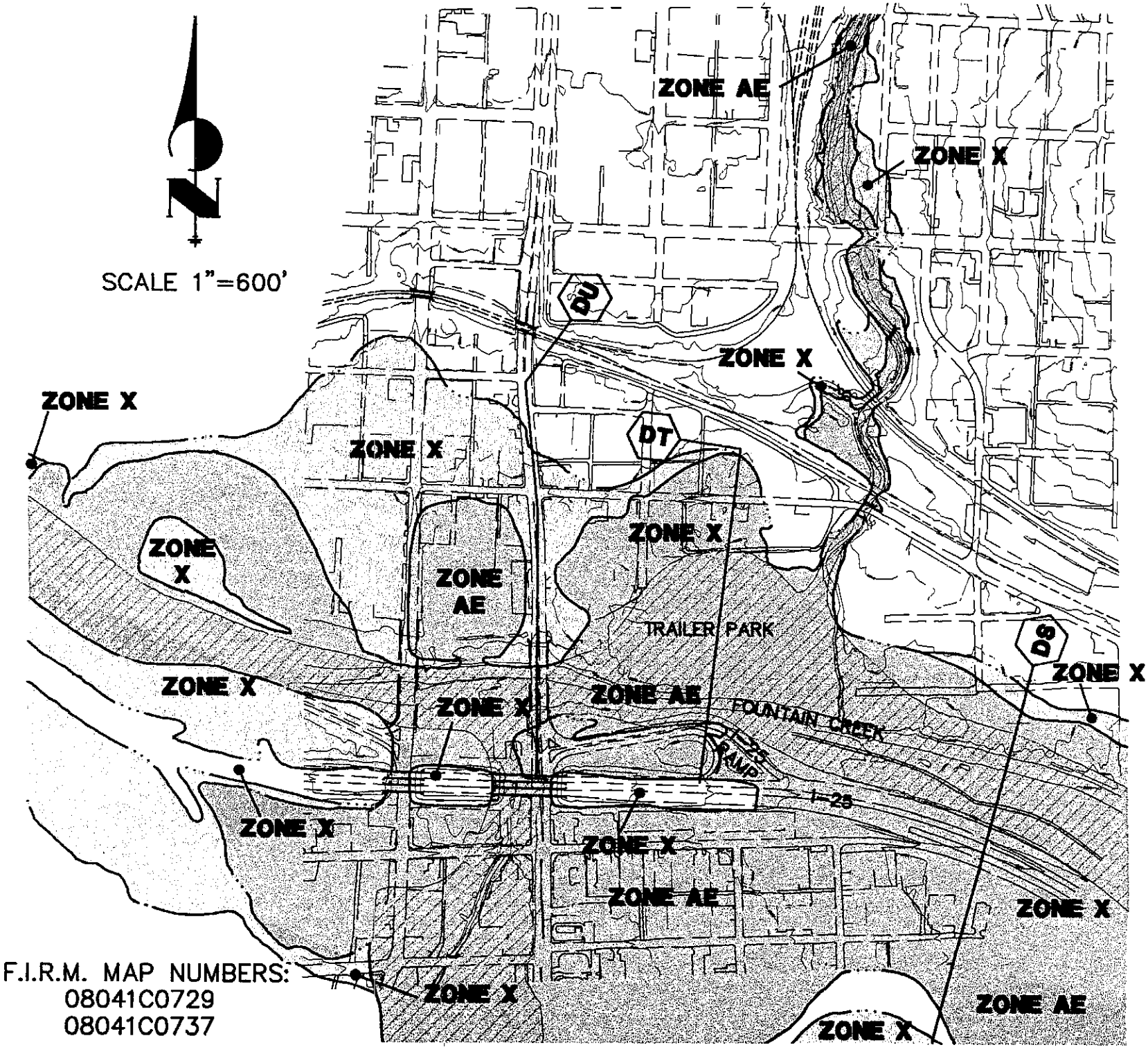
3. Muller Engineering Company, Inc. 1994. Fountain Creek Drainage Basin Planning Study. Prepared for The City of Colorado Springs, Colorado.

4. U.S. Army Corps of Engineers, Albuquerque District 1973. Floodplain Information, Fountain Creek and Jimmy Camp Creek, Colorado Springs and Fountain, El Paso County, Colorado. Prepared for Pikes Peak Area Council of Governments.

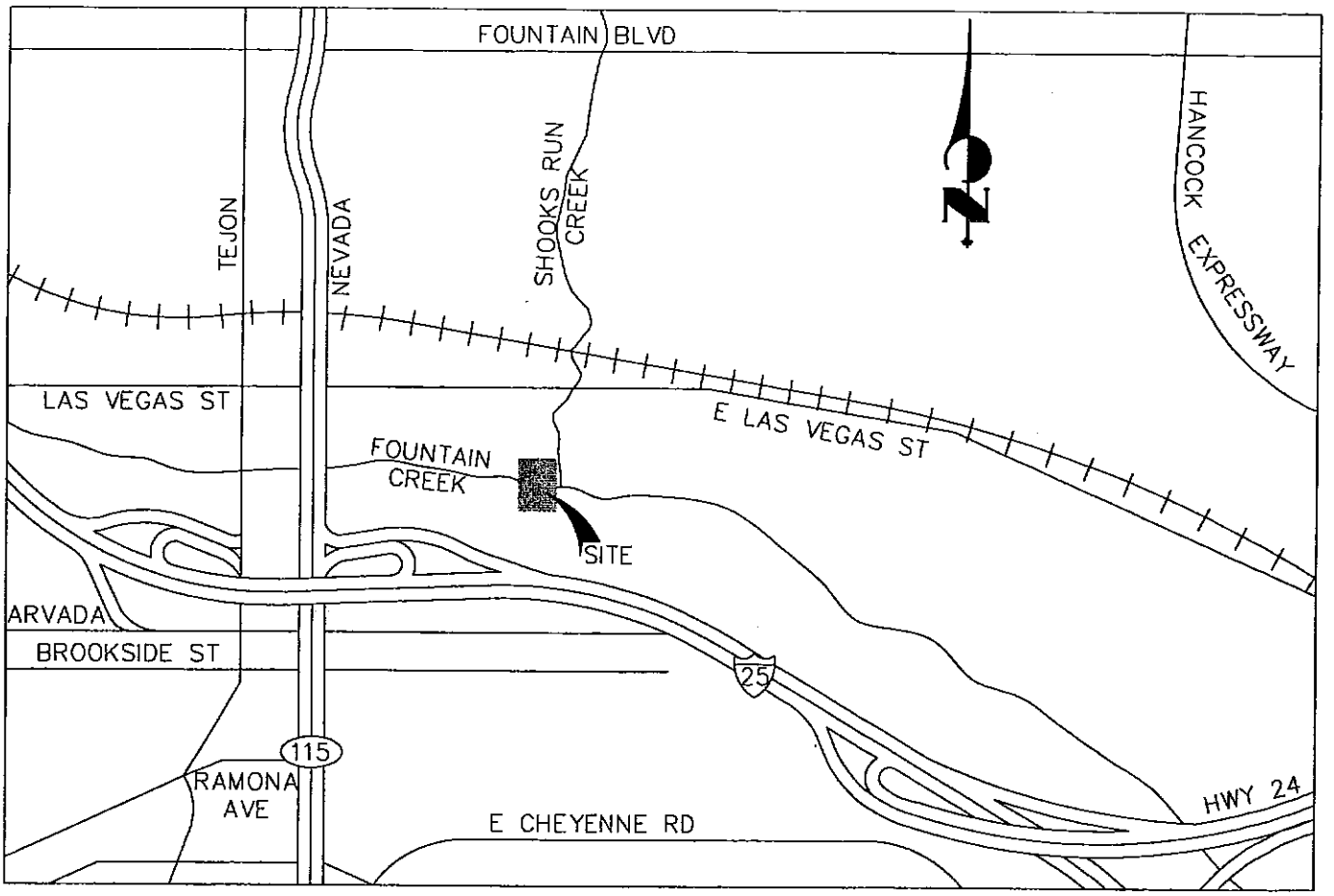
5. US Geological Survey data for gage 07105500 on Fountain Creek near Tejon and Nevada via USGS website, www.usgs.gov

APPENDIX A

F.E.M.A. F.I.R.M. MAP


N
SCALE 1"=600'
ZONE AE
ZONE X
DU
ZONE X
ZONE X
DT
ZONE X
ZONE X
ZONE AE
TRAILER PARK
DS
ZONE X
ZONE X
ZONE AE
FOUNTAIN CREEK
ZONE X
I-25 RAMP
I-25
ZONE X
ZONE X
ZONE AE
ZONE X
ZONE X
ZONE AE
ZONE X
F.I.R.M. MAP NUMBERS:
08041C0729
08041C0737

VICINITY MAP



VICINITY MAP

NTS

CONTOUR MAP

APPENDIX B

COMPARISON OF CROSS SECTIONAL ELEVATIONS AT PROPOSED STRUCTURE

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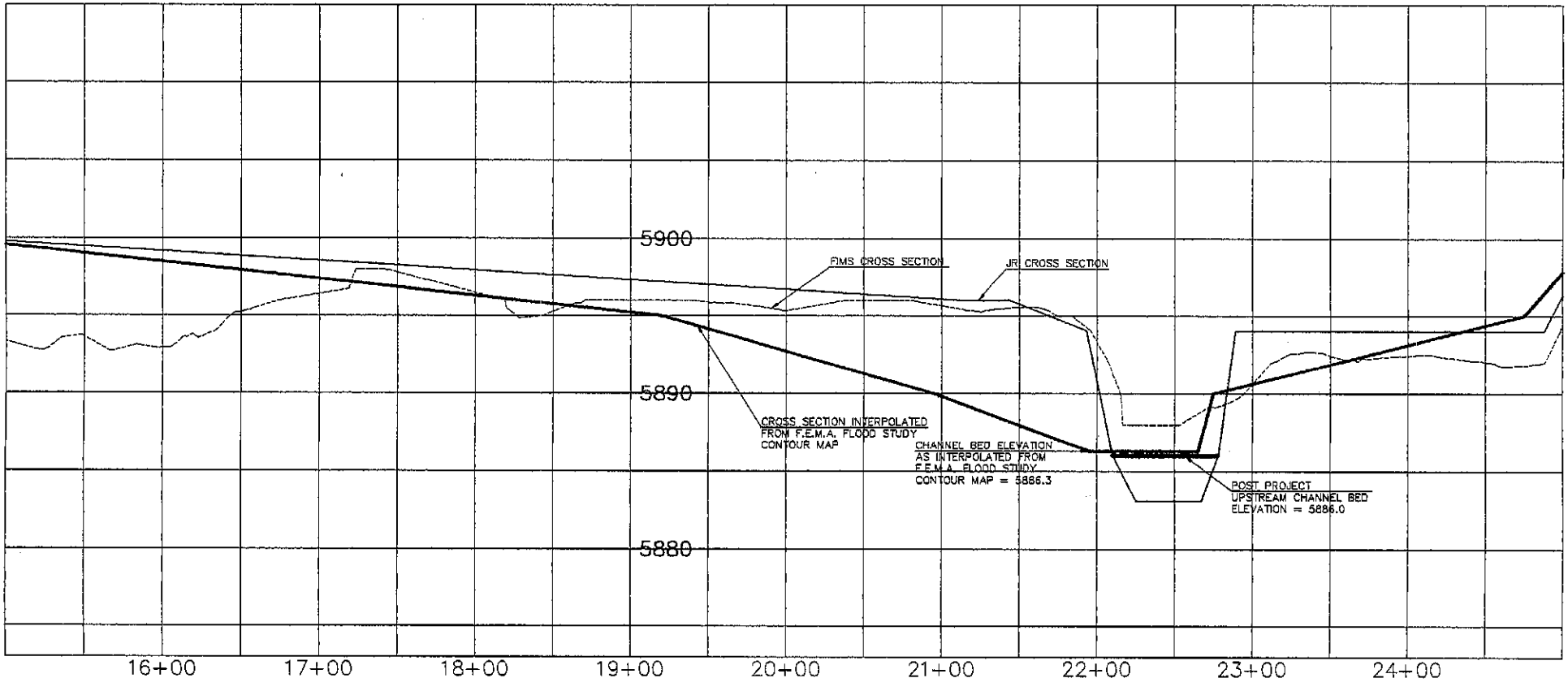
COMPARISON OF CROSS SECTION ELEVATIONS AT PROPOSED STRUCTURE

SCALE: 1" = 100' HORIZ
1" = 10' VERT



COMPARISON OF BED SLOPE ELEVATIONS

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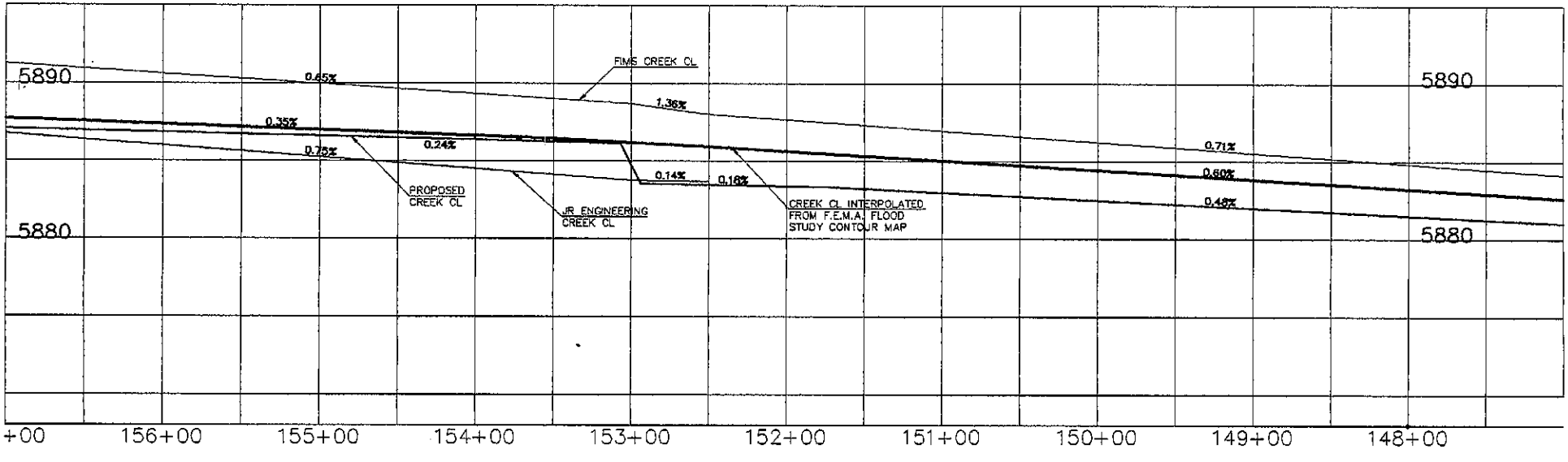
COMPARISON OF BED SLOPE ELEVATIONS

SCALE: 1" = 100' HORIZ
1" = 10' VERT



COMPARISON OF BASE FLOOD ELEVATIONS

Comparison of Base Flood Elevations in Different Models

Station 157+00

Model	Effective (F.E.M.A.)	Duplicate Effective	Modified Effective	Pre-Project	Post-Project
Floodplain WSE	5903	5903.03	5903.03	5906.09	5904.82
Increase in Floodplain WSE from Preceeding Model	NA	0.03	0	3.06	-1.27
Floodway WSE	5903	5902.87	5902.86	5907.54	5906.36
Increase in Floodway WSE from Preceeding Model	NA	-0.13	-0.01	4.68	-1.18
Floodway Width	800	794	794	800	800

Station 152+81

Model	Effective (F.E.M.A.)	Duplicate Effective	Modified Effective	Pre-Project	Post-Project
Floodplain WSE	NA	NA	5898.98	5901.92	5900.88
Increase in Floodplain WSE from Preceeding Model	NA	NA	NA	2.94	-1.04
Floodway WSE	NA	NA	5899.33	5902.9	5902.02
Increase in Floodway WSE	NA	NA	NA	3.57	-0.88
Increase in Floodway WSE from Preceeding Model	NA	NA	647	579	521

Station 152+79

Model	Effective (F.E.M.A.)	Duplicate Effective	Modified Effective	Pre-Project	Post-Project
Floodplain WSE	NA	NA	5898.96	5901.91	5900.75
Increase in Floodplain WSE from Preceeding Model	NA	NA	NA	2.95	-1.16
Floodway WSE	NA	NA	5899.32	5902.89	5901.77
Increase in Floodway WSE from Preceeding Model	NA	NA	NA	3.57	-1.12
Floodway Width	NA	NA	646	578	518

Station 144+00

Model	Effective (F.E.M.A.)	Duplicate Effective	Modified Effective	Pre-Project	Post-Project
Floodplain WSE	5891.6	5891.62	5891.62	5891.62	5891.61
Increase in Floodplain WSE from Preceeding Model	NA	0.02	0	0	-0.01
Floodway WSE	5891.9	5891.79	5891.79	5891.79	5891.79
Increase in Floodway WSE	NA	-0.11	0	0	0
Increase in Floodway WSE from Preceeding Model	400	400	400	400	400

LOW FLOW CONVEYANCE CAPACITY CALCULATIONS

Table of Predicted Low Flows Passing Through Low Water Crossing

Flow UNDER Low Water Crossing

Method	Flow Rate (cfs)
Mannings Formula (water touching bottom of crossing slab)	168
Mannings Formula (water NOT touching bottom of crossing slab)	180
Flow Master	160
HEC-RAS	166

Flow to TOP of Low Water Crossing (but not over topping)

Method	Flow Rate (cfs)
Flow Master	380
HEC-RAS	317
Orifice Equation	426
Culvert Nomograph	426

Allowable flows under the low water crossing are at an elevation of 5885 whereas flows to the top of the low water crossing are at 5886. Flows corresponding to these elevation limits were calculated by several different methods.

Manning's Formula was used twice. The first represented the situation where the water moving under the low water crossing was assumed to be touching the ground, creek banks, and concrete on the piers and slab of the low water crossing. This is the most conservative Manning's Formula method. The second may be more representative of true conditions because when the water flows through the crossing, if it touches the top slab before going through, it will dip slightly so that it will not be touching the slab the whole way through the crossing. Flow Master was used for both elevation limits by inputting the typical cross section at the proposed low water crossing and finding the flows through it at the two elevations. HEC-RAS was also used for both elevation limits in a similar fashion as Flow Master, but with HEC-RAS there are additional cross sections up and down stream of the proposed low water crossing which impact the resulting flows. The last two methods used, the orifice equaiton and culvert nomograph, are based on the same theory that the proposed structure acts like an orifice or culvert with a controled inlet.

* Methods using Manning's "n" values have "n" values as follows: Concrete "n" = 0.013; Rough Rip Rap "n" = 0.045; Smooth Rip Rap "n" = 0.035. The weighted "n" value for the surface when water passes through the crossing and touches the slab = 0.022 and when water does not touch the top slab = 0.032.

Client: _____ Job No: 29247.20

Project: Pikes Peak Greenway Trail By: JAW Chk. By: _____ Date: 6-27-01

Subject: _____ Sheet No: 1 of 1

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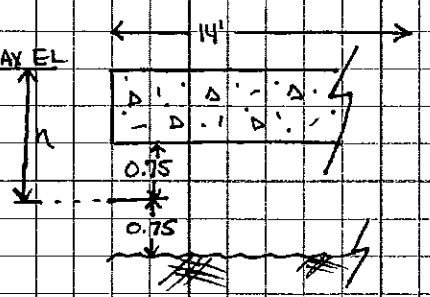
To solve for maximum capacity through low water crossing as an orifice:

ORIFICE EQUATION:

$$Q = 0.6 \cdot A\sqrt{2gh}$$



$A = 64.35\ ft^2$

$g = 32.2\ ft/s^2$

$h_1 = 1.75'$ → assumes still water at opening

$h_2 = V_{HEAD} + h_1$ → take velocity into account = 1.89

$V_{HEAD} = \frac{V^2}{2g} = 0.140$

$V = 3.0\ ft/s$ → as estimated by HEC-RAS

$$Q = 0.6(64.35)(2 \cdot 32.2 \cdot 1.89)^{1/2}$$

$\boxed{Q = 425.96}$ → 5886 (TOP OF CROSSING) AS MAX ELEVATION

$h_1 = 0.75$

$h_2 = 0.89$

$$Q = 0.6(64.35)(2 \cdot 32.2 \cdot 0.89)^{1/2}$$

$\boxed{Q = 292.31\ cfs}$ → 5885 (TOP OF OPENING) AS MAX ELEV

Client: _____ Job No: 29247.20

Project: Pikes Peak Greenway Trail By: JAW Chk. By: _____ Date: 6·26·01

Subject: _____ Sheet No: 1 of 2

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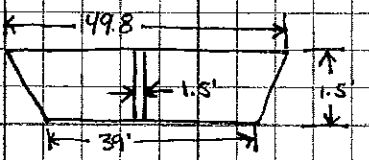
To solve for maximum capacity of flow under low water crossing:

MANNING'S FORMULA:

$$Q = \frac{1.49}{n} \cdot AR^{2/3} \cdot S_o^{1/2}$$



$S_o = 0.00214$

$R = \frac{\text{AREA}}{\text{PER(WET)}}$

$A = \frac{1}{2}(B_1 + B_2)h$

$B_1 = 39' + 1.5' = 37.5'$

$B_2 = 49.8' - 1.5' = 48.3'$

$h = 1.5'$

$A = \underline{64.35\ ft^2}$

$P_W \simeq B_1 + B_2 + 4h$

$P_W = \underline{91.8\ ft}$

$R = \frac{64.35}{91.8} = \underline{0.70098\ ft}$

$$Q = \frac{1.49}{n}(64.35\ ft^2)(0.70098\ ft)^{2/3}(0.00214)^{1/2}$$

$$Q = \frac{3.71}{n}$$

"n"	Q
0.013	285 cfs
→ 0.022	168 cfs
0.030	124 cfs
0.032	116 cfs
0.040	92.75 cfs
0.050	74.2 cfs

* This is not the flow before overtopping, it is the flow under concrete slab.

