Final Bridge and Channel Design Report

East Fork Jimmy Camp Creek at Fontaine Boulevard
Lorson Ranch Development

CDR-16-009
El Paso County, Colorado

Prepared for:
Lorson Development
212 North Wahsatch Suite 301
Colorado Springs, Colorado 80903

Prepared by:

Kiowa
Engineering Corporation

1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

Kiowa Project No. 16031
January 22, 2018

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Engineer's Statement:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Kiowa Engineering Corporation, 1604 South 21st Street, Colorado Springs, Colorado 80904

Richard N. Wray
Registered Engineer #19310
For and on Behalf of Kiowa Engineering Corporation

1/22/18
Date

Developer's Statement:

I, the Developer, have read and will comply with all of the requirements specified in this drainage report and plan.

BY: _____

JEFF MARK
Printed

1/23/18
Date

ADDRESS: Lorson Development, LLC
212 North Wahsatch Suite 300
Colorado Springs, Colorado 80903

El Paso County:

Filed in accordance with the requirements of the Drainage Criteria Manual Volumes 1 and 2, El Paso County Engineering Criteria Manual and Land Development Code, as amended.

Jennifer Irvine, P.E.
County Engineer/ECM Administrator

Date

Approved
By:Jennifer Irvine, County Engineer
Date:02/06/2018
El Paso County Department of Public Works

I. General Location and Description

This report serves to summarize the design of the East Fork Jimmy Camp Creek (EFJCC), drainageway and for the bridge at Fontaine Boulevard within the Lorson Ranch Development. It is proposed to construct four low flow rock drops, low flow channels, a grouted rock check and soil riprap bank linings at selective locations along a 3,400-lineal foot segment of the EFJCC. The work along the drainageway will begin approximately 200 feet south of the centerline for future Fontaine Boulevard and extend upstream to the northern property line of the Lorson Ranch development. To provide for a continuous design, at the northern property line a short portion of the EFJCC drainageway that lies within the Banning-Lewis Ranch property has been included in the drawings. Banning Lewis-Ranch lies within in the City of Colorado Springs. The location of the site is shown on Figure 1.

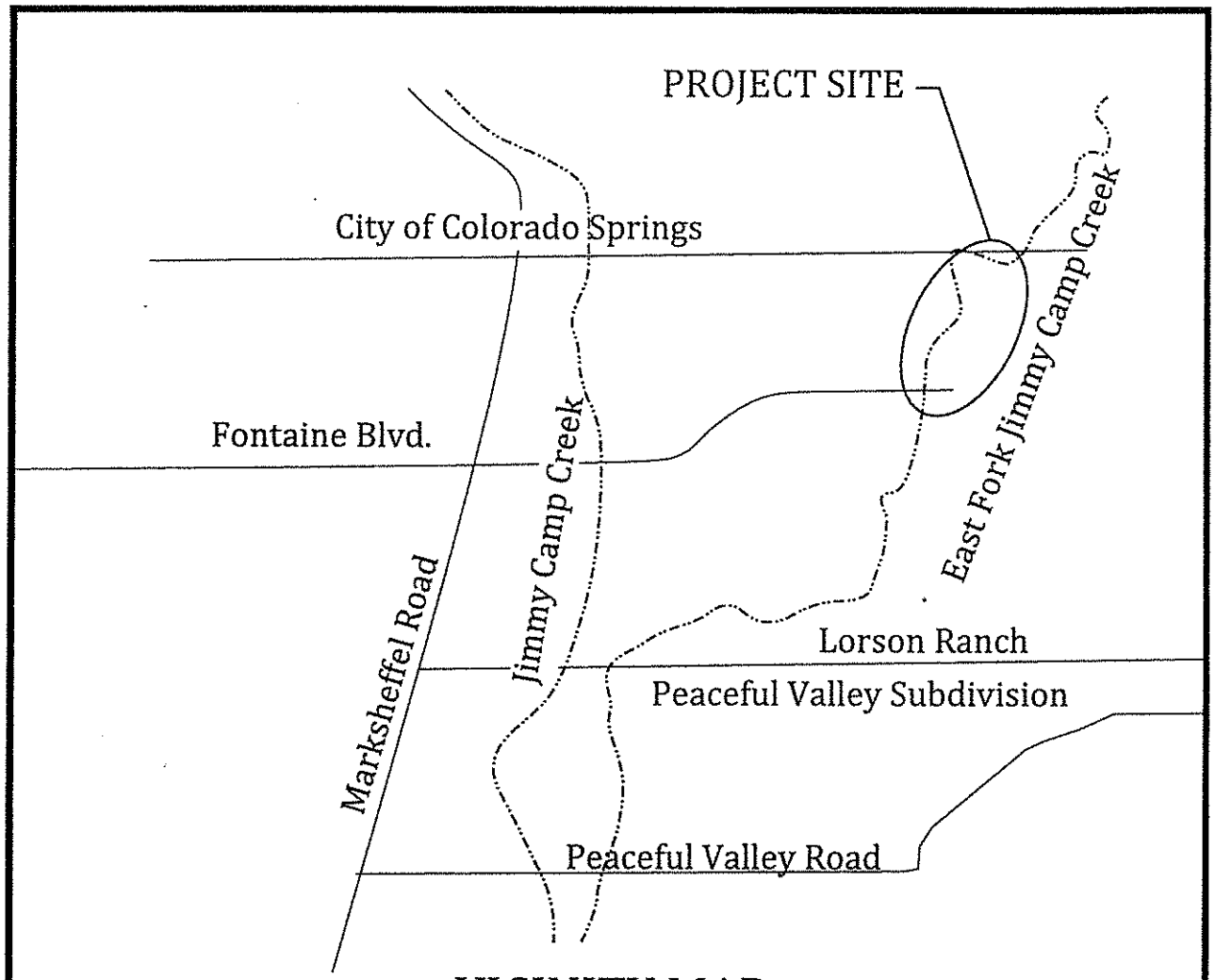
Upon the completion of the drainageway facilities and acceptance by El Paso County and Lorson Ranch Metropolitan District, easements and or tracts will be dedicated for the purposes of maintenance access. Tract E, a tract of land dedicated as an area for future development was created when Pioneer Landing at Lorson Ranch Filing 2B was platted. Most of the proposed drainageway facilities shown on the plans are confined to Tract E. There is a short length within the upper segment of drainageway will drainageway that will abut a future Lorson East filing. With the platting of the first filing within Lorson East, Tract E will be re-platted and enlarged to contain the drainage facilities shown on the plans within a new tract dedicated for open space, floodplain preservation and drainage maintenance access. Operation and maintenance of the drainageway will be the responsibility of the Lorson Ranch Metropolitan District. Upon completion of a LOMR that accounts for the channel and bridge structures subject to this design, there will be no residential lots within future Lorson East filings will be platted into the 100-year floodplain.

The bridge over EFJCC at Fontaine Boulevard is also included within the design plans. The bridge will be a clear-span precast structure that has the capacity to pass the 100-year discharge. The ultimate roadway right-of-way is proposed to be 130-feet. The structure will be 126 feet out-to-out. The roadway section shown on the design plans includes four lanes with a 16-foot median and 5-foot detached sidewalks. Protective guardrails as shown on the drawings have been designed in conformance with Colorado Department of Transportation M-standards. The use of a clear-span structure is consistent with the US Army Corps of Engineers 404 permit issued for the Lorson Ranch Development that requires that a natural invert be constructed. Once the bridge and roadway facilities are completed and accepted by El Paso County, El Paso County will assume maintenance responsibility for the structure and roadway.

The developer intends to request reimbursement for the cost to construct the bridge and drainageway facilities, or request credit against future drainage and bridge fees. Reimbursement will be processed in accordance with sections 1.7 and 3.3 of the Drainage Criteria Manual (DCM). The drainageway facilities will be operated and maintained by the Lorson Ranch Metropolitan District.

II. Project Background

EFJCC is a natural drainageway that was shown to be stabilized in the Lorson Ranch Master Development Drainage Plan (MDDP). The MDDP as last updated showed the EFJCC drainageway to be reconfigured into a trapezoidal channel section capable of conveying the 100-year discharge as listed in the MDDP as derived from the Jimmy Camp Creek Drainage Basin Planning Study (DBPS), that was prepared in 1988. Between future Lorson Boulevard and the downstream limits of this project, the channel has been stabilized into a trapezoidal section with buried grouted rock checks



VICINITY MAP

SCALE: N.T.S.

FIGURE 1

across the invert, and soil/riprap bank lining. The segment below the project site is presently stable and functioning as intended in the design.

In April 2015, the City of Colorado Springs adopted an update to the 1987 Jimmy Camp Creek DBPS. The primary findings and recommendations summarized in the updated 2015 DBPS was in regrading to hydrology and the recommendation for implementation of full spectrum detention (FSD) within the overall Jimmy Camp Creek watershed. The long-term stable sloped estimated in the 2015 DBPS was used as the basis for the hydraulic design for the facilities shown on the design drawings. The existing basin condition hydrology summarized in the DBPS was used in combination with the hydrology summarized in the El Paso County Flood Insurance Study in the hydraulic design of the bridge and EFJCC drainageway work shown on the drawings.

Another finding of the 2015 DBPS was that with the assumption of the maintenance of existing basin condition flow rates through the implementation of FSD, the low flow channel would still need of stabilization because of the anticipation of continuous low flow once the basin develops into an urban watershed. The 2015 DBPS also called for the 100-year floodplain to be preserved for many segments of the natural drainageways within the Jimmy Camp Creek watershed, including the EFJCC drainageway subject to this design. Low flow stabilization was called for in the 2015 DBPS for the EFJCC, along with selective bank lining and the preservation of the 100-year floodplain.

Though the 2015 DBPS was never adopted by El Paso County, the County is now requiring development to provide for FSD, as is the City of Colorado Springs. The implementation of FSD is being accomplished in the County through the adoption of Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs Drainage Criteria Manual, Volume 1.

III. Previous Reports and Jurisdictional Requirements

The basis for the development of the design has been developed from referencing the following reports:

1. ***Lorson Ranch Master Development Drainage Plan (MDDP), prepared by Core Engineering, latest version (not approved by El Paso County).***
2. ***Jimmy Camp Creek Drainage Basin Planning Study (DBPS), prepared by Kiowa Engineering, 2015 (not approved by El Paso County).***
3. ***City of Colorado Springs and El Paso County Drainage Criteria Manual, 1987.***
4. ***El Paso County Engineering Criteria Manual, most current version.***
5. ***City of Colorado Springs Drainage Criteria Manual, Chapters 6 and 12, May 2014.***
6. ***The City of Colorado Springs and El Paso County Flood Insurance Study (FIS), prepared by the Federal Emergency Management Agency, effective 1997.***
7. ***East Fork Jimmy Camp Creek Letter of Map Revision, Case Number 14-08-0543P, Lorson Ranch Development, effective date January 2015.***

Reference 7 provides for the existing condition floodplain and floodway for the segment of EFJCC subject to this design. The existing condition floodplain has been shown on the design drawings and has been modified to show the effect of the bridge crossing at Fontaine Boulevard. Because the bridge structure and channel stabilization measures occur within the regulatory floodplain and floodway, a Conditional Letter of Map Revision (CLOMR) has been processed through FEMA as part of gaining the necessary construction approvals for the project. Reference 7 has been included in the Appendix. The approved CLOMR is contained within Appendix D.

Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs DCM was made part of Reference 3 by El Paso County Board of County Commissioners Resolution 15-042.

IV. Site Description

The EFJCC floodplain within the design reach is well vegetated with native grasses that are in fair to good condition that exists on the floodplain overbanks and within the greater valley in general. There is very little evidence of active invert degradation or bank sloughing. Current longitudinal slope along the project is ranges from .2 to .5 percent. There is presently no base flow in this segment. There is at some locations a small low flow channel that has formed and has a top width of approximately 20 feet. Topography used in the design was compiled at a one-foot contour interval and is dated 2015. The topography reflects the grading within Pioneer Landing Filing 2 that lies west of the drainageway and north of Fontaine Boulevard. There are presently no encroachments into the floodplain or channel thread associated with man-made structures. There is presently no existing water, wastewater, gas or electric utilities that impact the construction of the proposed drainageway facilities. A future wastewater and water line is proposed at Fontaine Boulevard. Each of these future utilities have been shown on the design plans. Approval of the water and wastewater design plans would ultimately come from Widefield Water and Sanitation District.

V. Hydrology

Hydrology for use in determining the typical channel sections shown on the plans were obtained from Reference 7. The 100-year discharges shown in Reference 7 (ranging from 4,400 to 4,750 cubic feet per second), have been used in the hydraulic design of the bridge at Fontaine and in determining the proposed condition floodplain shown on the design plans. The low flow channel was sized using ten percent of the peak flow rate for the 10-year recurrence interval (ranging 440 to 475 cubic feet per second), as listed in Reference 2 in accordance with Reference 3. Basin area at Fontaine Boulevard is approximately 9.6 square miles. The watershed above Fontaine Boulevard is presently undeveloped. Provided on Table 1 is a summary of the peak flows for existing watershed development conditions for References 2 and 7

The assumption that FSD will be required for all future development is reflected in the use of the FIS discharges in this design. There is a good correlation between the FIS and DBPS 100-year discharges for the segment of EFJCC subject to this design. Use of the existing basin condition flow rates is consistent with the requirements set forth in the annexation agreement between the owners of Banning-Lewis Ranch and the City of Colorado Springs. The future FSD's within Banning-Lewis Ranch will be publicly operated and maintained facilities. The plan and profile that summarize the peak discharges from Reference 2 are included in the Appendix.

VI. Hydraulics

The hydraulic design of the drainageway and bridge as presented on the plans was carried out using the US Army Corps of Engineers HEC-RAS modeling system. The HEC-RAS model was used to determine the 100-year hydraulic grade line shown on the plan and profiles. The 100-year profile for the FIS hydrology has been determined. The location for the proposed 100-year floodplain using FIS hydrology has been presented on the plan view of the design plans and on the grading plan. Contained within the Appendix of this report are floodplain maps that show the proposed (pre-project) and regulatory (FIS LOMR) 100-year floodplains using the FIS hydrology. The location for selected HEC-RAS cross-sections are shown on the design profile. The HEC-RAS cross-sections are presented on the floodplain work maps contained in Appendix A. The summary output and cross-section plots for the HEC-RAS models have been included in the Appendix of this memorandum.

The propose drainageway design concepts put forth on the plans are 100-year selective bank lining with low flow stabilization. As described in the DBPS, even with FSD implemented throughout the watershed the low flow area of the drainageway will continue to degrade to a flatter longitudinal

TABLE 1: **SUMMARY OF DESIGN DISCHARGES**
PROJECT: **EAST FORK JIMMY CAMP CREEK**
PROJECT NO: **16031**

DESIGN POINT	LOCATION	EL PASO COUNTY FIS (1)		JIMMY CAMP CREEK DBPS	
		10-YEAR (CFS)	100-YEAR (CFS)	10-YEAR (CFS)	100-YEAR (CFS)
A	800 FT DOWNSTREAM OF FONTAINE BOULEVARD	2400	4750	1850	4260
B	PROFILE STATION 20+00	2200	4400	1830	4260
C	500-FEET UPSTREAM LORSON RANCH NORTH PROPERTY LINE	2200	4400	1830	4260

(1) FIS DISCHARGES USED FOR THE DESIGN OF BRIDGE AND DRAINAGEWAY FACILITIES
(2) ALL DISCHARGES LISTED IN TABLE 1 ARE FOR THE EXISTING WATERSHED CONDITIONS

slope. The effect of development within the watershed will be to increase the frequency and duration of base flows. Base flows will increase with the development because of discharges from future FSD's and irrigation return flows. Natural drainageway will eventually degrade along the invert in turn causing bank sloughing to occur if grade control is not implemented. The bank full capacity as estimated in the DBPS represents rate of runoff that would form the low flow channel over time. The bank full capacity for most natural watersheds represents a flow rate usually between the 2-year to and 5-year recurrence intervals. In order to comply with County DCM criteria, the low flow channel capacity for this design was set at 10 percent of the predominant 100-year FIS discharge (445 cubic feet per second) for the reach. While considerably higher than the bank full capacity estimated in Reference 2, (100 cubic feet per second), designing the low channel at the higher discharge will stabilize the low for over a wider range of runoff events. The crest of the drops has been sized to be able to convey 475 cubic feet per second. A buried grouted rock check has been added at the downstream terminus of the project that will extend into the toe of the soil riprap channel banks. The check will limit the possibility of a head cut from developing that could migrate upstream through the bridge and the drainageway above.

A qualitative channel stability analysis was carried as part of developing the design for EFJCC. The analysis consisted of a field inspection, historic topographic mapping comparisons and the determination of existing channel slopes. Field observations revealed no indication of invert degradation along the entire length of the design reach. There is presently no base flow in the drainageway which explains the relative lack if any significant head cutting or bank erosion. The long term stable slope for this segment the East Fork Jimmy Camp Creek was estimated at .09 percent. The current slope is approximately .76 percent through the project reach. This means that if the drainageway is left unchecked with increasing base flows, the invert could fall as much as 8-feet at the north property line. The grouted low check grade controls have been designed to prevent the possibility of long-term invert degradation. The longitudinal location of the grade controls as well as the depth of the upstream cut-off wall that is integral with the crest of each structure, were determined by projecting the long-term slope of .09 percent upstream such that if a head cut was to from and move upstream along the low flow, the invert of the head cut would not reach an elevation that is below the bottom of the grouted rock sill, and/or the bottom of the cut-off wall.

The design of the channel stabilization measures using .25 percent has been based upon guidance offered in section 3.1.2 of Reference 5. The development of the watershed upstream of Lorson Ranch will occur over the next 30 to 40 years. As such the sediment supply to the reach of East Fork Jimmy Camp Creek as it passes through Lorson Ranch will remain the same as present conditions. Designing the low flow and stabilized channel section at the slope called for in the Jimmy Camp Creek DBPS (.09 percent) now could cause aggradation of sediment along the low flow and floodplain benches due to extremely low flow velocities (less than 3 feet per second). As pointed out in section 3.1.2, it is in some cases better to phase the construction of the channel drops, as a phased approach better recognizes the fact that the natural sediment supply will change as the basin moves from un-developed to developed. It is this guidance that the drops shown in this design have been determined.

Based upon the field observations regarding channel stability, the EFJCC low flow channel was designed to operate at normal depths of flow, thereby eliminating channel instability associated with super-critical flow conditions. The low flow channel lining is proposed to be a combination of soil/riprap bank and turf reinforcement mats depending upon velocity. The locations where selective 100-year soil/riprap lining is proposed was based upon the velocities returned by the HEC-RAS model. Velocities for the 100-year discharge range from 4.1 to 9.9 feet per second. Calculations related to the sizing of the soil/riprap bank and channel sections are contained within the Appendix of the report. The low flow is in normal conditions for most of the reach except at the crest of the grouted boulder drops. At the outside channel bends of the floodplain soil/riprap is proposed as the bank lining material. The top of the bank where selective linings have been proposed reflect the freeboard criteria per County DCM requirements. There was also an effort to realign portions of the

low flow channel away the toe of an outside bend of the drainageway. The intent of the positioning of the low flow was to minimize disturbance to the vegetation on the benches of the 100-year floodplain that could occur during construction. Finally, shear stress calculations were carried out for the 10- and 100-year flow conditions at each segment of the drainageway. Maximum 100-year shear stress on the bench was calculated at .83 pounds per square foot. Permissible shear stress for native vegetation with Class B retardance, similar to the vegetation present at the site, is 2.1 pounds per square foot. Channel design calculations are included in the Appendix of this memorandum.

VII. Design Elements

Presented on the design plans associated with this design memorandum are the proposed drainageway conditions. The drops have been designed to raise the invert anywhere from two to three feet. Design criteria for the project are summarized as follows:

Channel design slope:	.25 percent
Maximum low flow drop height:	3.8 feet
Outside bend slopes- riprap	2.5 to 1 maximum
Low flow channel side slopes- TRM lined	3 to 1 maximum
Low flow channel side slopes- riprap lined	3 to 1 maximum
Low flow channel depth	3 feet
Manning's n-values:	.025-.04
Froude number-(excluding crests of drops):	.25-.84
Minimum channel radius	150 feet
Maximum design velocity	
Grass-lined	5 feet per second
Reinforced turf (TRM)	7 feet per second
Permissible shear stress: low flow channel	
TRM (curled wood mat)	1.55 psf
Type VL riprap	2.5 psf
Permissible shear stress: floodplain benches and overbanks	
Class B retardance, native vegetation	2.1 psf
TRM (curled wood mat)	1.55 psf
Type M riprap	5.0 psf

The low flow drops will be constructed using grouted boulders. The selection of grouted boulders was chosen to address long-term durability of the drop knowing that they would be overtopped in a flood exceeding the low flow design discharge. Each grade control has an integral grouted boulder sill followed by a 25-foot soil/riprap transition to the low flow channel section. A concrete cut-off wall is proposed at the crest of each grade control that will extend into the adjacent floodplain section. The bottom depth of the cut-off walls and the grouted boulder sills have been determined so that the degradation to the ultimate channel slope of .09 percent would not cause the grade control to be undermined. Wherever soil riprap linings are proposed, rock sizing and freeboard criteria followed is in accordance with the DCM.

A geotechnical investigation was conducted to support the design of the foundation for the bridge at Fontaine. The geotechnical report is included within the Appendix. Two soil borings were drilled at near the location of the proposed footings for the bridge. Because of the depth to bedrock, deep foundations are proposed using driven H-piles. A precast bridge section has been chosen that has a 48-foot clear span and a 13-foot rise. The 100-year discharge can be passed through the bridge at a headwater to depth ratio of 1. Bridge velocity during a 100-year event is estimated at between 10.5 and 14.5 feet per second. The Geotechnical Report has been included in this report within Appendix C.

The construction of the improvements shown on the plans will result in a long-term stable drainageway corridor and prevent damages that could arise from bank sloughing related to the erosion of the drainageway's invert. Because the low flow channel will be stabilized both horizontally and vertically the potential for negative impacts upon the native vegetative habitat will be minimized. A stabilized floodplain corridor will result from the construction of the proposed drainageway structures and over the long–term, the environmental quality of the corridor will be enhanced and preserved.

Maintenance access to the proposed drops will be provided via platted tracts within Pioneer Land Filing 2 and from tracts or easements within the future Lorson East filings. The locations of the maintenance roads are shown on the design plans. The benches of the channel are relatively flat and will allow for access to the crest of each drop. Access to the floodplain bench will allow for maintenance of proposed storm sewer outfalls from the adjacent Pioneer Landing Filing 2B and future Lorson East filings. Access points to the 100-year floodplain will be identified in the Lorson East MDDP and subsequent subdivision plat(s). Access roadways will have an all-weather surface and be a minimum of 12-feet in width.

VIII. Construction Permitting

The following permits are anticipated to allow for the construction of the project as shown on the design plans. A copy of the Lorson Ranch 404 Permit is included within the Appendix.

Notification of project in conformance with 404 permit - USACOE

Floodplain Development Permit – Regional Building Department

Grading and Erosion Control Permit (ESQCP) – El Paso County

Construction Stormwater Discharge Permit – CDPHE

Construction Dewatering Permit - CDPHE

Conditional Letter of Map Revision - FEMA

IX. Drainage and Bridge Fees

The Lorson Ranch Development and specifically Lorson Ranch East lies wholly within the Jimmy Camp Creek drainage basin. Drainage and bridge fees have been established by the County for the Jimmy Camp Creek drainage basin for assessment against platted land within the watershed. The drainageway structures will be public to be maintained by the Lorson Ranch Metropolitan District and are considered reimbursable or creditable against drainage fees owed when land within Lorson East is platted pending approval through the DCM reimbursement process. Construction of the bridge at Fontaine Boulevard will be creditable against bridge fees owed pending approval through the DCM reimbursement process.

The current 2017 drainage and bridge fees for the Jimmy Camp Creek drainage basin are as follows:

Drainage Fee:	$16,270 per all impervious acres
Drainage Fee Escrow (BOCC Reas.16-320)	$7,285 per acre
Total Drainage Fee	$23,555 per acre
Bridge Fee:	$735 per acre

X. Phasing

Construction of the drainage and bridge facilities shown on the plans is to be completed all at once and no phasing of the construction is proposed. The construction will commence prior to or concurrent with the development of the first filing within Lorson East. Plans are to commence with construction in Winter 2018 with substantial completion in Summer 2018.

Completion of the roadway will initially involve only the two lanes on an interim basis until such time that traffic warrants completing the full design section for Fontaine Boulevard. The full bridge length will be constructed as shown on the plans. The final configuration of the interim roadway section will be shown on the Fontaine Boulevard design plans being prepared by Core Engineering. Fine grading, paving, curb and gutter and sidewalks will be installed when the roadway is extended east from its present point of terminus.

Appendix A:

Hydrologic and Hydraulic Calculations

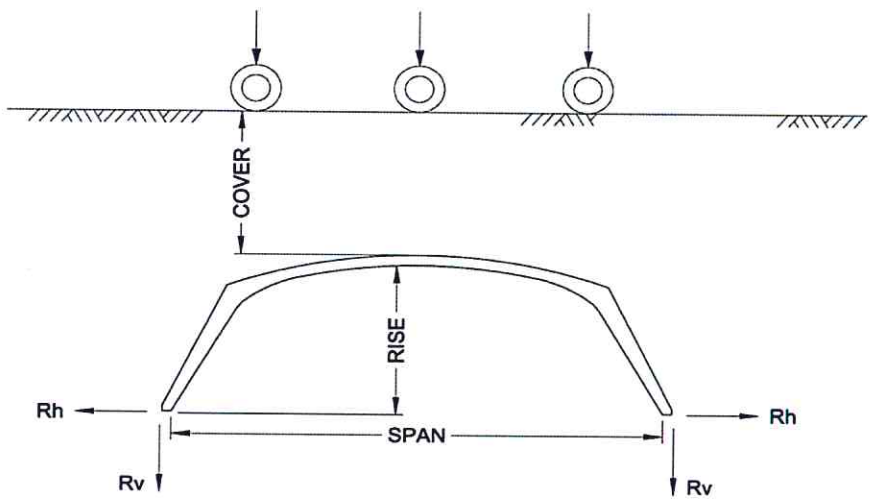
CON SPAN -SERIES

BRIDGE REACTIONS

JOB #: 434050
NAME: Lorson Ranch
DATE: 22-Nov-16
BY: jal

LOADS:

Cover at structure center:	4		
Shape ID:	O848		
Bridge span:	48 ft	Vertical load, per leg, R_v (DL Only)	**28.3 k/f**
Bridge rise:	13.1 ft	Horizontal load, per leg, R_h (DL Only)	**15.1 k/f**
Design live load:	Piles, HL-93 Tandem	Vertical load, per leg, R_v (DL + LL)	**33.8 k/f**
		Horizontal load, per leg, R_h (DL+LL)	**18.0 k/f**



Notes:
1) Axle load positions are varied to produce critical reactions shown here.
2) Reactions are unfactored loads.
3) Impact is not included.
4) Units are kips/ft.
5) Soil Weight = 120 pcf.
6) reactions are based on pile foundations.

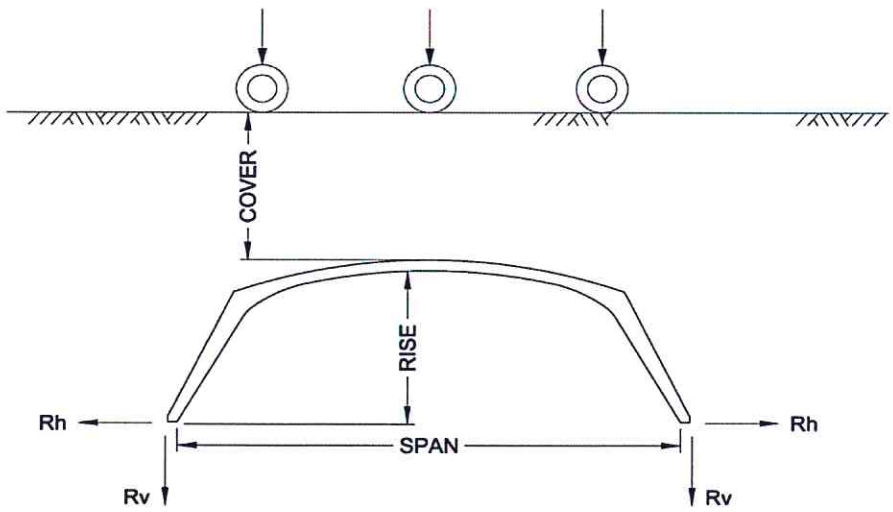
CON SPAN -SERIES

BRIDGE REACTIONS

JOB #: 434050
NAME: Lorson Ranch
DATE: 22-Nov-16
BY: JAL

LOADS:

Cover at structure center:	2		
Shape ID:	O848		
Bridge span:	48 ft	Vertical load, per leg, R_v (DL Only)	**23.1 k/f**
Bridge rise:	13.1 ft	Horizontal load, per leg, R_h (DL Only)	**8.8 k/f**
Design live load:	Piles, HL-93 Tandem	Vertical load, per leg, R_v (DL + LL)	**28.6 k/f**
		Horizontal load, per leg, R_h (DL+LL)	**13.4 k/f**



Notes:
1) Axle load positions are varied to produce critical reactions shown here.
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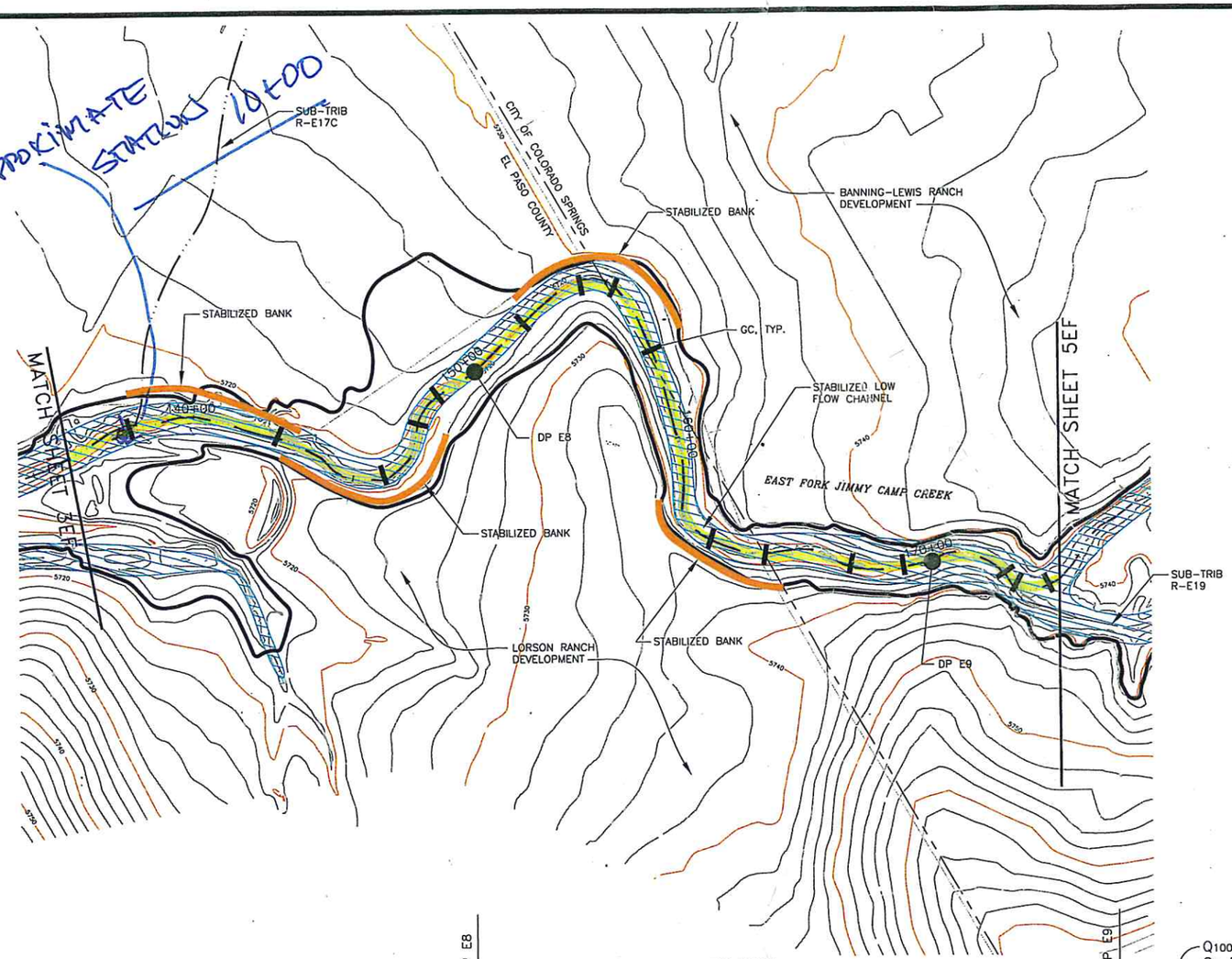
3) Impact is not included.
4) Units are kips/ft.
5) Soil Weight = 120 pcf.
6) reactions are based on pile foundations.



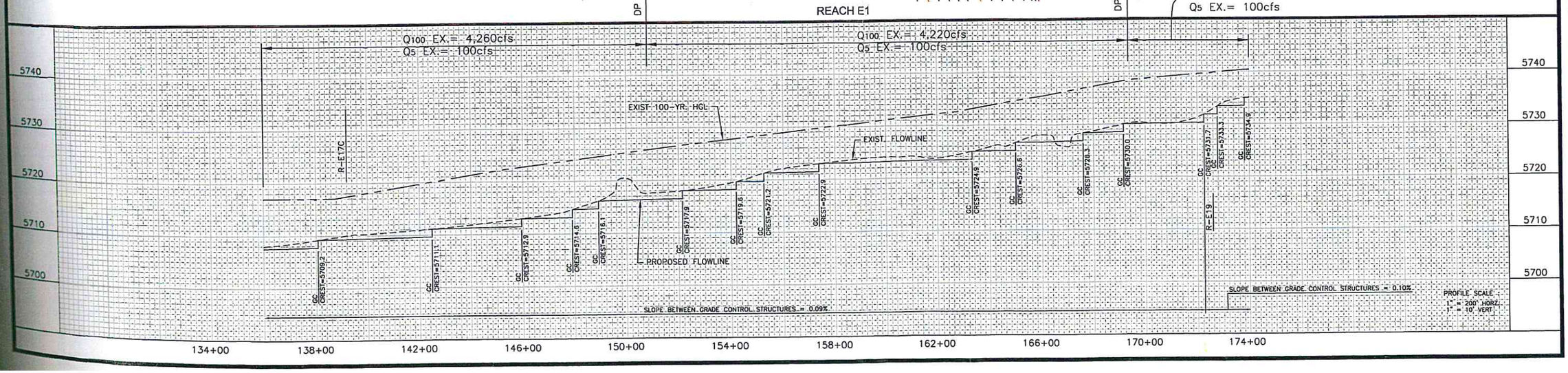
LEGEND

- 100-YR FLOODPLAIN
- STREAM FLOWLINE
- CORPORATE LIMITS
- STABILIZED LOW FLOW CHANNEL
- STABILIZED BANK
- PROPOSED FILL
- POTENTIAL JURISDICTIONAL WETLANDS
- OPEN WATER
- RIPARIAN TREES AND SHRUBS MAY INCLUDE SMALL AREAS OF WETLANDS
- POTENTIAL JURISDICTIONAL WATERS OF THE U.S. MAY INCLUDE SMALL AREAS OF WETLANDS AND/OR RIPARIAN SPECIES

FLOODPLAIN BOUNDARIES ARE FOR PLANNING INFORMATION ONLY AND ARE NOT INTENDED TO BE USED FOR FLOODPLAIN REGULATION OR MANAGEMENT.

THIS DRAWING IS A PLANNING EXHIBIT REPRESENTING CONCEPTUAL ENGINEERING AND IS SUBJECT TO REFINEMENT. THIS DRAWING SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES.

DISCHARGES UPSTREAM OF DP E1 HAD NO AREA ADJUSTMENT APPLIED



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JIMMY CAMP CREEK DRAINAGE BASIN PLANNING STUDY
EAST FORK JIMMY CAMP CREEK
CONCEPTUAL DESIGN PLAN & PROFILE
CITY OF COLORADO SPRINGS, COLORADO

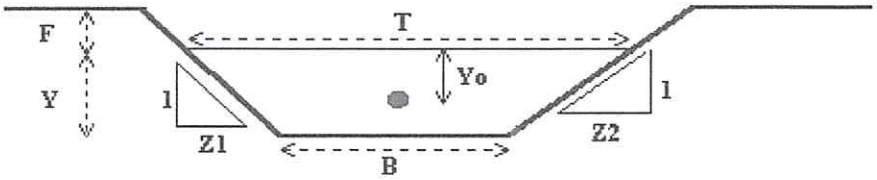
Project No.:	14008
Date:	OCTOBER 2014
Design:	RNW
Drawn:	JLN
Check:	RNW
Revisions:	

4EF

14008-4EF-766cdpp.dwg/Aug 19, 2014

Normal Flow Analysis - Trapezoidal Channel

Project:	16031 East Fork Jimmy Camp Creek
Channel ID:	Q10 Low Flow Channel

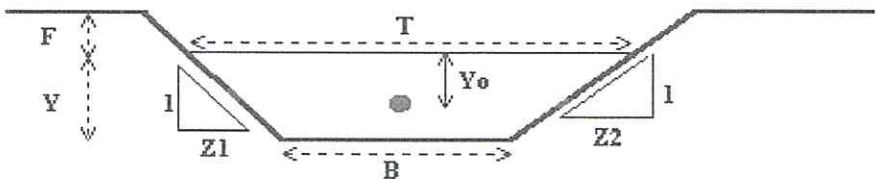


Design Information (Input)			
Channel Invert Slope	So =	0.0025	ft/ft
Manning's n	n =	0.030	
Bottom Width	B =	25.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft
Freeboard Height	F =	0.00	ft
Design Water Depth	Y =	**3.00**	ft

Normal Flow Condtion (Calculated)			
Discharge	**Q =**	**443.85**	cfs
Froude Number	**Fr =**	**0.50**	
Flow Velocity	**V =**	**4.35**	fps
Flow Area	A =	102.00	sq ft
Top Width	T =	43.00	ft
Wetted Perimeter	P =	43.97	ft
Hydraulic Radius	R =	2.32	ft
Hydraulic Depth	D =	2.37	ft
Specific Energy	Es =	3.29	ft
Centroid of Flow Area	Yo =	1.37	ft
Specific Force	Fs =	12.43	kip

Critical Flow Analysis - Trapezoidal Channel

Project:	16031 East Fork Jimmy Camp Creek
Channel ID:	Q10 low flow channel at crests of drops



Design Information (Input)			
Bottom Width	B =	25.00	ft
Left Side Slope	Z1 =	3.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft
Design Discharge	Q =	**475.00**	cfs

Critical Flow Condition (Calculated)			
Critical Flow Depth	**Y =**	**2.05**	ft
Critical Flow Area	A =	63.86	sq ft
Critical Top Width	T =	37.30	ft
Critical Hydraulic Depth	D =	1.71	ft
Critical Flow Velocity	V =	7.44	fps
Froude Number	**Fr =**	**1.00**	
Critical Wetted Perimeter	P =	37.97	ft
Critical Hydraulic Radius	R =	1.68	ft
Critical (min) Specific Energy	Esc =	2.91	ft
Centroid on the Critical Flow Area	Yoc =	0.89	ft
Critical (min) Specific Force	Fsc =	10.40	kip

τ stress $\tau = ds$ w $S \doteq .25\%$

$d = 3'$

$\tau = .47$ psf.

τ_p for TRM = 1.55 psf

τ_p for Soil/Riprap = 3.2 psf

τ_p for Rect. class 'B' 2.1 psf (not. Floodplain Veg.

1/1

SHEAR STRESS CALCULATIONS
PROJECT: **EAST FORK JIMMY CAMP CREEK**
PROJECT NO: **16031**

MAXIMUM DEPTH OVER INVERT

PROFILE STA	HEC-RAS RIVER STATION	CRITICAL DEPTH?	SLOPE (%)	10-YR DEPTH (FT)	SHEAR STRESS (PSF) 10-YR SHEAR STRESS (PSF)	100-YR DEPTH (PSF)	100-YR SHEAR STRESS (PSF)
16+05	12200	N	0.25	6.4	1.00	8.3	1.29
19+05	12500	N	0.25	5.5	1.51	6.9	1.08
22+55	12850	N	0.25	6.5	1.81	8.3	1.29
26+76	13272	N	0.25	6.1	1.83	7.7	1.20
29+79	13575	N	0.25	6.1	1.80	7.8	1.22
37+33	14330	N	0.25	6.0	1.80	7.8	1.22

DEPTH OVER BENCH

PROFILE STA	RIVER STA	CRITICAL DEPTH?	SLOPE (%)	10-YR DEPTH (FT)	SHEAR STRESS (PSF) 10-YR SHEAR STRESS (PSF)	100-YR DEPTH (PSF)	100-YR SHEAR STRESS (PSF)
16+05	12200	N	0.25	3.4	0.53	5.3	0.83
19+05	12500	N	0.25	2.5	0.39	3.9	0.61
22+55	12850	N	0.25	3.5	0.55	5.3	0.83
26+76	13272	N	0.25	3.1	0.48	4.7	0.73
29+79	13575	N	0.25	3.1	0.48	4.8	0.75
37+33	14330	N	0.25	3.0	0.47	4.8	0.75

HEC-15

- γ = unit weight of water (62.4 lb./ft.^{3}or 9810 N./m.^{2})
- d = maximum depth of flow (ft. or m.)
- S = channel slope (ft./ft. or m./m.)

