SAND CREEK - CENTER TRIBUTARY
CHANNEL ANALYSIS REPORT
FOR
SOLACE APARTMENTS

Prepared For:
Jackson Dearborn Partners
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Add PCD File No. SP201

January 3, 2019
Project No. 25174.00

Prepared By:
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If no LOMR/CLOMR will be processed at this time then please include this analysis in the preliminary drainage report.

CONTENTS

OVERVIEW

This report was prepared to provide design information for the existing Sand Creek -Center Tributary Drainageway as part of the Solace Apartment development. This document is the Channel Analysis report for the Solace Apartments. The Sand Creek-Center Tributary Drainageway has been studied as part of a Flood Insurance Study (FIS) for El Paso County Colorado, Volume 7 of 8, revised December 7, 2018 and Sand Creek Drainage Basin Planning Study, dated January 1993. Existing flow rates from the Sand Creek Planning Study were used as the basis for the design of the existing channel condition.

GENERAL LOCATION AND DESCRIPTION

Location

The proposed Solace Apartments, known as "Solace" from herein, is a parcel of land located in Section 7, Township 14 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. Solace is a 28.99 acre, urban, multifamily-development and is comprised of 16 apartment buildings and associated infrastructure. Solace is bound by existing industrial developments to the North and vacant land to the West. Galley Road bounds the property to the south and existing light industrial businesses to the east. A vicinity map of the area is presented in Appendix A.

Description of Property

Solace is currently unoccupied and undeveloped. The existing ground cover is sparse vegetation and open space, typical of a Colorado rolling range land condition. In general, Solace slopes from northwest to southeast. The existing conditions of the Sand Creek -Center Tributary Drainageway on the site are heavily wooded for the length of the channel throughout the Solace site.

Per an NRCS web soil survey of the area, Solace is made up of Type B soils with a very small percentage of Type A in the northwest corner of the property. This Type B soil is a blendon sandy loam. This soil type has a moderate infiltration rate when thoroughly wet. It also consists of moderately deep or deep, moderately well drained or well drained soil. A soil survey map has been presented in Appendix A.

Floodplain Statement

Based on the FEMA FIRM Map number 08041C0558G, dated December 7, 2018, a portion of the existing drainageway lies within Zone AE and Zone X. Zone AE is defined as area subject to inundation by the 1-percent-annual-chance flood event and is a flood hazard area. Zone X is defined as area outside the Special Flood Hazard Area (SFHA) and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. The FIRM Map has been presented in Appendix A. Currently a portion of the Solace site lies within Zone AE at the extension of Paonia Street to Galley Road, as seen in FEMA FIRM Map number 08041C0558G.

PREVIOUS SAND CREEK STUDIES

Solace lies within Sand Creek Drainage Basin based on the "*Sand Creek Drainage Basin Planning Study*" prepared by Kiowa Engineering in January 1993.

The Sand Creek Drainage Basin covers approximately 54 square miles in unincorporated El Paso County, CO. The Sand Creek Drainage Basin is tributary to Fountain Creek. In its existing condition, the basin is comprised of developed land with the exception of the Solace Parcel which is comprised of rolling rangeland with fair to good vegetative cover associated with Colorado's semi-arid climate. The natural Drainageway within the site limits is typically deep and narrow with a well-defined flow path in most areas. Anticipated land use for the Solace parcel includes multifamily residential and open space.

As part of its drainage research, JR Engineering reviewed the following drainage studies, reports and LOMRs:

- Sand Creek Drainage Basin Planning Study prepared by Kiowa Engineering Corporation in January 1993.
- Flood Insurance Study– El Paso County, Colorado & Incorporated Areas Vol 7 of 8, December 2018.
- LOMR- Case No. 05-08-0368P Federal Emergency Management Agency, May 23, 2007.

The *Sand Creek Drainage Basin Planning Study* was used to establish a stormwater management plan for the existing and future stormwater infrastructure needs within the Sand Creek Drainage Basin. Based on provided drainage maps and analysis, in its existing condition, the Sand Creek-Center Tributary Drainageway contains a 100-year flow of 720 cfs at upstream station 1053 then jumps to 960 cfs at station 1030 in Sand Creek along Solace's east property line. The major Sand Creek-Center Tributary Drainageway conveys the stormwater south along the eastern property line where it ultimately outfalls into the Fountain Creek. JR Engineering also performed a hydrologic analysis to determine the flows in the Sand Creek-Center Tributary Drainageway and arrived at similar results to those shown in the *Sand Creek Drainage Basin Planning Study*, thus verifying the validity of these flows. These basin calculations show that the 720-960 cfs are still valid for this existing condition, a summary table of the flows in the Sand Creek Drainageway based on various studies can be found below.

SOLACE APARTMENTS Sand Creek Center Tributary Flow Summary Table		
Report/Study	Location	Flow (cfs)
Sand Creek DBPS, Kiowa Engineering, Rev. March 1996	DP 45, @ Galley Rd.	1,180
Flood Insurance Study, El Paso County, Rev. December 7, 2018	Section N, @ Galley Road	723
JR Engineering October 2019	@ Galley Road	956

Table VII-1 of the DBPS(pg 55) indicates that flow at DP45 is 1340cfs(100yr).

CENTER TRIBUTARY SAND CREEK

42	Airport Road	1.6	2010	1200
43	Powers Blvd.	1.3	1710	980
44	U. S. 24	1.1	1680	960
45	Galley Road	0.8	1340	650

This channel analysis or the submitted prelim drainage report does not include the stated hydrologic analysis. Include with the resubmittal.

Update the narrative explaining which flow between the three studies is eventually used for the model and why.

It is unclear if the intent of the inlet is to capture the total 792cfs or only capture some of the offsite flows. If the inlet is not capturing all the flow, are the inlets downstream intended to capture the flow? Does the road have the capacity to convey this flow? Please address. Also see comments on your flood map

FEMA prepared a revised FIS for El Paso County Colorado, Volume 7 of 8, dated December 7, 2018. The effective floodplain for the site is shown on the FIRM 08041C0752G, revised to reflect LOMR, dated May 23, 2007. The study area of the FIS where the Sand Creek Drainageway crosses Galley Road, was found to overtop the culverts and flow onto the road. According to the FIS, this crossing has a 10% annual chance of flooding and is located in Zone AE of the FIRM. This location is a Special Flood Hazard Area (SFHA) inundated by the 100-year flood, Zone AE (base flood elevations determined). The *Sand Creek Drainage Basin LOMR* was executed on May 23, 2007. The LOMR revised the flood zone or the area south of Galley Road. See FIRM Map Panel 08041C0752G for limits of LOMR study and revised flood zones, presented in Appendix C.

To the west of the Sand Creek-Center Tributary Drainageway is a secondary Drainageway that captures the flow coming from the west side of Paonia Street. This drainage way is located at the proposed extension of Paonia Street to meet Galley Road. According to *Sand Creek Drainage Basin LOMR*, the flow present in this secondary drainageway in a 1-percent-annual-chance flood event is 792 cfs. To address this drainage on Paonia Street, the proposed extension will include an inlet that will capture the water from the west of the street and pipe it directly to the Sand Creek Drainageway.

Channel Deficiencies

The *Sand Creek Drainage Basin Planning Study* performed a hydraulic analysis of the Sand Creek-Center Tributary Drainageway between Galley Road and Paonia Street, and an analysis of the crossing structure for Sand Creek at Galley Road. For the crossing structure at Galley Road they determined that the existing crossing structures were inadequate for the demands of the Drainageway and would require improvements to expand the capacity of these structures. These results can be seen in Table IV-1 Summary of Hydraulic Structures – Crossings: Sand Creek Drainage Basin Planning Study shown below. The Study proposed improvements to the existing crossing structures by replacing them with 3-8'Wx 5'H Concrete Box Culverts.

Indicate what improvements are required to mitigate this concentrated flow entering the drainageway.

TABLE IV-1: SUMMARY OF HYDRAULIC STRUCTURES - CROSSINGS
SAND CREEK DRAINAGE BASIN PLANNING STUDY

LOCATION	REACH #	SIZE	TYPE	CAPACITY EXISTING	CAPACITY FUTURE (1)	COMMENTS
Airport Road	CT-1	5-6'x8'	BOX CULVERT	ADEQUATE	ADEQUATE	
Pikes Peak Ave.	CT-1	NONE		INADEQUATE	INADEQUATE	POWERS BLVD. OVERTOPPED FREQUENTLY BE-TWEEN BIJOU ST. AND PIKES PEAK AVE.
Powers Blvd.	CT-1	VARIOUS	METAL PIPE	INADEQUATE	INADEQUATE	
Platte Ave (US 24)	CT-1	8'x4'	BOX CULVERT	INADEQUATE	INADEQUATE	APPROACH CHANNEL IN NEED OF REALIGNMENT
Terminal Avenue	CT-2	2-4'x8'	BOX CULVERT	INADEQUATE	INADEQUATE	
Galley Road	CT-2	3-42"x72"	METAL ARCH PIPE	INADEQUATE	INADEQUATE	
Omaha Boulevard	CT-2	2-36"x57"	METAL ARCH PIPE	INADEQUATE	INADEQUATE	

The study also found the existing channel for the Sand Creek-Center Tributary Drainageway between Galley Road and Paonia Street to be inadequate for the given flow rate. The report says

that the existing channel has limited maintenance access, leading to the channel degrading and being filled with obstructions. Those findings can be seen in Table IV-2 Summary of Hydraulic Structures – Channels: Sand Creek Drainage Basin Planning Study. The *Sand Creek Drainage Basin Planning Study* recommended improvements to the existing channel by lining the channel with concrete.

TABLE IV-2: SUMMARY OF HYDRAULIC STRUCTURES - CHANNELS
SAND CREEK DRAINAGE BASIN PLANNING STUDY

LOCATION FROM / TO	REACH #	DIMENSIONS TW (ft)	SS	DEPTH (ft)	TYPE	CAPACITY (1) ADQ	INADQ	COMMENTS
CENTER TRIBUTARY								
East Fork Sand Creek to Airport Road	CT-1	45	2:1	6	Riprap lined trapezoidal channel	X	X	Riprap has failed or is non-existent along some portions of this segment of the Center Tributary
Pikes Peak to Bijou St.	CT-1			N/A	Rubble lined ditches along Powers Blvd.			Flow passes over and along Powers Blvd. street section on a frequent basis. Road closures common.
Bijou St. to Platte Ave.	CT-1			N/A	Unlined, natural.			Overbanks vegetated, channel dry with sand invert, no. vegetation. Channel eroded at outlet of US24 culvert.
Platte Ave. to Terminal Ave.	CT-2	15-25	1:1	4-6	Trapezoidal concrete lined.	X		Channel has adequate capacity.
Terminal Avenue to Galley Road	CT-2	21	1:1	5	Trapezoidal concrete lined.	X		Channel has adequate capacity.
Galley Road to Paonia Ct. (ext)	CT-2	30-40	varies	4-5	Unimproved segment.		X	Channel is degraded and filled with debris. Poor maintainance access.
Paonia Ct. to Omaha Blvd.	CT-2	21	1:1	5	Trapezoidal concrete lined channel.	X		Maintainence access poor. Debris and trash in channel.

The GeoHecRas model results completed with this report contain similar findings to those in the drainage basin planning study. Average velocities of 10-12 fps for a majority of the channel reach exceed allowable limits for an unprotected channel. The current Galley road crossing structures lack of capacity also leads to overtopping of the road during these events. This report confirms that both this Sand Creek channel reach and Galley Road crossing structures are inadequate for the 100-yr storm event.

