Final Bridge and Channel Design Report

Sand Creek Drainageway
Sterling Ranch Road and Briargate Parkway
Branding Iron at Sterling Ranch Filing 2
Homestead at Sterling Ranch Filing 2

CDR XX-XXX
El Paso County, Colorado

20-004

Engineering Review
07/22/2020 10:07:53 AM
dsdrice
JeffRice@elpasoco.com
(719) 520-7877
EPC Planning & Community Development Department

Also see comment letter. Blue highlights are on areas of concern that need to be revised or verified.

Prepared for:
Sterling Ranch Metropolitan District
20 Boulder Crescent Suite 2nd Floor
Colorado Springs, Colorado 80903

Prepared by:

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

Kiowa Project No. 19032
May 19, 2020

Page

List of Figures

Provide Sand Creek DBPS maps and excerpts

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 Date
Registered Engineer #19310
For and on Behalf of Kiowa Engineering Corporation

Developer's Statement:

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

BY: _____ _____

Date

James Morley
Printed

ADDRESS: Sterling Ranch Metropolitan District
20 Boulder Crescent Suite 2nd floor
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. Date
County Engineer/ECM Administrator

I. General Location and Description

This report serves to summarize the design of the Sand Creek drainageway and for two bridges in the Sterling Ranch Development. It is proposed to construct nineteen grouted sloping boulder drops, 100-year capacity with benched overbank channel and clear span precast bridges at Sterling Ranch Road and at Briargate Boulevard. Total length of Sand Creek subject to the design is approximately 8,900 lineal. The work along the drainageway will begin approximately 200 feet north of the south property line of the Sterling Ranch development and ends at the north property line. The proposed drainageway and bridge improvements lie within El Paso County. The location of the site is shown on Figure 1.

Clarify or split this sentence.

existing

Upon the completion of the drainageway facilities and acceptance by El Paso County and Sterling Ranch Metropolitan District, easements and or tracts will be dedicated for the purposes of maintenance access. Most of the channel and bridge work will occur within Tract D of Sterling Ranch Filing No. 1. The portions of the drainageway south of Sterling Ranch Road and North of Briargate Parkway will be constructed within un-platted land owned by the developer of Sterling Ranch. Operation and maintenance of the drainageway will be the responsibility of the Sterling Ranch Metropolitan District. Upon completion of a CLOMR that accounts for the channel and bridge structures subject to this design, there will be no residential lots within future Sterling Ranch Filings that will lie within the 100-year floodplain. The proposed lots for Branding Iron at Sterling Ranch Filing 2 and Homestead at Sterling Ranch Filing 2 all lie outside od the effective 100-yar floodplain.

The bridges over Sand Creek at Sterling Ranch Road and at Briargate Parkway are included within the design plans. The bridges will be clear-span precast structures that have the capacity to pass the 100-year discharge. The proposed road right-of-ways are 80-feet for Sterling Ranch Road and 130 feet for Briargate Parkway. The structure at Sterling Ranch Road will be 84-feet feet out-to-out. The roadway section for Sterling Ranch Road shown on the roadway design plans includes two 12-foot lanes and a 12-foot painted median, Type A curb and gutter, and 6-foot detached sidewalks. The ultimate roadway section for Briargate Parkway as shown on the roadway design plans includes four 12-foot lanes and a 16-foot raised median, 8-foot paved shoulders, Type A curb and gutter, and 6-foot detached sidewalks. Protective guardrails as shown on the drawings have been designed in conformance with Colorado Department of Transportation M-standards. The roadway design plans have been included within Appendix C of this report.

Once the bridge and roadway facilities are completed and accepted by El Paso County, El Paso County will assume maintenance responsibility for the structures and roadways. The developer intends to request reimbursement for the cost to construct the bridges 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 Sterling Ranch Metropolitan District.

II. Project Background

Sand Creek within Sterljng Ranch is a natural drainageway at his time that was shown to be stabilized in the Sterling Ranch Master Development Drainage Plan (MDDP). The MDDP as last showed Sand Creek to be reconfigured into a trapezoidal channel section capable of conveying the 100-year discharge as listed in the MDDP. The channel as proposed is a benched trapezoidal channel. This section was chosen to meet the hydraulic conditions and to conform with the Sterling Ranch 404 permit. Transitions to a trapezoidal section occurs at the crossings of the roadways. At the upstream and downstream termini of the project, the channel will be transitioned to meet the existing natural channel section. The present average slope of the drainageway within the design reach is 1.8 percent. There are short segments of the drainageway that have slopes that exceed 4 percent and some

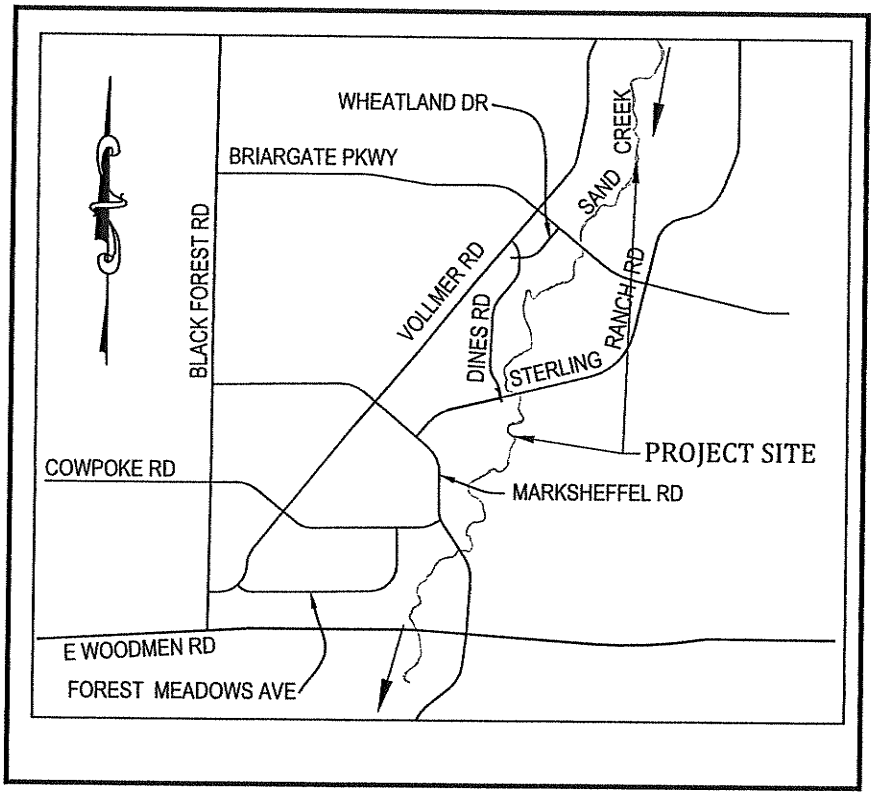


FIGURE 1
VICINITY MAP
SCALE: N.T.S.

reaches as flat as .5 percent. To create a stable invert slope capable of conveying developed runoff drop structures are necessary. For a sand bed channel, a slope of less than 1 percent is necessary to keep the flow in a sub-critical flow regime and prevent long-term degradation of the invert and the associated bank sloughing that would come from under-cutting. Drop structures for this segment of Sand Creek were identified in the MDDP as well as in the DBPPS.

III. Previous Reports and Jurisdictional Requirements

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

1. ***Sterling Ranch Master Development Drainage Plan (MDDP), prepared by M & S Civil Consultants, July 2018.*** October
2. ***Sand Creek Drainage Basin Planning Study (DBPS), prepared by Kiowa Engineering, 1996.***
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, May 2014.***
6. ***The City of Colorado Springs and El Paso County Flood Insurance Study (FIS), prepared by the Federal Emergency Management Agency, effective 2018.***
7. ***Sterling Ranch Channel Improvements and Mitigation Plan, prepared by Core Consultants, October 2015.***

Retreat at Timber Ridge FDR - 2020?

Reference 6 provides for the existing condition floodplain and floodway for the segment of Sand Creek subject to this design. The existing condition floodplain has been shown on the design drawings. Because the bridge structure and channel stabilization measures occur within the regulatory floodplain and floodway, a Conditional Letter of Map Revision (CLOMR) will be required to be processed through FEMA as part of gaining the necessary construction approvals for the project.

Chapter 6 and Section 3.2.1 of Chapter 13 of Reference 5 was made part of Reference 4 by El Paso County Board of County Commissioners Resolution 15-042.

7?

Reference 6 called for a stabilized floodplain for the reach of Sand Creek in Sterling Ranch and preservation of riparian resources wherever possible. Riprap bank protection at all outside bends were called out in the DBPS. Drop structures to create a longitudinal channel slope of 1 percent were also identified for this reach of Sand Creek. The channel concept advanced in this design allow for the preservation and/or creation of riparian habitat along the cannel benches. Wetland areas may develop along the low flow channel upstream of the proposed drops.

IV. Site Description

Provide a complete and thorough discussion on Reference 2 including correlation of DBPS costs to anticipated costs for each reach and item.

The Sand creek 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 little evidence of active invert degradation or bank sloughing except for the channel bends that occur at the location of future Sterling Ranch Road. Current longitudinal slope along the project is ranges from .5 to 4.2 percent, with an average slop of 1.8 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 10 feet. Topography used in the design was compiled at a two-foot contour interval and is dated 2007. The topography does not reflect the grading that has occurred

platted in

for the development Sterling Ranch Filing No, 1. There are presently no developed lots that lie within the 100-year floodplain. Lots proposed for the Homestead at Sterling Ranch Filing No. 2 and Branding Iron at Sterling Ranch Filing No. 2 subdivisions will not encroach into the 100-year floodplain.

There is presently an existing sanitary sewer outfall that crosses the drainageway just upstream of the south property line of the development. A 24-inch water line is proposed cross the drainageway just upstream of future Briargate Boulevard. The water and wastewater facilities that may impact the drainageway are all owned and maintained by the Woodmen Heights Metropolitan District.

Woodmen Hills or
Sterling Ranch?

V. Hydrology

Hydrology for use in determining the typical channel sections shown on the plans were obtained from Reference 6. The 100-year discharges shown in Reference 6 is 2,600 cubic feet per second. The 100-year peak discharges from references 1 and 2 were reviewed as well. A comparison if peak discharges is presented below.

Existing Development Condition Peak Discharges

Sand Creek at Sterling Ranch

Location: South Property Line (cfs)	5yr	10yr	100yr
City of Colorado Springs FIS	NR	1,200	2,600
Sand Creek DBPS	NR	770	2,620
Sterling Ranch MDDP	435	713	1,912

The above listed discharges all assume existing, or pre-development conditions. The hydrology used in the FIS was obtained from a Soil Conservation Service study conducted in 1975 for eth Sand Creek watershed using the "SCS method. The hydrology developed in the DBPS also used the SCS method and obtained similar. The MDDP used the U. S. Army Corps of Engineers HEC-1 hydrograph model and the SCS curve numbers to develop the peak discharges shown above. The MDDP applied a Type II storm distribution as proposed to the Type IIA distribution applied in the FIS and DBPS. This will typically cause peak discharges to decrease 10 to 15 percent. As the difference in the peak discharges cause relatively small differences in the hydraulic design the channel and the bridges, the FIS 100-year discharge was used in the hydraulic design of the channel and bridge improvements. According to the criteria set forth in Reference 4, the low flow channel was sized using 10 percent of the 100-year discharge, or 260 cubic feet per second.

The assumption that FSD will be required for all future development is reflected in the use of the existing development discharges in this design. There is a good correlation between the FIS and DBPS 100-year discharges for the segment of Sand Creek subject to this design. The future FSD's within Sterling Ranch will be publicly operated and maintained facilities by the Sterling Ranch Metropolitan District.

Address the effects of diversions upstream of the confluence at DP 53. See comment letter.

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 A of this report are floodplain maps that show the effective regulatory 100-year floodplain. The location for selected HEC-RAS cross-sections are shown on the design profile. The HEC-RAS cross-sections are contained within Appendix A. The summary output for the 10-. 50- 100-yar and 500-year recurrence intervals have been included in the Appendix A of this report

not found

doesn't match plans

The propose drainageway design concept put forth on the plans are 100-year benched channel section. The design slope ranges from 0.05 to 0.085 percent. The low flow area will be stabilized using soil riprap. Bottom width of the low flow is 15 feet and the top with is 40 feet. The depth of the low flow channel is 2.5 feet. Low flow channel banks will be placed at a three-to-one slopes. channel selective bank lining with low flow stabilization. Even with FSD implemented throughout the watershed the low flow area of the drainageway will continue to degrade to a flatter longitudinal 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 FSDs.

missing text?

how much?

The channel benches will be stabilized using turf reinforcement mat (TRM). The benches range in width from 20 to 50 feet, however the predominant bench width is 35 feet. Tractive force calculations that support the use of TRM on the channel benches in contained in Appendix A. The benches will slope toward the low channel at 1 percent. Shear stress calculations were carried out for the 10- and 100-year flow conditions. Maximum 100-year shear stress on the bench was calculated at .78 pounds per square foot. Permissible shear stress for woven TRM is 1.55 pounds per square foot.

The 100-year overbank channel slopes will be placed at four -to-one and will be lined with Type M soil riprap at outside bends and grass-lied at inside bends. The depth of flow on the overbank is 3.5 feet. At a total channel depth of at 6.35 feet deep, the section provides one-foot of freeboard above the 100-year design water surface. Tractive force calculations for the grassed overbank slopes were carried out. 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. Calculated shears stress was .52 pounds per square foot. All grass-lined overbank slopes will be temporarily cover with erosion control blanket and reseeded using native grass seed.

The existing drainageway will eventually degrade along the invert in turn causing bank sloughing to occur if grade control is not implemented. Grouted sloping boulder drops are proposed at 19 locations along the design alignment. The drops range in vertical height from 6 to 7 feet. Each drop is 70-feet long and has a 30-foot stilling basin upstream of the sills. The crests have been sized to convey the 100-year design discharge.

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:

If there is a deviation for centerline radius, superelevation and spiral flow need to be addressed.

Channel design slope:	.5-.85 percent
Maximum low flow drop height:	7 feet
Outside bend slopes- riprap or grass-lined	4 to 1 maximum
Low flow channel side slopes- riprap lined	3 to 1 maximum
Soil riprap slopes at bridge approaches and exits	3 to 1 maximum

See comment letter.

Low flow channel depth	2.5 feet
Manning's n-values:	.025-.035
Froude number-(excluding crests of drops):	.25-.-.75
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 M soil 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 soil riprap	5.0 psf

Model does not meet these.

The drops will be constructed using grouted boulders. The selection of grouted boulders was chosen to address long-term durability of the drop. Each drop has an integral grouted boulder sill. Sheet pile cut-off walls are proposed at the crest of each drop that will extend across the entire width of the drop. The bottom depth of the sheet pile cut-off walls ranges from 6 to 7 feet. Wherever soil riprap linings are proposed, rock sizing and freeboard criteria followed is in accordance with Chapter 8 of the Urban Drainage and Flood Control Manual, equation 8-11.

A geotechnical investigation was conducted to support the design of the foundation for the bridge at Sterling Ranch Road and Briargate Parkway. The geotechnical report is included within the Appendix B. Two soil borings were drilled near the locations of the proposed footings for the bridges. Because of the depth to bedrock, deep foundations are proposed using driven H-piles at Briargate Boulevard. Bedrock is shallow at the Sterling Ranch Road and therefore it is assumed that spread footings will be used. A precast bridge section has been chosen that has a 35-foot clear span and a 10-foot, nine-inch rise. The 100-year discharge can be passed through the bridge at a headwater to depth ratio of .75 Bridge velocity during a 100-year event is estimated at between 12.5 to 12.7 feet per second. A type M riprap invert will be provided at each bridge crossing.

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 benches and over the long term, the environmental quality of the corridor will be enhanced and preserved.

Maintenance access to the proposed drops and drainageway will be provided via platted tracts within Branding Iron and Homestead subdivisions. Access trail will have an all-weather surface and be a minimum of 12-feet in width and will be continuous along the west overbank of the channel.

and additional easements as necessary

both

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 Sterling Ranch 404 Permit is included within the Appendix.

USACOE 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

State Engineer - Dam embankment extension

IX. Drainage and Bridge Fees

Drainage Board and

The Sterling Ranch Development and specifically Sterling Ranch East lies wholly within the Sand Creek drainage basin. Drainage and bridge fees have been established by the County for the Sand Creek drainage basin for assessment against platted land within the watershed. The drainageway structures will be public and will be maintained by the Sterling Ranch Metropolitan District. The costs for the public drainageway improvements are reimbursable or creditable against drainage and bridge fees owed when land within Sterling Ranch is platted. Reimbursement of drainage and bridge improvements require approval through the DCM reimbursement process. Construction of the bridge at Sterling Ranch Road and at Briargate Parkway will be creditable against bridge fees owed pending approval through the DCM reimbursement process.

The current 2020 drainage and bridge fees for the Sand Creek drainage basin are as follows:

delete

Drainage Fee:	$19,698 per impervious acre
Bridge Fee:	$ 8,057 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 Branding Iron Filing No. 2 and Homestead Filing No., 2 subdivisions.

Completion of the Briargate Parkway roadway will initially involve only the two lanes on an interim basis until such time that traffic warrants completing the full design section for Briargate Parkway. 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 Briargate Boulevard design plans being prepared by others. Fine grading, paving, curb and gutter and sidewalks will be installed when the roadways are extended east from their present points of terminus.

XI. Conclusions

The development of the Branding Iron at Sterling Ranch and Homestead at Sterling Ranch subdivisions 1 requires that drainageway stabilization be implemented along Sand Creek. The stabilization measures are intended to provide protection to the residential lots from long term erosion of the banks and invert of Sand Creek. Stabilization of the drainageway to convey 100-year peak discharges will also promote better water quality to downstream reaches of Sand Creek and Fountain Creek as the potential for sediment from bank sloughing to be conveyed downstream will be eliminated. Upon construction of the drainageway stabilization measures as shown on the design plans, adjacent and downstream properties will not be adversely impacted by the runoff from these subdivisions and upstream drainage basins that will be conveyed by this segment Sand Creek.

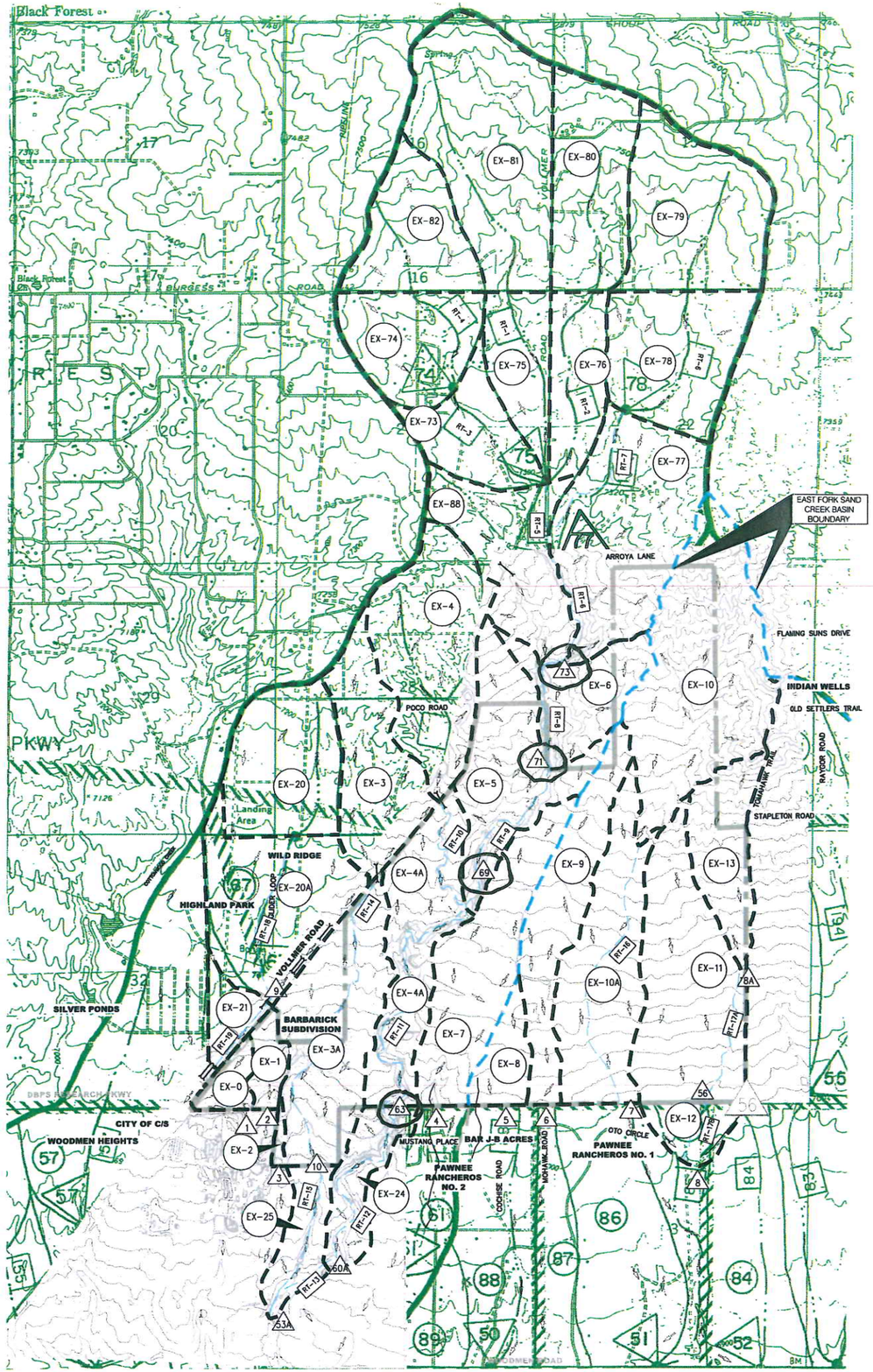
Address MDDP recommendations, including this:

POND W3

It should be noted that after the initial run of the Proposed Condition Model, it was determined that the peak developed 100-year flow reaching the subject reach were higher than the 100-year existing condition flow rates and higher than the 100-year peak flows anticipated by the Wilson Study. To reduce the runoff, a detention facility has been added to the model upstream of Sterling Ranch Road within the Sterling Ranch Development. The incorporation of this facility when coupled with multiple Full Spectrum Detention facilities will allow the development upstream of the City/County boundary to release developed discharge at a rate this is at or below the current existing flow rates. It should be noted that the location of the facility was previously planned as a regional pond /park site in the Sterling Ranch 2010 MDDP (Draft) and Sketch Plan. Stage storage and stage volume worksheets are included in the attachments for this pond. It is anticipated that this facility can be designed without having to be jurisdiction in nature. Based upon preliminary modeling the pond will reduce 100 year peak runoff rates from 2204 to less than 1400 cfs. The pond will detain a maximum of 78 acre feet at a depth of around 10 feet. The pond embankment containing the 100 year event will be separate from Sterling Ranch Road. An exhibit detailing the concept design is provided in the appendix of this report. It is important to note that this pond will allow for the free discharge of the 2 year storm and is not intended to provide water quality and will meet the state statue regarding the allowable release times.

Design point 61 is located on the maps between Sand Creek Regional Detention Pond 3 and south boundary of Sterling Ranch just upstream of Mustang Road. Future development in the watershed should attempt to mimic the flow rates provided within the report with special consideration given to the flow at the City/County boundary line at Design Point 61. It should be noted that the hydrologic calculations contained in this memorandum are intended to aid in the design of the crossing structure at Marksheffel Road north of City Pond 3 (DP 60A) and as a planning resource to limit the amount of developed runoff discharged into the Sand Creek Channel. This report is not intended to be utilized for final design of stormwater storage facilities and infrastructure. It should also be noted, that this report did not include City Pond 3 in any of its models and was only used as a comparison point.

Appendix A
Hydrologic and Hydraulic Calculations



0 600 1200 2400
Scale in Feet

LEGEND

BASIN ID – SC3-77

DESIGN POINT – 87

REACH IDENTIFIER – RT-17A

BASIN BOUNDARY

EAST FORK SAND CREEK BASIN BOUNDARY

FLOW DIRECTION

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES
FOR BURIED UTILITY INFORMATION
48 HRS BEFORE YOU DIG
CALL 1-800-922-1987

File: C:\105002A\Sterling Ranch District\dwg\Eng Exhibits\2018 MDDP\2018-MDDP-ExistCondWSMapMap.dwg Plotstamp: 11/13/2018 1:52 PM

BASIN SUMMARY

BASIN	CN	AREA (acres)	AREA (sq mi)	Q_2 (cfs)	Q_5 (cfs)	Q_{10} (cfs)	Q_{25} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)
EX-0	62	23.8	0.037	5.0	8.2	13.0	19.6	25.7	32.2
EX-1	62	25.7	0.040	4.8	7.9	12.4	18.7	24.5	30.9
EX-2	62	5.5	0.009	1.1	1.8	2.8	4.3	5.6	7.1
EX-3	62	136.8	0.214	22.0	36.4	57.6	86.9	114.0	143.1
EX-3A	61	188.1	0.294	28.3	47.4	75.7	115.1	152.2	192.6
EX-4	62	192.0	0.300	30.1	49.9	79.1	119.5	157.0	197.3
EX-4A	62	151.5	0.237	24.7	40.8	64.4	97.0	127.2	160.1
EX-5	62	153.9	0.240	24.2	40.0	63.4	95.9	125.9	158.2
EX-6	62	90.2	0.141	15.3	25.5	40.1	60.7	79.9	100.5
EX-7	56	165.0	0.258	11.6	21.5	37.5	60.9	83.1	107.4
EX-8	45	42.0	0.066	0.5	1.7	4.5	9.4	14.5	20.5
EX-9	54	131.9	0.206	12.2	23.9	43.1	70.9	97.0	125.2
EX-10	60	270.7	0.423	32.7	56.0	91.1	140.1	185.9	236.1
EX-10A	41	179.3	0.280	0.6	2.2	7.3	17.4	29.1	43.1
EX-11	43	209.3	0.327	18.0	29.8	47.7	73.4	98.3	126.1
EX-12	51	39.5	0.062	2.2	5.1	10.1	17.7	25.1	33.3
EX-13	55	89.3	0.139	7.7	15.2	27.1	44.2	60.5	78.4
EX-20	62	143.4	0.224	25.4	42.1	66.7	100.7	132.3	166.2
EX-20A	64	179.7	0.281	32.2	51.9	80.5	119.8	155.9	194.6
EX-21	65	33.3	0.052	8.6	13.5	20.7	30.5	39.4	49.0
EX-24	59	63.1	0.099	9.5	16.6	27.5	42.9	57.4	73.0
EX-25	43	54.4	0.085	0.3	1.5	4.8	10.7	17.2	25.1
EX-73	63	90.0	0.141	16.4	26.4	41.3	62.1	81.3	102.0
EX-74	63	119.7	0.187	22.3	36.5	57.3	85.9	112.3	140.7
EX-75	63	79.3	0.124	13.1	21.5	33.7	50.5	66.1	82.8
EX-76	63	86.4	0.135	14.2	23.1	36.4	54.6	71.4	89.6
EX-77	62	230.6	0.360	34.7	56.9	90.6	137.5	180.9	227.7
EX-78	63	155.6	0.243	28.1	45.3	70.6	106.2	139.1	174.5
EX-79	63	189.0	0.295	34.9	57.0	89.5	134.3	175.6	220.1
EX-80	63	147.7	0.231	27.3	44.3	69.6	104.5	136.8	171.4
EX-81	62	262.9	0.411	42.6	70.2	111.0	167.4	219.6	275.7
EX-82	62	117.8	0.184	20.0	33.2	52.8	80.0	105.1	132.3
EX-88	62	139.2	0.217	22.2	36.7	58.0	87.6	115.0	144.4

DESIGN POINT SUMMARY (PEAK FLOW)

DESIGN POINT	AREA (sq mi)	Q_2 (cfs)	Q_5 (cfs)	Q_{10} (cfs)	Q_{25} (cfs)	Q_{50} (cfs)	Q_{100} (cfs)	LOCATION
DP-74	0.371	39.3	65.3	104.8	158.9	209.1	262.8	
DP-75	1.413	141.2	235.1	376.6	566.6	750.9	950.5	
DP-78	0.538	59.7	98.4	154.0	232.6	306.2	385.3	
DP-73	2.528	225.9	380.7	618.0	957.0	1260.4	1582.3	
DP-71	2.669	229.3	388.9	629.7	978.8	1277.3	1637.9	STERLING RANCH NORTHERN BNDRY
DP-69	3.209	253.0	434.8	707.7	1100.0	1453.3	*1870.4	
DP-63	3.446	251.4	430.7	713.1	1113.2	1496.2	1911.5	STERLING RANCH SOUTHERN BNDRY
DP-10	0.508	36.5	56.0	106.4	162.9	220.6	287.2	COLORADO SPRINGS/EL PASO BNDRY
DP-9A	0.557	55.3	94.3	150.3	227.7	299.5	380.5	VOLLMER/TAHITI DRIVE
DP-9	0.505	52.8	88.8	142.1	214.2	281.0	351.4	VOLLMER/LOCHWINNOCH LN
DP-8A	0.139	7.7	15.2	27.1	44.2	60.5	78.4	D/S STERLING RANCH EASTERN BNDRY
DP-8	0.528	24.2	45.1	77.8	124.4	169.5	220.9	D/S STERLING RANCH SOUTHERN BNDRY
DP-7	0.703	32.4	57.1	97.3	156.1	213.8	277.9	STERLING RANCH SOUTHERN BNDRY
DP-6	0.206	12.2	23.9	43.1	70.9	97.0	125.2	STERLING RANCH SOUTHERN BNDRY
DP-5	0.066	0.5	1.7	4.5	9.4	14.5	20.5	STERLING RANCH SOUTHERN BNDRY
DP-4	0.258	11.6	21.5	37.5	60.9	83.1	107.4	STERLING RANCH SOUTHERN BNDRY
DP-3	0.009	1.1	1.8	2.8	4.3	5.6	7.1	STERLING RANCH SOUTHERN BNDRY
DP-2	0.040	4.8	7.9	12.4	18.7	24.5	30.9	STERLING RANCH SOUTHERN BNDRY
DP-1	0.037	5.0	8.2	13.0	19.6	25.7	32.2	STERLING RANCH SOUTHERN BNDRY
DP-60A	3.545	247.7	430.2	707.1	1113.0	1496.6	1913.5	FUTURE MARKSHEFFEL X-ING
DP-56	0.466	23.2	42.5	71.9	115.6	157.4	202.9	STERLING RANCH SOUTHERN BNDRY
DP-53A	4.138	262.1	454.0	763.2	1196.5	1609.8	2061.5	SAND CREEK AND POND 3

DESIGN POINT SUMMARY (VOLUME)

DESIGN POINT	AREA (sq mi)	V_2 (ac-ft)	V_5 (ac-ft)	V_{10} (ac-ft)	V_{25} (ac-ft)	V_{50} (ac-ft)	V_{100} (ac-ft)	LOCATION
DP-74	0.371	5.9	9.0	13.6	19.8	25.5	31.6	
DP-75	1.413	22.7	34.5	51.7	75.4	97.1	120.5	
DP-78	0.538	8.9	13.5	20.1	29.3	37.7	46.7	
DP-73	2.528	40.4	61.5	92.1	134.3	173.1	214.9	
DP-71	2.669	42.5	64.9	97.1	141.6	182.5	226.6	STERLING RANCH NORTHERN BNDRY
DP-69	3.209	50.7	77.4	116.1	169.4	218.6	271.4	
DP-63	3.446	54.1	82.5	123.8	180.8	233.3	289.9	STERLING RANCH SOUTHERN BNDRY
DP-10	0.508	7.6	11.7	17.6	25.8	33.4	41.6	COLORADO SPRINGS/EL PASO BNDRY
DP-9A	0.557	9.3	14.1	21.1	30.7	39.4	48.8	VOLLMER/TAHITI DRIVE
DP-9	0.505	8.4	12.7	19.0	27.6	35.5	44.0	VOLLMER/LOCHWINNOCH LN
DP-8A	0.139	1.3	2.1	3.4	5.2	7.0	8.9	D/S STERLING RANCH EASTERN BNDRY
DP-8	0.528	4.4	7.0	11.1	16.8	22.3	28.4	D/S STERLING RANCH SOUTHERN BNDRY
DP-7	0.703	6.1	10.0	15.9	24.3	32.4	41.3	STERLING RANCH SOUTHERN BNDRY
DP-6	0.206	2.4	4.0	6.3	9.6	12.7	16.0	STERLING RANCH SOUTHERN BNDRY
DP-5	0.066	0.2	0.4	0.8	1.4	1.9	2.6	STERLING RANCH SOUTHERN BNDRY
DP-4	0.258	2.6	4.2	6.7	10.2	13.5	17.2	STERLING RANCH SOUTHERN BNDRY
DP-3	0.009	0.1	0.2	0.3	0.5	0.6	0.8	STERLING RANCH SOUTHERN BNDRY
DP-2	0.040	0.6	0.9	1.4	2.1	2.7	3.4	STERLING RANCH SOUTHERN BNDRY
DP-1	0.037	0.6	0.9	1.3	1.9	2.5	3.1	STERLING RANCH SOUTHERN BNDRY
DP-60A	3.545	55.3	84.4	126.4	184.8	239.5	296.6	FUTURE MARKSHEFFEL X-ING
DP-56	0.466	4.0	6.3	9.9	14.9	19.8	25.1	SAND CREEK AND POND 3
DP-53A	4.138	63.0	96.4	144.7	211.8	273.9	340.9	SAND CREEK AND POND 3

EFSC DBPS DESIGN POINT SUMMARY (PEAK FLOW)

DBPS DESIGN POINT	AREA (sq mi)	Q_{10} (cfs)	Q_{100} (cfs)
DP-50	0.32	47.0	195.7
DP-51 (BASIN 86)	0.33	17.7	74.1
DP-52	1.67	80.5	455.5
DP-56	0.79	63.6	265.0

Values reported from SCDBPS
(DP 50, 51, 52 Not analyzed as a part of this study)
DBPS Reach 85(Basin91)=Q10=28.8cfs Q100=115.2cfs

Discharge Summary
Sand Creek

DP-63 So PL 1912
DP 69 @ Briargate +/- 1870
DP 71 No PL 1637

Q100 FIS = 2600 cfs

M&S CIVIL CONSULTANTS, INC
20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

2018 STERLING RANCH MDDP

EXISTING HYDROLOGIC CONDITIONS MAP

PROJECT NO. 09-002 | FILE: \dwg\Eng Exhibits\2018-MDDP-ExistCondWSMapMap.dwg

DESIGNED BY: DLM
DRAWN BY: DLM
CHECKED BY: VAS

SCALE
HORIZ: NTS
VERT: NTS

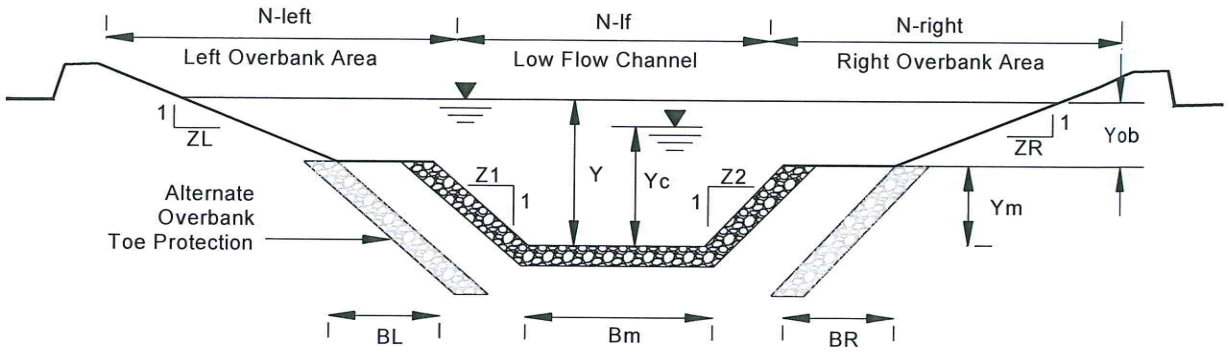
DATE: 08-22-18

DM1

Capacity Analysis of Composite Channel

Project: 19032 Sand Creek at Sterling Ranch

Channel ID: Q100 = 2600 (FIS) slope =~~0.02%~~ 0.2%



Design Information (Input)

Channel Invert Slope	So =	0.00200	ft/ft	Left Overbank Bottom Width	BL = 35.00 ft
				Left Overbank Side Slope	ZL = 4.00 ft/ft
Low Flow Channel Bottom Width	Bm =	25.00	ft	Left Overbank Manning's n	n-left = 0.0300
Low Flow Channel Left Side Slope	Z1 =	3.00	ft/ft	Right Overbank Bottom Width	BR = 35.00 ft
Low Flow Channel Right Side Slope	Z2 =	3.00	ft/ft	Right Overbank Side Slope	ZR = 4.00 ft/ft
Low Flow Channel Manning's Nn for Qd	n-lf =	0.0300		Right Overbank Manning's n	n-right = 0.0300
Low Flow Channel Manning's Nn for Q100 (See USDCM Vol. II, n vs. Depth Graph)	n-m-Q100 =	0.0350			
Low Flow Channel Bank-full depth	**Ym =**	**2.50**	**ft**	**Overbank Flow Depth Yob (Y - Ym)**	**Yob = 3.50 ft**

Low Flow Channel Condition for Qd			**Low Flow Channel Flow Condition for Q100**		
Top width	Tlf =	40.0 ft	Top width	Tm =	40.0 ft
Flow area	Alf =	81.3 sq ft	Flow area	Am =	221.3 sq ft
Wetted perimeter	Plf =	40.8 ft	Wetted perimeter	Pm =	40.8 ft
Discharge (Calculated)	**Qlf =**	**285.6 cfs**	**Discharge**	**Qm =**	**1,299.9 cfs**
Velocity	**Vlf=**	**3.5 fps**	**Velocity**	**Vm =**	**5.9 fps**
Froude number	**Fr-lf =**	**0.43**	**Froude number**	**Frm =**	**0.44**
Qd Critical Velocity	Vlfc =	6.47 fps	100-Yr. Critical Velocity	Vmc =	10.2 fps
Qd Critical Depth	Ylfc =	1.50 ft	100-Yr. Critical Depth	Ymc =	3.7 ft

Left Overbank Flow Condition for Q100			**Right Overbank Flow Condition for Q100**		
Top width	TL =	49.0 ft	Top width	TR =	49.0 ft
Flow area	AL =	147.0000 sq ft	Flow area	AR =	147.0000 sq ft
Wetted perimeter	PL =	49.4300 ft	Wetted perimeter	PR =	49.4300 ft
Discharge	**QL =**	**675.2 cfs**	**Discharge**	**QR =**	**675.2 cfs**
Velocity	**VL =**	**4.6 fps**	**Velocity**	**VR =**	**4.6 fps**
Froude number	**FrL =**	**0.47**	**Froude number**	**FrR =**	**0.47**
100-Yr. Critical Velocity	VLc =	7.9 fps	100-Yr. Critical Velocity	VRc =	7.9 fps
100-Yr. Critical Depth in Overbanks	YLc =	2.2 ft	100-Yr. Critical Depth in Overbanks	YRc =	2.2 ft

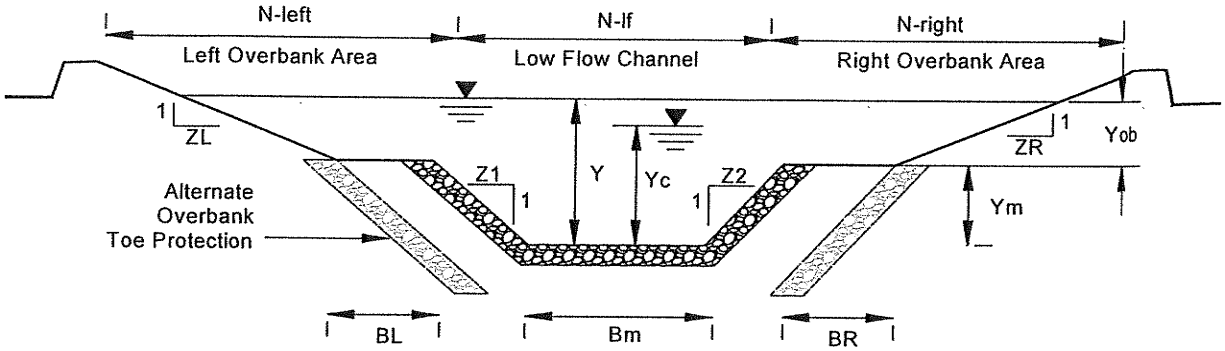
Composite Cross-Section Flow Condition for Q100

Top width	**T =**	**138.0 ft**	**Discharge**	**Q =**	**2,650.4 cfs**
Channel Depth Y	**Y =**	**6.00 ft**	**Velocity**	**V =**	**5.1 fps**
Flow area	A =	515.3 sq ft	**Froude number**	**Fr =**	**0.47**
Wetted perimeter	P =	139.7 ft	100-Yr. Critical Velocity	Vc =	8.8 fps
Cross-Sectional Manning's n (Calculated)	n =	0.0309	100-Yr. Critical Depth in Overbanks	Yc =	1.87 ft

Capacity Analysis of Composite Channel

Project: 19032 Sand Creek at Sterling Ranch

Channel ID: Q100 = 2600 (FIS) Q LOW = 260 cfs S=0.5%



Design Information (Input)

Channel Invert Slope	So =	0.00500 ft/ft	Left Overbank Bottom Width	BL =	35.00 ft
			Left Overbank Side Slope	ZL =	4.00 ft/ft
Low Flow Channel Bottom Width	Bm =	25.00 ft	Left Overbank Manning's n	n-left =	0.0300
Low Flow Channel Left Side Slope	Z1 =	3.00 ft/ft	Right Overbank Bottom Width	BR =	35.00 ft
Low Flow Channel Right Side Slope	Z2 =	3.00 ft/ft	Right Overbank Side Slope	ZR =	4.00 ft/ft
Low Flow Channel Manning's Nn for Qd	n-lf =	0.0300	Right Overbank Manning's n	n-right =	0.0300
Low Flow Channel Manning's Nn for Q100 (See USDCM Vol. II, n vs. Depth Graph)	n-m-Q100 =	0.0350			
Low Flow Channel Bank-full depth	Ym =	2.50 ft	**Overbank Flow Depth Yob (Y - Ym)**	Yob =	2.50 ft

Low Flow Channel Condition for Qd			**Low Flow Channel Flow Condition for Q100**		
Top width	Tlf =	40.0 ft	Top width	Tm =	40.0 ft
Flow area	Alf =	81.3 sq ft	Flow area	Am =	181.3 sq ft
Wetted perimeter	Plf =	40.8 ft	Wetted perimeter	Pm =	40.8 ft
Discharge (Calculated)	Qlf =	451.6 cfs	**Discharge**	Qm =	1,474.2 cfs
Velocity	Vlf=	5.6 fps	**Velocity**	Vm =	8.1 fps
Froude number	Fr-lf =	0.69	**Froude number**	Frm =	0.67
Qd Critical Velocity	Vlfc =	7.33 fps	100-Yr. Critical Velocity	Vmc =	10.6 fps
Qd Critical Depth	Ylfc =	1.99 ft	100-Yr. Critical Depth	Ymc =	3.9 ft

Left Overbank Flow Condition for Q100			**Right Overbank Flow Condition for Q100**		
Top width	TL =	45.0 ft	Top width	TR =	45.0 ft
Flow area	AL =	100.0000 sq ft	Flow area	AR =	100.0000 sq ft
Wetted perimeter	PL =	45.3100 ft	Wetted perimeter	PR =	45.3100 ft
Discharge	QL =	595.3 cfs	**Discharge**	QR =	595.3 cfs
Velocity	VL =	6.0 fps	**Velocity**	VR =	6.0 fps
Froude number	FrL =	0.70	**Froude number**	FrR =	0.70
100-Yr. Critical Velocity	VLc =	7.6 fps	100-Yr. Critical Velocity	VRc =	7.6 fps
100-Yr. Critical Depth in Overbanks	YLc =	2.0 ft	100-Yr. Critical Depth in Overbanks	YRc =	2.0 ft

Composite Cross-Section Flow Condition for Q100

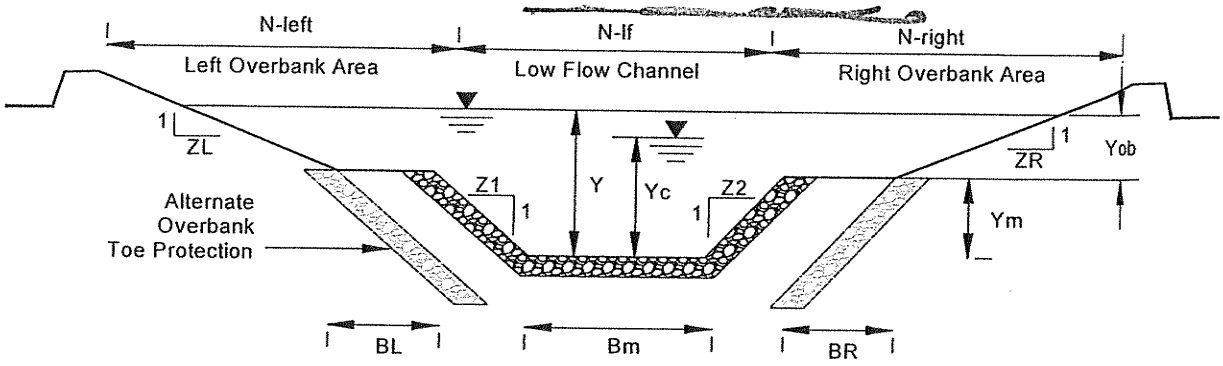
Top width	T =	130.0 ft	**Discharge**	Q =	2,664.9 cfs *
Channel Depth Y	Y =	5.00 ft	**Velocity**	V =	7.0 fps
Flow area	A =	381.3 sq ft	**Froude number**	Fr =	0.72
Wetted perimeter	P =	131.4 ft	100-Yr. Critical Velocity	Vc =	8.8 fps
Cross-Sectional Manning's n (Calculated)	n =	0.0307	100-Yr. Critical Depth in Overbanks	Yc =	1.88 ft

* Q100 Design = 2600 cfs

Capacity Analysis of Composite Channel

Project: 19032 Sand Creek at Sterling Ranch

Channel ID: Q100 = 2600 (FIS) Q LOW = 260 cfs S=0.5% Benches varied 20-foot left 50 right



Design Information (Input)

Channel Invert Slope	So =	0.00500 ft/ft	Left Overbank Bottom Width	BL =	20.00 ft
			Left Overbank Side Slope	ZL =	4.00 ft/ft
Low Flow Channel Bottom Width	Bm =	25.00 ft	Left Overbank Manning's n	n-left =	0.0300
Low Flow Channel Left Side Slope	Z1 =	3.00 ft/ft	Right Overbank Bottom Width	BR =	50.00 ft
Low Flow Channel Right Side Slope	Z2 =	3.00 ft/ft	Right Overbank Side Slope	ZR =	4.00 ft/ft
Low Flow Channel Manning's Nn for Qd	n-lf =	0.0300	Right Overbank Manning's n	n-right =	0.0300
Low Flow Channel Manning's Nn for Q100 (See USDCM Vol. II, n vs. Depth Graph)	n-m-Q100 =	0.0350			
Low Flow Channel Bank-full depth	Ym =	2.50 ft	**Overbank Flow Depth Yob (Y - Ym)**	Yob =	2.50 ft

Low Flow Channel Condition for Qd			**Low Flow Channel Flow Condition for Q100**		
Top width	Tlf =	40.0 ft	Top width	Tm =	40.0 ft
Flow area	Alf =	81.3 sq ft	Flow area	Am =	181.3 sq ft
Wetted perimeter	Plf =	40.8 ft	Wetted perimeter	Pm =	40.8 ft
Discharge (Calculated)	Qlf =	451.6 cfs	**Discharge**	Qm =	1,474.2 cfs
Velocity	Vlf=	5.6 fps	**Velocity**	Vm =	8.1 fps
Froude number	Fr-lf =	0.69	**Froude number**	Frm =	0.67
Qd Critical Velocity	Vlfc =	7.33 fps	100-Yr. Critical Velocity	Vmc =	10.6 fps
Qd Critical Depth	Ylfc =	1.99 ft	100-Yr. Critical Depth	Ymc =	3.9 ft

Left Overbank Flow Condition for Q100			**Right Overbank Flow Condition for Q100**		
Top width	TL =	30.0 ft	Top width	TR =	60.0 ft
Flow area	AL =	62.5000 sq ft	Flow area	AR =	137.5000 sq ft
Wetted perimeter	PL =	30.3100 ft	Wetted perimeter	PR =	60.3100 ft
Discharge	QL =	355.6 cfs	**Discharge**	QR =	836.5 cfs
Velocity	VL =	5.7 fps	**Velocity**	VR =	6.1 fps
Froude number	FrL =	0.69	**Froude number**	FrR =	0.71
100-Yr. Critical Velocity	VLc =	7.4 fps	100-Yr. Critical Velocity	VRc =	7.8 fps
100-Yr. Critical Depth in Overbanks	YLc =	2.0 ft	100-Yr. Critical Depth in Overbanks	YRc =	2.0 ft

Composite Cross-Section Flow Condition for Q100

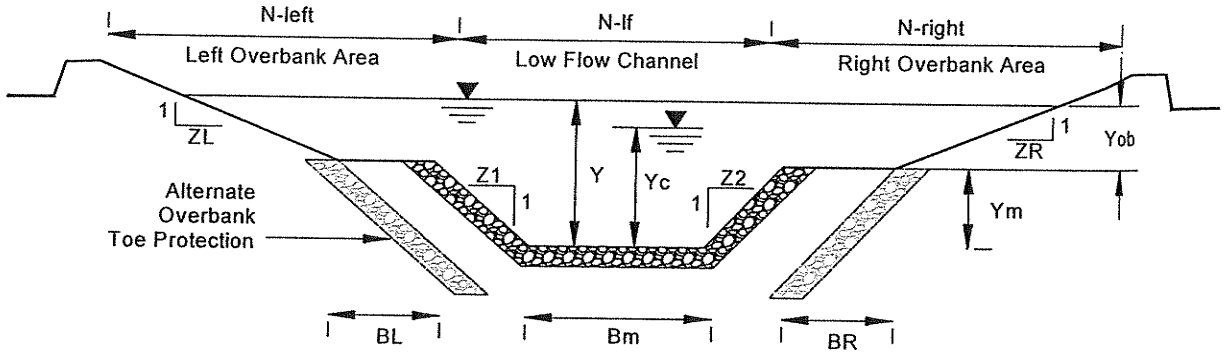
Top width	T =	130.0 ft	**Discharge**	* Q =	2,666.3 cfs
Channel Depth Y	Y =	5.00 ft	**Velocity**	V =	7.0 fps
Flow area	A =	381.3 sq ft	**Froude number**	Fr =	0.72
Wetted perimeter	P =	131.4 ft	100-Yr. Critical Velocity	Vc =	8.8 fps
Cross-Sectional Manning's n (Calculated)	n =	0.0306	100-Yr. Critical Depth in Overbanks	Yc =	1.88 ft

* Q design = 2600 cfs

Capacity Analysis of Composite Channel

Project: 19032 Sand Creek at Sterling Ranch

Channel ID: Q100 = 2600 (FIS) Q LOW = 260 cfs S=0.85%



Design Information (Input)

Channel Invert Slope	So =	0.00850 ft/ft	Left Overbank Bottom Width	BL =	35.00 ft
			Left Overbank Side Slope	ZL =	4.00 ft/ft
Low Flow Channel Bottom Width	Bm =	25.00 ft	Left Overbank Manning's n	n-left =	0.0300
Low Flow Channel Left Side Slope	Z1 =	3.00 ft/ft	Right Overbank Bottom Width	BR =	35.00 ft
Low Flow Channel Right Side Slope	Z2 =	3.00 ft/ft	Right Overbank Side Slope	ZR =	4.00 ft/ft
Low Flow Channel Manning's Nn for Qd	n-lf =	0.0300	Right Overbank Manning's n	n-right =	0.0300
Low Flow Channel Manning's Nn for Q100 (See USDCM Vol. II, n vs. Depth Graph)	n-m-Q100 =	0.0350			
Low Flow Channel Bank-full depth	Ym =	2.50 ft	**Overbank Flow Depth Yob (Y - Ym)**	Yob =	2.50 ft

Low Flow Channel Condition for Qd			**Low Flow Channel Flow Condition for Q100**		
Top width	Tlf =	40.0 ft	Top width	Tm =	40.0 ft
Flow area	Alf =	81.3 sq ft	Flow area	Am =	181.3 sq ft
Wetted perimeter	Plf =	40.8 ft	Wetted perimeter	Pm =	40.8 ft
Discharge (Calculated)	Qlf =	588.8 cfs	**Discharge**	Qm =	1,922.1 cfs
Velocity	Vlf=	7.3 fps	**Velocity**	Vm =	10.6 fps
Froude number	Fr-lf =	0.90	**Froude number**	Frm =	0.88
Qd Critical Velocity	Vlfc =	7.86 fps	100-Yr. Critical Velocity	Vmc =	11.6 fps
Qd Critical Depth	Ylfc =	2.34 ft	100-Yr. Critical Depth	Ymc =	4.6 ft
Left Overbank Flow Condition for Q100			**Right Overbank Flow Condition for Q100**		
Top width	TL =	45.0 ft	Top width	TR =	45.0 ft
Flow area	AL =	100.0000 sq ft	Flow area	AR =	100.0000 sq ft
Wetted perimeter	PL =	45.3100 ft	Wetted perimeter	PR =	45.3100 ft
Discharge	QL =	776.2 cfs	**Discharge**	QR =	776.2 cfs
Velocity	VL =	7.8 fps	**Velocity**	VR =	7.8 fps
Froude number	FrL =	0.92	**Froude number**	FrR =	0.92
100-Yr. Critical Velocity	VLc =	8.3 fps	100-Yr. Critical Velocity	VRc =	8.3 fps
100-Yr. Critical Depth in Overbanks	YLc =	2.4 ft	100-Yr. Critical Depth in Overbanks	YRc =	2.4 ft

Composite Cross-Section Flow Condition for Q100

Top width	T =	130.0 ft	**Discharge**	Q =	3,474.5 cfs
Channel Depth Y	Y =	5.00 ft	**Velocity**	V =	9.1 fps
Flow area	A =	381.3 sq ft	**Froude number**	Fr =	0.94
Wetted perimeter	P =	131.4 ft	100-Yr. Critical Velocity	Vc =	9.5 fps
Cross-Sectional Manning's n (Calculated)	n =	0.0307	100-Yr. Critical Depth in Overbanks	Yc =	2.37 ft

$Q_{100} = 2600$ cfs

$Q_{LF} = 260$ cfs

Kiowa Engineering Corporation

Project Name: Sand Creek SR Project No: 19032

Description: Riprap Sizing

By: RWW Date: 5/1/20

① @ Bridges Riprap sizing per UDFCD Eq. 8-11

100-yr Bridge velocities (From HEC-RAS)

@ Briargate S = 0.85%

approach	6.2 fps
outlet	12.2 fps
departure	10.3 fps.

$$d_{50} \geq \left[\frac{VS^{.17}}{4.5(G_s-1)^{.66}}\right] \quad \text{Assume } G_s = 2.6$$

$$d_{50} \geq \frac{VS^{.17}}{6.13}$$

within bridge and @ inlet & outlet: $d_{50} \geq \frac{12.2(.0085)^{.17}}{6.13} = .88'$

∴ use 12" D_{50}

@ Sterling Ranch Road S = 0.5%

approach	6.4 Fps
outlet	12.7 Fps
departure	7.0 fps

$$d_{50} = \frac{12.7(.005)^{.17}}{6.13} = .84$$

∴ use 12" D_{50}

8.1 Riprap Sizing

Procedures for sizing rock to be used in soil riprap, void-filled riprap, and riprap over bedding are the same.

8.1.1 Mild Slope Conditions

When subcritical flow conditions occur and/or slopes are mild (less than 2 percent), UDFCD recommends the following equation (Hughes, et al, 1983):

$$d_{50} \geq \left[\frac{VS^{0.17}}{4.5(G_s - 1)^{0.66}} \right]^2 \qquad \text{Equation 8-11}$$

Where:

V = mean channel velocity (ft/sec)

S = longitudinal channel slope (ft/ft)

d_{50} = mean rock size (ft)

Gs = specific gravity of stone (minimum = 2.50, typically 2.5 to 2.7), Note: In this equation (Gs -1) considers the buoyancy of the water, in that the specific gravity of water is subtracted from the specific gravity of the rock.

Note that Equation 8-11 is applicable for sizing riprap for channel lining with a longitudinal slope of no more than 2%. This equation is not intended for use in sizing riprap for steep slopes (typically in excess of 2 percent), rundowns, or protection downstream of culverts. Information on rundowns is provided in Section 7.0 of the *Hydraulic Structures* chapter of the USDCM, and protection downstream of culverts is discussed in the *Culverts and Bridges* chapter. For channel slopes greater than 2% use one of the methods presented in 8.1.2.

Rock size does not need to be increased for steeper channel side slopes, provided the side slopes are no steeper than 2.5H:1V (UDFCD 1982). Channel side slopes steeper than 2.5H:1V are not recommended because of stability, safety, and maintenance considerations. See Figure 8-34 for riprap placement specifications. At the upstream and downstream termination of a riprap lining, the thickness should be increased 50% for at least 3 feet to prevent undercutting.

8.1.2 Steep Slope Conditions

Steep slope rock sizing equations are used for applications where the slope is greater than 2 percent and/or flows are in the supercritical flow regime. The following rock sizing equations may be referred to for riprap design analysis on steep slopes:

- CSU Equation, *Development of Riprap Design Criteria by Riprap Testing in Flumes: Phase II* (prepared by S.R. Abt, et al, Colorado State University, 1988). This method was developed for steep slopes from 2 to 20 percent.

- USDA- Agricultural Research Service Equations, *Design of Rock Chutes* (by K.M. Robinson, et al, USDA- ARS, 1998 Transactions of ASAE) and *An Excel Program to Design Rock Chutes for Grade*

Kiowa Engineering Corporation

Project Name: SC @ Sterling Ranch Project No: 2 of 3
Description: Riprap Sizing 19032
By: RAW Date: 5/1/20

(2) Within drainageway

100yr Flow condition ⇒ Composite channel design

$S = 0.5\%$

Velocity in low flow during 100-year = 8.1 fps

$$d_{50} > \frac{8.1(.005)^{.17}}{6.13} = .53 \quad \text{use } D_{50} = 9''.$$

Overbank velocity during 100-year = 7.8 fps

per above calc, $d_{50} \geq .53$

use $9'' D_{50}$

Kiowa Engineering Corporation

Project Name: SC @ Sterling Ranch Project No: 19032

Description: Riprap Sizing.