Retardation Class for Lining Materials

Retardance Class	Cover	Condition
A	Weeping Lovegrass	Excellent stand, tall (average 30 in. or 760 mm)
	Yellow Bluestem Ischaemum	Excellent stand, tall (average 36 in. or 915 mm)
B	Kudzu	Very dense growth, uncut
	Bermuda grass	Good stand, tall (average 12 in. or 305 mm)
*	Native grass mixture little bluestem, bluestem, blue gamma, other short and long stem midwest grasses	Good stand, unmowed
	Weeping lovegrass	Good Stand, tall (average 24 in. or 610 mm)
	Lespedeza sericea	Good stand, not woody, tall (average 19 in. or 480 mm)
	Alfalfa	Good stand, uncut (average 11 in or 280 mm)
	Weeping lovegrass	Good stand, unmowed (average 13 in. or 330 mm)
	Kudzu	Dense growth, uncut
	Blue gamma	Good stand, uncut (average 13 in. or 330 mm)
C	Crabgrass	Fair stand, uncut (10-to-48 in. or 55-to-1220 mm)
	Bermuda grass	Good stand, mowed (average 6 in. or 150 mm)
	Common lespedeza	Good stand, uncut (average 11 in. or 280 mm)
	Grass-legume mixture: summer (orchard grass redtop, Italian ryegrass, and common lespedeza)	Good stand, uncut (6-8 in. or 150-200 mm)
	Centipedegrass	Very dense cover (average 6 in. or 150 mm)
	Kentucky bluegrass	

		Good stand, headed (6-12 in. or 150-305 mm)
D	Bermuda grass	Good stand, cut to 2.5 in. or 65 mm
	Common lespedeza	Excellent stand, uncut (average 4.5 in. or 115 mm)
	Buffalo grass	Good stand, uncut (3-6 in. or 75-150 mm)
	Grass-legume mixture: fall, spring (orchard grass Italian ryegrass, and common lespedeza	Good Stand, uncut (4-5 in. or 100-125 mm)
	Lespedeza sericea	After cutting to 2 in. or 50 mm (very good before cutting)
E	Bermuda grass	Good stand, cut to 1.5 in. or 40 mm
	Bermuda grass	Burned stubble

Permissible Shear Stresses for Various Linings

Protective Cover	(lb./sq.ft.)	t_p (N/m^2)
Retardance Class A Vegetation (See the "Retardation Class for Lining Materials" table above)	3.70	177
Retardance Class B Vegetation (See the "Retardation Class for Lining Materials" table above)	2.10	101
Retardance Class C Vegetation (See the "Retardation Class for Lining Materials" table above)	1.00	48
Retardance Class D Vegetation (See the "Retardation Class for Lining Materials" table above)	0.60	29
Retardance Class E Vegetation (See the "Retardation Class for Lining Materials" table above)	0.35	17
Woven Paper	0.15	7
Jute Net	0.45	22
Single Fiberglass	0.60	29
Double Fiberglass	0.85	41

Straw W/Net	1.45	69
Curled Wood Mat	1.55	74
Synthetic Mat	2.00	96
Gravel, D_{50} = 1 in. or 25 mm	0.40	19
Gravel, D_{50} = 2 in. or 50 mm	0.80	38
Rock, D_{50} = 6 in. or 150 mm	2.50	120
Rock, D_{50} = 12 in. or 300 mm	5.00	239
6-in. or 50-mm Gabions	35.00	1675
4-in. or 100-mm Geoweb	10.00	479
Soil Cement (8% cement)	>45	>2154
Dycel w/out Grass	>7	>335
Petraflex w/out Grass	>32	>1532
Armorflex w/out Grass	12-20	574-957
Erikamat w/3-in or 75-mm Asphalt	13-16	622-766
Erikamat w/1-in. or 25 mm Asphalt	<5	<239
Armorflex Class 30 with longitudinal and lateral cables, no grass	>34	>1628
Dycel 100, longitudinal cables, cells filled with mortar	<12	<574
Concrete construction blocks, granular filter underlayer	>20	>957
Wedge-shaped blocks with drainage slot	>25	>1197

Trial Runs

To optimize the roadside channel system design, make several trial runs before a final design is achieved. Refer to HEC-15 for more information on channel design techniques and considerations.

KIOWA ENGINEERING CORPORATION

JOB Larson Ranch Fountain Bridge
SHEET NO. 1 OF 4
CALCULATED BY RAW DATE 10/22/16
CHECKED BY DATE RRJ 7/10/17
SCALE Riprap Sizing

Riprap Sizing Through Bridge : Station 10+00

Bridge Velocity = 14.5 @ outlet RS 11523
per HEC RAS, Q_{100} = 4750 cfs
Slope = .25 % ≈ .0025 ft

$$\frac{VS^{.17}}{(S_s-1)^{.66}}$$ Assume $S_s = 2.6$

$$\frac{(14.5)(.0025)^{.17}}{(2.6-1)^{.66}} = \frac{5.32}{1.36} = 3.92$$ upper end of L

Per Table 10-6 (EPCKS DCM)

Required rock size Type M (cons.)

Kiowa Engineering Corporation

CLIENT ~~Lower Rock Fontaine~~ JOB NO. 16031 PAGE 2/4
PROJECT Bordac DATE CHECKED DATE 10/22/16
DETAIL Channel Hydraulics CHECKED BY COMPUTED BY RJW

REV 7-10-17

Riprap Sizing

Station 18+50 to 22+50

Per HEC Ras: Velocity Range 6.1 - 10.4 fps
Stream Slope.

c fps: $\frac{10.4(.0025)^{.17}}{(2.6-1)} = \frac{3.75}{1.36} = 2.8$

upper end of VL; use next size up.
Per Table 10-6 use Type VL

∴ 12" Thick

depth of flow ≈ 10'

Station 27+20 to 31+24

Per HEC RAS: Velocity Range 5.9 - 9.4'

c 9.4 fps: $\frac{9.4(.0025)^{.17}}{1.36} = 2.5$

per Table 10-6 Type VL

Kiowa Engineering Corporation

CLIENT Larson Bunk
PROJECT
DETAIL Riprap Sizing

JOB NO. 16031
DATE CHECKED
CHECKED BY

PAGE 3/4
DATE 10/22/16
COMPUTED BY
Rev. 7-10-17

Sta 35+80 — 39+00

Per HEC RAS Velocity Range 8.0-10.0 fps

e Velocity = 10.0 fps

$$\frac{10.0\,(.0025)^{.17}}{1.36} = 2.65$$

Per Table 10.6 use Type VL Soil Riprap

TABLE 10-6

RIPRAP REQUIREMENTS FOR CHANNEL LININGS **

$VS^{0.17}/(S_s-1)^{0.66}$* (ft^{1}/2/sec)	Rock Type ***
1.4 to 3.2	VL
3.3 to 3.9	L
4.0 to 4.5	M
4.6 to 5.5	H
5.6 to 6.4	VH

* where:

V = mean channel flow velocity, in fps;

S = longitudinal channel slope, in feet per foot (ft/ft); and

S_s = specific gravity of stone (minimum S_s = 2.50)

** Table valid only for Froude number of 0.8 or less and side slopes no steeper than 2h:1v.

*** Type VL and L riprap may be buried after placement to reduce vandalism.

KIOWA ENGINEERING CORPORATION

JOB Lawson Bank EFIC

SHEET NO. 1/2 OF 2/14/17

CALCULATED BY RJW DATE Rev 7/10/17

CHECKED BY _____ DATE _____

SCALE Channel Hydraulics

Super Elevation

per DCM

Super Elevation

Height $H = \frac{CV^2W}{gR}$

C = .5 (subcritical flow)

Station 28+00 to 31+00

Max 100 yr Velocity = 9.4 fps (max)

Min " " = 5.9 fps (min)

use Avg through segment 7.6 fps

℄ R 28+00 to 31+00 150' ≈ 210' @ mid bank

Flood plain width (use @ Station 29+50) = 95'

$$H = \frac{.5(7.6)^2(95)}{g(150)} = .60' \text{ use } 1.0'$$

Sta 36+00 - 39+00

Velocity Range 8-10 fps use Avg = 9.0 fps

R = 200' @ Sta 37+00 W = 170'

$$H = \frac{.5(9.0)^2(170)}{g(200)} = 1.06 \text{ use } 1.0'$$

KIOWA ENGINEERING CORPORATION

JOB Larson Park EFJCC

SHEET NO. 2 OF 7

CALCULATED BY FJW DATE 2/14/17

CHECKED BY DATE Rev 7-10-17

SCALE Channel Hydraulics

Station 18+50 to 22+00

Velocity Range 6.11 – 10.4 fps

use Average = 9.4 fps

R = 195' to ℄ @ mid-bank

Floodplain width 230'

$$H = \frac{.5(10.4)^2(230)}{9(195)} = 1.98' \text{ use } 2'$$

KIOWA ENGINEERING CORPORATION

JOB Lawson Bank EE TCC
SHEET NO. 1 OF 2/14/17
CALCULATED BY RNW DATE
CHECKED BY DATE
SCALE Channel Hydraulics

Bank Heights outside beads w/ Soil Riprap

Sta	100yr WS	TOR w/ FB (1.0)
27+20	26.2	27.2 (use 28.0)
28+00	28.2	29.2
29+00	28.8	29.8
30+00	29.4	30.4
32+00	29.8	30.8

w/ 1.0' FB

36+00	32.0	33.0
37+00	32.2	33.2
38+00	33.3	34.3

w/ FB = 2.0

19+50	20.5	22.5
21+00	22.4	24.4
22+00	22.8	24.8

KIOWA ENGINEERING CORPORATION

JOB Fountain Blvd Bridge / EFRC
SHEET NO. 1 OF 1
CALCULATED BY RWW DATE
CHECKED BY DATE
SCALE Hydraulics

Cutoff El. & Crest and Sill

Sill Station	Downstream Control Elev / Sta	Sill Elev / BOR	Sill invert @ .0009%	
12+95	2.0 / 8+00	4.0 / 1.0	1.6 ✓	ok
18+00	7.0 / 13+30	8.5 / 5.5	6.6 ✓	ok
23+85	11.5 / 18+35	13.5 / 10.5	11.0 ✓	ok
26+85	16.5 / 24+20	17.5 / 14.5	16.3 ✓	ok
* 35+80	20.5 / 27+20	23.6 / 20.6	19.8	.8 above

Crest Station	Crest Elev	5" cutoff Elev	Sill Elev. @ .0009%	
13+30	7.0	2.0	1.6	.4 above
18+35	11.5	6.5	6.6	ok below
24+20	16.5	11.5	11.0	.5 above
27+20	20.5	14.5	16.3	ok
36+15	25.0	20.0	19.80	.2 above ok

* Bottom of vault @ 35+80 .8' above longterm crest. Crest cut-off wall is below long-term sill invert so sill is probably ok at .8' above.

Seepage Analysis (Lane's Weighted Creep Method Calculation)

10-YR FLOW COND

Location	C_w	Weep Drain System	C_w	H_s	Drop Height	L_a	L_f	L_s	L_H	Required $L_{v\text{-}calc}$	$L_{v\text{-}Struct}$	L_v Difference $L_{v\text{-}calc}$ and $L_{v\text{-}Struct}$	Additional Calculated Cut off Wall Depth	**Additional Cut off Wall Depth**
Sta. 24+20	6.0	No	6.0	**3.0 ft**	3.6 ft	10.0ft	36.0ft	0.0ft	**46.0 ft**	2.7 ft	**5.0 ft**	0.0 ft	0.0 ft	**0 ft**
			##											

Equations:

$C_w = [(L_H/3)+L_v] / H_s$ (USDCM Eqn 9-5)

C_w = Lane's Weighted Creep Ratio

Table 9-3: Lane's Weighted Creep Recommended Ratios (USDCM)

- C_w = 8.5 Very fine sand or silt
- C_w = 7.0 Fine Sand
- C_w = 6.0 Medium Sand
- C_w = 5.0 Coarse Sand
- C_w = 4.0 Fine Gravel
- C_w = 3.0 Coarse gravel including cobbles or Soft Clay
- C_w = 2.0 Medium Clay

Weep Drain System: 10% Reduction is C_w if weep drain system is used

H_s = Head Differential between analysis points -- Taken from HEC-Ras

Drop Height = Difference between Crest and Sill

L_H = Sum of the Horizontal Creep Distances (Less than 45 degrees)

$L_H = L_a + L_f$

L_a = Approach Length

L_s = Length of stilling basin (Toe to Sill)

L_f = Drop Face Length (Crest to Toe)

L_v = Sum of the Vertical Creep Distances (Steeper than 45 degrees)

$L_{v\text{-}Struct}$ = Vertical creep distances of structure w/o cut off wall

Additional Calculated Cutoff Wall Depth = Half of L_v Difference if Sheet Pile

Seepage Analysis (Lane's Weighted Creep Method Calculation)

100-YR FLOW COND

Location	C_w	Weep Drain System	C_w	H_s	Drop Height	L_a	L_f	L_s	L_H	Required $L_{v\text{-}calc}$	$L_{v\text{-}Struct}$	L_v Difference $L_{v\text{-}calc}$ and $L_{v\text{-}Struct}$	Additional Calculated Cut off Wall Depth	Additional Cut off Wall Depth
Sta. 24+20	6.0	No	6.0	1.1 ft	3.6 ft	10.0ft	36.0ft	0.0ft	46.0 ft	-8.7 ft	12.0 ft	0.0 ft	0.0 ft	0 ft *
			##											

* CUT-OFF WALL NOT REQUIRED AT DROPS PER UDFCD 9.2.4

Equations:

$C_w = [(L_H/3)+L_v] / H_s$ (USDCM Eqn 9-5)

C_w = Lane's Weighted Creep Ratio

Table 9-3: Lane's Weighted Creep Recommended Ratios (USDCM)

- C_w = 8.5 Very fine sand or silt
- C_w = 7.0 Fine Sand
- C_w = 6.0 Medium Sand
- C_w = 5.0 Coarse Sand
- C_w = 4.0 Fine Gravel
- C_w = 3.0 Coarse gravel including cobbles or Soft Clay
- C_w = 2.0 Medium Clay

Weep Drain System: 10% Reduction is C_w if weep drain system is used

H_s = Head Differential between analysis points -- Taken from HEC-Ras

Drop Height = Difference between Crest and Sill

L_H = Sum of the Horizontal Creep Distances (Less than 45 degrees)

$L_H = L_a + L_f$

L_a = Approach Length

L_s = Length of stilling basin (Toe to Sill)

L_f = Drop Face Length (Crest to Toe)

L_v = Sum of the Vertical Creep Distances (Steeper than 45 degrees)

$L_{v\text{-}Struct}$ = Vertical creep distances of structure w/o cut off wall

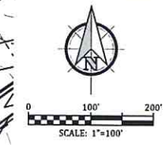
Additional Calculated Cutoff Wall Depth = Half of L_v Difference if Sheet Pile

PROFILE
TA

HEC-RAS Plan: Prop Cond River: East Tributary Reach: Main Reach

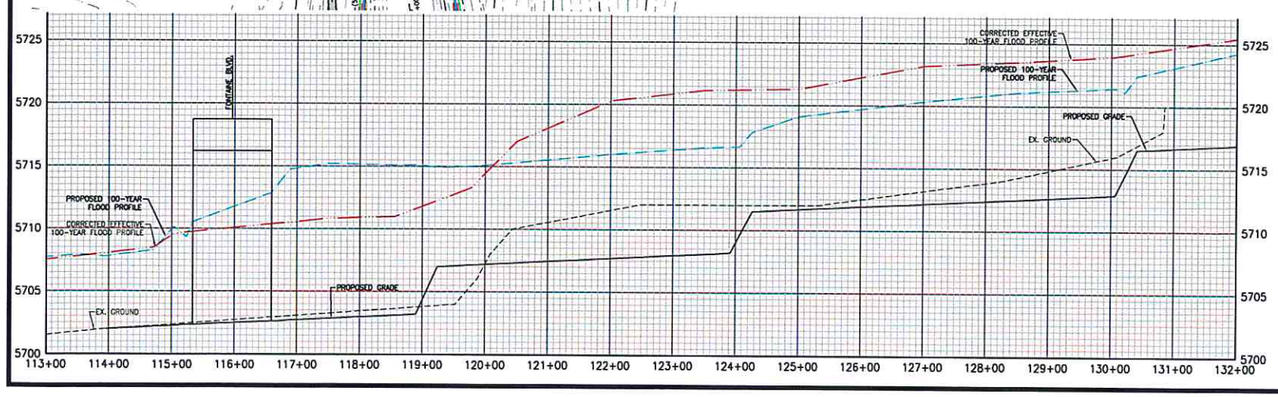
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Reach	14800	10yr	2200.00	5728.60	5733.67	5733.67	5735.14	0.011180	10.69	283.84	111.82	0.89
Main Reach	14800	50yr	3850.00	5728.60	5735.18	5735.18	5736.92	0.010002	12.26	483.65	152.71	0.88
Main Reach	14800	100yr	4400.00	5728.60	5735.56	5735.56	5737.39	0.009940	12.74	544.24	163.09	0.89
Main Reach	14800	500yr	5700.00	5728.60	5736.45	5736.40	5738.36	0.009308	13.43	699.12	187.01	0.88
Main Reach	14650	10yr	2200.00	5727.87	5733.45	5731.85	5733.97	0.003280	6.06	437.60	134.68	0.49
Main Reach	14650	50yr	3850.00	5727.87	5734.92	5733.23	5735.69	0.003631	7.61	658.38	167.85	0.53
Main Reach	14650	100yr	4400.00	5727.87	5735.33	5733.63	5736.17	0.003690	8.00	729.84	177.77	0.54
Main Reach	14650	500yr	5700.00	5727.87	5736.19	5734.41	5737.23	0.003956	8.98	894.14	225.01	0.58
Main Reach	14527	10yr	2200.00	5726.23	5732.43	5731.94	5733.35	0.007347	7.70	287.38	102.92	0.78
Main Reach	14527	50yr	3850.00	5726.23	5733.62	5733.19	5735.01	0.007627	9.52	424.14	126.82	0.82
Main Reach	14527	100yr	4400.00	5726.23	5733.93	5733.58	5735.47	0.007804	10.05	464.73	132.96	0.83
Main Reach	14527	500yr	5700.00	5726.23	5734.54	5734.34	5736.46	0.008455	11.31	550.38	149.33	0.88
Main Reach	14500	10yr	2200.00	5726.17	5732.33	5731.60	5733.14	0.005886	7.19	306.12	101.58	0.73
Main Reach	14500	50yr	3850.00	5726.17	5733.61	5732.93	5734.74	0.006086	8.54	450.58	125.23	0.79
Main Reach	14500	100yr	4400.00	5726.17	5733.96	5733.30	5735.18	0.006160	8.88	495.74	132.15	0.81
Main Reach	14500	500yr	5700.00	5726.17	5734.68	5734.04	5736.11	0.006336	9.66	597.24	157.47	0.81
Main Reach	14330	10yr	2200.00	5725.81	5731.68	5730.72	5732.24	0.004087	6.11	360.35	129.76	0.65
Main Reach	14330	50yr	3850.00	5725.81	5733.01	5731.94	5733.75	0.004419	6.90	558.30	164.10	0.66
Main Reach	14330	100yr	4400.00	5725.81	5733.39	5732.27	5734.16	0.004455	7.07	622.19	173.54	0.66
Main Reach	14330	500yr	5700.00	5725.81	5734.18	5732.93	5735.03	0.004472	7.43	768.53	201.43	0.65
Main Reach	14251	10yr	2200.00	5725.65	5730.57	5730.44	5731.62	0.017673	8.19	268.48	111.63	0.93
Main Reach	14251	50yr	3850.00	5725.65	5731.96	5731.58	5733.15	0.013284	8.74	440.40	137.11	0.86
Main Reach	14251	100yr	4400.00	5725.65	5732.34	5731.89	5733.57	0.012537	8.90	494.21	145.92	0.85
Main Reach	14251	500yr	5700.00	5725.65	5733.14	5732.59	5734.46	0.011347	9.21	618.97	165.50	0.84
Main Reach	14231	10yr	2200.00	5725.01	5730.53	5729.82	5731.26	0.009571	6.88	319.74	111.89	0.72
Main Reach	14231	50yr	3850.00	5725.01	5731.89	5731.06	5732.86	0.009075	7.89	488.08	134.67	0.73
Main Reach	14231	100yr	4400.00	5725.01	5732.26	5731.38	5733.29	0.008919	8.16	539.42	142.12	0.74
Main Reach	14231	500yr	5700.00	5725.01	5733.04	5732.09	5734.21	0.008640	8.69	658.30	159.01	0.75
Main Reach	14215	10yr	2200.00	5724.86	5730.37	5729.66	5731.11	0.009552	6.91	318.19	110.41	0.72
Main Reach	14215	50yr	3850.00	5724.86	5731.73	5730.91	5732.72	0.009189	7.96	483.87	132.73	0.73
Main Reach	14215	100yr	4400.00	5724.86	5732.10	5731.22	5733.16	0.009122	8.24	534.13	139.39	0.74
Main Reach	14215	500yr	5700.00	5724.86	5732.87	5731.95	5734.07	0.008946	8.79	648.30	156.94	0.76
Main Reach	14179	10yr	2200.00	5724.51	5730.00	5729.29	5730.77	0.009770	7.01	313.81	107.31	0.72
Main Reach	14179	50yr	3850.00	5724.51	5731.36	5730.57	5732.38	0.009714	8.11	474.97	131.03	0.75
Main Reach	14179	100yr	4400.00	5724.51	5731.73	5730.93	5732.82	0.009689	8.39	524.66	137.49	0.76
Main Reach	14179	500yr	5700.00	5724.51	5732.49	5731.66	5733.74	0.009580	8.96	636.07	153.87	0.78
Main Reach	13950	10yr	2200.00	5723.84	5728.70	5727.54	5729.28	0.004398	6.22	410.92	146.30	0.55
Main Reach	13950	50yr	3850.00	5723.84	5729.93	5728.77	5730.78	0.004929	7.88	612.55	181.68	0.61
Main Reach	13950	100yr	4400.00	5723.84	5730.25	5729.12	5731.20	0.005139	8.35	671.83	192.23	0.62
Main Reach	13950	500yr	5700.00	5723.84	5730.94	5729.88	5732.09	0.005428	9.29	814.50	216.04	0.65
Main Reach	13720.34	10yr	2200.00	5723.55	5727.26	5726.65	5727.97	0.007270	7.36	387.41	162.35	0.69
Main Reach	13720.34	50yr	3850.00	5723.55	5728.53	5727.75	5729.46	0.006771	8.71	626.37	215.38	0.70
Main Reach	13720.34	100yr	4400.00	5723.55	5728.90	5728.13	5729.87	0.006517	8.99	710.39	231.53	0.70
Main Reach	13720.34	500yr	5700.00	5723.55	5729.73	5728.83	5730.75	0.005906	9.44	917.12	267.15	0.68
Main Reach	13575	10yr	2200.00	5721.83	5726.33	5725.52	5726.99	0.006042	6.70	370.91	141.93	0.63
Main Reach	13575	50yr	3850.00	5721.83	5727.52	5726.69	5728.50	0.006389	8.36	558.89	175.39	0.68
Main Reach	13575	100yr	4400.00	5721.83	5727.83	5727.04	5728.91	0.006554	8.83	615.18	184.86	0.69
Main Reach	13575	500yr	5700.00	5721.83	5728.44	5727.75	5729.78	0.007123	9.94	735.29	208.30	0.74
Main Reach	13437.94	10yr	2200.00	5719.89	5725.39	5724.80	5726.16	0.005993	7.04	312.57	116.95	0.76
Main Reach	13437.94	50yr	3850.00	5719.89	5726.52	5726.02	5727.61	0.006560	8.36	460.26	145.54	0.83
Main Reach	13437.94	100yr	4400.00	5719.89	5726.82	5726.36	5728.00	0.006750	8.71	505.27	153.81	0.85
Main Reach	13437.94	500yr	5700.00	5719.89	5727.48	5727.06	5728.83	0.006970	9.30	612.80	171.95	0.87
Main Reach	13342	10yr	2200.00	5719.60	5723.99	5723.99	5725.13	0.021774	8.58	256.36	113.99	1.01
Main Reach	13342	50yr	3850.00	5719.60	5725.12	5725.12	5726.56	0.019808	9.82	400.15	141.42	1.01
Main Reach	13342	100yr	4400.00	5719.60	5725.44	5725.44	5726.95	0.019141	9.83	447.40	149.41	1.00
Main Reach	13342	500yr	5700.00	5719.60	5726.09	5726.09	5727.77	0.018437	10.37	549.56	164.87	1.00
Main Reach	13322	10yr	2200.00	5718.21	5723.26	5723.25	5724.48	0.020493	8.87	248.07	102.75	1.01
Main Reach	13322	50yr	3850.00	5718.21	5724.49	5724.49	5725.97	0.019012	9.76	394.33	134.11	1.00
Main Reach	13322	100yr	4400.00	5718.21	5724.96	5724.81	5726.38	0.016569	9.57	459.55	144.73	0.95
Main Reach	13322	500yr	5700.00	5718.21	5725.62	5725.50	5727.23	0.016359	10.16	561.05	159.84	0.96
Main Reach	13307	10yr	2200.00	5717.16	5723.56	5722.26	5724.12	0.008802	6.01	366.21	118.47	0.60
Main Reach	13307	50yr	3850.00	5717.16	5724.74	5723.68	5725.58	0.008353	7.37	522.69	145.51	0.68
Main Reach	13307	100yr	4400.00	5717.16	5725.17	5724.04	5726.04	0.008056	7.49	587.50	155.09	0.68
Main Reach	13307	500yr	5700.00	5717.16	5725.84	5724.78	5726.88	0.008661	8.19	695.92	169.04	0.71

39+00
36+95
36+15
35+80
33+55
31+25
29+80
27+20
26+85



LEGEND

- EFFECTIVE 100-YEAR FLOODPLAIN
- EFFECTIVE 500-YEAR FLOODPLAIN
- EFFECTIVE FLOODWAY
- CORRECTED EFFECTIVE 100-YEAR FLOODPLAIN
- CORRECTED EFFECTIVE 500-YEAR FLOODPLAIN
- PROPOSED 100-YEAR FLOODPLAIN
- PROPOSED 500-YEAR FLOODPLAIN
- PROPOSED FLOODWAY
- (6020) EXISTING CONTOURS
- 6020 PROPOSED CONTOURS



TOPOGRAPHIC MAPPING IS BASED UPON AERIAL TOPOGRAPHIC MAPPING PROVIDED BY CORE ENGINEERING INC., COLORADO STATE PLANE COORDINATES 1983, AND NATIONAL GEODETIC VERTICAL DATUM OF 1929.

THE TOPOGRAPHY WAS COMPILED IN ACCORDANCE WITH NATIONAL MAPPING STANDARDS FOR 1"=200' & 2' CONTOUR INTERVAL DETAIL.

SITE BENCHMARK: FIMS MONUMENT NO. F204

RICHARD N. WRAY DATED
COLORADO LIC. 19310

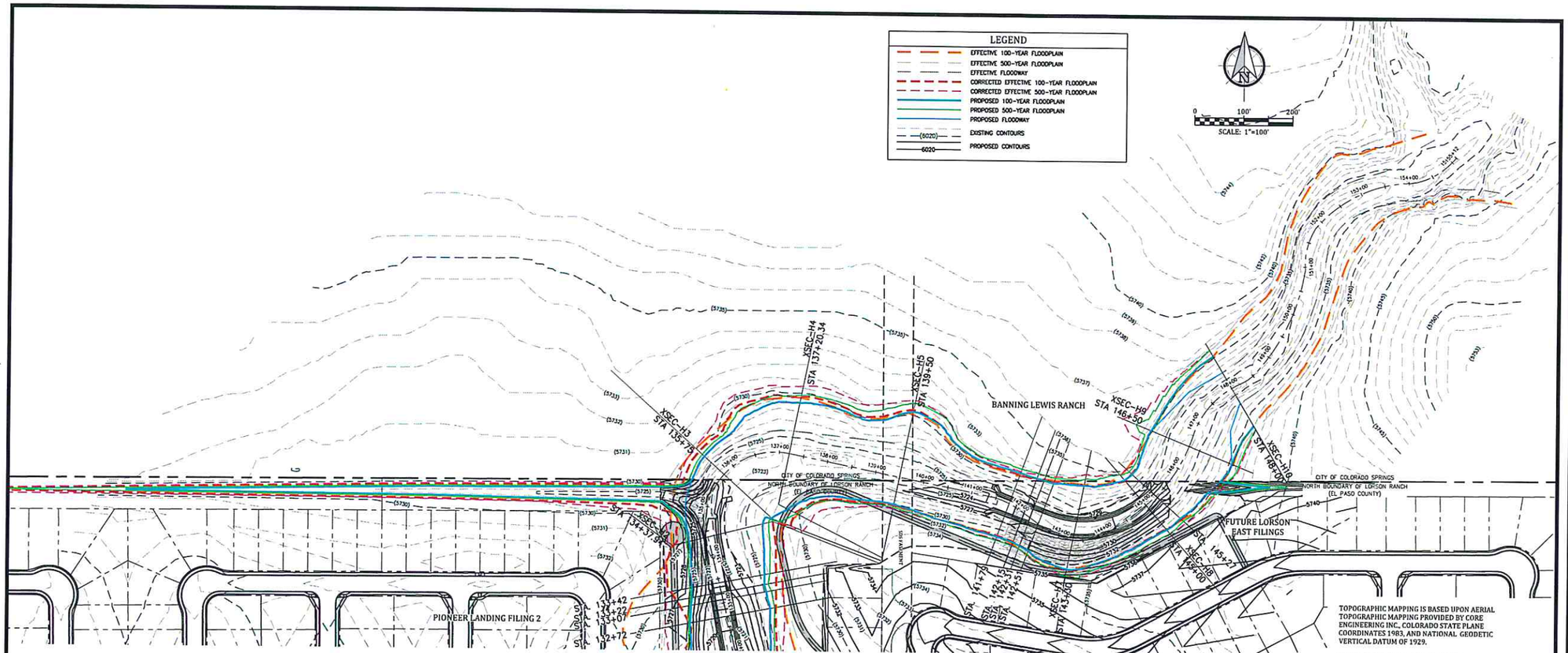
Kiowa Engineering Corporation
Celebrating 30 years
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

EAST TRIBUTARY JIMMY CAMP CREEK CLOMR
LORSON RANCH
PROPOSED CONDITIONS FLOODPLAIN MAP
EL PASO COUNTY, COLORADO

Project No.:	16031
Date:	June 21, 2017
Design:	RNW
Drawn:	ELS
Check:	RNW
Revisions:	

SHEET 3 OF 4 SHEETS

17001 Base+xy/Oct 24, 2017



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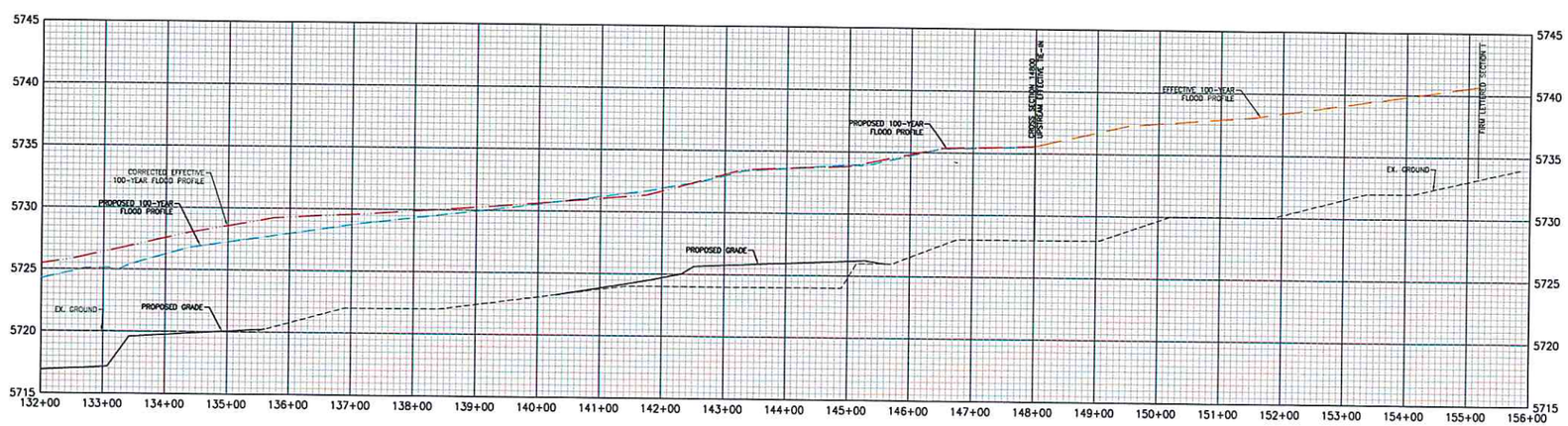

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SHEET 4 OF 4 SHEETS

17001 Base Map/Oct 24, 2017

HEC-RAS Plan: Prop Cond River: East Tributary Reach: Main Reach (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Reach	13272	10yr	2200.00	5717.07	5723.50	5721.93	5723.91	0.003331	5.11	430.12	131.28	0.50
Main Reach	13272	50yr	3850.00	5717.07	5724.68	5723.13	5725.32	0.004149	6.41	600.35	156.75	0.58
Main Reach	13272	100yr	4400.00	5717.07	5725.12	5723.48	5725.79	0.004021	6.56	670.60	165.13	0.57
Main Reach	13272	500yr	5700.00	5717.07	5725.78	5724.19	5726.60	0.004425	7.26	784.66	177.87	0.61
Main Reach	13041	10yr	2400.00	5716.50	5721.14	5721.14	5722.20	0.021307	8.28	290.00	137.15	1.00
Main Reach	13041	50yr	4000.00	5716.50	5722.05	5722.05	5723.45	0.018536	9.50	421.23	150.70	1.00
Main Reach	13041	100yr	4750.00	5716.50	5722.43	5722.43	5723.96	0.017653	9.91	479.25	157.51	1.00
Main Reach	13041	500yr	6000.00	5716.50	5722.99	5722.99	5724.71	0.016649	10.51	570.91	167.85	1.00
Main Reach	13021	10yr	2400.00	5714.43	5719.58	5719.58	5720.87	0.013799	9.11	263.44	105.04	1.01
Main Reach	13021	50yr	4000.00	5714.43	5720.74	5720.74	5722.22	0.012745	9.78	408.84	138.04	1.00
Main Reach	13021	100yr	4750.00	5714.43	5721.14	5721.14	5722.76	0.012681	10.22	464.96	143.68	1.00
Main Reach	13021	500yr	6000.00	5714.43	5721.72	5721.72	5723.56	0.012622	10.87	551.89	152.06	1.01
Main Reach	13006	10yr	2400.00	5712.88	5719.61	5718.13	5720.15	0.004053	5.87	408.92	124.38	0.57
Main Reach	13006	50yr	4000.00	5712.88	5720.95	5719.47	5721.66	0.004215	6.77	591.20	145.68	0.59
Main Reach	13006	100yr	4750.00	5712.88	5721.45	5719.93	5722.24	0.004292	7.13	666.04	152.83	0.60
Main Reach	13006	500yr	6000.00	5712.88	5722.16	5720.58	5723.10	0.004441	7.68	781.34	164.23	0.62
Main Reach	12970	10yr	2400.00	5712.79	5719.51	5718.01	5719.99	0.003707	5.59	429.02	129.47	0.54
Main Reach	12970	50yr	4000.00	5712.79	5720.85	5719.24	5721.50	0.003832	6.46	619.49	151.94	0.56
Main Reach	12970	100yr	4750.00	5712.79	5721.36	5719.67	5722.08	0.003895	6.81	697.97	159.56	0.57
Main Reach	12970	500yr	6000.00	5712.79	5722.09	5720.33	5722.92	0.004025	7.33	818.72	171.62	0.59
Main Reach	12850	10yr	2400.00	5712.50	5719.20	5717.60	5719.57	0.002839	4.90	489.54	152.19	0.48
Main Reach	12850	50yr	4000.00	5712.50	5720.58	5718.66	5721.06	0.002801	5.57	718.71	182.94	0.49
Main Reach	12850	100yr	4750.00	5712.50	5721.10	5719.06	5721.62	0.002805	5.81	817.33	195.22	0.50
Main Reach	12850	500yr	6000.00	5712.50	5721.86	5719.66	5722.45	0.002796	6.18	971.49	211.38	0.51
Main Reach	12700	10yr	2400.00	5712.14	5718.63	5717.13	5719.10	0.003298	5.51	435.88	126.99	0.52
Main Reach	12700	50yr	4000.00	5712.14	5719.88	5718.28	5720.55	0.003779	6.61	605.26	145.09	0.57
Main Reach	12700	100yr	4750.00	5712.14	5720.33	5718.70	5721.11	0.003874	7.06	675.54	166.57	0.58
Main Reach	12700	500yr	6000.00	5712.14	5721.00	5719.36	5721.92	0.003958	7.72	800.50	207.02	0.60
Main Reach	12500	10yr	2400.00	5711.68	5717.63	5716.73	5718.25	0.005420	6.36	377.62	129.03	0.65
Main Reach	12500	50yr	4000.00	5711.68	5718.70	5717.83	5719.60	0.005940	7.59	526.85	147.71	0.71
Main Reach	12500	100yr	4750.00	5711.68	5719.11	5718.25	5720.12	0.006110	8.07	588.73	153.89	0.73
Main Reach	12500	500yr	6000.00	5711.68	5719.67	5718.87	5720.89	0.006579	8.87	676.14	161.95	0.77
Main Reach	12426	10yr	2400.00	5711.50	5716.44	5716.44	5717.57	0.015662	8.50	282.24	446.05	0.99
Main Reach	12426	50yr	4000.00	5711.50	5717.45	5717.45	5718.89	0.014542	9.62	415.99	472.98	0.99
Main Reach	12426	100yr	4750.00	5711.50	5717.85	5717.85	5719.41	0.014174	10.02	473.95	494.48	0.99
Main Reach	12426	500yr	6000.00	5711.50	5718.47	5718.47	5720.17	0.012943	10.50	578.80	554.80	0.96
Main Reach	12406	10yr	2400.00	5709.61	5714.91	5714.91	5716.28	0.014224	9.41	255.11	423.16	0.99
Main Reach	12406	50yr	4000.00	5709.61	5716.20	5716.20	5717.82	0.012968	10.22	391.23	461.92	0.99
Main Reach	12406	100yr	4750.00	5709.61	5716.66	5716.66	5718.41	0.012730	10.60	447.97	472.69	0.99
Main Reach	12406	500yr	6000.00	5709.61	5717.65	5717.33	5719.31	0.010116	10.33	580.92	497.10	0.90
Main Reach	12391	10yr	2400.00	5708.18	5714.70	5713.48	5715.50	0.005769	7.18	334.16	440.49	0.67
Main Reach	12391	50yr	4000.00	5708.18	5716.06	5715.07	5717.15	0.006445	8.39	476.83	475.55	0.73
Main Reach	12391	100yr	4750.00	5708.18	5716.67	5715.63	5717.82	0.006195	8.62	551.01	488.23	0.72
Main Reach	12391	500yr	6000.00	5708.18	5717.96	5716.36	5719.03	0.004754	8.29	724.08	514.73	0.65
Main Reach	12356	10yr	2400.00	5708.09	5714.66	5713.23	5715.27	0.004390	6.28	382.32	481.16	0.57
Main Reach	12356	50yr	4000.00	5708.09	5716.00	5714.53	5716.89	0.004943	7.56	529.33	507.12	0.63
Main Reach	12356	100yr	4750.00	5708.09	5716.61	5715.05	5717.57	0.004838	7.89	601.91	516.87	0.63
Main Reach	12356	500yr	6000.00	5708.09	5717.89	5715.82	5718.84	0.003876	7.84	765.40	536.56	0.58
Main Reach	12200	10yr	2400.00	5707.70	5714.12	5712.73	5714.65	0.003380	5.84	410.63	523.86	0.54
Main Reach	12200	50yr	4000.00	5707.70	5715.40	5713.84	5716.19	0.003791	7.15	559.11	542.90	0.59
Main Reach	12200	100yr	4750.00	5707.70	5716.03	5714.29	5716.89	0.003643	7.45	637.97	552.35	0.58
Main Reach	12200	500yr	6000.00	5707.70	5717.46	5715.00	5718.26	0.003045	7.17	837.40	589.38	0.54
Main Reach	12050	10yr	2400.00	5707.32	5713.40	5712.43	5714.04	0.004747	6.44	372.67	544.62	0.62
Main Reach	12050	50yr	4000.00	5707.32	5714.54	5713.49	5715.51	0.005310	7.89	506.87	561.93	0.68
Main Reach	12050	100yr	4750.00	5707.32	5715.33	5713.97	5716.28	0.004419	7.82	607.42	574.06	0.64
Main Reach	12050	500yr	6000.00	5707.32	5717.07	5714.65	5717.84	0.002493	7.06	877.71	655.24	0.50
Main Reach	11976.79	10yr	2400.00	5707.13	5712.75	5712.27	5713.59	0.007589	7.36	326.09	597.15	0.77
Main Reach	11976.79	50yr	4000.00	5707.13	5713.77	5713.33	5715.00	0.008178	8.92	448.33	660.65	0.83
Main Reach	11976.79	100yr	4750.00	5707.13	5715.01	5713.76	5715.95	0.004645	7.75	612.57	722.02	0.65
Main Reach	11976.79	500yr	6000.00	5707.13	5717.29	5714.42	5717.58	0.001098	4.80	1565.82	920.75	0.33
Main Reach	11923	10yr	2400.00	5706.99	5711.81	5711.81	5712.91	0.022077	8.42	285.11	770.48	0.99
Main Reach	11923	50yr	4000.00	5706.99	5713.45	5712.76	5714.42	0.010740	7.89	506.94	812.06	0.74
Main Reach	11923	100yr	4750.00	5706.99	5714.95	5713.15	5715.80	0.005033	6.49	732.28	847.67	0.53
Main Reach	11923	500yr	6000.00	5706.99	5717.42	5713.75	5717.49	0.000213	1.73	2975.57	983.52	0.12