Channel Improvement Recommendations

The *Sand Creek Drainage Basin Planning Study (DBPS)* concluded that the Sand Creek-Center Tibutary Drainageway channel, in its current state, is inadequate to handle the historical flows tributary to the channel. This report falls in line, indicating that improvements shall be made to the channel in order to provide adequate capacity and prevent erosion. In the DBPS improvements are also designated for the crossing structures at Galley Road to provide adequate capacity and prevent overtopping of the road. Upon further investigation, this report found that overtopping of the Galley Road

Figure 1: Existing Drainage Structures at Galley Road (Viewed from South)

Add a photograph of the overflow structure on the north side of Galley Road

appears to be addressed via the overflow structures and associate downstream bank protections shown in Figure 1. The site visit revealed a concrete weir under the pedestrian railing to safely pass overtopping flows. This in conjunction with the riprap bank protection leads JR to recommend that culvert replacement not to be required of the Solace Development. Improvements to increase the capacity of the culverts at Galley Road by upsizing to a larger culvert(s), is a potential improvement that could occur in the future. Culvert improvements are only necessary should the County deem the historic overtopping of Galley Road above acceptable tolerance. Currently, no adjacent structures are impacted by this overtopping.

Is the overflow structure adequate? Provide analysis of the overflow structure and bank protection. Without this analysis the County cannot determine whether this structure is acceptable. Coordination with the Engineering Manager and/or County Engineer will be required.

Based upon the findings to the *Sand Creek Drainage Basin Planning Study* and the conforming GeoHecRas modeling contained in this report, potential recommended channel improvements include:

- Widening of the channel west bank to reduce flow depth, thus corresponding velocities
- Lining portions of the channel with riprap or other protective surfaces
- Adding check structures and potentially drop structures to reduce channel grade

CONCEPT COST ESTIMATE

Below is Conceptual Cost Estimate for the proposed channel improvements to the Sand Creek-Center Tributary Drainageway.

Table 3: Cost Opinion-Public Reimbursable

PUBLIC DRAINAGE FACILITIES				
Item	**Quantity**	**Unit**	**Unit Price**	**Extended Cost**
Clearing & Grubbing	2	AC	$5,000.00	$10,000.00
Channel Widening Earthwork (Cut)	7000	CY	$3.00	$21,000.00
Riprap Lining (Type M)	5100	CY	$85.00	$433,500.00
Check Structures	3	EA	$10,000.00	$30,000.00
Drop Structures	1	EA	$20,000.00	$20,000.00
			Sub-Total	$514,500.00
	10% Eng. And Contingency			$51,450.00
			Grand Total	$565,950.00

DRAINAGE DESIGN CRITERIA

Development Criteria Reference

Storm drainage analysis techniques were taken from the "*City of Colorado Spring/El Paso County Drainage Criteria Manual*" Volumes 1 and 2 (EPCDCM), dated October 12, 1994, the "*Urban Storm Drainage Criteria Manual"* Volumes 1 - 3 (USDCM) and Chapter 6 and Section 3.2.1 of Chapter 13 of the "Colorado Springs Drainage Criteria Manual (CCSDCM), dated May 2014, as adopted by El Paso County.

Hydrologic Criteria

The hydrologic analysis for this project is based on the *Sand Creek Drainage Basin Planning Study*. The flow rates for the 100-yr storm event were taken from sheets CTP-2 & CTP-3 of this study. The Baseline Flows from the *Sand Creek Drainage Basin Planning Study* are included in Appendix C.

Hydraulic Criteria

GeoHecRas was used as the primary analysis method for the site. GeoHecRas was used to model existing flows within the Sand Creek-Center Tributary Drainageway. This model was used to verify flood plains and analyze any overtopping that may occur within the project site. The 100-year water surface profiles for the model were analyzed form the north property line of the site to the area 100 feet south of the Galley Road Crossing. Hydraulic computations for the models are contained in Appendix B.

Add a narrative describing the parameters used for the GeoHecRas model such as:
- the manning's n value. Include a table with the manning's n values and it's respective characteristics.
- The boundary conditions used (upstream & downstream).

SUMMARY

This analysis of the Sand Creek-Center Tributary Drainageway remains consistent with previous studies. Velocities in the drainageway are of concern and require channel improvements, such as widening and riprap lining to ensure the Sand Creek Drainageway remains stable during a 100-yr event. This report meets the latest El Paso County Drainage Criteria requirements for this site.

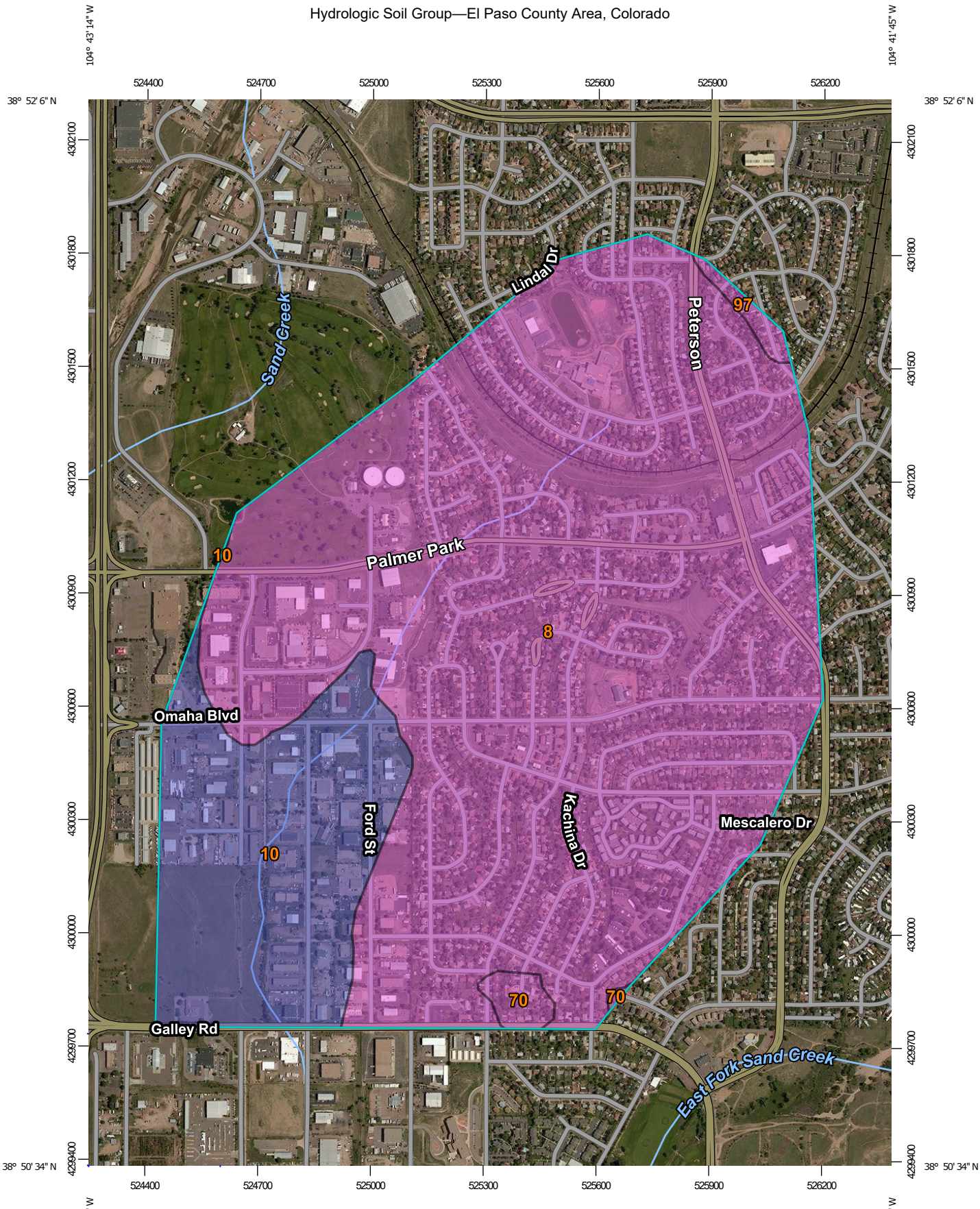
REFERENCES:

1. El Paso County Drainage Criteria Manual Volume 1, El Paso County, CO, 1994.
2. Urban Storm Drainage Criteria Manual, Urban Drainage and Flood Control District, Latest Revision.
3. Flood Insurance Study- El Paso County, Colorado & Incorporated Areas Vol 7 of 8, Federal Emergency Management Agency, December 7, 2018.
4. Sand Creek Drainage Basin Planning Study, Kiowa Engineering, January 1993.
5. Sand Creek Drainage Basin LOMR, Federal Emergency Management Agency, May 23, 2007.

Provide a summary of the change in water surface elevation in comparison to the FEMA FIS along the reach

APPENDIX A

FIGURES AND EXHIBITS



Map Scale: 1:13,800 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 17, Sep 13, 2019

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

Date(s) aerial images were photographed: Jun 3, 2014—Jun 17, 2014

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	565.8	80.8%
10	Blendon sandy loam, 0 to 3 percent slopes	B	124.2	17.7%
70	Pits, gravel	A	6.1	0.9%
97	Truckton sandy loam, 3 to 9 percent slopes	A	4.0	0.6%
Totals for Area of Interest			**700.2**	**100.0%**

Description

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

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

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

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

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

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

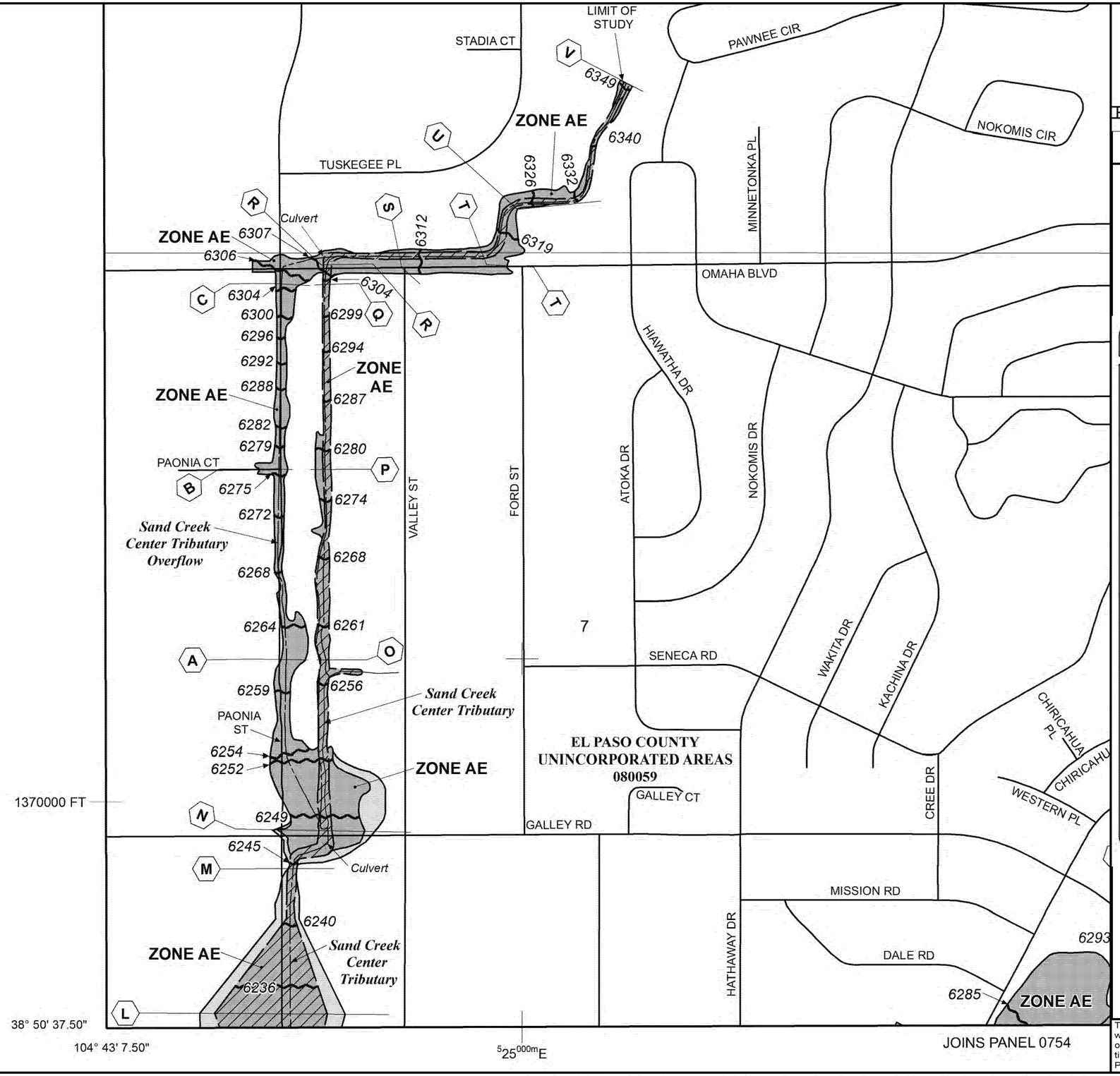
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