By: RJW Date: 5/1/20

(3) Shear Stress:

Overbanks benches:

Maximum depth of flow (outside of bridges)

@ S = 0.5% 5.0'

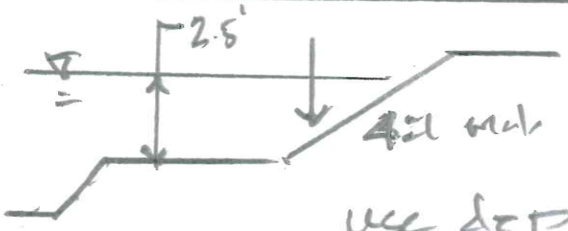
Maximum depth on overbank = 5.0 - 2.5 = 2.5'

Shear Stress $\tau = \gamma d S = 62.4(2.5)(.005) = .78$ psf

Will recommend curled woodmat (TRM)

permissible $\tau = 1.55$.

Inside bends of channel



use depth @ 1/3 point of slope ≈ 1.68'

$\tau = 62.4(1.68)(.005) = .52$ psf

Recommend Erosion Control blanket (temporary) & establishment of Class 'B' Vegetative cover

DESIGN OF ROADSIDE CHANNELS WITH FLEXIBLE LININGS

Hydraulic Engineering Circular No. 15

Prepared By

Simons, Li & Associates, Inc.
3555 Stanford Road
P.O. Box 1816
Fort Collins, Colorado 80522

For

U.S. Department of Transportation
Federal Highway Administration

October 25, 1985

Table 4.1. Permissible Shear Stresses for Lining Materials.

Lining Category	Lining Type	Permissible Unit Shear Stress (lb/ft2)
Temporary	Woven Paper Net	0.15
	Jute Net	0.45
	Fiberglass Roving*	0.75
	Straw and Erosion Net	1.45 ← OB slope
	Curled Wood Mat (TRM)	1.55 ← bench
	Nylon Mat	2.00
Vegetative	Class A	3.70
	Class B	2.10 ← OB slope
	Class C	1.00
	Class D	0.60
	Class E	0.35
Gravel Riprap	1-inch	0.40
	2-inch	0.80
Rock Riprap	6-inch	2.50
	12-inch	5.00

* single and double applications

TABLE 3.1.--Classification of vegetal covers as to degree of retardance (6)

Note: Covers classified have been tested in experimental channels. Covers were green and generally uniform.

Retardance	Cover	Condition
A	Weeping lovegrass	Excellent stand, tall, (average 30")
	Yellow bluestem Ischaemum ..	Excellent stand, tall, (average 36")
B	Kudzu	Very dense growth, uncut
	Bermudagrass	Good stand, tall (average 12")
	Native grass mixture (little bluestem, blue grama, and other long and short midwest grasses)	Good stand, unmowed
	Weeping lovegrass	Good stand, tall, (average 24")
	Lespedeza sericea	Good stand, not woody, tall (average 19")
	Alfalfa	Good stand, uncut, (average 11")
	Weeping lovegrass	Good stand, mowed, (average 13")
	Kudzu	Dense growth, uncut
	Blue grama	Good stand, uncut,(average 13")
C	Crabgrass	Fair stand, uncut (10 to 48")
	Bermudagrass	Good stand, mowed (average 6")
	Common lespedeza	Good stand, uncut (average 11")
	Grass-legume mixture--summer (orchard grass, redtop, Italian ryegrass, and common lespedeza)	Good stand, uncut (6 to 8 inches)
	Centipedegrass	Very dense cover (average 6 inches)
	Kentucky bluegrass	Good stand, headed (6 to 12 inches)
D	Bermudagrass	Good stand, cut to 2.5-inch height
	Common lespedeza	Excellent stand, uncut (average 4.5")
	Buffalograss	Good stand, uncut (3 to 6 inches)
	Grass-legume mixture--fall, spring (Orchardgrass, redtop, Italian ryegrass, and common lespedeza)	Good stand, uncut (4 to 5 inches)
	Lespedeza sericea	After cutting to 2-inch height. Very good stand before cutting.
E	Bermudagrass	Good stand, cut to 1.5 inches height
	Bermudagrass	Burned stubble.

PROPOSED CONDITION

HEC-RAS Plan: PP Profiles River: Sand Creek Reach: CLOMR CL

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)	
CLOMR CL	10150	10yr	1200.00	7150.00	7154.22	7153.83	7154.74	0.010591	5.57	208.40	112.90	0.67
CLOMR CL	10150	50yr	2100.00	7150.00	7154.91	7154.71	7155.67	0.013470	7.28	299.92	151.62	0.78
CLOMR CL	10150	100yr	2600.00	7150.00	7155.17	7155.02	7156.08	0.013769	7.84	340.34	154.37	0.81
CLOMR CL	10150	500yr	3800.00	7150.00	7155.73	7155.63	7156.96	0.014090	8.91	428.89	160.19	0.84
CLOMR CL	9654	10yr	1200.00	7146.00	7149.50		7150.00	0.008634	6.03	225.38	135.18	0.64
CLOMR CL	9654	50yr	2100.00	7146.00	7150.45		7151.02	0.006771	6.50	357.97	142.81	0.59
CLOMR CL	9654	100yr	2600.00	7146.00	7150.88		7151.50	0.006414	6.80	419.15	146.20	0.59
CLOMR CL	9654	500yr	3800.00	7146.00	7151.76		7152.52	0.005878	7.41	552.15	153.30	0.58
CLOMR CL	9590	10yr	1200.00	7144.80	7149.55		7149.69	0.001568	3.29	400.72	145.19	0.29
CLOMR CL	9590	50yr	2100.00	7144.80	7150.47		7150.71	0.001953	4.21	537.22	152.52	0.33
CLOMR CL	9590	100yr	2600.00	7144.80	7150.89		7151.18	0.002110	4.63	601.98	155.88	0.35
CLOMR CL	9590	500yr	3800.00	7144.80	7151.70		7152.16	0.003163	6.23	773.56	269.74	0.44
CLOMR CL	9540	10yr	1200.00	7144.80	7148.72	7148.72	7149.47	0.010526	7.45	191.62	120.31	0.72
CLOMR CL	9540	50yr	2100.00	7144.80	7149.41	7149.41	7150.43	0.011988	9.00	276.85	126.75	0.79
CLOMR CL	9540	100yr	2600.00	7144.80	7149.74	7149.74	7150.89	0.012197	9.57	319.20	129.83	0.81
CLOMR CL	9540	500yr	3800.00	7144.80	7150.54	7150.54	7151.81	0.010998	10.17	438.03	178.02	0.79
CLOMR CL	9500	10yr	1200.00	7135.80	7142.26		7142.35	0.000594	2.45	545.89	158.91	0.19
CLOMR CL	9500	50yr	2100.00	7135.80	7143.32		7143.48	0.000822	3.25	717.94	167.35	0.23
CLOMR CL	9500	100yr	2600.00	7135.80	7143.81		7143.99	0.000909	3.59	801.94	171.32	0.24
CLOMR CL	9500	500yr	3800.00	7135.80	7144.85		7145.09	0.001047	4.23	981.44	174.96	0.26
CLOMR CL	9471	10yr	1200.00	7135.80	7142.01		7142.30	0.001024	4.67	329.96	120.91	0.36
CLOMR CL	9471	50yr	2100.00	7135.80	7142.90		7143.40	0.001517	6.29	440.78	128.03	0.44
CLOMR CL	9471	100yr	2600.00	7135.80	7143.32		7143.91	0.001718	6.99	494.78	131.36	0.48
CLOMR CL	9471	500yr	3800.00	7135.80	7144.18		7144.99	0.002090	8.36	610.69	138.42	0.54
CLOMR CL	9470	10yr	1200.00	7137.80	7141.54	7141.42	7142.26	0.004760	7.43	208.48	117.11	0.72
CLOMR CL	9470	50yr	2100.00	7137.80	7142.47		7143.35	0.004616	8.64	320.39	124.52	0.74
CLOMR CL	9470	100yr	2600.00	7137.80	7142.90		7143.87	0.004556	9.16	374.88	127.98	0.75
CLOMR CL	9470	500yr	3800.00	7137.80	7143.77		7144.95	0.004544	10.27	489.86	134.97	0.77
CLOMR CL	9420	10yr	1200.00	7137.55	7141.33	7141.17	7142.02	0.004494	7.28	213.23	117.44	0.71
CLOMR CL	9420	50yr	2100.00	7137.55	7142.27		7143.12	0.004365	8.47	326.90	124.94	0.72
CLOMR CL	9420	100yr	2600.00	7137.55	7142.70		7143.64	0.004320	8.99	382.02	128.42	0.73
CLOMR CL	9420	500yr	3800.00	7137.55	7143.58		7144.72	0.004351	10.12	497.32	135.41	0.76
CLOMR CL	9240	10yr	1200.00	7136.65	7140.27	7140.27	7141.10	0.005649	7.90	194.75	116.17	0.78
CLOMR CL	9240	50yr	2100.00	7136.65	7141.06	7141.06	7142.17	0.006141	9.56	288.91	122.48	0.85
CLOMR CL	9240	100yr	2600.00	7136.65	7141.42	7141.42	7142.67	0.006363	10.30	332.83	125.32	0.88
CLOMR CL	9240	500yr	3800.00	7136.65	7142.18	7142.18	7143.73	0.006570	11.67	430.55	131.41	0.92
CLOMR CL	9190	10yr	1200.00	7136.40	7139.64	7139.64	7140.35	0.013603	7.09	190.71	133.11	0.79
CLOMR CL	9190	50yr	2100.00	7136.40	7140.30	7140.30	7141.25	0.014143	8.44	279.99	138.38	0.84
CLOMR CL	9190	100yr	2600.00	7136.40	7140.61	7140.61	7141.68	0.014152	8.98	323.07	140.84	0.85
CLOMR CL	9190	500yr	3800.00	7136.40	7141.22	7141.22	7142.60	0.014578	10.15	410.74	145.74	0.89
CLOMR CL	9150	10yr	1200.00	7128.40	7134.86		7134.95	0.000593	2.45	545.97	158.91	0.19
CLOMR CL	9150	50yr	2100.00	7128.40	7135.92		7136.06	0.000823	3.25	717.69	167.34	0.23
CLOMR CL	9150	100yr	2600.00	7128.40	7136.41		7136.58	0.000912	3.59	800.77	171.26	0.24
CLOMR CL	9150	500yr	3800.00	7128.40	7137.43		7137.68	0.001090	4.31	982.78	186.92	0.27
CLOMR CL	9121	10yr	1200.00	7128.40	7134.61		7134.91	0.001023	4.67	330.02	120.91	0.36
CLOMR CL	9121	50yr	2100.00	7128.40	7135.50		7135.99	0.001520	6.30	440.44	128.01	0.44
CLOMR CL	9121	100yr	2600.00	7128.40	7135.91		7136.50	0.001730	7.01	493.43	131.28	0.48
CLOMR CL	9121	500yr	3800.00	7128.40	7136.76		7137.58	0.002112	8.39	608.13	138.09	0.54
CLOMR CL	9120	10yr	1200.00	7130.40	7134.14	7134.02	7134.86	0.004727	7.41	209.05	117.15	0.72
CLOMR CL	9120	50yr	2100.00	7130.40	7135.06		7135.95	0.004655	8.66	319.42	124.46	0.75
CLOMR CL	9120	100yr	2600.00	7130.40	7135.47		7136.46	0.004689	9.25	371.07	127.74	0.76
CLOMR CL	9120	500yr	3800.00	7130.40	7136.32		7137.54	0.004730	10.41	483.01	134.57	0.79
CLOMR CL	9070	10yr	1200.00	7130.15	7133.93	7133.77	7134.62	0.004525	7.30	212.66	117.40	0.71
CLOMR CL	9070	50yr	2100.00	7130.15	7134.84		7135.71	0.004480	8.55	323.86	124.75	0.73
CLOMR CL	9070	100yr	2600.00	7130.15	7135.25		7136.22	0.004562	9.17	374.69	127.96	0.75
CLOMR CL	9070	500yr	3800.00	7130.15	7136.09		7137.29	0.004652	10.35	485.84	134.73	0.78
CLOMR CL	8990	10yr	1200.00	7129.75	7133.37	7133.37	7134.20	0.005645	7.90	194.81	116.18	0.78
CLOMR CL	8990	50yr	2100.00	7129.75	7134.16	7134.16	7135.27	0.006137	9.55	288.97	122.49	0.85
CLOMR CL	8990	100yr	2600.00	7129.75	7134.52	7134.52	7135.77	0.006367	10.31	332.77	125.32	0.88
CLOMR CL	8990	500yr	3800.00	7129.75	7135.28	7135.28	7136.83	0.006570	11.67	430.55	131.41	0.92
CLOMR CL	8940	10yr	1200.00	7129.50	7132.74	7132.74	7133.45	0.013569	7.08	191.08	134.04	0.79
CLOMR CL	8940	50yr	2100.00	7129.50	7133.40	7133.40	7134.35	0.014048	8.41	281.75	140.85	0.83
CLOMR CL	8940	100yr	2600.00	7129.50	7133.71	7133.71	7134.78	0.014013	8.94	325.92	144.08	0.85
CLOMR CL	8940	500yr	3800.00	7129.50	7134.32	7134.32	7135.68	0.014449	10.11	415.40	150.34	0.88

provide more sections

drop

HEC-RAS Plan: PP Profiles River: Sand Creek Reach: CLOMR CL (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)	
CLOMR CL	8900	10yr	1200.00	7121.50	7127.96		7128.05	0.000594	2.45	545.89	158.91	0.19
CLOMR CL	8900	50yr	2100.00	7121.50	7129.02		7129.17	0.000820	3.25	718.59	167.38	0.23
CLOMR CL	8900	100yr	2600.00	7121.50	7129.52		7129.69	0.000906	3.59	802.70	171.35	0.24
CLOMR CL	8900	500yr	3800.00	7121.50	7130.56		7130.80	0.001041	4.22	982.72	174.49	0.26
CLOMR CL	8871	10yr	1200.00	7121.50	7127.71		7128.00	0.001024	4.67	329.96	120.91	0.36
CLOMR CL	8871	50yr	2100.00	7121.50	7128.61		7129.10	0.001512	6.29	441.32	128.07	0.44
CLOMR CL	8871	100yr	2600.00	7121.50	7129.03		7129.62	0.001709	6.98	495.68	131.42	0.48
CLOMR CL	8871	500yr	3800.00	7121.50	7129.88		7130.70	0.002098	8.38	611.26	139.89	0.54
CLOMR CL	8870	10yr	1200.00	7123.50	7127.24	7127.12	7127.96	0.004760	7.43	208.48	117.11	0.72
CLOMR CL	8870	50yr	2100.00	7123.50	7128.18		7129.06	0.004549	8.59	322.09	124.63	0.74
CLOMR CL	8870	100yr	2600.00	7123.50	7128.62		7129.58	0.004469	9.10	377.45	128.14	0.74
CLOMR CL	8870	500yr	3800.00	7123.50	7129.51		7130.66	0.004423	10.17	494.48	135.25	0.76
CLOMR CL	8820	10yr	1200.00	7123.25	7127.03		7127.72	0.004473	7.27	213.83	117.46	0.70
CLOMR CL	8820	50yr	2100.00	7123.25	7127.99		7128.83	0.004266	8.40	329.59	125.11	0.72
CLOMR CL	8820	100yr	2600.00	7123.25	7128.43		7129.35	0.004205	8.91	385.66	128.85	0.72
CLOMR CL	8820	500yr	3800.00	7123.25	7129.32		7130.44	0.004202	9.99	503.41	135.77	0.74
CLOMR CL	8460	10yr	1200.00	7121.45	7125.07	7125.07	7125.90	0.005652	7.90	194.71	116.17	0.78
CLOMR CL	8460	50yr	2100.00	7121.45	7125.86	7125.86	7126.97	0.006136	9.55	288.99	122.49	0.85
CLOMR CL	8460	100yr	2600.00	7121.45	7126.21	7126.21	7127.47	0.006369	10.31	332.73	125.32	0.88
CLOMR CL	8460	500yr	3800.00	7121.45	7126.98	7126.98	7128.53	0.006558	11.66	430.83	131.43	0.91
CLOMR CL	8410	10yr	1200.00	7121.20	7124.44	7124.44	7125.15	0.013480	7.06	191.37	133.16	0.79
CLOMR CL	8410	50yr	2100.00	7121.20	7125.10	7125.10	7126.05	0.014150	8.44	279.94	138.38	0.84
CLOMR CL	8410	100yr	2600.00	7121.20	7125.41	7125.41	7126.48	0.014158	8.98	323.02	140.84	0.85
CLOMR CL	8410	500yr	3800.00	7121.20	7126.02	7126.02	7127.40	0.014583	10.15	410.69	145.74	0.89
CLOMR CL	8370	10yr	1200.00	7113.20	7119.67		7119.75	0.000593	2.45	545.99	158.92	0.19
CLOMR CL	8370	50yr	2100.00	7113.20	7120.71		7120.85	0.000830	3.26	715.60	167.24	0.23
CLOMR CL	8370	100yr	2600.00	7113.20	7121.19		7121.37	0.000922	3.61	798.04	171.14	0.24
CLOMR CL	8370	500yr	3800.00	7113.20	7122.20		7122.45	0.001077	4.27	974.26	176.65	0.27
CLOMR CL	8341	10yr	1200.00	7113.20	7119.44		7119.71	0.001291	4.51	332.88	121.11	0.34
CLOMR CL	8341	50yr	2100.00	7113.20	7120.35		7120.79	0.001842	5.97	446.17	128.37	0.42
CLOMR CL	8341	100yr	2600.00	7113.20	7120.77		7121.29	0.002055	6.59	501.55	131.78	0.45
CLOMR CL	8341	500yr	3800.00	7113.20	7121.65		7122.36	0.002435	7.78	620.52	138.63	0.50
CLOMR CL	8340	10yr	1200.00	7115.20	7119.15		7119.68	0.004494	6.45	233.50	118.81	0.61
CLOMR CL	8340	50yr	2100.00	7115.20	7120.07		7120.76	0.004538	7.58	346.49	126.19	0.64
CLOMR CL	8340	100yr	2600.00	7115.20	7120.50		7121.27	0.004546	8.07	401.32	129.62	0.65
CLOMR CL	8340	500yr	3800.00	7115.20	7121.38		7122.33	0.004624	9.10	517.40	136.60	0.67
CLOMR CL	8290	10yr	1200.00	7114.95	7118.95		7119.45	0.004186	6.29	239.66	119.23	0.59
CLOMR CL	8290	50yr	2100.00	7114.95	7119.87		7120.53	0.004342	7.46	351.86	126.53	0.62
CLOMR CL	8290	100yr	2600.00	7114.95	7120.29		7121.04	0.004381	7.97	406.46	129.94	0.64
CLOMR CL	8290	500yr	3800.00	7114.95	7121.16		7122.09	0.004515	9.02	521.61	136.84	0.66
CLOMR CL	8140	10yr	1200.00	7114.20	7117.79	7117.79	7118.60	0.007601	7.80	191.43	115.95	0.76
CLOMR CL	8140	50yr	2100.00	7114.20	7118.56	7118.56	7119.62	0.008157	9.35	282.07	122.04	0.84
CLOMR CL	8140	100yr	2600.00	7114.20	7118.89	7118.89	7120.10	0.008487	10.07	323.58	124.73	0.86
CLOMR CL	8140	500yr	3800.00	7114.20	7119.62	7119.62	7121.13	0.008693	11.35	416.89	130.58	0.90
CLOMR CL	8090	10yr	1200.00	7113.95	7117.19	7117.19	7117.90	0.013480	7.06	191.37	133.16	0.79
CLOMR CL	8090	50yr	2100.00	7113.95	7117.85	7117.85	7118.80	0.014150	8.44	279.94	138.38	0.84
CLOMR CL	8090	100yr	2600.00	7113.95	7118.16	7118.16	7119.23	0.014158	8.98	323.02	140.84	0.85
CLOMR CL	8090	500yr	3800.00	7113.95	7118.77	7118.77	7120.15	0.014583	10.15	410.69	145.74	0.89
CLOMR CL	8050	10yr	1200.00	7106.10	7112.56		7112.65	0.000594	2.45	545.89	158.91	0.19
CLOMR CL	8050	50yr	2100.00	7106.10	7113.62		7113.78	0.000822	3.25	717.77	167.34	0.23
CLOMR CL	8050	100yr	2600.00	7106.10	7114.11		7114.29	0.000911	3.59	801.38	171.29	0.24
CLOMR CL	8050	500yr	3800.00	7106.10	7115.14		7115.39	0.001055	4.24	981.39	177.03	0.26
CLOMR CL	8021	10yr	1200.00	7106.10	7112.31		7112.60	0.001024	4.67	329.96	120.91	0.36
CLOMR CL	8021	50yr	2100.00	7106.10	7113.20		7113.69	0.001518	6.30	440.57	128.02	0.44
CLOMR CL	8021	100yr	2600.00	7106.10	7113.62		7114.21	0.001723	7.00	494.14	131.32	0.48
CLOMR CL	8021	500yr	3800.00	7106.10	7114.48		7115.29	0.002093	8.36	610.01	138.11	0.54
CLOMR CL	8020	10yr	1200.00	7108.10	7111.84	7111.72	7112.56	0.004737	7.42	208.88	117.14	0.72
CLOMR CL	8020	50yr	2100.00	7108.10	7112.76		7113.65	0.004645	8.66	319.66	124.48	0.75
CLOMR CL	8020	100yr	2600.00	7108.10	7113.19		7114.17	0.004812	9.20	373.26	127.88	0.76
CLOMR CL	8020	500yr	3800.00	7108.10	7114.05		7115.25	0.004609	10.32	487.42	134.83	0.78
CLOMR CL	7970	10yr	1200.00	7107.85	7111.63	7111.47	7112.32	0.004500	7.28	213.12	117.43	0.71
CLOMR CL	7970	50yr	2100.00	7107.85	7112.58		7113.42	0.004396	8.49	326.05	124.89	0.73
CLOMR CL	7970	100yr	2600.00	7107.85	7112.99		7113.93	0.004382	9.04	380.08	128.30	0.74
CLOMR CL	7970	500yr	3800.00	7107.85	7113.85		7115.01	0.004449	10.19	493.49	135.19	0.76

drop

provide more sections

drop

drop

HEC-RAS Plan: PP Profiles River: Sand Creek Reach: CLOMR CL (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)	
CLOMR CL	7840	10yr	1200.00	7107.20	7110.82	7110.82	7111.65	0.005656	7.90	194.66	116.17	0.78
CLOMR CL	7840	50yr	2100.00	7107.20	7111.61	7111.61	7112.72	0.006136	9.55	288.99	122.49	0.85
CLOMR CL	7840	100yr	2600.00	7107.20	7111.96	7111.96	7113.22	0.006369	10.31	332.73	125.32	0.88
CLOMR CL	7840	500yr	3800.00	7107.20	7112.73	7112.73	7114.28	0.006558	11.66	430.83	131.43	0.91
CLOMR CL	7790	10yr	1200.00	7106.95	7110.19	7110.19	7110.90	0.013480	7.06	191.37	133.16	0.79
CLOMR CL	7790	50yr	2100.00	7106.95	7110.85	7110.85	7111.80	0.014150	8.44	279.94	138.38	0.84
CLOMR CL	7790	100yr	2600.00	7106.95	7111.16	7111.16	7112.23	0.014158	8.98	323.02	140.84	0.85
CLOMR CL	7790	500yr	3800.00	7106.95	7111.77	7111.77	7113.15	0.014583	10.15	410.69	145.74	0.89
CLOMR CL	7750	10yr	1200.00	7099.00	7105.44		7105.54	0.000300	2.81	542.32	158.73	0.20
CLOMR CL	7750	50yr	2100.00	7099.00	7107.33		7107.45	0.000265	2.99	856.89	173.86	0.20
CLOMR CL	7750	100yr	2600.00	7099.00	7108.59		7108.70	0.000209	2.86	1076.51	175.91	0.18
CLOMR CL	7750	500yr	3800.00	7099.00	7111.57		7111.67	0.000133	2.89	1607.75	180.51	0.15
CLOMR CL	7721	10yr	1200.00	7099.00	7105.21		7105.50	0.001025	4.67	329.73	120.89	0.36
CLOMR CL	7721	50yr	2100.00	7099.00	7107.15		7107.42	0.000739	4.87	578.31	136.36	0.32
CLOMR CL	7721	100yr	2600.00	7099.00	7108.44		7108.68	0.000536	4.62	781.26	146.63	0.28
CLOMR CL	7721	500yr	3800.00	7099.00	7111.47		7111.66	0.000296	4.20	1245.19	171.96	0.22
CLOMR CL	7720	10yr	1200.00	7101.00	7104.72	7104.62	7105.46	0.004919	7.52	205.79	116.93	0.74
CLOMR CL	7720	50yr	2100.00	7101.00	7107.08		7107.42	0.001280	5.52	503.87	135.80	0.41
CLOMR CL	7720	100yr	2600.00	7101.00	7108.40		7108.67	0.000791	5.00	691.11	146.33	0.33
CLOMR CL	7720	500yr	3800.00	7101.00	7111.46		7111.66	0.000370	4.36	1178.09	171.86	0.24
CLOMR CL	7670	10yr	1200.00	7100.75	7104.41	7104.37	7105.20	0.005379	7.76	198.61	116.44	0.77
CLOMR CL	7670	50yr	2100.00	7100.75	7107.04		7107.34	0.001086	5.21	533.64	137.54	0.38
CLOMR CL	7670	100yr	2600.00	7100.75	7108.39		7108.63	0.000681	4.74	722.90	144.74	0.31
CLOMR CL	7670	500yr	3800.00	7100.75	7111.45		7111.64	0.000343	4.26	1201.05	169.75	0.24
CLOMR CL	7290	10yr	1200.00	7098.85	7104.25		7104.42	0.000734	3.83	413.80	130.39	0.30
CLOMR CL	7290	50yr	2100.00	7098.85	7106.95		7107.08	0.000342	3.50	794.02	148.78	0.22
CLOMR CL	7290	100yr	2600.00	7098.85	7108.32		7108.44	0.000265	3.44	1001.95	160.62	0.20
CLOMR CL	7290	500yr	3800.00	7098.85	7111.41		7111.52	0.000172	3.37	1552.50	185.66	0.17
CLOMR CL	7238	10yr	1200.00	7098.58	7103.89	7102.17	7104.33	0.001566	5.53	232.40	54.93	0.44
CLOMR CL	7238	50yr	2100.00	7098.58	7106.50	7103.35	7107.01	0.001033	5.99	373.15	54.97	0.39
CLOMR CL	7238	100yr	2600.00	7098.58	7107.82	7103.91	7108.37	0.000891	6.21	444.66	54.98	0.37
CLOMR CL	7238	500yr	3800.00	7098.58	7110.83	7105.11	7111.46	0.000682	6.61	607.08	55.02	0.34
CLOMR CL	7100	Bridge										
CLOMR CL	6990	10yr	1200.00	7096.49	7100.06	7100.06	7101.37	0.008097	9.34	135.38	50.91	0.94
CLOMR CL	6990	50yr	2100.00	7096.49	7101.25	7101.25	7103.17	0.007813	11.41	196.23	50.93	0.97
CLOMR CL	6990	100yr	2600.00	7096.49	7101.87	7101.87	7104.06	0.007480	12.21	227.66	50.94	0.97
CLOMR CL	6990	500yr	3800.00	7096.49	7103.14	7103.14	7105.98	0.007169	13.94	292.58	50.95	0.99
CLOMR CL	6950	10yr	1200.00	7096.15	7099.77	7099.77	7100.60	0.005649	7.90	194.75	116.17	0.78
CLOMR CL	6950	50yr	2100.00	7096.15	7100.56	7100.56	7101.67	0.006144	9.56	288.85	122.48	0.85
CLOMR CL	6950	100yr	2600.00	7096.15	7100.92	7100.92	7102.17	0.006363	10.30	332.83	125.32	0.88
CLOMR CL	6950	500yr	3800.00	7096.15	7101.68	7101.68	7103.23	0.006568	11.67	430.61	131.41	0.91
CLOMR CL	6820	10yr	1200.00	7095.04	7098.66	7098.66	7099.49	0.005645	7.90	194.81	116.18	0.78
CLOMR CL	6820	50yr	2100.00	7095.04	7099.45	7099.45	7100.56	0.006137	9.55	288.97	122.49	0.85
CLOMR CL	6820	100yr	2600.00	7095.04	7099.81	7099.81	7101.06	0.006367	10.31	332.77	125.32	0.88
CLOMR CL	6820	500yr	3800.00	7095.04	7100.57	7100.57	7102.12	0.006568	11.67	430.61	131.41	0.91
CLOMR CL	6770	10yr	1200.00	7094.62	7097.86	7097.86	7098.57	0.013603	7.09	190.71	133.11	0.79
CLOMR CL	6770	50yr	2100.00	7094.62	7098.52	7098.52	7099.47	0.014143	8.44	279.99	138.38	0.84
CLOMR CL	6770	100yr	2600.00	7094.62	7098.83	7098.83	7099.90	0.014142	8.98	323.14	140.85	0.85
CLOMR CL	6770	500yr	3800.00	7094.62	7099.44	7099.44	7100.82	0.014578	10.15	410.74	145.74	0.89
CLOMR CL	6730	10yr	1200.00	7085.70	7092.17		7092.25	0.000593	2.45	548.07	158.92	0.19
CLOMR CL	6730	50yr	2100.00	7085.70	7093.22		7093.37	0.000820	3.25	718.48	167.38	0.23
CLOMR CL	6730	100yr	2600.00	7085.70	7093.72		7093.89	0.000906	3.59	802.64	171.35	0.24
CLOMR CL	6730	500yr	3800.00	7085.70	7094.76		7095.00	0.001041	4.22	983.32	175.15	0.26
CLOMR CL	6701	10yr	1200.00	7085.70	7091.92		7092.21	0.001022	4.67	330.16	120.93	0.35
CLOMR CL	6701	50yr	2100.00	7085.70	7092.81		7093.30	0.001512	6.29	441.35	128.07	0.44
CLOMR CL	6701	100yr	2600.00	7085.70	7093.23		7093.82	0.001710	6.98	495.64	131.42	0.48
CLOMR CL	6701	500yr	3800.00	7085.70	7094.10		7094.90	0.002066	8.32	613.15	138.40	0.53
CLOMR CL	6700	10yr	1200.00	7087.70	7091.45	7091.32	7092.16	0.004681	7.38	209.87	117.21	0.72
CLOMR CL	6700	50yr	2100.00	7087.70	7092.38		7093.26	0.004541	8.59	322.30	124.65	0.74
CLOMR CL	6700	100yr	2600.00	7087.70	7092.82		7093.78	0.004471	9.10	377.41	128.14	0.74
CLOMR CL	6700	500yr	3800.00	7087.70	7093.71		7094.86	0.004421	10.17	494.57	135.25	0.76
CLOMR CL	6650	10yr	1200.00	7087.45	7091.24	7091.07	7091.92	0.004463	7.26	213.82	117.48	0.70
CLOMR CL	6650	50yr	2100.00	7087.45	7092.19		7093.02	0.004279	8.41	329.25	125.09	0.72
CLOMR CL	6650	100yr	2600.00	7087.45	7092.63		7093.55	0.004218	8.92	385.25	128.63	0.72

drop

provide more sections

drop

provide more sections

drop

drop

provide another section

drop

HEC-RAS Plan: PP Profiles River: Sand Creek Reach: CLOMR CL (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
CLOMR CL	6650	500yr	3800.00	7087.45	7093.52		7094.63	0.004216	10.00	502.84	135.74	0.75
CLOMR CL	6340	10yr	1200.00	7085.90	7089.52	7089.52	7090.35	0.005845	7.90	194.81	116.18	0.78
CLOMR CL	6340	50yr	2100.00	7085.90	7090.31	7090.31	7091.42	0.006141	9.56	288.91	122.48	0.85
CLOMR CL	6340	100yr	2600.00	7085.90	7090.67	7090.67	7091.92	0.006367	10.31	332.77	125.32	0.88
CLOMR CL	6340	500yr	3800.00	7085.90	7091.43	7091.43	7092.98	0.006570	11.67	430.55	131.41	0.92
CLOMR CL	6290	10yr	1200.00	7085.65	7088.89	7088.89	7089.60	0.013603	7.09	190.71	133.11	0.79
CLOMR CL	6290	50yr	2100.00	7085.65	7089.55	7089.55	7090.50	0.014143	8.44	279.99	138.38	0.84
CLOMR CL	6290	100yr	2600.00	7085.65	7089.86	7089.86	7090.93	0.014152	8.98	323.07	140.84	0.85
CLOMR CL	6290	500yr	3800.00	7085.65	7090.47	7090.47	7091.85	0.014531	10.14	411.16	145.76	0.88
CLOMR CL	6250	10yr	1200.00	7076.70	7083.16		7083.25	0.000594	2.45	545.83	158.91	0.19
CLOMR CL	6250	50yr	2100.00	7076.70	7084.22		7084.36	0.000823	3.25	717.72	167.34	0.23
CLOMR CL	6250	100yr	2600.00	7076.70	7084.71		7084.89	0.000911	3.59	801.30	171.29	0.24
CLOMR CL	6250	500yr	3800.00	7076.70	7085.74		7085.99	0.001060	4.25	981.87	176.84	0.27
CLOMR CL	6221	10yr	1200.00	7076.70	7082.91		7083.20	0.001024	4.67	329.92	120.91	0.36
CLOMR CL	6221	50yr	2100.00	7076.70	7083.80		7084.29	0.001519	6.30	440.53	128.02	0.44
CLOMR CL	6221	100yr	2600.00	7076.70	7084.22		7084.81	0.001724	7.00	494.03	131.32	0.48
CLOMR CL	6221	500yr	3800.00	7076.70	7085.08		7085.89	0.002094	8.36	609.98	138.13	0.54
CLOMR CL	6220	10yr	1200.00	7078.70	7082.44	7082.32	7083.16	0.004789	7.43	208.33	117.11	0.72
CLOMR CL	6220	50yr	2100.00	7078.70	7083.36		7084.25	0.004650	8.66	319.58	124.47	0.75
CLOMR CL	6220	100yr	2600.00	7078.70	7083.78		7084.77	0.004618	9.20	373.10	127.87	0.76
CLOMR CL	6220	500yr	3800.00	7078.70	7084.65		7085.85	0.004608	10.32	487.45	134.83	0.78
CLOMR CL	6170	10yr	1200.00	7078.45	7082.23	7082.07	7082.92	0.004503	7.28	213.08	117.43	0.71
CLOMR CL	6170	50yr	2100.00	7078.45	7083.16		7084.02	0.004403	8.50	325.89	124.88	0.73
CLOMR CL	6170	100yr	2600.00	7078.45	7083.59		7084.53	0.004386	9.04	379.98	128.30	0.74
CLOMR CL	6170	500yr	3800.00	7078.45	7084.45		7085.61	0.004450	10.19	493.45	135.19	0.76
CLOMR CL	6040	10yr	1200.00	7077.80	7081.42	7081.42	7082.25	0.005849	7.90	194.75	116.17	0.78
CLOMR CL	6040	50yr	2100.00	7077.80	7082.21	7082.21	7083.32	0.006134	9.55	289.03	122.49	0.85
CLOMR CL	6040	100yr	2600.00	7077.80	7082.56	7082.56	7083.82	0.006367	10.31	332.77	125.32	0.88
CLOMR CL	6040	500yr	3800.00	7077.80	7083.33	7083.33	7084.88	0.006570	11.67	430.55	131.41	0.92
CLOMR CL	5990	10yr	1200.00	7077.55	7080.79	7080.79	7081.50	0.013603	7.09	190.71	133.11	0.79
CLOMR CL	5990	50yr	2100.00	7077.55	7081.45	7081.45	7082.40	0.014143	8.44	279.99	138.38	0.84
CLOMR CL	5990	100yr	2600.00	7077.55	7081.76	7081.76	7082.83	0.014142	8.98	323.14	140.85	0.85
CLOMR CL	5990	500yr	3800.00	7077.55	7082.37	7082.37	7083.75	0.014578	10.15	410.74	145.74	0.89
CLOMR CL	5950	10yr	1200.00	7068.60	7075.06		7075.15	0.000594	2.45	545.81	158.91	0.19
CLOMR CL	5950	50yr	2100.00	7068.60	7076.12		7076.26	0.000822	3.25	717.77	167.34	0.23
CLOMR CL	5950	100yr	2600.00	7068.60	7076.61		7076.79	0.000911	3.59	801.36	171.29	0.24
CLOMR CL	5950	500yr	3800.00	7068.60	7077.64		7077.89	0.001049	4.23	980.75	175.21	0.26
CLOMR CL	5921	10yr	1200.00	7068.60	7074.81		7075.10	0.001024	4.67	329.90	120.91	0.36
CLOMR CL	5921	50yr	2100.00	7068.60	7075.70		7076.19	0.001518	6.30	440.57	128.02	0.44
CLOMR CL	5921	100yr	2600.00	7068.60	7076.12		7076.71	0.001723	7.00	494.14	131.32	0.48
CLOMR CL	5921	500yr	3800.00	7068.60	7076.98		7077.79	0.002094	8.36	609.94	138.08	0.54
CLOMR CL	5920	10yr	1200.00	7070.60	7074.34	7074.22	7075.06	0.004780	7.44	208.13	117.09	0.73
CLOMR CL	5920	50yr	2100.00	7070.60	7075.26		7076.15	0.004645	8.66	319.66	124.48	0.75
CLOMR CL	5920	100yr	2600.00	7070.60	7075.68		7076.67	0.004614	9.20	373.20	127.87	0.76
CLOMR CL	5920	500yr	3800.00	7070.60	7076.55		7077.75	0.004611	10.32	487.36	134.82	0.78
CLOMR CL	5870	10yr	1200.00	7070.35	7074.13	7073.97	7074.82	0.004504	7.28	213.06	117.43	0.71
CLOMR CL	5870	50yr	2100.00	7070.35	7075.06		7075.92	0.004401	8.50	325.93	124.88	0.73
CLOMR CL	5870	100yr	2600.00	7070.35	7075.49		7076.43	0.004386	9.04	379.95	128.29	0.74
CLOMR CL	5870	500yr	3800.00	7070.35	7076.35		7077.51	0.004452	10.20	493.35	135.18	0.76
CLOMR CL	5740	10yr	1200.00	7069.70	7073.32	7073.32	7074.15	0.005856	7.90	194.66	116.17	0.78
CLOMR CL	5740	50yr	2100.00	7069.70	7074.11	7074.11	7075.22	0.006136	9.55	288.99	122.49	0.85
CLOMR CL	5740	100yr	2600.00	7069.70	7074.46	7074.46	7075.72	0.006369	10.31	332.73	125.32	0.88
CLOMR CL	5740	500yr	3800.00	7069.70	7075.23	7075.23	7076.78	0.006558	11.66	430.83	131.43	0.91
CLOMR CL	5690	10yr	1200.00	7069.45	7072.69	7072.69	7073.40	0.013480	7.06	191.37	133.16	0.79
CLOMR CL	5690	50yr	2100.00	7069.45	7073.35	7073.35	7074.30	0.014150	8.44	279.94	138.38	0.84
CLOMR CL	5690	100yr	2600.00	7069.45	7073.66	7073.66	7074.73	0.014158	8.98	323.02	140.84	0.85
CLOMR CL	5690	500yr	3800.00	7069.45	7074.27	7074.27	7075.65	0.014583	10.15	410.69	145.74	0.89
CLOMR CL	5650	10yr	1200.00	7061.70	7068.18		7068.25	0.000594	2.45	545.83	158.91	0.19
CLOMR CL	5650	50yr	2100.00	7061.70	7069.22		7069.38	0.000821	3.25	718.21	167.36	0.23
CLOMR CL	5650	100yr	2600.00	7061.70	7069.72		7069.89	0.000908	3.59	802.14	171.33	0.24
CLOMR CL	5650	500yr	3800.00	7061.70	7070.75		7070.99	0.001043	4.22	981.89	174.23	0.26
CLOMR CL	5621	10yr	1200.00	7061.70	7067.91		7068.20	0.001024	4.67	329.92	120.91	0.36
CLOMR CL	5621	50yr	2100.00	7061.70	7068.81		7069.30	0.001514	6.29	441.03	128.05	0.44
CLOMR CL	5621	100yr	2600.00	7061.70	7069.22		7069.81	0.001715	6.99	495.06	131.38	0.48

HEC-RAS Plan: PP Profiles River: Sand Creek Reach: CLOMR CL (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
CLOMR CL	5621	500yr	3800.00	7061.70	7070.09		7070.89	0.002081	8.35	611.60	138.41	0.54
CLOMR CL	5620	10yr	1200.00	7063.70	7067.44	7067.32	7068.16	0.004766	7.43	208.38	117.11	0.72
CLOMR CL	5620	50yr	2100.00	7063.70	7068.37		7069.26	0.004589	8.62	321.08	124.57	0.74
CLOMR CL	5620	100yr	2600.00	7063.70	7068.80		7069.77	0.004528	9.14	375.72	128.03	0.75
CLOMR CL	5620	500yr	3800.00	7063.70	7069.69		7070.88	0.004498	10.23	491.60	135.08	0.77
CLOMR CL	5570	10yr	1200.00	7063.45	7067.23	7067.07	7067.92	0.004481	7.27	213.48	117.46	0.70
CLOMR CL	5570	50yr	2100.00	7063.45	7068.18		7069.02	0.004323	8.44	328.03	125.02	0.72
CLOMR CL	5570	100yr	2600.00	7063.45	7068.61		7069.54	0.004277	8.98	383.36	128.51	0.73
CLOMR CL	5570	500yr	3800.00	7063.45	7069.49		7070.63	0.004293	10.07	499.66	135.55	0.75
CLOMR CL	5340	10yr	1200.00	7062.30	7065.92	7065.92	7066.75	0.005649	7.90	194.75	116.17	0.78
CLOMR CL	5340	50yr	2100.00	7062.30	7066.71	7066.71	7067.82	0.006134	9.55	289.03	122.49	0.85
CLOMR CL	5340	100yr	2600.00	7062.30	7067.06	7067.06	7068.32	0.006367	10.31	332.77	125.32	0.88
CLOMR CL	5340	500yr	3800.00	7062.30	7067.83	7067.83	7069.38	0.006570	11.67	430.55	131.41	0.92
CLOMR CL	5290	10yr	1200.00	7062.05	7065.29	7065.29	7066.07	0.006556	7.37	190.25	133.09	0.82
CLOMR CL	5290	50yr	2100.00	7062.05	7066.02	7066.02	7067.06	0.006707	8.85	290.35	138.97	0.87
CLOMR CL	5290	100yr	2600.00	7062.05	7066.38	7066.38	7067.53	0.006761	9.49	337.62	141.67	0.88
CLOMR CL	5290	500yr	3800.00	7062.05	7067.05	7067.05	7068.50	0.006906	10.79	437.27	147.19	0.92
CLOMR CL	5250	10yr	1200.00	7054.10	7061.09		7061.16	0.000201	2.28	630.00	163.09	0.17
CLOMR CL	5250	50yr	2100.00	7054.10	7062.25		7062.37	0.000294	3.10	824.77	172.38	0.21
CLOMR CL	5250	100yr	2600.00	7054.10	7062.79		7062.95	0.000331	3.46	919.51	174.54	0.22
CLOMR CL	5250	500yr	3800.00	7054.10	7063.91		7064.12	0.000402	4.17	1114.64	176.31	0.25
CLOMR CL	5221	10yr	1200.00	7054.10	7060.95		7061.14	0.000603	3.86	408.26	125.98	0.28
CLOMR CL	5221	50yr	2100.00	7054.10	7062.03		7062.34	0.000847	5.11	549.72	134.67	0.34
CLOMR CL	5221	100yr	2600.00	7054.10	7062.54		7062.91	0.000939	5.84	619.33	138.34	0.36
CLOMR CL	5221	500yr	3800.00	7054.10	7063.58		7064.08	0.001103	6.65	765.31	142.12	0.40
CLOMR CL	5220	10yr	1200.00	7056.10	7060.86		7061.13	0.001365	4.77	331.97	125.27	0.41
CLOMR CL	5220	50yr	2100.00	7056.10	7061.95		7062.33	0.001536	5.88	472.79	133.96	0.45
CLOMR CL	5220	100yr	2600.00	7056.10	7062.45		7062.90	0.001591	6.35	542.05	138.01	0.46
CLOMR CL	5220	500yr	3800.00	7056.10	7063.50		7064.07	0.001671	7.26	687.97	141.80	0.49
CLOMR CL	5170	10yr	1200.00	7055.85	7060.83		7061.05	0.001092	4.41	359.51	127.01	0.37
CLOMR CL	5170	50yr	2100.00	7055.85	7061.91		7062.25	0.001299	5.55	501.22	135.64	0.41
CLOMR CL	5170	100yr	2600.00	7055.85	7062.41		7062.82	0.001413	6.12	570.44	144.85	0.44
CLOMR CL	5170	500yr	3800.00	7055.85	7063.42		7063.98	0.001627	7.28	735.28	178.96	0.48
CLOMR CL	4840	10yr	1200.00	7055.85	7059.47	7059.47	7060.30	0.005649	7.90	194.75	116.17	0.78
CLOMR CL	4840	50yr	2100.00	7055.85	7060.26	7060.26	7061.37	0.006144	9.56	288.85	122.48	0.85
CLOMR CL	4840	100yr	2600.00	7055.85	7060.62	7060.62	7061.87	0.006363	10.30	332.83	125.32	0.88
CLOMR CL	4840	500yr	3800.00	7055.85	7061.37	7061.37	7062.93	0.006590	11.68	430.10	131.38	0.92
CLOMR CL	4790	10yr	1200.00	7053.95	7057.19	7057.19	7057.90	0.013480	7.06	191.37	133.16	0.79
CLOMR CL	4790	50yr	2100.00	7053.95	7057.85	7057.85	7058.80	0.014150	8.44	279.94	138.38	0.84
CLOMR CL	4790	100yr	2600.00	7053.95	7058.16	7058.16	7059.23	0.014158	8.98	323.02	140.84	0.85
CLOMR CL	4790	500yr	3800.00	7053.95	7058.77	7058.77	7060.15	0.014583	10.15	410.69	145.74	0.89
CLOMR CL	4750	10yr	1200.00	7046.00	7052.46		7052.55	0.000594	2.45	545.89	158.91	0.19
CLOMR CL	4750	50yr	2100.00	7046.00	7053.52		7053.66	0.000820	3.25	718.35	167.37	0.23
CLOMR CL	4750	100yr	2600.00	7046.00	7054.02		7054.19	0.000907	3.59	802.53	171.34	0.24
CLOMR CL	4750	500yr	3800.00	7046.00	7055.06		7055.30	0.001051	4.24	984.17	178.37	0.26
CLOMR CL	4721	10yr	1200.00	7046.00	7052.21		7052.50	0.001024	4.67	329.96	120.91	0.36
CLOMR CL	4721	50yr	2100.00	7046.00	7053.11		7053.60	0.001513	6.29	441.20	128.06	0.44
CLOMR CL	4721	100yr	2600.00	7046.00	7053.53		7054.12	0.001711	6.98	495.48	131.41	0.48
CLOMR CL	4721	500yr	3800.00	7046.00	7054.40		7055.20	0.002066	8.32	612.98	138.24	0.53
CLOMR CL	4720	10yr	1200.00	7048.00	7051.74	7051.62	7052.48	0.004767	7.43	208.36	117.11	0.72
CLOMR CL	4720	50yr	2100.00	7048.00	7052.68		7053.56	0.004585	8.61	321.67	124.81	0.74
CLOMR CL	4720	100yr	2600.00	7048.00	7053.11		7054.08	0.004488	9.11	376.88	128.10	0.75
CLOMR CL	4720	500yr	3800.00	7048.00	7054.00		7055.16	0.004440	10.19	493.82	135.21	0.76
CLOMR CL	4670	10yr	1200.00	7047.75	7051.53		7052.22	0.004482	7.27	213.48	117.45	0.70
CLOMR CL	4670	50yr	2100.00	7047.75	7052.48		7053.32	0.004293	8.42	328.86	125.07	0.72
CLOMR CL	4670	100yr	2600.00	7047.75	7052.93		7053.85	0.004229	8.93	384.90	128.60	0.73
CLOMR CL	4670	500yr	3800.00	7047.75	7053.82		7054.93	0.004219	10.01	502.68	135.73	0.75
CLOMR CL	4340	10yr	1200.00	7046.10	7049.72	7049.72	7050.55	0.005645	7.90	194.81	116.18	0.78
CLOMR CL	4340	50yr	2100.00	7046.10	7050.51	7050.51	7051.62	0.006141	9.56	288.91	122.48	0.85
CLOMR CL	4340	100yr	2600.00	7046.10	7050.87	7050.87	7052.12	0.006367	10.31	332.77	125.32	0.88
CLOMR CL	4340	500yr	3800.00	7046.10	7051.63	7051.63	7053.18	0.006570	11.67	430.55	131.41	0.92
CLOMR CL	4290	10yr	1200.00	7045.85	7049.09	7049.09	7049.80	0.013603	7.09	190.71	133.11	0.79
CLOMR CL	4290	50yr	2100.00	7045.85	7049.75	7049.75	7050.70	0.014143	8.44	279.99	138.38	0.84
CLOMR CL	4290	100yr	2600.00	7045.85	7050.06	7050.06	7051.13	0.014152	8.98	323.07	140.84	0.85

provide more sections incl. outfall

drop

provide more sections

provide more sections

drop

provide more sections

drop

HEC-RAS Plan: PP Profiles River: Sand Creek Reach: CLOMR CL (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
CLOMR CL	4290	500yr	3800.00	7045.65	7050.67	7050.67	7052.05	0.014578	10.15	410.74	145.74	0.89
CLOMR CL	4250	10yr	1200.00	7037.80	7044.26		7044.35	0.000594	2.45	545.89	158.91	0.19
CLOMR CL	4250	50yr	2100.00	7037.80	7045.32		7045.47	0.000820	3.25	718.59	167.38	0.23
CLOMR CL	4250	100yr	2600.00	7037.80	7045.83		7046.00	0.000902	3.58	803.78	171.40	0.24
CLOMR CL	4250	500yr	3800.00	7037.80	7046.86		7047.10	0.001039	4.21	983.33	174.77	0.26
CLOMR CL	4221	10yr	1200.00	7037.80	7044.01		7044.30	0.001024	4.67	329.96	120.91	0.36
CLOMR CL	4221	50yr	2100.00	7037.80	7044.91		7045.40	0.001512	6.29	441.32	128.07	0.44
CLOMR CL	4221	100yr	2600.00	7037.80	7045.34		7045.92	0.001698	6.98	498.89	131.49	0.47
CLOMR CL	4221	500yr	3800.00	7037.80	7046.20		7047.00	0.002065	8.32	613.26	138.51	0.53
CLOMR CL	4220	10yr	1200.00	7039.80	7043.54	7043.42	7044.26	0.004734	7.41	208.93	117.14	0.72
CLOMR CL	4220	50yr	2100.00	7039.80	7044.48		7045.36	0.004558	8.60	321.85	124.62	0.74
CLOMR CL	4220	100yr	2600.00	7039.80	7044.94		7045.88	0.004372	9.03	380.39	128.32	0.74
CLOMR CL	4220	500yr	3800.00	7039.80	7045.81		7046.96	0.004408	10.16	495.07	135.28	0.76
CLOMR CL	4170	10yr	1200.00	7039.55	7043.34	7043.17	7044.02	0.004427	7.24	214.49	117.52	0.70
CLOMR CL	4170	50yr	2100.00	7039.55	7044.29		7045.12	0.004286	8.42	329.04	125.08	0.72
CLOMR CL	4170	100yr	2600.00	7039.55	7044.76		7045.66	0.004085	8.82	389.62	128.89	0.71
CLOMR CL	4170	500yr	3800.00	7039.55	7045.63		7046.74	0.004188	9.98	504.01	135.81	0.74
CLOMR CL	3640	10yr	1200.00	7036.90	7040.51	7040.51	7041.35	0.005731	7.94	193.62	185.69	0.79
CLOMR CL	3640	50yr	2100.00	7036.90	7041.32	7041.32	7042.42	0.006072	9.52	290.11	198.69	0.84
CLOMR CL	3640	100yr	2600.00	7036.90	7041.64	7041.64	7042.92	0.006546	10.41	329.47	200.99	0.89
CLOMR CL	3640	500yr	3800.00	7036.90	7042.45	7042.45	7043.98	0.006457	11.60	433.18	211.88	0.91
CLOMR CL	3590	10yr	1200.00	7036.65	7039.93	7039.93	7040.60	0.012668	6.91	196.08	227.62	0.76
CLOMR CL	3590	50yr	2100.00	7036.65	7040.58	7040.58	7041.50	0.013423	8.28	285.79	248.12	0.82
CLOMR CL	3590	100yr	2600.00	7036.65	7040.88	7040.88	7041.93	0.013727	8.88	327.61	257.66	0.84
CLOMR CL	3590	500yr	3800.00	7036.65	7041.52	7041.52	7042.84	0.013717	9.93	421.48	277.11	0.86
CLOMR CL	3550	10yr	1200.00	7027.70	7034.16	7030.47	7034.25	0.000594	2.45	545.88	158.90	0.19
CLOMR CL	3550	50yr	2100.00	7027.70	7035.21	7031.57	7035.35	0.000826	3.26	716.58	167.29	0.23
CLOMR CL	3550	100yr	2600.00	7027.70	7035.70	7032.09	7035.88	0.000917	3.60	799.46	171.20	0.24
CLOMR CL	3550	500yr	3800.00	7027.70	7036.73	7033.44	7036.98	0.001090	4.31	992.98	335.51	0.27
CLOMR CL	3521	10yr	1200.00	7027.70	7033.91	7031.51	7034.20	0.001025	4.67	329.75	120.90	0.36
CLOMR CL	3521	50yr	2100.00	7027.70	7034.79	7033.47	7035.29	0.001530	6.31	439.28	127.94	0.45
CLOMR CL	3521	100yr	2600.00	7027.70	7035.20	7033.94	7035.80	0.001743	7.03	491.98	131.20	0.48
CLOMR CL	3521	500yr	3800.00	7027.70	7036.06	7034.80	7036.88	0.002117	8.40	607.55	311.48	0.54
CLOMR CL	3520	10yr	1200.00	7029.70	7033.43	7033.33	7034.16	0.004853	7.48	206.90	117.01	0.73
CLOMR CL	3520	50yr	2100.00	7029.70	7034.32	7034.13	7035.24	0.004867	8.80	314.34	124.14	0.76
CLOMR CL	3520	100yr	2600.00	7029.70	7034.73	7034.42	7035.75	0.004859	9.37	366.43	127.45	0.77
CLOMR CL	3520	500yr	3800.00	7029.70	7035.61	7035.26	7036.83	0.004769	10.44	481.66	134.49	0.79
CLOMR CL	3470	10yr	1200.00	7029.45	7033.18	7033.08	7033.91	0.004850	7.48	206.95	117.01	0.73
CLOMR CL	3470	50yr	2100.00	7029.45	7034.08	7033.88	7034.99	0.004818	8.77	315.49	124.21	0.76
CLOMR CL	3470	100yr	2600.00	7029.45	7034.49	7034.24	7035.50	0.004834	9.35	367.11	127.49	0.77
CLOMR CL	3470	500yr	3800.00	7029.45	7035.38	7035.00	7036.59	0.004693	10.38	484.36	134.65	0.78
CLOMR CL	3420	10yr	1200.00	7029.20	7032.83	7032.83	7033.65	0.005563	7.85	195.96	116.26	0.78
CLOMR CL	3420	50yr	2100.00	7029.20	7033.64	7033.64	7034.72	0.005972	9.46	291.86	122.68	0.84
CLOMR CL	3420	100yr	2600.00	7029.20	7034.00	7034.00	7035.22	0.006167	10.19	336.59	125.56	0.86
CLOMR CL	3420	500yr	3800.00	7029.20	7034.70	7034.70	7036.28	0.006742	11.78	426.68	131.18	0.93
CLOMR CL	3370	10yr	1200.00	7028.95	7032.21	7032.21	7032.97	0.006339	7.29	192.94	153.24	0.81
CLOMR CL	3370	50yr	2100.00	7028.95	7032.95	7032.95	7033.96	0.006430	8.72	294.85	168.04	0.85
CLOMR CL	3370	100yr	2600.00	7028.95	7033.29	7033.29	7034.43	0.006546	9.39	341.52	174.69	0.87
CLOMR CL	3370	500yr	3800.00	7028.95	7033.98	7033.98	7035.40	0.006696	10.68	441.97	184.42	0.91
CLOMR CL	3330	10yr	1200.00	7021.00	7027.46	7023.77	7027.55	0.000594	2.45	545.89	158.91	0.19
CLOMR CL	3330	50yr	2100.00	7021.00	7028.52	7024.87	7028.66	0.000822	3.25	717.77	189.94	0.23
CLOMR CL	3330	100yr	2600.00	7021.00	7029.01	7025.39	7029.19	0.000911	3.59	801.27	204.19	0.24
CLOMR CL	3330	500yr	3800.00	7021.00	7030.04	7026.73	7030.29	0.001048	4.23	980.72	219.98	0.26
CLOMR CL	3301	10yr	1200.00	7021.00	7027.21	7024.81	7027.50	0.001024	4.67	329.96	176.17	0.36
CLOMR CL	3301	50yr	2100.00	7021.00	7028.10	7026.75	7028.59	0.001518	6.30	440.57	197.35	0.44
CLOMR CL	3301	100yr	2600.00	7021.00	7028.52	7027.23	7029.11	0.001725	7.00	494.01	203.28	0.48
CLOMR CL	3301	500yr	3800.00	7021.00	7029.38	7028.10	7030.19	0.002094	8.36	610.08	215.71	0.54
CLOMR CL	3300	10yr	1200.00	7023.00	7026.74	7026.61	7027.46	0.004734	7.41	208.93	162.70	0.72
CLOMR CL	3300	50yr	2100.00	7023.00	7027.66	7027.42	7028.55	0.004648	8.66	319.60	187.58	0.75
CLOMR CL	3300	100yr	2600.00	7023.00	7028.08	7027.79	7029.07	0.004619	9.21	373.07	197.06	0.76
CLOMR CL	3300	500yr	3800.00	7023.00	7028.96	7028.55	7030.15	0.004600	10.31	487.75	209.63	0.78
CLOMR CL	3250	10yr	1200.00	7022.75	7026.54	7026.36	7027.22	0.004427	7.24	214.49	132.46	0.70
CLOMR CL	3250	50yr	2100.00	7022.75	7027.46	7027.17	7028.32	0.004399	8.49	325.99	143.36	0.73
CLOMR CL	3250	100yr	2600.00	7022.75	7027.89	7027.52	7028.83	0.004388	9.04	379.89	148.40	0.74