Client: _____ Job No: 29247.20

Project: Pikes Peak Greenway Trail By: JAW Chk. By: _____ Date: 6·27·01

Subject: _____ Sheet No: 2 of 2

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MANNING'S FORMULA CONTINUED:

- ASSUME FLOW IS NOT TOUCHING BOTTOM OF LOW WATER CROSSING SLAB

$P_W \approx B_1 + 4h$

$P_W = 43.5$

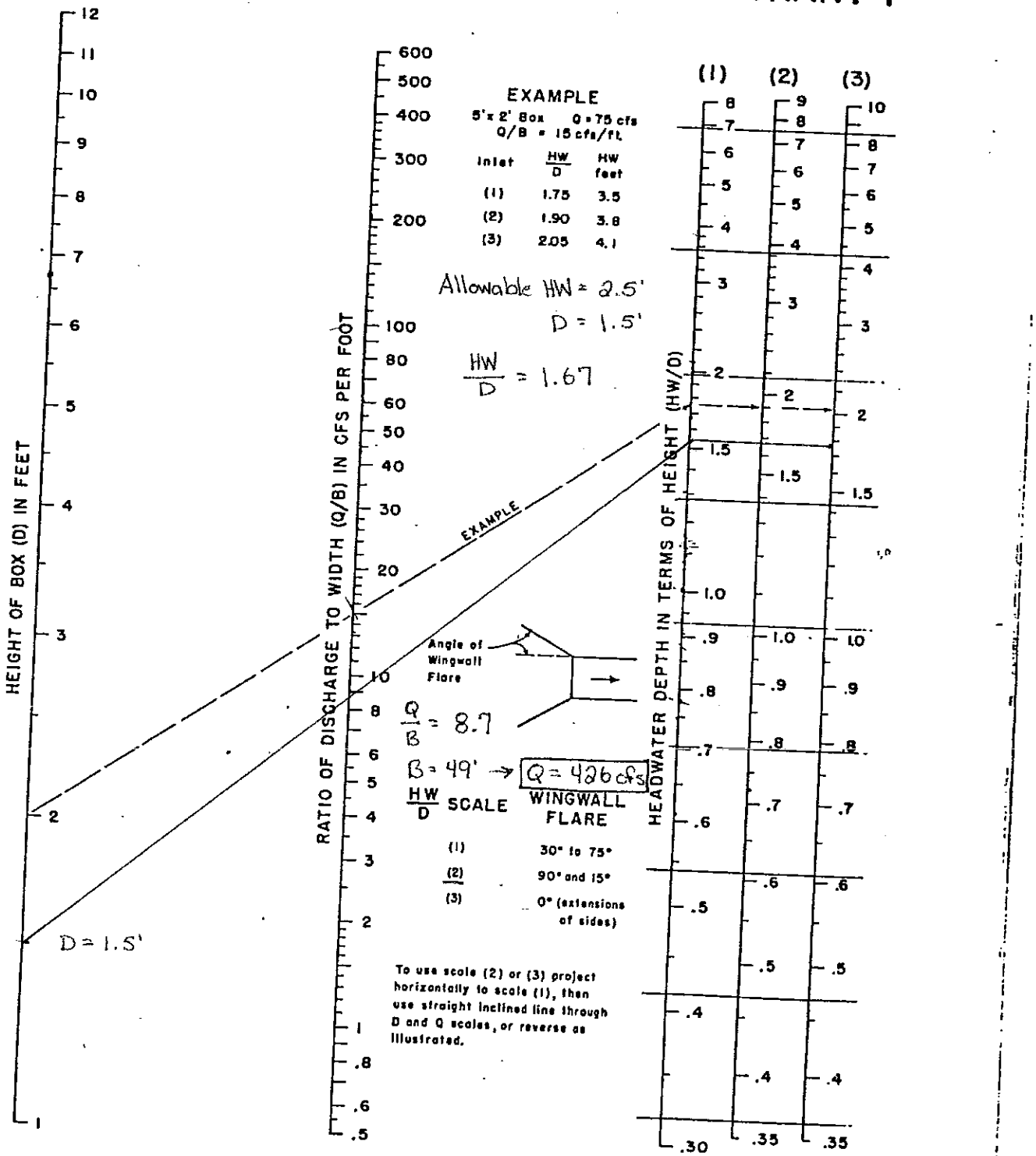
$R = \frac{\text{AREA}}{\text{PERIM}_W} = \frac{64.35}{43.5} = 1.48$

$$Q = \frac{1.49}{n}(64.35)(01.48)^{2/3}(0.00214)^{1/2}$$

$$Q = \frac{5.76}{n}$$

	"n"	Q
	0.013	443
	0.022	262 cfs
	0.030	192
→	0.032	180 cfs
	0.040	144
	0.050	115.2

CHART 1



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

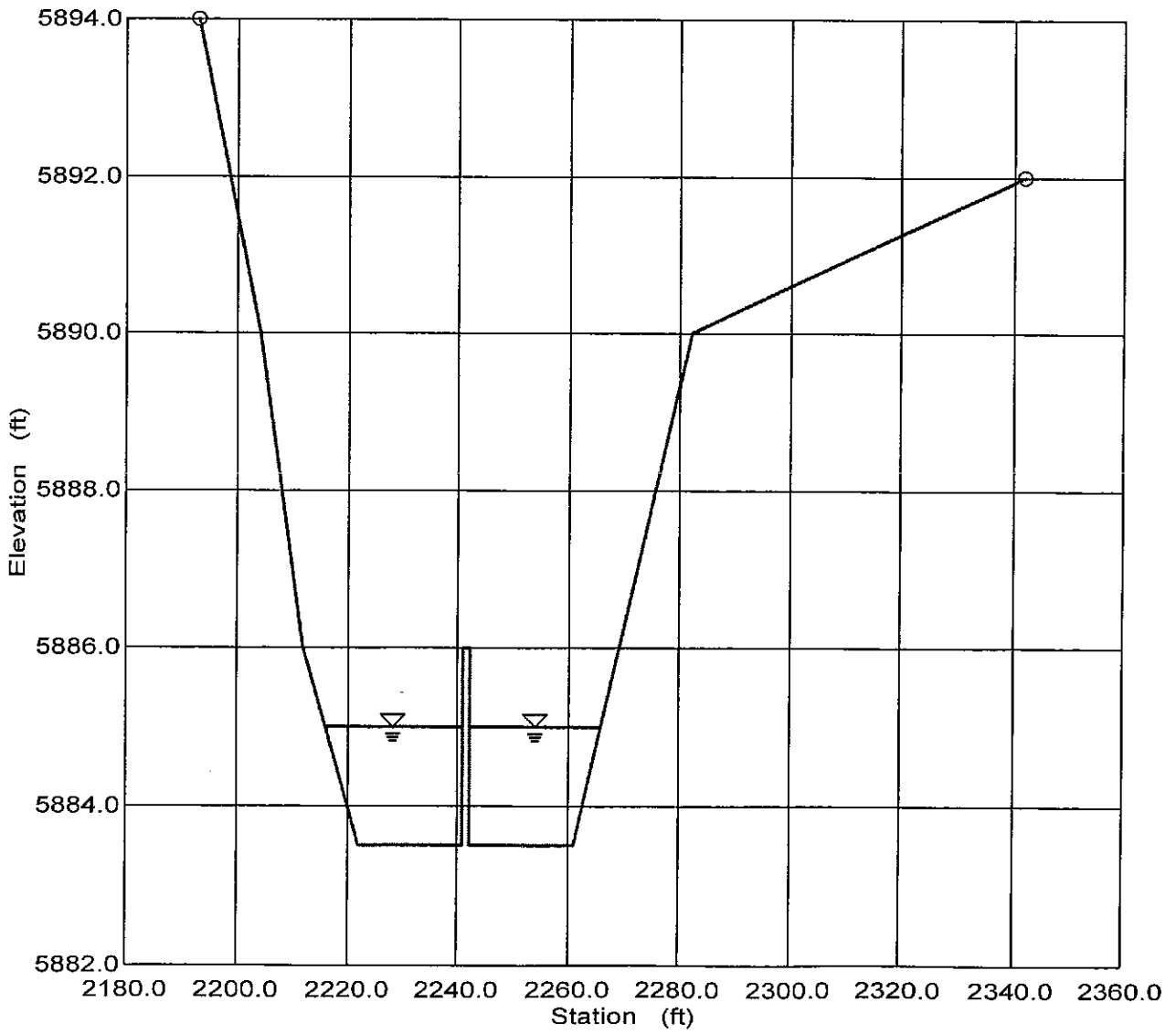
BUREAU OF PUBLIC ROADS JAN. 1963

Low Flows @ Proposed Low Water Crossing
Cross Section for Irregular Channel

Project Description	
Project File	h:\fmw\project3.fm2
Worksheet	XS @ Proposed Low Water Crossing
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.032	
Channel Slope	0.002140	ft/ft
Water Surface Elevation	5,885.00	ft
Discharge	160.00	cfs

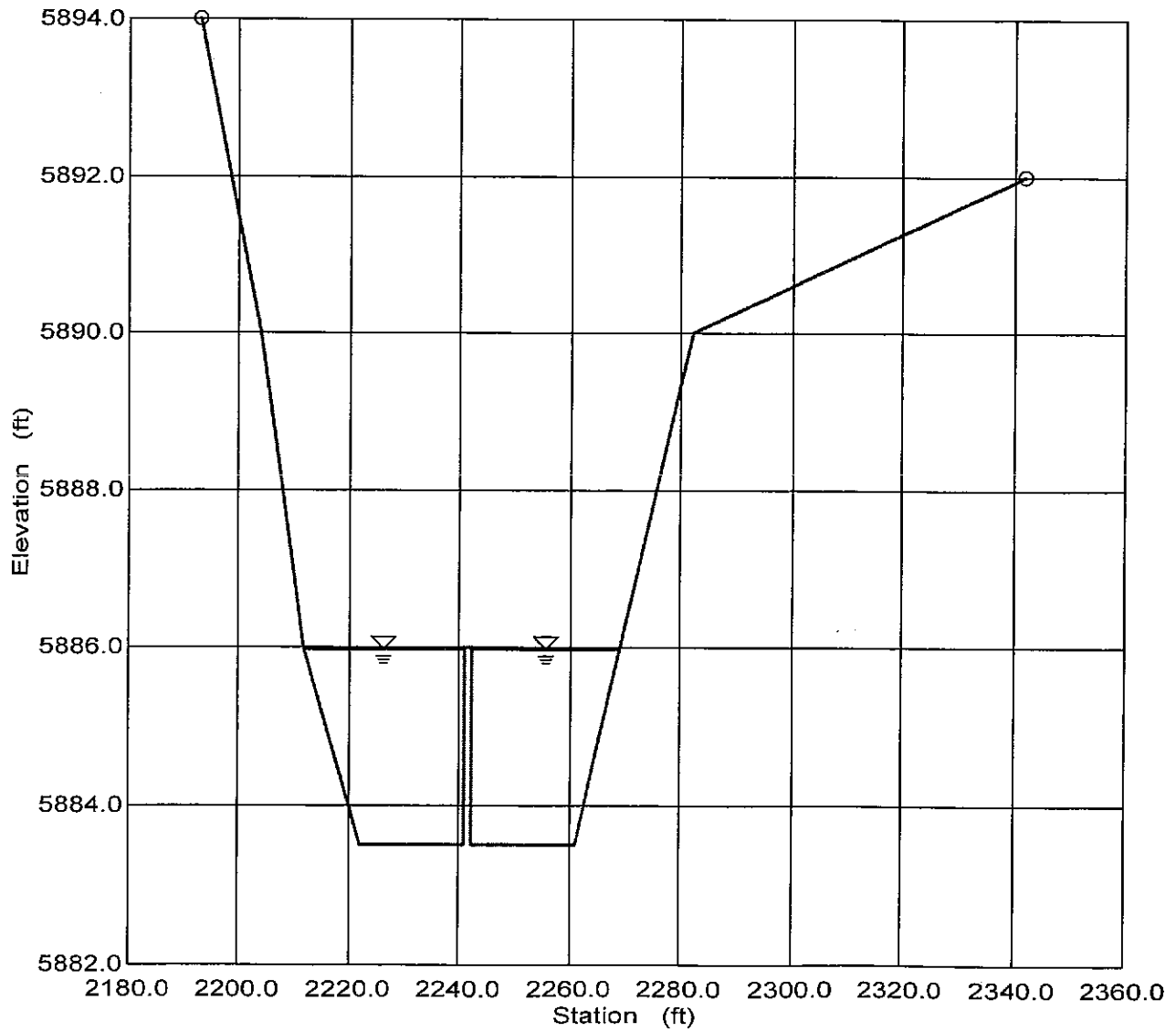
– MAX EL = 5885



Low Flows @ Proposed Low Water Crossing
Cross Section for Irregular Channel

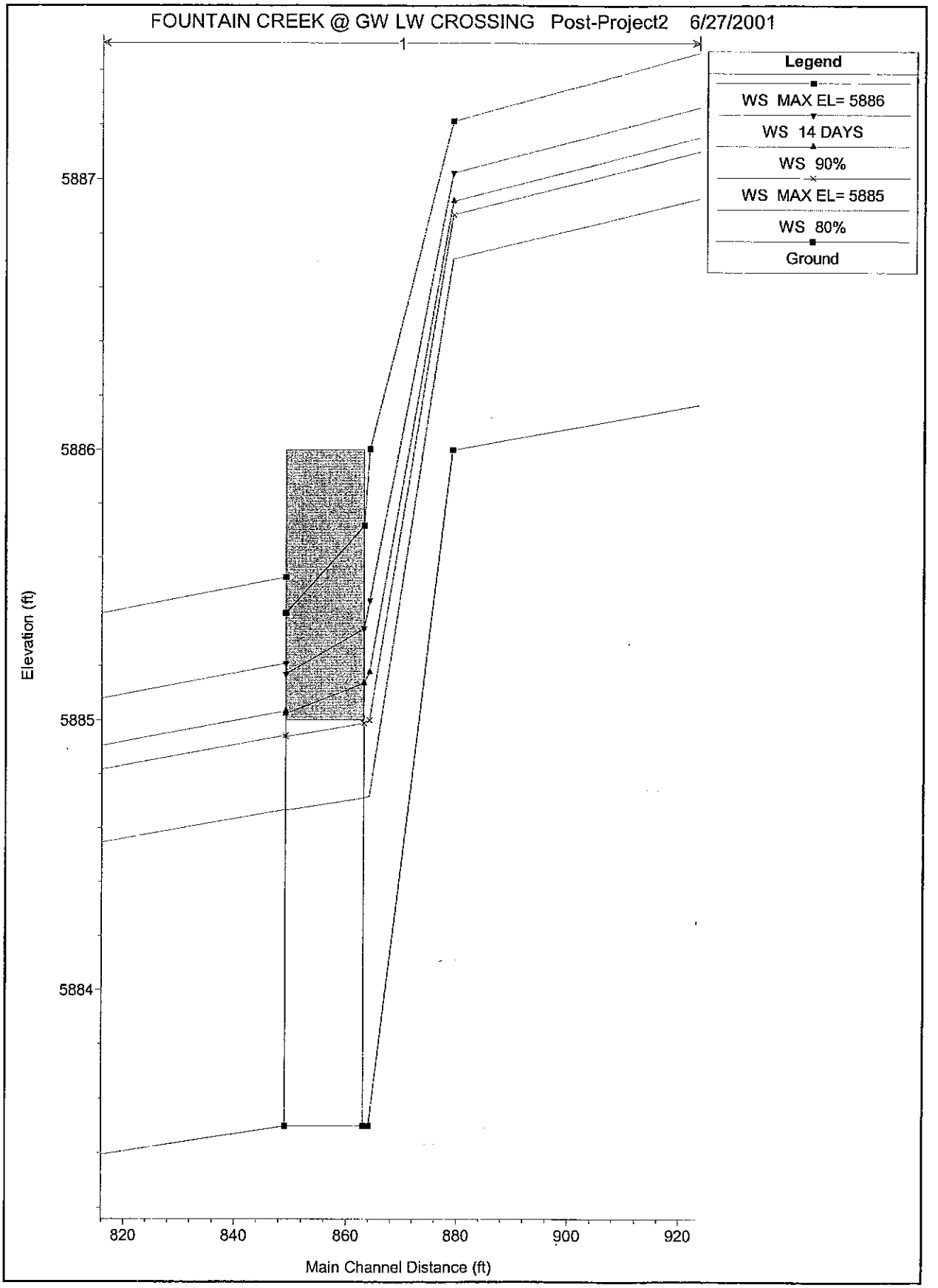
Project Description	
Project File	h:\fmw\project3.fm2
Worksheet	XS @ Proposed Low Water Crossing
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.032	
Channel Slope	0.002140	ft/ft
Water Surface Elevation	5,885.99	ft
Discharge	380.00	cfs — MAX EL = 5886



HEC-RAS Plan: PostProject2 River: Fountain Creek Reach: 1

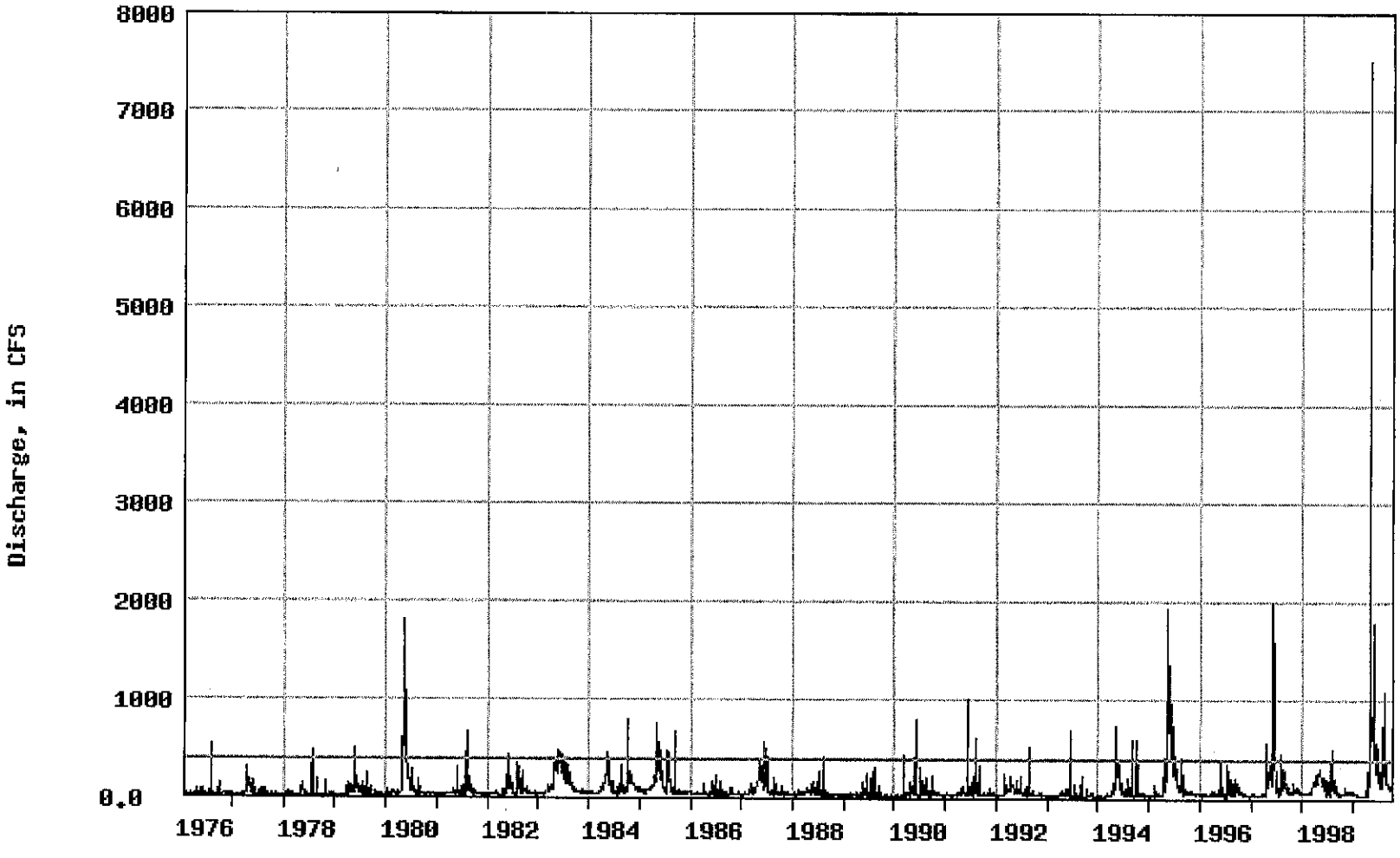
Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	15700	166.0	5887.70	5889.17	5888.5	5889.3	0.001889	2.2	75.1	65	0.36
1	15700	317.0	5887.70	5889.74	5888.9	5889.9	0.002028	2.8	114.7	75	0.39
1	15300	166.0	5886.00	5886.87	5886.9	5887.2	0.021101	4.6	35.7	54	1.01
1	15300	317.0	5886.00	5887.23	5887.2	5887.7	0.018248	5.6	56.2	57	1.00
1	15285	166.0	5883.50	5885.00	5884.3	5885.1	0.001725	2.5	66.8	50	0.38
1	15285	317.0	5883.50	5886.00	5884.7	5886.1	0.001069	2.6	120.2	57	0.32
1	15280	Bridge									
1	15270	166.0	5883.50	5884.96	5884.3	5885.1	0.002622	2.6	64.4	50	0.40
1	15270	317.0	5883.50	5885.56	5884.7	5885.7	0.002884	3.3	95.6	54	0.44
1	14400	166.0	5880.80	5881.69	5881.5	5881.9	0.005907	3.2	51.1	65	0.64
1	14400	317.0	5880.80	5882.10	5881.8	5882.4	0.005904	4.0	79.4	74	0.68


FOUNTAIN CREEK @ GW LW CROSSING Post-Project2 6/27/2001
1
Legend
WS MAX EL= 5886
WS 14 DAYS
WS 90%
WS MAX EL= 5885
WS 80%
Ground
5887
5886
5885
5884
Elevation (ft)
820
840
860
880
900
920
Main Channel Distance (ft)

GRAPH OF HISTORIC DAILY PEAK FLOWS

Graph of Daily Peak Flows from USGS Gage

Fountain Creek At Colorado Springs, Co.
Station Number: 07105500



Legend: Discharge, in CFS
Estimated Discharge, in CFS
Discharge Passing Under Low Water Crossing, in CFS