MAP SCALE 1" = 500'

0 500 1000 FEET

NFIP

PANEL 0752G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 752 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

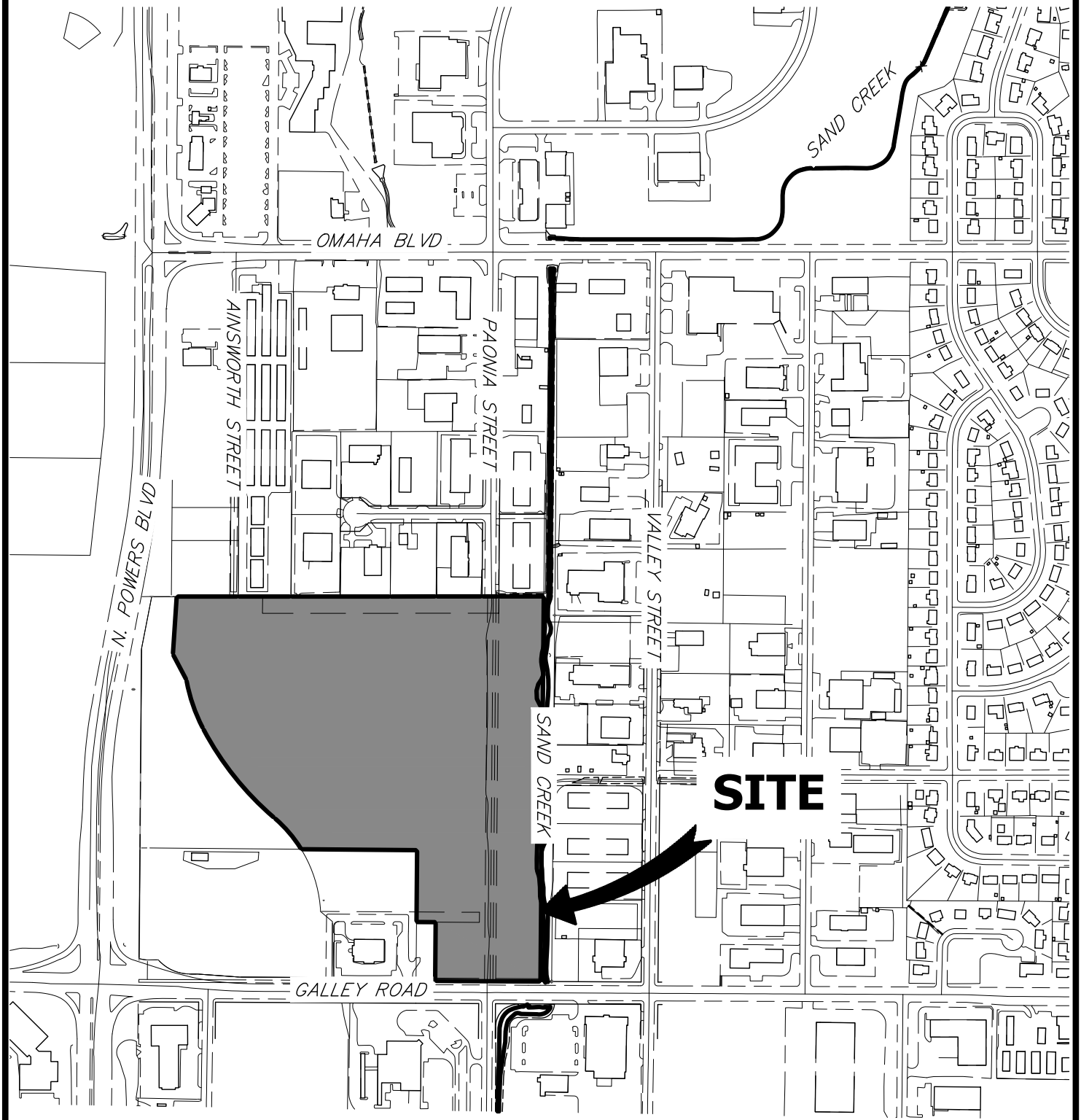
COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0752	G
EL PASO COUNTY	080059	0752	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0752G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency



VICINITY MAP
SOLACE APARTMENTS
JOB NO. 15504.03
4/27/2018

500 250 0 500 1000

ORIGINAL SCALE: 1" = 500'

J·R ENGINEERING
A Westrian Company

Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

The channel analysis and drainage report is unclear on the design intent for the flows from FEMA FIS X-Sections B and P.

-If the intent is to divert Flows from XS B then channel analysis needs to account for this additional flow.

-If the intent is to convey the flow on Paonia St extension then this channel analysis shall include the street in the modeling to show the limits of the 100yr flow along Paonia St and at the intersection of Galley Rd.

Model both the existing condition and proposed condition

Proposed condition model to include the proposed check structure and drop structures.

Provide a typical cross section detail for the proposed channel design.

Show the HEC-RAS Cross Sections
Show the Model alignment station

Overlay the FEMA appoved BFE sections

The storage areas (detention ponds) needs to be included in the model. Update the narrative accordingly.

CONCRETE LINED CHANNEL

PAONIA STREET

LEY ST

PARK AREA

CLUBHOUSE & POOL AREA

DOG RUN AREA

GATE

GALLEY RD

36"X58" CMP

CONCRETE LINED CHANNEL

FEMA FIRM FLOOD PLANE LIMITS

100YR

6270 6260 6252 6250 6248 6240

60 30 0 60 120

ORIGINAL SCALE: 1" = 60'

100 YEAR FLOOD MAP
SOLACE APARTMENTS
JOB NO. 25174.00
1/23/20
SHEET 1 OF 1

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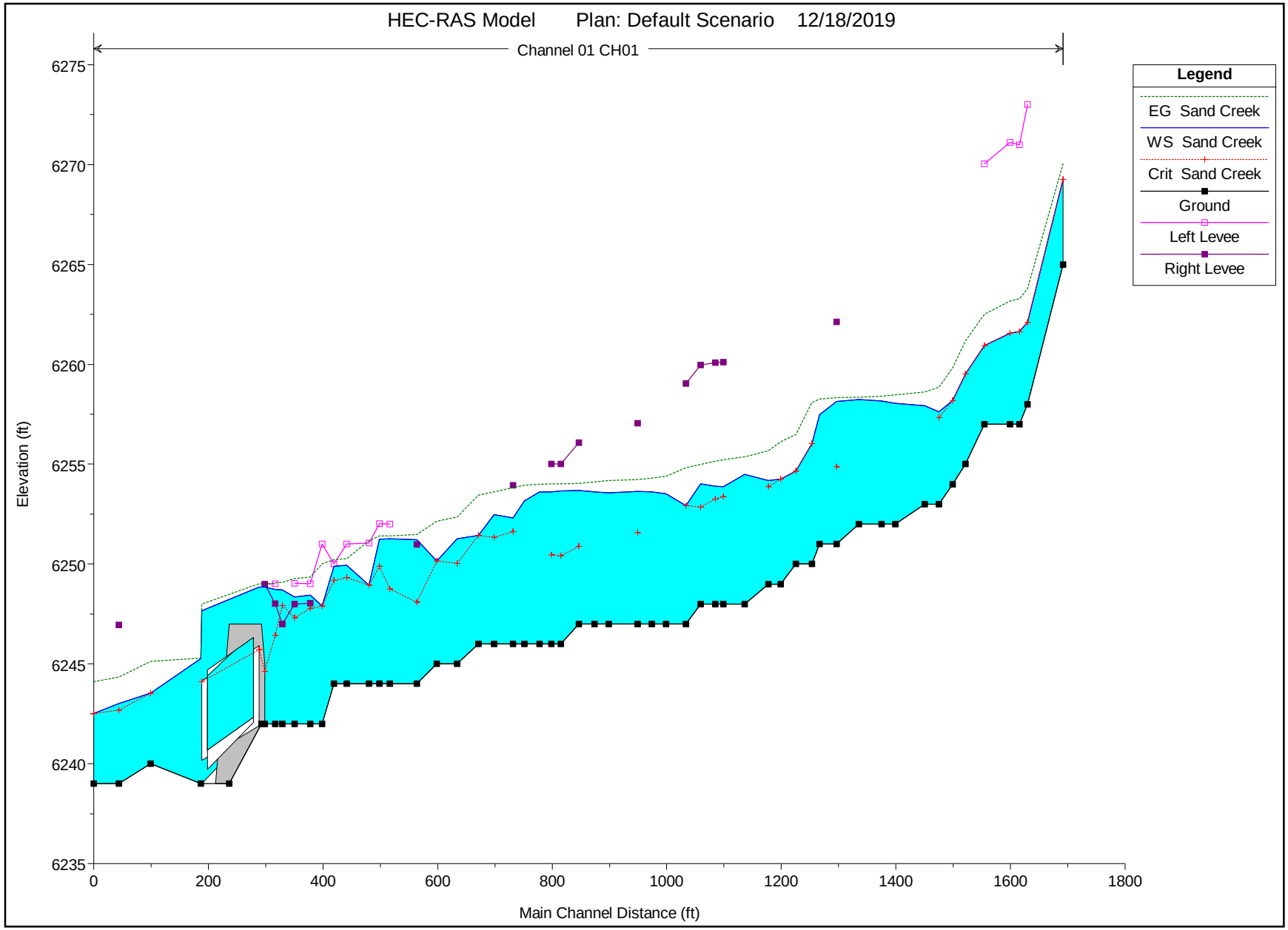
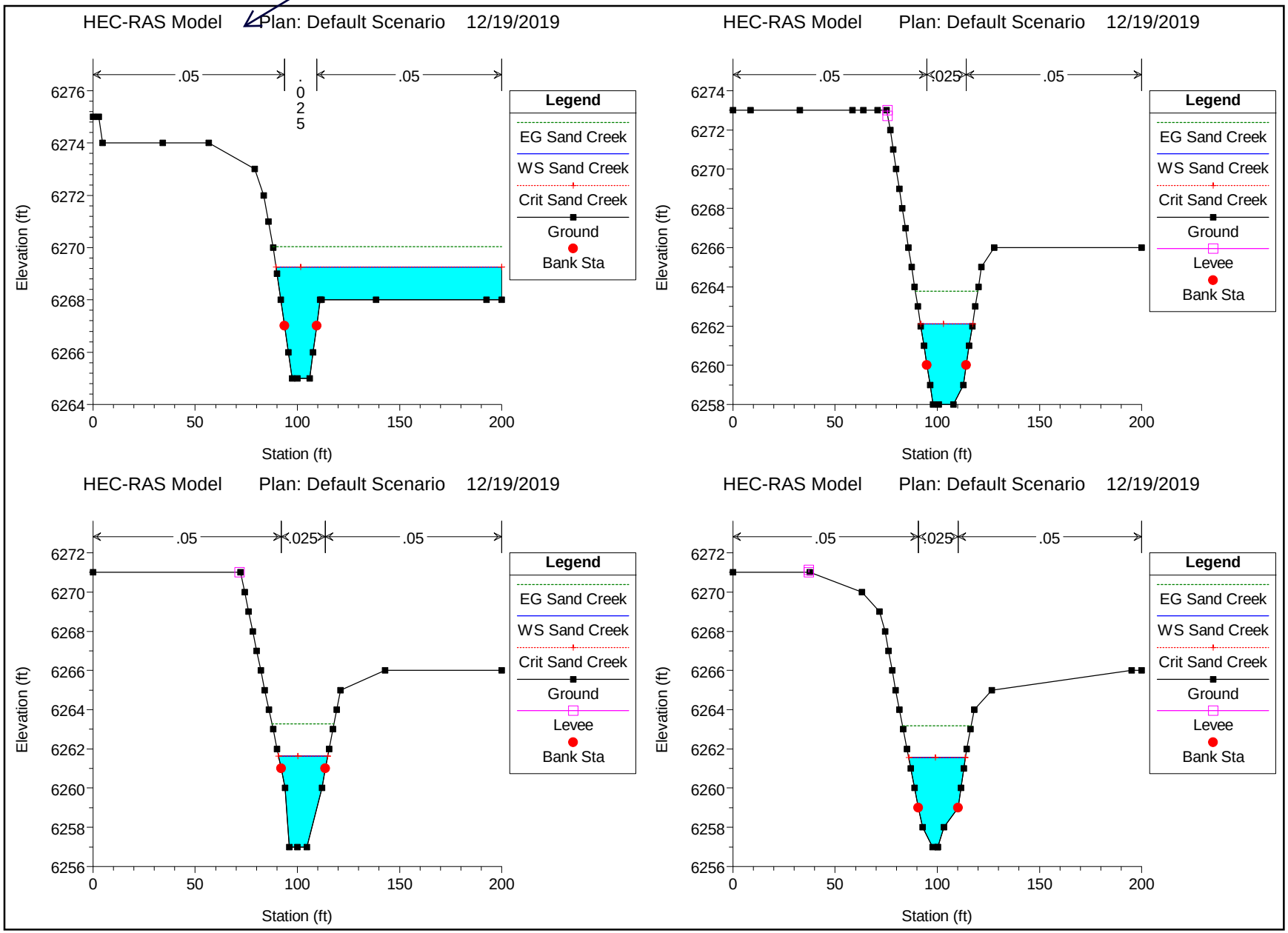
APPENDIX B