24+20

23+85

22+55

21+05

19+05

18+35

18+00

17+60

16+05

14+55

13+30

HEC-RAS Plan: Prop Cond River: East Tributary Reach: Main Reach (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main Reach	11903	10yr	2400.00	5704.82	5710.43	5710.04	5711.41	0.016427	7.96	301.39	748.81	0.87
Main Reach	11903	50yr	4000.00	5704.82	5713.71	5711.25	5714.18	0.003202	5.35	747.97	834.18	0.43
Main Reach	11903	100yr	4750.00	5704.82	5715.08	5711.66	5715.48	0.002143	4.92	985.68	866.91	0.36
Main Reach	11903	500yr	6000.00	5704.82	5717.43	5712.29	5717.48	0.000153	1.61	3303.05	991.82	0.10
Main Reach	11888	10yr	2400.00	5703.20	5710.78	5708.52	5711.13	0.003305	4.75	505.20	766.95	0.42
Main Reach	11888	50yr	4000.00	5703.20	5713.79	5709.70	5714.08	0.001605	4.31	928.89	840.26	0.31
Main Reach	11888	100yr	4750.00	5703.20	5715.14	5710.26	5715.40	0.001247	4.14	1147.26	872.67	0.28
Main Reach	11888	500yr	6000.00	5703.20	5717.43	5710.92	5717.48	0.000127	1.56	3498.57	994.53	0.09
Main Reach	11856	10yr	2400.00	5703.12	5710.73	5708.23	5711.02	0.002465	4.30	558.52	760.97	0.37
Main Reach	11856	50yr	4000.00	5703.12	5713.77	5709.35	5714.02	0.001306	4.00	999.67	839.56	0.28
Main Reach	11856	100yr	4750.00	5703.12	5715.12	5709.74	5715.35	0.001053	3.87	1226.42	874.40	0.26
Main Reach	11856	500yr	6000.00	5703.12	5717.43	5710.46	5717.47	0.000120	1.53	3598.54	1034.46	0.09
Main Reach	11750	10yr	2400.00	5702.87	5710.71	5706.24	5710.83	0.000787	2.79	861.41	622.48	0.21
Main Reach	11750	50yr	4000.00	5702.87	5713.78	5707.27	5713.90	0.000531	2.82	1421.29	791.32	0.19
Main Reach	11750	100yr	4750.00	5702.87	5715.23	5707.77	5715.27	0.000121	1.49	3111.42	856.78	0.09
Main Reach	11750	500yr	6000.00	5702.87	5717.45	5708.46	5717.46	0.000026	0.80	7472.73	1001.52	0.04
Main Reach	11688	10yr	2400.00	5702.72	5710.24	5707.47	5710.71	0.003177	5.51	435.25	83.27	0.43
Main Reach	11688	50yr	4000.00	5702.72	5713.33	5708.97	5713.80	0.002164	5.54	722.34	142.49	0.37
Main Reach	11688	100yr	4750.00	5702.72	5714.76	5709.60	5715.21	0.002050	5.38	883.32	210.90	0.36
Main Reach	11688	500yr	6000.00	5702.72	5717.04	5710.52	5717.42	0.001494	4.92	1234.33	432.44	0.31
Main Reach	11668	10yr	2400.00	5702.65	5709.58	5707.38	5710.50	0.004497	7.69	312.11	70.49	0.53
Main Reach	11668	50yr	4000.00	5702.65	5712.21	5709.11	5713.50	0.004028	9.13	438.30	71.83	0.53
Main Reach	11668	100yr	4750.00	5702.65	5713.45	5709.83	5714.66	0.003717	9.54	497.76	72.29	0.52
Main Reach	11668	500yr	6000.00	5702.65	5715.41	5710.93	5717.01	0.003324	10.13	592.19	153.99	0.51
Main Reach	11595		Bridge									
						FOUNTAINE BLVD						
Main Reach	11523	10yr	2400.00	5702.35	5707.34	5706.88	5709.09	0.013127	10.61	226.22	68.09	0.86
Main Reach	11523	50yr	4000.00	5702.35	5708.67	5706.61	5711.62	0.015928	13.79	290.04	68.87	0.99
Main Reach	11523	100yr	4750.00	5702.35	5709.34	5709.33	5712.71	0.015811	14.74	322.24	69.27	1.00
Main Reach	11523	500yr	6000.00	5702.35	5710.47	5710.47	5714.41	0.015005	15.93	376.59	69.94	1.00
Main Reach	11503	10yr	2400.00	5702.28	5707.53	5706.43	5708.47	0.008549	7.79	308.06	73.90	0.67
Main Reach	11503	50yr	4000.00	5702.28	5709.30	5707.87	5710.55	0.008062	8.95	447.02	82.91	0.68
Main Reach	11503	100yr	4750.00	5702.28	5710.16	5708.46	5711.46	0.007385	9.13	520.15	87.42	0.66
Main Reach	11503	500yr	6000.00	5702.28	5710.97	5709.37	5712.56	0.008103	10.12	592.83	91.36	0.70
Main Reach	11471.55	10yr	2600.00	5702.19	5706.53	5706.23	5707.96	0.015821	9.61	270.41	75.38	0.89
Main Reach	11471.55	50yr	4300.00	5702.19	5707.68	5707.68	5709.88	0.018562	11.90	361.43	82.25	1.00
Main Reach	11471.55	100yr	5200.00	5702.19	5708.32	5708.32	5710.75	0.018245	12.52	415.32	86.31	1.01
Main Reach	11471.55	500yr	6450.00	5702.19	5709.13	5709.13	5711.85	0.017620	13.24	487.18	90.49	1.01
Main Reach	11395	10yr	2600.00	5702.00	5705.69	5705.29	5706.69	0.014053	8.01	324.46	110.15	0.82
Main Reach	11395	50yr	4300.00	5702.00	5707.12	5706.40	5708.32	0.011044	8.77	490.30	121.00	0.77
Main Reach	11395	100yr	5200.00	5702.00	5707.80	5706.90	5709.07	0.010193	9.07	573.17	126.45	0.75
Main Reach	11395	500yr	6450.00	5702.00	5708.84	5707.54	5710.12	0.008598	9.07	710.93	137.97	0.70
Main Reach	11355.87	10yr	2600.00	5700.80	5705.82	5704.32	5706.37	0.002358	5.95	436.76	116.13	0.54
Main Reach	11355.87	50yr	4300.00	5700.80	5707.25	5705.49	5708.01	0.002460	7.00	614.13	131.66	0.57
Main Reach	11355.87	100yr	5200.00	5700.80	5707.93	5706.04	5708.77	0.002442	7.37	706.02	139.38	0.58
Main Reach	11355.87	500yr	6450.00	5700.80	5708.96	5706.71	5709.84	0.002209	7.53	856.47	151.28	0.56
Main Reach	11125	10yr	2600.00	5700.60	5704.74	5704.08	5705.59	0.004704	7.40	351.34	113.28	0.74
Main Reach	11125	50yr	4300.00	5700.60	5706.38	5705.23	5707.32	0.003520	7.78	552.73	132.85	0.67
Main Reach	11125	100yr	5200.00	5700.60	5707.16	5705.73	5708.12	0.003136	7.88	659.70	142.35	0.65
Main Reach	11125	500yr	6450.00	5700.60	5708.41	5706.39	5709.31	0.002429	7.60	848.27	160.00	0.58
Main Reach	10890.13	10yr	2600.00	5698.80	5704.06	5702.85	5704.70	0.002744	6.39	407.20	114.34	0.60
Main Reach	10890.13	50yr	4300.00	5698.80	5705.91	5704.03	5706.61	0.002146	6.73	639.17	137.15	0.55
Main Reach	10890.13	100yr	5200.00	5698.80	5706.74	5704.58	5707.47	0.001972	6.86	757.91	147.44	0.53
Main Reach	10890.13	500yr	6450.00	5698.80	5708.11	5705.27	5708.79	0.001558	6.65	970.43	164.47	0.48
Main Reach	10600	10yr	2600.00	5698.40	5703.25	5702.06	5703.87	0.002932	6.31	411.73	176.61	0.60
Main Reach	10600	50yr	4300.00	5698.40	5705.41	5703.24	5706.00	0.001862	6.18	696.06	222.57	0.50
Main Reach	10600	100yr	5200.00	5698.40	5706.30	5703.77	5706.91	0.001675	6.25	831.51	243.12	0.48
Main Reach	10600	500yr	6450.00	5698.40	5708.11	5704.42	5708.38	0.000682	4.46	1717.32	303.29	0.31
Main Reach	10500	10yr	2600.00	5697.97	5703.05	5701.51	5703.59	0.002279	5.90	440.80	194.92	0.54
Main Reach	10500	50yr	4300.00	5697.97	5705.28	5702.73	5705.81	0.001539	5.87	732.82	240.71	0.46
Main Reach	10500	100yr	5200.00	5697.97	5706.18	5703.28	5706.74	0.001419	5.98	869.44	261.56	0.45
Main Reach	10500	500yr	6450.00	5697.97	5708.11	5703.96	5708.30	0.000473	3.84	2009.95	322.67	0.26
Main Reach	10350	10yr	2600.00	5697.80	5702.62	5701.34	5703.21	0.002697	6.17	421.09	193.79	0.58
Main Reach	10350	50yr	4300.00	5697.80	5705.07	5702.52	5705.58	0.001496	5.75	748.43	244.07	0.45
Main Reach	10350	100yr	5200.00	5697.80	5706.00	5703.04	5706.52	0.001354	5.83	892.69	263.16	0.44

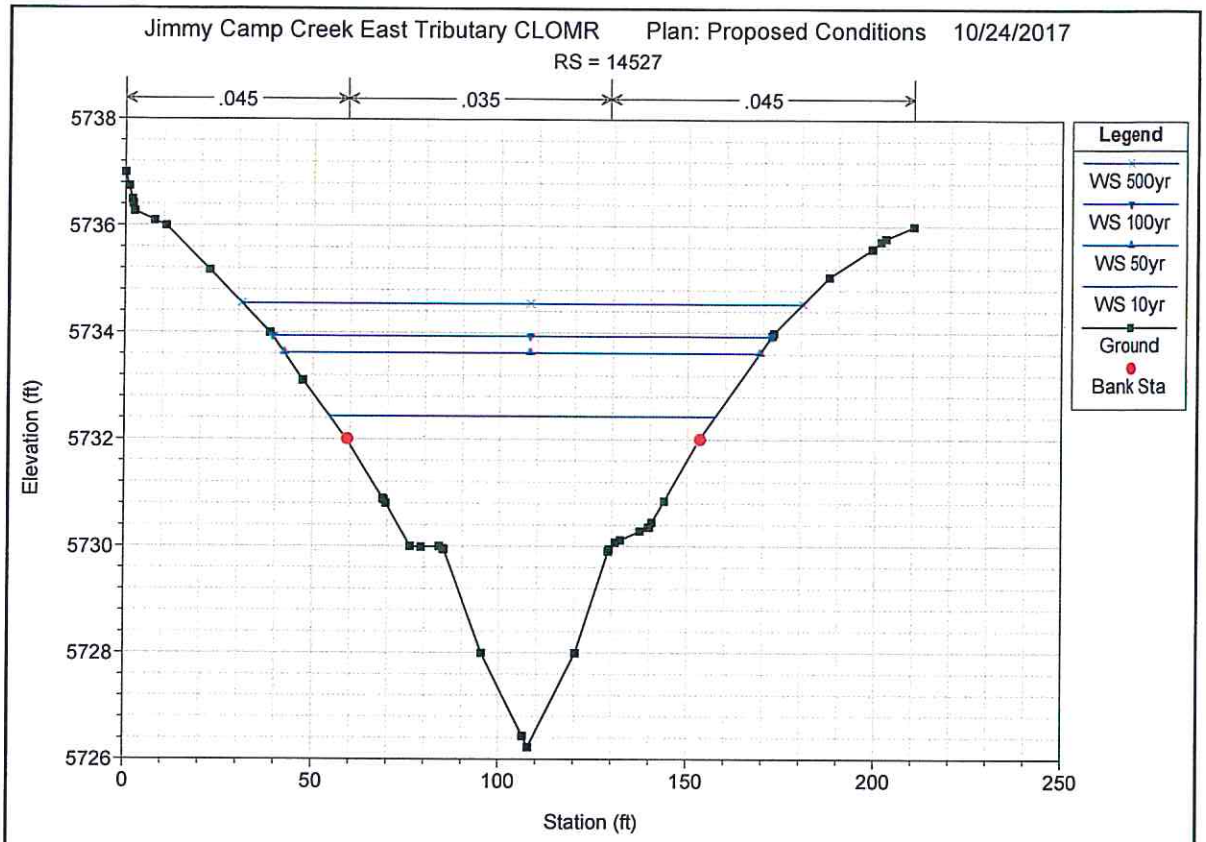
12+95

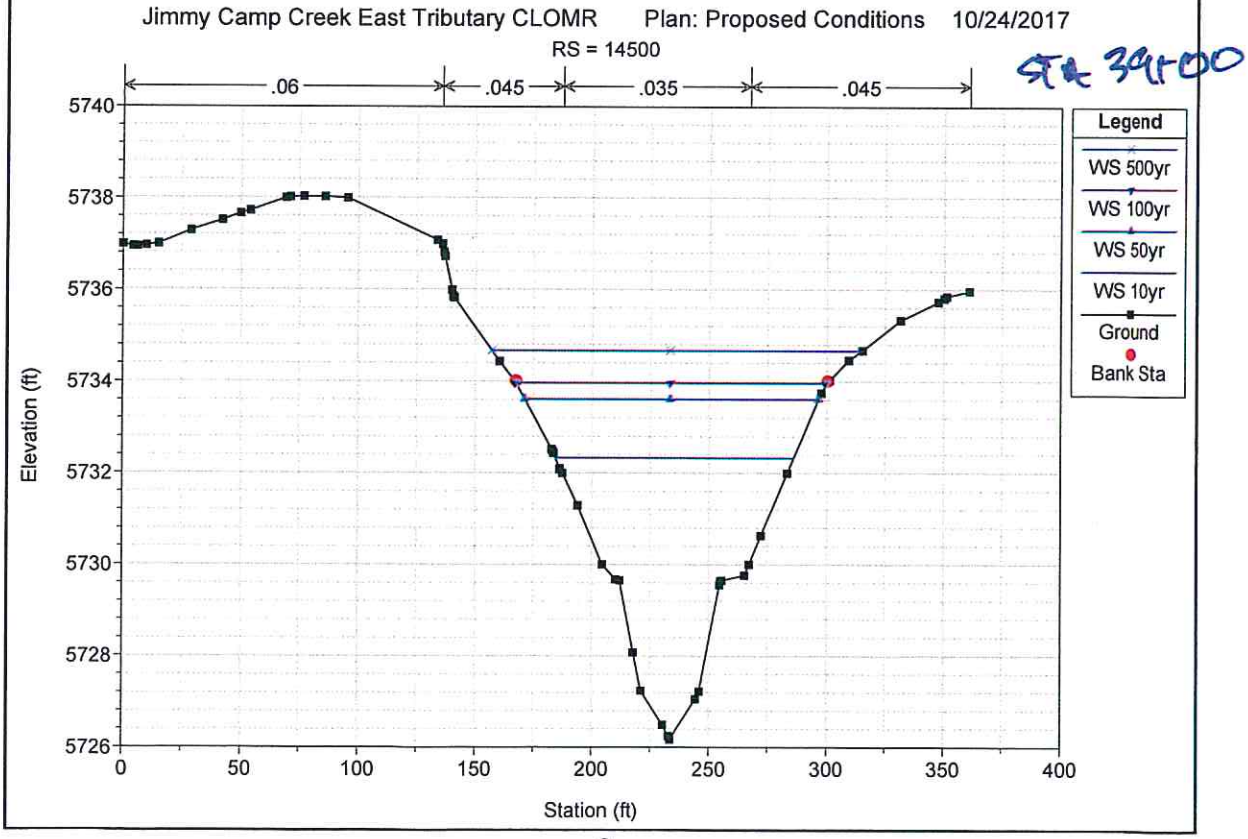
11+55

10+73

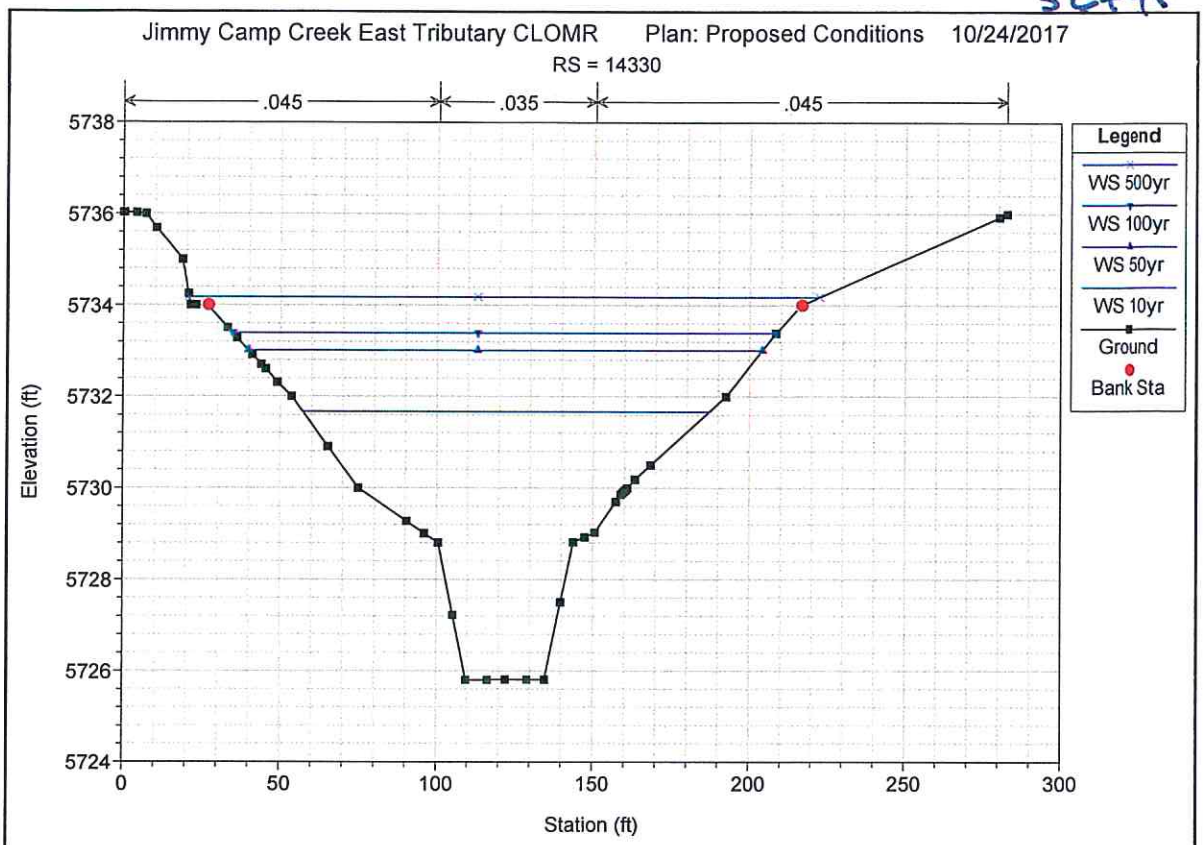
9+28

DS LIMIT

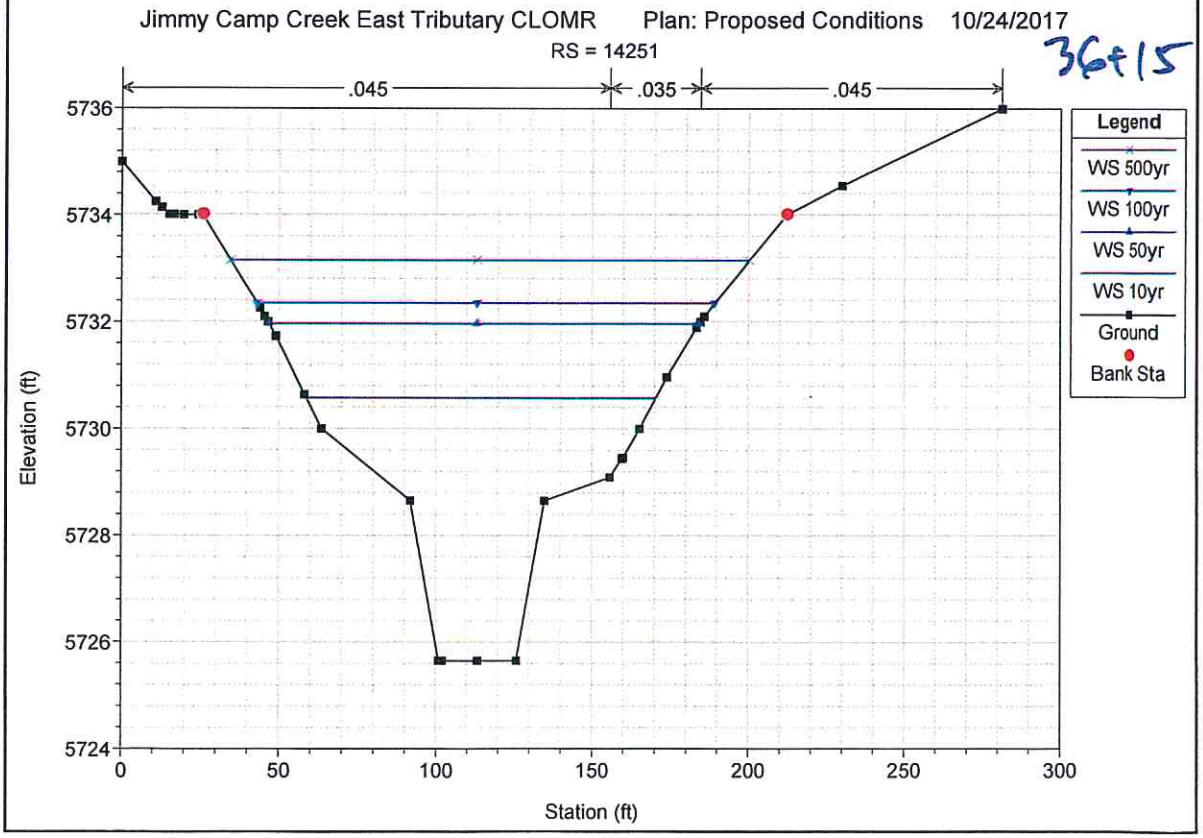

Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 14527
.045
.035
.045
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

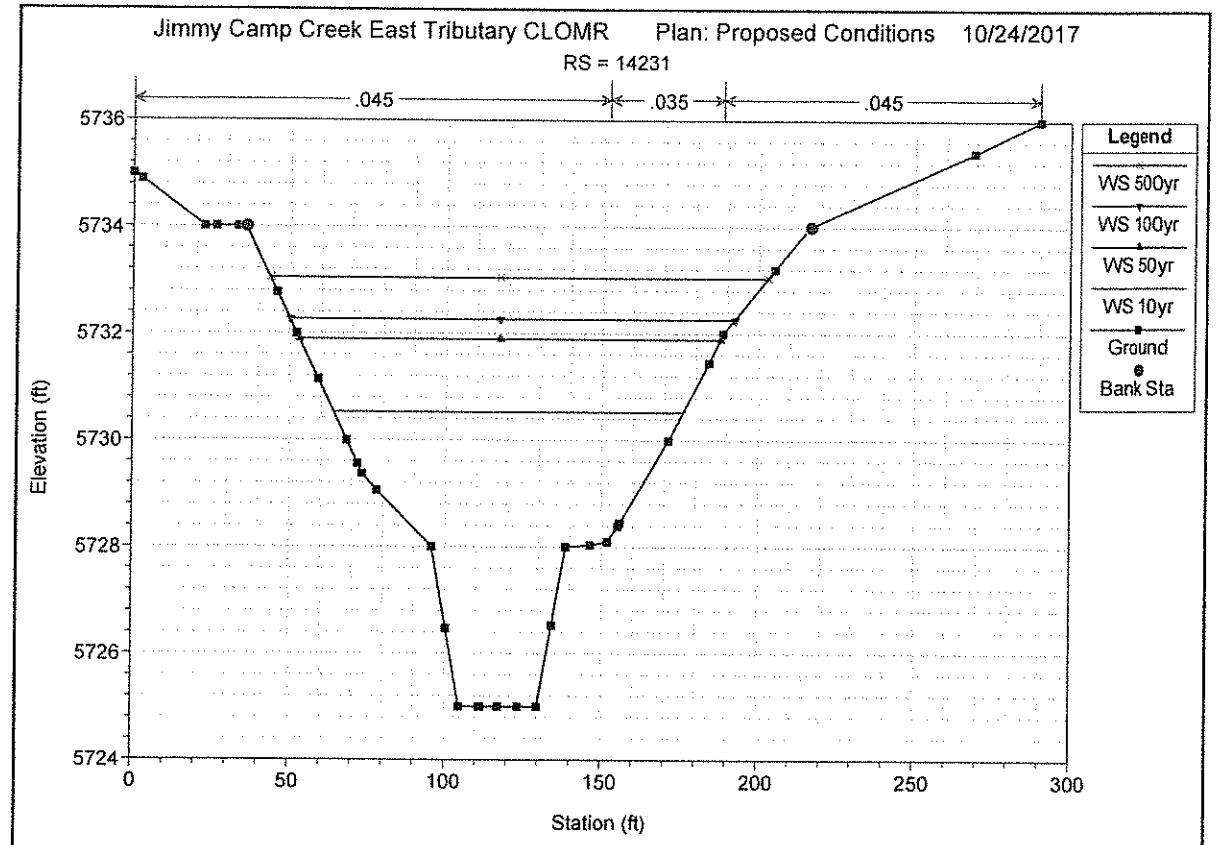

Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 14500
.06
.045
.035
.045
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

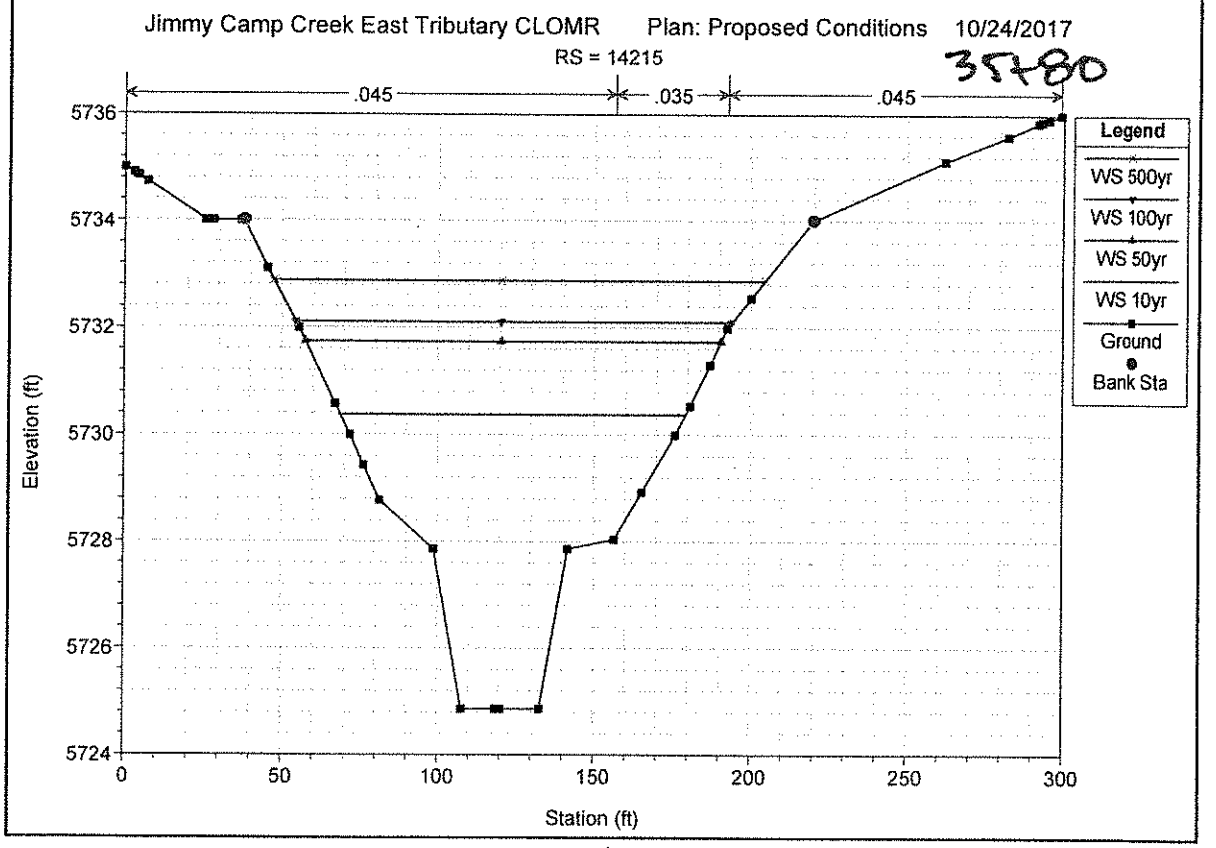
36+95

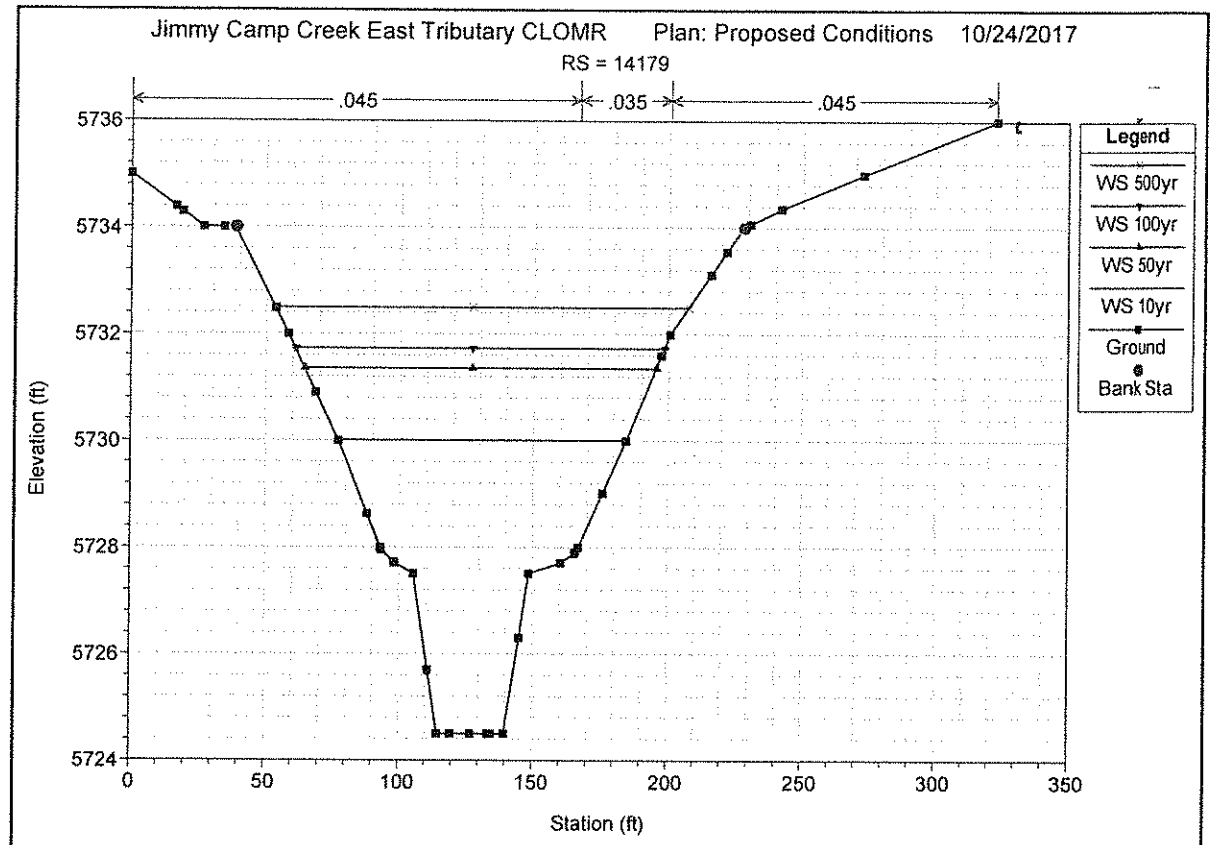

Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 14330
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta

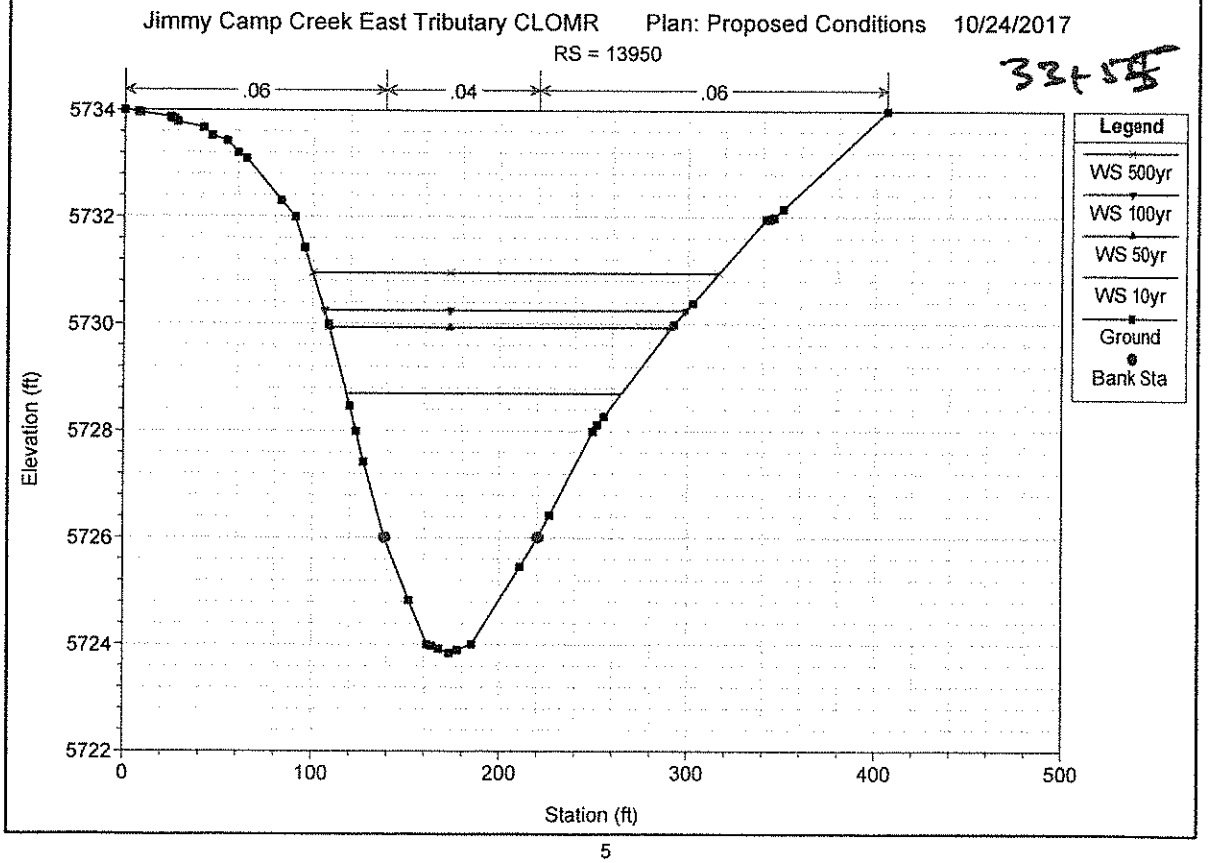
36+15

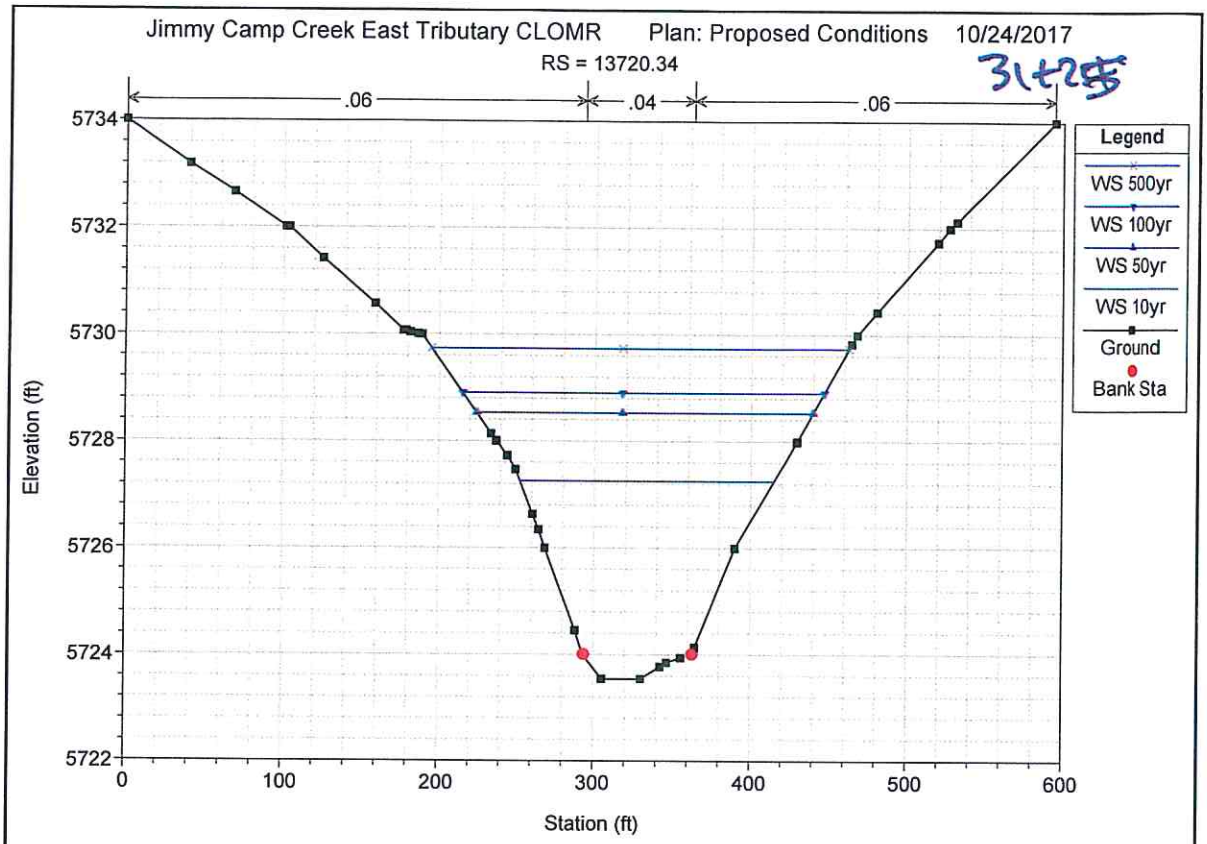

Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 14251
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta

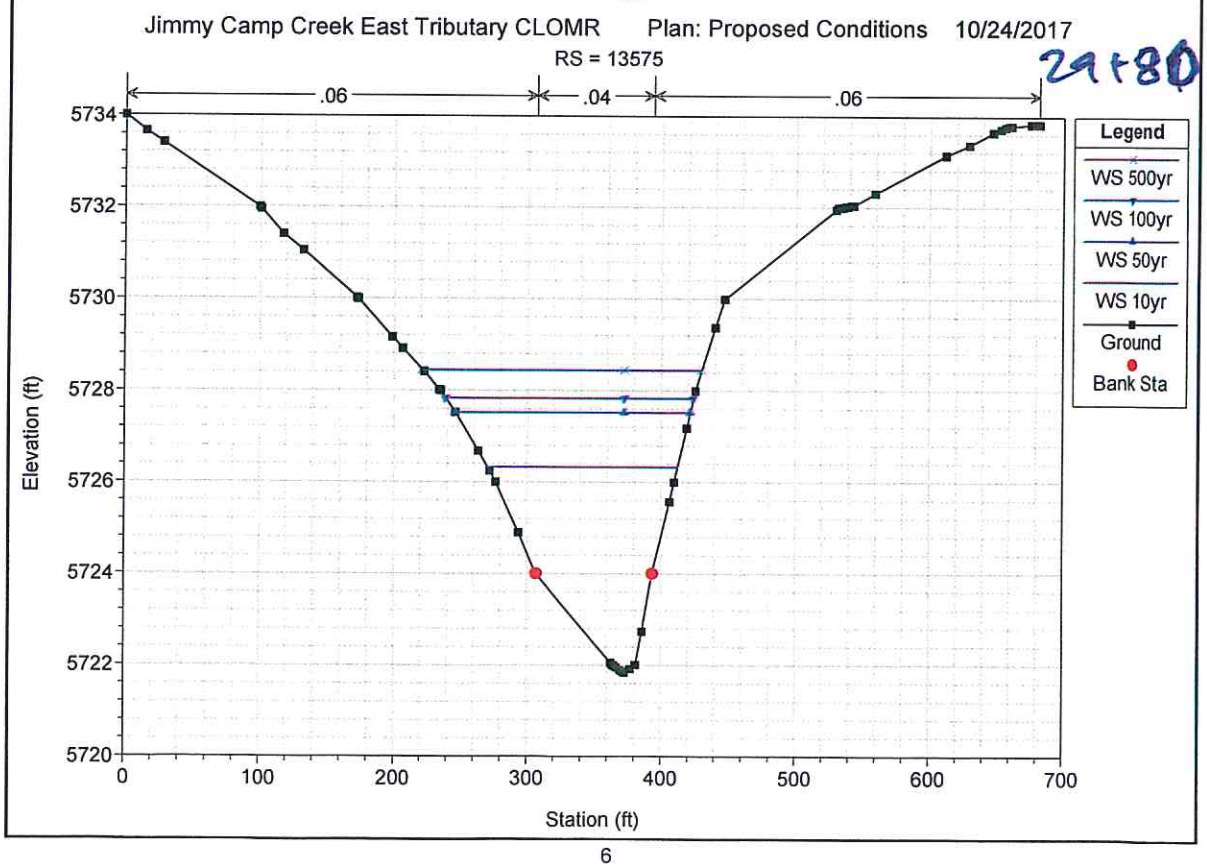

Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 14231
.045
.035
.045
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