drop

provide more sections

drop

drop

HEC-RAS Plan: PP Profiles River: Sand Creek Reach: CLOMR CL (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)	
CLOMR CL	3250	500yr	3800.00	7022.75	7028.75	7028.25	7029.91	0.004438	10.19	493.88	158.96	0.76
CLOMR CL	3140	10yr	1200.00	7022.20	7025.82	7025.82	7026.65	0.005656	7.90	194.66	116.17	0.78
CLOMR CL	3140	50yr	2100.00	7022.20	7026.61	7026.61	7027.72	0.006136	9.55	288.99	122.49	0.85
CLOMR CL	3140	100yr	2600.00	7022.20	7026.96	7026.96	7028.22	0.006369	10.31	332.73	125.32	0.88
CLOMR CL	3140	500yr	3800.00	7022.20	7027.73	7027.73	7029.28	0.006575	11.67	430.45	131.41	0.92
CLOMR CL	3090	10yr	1200.00	7021.95	7025.19	7025.19	7025.90	0.013480	7.06	191.37	133.16	0.79
CLOMR CL	3090	50yr	2100.00	7021.95	7025.85	7025.85	7026.80	0.014150	8.44	279.94	138.38	0.84
CLOMR CL	3090	100yr	2600.00	7021.95	7026.16	7026.16	7027.23	0.014158	8.98	323.02	140.84	0.85
CLOMR CL	3090	500yr	3800.00	7021.95	7026.77	7026.77	7028.15	0.014563	10.15	410.69	145.74	0.89
CLOMR CL	3050	10yr	1200.00	7014.00	7020.47		7020.55	0.000593	2.45	546.12	158.92	0.19
CLOMR CL	3050	50yr	2100.00	7014.00	7021.52		7021.66	0.000823	3.25	717.53	167.33	0.23
CLOMR CL	3050	100yr	2600.00	7014.00	7022.01		7022.19	0.000911	3.59	801.36	171.29	0.24
CLOMR CL	3050	500yr	3800.00	7014.00	7023.04		7023.28	0.001053	4.23	979.25	174.81	0.26
CLOMR CL	3021	10yr	1200.00	7014.00	7020.22		7020.51	0.001022	4.66	330.20	120.93	0.35
CLOMR CL	3021	50yr	2100.00	7014.00	7021.10		7021.59	0.001521	6.30	440.32	128.00	0.44
CLOMR CL	3021	100yr	2600.00	7014.00	7021.52		7022.11	0.001724	7.00	494.07	131.32	0.48
CLOMR CL	3021	500yr	3800.00	7014.00	7022.36		7023.18	0.002114	8.39	607.92	138.13	0.54
CLOMR CL	3020	10yr	1200.00	7016.00	7019.75	7019.62	7020.46	0.004668	7.38	210.08	117.22	0.72
CLOMR CL	3020	50yr	2100.00	7016.00	7020.65	7020.41	7021.55	0.004682	8.68	318.75	124.42	0.75
CLOMR CL	3020	100yr	2600.00	7016.00	7021.08	7020.77	7022.07	0.004621	9.21	373.01	127.86	0.76
CLOMR CL	3020	500yr	3800.00	7016.00	7021.92	7021.53	7023.14	0.004734	10.42	482.88	134.56	0.79
CLOMR CL	2970	10yr	1200.00	7015.75	7019.37	7019.37	7020.20	0.005645	7.90	194.81	116.18	0.78
CLOMR CL	2970	50yr	2100.00	7015.75	7020.16	7020.16	7021.27	0.006134	9.55	289.03	122.49	0.85
CLOMR CL	2970	100yr	2600.00	7015.75	7020.52	7020.52	7021.77	0.006367	10.31	332.77	125.32	0.88
CLOMR CL	2970	500yr	3800.00	7015.75	7021.28	7021.28	7022.83	0.006570	11.67	430.55	131.41	0.92
CLOMR CL	2740	10yr	1200.00	7014.60	7018.23	7017.90	7018.62	0.003198	5.96	293.19	186.23	0.59
CLOMR CL	2740	50yr	2100.00	7014.60	7019.09	7018.51	7019.53	0.002898	6.65	460.02	202.45	0.58
CLOMR CL	2740	100yr	2600.00	7014.60	7019.49	7018.79	7019.98	0.002808	6.97	541.98	209.95	0.58
CLOMR CL	2740	500yr	3800.00	7014.60	7020.35		7020.89	0.002582	7.53	730.37	226.31	0.58
CLOMR CL	2690	10yr	1200.00	7014.35	7017.60	7017.60	7018.30	0.013231	7.02	192.72	188.15	0.78
CLOMR CL	2690	50yr	2100.00	7014.35	7018.24	7018.24	7019.20	0.014254	8.48	279.24	198.25	0.84
CLOMR CL	2690	100yr	2600.00	7014.35	7018.56	7018.56	7019.63	0.013999	8.94	324.24	203.47	0.84
CLOMR CL	2690	500yr	3800.00	7014.35	7019.22	7019.22	7020.55	0.013794	9.96	418.22	213.90	0.86
CLOMR CL	2650	10yr	1200.00	7006.73	7013.19		7013.28	0.000594	2.45	545.89	158.91	0.19
CLOMR CL	2650	50yr	2100.00	7006.73	7014.25		7014.39	0.000821	3.25	718.10	167.36	0.23
CLOMR CL	2650	100yr	2600.00	7006.73	7014.75		7014.92	0.000908	3.59	802.11	171.32	0.24
CLOMR CL	2650	500yr	3800.00	7006.73	7015.80		7016.04	0.001030	4.20	986.20	174.95	0.26
CLOMR CL	2621	10yr	1200.00	7006.73	7012.94		7013.23	0.001024	4.67	329.96	120.91	0.36
CLOMR CL	2621	50yr	2100.00	7006.73	7013.84		7014.33	0.001515	6.29	440.94	128.04	0.44
CLOMR CL	2621	100yr	2600.00	7006.73	7014.25		7014.84	0.001716	6.99	494.97	131.38	0.48
CLOMR CL	2621	500yr	3800.00	7006.73	7015.15		7015.95	0.002047	8.30	616.13	139.48	0.53
CLOMR CL	2620	10yr	1200.00	7008.73	7012.47	7012.35	7013.19	0.004767	7.43	208.36	117.11	0.72
CLOMR CL	2620	50yr	2100.00	7008.73	7013.40		7014.29	0.004599	8.63	320.81	124.55	0.74
CLOMR CL	2620	100yr	2600.00	7008.73	7013.83		7014.80	0.004530	9.14	375.63	128.02	0.75
CLOMR CL	2620	500yr	3800.00	7008.73	7014.79		7015.91	0.004231	10.02	502.22	135.70	0.75
CLOMR CL	2570	10yr	1200.00	7008.48	7012.28	7012.10	7012.95	0.004485	7.27	213.40	117.45	0.70
CLOMR CL	2570	50yr	2100.00	7008.48	7013.20		7014.05	0.004337	8.45	327.64	124.99	0.72
CLOMR CL	2570	100yr	2600.00	7008.48	7013.64		7014.57	0.004288	8.97	383.02	128.48	0.73
CLOMR CL	2570	500yr	3800.00	7008.48	7014.62		7015.69	0.003986	9.81	512.78	136.32	0.73
CLOMR CL	2350	10yr	1200.00	7007.38	7011.00	7011.00	7011.83	0.005649	7.90	194.75	116.17	0.78
CLOMR CL	2350	50yr	2100.00	7007.38	7011.79	7011.79	7012.90	0.006134	9.55	289.03	122.49	0.85
CLOMR CL	2350	100yr	2600.00	7007.38	7012.15	7012.15	7013.40	0.006367	10.31	332.77	125.32	0.88
CLOMR CL	2350	500yr	3800.00	7007.38	7014.00		7014.88	0.003020	9.01	580.30	155.13	0.64
CLOMR CL	2300	10yr	1200.00	7007.13	7010.37	7010.37	7011.15	0.006556	7.37	190.25	133.09	0.82
CLOMR CL	2300	50yr	2100.00	7007.13	7011.10	7011.10	7012.14	0.006707	8.85	290.35	136.97	0.87
CLOMR CL	2300	100yr	2600.00	7007.13	7011.44	7011.44	7012.61	0.006781	9.49	337.62	141.67	0.88
CLOMR CL	2300	500yr	3800.00	7007.13	7014.14		7014.66	0.001586	6.69	776.21	232.41	0.47
CLOMR CL	2260	10yr	1200.00	6999.18	7007.03		7007.08	0.000114	1.88	774.47	170.03	0.13
CLOMR CL	2260	50yr	2100.00	6999.18	7009.87		7009.92	0.000084	2.04	1293.01	195.82	0.12
CLOMR CL	2260	100yr	2600.00	6999.18	7011.27		7011.32	0.000075	2.10	1574.84	208.80	0.11
CLOMR CL	2260	500yr	3800.00	6999.18	7014.46		7014.51	0.000056	2.16	2288.77	235.65	0.10
CLOMR CL	2231	10yr	1200.00	6999.18	7006.96		7007.07	0.000306	3.03	529.13	133.44	0.20
CLOMR CL	2231	50yr	2100.00	6999.18	7009.82		7009.92	0.000191	3.01	932.06	147.60	0.17
CLOMR CL	2231	100yr	2600.00	6999.18	7011.21		7011.31	0.000175	3.15	1154.83	175.87	0.17

drop

provide more sections

drop

provide more sections

drop

HEC-RAS Plan: PP Profiles River: Sand Creek Reach: CLOMR CL (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)	
CLOMR CL	2231	500yr	3800.00	6999.18	7014.42		7014.51	0.000120	3.08	1829.54	233.51	0.14
CLOMR CL	2230	10yr	1200.00	7001.18	7006.93		7007.07	0.000541	3.45	480.49	133.22	0.26
CLOMR CL	2230	50yr	2100.00	7001.18	7009.81		7009.92	0.000257	3.18	865.62	147.54	0.20
CLOMR CL	2230	100yr	2600.00	7001.18	7011.20		7011.31	0.000224	3.29	1088.48	175.50	0.19
CLOMR CL	2230	500yr	3800.00	7001.18	7014.41		7014.51	0.000140	3.16	1763.85	233.50	0.16
CLOMR CL	2200	10yr	1200.00	7001.12	7006.92		7007.05	0.000521	3.40	466.65	133.59	0.26
CLOMR CL	2200	50yr	2100.00	7001.12	7009.80		7009.91	0.000253	3.17	873.04	149.16	0.19
CLOMR CL	2200	100yr	2600.00	7001.12	7011.20		7011.30	0.000212	3.21	1092.19	165.93	0.18
CLOMR CL	2200	500yr	3800.00	7001.12	7014.41		7014.50	0.000141	3.18	1690.35	206.80	0.16
CLOMR CL	2136	10yr	1200.00	7000.99	7006.93		7007.01	0.000305	2.59	578.95	154.70	0.20
CLOMR CL	2136	50yr	2100.00	7000.99	7009.81		7009.88	0.000162	2.53	1075.01	189.04	0.16
CLOMR CL	2136	100yr	2600.00	7000.99	7011.21		7011.28	0.000131	2.53	1350.99	205.79	0.14
CLOMR CL	2136	500yr	3800.00	7000.99	7014.42		7014.49	0.000083	2.45	2050.54	225.10	0.12
CLOMR CL	2086	10yr	1200.00	7000.89	7006.51	7004.45	7006.94	0.001392	5.44	233.39	53.92	0.42
CLOMR CL	2086	50yr	2100.00	7000.89	7009.28	7005.71	7009.82	0.000967	6.04	369.23	53.94	0.38
CLOMR CL	2086	100yr	2600.00	7000.89	7010.62	7006.29	7011.21	0.000872	6.36	434.52	53.94	0.37
CLOMR CL	2086	500yr	3800.00	7000.89	7013.71	7007.60	7014.41	0.000701	6.91	585.80	53.96	0.35
CLOMR CL	2050	Bridge										
CLOMR CL	1992	10yr	1200.00	7000.70	7004.91	7004.20	7005.84	0.004431	7.84	157.84	44.92	0.71
CLOMR CL	1992	50yr	2100.00	7000.70	7005.55	7005.55	7007.61	0.007888	11.63	186.81	44.93	0.98
CLOMR CL	1992	100yr	2600.00	7000.70	7006.12	7006.12	7008.56	0.008020	12.71	212.10	44.94	1.01
CLOMR CL	1992	500yr	3800.00	7000.70	7007.58	7007.58	7010.64	0.007129	14.24	277.81	44.95	0.99
CLOMR CL	1942	10yr	1200.00	7000.60	7005.06		7005.41	0.001885	5.34	295.50	122.91	0.47
CLOMR CL	1942	50yr	2100.00	7000.60	7006.09		7006.58	0.002066	6.52	426.19	131.14	0.51
CLOMR CL	1942	100yr	2600.00	7000.60	7006.57		7007.12	0.002134	7.03	489.27	134.94	0.53
CLOMR CL	1942	500yr	3800.00	7000.60	7007.53		7008.28	0.002318	8.17	624.50	146.96	0.57
CLOMR CL	1640	10yr	1200.00	7000.00	7003.62	7003.62	7004.45	0.005849	7.90	194.75	116.17	0.78
CLOMR CL	1640	50yr	2100.00	7000.00	7004.41	7004.41	7005.52	0.006134	9.55	289.03	122.49	0.85
CLOMR CL	1640	100yr	2600.00	7000.00	7004.77	7004.77	7006.02	0.006367	10.31	332.77	125.32	0.88
CLOMR CL	1640	500yr	3800.00	7000.00	7005.53	7005.53	7007.08	0.006573	11.67	430.48	131.41	0.92
CLOMR CL	1590	10yr	1200.00	6999.90	7003.14	7003.14	7003.85	0.013603	7.09	190.71	133.11	0.79
CLOMR CL	1590	50yr	2100.00	6999.90	7003.80	7003.80	7004.75	0.014143	8.44	279.99	138.38	0.84
CLOMR CL	1590	100yr	2600.00	6999.90	7004.11	7004.11	7005.18	0.014152	8.98	323.07	140.84	0.85
CLOMR CL	1590	500yr	3800.00	6999.90	7004.72	7004.72	7006.10	0.014578	10.15	410.74	145.74	0.89
CLOMR CL	1550	10yr	1200.00	6992.12	6998.88		6998.95	0.000467	2.25	593.50	161.29	0.17
CLOMR CL	1550	50yr	2100.00	6992.12	7000.02		7000.14	0.000640	2.98	781.51	170.36	0.20
CLOMR CL	1550	100yr	2600.00	6992.12	7000.54		7000.69	0.000708	3.29	872.02	174.30	0.21
CLOMR CL	1550	500yr	3800.00	6992.12	7001.66		7001.87	0.000807	3.86	1070.45	179.08	0.23
CLOMR CL	1521	10yr	1200.00	6992.12	6998.69		6998.92	0.000753	4.18	373.87	123.78	0.31
CLOMR CL	1521	50yr	2100.00	6992.12	6999.72		7000.09	0.001062	5.54	504.87	131.98	0.38
CLOMR CL	1521	100yr	2600.00	6992.12	7000.19		7000.63	0.001189	6.13	568.01	135.75	0.40
CLOMR CL	1521	500yr	3800.00	6992.12	7001.20		7001.80	0.001401	7.26	710.68	146.83	0.45
CLOMR CL	1520	10yr	1200.00	6994.12	6998.55		6998.90	0.001966	5.42	291.00	122.62	0.48
CLOMR CL	1520	50yr	2100.00	6994.12	6999.58		7000.07	0.002132	6.59	421.45	130.86	0.52
CLOMR CL	1520	100yr	2600.00	6994.12	7000.05		7000.62	0.002197	7.11	484.33	134.84	0.54
CLOMR CL	1520	500yr	3800.00	6994.12	7001.07		7001.78	0.002274	8.10	626.42	145.24	0.56
CLOMR CL	1470	10yr	1200.00	6994.02	6998.45		6998.81	0.001961	5.42	291.24	122.64	0.48
CLOMR CL	1470	50yr	2100.00	6994.02	6999.47		6999.96	0.002155	6.61	419.92	130.76	0.52
CLOMR CL	1470	100yr	2600.00	6994.02	6999.93		7000.50	0.002229	7.14	481.90	134.50	0.54
CLOMR CL	1470	500yr	3800.00	6994.02	7000.88		7001.66	0.002526	8.46	616.94	157.67	0.59
CLOMR CL	1210	10yr	1200.00	6993.50	6997.12	6997.12	6997.95	0.005645	7.90	194.81	116.18	0.78
CLOMR CL	1210	50yr	2100.00	6993.50	6997.91	6997.91	6999.02	0.006137	9.55	288.97	122.49	0.85
CLOMR CL	1210	100yr	2600.00	6993.50	6998.27	6998.27	6999.52	0.006367	10.31	332.77	125.32	0.88
CLOMR CL	1210	500yr	3800.00	6993.50	6999.03	6999.03	7000.58	0.006570	11.67	430.55	131.41	0.92
CLOMR CL	1160	10yr	1200.00	6993.40	6996.64	6996.64	6997.35	0.013603	7.09	190.71	133.11	0.79
CLOMR CL	1160	50yr	2100.00	6993.40	6997.30	6997.30	6998.25	0.014143	8.44	279.99	138.38	0.84
CLOMR CL	1160	100yr	2600.00	6993.40	6997.61	6997.61	6998.68	0.014152	8.98	323.07	140.84	0.85
CLOMR CL	1160	500yr	3800.00	6993.40	6998.22	6998.22	6999.60	0.014578	10.15	410.74	145.74	0.89
CLOMR CL	1120	10yr	1200.00	6986.68	6993.25		6993.33	0.000544	2.38	562.95	159.77	0.18
CLOMR CL	1120	50yr	2100.00	6986.68	6994.32		6994.45	0.000759	3.16	737.47	168.28	0.22
CLOMR CL	1120	100yr	2600.00	6986.68	6994.81		6994.98	0.000845	3.50	821.77	172.24	0.23
CLOMR CL	1120	500yr	3800.00	6986.68	6995.84		6996.07	0.000984	4.13	1001.29	175.31	0.26
CLOMR CL	1091	10yr	1200.00	6986.68	6993.03		6993.29	0.000912	4.48	346.05	121.97	0.34

Sterling Ranch Blvd.

provide more sections

drop

provide more sections

drop

HEC-RAS Plan: PP Profiles River: Sand Creek Reach: CLOMR CL (Continued)

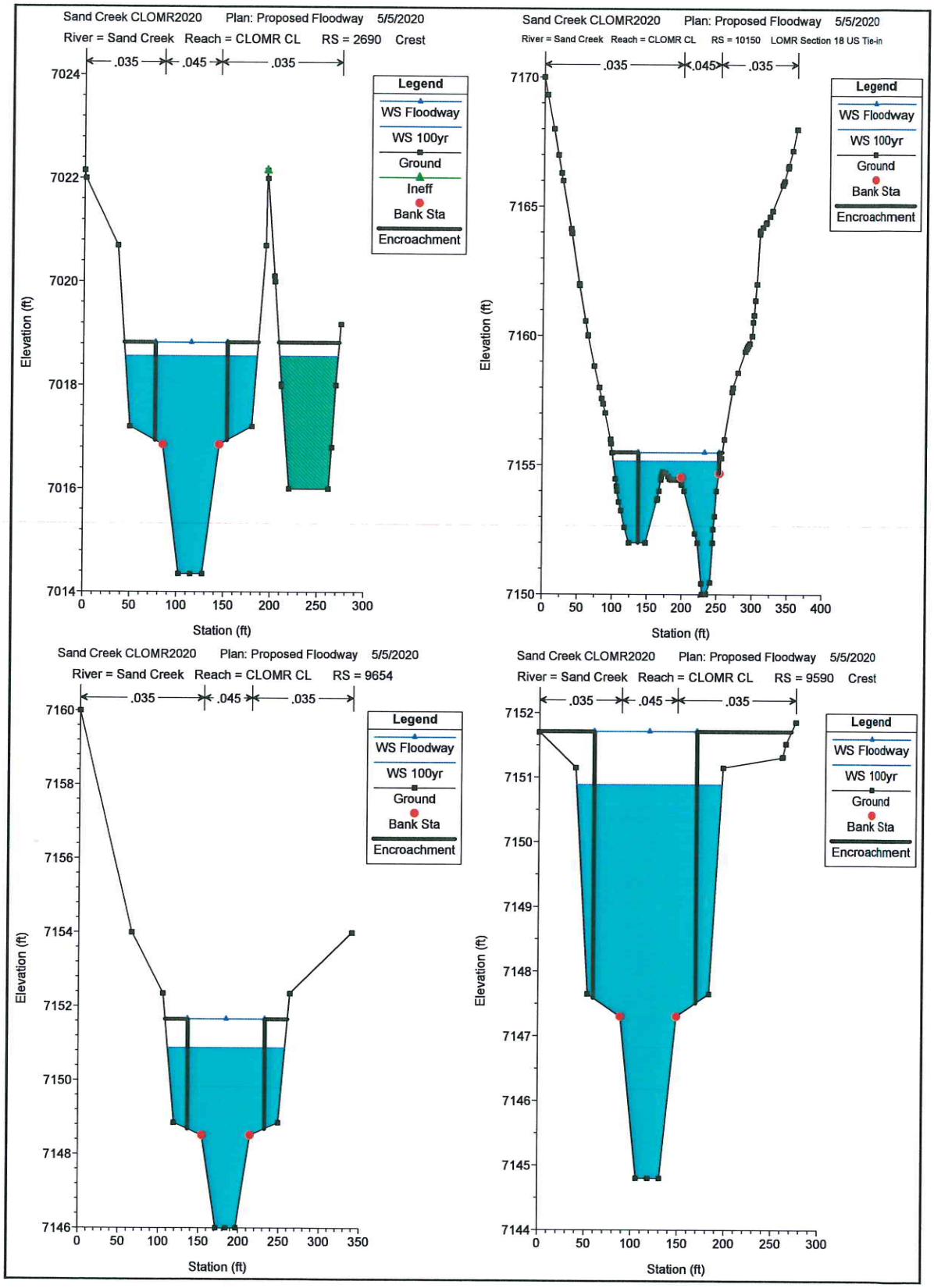
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
CLOMR CL	1091	50yr	2100.00	6986.68	6993.94		6994.39	0.001347	6.03	461.27	129.31	0.42
CLOMR CL	1091	100yr	2600.00	6986.68	6994.37		6994.91	0.001531	6.71	516.66	132.69	0.45
CLOMR CL	1091	500yr	3800.00	6986.68	6995.24		6995.98	0.001875	8.04	635.42	139.68	0.51
CLOMR CL	1090	10yr	1200.00	6988.68	6992.78		6993.27	0.002936	6.25	250.93	119.98	0.58
CLOMR CL	1090	50yr	2100.00	6988.68	6993.68		6994.36	0.003263	7.85	362.70	127.21	0.63
CLOMR CL	1090	100yr	2600.00	6988.68	6994.10		6994.88	0.003378	8.25	416.63	130.58	0.65
CLOMR CL	1090	500yr	3800.00	6988.68	6994.96		6995.95	0.003590	9.46	531.79	137.44	0.69
CLOMR CL	1040	10yr	1200.00	6988.58	6992.19	6992.19	6993.03	0.005782	7.96	192.94	116.05	0.79
CLOMR CL	1040	50yr	2100.00	6988.58	6992.99	6992.99	6994.10	0.006137	9.55	288.97	122.49	0.85
CLOMR CL	1040	100yr	2600.00	6988.58	6993.35	6993.35	6994.60	0.006367	10.31	332.77	125.32	0.88
CLOMR CL	1040	500yr	3800.00	6988.58	6994.11	6994.11	6995.66	0.006568	11.67	430.61	131.41	0.91
CLOMR CL	644	10yr	1200.00	6983.10	6985.31	6984.94	6985.73	0.004246	5.23	234.83	141.18	0.69
CLOMR CL	644	50yr	2100.00	6983.10	6985.89	6985.56	6986.60	0.004955	6.83	318.34	146.75	0.79
CLOMR CL	644	100yr	2600.00	6983.10	6986.14	6985.86	6987.02	0.005376	7.61	355.30	148.76	0.83
CLOMR CL	644	500yr	3800.00	6983.10	6986.61	6986.51	6987.93	0.006500	9.35	425.93	151.98	0.94

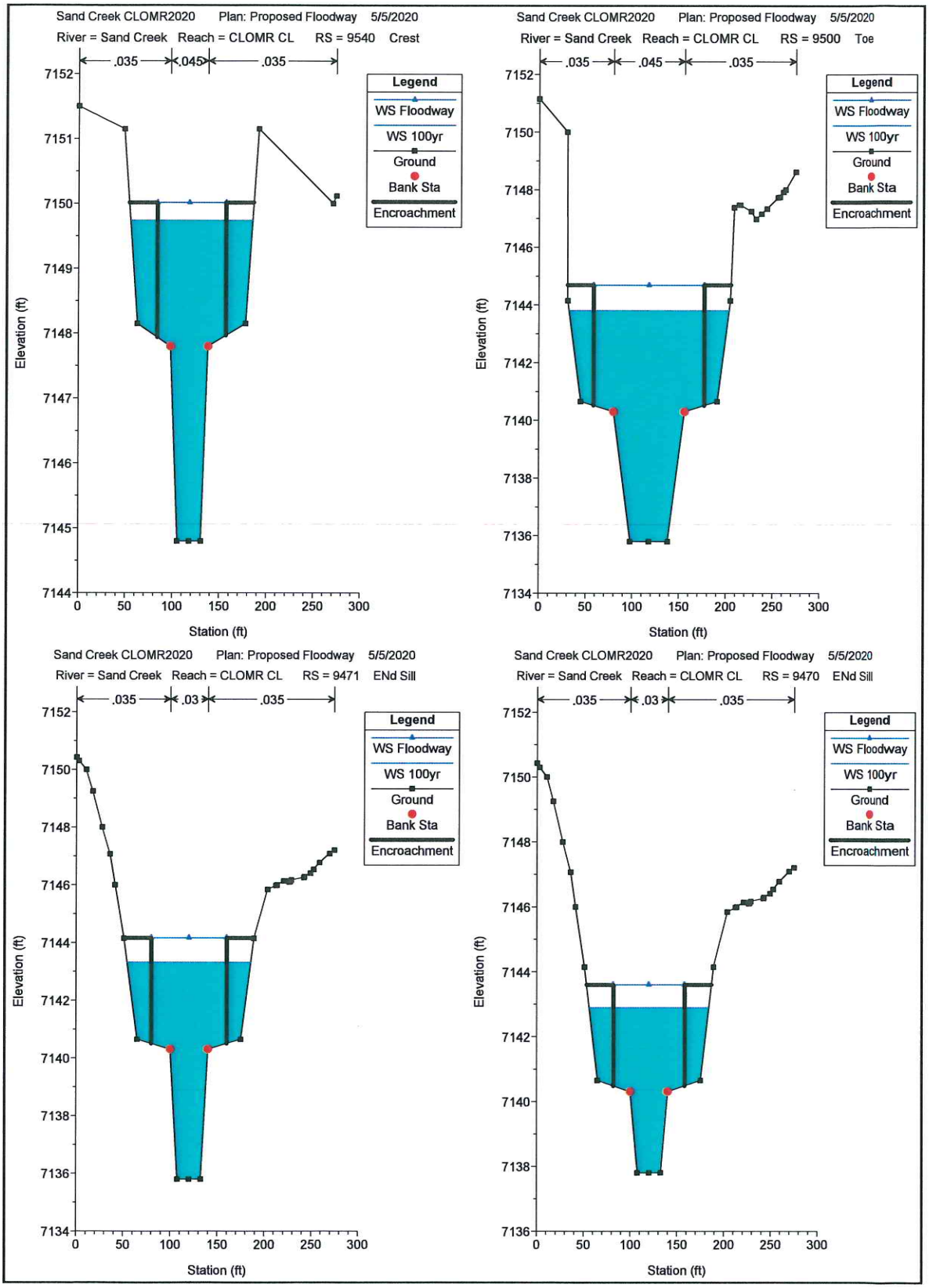
Provide modeling to DP 53A

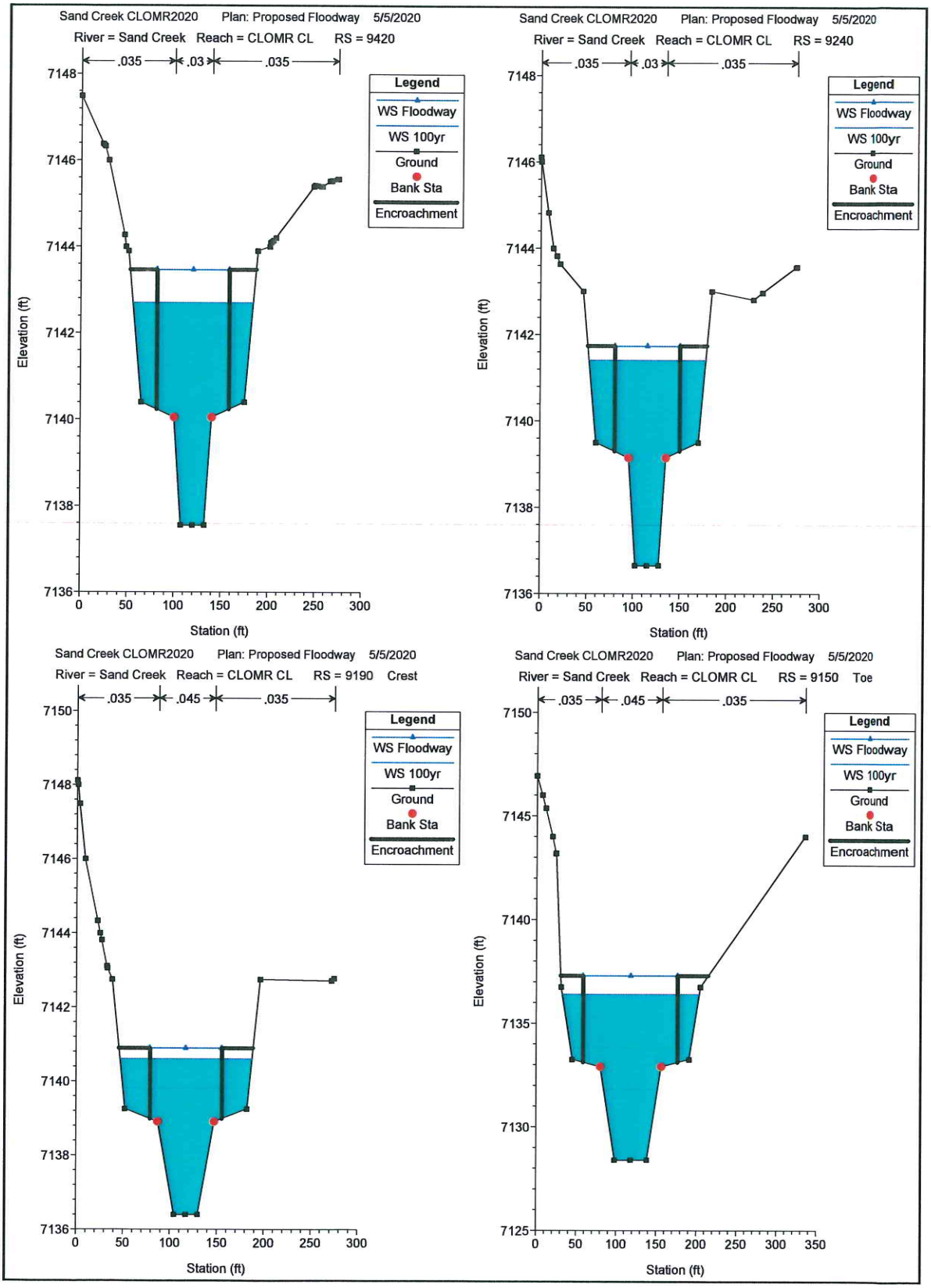
Where is this?

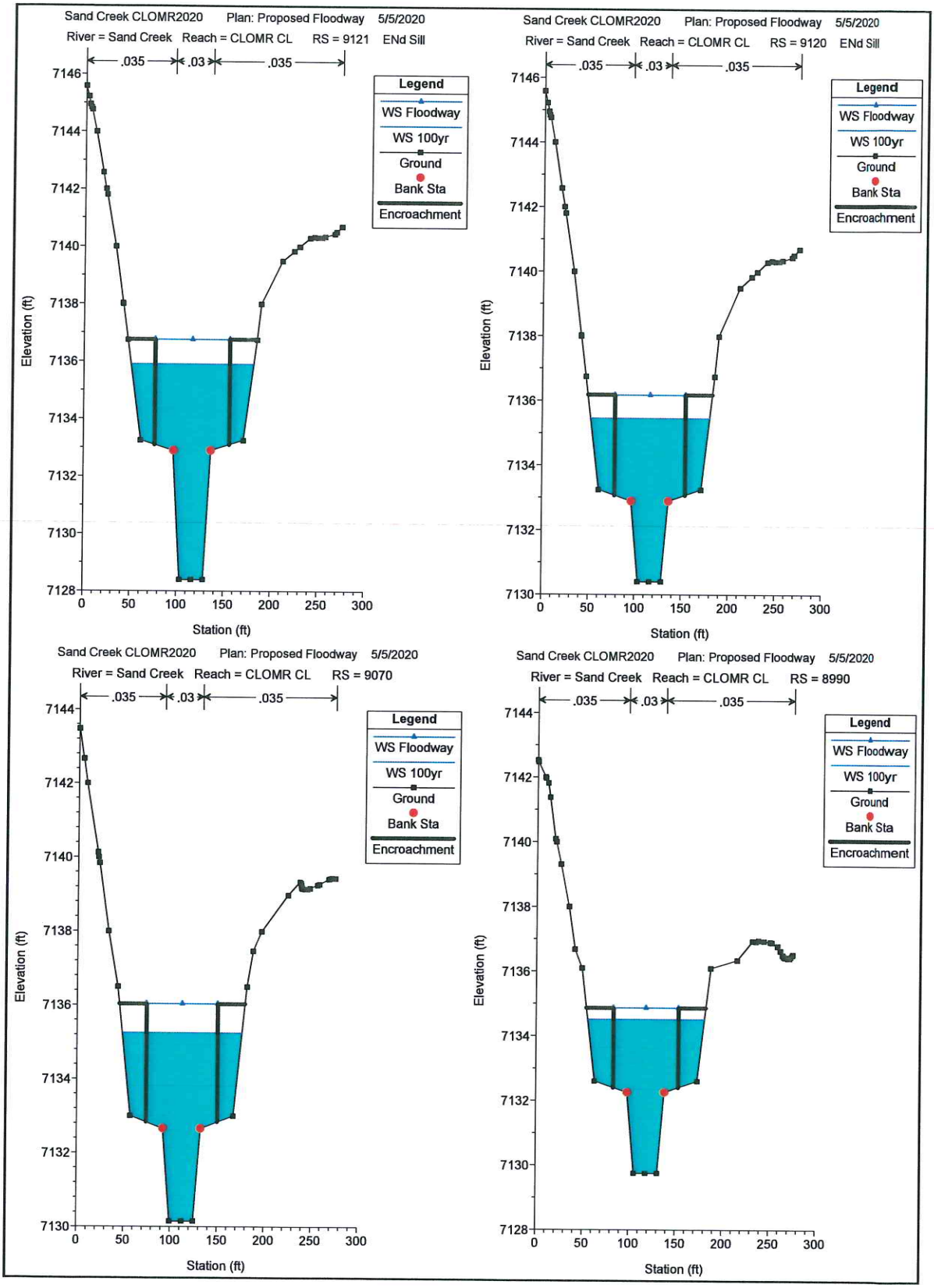
Label drops and bridge crossings

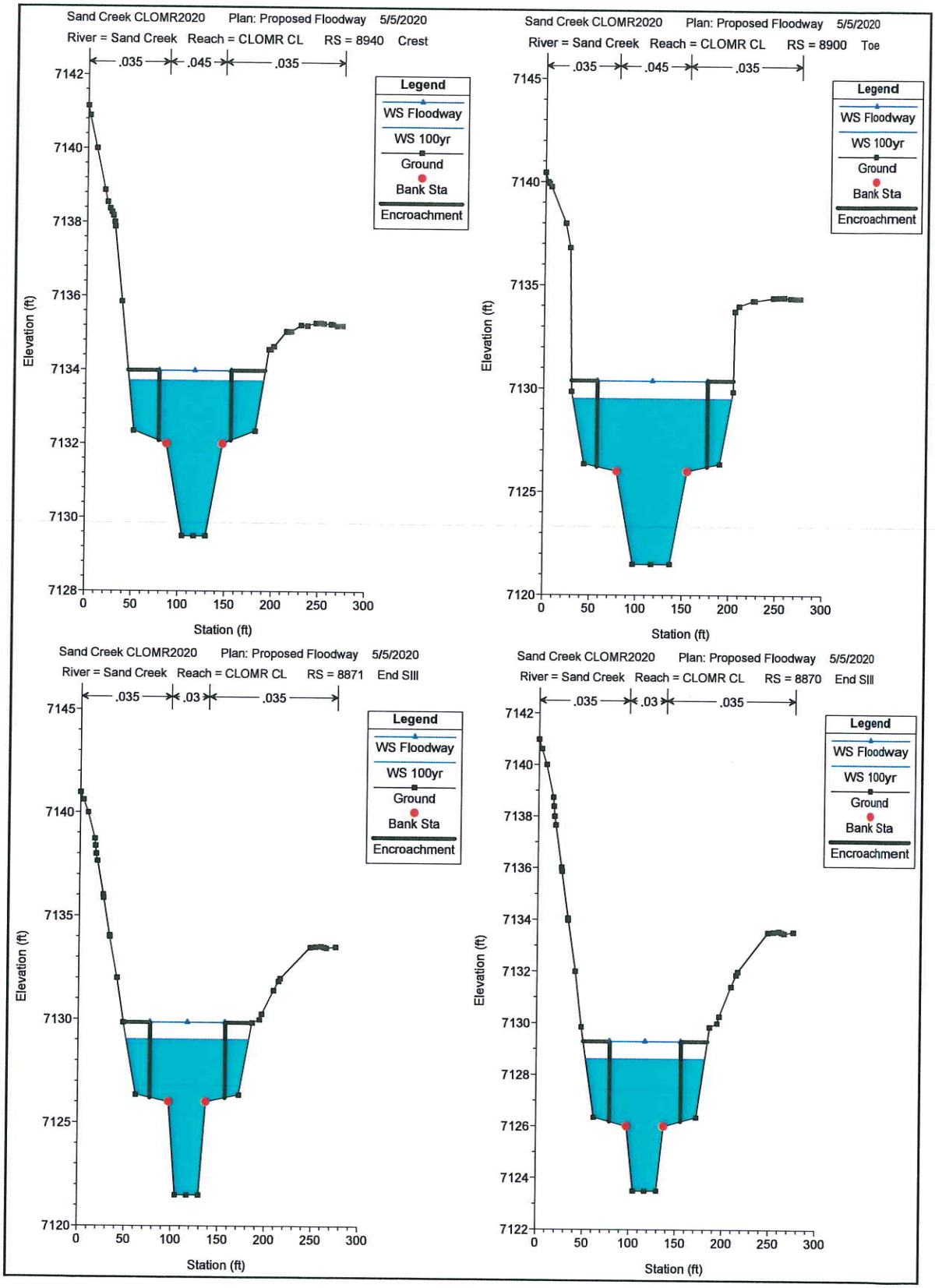
Excessive velocities.

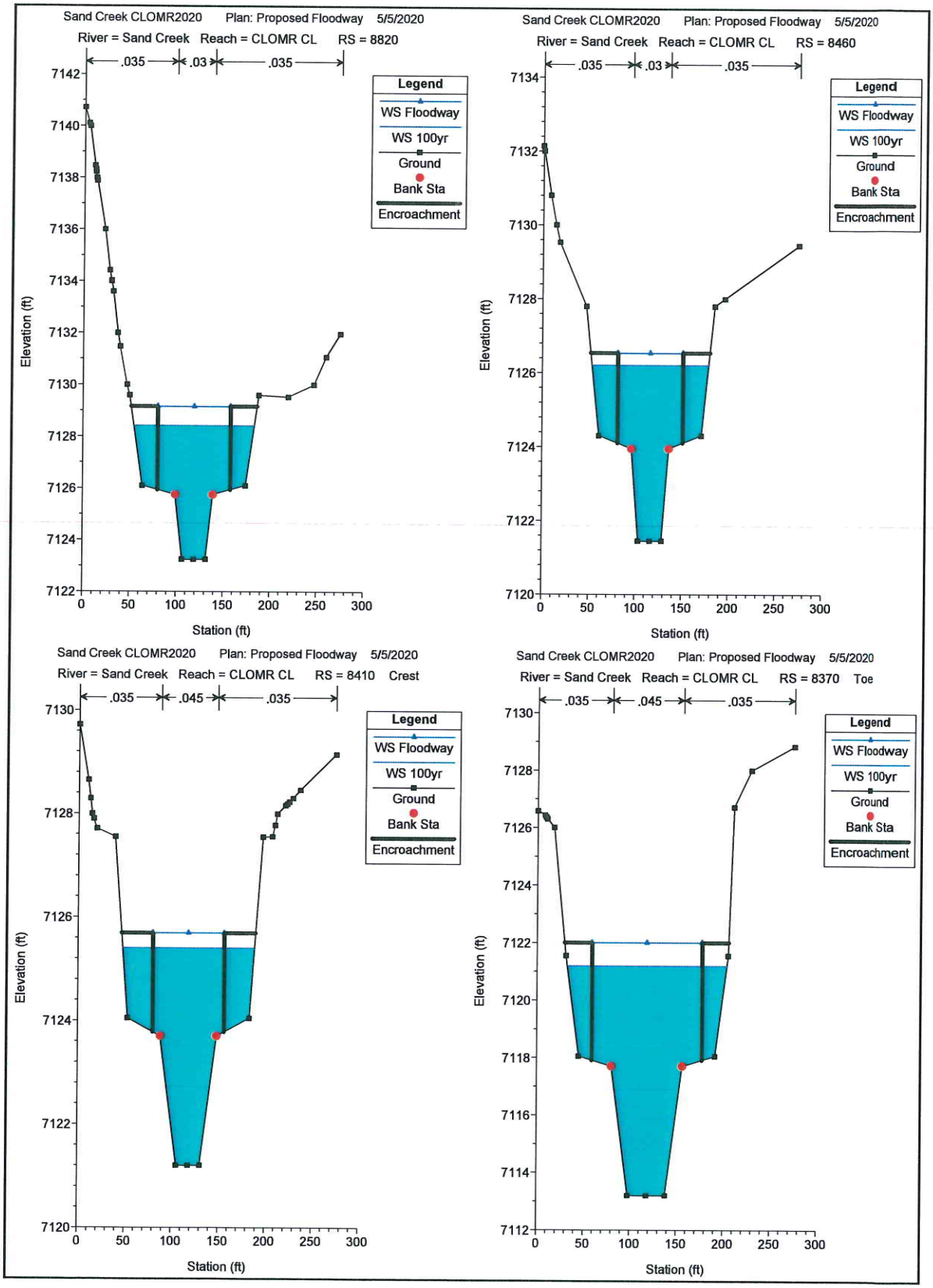

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 2690 Crest
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 10150 LOMR Section 18 US Tie-in
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 9654
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 9590 Crest
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

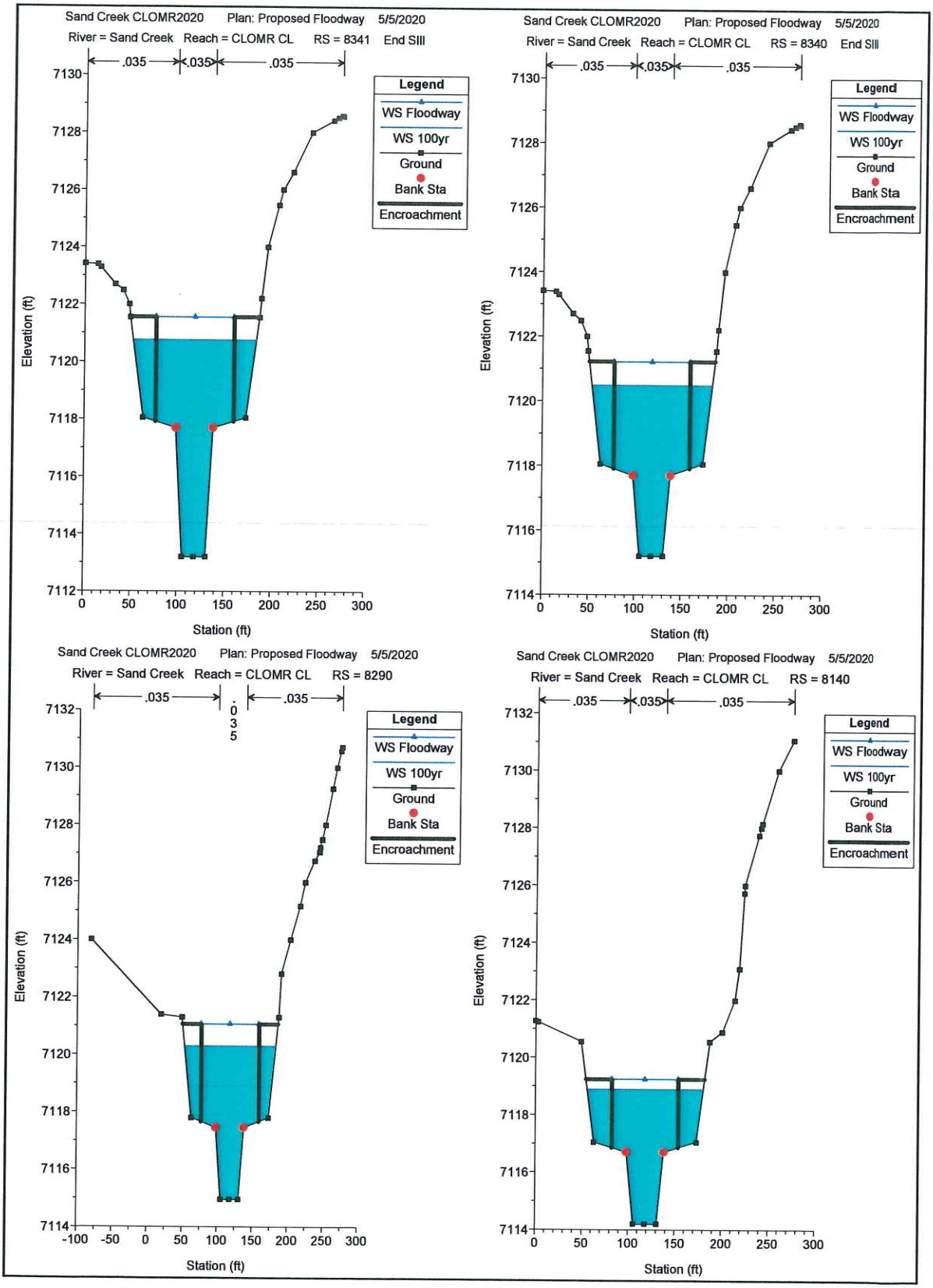

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 9540 Crest
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 9500 Toe
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 9471 ENd Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 9470 ENd Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

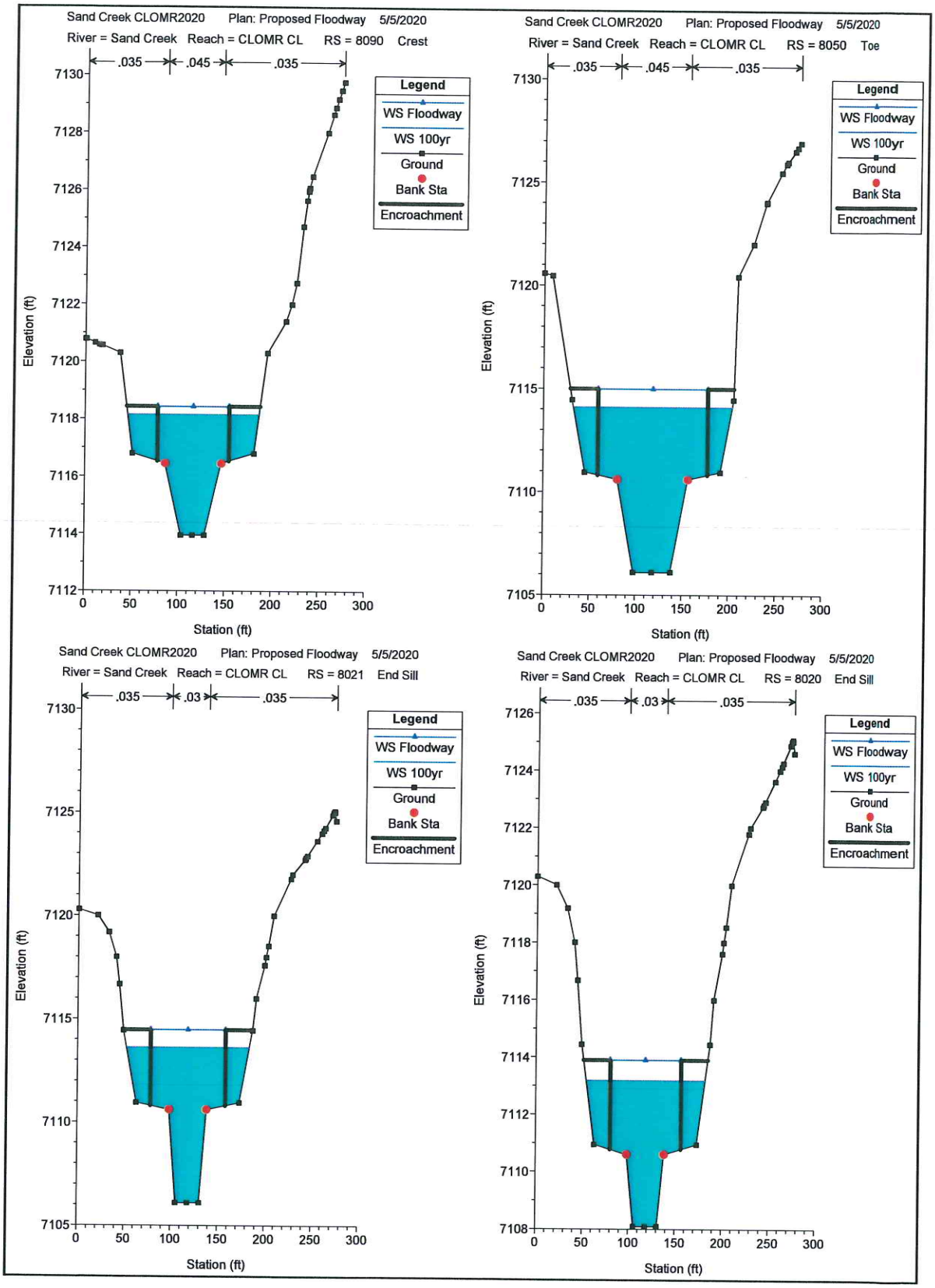

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 9420
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 9240
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 9190 Crest
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 9150 Toe
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

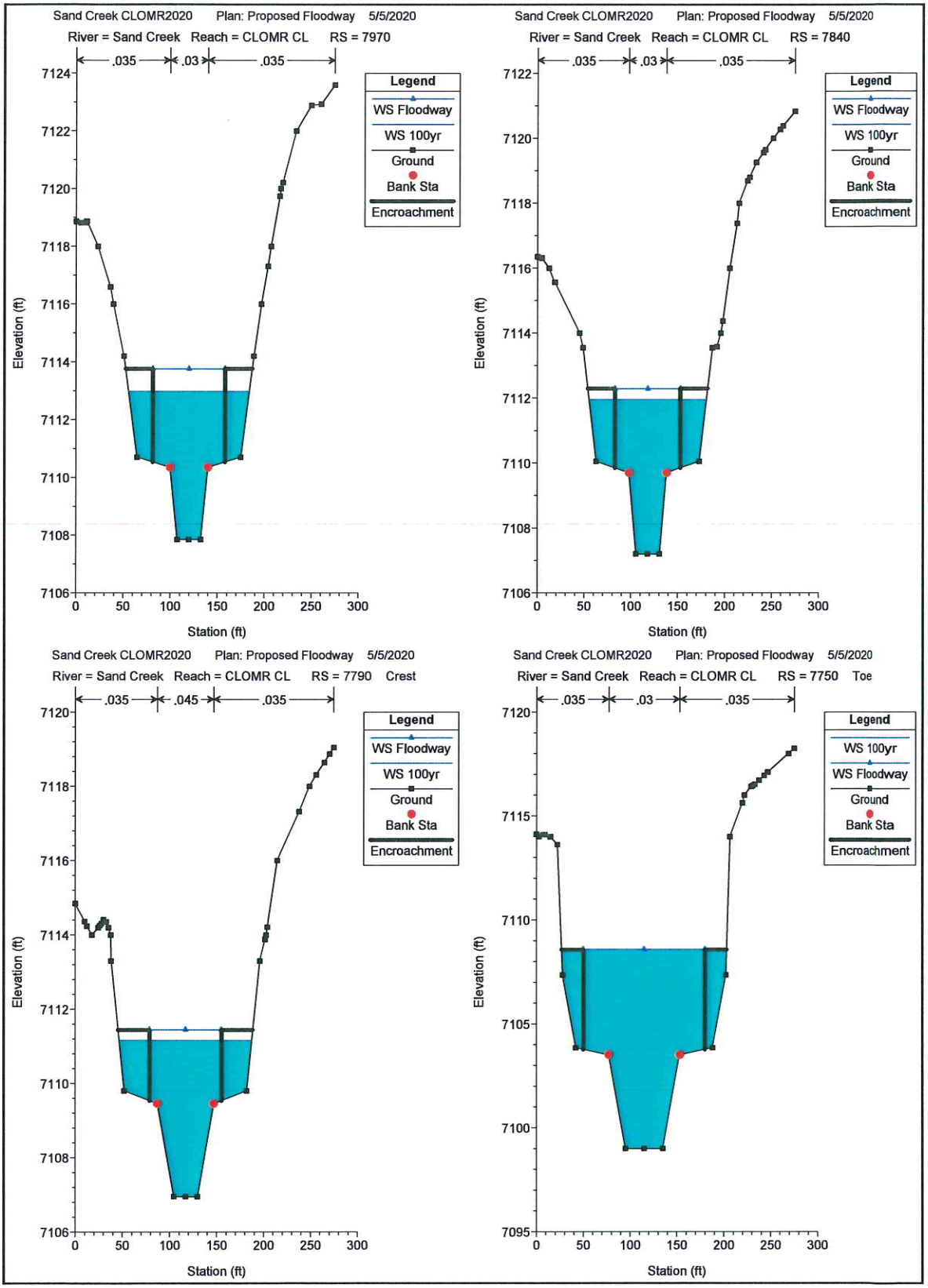

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 9121 ENd Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 9120 ENd Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 9070
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 8990
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

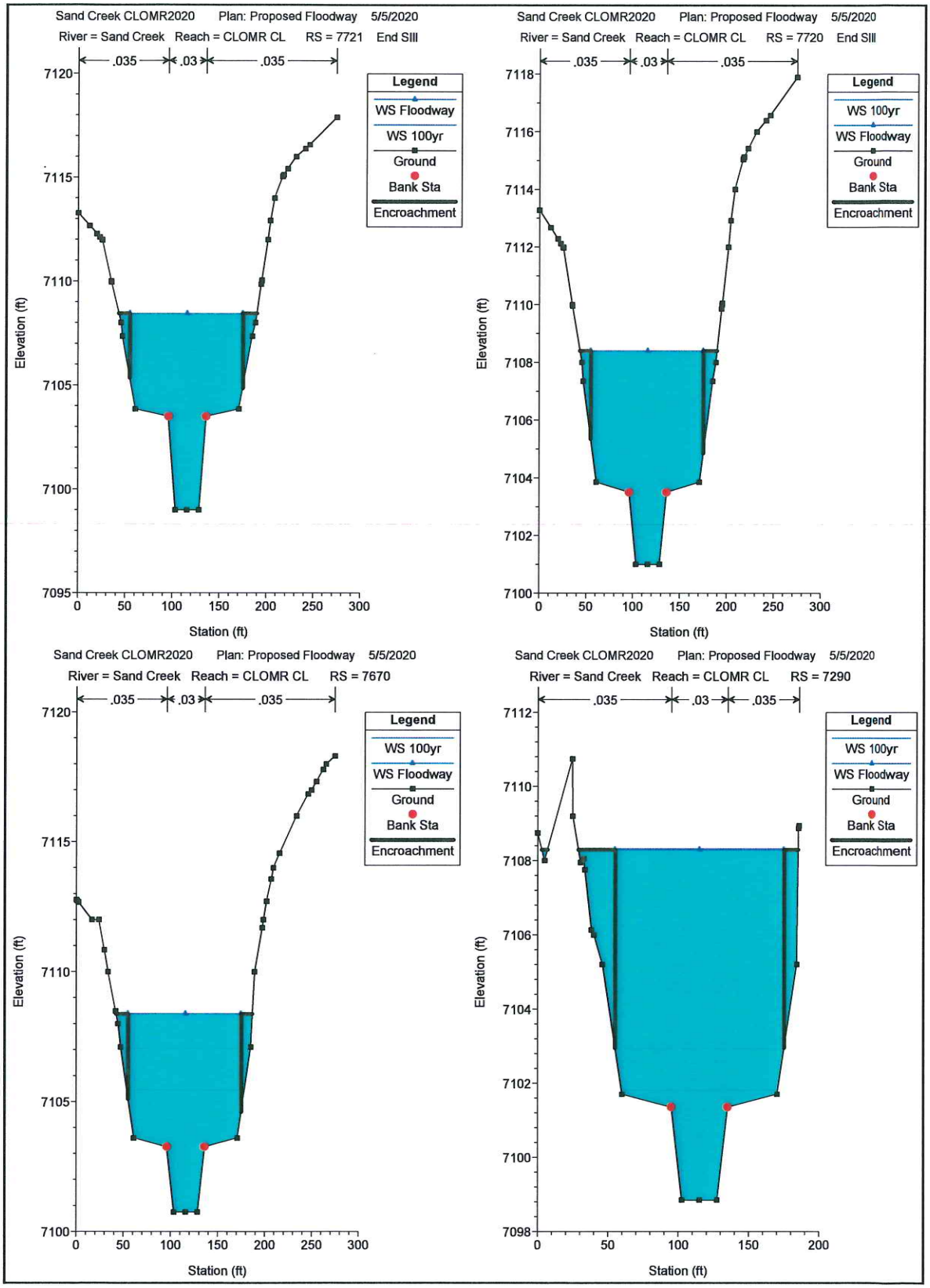

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 8940 Crest
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 8900 Toe
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 8871 End SIII
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 8870 End SIII
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