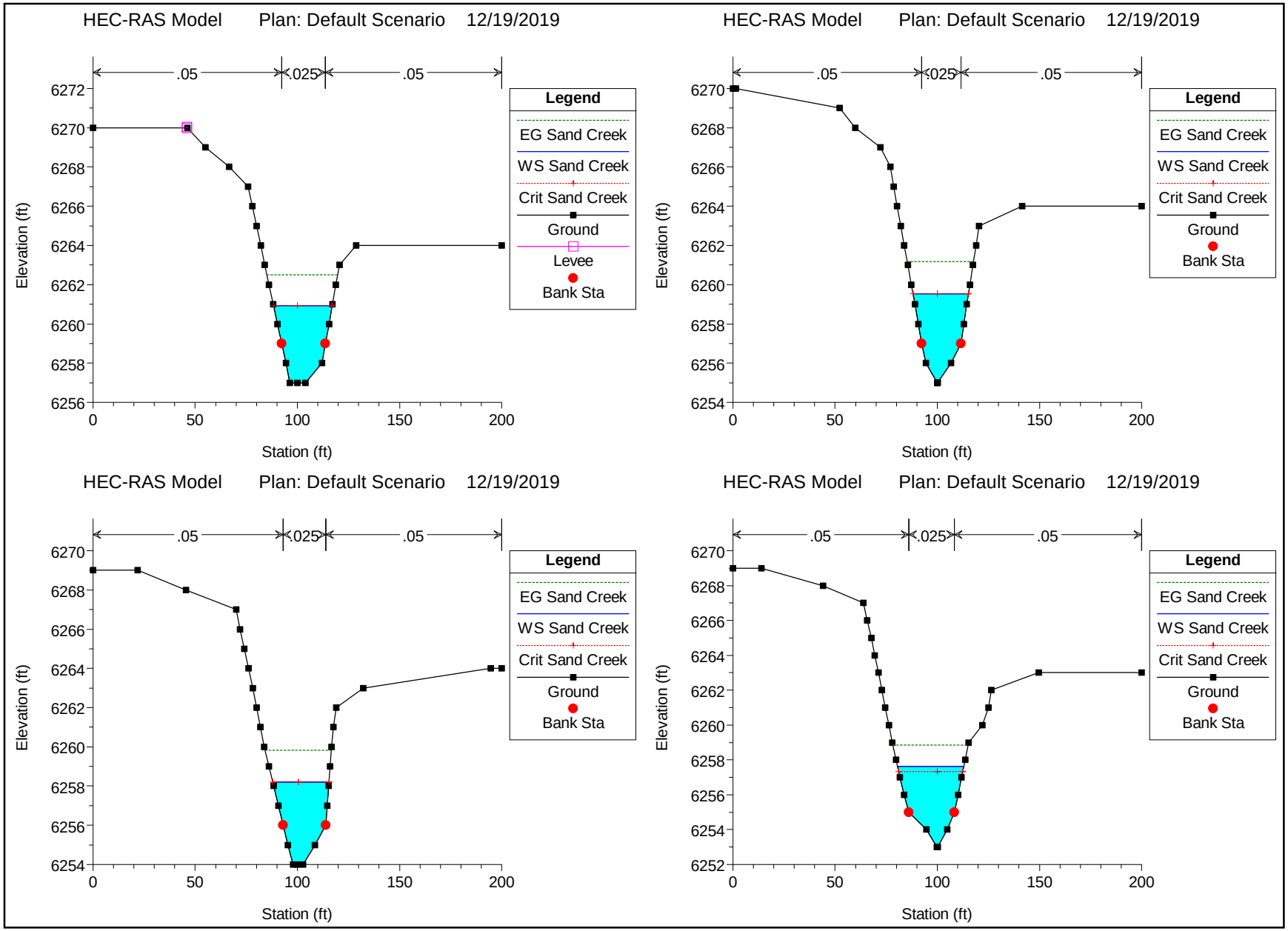
HYDRAULIC CALCULATIONS

Submit the input/output data


HEC-RAS Model Plan: Default Scenario 12/18/2019
Channel 01 CH01
Legend
EG Sand Creek
WS Sand Creek
Crit Sand Creek
Ground
Left Levee
Right Levee
Elevation (ft)
6275
6270
6265
6260
6255
6250
6245
6240
6235
0
200
400
600
800
1000
1200
1400
1600
1800
Main Channel Distance (ft)