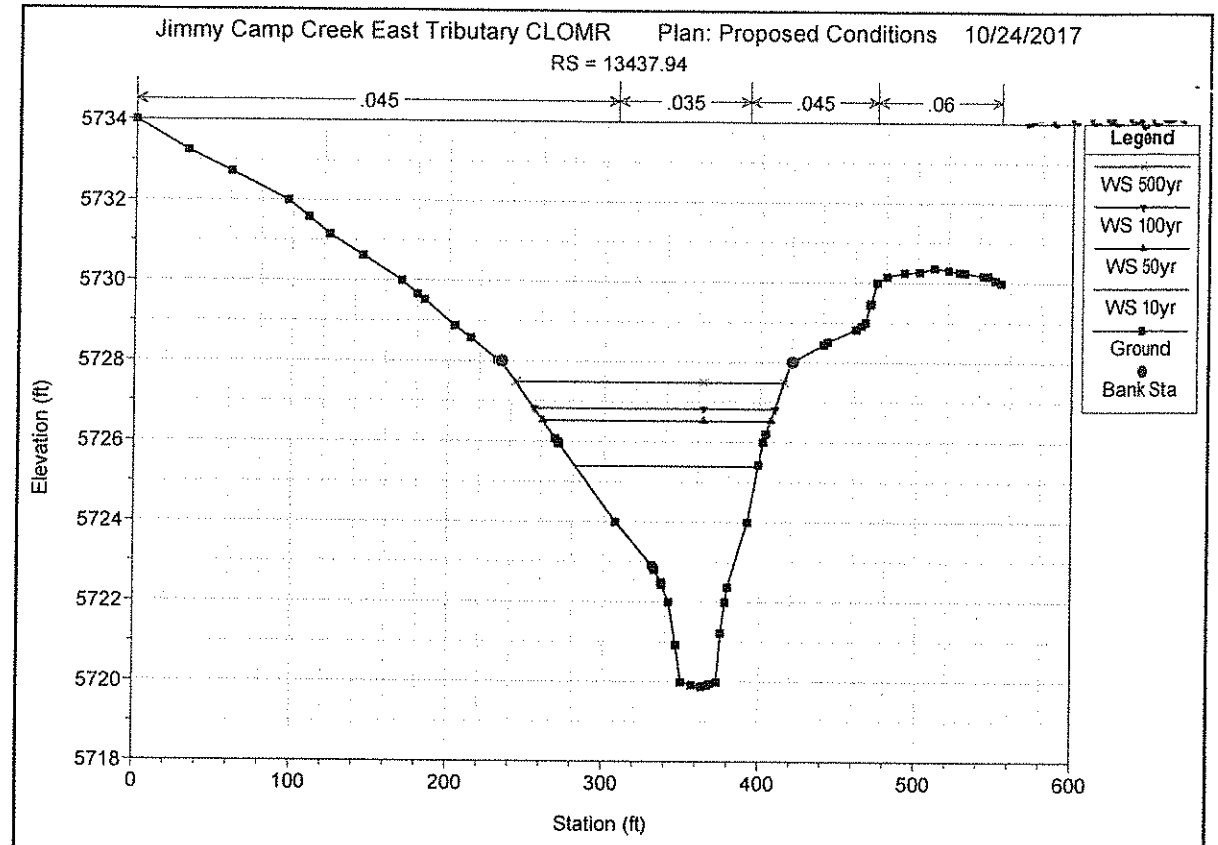

Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 14215
35+80
.045
.035
.045
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

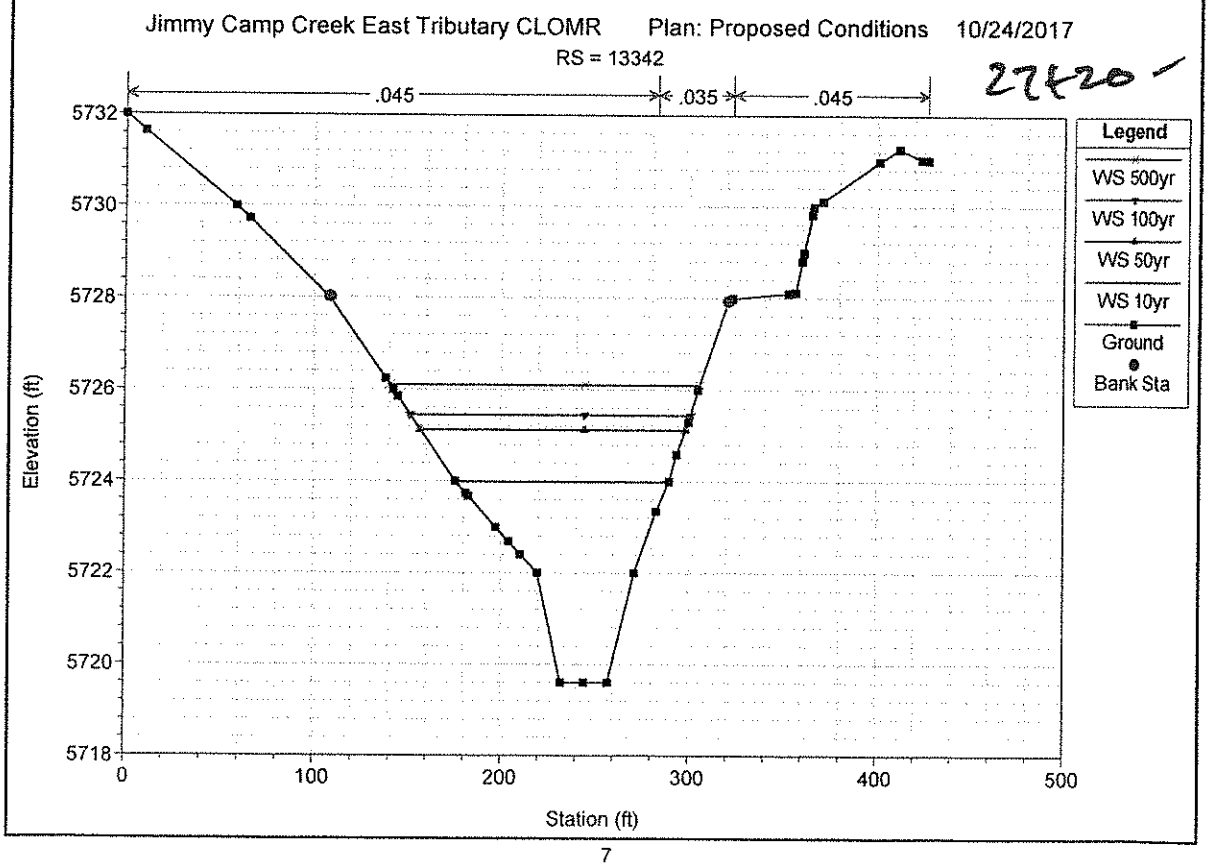

Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 14179
.045
.035
.045
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 13950
.06
.04
.06
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR
Plan: Proposed Conditions
10/24/2017
RS = 13720.34
31+25
.06
.04
.06
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR
Plan: Proposed Conditions
10/24/2017
RS = 13575
29+80
.06
.04
.06
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

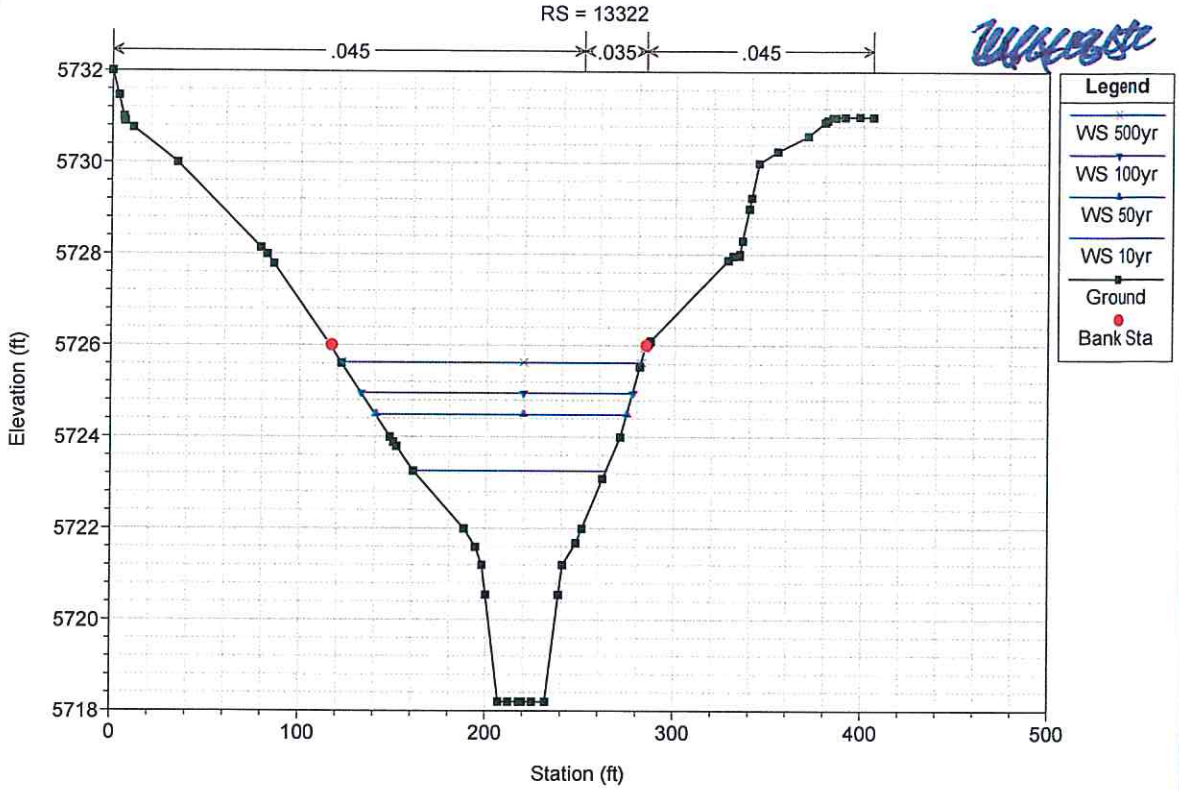

Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 13437.94
.045
.035
.045
.06
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 13342
.045
.035
.045
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

27+20

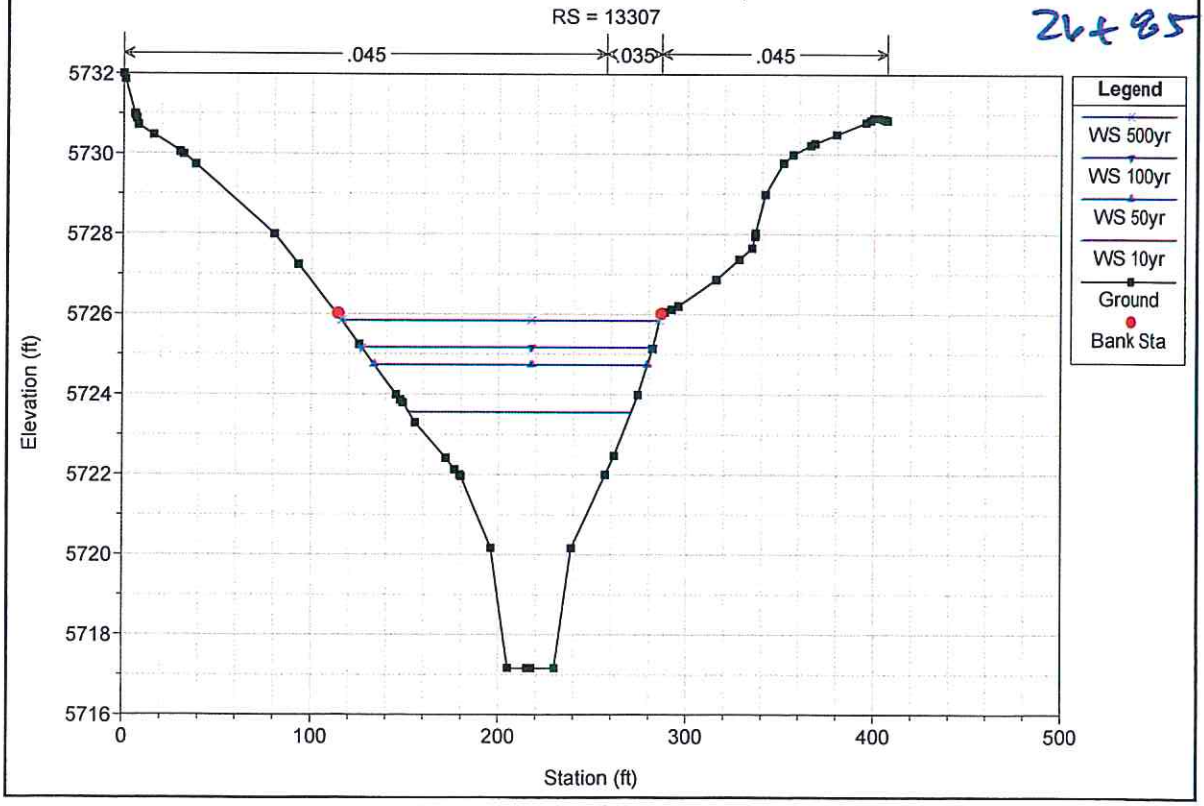
Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017

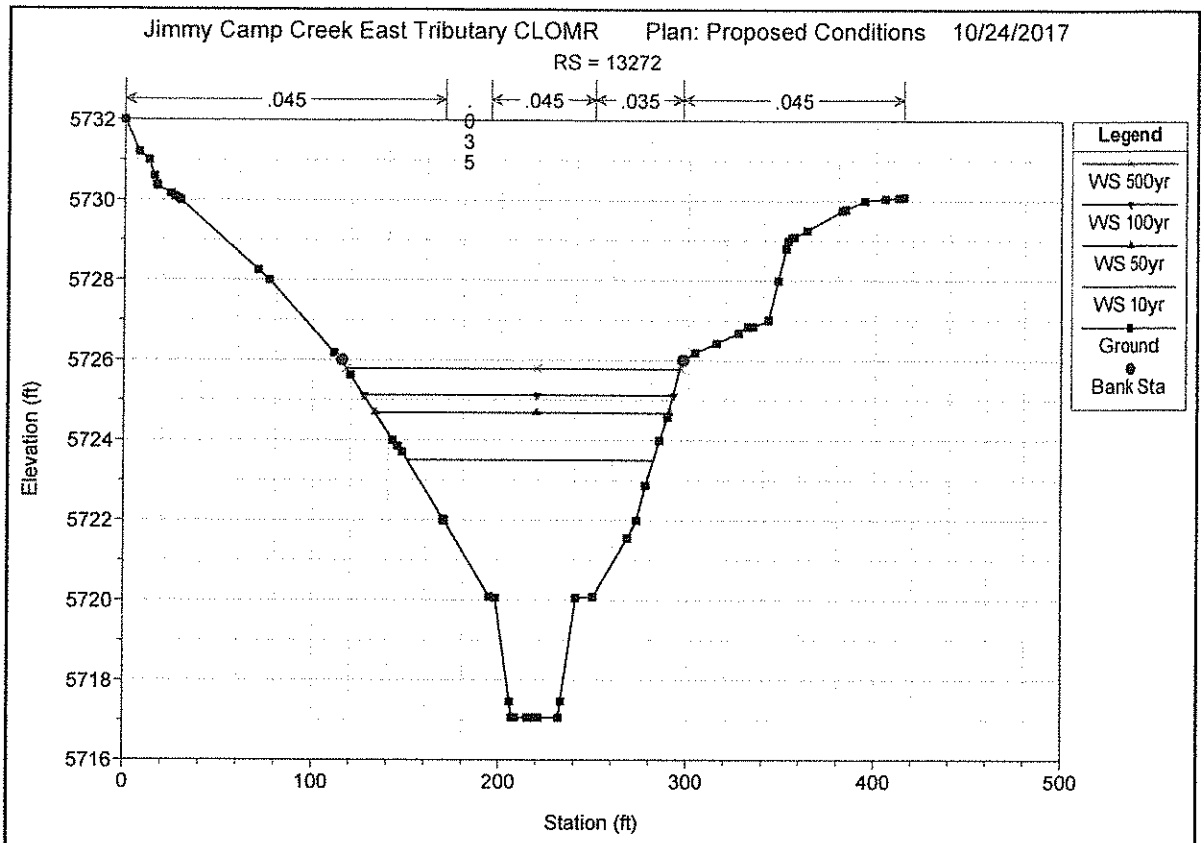
RS = 13322

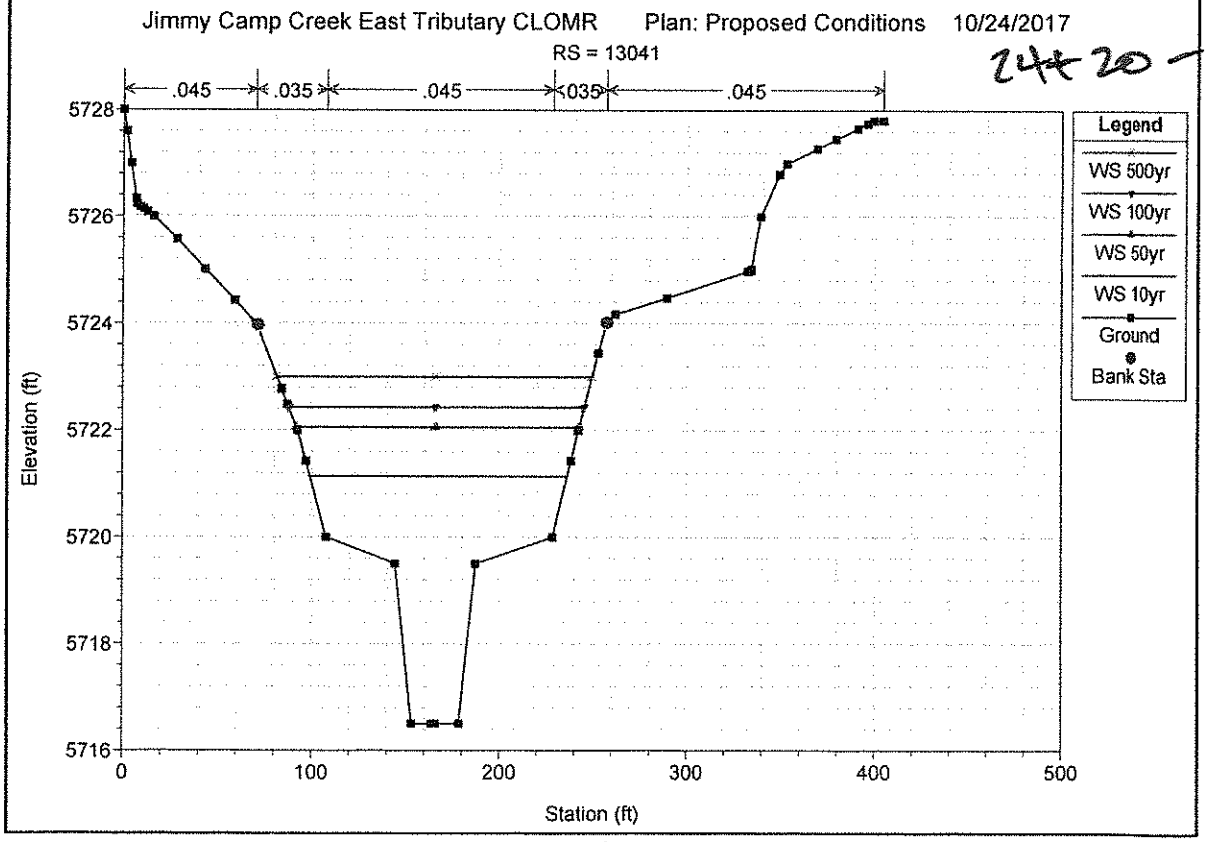


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017

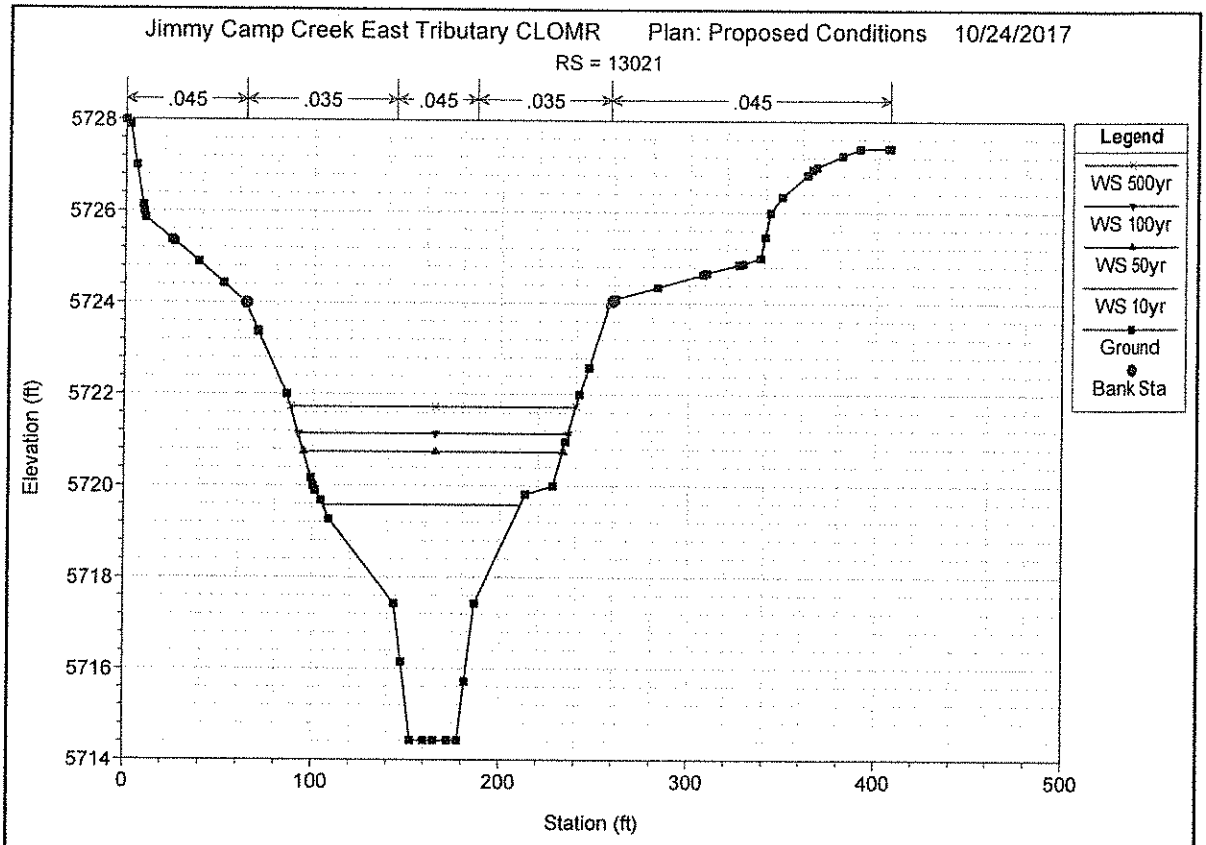
RS = 13307

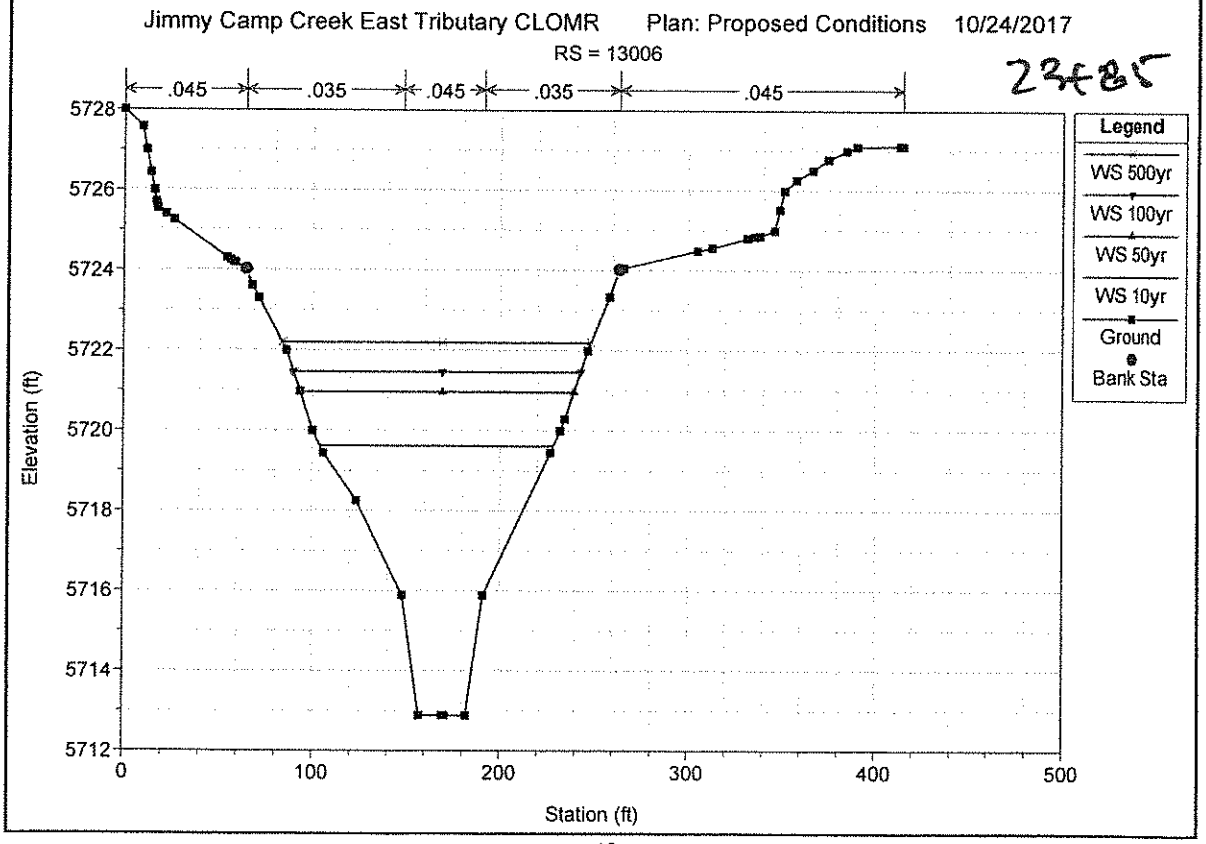



Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 13272
.045
.035
.045
.035
.045
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

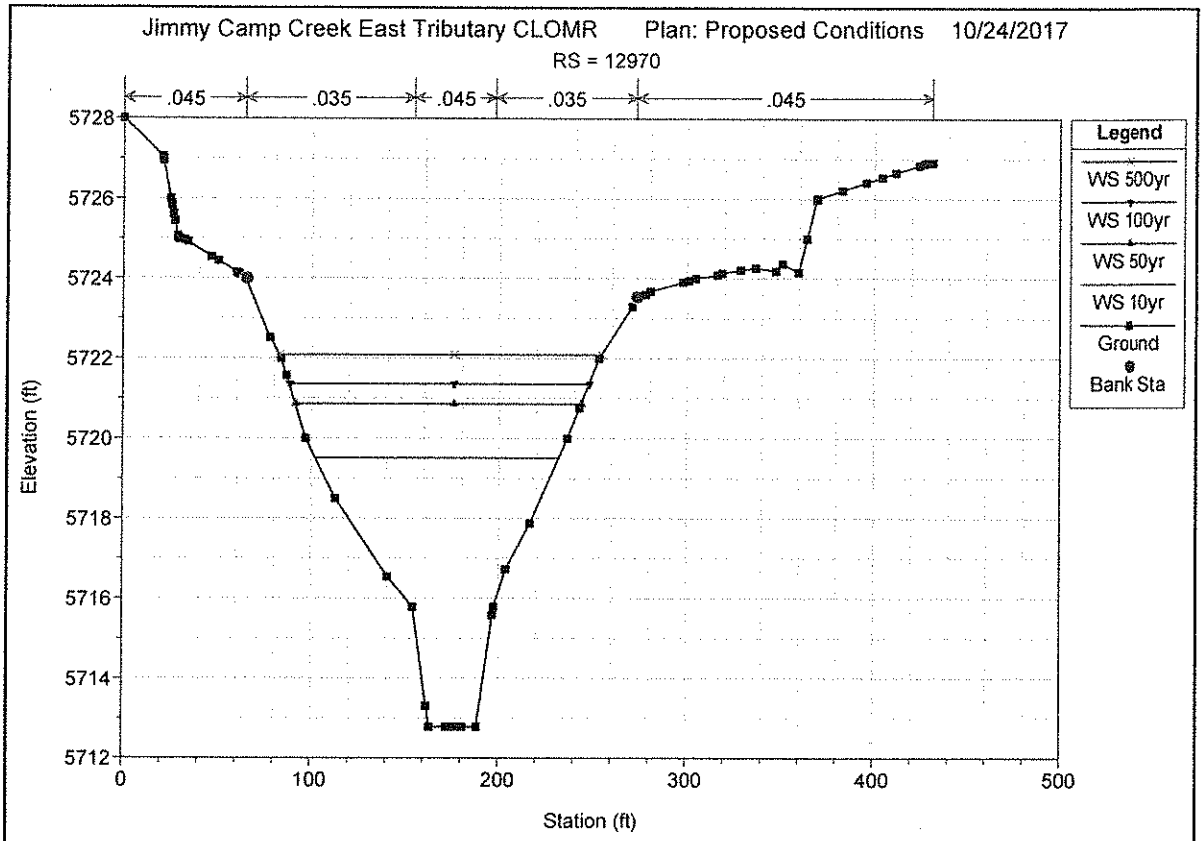

Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 13041
.045
.035
.045
.035
.045
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

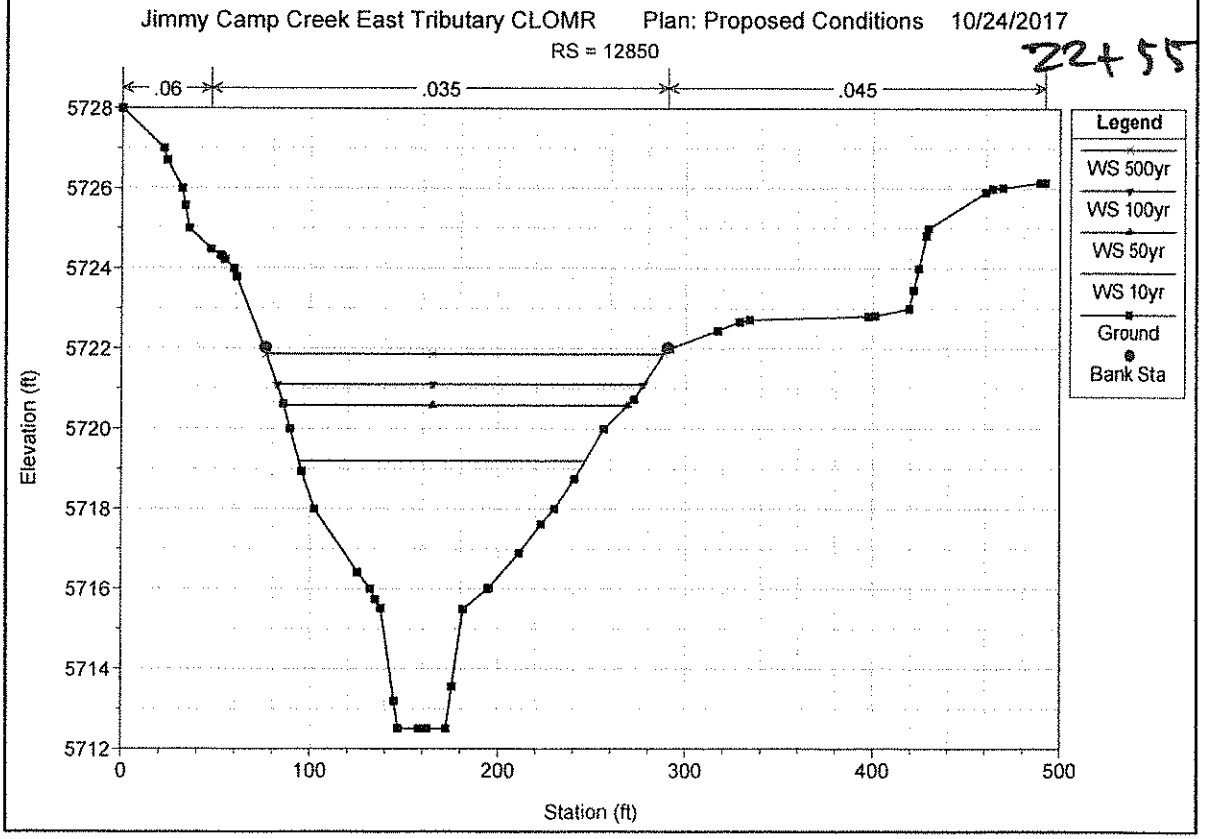
24+20

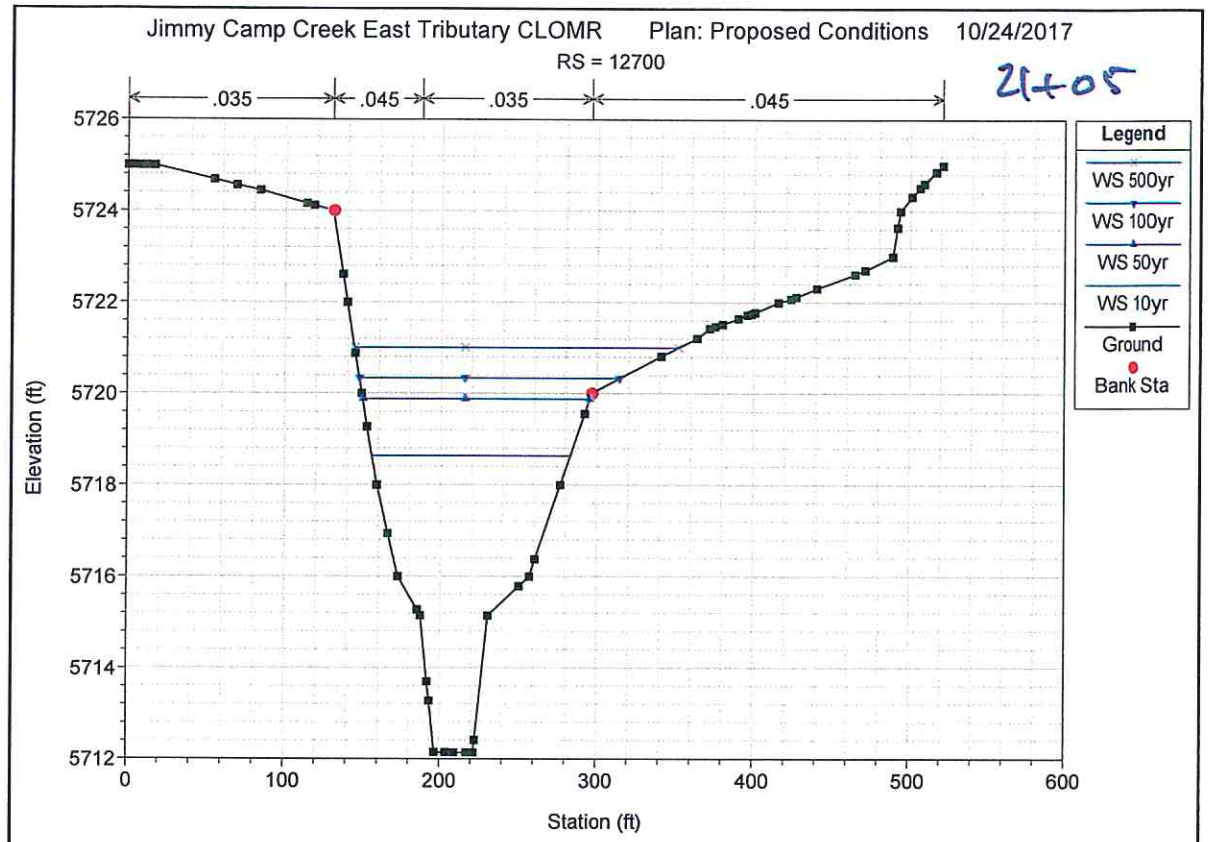

Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 13021
.045
.035
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta

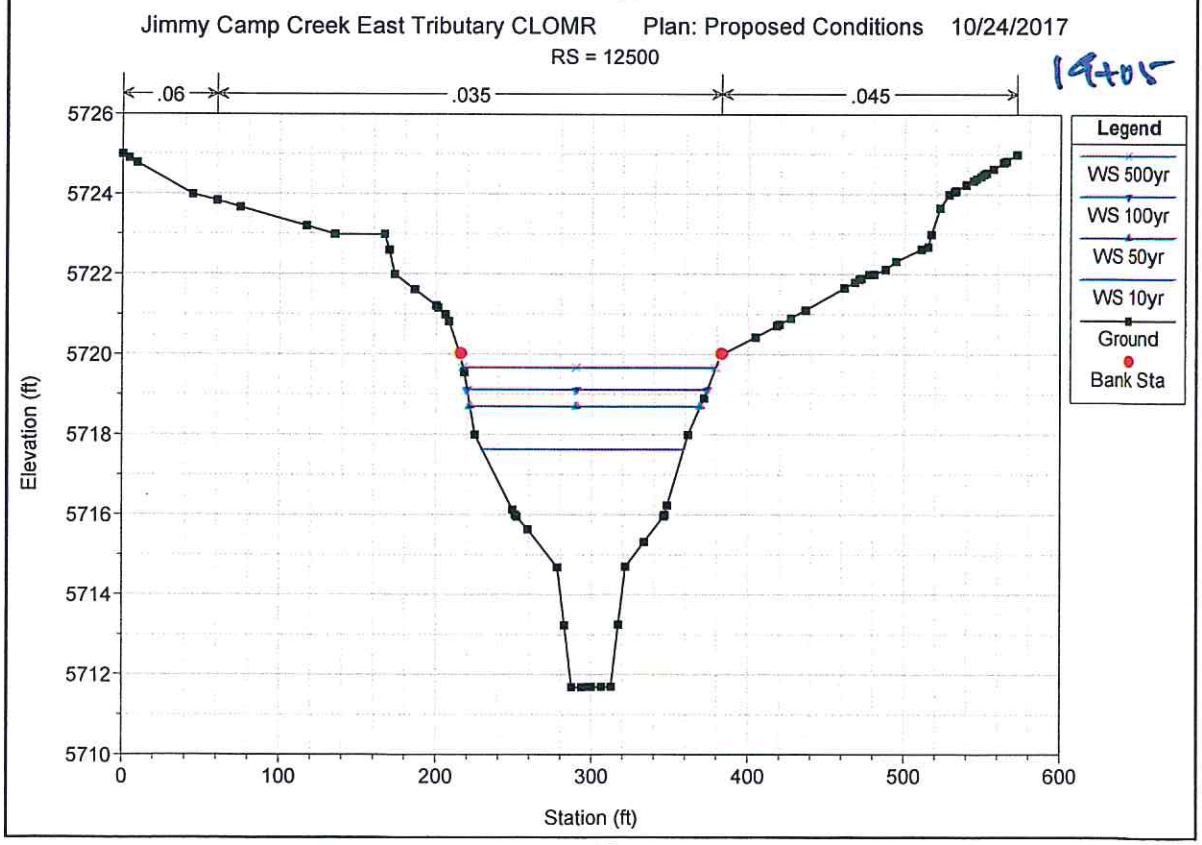

Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 13006
.045
.035
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta

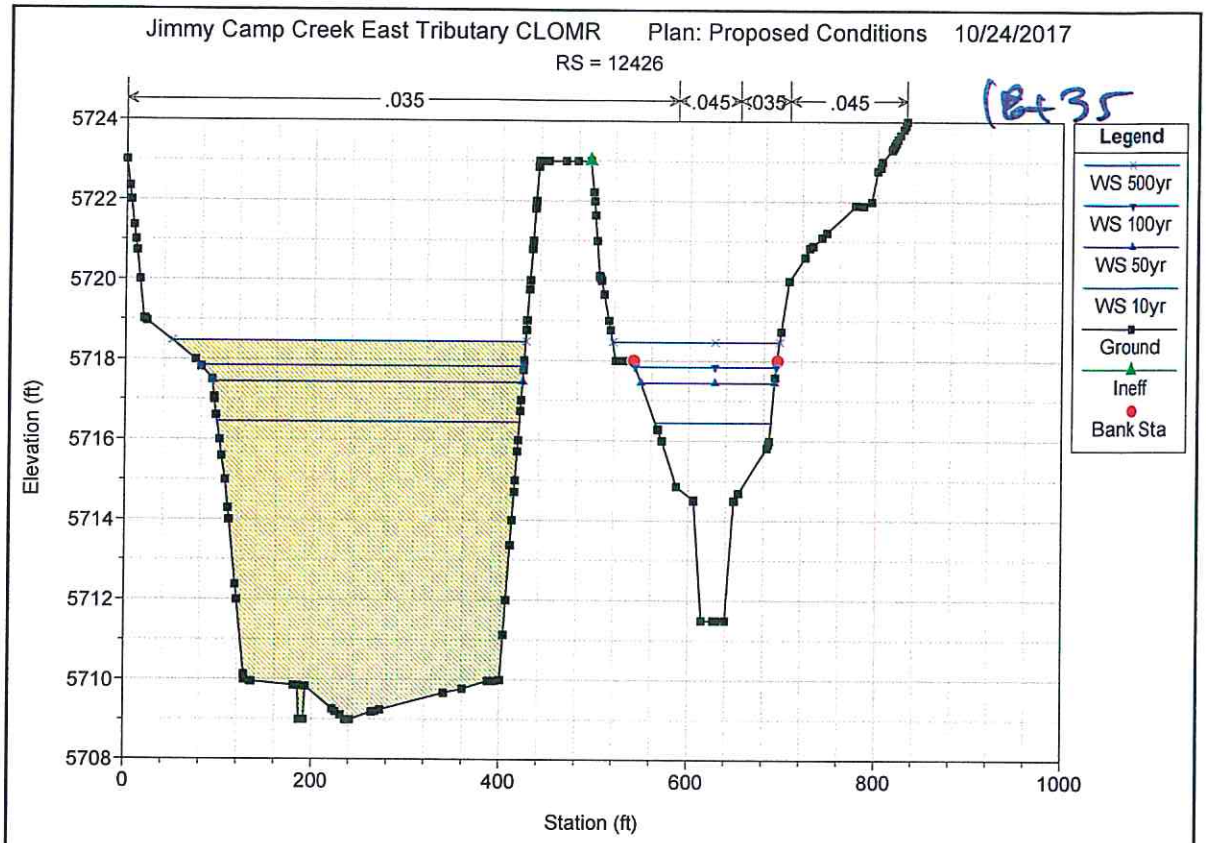
23+85

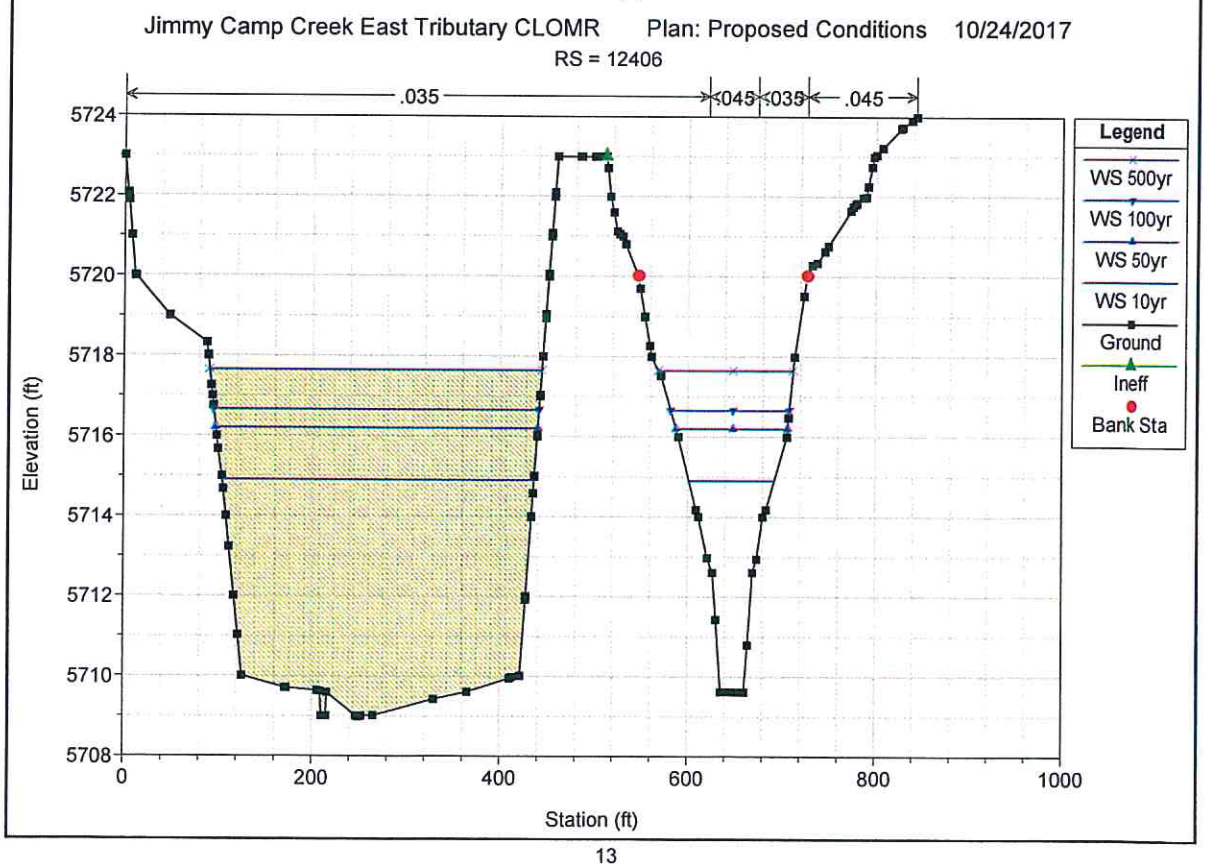

Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 12970
.045
.035
.045
.035
.045
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

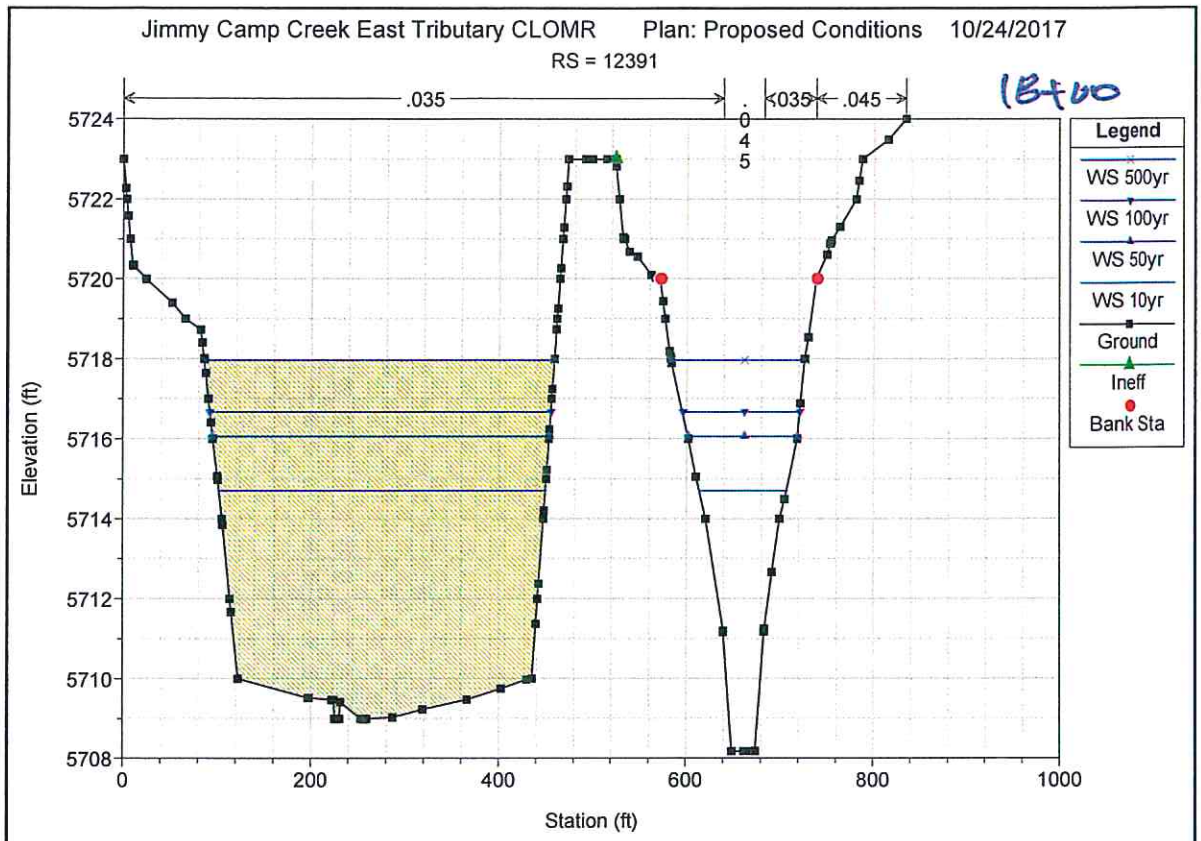

Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 12850
22+55
.06
.035
.045
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

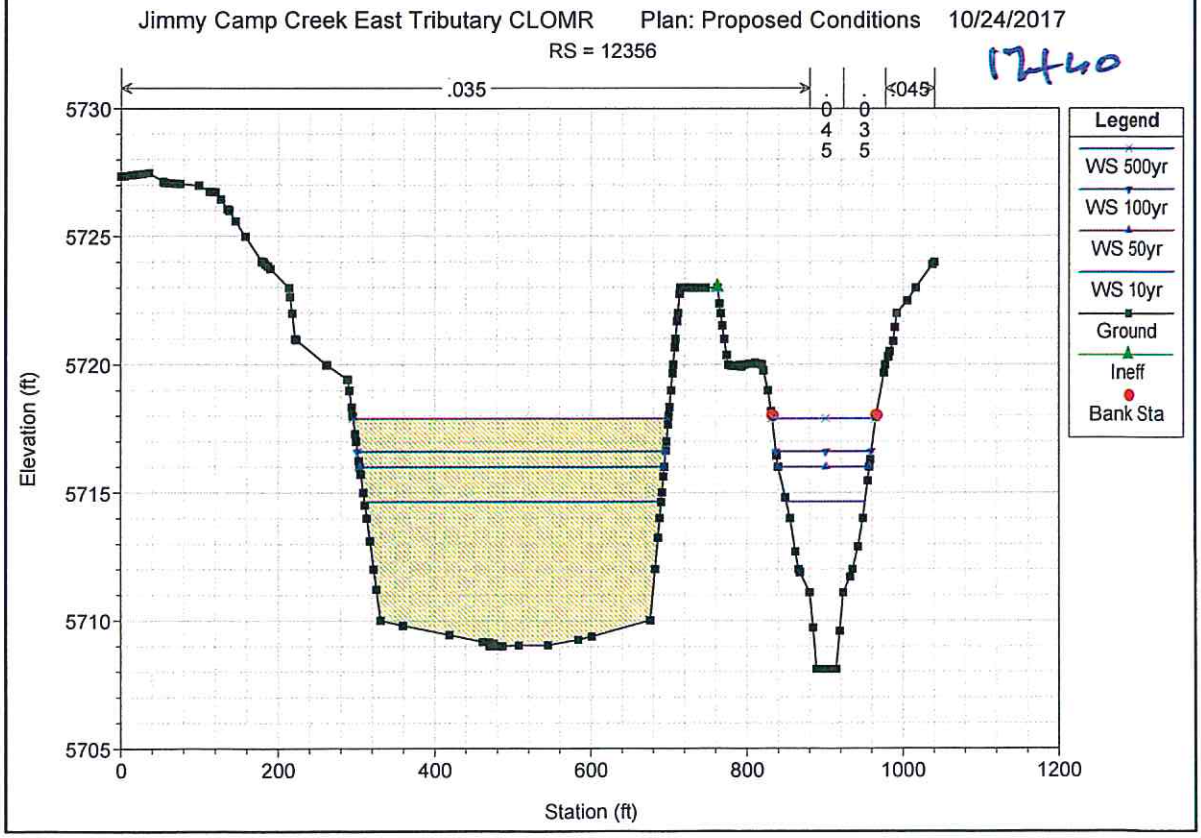

Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 12700
21+05
.035
.045
.035
.045
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

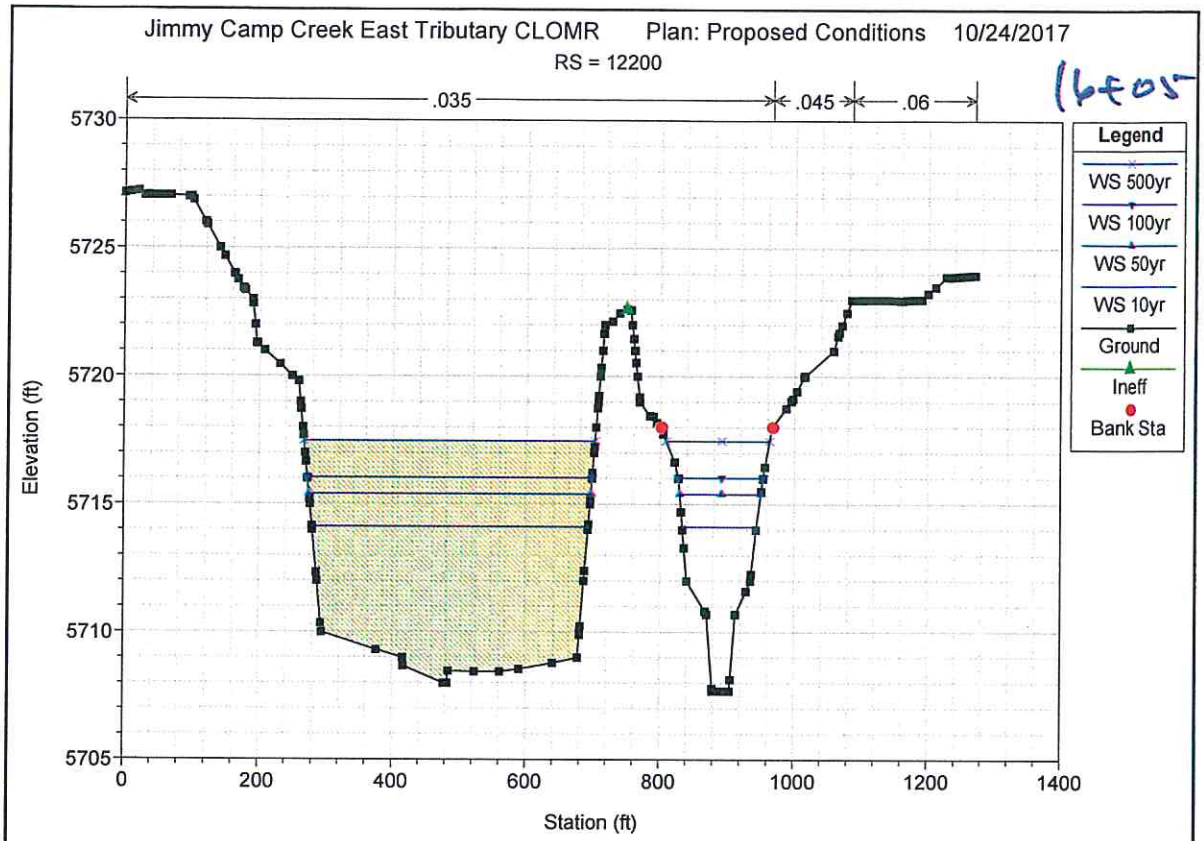

Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 12500
19+05
.06
.035
.045
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

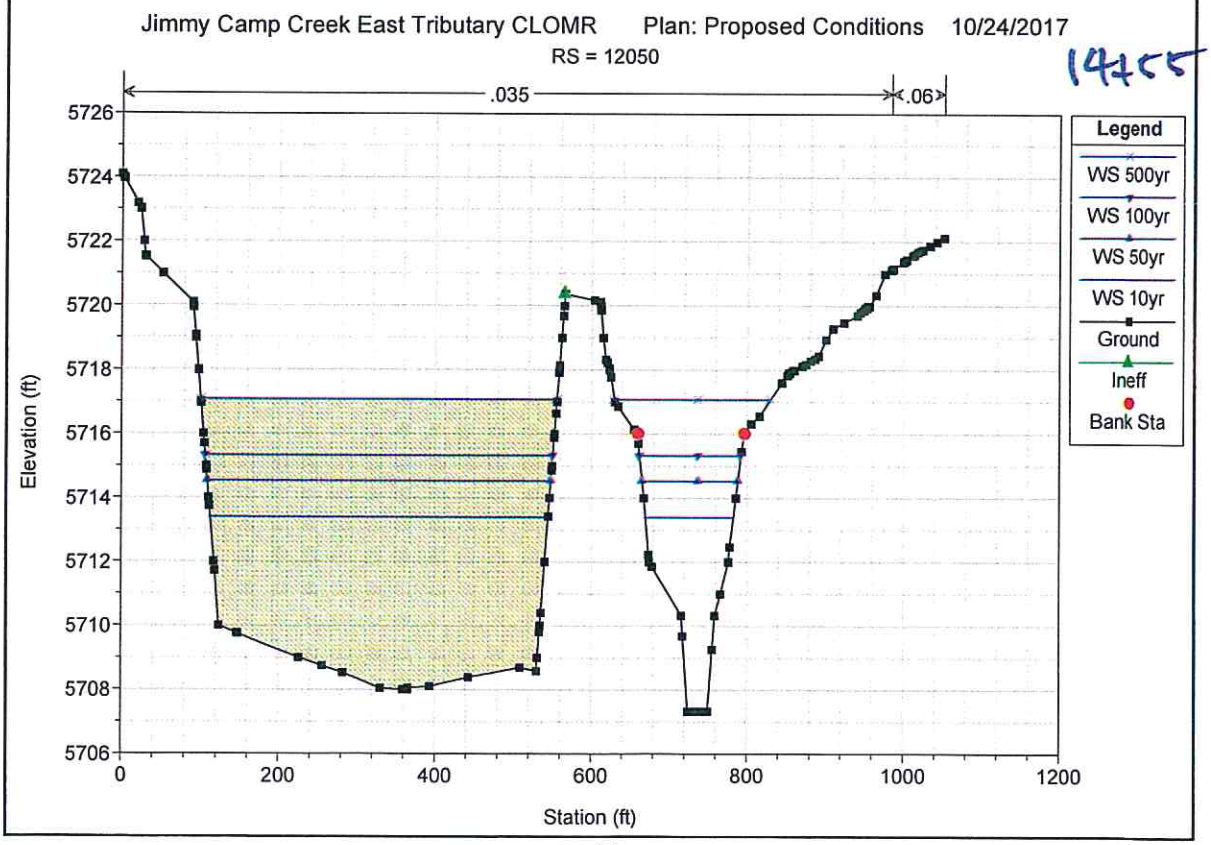

Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 12426
.035
.045
.035
.045
1B+35
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

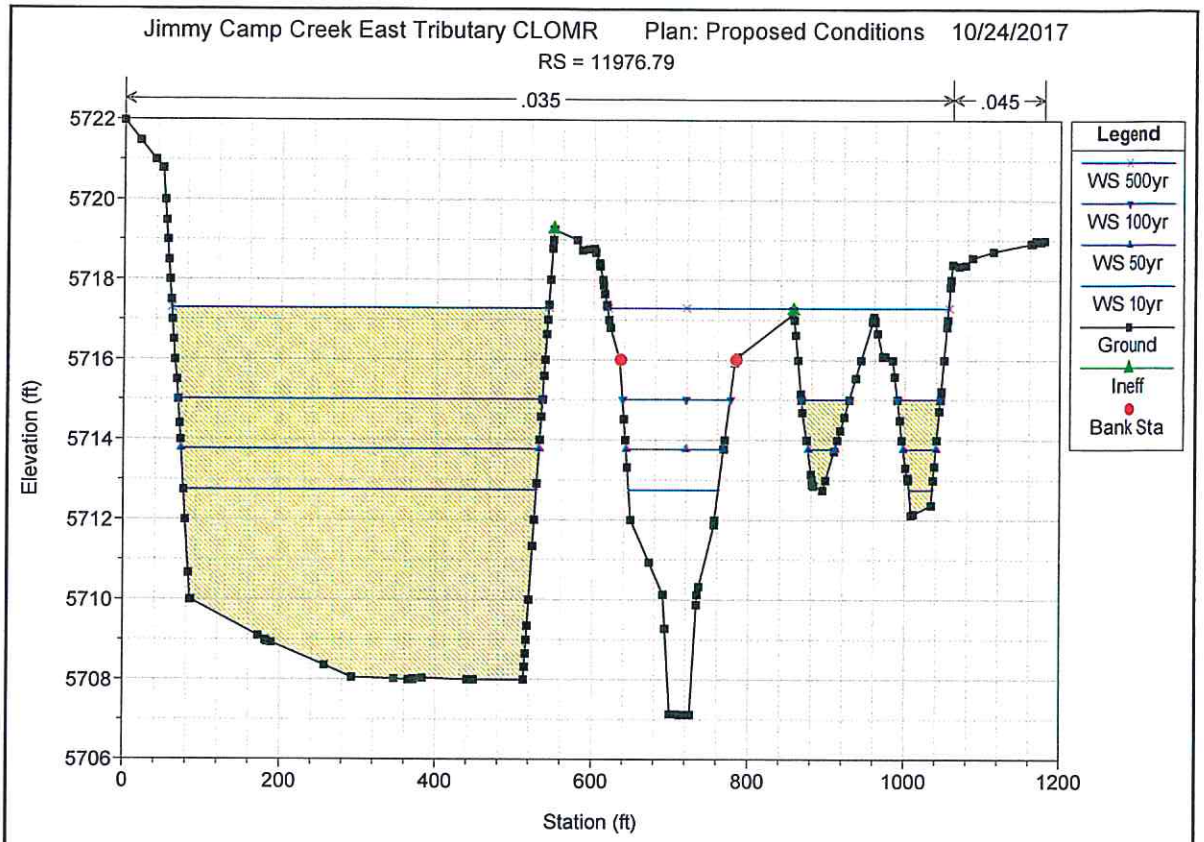

Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 12406
.035
.045
.035
.045
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

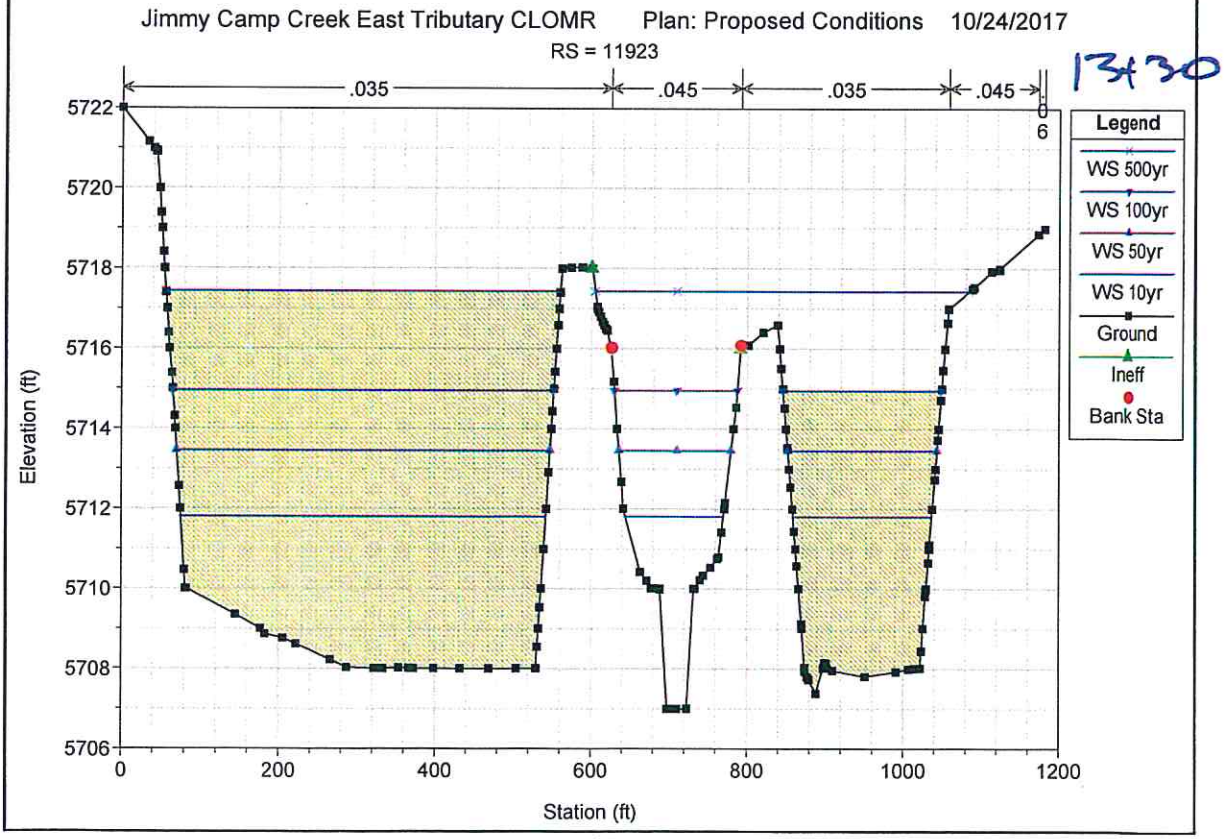

Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 12391
18+00
.035
.045
.035
.045
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