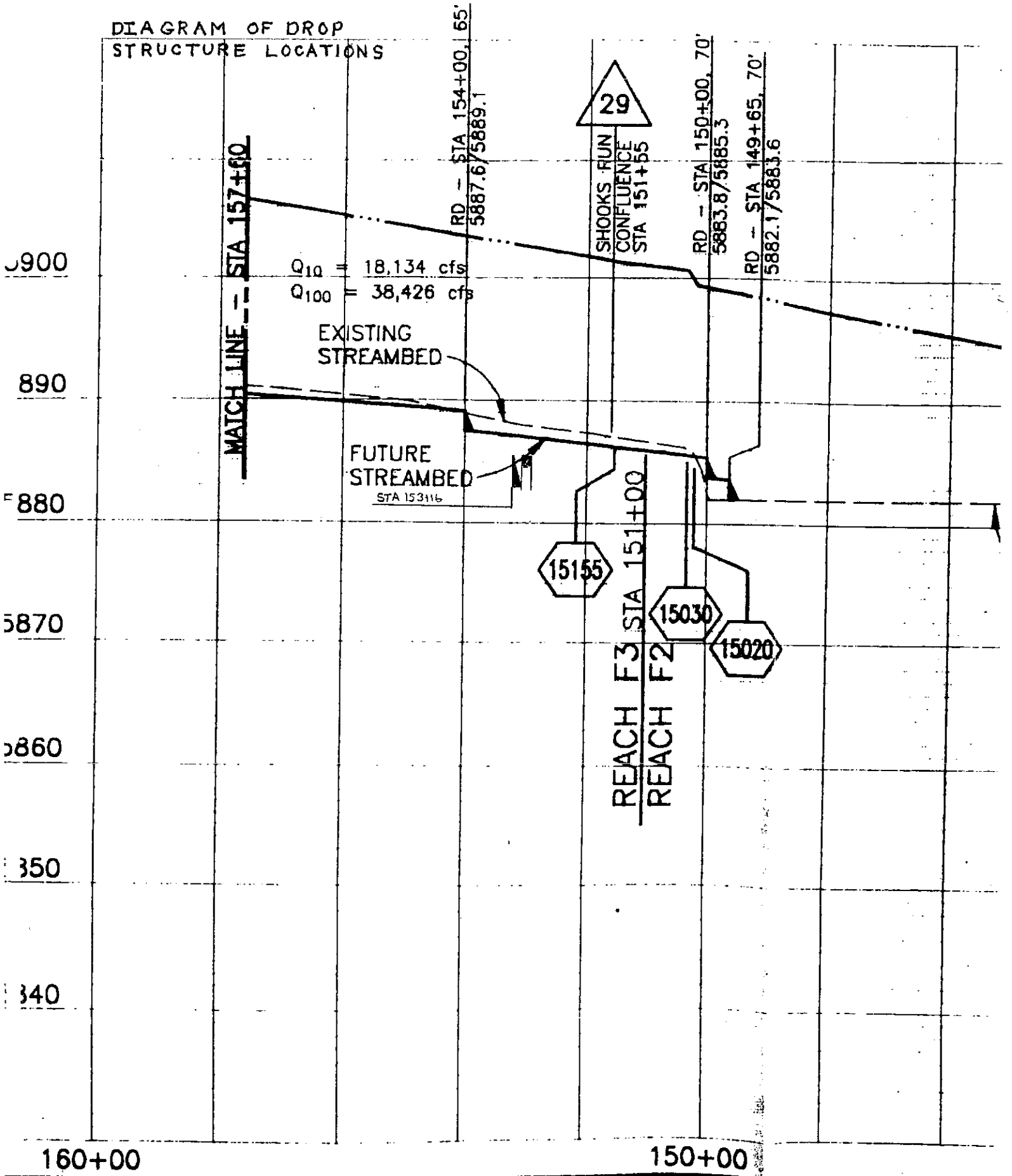
TABLE OF HISTORIC PEAK FLOWS

Table of Low Flows in Fountain Creek

Year	Flow (cfs) at: 80th Percentile of Days	90th Percentile of Days	A maximum of 14 days in a row had flows (cfs) greater than:	Peak Flows (cfs) in a given year (shaded flows indicate those that would overtop low water crossing											
1976	25	30	25	540	140										
1977	40	66	127	302	216										
1978	30	48	65	473	320	170									
1979	68	100	75	501	335	230									
1980	100	375	740	1813	1330	833	620	425	280						
1981	50	80	76	655	440	305	260								
1982	80	130	75	427	350	310	275								
1983	273	350	378	467	467	430	401	380	351	349	340	335	325	270	
1984	170	225	225	790	440	325	290	260							
1985	180	300	350	730	665	580	560	470	450	380	270				
1986	52	65	40	225											
1987	123	200	230	551	482	375	325	260							
1988	62	76	88	420	280										
1989	38	60	38	308	254										
1990	65	115	70	780	437	302	218								
1991	70	120	95	995	605	318	255								
1992	82	123	123	510	240										
1993	37	40	60	683	225										
1994	107	213	238	725	582	575	480	375	345	340	238				
1995	250	435	740	1940	1344	942	813	740	740	690	450	401	400	300	280
1996	65	75	110	395	340	270									
1997	180	275	400	2000	1250	510	505	440	435	420	300	290	280		
1998	154	206	250	488	305	290	255								
1999	375	680	740	7500	1875	1100	1000	813	813	750	570	565	520	500	400
AVERAGE	111.50	182.79	223.25		380	375	360	250							

* All information is interpolated off of USGS data for gage 07105500 on Fountain Creek near Tejon and Nevada
* A flow at the nth percentile of days signifies that for n% of the days out of a given year, the creek has flows less than the nth percentile flow

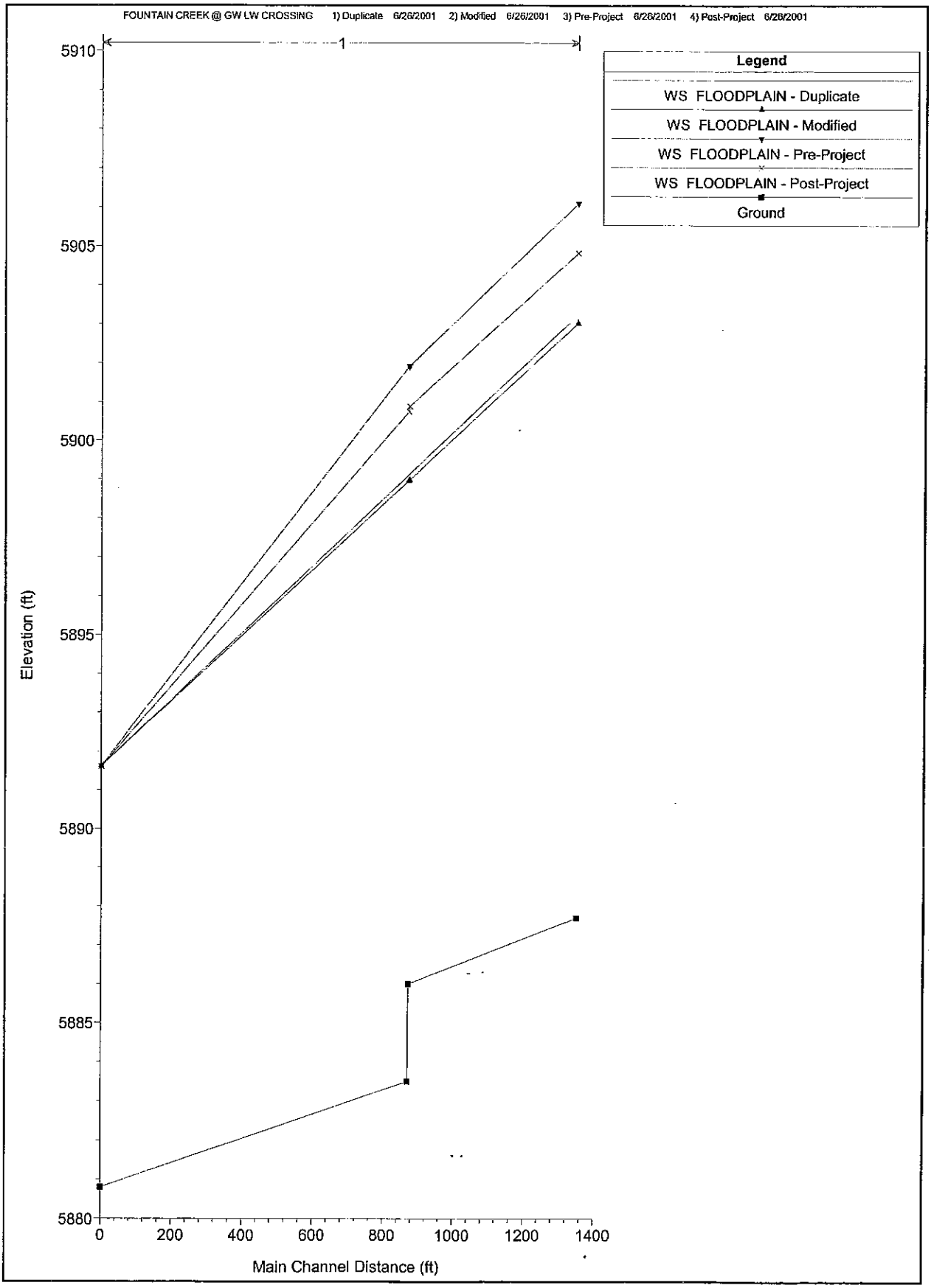
DIAGRAM OF DROP STRUCTURE LOCATIONS AS PRESENTED IN THE MULLER ENGINEERING FOUNTAIN CREEK DRAINAGE BASIN PLANNING STUDY



JLLER ENGINEERING CO., INC.
CONSULTING ENGINEERS
Thomas & Thomas
Obering, Wurth & Associates

APPENDIX C

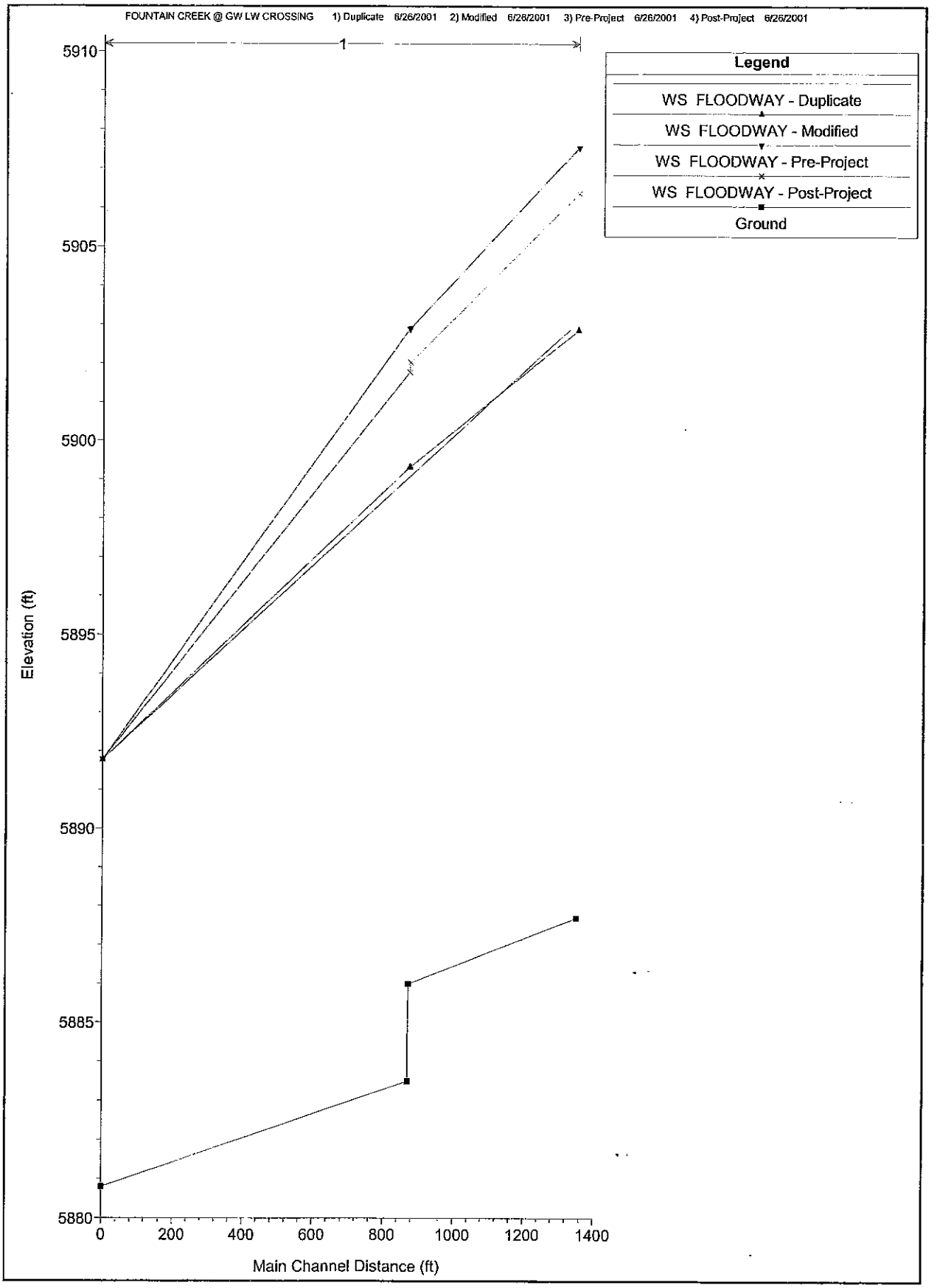
FLOODPLAIN PROFILE AND ELEVATIONS


FOUNTAIN CREEK @ GW LW CROSSING 1) Duplicate 6/26/2001 2) Modified 6/26/2001 3) Pre-Project 6/26/2001 4) Post-Project 6/26/2001
1
Legend
WS FLOODPLAIN - Duplicate
WS FLOODPLAIN - Modified
WS FLOODPLAIN - Pre-Project
WS FLOODPLAIN - Post-Project
Ground
Elevation (ft)
5910
5905
5900
5895
5890
5885
5880
0
200
400
600
800
1000
1200
1400
Main Channel Distance (ft)

HEC-RAS River: Fountain Creek Reach: 1

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	15700	FLOODPLAIN	Duplicate	44700.00	5887.70	5903.03	5903.03	5905.45	0.004216	17.52	5940.67	1106.77	0.80
1	15700	FLOODPLAIN	Modified	44700.00	5887.70	5903.03	5903.03	5905.45	0.004216	17.52	5940.67	1106.77	0.80
1	15700	FLOODPLAIN	Pre-Project	44700.00	5887.70	5906.09		5906.86	0.001276	10.93	9840.09	1409.24	0.46
1	15700	FLOODPLAIN	Post-Project	44700.00	5887.70	5904.82	5903.03	5906.02	0.002040	13.16	8091.26	1291.49	0.57
1	15281	FLOODPLAIN	Modified	44700.00	5886.30	5898.98	5898.98	5902.30	0.005198	19.07	5145.04	791.74	0.95
1	15281	FLOODPLAIN	Pre-Project	44700.00	5883.10	5901.92		5905.63	0.003627	18.63	4549.15	634.87	0.81
1	15281	FLOODPLAIN	Post-Project	44700.00	5886.00	5900.88	5900.88	5904.15	0.007943	18.48	3987.96	626.85	0.89
1	15279	FLOODPLAIN	Modified	44700.00	5886.30	5898.96	5898.96	5902.30	0.005217	19.09	5136.92	791.22	0.96
1	15279	FLOODPLAIN	Pre-Project	44700.00	5883.10	5901.91	5901.91	5905.63	0.003638	18.64	4544.50	634.81	0.81
1	15279	FLOODPLAIN	Post-Project	44700.00	5883.50	5900.75	5900.75	5904.09	0.006958	18.35	4042.25	625.85	0.84
1	14400	FLOODPLAIN	Duplicate	44700.00	5880.80	5891.62	5891.62	5894.79	0.005861	16.66	3492.58	563.68	0.97
1	14400	FLOODPLAIN	Modified	44700.00	5880.80	5891.62	5891.62	5894.79	0.005861	16.66	3492.58	563.68	0.97
1	14400	FLOODPLAIN	Pre-Project	44700.00	5880.80	5891.62	5891.62	5894.79	0.005871	16.67	3490.38	563.56	0.97
1	14400	FLOODPLAIN	Post-Project	44700.00	5880.80	5891.61	5891.60	5894.79	0.005902	16.70	3483.78	563.21	0.97

FLOODWAY PROFILE AND ELEVATIONS


FOUNTAIN CREEK @ GW LW CROSSING 1) Duplicate 6/26/2001 2) Modified 6/26/2001 3) Pre-Project 6/26/2001 4) Post-Project 6/26/2001
Legend
WS FLOODWAY - Duplicate
WS FLOODWAY - Modified
WS FLOODWAY - Pre-Project
WS FLOODWAY - Post-Project
Ground
Elevation (ft)
5910
5905
5900
5895
5890
5885
5880
0
200
400
600
800
1000
1200
1400
Main Channel Distance (ft)

HEC-RAS River: Fountain Creek Reach: 1

Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	15700	FLOODWAY	Duplicate	44700.00	5887.70	5902.87	5902.87	5905.69	0.004770	18.50	5289.20	793.60	0.85
1	15700	FLOODWAY	Modified	44700.00	5887.70	5902.86	5902.86	5905.69	0.004787	18.52	5281.84	793.57	0.86
1	15700	FLOODWAY	Pre-Project	44700.00	5887.70	5907.54		5908.30	0.001052	10.46	9021.04	800.00	0.42
1	15700	FLOODWAY	Post-Project	44700.00	5887.70	5905.36	5902.86	5907.36	0.001455	11.79	8081.59	800.00	0.49
1	15281	FLOODWAY	Modified	44700.00	5885.30	5899.33	5899.32	5903.18	0.005448	19.89	4609.42	646.78	0.98
1	15281	FLOODWAY	Pre-Project	44700.00	5883.10	5902.90		5907.13	0.003560	19.18	4245.39	578.62	0.81
1	15281	FLOODWAY	Post-Project	44700.00	5885.00	5902.02	5902.02	5905.77	0.007622	19.11	3806.66	521.46	0.88
1	15279	FLOODWAY	Modified	44700.00	5886.30	5899.32	5899.32	5903.18	0.005468	19.91	4602.47	646.33	0.98
1	15279	FLOODWAY	Pre-Project	44700.00	5883.10	5902.89	5902.89	5907.13	0.003567	19.19	4241.16	578.14	0.81
1	15279	FLOODWAY	Post-Project	44700.00	5883.50	5901.77	5901.77	5905.63	0.006862	19.04	3610.81	518.26	0.84
1	14400	FLOODWAY	Duplicate	44700.00	5880.80	5891.79	5891.43	5895.18	0.005902	16.92	3262.80	400.00	0.97
1	14400	FLOODWAY	Modified	44700.00	5880.80	5891.79	5891.43	5895.18	0.005902	16.92	3262.80	400.00	0.97
1	14400	FLOODWAY	Pre-Project	44700.00	5880.80	5891.79	5891.38	5895.18	0.005902	16.92	3262.80	400.00	0.97
1	14400	FLOODWAY	Post-Project	44700.00	5880.80	5891.79	5891.43	5895.18	0.005902	16.92	3262.80	400.00	0.97

DUPLICATE EFFECTIVE MODEL

HEC-RAS September 1998 Version 2.2
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X    X
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PROJECT DATA
Project Title: FOUNTAIN CREEK @ GW LW CROSSING
Project File : FCGWLWC.prj
Run Date and Time: 6/26/2001 9:20:21 AM

Project in English units

Project Description:
Flood Plain Development Permit Model

GEOMETRY DATA

Geometry Title: Duplicate Effective
Geometry File : x:\2920000.all\2924720\HEC RAS Models\FPpermit\FCGWLWC.g02

CROSS SECTION RIVER: Fountain Creek
REACH: 1 RS: 15700

INPUT
Description: FEMA FIRM Section DT (260)
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	5925	1008	5920	1018	5915	1025	5910	1070	5905
1325	5902	1355	5902	1505	5900	2195	5895	2210	5890
2220	5888.6	2230	5887.7	2265	5887.7	2275	5888.6	2290	5890
2320	5895	2335	5900	2350	5905	2400	5905	2410	5903
2430	5905	2610	5910	2725	5910	2740	5905	2750	5900
2830	5898	2875	5900	3310	5905	3935	5910	4075	5915
4220	5920								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.06	2210	.033	2290	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
2210	2290	1325.8	1325	1350	.1	.3

CROSS SECTION RIVER: Fountain Creek
REACH: 1 RS: 14400

INPUT
Description: FEMA FIRM Section DS (250)
Station Elevation Data num= 29

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	5915	1050	5910	1160	5905	1390	5900	1490	5895
1640	5890	1750	5885	1760	5882	1770	5880.8	1820	5880.8
1830	5882	1920	5884.7	2030	5883.2	2090	5885	2115	5890
2125	5891	2155	5891	2165	5890	2170	5888	2175	5890
2180	5891	2240	5891	2250	5890	2270	5885	2290	5884
2320	5885	2950	5890	3110	5895	3125	5900		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
1000	.07	1640	.04	1750	.03	1920	.04	2115	.02
2165	.07								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1750	1920	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Fountain Creek

Reach	River Sta.	n1	n2	n3	n4	n5	n6
1	15700	.06	.033	.06			
1	14400	.07	.04	.03	.04	.02	.07