Add the river station
for each cross section




HEC-RAS Model Plan: Default Scenario 12/19/2019
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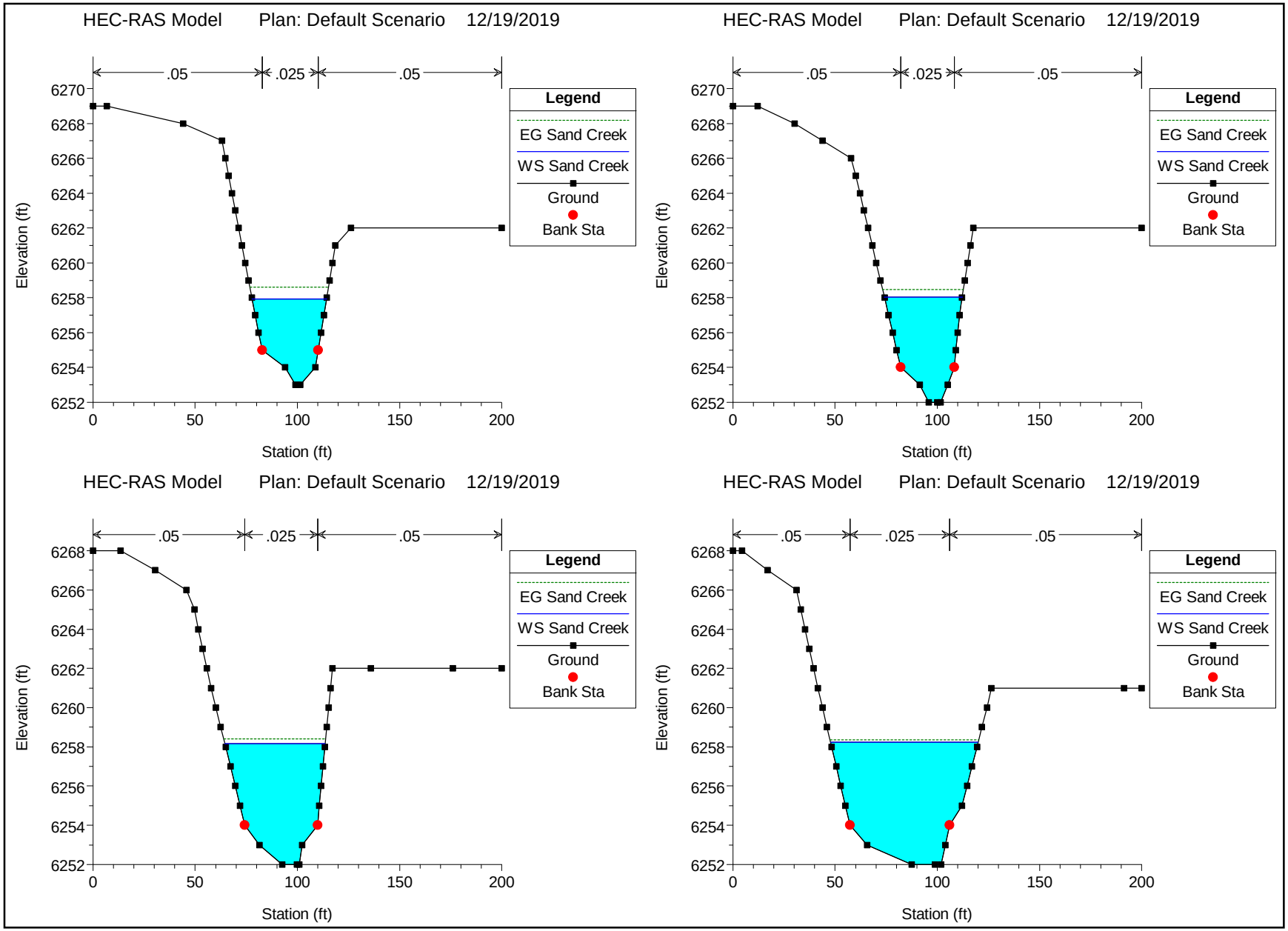
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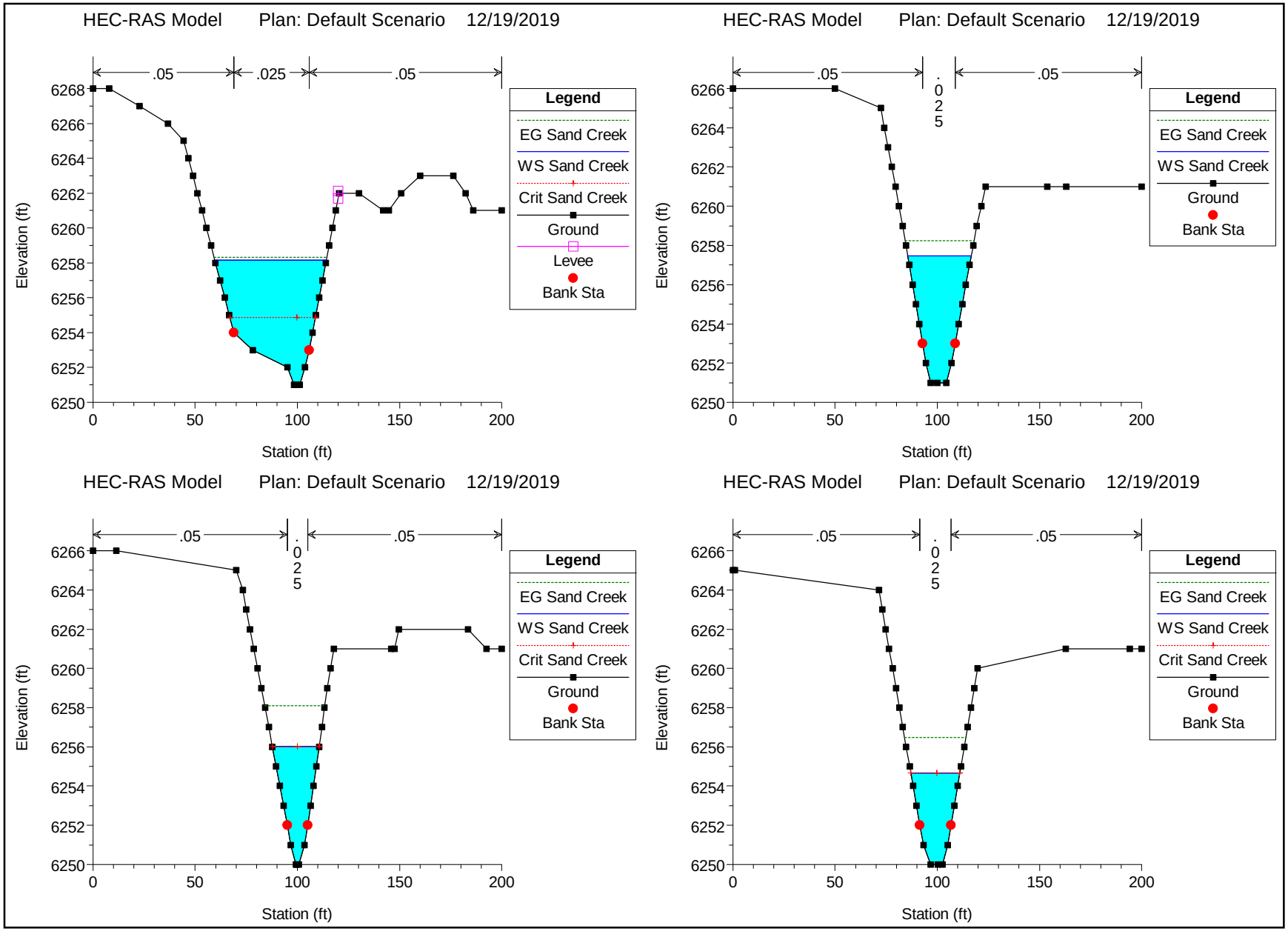
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Elevation (ft)
Station (ft)
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WS Sand Creek
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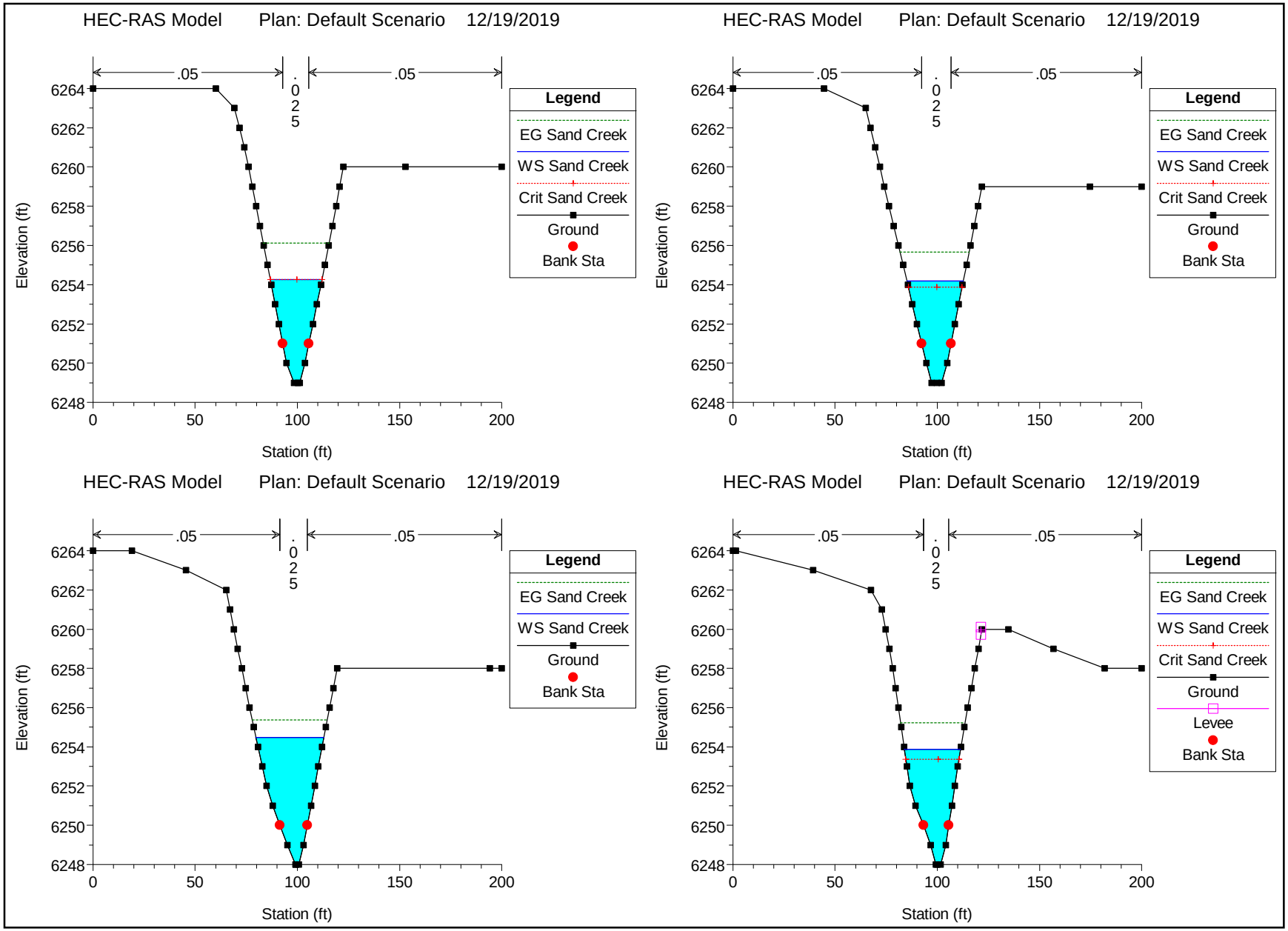
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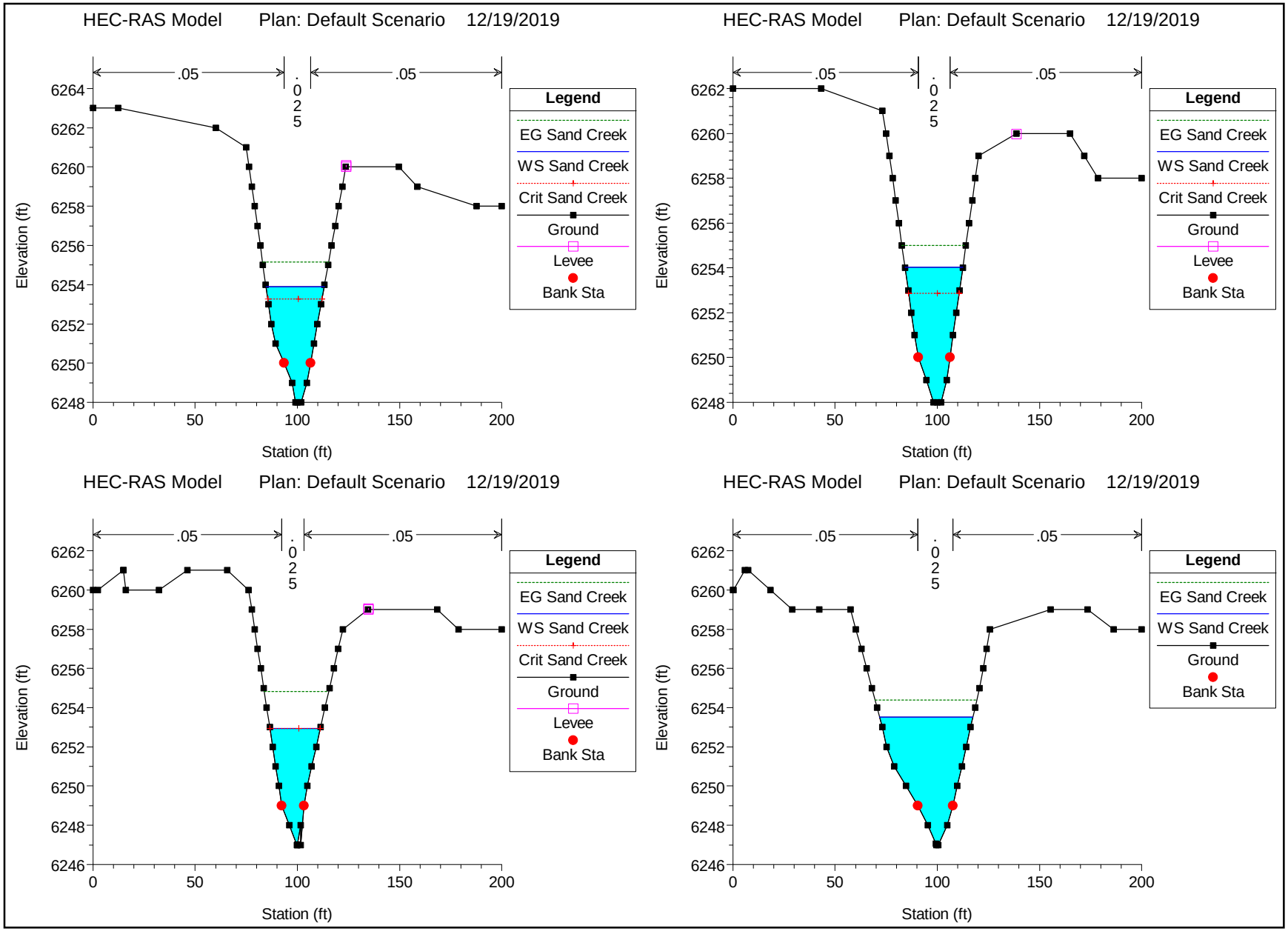
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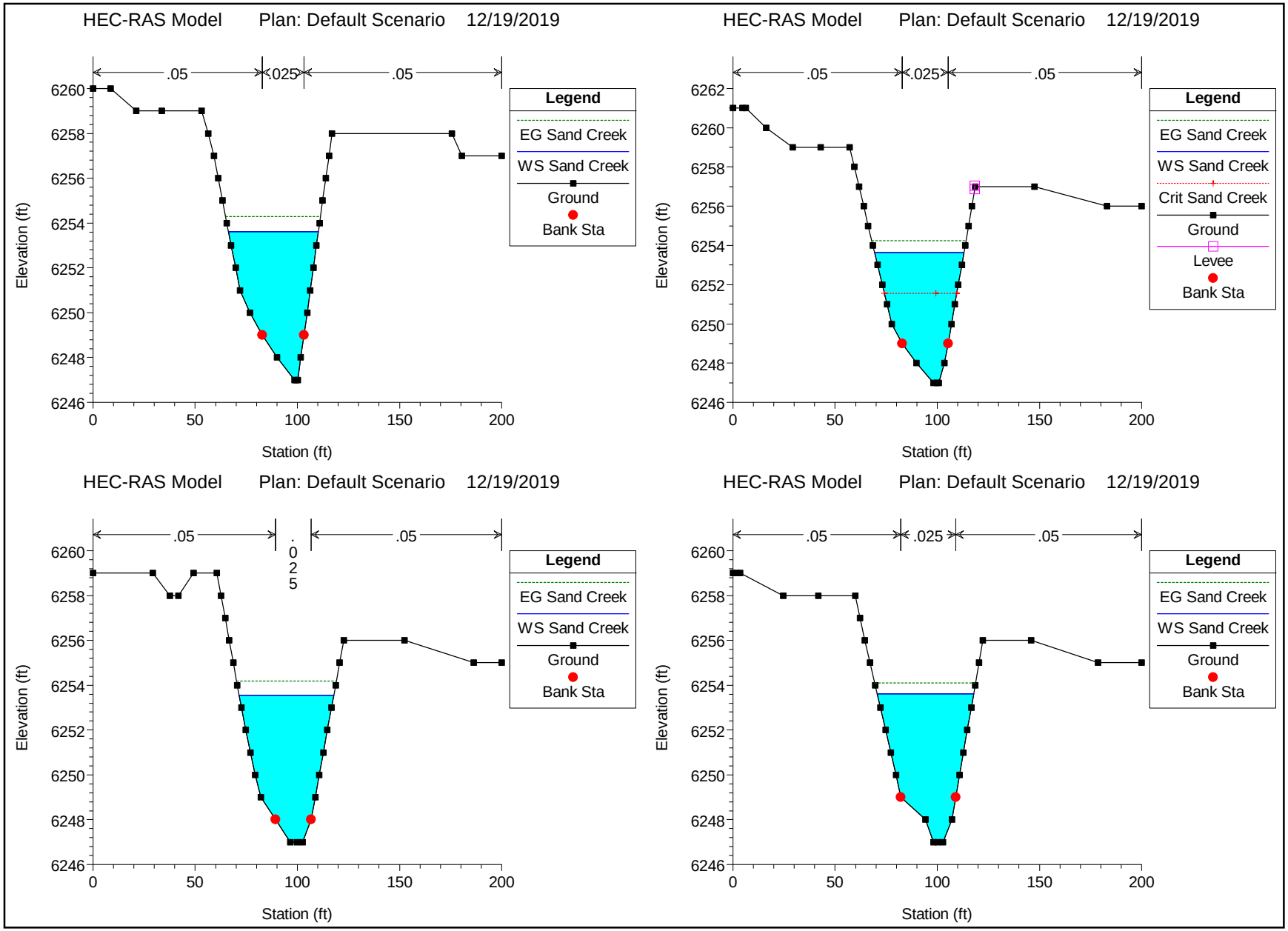