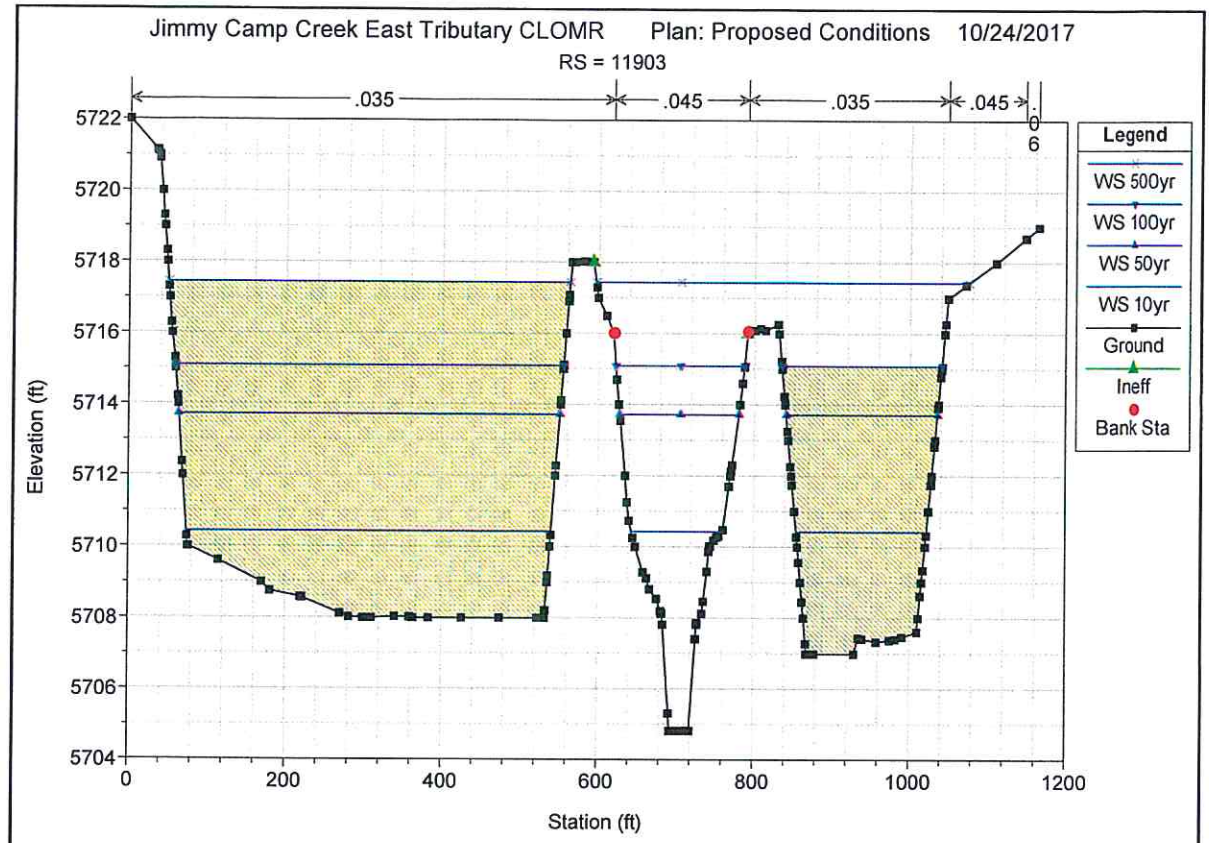

Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 12356
17+40
.035
.045
.045
.035
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 12200
16+05
.035
.045
.06
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 12050
14+55
.035
.06
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 11976.79
.035
.045
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 11923
13+30
.035
.045
.035
.045
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 11903
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.045
.035
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.06
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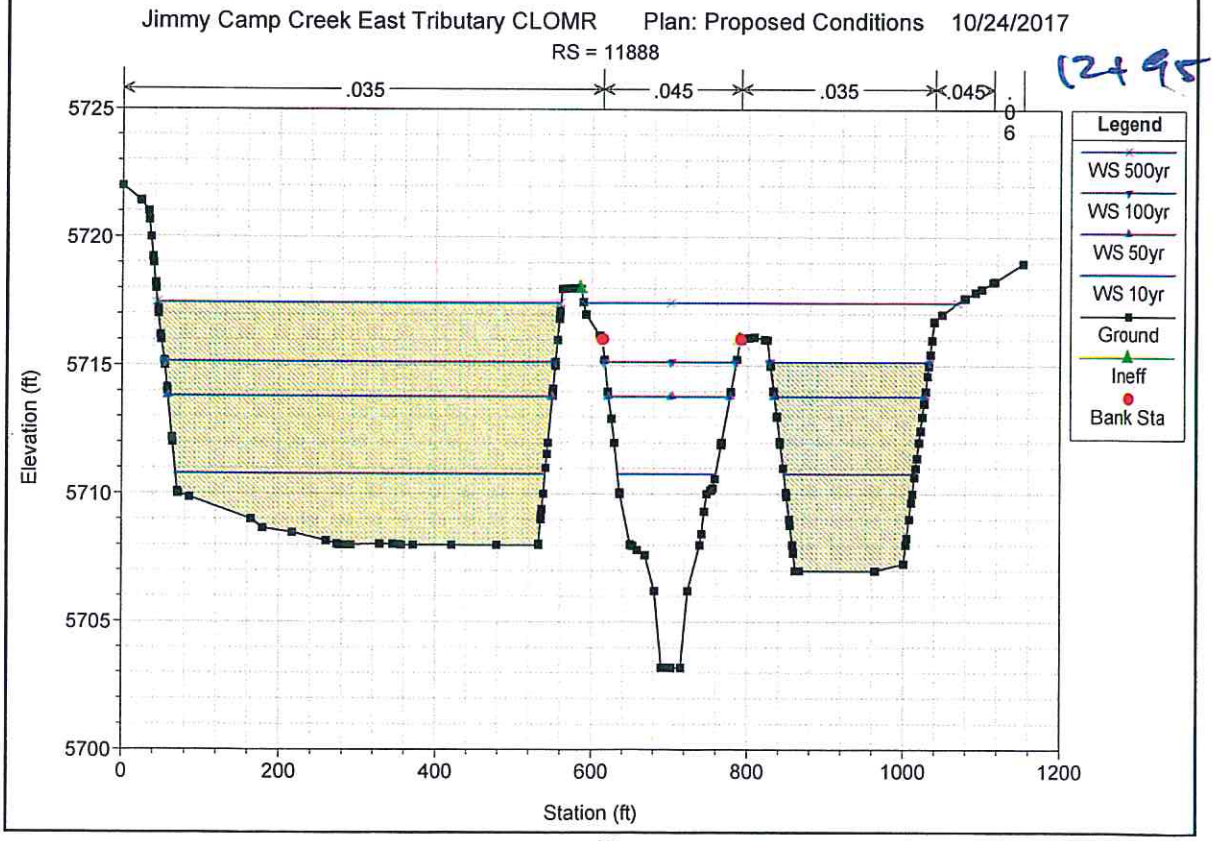
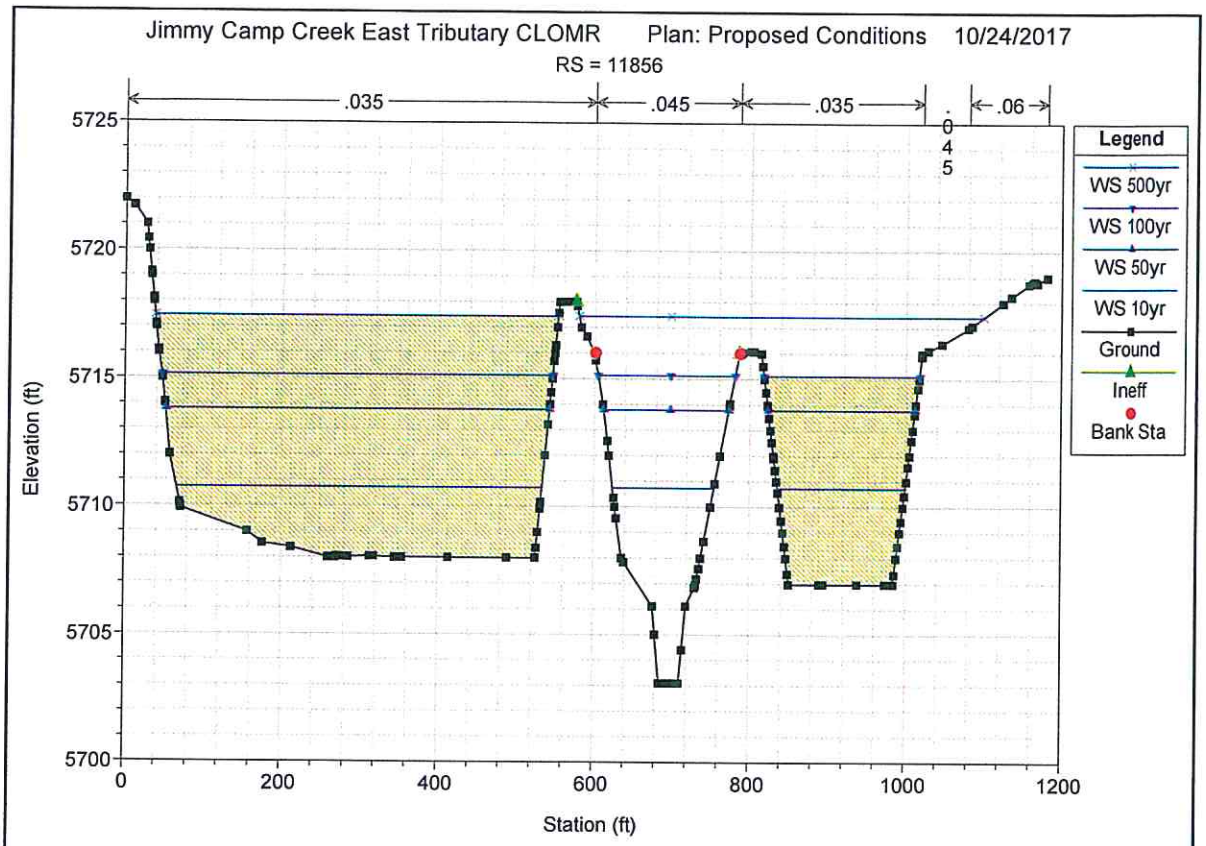
WS 100yr
WS 50yr
WS 10yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 11888
12+95
.035
.045
.035
.045
.06
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)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RS = 11856
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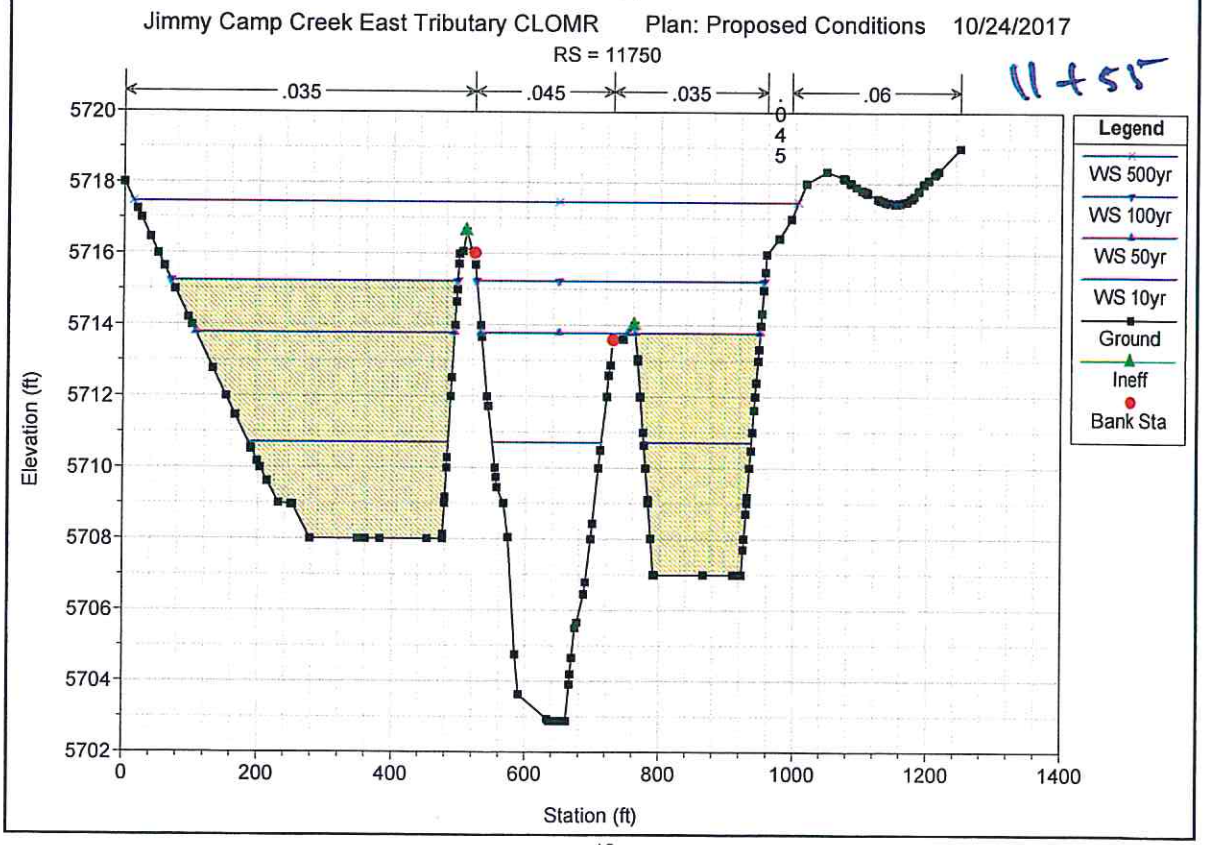
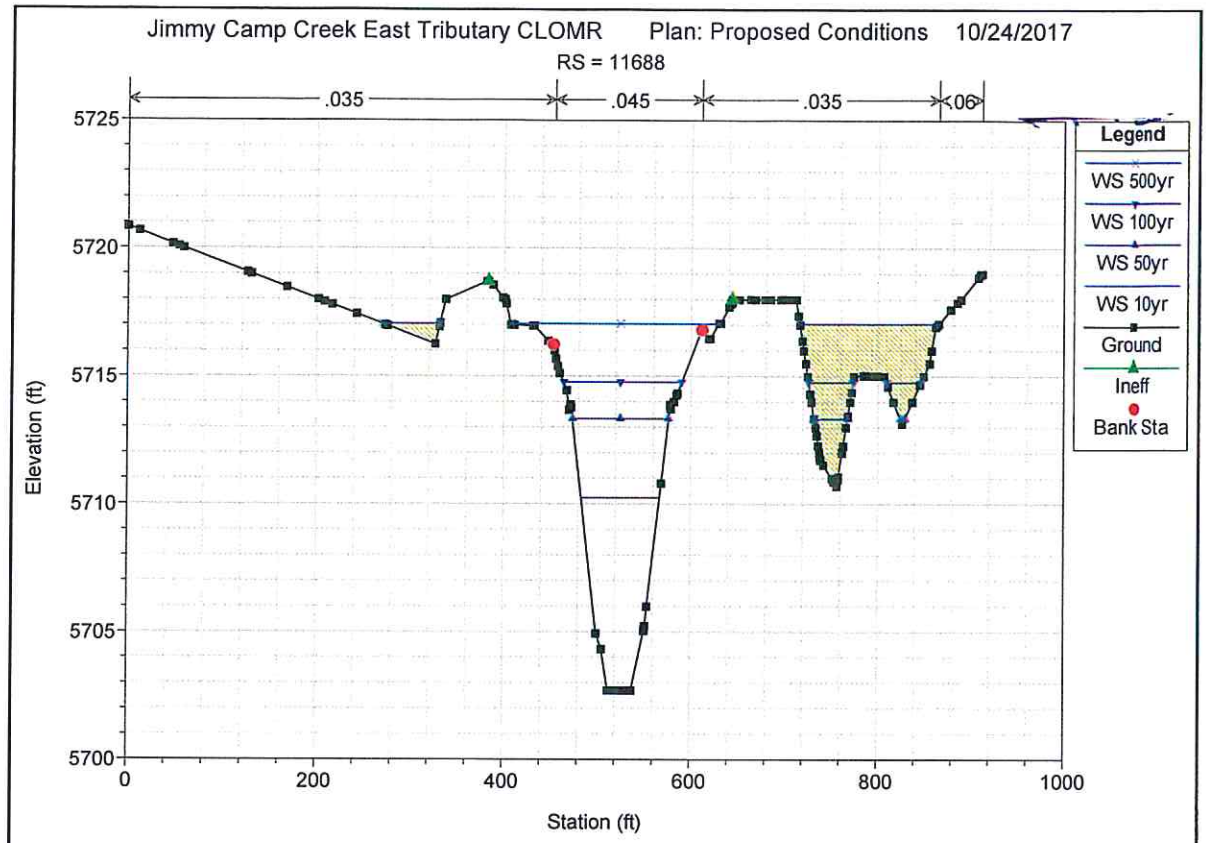
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 11750
11+51
.035
.045
.035
.045
.06
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 11688
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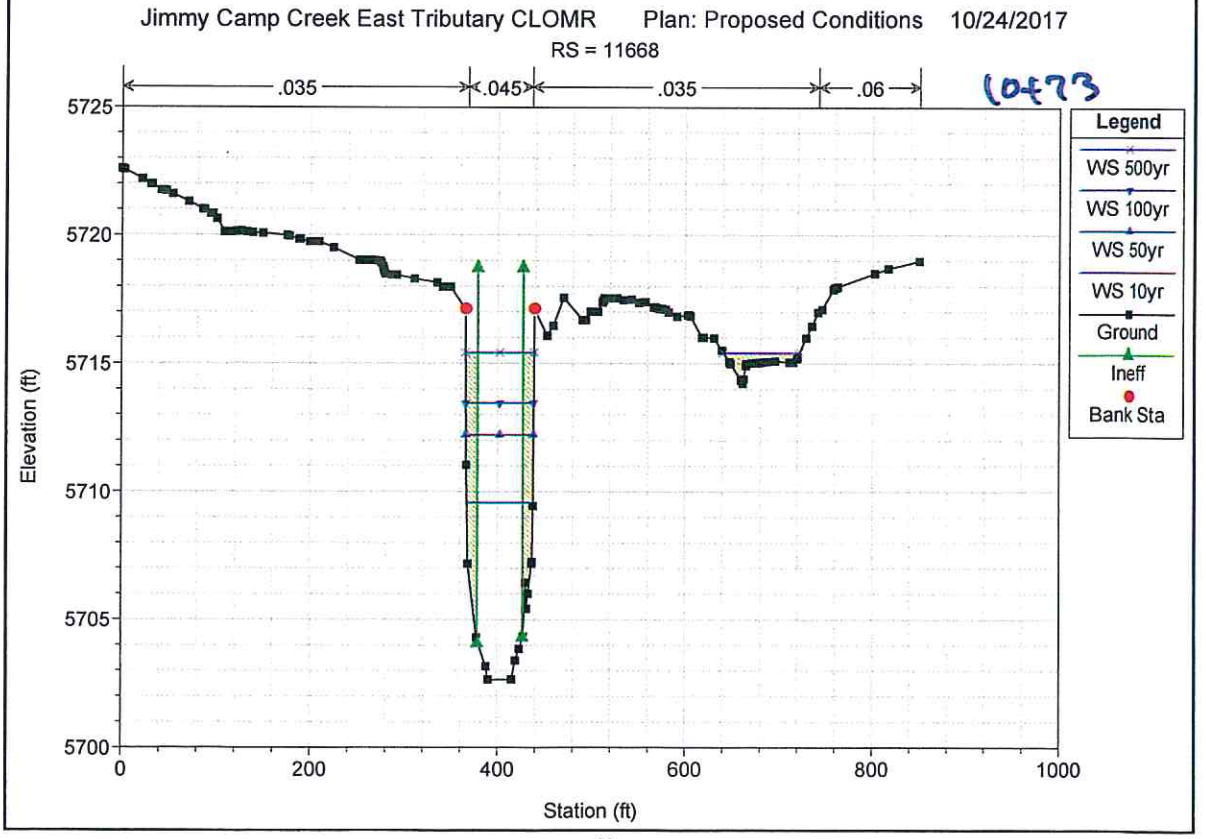
.035
.06
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 11668
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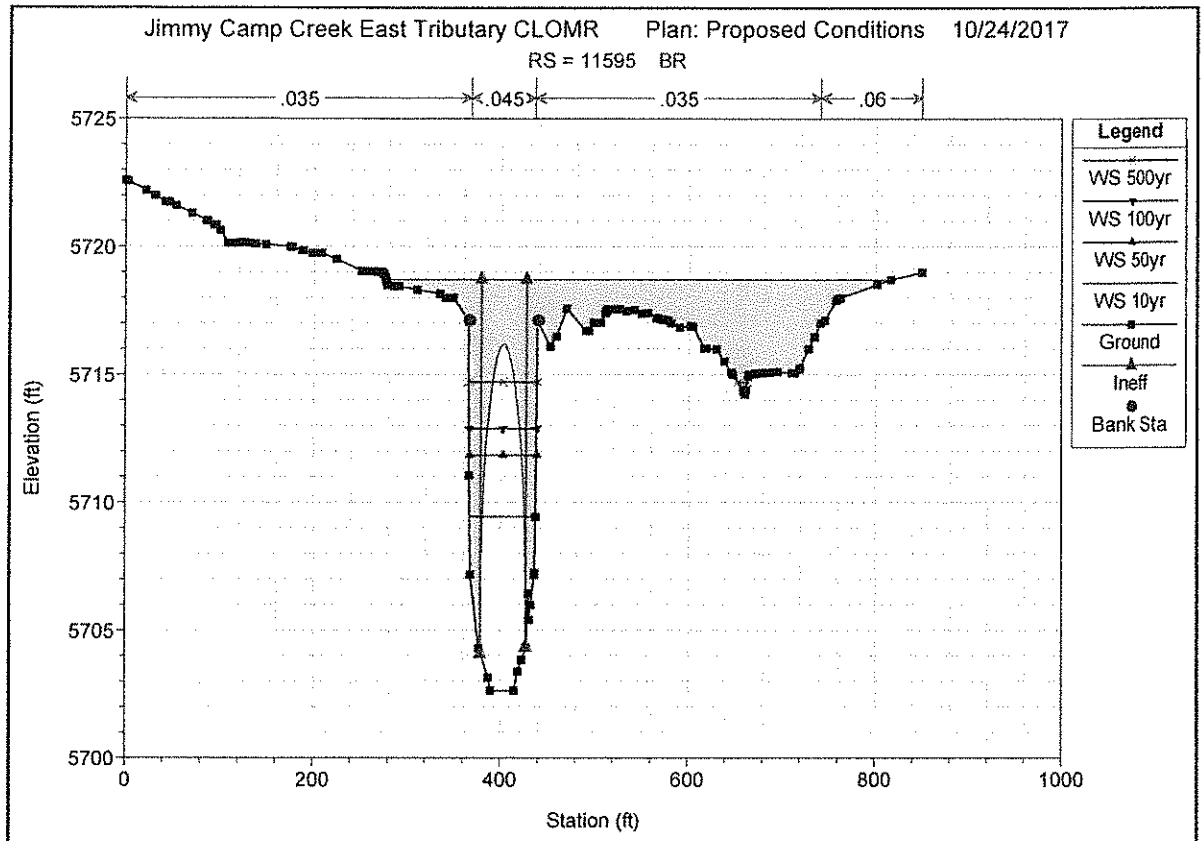
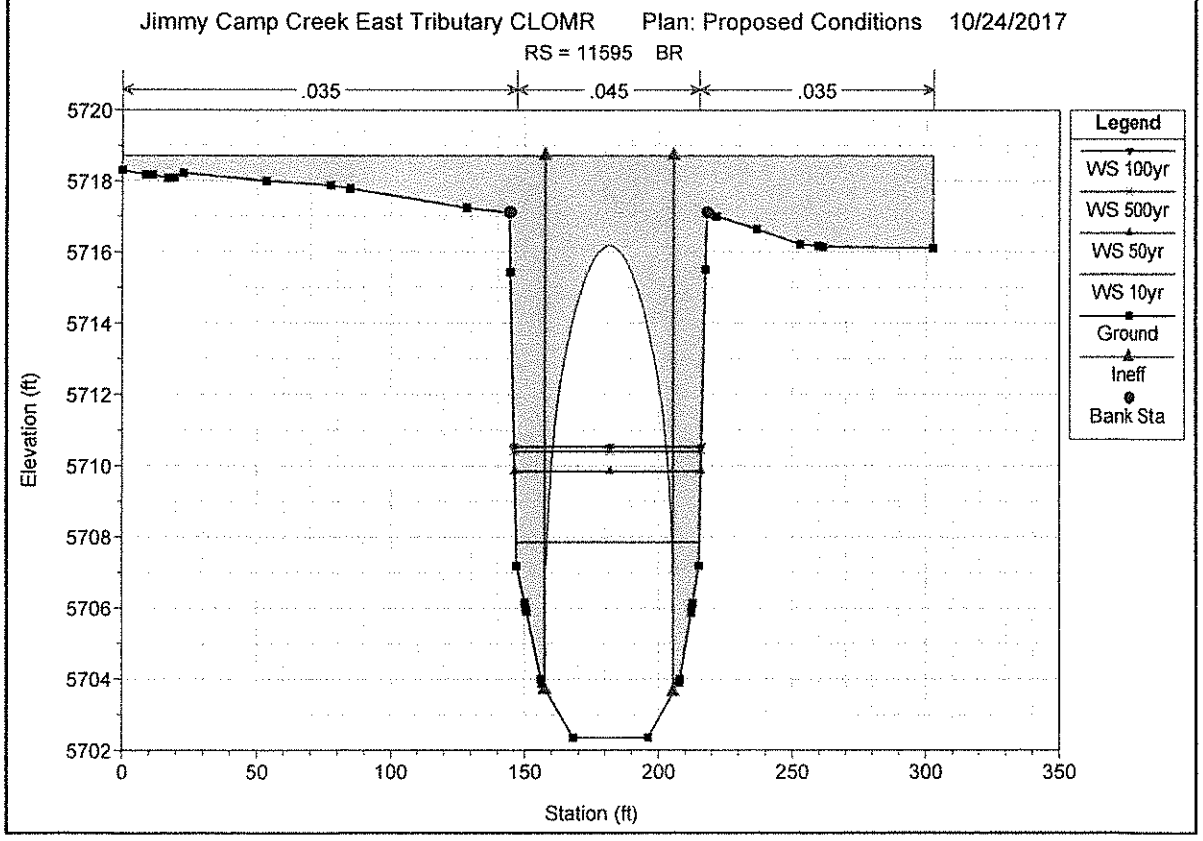
.045
.035
.06
1 of 73
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 11595 BR
.035
.045
.035
.06
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 11595 BR
.035
.045
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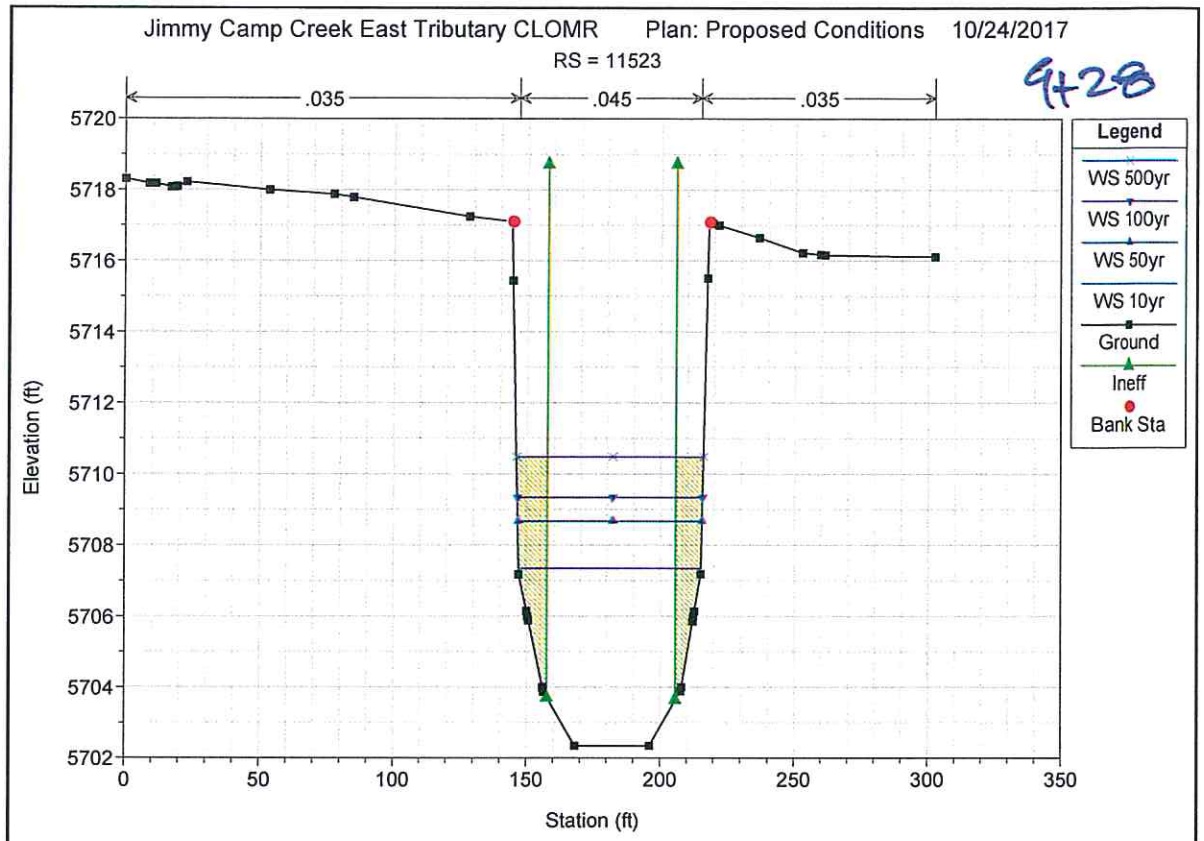
Legend
WS 100yr
WS 500yr
WS 50yr
WS 10yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 11523
9+28
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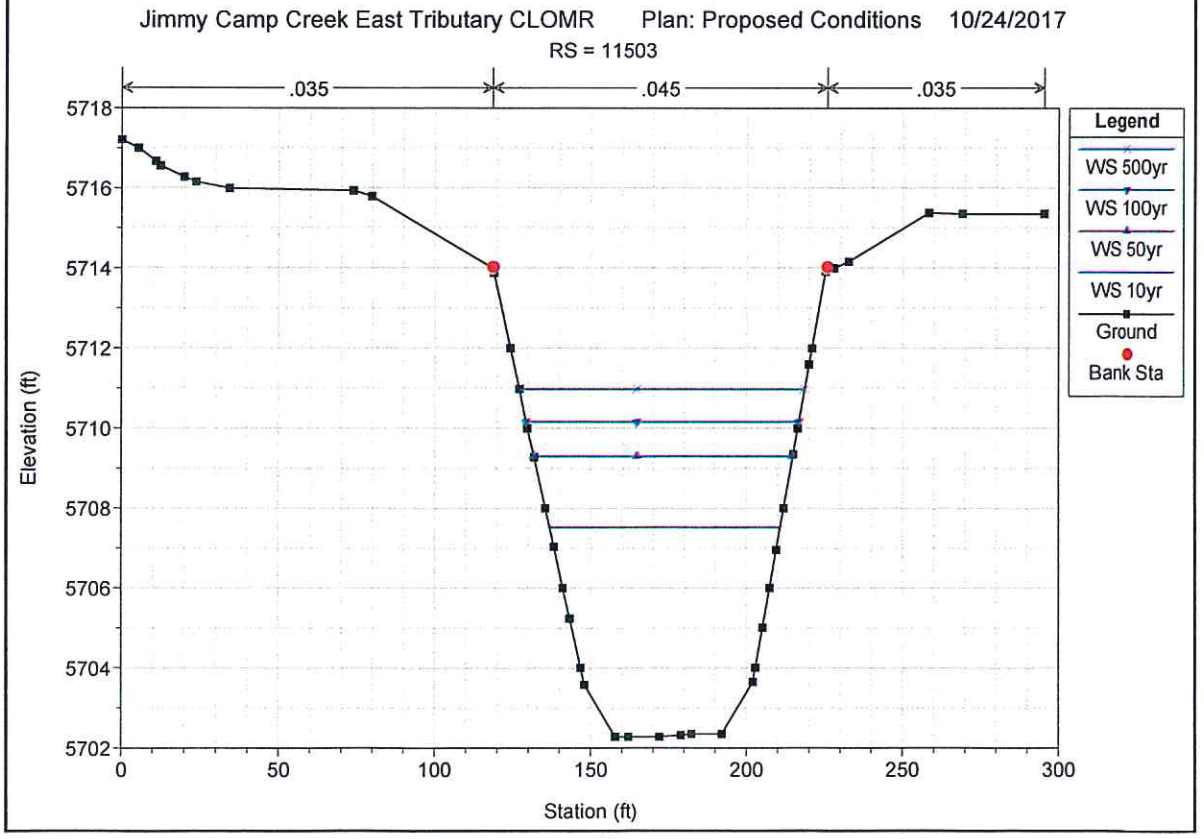
.045
.035
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


Jimmy Camp Creek East Tributary CLOMR Plan: Proposed Conditions 10/24/2017
RS = 11503
.035
.045
.035
Legend
WS 500yr
WS 100yr
WS 50yr
WS 10yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

Appendix B

LOMR Case Number 14-08-0534P

Lorson Ranch 404 Permit

 | Issue Date: September 16, 2014 | Effective Date: January 29, 2015 | Case No.: 14-08-0534P | LOMR-APP

EFCC

Follows Conditional Case No.: 06-08-B425R

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	El Paso County Colorado (Unincorporated Areas)	CHANNELIZATION	HYDRAULIC ANALYSIS NEW TOPOGRAPHIC DATA
	COMMUNITY NO.: 080059		
IDENTIFIER	Lorso Ranch Development, East Tributary of Jimmy Camp Creek	APPROXIMATE LATITUDE & LONGITUDE: 38.732, -104.631 SOURCE: Precision Mapping Streets DATUM: NAD 83	

ANNOTATED MAPPING ENCLOSURES	ANNOTATED STUDY ENCLOSURES
TYPE: FIRM* NO.: 08041C0957F DATE: March 17, 1997 TYPE: FIRM* NO.: 08041C1000F DATE: March 17, 1997	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: August 23, 1999 PROFILE(S): 117P-119P FLOODWAY DATA TABLE: 5

Enclosures reflect changes to flooding sources affected by this revision.
* FIRM - Flood Insurance Rate Map; ** FBFM - Flood Boundary and Floodway Map; *** FHBM - Flood Hazard Boundary Map

FLOODING SOURCE(S) & REVISED REACH(ES)

Jimmy Camp Creek East Tributary - from approximately 4,260 feet upstream to approximately 14,470 feet upstream of Peaceful Valley Road

[redacted]

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Jimmy Camp Creek East Tributary	Zone AE	Zone AE	YES	YES
	BFEs	BFEs	YES	YES
	Zone X (shaded)	Zone X (shaded)	YES	YES
	Floodway	Floodway	YES	YES

* BFEs - Base Flood Elevations

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

142877 PT202.02.BKR.14080534P.BG 102-I-A-C

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

OTHER COMMUNITIES AFFECTED BY THIS REVISION

CID Number: 080060 **Name:** City of Colorado Springs, Colorado

AFFECTED MAP PANELS	AFFECTED PORTIONS OF THE FLOOD INSURANCE STUDY REPORT
TYPE: FIRM* NO.: 08041C0957F DATE: March 17, 1997 TYPE: FIRM* NO.: 08041C1000F DATE: March 17, 1997	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: August 23, 1999 PROFILE(S): 119P FLOODWAY DATA TABLE: 5

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

We provide the floodway designation to your community as a tool to regulate floodplain development. Therefore, the floodway revision we have described in this letter, while acceptable to us, must also be acceptable to your community and adopted by appropriate community action, as specified in Paragraph 60.3(d) of the NFIP regulations.

NFIP regulations Subparagraph 60.3(b)(7) requires communities to ensure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management ordinances; therefore, responsibility for maintenance of the altered or relocated watercourse, including any related appurtenances such as bridges, culverts, and other drainage structures, rests with your community. We may request that your community submit a description and schedule of maintenance activities necessary to ensure this requirement.

COMMUNITY REMINDERS

We based this determination on the base (1-percent-annual-chance) flood discharges computed in the FIS for your community without considering subsequent changes in watershed characteristics that could increase flood discharges. Future development of projects upstream could cause increased flood discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on flood discharges subsequent to the publication of the FIS report for your community and could, therefore, establish greater flood hazards in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Jeanine D. Petterson
Director, Mitigation Division
Federal Emergency Management Agency, Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, CO 80225-0267
(303) 235-4830

STATUS OF THE COMMUNITY NFIP MAPS

We will not physically revise and republish the FIRM and FIS report for your community to reflect the modifications made by this LOMR at this time. When changes to the previously cited FIRM panels and FIS report warrant physical revision and republication in the future, we will incorporate the modifications made by this LOMR at that time.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

A notice of changes will be published in the *Federal Register*. This information also will be published in your local newspaper on or about the dates listed below and through FEMA's Flood Hazard Mapping website at https://www.floodmaps.fema.gov/fhm/Scripts/bfe_main.asp.

LOCAL NEWSPAPER Name: *The Colorado Springs Gazette*
Dates: September 24, 2014 and October 1, 2014

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised flood hazard determination information presented in this LOMR may be changed.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 847 South Pickett Street, Alexandria, VA 22304-4605. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Luis Rodriguez, P.E., Chief
Engineering Management Branch
Federal Insurance and Mitigation Administration

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NGVD)		
JIMMY CAMP CREEK EAST TRIBUTARY								
A	1,672	240	1,535	3.6	5,676.0	5,674.8[2]	5,675.6[2]	0.8
B	1,962	700	862	6.4	5,681.3	5,681.3	5,682.3	1.0
C	4,362	340	2,188	2.5	5,686.6	5,686.6	5,687.3	0.7
D	5,693	80	660	8.3	5,689.5	5,689.5	5,690.0	0.5
E	7,983	105	788	7.0	5,699.2	5,699.2	5,699.6	0.4
F	9,875	158	822	6.3	5,702.8	5,702.8	5,703.5	0.7
G	11,583	138	698	6.8	5,710.6	5,710.6	5,710.6	0.0
H	12,984	85	441	10.8	5,724.1	5,724.1	5,724.4	0.3
I	15,904	230	1,361	3.2	5,740.7	5,740.7	5,741.3	0.6
J	17,782	220	518	8.5	5,760.2	5,760.2	5,760.2	0.0
K	19,162	260	735	5.0	5,772.0	5,772.0	5,772.5	0.5
L	20,462	670	647	5.6	5,785.7	5,785.7	5,785.8	0.1
M	23,542	600	1,259	2.9	5,813.0	5,813.0	5,813.0	0.0
N	25,272	450	596	6.1	5,828.1	5,828.1	5,828.8	0.7
O	26,532	400	900	3.7	5,843.6	5,843.6	5,844.6	1.0
P	28,502	195	346	7.8	5,866.6	5,866.6	5,866.6	0.0
Q	30,442	190	550	4.9	5,882.8	5,882.8	5,883.1	0.3
R	30,662	200	613	4.4	5,884.7	5,884.7	5,884.7	0.0
S	30,704	200	580	4.7	5,887.2	5,887.2	5,887.2	0.0
T	30,804	280	996	2.7	5,887.2	5,887.2	5,887.2	0.0
U	32,164	230	435	5.5	5,898.3	5,898.3	5,899.0	0.7
V	33,244	350	518	4.6	5,910.4	5,910.4	5,910.6	0.2
W	34,324	150	318	7.6	5,921.7	5,921.7	5,921.7	0.0
X	36,344	130	255	7.9	5,954.3	5,954.3	5,954.3	0.0
Y	38,444	70	221	9.0	5,986.5	5,986.5	5,986.5	0.0
Z	40,934	110	187	7.2	6,025.3	6,025.3	6,025.4	0.1
AA	42,144	198	240	5.6	6,059.0	6,059.0	6,059.0	0.0
AB	43,064	100	178	7.6	6,080.9	6,080.9	6,080.9	0.0

REVISED DATA

[1] Feet Above Confluence With Jimmy Camp Creek

[2] Elevation Computerd Without Consideration of Backwater Effects From Jimmy Camp Creek

REVISED TO REFLECT LOMR EFFECTIVE: January 29, 2015

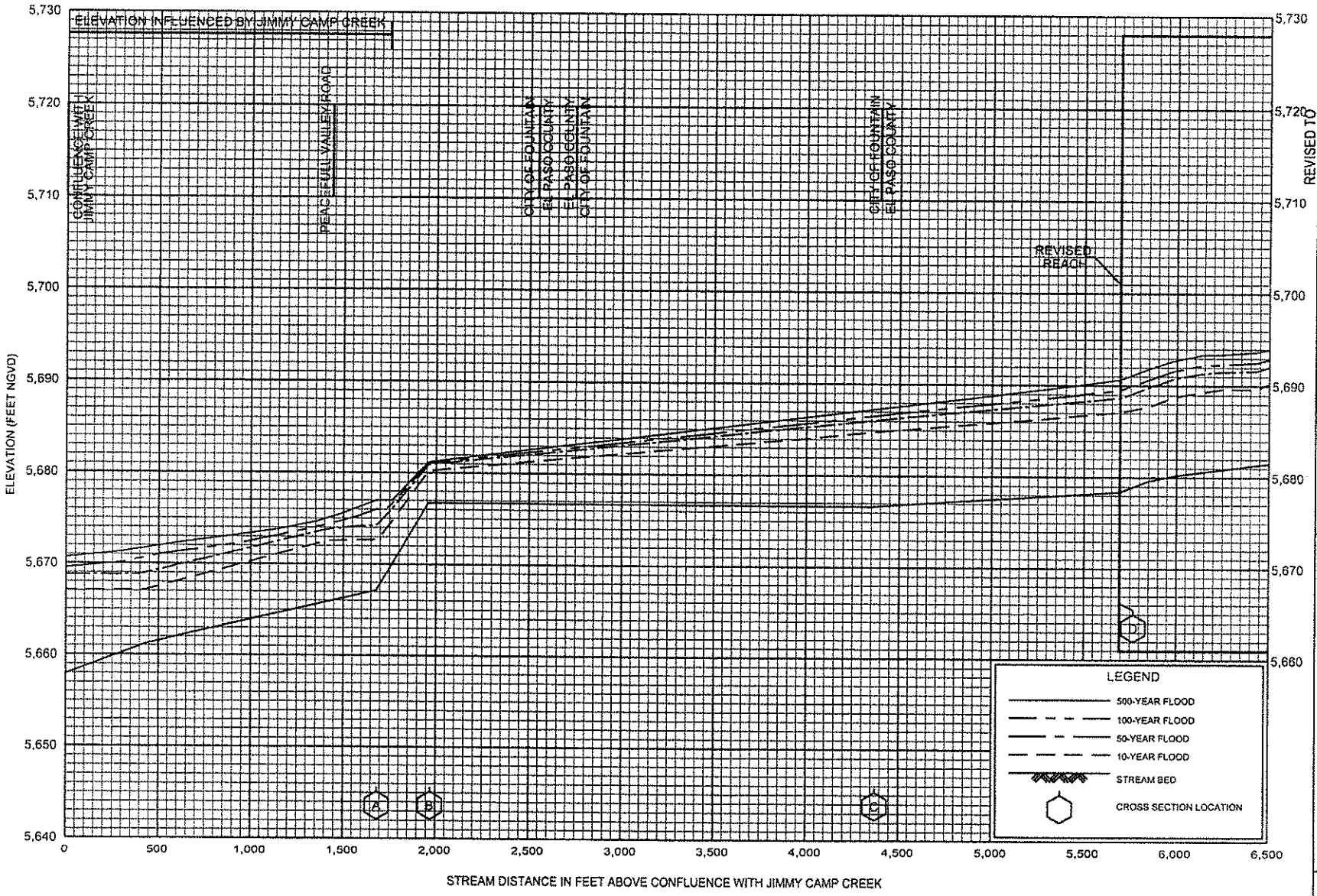
TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

EL PASO COUNTY, CO
AND INCORPORATED AREAS

FLOODWAY DATA

JIMMY CAMP CREEK EAST TRIBUTARY

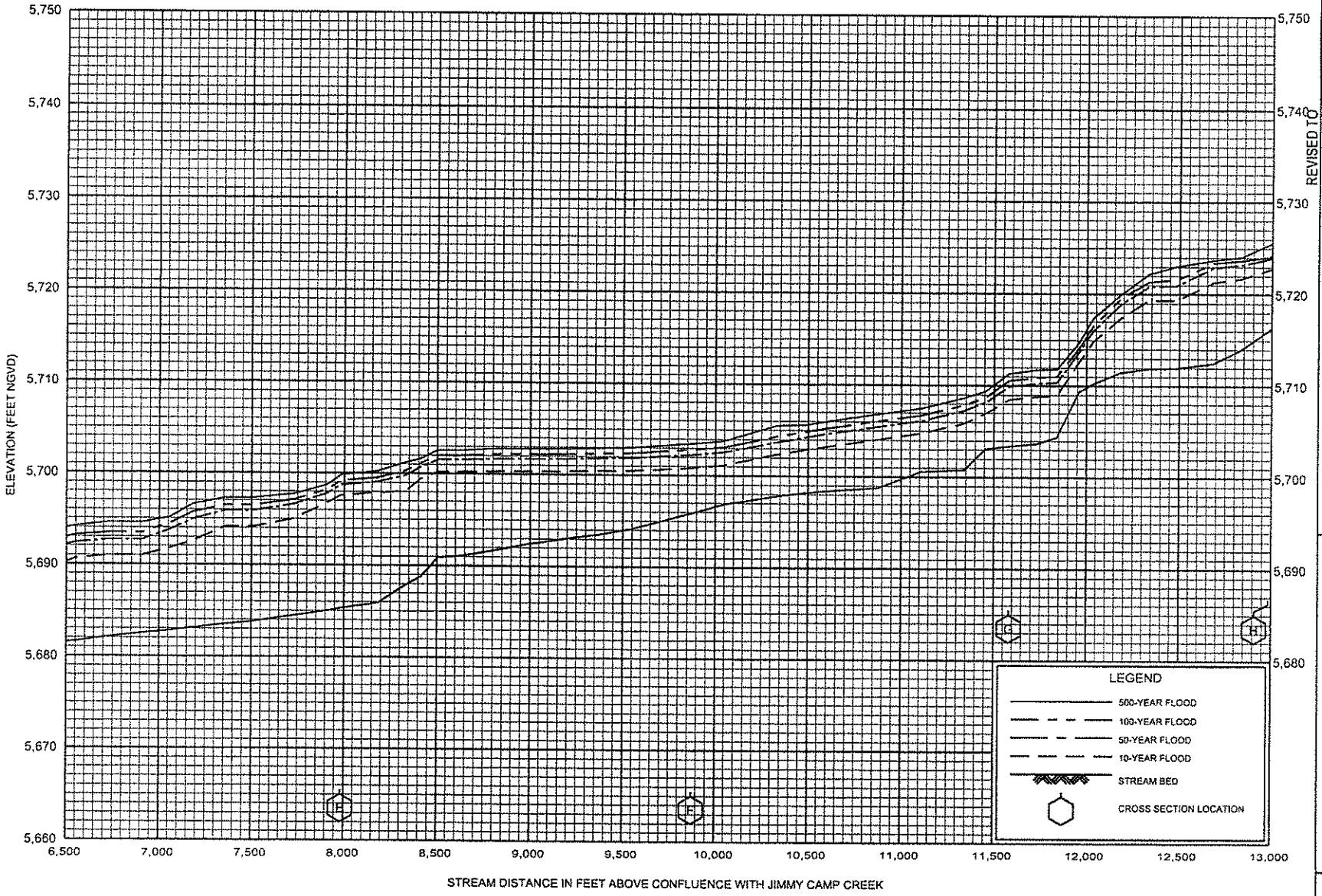


FLOOD PROFILES

JIMMY CAMP CREEK EAST TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

EL PASO COUNTY, CO
AND INCORPORATED AREAS



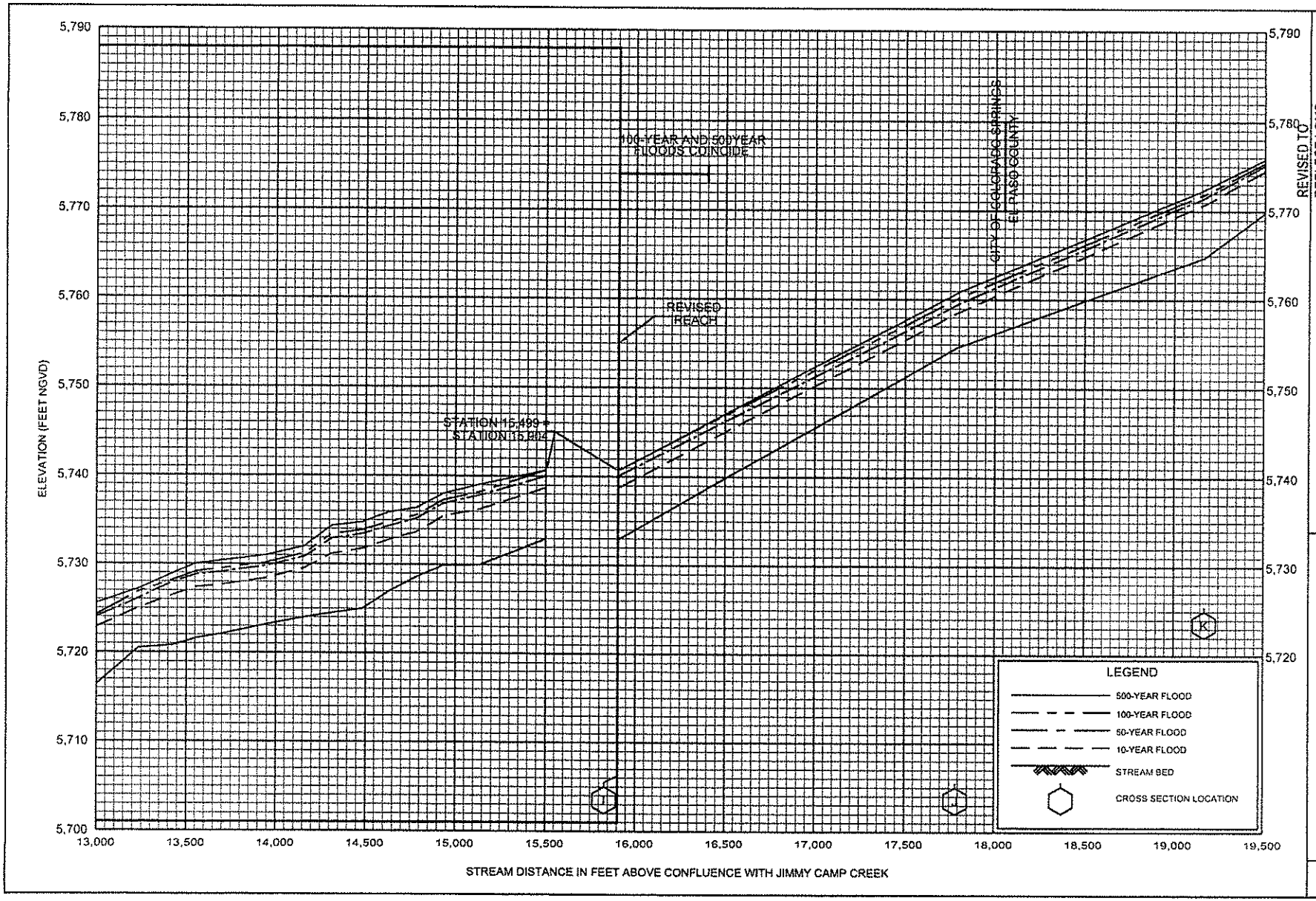
REVISED TO REFLECT LOMR EFFECTIVE: January 29, 2015

FLOOD PROFILES

JIMMY CAMP CREEK EAST TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

EL PASO COUNTY, CO
AND INCORPORATED AREAS

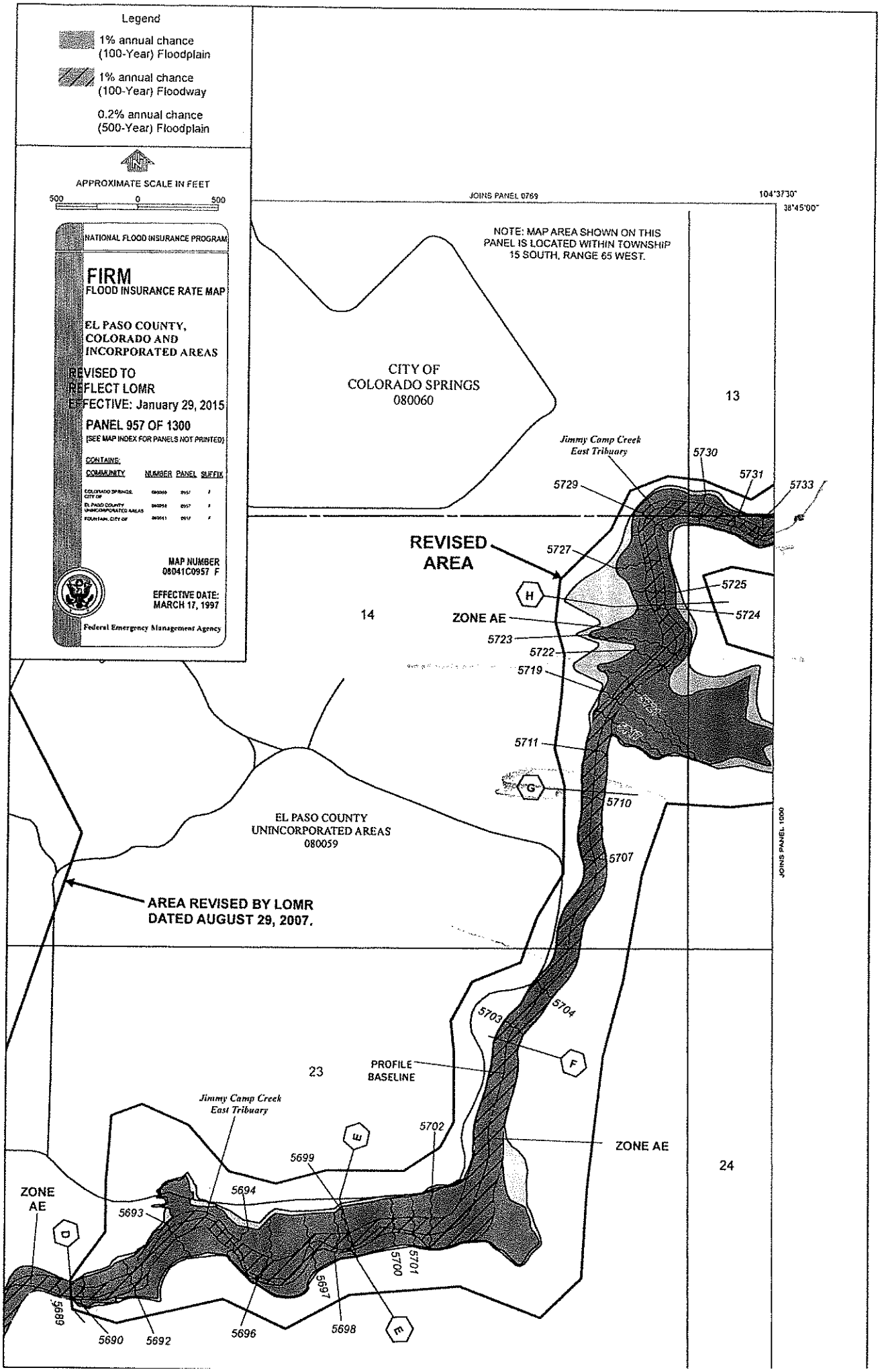


FLOOD PROFILES

JIMMY CAMP CREEK EAST TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

EL PASO COUNTY, CO
AND INCORPORATED AREAS


Legend
1% annual chance (100-Year) Floodplain
1% annual chance (100-Year) Floodway
0.2% annual chance (500-Year) Floodplain
APPROXIMATE SCALE IN FEET
500 0 500
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO AND INCORPORATED AREAS
REVISED TO REFLECT LOMR EFFECTIVE: January 29, 2015
PANEL 957 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
COLORADO SPRINGS, CITY OF 080060 0957 F
EL PASO COUNTY UNINCORPORATED AREAS 080059 0957 F
FOUNTAIN, CITY OF 080061 0957 F
MAP NUMBER 08041C0957 F
EFFECTIVE DATE: MARCH 17, 1997
Federal Emergency Management Agency
JOINS PANEL 0769
104°37'30"
38°45'00"
NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 15 SOUTH, RANGE 65 WEST.
CITY OF COLORADO SPRINGS 080060
13
14
23
24
Jimmy Camp Creek East Tributary
REVISED AREA
ZONE AE
EL PASO COUNTY UNINCORPORATED AREAS 080059
AREA REVISED BY LOMR DATED AUGUST 29, 2007.
PROFILE BASELINE
JOINS PANEL 1000
5730
5731
5733
5729
5727
5725
5724
5723
5722
5719
5711
5710
5707
5704
5703
5702
5701
5700
5699
5698
5697
5696
5694
5693
5692
5690
5689
H
G
F
E
D
B

Legend

- 1% annual chance (100-Year) Floodplain
- 1% annual chance (100-Year) Floodway
- 0.2% annual chance (500-Year) Floodplain

APPROXIMATE SCALE IN FEET

2,000 0 2,000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 1000 OF 1300

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	1000	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	1000	F

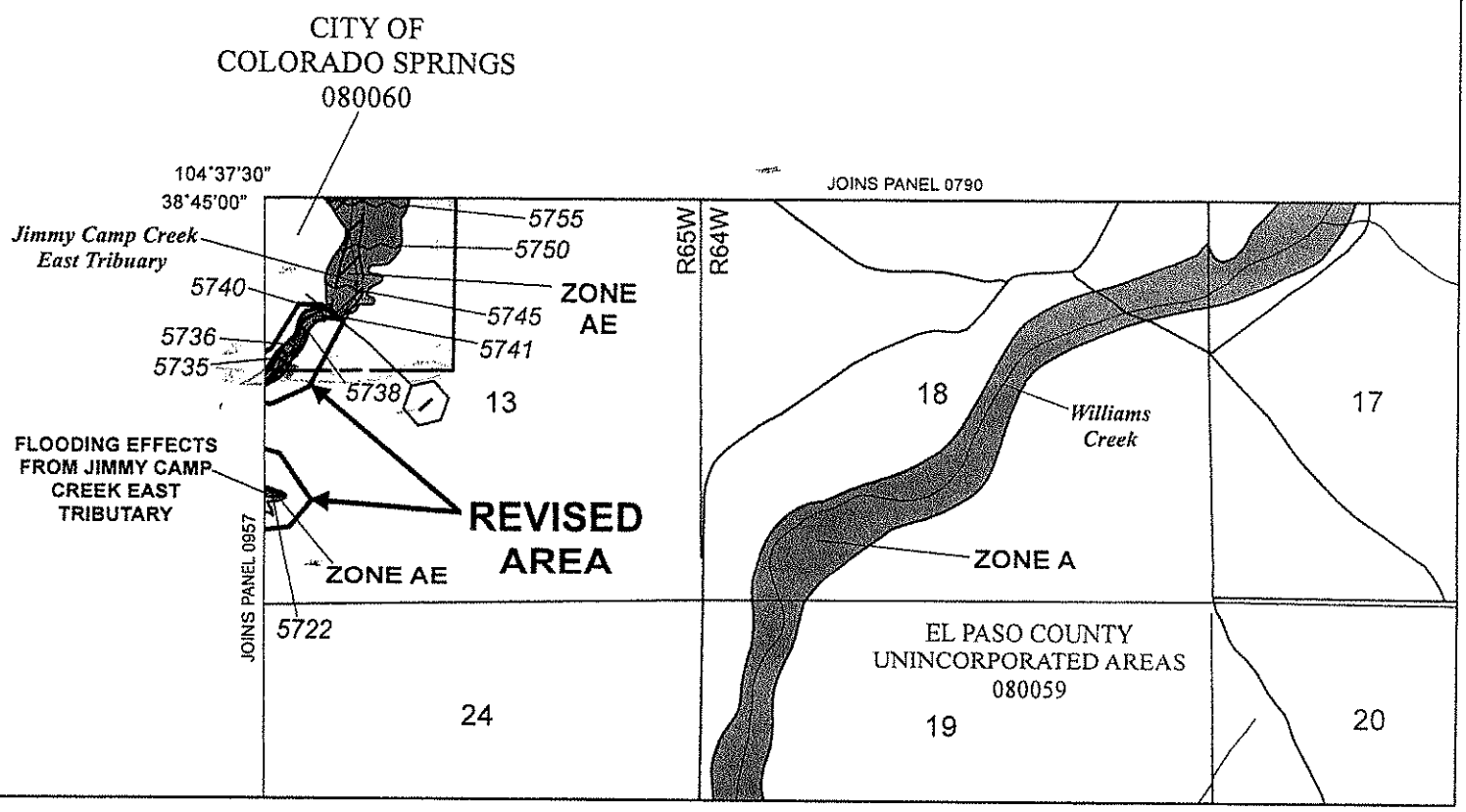
REVISED TO REFLECT LOMR EFFECTIVE: January 29, 2015

MAP NUMBER 08041C1000 F

EFFECTIVE DATE: MARCH 17, 1997

Federal Emergency Management Agency

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 15 SOUTH, RANGE 64 WEST AND TOWNSHIP 16 SOUTH, RANGE 65 WEST.