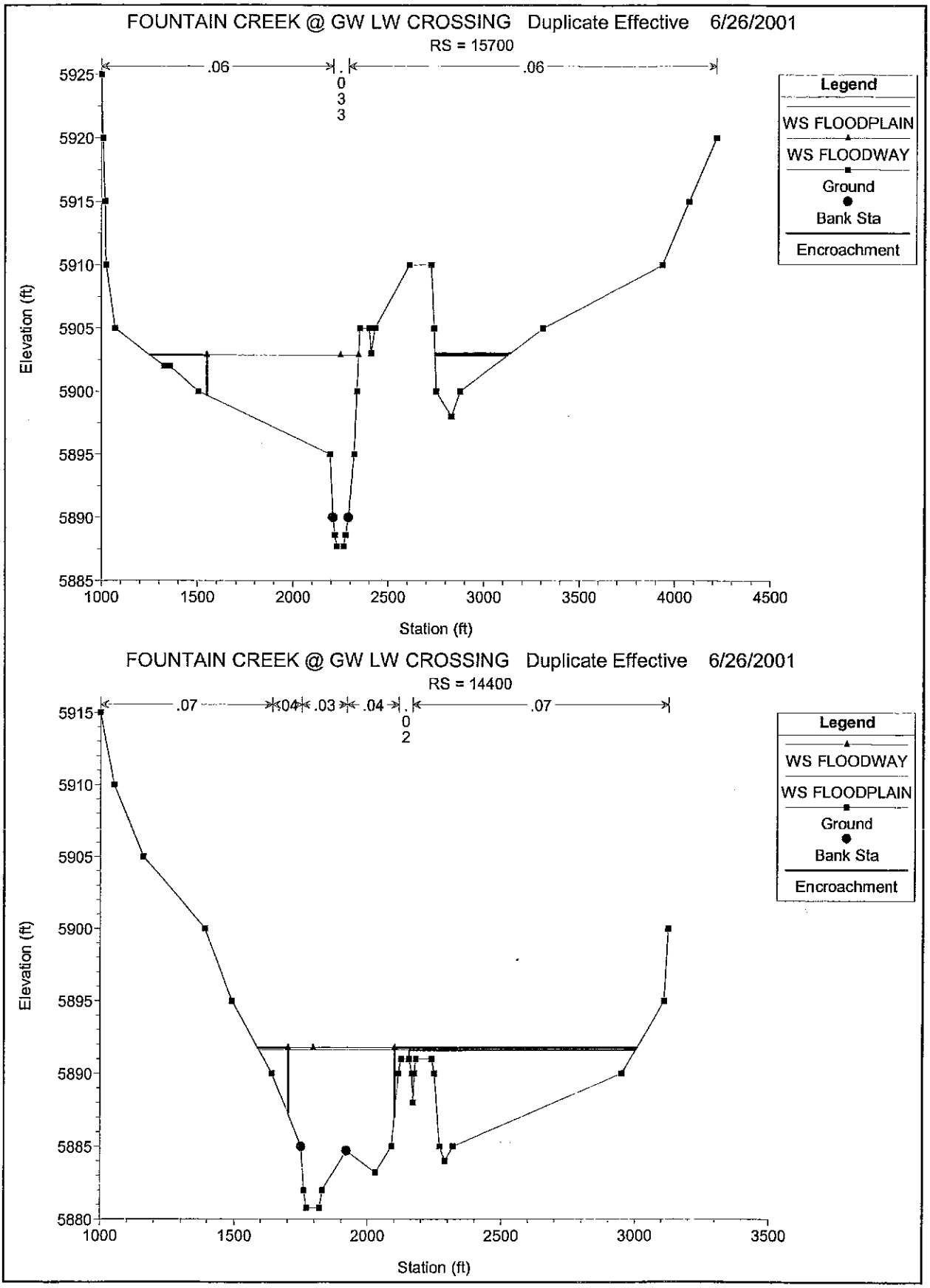
SUMMARY OF REACH LENGTHS

River: Fountain Creek

Reach	River Sta.	Left	Channel	Right
1	15700	1325.8	1325	1350
1	14400	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Fountain Creek

Reach	River Sta.	Contr.	Expan.
1	15700	.1	.3
1	14400	.1	.3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.03
.06
Legend
WS FLOODPLAIN
WS FLOODWAY
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
FOUNTAIN CREEK @ GW LW CROSSING Duplicate Effective 6/26/2001
RS = 14400
.07
.04
.03
.04
.07
Legend
WS FLOODWAY
WS FLOODPLAIN
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

MODIFIED EFFECTIVE MODEL

FCGWLWC.rep

HEC-RAS September 1998 Version 2.2
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

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X     X  X        X            X  X     X    X        X
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PROJECT DATA
Project Title: FOUNTAIN CREEK @ GW LW CROSSING
Project File : FCGWLWC.prj
Run Date and Time: 6/26/2001 9:28:38 AM

Project in English units

Project Description:
Flood Plain Development Permit Model

GEOMETRY DATA

Geometry Title: Modified Effective
Geometry File : x:\2920000.all\2924720\HEC RAS Models\FPpermit\FCGWLWC.g03

CROSS SECTION RIVER: Fountain Creek
REACH: 1 RS: 15700

INPUT
Description: FEMA FIRM Section DT (260)
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	5925	1008	5920	1018	5915	1025	5910	1070	5905
1325	5902	1355	5902	1505	5900	2195	5895	2210	5890
2220	5888.6	2230	5887.7	2265	5887.7	2275	5888.6	2290	5890
2320	5895	2335	5900	2350	5905	2400	5905	2410	5903
2430	5905	2610	5910	2725	5910	2740	5905	2750	5900
2830	5898	2875	5900	3310	5905	3935	5910	4075	5915
4220	5920								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.06	2210	.033	2290	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
2210	2290	453	478	453	.1 .3

CROSS SECTION RIVER: Fountain Creek
REACH: 1 RS: 15281

INPUT
Description: Section at downstream end of proposed low water crossing
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1640	5905	1675	5900	2095	5890	2170	5887	2195	5886.3
2265	5886.3	2275	5890	2475	5895	2510	5899	2512	5905

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1640	.07	2170	.03	2275	.07

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
2170	2275	2	2	.1	.3

CROSS SECTION RIVER: Fountain Creek
REACH: 1 RS: 15279

INPUT
Description: Section at downstream end of proposed low water crossing
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1640	5905	1675	5900	2095	5890	2170	5887	2195	5886.3
2265	5886.3	2275	5890	2475	5895	2510	5899	2512	5905

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1640	.07	2170	.03	2275	.07

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
2170	2275	870	870	.1	.3

CROSS SECTION RIVER: Fountain Creek
REACH: 1 RS: 14400

INPUT
Description: FEMA FIRM Section DS (250)
Station Elevation Data num= 29

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	5915	1050	5910	1160	5905	1390	5900	1490	5895
1640	5890	1750	5885	1760	5882	1770	5880.8	1820	5880.8
1830	5882	1920	5884.7	2030	5883.2	2090	5885	2115	5890
2125	5891	2155	5891	2165	5890	2170	5888	2175	5890
2180	5891	2240	5891	2250	5890	2270	5885	2290	5884
2320	5885	2950	5890	3110	5895	3125	5900		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
1000	.07	1640	.04	1750	.03	1920	.04	2115	.02
2165	.07								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1750	1920	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Fountain Creek

Reach	River Sta.	n1	n2	n3	n4	n5	n6

1		15700	.06	.033	.06	
1		15281	.07	.03	.07	
1		15279	.07	.03	.07	
1		14400	.07	.04	.03	.04 .02 .07

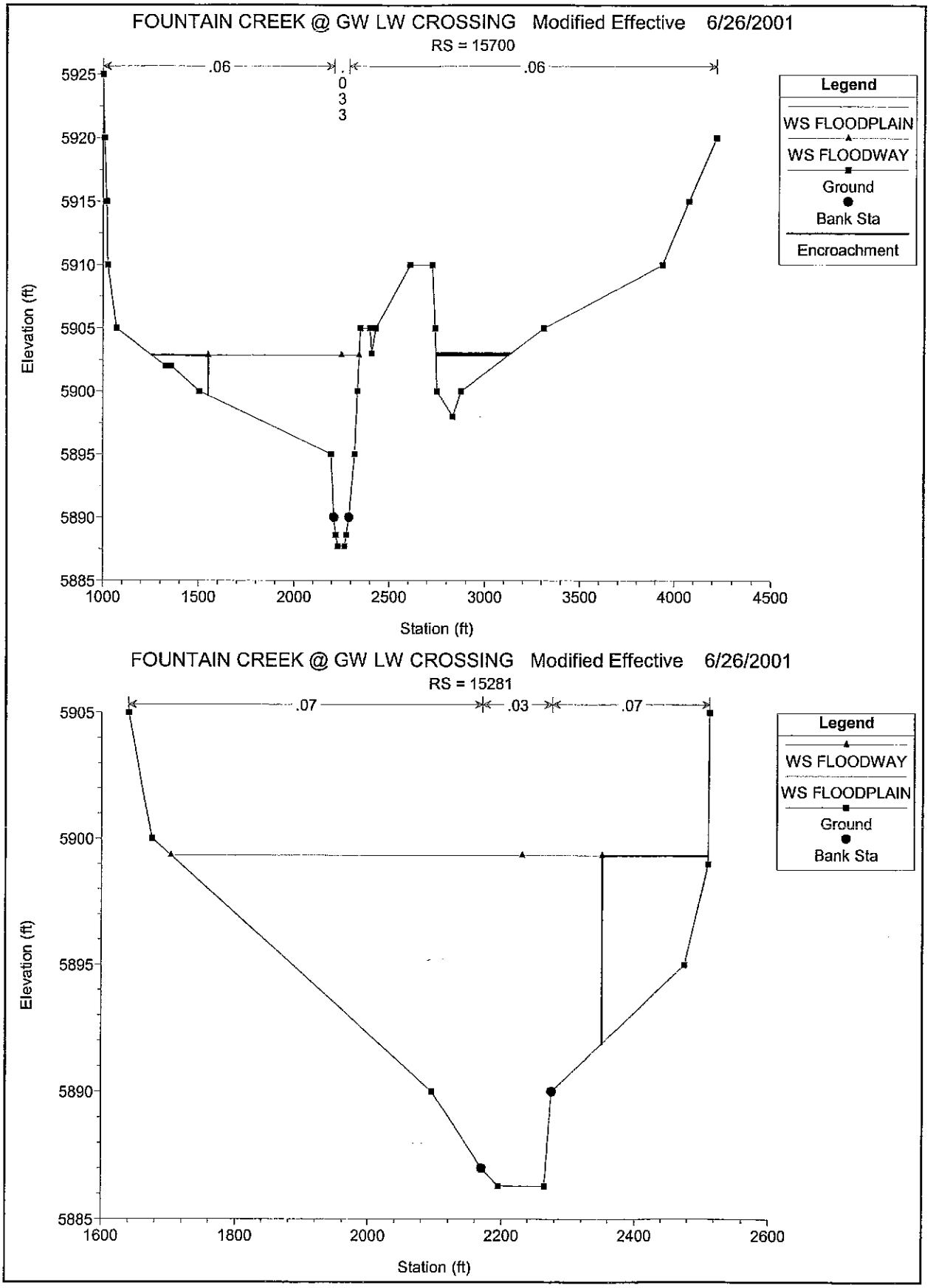
SUMMARY OF REACH LENGTHS

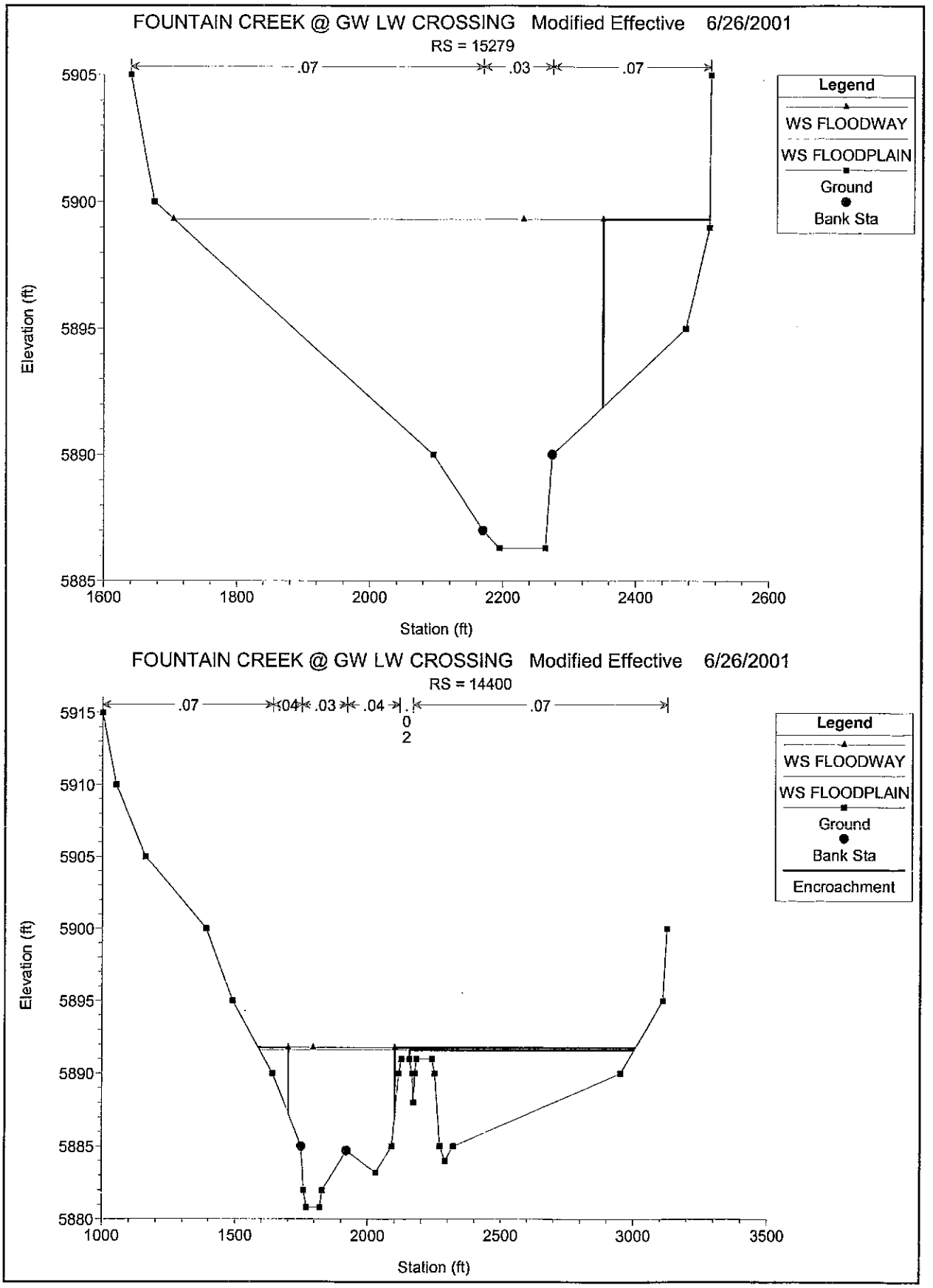
River: Fountain Creek

Reach	River Sta.	Left	Channel	Right
1	15700	453	478	453
1	15281	2	2	2
1	15279	870	870	870
1	14400	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Fountain Creek

Reach	River Sta.	Contr.	Expan.
1	15700	.1	.3
1	15281	.1	.3
1	15279	.1	.3
1	14400	.1	.3


FOUNTAIN CREEK @ GW LW CROSSING Modified Effective 6/26/2001
RS = 15700
.06
.033
.06
Legend
WS FLOODPLAIN
WS FLOODWAY
Ground
Bank Sta
Encroachment
Elevation (ft)
5925
5920
5915
5910
5905
5900
5895
5890
5885
1000
1500
2000
2500
3000
3500
4000
4500
Station (ft)
FOUNTAIN CREEK @ GW LW CROSSING Modified Effective 6/26/2001
RS = 15281
.07
.03
.07
Legend
WS FLOODWAY
WS FLOODPLAIN
Ground
Bank Sta
Elevation (ft)
5905
5900
5895
5890
5885
1600
1800
2000
2200
2400
2600
Station (ft)


FOUNTAIN CREEK @ GW LW CROSSING Modified Effective 6/26/2001
RS = 15279
.07
.03
.07
Legend
WS FLOODWAY
WS FLOODPLAIN
Ground
Bank Sta
Elevation (ft)
5905
5900
5895
5890
5885
1600
1800
2000
2200
2400
2600
Station (ft)
FOUNTAIN CREEK @ GW LW CROSSING Modified Effective 6/26/2001
RS = 14400
.07
.04
.03
.04
.07
Legend
WS FLOODWAY
WS FLOODPLAIN
Ground
Bank Sta
Encroachment
Elevation (ft)
5915
5910
5905
5900
5895
5890
5885
5880
1000
1500
2000
2500
3000
3500
Station (ft)