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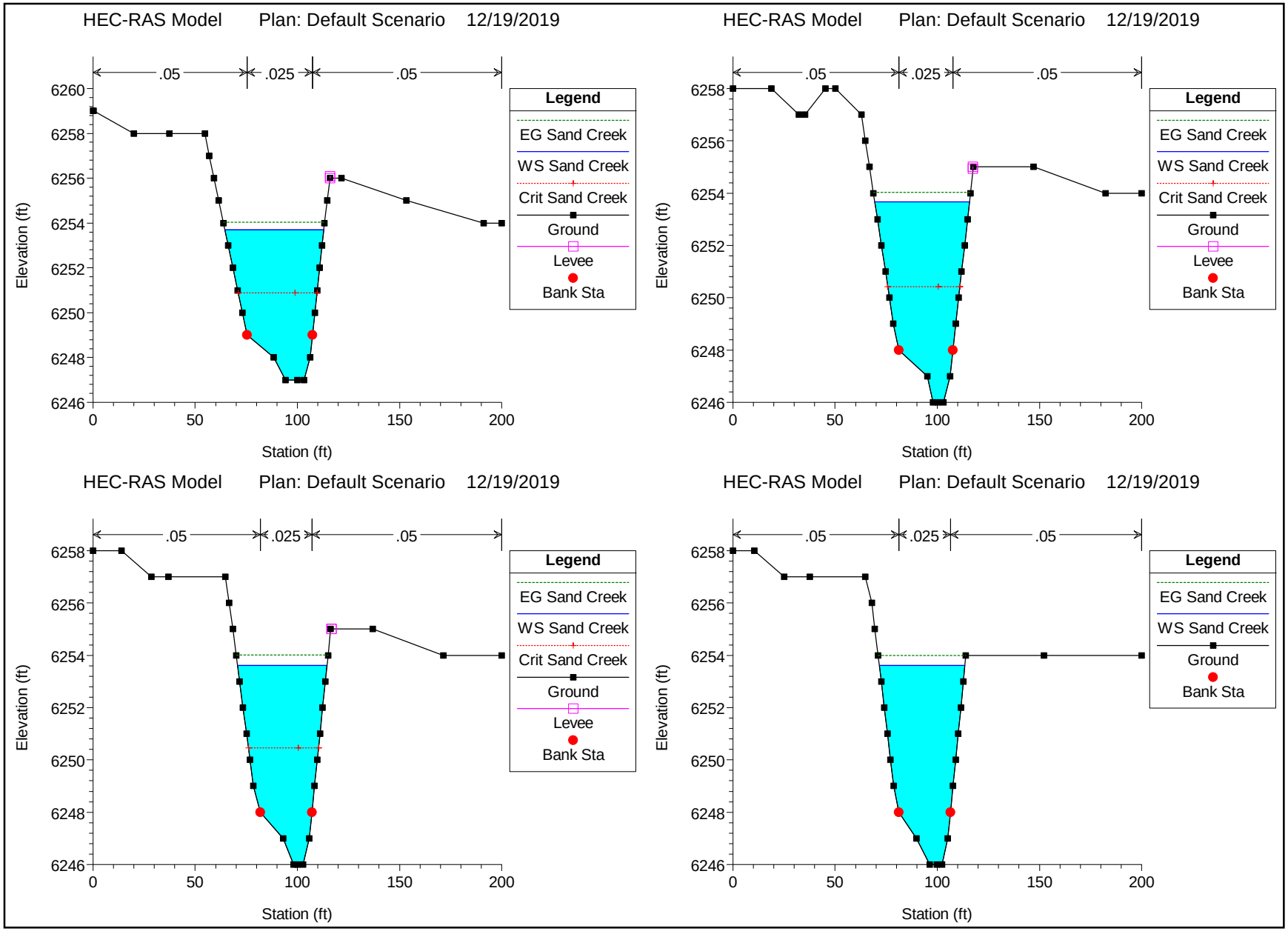
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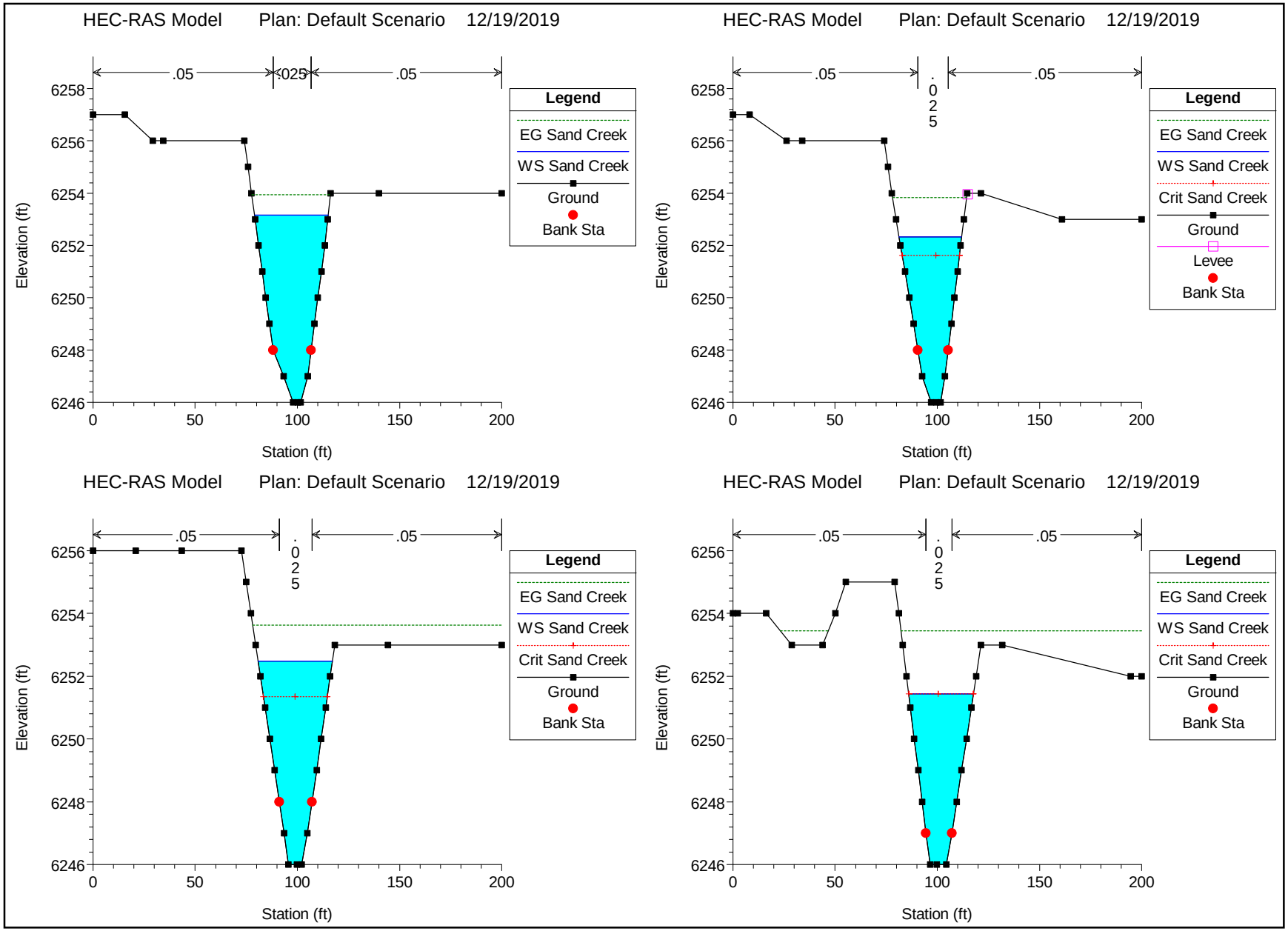
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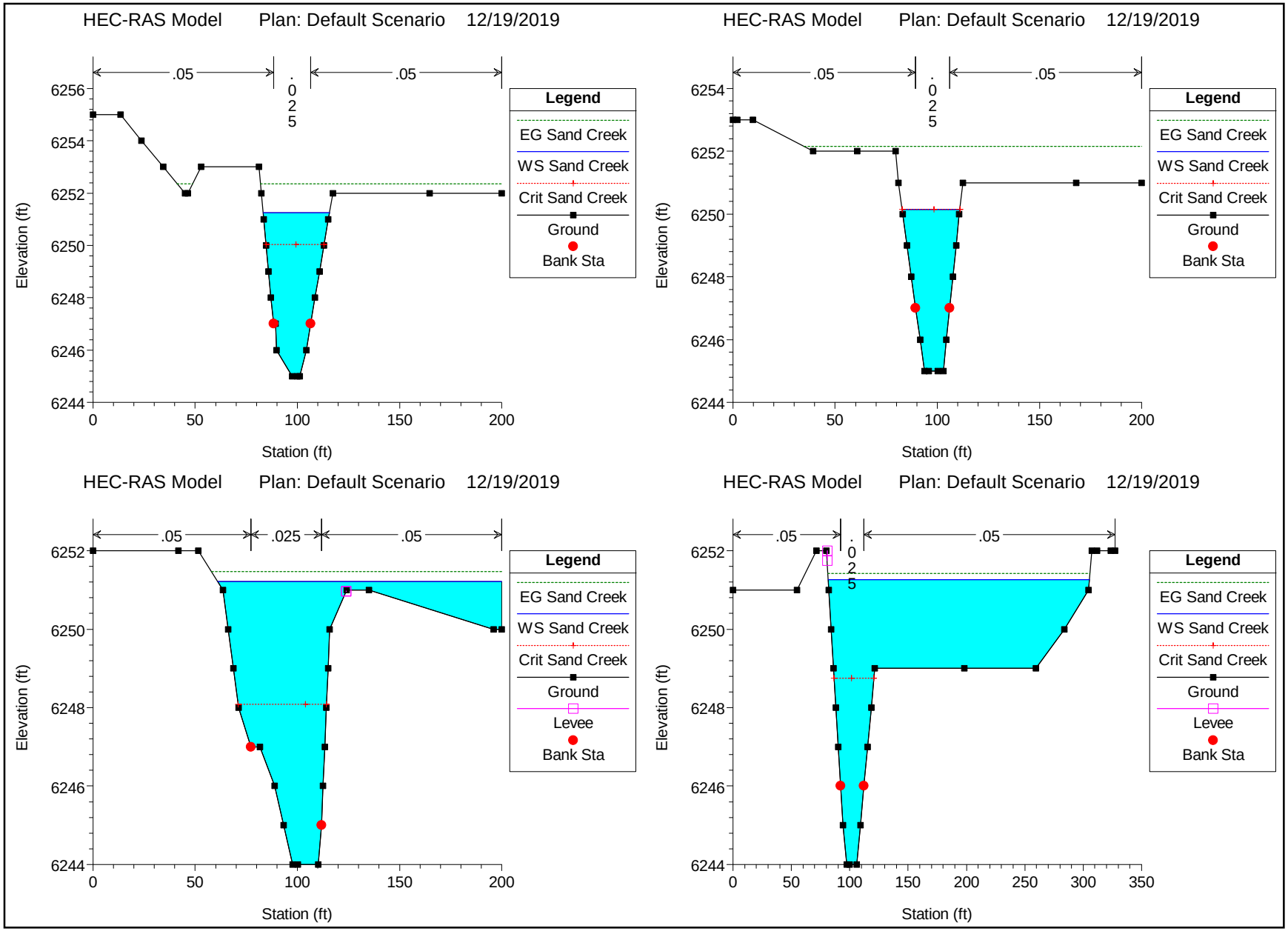
HEC-RAS Model Plan: Default Scenario 12/19/2019
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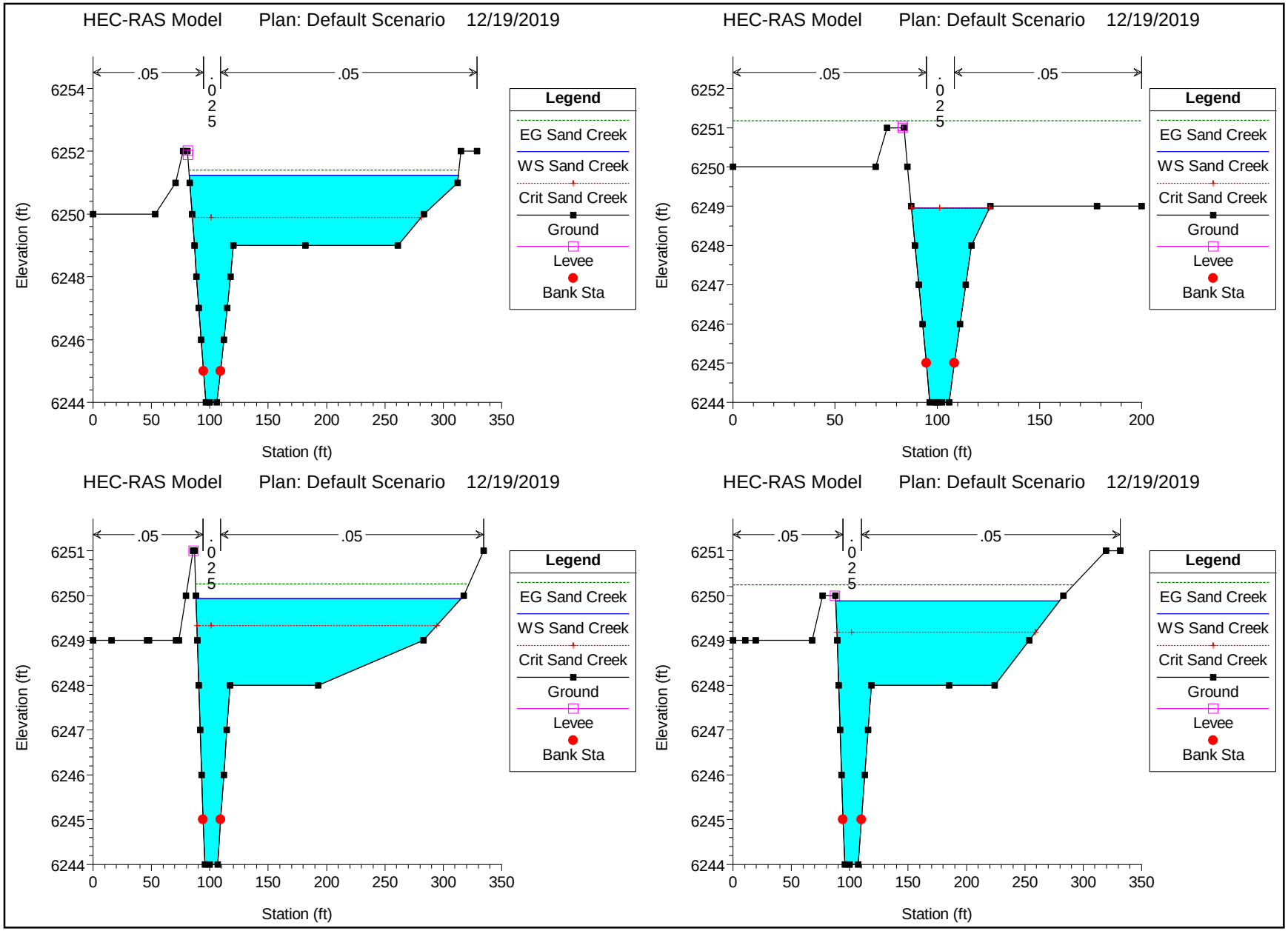
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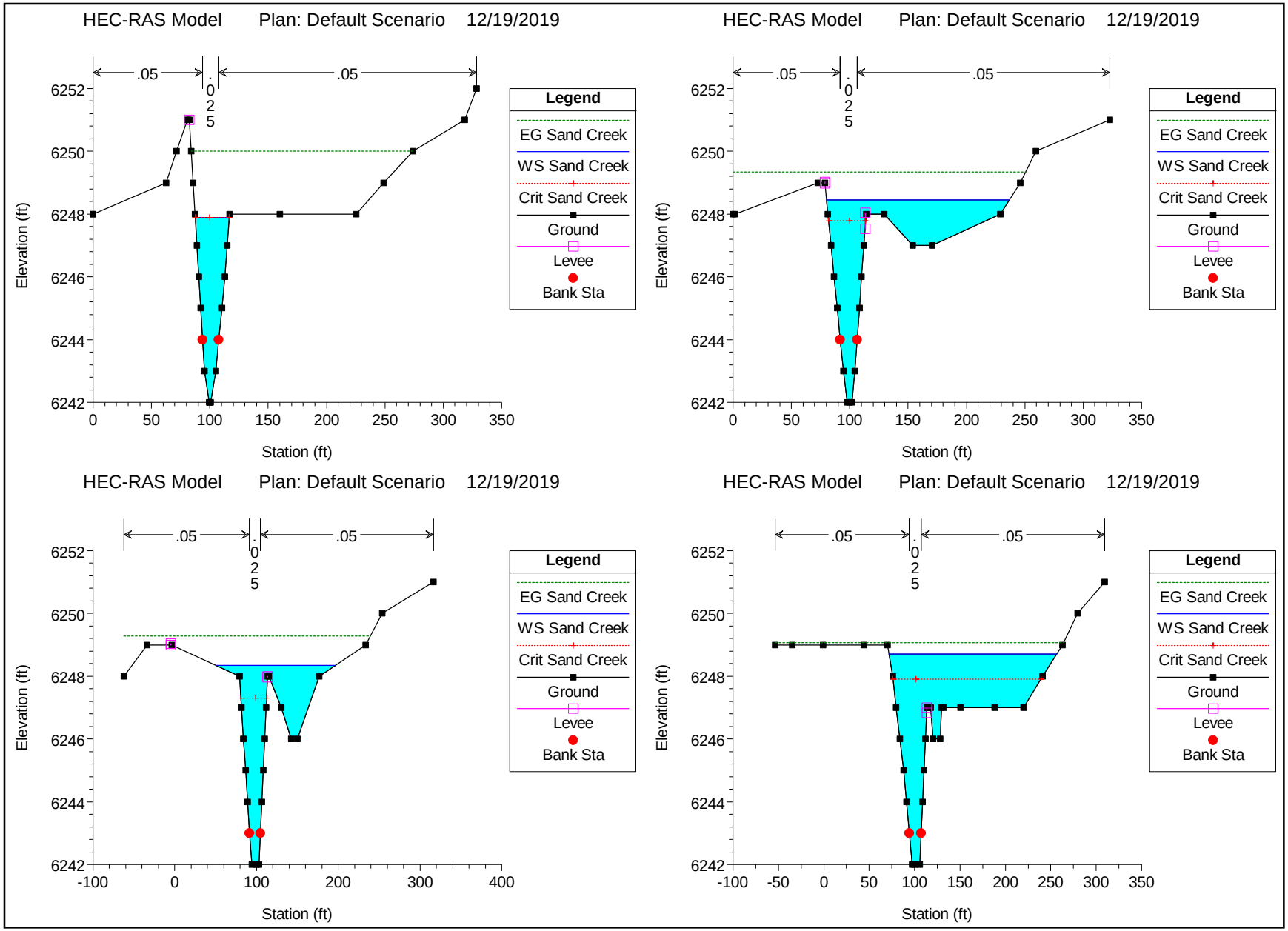
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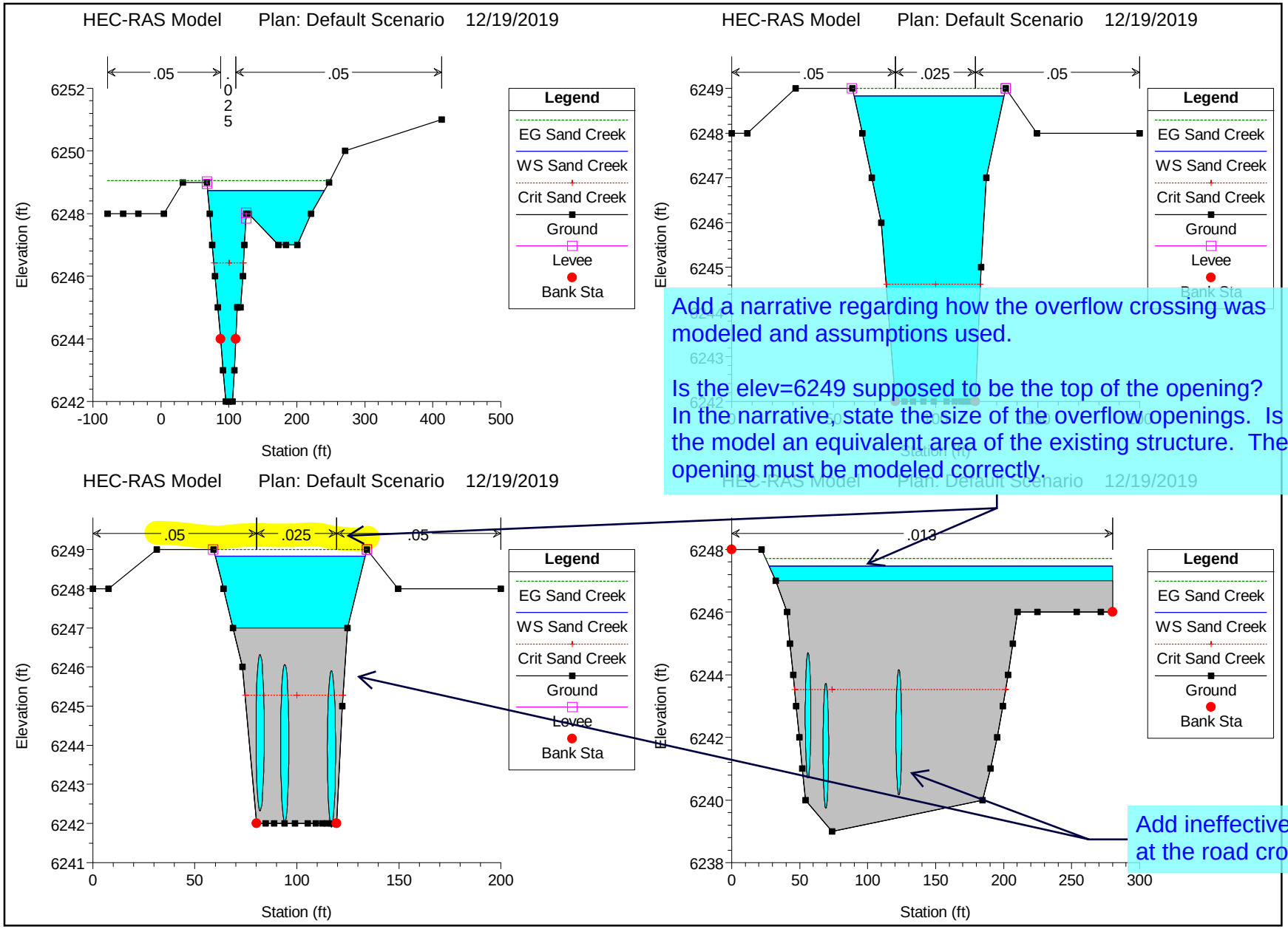
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Add a narrative regarding how the overflow crossing was modeled and assumptions used.