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, U.S. ARMY CORPS OF ENGINEERS
SOUTHERN COLORADO REGULATORY OFFICE
200 S. SANTA FE AVENUE, SUITE 301
PUEBLO, COLORADO 81003

September 7, 2017

Regulatory Division

SUBJECT: Action No. SPA-2005-00757; Modification to the Lorson Ranch Permit in El Paso County, Colorado

Elizabeth Klein
Kiowa Engineering
1604 South 21st Street
Colorado Springs, CO 80904

Ms. Klein:

The U.S. Army Corps of Engineers (Corps) is in receipt of your letter dated August 3, 2017, requesting a modification to the Department of the Army permit for the discharge of dredged and fill material into waters of the United States associated with Lorson Ranch. This includes the bridge construction and stream configurations and updating delineation for upland swale in the Lorson ranch development, Fountain, El Paso County, Colorado.

We have reviewed and hereby approve your request. Action Number SPA-2005-00757 is modified as follows: This includes approval of the Special Condition 1 - Lorson Blvd. & Fontaine Blvd. bridge design and stream configuration, Special Condition 2 – no action required; and Upper Reach Item #2 Stabilization – No permit required.

Replace the project description on page one of your permit with: Insert the approved designs into the Permit as an attachment to the Special Condition 1.

The expiration date of your is still September 30, 2021.

This modification is effective immediately. All other terms and conditions of the original permit remain in full force and effect.

If you have any questions concerning this letter, please contact me at (719) 543-6915 or by e-mail at Van.A.Truan@usace.army.mil.

Sincerely,

TRUAN.VAN.ALLAN.1231422150

Digitally signed by TRUAN.VAN.ALLAN.1231422150
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=TRUAN.VAN.ALLAN.1231422150
Date: 2017.09.07 09:15:45 -06'00'

Van Truan
Chief, Southern Colorado
Regulatory Branch

Josh
719-543-6914

16031 Air

Kiowa
Engineering Corporation

August 3, 2017

Mr. Van Truan
U. S. Army Corps of Engineers
200 South Santa Fe Avenue Suite 301
Pueblo, Colorado 81003

Re: SPA Action No. 2005 00757
Lorson Ranch East Fork Jimmy Camp Creek Permit Modification Amendment No.1
El Paso County, Colorado
(Kiowa Project No. 16031)

Dear Van:

Following our telephone conversation of last January, we are submitting a Permit Modification Amendment No. 1 for the above-mentioned project on behalf of Lorson Development and requesting your concurrence.

Action Number 2005 00757 Modification Amendment Request No. 1

Project impacts for the East Fork Jimmy Camp Creek on the Lorson Ranch were originally authorized under the above-mentioned Action Number by the Pueblo Regulatory Office on September 22, 2006 with an expiration date of December 31, 2009. The permit authorized channel bank linings, grade control structures and two roadway crossings for three segments for the entire length of the East Fork Jimmy Camp Creek on the Lorson Ranch. See Exhibit 1, Permit Modification Amendment 1 Map (attached) for location of existing, proposed, and future activities discussed here.

The central stream segment, designed as a reconfigured reach (Item#1 on Exhibit 1) was completed in about 2007 or 8. Subsequently, a construction standstill in 2009 occurred with no further activity. It appears that the permit has been extended twice, first to September 2001 and then to September 2021.

At that time, about 3,600 linear feet of reconfigured trapezoidal channel consisting of 100-Year riprap bank linings and grouted grade control structures were completed (*Photograph #1*). The bottom width was designed at about 60-feet wide and the top width was about 180-feet wide. Currently, the reconfigured channel is vegetated with upland vegetation with areas of exposed rock on the bank linings and grouted drops structures.

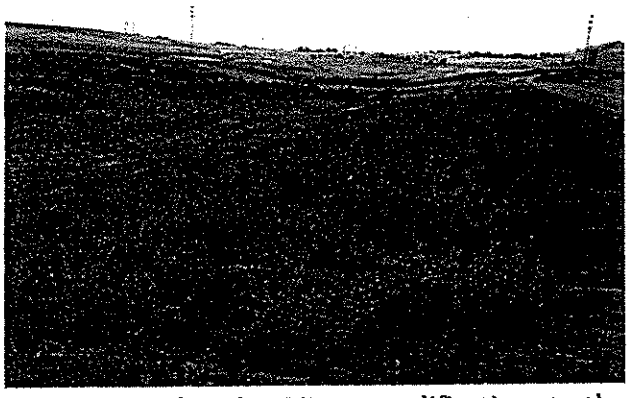
The purpose of this Modification Amendment is to address and clarify Special Conditions in the permit and summarize all future activities that were originally authorized in this permit. An

1604 South 21st Street, Colorado Springs, Colorado 80904-4208

additional Modification Amendment Request will be submitted in the future to address remaining authorized activities.

Special Condition 1

Per Special Condition 1, final design drawings for Fontaine Boulevard and Lorson Boulevard Bridges need to be submitted for review and approval 60 days prior to construction. At this time, we are transmitting final design drawings for the proposed Fontaine Boulevard and Lorson Bridges (see attachments.)



The proposed Fontaine Boulevard Bridge (Item #3) will be a 48-foot span, 130-foot long by 14-foot high arched Contech pre-cast bridge and pre-cast headwalls with an ungrouted rock invert. This bridge will be constructed over the north termination of the existing reconfigured trapezoidal channel reach (*Photograph #2*). Minor modifications to the reconfigured channel in the vicinity of the bridge will be necessary to link the existing improvements to the proposed bridge.

The proposed Lorson Boulevard Bridge (Item #4) is currently in final design and is expected to be constructed in the early spring of 2018. The location of Lorson Boulevard Bridge will be over the reconfigured channel at about the location of Photograph #1. The Lorson Boulevard Bridge will be a 48-foot span, 84-foot long by 13-foot high arched Contech pre-cast bridge and pre-cast headwalls with an ungrouted rock invert. Similar to Fontaine Boulevard Bridge, minor modifications to the reconfigured channel under the bridge will be required to match the existing condition.

Special Condition 2

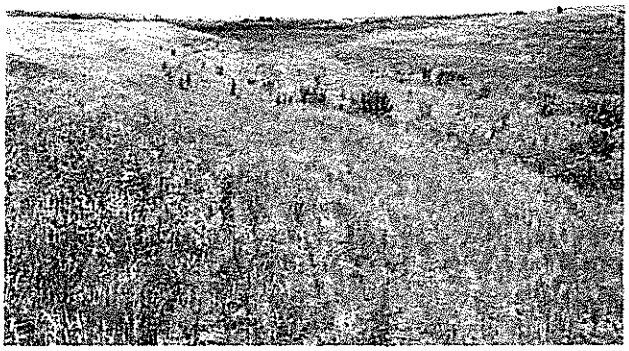
This Special Condition refers to the lower stream preservation reach (Item #5 on Exhibit 1) that has not yet been designed. This reach will be about 3,900 linear feet of three-to-one riprap bank linings in select locations with possibly one to several grade control structures. We anticipate the bottom width of the channel will be less than 20-feet. The design concept for this reach is to retain the stream alignment, to avoid future channel incision and to lay back nearly vertical banks to three-to-one. Modifications to this channel segment are anticipated to be minimal.

The Lorson Ranch has been delineated twice during the permitting process. The original delineation by Savage and Savage in 2002 for the overall project delineated both the Mainstem Jimmy Camp Creek and the East Fork Jimmy Camp Creek. Subsequently, the Mainstem Jimmy Camp Creek was permitted and completed under Action No. 2002 00701. The East Fork Jimmy Camp Creek in the Lorson Ranch was again delineated in March 7, 2006 by AG Environmental Services, Inc. under Action No. 2005 00757. The existing delineations for this reach will be reviewed and verified for current conditions. The existing delineations for this reach will be reviewed and verified

for current conditions. Improvements for this segment will be addressed in a future permit modification amendment.

Upper Reach Item#2 Stabilized Channel

The upper reach (Item#2 *Photograph# 3*) was originally a portion of the stream reconfiguration reach. This upper segment was not and currently is not wetland or a water of the U.S. This reach is a vegetated swale with upland vegetation and lacks a bed and bank configuration. The permit requests the channel design for this reach for clarity.



Prior to design, this reach was re-evaluated by Kiowa according to current criteria with the result being that channel reconfiguration is no longer required. A stabilized floodplain section can appropriately be applied here with three small sloping grouted boulder drop structures 6-foot long, 2,900 linear feet of low flow soil/rock and TRM lined channel and 1,020 linear feet buried rock/soil bank linings in select locations on outside bends. The bottom width of the low flow channel will be 25-feet and the top-width will be 43-feet. The stabilized floodplain section allows for the preservation of the stream alignment and prevents future channel incision. The overall design will provide an alternative with significantly less environmental impact than a reconfigured channel This portion of the work will be constructed in an upland swale and therefore is non-jurisdictional, but design plans are being submitted per permit request for review and approval by the COE 60 days prior to construction.

Please let us know if you need more information.

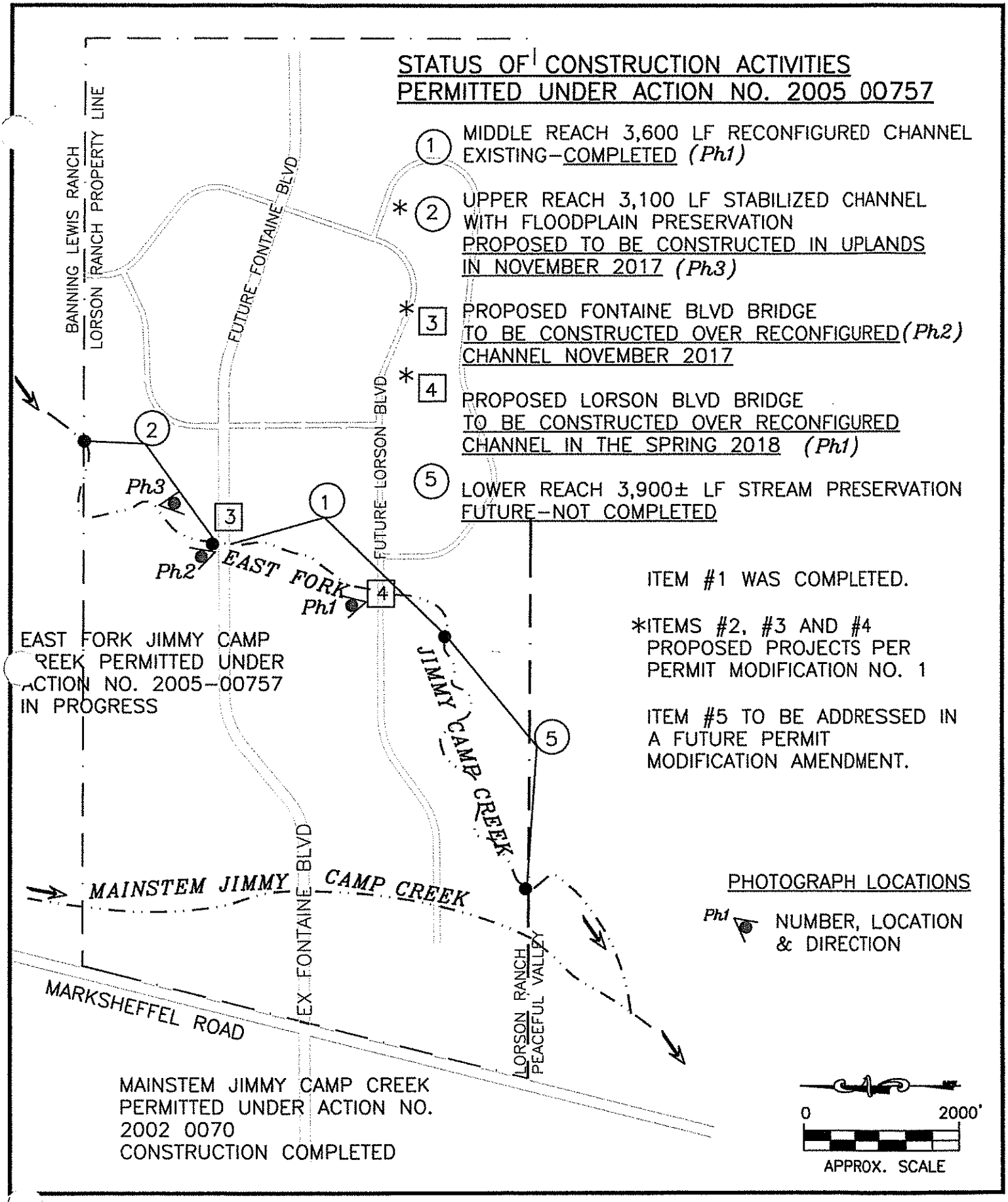
Sincerely,
KIOWA ENGINEERING CORPORATION

Elizabeth Klein

Elizabeth A. Klein
Certified Wetland Scientist

Encs. Exhibit 1
Fontaine Boulevard Bridge and East Fork Jimmy Camp Creek Channel Design Drawings
Lorson Boulevard Bridge

cc: Jeff Mark, Lorson Development
Richard Schindler, Core Engineering



LORSON RANCH
PERMIT MODIFICATION AMENDMENT NO. 1 MAP

ACTION NO. 2005 00757
EL PASO COUNTY, COLORADO

EXHIBIT 1

DATE: 08/03/17
PROJECT NO. 16031

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719)630-7342

DEPARTMENT OF THE ARMY PERMIT

Permittee Lorson LLC nominee for Lorson Conservation Investment 1, LLLP

Permit No. 2005 00757

Issuing Office Albuquerque District Corps of Engineers

NOTE: The term "you" and its derivatives, as used in this permit, means the permittee or any future transferee. The term "this office" refers to the appropriate district or division office of the Corps of Engineers having jurisdiction over the permitted activity or the appropriate official of that office acting under the authority of the commanding officer.

You are authorized to perform work in accordance with the terms and conditions specified below.

Project Description: The work includes modifying the lower 3,110 linear feet of stream with bank protection while preserving the stream alignment (stream preservation reach), and reconfiguring the upper 5,825 linear feet of the stream (reconfiguration reach). Specifically:

In the lower stream preservation reach, about 3,110 linear feet will be treated on one or both banks by regrading the overbank to 3H:1V and treating with concrete or synthetic matting with seeded topsoil beneath the mat. About 350 linear feet will be treated with stone toe protection with soil coir lifts. One or two grade control structures may be built to provide protection from future channel incision.

In the upper reconfiguration reach, a breached stock pond dam will be removed. About 4,025 linear feet of the upper channel will be reconstructed with a bottom width of about 40 feet, side slopes no steeper than 5H:1V, and a natural channel bottom. The new channel side slopes will be protected with a mat material that will provide stability while allowing establishment of vegetation. Eleven boulder grade control structures will be built.

The upper 1,800 linear feet of the channel is actually an upland swale and is not a water of the U.S. However, it's channel design is included in the permit for clarity.

Two road crossings will be built in the upper reach for Lorson Boulevard and Fontaine Boulevard. These structures will be two or three concrete arch, natural bottom spans. A temporary construction crossing may be built in the upper stream portion.

The project will be constructed in accordance with the attached drawings, entitled, "Lorson Ranch channel modification in East Tributary of Jimmy Camp Creek near Fountain, El Paso County, Colorado, Application by: Lorson LLC, Application No. 2005 00757," sheets 1 through 16, dated May 17, 2006.

Project Location: In the East Tributary of Jimmy Camp Creek and adjacent wetlands in the east portion of the Lorson Ranch development located east of the intersection of Fountaine Boulevard and Marksheffel Road near Fountain, El Paso County, Colorado, Sections 13, 14 and 23, Township 15S, Range 65W (38° 44.1' N Latitude, 104° 37.9' W Longitude).

Permit Conditions:

General Conditions:

1. The time limit for completing the work authorized ends on December 31, 2009. If you find that you need more time to complete the authorized activity, submit your request for a time extension to this office for consideration at least one month before the above date is reached.

2. You must maintain the activity authorized by this permit in good condition and in conformance with the terms and conditions of this permit. You are not relieved of this requirement if you abandon the permitted activity, although you may make a good faith transfer to a third party in compliance with General Condition 4 below. Should you wish to cease to maintain the authorized activity or should you desire to abandon it without a good faith transfer, you must obtain a modification of this permit from this office, which may require restoration of the area.

3. If you discover any previously unknown historic or archeological remains while accomplishing the activity authorized by this permit, you must immediately notify this office of what you have found. We will initiate the Federal and state coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

4. If you sell the property associated with this permit, you must obtain the signature of the new owner in the space provided and forward a copy of the permit to this office to validate the transfer of this authorization.

5. If a conditioned water quality certification has been issued for your project, you must comply with the conditions specified in the certification as special conditions to this permit. For your convenience, a copy of the certification is attached if it contains such conditions.

6. You must allow representatives from this office to inspect the authorized activity at any time deemed necessary to ensure that it is being or has been accomplished in accordance with the terms and conditions of your permit.

Special Conditions:

After a detailed and careful review of all of the conditions contained in this permit, the permittee acknowledges that, although said conditions were required by the Corps of Engineers, nonetheless the permittee agreed to those conditions voluntarily to facilitate issuance of the permit; the permittee will comply fully with all the terms of all the permit conditions.

1. Final bridge designs for Fontaine Boulevard and Lorson Boulevard will be submitted to the Corps of Engineers for review and approval 60 days prior to start of each bridge construction. Project construction of each structure may begin upon the Corps of Engineers' issuance of a start-of-work authorization.

2. The bank armoring for the stream preservation (lower) reach will be ungrouted stone toe with coir fabric lifts or similar materials. A final design for the stream preservation reach, including vegetation species list, will be submitted to the Corps of Engineers for review and

approval 60 days prior to start of bank armoring construction. Project construction may begin upon the Corps of Engineers' issuance of a start-of-work authorization.

3. The bank armoring for the reconfiguration (upper) reach will be armorflex, geogrid, or similar materials. The bank armoring will be covered with at least 6 inches of topsoil and seeded with grasses. The boulder grade control structures will be ungrouted. A final design for the reconfigured channel reach, including vegetation species list, will be submitted to the Corps of Engineers for review and approval 60 days prior to start of channel construction. Project construction may begin upon the Corps of Engineers' issuance of a start-of-work authorization.

4. Sloping boulder grade control structures will be ungrouted and designed to allow passage of small fish. For the stream preservation (lower) reach, the location of grade control structures and their design will be submitted to the Corps of Engineers for review and approval 60 days prior to the start of grade control structure construction.

5. Erosion control measures will be implemented to prevent upland erosion into the East Tributary of Jimmy Camp Creek. All upland areas disturbed by the permittee or their (sub)contractors located within 200 feet of the stream will be treated with erosion control measures including placing topsoil, seeding, and mulching within 21 calendar days after final grading or final earth disturbance or in accordance with the erosion control plan required by El Paso County. An erosion control plan or a summary of the County's approved plan will be provided to the Corps of Engineers within 60 days of permit issuance.

6. Noxious weeds will be controlled in all project-disturbed areas within 200 feet of the stream during the 5-year maintenance period. A plan for such control will be provided to the Corps of Engineers within 60 days of permit issuance, for review and approval.

7. A detailed mitigation plan will be provided to the Corps of Engineers within 60 days of permit issuance, for review and approval prior to start of project construction. Project construction may begin upon the Corps of Engineers' issuance of a start-of-work authorization. The plan will provide for the mitigation of the loss of 4.56 acres of wetland shrubs and the loss of riparian trees. The mitigation work will begin in the spring following winter construction (or in the fall following summer construction) and be completed within 6 months of project construction. The plan will include, but is not limited to, the following items:

- A typical cross section showing the area to be planted with shrubs and trees,
- Planting densities and number and species of trees,
- Methods and times of year for planting. (If willow stakes are used, they must be planted with no more than 6 inches of the stake exposed above the ground.) And,
- A plan for short and long term management and maintenance of the mitigation sites, including supplemental tree watering if needed,

replacement of failed plantings before the end of the 5-year monitoring period, and other contingency needs.

8. The mitigation efforts must be maintained for at least 5 years including 5 growing seasons or until the Corps of Engineers has determined that the mitigation efforts have been successful. Tree plantings will be deemed successful when 80% of the planted trees are alive at the end of the 5-year period. Willow shrub plantings will be deemed successful when 50% of the planted shrubs are alive at the end of the 5-year period.

9. An annual monitoring report of mitigation activities is required and will be sent to the Corps of Engineers by October 31 of each year. The monitoring report will include as a minimum:

- A drawing or sketch showing photographic monitoring points,
- Before and after photographs from fixed photographic location(s),
- A brief discussion of the overall success, any bare or problem areas, and a plan to remedy any problem areas.

10. A letter of intent from the local governing authority will be provided as financial assurances for construction, and for contingency and monitoring of the mitigation for the 5-year monitoring period. The assurances of the mitigation effort will be provided sufficient to hire an independent contractor to complete the proposed mitigation should the permittee default. The financial assurance for construction of the mitigation project will in an amount equal to 115 percent of the estimated cost of construction. The financial assurance for contingency and monitoring of the mitigation for the 5-year monitoring period will be in an amount equal to 25% of the construction costs and will be to assure the success of the mitigation. The letter of intent will be submitted to the Corps of Engineers, for approval, within 90 days of permit issuance.

11. Any changes to the project must be approved by the Corps of Engineers through a permit modification prior to the changes being implemented.

Further information:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

( ) Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).

(XX) Section 404 of the Clean Water Act (33 U.S.C. 1344).

( ) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 U.S.C. 1413).

2. Limits of this authorization.

a. This permit does not obviate the need to obtain other Federal, state, or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal project.

3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data: The determination of this office that issuance of this permit is not contrary to the public interest was made in reliance on the information you provided.

5. Reevaluation of Permit Decision. This office may reevaluate its decision on this permit at any time the circumstances warrant. Circumstances that could require a reevaluation include, but are not limited to, the following:

a. You fail to comply with the terms and conditions of this permit.

b. The information provided by you in support of your permit application proves to have been false, incomplete, or inaccurate (See 4 above).

c. Significant new information surfaces which this office did not consider in reaching the original public interest decision.

Such a reevaluation may result in a determination that it is appropriate to use the suspension, modification, and revocation procedures contained in 33 CFR 325.7 or enforcement procedures such as those contained in 33 CFR 326.4 and 326.5. The referenced enforcement procedures provide for the issuance of an administrative order requiring you to comply with the terms and conditions of your permit and for the initiation of legal action where appropriate. You will be required to pay for any corrective measures ordered by this office, and if you fail to comply with such directive, this office may in certain situations (such as those specified in 33 CFR 209.170) accomplish the corrective measures by contract or otherwise and bill you for the cost.

6. Extensions. General condition 1 establishes a time limit for the completion of the activity authorized by this permit. Unless there are circumstances requiring either a prompt completion of the authorized activity or a reevaluation of the public interest decision, the Corps will normally give favorable consideration to a request for an extension of this time limit.

Your signature below, as permittee, indicates that you accept and agree to comply with the terms and conditions of this permit.

(PERMITTEE)

(DATE)

This permit becomes effective when the Federal official, designated to act for the Secretary of the Army, has signed below.

Van A. Truan
Chief, Southern Colorado Regulatory Office
(for the DISTRICT ENGINEER)

22 September 2006
(DATE)

When the structures or work authorized by this permit are still in existence at the time the property is transferred, the terms and conditions of this permit will continue to be binding on the new owner(s) of the property. To validate the transfer of this permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below.

(TRANSFERREE)

(DATE)

Appendix C

Fontaine Boulevard Bridge Geotechnical Report

NCRS Soil Survey

ROCKY MOUNTAIN GROUP

Geotechnical Report

Fontaine Boulevard Bridge over East Tributary of Jimmy Camp Creek Lorson Ranch El Paso County, Colorado

PREPARED FOR:

Lorson Ranch Metropolitan District No.1
212 N. Wahsatch Ave, Ste. 301
Colorado Springs, CO 80903

JOB NO. 152808

September 23, 2016

Respectfully Submitted,
RMG – Rocky Mountain Group

COLORADO LICENSED
NATHAN A. DOWDEN
31266
9-23-16
PROFESSIONAL ENGINEER

Nathan A. Dowden, P.E.
Sr. Geotechnical Engineer

Reviewed by

Tony Munger, P.E.
Sr. Geotechnical Engineer

TABLE OF CONTENTS

GENERAL SITE AND PROJECT DESCRIPTION

Purpose and Scope of Study

This report present the results of a geotechnical engineering study for the proposed Fontaine Boulevard Bridge over the East Tributary of Jimmy Camp Creek at Lorson Ranch in El Paso County, Colorado. The site is located in the central portion of Lorson Ranch in the east central portion of El Paso County. The location of the project site is shown on the Site Vicinity Map, Figure 1.

This report has been prepared to summarize the data obtained during this study and to present our conclusions and recommendations based on the proposed construction and the subsurface conditions encountered. Design parameters and a discussion of geotechnical engineering considerations related to the proposed structure are included in the report.

Proposed Construction

We understand a single-span bridge will be constructed to carry Fontaine Boulevard over the East Tributary of Jimmy Camp Creek. Based on the information provided by Kiowa Engineering, we understand the proposed structure is a Con-Span® Bridge with a 50-foot span. The Con-Span® Bridge will support approximately 6 feet of soil cover and vehicular traffic loads. Driven H-Piles or drilled caissons are being considered for support of the structure at the bridge abutments. Unfactored vertical loads at the abutments are anticipated to be on the order of 35-40 kips/ft.

If the proposed construction varies significantly from that described above or depicted herein, we should be notified to re-evaluate the recommendations provided herein.

Existing Site Conditions

The site is presently being developed as residential lots. West of the East Tributary of Jimmy Camp Creek, Lorson Ranch Master Planned Community is currently under construction. East of the East Tributary, the land is vacant and Lorson Ranch is preparing to develop additional residential lots. The ephemeral channel of the East Tributary trends, generally, north to south. The topography on the site generally slopes gently toward the East Tributary. At the time of drilling, the height of the creek banks was on the order of approximately 10 feet, and the creek was dry. Vegetation in the area primarily consists of occasional grass and weeds.

FIELD INVESTIGATION AND LABORATORY TESTING

Drilling

The subsurface conditions at the site were investigated by drilling two exploratory test borings. The approximate locations of the test borings are presented in the Test Boring Location Plan, Figure 2.

The test borings were advanced with a power-driven, continuous-flight auger drill rig to depths of about 44 to 24 feet below the existing ground surface at TB-1 and TB-2, respectively. Samples were obtained in general accordance with ASTM D-1586 utilizing a 2-inch OD split-barrel sampler or in general accordance with ASTM D-3550 utilizing a 2½-inch OD modified California sampler. An Explanation of Test Boring Logs is presented in Figure 3. The Test Boring Logs are presented in Figure 4.

Laboratory Testing

The moisture content for the recovered samples was obtained in the laboratory. Grain-size analysis and Atterberg Limits tests were performed on selected samples for purposes of classification and to develop pertinent engineering properties. Soil Classification Data is presented in Figure 5. A Summary of Laboratory Test Results are presented in Figure 6.

SUBSURFACE CONDITIONS

Subsurface Materials

The subsurface materials encountered in the test borings were classified using the Unified Soils Classification System (USCS) and the materials were grouped into the general categories of native silty to clayey sand, native sandy clay extending to depths of approximately 20 to 40 feet below the existing ground surface. The native sands and clays are underlaid by sandy claystone and shale bedrock with occasional seams of clayey sandstone. The claystone/shale bedrock extended to the maximum depth of drilling in each test boring.

Additional descriptions and the interpreted distribution (approximate depths) of the subsurface materials are presented on the Test Boring Logs. The classifications shown on the logs are based upon the engineer's classification of the samples at the depths indicated. Stratification lines shown on the logs represent the approximate boundaries between material types and the actual transitions may be gradual and vary with location.

Groundwater

Groundwater was observed in Test Boring 1 at a depth of 19 feet below the existing ground surface at the time of field exploration. Groundwater was not encountered in Test Boring 2 either at the time of drilling or subsequent water-level checks. Fluctuations in groundwater and subsurface moisture conditions may occur due to variations in rainfall and other factors not readily apparent at this time. Development of the site and adjacent properties may also affect groundwater levels.

CONCLUSIONS AND RECOMMENDATIONS

The following discussion is based on the subsurface conditions encountered in the test borings and on the project characteristics previously described. If conditions are different from those described in this report or the project characteristics change, RMG should be retained to review our recommendations and adjust them, if necessary.

Bridge Foundation Recommendations

We recommend the proposed bridge structure founded on driven H-piles and/or drilled pier caissons bearing in the bedrock. Both foundation systems will have the advantage that they will experience small total and differential settlements. Depending on the time of year the foundation system is constructed, we anticipate that caisson shafts may require casing during drilling and possibly dewatering because of the presence of granular soils and the possible presence of groundwater. The presence of groundwater above the bearing elevation will not impact construction of pile foundation systems. Individual piles are anticipated to have lower supporting capacities than individual caissons. Recommendations for design and construction of drilled caissons and driven H-Piles are presented below.

Driven H-Piles

The design and construction criteria presented below should be observed for design of drive H-piles.

1. H-piles should be driven to virtual refusal into the bedrock. H-piles driven to virtual refusal may be design to their structural capacity. Virtual refusal is defined in Section 502.05 of the Colorado Department of Transportation's (CDOT) "Standard Specifications for Roads and Bridge Construction" (2011). Assuming the AASHTO LRFD method is utilized for design, ultimate capacities of the piles should be calculated using an ultimate pile stress of 40 ksi for AASHTO M270 Grade 50 steel. The ultimate capacity assumes a weighted load factor of 1.6. We recommend a resistance factor of 0.5 be used for pile design.

   The AASHTO LRFD resistance factor may be increased to 0.65 if supported by site-specific Pile Driving Analyzer (PDA) testing is performed on production piles. The resistance factor may be increased to 0.75 if static load testing of production piles is performed. If dynamic load testing is conducted on a minimum of 2 percent of production piles (but no fewer than 2 piles), the resistance factor may be increased to 0.8.

2. Based on our field exploration, laboratory testing and experience with similar properly constructed driven pile foundations, we estimate individual pile settlement will be on the order of ½ inch or less when designed in accordance with the criteria presented herein. The settlement of closely spaced piles in groups may be greater and should be studied on a individual basis.

3. Assuming a computer program such as LPILE is to be used, we recommend the following parameters be used for the analysis of laterally loaded piles:

Table 1 - Soil Properties for Lateral Analysis of Piles

Material		k_s (psi/in)	k_c (psi/in)	ϕ (degrees)	c (psi)	ε_{50}	γ_m/γ_b (pci)
Granular embankment fill		90	90	32	-	-	0.075/-
Native granular soils	Above water level	90	90	30	-	-	0.070/-
	Below water level	60	60	30	-	-	-/0.035
Native cohesive soils	Above water level	750	300	-	400	0.010	0.065/-
	Below water level	500	200	-	100	0.020	-/0.033
Claystone Bedrock		2000	800	-	500	0.004	-/0.040

k_s = modulus of subgrade reaction for static loading
k_c = modulus of subgrade reaction for cyclic loading
ϕ = angle of internal friction
c = undrained shear strength
ε_{50} = strain at 50% of peak strength
γ_m = moist unit weight
γ_b = buoyant unit weight

4. Resistance to horizontal forces may be provided by battered piles. It is normal to assume a battered pile can resist the same axial load as a vertical pile of the same type and size driven to the same elevation. The vertical and horizontal components of the load will depend on the batter inclinations. Batters should not exceed 1 horizontal to 4 vertical.

5. Closely spaced piles will require appropriate reductions of the lateral and axial capacities. Reduction in lateral load capacity may be avoided by spacing piles a center-to-center distance in the direction parallel to loading of at least 6 times the pile section depth, and at least 2.5 times the section depth in the direction perpendicular to loading. For axial loading, the center-to-center pile spacing should be a minimum of three times the section depth. More closely spaced piles should be studied on an individual basis to determine the appropriate reduction in axial and lateral load design parameters.

6. In our opinion, pile tip protection will generally not be required to reduce potential damage during driving. However, the contractor should be prepared for its use if unexpected hard driving conditions are encountered.

7. The contractor should select a driving hammer according to the criteria presented in Sections 502.03 and 502.04 of the CDOT Standard Specifications.

8. We anticipate that the piles will penetrate approximately 2 to 4 feet into bedrock at the time the virtual refusal is met. Based on construction information from the previously constructed Fontaine Boulevard bridge over Jimmy Camp Creek (located approximately 0.8 mile west of the subject site), we expect penetration into the bedrock may exceed the above values. If the pile penetration into bedrock is excessive, a Pile Driving Analyzer (PDA) should be used to

evaluate the conditions and determine virtual refusal based on the pile loads and the efficiency of the hammer.

9. The pile hammer should be operated at the manufacturer's recommended stroke when measuring penetration resistance for virtual refusal.

10. The pile driving operations should be observed by a qualified representative from RMG on a full-time basis. Each pile should be observed and checked for buckling, crimping and alignment in addition to recording penetration resistance and general pile driving operations.

Drilled Caissons

The design and construction criteria presented below should be observed for design of drilled caisson foundation systems.

1. Recommended ultimate end bearing capacities and ultimate side resistance for the LRFD method are 120 and 9.0 ksf, respectively. For the LRFD method, the capacities assume a weighted load factor of 1.6 and resistance factors of 0.5 and 0.55 for end bearing and side resistance, respectively. Skin friction values are for the portion of the caisson in unweathered bedrock.

2. Caissons should penetrate at least three pier diameters or 10 feet, whichever is greater, into the bedrock.

3. Caissons should be designed to resist lateral loads using the soil parameters presented above under "Driven H-Piles."

4. Closely spaced caissons will require appropriate reductions of the lateral and axial capacities. Reduction in lateral load capacity may be avoided by spacing the caissons at a distance of at least 6 diameters from center to center in the direction parallel to loading and 2.5 diameters in the direction perpendicular to loading. For axial loading, the caissons should be spaced at a minimum 3 diameters center to center. More closely spaced piers should be studied on an individual basis to determine the appropriate reduction in axial and lateral load design parameters.

5. The pier length-to-diameter ratio should not exceed 30.

6. Based on the results of our field exploration, laboratory testing, analysis and our experience with similar, properly constructed drilled-caisson foundations, we estimate caisson settlement will be low. Generally, we estimate the settlement of caissons 4 feet or less in diameter will be approximately 1 inch or less when designed according to the criteria presented herein and the caissons are properly constructed. The settlement of closely spaced caissons will be larger and should be studied on an individual basis.

7. Caisson holes should be properly cleaned and dewatered prior to the placement of concrete.

8. The presence of water and granular soils in the exploratory borings indicates casing and/or dewatering equipment will likely be required for caissons at this site. In no case should

concrete be placed in more than 3 inches of water unless the tremie method is used. If water cannot be removed or prevented with the use of casing or dewatering equipment prior to placement of concrete, the tremie method should be used after the hole has been cleaned.

9. Casing procedures should be evaluated by the geotechnical engineer on piers which will be subjected to lateral loads. Oversizing the portion of the hole in the overburden to allow casing insertion can reduce the lateral pier capacity, particularly if the hole is processed with a dense, viscous mixture of water and soil which is not displaced from the annular space around the casing during concreting. Depending on loading conditions and construction practices, additional measures such as modification of the slurry with cementitious materials or densification of the materials around the pier top after construction may be required.
10. When water and/or a drilling slurry is present outside the casing, care should be taken that concrete of sufficiently high slump is placed to a sufficiently high elevation inside the casing to prevent intrusion of the water and/or slurry into the concrete when the casing is withdrawn.
11. The drilled shaft contractor should mobilize equipment of sufficient size and operating condition to achieve the required penetration in the very hard bedrock.
12. Concrete should be placed in caissons the same day they are drilled. The presence of water or caving soils may require that concrete be placed immediately after the caisson hole is completed. Failure to place concrete the day of drilling will normally result in a requirement for additional bedrock penetration.
13. Caisson drilling operations should be observed by a qualified representative of RMG on a full-time basis.

Bridge Abutments/Con-Span® Arches

We recommend backfill placed against the abutments/Con-Span® arches consist of granular soils meeting the requirements of a Class 1 structure backfill in Section 703.08 of the CDOT Standard Specifications. Assuming Class 1 backfill is used, we recommend earth retaining structures be designed for an equivalent fluid unit weight of 40 pcf for the active condition, 55 pcf for the at-rest condition and 45 pcf for the intermediate condition. The moisture content and compacted density of the backfill should be in accordance with Section 203.07 of the standard specifications.

Cantilevered Retaining Walls

It is our opinion cantilevered, cast-in-place (CIP) retaining walls, if utilized, may be founded on spread footings. The design and construction criteria presented below should be observed for a shallow foundation system.

1. Spread footing foundations bearing on native granular soils and/or new structural fill may be designed for an allowable bearing pressure of 1,500 psf.

2. We recommend the walls be designed for lateral earth pressure computed using the following parameters:

   Active Earth Pressure Coefficient: 0.38
   At-Rest Earth Pressure Coefficient: 0.55
   Passive Earth Pressure Coefficient: 2.66
   Moist Unit Weight: 120 pcf
   Buoyant Unit Weight: 60 pcf

   In addition to passive earth pressures, friction at the bottom of wall may be used to resist lateral loads. An allowable coefficient of friction of 0.3 may be used for foundations bearing on the native granular soils and/or new structural fill. All earth retaining walls should be designed for surcharge pressures, such as traffic, construction materials and equipment. The buildup of water behind an earth retaining structure will increase the lateral earth pressure imposed on the retaining structure.

3. The horizontal extent of the select backfill material should be equal to at least 60% of the backfill height for the active or at-rest conditions and 200% of the backfill height for the passive condition.

4. Material used for backfill of retaining earth structures should consist of a select granular material approved by the geotechnical engineer. Select granular material should have a maximum of 15% passing the No. 200 sieve and a maximum plasticity index of 10. Some of the on-site granular soils will be suitable for reuse as select granular backfill material. Backfill should be placed in uniform lifts and compacted to 95% of the maximum Modified Proctor density (AASHTO T-180) at a moisture content near optimum. Care should be taken not to overcompact the backfill since this could cause excessive lateral pressure on the walls.

5. Footings should be provided with adequate soil cover above their bearing elevation for frost protection. Placement of foundations at least 30 inches below the exterior grade is typically used in this area.

6. Structural fill placed for support of foundations should be compacted to a minimum 95% of the maximum Modified Proctor density (AASHTO T-180) at a moisture content near optimum. New fill should extend down from the edges of the footings at a minimum 1 horizontal to 1 vertical projection.

7. Structural fill should be a minus 2-inch material that has a maximum of 30% passing the No. 200 sieve, a maximum liquid limit of 30, and a maximum plasticity index of 10. Some of the tested samples of the on-site materials meet these criteria. The geotechnical engineer should approve any proposed fill material prior to placement.