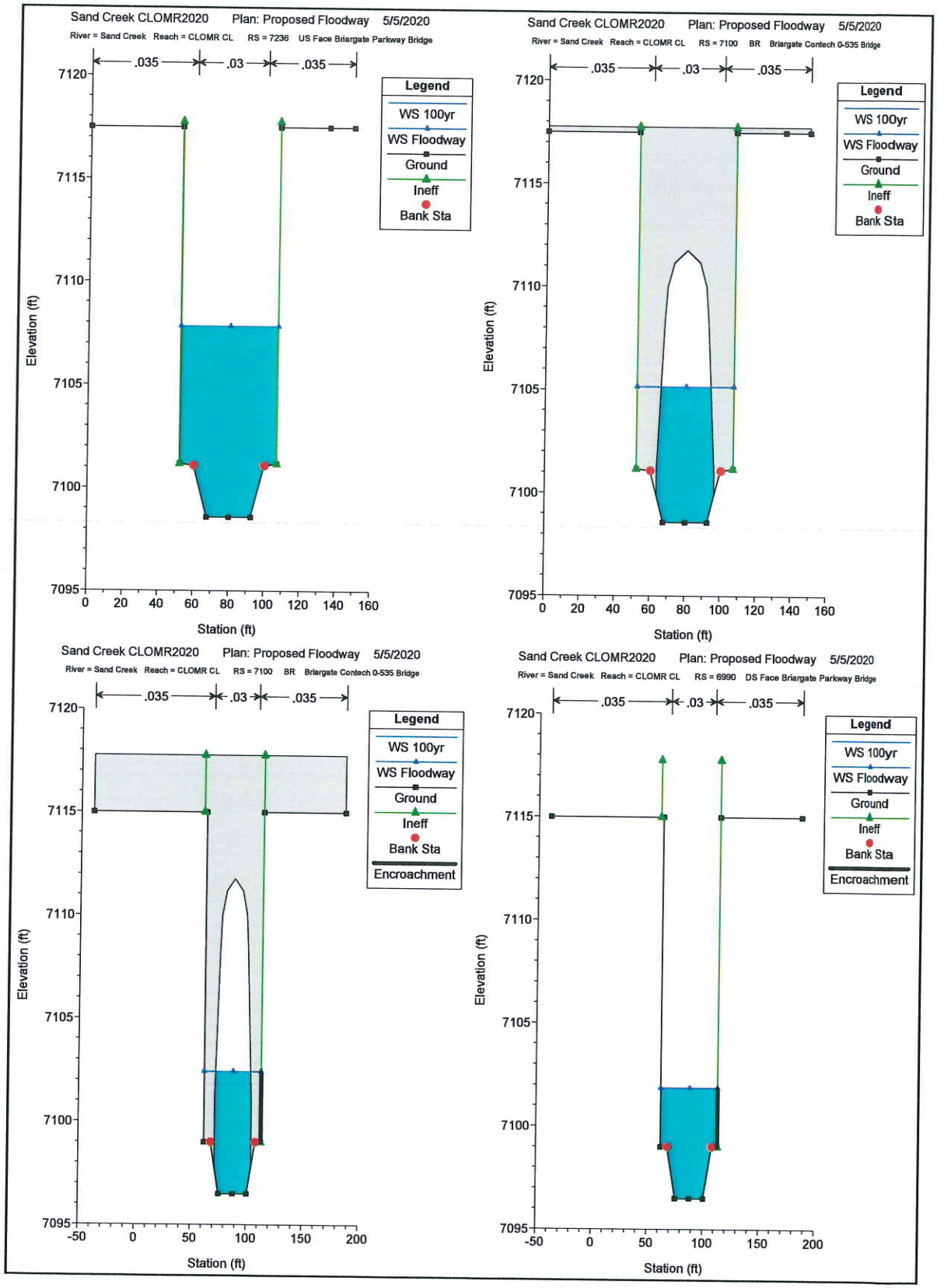

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 8820
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 8460
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 8410 Crest
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 8370 Toe
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

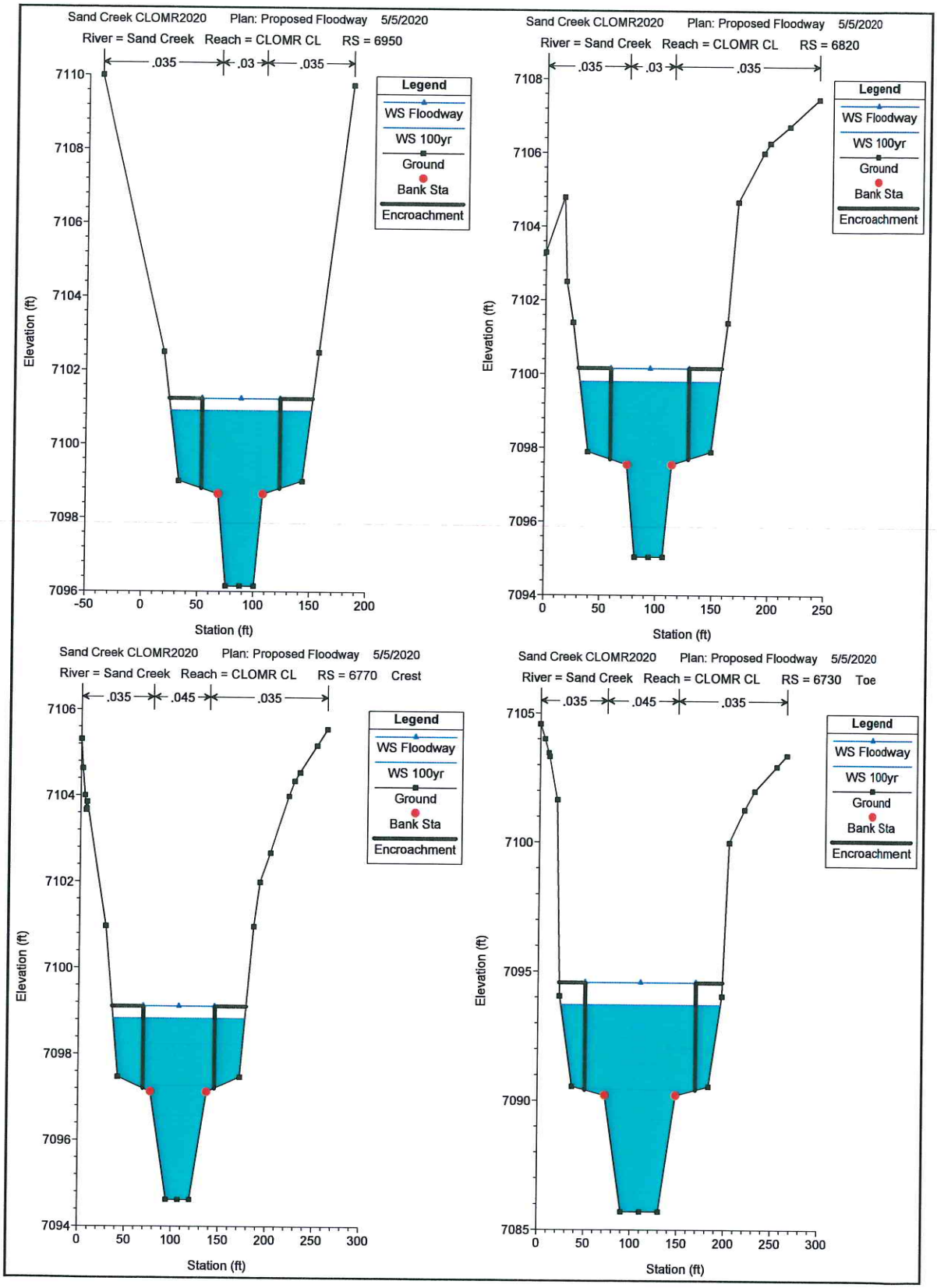

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 8341 End SIII
.035
.035
.035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 8340 End SIII
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 8290
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 8140

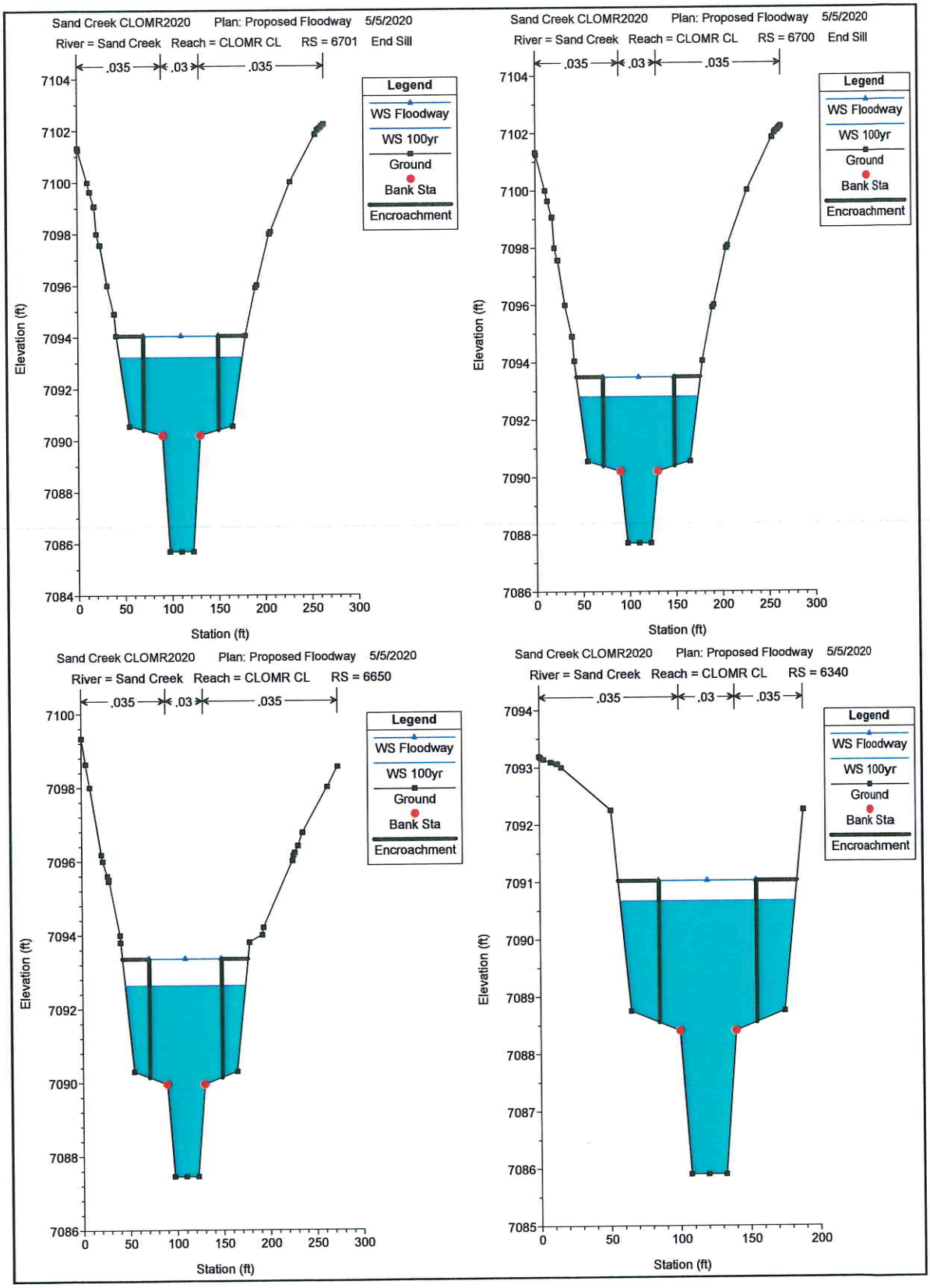

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 8090 Crest
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 8050 Toe
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 8021 End Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 8020 End Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

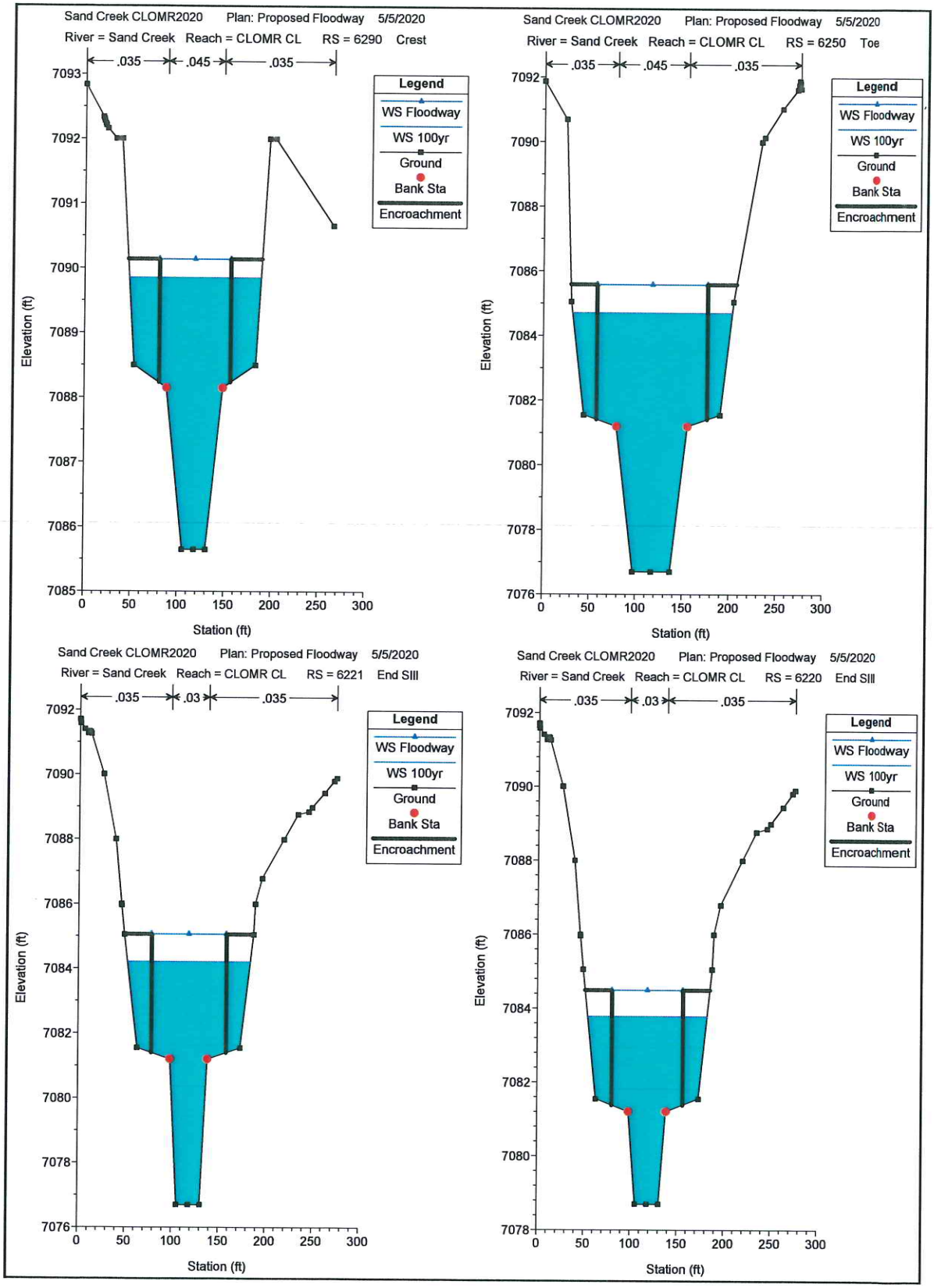

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 7970
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 7840
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 7790 Crest
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 7750 Toe
.035 .03 .035
Legend
WS 100yr
WS Floodway
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

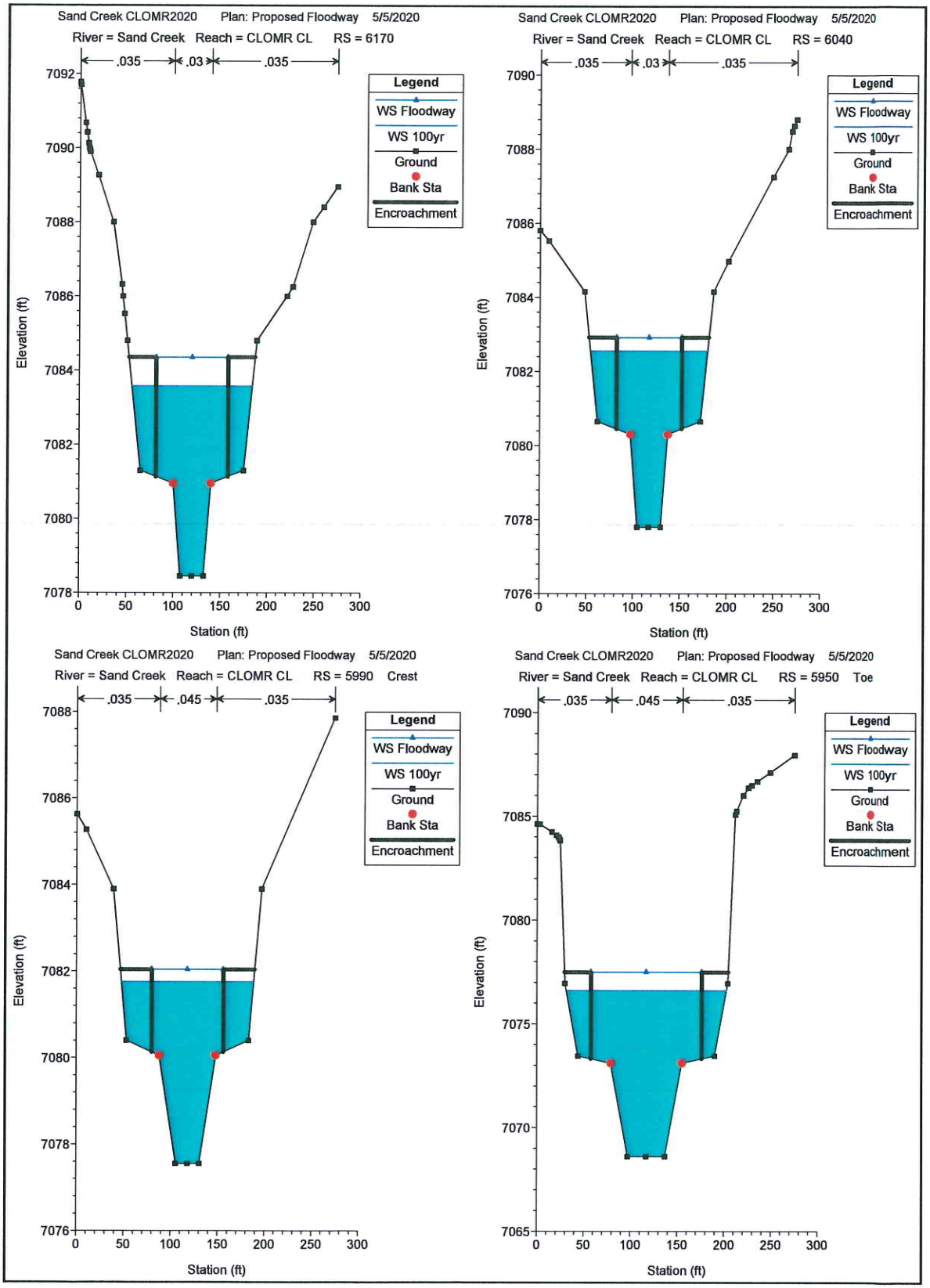

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 7721 End Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 7720 End Sill
.035 .03 .035
Legend
WS 100yr
WS Floodway
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 7670
.035 .03 .035
Legend
WS 100yr
WS Floodway
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 7290
.035 .03 .035
Legend
WS 100yr
WS Floodway
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

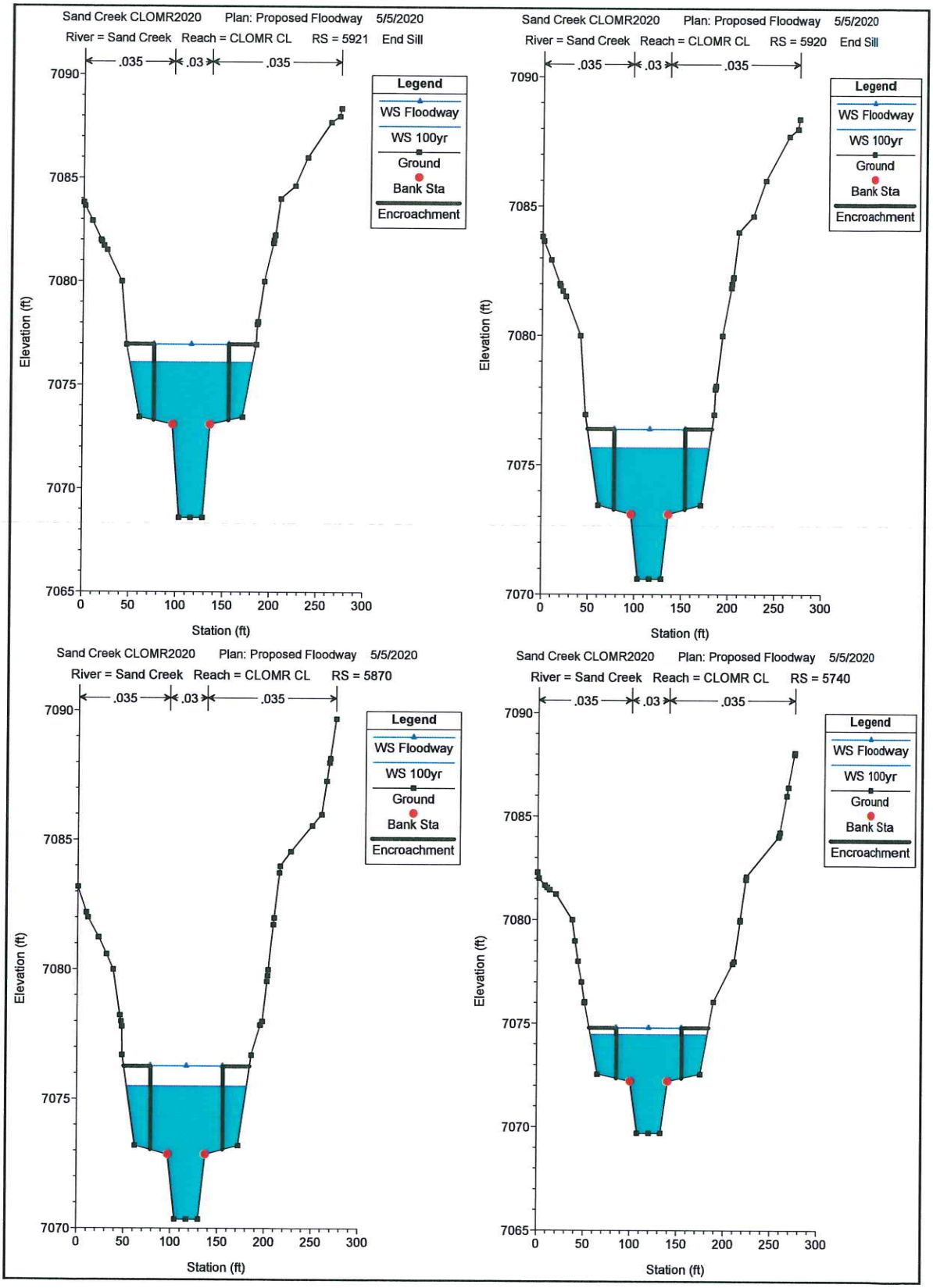

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 7236 US Face Briargate Parkway Bridge
.035
.03
.035
Legend
WS 100yr
WS Floodway
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 7100 BR Briargate Contech 0-535 Bridge
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 7100 BR Briargate Contech 0-535 Bridge
Encroachment
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 6990 DS Face Briargate Parkway Bridge

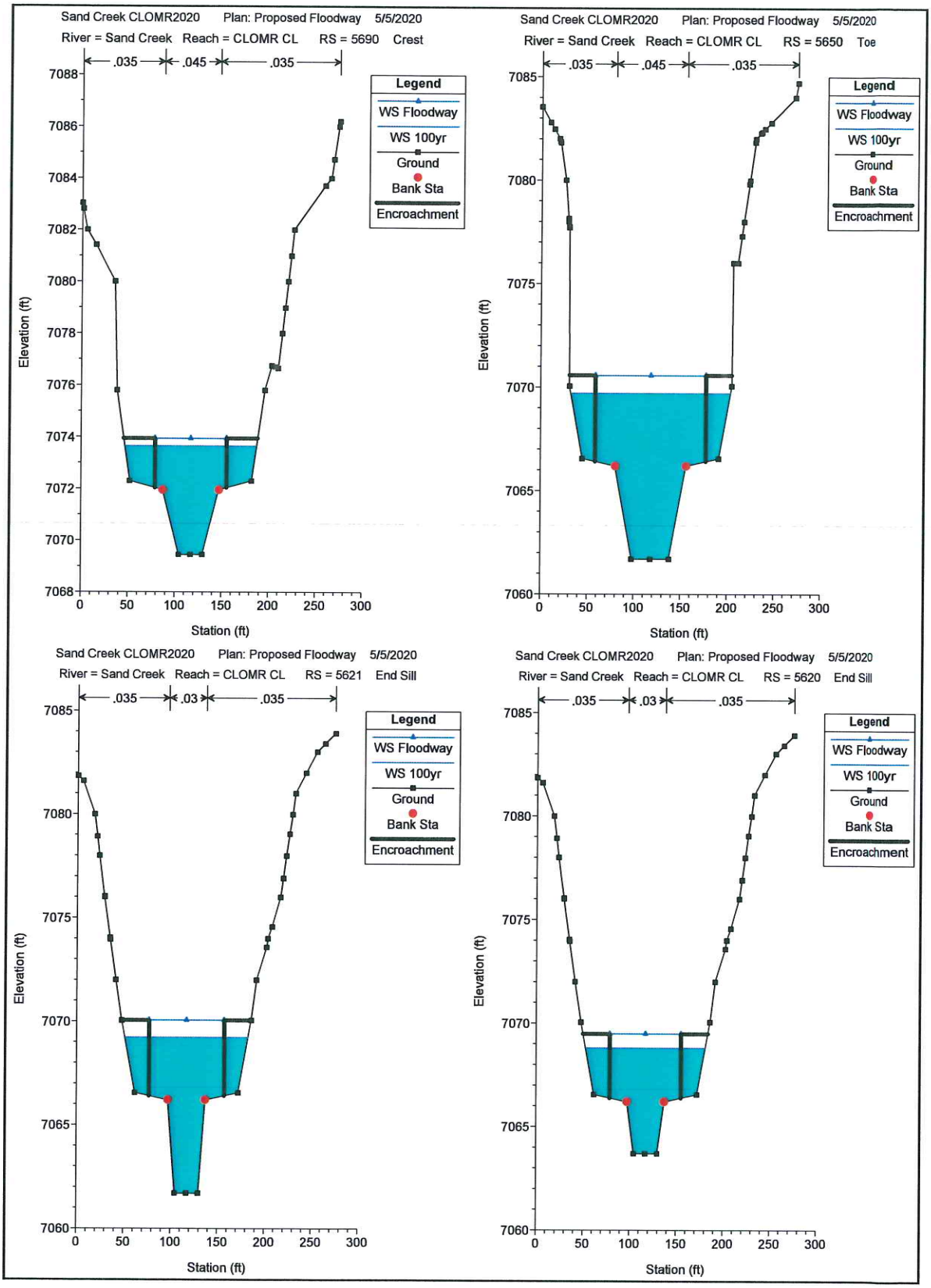

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 6950
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 6820
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 6770 Crest
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 6730 Toe
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

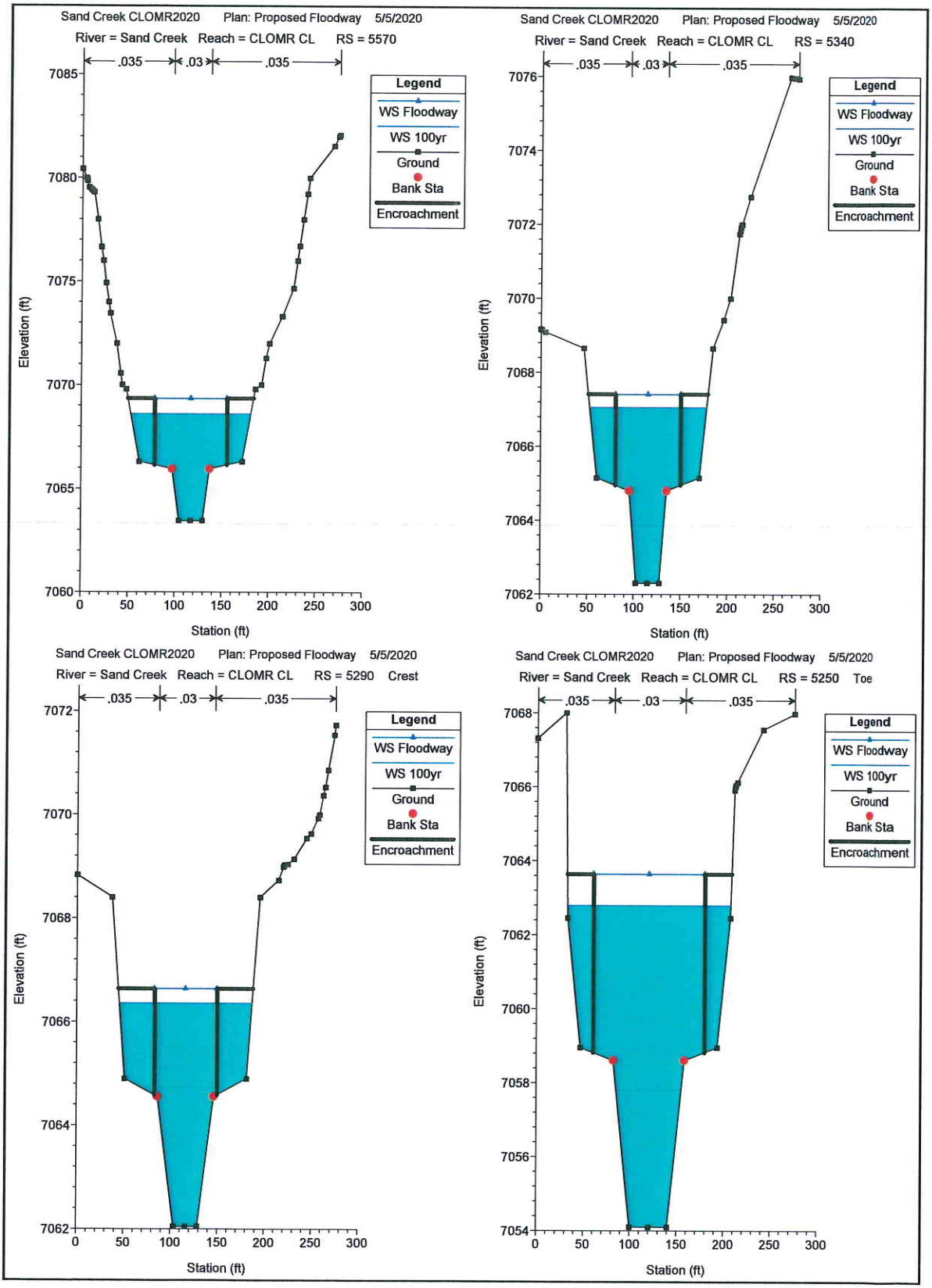

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 6701 End Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 6700 End Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 6650
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 6340
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

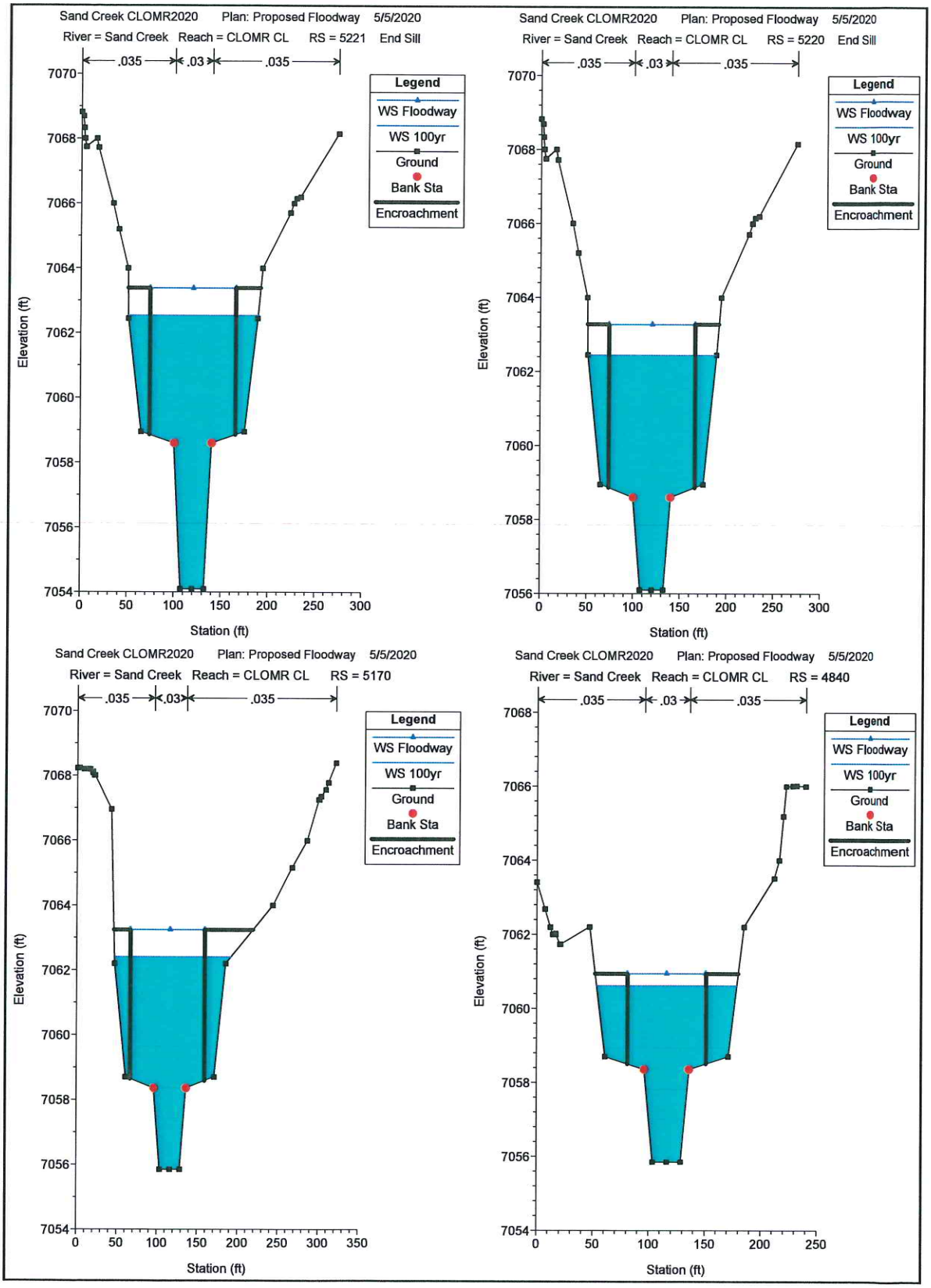

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 6290 Crest
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 6250 Toe
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 6221 End SIII
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 6220 End SIII
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

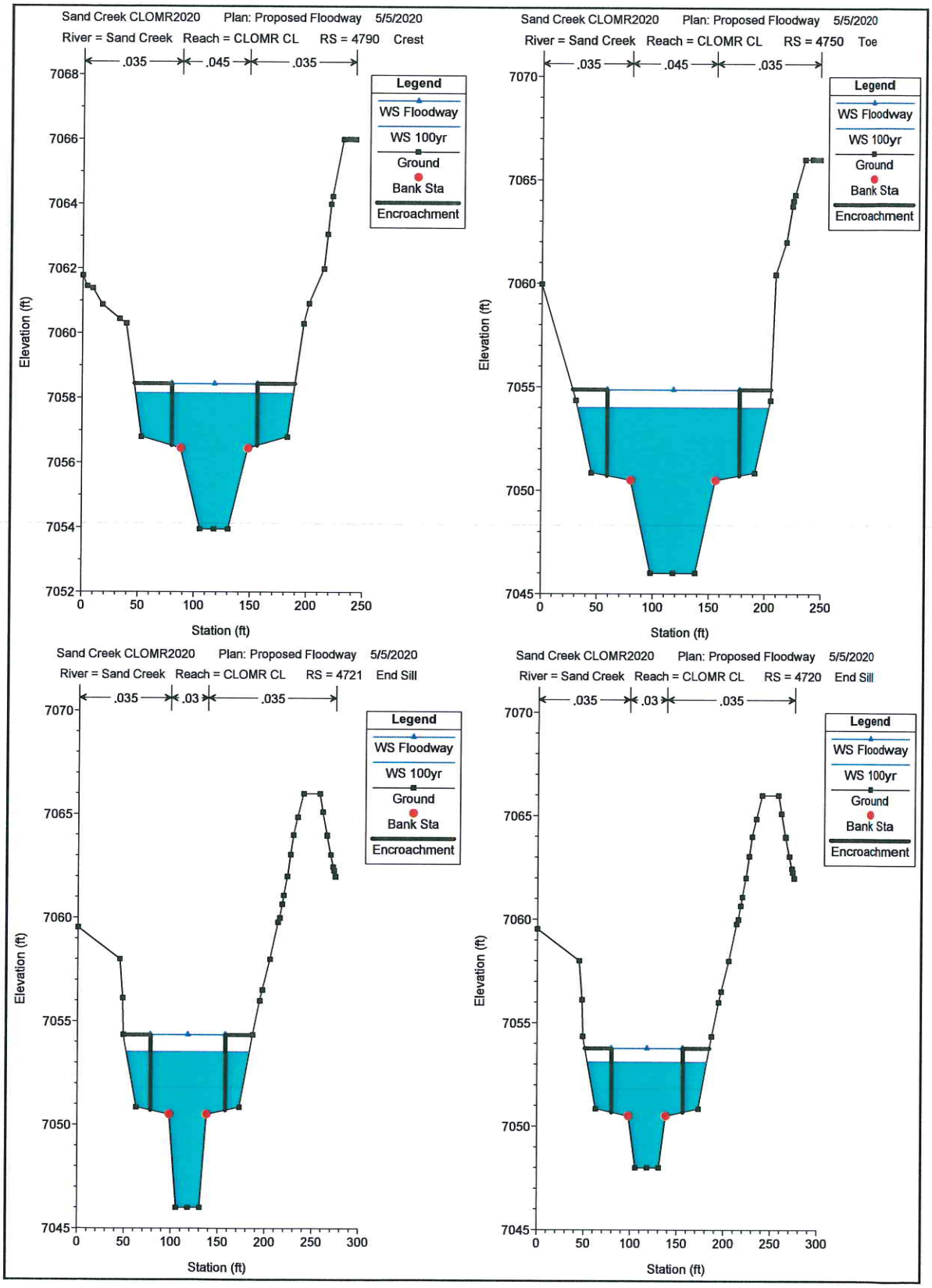

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 6170
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 6040
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 5990 Crest
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 5950 Toe
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

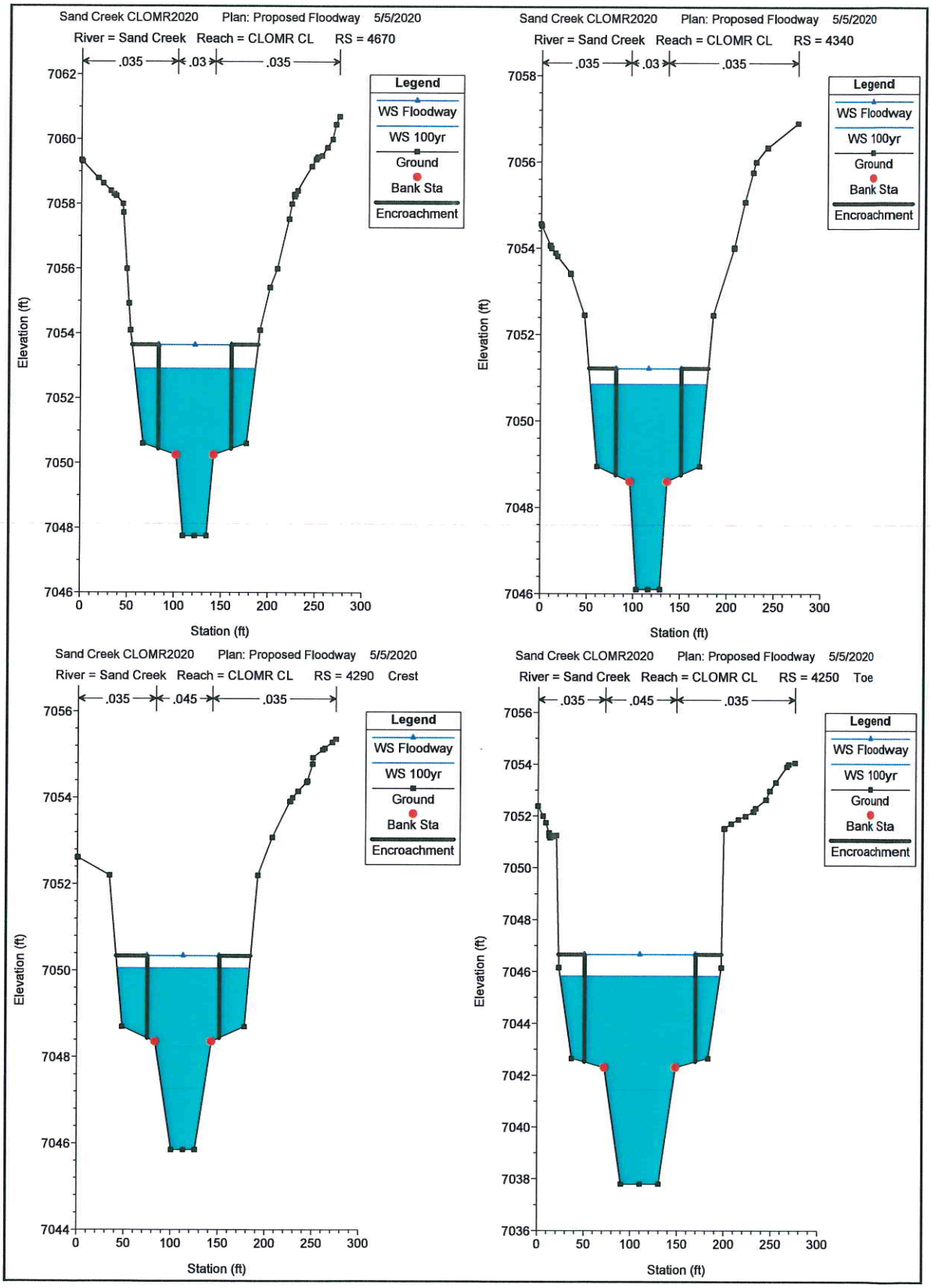

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 5921 End Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 5920 End Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 5870
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 5740
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

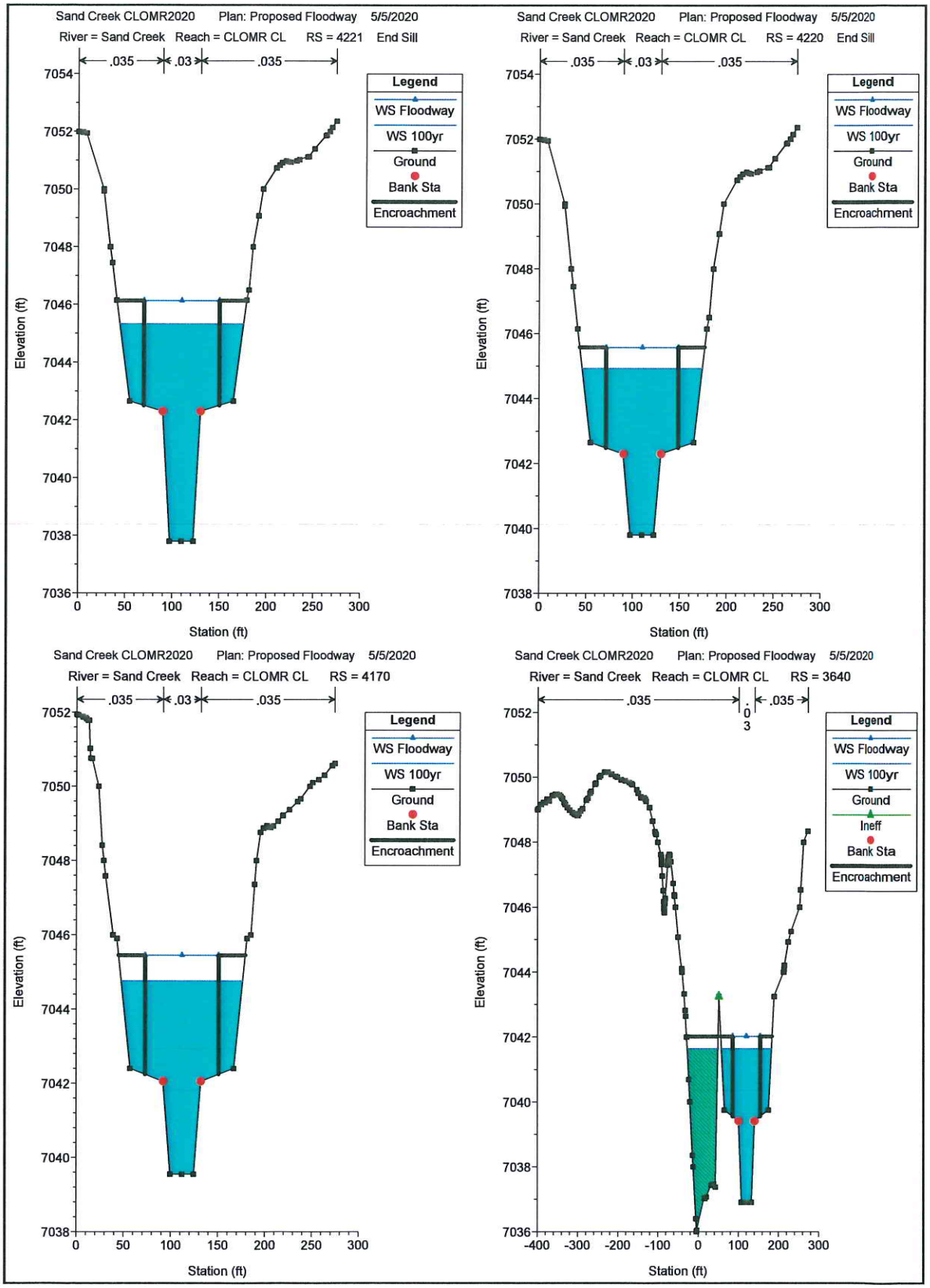

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 5690 Crest
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 5650 Toe
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 5621 End Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 5620 End Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

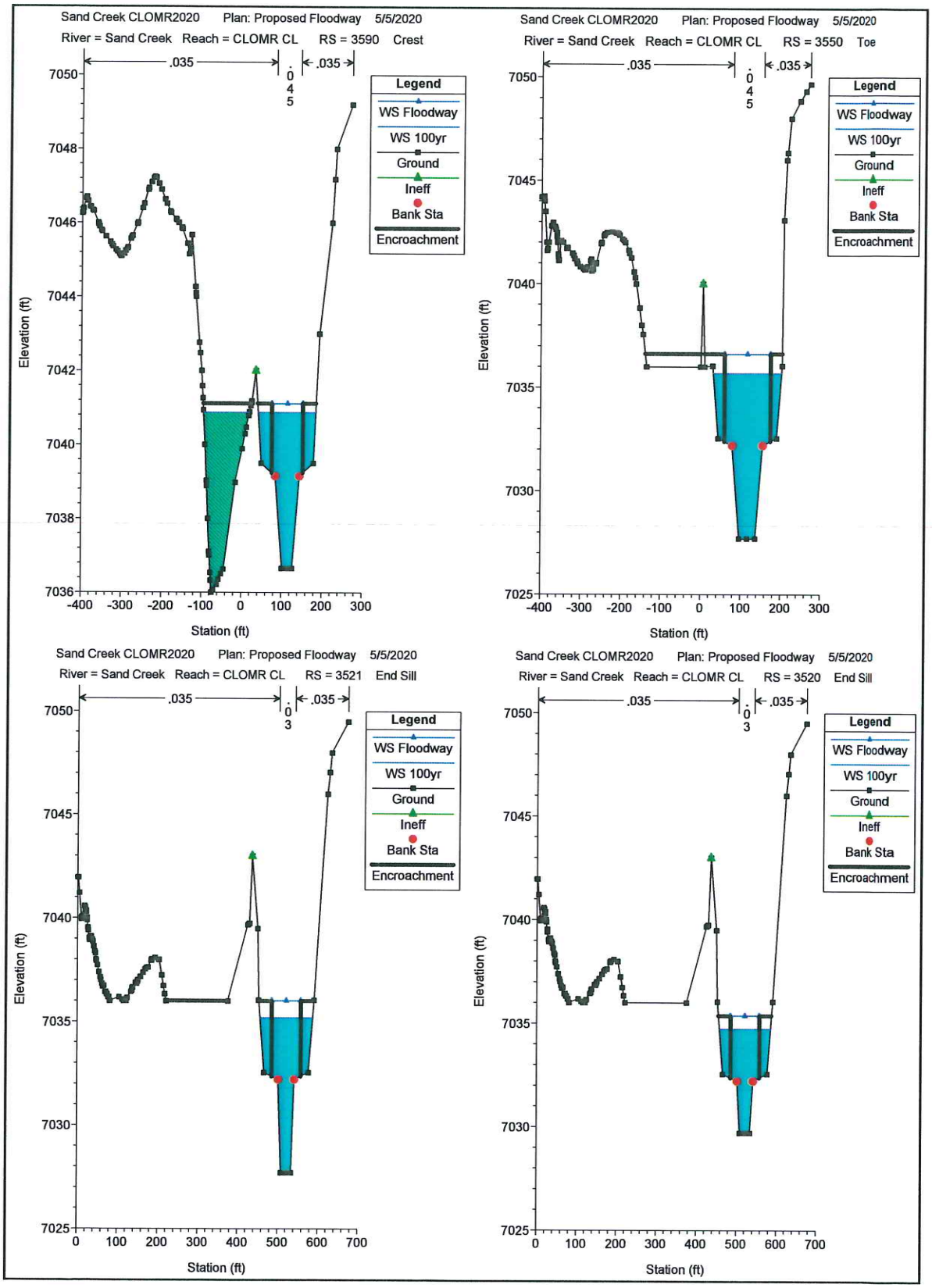

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 5570
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 5340
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 5290 Crest
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 5250 Toe
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

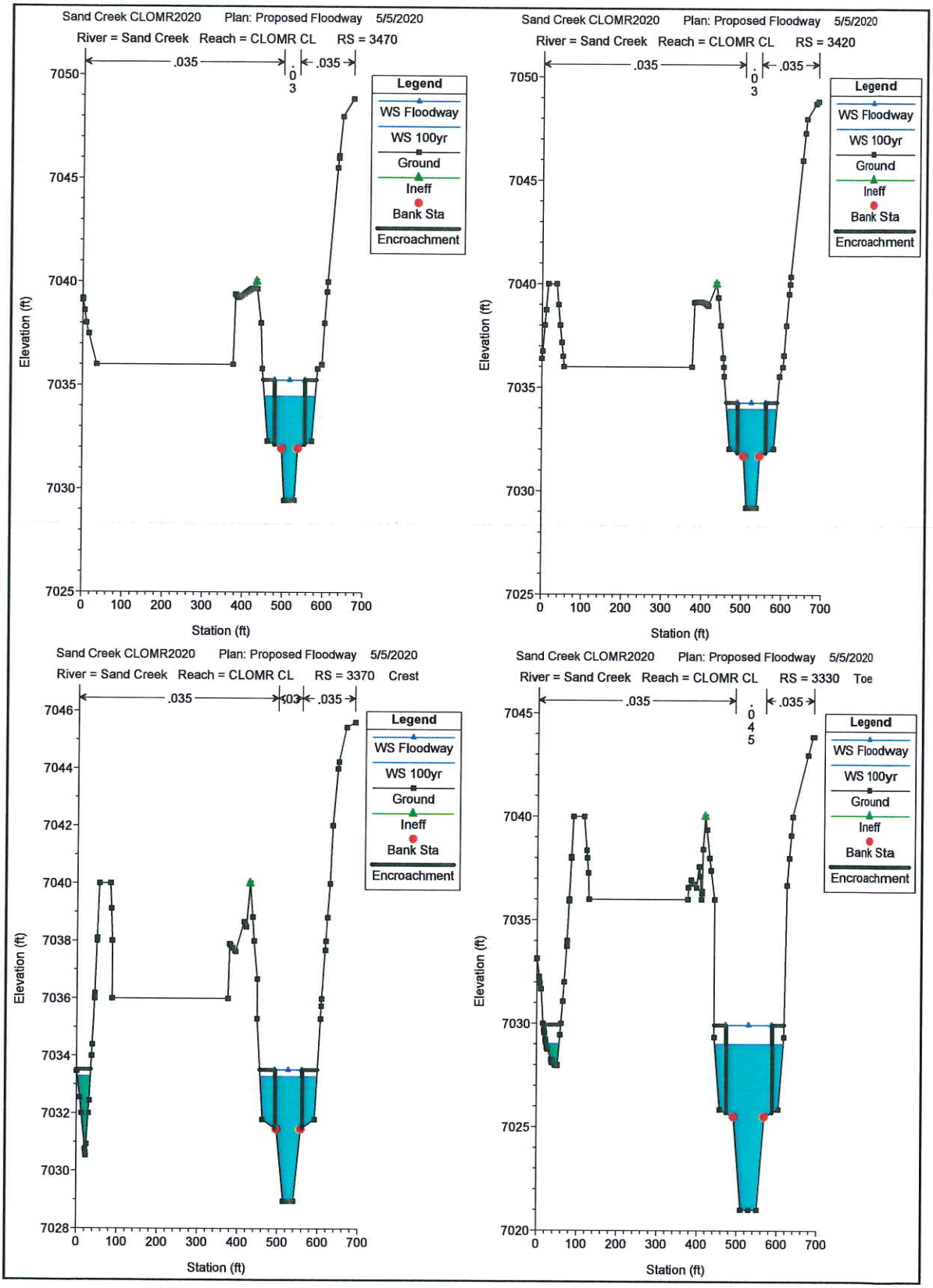

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 5221 End Sill
.035
.03
.035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 5220 End Sill
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 5170
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 4840

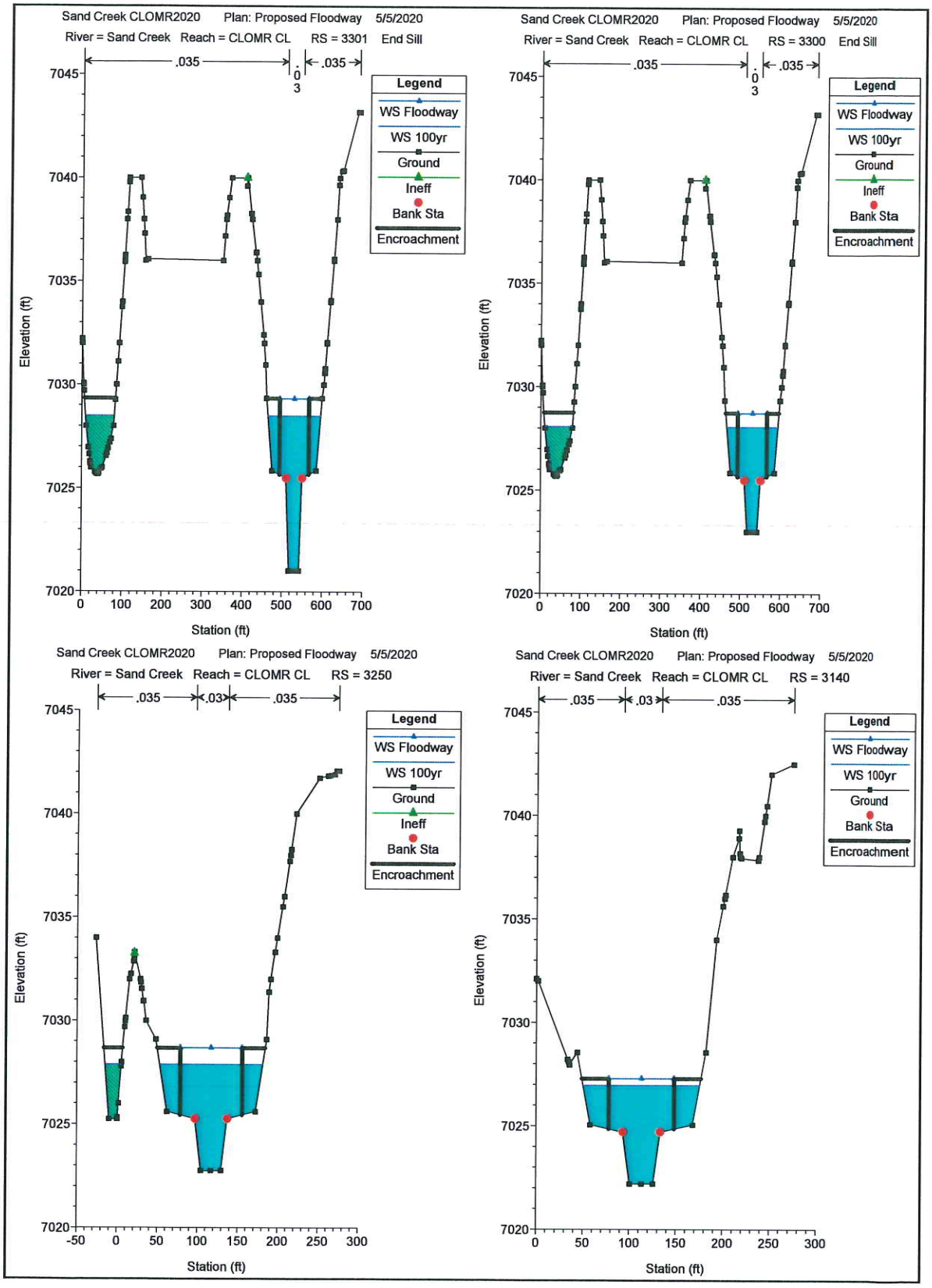

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 4790 Crest
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 4750 Toe
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 4721 End Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 4720 End Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