Is the elev=6249 supposed to be the top of the opening?
In the narrative, state the size of the overflow openings. Is the model an equivalent area of the existing structure. The opening must be modeled correctly.
HEC-RAS Model Plan: Default Scenario 12/19/2019
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Ground
Levee
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Elevation (ft)
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WS Sand Creek
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Ground
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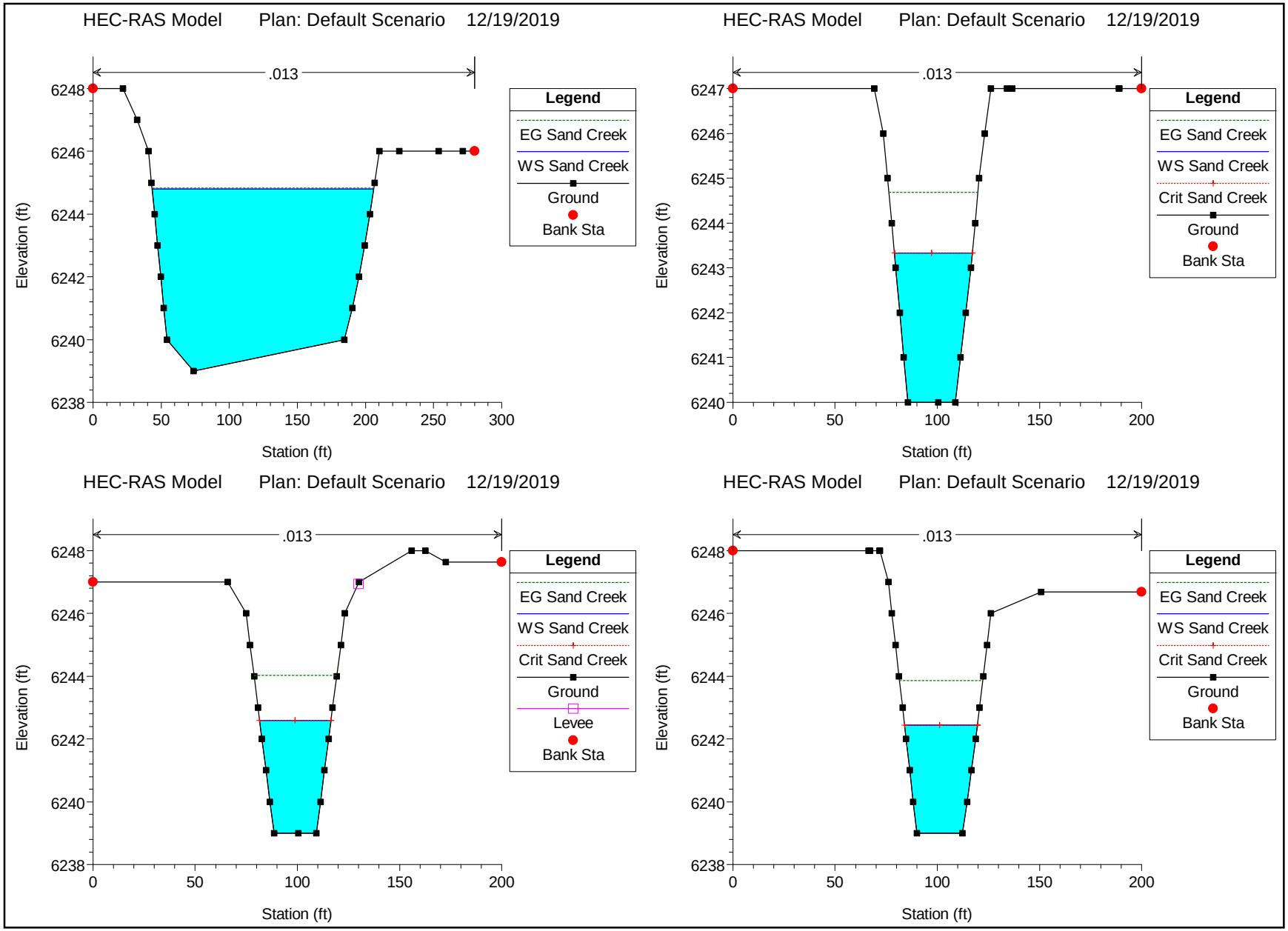
Add ineffective areas at the road crossing.