PRE-PROJECT MODEL

FCGWLWC.rep

HEC-RAS September 1998 Version 2.2
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

```
X     X  XXXXXX    XXXX         XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X    X
X     X  X        X            X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X        X
X     X  X        X    X       X   X    X    X        X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
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PROJECT DATA
Project Title: FOUNTAIN CREEK @ GW LW CROSSING
Project File : FCGWLWC.prj
Run Date and Time: 6/26/2001 9:29:50 AM

Project in English units

Project Description:
Flood Plain Development Permit Model

GEOMETRY DATA

Geometry Title: Pre-Project
Geometry File : x:\2920000.all\2924720\HEC RAS Models\FPpermit\FCGWLWC.g04

CROSS SECTION RIVER: Fountain Creek
REACH: 1 RS: 15700

INPUT
Description: FEMA FIRM Section DT (260)
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	5925	1008	5920	1018	5915	1025	5910	1070	5905
1325	5902	1355	5902	1505	5900	2195	5895	2210	5890
2220	5888.6	2230	5887.7	2265	5887.7	2275	5888.6	2290	5890
2320	5895	2335	5900	2350	5905	2400	5905	2410	5903
2430	5905	2610	5910	2725	5910	2740	5905	2750	5900
2830	5898	2875	5900	3310	5905	3935	5910	4075	5915
4220	5920								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.06	2210	.033	2290	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
2210	2290	453	478	453	.1 .3

CROSS SECTION RIVER: Fountain Creek
REACH: 1 RS: 15281

INPUT
Description: Section at downstream end of proposed low water crossing
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1678	5906	1750	5904	1880	5902	1895	5900	2075	5898
2110	5896	2143	5896	2193	5894	2210	5886	2220	5884
2225	5883.1	2267	5883.1	2278	5886	2289	5894	2488	5894
2515	5899.3	2516	5905						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1678	.07	2193	.03	2289	.055

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
2193	2289	2	2	.1	.3

CROSS SECTION RIVER: Fountain Creek
REACH: 1 RS: 15279

INPUT
Description: Section at downstream end of proposed low water crossing
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1678	5906	1750	5904	1880	5902	1895	5900	2075	5898
2110	5896	2143	5896	2193	5894	2210	5886	2220	5884
2225	5883.1	2267	5883.1	2278	5886	2289	5894	2488	5894
2515	5899.3	2516	5905						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1678	.07	2193	.03	2289	.055

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
2193	2289	870	870	.1	.3

CROSS SECTION RIVER: Fountain Creek
REACH: 1 RS: 14400

INPUT
Description: FEMA FIRM Section DS (250)
Station Elevation Data num= 29

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	5915	1050	5910	1160	5905	1390	5900	1490	5895
1640	5890	1750	5885	1760	5882	1770	5880.8	1820	5880.8
1830	5882	1920	5884.7	2030	5883.2	2090	5885	2115	5890
2125	5891	2155	5891	2165	5890	2170	5888	2175	5890
2180	5891	2240	5891	2250	5890	2270	5885	2290	5884
2320	5885	2950	5890	3110	5895	3125	5900		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
1000	.07	1640	.04	1750	.03	1920	.04	2115	.02
2165	.07								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1750	1920	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Fountain Creek

Reach	River Sta.	n1	n2	n3	n4	n5	n6
1	15700	.06	.033	.06			
1	15281	.07	.03	.055			
1	15279	.07	.03	.055			
1	14400	.07	.04	.03	.04	.02	.07

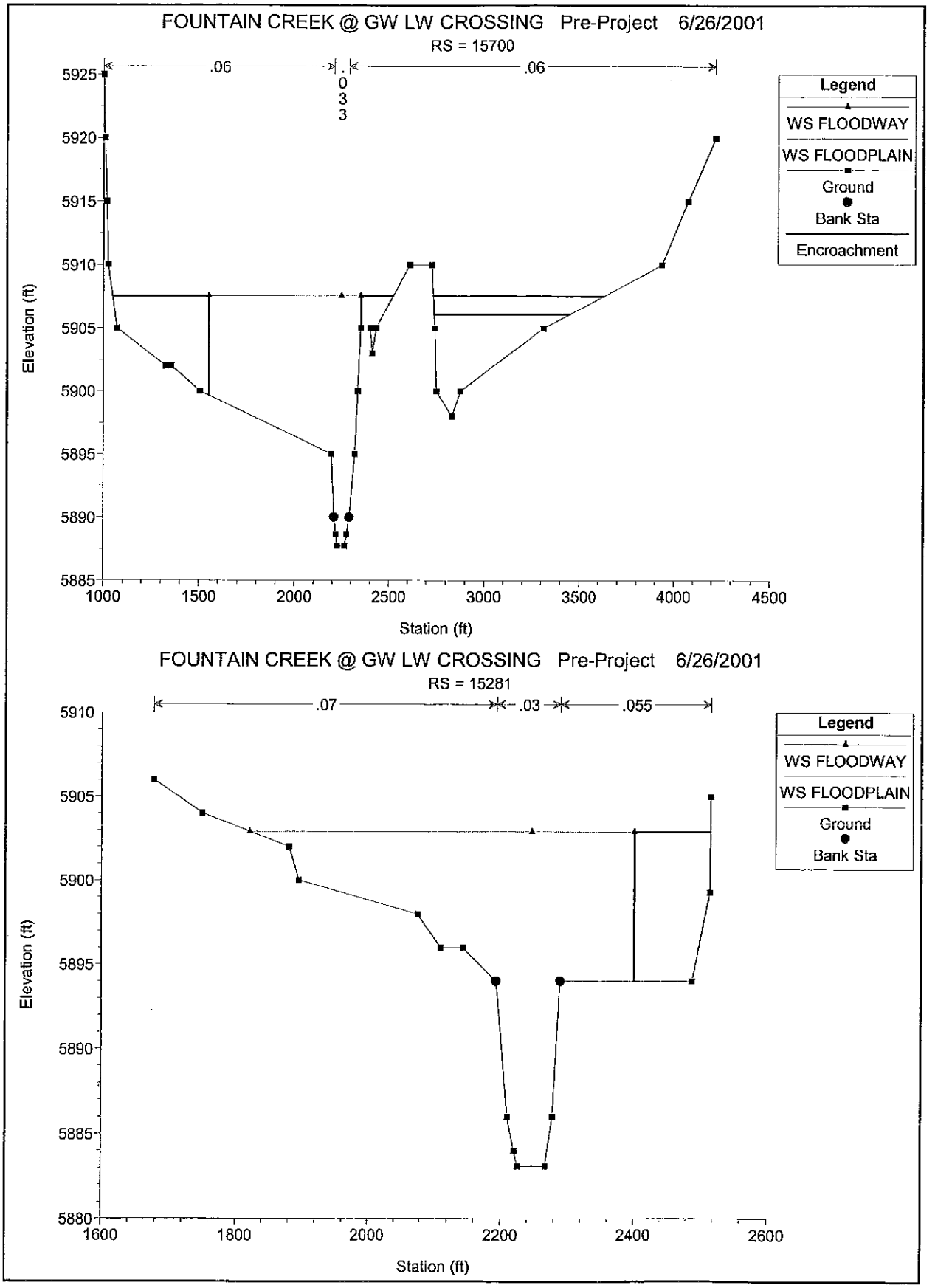
SUMMARY OF REACH LENGTHS

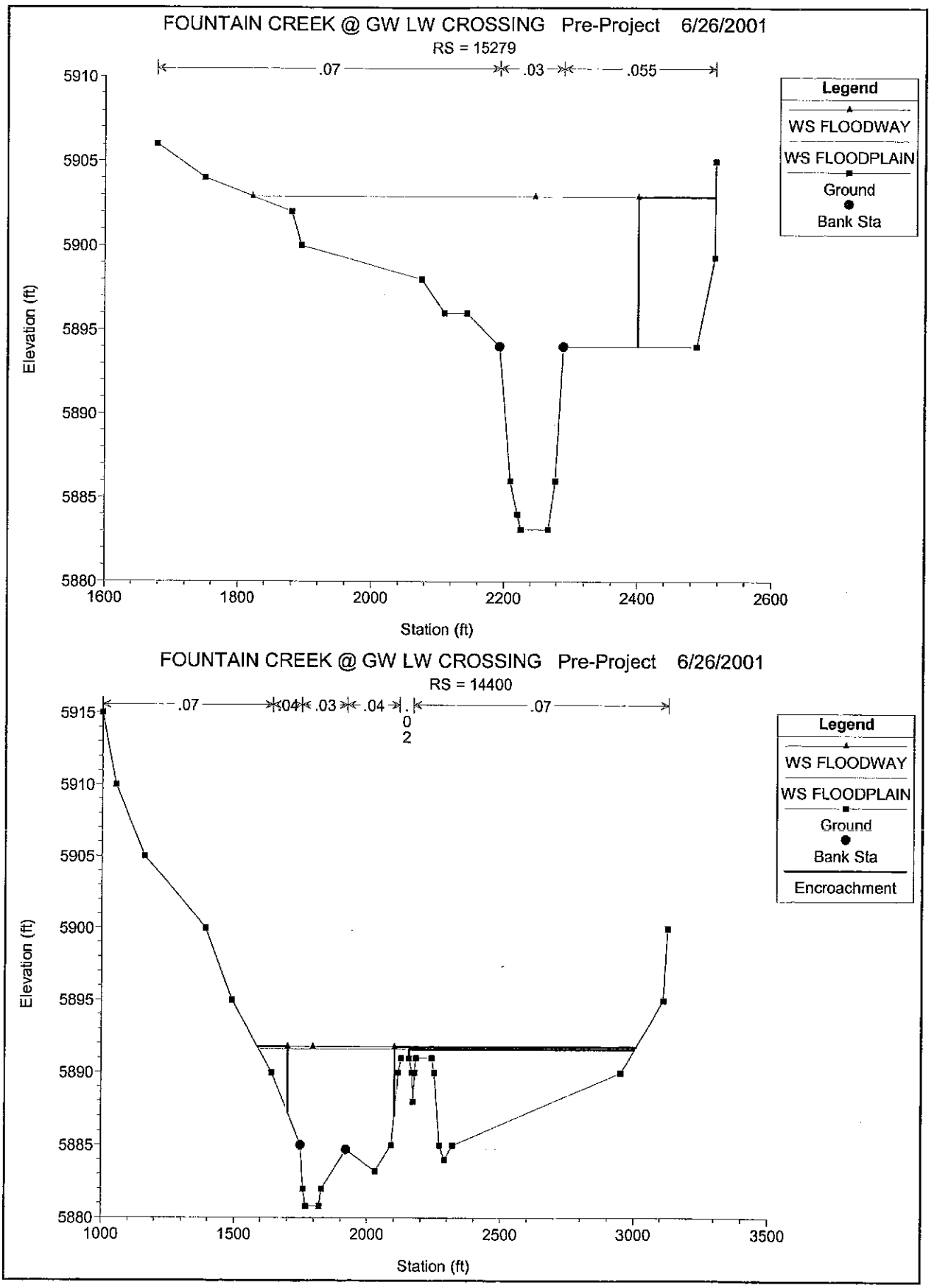
River: Fountain Creek

Reach	River Sta.	Left	Channel	Right
1	15700	453	478	453
1	15281	2	2	2
1	15279	870	870	870
1	14400	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Fountain Creek

Reach	River Sta.	Contr.	Expan.
1	15700	.1	.3
1	15281	.1	.3
1	15279	.1	.3
1	14400	.1	.3


FOUNTAIN CREEK @ GW LW CROSSING Pre-Project 6/26/2001
RS = 15700
.06
.033
.06
Legend
WS FLOODWAY
WS FLOODPLAIN
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
FOUNTAIN CREEK @ GW LW CROSSING Pre-Project 6/26/2001
RS = 15281
.07
.03
.055
Legend
WS FLOODWAY
WS FLOODPLAIN
Ground
Bank Sta
Elevation (ft)
Station (ft)


FOUNTAIN CREEK @ GW LW CROSSING Pre-Project 6/26/2001
RS = 15279
.07
.03
.055
Legend
WS FLOODWAY
WS FLOODPLAIN
Ground
Bank Sta
Elevation (ft)
Station (ft)
5910
5905
5900
5895
5890
5885
5880
1600
1800
2000
2200
2400
2600
FOUNTAIN CREEK @ GW LW CROSSING Pre-Project 6/26/2001
RS = 14400
.07
.04
.03
.04
.07
Legend
WS FLOODWAY
WS FLOODPLAIN
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
5915
5910
5905
5900
5895
5890
5885
5880
1000
1500
2000
2500
3000
3500

POST-PROJECT MODEL

HEC-RAS September 1998 Version 2.2
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X    X
X     X  X        X            X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X       X
X     X  X        X    X       X   X    X    X       X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
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PROJECT DATA
Project Title: FOUNTAIN CREEK @ GW LW CROSSING
Project File : FCGWLWC.prj
Run Date and Time: 6/26/2001 10:16:11 AM

Project in English units

Project Description:
Flood Plain Development Permit Model

GEOMETRY DATA

Geometry Title: Post-Project
Geometry File : x:\2920000.all\2924720\HEC RAS Models\FPpermit\FCGWLWC.g01

CROSS SECTION RIVER: Fountain Creek
REACH: 1 RS: 15700

INPUT
Description: FEMA FIRM Section DT (260)
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	5925	1008	5920	1018	5915	1025	5910	1070	5905
1325	5902	1355	5902	1505	5900	2195	5895	2210	5890
2220	5888.6	2230	5887.7	2265	5887.7	2275	5888.6	2290	5890
2320	5895	2335	5900	2350	5905	2400	5905	2410	5903
2430	5905	2610	5910	2725	5910	2740	5905	2750	5900
2830	5898	2875	5900	3310	5905	3935	5910	4075	5915
4220	5920								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1000	.06	2210	.033	2290	.06

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
2210	2290	453	478	453	.1	.3

CROSS SECTION RIVER: Fountain Creek
REACH: 1 RS: 15281

INPUT
Description: Section at upstream end of low water crossing
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1678	5906	1750	5904	1880	5902	1895	5900	2075	5898
2110	5896	2143	5896	2193	5894	2204	5890	2212	5886
2222	5886	2261	5886	2282	5890	2342	5892	2488	5894
2515	5899.3	2516	5905						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1678	.07	2193	.04	2282	.055

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
2193	2282	2	2	.1	.3

CROSS SECTION RIVER: Fountain Creek
REACH: 1 RS: 15279

INPUT
Description: Section at downstream end of proposed low water crossing
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1678	5906	1750	5904	1880	5902	1895	5900	2075	5898
2110	5896	2143	5896	2193	5894	2204	5890	2212	5886
2222	5883.5	2261	5883.5	2282	5890	2342	5892	2488	5894
2515	5899.3	2516	5905						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1678	.07	2193	.04	2282	.055

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
2193	2282	870	870	.1	.3

CROSS SECTION RIVER: Fountain Creek
REACH: 1 RS: 14400

INPUT
Description: FEMA FIRM Section DS (250)
Station Elevation Data num= 29

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1000	5915	1050	5910	1160	5905	1390	5900	1490	5895
1640	5890	1750	5885	1760	5882	1770	5880.8	1820	5880.8
1830	5882	1920	5884.7	2030	5883.2	2090	5885	2115	5890
2125	5891	2155	5891	2165	5890	2170	5888	2175	5890
2180	5891	2240	5891	2250	5890	2270	5885	2290	5884
2320	5885	2950	5890	3110	5895	3125	5900		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
1000	.07	1640	.04	1750	.03	1920	.04	2115	.02
2165	.07								

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1750	1920	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Fountain Creek

Reach	River Sta.	n1	n2	n3	n4	n5	n6
1	15700	.06	.033	.06			
1	15281	.07	.04	.055			
1	15279	.07	.04	.055			
1	14400	.07	.04	.03	.04	.02	.07

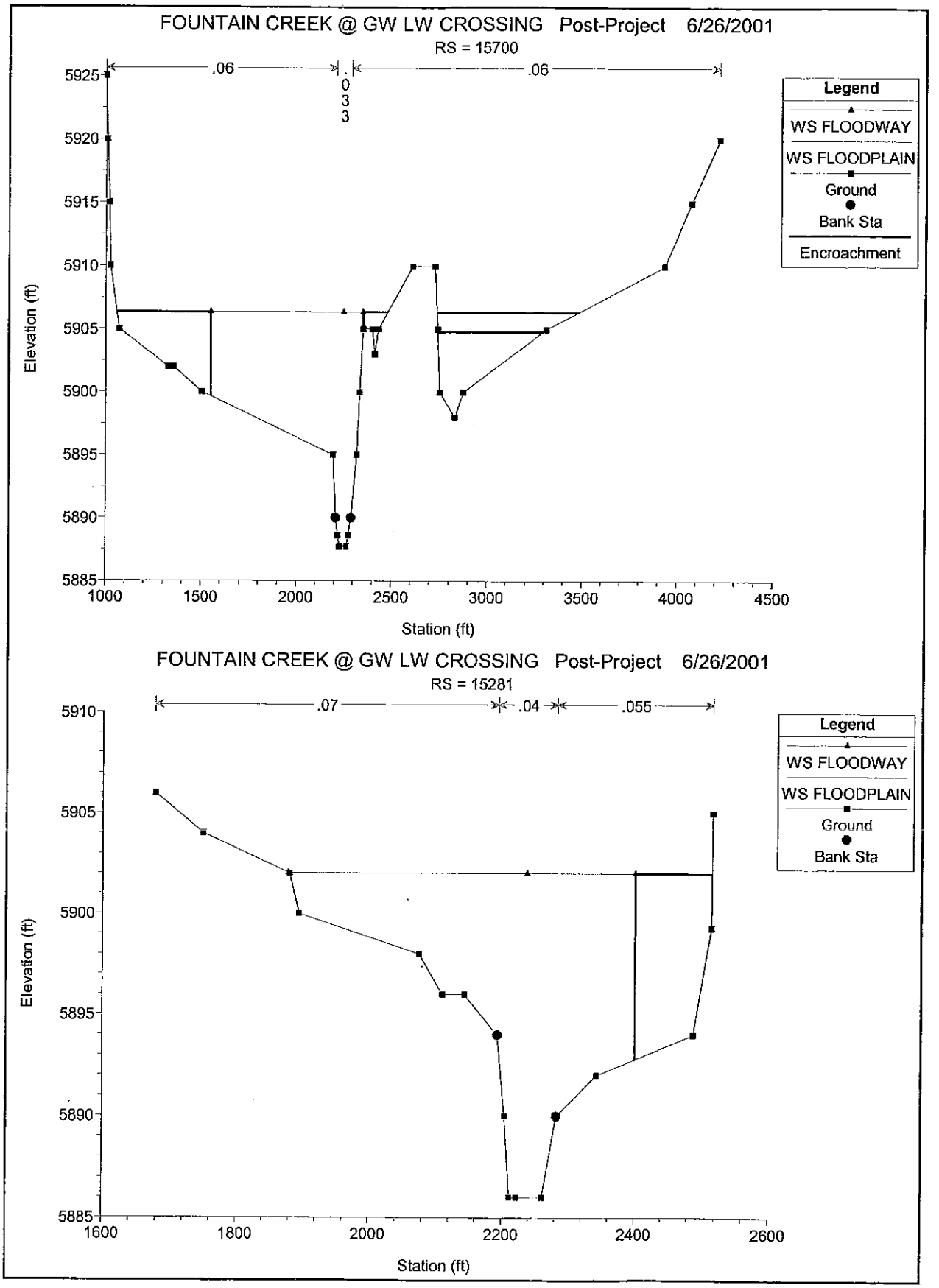
SUMMARY OF REACH LENGTHS

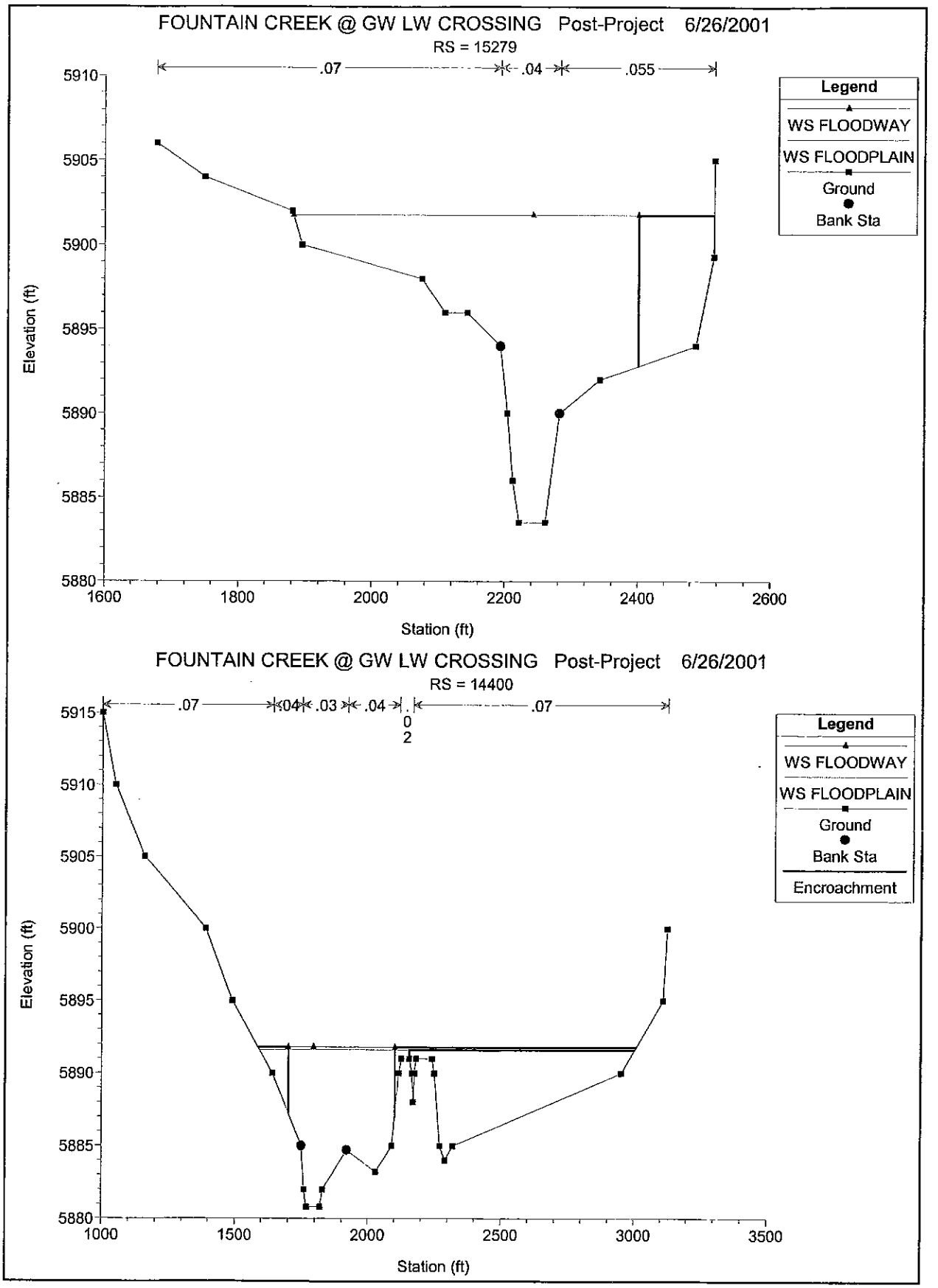
River: Fountain Creek

Reach	River Sta.	Left	Channel	Right
1	15700	453	478	453
1	15281	2	2	2
1	15279	870	870	870
1	14400	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Fountain Creek

Reach	River Sta.	Contr.	Expan.
1	15700	.1	.3
1	15281	.1	.3
1	15279	.1	.3
1	14400	.1	.3


FOUNTAIN CREEK @ GW LW CROSSING Post-Project 6/26/2001
RS = 15700
.06
.033
.06
Legend
WS FLOODWAY
WS FLOODPLAIN
Ground
Bank Sta
Encroachment
Elevation (ft)
5925
5920
5915
5910
5905
5900