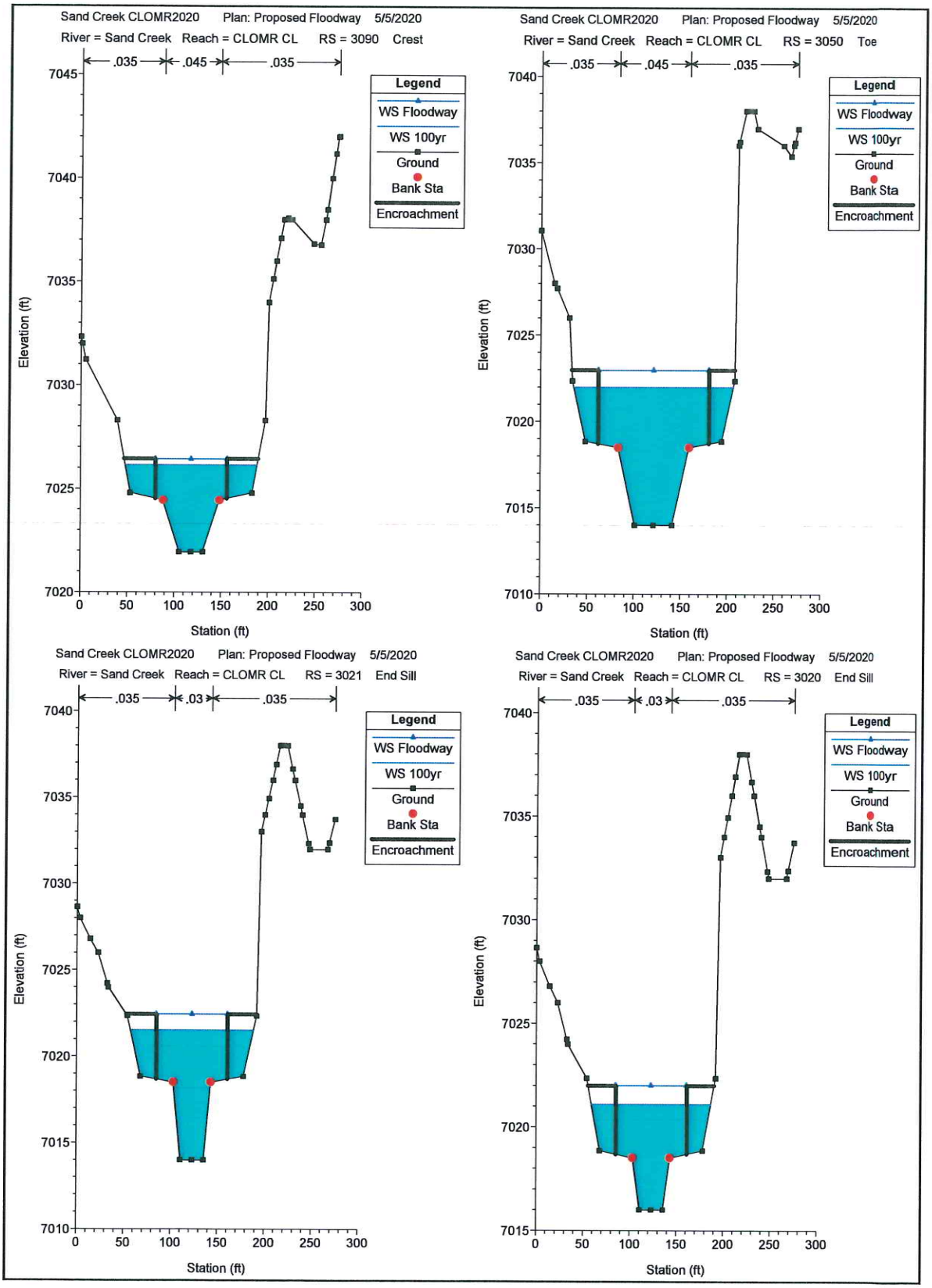

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 4670
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 4340
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 4290 Crest
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 4250 Toe
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

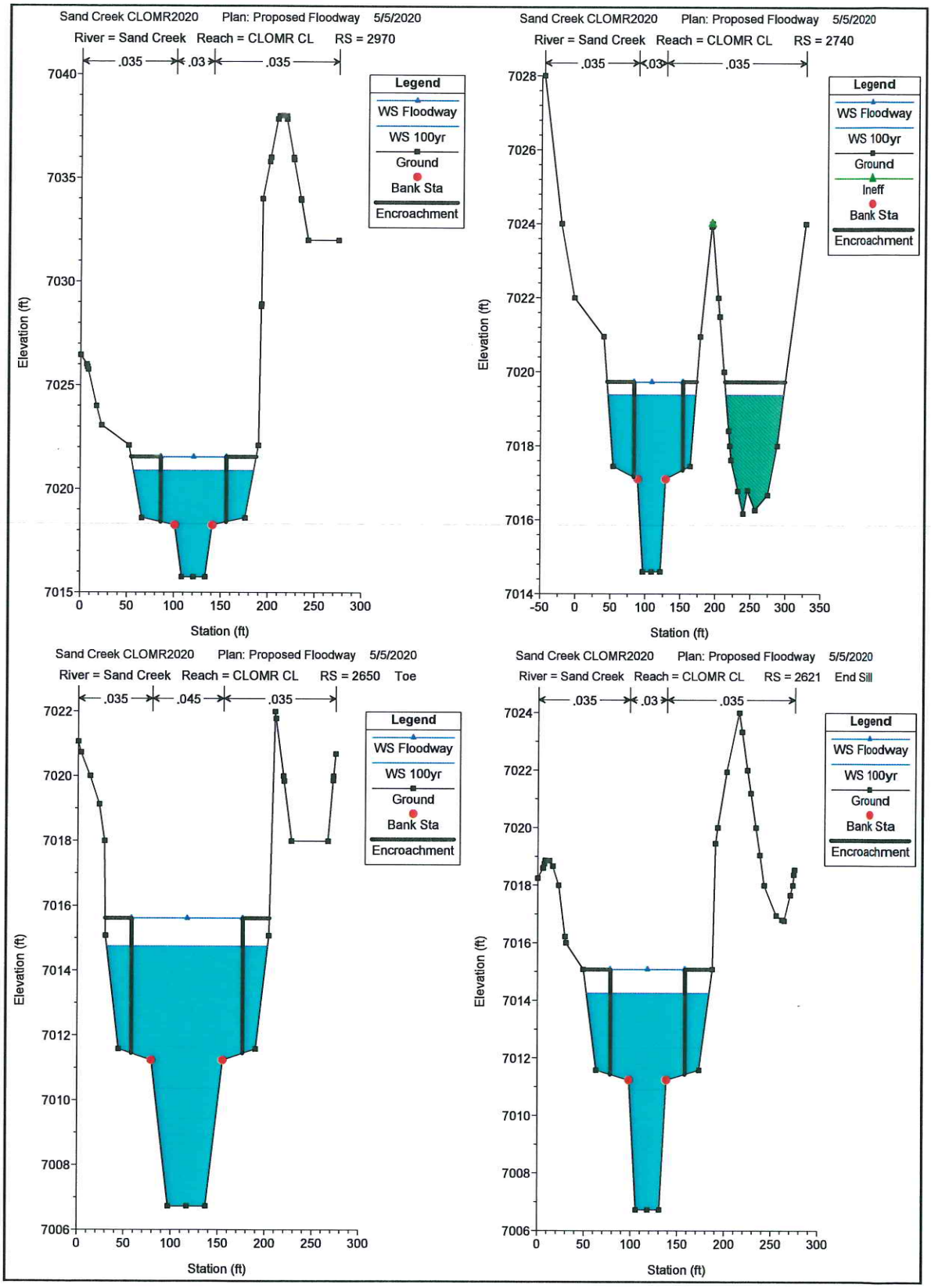

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 4221 End Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 4220 End Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 4170
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 3640
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

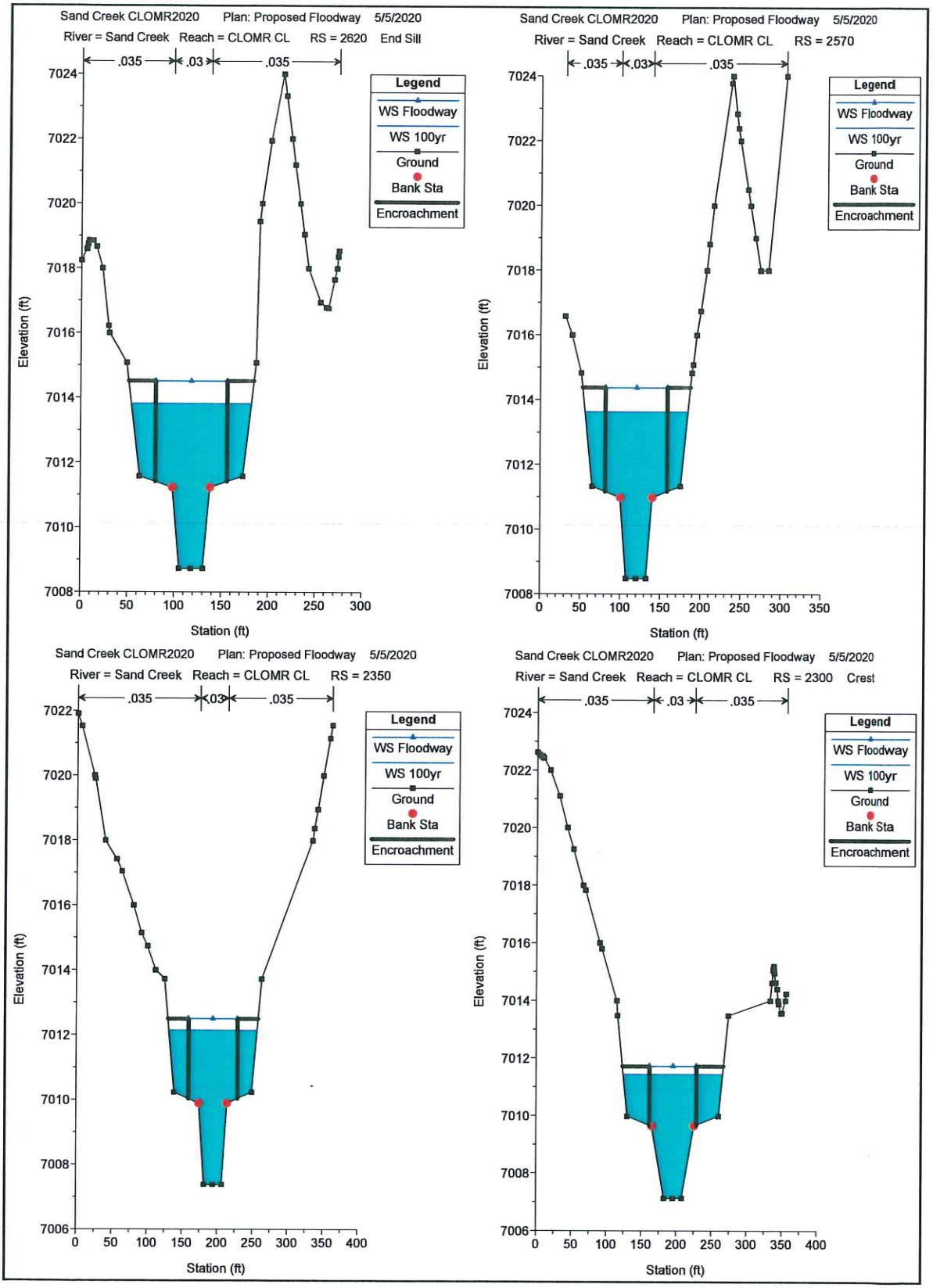

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 3590 Crest
.035
.045
.035
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 3550 Toe
.035
.045
.035
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 3521 End Sill
.035
.03
.035
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 3520 End Sill
.035
.03
.035
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

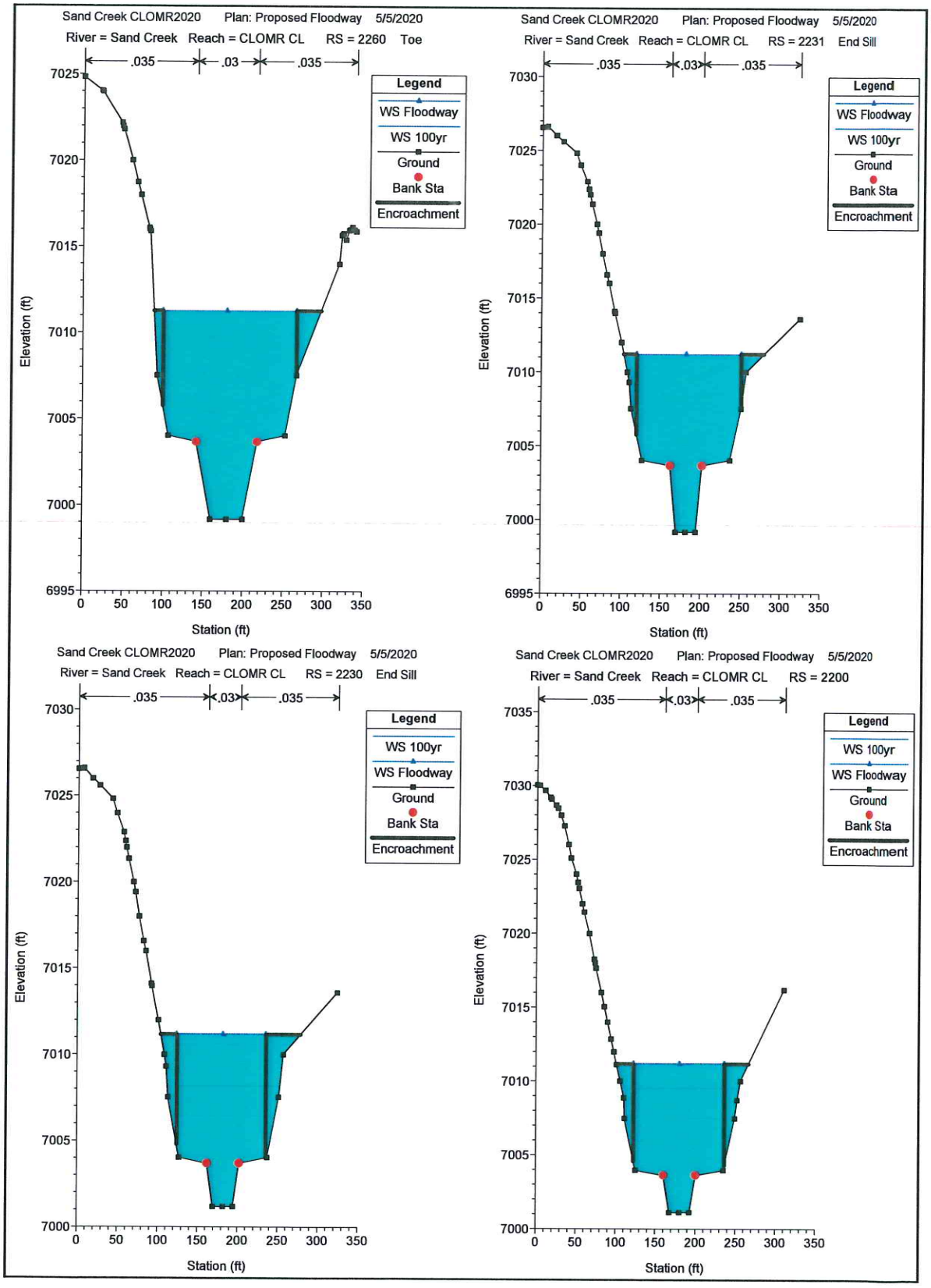

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 3470
.035
.03
.035
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 3420
.035
.03
.035
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 3370 Crest
.035
.03
.035
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 3330 Toe
.035
.045
.035
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

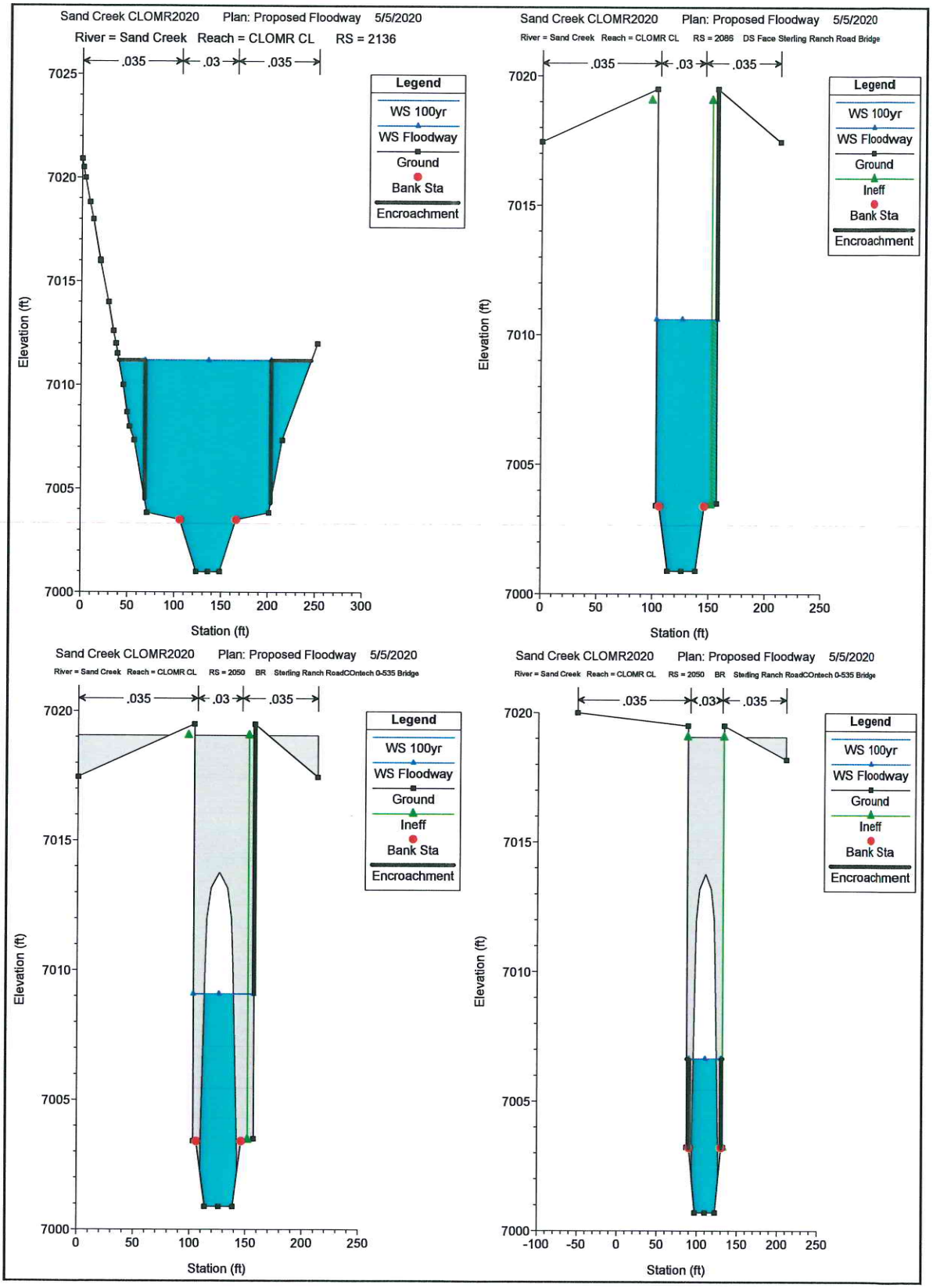

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 3301 End Sill
.035
.035
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 3300 End Sill
.035
.035
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 3250
.035
.03
.035
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 3140
.035
.03
.035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

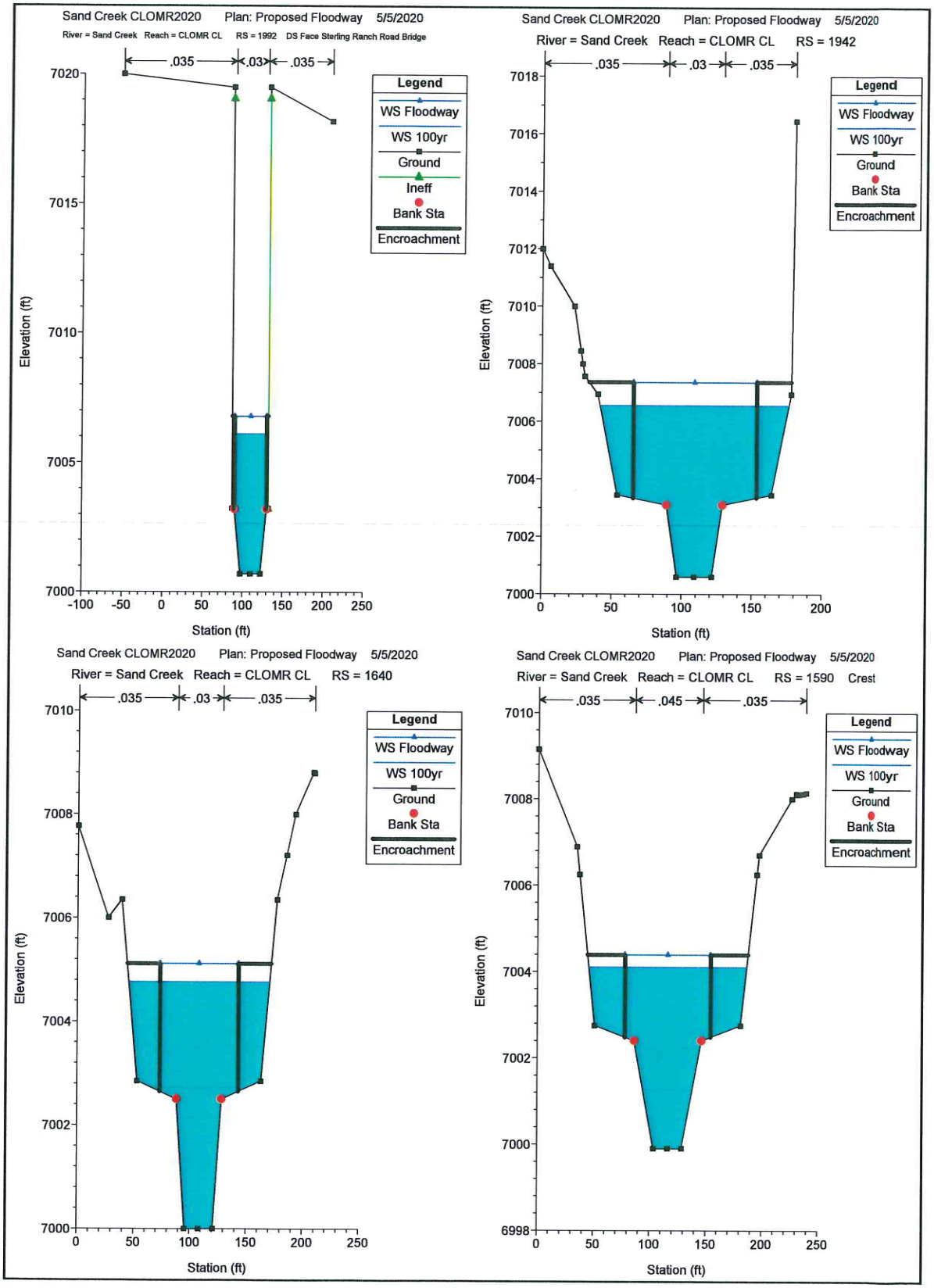

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 3090 Crest
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 3050 Toe
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 3021 End Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 3020 End Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

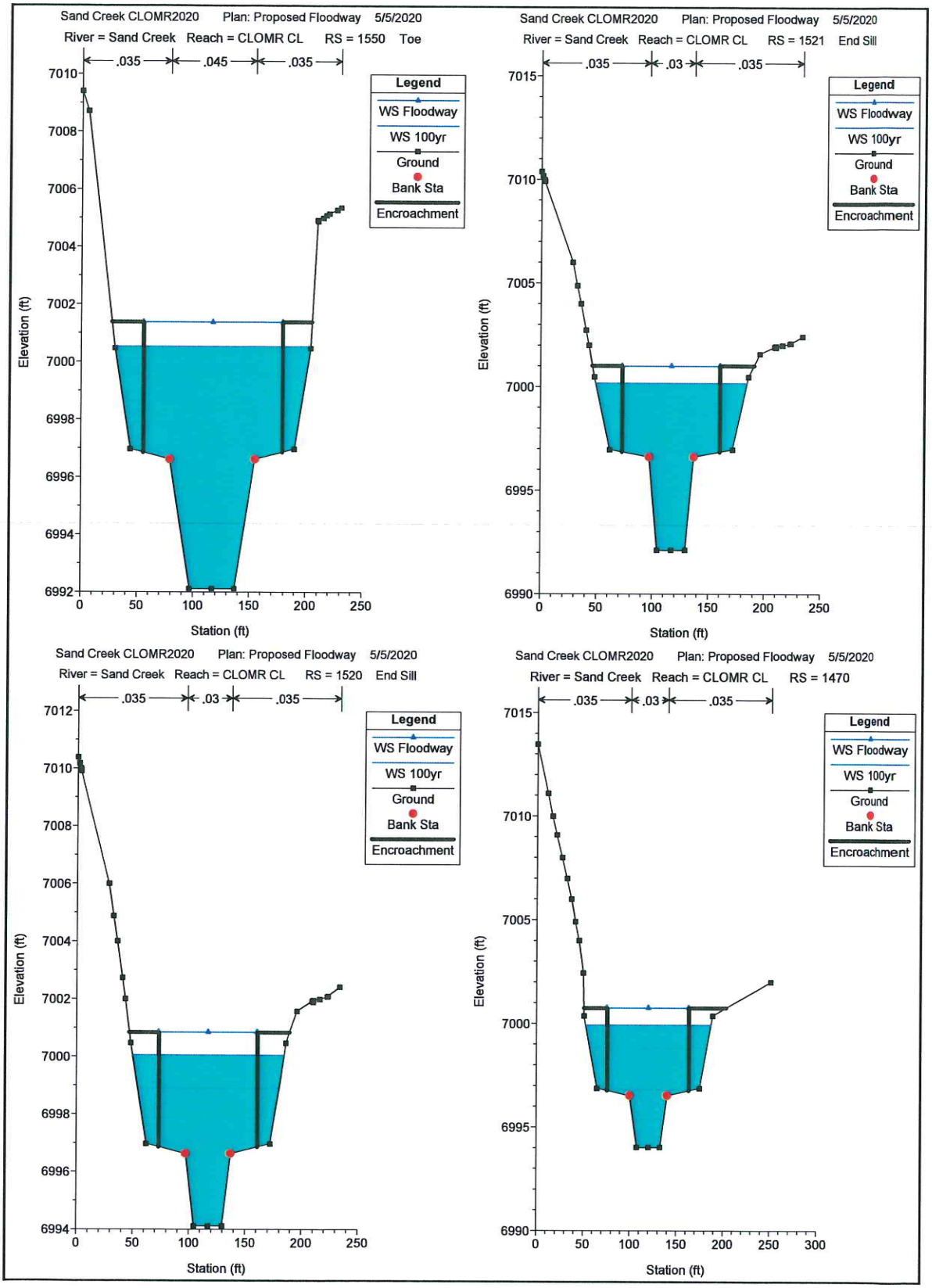

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 2970
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 2740
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 2650 Toe
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 2621 End Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

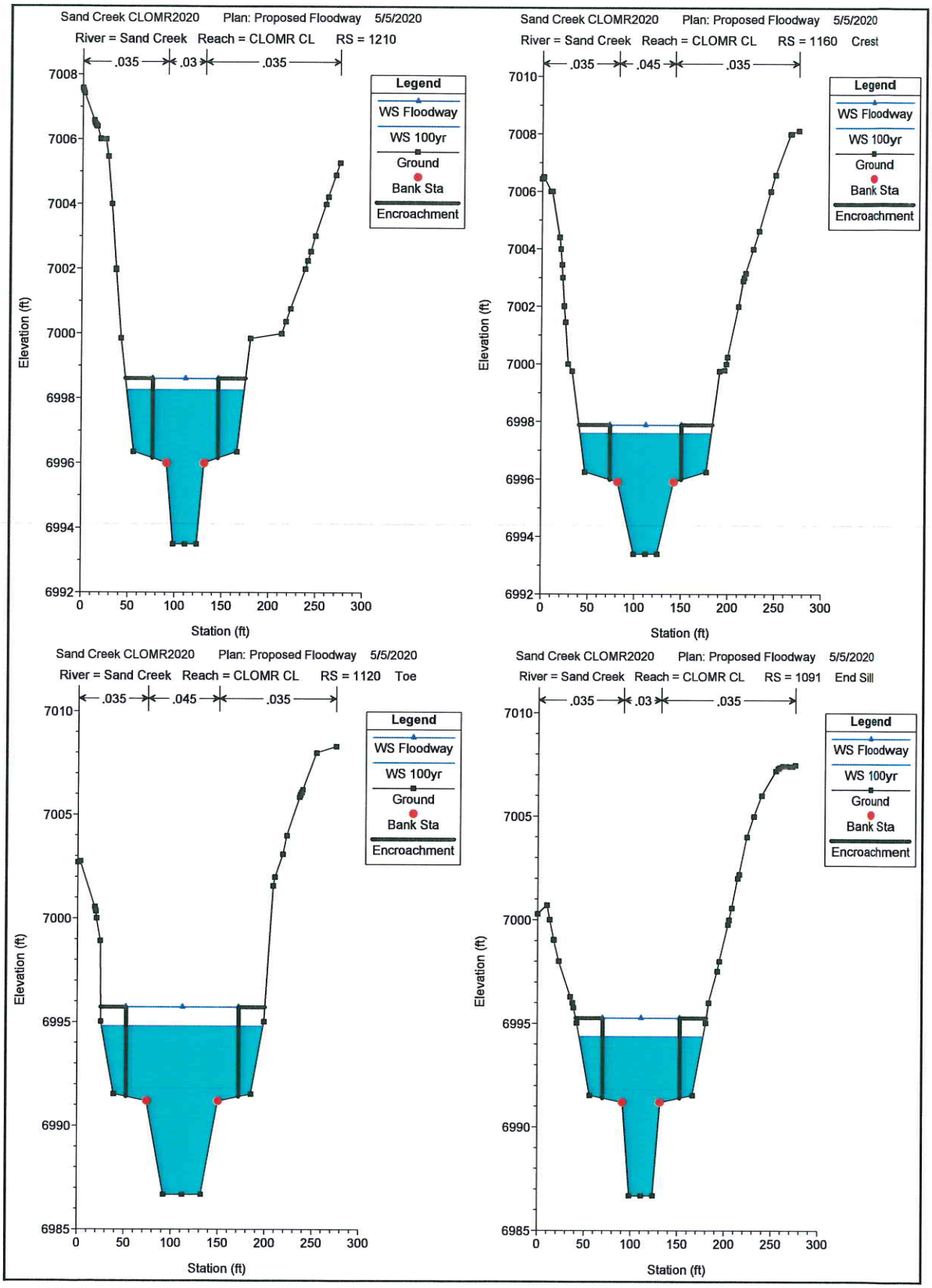

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 2620 End Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 2570
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 2350
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 2300 Crest
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

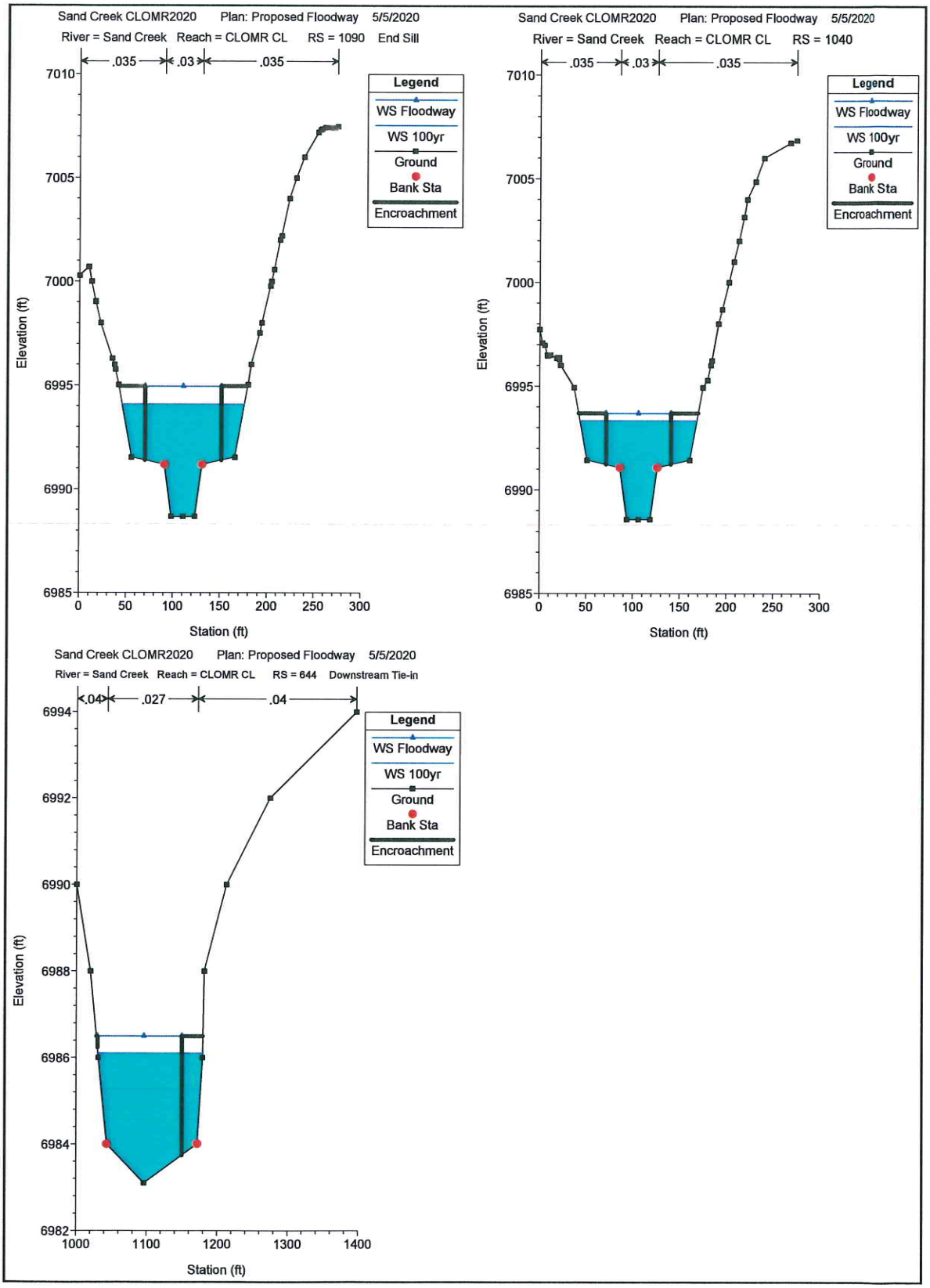

Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 2260 Toe
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 2231 End Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 2230 End Sill
.035 .03 .035
Legend
WS 100yr
WS Floodway
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 2200
.035 .03 .035
Legend
WS 100yr
WS Floodway
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)


Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 2136
.035 .03 .035
Legend
WS 100yr
WS Floodway
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 2086 DS Face Sterling Ranch Road Bridge
.035 .03 .035
Legend
WS 100yr
WS Floodway
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 2050 BR Sterling Ranch RoadCOntech 0-535 Bridge
.035 .03 .035
Legend
WS 100yr
WS Floodway
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 2050 BR Sterling Ranch RoadCOntech 0-535 Bridge
.035 .03 .035
Legend
WS 100yr
WS Floodway
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)


Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 1992 DS Face Sterling Ranch Road Bridge
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 1942
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 1640
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 1590 Crest
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)


Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 1550 Toe
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 1521 End Sill
.035 .03 .035
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 1520 End Sill
.035 .03 .035
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 1470
.035 .03 .035


Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 1210
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 1160 Crest
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 1120 Toe
.035 .045 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 1091 End Sill
.035 .03 .035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)


Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 1090 End Sill
.035
.03
.035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 1040
.035
.03
.035
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
Sand Creek CLOMR2020 Plan: Proposed Floodway 5/5/2020
River = Sand Creek Reach = CLOMR CL RS = 644 Downstream Tie-in
.04
.027
.04
Legend
WS Floodway
WS 100yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

National Flood Hazard Layer FIRMette

FEMA

8°57'32.20"N

104°4'07.99"W

38°57'4.22"N

Feet

250 500 1,000 1,500 2,000

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) Zone A, V, A99
- With BFE or Depth Zone AE, AO, AH, VE, AR
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Area of 1% annual chance flood with average depth less than one foot or with drainag areas of less than one square mile Zone
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee. See Notes. Zone X
- Area with Flood Risk due to Levee Zone D

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard Zone X
- Effective LOMRs
- Area of Undetermined Flood Hazard Zone

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represe an authoritative property location.

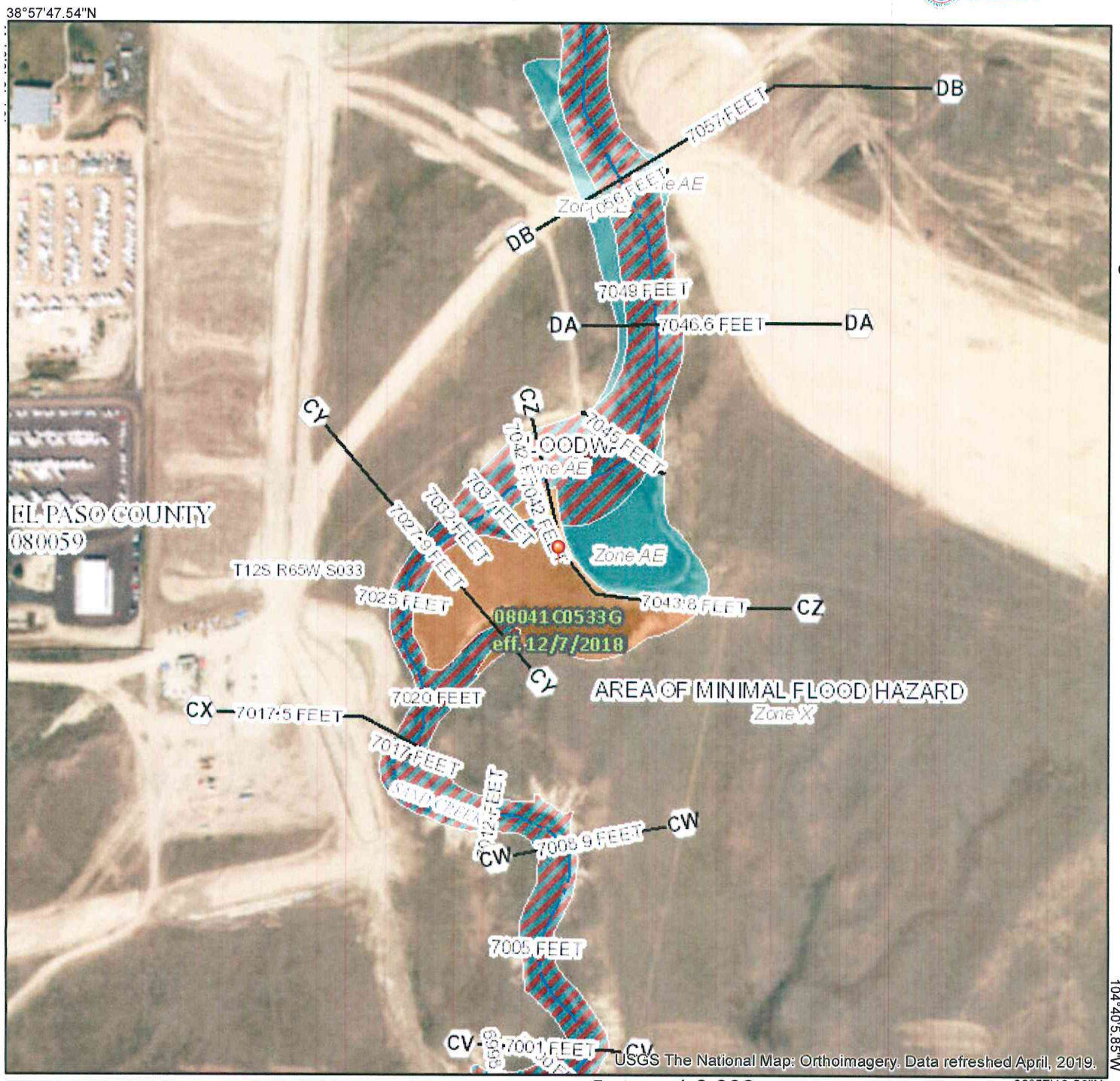
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/5/2020 at 1:41:59 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

National Flood Hazard Layer FIRMette

FEMA



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) Zone A, V, A99
- With BFE or Depth Zone AE, AO, AH, VE, AR
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Area of 1% annual chance flood with average depth less than one foot or with drainag areas of less than one square mile Zone
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee. See Notes. Zone X
- Area with Flood Risk due to Levee Zone D

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard Zone X
- Effective LOMRs
- Area of Undetermined Flood Hazard Zone

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represe an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/5/2020 at 1:54:55 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

National Flood Hazard Layer FIRMette

FEMA

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) Zone A, V, A99
- With BFE or Depth Zone AE, AO, AH, VE, AR
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Area of 1% annual chance flood with average depth less than one foot or with drainag areas of less than one square mile Zone
- Future Conditions 1% Annual Chance Flood Hazard Zone
- Area with Reduced Flood Risk due to Levee. See Notes. Zone X
- Area with Flood Risk due to Levee Zone D

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard Zone X
- Effective LOMRs
- Area of Undetermined Flood Hazard Zone

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

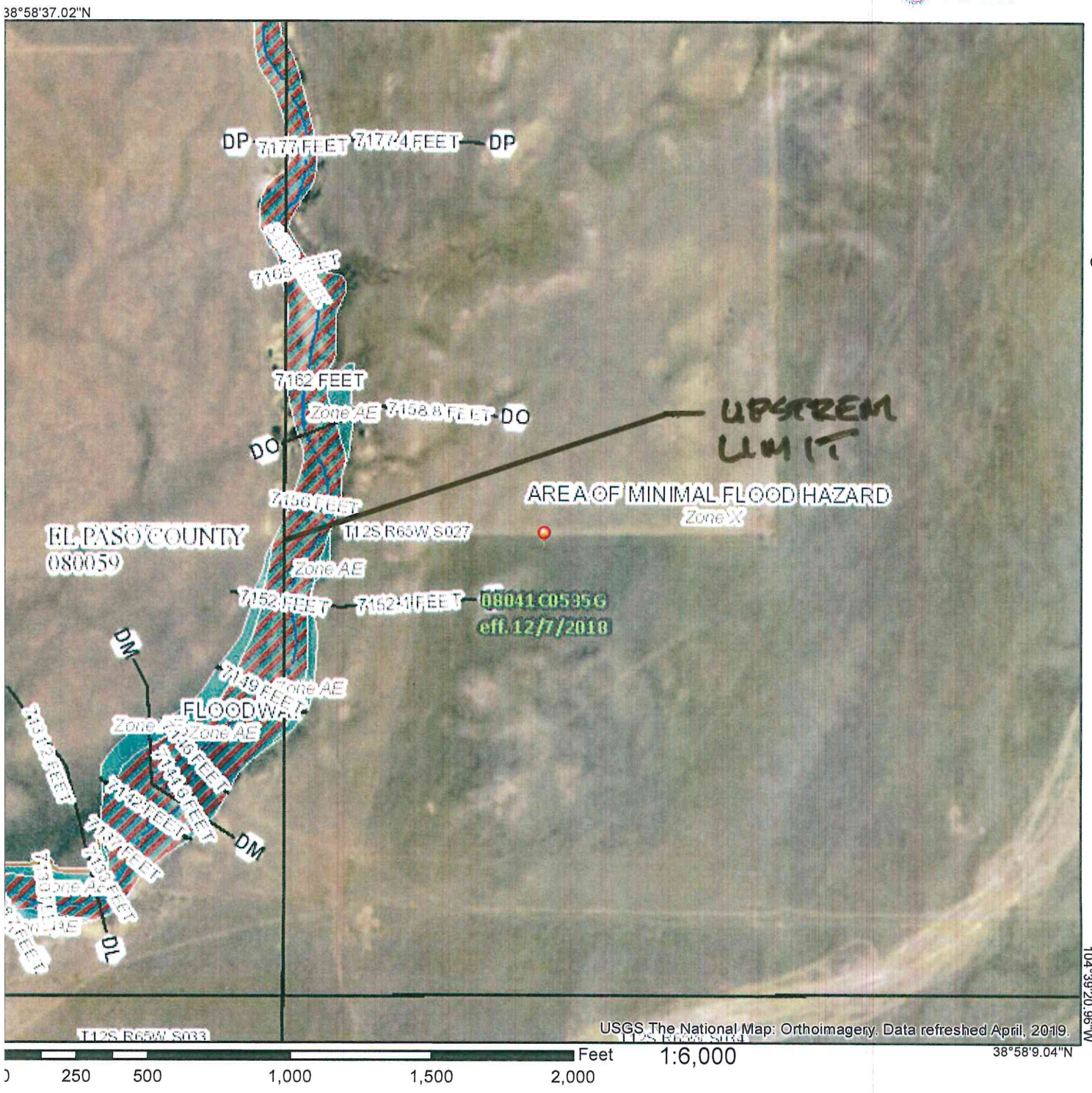
The pin displayed on the map is an approximate point selected by the user and does not represe an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/5/2020 at 1:34:46 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

National Flood Hazard Layer FIRMette



FEMA

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) Zone A, V, A99
- With BFE or Depth Zone AE, AO, AH, VE, AR
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Area of 1% annual chance flood with average depth less than one foot or with drainag areas of less than one square mile Zone
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee. See Notes. Zone X
- Area with Flood Risk due to Levee Zone D

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard Zone X
- Effective LOMRs
- Area of Undetermined Flood Hazard Zone

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

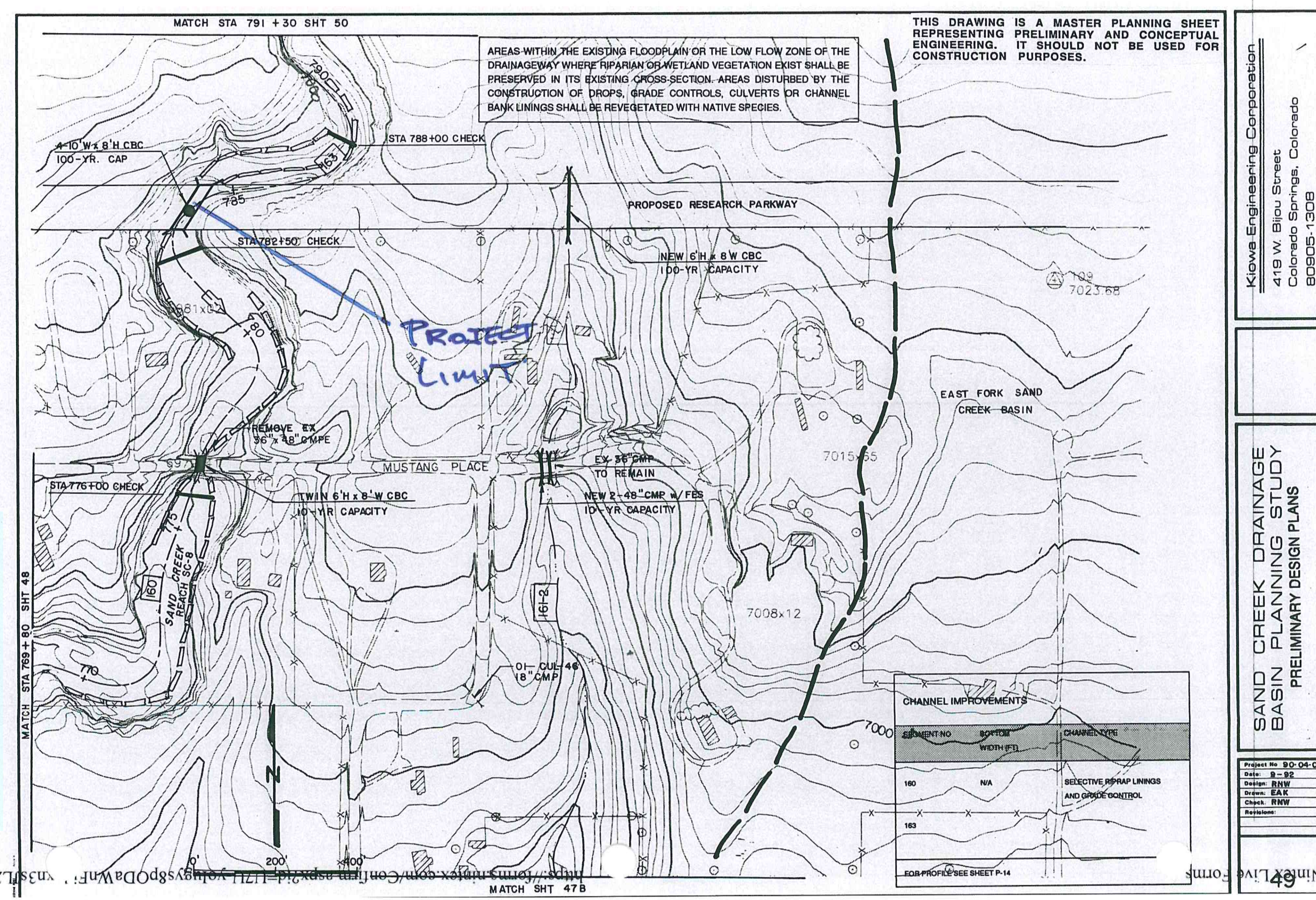
N

The pin displayed on the map is an approximate point selected by the user and does not represe an authoritative property location.