8. Areas of loose material encountered within the foundation excavation should be removed and replaced with nonexpansive fill material compacted to 95% of the maximum Modified Proctor density (AASHTO T-180) near the optimum moisture content, or compacted $^3/_4$"

to 2" crushed rock. As an alternate to removal and replacement, the loose materials should be removed and the footings extended to adequate native bearing material.

9. Granular foundation soils should be densified with a smooth vibratory compactor prior to placement of concrete.

10. Depending on the ground water level and the construction depth of the proposed walls, dewatering of the excavation may be required during construction. Dewatering should be conducted by using sumps or drains well below footing elevations to avoid loss of supporting capacity of the soils.

11. The native soils at the base of the excavation may soften due to construction traffic and the presence of water. In order to reduce this problem, we recommend the contractor consider a lean concrete "mud mat." In lieu of the "mud mat," a thick layer of gravel may provide a stable working platform.

12. A qualified representative of RMG should observe all foundation excavations prior to concrete placement.

Embankments

All areas to receive fill should be stripped of topsoil and organic matter, and prepared in accordance with Section 203.06 of the CDOT Standard Specifications. Embankments placed on slopes steeper than 4:1 should be keyed into the slope in accordance with Section 203.07. After each bench is cut into the slope, the materials exposed in the bench should be inspected for any weak or disturbed materials. If encountered, such materials should be removed. Compaction of all fill should be in accordance with Section 203.07 of the CDOT Standard Specifications.

Water Soluble Sulfates

The concentration of water soluble sulfates measured in representative samples obtained from Lorson Ranch range from approximately 0.01% on a tested sample of granular soil to 0.20% to 0.23% for the tested samples of bedrock. These concentrations of water soluble sulfates represent a negligible to severe degree (at the lower range for "severe") of sulfate attack on concrete exposed to these materials. The degree of attack is based on a range of negligible, positive, severe and very severe as presented in Table 4.3.1 of ACI 318-05 (American Concrete Institute).

Based on this information, we believe special sulfate resistant cement will not be required for concrete exposed to the on-site soils. For concrete exposed to the bedrock, we recommend concrete contain ASTM C 150 Type V cement. Concrete should have a minimum cement content of 564 pounds (6 sacks) per cubic yard, have a maximum water-cement ratio (by weight) of 0.45, and have air entrainment.

The above recommendation conforms with the general guidance of the American Concrete Institute (ACI) and the Portland Cement Association (PCA). However, Type V cement may have limited local availability. When this is the case, PCA guidance suggests that project specifications should allow for equivalent alternatives provided that the equivalence can meet the requirements of Section 2.2.7 of ACI 201.2R-10.

CLOSING

This report has been prepared for the exclusive purpose of providing geotechnical engineering information and recommendations for development described in this report. RMG should be retained to review the final construction documents prior to construction to verify our findings, conclusions and recommendations have been appropriately implemented.

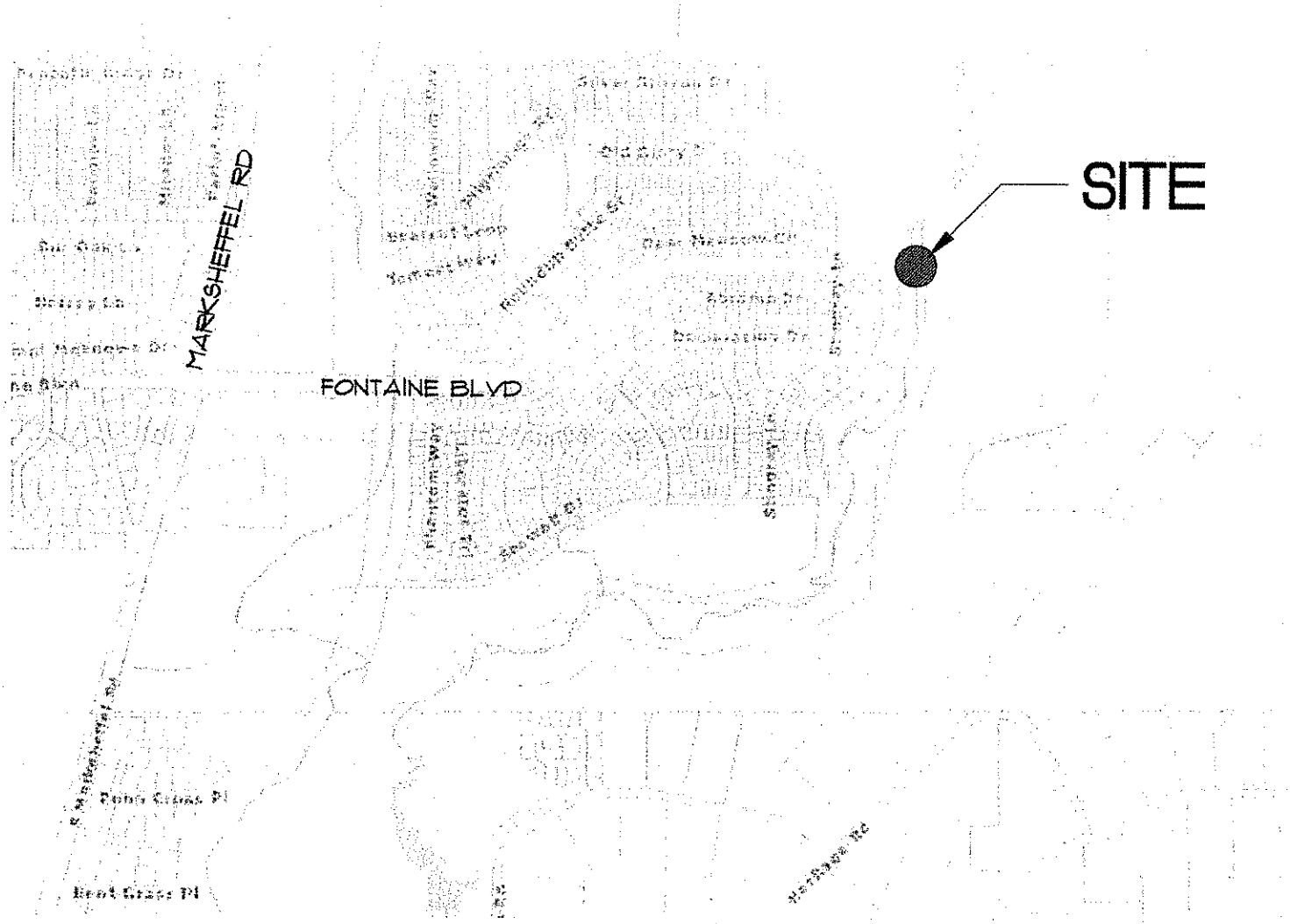
This report has been prepared for the exclusive use by **Lorson Ranch Metropolitan District No. 1** for application as an aid in the design and construction of the proposed structure in accordance with generally accepted geotechnical engineering practices. The analyses and recommendations in this report are based in part upon data obtained from test borings, site observations and the information presented herein. The nature and extent of variations in soil types and distributions, groundwater, and subsurface conditions may not become evident until construction. If variations then become evident, RMG should be retained immediately to review the recommendations presented in this report considering the varied condition, and either verify or modify them in writing.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by geotechnical engineers practicing in this or similar localities. RMG does not warrant the work of regulatory agencies or other third parties supplying information which may have been used during the preparation of this report. No warranty, express or implied is made by the preparation of this report. Third parties reviewing this report should draw their own conclusions regarding site conditions and specific construction techniques to be used on this project.

The scope of services for this project does not include, either specifically or by implication, environmental assessment of the site or identification of contaminated or hazardous materials or conditions. Development of recommendations for the mitigation of environmentally related conditions, including but not limited to biological or toxicological issues, are beyond the scope of this report. If the Client desires investigation into the potential for such contamination or conditions, other studies should be undertaken.

If we can be of further assistance in discussing the contents of this report or analysis of the proposed development, from a geotechnical engineering point-of-view, please feel free to contact us.

FIGURES



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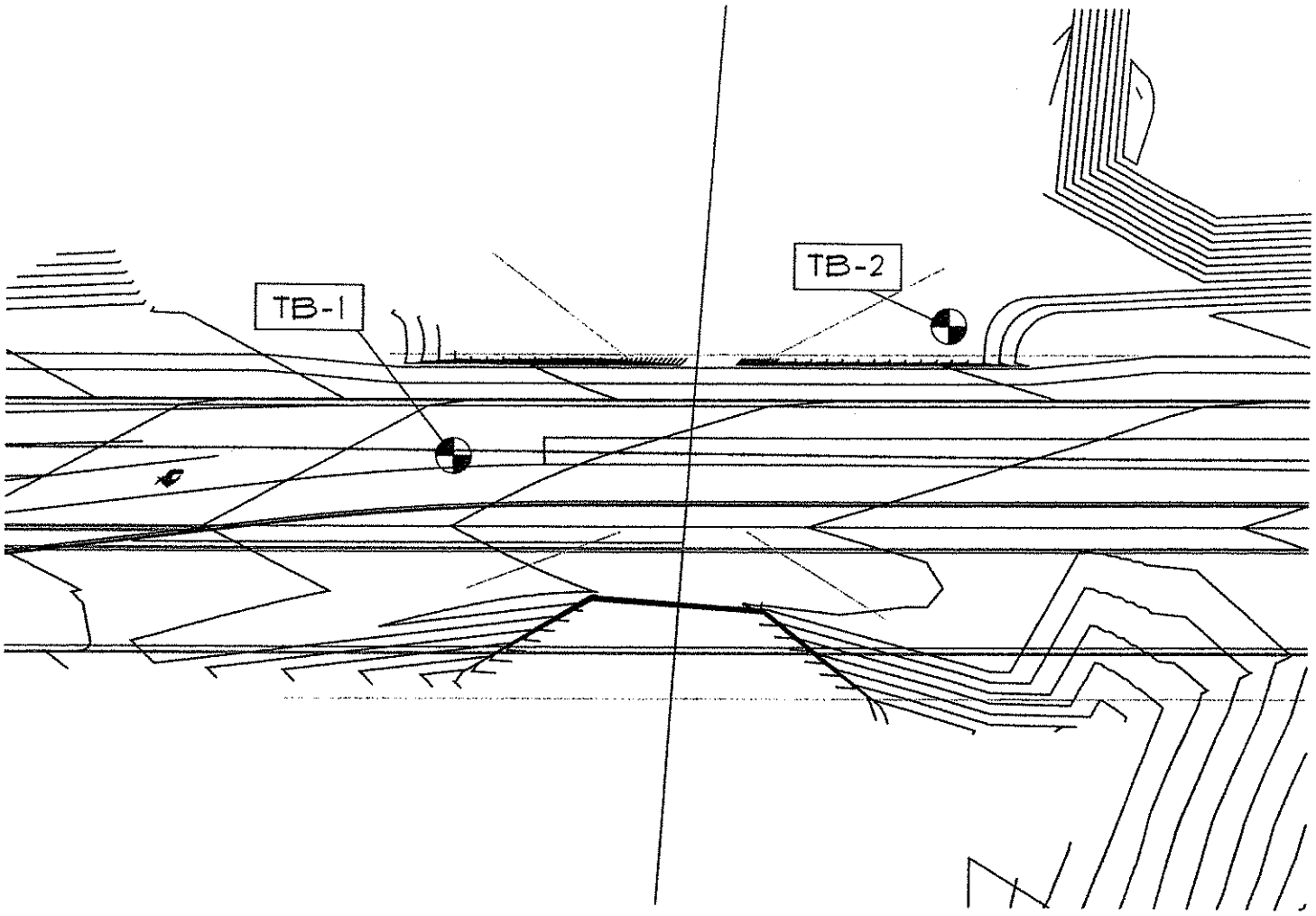
SITE VICINITY MAP

FONTAINE BOULEVARD
BRIDGE CROSSING
EL PASO COUNTY, COLORADO
LORSON RANCH METRO DISTRICT

JOB No. 152808

FIG No. 1

DATE 9-23-2016



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TEST BORING LOCATION PLAN

FONTAINE BOULEVARD
BRIDGE CROSSING
EL PASO COUNTY, COLORADO
LORSON RANCH METRO DISTRICT

JOB No. 152808

FIG No. 2

DATE 9-23-2016

SOILS DESCRIPTION

- CLAYEY SAND
- CLAYSTONE
- SANDY CLAY
- SHALE
- SILTY SAND
- SILTY TO CLAYEY SAND

SYMBOLS AND NOTES

XX	STANDARD PENETRATION TEST - MADE BY DRIVING A SPLIT-BARREL SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-1586. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).
XX	UNDISTURBED CALIFORNIA SAMPLE - MADE BY DRIVING A RING-LINED SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-3550. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).
	FREE WATER TABLE
	DEPTH AT WHICH BORING CAVED
BULK	DISTURBED BULK SAMPLE
AUG	AUGER "CUTTINGS"
4.5	WATER CONTENT (%)

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EXPLANATION OF TEST BORING LOGS

JOB No. 152808

FIGURE No. 3

DATE 9/23/16

TEST BORING: 1

DATE DRILLED: 9/23/16
TOB ELEV: 5733
GROUNDWATER @ 19.0 '
9/23/16

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY TO CLAYEY, brown, loose to medium dense, moist				
			16	9.6
10			15	7.8
			14	8.6
20			5	13.3
CLAY, SANDY, brown, moist to wet				
SAND, SILTY, with gravel, tan, loose, moist to wet			18	15.1
30				
40				
CLAY, SANDY, brown, moist to wet				
CLAYSTONE, SANDY, brown to gray, moist to wet				
SHALE, SANDY, gray, very hard, moist to wet				
50				
			50/3"	--

TEST BORING: 2

DATE DRILLED: 9/23/16
TOB ELEV: 5731
NO GROUNDWATER ON
9/23/16

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, moist				
SAND, CLAYEY, brown, medium dense, moist			14	6.6
CLAY, SANDY, brown, stiff to very stiff, moist			16	11.6
10			15	16.8
20			50/12"	17.9
CLAYSTONE, SANDY, brown, medium hard, moist				
			50/8"	14.5
30			50/9"	--

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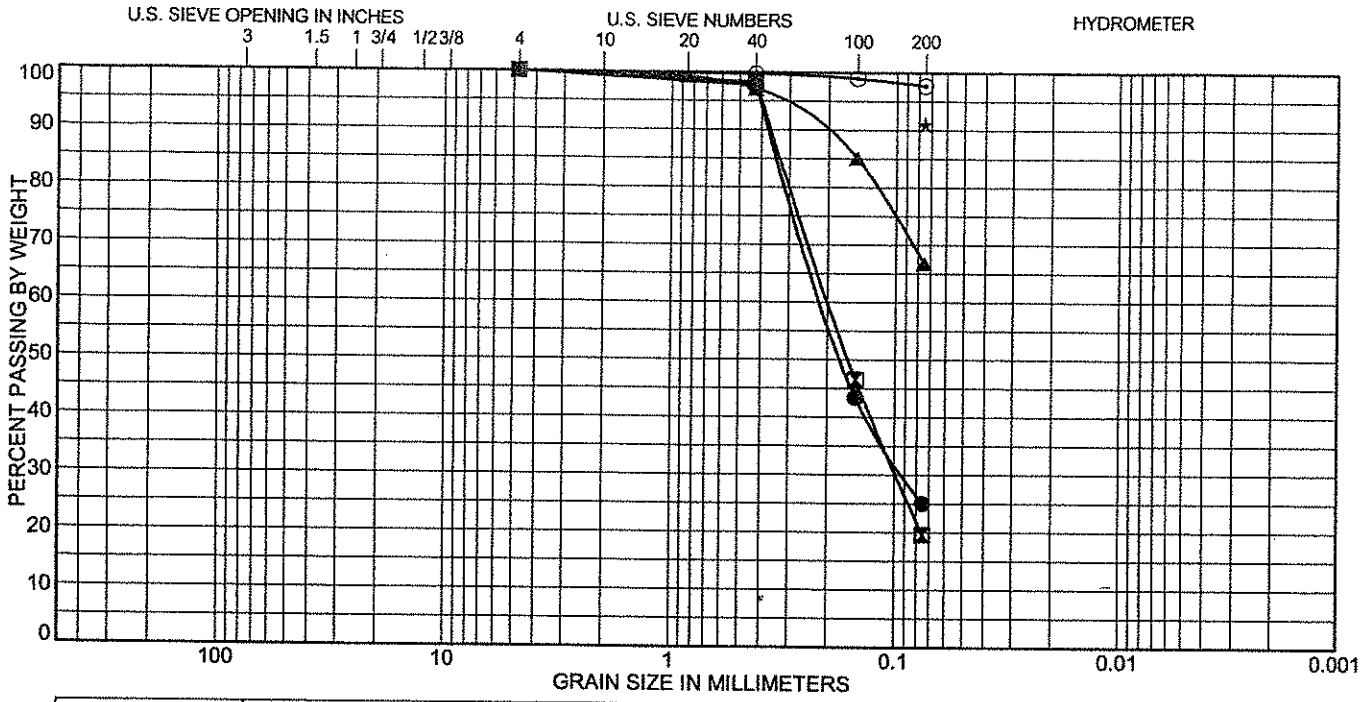
TEST BORING LOGS

JOB No. 152808

FIGURE No. 4

DATE 9/23/16



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	1	9.0	CLAYEY SAND(SC)	30	15	15
⊠	1	24.0	SILTY SAND(SM)	NP	NP	NP
▲	2	9.0	SANDY LEAN CLAY(CL)	44	12	32
★	2	14.0	LEAN CLAY(CL)	39	13	26
⊙	2	19.0	FAT CLAY(CH)	56	15	41

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	1	9.0	0.0	75.0	25.0	
⊠	1	24.0	0.0	80.4	19.6	
▲	2	9.0	0.0	33.2	66.8	
★	2	14.0			91.0	
⊙	2	19.0	0.0	2.3	97.7	

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SOIL CLASSIFICATION DATA

JOB No. 152808

FIGURE No. 5

DATE 9/23/16

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	% Swell/ Collapse	FHA Expansion Pressure (psf)
1	4.0	9.6							
1	9.0	7.8		30	15	0.0	25.0		
1	14.0	8.6							
1	19.0	13.3							
1	24.0	15.1		NP	NP	0.0	19.6		
2	4.0	6.6							
2	9.0	11.6		44	32	0.0	66.8		
2	14.0	16.8		39	26		91.0		
2	19.0	17.9		56	41	0.0	97.7		
2	24.0	14.5							

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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 152808
FIGURE No. 6
PAGE 1 OF 1
DATE 9/23/16

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

El Paso County Area, Colorado

Lorson Ranch

April 26, 2017

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a 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). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:13,900 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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 14, Sep 23, 2016

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

Date(s) aerial images were photographed: Apr 15, 2011—Sep 22, 2011

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.

Map Unit Legend

El Paso County Area, Colorado (CO625)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
2	Ascalon sandy loam, 1 to 3 percent slopes	12.5	1.5%
3	Ascalon sandy loam, 3 to 9 percent slopes	11.0	1.3%
10	Blendon sandy loam, 0 to 3 percent slopes	70.2	8.2%
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	75.7	8.9%
30	Fort Collins loam, 0 to 3 percent slopes	24.8	2.9%
52	Manzanst clay loam, 0 to 3 percent slopes	315.6	37.0%
54	Midway clay loam, 3 to 25 percent slopes	3.7	0.4%
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	129.4	15.2%
59	Nunn clay loam, 0 to 3 percent slopes	85.4	10.0%
75	Razor-Midway complex	25.8	3.0%
104	Vona sandy loam, warm, 0 to 3 percent slopes	9.7	1.1%
108	Wiley silt loam, 3 to 9 percent slopes	89.2	10.5%
Totals for Area of Interest		**852.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion

of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

2—Ascalon sandy loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367q
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Ascalon and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ascalon

Setting

Landform: Flats
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium and/or eolian deposits

Typical profile

A - 0 to 8 inches: sandy loam
Bt - 8 to 21 inches: sandy clay loam
BC - 21 to 27 inches: sandy loam
Ck1 - 27 to 48 inches: sandy loam
Ck2 - 48 to 60 inches: loamy sand

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Sandy Plains LRU's A & B (R069XY026CO)
Other vegetative classification: SANDY PLAINS (069BY026CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

3—Ascalon sandy loam, 3 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2tlny
Elevation: 3,870 to 5,960 feet
Mean annual precipitation: 13 to 18 inches
Mean annual air temperature: 46 to 54 degrees F
Frost-free period: 95 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Ascalon and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ascalon

Setting

Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Wind-reworked alluvium and/or calcareous sandy eolian deposits

Typical profile

Ap - 0 to 6 inches: sandy loam
Bt1 - 6 to 12 inches: sandy clay loam
Bt2 - 12 to 19 inches: sandy clay loam
Bk1 - 19 to 35 inches: fine sandy loam
Bk2 - 35 to 80 inches: fine sandy loam

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 5.98 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline (0.1 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 1.0
Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Sandy Plains (R067BY024CO)
Hydric soil rating: No

Minor Components

Olnest

Percent of map unit: 10 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy Plains (R067BY024CO)
Hydric soil rating: No

Vona

Percent of map unit: 5 percent
Landform: Interfluves
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy Plains (R067BY024CO)
Hydric soil rating: No

10—Blendon sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3671
Elevation: 6,000 to 6,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Blendon and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blendon

Setting

Landform: Alluvial fans, terraces
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Typical profile

A - 0 to 10 inches: sandy loam
Bw - 10 to 36 inches: sandy loam
C - 36 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 2 percent
Available water storage in profile: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Sandy Foothill (R049BY210CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

28—Ellicott loamy coarse sand, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 3680
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 47 to 50 degrees F

Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition
Ellicott and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ellicott

Setting
Landform: Flood plains, stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium

Typical profile
A - 0 to 4 inches: loamy coarse sand
C - 4 to 60 inches: stratified coarse sand to sandy loam

Properties and qualities
Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A
Ecological site: Sandy Bottomland LRU's A & B (R069XY031CO)
Other vegetative classification: SANDY BOTTOMLAND (069AY031CO)
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquoll
Percent of map unit:
Landform: Swales
Hydric soil rating: Yes

Other soils
Percent of map unit:
Hydric soil rating: No

Pleasant
Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

30—Fort Collins loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3683
Elevation: 5,200 to 6,500 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Fort collins and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fort Collins

Setting

Landform: Flats
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

A - 0 to 9 inches: loam
Bt - 9 to 16 inches: clay loam
Bk - 16 to 21 inches: clay loam
Ck - 21 to 60 inches: loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Loamy Plains (R067BY002CO)
Other vegetative classification: LOAMY PLAINS (069AY006CO)

Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:
Hydric soil rating: No

52—Manzanst clay loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2w4nr
Elevation: 4,060 to 6,660 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Manzanst and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Manzanst

Setting

Landform: Terraces, drainageways
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear, concave
Parent material: Clayey alluvium derived from shale

Typical profile

A - 0 to 3 inches: clay loam
Bt - 3 to 12 inches: clay
Btk - 12 to 37 inches: clay
Bk1 - 37 to 52 inches: clay
Bk2 - 52 to 79 inches: clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 3 percent
Salinity, maximum in profile: Slightly saline (4.0 to 7.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 10.0
Available water storage in profile: High (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: C
Ecological site: Saline Overflow (R067BY037CO)
Hydric soil rating: No

Minor Components

Ritoazul

Percent of map unit: 7 percent
Landform: Drainageways, interfluves
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Clayey Plains (R067BY042CO)
Hydric soil rating: No

Arvada

Percent of map unit: 6 percent
Landform: Drainageways, interfluves
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Salt Flat (R067XY033CO)
Hydric soil rating: No

Wiley

Percent of map unit: 2 percent
Landform: Interfluves
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Loamy Plains (R067BY002CO)
Hydric soil rating: No

54—Midway clay loam, 3 to 25 percent slopes

Map Unit Setting

National map unit symbol: 368y
Elevation: 5,200 to 6,200 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Midway and similar soils: 85 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Midway

Setting

Landform: Hills

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Slope alluvium over residuum weathered from shale

Typical profile

A - 0 to 4 inches: clay loam

C - 4 to 13 inches: clay

Cr - 13 to 17 inches: weathered bedrock

Properties and qualities

Slope: 3 to 25 percent

Depth to restrictive feature: 6 to 20 inches to paralithic bedrock

Natural drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum in profile: 15 percent

Gypsum, maximum in profile: 15 percent

Salinity, maximum in profile: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)

Sodium adsorption ratio, maximum in profile: 15.0

Available water storage in profile: Very low (about 2.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: D

Ecological site: Shaly Plains LRU's A & B (R069XY046CO)

Other vegetative classification: SHALY PLAINS (069AY046CO)

Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:

Hydric soil rating: No

Pleasant

Percent of map unit:

Landform: Depressions

Hydric soil rating: Yes

56—Nelson-Tassel fine sandy loams, 3 to 18 percent slopes

Map Unit Setting

National map unit symbol: 3690
Elevation: 5,600 to 6,400 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Nelson and similar soils: 45 percent
Tassel and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nelson

Setting

Landform: Hills
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous residuum weathered from interbedded sedimentary rock

Typical profile

A - 0 to 5 inches: fine sandy loam
Ck - 5 to 23 inches: fine sandy loam
Cr - 23 to 27 inches: weathered bedrock

Properties and qualities

Slope: 3 to 12 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Shaly Plains (R067BY045CO)

Other vegetative classification: SHALY PLAINS (069AY046CO)
Hydric soil rating: No

Description of Tassel

Setting

Landform: Hills
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous slope alluvium over residuum weathered from sandstone

Typical profile

A - 0 to 4 inches: fine sandy loam
C - 4 to 10 inches: fine sandy loam
Cr - 10 to 14 inches: weathered bedrock

Properties and qualities

Slope: 3 to 18 percent
Depth to restrictive feature: 6 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Available water storage in profile: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: Shaly Plains (R067BY045CO)
Other vegetative classification: SHALY PLAINS (069AY046CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

59—Nunn clay loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3693
Elevation: 5,400 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Nunn and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nunn

Setting

Landform: Terraces, fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile

A - 0 to 12 inches: clay loam
Bt - 12 to 26 inches: clay loam
BC - 26 to 30 inches: clay loam
Bk - 30 to 58 inches: sandy clay loam
C - 58 to 72 inches: clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: C

Ecological site: Clayey Plains LRU's A & B (R069XY042CO)
Other vegetative classification: CLAYEY PLAINS (069AY042CO)
Hydric soil rating: No

Minor Components

Other soils
Percent of map unit:
Hydric soil rating: No

Pleasant
Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

75—Razor-Midway complex

Map Unit Setting
National map unit symbol: 369p
Elevation: 5,300 to 6,100 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition
Razor and similar soils: 50 percent
Midway and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Razor

Setting
Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Concave, linear
Across-slope shape: Linear
Parent material: Clayey slope alluvium over residuum weathered from shale

Typical profile
A - 0 to 4 inches: stony clay loam
Bw - 4 to 22 inches: cobbly clay loam
Bk - 22 to 29 inches: cobbly clay
Cr - 29 to 33 inches: weathered bedrock

Properties and qualities
Slope: 3 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 5 percent
Salinity, maximum in profile: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 15.0
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups
Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: Alkaline Plains LRU's A & B (R069XY047CO)
Other vegetative classification: ALKALINE PLAINS (069AY047CO)
Hydric soil rating: No

Description of Midway

Setting
Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Slope alluvium over residuum weathered from shale

Typical profile
A - 0 to 4 inches: clay loam
C - 4 to 13 inches: clay
Cr - 13 to 17 inches: weathered bedrock

Properties and qualities
Slope: 3 to 25 percent
Depth to restrictive feature: 6 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 15 percent
Salinity, maximum in profile: Very slightly saline to moderately saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 15.0
Available water storage in profile: Very low (about 2.2 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Shaly Plains LRU's A & B (R069XY046CO)
Other vegetative classification: SHALY PLAINS (069AY045CO)

Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:
Hydric soil rating: No

104—Vona sandy loam, warm, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2t516
Elevation: 3,590 to 6,000 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 130 to 170 days
Farmland classification: Not prime farmland

Map Unit Composition

Vona, warm, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Vona, Warm

Setting

Landform: Sand sheets
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian sands

Typical profile

A - 0 to 5 inches: sandy loam
Bt1 - 5 to 12 inches: sandy loam
Bt2 - 12 to 17 inches: sandy loam
Bk - 17 to 41 inches: sandy loam
BCk - 41 to 79 inches: loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained

Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.5 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: Sandy Plains (R067BY024CO)
Other vegetative classification: Loamy, Dry (G067BW019CO), Sandy Plains #24 (067XY024CO_2)
Hydric soil rating: No

Minor Components

Valent, warm

Percent of map unit: 5 percent
Landform: Sand sheets
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Ecological site: Deep Sand (R067BY015CO)
Other vegetative classification: Sandy, Dry (G067BW026CO), Deep Sands #15 (067XY015CO_3)
Hydric soil rating: No

Olnest, warm

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy Plains (R067BY024CO)
Other vegetative classification: Loamy, Dry (G067BW019CO)
Hydric soil rating: No

Otero

Percent of map unit: 5 percent
Landform: Hillslopes
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope, head slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Sandy Plains (R067BY024CO)
Other vegetative classification: Loamy, Dry (G067BW019CO), SANDY PLAINS (067XY024CO_1)
Hydric soil rating: No

108—Wiley silt loam, 3 to 9 percent slopes

Map Unit Setting

National map unit symbol: 367b
Elevation: 5,200 to 6,200 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Wiley and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wiley

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous silty eolian deposits

Typical profile

A - 0 to 4 inches: silt loam
Bt - 4 to 16 inches: silt loam
Bk - 16 to 60 inches: silt loam

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 11.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Loamy Plains (R067BY002CO)
Other vegetative classification: LOAMY PLAINS (069AY006CO)
Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit:
Hydric soil rating: No

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Appendix D

East Fork Jimmy Camp Creek Conditional Letter of Map Revision

Case No. 17-08-1043R

Federal Emergency Management Agency

Washington, D.C. 20472

December 28, 2017

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

IN REPLY REFER TO:
Case No.: 17-08-1043R

The Honorable Darryl Glenn
President, El Paso County Board of County Commissioners
200 South Cascade Avenue, Suite 100
Colorado Springs, CO 80903

Community Name: El Paso County, CO
Community No.: 080059

104

Dear Mr. Glenn:

We are providing our comments with the enclosed Conditional Letter of Map Revision (CLOMR) on a proposed project within your community that, if constructed as proposed, could revise the effective Flood Insurance Study report and Flood Insurance Rate Map for your community.

If you have any questions regarding the floodplain management regulations for your community, the National Flood Insurance Program (NFIP) in general, or technical questions regarding this CLOMR, please contact the Director, Mitigation Division of the Federal Emergency Management Agency (FEMA) Regional Office in Denver, at (303) 235-4830, or the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at https://www.fema.gov/national-flood-insurance-program.

Sincerely,

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

List of Enclosures:
Conditional Letter of Map Revision Comment Document

cc: The Honorable John Suthers
Mayor, City of Colorado Springs

Mr. Keith Curtis, P.E., CFM
Regional Floodplain Administrator
El Paso County and City of Colorado Springs

Mr. Richard N. Wray, P.E.
Principal
Kiowa Engineering Corporation

Federal Emergency Management Agency

Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION COMMENT DOCUMENT

COMMUNITY INFORMATION		PROPOSED PROJECT DESCRIPTION	BASIS OF CONDITIONAL REQUEST
COMMUNITY	El Paso County Colorado (Unincorporated Areas)	BRIDGE CHANNELIZATION DETENTION BASIN	FLOODWAY HYDRAULIC ANALYSIS UPDATED TOPOGRAPHIC DATA
	COMMUNITY NO.: 080059		
IDENTIFIER	East Tributary Jimmy Camp Creek CLOMR Lorson Ranch	APPROXIMATE LATITUDE & LONGITUDE: 38.738, -104.630 SOURCE: USGS QUADRANGLE DATUM: NAD 83	

AFFECTED MAP PANELS

TYPE: FIRM*	NO.: 08041C0957F	DATE: March 17, 1997	* FIRM - Flood Insurance Rate Map
TYPE: FIRM	NO.: 08041C1000F	DATE: March 17, 1997	

FLOODING SOURCE AND REACH DESCRIPTION

Jimmy Camp Creek East Tributary - from approximately 5,260 feet upstream to approximately 13,350 feet upstream of Peaceful Valley Road

PROPOSED PROJECT DESCRIPTION

Flooding Source	Proposed Project	Location of Proposed Project
Jimmy Camp Creek East Tributary	2 New Bridges	Approximately 8,030 feet upstream and approximately 10,120 feet upstream of Peaceful Valley Road
	Channelization	From approximately 9,930 feet upstream to approximately 13,110 feet upstream of Peaceful Valley Road
	New Detention Basin	On the left bank from approximately 10,200 feet upstream to approximately 11,020 feet upstream of Peaceful Valley Road

SUMMARY OF IMPACTS TO FLOOD HAZARD DATA

Flooding Source	Effective Flooding	Proposed Flooding	Increases	Decreases
Jimmy Camp Creek East Tributary	Floodway	Floodway	Yes	Yes
	BFEs*	BFEs	Yes	Yes
	Zone AE	Zone AE	Yes	Yes
	Zone X (shaded)	Zone X (shaded)	Yes	Yes

* BFEs - Base (1-percent-annual-chance) Flood Elevations

COMMENT

This document provides the Federal Emergency Management Agency's (FEMA's) comment regarding a request for a CLOMR for the project described above. This document is not a final determination; it only provides our comment on the proposed project in relation to the flood hazard information shown on the effective National Flood Insurance Program (NFIP) map. We reviewed the submitted data and the data used to prepare the effective flood hazard information for your community and determined that the proposed project meets the minimum floodplain management criteria of the NFIP. Your community is responsible for approving all floodplain development and for ensuring that all permits required by Federal or State/Commonwealth law have been received. State/Commonwealth, county, and community officials, based on their knowledge of local conditions and in the interest of safety, may set higher standards for construction in the Special Flood Hazard Area (SFHA), the area subject to inundation by the base flood). If the State/Commonwealth, county, or community has adopted more restrictive or comprehensive floodplain management criteria, these criteria take precedence over the minimum NFIP criteria.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional information about the NFIP is available on the FEMA website at https://www.fema.gov/national-flood-insurance-program.

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION COMMENT DOCUMENT (CONTINUED)

OTHER COMMUNITIES AFFECTED BY THIS CONDITIONAL REQUEST

CID Number: 080060 **Name:** City of Colorado Springs, CO

AFFECTED MAP PANELS

TYPE: FIRM	NO.: 08041C0957F	DATE: March 17, 1997
TYPE: FIRM	NO.: 08041C1000F	DATE: March 17, 1997

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional information about the NFIP is available on the FEMA website at https://www.fema.gov/national-flood-insurance-program.

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Engineering Services Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION COMMENT DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

To determine the changes in flood hazards that will be caused by the proposed project, we compared the hydraulic modeling reflecting the proposed project (referred to as the proposed conditions model) to the hydraulic modeling used to prepare the Flood Insurance Study (FIS) (referred to as the effective model). If the effective model does not provide enough detail to evaluate the effects of the proposed project, an existing conditions model must be developed to provide this detail. This existing conditions model is then compared to the effective model and the proposed conditions model to differentiate the increases or decreases in flood hazards caused by more detailed modeling from the increases or decreases in flood hazards that will be caused by the proposed project.

The table below shows the changes in the BFEs:

BFE Comparison Table

Flooding Source: Jimmy Camp Creek East Tributary		BFE Change (feet)	Location of maximum change
Existing vs. Effective	Maximum increase	0.7	Approximately 10,730 feet upstream of Peaceful Valley Road
	Maximum decrease	1.2	Approximately 11,820 feet upstream of Peaceful Valley Road
Proposed vs. Existing	Maximum increase	4.4	Approximately 10,280 feet upstream of Peaceful Valley Road
	Maximum decrease	4.5	Approximately 10,930 feet upstream of Peaceful Valley Road
Proposed vs. Effective	Maximum increase	4.3	Approximately 10,280 feet upstream of Peaceful Valley Road
	Maximum decrease	4.8	Approximately 10,930 feet upstream of Peaceful Valley Road

Increases due to the proposed project that exceed those permitted under Paragraphs (c)(10) or (d)(3) of Section 60.3 of the NFIP regulations must adhere to Section 65.12 of the NFIP regulations. With this request, your community has complied with all requirements of Paragraph 65.12(a) of the NFIP regulations. Compliance with Paragraph 65.12(b) also is necessary before FEMA can issue a Letter of Map Revision when a community proposes to permit encroachments into the effective regulatory floodway that will cause BFE increases in excess of those permitted under Paragraph 60.3(d)(3).

NFIP regulations Subparagraph 60.3(b)(7) requires communities to ensure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management ordinances; therefore, responsibility for maintenance of the altered or relocated watercourse, including any related appurtenances such as bridges, culverts, and other drainage structures, rests with your community. We may request that your community submit a description and schedule of maintenance activities necessary to ensure this requirement.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional information about the NFIP is available on the FEMA website at https://www.fema.gov/national-flood-insurance-program.

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION COMMENT DOCUMENT (CONTINUED)

COMMUNITY INFORMATION (CONTINUED)

DATA REQUIRED FOR FOLLOW-UP LOMR

Upon completion of the project, your community must submit the data listed below and request that we make a final determination on revising the effective FIRM and FIS report. If the project is built as proposed and the data below are received, a revision to the FIRM and FIS report would be warranted.

• Detailed application and certification forms must be used for requesting final revisions to the maps. Therefore, when the map revision request for the area covered by this letter is submitted, Form 1, entitled "Overview and Concurrence Form," must be included. A copy of this form may be accessed at https://www.fema.gov/media-library/assets/documents/1343.

• The detailed application and certification forms listed below may be required if as-built conditions differ from the proposed plans. If required, please submit new forms, which may be accessed at https://www.fema.gov/media-library/assets/documents/1343, or annotated copies of the previously submitted forms showing the revised information.

Form 2, entitled "Riverine Hydrology and Hydraulics Form." Hydraulic analyses for as-built conditions of the base flood, the 10-percent, 2-percent, and 0.2-percent-annual-chance floods, and the regulatory floodway, must be submitted with Form 2.

Form 3, entitled "Riverine Structures Form."

• A certified topographic work map showing the revised and effective base and 0.2-percent-annual-chance floodplain and floodway boundaries. Please ensure that the revised information ties-in with the current effective information at the downstream and upstream ends of the revised reach.

• An annotated copy of the FIRM, at the scale of the effective FIRM, that shows the revised base and 0.2-percent-annual-chance floodplain and floodway boundary delineations shown on the submitted work map and how they tie-in to the base and 0.2-percent-annual-chance floodplain and floodway boundary delineations shown on the current effective FIRM at the downstream and upstream ends of the revised reach.

• As-built plans, certified by a registered Professional Engineer, of all proposed project elements.

• A copy of the public notice distributed by your community stating its intent to revise the regulatory floodway, or a signed statement by your community that it has notified all affected property owners and affected adjacent jurisdictions.

• Documentation of the individual legal notices sent to property owners who will be affected by any widening or shifting of the base floodplain and/or any BFE increases along Jimmy Camp Creek East Tributary.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional information about the NFIP is available on the FEMA website at https://www.fema.gov/national-flood-insurance-program.

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Engineering Services Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION COMMENT DOCUMENT (CONTINUED)

COMMUNITY INFORMATION (CONTINUED)

DATA REQUIRED FOR FOLLOW-UP LOMR (continued)

• FEMA's fee schedule for reviewing and processing requests for conditional and final modifications to published flood information and maps may be accessed at https://www.fema.gov/forms-documents-and-software/flood-map-related-fees. The fee at the time of the map revision submittal must be received before we can begin processing the request. Payment of this fee can be made through a check or money order, made payable in U.S. funds to the National Flood Insurance Program, or by credit card (Visa or MasterCard only). Please either forward the payment, along with the revision application, to the following address:

LOMC Clearinghouse
Attention: LOMR Manager
3601 Eisenhower Avenue, Suite 500
Alexandria, Virginia 22304-6426

or submit the LOMR using the Online LOMC portal at: https://hazards.fema.gov/femaportal/onlinelomc/signin

After receiving appropriate documentation to show that the project has been completed, FEMA will initiate a revision to the FIRM and FIS report. Because the flood hazard information (i.e., base flood elevations, base flood depths, SFHAs, zone designations, and/or regulatory floodways) will change as a result of the project, a 90-day appeal period will be initiated for the revision, during which community officials and interested persons may appeal the revised flood hazard information based on scientific or technical data.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional information about the NFIP is available on the FEMA website at https://www.fema.gov/national-flood-insurance-program.

Patrick "Rick" F. Sacbibit, P.E., Branch Chief
Engineering Services Branch
Federal Insurance and Mitigation Administration

Federal Emergency Management Agency
Washington, D.C. 20472

CONDITIONAL LETTER OF MAP REVISION COMMENT DOCUMENT (CONTINUED)

COMMUNITY INFORMATION (CONTINUED)

COMMUNITY REMINDERS

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Jeanine P. Petterson
Director, Mitigation Division
Federal Emergency Management Agency, Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, CO 80225-0267
(303) 235-4830

A preliminary study is being conducted for El Paso County, Colorado, and Incorporated Areas. Preliminary copies of the revised FIRM and FIS report were submitted to your community for review on July 29, 2015, and may become effective before the revision request following this CLOMR is submitted. Please ensure that the data submitted for the revision ties into the data effective at the time of the submittal.

This comment is based on the flood data presently available. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 3601 Eisenhower Avenue, Suite 500, Alexandria, VA 22304-6426. Additional information about the NFIP is available on the FEMA website at https://www.fema.gov/national-flood-insurance-program.

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