5895
5890
5885
1000
1500
2000
2500
3000
3500
4000
4500
Station (ft)
FOUNTAIN CREEK @ GW LW CROSSING Post-Project 6/26/2001
RS = 15281
.07
.04
.055
Legend
WS FLOODWAY
WS FLOODPLAIN
Ground
Bank Sta
Elevation (ft)
5910
5905
5900
5895
5890
5885
1600
1800
2000
2200
2400
2600
Station (ft)


FOUNTAIN CREEK @ GW LW CROSSING Post-Project 6/26/2001
RS = 15279
.07
.04
.055
Legend
WS FLOODWAY
WS FLOODPLAIN
Ground
Bank Sta
Elevation (ft)
5910
5905
5900
5895
5890
5885
5880
1600
1800
2000
2200
2400
2600
Station (ft)
FOUNTAIN CREEK @ GW LW CROSSING Post-Project 6/26/2001
RS = 14400
.07
.04
.03
.04
.07
Legend
WS FLOODWAY
WS FLOODPLAIN
Ground
Bank Sta
Encroachment
Elevation (ft)
5915
5910
5905
5900
5895
5890
5885
5880
1000
1500
2000
2500
3000
3500
Station (ft)

APPENDIX D

PROJECT PLAN SHEETS

PIKES PEAK GREENWAY TRAIL - LOW WATER CROSSING

CITY OF COLORADO SPRINGS, COUNTY OF EL PASO, STATE OF COLORADO

JUNE 2001

GENERAL NOTES

1. ALL CONSTRUCTION SHALL CONFORM TO THE CITY OF COLORADO SPRINGS' STANDARD SPECIFICATIONS AND ALL PROVISIONS REFERRED TO IN THE PROJECT MANUAL.
2. ALL MATERIALS AND WORKMANSHIP SHALL BE SUBJECT TO INSPECTION BY THE CITY OF COLORADO SPRINGS ENGINEERING AND PARKS DIVISION. THE CITY RESERVES THE RIGHT TO ACCEPT OR REJECT ANY SUCH MATERIALS AND WORKMANSHIP THAT DOES NOT CONFORM TO IT'S STANDARDS AND SPECIFICATIONS.
3. THE CONTRACTOR SHALL NOTIFY THE CITY OF COLORADO SPRINGS ENGINEERING AND PARKS DIVISION A MINIMUM OF 48 HOURS PRIOR TO STARTING CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR NOTIFYING THE AFFECTED UTILITY AGENCIES (OR THEIR LOCATING AGENCY) 48 HOURS IN ADVANCE OF CONSTRUCTION FOR UTILITY LOCATING.
4. LOCATION OF EXISTING UTILITIES SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO ACTUAL CONSTRUCTION. FOR INFORMATION CONTACT: UNDERGROUND LOCATORS AT 1-800-922-1987. THE UTILITY INFORMATION SHOWN ON THESE PLANS REPRESENTS THE BEST AVAILABLE INFORMATION COMPILED TO THIS DATE. NO UNDERGROUND INVESTIGATIONS WERE MADE AS TO THE DEPTH OF ANY OF THE UTILITY LINES UNLESS SPECIFICALLY NOTED ON THE PLANS.
5. THE CONTRACTOR SHALL HAVE ONE (1) SIGNED COPY OF THE PLANS AND PROJECT MANUAL (APPROVED BY THE CITY OF COLORADO SPRINGS ENGINEERING DIVISION) AT THE JOB SITE AT ALL TIMES.
6. THE CONTRACTOR IS REQUIRED TO OBTAIN THE NECESSARY CONSTRUCTION PERMITS PRIOR TO THE START OF WORK.
7. THE CONTRACTOR SHALL, AT HIS EXPENSE, REPAIR ANY UTILITIES DISTURBED OR DISRUPTED BY CONSTRUCTION ACTIVITIES.
8. ALL STATIONING IS CENTERLINE OF TRAIL UNLESS OTHERWISE NOTED
9. THE CONTRACTOR SHALL NOTIFY THE OWNER (CITY) AND ENGINEER OF ANY PROBLEM IN CONFORMING TO THE APPROVED PLANS FOR ANY ELEMENT OF THE PROPOSED IMPROVEMENTS PRIOR TO ITS CONSTRUCTION.
10. SUBGRADE UNDER TRAILWAY SHALL BE COMPACTED TO 95% STANDARD PROCTOR IN ACCORDANCE WITH SECTION 306.
11. THE CONTRACTOR SHALL CONDUCT THE WORK IN A SAFE AND WORKMANLIKE MANNER, AND SHALL COMPLY WITH ALL APPLICABLE GOVERNMENTAL REGULATIONS REGARDING HEALTH AND SAFETY, PARTICULARLY INCLUDING THOSE PERTAINING TO EXCAVATION AND TRENCHING.
12. THE CONTRACTOR SHALL LIMIT CONSTRUCTION ACTIVITIES TO THOSE AREAS WITHIN THE CONSTRUCTION EASEMENTS AND/OR TOES OF SLOPES AS SHOWN ON THE PLANS. ANY DISTURBANCE BEYOND THESE LIMITS SHALL BE RESTORED TO ORIGINAL CONDITION BY THE CONTRACTOR AT HIS OWN EXPENSE. CONSTRUCTION ACTIVITIES IN ADDITION TO NORMAL CONSTRUCTION PROCEDURES SHALL INCLUDE THE PARKING OF VEHICLES OR EQUIPMENT, DISPOSAL OF LITTER, AND ANY OTHER ACTION WHICH WOULD ALTER EXISTING CONDITIONS.
13. THE CONTRACTOR SHALL BE RESPONSIBLE FOR RESETTING ANY LAND MONUMENTS DAMAGED DURING CONSTRUCTION. ANY MONUMENTS TO BE RESET WILL BE DONE UNDER THE SUPERVISION OF A REGISTERED LAND SURVEYOR AT THE CONTRACTOR'S EXPENSE.
14. NO ALLOWANCE HAS BEEN MADE FOR DISTURBANCE OUTSIDE THE TRAILWAY OR FOR CONTRACTOR'S STAGING AREA(S). CONTRACTOR IS RESPONSIBLE TO RESEED AREAS DISTURBED OUTSIDE TRAILWAY OR IN STAGING AREA(S).
15. COMPACTION OF EMBANKMENT MATERIAL SHALL BE EITHER STANDARD PROCTOR (ASTM D-698/AASHTO T-99) OR MODIFIED PROCTOR (ASTM D-1557/AASHTO T-180). BASE COURSE MATERIAL SHALL BE COMPACTED TO A MINIMUM OF 95% OF THE MAXIMUM PROCTOR DENSITY (ASTM D-1557/AASHTO T-180).
16. BENCHMARKS:
    1. A #5 REBAR LOCATED AT BANK EDGE ON SOUTH SIDE OF CREEK APPROXIMATELY 220 FEET UPSTREAM FROM SHOOKS RUN EL = 5893.53
    2. A NAIL IN ASPHALT TRAIL ON NORTH SIDE OF CREEK ON EAST SIDE OF WASHED OUT TRAIL EL = 5899.11

EROSION CONTROL CRITERIA:

ALL CONSTRUCTION IS TO BE PREFORMED IN ACCORDANCE WITH THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT (CDPHE) WATER QUALITY CONTROL DIVISION.

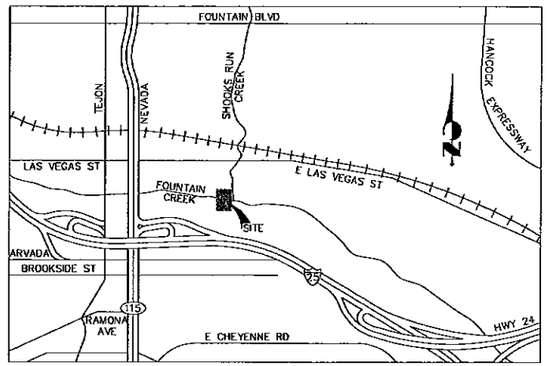
EROSION CONTROL MEASURES SHALL BE IMPLEMENTED IN A MANNER THAT WILL PROTECT PROPERTIES AND PUBLIC FACILITIES AND DRAINAGE CHANNELS FROM THE ADVERSE EFFECTS OF EROSION AND SEDIMENTATION AS A RESULT OF CONSTRUCTION AND EARTHWORK ACTIVITIES WITHIN THE PROJECT SITE.

1. LOCATE AND SET THE STRAW BALE CHECK DAMS AS SHOWN ON THE EROSION CONTROL PLAN. AT THIS TIME, LAY TURF REINFORCEMENT MATTING AS SPECIFIED IN THE PLANS AND RESEED REMAINING DISTURBED AREAS WITH AN APPROVED SEED MIX. REFER TO THE EROSION CONTROL PLAN FOR SEEDING GUIDELINES.
2. THE STRAW BALE CHECK DAMS SHALL BE KEPT IN PLACE AND MAINTAINED UNTIL EROSION AND SEDIMENTATION POTENTIAL IS MITIGATED. REMOVAL OF SILT AND SEDIMENT COLLECTED BY THE STRAW BALES IS REQUIRED ONCE IT REACHES HALF THE HEIGHT OF THE STRAW BALES.
3. EROSION CONTROL DEVICES SHOULD BE CHECKED AFTER EVERY STORM. REPAIRS OR REPLACEMENT SHOULD BE MADE AS NECESSARY TO MAINTAIN PROPER PROTECTION.

EROSION CONTROL COST ESTIMATE:

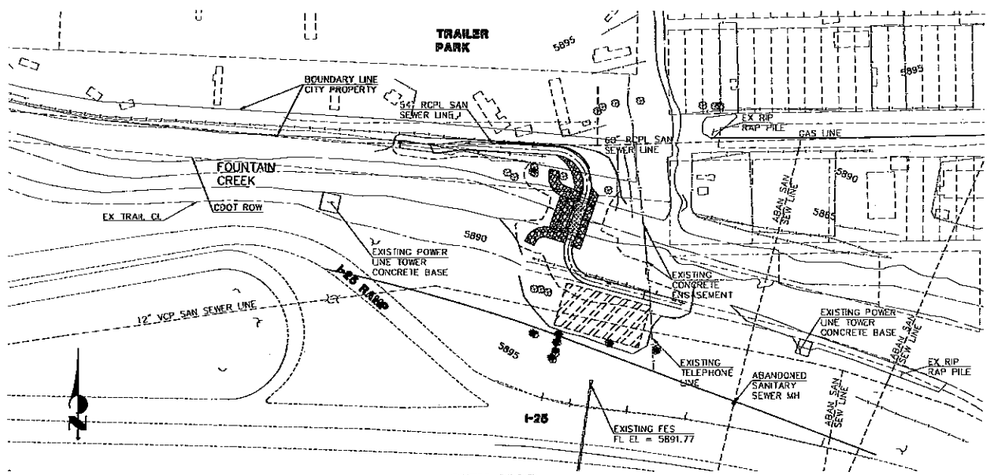
1.	7 EACH – 3 BALE CHECK DAM @ $4.00/BALE	$ 84
2.	142 LF – SILT FENCE @ $2.00/LF	$284
3.	25% MAINTENANCE AND REPLACEMENT	$ 71
4.	0.59 ACRES – RESEED WITH APPROVED SEED MIX @ $500.00/ACRE	$295
	TOTAL	$734

JR ENGINEERING CANNOT AND DOES NOT GUARANTEE THAT THE CONSTRUCTION COSTS WILL NOT VARY FROM THESE OPINIONS OR PROBABLE CONSTRUCTION COSTS. THESE OPINIONS REPRESENT OUR BEST JUDGMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY.



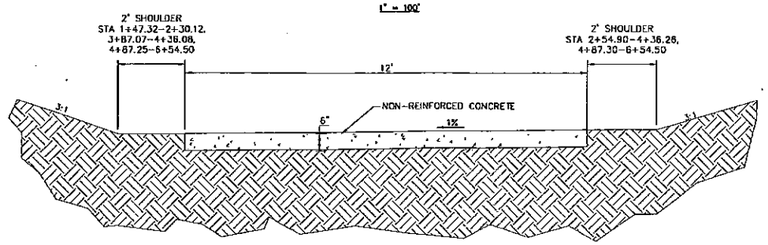
VICINITY MAP

NTS



KEY MAP

1" = 100'



CONCRETE TRAIL TYPICAL SECTION

1" = 2'

CITY APPROVALS

ACCEPTANCE BY THE CITY OF COLORADO SPRINGS ON DESIGN WORK BY DESIGN PROFESSIONALS CONSTITUTES BELIEF THAT THE WORK HAS BEEN DONE IN ACCORDANCE WITH CITY STANDARDS AND ORDINANCES. THE DESIGN, CONSTRUCTION DESIGN DRAWINGS, AND PROJECT MANUAL ARE THE RESPONSIBILITY OF THE DESIGN PROFESSIONAL AND CITY ACCEPTANCE DOES NOT RELIEVE THE PROFESSIONAL OF SAID RESPONSIBILITY.

PARKS & RECREATION DEPARTMENT
REVIEW SIGNATURES:

BY: _____ DATE: _____
FRED MAIS, MANAGER, DESIGN & DEVELOPMENT

BY: _____ DATE: _____
JIM MCGANNON, CITY FORESTER

BY: _____ DATE: _____
TERRY PUTMAN, MANAGER, PLANNING & RES. DEVELOPMENT

BY: _____ DATE: _____
RICK SEVERSON, REGIONAL PARKS SUPERVISOR

BY: _____ DATE: _____
KURT SCHROEDER, MANAGER, URBAN PARKS

BY: _____ DATE: _____
SAM SCHNEITER, CONSTRUCTION ADMINISTRATOR

APPROVAL SIGNATURES:

BY: _____ DATE: _____
PAUL BUTCHER, MANAGER, GROUP SUPPORT

BY: _____ DATE: _____
FRED MAIS, MANAGER, DESIGN & DEVELOPMENT

BY: _____ DATE: _____
TERRY PUTMAN, MANAGER, PLANNING & RES. DEVELOPMENT

BY: _____ DATE: _____
KURT SCHROEDER, MANAGER, URBAN PARKS

ENGINEER'S STATEMENT

DETAILED IMPROVEMENT PLANS AND SPECIFICATIONS ENGINEER'S STATEMENT:

THESE DETAILED PLANS AND SPECIFICATIONS WERE PREPARED UNDER MY DIRECTION AND SUPERVISION. SAID DETAILED PLANS AND SPECIFICATIONS HAVE BEEN PREPARED ACCORDING TO THE CRITERIA ESTABLISHED BY THE CITY FOR DETAILED DRAINAGE PLANS AND SPECIFICATIONS, AND SAID DETAILED PLANS AND SPECIFICATIONS ARE IN CONFORMITY WITH THE MASTER PLAN OF THE DRAINAGE BASIN. SAID DETAILED DRAINAGE PLANS AND SPECIFICATIONS MEET THE PURPOSES FOR WHICH THE PARTICULAR DRAINAGE FACILITY IS DESIGNED. I ACCEPT RESPONSIBILITY FOR ANY LIABILITY DIRECTLY CAUSED BY ANY NEGLIGENT ACTS, ERRORS, OR OMISSIONS ON MY PART IN PREPARATION OF THE DETAILED IMPROVEMENT PLANS AND SPECIFICATIONS.

FOR REVIEW PURPOSES ONLY

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF JR ENGINEERING.

_____ _____
CYNTHIA M. BLEVINS, COLORADO P.E. NO. 34484 DATE

SHEET INDEX

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AGENCIES, JR ENGINEERING APPROVES THEIR USE ONLY FOR PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR
CITY OF COLORADO SPRINGS
PARKS & RECREATION DEPARTMENT
30 SOUTH NEVADA AVE, COLORADO SPRINGS, CO 80903 (719) 578-6640

J.R. ENGINEERING
A Subsidiary of Westrian
Public Works Division
4210 Arrowswest Drive • Colorado Springs, CO 80907
719-593-8800 • Fax 719-528-6848 • www.jrengineering.com

No.	BY	DATE

H-SCALE	VARIES
V-SCALE	N/A
DATE	3/15/01
DESIGNED BY	JAW
DRAWN BY	RCM
CHECKED BY	

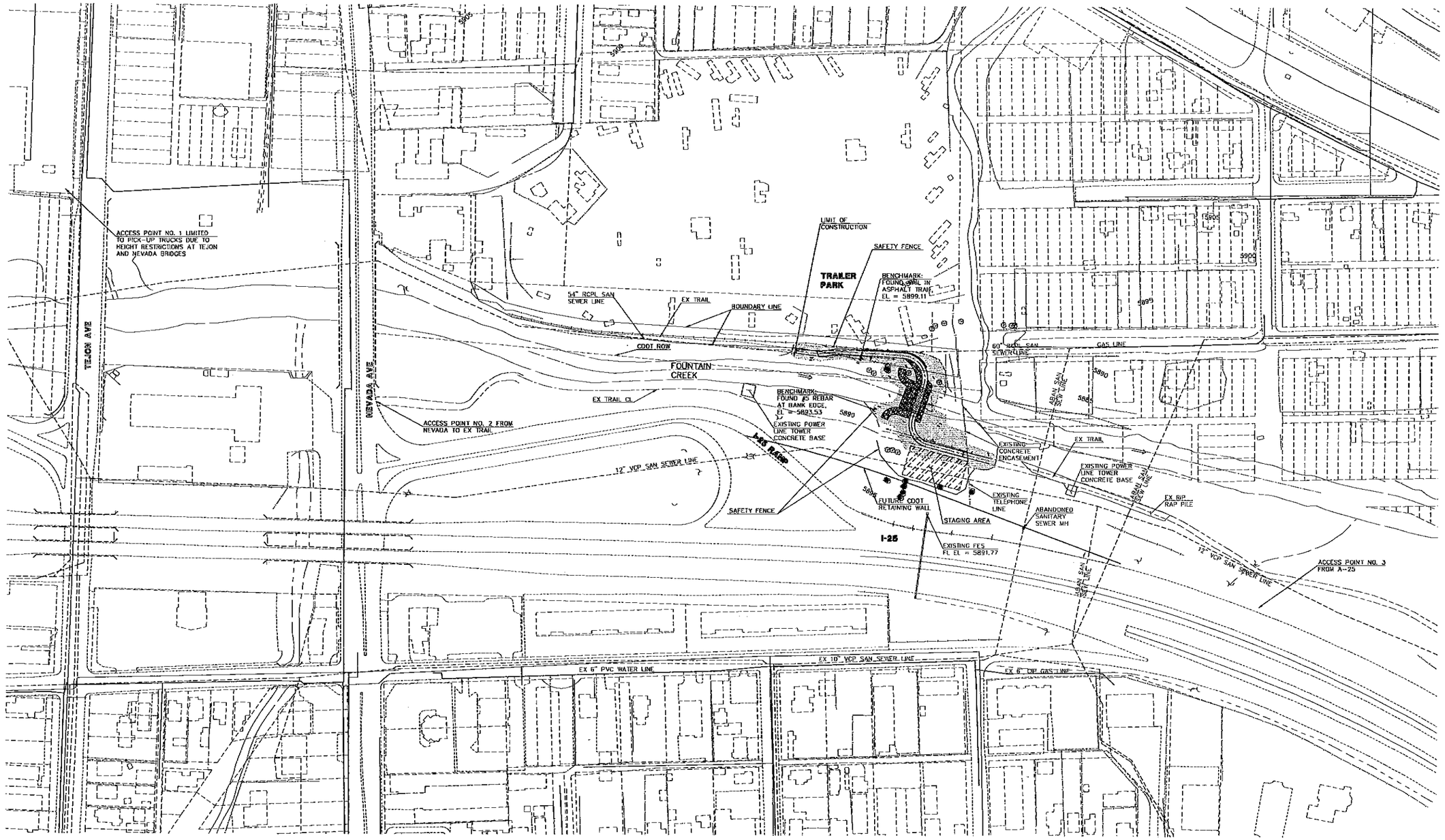
PIKES PEAK GREENWAY TRAIL
LOW WATER CROSSING

CONSTRUCTION DRAWINGS

TITLE SHEET

SHEET 1 OF 9

JOB NO. 9247.20



NOTES:

ACCESS POINT NO. 1: ACCESS EXISTING TRAIL FROM TEJON, DRIVE EAST ON EXISTING TRAIL TO SITE. THIS ACCESS POINT IS LIMITED TO PICKUP TRUCKS DUE TO HEIGHT RESTRICTIONS AT TEJON AND NEVADA BRIDGES.

ACCESS POINT NO. 2: ACCESS SITE FROM SOUTHBOUND NEVADA AVE. FOLLOW EXISTING TRAIL TO SITE.

ACCESS POINT NO. 3: ACCESS SITE FROM NORTHBOUND I-25. MAY REQUIRE COORDINATION WITH CDOT CONTRACTOR.

CONTRACTOR TO ALLOW CREEK FLOW DURING CONSTRUCTION OF PROJECT. THIS MAY BE ACCOMPLISHED THROUGH USE OF COFFER DAM OR TEMPORARY PIPING SYSTEM.

100 50 0 100 200

SCALE: 1" = 100'

UNTIL SUCH TIME AS THESE DRAWINGS ARE APPROVED BY THE APPROPRIATE REVIEWING AUTHORITY, ENGINEERING APPROVES THEM FOR ONLY FOR THE PURPOSES DESIGNATED BY WRITTEN AUTHORIZATION.

PREPARED FOR

CITY OF COLORADO SPRINGS
PARKS & RECREATION DEPARTMENT
1401 RECREATION WAY, COLORADO SPRINGS CO 80905 (719) 578-6640

J·R ENGINEERING
A Subsidiary of Worley
Rocky Mountain Division
4700 Arrowhead Drive • Colorado Springs, CO 80907
719-590-6800 • Fax 719-598-0800 • www.jrengineering.com

BY	DATE

No.		

H-SCALE	VARIES
V-SCALE	N/A
DATE	3/15/01
DESIGNED BY	JAW
DRAWN BY	RGM
CHECKED BY	

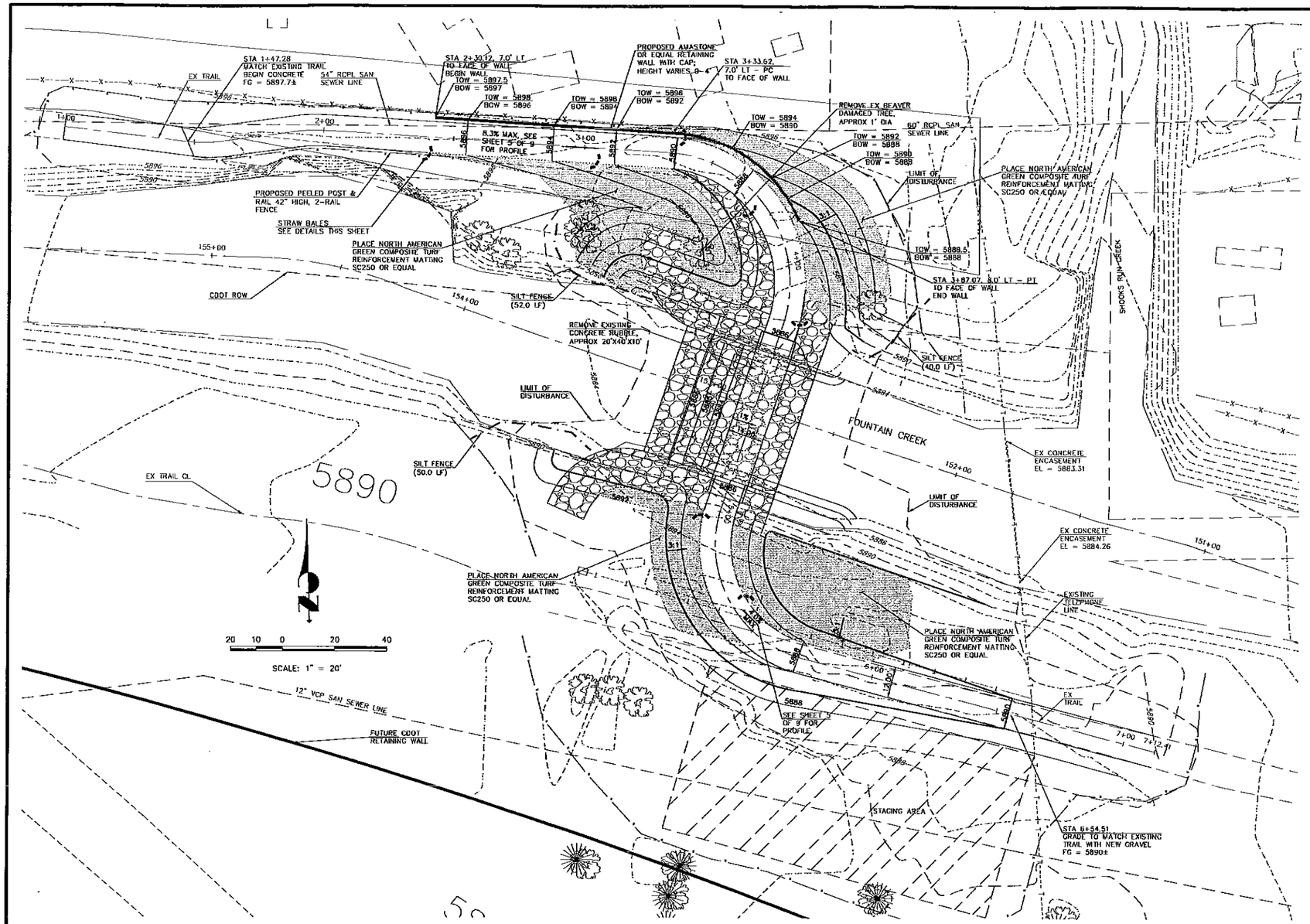
PIKES PEAK GREENWAY TRAIL
LOW WATER CROSSING

CONSTRUCTION DRAWINGS

PROPERTY MAP AND CONSTRUCTION ACCESS

SHEET 2 OF 9

JOB NO. 9247.20



EROSION PROTECTION & REVEGETATION REQUIREMENTS
"PER U.S.D.A. SOIL CONSERVATION SERVICE GUIDELINES"
(OR EQUIVALENT)

1. PRACTICE NO. & NAME 342 — CRITICAL AREA TREATMENT
   RANGE SITE SANDY FOOTHILLS
2. PLANNED:
   A. SEEDBED PREP: SEEDING OPERATION:
      METHOD A. METHOD:
      B. DATES OCTOBER 15 – MAY 1 DRILL XX
      C. DISK TILED XX INTERSEED
      FIRM SEEDBED XX BROADCAST
      STUBBLE COVER B. DRILL SPACING – 12"
      INTERSEED TYPE GRASSIN/AGITATOR
      OTHER C. DATE OCTO 15 – MAY 31
      D. PLANTING DEPTH 1/4 – 1/2"
      FERTILIZER: WEED CONTROL: N/A
      POUNDS ACTUAL PER ACRE N2 40 MOWING:
      (AVAILABLE) CHEMICAL: XX
      P2O5 40 DATES:
      K N/A SEE S.C.S. FOR SPECIFIC RECOMENDATIONS AT HERBICIDE APPLICATION TIME

MULCH:

KIND: LONG - STEM NATIVE HAY
AMOUNT: 4,000 POUNDS/ACRE
HOW-APPLIED: N/A
HOW-ANCHORED: CRIMPED
ANCHORAGE DEPTH: 4"

SEED:

VARIETY	SPECIES	REQUIRED PLS RATES PER ACRES (100%)
GOSHEN	PRAIRIE SANDREED	6.5
VAUGHN	SIDEOATS GRAMMA	9.0
LOVINGTON	BLUE GRAMMA	3.0
BLACKWELL	SWITCH GRASS	4.5
PASTURA	LIVE BLUESTEM	7.0

(2) % OF SPECIES IN MIXTURE	(3) PLS SEEDING RATE PER SPECIES/ACRE (1) x (2)	(4) PLANNED ACRE	(5) TOTAL PLS LBS/ SPECIES PLANNED (3) X (4)
15	0.98	13	12.7
25	2.25	13	29.3
15	0.45	13	5.9
20	0.90	13	11.7
25	1.75	13	22.8

TEMPORARY SEEDING (T8) N.T.S

SEEDING GUIDELINES

1. SEEDBED PREPARATION
   THE SEEDBED SHOULD BE WELL-SETTLED AND FIRM, BUT FRIABLE ENOUGH THAT THE SEED CAN BE PLACED AT THE SPECIFIED DEPTHS. COMPETITIVE STANDS OF WEEDS THAT ARE RESENT BEFORE SEEDING MUST BE CONTROLLED BY SHALLOW TILLAGE OR BY APPLICATION OF ERBICIDES. SOILS THAT HAVE BEEN OVER-COMPACTED BY TRAFFIC OR EQUIPMENT, SPECIALLY WHEN WET, SHOULD BE TILLED TO BREAK UP ROOTING-RESTRICTIVE LAYERS, THAN HARROWED, ROLLED, OR PACKED TO PREPARE THE REQUIRED FIRM SEEDBED.
2. FERTILIZER
   FERTILIZER SHOULD BE APPLIED AT A RATE OF 50 POUNDS OF AVAILABLE NITROGEN PER ACRE AND 40 POUNDS OF AVAILABLE PHOSPHATE PER ACRE. THE TIME OF APPLICATION SHOULD BE IMMEDIATELY PRIOR TO SEEDING, AT THE TIME OF SEEDING, OR IMMEDIATELY FOLLOWING SEEDING, DEPENDING ON THE KIND OF FERTILIZER AND TYPE OF EQUIPMENT USED.
3. SEEDING
   SEED SHOULD BE PLANTED WITH A GRASS DRILL ON ALL SLOPES OF 3 (3:1) OR FLATTER. SEED MAY BE BROADCAST BY HAND, BY 33 MECHANICAL SPREADER, OR BY HYDRAULIC EQUIPMENT ON AREAS THAT ARE SMALL, TOO STEEP, OR NOT ACCESSIBLE FOR SEED DRILL OPERATIONS.

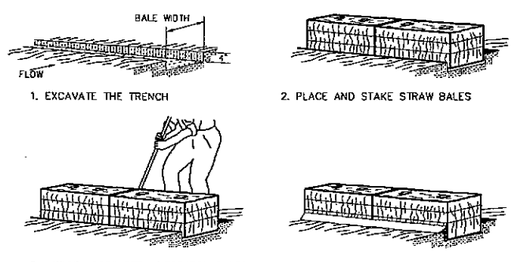
   SEED PLANTED WITH A DRILL SHOULD BE COVERED WITH SOIL TO A DEPTH OF 1/4 TO3/4 INCH. SEED PLANTED BY THE BROADCAST METHOD SHALL BE INCORPORATED INTO THE SOIL SURFACE, NOT TO EXCEED A DEPTH OF _ INCH, BY RAKING, HARROWING, OR OTHER PROVEN METHOD.

   THE TIME OF SEEDING IS FROM OCTOBER 15TH – MAY 31ST. SEED PLANTED IN THE LATE FALL WILL REMAIN DORMANT UNTIL SPRING, WHEN IT WILL GERMINATE.
4. MULCHING
   SEEDED AREAS SHOULD BE MULCHED TO CONSERVE MOISTURE; PREVENT SURFACE COMPACTION OR CRUSTING; REDUCE RUNOFF AND EROSION; CONTROL INSECTS; AND HELP ESTABLISH PLANT COVER

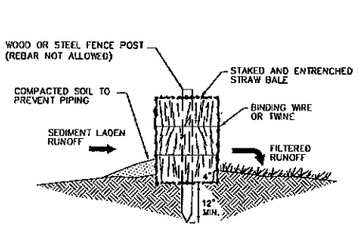
   NATIVE HAY OR STRAW SHOULD BE APPLIED AT A RATE OF 4,000 POUNDS PER ACRE AND CRIMPED INTO THE GROUND. ON SLOPES GREATER THAN 3:1, AN AGRONOMY BLANKET SHOULD BE USED.
5. SUPPLEMENTAL WATER
   IN LOW RAINFALL AREAS, WHERE WATER IS AVAILABLE AND WHERE RAPID ESTABLISHMENT IS NEEDED, IRRIGATION OF NEW SEEDING SHOULD BE PERFORMED DURING THE FIRST GROWING SEASON. WATER SHOULD BE APPLIED AT APPROXIMATELY ONE WEEK INTERVALS, AT A RATE OF 3/4 TO 1 INCH PER APPLICATION, WHEN RAINFALL IS DEFICIENT FOR PLANT DEVELOPMENT.

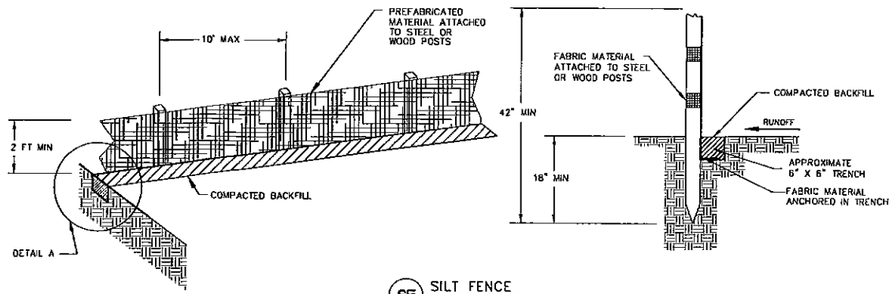
LEGEND

DESCRIPTION	SYMBOL
EXISTING GRADE INDEX CONTOUR	6910
EXISTING GRADE NOMINAL CONTOUR	
PROPOSED FINISH INDEX CONTOUR	6910
PROPOSED FINISH NOMINAL CONTOUR	
PROPERTY LINE	
EXISTING STORM SEWER	
SILT FENCE	
STRAW BALE CHECK DAM	



STRAW BALE BARRIOR (STB) N.T.S





SILT FENCE (SF) N.T.S

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

48 HOURS BEFORE YOU DIG,
CALL UTILITY LOCATORS
1-800-922-1987
UTILITY NOTIFICATION CENTER OF COLORADO
GAS, ELECTRIC, WATER AND WASTEWATER

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF JR ENGINEERING

FOR REVIEW PURPOSES ONLY

CYNTHIA M. BLEVINS, COLORADO P.E. #34484 DATE

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PREPARED FOR
CITY OF COLORADO SPRINGS
PARKS & RECREATION DEPARTMENT
30 NORTH 3RD STREET COLORADO SPRINGS, CO 80901 (719) 385-5931

J.R. ENGINEERING
A Subsidiary of Wesnian
Pulde Wood Dobson
420 Arrowswest Drive • Colorado Springs, CO 80907
719-593-0600 • FAX 719-528-6848 • www.jrengineering.com

No.	REVISION	BY	DATE

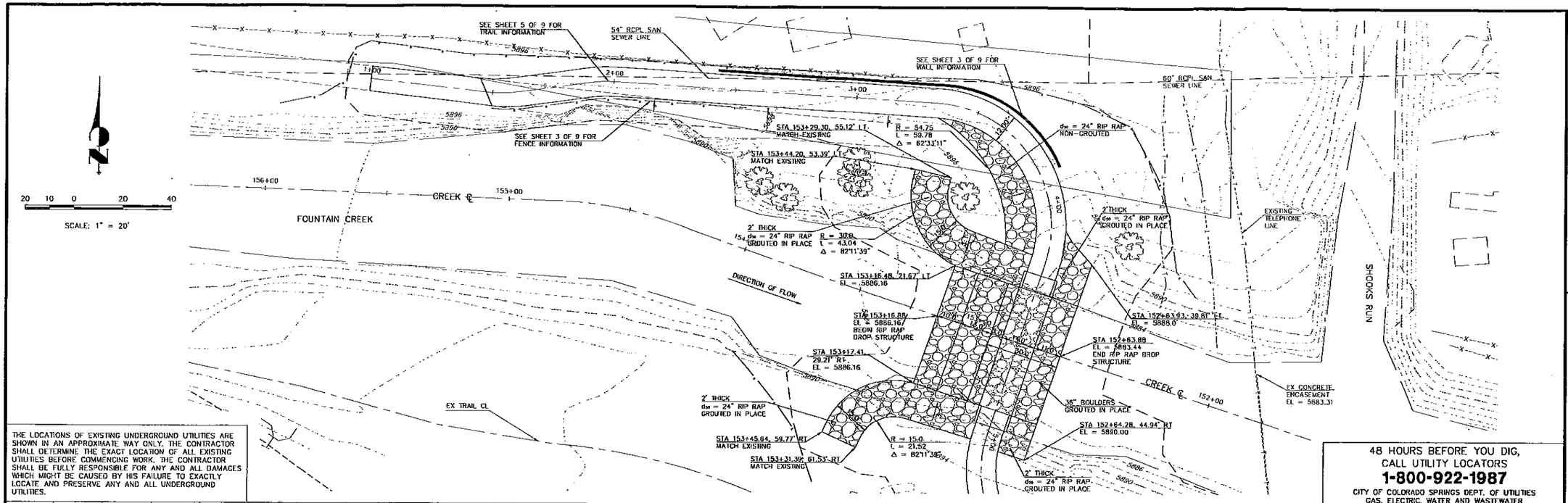
H-SCALE	1"=20'	DESIGNED BY	JAW
V-SCALE	N/A	DRAWN BY	RGM
DATE	8/30/00	CHECKED BY	

PIKES PEAK GREENWAY TRAIL
LOW WATER CROSSING

CONSTRUCTION DRAWINGS

GRADING AND EROSION CONTROL PLAN

SHEET 3 OF 9
JOB NO. 9247.20



20 10 0 20 40

SCALE: 1" = 20'

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GAS, ELECTRIC, WATER AND WASTEWATER

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CITY OF COLORADO SPRINGS
PARKS & RECREATION DEPARTMENT
1401 RECORDER MAY, COLORADO SPRINGS CO 80905 (719) 578-6640

J·R ENGINEERING
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Public Works Division
4align Arrowswest Drive • Colorado Springs, CO 80907
719-593-2593 • Fax: 719-528-6848 • www.jrengineering.com

No.	REVISION	BY	DATE

H-SCALE 1"=20' | V-SCALE 1"=2' | DATE 08/30/00 | DESIGNED BY JAW | DRAWN BY RGM | CHECKED BY

PIKES PEAK GREENWAY TRAIL
LOW WATER CROSSING
CONSTRUCTION DRAWINGS
STREAM PLAN & PROFILE

SHEET 4 OF 9
JOB NO. 9247.20

STATEMENT:

THE CITY OF COLORADO SPRINGS RECOGNIZES THE DESIGN ENGINEER AS HAVING RESPONSIBILITY FOR THE DESIGN; THE CITY HAS LIMITED ITS SCOPE OF REVIEW ACCORDINGLY.

RESUBMITTAL REQUIRED IF CONSTRUCTION HAS NOT COMMENCED WITHIN 180 DAYS AFTER REVIEW DATE.

REVIEW:

STREET DESIGN:
CURB & GUTTER REVIEW _____ DATE _____
FINAL REVIEW _____ DATE _____

DRAINAGE DESIGN: DRAINAGE BASIN _____
FILED IN ACCORDANCE WITH SECTION 15-3-906 OF COLORADO SPRINGS 1980, AS AMENDED
_____ DATE _____

DESIGN DATA:

SIDEWALKS: WIDTH: _____
LOCATION: ☐ Attached ☐ Detached

CURB TYPE ☐ 1 ☐ 2 ☐ 3
R/W WIDTH _____ F/C-F/C _____
STREET TYPE _____ HVEEM _____

ASPHALT THICKNESS:
AC Surface _____
AC Base _____

AGG. BASE THICKNESS:
Class 6 _____
Class 5 _____
Class 2 _____

BENCHMARKS:

1. FOUND #4 REBAR WITH YELLOW PLASTIC CAP LOCATED AT THE NE CORNER OF LOT 11- PLS # 18465 EL = 6299.03