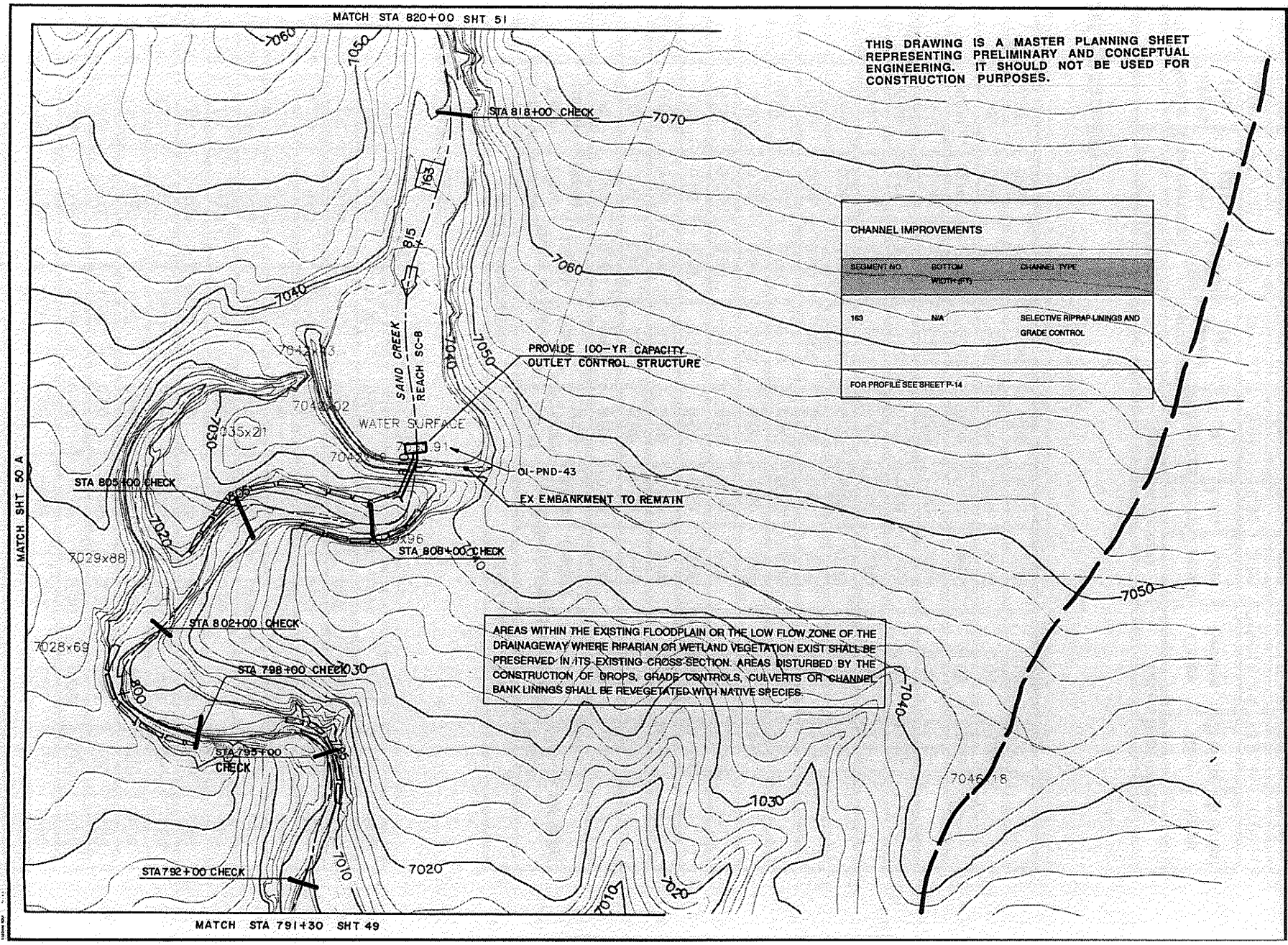
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 5/5/2020 at 1:28:11 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



Provide Sheets 48 and 47

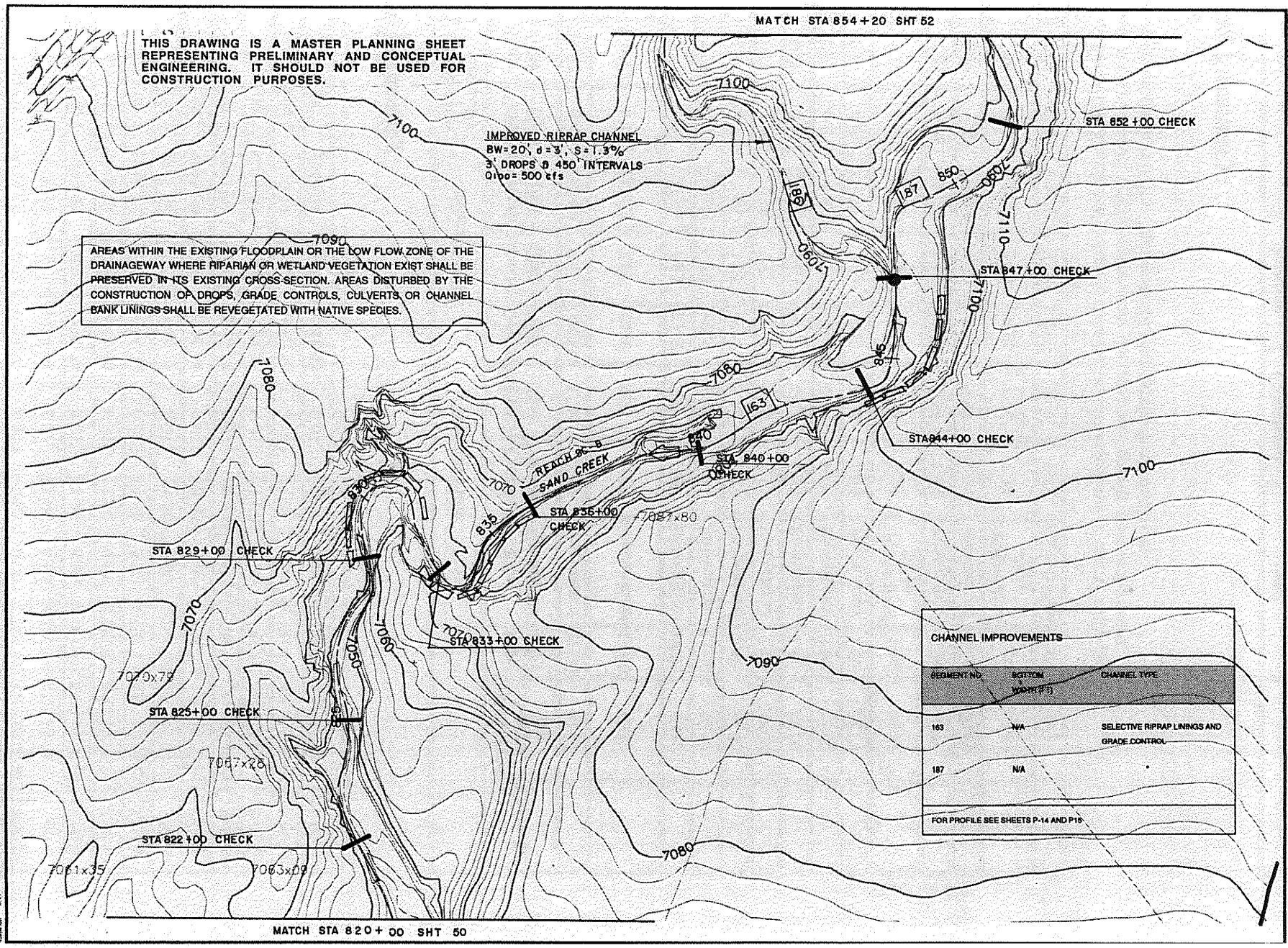


Kiowa Engineering Corporation
419 W. Bijou Street
Colorado Springs, Colorado
80905-1308

SAND CREEK DRAINAGE BASIN PLANNING STUDY

PRELIMINARY DESIGN PLANS

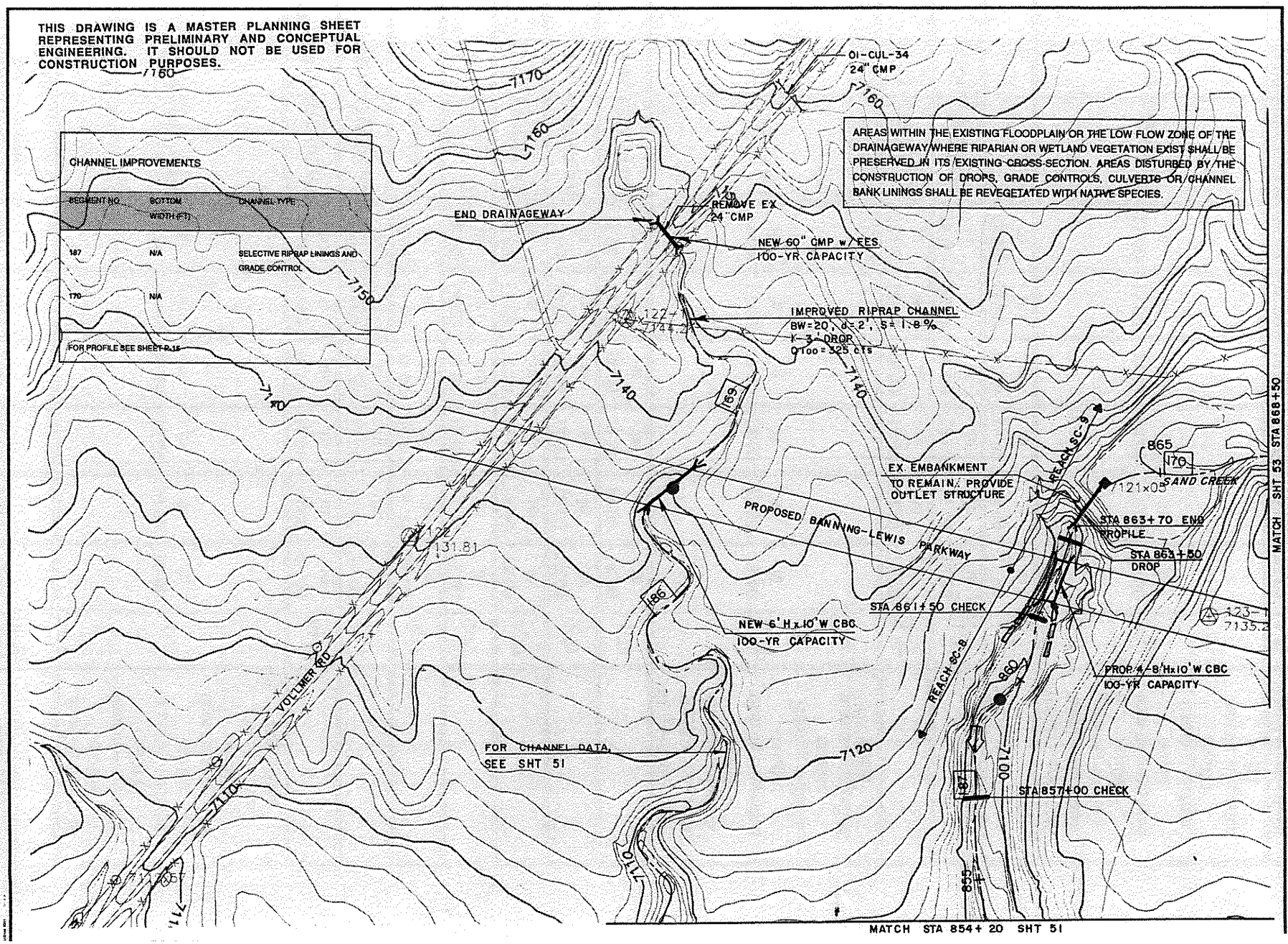
Project No	90-04-09
Date:	11/92
Design:	RNW
Drawn:	EAK
Check:	RNW
Revisions:	



Kiowa Engineering Corporation
419 W. Bijou Street
Colorado Springs, Colorado
80905-1308

SAND CREEK DRAINAGE BASIN PLANNING STUDY
PRELIMINARY DESIGN PLANS

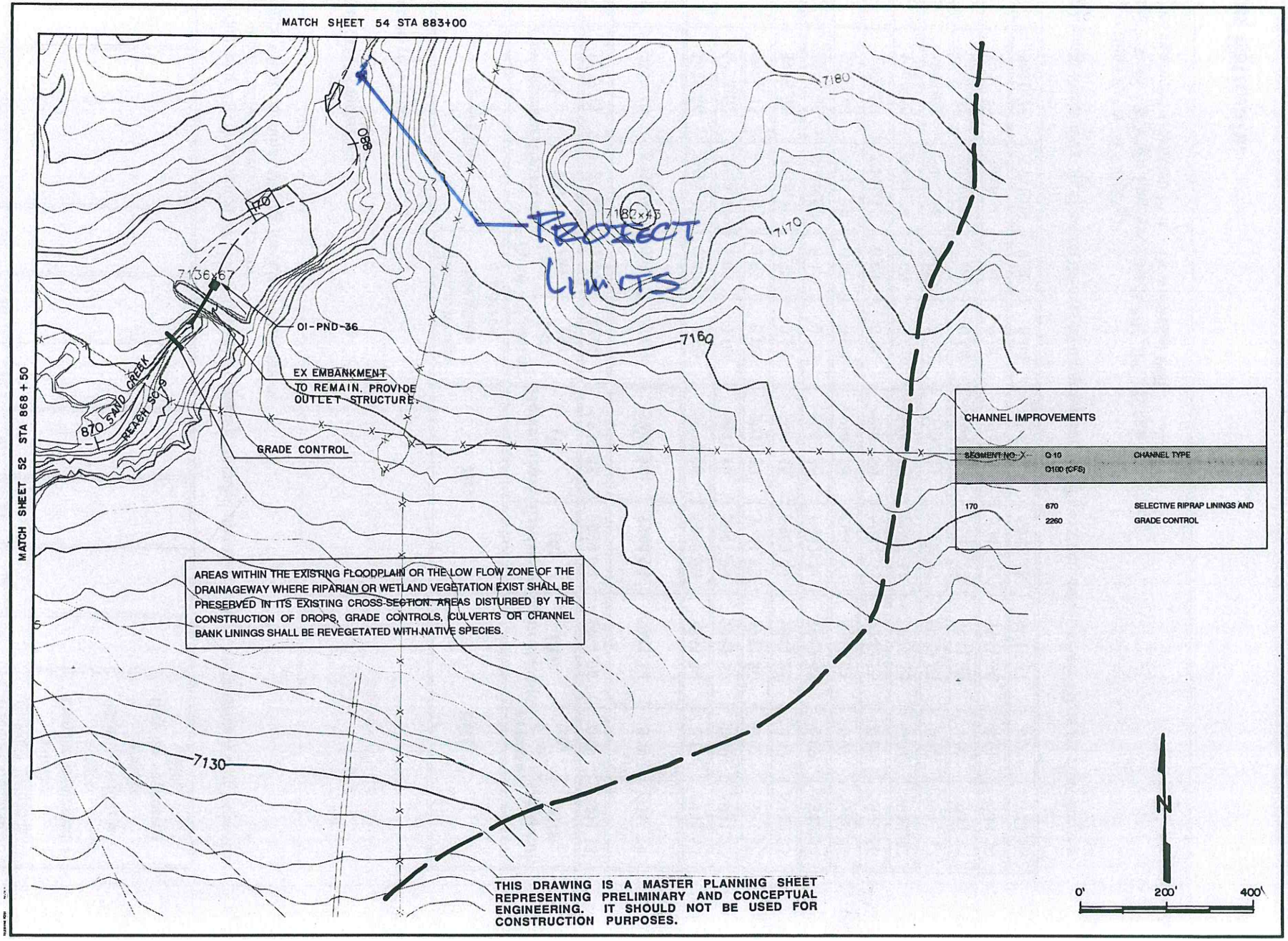
Project No.	90-04-09
Date:	11/92
Design:	RNW
Drawn:	EAK
Check:	RNW
Revisions:	



Kiowa Engineering Corporation
419 W. Bijou Street
Colorado Springs, Colorado
80905-1308

SAND CREEK DRAINAGE BASIN PLANNING STUDY
PRELIMINARY DESIGN PLANS

Project No.	90-04-09
Date:	11/92
Design:	RNW
Drawn:	EAK
Check:	RNW
Revisions:	



Kiowa Engineering Corporation
419 W. Bijou Street
Colorado Springs, Colorado
80905-1308

SAND CREEK DRAINAGE BASIN PLANNING STUDY
PRELIMINARY DESIGN PLANS

Project No	90-04-09
Date:	9-92
Design:	RNW
Drawn:	EAK
Check:	RNW
Revisions:	

Appendix B

Sterling Ranch Road and Briargate Parkway Bridges Geotechnical Report

ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
PHONE (719) 531-5599
FAX (719) 531-5238

SUBSURFACE SOIL INVESTIGATION
STERLING RANCH BRIDGES
STERLING RANCH ROAD OVER SAND CREEK
BRIARGATE BOULEVARD OVER SAND CREEK
COLORADO SPRINGS, COLORADO

Prepared for:

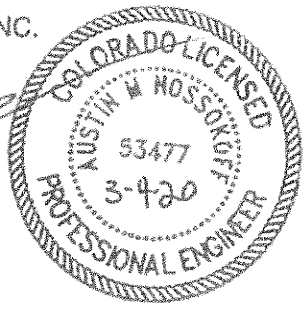
C&C Land
20 Boulder Crescent, 2nd Floor
Colorado Springs, Colorado 80903

Attn: Chaz Collins

March 4, 2020

Respectfully Submitted,

ENTECH ENGINEERING, INC.



Austin M. Nossokoff, P.E.

Reviewed by:

Joseph C. Goode, Jr., P.E.
President

AMN/amn

Encl.

Entech Job No. 200045
F:\AA projects\2020\200045-C&C LAnd-Sterling Ranch Bridges-220-SSI\200045 ssi.doc

Table of Contents

Tables

Figures

List of Appendices

SUBSURFACE SOIL INVESTIGATION
STERLING RANCH BRIDGES
STERLING RANCH ROAD OVER SAND CREEK &
BRIARGATE BOULEVARD OVER SAND CREEK
EL PASO COUNTY, COLORADO

1.0 INTRODUCTION

C&C Land is planning the construction of two vehicular bridges over sand creek for the proposed Sterling Ranch Road and Briargate Boulevard in El Paso County northeast of Colorado Springs, Colorado. The approximate location of the site is shown on the Vicinity Map, Figure 1. The planned layouts of the proposed bridges are shown on Figure 2, Site Plan/Test Boring Location Map.

This report describes the subsurface investigation conducted for the planned bridges and provides recommendations for foundation design and construction. The subsurface soil investigation included drilling test borings at four (4) locations within the footprints of the planned bridge foundations, collecting samples of soil, and conducting a geotechnical evaluation of the investigation findings. All drilling and subsurface investigation activities were performed by Entech Engineering, Inc. (Entech). The contents of this report, including the geotechnical evaluation and recommendations, are subject to the limitations and assumptions presented in Section 6.0.

2.0 PROJECT AND SITE DESCRIPTION

It is Entech's understanding that the project will consist of the construction of two (2) vehicular bridges spanning Sand Creek with driven H-pile foundations and associated site improvements. At the time of drilling, the sites for the proposed bridges were vacant. The crossing for the proposed Briargate Boulevard had been graded at the time of drilling. Sand Creek flows to the south. Current vegetation on the site consisted of grasses and small shrubs.

3.0 SUBSURFACE EXPLORATIONS AND LABORATORY TESTING

The subsurface conditions were investigated by drilling four (4) exploratory test borings, one at each bridge abutment. The borings were drilled to depths 20 feet below the existing ground surface using a truck-mounted continuous flight auger-drilling rig supplied and operated by Entech Engineering, Inc. Boring Logs descriptive of the subsurface conditions encountered during drilling and subsequent to drilling are presented in Appendix A. At the conclusion of drilling, observations of groundwater levels were made in each of the open borings. The approximate locations of the test borings are indicated on Figure 2.

Soil samples were obtained from the borings utilizing the Standard Penetration Test (ASTM D-1586) using a 2-inch O.D. split-barrel sampler and a California Sampler. Results of the Standard Penetration Test (SPT) are included on the Test Boring Logs in terms of N-values expressed in blows per foot (bpf). Soil samples recovered from the borings were visually classified and recorded on the Test Boring Logs. The soil classifications were later verified utilizing laboratory testing and grouped by soil type. The soil type numbers are included on the Test Boring Logs. It should be understood that the soil descriptions shown on the Test Boring Logs may vary between boring location and sample depth.

It should also be noted that the lines of stratigraphic separation shown on the Test Boring Logs represent approximate boundaries between soil types and the actual stratigraphic transitions may be more gradual and vary with location. The Test Boring Logs are presented in Appendix A.

Moisture Content, ASTM D-2216, was obtained in the laboratory for all recovered samples. Grain-Size, ASTM D-422, and Atterberg Limits, ASTM D-4318, were determined for various samples for the purpose of classification and to obtain pertinent engineering characteristics. Volume change testing was performed on selected samples using the Swell/Consolidation Test (ASTM D-4546) in order to evaluate potential expansion/consolidation characteristics of the soil and bedrock. Sulfate testing was performed on select samples to determine the corrosive characteristics of the soils. The Laboratory Test Results are included in Appendix B and summarized in Table 1.

4.0 SUBSURFACE CONDITIONS

Four (4) soil types were encountered in the borings drilled for the subsurface investigation: Type 1: silty sand fill (SM), Type 2: very silty sand (SM), Type 3: silty to very silty sandstone (SM), and Type 4: sandy to very sandy claystone (CL). The soils were classified in accordance with the Unified Soil Classification System (USCS) using the laboratory testing results and the observations made during drilling.

4.1 Soil and Rock

Soil Type 1 is a silty sand fill (SM). The sand fill was encountered in Test Boring 1 at the existing ground surface extending to a depth of 6 feet. Standard Penetration Testing conducted on the sand resulted in SPT N-values of 4 to 6 blows per foot (bpf), which indicates loose states. Moisture content and grain size testing resulted in a moisture contents of 7 to 8 percent with approximately 29 percent of the soil size particles passing the No. 200 sieve. Atterberg limit testing was performed on a sample of sand fill and resulted in a liquid limit of no value with a plastic index of non-plastic. Sulfate testing on the sand resulted in 0.00 percent soluble sulfate

by weight, indicating negligible potential for below grade concrete degradation due to sulfate attack.

Soil Type 2 is a very silty sand (SM). The sand was encountered in three (3) of the test borings at the existing ground surface extending to depths of 1 to 10 feet. Standard Penetration Testing conducted on the soil resulted in SPT N-values of 7 to 26 blows per foot (bpf), indicating the sand is loose to medium dense in terms of density. Moisture content and grain size testing resulted in moisture contents of 5 to 20 percent with approximately 40 percent of the soil size particles passing the No. 200 sieve. Atterberg limit testing was performed on a sample of sand fill and resulted in a liquid limit of 15 with a plastic index of 3. Sulfate testing on the sand resulted in less than 0.01 percent soluble sulfate by weight, indicating negligible potential for below grade concrete degradation due to sulfate attack.

Soil Type 3 is a silty to very silty sandstone (SM). The sandstone was encountered in all of the test borings at depths ranging from 1 to 10 feet bgs and extending to depths of 12 feet and the termination of the borings (20 feet). Standard Penetration Testing conducted on the soil resulted in SPT N-values of greater than 50 blows per foot (bpf), indicating the sandstone is very dense in terms of density. Moisture content and grain size testing resulted in moisture contents of 10 to 17 percent with approximately 14 to 42 percent of the soil size particles passing the No. 200 sieve. Atterberg limit testing resulted int liquid limits of no value to 32 and plastic indexes of non plastic to 6. Sulfate testing on the sandstone resulted in 0.00 to less than 0.01 percent soluble sulfate by weight, indicating negligible potential for below grade concrete degradation due to sulfate attack.

Soil Type 4 is sandy to very sandy claystone (CL). The claystone was encountered in Test Boring 1 at a depth of 12 feet bgs and extending to the termination of the boring (20 feet). Standard Penetration Testing conducted on the soil resulted in SPT N-values of greater than 50 blows per foot (bpf), indicating the soil is hard in terms of consistency. Moisture content and grain size testing resulted in moisture contents of 15 to 16 percent with approximately 59 percent of the soil size particles passing the No. 200 sieve. Atterberg limit testing resulted in a liquid limit of 35 and a plastic index of 14.

Additional descriptions and engineering properties of the soil encountered during drilling are included on the boring logs. Laboratory Testing Results are summarized on Table 1 and presented in Appendix B. It should be understood that the soil descriptions reported on the boring logs may vary between boring locations and sampling depths. Similarly, the lines of stratigraphic separation shown on the boring logs represent approximate boundaries between soil types and the actual transitions between types may be more gradual or variable.

4.2 Groundwater

Groundwater was encountered at depths ranging from 13 to 16.5 feet in Test Boring Nos. 3 and 4. Test Boring Nos. 1 and 2 were dry to 18 feet after drilling. Groundwater may affect development of significant foundation excavations or during installation of deep utilities depending on the final grading plans. Creek flow will vary due to rainfall, drainage, and other factors not readily apparent at this time. It should be noted that groundwater levels, observed at the time of the subsurface investigation, could change due to seasonal variations, changes in land runoff characteristics and future development including of nearby areas.

5.0 GEOTECHNICAL EVALUATION AND RECOMMENDATIONS

The following discussion is based on the subsurface conditions encountered in the borings drilled in the planned bridge footprints. If subsurface conditions different from those described herein are encountered during construction or if the project elements change from those described, Entech Engineering, Inc. should be notified so that the evaluation and recommendations presented can be reviewed and revised if necessary.

The site will be developed by constructing two (2) bridges over Sand Creek and associated site improvements at Sterling Ranch Road and Briargate Boulevard Crossings. The proposed bridges are expected to utilize driven H-pile foundations

Subsurface soil conditions encountered in the test borings drilled for the planned interchanges consisted of sand fill and silty to very silty sand overlying silty to very silty sandstone and sandy to very sandy claystone. Bedrock was encountered at depths of 1 to 10 feet in the test borings.

The surficial sands and sand fill were encountered in loose to medium dense states. The underlying sandstone was encountered in dense states, and the underlying claystone was encountered at hard consistencies.

5.1 Foundation Recommendations

The main purpose of the subsurface investigation was to gather soil and bedrock information for the proposed bridge abutments for use in providing foundation recommendations and design values. Recommendations for bridge supports using driven H-piles, shallow spread footings, and parameters for retaining walls are provided.

5.1.1 Deep Foundation Systems (Driven H-piles)

Based on evaluation of the site subsurface conditions, it is believed that the planned H-piles will achieve most of their compressive strength through end bearing and skin friction in the underlying sandstone and claystone bedrock (Soil Types 3 and 4). Some frictional resistance will also be developed in the overburden sand (Soil Type 1). Design parameters for use in the H-pile design, which include allowable end bearing, side resistance, and resisting factors are presented in Table 2. L Pile parameters for the sand, sandstone, and claystone are also included in Table 2. The recommendations and parameters apply to piles spaced by horizontal distances of at least 3 times the pile width. If the piles are spaced closer, reductions in the allowable pile capacity may be warranted. The following unit weights are recommended for the site soil and bedrock.

Unit weight of native overburden sand	120 pcf
Unit weight of sandstone bedrock	125 pcf
Unit weight of siltstone and claystone bedrock	125 pcf

It is recommended that full-time observation of the H-pile installation be performed to compile driving logs for each pile. At a minimum, the log should include: the driving resistance per foot of pile and per inch of pile over the last 3 inches; the pile driver make and model; rated energy; pile cushion/condition; observed damage; and final pile top location. The guidance set forth in the

State of Colorado Standard Specifications for Road and Bridge Construction, Section 502, Piling, is recommended. Piles should be driven 10 feet into bedrock or refusal.

5.1.2 Shallow Foundation Parameters

Structures associated with the bridges can be supported with shallow foundations resting on the native sands, recompacted loose sands, or sandstone. It should be noted that due to potential shallow groundwater on this site (due to the proximity to Sand Creek), extensive subgrade improvements are anticipated to support shallow foundations. The foundation members should bear on the native site sands, sandstone, or be recompacted according to the "Structural Fill" paragraph. Any topsoil must be removed and the existing subgrade cleared of any debris prior to excavation. Loose soils or uncontrolled fill material beneath foundation components will require removal and recompaction. Any expansive soils encountered beneath the foundation will require removal and replacement with non-expansive structural fill compacted according to the "Structural Fill" paragraph. Any new fill should be placed to the requirements of the "Structural Fill" paragraph. On-site granular sands may be used as structural fill as approved by Entech. Any import material should be approved by Entech prior to hauling to the site.

Provided the above recommendations are followed, an allowable bearing pressure of 2400 psf is recommended for the native sands. For recompacted sands or imported granular structural fill, an allowable bearing capacity of 3000 psf is recommended. An allowable bearing capacity of 4000 psf is recommended for undisturbed sandstone. Footings should extend a minimum of 30 inches below the adjacent exterior surface grade for frost protection. Following the above foundation subgrade preparation recommendations, and adhering to the recommended maximum allowable bearing pressure, it is expected to result in foundation designs which should limit total and differential vertical movements.

Foundation excavations are recommended to extend at least 3 feet horizontally beyond the foundation limits in order to provide adequate space for installation of drain materials (if necessary) and placement of controlled fill. All foundation excavation side slopes should be inclined at angles of $1\frac{1}{2}$ horizontal to 1 vertical or flatter, as necessary, to provide for excavation sidewall stability during construction or as required by OSHA regulations.

Entech should observe overexcavated subgrades as well as the overall foundation excavation subgrade and evaluate if the exposed conditions are consistent with those described in this report. Entech should also provide recommendations for overexcavation depth and other subgrade improvements, if necessary, and the need for drain systems based on the excavation conditions observed at that time.

5.1.3 Retaining Wall Parameters

The following values are recommended for use in designing retaining walls with unbalanced lateral loading that may be associated with this project. Roadway/Vehicle surcharge loading is required for wall design.

Recommended Design Values – Lateral Loading

Equivalent fluid density for lateral earth pressure (active), pcf (site granular soils)	45
Equivalent fluid density for lateral earth pressure (passive), pcf	300
Equivalent fluid density for lateral earth pressure (at rest), pcf	60
Soil density (compacted sand), pcf	125
Angle of Internal Friction (loose silty sand and sandy clay-silt)	26°
Angle of Internal Friction (compacted silty sand)	34°
Coefficient of sliding between concrete and silty gravelly sand	0.35
Bearing capacity of sand, psf	2400 psf
Bearing capacity of sandstone, psf	3500 psf

*Note: The above lateral loading design values are for level back slope angles and no surcharge loads. If wall backfill is submerged, water pressures must be taken into account as additional wall loading. If backfill slope angles are greater than zero degrees, or if the backfill is surcharged, the design values must be adjusted to account for additional lateral loading.

5.2 Site Seismic Classification

Based on the subsurface conditions encountered at the site and in accordance with Section 1613 of the 2015 International Building Code (IBC), the site meets the conditions of a Site Class C.

5.3 Surface and Subsurface Drainage

Positive surface drainage must be maintained around structures to minimize infiltration of surface water. A minimum gradient of 5 percent in the first 10 feet adjacent to foundation components is recommended. A minimum gradient of 2 percent is recommended for paved areas. All grades should be directed away from structures.

To help minimize infiltration of water into foundation zones, vegetative plantings placed close to foundation components should be limited to those species having low watering requirements and irrigated grass should not be located within 5 feet of foundation components. Similarly, sprinklers are not recommended to discharge water within 5 feet of foundation components. Irrigation near foundations should be limited to the minimum amount sufficient to maintain vegetation. Application of more irrigation water than necessary can increase the potential for foundation movement.

5.4 Concrete

Soluble sulfate testing was conducted on three samples of the site soils to evaluate the potential for sulfate attack on concrete placed below the surface grade. The test results indicated less than 0.01 percent soluble sulfate by weight for the site soils. The test results indicate the sulfate component of the in-place site soils present a negligible exposure threat to concrete placed below grade that comes into contact with the site soils.

Type II cement is recommended for concrete at this site. To further avoid concrete degradation during construction it is recommended that concrete not be placed on frozen or wet ground. Care should be taken to prevent the accumulation or ponding of water in foundation excavations prior to the placement of concrete. If standing water is present in the foundation excavations, it should be removed by ditching to sumps and pumping the water away from the foundation area

prior to concrete placement. If concrete is placed during periods of cold temperatures, the concrete must be kept from freezing. This may require covering the concrete with insulated blankets and adding heat to prohibit freezing.

5.5 Foundation Excavation Observations

Subgrade preparation for bridge foundations and associated improvements should be observed by Entech Engineering prior to construction of the foundation elements in order to verify that (1) no anomalies are present, (2) materials of the proper bearing capacity have been encountered or placed, and (3) no soft, loose, uncontrolled fill material, expansive soil or debris are present in the foundation area prior to concrete placement or backfilling. Pile driving should be observed to verify proper embedment or refusal. Piles should be driven 10 feet into bedrock or refusal. Entech should make final recommendations for over-excavation or stabilization, if required, at the time of excavation observation, if necessary.

5.6 Structural Fill

Areas to receive fill should have all topsoil, organic material or debris removed. Fill must be properly benched. The surface should be scarified and moisture conditioned to within ± 2 percent of its optimum moisture content and compacted to 95 percent of its maximum Modified Proctor Dry Density (ASTM D-1557) beneath footings or floor slabs prior to placing new fill. New fill beneath footings should be non-expansive and be placed in thin lifts not to exceed 6 inches after compaction while maintaining at least 95 percent of its maximum Modified Proctor Dry Density (ASTM D-1557). These materials should be placed at a moisture content conducive to compaction, usually ±2 percent of Proctor optimum moisture content. The placement and compaction of fill should be observed and tested by Entech Engineering, Inc. Imported soils should be approved by Entech Engineering, Inc. prior to being hauled to the site and on-site granular soils prior to placement.

Compacted, non-expansive granular soil, free of organics, debris and cobbles greater than 3-inches in diameter, is recommended for filling foundation components. All fill placed within the foundation areas should be non-expansive and be compacted to a minimum of 95 percent of the

soils maximum dry density as determined by the Modified Proctor Test (ASTM D-1557). Fill material placed beneath floor slabs should be compacted to a minimum of 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557. Fill material should be placed in horizontal lifts such that each finished lift has a compacted thickness of six inches or less. Fill should be placed at water contents conducive to achieving adequate compaction, usually within ±2 percent of the optimum water content as determined by ASTM D-1557. Mechanical methods can be used for placement and compaction of fill; however, heavy equipment should be kept at distance from foundation walls and below slab infrastructure to avoid overstressing. No water flooding techniques of any type should be used for compaction or placement of foundation or floor slab fill material.

5.7 Utility Trench Backfill

Fill placed in utility trenches should be compacted to a minimum of 95 percent of its maximum dry density as determined by the Standard Proctor Test (ASTM D-698) for cohesive soils and 95 percent as determined by the Modified Proctor Test (ASTM D-1557) for cohesionless soils. Fill should be placed in horizontal lifts having a compacted thickness of six inches or less and at a water content conducive to adequate compaction, within ±2 percent of the optimum water content. Mechanical methods should be used for fill placement; however, heavy equipment should be kept at a distance from foundation walls. No water flooding techniques of any type should be used for compaction or placement of utility trench fill.

Trench backfill placement should be performed in accordance with El Paso County specifications. All excavation and excavation shoring/bracing should be performed in accordance with OSHA guidelines.

5.8 General Backfill

Any areas to receive fill outside the foundation limits should have all topsoil, organic material, and debris removed. Fill must be properly benched into existing slopes in order to be adequately compacted. The fill receiving surface should be scarified to a depth of 12-inches and moisture conditioned to ± 2 percent of the optimum water content, and compacted to a minimum of 95 percent of the ASTM D-1557 maximum dry density before the addition of new fill. Fill should be placed in thin lifts not to exceed 6 inches in thickness after compaction while maintaining at least 95 percent of the ASTM D-1557 maximum dry density. Fill material should be free of vegetation and other unsuitable material and shall not contain rocks or fragments greater than 3-inches. Topsoil and strippings should be segregated from all other fill sources on the site. Fill placement and compaction beneath and around foundations, in utility trenches, beneath roadways or other structural features of the project should be observed and tested by Entech during construction.

5.9 Excavation Stability

Excavation sidewalls must be properly sloped, benched and/or otherwise supported in order to maintain stable conditions. All excavation openings and work completed therein shall conform to OSHA Standards as put forward in CFR 29, Part 1926.650-652, (Subpart P).

5.10 Winter Construction

In the event construction of the planned facility occurs during winter, foundations and subgrades should be protected from freezing conditions. Concrete should not be placed on frozen soil and once concrete has been placed, it should not be allowed to freeze. Similarly, once exposed, the foundation subgrade should not be allowed to freeze. During site grading and subgrade preparation, care should be taken to avoid burial of snow, ice or frozen material within the planned construction area.

5.11 Construction Observations

It is recommended that Entech observe and document the following activities during construction of the building foundations.

- Excavated subgrades and subgrade preparation.
- Drilled Pier Installation
- Placement of drains (if installed).
- Placement/compaction of fill material for the foundation components and retaining walls.
- Placement/compaction of utility bedding and trench backfill.

6.0 CLOSURE

The subsurface investigation, geotechnical evaluation and recommendations presented in this report are intended for use of C&C Land with application to the proposed bridges over Sand Creek at Sterling Ranch Road and Briargate Boulevard and their associated site improvements, in El Paso County northeast of Colorado Springs, Colorado. In conducting the subsurface investigation, laboratory testing, engineering evaluation and reporting, Entech Engineering, Inc. endeavored to work in accordance with generally accepted professional geotechnical and geologic practices and principles consistent with the level of care and skill ordinarily exercised by members of the geotechnical profession currently practicing in same locality and under similar conditions. No other warranty, expressed or implied is made. During final design and/or construction, if conditions are encountered which appear different from those described in this report, Entech Engineering, Inc. requests that it be notified so that the evaluation and recommendations presented herein can be reviewed and modified as appropriate.

If there are any questions regarding the information provided herein or if Entech Engineering, Inc. can be of further assistance, please do not hesitate to contact us.

TABLES

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT C&C LAND
PROJECT STERLING RANCH BRIDGES
JOB NO. 200045

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	FHA SWELL (PSF)	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	1	2-3			29.1	NV	NP	0.00			SM	FILL, SAND, SILTY
2	3	5			39.8	15	3	<0.01			SM	SAND, VERY SILTY
3	2	10			13.9	NV	NP	<0.01			SM	SANDSTONE, SILTY
3	4	2-3			14.7						SM	SANDSTONE, SILTY
3	4	15	17.1	110.2	42.2	32	6	0.00		1.9	SM	SANDSTONE, VERY SILTY
4	1	15	14.3	116.1						1.6	CL	CLAYSTONE, SANDY
4	1	20			58.7	35	14				CL	CLAYSTONE, VERY SANDY

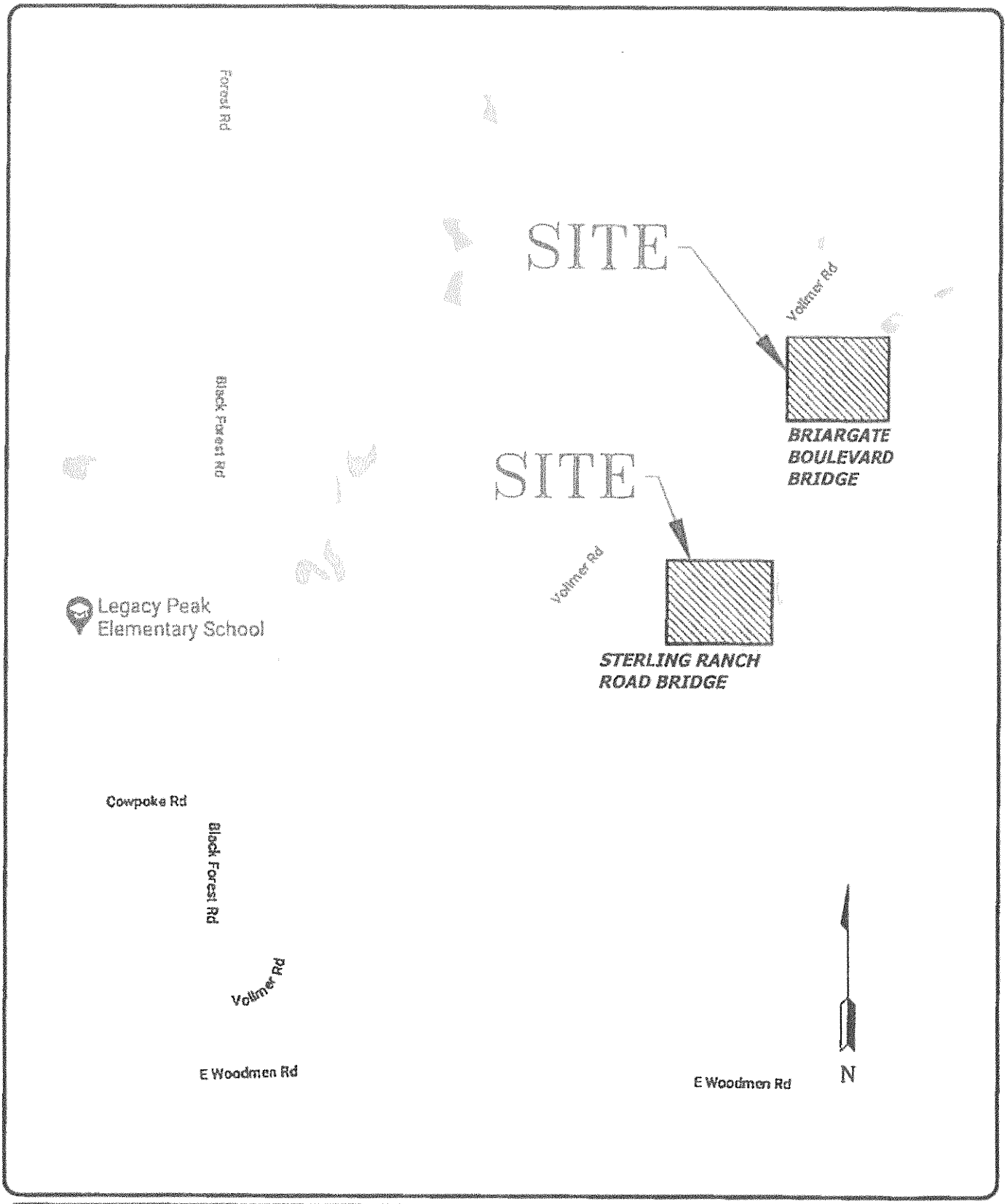
TABLE 2

Sterling Ranch Bridges - LPile Design Parameters

Depth Below Existing Ground Surface		Groundwater Elevation (ft) Below Existing Ground	Soil/Rock Description	Axial Pile Capacity Parameters		PRELIMINARY LPile Parameters					
Top	Bottom			Allowable Side Resistance (ksf)	Allowable End Bearing (ksf)	p-y Curve	Unit Weight γ[1] (pcf)	Peak Friction Angle ϕ (deg)	Initial Static Modulus of Subgrade Reaction, k (pci)	Undrained Cohesion s_u (psf)	Strain Factor ε_{50} (in/in)
0	6	13 to 16	Suitable Granular Structural Fill (Dense)	——	——	Sand	120 62[1]	32	25 20[1]	N/A	N/A
0	1 to 10		Native Silty Sand	——	——	Sand	120 62[1]	32	25 20[1]	N/A	N/A
1 to 10	12 to BOE		Silty Sandstone	3	30	Sand	125 67[1]	34	225 125[1]	N/A	N/A
12	BOE		Sandy to Very Sandy Claystone	3	30	Clay	115 57[1]	N/A	500	1500	0.005

[1] = Submerged

FIGURES



ENTECH ENGINEERING, INC.
365 ELKTON DRIVE
COLORADO SPRINGS, CO 80907 (719) 531-5599

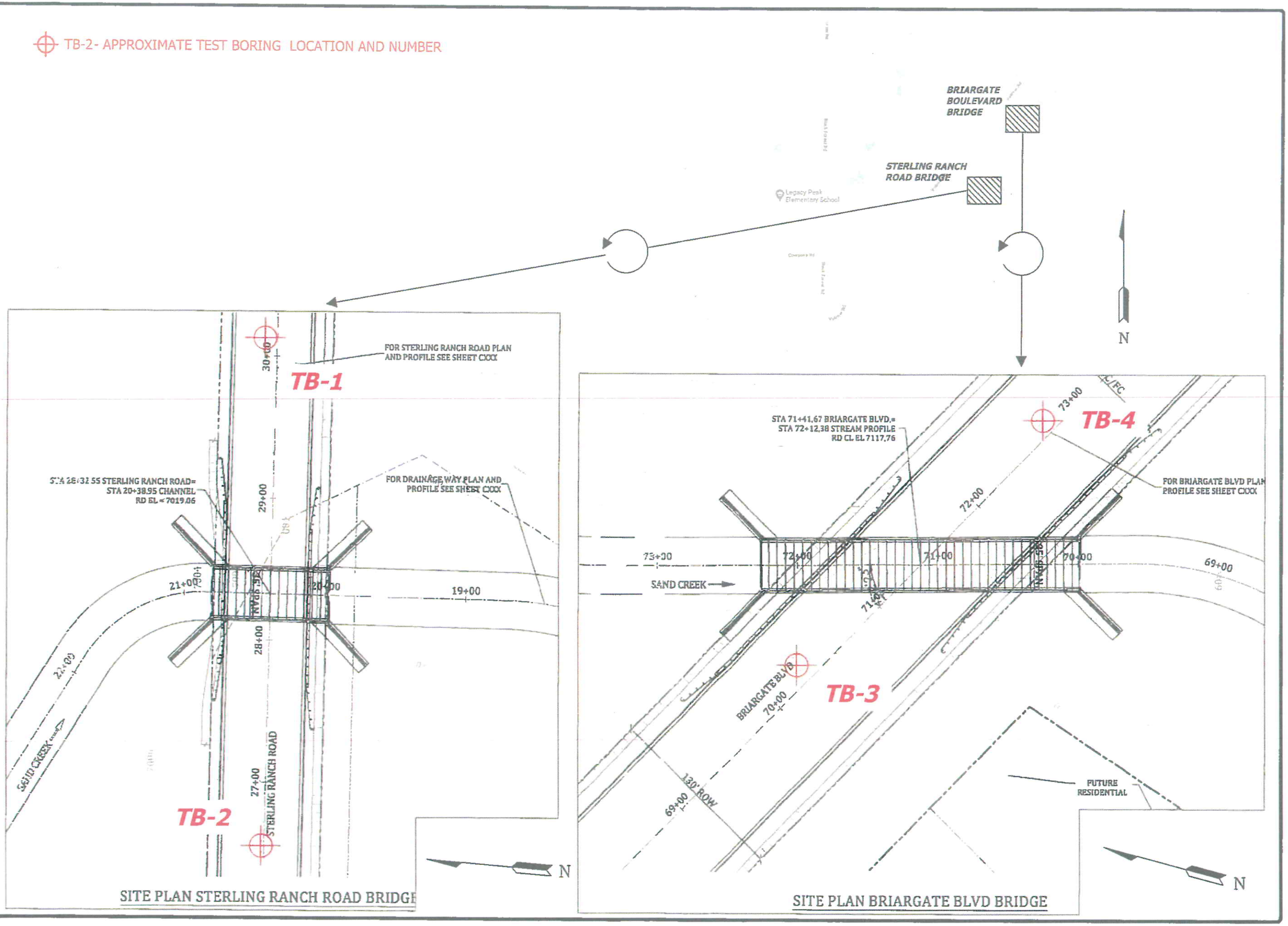
Vicinity Map
Sterling Ranch Bridges
Sterling Ranch Rd & Briargate Blvd Over Sand Creek
El Paso County, CO
For: C & C Land

DRAWN:	DATE:	CHECKED:	DATE:
AMN	2/14/20		

JOB NO.: 200045

FIG NO.: 1

TB-2- APPROXIMATE TEST BORING LOCATION AND NUMBER



REVISIONS	BY:

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

Site Plan/Test Boring Map
Sterling Ranch Bridges
Sterling Ranch Rd & Briargate Blvd
Over Sand Creek
El Paso County, CO
For: C & C Land

DRAWN BY:	AMN
DESIGNED BY:	AMN
CHECKED BY:	
DATE:	02/27/2020
SCALE:	AS SHOWN
JOB NO.	200045
PICTURE NO.	

APPENDIX A: Test Boring Logs

TEST BORING NO. 1
DATE DRILLED 1/23/2020
Job # 200045

REMARKS

DRY TO 18', 1/28/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			6	7.7	1	FILL 0-6', SAND, SILTY, FINE TO COARSE GRAINED, BROWN, LOOSE, MOIST
5			4	6.9	1	SANDSTONE, SILTY, FINE GRAINED, TAN, VERY DENSE, MOIST
10			50/7"	14.6	3	CLAYSTONE, SANDY TO VERY SANDY, GRAY BROWN, HARD, MOIST
15			50/8"	15.3	4	
20			50/7"	15.9	4	

TEST BORING NO. 2
DATE DRILLED 1/23/2020
CLIENT C&C LAND
LOCATION STERLING RANCH BRIDGES

REMARKS

DRY TO 18', 1/28/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			26	5.2	2	SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST
5			50/11"	13.5	3	SANDSTONE, SILTY, FINE GRAINED, TAN, VERY DENSE, MOIST
10			50/6"	10.0	3	SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN TO GRAY BROWN, VERY DENSE, MOIST
15			50/10"	11.2	3	
20			50/5"	12.2	3	

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN	DATE	CHECKED	DATE
			12/10/20

JOB NO. 200045
FIG NO. A- 1

TEST BORING NO. 3
DATE DRILLED 1/23/2020
Job # 200045

REMARKS

WATER @ 16.5', 1/28/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
						SAND, SILTY TO VERY SILTY, FINE TO COARSE GRAINED, TAN TO BROWN, MEDIUM DENSE TO LOOSE, MOIST
			16	5.0	2	
5			7	19.7	2	
10			24	15.1	2	SANDSTONE, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, VERY DENSE, MOIST TO VERY MOIST
15			50/10"	12.7	3	
20			50/10"	17.3	3	

TEST BORING NO. 4
DATE DRILLED 1/23/2020
CLIENT C&C LAND
LOCATION STERLING RANCH BRIDGES

REMARKS

WATER @ 13', 1/28/20

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
					2	SAND, SILTY, TAN
			50/10"	7.1	3	SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST
5			50/11"	9.2	3	
10			50/9"	10.3	3	
15			10/10"	16.4	3	SANDSTONE, VERY SILTY, FINE GRAINED, GRAY BROWN, VERY DENSE, MOIST TO VERY MOIST
20			50/4"	14.9	3	COARSE GRAINED LENSES

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

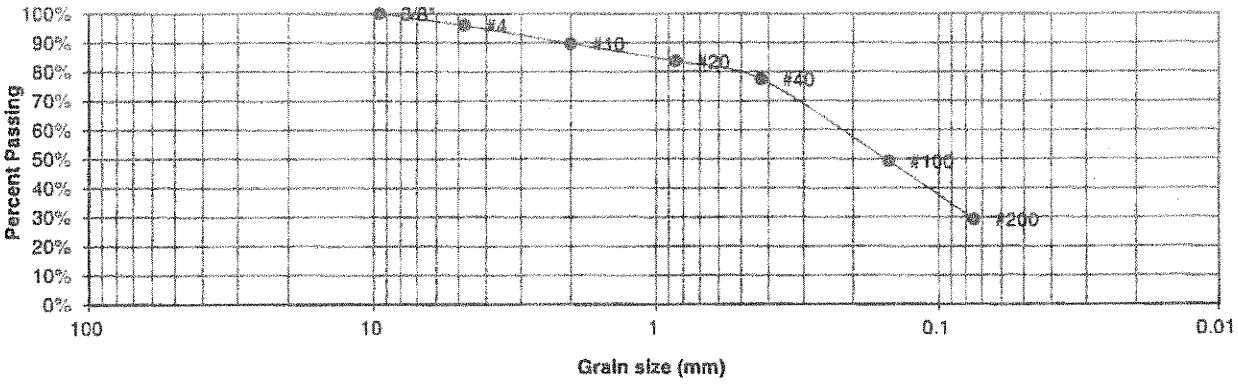
DRAWN	DATE	CHECKED:	DATE
			2/10/20

JOB NO. 200045
FIG NO A- 2

APPENDIX B: Laboratory Test Results

UNIFIED CLASSIFICATION	SM	CLIENT	C&C LAND
SOIL TYPE #	1	PROJECT	STERLING RANCH BRIDGES
TEST BORING #	1	JOB NO.	200045
DEPTH (FT)	2-3	TEST BY	BL

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	95.9%
10	89.7%
20	83.6%
40	77.3%
100	49.2%
200	29.1%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

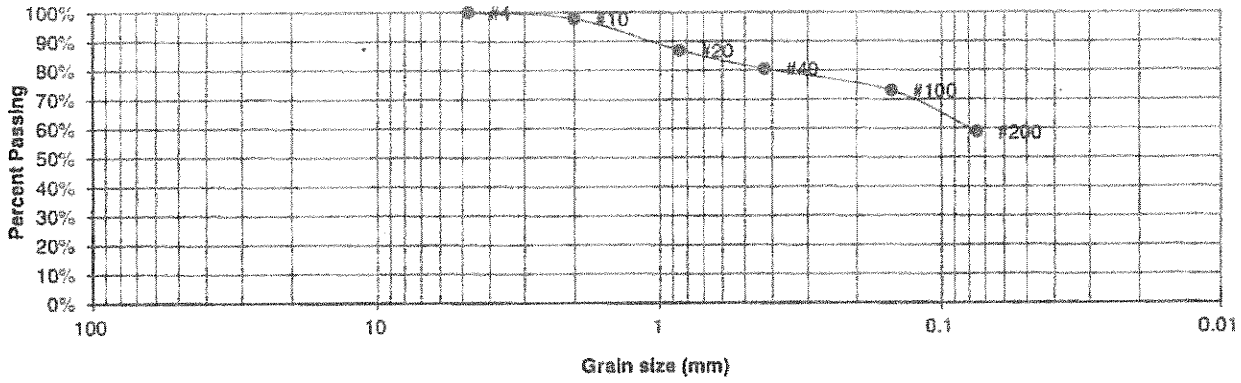
DRAWN:	DATE	CHECKED:	DATE: 2/10/20

JOB NO 200045

FIG NO B-1

UNIFIED CLASSIFICATION	CL	CLIENT	C&C LAND
SOIL TYPE #	4	PROJECT	STERLING RANCH BRIDGES
TEST BORING #	1	JOB NO.	200045
DEPTH (FT)	20	TEST BY	BL

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	97.8%
20	86.9%
40	80.5%
100	72.9%
200	58.7%

Atterberg Limits

Plastic Limit	21
Liquid Limit	35
Plastic Index	14

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

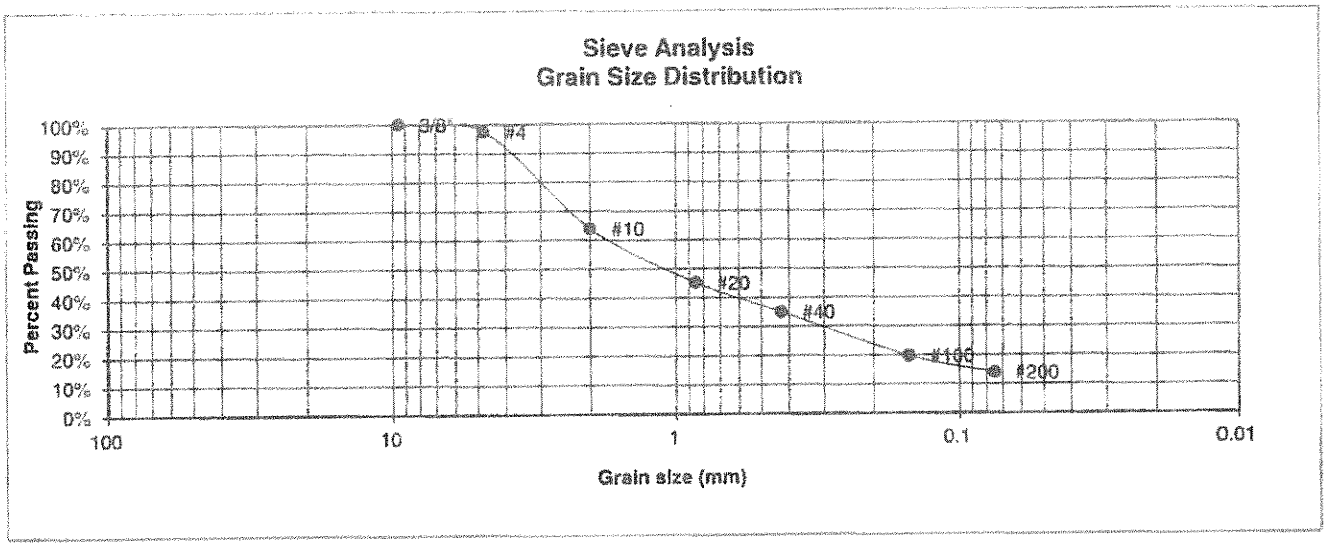
LABORATORY TEST RESULTS

DRAWN	DATE	CHECKED	DATE
			4/16/20

JOB NO 200045

FIG NO B-2

UNIFIED CLASSIFICATION	SM	CLIENT	C&C LAND
SOIL TYPE #	3	PROJECT	STERLING RANCH BRIDGES
TEST BORING #	2	JOB NO.	200045
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.4%
10	63.9%
20	45.2%
40	35.0%
100	19.7%
200	13.9%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

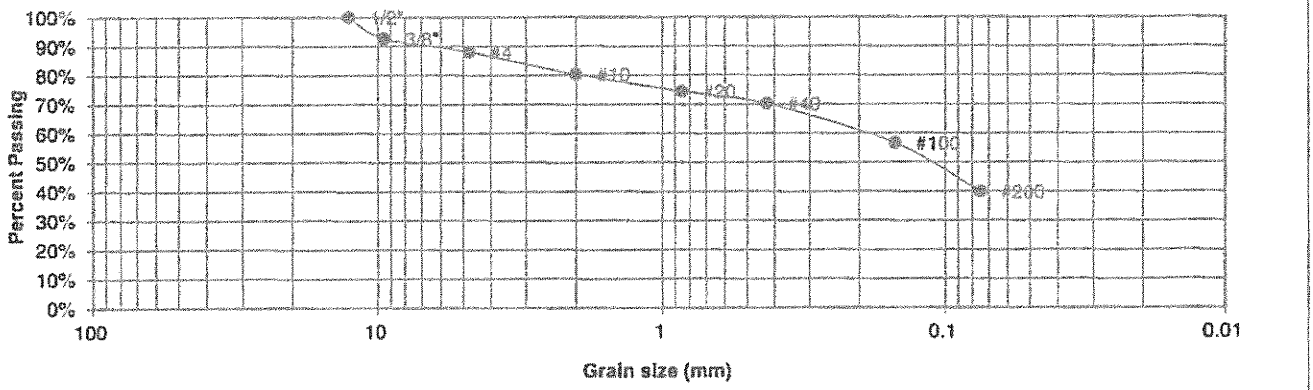
LABORATORY TEST RESULTS

DRAWN	DATE	CHECKED:	DATE: 2/11/20

JOB NO 200045

FIG NO B-3

UNIFIED CLASSIFICATION	SM	CLIENT	C&C LAND
SOIL TYPE #	2	PROJECT	STERLING RANCH BRIDGES
TEST BORING #	3	JOB NO.	200045
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	92.6%
4	88.0%
10	80.3%
20	74.4%
40	70.1%
100	56.5%
200	39.8%

Atterberg Limits	
Plastic Limit	12
Liquid Limit	15
Plastic Index	3

Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

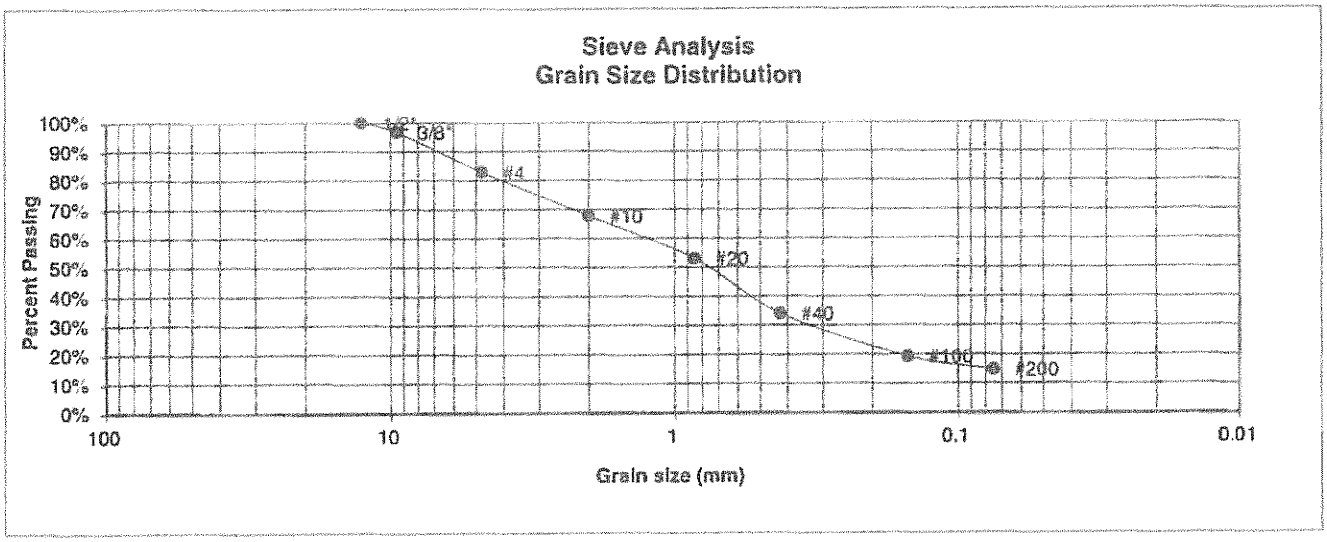
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED	DATE:
		MV	3-2-20

JOB NO.: 200045

FIG NO: B-4

UNIFIED CLASSIFICATION	SM	CLIENT	C&C LAND
SOIL TYPE #	3	PROJECT	STERLING RANCH BRIDGES
TEST BORING #	4	JOB NO.	200045
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	96.7%
4	82.8%
10	67.8%
20	53.0%
40	34.0%
100	19.2%
200	14.7%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

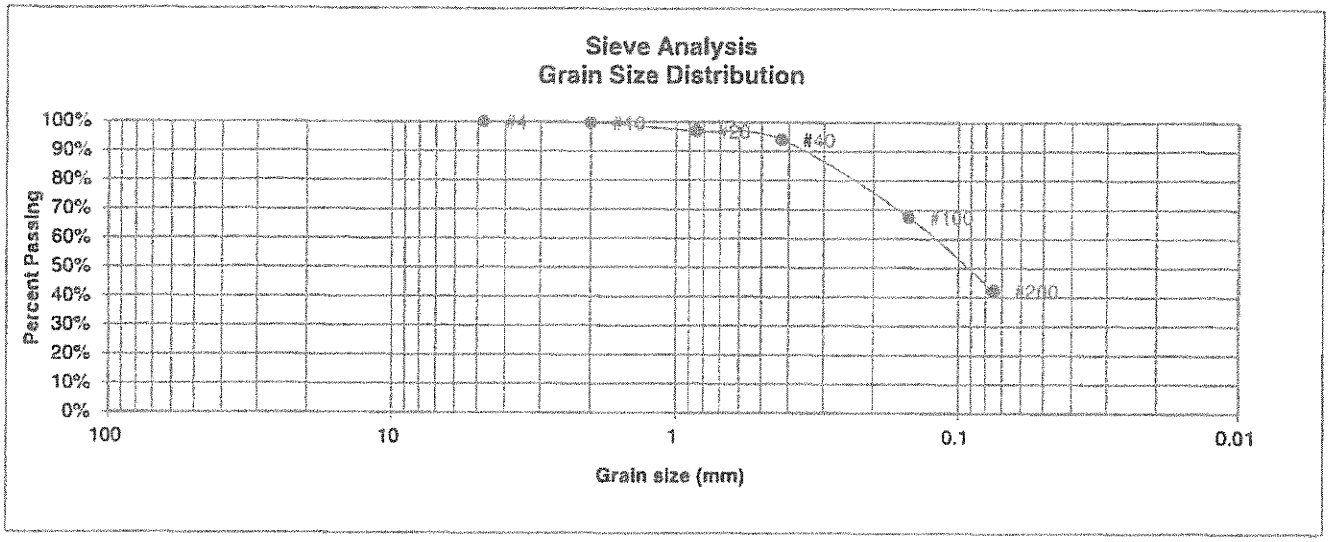
LABORATORY TEST RESULTS

DRAWN	DATE	CHECKED	DATE
			2/10/20

JOB NO. 200045

FIG NO B-5

UNIFIED CLASSIFICATION	SM	CLIENT	C&C LAND
SOIL TYPE #	3	PROJECT	STERLING RANCH BRIDGES
TEST BORING #	4	JOB NO.	200045
DEPTH (FT)	15	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.7%
20	96.9%
40	94.0%
100	67.4%
200	42.2%

Atterberg Limits	
Plastic Limit	26
Liquid Limit	32
Plastic Index	6

Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN	DATE	CHECKED	DATE
			2/10/20

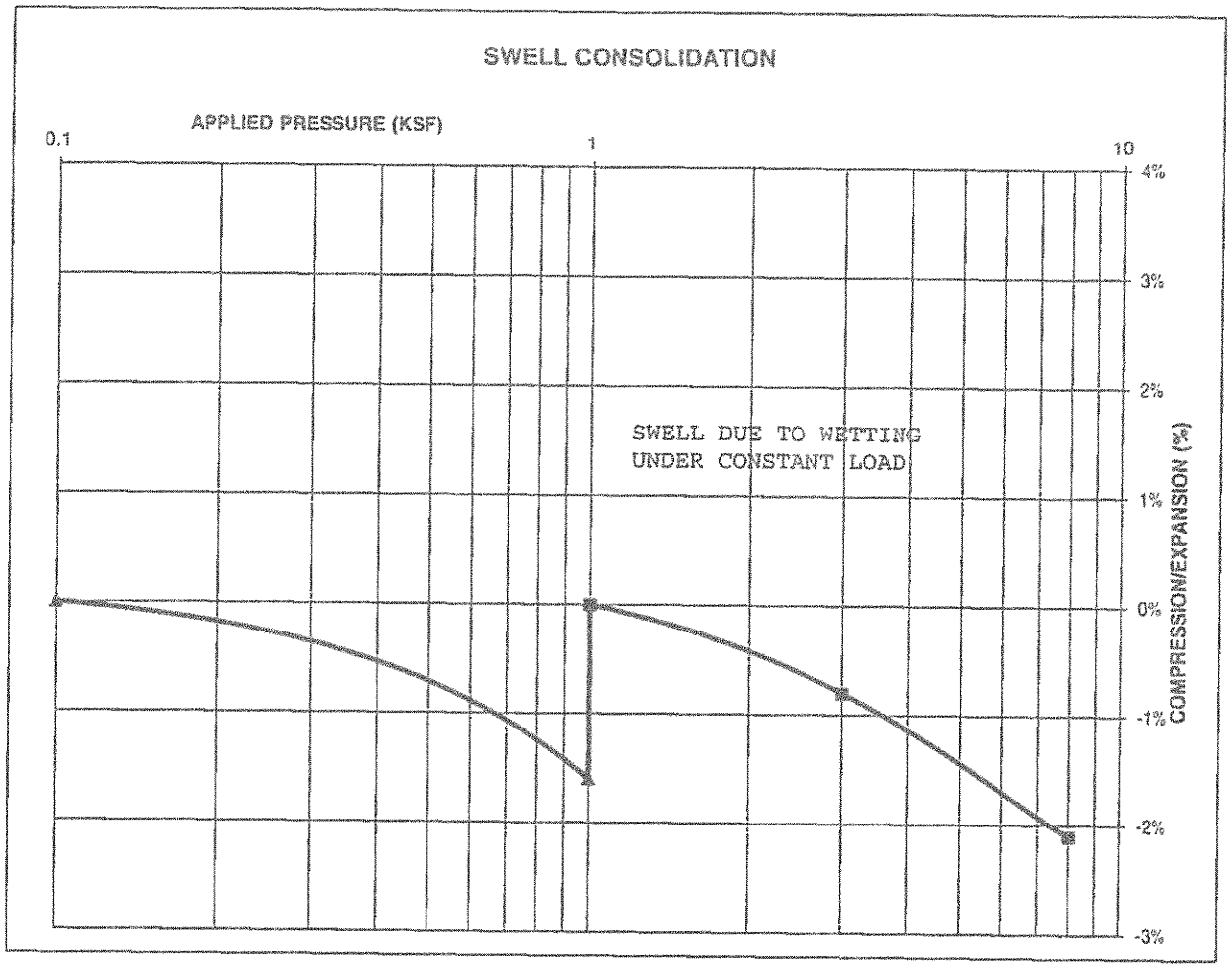
JOB NO 200045

FIG NO. B-6

CONSOLIDATION TEST RESULTS

TEST BORING #	1	DEPTH(ft)	15
DESCRIPTION	CL	SOIL TYPE	4
NATURAL UNIT DRY WEIGHT (PCF)			116
NATURAL MOISTURE CONTENT			14.3%
SWELL/CONSOLIDATION (%)			1.6%

JOB NO. 200045
CLIENT C&C LAND
PROJECT STERLING RANCH BRIDGES



ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
TEST RESULTS

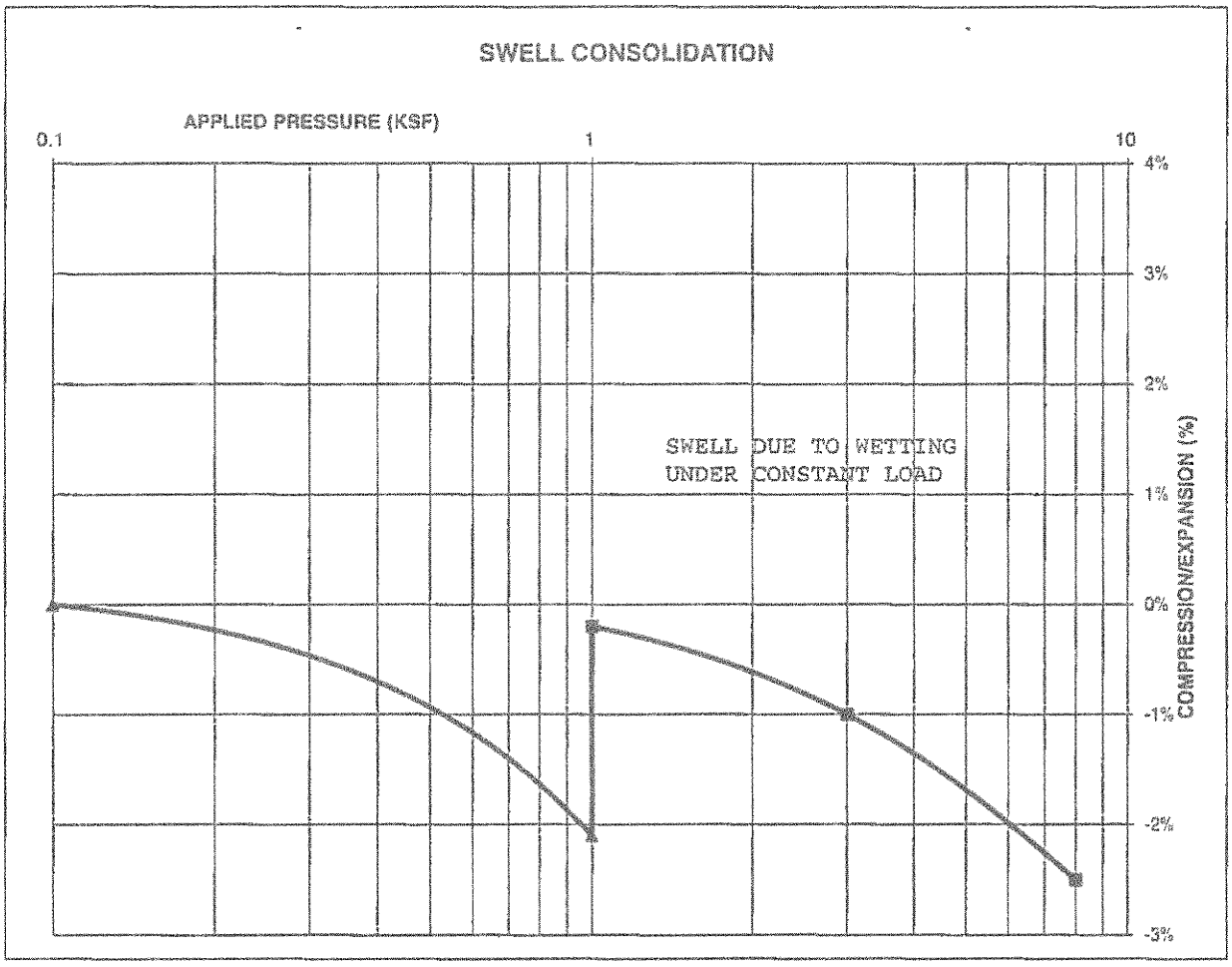
DRAWN	DATE	CHECKED	DATE
			2/10/20

JOB NO. 200045
FIG NO. B-7

CONSOLIDATION TEST RESULTS

TEST BORING #	4	DEPTH(ft)	15
DESCRIPTION	SM	SOIL TYPE	3
NATURAL UNIT DRY WEIGHT (PCF)			110
NATURAL MOISTURE CONTENT			17.1%
SWELL/CONSOLIDATION (%)			1.9%

JOB NO. 200045
CLIENT C&C LAND
PROJECT STERLING RANCH BRIDGES



ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			2/10/20

JOB NO. 200045
FIG NO. B-8

CLIENT	C&C LAND	JOB NO.	200045
PROJECT	STERLING RANCH BRIDGES	DATE	2/4/2020
LOCATION	STERLING RANCH BRIDGES	TEST BY	BL

BORING NUMBER	DEPTH, (ft)	SOIL TYPE NUMBER	UNIFIED CLASSIFICATION	WATER SOLUBLE SULFATE, (wt%)
TB-1	2-3	1	SM	0.00
TB-2	10	3	SM	<0.01
TB-4	15	3	SM	0.00
TB-3	5	2	SM	<0.01

QC BLANK PASS

ENTECH
ENGINEERING, INC.
503 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST
SULFATE RESULTS

DRAWN	DATE	CHECKED:	DATE:
		DN	3-2-20

JOB NO. 200045

FIG NO B-9

Appendix C

Roadway Design Plans

Briargate Parkway and Sterling Ranch Road

M & S Civil

STERLING RANCH-STERLING RANCH ROAD

COUNTY OF EL PASO, STATE OF COLORADO

STREET IMPROVEMENT PLANS

DECEMBER 2017

AGENCIES

OWNER/DEVELOPER:	SR LAND, LLC 20 BOULDER CRESCENT, SUITE 201 COLORADO SPRINGS, CO 80903 JIM MORLEY (719) 471-1742	FIRE DISTRICT:	BLACK FOREST FIRE PROTECTION DISTRICT 11445 TEACHOUT ROAD COLORADO SPRINGS, CO 80908 CHIEF BRYAN JACK (719) 495-4300
CIVIL ENGINEER:	M & S CIVIL CONSULTANTS, INC. 20 BOULDER CRESCENT, SUITE 110 COLORADO SPRINGS, CO 80903 VIRGIL A. SANCHEZ P.E. (719) 955-5485	GAS DEPARTMENT:	COLORADO SPRINGS UTILITIES 7710 DURANT DR. COLORADO SPRINGS, CO 80947 TIM WENDT (719) 668-3556
COUNTY ENGINEERING:	EL PASO COUNTY DEVELOPMENT SERVICES 2880 INTERNATIONAL CIRCLE, SUITE 110 COLORADO SPRINGS, CO 80910 JENNIFER IRVINE, P.E. (719) 520-6300	ELECTRIC DEPARTMENT:	MOUNTAIN VIEW ELECTRIC 11140 E. WOODMEN ROAD FALCON, CO 80831 (719) 495-2283
TRAFFIC ENGINEERING:	EL PASO COUNTY PUBLIC SERVICES & TRANSPORTATION DEPARTMENT 3275 AKERS DRIVE COLORADO SPRINGS, CO 80922 JENNIFER IRVINE, P.E. (719) 520-6460	COMMUNICATIONS:	QWEST COMMUNICATIONS (U.N.C.C. LOCATORS) (800) 922-1987 AT&T (LOCATORS) (719) 635-3674
WATER RESOURCES	STERLING RANCH METRO DISTRICT ENGINEERS JDS-HYDRO CONSULTANTS 545 E. PIKES PEAK AVE., SUITE 300 COLORADO SPRINGS, CO 80903 JOHN MCGINN (719) 668-8769		

BENCHMARKS

1. THE TOP OF AN ALUMINUM SURVEYORS CAP, STAMPED "9853"
   NORTHING = 411416.273
   EASTING = 235167.071
   ELEVATION = 7023.42

2. THE TOP OF A RED PLASTIC SURVEYORS CAP, ILLEGIBLE
   NORTHING = 410095.404
   EASTING = 235052.131
   ELEVATION = 7000.40

3. THE TOP OF A RED PLASTIC SURVEYORS CAP, STAMPED "38141"
   NORTHING = 411399.962
   EASTING = 233849.817
   ELEVATION = 7030.82

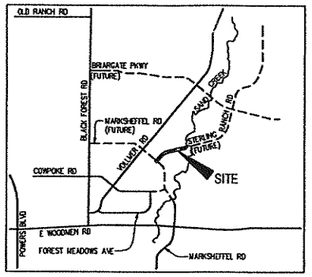
ABBREVIATIONS

ACT	ACTUAL	FL	FLOW LINE	PT	POINT OF TANGENCY
BCR	BACK OF CURB RETURN	FT	FEET, FOOT	PROP	PROPOSED
BOV	BLOWOFF VALVE ASSEMBLY	FUT	FUTURE	REM	REMOVE
BRK	BREAK	GRD	GRADE	ROW	RIGHT OF WAY
BT	BEGINNING OF TRANSITION	HORZ	HORIZONTAL	RSNTS	RESTRAINTS
CATV	CABLE TV	HP	HIGH POINT ELEVATION	RT	RIGHT
CL	CLASS, CENTERLINE	INT	INTERSECTION	SAN	SANITARY SEWER
CLR	CLEARANCE	LP	LOW POINT ELEVATION	SSD	STANDARD DETAIL
CONST	CONSTRUCT	LT	LEFT	STA	STATION
CSU	COLORADO SPRINGS UTILITIES	LOC	LOCATION	STM	STORM
ECR	END CURB RETURN	MIN	MINIMUM	TOB	TOP CORNER OF BOX
EL	ELEVATION	N,S,E,W	NORTH,SOUTH,EAST,WEST	TELE	TELEPHONE
EOA	EDGE OF ASPHALT	NTS	NOT TO SCALE	TYP	TYPICAL
EOP	END OF PAVEMENT	PC	POINT OF VERTICAL CURVATURE	UNK	UNKNOWN
EPC	EL PASO COUNTY	PCC	POINT OF COMPOUND CURVE	(E)	UNDERGROUND POWER
ESMT	EASEMENT	PCR	POINT OF CURB RETURN	UTIL	UTILITY
ET	END TRANSITION	PL	PROPERTY LINE	VERT	VERTICAL
EX	EXISTING	PRC	POINT OF REVERSE CURVE	WTR	WATER LINE
G	GAS	PUB	PUBLIC	XING	CROSSING
GB	GRADE BREAK	PVI	POINT OF VERTICAL INTERSECTION	YD	YARD (CUBIC)
		PVC	POINT OF VERTICAL CURVE		
		PVT	POINT OF VERTICAL TANGENT		

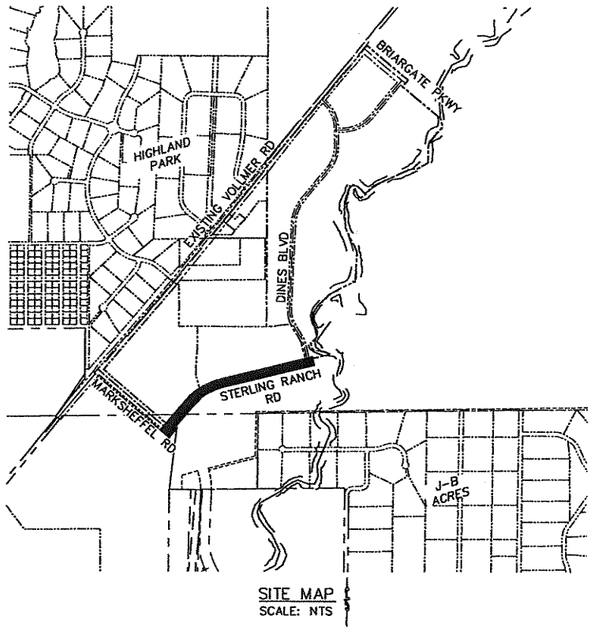
LEGEND

AIR & VACUUM VALVE STA
ANCHOR, CONC. REVERSE
CENTERLINE
ANODE
FENCE
EXISTING SANITARY SEWER
EXISTING GAS
EXISTING ELECTRIC (OH OR UG)
EXISTING TELEPHONE
EXISTING TELEVISION
EXISTING FIBER OPTIC
EXISTING WATER

PROPOSED GAS
PROPOSED SANITARY SEWER
PROPOSED WATER
RIGHT-OF-WAY
PROPERTY LINE
FIRE HYDRANT (EXISTING)
FIRE HYDRANT (PROPOSED)
STORM DRAIN
VALVE (PROPOSED)
VALVE (EXISTING)
BLOWOFF ASSY. (PROPOSED)
BLOWOFF ASSY. (EXISTING)
PLUG (PROPOSED)
PLUG (EXISTING)



VICINITY MAP
SCALE: NTS



SITE MAP
SCALE: NTS

Update when available

APPROVALS:

ENGINEER'S STATEMENT:

DETAILED IMPROVEMENT PLANS AND SPECIFICATIONS ENGINEER'S STATEMENT:

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

VIRGIL A SANCHEZ, COLORADO P.E. NO. 37160 — DATE
FOR AND ON BEHALF OF M&S CIVIL CONSULTANTS, INC.

OWNER/DEVELOPER STATEMENT:

THE OWNER WILL COMPLY WITH THE REQUIREMENTS OF THE DRAINAGE REPORT AND PLAN AND THIS SET OF CONSTRUCTION DOCUMENTS. THE OWNER WILL COMPLY WITH THE REQUIREMENTS OF THE GRADING AND EROSION CONTROL PLAN.

SR LAND, LLC — DATE
DIRECTOR OF PLANNING AND ENGINEERING

EL PASO COUNTY:

COUNTY PLAN REVIEW IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH COUNTY DESIGN CRITERIA. THE COUNTY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE COUNTY THROUGH APPROVAL OF THIS DOCUMENT ASSUMES NO RESPONSIBILITY FOR COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

FILED IN ACCORDANCE WITH THE REQUIREMENTS OF THE EL PASO COUNTY LAND DEVELOPMENT CODE, DRAINAGE CRITERIA, AND ENGINEERING CRITERIA MANUAL AS AMENDED.

JENNIFER IRVINE, P.E. — DATE
ENGINEERING MANAGER

STERLING RANCH METROPOLITAN DISTRICT:

THESE DOCUMENTS HAVE BEEN REVIEWED AND APPROVED FOR STORM DRAIN AND ASSOCIATED UTILITY SERVICE CONSTRUCTION.

FOR AND ON BEHALF OF THE STERLING RANCH METRO. DISTRICT — DATE

BLACK FOREST FIRE PROTECTION DISTRICT:

ALL FIRE HYDRANTS SHALL BE INSTALLED ACCORDING TO THE BLACK FOREST FIRE PROTECTION DISTRICT SPECIFICATIONS. THE NUMBER OF FIRE HYDRANTS AND HYDRANT LOCATIONS AS SHOWN ON THE WATER INSTALLATION PLAN ARE CORRECT AND ADEQUATE TO SATISFY THE FIRE PROTECTION REQUIREMENTS AS SPECIFIED BY THE BLACK FOREST FIRE PROTECTION DISTRICT.

FOR AND ON BEHALF OF THE BLACK FOREST FIRE PROTECTION DISTRICT — DATE

SHEET INDEX

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES
FOR BURIED UTILITY INFORMATION
48 HRS BEFORE YOU DIG
CALL 1-800-922-1987

STERLING RANCH – STERLING RANCH
STREET IMPROVEMENT PLANS
PROJECT NO. 08-002 | SCALE: HORIZONTAL: NTS VERTICAL: N/A | DATE: 07/05/2017 | SHEET 1 OF 5 | SI01
DESIGNED BY: ### | DRAWN BY: SU | CHECKED BY: ####

20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485
CIVIL CONSULTANTS, INC.

VIRGIL A. SANCHEZ, COLORADO P.E. NO. 37160
FOR AND ON BEHALF OF M&S CIVIL CONSULTANTS, INC.

REVISIONS:
NO. | DATE: | BY: | DESCRIPTION: | APPVD. BY: | DATE:

THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE OR LIABLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF RECORD.

CAUTION

File: C:\2008\Sterling Ranch District - Filing 2\Eng\Const Dwg\Street\Sterling Ranch Rd\SI01.dwg Plotstamp: 11/2/2017 2:35 PM

STERLING RANCH - BRIARGATE PARKWAY

FROM VOLLMER ROAD - WHEATLAND DRIVE

COUNTY OF EL PASO, STATE OF COLORADO

STREET IMPROVEMENT PLANS

INCLUDING SIGNAGE AND STRIPING PLAN

JANUARY 2018

AGENCIES

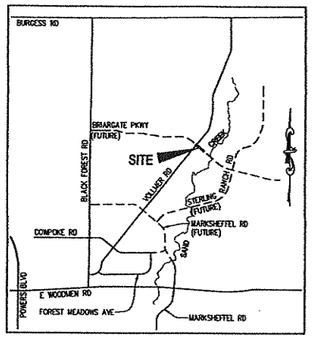
OWNER/DEVELOPER:	SR LAND, LLC 20 BOULDER CRESCENT, SUITE 201 COLORADO SPRINGS, CO 80903 JIM MORLEY (719) 471-1742
CIVIL ENGINEER:	M & S CIVIL CONSULTANTS, INC. 20 BOULDER CRESCENT, SUITE 110 COLORADO SPRINGS, CO 80903 VIRGIL A. SANCHEZ P.E. (719) 955-5485
COUNTY ENGINEERING:	EL PASO COUNTY PLANNING AND COMMUNITY DEVELOPMENT 2880 INTERNATIONAL CIRCLE, SUITE 110 COLORADO SPRINGS, CO 80910 JEFF RICE, P.E. (719) 520-6300
TRAFFIC ENGINEERING:	EL PASO COUNTY DEPARTMENT OF PUBLIC WORKS 3275 AKERS DRIVE COLORADO SPRINGS, CO 80922 JENNIFER IRVINE, P.E. (719) 520-6460
WATER RESOURCES:	STERLING RANCH METRO DISTRICT ENGINEERS JDS-HYDRO CONSULTANTS 545 E. PIKES PEAK AVE., SUITE 300 COLORADO SPRINGS, CO 80903 JOHN MCGINN (719) 668-8769
FIRE DISTRICT:	BLACK FOREST FIRE PROTECTION DISTRICT 11445 TEACHOUT ROAD COLORADO SPRINGS, CO 80908 CHIEF BRYAN JACK (719) 495-4300
GAS DEPARTMENT:	COLORADO SPRINGS UTILITIES 7710 DURANT DR. COLORADO SPRINGS, CO 80947 TIM WENDT (719) 668-3556
ELECTRIC DEPARTMENT:	MOUNTAIN VIEW ELECTRIC 11140 E. WOODMEN ROAD FALCON, CO 80831 (719) 495-2283
COMMUNICATIONS:	CENTURYLINK / COMCAST COMMUNICATIONS (U.N.C.C. LOCATORS) (800) 922-1987 AT&T (LOCATORS) (719) 635-3674

BENCHMARKS:

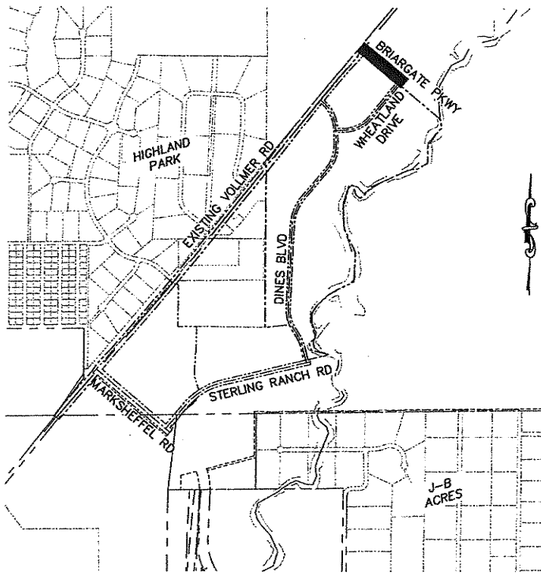
1. THE TOP OF AN ALUMINUM SURVEYORS CAP, STAMPED "9853", AT THE SOUTHEAST BOUNDARY CORNER OF BARBARICK SUBDIVISION
   NORTHING = 411416.273
   EASTING = 235167.071
   ELEVATION = 7023.42
2. THE TOP OF A RED PLASTIC SURVEYORS CAP, ILLEGIBLE, AT THE NORTHWEST BOUNDARY CORNER OF PAWNEE RANCHEROS SUBDIVISION
   NORTHING = 410095.404
   EASTING = 235052.131
   ELEVATION = 7000.40
3. THE TOP OF A RED PLASTIC SURVEYORS CAP, STAMPED "38141", AT THE SOUTHWEST BOUNDARY CORNER OF BARBARICK SUBDISION
   NORTHING = 411399.962
   EASTING = 233849.817
   ELEVATION = 7030.82

BASIS OF BEARINGS:

THE SOUTH LINE OF THE SOUTHWEST QUARTER (SW1/4) OF SECTION 34, TOWNSHIP 12 SOUTH, RANGE 65 WEST OF THE 6TH P.M. AS MONUMENTED AT THE SOUTHWEST CORNER OF SAID SOUTHWEST QUARTER (SW1/4) BY A 2-1/2" ALUMINUM CAP STAMPED "LS 11624" AND AT THE SOUTHEAST CORNER OF SAID SOUTHWEST QUARTER (SW1/4) BY A 2-1/2" ALUMINUM CAP STAMPED "LS 11624", SAID LINE BEARS N 89°14'14" E, A DISTANCE OF 2,722.56 FEET.



VICINITY MAP
N.T.S.



SITE MAP
N.T.S.

RECEIVED VERSION
JAN 04 2018

APPROVALS:

ENGINEER'S STATEMENT:

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

VIRGIL A SANCHEZ, COLORADO P.E. NO. 37160 — DATE 1-4-18
FOR AND ON BEHALF OF M&S CIVIL CONSULTANTS, INC.

OWNER/DEVELOPER STATEMENT:

I, THE OWNER HAVE READ AND WILL COMPLY WITH ALL OF THE REQUIREMENTS SPECIFIED IN THESE DETAILED PLANS AND SPECIFICATIONS.

SR LAND, LLC — DATE 1-4-18

EL PASO COUNTY:

COUNTY PLAN REVIEW IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH COUNTY DESIGN CRITERIA. THE COUNTY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE COUNTY THROUGH APPROVAL OF THIS DOCUMENT ASSUMES NO RESPONSIBILITY FOR COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

FILED IN ACCORDANCE WITH THE REQUIREMENTS OF THE EL PASO COUNTY LAND DEVELOPMENT CODE, DRAINAGE CRITERIA, AND ENGINEERING CRITERIA MANUAL AS AMENDED.

JENNIFER IRVINE, P.E. — DATE 30 JAN 18
COUNTY ENGINEER/ECM ADMINISTRATOR

STERLING RANCH METROPOLITAN DISTRICT:

THESE DOCUMENTS HAVE BEEN REVIEWED AND APPROVED FOR STORM DRAIN AND ASSOCIATED UTILITY SERVICE CONSTRUCTION.

FOR AND ON BEHALF OF THE STERLING RANCH METRO. DISTRICT — DATE 1-4-18

SHEET INDEX

ABBREVIATIONS

ACT	ACTUAL	FL	FLOW LINE	PT	POINT OF TANGENCY		
BCR	BACK OF CURB RETURN	FT	FEET, FOOT	PROP	PROPOSED	AIR & VACUUM VALVE STA	
BOV	BLOWOFF VALVE ASSEMBLY	FUT	FUTURE	REM	REMOVE	ANCHOR, CONC. REVERSE	
BRK	BREAK	GRD	GRADE	ROW	RIGHTS OF WAY	ANODE	
BT	BEGINNING OF TRANSITION	HORZ	HORIZONTAL	RSNTS	RESTRAINTS	CENTERLINE	
CATV	CABLE TV	HP	HIGH POINT ELEVATION	RT	RIGHT	FENCE	
CL	CLASS, CENTERLINE	INT	INTERSECTION	SAN	SANITARY SEWER	EXISTING SANITARY SEWER	
CLR	CLEARANCE	LP	LOW POINT ELEVATION	SD	STANDARD DETAIL	EXISTING GAS	
CONST	CONSTRUCT	LT	LEFT	STA	STATION	EXISTING ELECTRIC (OH OR UG)	
CSU	COLORADO SPRINGS UTILITIES	LOC	LOCATION	STM	STORM	EXISTING TELEPHONE	
ECR	END CURB RETURN	MIN	MINIMUM	TOB	TOP CORNER OF BOX	EXISTING TELEVISION	
EL	ELEVATION	N,S,E,W	NORTH, SOUTH, EAST, WEST	TELE	TELEPHONE	EXISTING FIBER OPTIC	
EOA	EDGE OF ASPHALT	NTS	NOT TO SCALE	TYP	TYPICAL	EXISTING WATER	
EOP	END OF PAVEMENT	PC	POINT OF VERTICAL CURVATURE	UNK	UNKNOWN		
EPC	EL PASO COUNTY	PCC	POINT OF COMPOUND CURVE	UP	UNDERGROUND POWER		
ESMT	EASEMENT	PCR	POINT OF CURB RETURN	UTIL	UTILITY		
ET	END TRANSITION	PL	PROPERTY LINE	VERT	VERTICAL		
(E) EXIST	EXISTING	PRC	POINT OF REVERSE CURVE	WTR	WATER LINE		
G	GAS	PUB	PUBLIC	XING	CROSSING		
GB	GRADE BREAK	PVI	POINT OF VERTICAL INTERSECTION	YD	YARD (CUBIC)		
		PVC	POINT OF VERTICAL CURVE				
		PVT	POINT OF VERTICAL TANGENT				

LEGEND

PROPOSED GAS	G
PROPOSED SANITARY SEWER	S
PROPOSED WATER	W
RIGHT-OF-WAY	
PROPERTY LINE	
FIRE HYDRANT (EXISTING)	
FIRE HYDRANT (PROPOSED)	
STORM DRAIN	
VALVE (PROPOSED)	
VALVE (EXISTING)	
BLOWOFF ASSY. (PROPOSED)	
BLOWOFF ASSY. (EXISTING)	
PLUG (PROPOSED)	
PLUG (EXISTING)	

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES
FOR BURIED UTILITY INFORMATION 48 HRS BEFORE YOU DIG CALL 1-800-922-1987

THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

CAUTION

REVISIONS: NO. | DATE | BY | DESCRIPTION

STERLING RANCH — BRIARGATE PARKWAY
STREET IMPROVEMENT PLAN
PROJECT NO. 09-002 | DESIGNED BY: DLM | DRAWN BY: ELT | CHECKED BY: VAS
SCALE: HORIZONTAL: N/A VERTICAL: N/A
DATE: 1/3/2018
SHEET 1 OF 5
SI01

20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE 719.955.5485
M&S CIVIL CONSULTANTS, INC.

VIRGIL A. SANCHEZ, COLORADO P.E. NO. 37160
FOR AND ON BEHALF OF M&S CIVIL CONSULTANTS, INC.

File: C:\2600Z\Sterling Ranch District\Eng\Const Dwg\Street\Briargate Pkwy\SI01.dwg Plotstamp: 1/4/2018 8:01 AM

SF 16-013

GENERAL CONSTRUCTION NOTES:

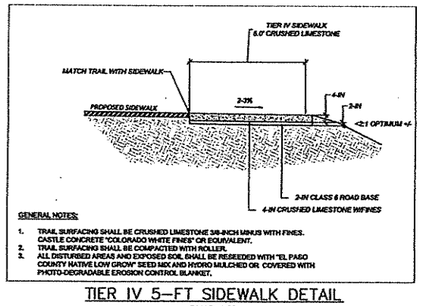
1. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE EXISTENCE AND LOCATION OF ALL UNDERGROUND UTILITIES ALONG THE ROUTE OF THE WORK. THE OMISSION FROM OR THE INCLUSION OF UTILITY LOCATIONS ON THE PLANS IS NOT TO BE CONSIDERED AS THE NONEXISTENCE OF OR A DEFINITE LOCATION OF EXISTING UNDERGROUND UTILITIES.
2. THE CONTRACTOR WILL TAKE THE NECESSARY PRECAUTIONS TO PROTECT EXISTING UTILITIES FROM DAMAGE DUE TO THIS OPERATION. ANY DAMAGE TO THE UTILITIES WILL BE REPAIRED AT THE CONTRACTOR'S EXPENSE, AND ANY SERVICE DISRUPTION WILL BE SETTLED BY THE CONTRACTOR.
3. ADDITIONAL EROSION CONTROL STRUCTURES MAY BE REQUIRED AT THE TIME OF CONSTRUCTION.
4. ALL BACKFILL, SUB-BASE, AND/OR BASE COURSE (CLASS 6) MATERIAL SHALL BE COMPACTED PER THE SOILS ENGINEER'S RECOMMENDATIONS, AND APPROVED BY EL PASO COUNTY PLANNING AND COMMUNITY DEVELOPMENT DIVISION.
5. ALL STATIONING IS CENTERLINE OF IMPROVEMENTS UNLESS OTHERWISE INDICATED. ALL ELEVATIONS ARE FLOW LINE UNLESS OTHERWISE INDICATED AS TOP BACK OF CURB (TBC), ASPHALT (ASP), OR TOP OF INLET OR BOX (TOB).
6. ALL DISTURBED PAVEMENT EDGES SHALL BE CUT TO NEAT LINES. REPAIR SHALL CONFORM TO EPC ECM APPENDIX K – 1.2C.
7. ALL INTERSECTION ACCESSES TO BE CONSTRUCTED WITH A 25 FOOT SIGHT VISIBILITY TRIANGLES EXCEPT BRAIRGATE PARKWAY AND VOLLMER ROAD WHICH ARE ARTERIALS AND A 50 FOOT SIGHT VISIBILITY TRIANGLE IS REQUIRED AND THERE SHALL BE NO OBSTRUCTIONS GREATER THAN 18" VERTICAL IN THIS AREA.
8. ALL CULVERTS AND STORM DRAIN PIPES SHALL BE SMOOTH INTERIOR CORRUGATED POLYETHYLENE PIPE (HDPE), REINFORCED CONCRETE PIPE (RCP). ALL CULVERTS SHALL BE PLACED COMPLETE WITH FLARED END SECTIONS. ADEQUACY OF MATERIAL THICKNESS FOR ANY CSP INSTALLED SHALL BE VERIFIED BY OWNER'S GEOTECHNICAL ENGINEER TO SUPPORT MINIMUM 50 YEAR DESIGN LIFE. CULVERTS MUST CONFORM TO EPC ECM SECTION 3.32 – CULVERTS.
9. ASPHALT THICKNESS AND BASE COURSE THICKNESS (COMPACTED) FOR ROADS SHALL BE PER DESIGN REPORT BY OWNER'S GEOTECHNICAL ENGINEER. OWNER'S GEOTECHNICAL ENGINEER TO BE ON SITE AT THE TIME OF ROAD CONSTRUCTION TO EVALUATE SOIL CONDITIONS AND DETERMINE IF ADDITIONAL MEASURES ARE NECESSARY TO ASSURE STABILITY OF THE NEW ROADS. PAVEMENT DESIGN SHALL BE APPROVED BY EL PASO COUNTY PLANNING AND COMMUNITY DEVELOPMENT DIVISION PRIOR TO CONSTRUCTION.

SIGNING AND STRIPING NOTES:

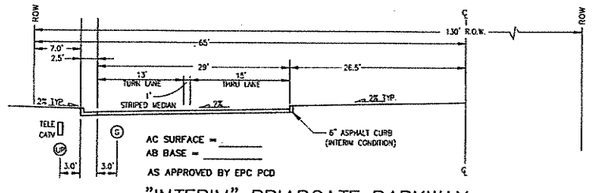
1. ALL SIGNS AND PAVEMENT MARKINGS SHALL BE IN COMPLIANCE WITH THE CURRENT MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD).
2. REMOVAL OF EXISTING PAVEMENT MARKINGS SHALL BE ACCOMPLISHED BY A METHOD THAT DOES NOT MATERIALLY DAMAGE THE PAVEMENT. THE PAVEMENT MARKINGS SHALL BE REMOVED TO THE EXTENT THAT THEY WILL NOT BE VISIBLE UNDER DAY OR NIGHT CONDITIONS. AT NO TIME WILL IT BE ACCEPTABLE TO PAINT OVER EXISTING PAVEMENT MARKINGS.
3. ANY DEVIATION FROM THE STRIPING AND SIGNING PLAN SHALL BE APPROVED BY EL PASO COUNTY PLANNING AND COMMUNITY DEVELOPMENT DIVISION.
4. ALL SIGNS SHOWN ON THE SIGNING AND STRIPING PLAN SHALL BE NEW SIGNS. EXISTING SIGNS MAY REMAIN OR BE REUSED IF THEY MEET CURRENT EL PASO COUNTY AND MUTCD STANDARDS.
5. STREET NAME AND REGULATORY STOP SIGNS SHALL BE ON THE SAME POST AT INTERSECTIONS.
6. ALL REMOVED SIGNS SHALL BE DISPOSED OF IN A PROPER MANNER BY THE CONTRACTOR.
7. ALL STREET NAME SIGNS SHALL HAVE "D" SERIES LETTERS, WITH LOCAL ROADWAY SIGNS BEING 4" UPPER-LOWER CASE LETTERING ON 8" BLANK AND NON-LOCAL ROADWAY SIGNS BEING 6" LETTERING, UPPER-LOWER CASE ON 12" BLANK, WITH A WHITE BORDER THAT IS NOT RECESSED. MULTI-LANE ROADWAYS WITH SPEED LIMITS OF 40 MPH OR HIGHER SHALL HAVE 8" UPPER-LOWER CASE LETTERING ON 18" BLANK WITH A WHITE BORDER THAT IS NOT RECESSED. THE WIDTH OF THE NON-RECESSED WHITE BORDERS SHALL MATCH PAGE 255 OF THE 2012 MUTCD "STANDARD HIGHWAY SIGNS"
8. ALL TRAFFIC SIGNS SHALL HAVE A MINIMUM HIGH INTENSITY PRISMATIC GRADE SHEETING.
9. ALL LOCAL RESIDENTIAL STREET SIGNS SHALL BE MOUNTED ON A 1.75" X 1.75" SQUARE TUBE SIGN POST AND STUB POST BASE. FOR OTHER APPLICATIONS, REFER TO THE CDOT STANDARD S-614-8 REGARDING USE OF THE P2 TUBULAR STEEL POST SLIPBASE DESIGN.
10. ALL SIGNS SHALL BE SINGLE SHEET ALUMINUM WITH 0.100" MINIMUM THICKNESS.
11. ALL LIMIT LINES/STOP LINES, CROSSWALK LINES, PAVEMENT LEGENDS, AND ARROWS SHALL BE A MINIMUM 125 MIL THICKNESS PREFORMED THERMOPLASTIC PAVEMENT MARKINGS WITH TAPERED LEADING EDGES PER CDOT STANDARD S-627-1. WORD AND SYMBOL MARKINGS SHALL BE THE NARROW TYPE. STOP BARS SHALL BE 24" IN WIDTH. CROSSWALKS LINES SHALL BE 12" WIDE AND 8' LONG PER CDOT S-627-1.
12. ALL LONGITUDINAL LINES SHALL BE A MINIMUM 15MIL THICKNESS EPOXY PAINT. ALL NON-LOCAL RESIDENTIAL ROADWAYS SHALL INCLUDE BOTH RIGHT AND LEFT EDGE LINE STRIPING AND ANY ADDITIONAL STRIPING AS REQUIRED BY CDOT S-627-1.
13. THE CONTRACTOR SHALL NOTIFY EL PASO COUNTY DEPARTMENT OF PUBLIC WORKS (719) 520-6819 PRIOR TO AND UPON COMPLETION OF SIGNING AND STRIPING.
14. THE CONTRACTOR SHALL OBTAIN A WORK IN THE RIGHT OF WAY PERMIT FROM THE EL PASO COUNTY DEPARTMENT OF PUBLIC WORKS PRIOR TO ANY WORK WITHIN AN EXISTING EL PASO COUNTY ROADWAY, INCLUDING SIGNAGE OR STRIPING.

STANDARD NOTES FOR EL PASO COUNTY CONSTRUCTION PLANS

1. ALL DRAINAGE AND ROADWAY CONSTRUCTION SHALL MEET THE STANDARDS AND SPECIFICATIONS OF THE CITY OF COLORADO SPRINGS/EL PASO COUNTY DRAINAGE CRITERIA MANUAL, VOLUMES 1 AND 2, AND THE EL PASO COUNTY ENGINEERING CRITERIA MANUAL.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR THE NOTIFICATION AND FIELD NOTIFICATION OF ALL EXISTING UTILITIES, WHETHER SHOWN ON THE PLANS OR NOT, BEFORE BEGINNING CONSTRUCTION. LOCATION OF EXISTING UTILITIES SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION. CALL 811 TO CONTACT THE UTILITY NOTIFICATION CENTER OF COLORADO (UNCC).
3. CONTRACTOR SHALL KEEP A COPY OF THESE APPROVED PLANS, THE GRADING AND EROSION CONTROL PLAN, THE STORMWATER MANAGEMENT PLAN (SWMP), THE SOILS AND GEOTECHNICAL REPORT, AND THE APPROPRIATE DESIGN AND CONSTRUCTION STANDARDS AND SPECIFICATIONS AT THE JOB SITE AT ALL TIMES, INCLUDING THE FOLLOWING:
   a. EL PASO COUNTY ENGINEERING CRITERIA MANUAL (ECM)
   b. CITY OF COLORADO SPRINGS/EL PASO COUNTY DRAINAGE CRITERIA MANUAL, VOLUMES 1 AND 2
   c. COLORADO DEPARTMENT OF TRANSPORTATION (CDOT) STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION
   d. CDOT M & S STANDARDS
4. NOTWITHSTANDING ANYTHING DEPICTED IN THESE PLANS IN WORDS OR GRAPHIC REPRESENTATION, ALL DESIGN AND CONSTRUCTION RELATED TO ROADS, STORM DRAINAGE AND EROSION CONTROL SHALL CONFORM TO THE STANDARDS AND REQUIREMENTS OF THE MOST RECENT VERSION OF THE RELEVANT ADOPTED EL PASO COUNTY STANDARDS, INCLUDING THE LAND DEVELOPMENT CODE, THE ENGINEERING CRITERIA MANUAL, THE DRAINAGE CRITERIA MANUAL, AND THE DRAINAGE CRITERIA MANUAL VOLUME 2. ANY DEVIATIONS FROM REGULATIONS AND STANDARDS MUST BE REQUESTED, AND APPROVED, IN WRITING. ANY MODIFICATIONS NECESSARY TO MEET CRITERIA AFTER-THE-FACT WILL BE ENTIRELY THE DEVELOPER'S RESPONSIBILITY TO RECTIFY.
5. IT IS THE DESIGN ENGINEER'S RESPONSIBILITY TO ACCURATELY SHOW EXISTING CONDITIONS, BOTH ONSITE AND OFFSITE, ON THE CONSTRUCTION PLANS. ANY MODIFICATIONS NECESSARY DUE TO CONFLICTS, OMISSIONS, OR CHANGED CONDITIONS WILL BE ENTIRELY THE DEVELOPER'S RESPONSIBILITY TO RECTIFY.
6. CONTRACTOR SHALL SCHEDULE A PRE-CONSTRUCTION MEETING WITH EL PASO COUNTY PLANNING AND COMMUNITY DEVELOPMENT – INSPECTIONS, PRIOR TO STARTING CONSTRUCTION.
7. IT IS THE CONTRACTOR'S RESPONSIBILITY TO UNDERSTAND THE REQUIREMENTS OF ALL JURISDICTIONAL AGENCIES AND TO OBTAIN ALL REQUIRED PERMITS, INCLUDING BUT NOT LIMITED TO EL PASO COUNTY EROSION AND STORMWATER QUALITY CONTROL PERMIT (ESQCP), REGIONAL BUILDING FLOODPLAIN DEVELOPMENT PERMIT, U.S. ARMY CORPS OF ENGINEERS-ISSUED 401 AND/OR 404 PERMITS, AND COUNTY AND STATE FUGITIVE DUST PERMITS.
8. CONTRACTOR SHALL NOT DEVIATE FROM THE PLANS WITHOUT FIRST OBTAINING WRITTEN APPROVAL FROM THE DESIGN ENGINEER AND DEPARTMENT OF PUBLIC WORKS. CONTRACTOR SHALL NOTIFY THE DESIGN ENGINEER IMMEDIATELY UPON DISCOVERY OF ANY ERRORS OR INCONSISTENCIES.
9. ALL STORM DRAIN PIPE SHALL BE CLASS III RCP UNLESS OTHERWISE NOTED AND APPROVED BY DEPARTMENT OF PUBLIC WORKS.
10. CONTRACTOR SHALL COORDINATE GEOTECHNICAL TESTING PER ECM STANDARDS. PAVEMENT DESIGN SHALL BE APPROVED BY EL PASO COUNTY DEPARTMENT OF PUBLIC WORKS PRIOR TO PLACEMENT OF CURB AND GUTTER AND PAVEMENT.
11. ALL CONSTRUCTION TRAFFIC MUST ENTER/EXIT THE SITE AT APPROVED CONSTRUCTION ACCESS PONTS.
12. SIGHT VISIBILITY TRIANGLES AS IDENTIFIED IN THE PLANS SHALL BE PROVIDED AT ALL INTERSECTIONS. OBSTRUCTIONS GREATER THAN 18 INCHES VERTICAL ABOVE FLOWLINE ARE NOT ALLOWED WITHIN SIGHT TRIANGLES.
13. SIGNING AND STRIPING SHALL COMPLY WITH EL PASO COUNTY DOT AND MUTCD CRITERIA.
14. CONTRACTOR SHALL OBTAIN ANY PERMITS REQUIRED BY EL PASO COUNTY DEPARTMENT PUBLIC WORKS, INCLUDING WORK WITHIN THE RIGHT-OF-WAY AND SPECIAL TRANSPORT PERMITS.
15. THE LIMITS OF CONSTRUCTION SHALL REMAIN WITHIN THE PROPERTY LINE UNLESS OTHERWISE NOTED. THE OWNER/DEVELOPER SHALL OBTAIN WRITTEN PERMISSION AND EASEMENTS, WHERE REQUIRED, FROM ADJOINING PROPERTY OWNER(S) PRIOR TO ANY OFF-SITE DISTURBANCE, GRADING, OR CONSTRUCTION.

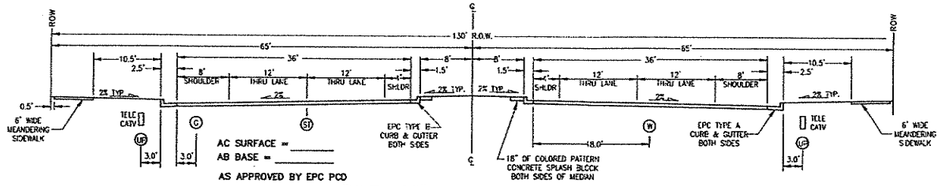


TIER IV 5-FT SIDEWALK DETAIL
SCALE: NTS



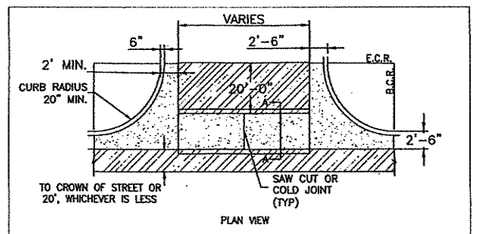
"INTERIM" BRIARGATE PARKWAY
SCALE: NTS

DESIGN SPEED = 50 MPH
POSTED SPEED = 25 MPH



"ULTIMATE" BRIARGATE PARKWAY
(MODIFIED) 4 LANE URBAN PRINCIPAL ARTERIAL CROSS SECTION
SCALE: NTS

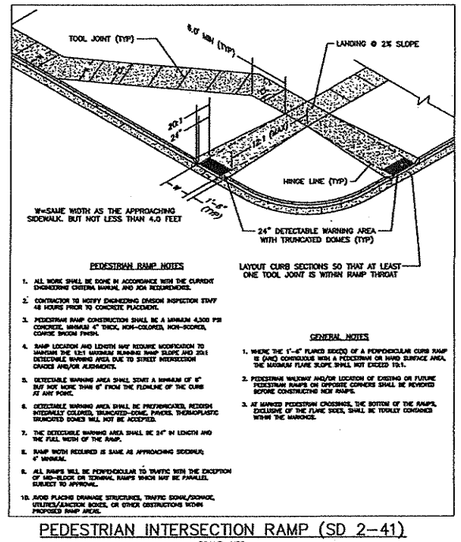
DESIGN SPEED = 50 MPH
POSTED SPEED = 45 MPH



NOTES

1. W = WIDTH SHALL BE 6' FOR LOCAL, 8' FOR COLLECTORS, AND 10' FOR ARTERIAL ROADS.
2. T = SQUARED-OFF RETURN TO BE POURED MONOLITHICALLY, 8" PCC FOR LOCAL ROADS, 9" FOR COLLECTORS WITH 6x6 – 4.4 W.W.F. OR #4 REINFORCING BAR @ 18" EACH WAY.
3. ZZZZ = 3" MINIMUM ASPHALT DEPTH (2 LIFTS).
4. DESIGN TO SPECIFY ELEVATIONS AT PI AND PCR.

TYPICAL CROSS PAN LAYOUT DETAIL (SD 2-26)
SCALE: NTS



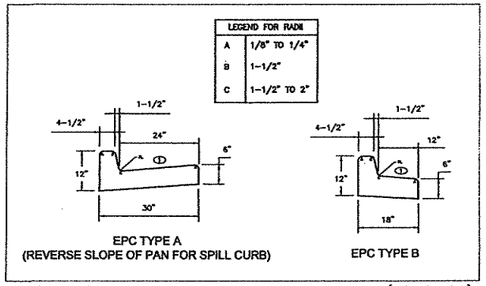
PEDESTRIAN RAMP NOTES

1. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE CURRENT ENGINEERING CRITERIA MANUAL AND ADA REQUIREMENTS.
2. CONTRACTOR TO NOTIFY ENGINEERING EROSION INSPECTION STAFF 48 HOURS PRIOR TO CONCRETE PLACEMENT.
3. PEDESTRIAN RAMP CONSTRUCTION SHALL BE A MINIMUM 4,500 PSI CONCRETE, MINIMUM 4" THICK, NON-COLORED, NON-SCORED, COARSE BROOM FINISH.
4. RAMP LOCATION AND LENGTH MAY REQUIRE MODIFICATION TO MAINTAIN THE 12:1 MAXIMUM RUNNING RAMP SLOPE AND 20:1 DETECTABLE WARNING AREA DUE TO STREET INTERSECTION GRADES AND/OR ALIGNMENTS.
5. DETECTABLE WARNING AREA SHALL JOINT A MINIMUM OF 6" BUT NOT MORE THAN 8" FROM THE FLOWLINE OF THE CURB AT ANY POINT.
6. DETECTABLE WARNING AREA SHALL BE PREFABRICATED, RESILIENT INTEGRALLY COLORED, TRUNCATED-DOME, PAVERS, THERMOPLASTIC TRUNCATED DOMES WILL NOT BE ACCEPTED.
7. THE DETECTABLE WARNING AREA SHALL BE 24" IN LENGTH AND THE FULL WIDTH OF THE RAMP.
8. RAMP WIDTH REQUIRED IS SAME AS APPROACHING SIDEWALK; 6' MINIMUM.
9. ALL RAMPS WILL BE PERPENDICULAR TO TRAFFIC WITH THE EXCEPTION OF MID-BLOCK OR TERMINAL RAMPS WHICH MAY BE PARALLEL SUBJECT TO APPROVAL.
10. AVOID PLACING DRAINAGE STRUCTURES, TRAFFIC SIGNAL/SIGNAGE, UTILITIES/JUNCTION BOXES, OR OTHER OBSTRUCTIONS WITHIN PROPOSED RAMP AREAS.

GENERAL NOTES

1. WHERE THE 1'-6" FLARED SIDES OF A PERPENDICULAR CURB RAMP IS (ARE) CONTIGUOUS WITH A PEDESTRIAN OR MIXED SURFACE AREA, THE MAXIMUM FLARE SLOPE SHALL NOT EXCEED 10:1.
2. PEDESTRIAN WALKWAY AND/OR LOCATION OF EXISTING OR FUTURE PEDESTRIAN RAMPS ON OPPOSITE CORNERS SHALL BE REVIEWED BEFORE CONSTRUCTING NEW RAMPS.
3. AT MARKED PEDESTRIAN CROSSINGS, THE BOTTOM OF THE RAMPS, EXCLUSIVE OF THE FLARE SIDES, SHALL BE TOWARD CONCAVE WITHIN THE MARKINGS.

PEDESTRIAN INTERSECTION RAMP (SD 2-41)
SCALE: NTS



TYPICAL CURB & GUTTER DETAILS DETAIL (SD 2-20)
SCALE: NTS

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES

FOR BURIED UTILITY INFORMATION
48 HRS BEFORE YOU DIG
CALL 1-800-922-1987

STERLING RANCH – BRIARGATE PARKWAY
NOTES & DETAILS SHEET
DATE: 1/3/2018
SHEET 2 OF 5
SI02
PROJECT NO. 09-002
SCALE: HORIZONTAL: N/A VERTICAL: N/A
DESIGNED BY: DJM
DRAWN BY: ELY
CHECKED BY: VAS

20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485
CIVIL CONSULTANTS, INC.

FOR AND ON BEHALF OF MAKS CIVIL CONSULTANTS, INC.
VIRGIL A. SANCHEZ, COLORADO P.E. NO. 37160

REVISIONS:
NO. | DATE | DESCRIPTION | BY

THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

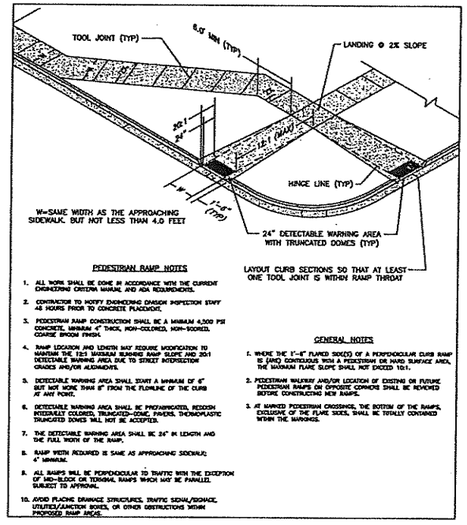
CAUTION

GENERAL CONSTRUCTION NOTES:

1. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE EXISTENCE AND LOCATION OF ALL UNDERGROUND UTILITIES ALONG THE ROUTE OF THE WORK. THE OMISSION FROM OR THE INCLUSION OF UTILITY LOCATIONS ON THE PLANS IS NOT TO BE CONSIDERED AS THE NONEXISTENCE OF OR A DEFINITE LOCATION OF EXISTING UNDERGROUND UTILITIES.
2. THE CONTRACTOR WILL TAKE THE NECESSARY PRECAUTIONS TO PROTECT EXISTING UTILITIES FROM DAMAGE DUE TO THIS OPERATION. ANY DAMAGE TO THE UTILITIES WILL BE REPAIRED AT THE CONTRACTOR'S EXPENSE, AND ANY SERVICE DISRUPTION WILL BE SETTLED BY THE CONTRACTOR.
3. ADDITIONAL EROSION CONTROL STRUCTURES MAY BE REQUIRED AT THE TIME OF CONSTRUCTION.
4. ALL BACKFILL, SUB-BASE, AND/OR BASE COURSE (CLASS 6) MATERIAL SHALL BE COMPACTED PER THE SOILS ENGINEER'S RECOMMENDATIONS, AND APPROVED BY EL PASO COUNTY DEVELOPMENT SERVICES ENGINEERING DIVISION.
5. ALL STATIONING IS CENTERLINE OF IMPROVEMENTS UNLESS OTHERWISE INDICATED. ALL ELEVATIONS ARE FLOW LINE UNLESS OTHERWISE INDICATED AS TOP BACK OF CURB (TBC), ASPHALT (ASP), OR TOP OF INLET OR BOX (TOB).
6. ALL DISTURBED PAVEMENT EDGES SHALL BE CUT TO NEAT LINES. REPAIR SHALL CONFORM TO EPC ECM APPENDIX K – 1.2C.
7. ALL INTERSECTION ACCESSES TO BE CONSTRUCTED WITH A 25 FOOT SIGHT VISIBILITY TRIANGLES EXCEPT [VOLLMER ROAD? MARKSHEFFEL ROAD? BRAIRGATE PARKWAY?] WHICH IS AN ARTERIAL AND A 50 FOOT SIGHT VISIBILITY TRIANGLE IS REQUIRED AND THERE SHALL BE NO OBSTRUCTIONS GREATER THAN 18" [?] IN THIS AREA.
8. ALL CULVERTS AND STORM DRAIN PIPES SHALL BE SMOOTH INTERIOR CORRUGATED POLYETHYLENE PIPE (HDPE), REINFORCED CONCRETE PIPE (RCP). ALL CULVERTS SHALL BE PLACED COMPLETE WITH FLARED END SECTIONS. ADEQUACY OF MATERIAL THICKNESS FOR ANY CSP INSTALLED SHALL BE VERIFIED BY OWNER'S GEOTECHNICAL ENGINEER TO SUPPORT MINIMUM 50 YEAR DESIGN LIFE. CULVERTS MUST CONFORM TO EPC ECM SECTION 3.32 – CULVERTS.
9. ASPHALT THICKNESS AND BASE COURSE THICKNESS (COMPACTED) FOR ROADS SHALL BE PER DESIGN REPORT BY OWNER'S GEOTECHNICAL ENGINEER. OWNER'S GEOTECHNICAL ENGINEER TO BE ON SITE AT THE TIME OF ROAD CONSTRUCTION TO EVALUATE SOIL CONDITIONS AND DETERMINE IF ADDITIONAL MEASURES ARE NECESSARY TO ASSURE STABILITY OF THE NEW ROADS. PAVEMENT DESIGN SHALL BE APPROVED BY EL PASO COUNTY DEVELOPMENT SERVICES ENGINEERING DIVISION PRIOR TO CONSTRUCTION.