2. FOUND #4 REBAR WITH YELLOW PLASTIC CAP LOCATED AT THE SW CORNER OF LOT 12- PLS # 18465 EL = 6310.52

STATEMENTS:

A. SEWER – ANY CHANGES OR ALTERATIONS EFFECTING THE GRADE, ALIGNMENT, ELEVATION, AND DEPTH OF COVER OF SEWERS AND APPURTENANCES SHOWN ON THIS DRAWING SHALL BE THE RESPONSIBILITY OF THE OWNER/DEVELOPER. THE OWNER/DEVELOPER SHALL BE RESPONSIBLE FOR ALL OPERATIONAL DAMAGES AND DEFECTS IN INSTALLATION AND MATERIAL FOR MAINS AND SERVICES FROM THE DATE OF APPROVAL UNTIL FINAL ACCEPTANCE IS ISSUED.

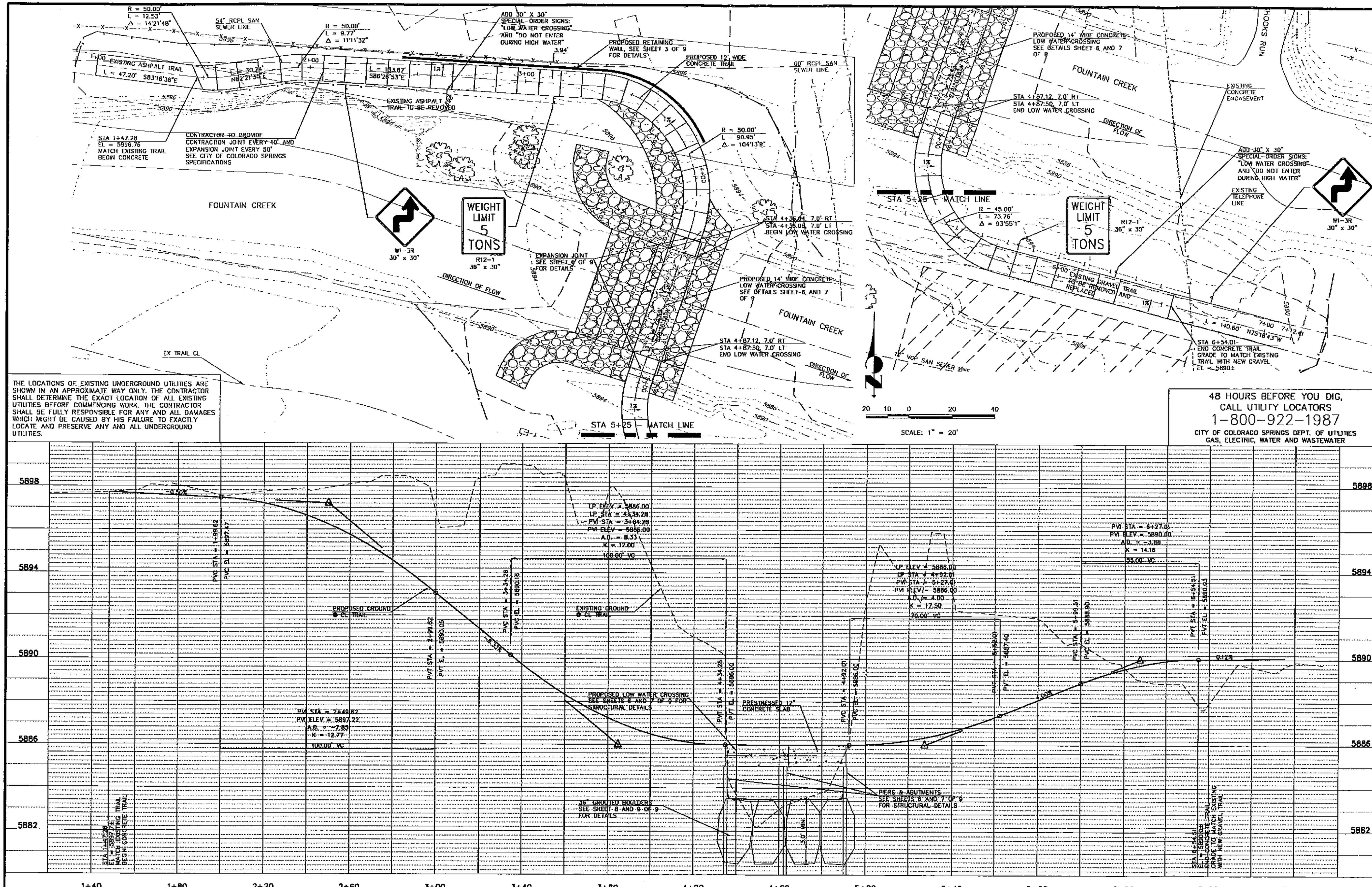
B. WATER – THIS APPROVAL SUBJECT TO THE FINAL STREET GRADE LEAVING A MINIMUM COVER OF 5'(FIVE FEET) OVER THE WATER MAIN. ANY CHANGES SHALL BE AT THE EXPENSE OF THE OWNER OR DEVELOPER.

BY: _____

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF JR ENGINEERING

FOR REVIEW PURPOSES ONLY

CYNTHIA M. BLEVINS, COLORADO P.E. #34484 _____ DATE



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GAS, ELECTRIC, WATER AND WASTEWATER

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REVIEW:

STREET DESIGN:
CURB & GUTTER REVIEW ________ DATE ________
FINAL REVIEW ________ DATE ________

DRAINAGE DESIGN: DRAINAGE BASIN ________
FILED IN ACCORDANCE WITH SECTION 15-3-906
OF COLORADO SPRINGS 1980, AS AMENDED
________ DATE ________

DESIGN DATA:

SIDEWALKS: WIDTH: ________
LOCATION: ☐ Attached ☐ Detached
CURB TYPE ☐ 1 ☐ 2 ☐ 3
R/W WIDTH ________ F/C-F/C ________
STREET TYPE ________ HVEEM ________

ASPHALT THICKNESS:
AC Surface ________
AC Base ________
AGG. BASE THICKNESS:
Class 6 ________
Class 5 ________
Class 2 ________

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BASED ON FIMS DATUM

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BY: ________

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PARKS & RECREATION DEPARTMENT

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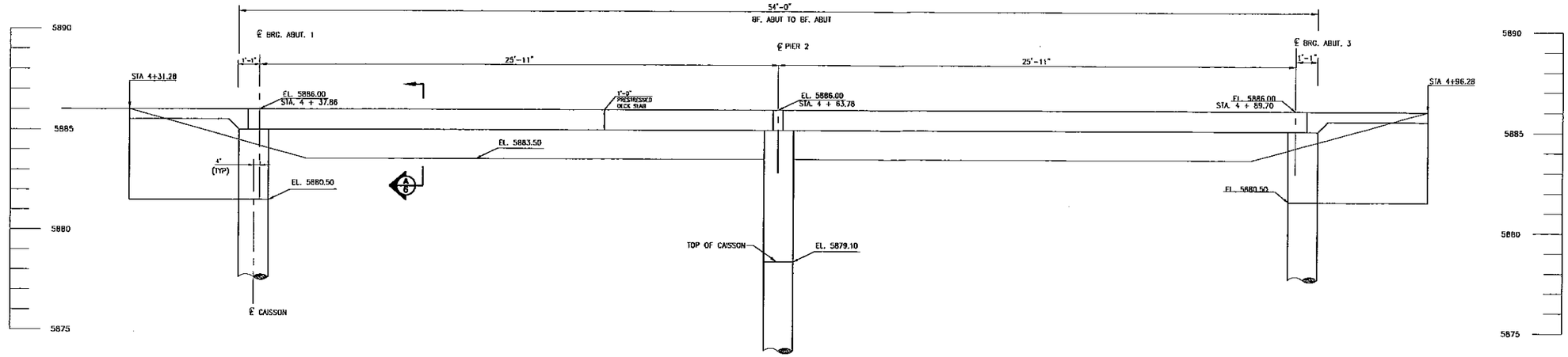
4310 ArrowsWest Drive Colorado Springs, CO 80907
719-590-5800 Fax: 719-528-6613 www.jrengineering.com

H-SCALE	1"=20'
V-SCALE	1"=2'
DATE	08/30/00
DESIGNED BY	JAW
DRAWN BY	RGM
CHECKED BY	

No.	REVISION	BY	DATE

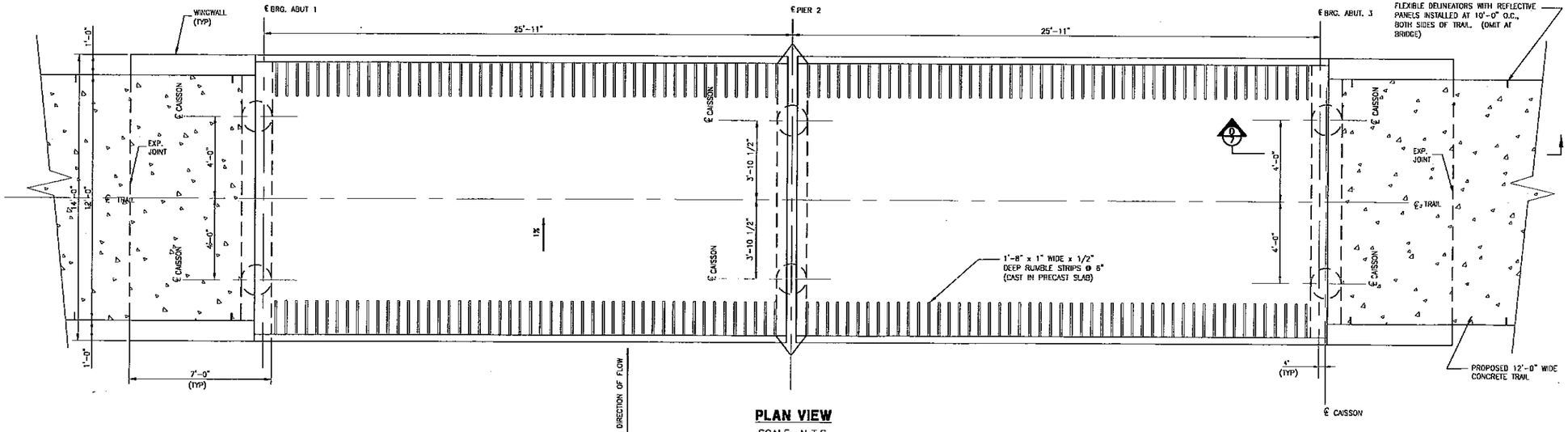
PIKES PEAK GREENWAY TRAIL
LOW WATER CROSSING
CONSTRUCTION DRAWINGS
TRAIL PLAN & PROFILE

SHEET 5 OF 9
JOB NO. 9247.20



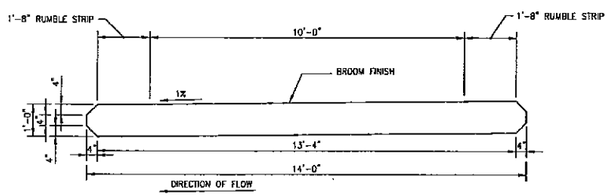
ELEVATION VIEW

SCALE: N.T.S.



PLAN VIEW

SCALE: N.T.S.



PRESTRESSED BRIDGE DECK SLAB TYPICAL SECTION

A 6 SCALE: N.T.S.

DESIGN DATA: 16TH EDITION (1996) OF THE AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES. (WITH 1997 INTERIM REVISIONS), AASHTO GUIDE SPECIFICATIONS FOR DESIGN OF PEDESTRIAN BRIDGES.

LOAD FACTOR:
f'_c = 4,500 psi
f_y = 60,000 psi

LOADING DATA:

LIVE LOAD :
10,000 LB = MAINTENANCE VEHICLE
85 PSF = PEDESTRIAN LOADING

DEAD LOAD:
VERTICAL EARTH LOAD = 120 LBS./CU. FT.
HORIZONTAL EARTH LOAD = 45 LBS./CU. FT.

CONCRETE SHALL CONFORM TO COLORADO DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS' CONCRETE, CLASS D.

CONCRETE SHALL RECEIVE A CLASS 1 FINISH PER THE COLORADO DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS UNLESS NOTED OTHERWISE.

GENERAL NOTES:

THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE STABILITY OF THE STRUCTURE DURING CONSTRUCTION.

ALL REINFORCING STEEL SHALL BE NON COATED UNLESS NOTED ON PLANS

THE FOLLOWING TABLE GIVES THE MINIMUM LAP SPLICE LENGTH FOR REINFORCING STEEL BARS, UNLESS SHOWN OR OTHERWISE NOTED.

BAR SIZE	#4	#5	#6	#7	#8
SPLICE LENGTH	1'-0"	1'-4"	1'-7"	1'-10"	2'-5"

ALL CONSTRUCTION JOINTS SHALL BE THOROUGHLY CLEANED BEFORE FRESH CONCRETE IS POURED.

ALL CONSTRUCTION JOINTS NOT SHOWN ON THE PLANS SHALL BE APPROVED BY THE ENGINEER.

STRUCTURE BACKFILL (CLASS 1) AND (FLOW-FILL) SHALL BE IN ACCORDANCE WITH THE COLORADO DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS, 1999 EDITION.

ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED 3/4"

PRESTRESSED SLABS SHALL BE DESIGNED BY THE MANUFACTURER. THE MANUFACTURER SHALL SUBMIT (2) SETS OF SHOP DRAWINGS FOR REVIEW PRIOR TO FABRICATION.

REFERENCE ENTECH GEOTECH REPORT #91450

THE LOCATIONS OF EXISTING ABOVE GROUND AND UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL ABOVE GROUND AND UNDERGROUND UTILITIES.

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FOR REVIEW PURPOSES ONLY

GREGORY A. MILES, COLORADO P.E. #35430 DATE

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PREPARED FOR

CITY OF COLORADO SPRINGS
PARKS & RECREATION DEPARTMENT

J·R ENGINEERING
A Subsidiary of Wrentham
Pulde Works Division
4200 Arrowhead Drive • Colorado Springs, CO 80907
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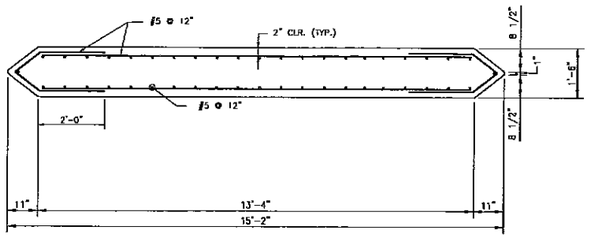
No.	REVISION	BY	DATE

H-SCALE	VARIES
V-SCALE	N/A
DATE	5/17/01
DESIGNED BY	JJM
DRAWN BY	NLC
CHECKED BY	

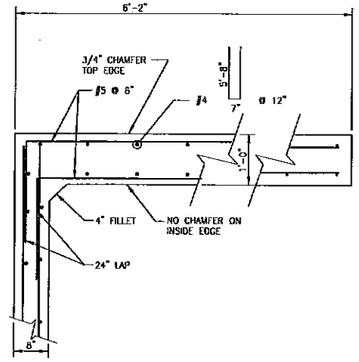
PIKES PEAK GREENWAY TRAIL
LOW WATER CROSSING
CONSTRUCTION DRAWINGS
STRUCTURAL DETAIL SHEET 1

SHEET 6 OF 9

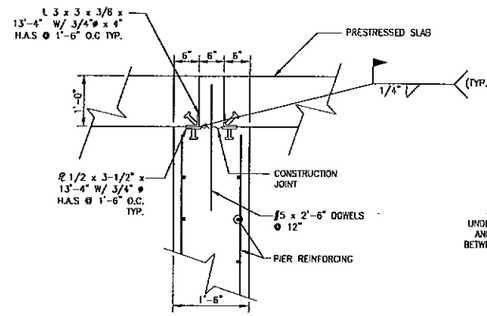
JOB NO. 9247.20.



PLAN VIEW
PIER #2 SECTION
SCALE: N.T.S.



PLAN VIEW
REINFORCING @ BACK WALL
SCALE: N.T.S.



ELEVATION VIEW
PIER #2 BEARING
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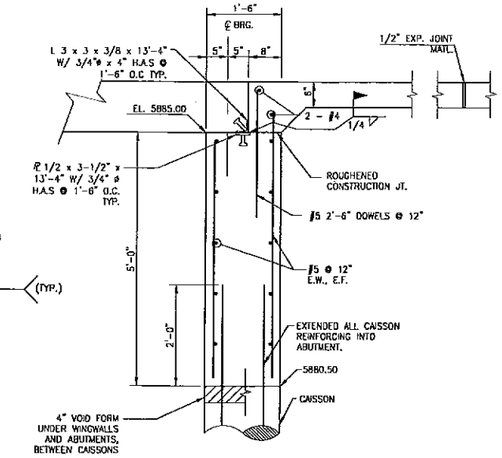
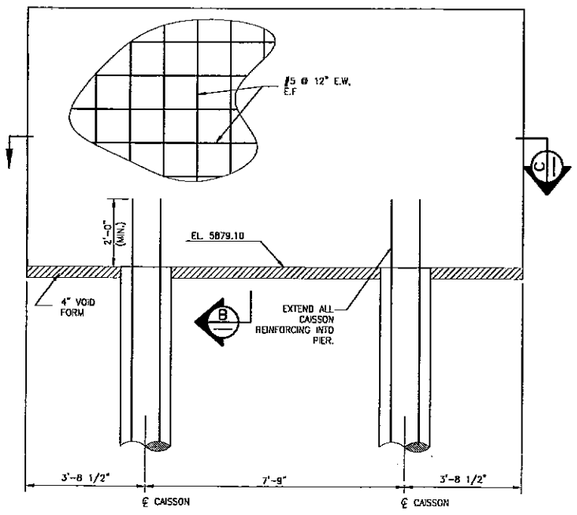


ELEVATION VIEW
ABUTMENT DETAIL
D / 7
SCALE: N.T.S.



PIER ELEVATION
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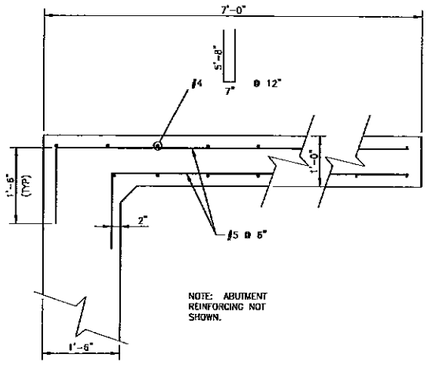
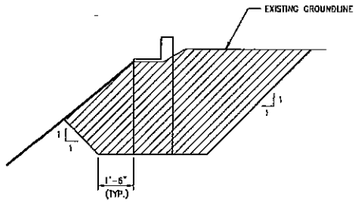
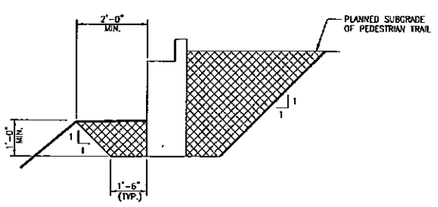


PLAN VIEW
WINGWALL REINFORCING
SCALE: N.T.S.



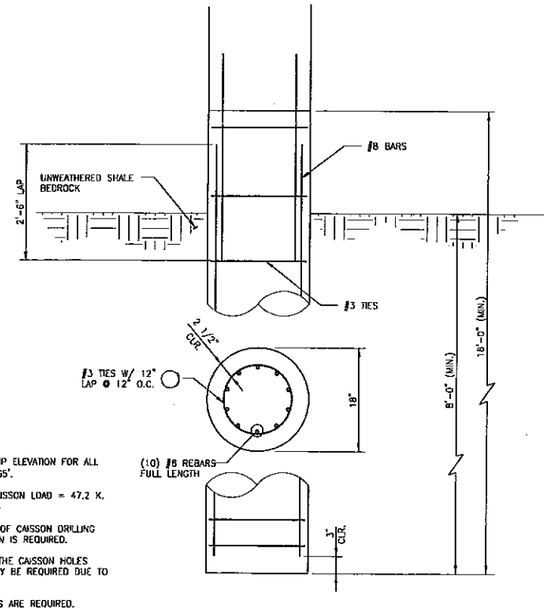


LIMITS OF STRUCTURE EXCAVATION

LIMITS OF STRUCTURE BACKFILL (CLASS 1)

STRUCTURE EXCAVATION **STRUCTURE BACKFILL**

STRUCTURE EXCAVATION AND BACKFILL
SCALE: N.T.S.



NOTES:

1. ESTIMATED TIP ELEVATION FOR ALL CAISSONS = 5865'.
2. MAXIMUM CAISSON LOAD = 47.2 K. (SERVICE LOADS)
3. INSPECTION OF CAISSON DRILLING AND INSTALLATION IS REQUIRED.
4. CASING OF THE CAISSON HOLES WILL MOST LIKELY BE REQUIRED DUE TO GROUND WATER.
5. SHEAR RINGS ARE REQUIRED.

CAISSON DETAIL
SCALE: N.T.S.

THE LOCATIONS OF EXISTING ABOVE GROUND AND UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. THE CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE CAUSED BY HIS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL ABOVE GROUND AND UNDERGROUND UTILITIES.

48 HOURS BEFORE YOU DIG,
CALL UTILITY LOCATORS
1-800-922-1987
UTILITY NOTIFICATION CENTER OF COLORADO
GAS, ELECTRIC, WATER AND WASTEWATER

PREPARED UNDER MY DIRECT SUPERVISION FOR AND ON BEHALF OF J.R. ENGINEERING

FOR REVIEW PURPOSES ONLY

GREGORY A. MILES, COLORADO P.E. #35430 DATE

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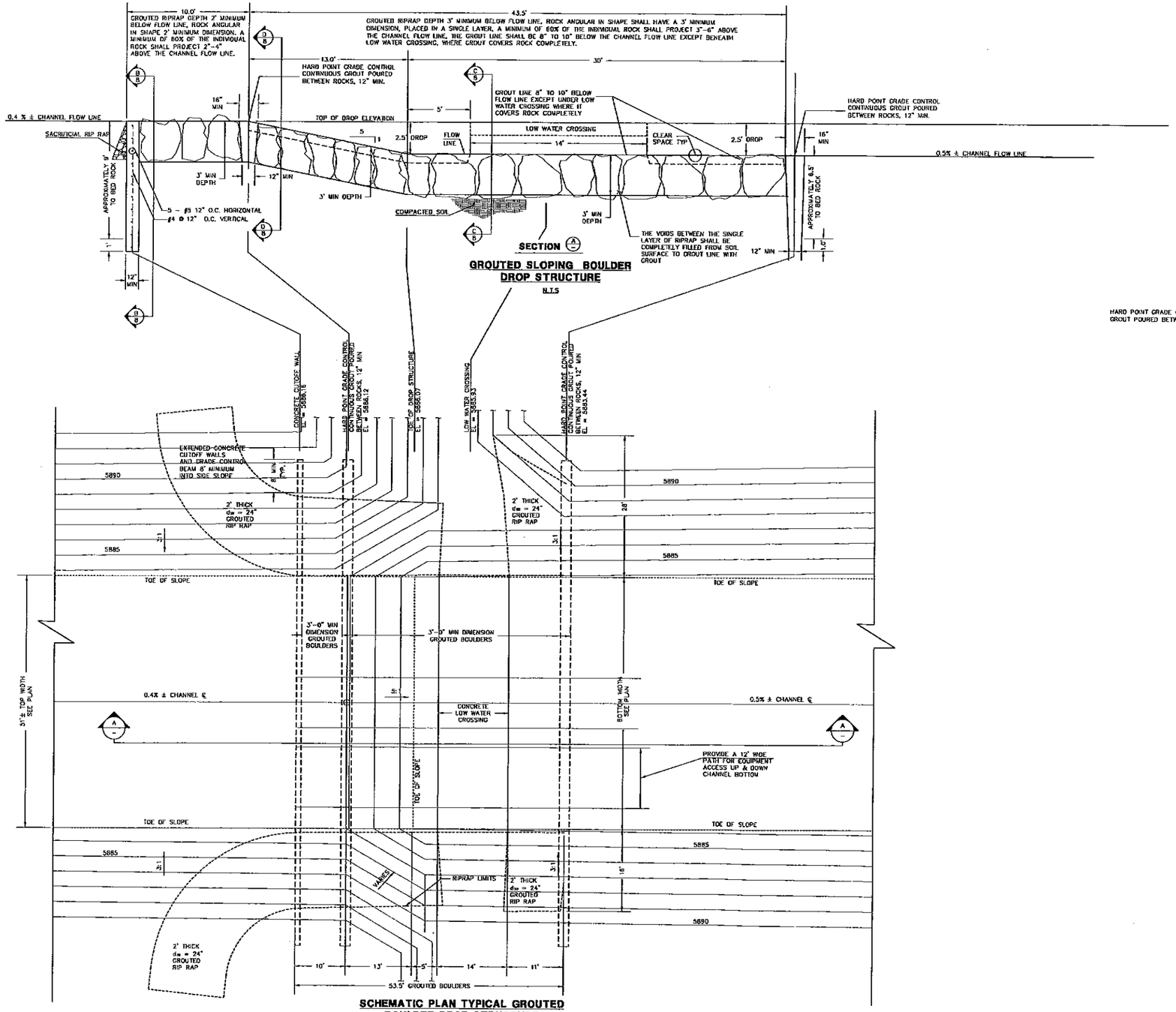
Public Works Division
4210 Arrowswest Drive • Colorado Springs, CO 80907
719-593-8800 • Fax: 719-593-9590 • www.jrengineering.com

No.	REVISION	BY	DATE

H-SCALE	VARIES	DESIGNED BY	JJM
V-SCALE	N/A	DRAWN BY	NLG
DATE	5/17/01	CHECKED BY	

PIKES PEAK GREENWAY TRAIL
LOW WATER CROSSING
CONSTRUCTION DRAWINGS
STRUCTURAL DETAIL SHEET 2

SHEET 7 OF 9
JOB NO. 9247.20



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1401 RECREATION WAY, COLORADO SPRINGS CO 80905 (719) 578-6640

J·R ENGINEERING
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Public Works Division
430 Arrowswest Drive • Colorado Springs, CO 80907
719-520-6600 • FAX 719-520-6601 • www.jrengineering.com

BY	DATE

No.	REVISION	BY

H-SCALE	VARIES
V-SCALE	N/A
DATE	4/20/01
DESIGNED BY	JAW
DRAWN BY	JAW
CHECKED BY	

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CYNTHIA M. BLEMNS, COLORADO P.E. #34454 DATE

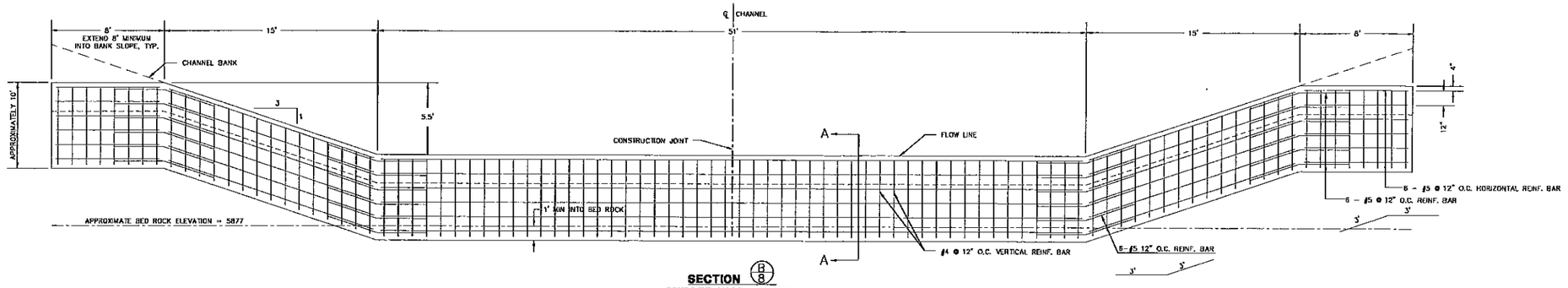
PIKES PEAK GREENWAY TRAIL
LOW WATER CROSSING

CONSTRUCTION DRAWINGS

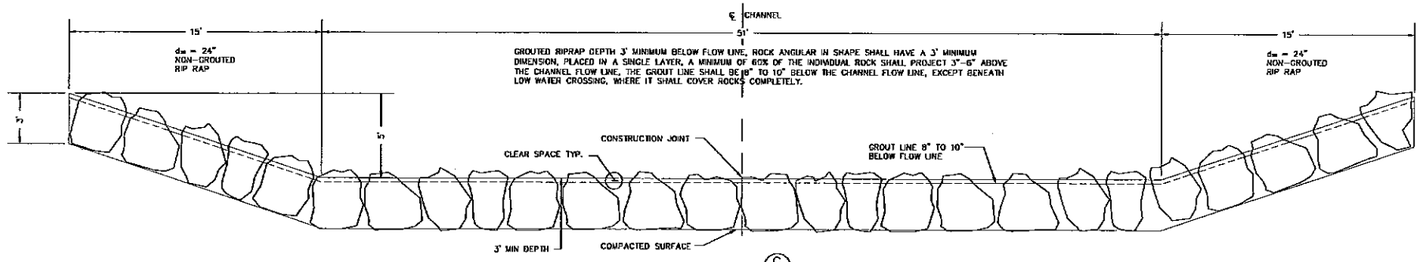
RIP RAP DETAIL SHEET 1

SHEET 8 OF 9

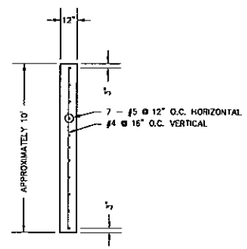
JOB NO. 9247.20



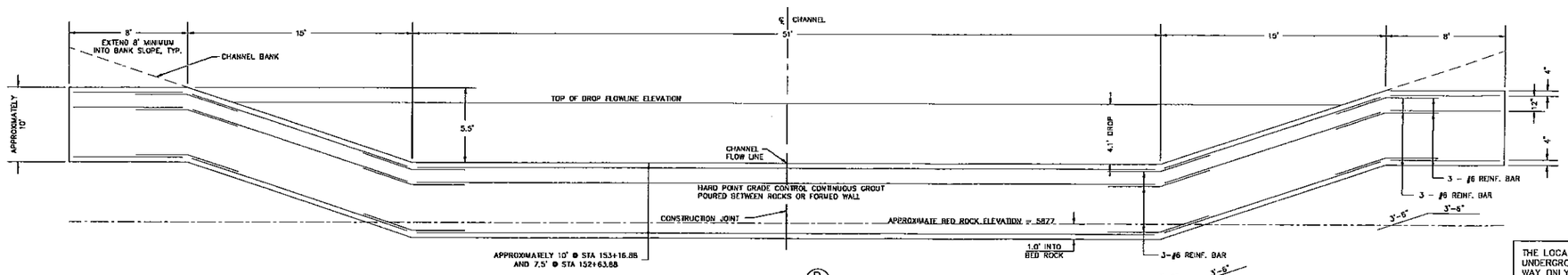
SECTION B/8
CUTOFF WALL DETAIL
NTS



SECTION C/8
HARD POINT GRADE CONTROL
NTS



SECTION A-A
REINFORCED CONCRETE CUTOFF WALL



SECTION D/8
HARD POINT GRADE CONTROL
NTS

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NO.	REVISION	BY	DATE

H-SCALE	VARIES
V-SCALE	N/A
DATE	4/20/01
DESIGNED BY	JAW
DRAWN BY	JAW
CHECKED BY	

PIKES PEAK GREENWAY TRAIL
LOW WATER CROSSING
CONSTRUCTION DRAWINGS
RIP RAP DETAIL SHEET 2

SHEET 9 OF 9
JOB NO. 9247.20