SIGNING AND STRIPING NOTES:

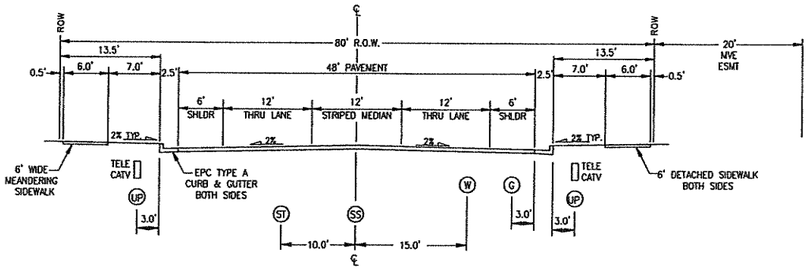
1. ALL SIGNS AND PAVEMENT MARKINGS SHALL BE IN COMPLIANCE WITH THE CURRENT MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD).
2. REMOVAL OF EXISTING PAVEMENT MARKINGS SHALL BE ACCOMPLISHED BY A METHOD THAT DOES NOT MATERIALLY DAMAGE THE PAVEMENT. THE PAVEMENT MARKINGS SHALL BE REMOVED TO THE EXTENT THAT THEY WILL NOT BE VISIBLE UNDER DAY OR NIGHT CONDITIONS. AT NO TIME WILL IT BE ACCEPTABLE TO PAINT OVER EXISTING PAVEMENT MARKINGS.
3. ANY DEVIATION FROM THE STRIPING AND SIGNING PLAN SHALL BE APPROVED BY EL PASO COUNTY DEVELOPMENT SERVICES.
4. ALL SIGNS SHOWN ON THE SIGNING AND STRIPING PLAN SHALL BE NEW SIGNS. EXISTING SIGNS MAY REMAIN OR BE REUSED IF THEY MEET CURRENT EL PASO COUNTY AND MUTCD STANDARDS.
5. STREET NAME AND REGULATORY STOP SIGNS SHALL BE ON THE SAME POST AT INTERSECTIONS.
6. ALL REMOVED SIGNS SHALL BE DISPOSED OF IN A PROPER MANNER BY THE CONTRACTOR.
7. ALL STREET NAME SIGNS SHALL HAVE "D" SERIES LETTERS, WITH LOCAL ROADWAY SIGNS BEING 4" UPPER-LOWER CASE LETTERING ON 8" BLANK AND NON-LOCAL ROADWAY SIGNS BEING 6" LETTERING, UPPER-LOWER CASE ON 12" BLANK, WITH A WHITE BORDER THAT IS NOT RECESSED. MULTI-LANE ROADWAYS WITH SPEED LIMITS OF 40 MPH OR HIGHER SHALL HAVE 8" UPPER-LOWER CASE LETTERING ON 18" BLANK WITH A WHITE BORDER THAT IS NOT RECESSED. THE WIDTH OF THE NON-RECESSED WHITE BORDERS SHALL MATCH PAGE 255 OF THE 2012 MUTCD "STANDARD HIGHWAY SIGNS"
8. ALL TRAFFIC SIGNS SHALL HAVE A MINIMUM HIGH INTENSITY PRISMATIC GRADE SHEETING.
9. ALL LOCAL RESIDENTIAL STREET SIGNS SHALL BE MOUNTED ON A 1.75" X 1.75" SQUARE TUBE SIGN POST AND STUB POST BASE. FOR OTHER APPLICATIONS, REFER TO THE CDOT STANDARD S-614-8 REGARDING USE OF THE P2 TUBULAR STEEL POST SLIPBASE DESIGN. ALL SIGNS SHALL BE SINGLE SHEET ALUMINUM WITH 0.100" MINIMUM THICKNESS.
10. ALL LIMIT LINES/STOP LINES, CROSSWALK LINES, PAVEMENT LEGENDS, AND ARROWS SHALL BE A MINIMUM 125 MIL THICKNESS PREFORMED THERMOPLASTIC PAVEMENT MARKINGS WITH TAPERED LEADING EDGES PER CDOT STANDARD S-627-1. WORD AND SYMBOL MARKINGS SHALL BE THE NARROW TYPE. STOP BARS SHALL BE 24" IN WIDTH. CROSSWALKS LINES SHALL BE 12" WIDE AND 8' LONG PER CDOT S-627-1.
11. ALL LONGITUDINAL LINES SHALL BE A MINIMUM 15MIL THICKNESS EPOXY PAINT. ALL NON-LOCAL RESIDENTIAL ROADWAYS SHALL INCLUDE BOTH RIGHT AND LEFT EDGE LINE STRIPING AND ANY ADDITIONAL STRIPING AS REQUIRED BY CDOT S-627-1.
12. THE CONTRACTOR SHALL NOTIFY EL PASO COUNTY DEVELOPMENT SERVICES (719) 520-6819 PRIOR TO AND UPON COMPLETION OF SIGNING AND STRIPING.
13. THE CONTRACTOR SHALL OBTAIN A WORK IN THE RIGHT OF WAY PERMIT FROM THE EL PASO COUNTY PUBLIC SERVICE DEPARTMENT (PSD) PRIOR TO ANY SIGNAGE OR STRIPING WORK WITHIN AN EXISTING EL PASO COUNTY ROADWAY.



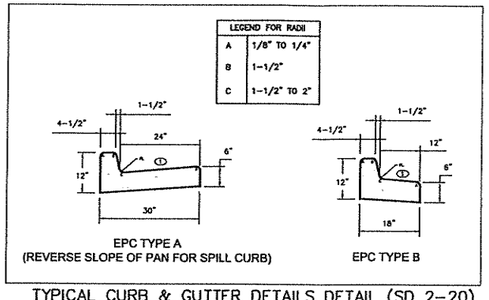
PEDESTRIAN INTERSECTION RAMP (SD 2-41)
SCALE: NTS

STANDARD NOTES FOR EL PASO COUNTY CONSTRUCTION PLANS

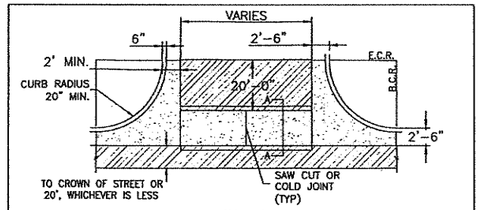
1. ALL DRAINAGE AND ROADWAY CONSTRUCTION SHALL MEET THE STANDARDS AND SPECIFICATIONS OF THE CITY OF COLORADO SPRINGS/EL PASO COUNTY DRAINAGE CRITERIA MANUAL, VOLUMES 1 AND 2, AND THE EL PASO COUNTY ENGINEERING CRITERIA MANUAL.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR THE NOTIFICATION AND FIELD NOTIFICATION OF ALL EXISTING UTILITIES, WHETHER SHOWN ON THE PLANS OR NOT, BEFORE BEGINNING CONSTRUCTION. LOCATION OF EXISTING UTILITIES SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION. CALL 811 TO CONTACT THE UTILITY NOTIFICATION CENTER OF COLORADO (UNCC).
3. CONTRACTOR SHALL KEEP A COPY OF THESE APPROVED PLANS, THE GRADING AND EROSION CONTROL PLAN, THE STORMWATER MANAGEMENT PLAN (SWMP), THE SOILS AND GEOTECHNICAL REPORT, AND THE APPROPRIATE DESIGN AND CONSTRUCTION STANDARDS AND SPECIFICATIONS AT THE JOB SITE AT ALL TIMES, INCLUDING THE FOLLOWING:
   a. EL PASO COUNTY ENGINEERING CRITERIA MANUAL (ECM)
   b. CITY OF COLORADO SPRINGS/EL PASO COUNTY DRAINAGE CRITERIA MANUAL, VOLUMES 1 AND 2
   c. COLORADO DEPARTMENT OF TRANSPORTATION (CDOT) STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION
   d. CDOT M & S STANDARDS
4. NOTWITHSTANDING ANYTHING DEPICTED IN THESE PLANS IN WORDS OR GRAPHIC REPRESENTATION, ALL DESIGN AND CONSTRUCTION RELATED TO ROADS, STORM DRAINAGE AND EROSION CONTROL SHALL CONFORM TO THE STANDARDS AND REQUIREMENTS OF THE MOST RECENT VERSION OF THE RELEVANT ADOPTED EL PASO COUNTY STANDARDS, INCLUDING THE LAND DEVELOPMENT CODE, THE ENGINEERING CRITERIA MANUAL, THE DRAINAGE CRITERIA MANUAL, AND THE DRAINAGE CRITERIA MANUAL VOLUME 2. ANY DEVIATIONS FROM REGULATIONS AND STANDARDS MUST BE REQUESTED, AND APPROVED, IN WRITING. ANY MODIFICATIONS NECESSARY TO MEET CRITERIA AFTER-THE-FACT WILL BE ENTIRELY THE DEVELOPER'S RESPONSIBILITY TO RECTIFY.
5. IT IS THE DESIGN ENGINEER'S RESPONSIBILITY TO ACCURATELY SHOW EXISTING CONDITIONS, BOTH ONSITE AND OFFSITE, ON THE CONSTRUCTION PLANS. ANY MODIFICATIONS NECESSARY DUE TO CONFLICTS, OMISSIONS, OR CHANGED CONDITIONS WILL BE ENTIRELY THE DEVELOPER'S RESPONSIBILITY TO RECTIFY.
6. CONTRACTOR SHALL SCHEDULE A PRE-CONSTRUCTION MEETING WITH EL PASO COUNTY DEVELOPMENT SERVICES DEPARTMENT (DSD) – INSPECTIONS, PRIOR TO STARTING CONSTRUCTION.
7. IT IS THE CONTRACTOR'S RESPONSIBILITY TO UNDERSTAND THE REQUIREMENTS OF ALL JURISDICTIONAL AGENCIES AND TO OBTAIN ALL REQUIRED PERMITS, INCLUDING BUT NOT LIMITED TO EL PASO COUNTY EROSION AND STORMWATER QUALITY CONTROL PERMIT (ESQCP), REGIONAL BUILDING FLOODPLAIN DEVELOPMENT PERMIT, U.S. ARMY CORPS OF ENGINEERS-ISSUED 401 AND/OR 404 PERMITS, AND COUNTY AND STATE FUGITIVE DUST PERMITS.
8. CONTRACTOR SHALL NOT DEVIATE FROM THE PLANS WITHOUT FIRST OBTAINING WRITTEN APPROVAL FROM THE DESIGN ENGINEER AND DSD. CONTRACTOR SHALL NOTIFY THE DESIGN ENGINEER IMMEDIATELY UPON DISCOVERY OF ANY ERRORS OR INCONSISTENCIES.
9. ALL STORM DRAIN PIPE SHALL BE CLASS III RCP UNLESS OTHERWISE NOTED AND APPROVED BY DSD.
10. CONTRACTOR SHALL COORDINATE GEOTECHNICAL TESTING PER ECM STANDARDS. PAVEMENT DESIGN SHALL BE APPROVED BY EL PASO COUNTY DSD PRIOR TO PLACEMENT OF CURB AND GUTTER AND PAVEMENT.
11. ALL CONSTRUCTION TRAFFIC MUST ENTER/EXIT THE SITE AT APPROVED CONSTRUCTION ACCESS POINTS.
12. SIGHT VISIBILITY TRIANGLES AS IDENTIFIED IN THE PLANS SHALL BE PROVIDED AT ALL INTERSECTIONS. OBSTRUCTIONS GREATER THAN 18 INCHES ABOVE FLOWLINE ARE NOT ALLOWED WITHIN SIGHT TRIANGLES.
13. SIGNING AND STRIPING SHALL COMPLY WITH EL PASO COUNTY DOT AND MUTCD CRITERIA. [IF APPLICABLE, ADDITIONAL SIGNING AND STRIPING NOTES WILL BE PROVIDED.]
14. CONTRACTOR SHALL OBTAIN ANY PERMITS REQUIRED BY EL PASO COUNTY DOT, INCLUDING WORK WITHIN THE RIGHT-OF-WAY AND SPECIAL TRANSPORT PERMITS.
15. THE LIMITS OF CONSTRUCTION SHALL REMAIN WITHIN THE PROPERTY LINE UNLESS OTHERWISE NOTED. THE OWNER/DEVELOPER SHALL OBTAIN WRITTEN PERMISSION AND EASEMENTS, WHERE REQUIRED, FROM ADJOINING PROPERTY OWNER(S) PRIOR TO ANY OFF-SITE DISTURBANCE, GRADING, OR CONSTRUCTION.



STERLING RANCH ROAD
URBAN NON-RESIDENTIAL COLLECTOR
SCALE: NTS



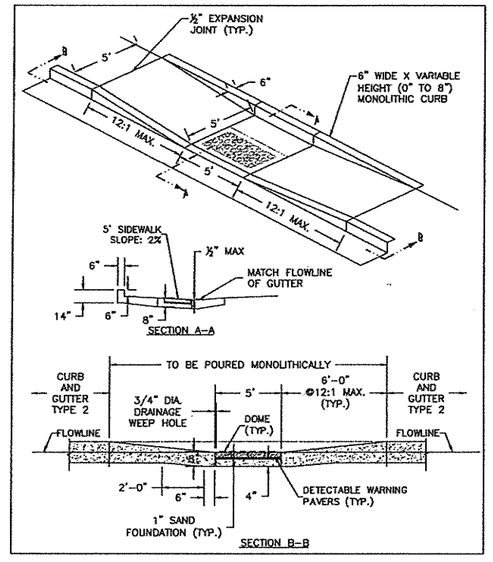
TYPICAL CURB & GUTTER DETAILS DETAIL (SD 2-20)
SCALE: NTS



NOTES

1. W – WIDTH SHALL BE 6' FOR LOCAL, 8' FOR COLLECTORS, AND 10' FOR ARTERIAL ROADS.
2. T – SQUARED-OFF RETURN TO BE POURED MONOLITHICALLY, 8" PCC FOR LOCAL ROADS, 9" FOR COLLECTORS WITH 6x6 – 4.4 W.W.F. OR #4 REINFORCING BAR @ 18" EACH WAY.
3. ▨ = 3" MINIMUM ASPHALT DEPTH (2 LIFTS).
4. DESIGN TO SPECIFY ELEVATIONS AT PI AND PCR.

TYPICAL CROSS PAN LAYOUT DETAIL (SD 2-26)
SCALE: NTS



PARALLEL PEDESTRIAN RAMP DETAIL (SD 2-50)
SCALE: NTS

FOR LOCATING & MARKING GAS, ELECTRIC, WATER & TELEPHONE LINES
FOR BURIED UTILITY INFORMATION
48 HRS BEFORE YOU DIG
CALL 1-800-922-1987

STERLING RANCH – STERLING RANCH ROAD
NOTES & DETAILS SHEET

PROJECT NO. 09-602 | SCALE: HORIZONTAL: NTS VERTICAL: N/A | DATE: 07/05/2017 | SHEET 2 OF 5 | SI02

DESIGNED BY: ####
DRAWN BY: SM
CHECKED BY: ####

20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE 719.955.5485
CIVIL CONSULTANTS, INC.

FOR AND ON BEHALF OF M&S CIVIL CONSULTANTS, INC.
VIRGIL A. SANCHEZ, COLORADO P.E. NO. 37160

REVISIONS:			
NO.	DATE:	BY:	DESCRIPTION:

APPVD. BY: DATE:

THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE, OR LIABLE FOR, UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES TO THE PLANS MUST BE IN WRITING AND MUST BE APPROVED BY THE PREPARER OF RECORD.

CAUTION

Appendix D

Sterling Ranch 404 Permit

NOT SIGNED
6-24-16

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
200 SOUTH SANTA FE AVENUE, SUITE 301
PUEBLO, COLORADO 81003-4270

REPLY TO
ATTENTION OF

February 18, 2016

Regulatory Division

SUBJECT: Action No. SPA-2015-00428-SCO, Sterling Ranch Residential Development Project, El Paso County, Colorado

Jim Morley
SR Land, LLC
20 Boulder Crescent Suite 201
Colorado Springs, CO 80903

Mr. Morley:

Enclosed for your review and signature are two copies of the draft permit for Action No. SPA-2015-00428-SCO discharge dredged and fill material into waters of the United States.

You may either sign the permit or object to the permit and request the permit to be modified in accordance with the enclosed Notification of Administrative Appeal Options and Process and Request For Appeal (NAAOP-RFA). If you elect to object to this permit, you must complete Section II (Request for Appeal or Objections to an Initial Proffered Permit) of the enclosure and return to: U.S. Army Corps of Engineers, Attn: Mr. Tom Cavanaugh, Administrative Appeal Review Officer, 1455 Market Street, Room 1760, San Francisco, CA 94103-1399, within 60 days of the date of this letter.

If you elect to sign the permit, please ensure that both copies are signed and dated and return them to the attention of the Regulatory Division at the address above. Your signature on the permit indicates that you accept the permit in its entirety and forfeit all rights to appeal the permit or its terms and conditions, and denotes your assurance that the work will be conducted in accordance with the plans, description, and all terms and conditions of the permit.

A fee in the amount of $100.00 for commercial project must be paid before the permit can be issued. Your check should be made payable to the "Finance and Accounting Officer, UFC, Albuquerque", and mailed to the attention of the Regulatory Division at the above address.

Within ten days, both signed copies of the accepted permit should be returned to us. One copy of the signed permit will be returned to you. The permit is not valid until signed by the U.S. Army Corps of Engineers. If you have any questions concerning this

permit, please contact me at 719-543-6915 or by e-mail at van.a.truan@usace.army.mil.

Sincerely,

Van Truan
Chief, Southern Colorado
Regulatory Branch

Enclosures

SIGNED

DEPARTMENT OF THE ARMY
ALBUQUERQUE DISTRICT, CORPS OF ENGINEERS
200 SOUTH SANTA FE AVENUE, SUITE 301
PUEBLO, COLORADO 81003-4270

REPLY TO
ATTENTION OF

February 29, 2016

Regulatory Division

SUBJECT: Action No. SPA-2015-00428-SCO, Sterling Ranch Residential Development Project, El Paso County, Colorado

Jim Morley
SR Land, LLC
20 Boulder Crescent Suite 201
Colorado Springs, CO 80903

Mr. Morley:

You are hereby authorized under Section 404 of the Clean Water Act to discharge dredged and fill material into waters of the United States to conduct work in associated with construction of the Sterling Ranch Residential Development in accordance with Action Number SPA-2015-00428-SCO. A copy of the permit is enclosed.

To use this permit, you must ensure that the work is conducted in accordance with the terms and conditions of the permit. You must submit revised drawings to us for approval prior to construction should any changes be found necessary in either the location or plans for the work. Approval of revised plans may be granted if they are found not contrary to the public interest.

This permit is not an approval of the project design features, nor does it imply that the construction is adequate for its intended purpose. This permit does not authorize any injury to property or invasion of rights or any infringement of Federal, state or local laws or regulations. You must possess the authority, including property rights, to undertake the proposed work.

Enclosed is a compliance certification form. Upon completion of the project, please sign and date the form and return it to this office.

If you have any questions concerning our regulatory program, please contact me at 719-543-6915 or by e-mail at van.a.truan@usace.army.mil. At your convenience,

please complete a Customer Service Survey at http://per2.nwp.usace.army.mil/survey.html.

Sincerely,

Van Truan
Chief, Southern Colorado
Regulatory Branch

Enclosure(s)

Certification of Compliance
with Department of the Army Permit

Action Number: SPA-2015-00428-SCO

Name of Permittee: SR Land, LLC

Upon completion of the activity authorized by this permit and any mitigation required by the permit, sign this certification and return it to the following address:

Van Truan
Albuquerque District, U.S. Army Corps of Engineers
200 South Santa Fe Avenue, Suite 301
Pueblo, Colorado 81003-4270

Please note that your permitted activity is subject to a compliance inspection by an U.S. Army Corps of Engineers representative. If you fail to comply with this permit, you are subject to permit suspension, modification, or revocation.

Please enclose photographs showing the completed project (if available).

I hereby certify that the work authorized by the above referenced permit has been completed in accordance with the terms and conditions of the said permit, and required mitigation was completed in accordance with the permit conditions.

Date Work Started _____

Date Work Completed _____

_____ _____
Date Signature of Permittee

DEPARTMENT OF THE ARMY PERMIT

Permittee Jim Morley

Permit No. SPA-2015-00428-SCO

Issuing Office Albuquerque District, U.S. Army 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 Sterling Ranch Residential Development Project includes installation of attendant utilities, channel improvements to the main stem of Sand Creek, three off-line stormwater detention ponds, development of two permanent residential access roads and associated culverts, and development of residential units. Permanent impacts to waters of the US will result from construction of the residential access roads and associated culverts, and construction of residential units in the unnamed western tributary to Sand Creek. Total cumulative permanent impacts from the discharge of fill material into waters/wetlands of the US from the proposed project will total 4.21 acres and 5,048 linear feet within the main channel of Sand Creek and its western tributary. The project will be constructed in accordance with the attached drawings, entitled, "Sterling Ranch Wetland Impact Location Map, Sterling Ranch Sketch Plan figure number 8, and Sterling Ranch Channel Improvements & Mitigation Plan sheets 1 through 3 dated October 13, 2015, in Sand Creek, El Paso County, Colorado, Application by Jim Morley, Application No. SPA-2015-00428-SCO".

Project Location: The project is located on 1,443.7 acres northeast of the intersection of Black Forest Road and Woodmen Road in unincorporated El Paso County, Colorado. The property is on the United States Geological Survey (USGS) Falcon Quadrangle on portions of Sections 27, 28, 32, 33, and 34 in Township 12 South, Range 65 West and the northwest portion of Section 4, Township 13 South, Range 65 West. The approximate coordinates of the project center are 39.964483 latitude and -104.664944 longitude (WGS 84 datum).

Permit Conditions: In accordance with the attached Colorado Department of Public Health and Environment Section 401 Water Quality Certification pages 1 through 6 of 6, dated February 4, 2016.

General Conditions:

1. The time limit for completing the work authorized ends on March 1, 2021. 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:

1. The permittee shall implement and abide by the compensatory mitigation plan titled Conceptual Mitigation Plan for Sterling Ranch Residential Development, prepared by CORE Consultants, Inc. on October 29, 2015 except where changes are necessary to comply with special conditions listed below. The permittee shall implement the mitigation plan concurrently with the construction of the project and complete the initial construction and plantings associated with the mitigation work prior to EITHER the initiation of operation OR completion of construction of the project. Completion of all elements of this mitigation plan is a requirement of this permit.

2. The permittee shall submit annual compensatory mitigation site monitoring reports to the Corps Albuquerque District Office by December 31st of each year, beginning in 2016, for a minimum of 3 years or until the Corps has determined that the mitigation performance standards and success criteria have been met. The monitoring reports shall be prepared in accordance with Corps Regulatory Guidance Letter 08-03 (Minimum Monitoring Requirements for Compensatory Mitigation Projects Involving the Restoration, Establishment, and/or Enhancement of Aquatic Resources) and current Corps Albuquerque District Mitigation Monitoring Guidelines available at http://www.spa.usace.army.mil/Missions/RegulatoryProgramandPermits/Mitigation.aspx. The mitigation monitoring reports shall at a minimum include the following:

a. Comparison of pre-construction site conditions to an as-built survey as submitted in accordance with Special Condition 4.

b. A map showing the wetland AND/OR Ordinary High Water Mark (OHWM) delineation, and aerial photos marked to show the wetland AND/OR OHWM boundary.

c. Photographs (minimum 5) from fixed photographic monitoring points with a location reference map and indicating camera orientation.

d. All data collected to document whether the mitigation site is achieving performance standards described in the mitigation plan and a narrative discussion of progress made toward meeting performance standards.

e. Fish and wildlife observations at the mitigation site.

f. Summary statement regarding the perceived success of the mitigation project and any potential problem areas. Suggestions and a timetable for corrections should be included if it is anticipated that project goals may not be met.

g. Date(s) of field inspection(s).

3. In order to assist the Corps in scheduling compliance inspections, the permittee shall notify the Corps Albuquerque District Office, in writing, at least 7 calendar days in advance of the initiation of mitigation construction AND no later than 15 calendar days following completion of construction activities.

4. Within 60 days after completion of construction of the mitigation project, the permittee shall submit as-built drawings and a description of the work conducted to the Corps Albuquerque District Office. The drawings shall include the following:

a. The Department of the Army Action Number.

b. A plan view drawing of the location of the authorized work footprint (as shown in permit drawings) with an overlay of the work as constructed in the same scale. The drawing should show all "earth disturbance," wetland impacts, structures, and the boundaries of any on-site and/or off-site mitigation or avoidance areas. The drawings shall contain, at a minimum, 1-foot OR greater topographic contours of the entire site.

c. Ground photographs of the completed work. The camera positions and view-angles of the ground photographs shall be identified on a map, aerial photograph, or project drawing.

d. A description of all deviations between the work as authorized by the permit and the work as constructed. Clearly indicate on the as-built drawings the location of any deviations.

5. Your responsibility to complete the required compensatory mitigation as set forth in Special Condition No. 1 will not be considered fulfilled until you have demonstrated mitigation success and have received written verification from the U.S. Army Corps of Engineers.

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).

(X) 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) 2/23/2016 (DATE)

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

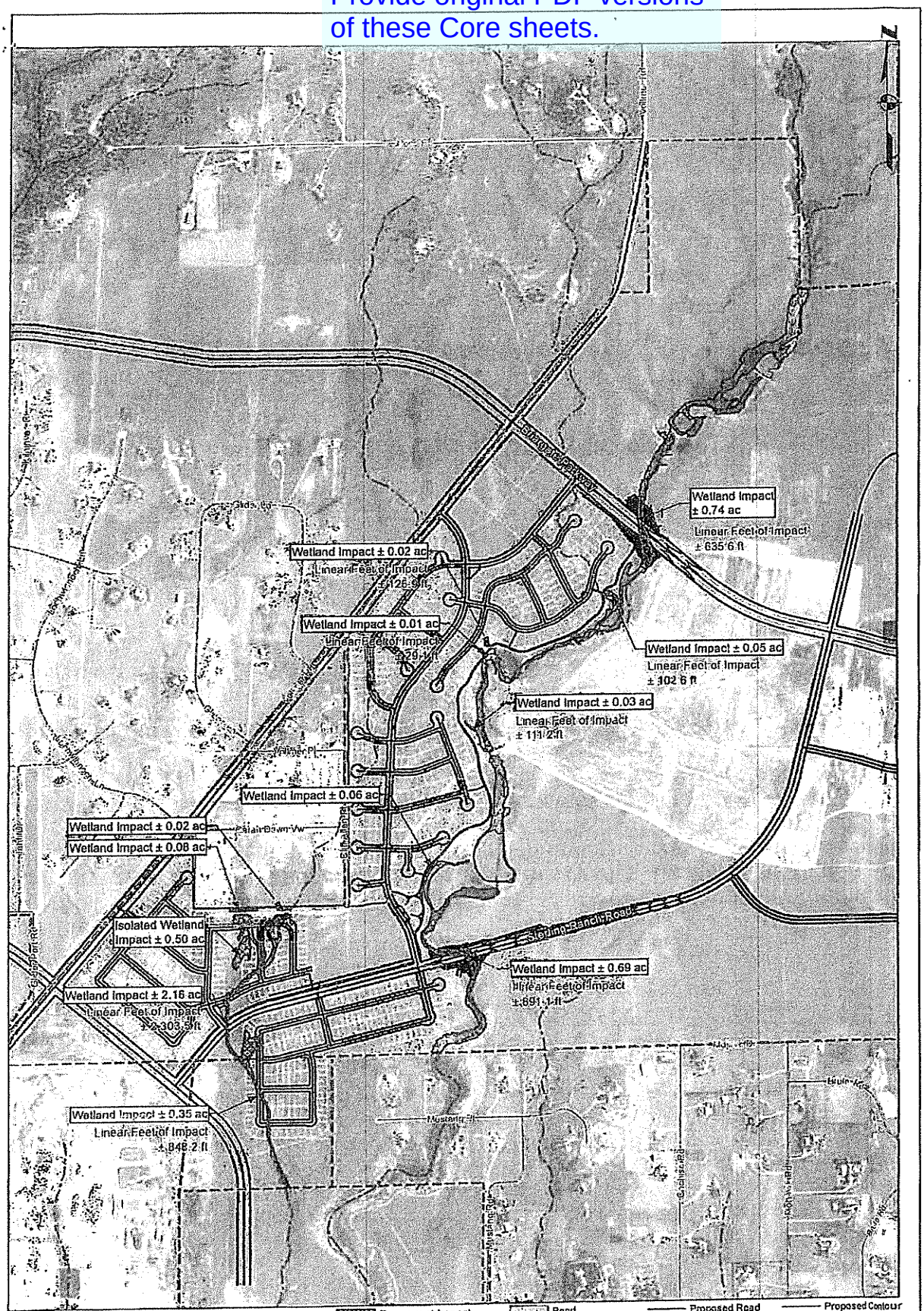
(FOR THE DISTRICT ENGINEER) 29 Feb 2016 (DATE)

Patrick J. Dagon
Lieutenant Colonel, U.S. Army
District Commander

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)

Provide original PDF versions of these Core sheets.



CORE CONSULTANTS

CIVIL ENGINEERING
DEVELOPMENT CONSULTING
LAND SURVEYING

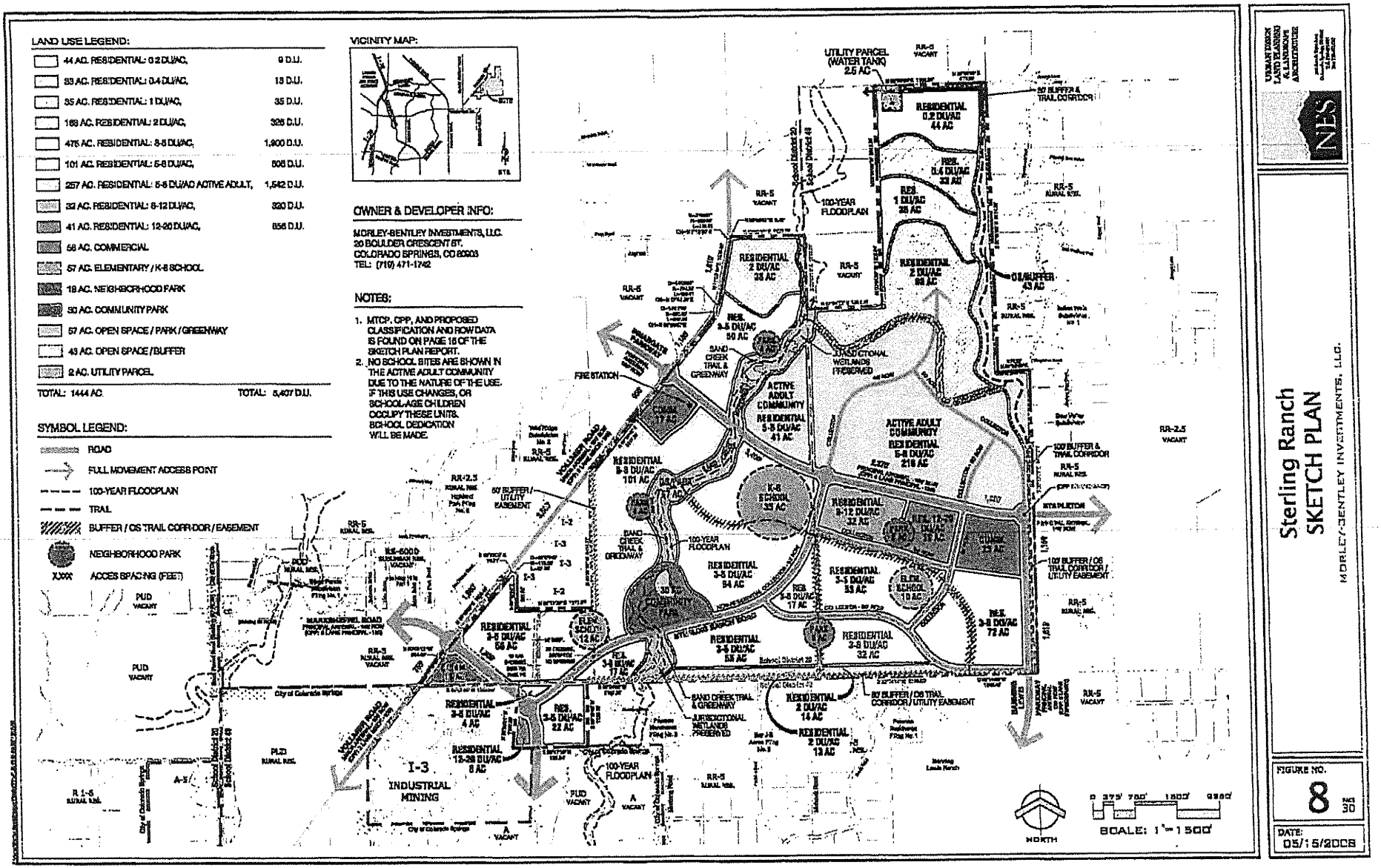
303.703.4444
1950 W. Littleton Blvd., Ste. 109
Littleton, CO 80120

Sterling Ranch

Wetland Impact Location Map

El Paso County, Colorado

Date: 10/13/2015
Project #: 15-001



URBAN PLANNING LAND PLANNING & LANDSCAPE ARCHITECTURE

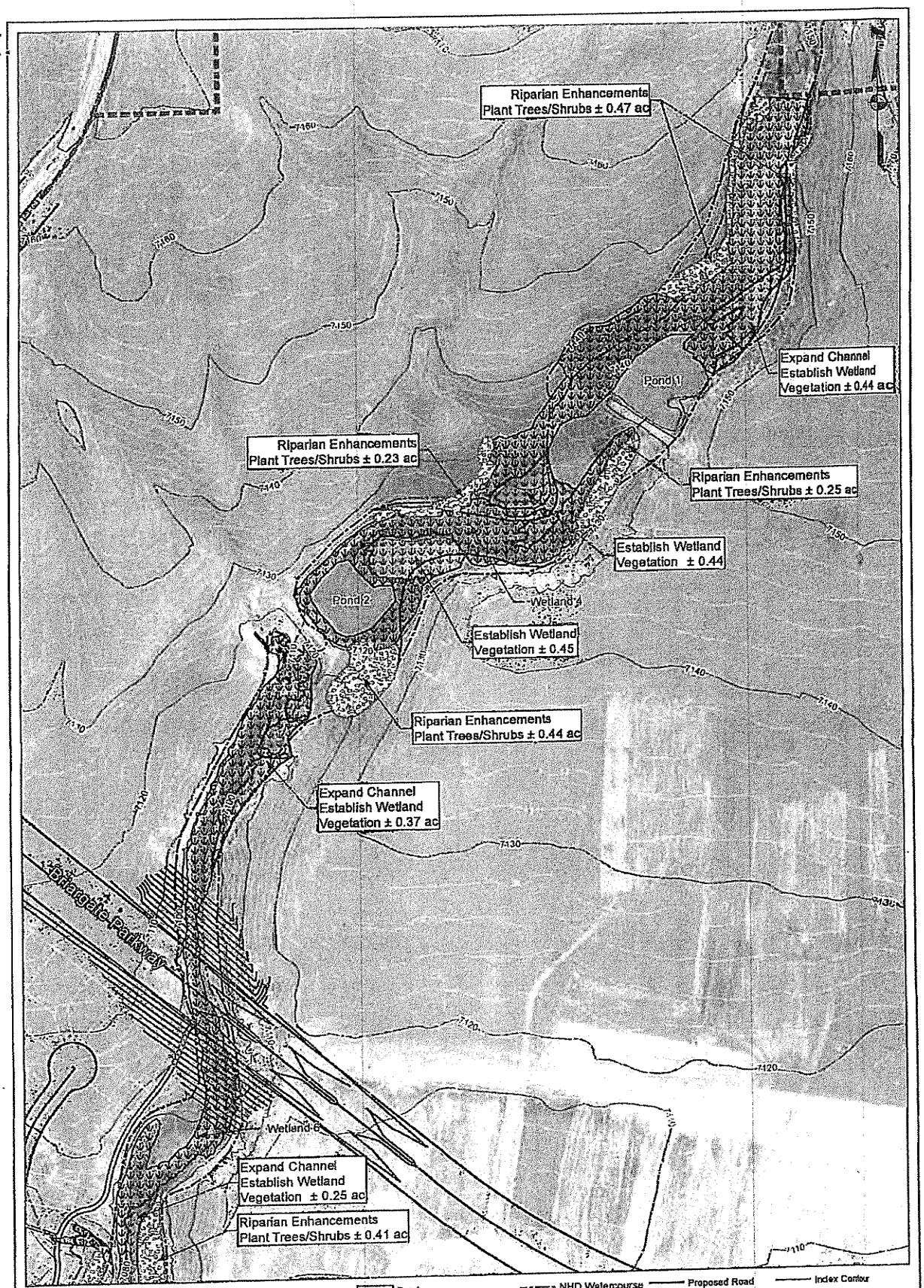
NES

Sterling Ranch
SKETCH PLAN

MORLEY-BENTLEY INVESTMENTS, LLC.

FIGURE NO.
8
PAGE 30

DATE:
05/15/2008



CORE CONSULTANTS

CIVIL ENGINEERING
DEVELOPMENT CONSULTING
LAND SURVEYING

303.703.4444
1950 W. Littleton Blvd., Ste. 105
Littleton, CO 80120

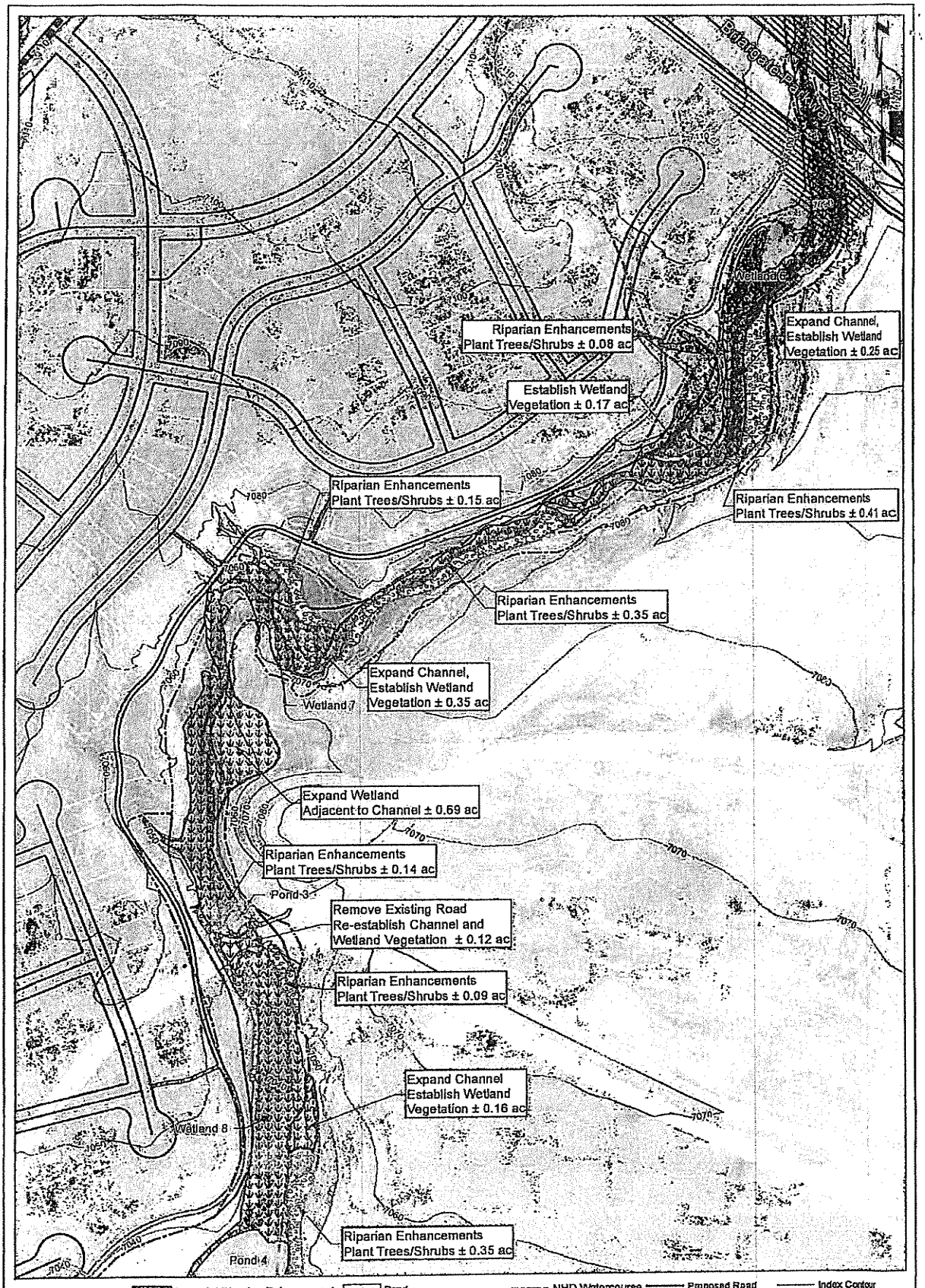
Sterling Ranch

Channel Improvements & Mitigation Plan

Sheet 1

El Paso County, Colorado

Date: 10/13/2015
Project #: 15-001



CORE CONSULTANTS

CIVIL ENGINEERING
DEVELOPMENT CONSULTING
LAND SURVEYING

303.703.4444
1950 W. Littleton Blvd., Ste. 109
Littleton, CO 80120

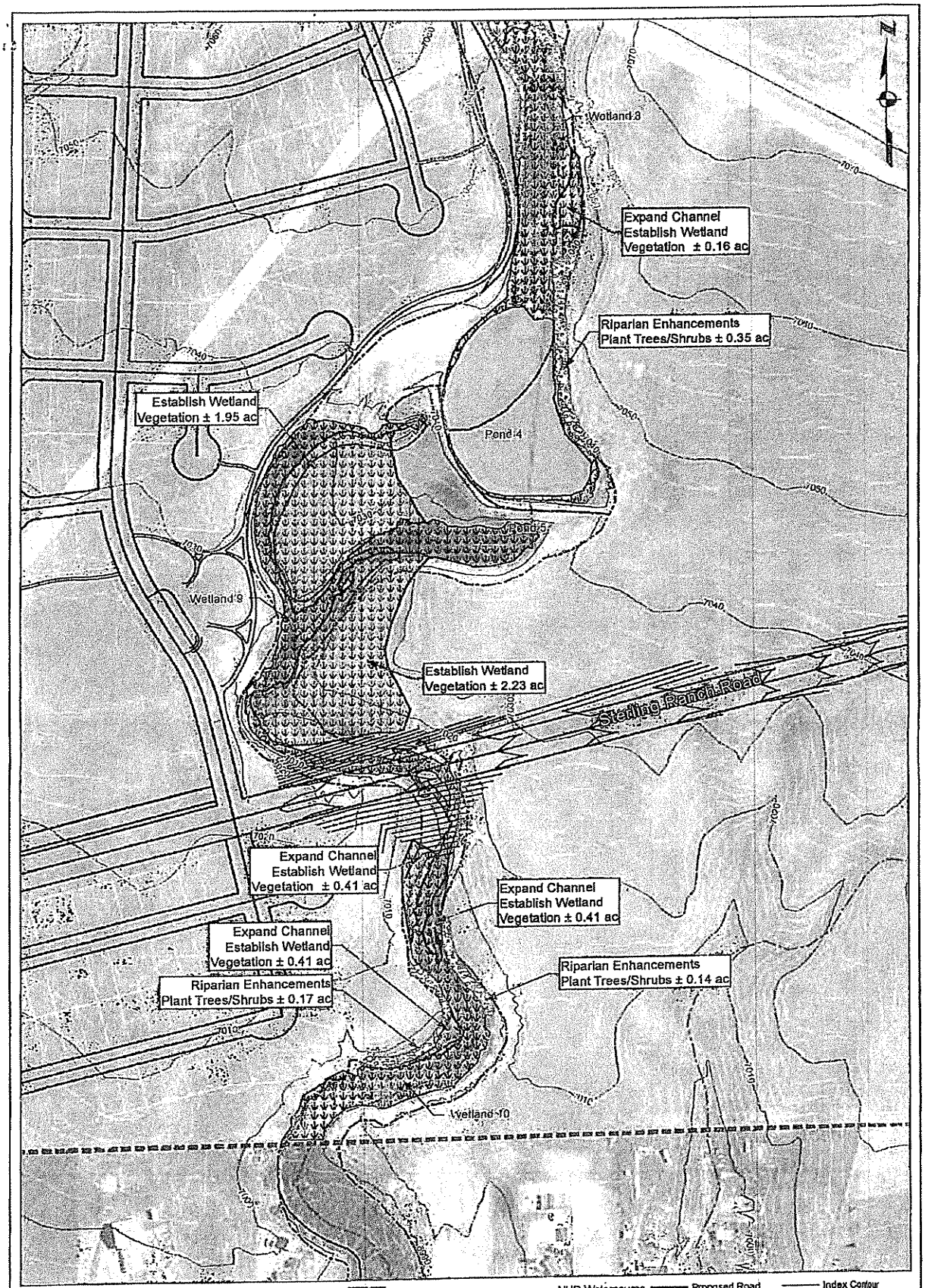
Sterling Ranch

Channel Improvements & Mitigation Plan

Sheet 2

El Paso County, Colorado

Date: 10/13/2015
Project #: 15-001



0 100 200
Feet

Potential Riparian Enhancement
Potential Wetland Mitigation Area
Existing Wetland
Pond
Dry Wash
Existing Isolated Wetland
NHD Watercourse
100-year Floodplain
500-year Floodplain
Proposed Road
Proposed Trail
Proposed Lot Lines
Proposed Contour
Index Contour
Intermediate Contour
Parcel Boundary

CORE CONSULTANTS
CIVIL ENGINEERING
DEVELOPMENT CONSULTING
LAND SURVEYING
303.703.4444
1950 W. Littleton Blvd., Ste 109
Littleton, CO 80120

Sterling Ranch

Channel Improvements & Mitigation Plan

Sheet 3

El Paso County, Colorado

Date: 10/13/2015
Project #: 15-001

PUBLIC NOTICE

US Army Corps of Engineers®
Albuquerque District
Project

Permit Application No.:	SPA-2015-00428-SCO
Project Name:	Sterling Ranch Residential Development Project
Applicant:	SR Land, LLC
Waterway:	Sand Creek
Public Notice Date:	December 9, 2015
Comment Due Date:	January 9, 2016
USACE Contact Phone:	(719) 543-8102

Reply To:

Southern Colorado Regulatory Office
US Army Corps of Engineers, Albuquerque District
200 South Santa Fe Avenue, Suite 301
Pueblo, Colorado 81003-4270

PERMIT APPLICATION UNDER SECTION 404 OF THE CLEAN WATER ACT (33 USC 1344)

Summary of Proposed Project: We are requesting public comment on the following project before the above comment due date. The application is for a permit to place dredged/fill material into waters of the US associated with the construction of a residential development in Sand Creek and one tributary located near Falcon, El Paso County, Colorado. Details of the proposed project are provided below.

Name of Applicant: SR Land, LLC, 20 Boulder Crescent, Suite 201, Colorado Springs, CO 80903.

Location: The project is located on 1,443.7 acres northeast of the intersection of Black Forest Road and Woodmen Road in unincorporated El Paso County, Colorado. The property is on the United States Geological Survey (USGS) Falcon Quadrangle on portions of Sections 27, 28, 32, 33, and 34 in Township 12 South, Range 65 West and the northwest portion of Section 4, Township 13 South, Range 65 West. The approximate coordinates of the project center are 39.964483 latitude and -104.664944 longitude (WGS 84 datum).

Description of Work: The Sterling Ranch Residential Development Project includes installation of attendant utilities, channel improvements to the main stem of Sand Creek, three off-line stormwater detention ponds, development of two permanent residential access roads and associated culverts, and development of residential units. Permanent impacts to waters of the US will result from construction of the residential access roads and associated culverts, and construction of residential units in the unnamed western

NEWS RELEASE

tributary to Sand Creek. Total cumulative permanent impacts to waters of the US from the proposed project will total 4.21 acres and 5,048 linear feet within the main channel of Sand Creek and its western tributary.

Purpose and Need: The project purpose is twofold: (1) the development of a medium sized single-family residential development and associated facilities and infrastructure on multiple parcels of land which will be incorporated in the City of Colorado Springs; and (2) creek channel improvements for hydrology and stormwater capability through control of flood water conveyance, establishing improved grade control, and facilitating improved water quality.

Likewise, the project need is twofold: (1) to satisfy market demand for additional housing in the City of Colorado Springs, El Paso County, based on recent County and City economic development reports; and (2) to address a County-wide high-priority stormwater management project while simultaneously managing an increase in stormwater runoff to Sand Creek via channel improvements.

Mitigation: Mitigation for impacts to wetlands and waters of the US on the Sterling Ranch project site is proposed within the Middle Fountain Creek watershed and includes creation of 4.21 acres of emergent wetlands located within and adjacent to the main channel of Sand Creek, with improvements throughout to allow for construction and reestablishment of wetlands.

Plans and Data: Drawings showing the location of the work site and other data are enclosed with this notice. If additional information is desired, it may be obtained from the applicant, or from:

Christopher M. Grosso
U.S. Army Corps of Engineers
Southern Colorado Regulatory Office
200 South Santa Fe Avenue, Suite 301
Pueblo, Colorado 81003-4270
(719) 543-8102
Fax No. (719) 543-9475
E-mail: Christopher.M.Grosso@usace.army.mil

Statement of Findings: The Corps consulted district files and records, the latest version of the National Register of Historic Places (NRHP), and state records of NRHP-eligible and potentially eligible historic properties to determine if there are any historic properties that may be affected by the proposed undertaking. Based on this initial information, the Corps has made a preliminary determination that the proposed project will not affect any historic properties that meet the criteria for inclusion in the NRHP.

The Corps has reviewed the U.S. Fish and Wildlife Service's latest published version of Federally-listed endangered and threatened species located in El Paso County, Colorado to determine if any listed species or their critical habitat may occur in the proposed project area. The Corps has made a preliminary determination that the

proposed project will not affect any Federally-listed endangered or threatened species or their critical habitat that are protected by the Endangered Species Act.

The applicant is required to obtain water quality certification, under Section 401 of the Clean Water Act, from the Colorado Department of Public Health and Environment. Section 401 requires that any applicant for an individual Section 404 permit provide proof of water quality certification to the Corps of Engineers prior to permit issuance.

In accordance with environmental procedures and documentation required by the National Environmental Policy Act of 1969, an environmental assessment will be prepared for this project. Upon completion, the assessment may be seen at the U.S. Army Corps of Engineers, Albuquerque District Office, at the address given above.

Comments: Any comments concerning this project should be received by the District Engineer no later than January 9, 2016. Comments received after the end of the Public Notice comment period will not be considered. However, more time may be given if a request, with a valid reason, is received prior to the suspense date. The Corps of Engineers is soliciting comments from the public; federal, state, and local agencies and officials; Indian tribes; and other interested parties in order to consider and evaluate the impacts of this proposed activity. Any comments received will be considered by the Corps of Engineers to determine whether to issue, modify, condition, or deny a permit for this proposal. To make this decision, comments are used to assess impacts on endangered species, historic properties, water quality, general environmental effects, and the other public interest factors listed below. Comments are used in the preparation of an Environmental Assessment and/or an Environmental Impact Statement pursuant to the National Environmental Policy Act. Comments are also used to determine the need for a public hearing and to determine the overall public interest of the proposed activity.

The decision whether to issue a permit will be based on an evaluation of the probable impact, including cumulative impacts, of the proposed activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefit which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. The evaluation of the impact of this activity will include application of the guidelines promulgated by the Administrator, EPA, under authority of Section 404(b) of the Clean Water Act. All factors relevant to the proposal and the cumulative effects will be considered; among these are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership, and, in general, the needs and welfare of the people.

If the District Engineer determines that the project complies with the 404(b) (1) guidelines, he will grant the permit unless issuance would be contrary to the public interest.

Any person may request a public hearing. The request must be submitted, in writing, to the District Engineer within 21 days of the date of this notice and must clearly set forth the reasons for holding a public hearing.

Patrick J. Dagon
Lieutenant Colonel, U.S. Army
District Commander

Enclosures:
Sheet 1 of 2 – Wetland Location Map
Sheet 2 of 2 – Wetland Impact Location Map

COLORADO
Department of Public
Health & Environment

Dedicated to protecting and improving the health and environment of the people of Colorado

February 4, 2016

SR Land, LLC
Attn: Jim Morley
20 Boulder Crescent, Ste. 201
Colorado Springs, CO 80903

Re: Section 401 Water Quality Certification
Colorado 401 Certification No.: 4378
US Corps of Engineers 404 Permit No.: SPA-2015-00428-SCO
Description: Construction of a residential development
Location: Latitude: 38.962389, Longitude -104.675084 in El Paso County, Colorado
Watercourse: Sand Creek and tributaries, Arkansas River Basin, Segment COARFO04 of Fountain Creek Sub-basin
Designation: Use Protected

Dear Mr. Morley:

The Colorado Department of Public Health and Environment (CDPHE), Water Quality Control Division (Division) has completed its review of the subject Clean Water Act (CWA) Section 404 Permit Application, and our preliminary determination with the issuance of the State of Colorado 401 Certification Public Notice (5 CCR 1002-82.5(B)). This segment is designated "Use Protected" thus no antidegradation review is required (5 CCR 1002-31.8(2)).

This letter shall serve as official notification that the Division is issuing "Regular Certification" in accordance with 5 CCR 1002-82.5(A)(2).

The 401 Certification issued by the Division pursuant to 5 CCR 1002-82.3(C) shall apply to both the construction and operation of the project for which a federal license or permit is required, and shall apply to the water quality impacts associated with the project. This certification does not constitute a relinquishment of the Division's authority as defined in the Colorado Water Quality Control Act, nor does it fulfill or waive any other local, state, or federal regulations.

If you have any questions or need additional information, please contact me at (303) 692-3586.

Sincerely,

John C. Hranac
Water Quality Assessor
Environmental Data Unit
Water Quality Control Division

Attachment

cc: US Army Corps of Engineers, Southern Colorado Regulatory Office
Applicant's Agent, Mr. Chris Haas - CORE Consultants, Inc.
File

Certification Requirements:

(A) The following requirements shall apply to all certifications:

(1) Authorized representatives from the Division shall be permitted to enter upon the site where the construction activity or operation of the project is taking place for purposes of inspection of compliance with BMPs and certification conditions.

(2) In the event of any changes in control or ownership of facilities where the construction activity or operation of the project is taking place, the successor shall be notified in writing by his predecessor of the existence of the BMPs and certification conditions. A copy of such notification shall be provided to the Division.

(3) If the permittee discovers that certification conditions are not being implemented as designed, or if there is an exceedance of water quality standards despite compliance with the certification conditions and there is reason to believe that the exceedance is caused, in whole or in part, by the project, the permittee shall verbally notify the Division of such failure or exceedance within two (2) working days of becoming aware of the same. Within ten (10) working days of such notification, the permittee shall provide to the Division, in writing, the following:

(a) In the case of the failure to comply with the certification conditions, a description of (i) the nature of such failure, (ii) any reasons for such failure, (iii) the period of non-compliance, and (iv) the measures to be taken to correct such failure to comply; and

(b) In the case of the exceedance of a water quality standard, (i) an explanation, to the extent known after reasonable investigation, of the relationship between the project and the exceedance, (ii) the identity of any other known contributions to the exceedance, and (iii) a proposal to modify the certification conditions so as to remedy the contribution of the project to the exceedance.

(4) Any anticipated change in discharge location and/or quantities associated with the project which may result in water quality impacts not considered in the original certification must be reported to the Division by submission of a written notice by the permittee prior to the change. If the change is determined to be significant, the permittee will be notified within ten days, and the change will be acknowledged and approved or disapproved.

(5) Any diversion from or bypass of facilities necessary to maintain compliance with the terms and conditions herein is prohibited, except (i) where unavoidable to prevent loss of life or severe property damage, or (ii) where excessive storm drainage or runoff would damage any facilities necessary for compliance with limitations and prohibitions herein. The Division shall be notified immediately in writing of each such diversion or bypass.

(6) At least fifteen days prior to commencement of a project in a watercourse, which the Division has certified, or conditionally certified, the permittee shall notify the following:

(a) Applicable local health departments;

(b) Owners or operators of municipal and domestic water treatment intakes which are located within twenty miles downstream from the site of the project; and

(c) Owners or operators of other intakes or diversions which are located within five miles downstream from the site of the project.

The permittee shall maintain a list of the persons and entities notified, including the date and form of notification.

(7) Immediately upon discovery of any spill or other discharge to waters of the state not authorized by the applicable license or permit, the permittee shall notify the following;

(a) Applicable local health departments;

(b) Owners or operators of municipal and domestic water treatment intakes which are located within twenty miles downstream from the site of the project; and

(c) Owners or operators of other intakes or diversions which are located within five miles downstream from the site of the project.

The permittee shall maintain a list of the persons and entities notified, including the date and form of notification.

(8) Construction operations within watercourses and water bodies shall be restricted to only those project areas specified in the federal license or permit.

(9) No construction equipment shall be operated below the existing water surface unless specifically authorized by the 401 certification issued by the Division.

(10) Work should be carried out diligently and completed as soon as practicable. To the maximum extent practicable, discharges of dredged or fill material shall be restricted to those periods when impacts to designated uses are minimal.

(11) The project shall incorporate provisions for operation, maintenance, and replacement of BMPs to assure compliance with the conditions identified in this section, and any other conditions placed in the permit or certification. All such provisions shall be identified and compiled in an operation and maintenance plan which will be retained by the project owner and available for inspection within a reasonable timeframe upon request by any authorized representative of the Division.

(12) The use of chemicals during construction and operation shall be in accordance with the manufacturers' specifications. There shall be no excess application and introduction of chemicals into state waters.

(13) All solids, sludges, dredged or stockpiled materials and all fuels, lubricants, or other toxic materials shall be controlled in a manner so as to prevent such materials from entering state waters.

(14) All seed, mulching material and straw used in the project shall be state-certified weed-free.

(15) Discharges of dredged or fill material in excess of that necessary to complete the project are not permitted.

(16) Discharges to state waters not identified in the license or permit and not certified in accordance therewith are not allowed, subject to the terms of any 401 certification.

(17) Except as otherwise provided pursuant to subsection 82.7(C), no discharge shall be allowed which causes non-attainment of a narrative water quality standard identified in the Basic Standards and Methodologies for Surface Waters, Regulation #31 (5 CCR 1002-31), including, but not limited to discharges of substances in amounts, concentrations or combinations which:

(a) Can settle to form bottom deposits detrimental to beneficial uses; or

(b) Form floating debris, scum, or other surface materials sufficient to harm existing beneficial uses; or

(c) Produce color, odor, or other conditions in such a degree as to create a nuisance or harm existing beneficial uses or impart any undesirable taste to significant edible aquatic species, or to the water; or

(d) Are harmful to the beneficial uses or toxic to humans, animals, plants, or aquatic life; or

(e) Produce a predominance of undesirable aquatic life; or

(f) Cause a film on the surface or produce a deposit on shorelines.

(B) Best Management Practices:

(1) Best management practices are required for all projects for which Division certification is issued except for section 402 permits. Project applicants must select BMPs to be employed in their project. A listing and description of best management practices is located in Appendix I of Regulation No. 82: 401 Certification Regulation 5 CCR 1002-82.

(2) All requests for certifications which require BMPs shall include a map of project location, a site plan, and a listing of the selected BMPs chosen for the project. At a minimum, each project must provide for the following:

(a) Permanent erosion and sediment control measures that shall be installed at the earliest practicable time consistent with good construction practices and that shall be maintained and replaced as necessary throughout the life of the project.

(b) Temporary erosion and sediment control measures that shall be coordinated with permanent measures to assure economical, effective, and continuous control throughout the construction phase and during the operation of the project.