HEC-RAS Model Plan: Default Scenario 12/19/2019
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HEC-RAS Model Plan: Default Scenario 12/19/2019
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HEC-RAS Model Plan: Default Scenario 12/19/2019
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Elevation (ft)
Station (ft)
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WS Sand Creek
Crit Sand Creek
Ground
Bank Sta

HEC-RAS Plan: Default Scenario River: Channel 01 Reach: CH01 Profile: Sand Creek

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)	
CH01	1053	Sand Creek	760.00	6265.00	6269.26	6269.26	6270.04	0.003762	8.51	179.27	110.42	0.77
CH01	1052	Sand Creek	760.00	6258.00	6262.11	6262.11	6263.78	0.005804	10.49	77.83	25.50	0.96
CH01	1051	Sand Creek	760.00	6257.00	6261.64	6261.64	6263.29	0.006883	10.30	74.47	24.12	0.98
CH01	1050	Sand Creek	760.00	6257.00	6261.55	6261.55	6263.17	0.005614	10.36	81.50	27.77	0.96
CH01	1049	Sand Creek	760.00	6257.00	6260.93	6260.93	6262.50	0.005917	10.15	80.51	28.71	0.97
CH01	1048	Sand Creek	760.00	6255.00	6259.52	6259.52	6261.19	0.005730	10.51	80.21	27.19	0.97
CH01	1047	Sand Creek	760.00	6254.00	6258.20	6258.20	6259.83	0.006013	10.34	79.30	27.50	0.98
CH01	1046	Sand Creek	760.00	6253.00	6257.62	6257.33	6258.86	0.004369	9.10	93.85	32.59	0.85
CH01	1045	Sand Creek	760.00	6253.00	6257.94		6258.62	0.002044	6.71	123.65	36.54	0.59
CH01	1044	Sand Creek	760.00	6252.00	6258.04		6258.47	0.000942	5.39	158.77	38.15	0.42
CH01	1043	Sand Creek	760.00	6252.00	6258.17		6258.40	0.000450	3.84	219.34	49.10	0.29
CH01	1042	Sand Creek	760.00	6252.00	6258.25		6258.35	0.000192	2.60	333.13	72.33	0.19
CH01	1041	Sand Creek	760.00	6251.00	6258.15	6254.86	6258.33	0.000342	3.46	250.00	54.53	0.26
CH01	1040	Sand Creek	760.00	6251.00	6257.48		6258.25	0.001509	7.34	129.48	31.17	0.53
CH01	1039	Sand Creek	720.00	6250.00	6256.03	6256.03	6258.09	0.005145	12.17	78.63	22.88	0.93
CH01	1038	Sand Creek	720.00	6250.00	6254.65	6254.65	6256.48	0.005632	11.04	74.30	23.99	0.96
CH01	1037	Sand Creek	720.00	6249.00	6254.26	6254.26	6256.12	0.005266	11.39	78.61	25.24	0.94
CH01	1036	Sand Creek	720.00	6249.00	6254.18	6253.87	6255.67	0.004153	10.16	86.85	27.64	0.84
CH01	1035	Sand Creek	720.00	6248.00	6254.49		6255.37	0.001997	8.12	123.42	33.33	0.60
CH01	1034	Sand Creek	720.00	6248.00	6253.87	6253.37	6255.23	0.003530	9.97	96.29	27.50	0.78
CH01	1033	Sand Creek	720.00	6248.00	6253.90	6253.27	6255.15	0.003218	9.54	100.27	28.48	0.75
CH01	1032	Sand Creek	720.00	6248.00	6254.02	6252.85	6254.99	0.002212	8.21	107.83	28.30	0.63
CH01	1031	Sand Creek	720.00	6247.00	6252.93	6252.93	6254.82	0.005902	11.67	81.05	24.65	0.92
CH01	1030	Sand Creek	960.00	6247.00	6253.53		6254.38	0.001956	8.14	169.51	45.64	0.61
CH01	1029	Sand Creek	960.00	6247.00	6253.61		6254.29	0.001452	7.08	180.40	43.93	0.52
CH01	1028	Sand Creek	960.00	6247.00	6253.63	6251.57	6254.24	0.001217	6.58	184.56	43.62	0.48
CH01	1027	Sand Creek	960.00	6247.00	6253.56		6254.17	0.001232	7.01	201.11	46.32	0.50
CH01	1026	Sand Creek	960.00	6247.00	6253.62		6254.11	0.000969	5.82	199.63	47.17	0.43
CH01	1025	Sand Creek	960.00	6247.00	6253.70	6250.88	6254.05	0.000644	4.85	227.01	48.43	0.35
CH01	1024	Sand Creek	960.00	6246.00	6253.67	6250.42	6254.02	0.000576	4.98	235.21	46.35	0.34
CH01	1023	Sand Creek	960.00	6246.00	6253.62	6250.47	6254.01	0.000626	5.21	225.63	43.80	0.35
CH01	1022	Sand Creek	960.00	6246.00	6253.61		6254.00	0.000607	5.19	221.85	41.91	0.35
CH01	1021	Sand Creek	960.00	6246.00	6253.17		6253.94	0.001350	7.37	164.92	36.16	0.51
CH01	1020	Sand Creek	960.00	6246.00	6252.32	6251.61	6253.82	0.003159	10.30	118.91	30.63	0.76
CH01	1019	Sand Creek	960.00	6246.00	6252.49	6251.34	6253.62	0.002313	9.03	140.23	36.35	0.66
CH01	1018	Sand Creek	960.00	6246.00	6251.44	6251.44	6253.45	0.004819	12.21	109.12	31.63	0.94
CH01	1017	Sand Creek	960.00	6245.00	6251.26	6250.03	6252.37	0.002324	8.73	133.16	32.49	0.65
CH01	1016	Sand Creek	960.00	6245.00	6250.14	6250.14	6252.15	0.005299	11.66	96.28	28.21	0.95
CH01	1015	Sand Creek	960.00	6244.00	6251.21	6248.09	6251.47	0.000477	4.25	314.68	138.95	0.31
CH01	1014	Sand Creek	960.00	6244.00	6251.27	6248.75	6251.42	0.000382	4.04	569.27	223.80	0.27
CH01	1013	Sand Creek	960.00	6244.00	6251.23	6249.89	6251.41	0.000458	4.60	563.71	230.59	0.31
CH01	1012	Sand Creek	960.00	6244.00	6248.95	6248.95	6251.18	0.005915	12.72	104.90	38.16	1.02
CH01	1011	Sand Creek	960.00	6244.00	6249.93	6249.33	6250.26	0.001070	6.13	417.77	226.74	0.45
CH01	1010	Sand Creek	960.00	6244.00	6249.88	6249.18	6250.23	0.001094	6.17	384.91	191.66	0.45
CH01	1009	Sand Creek	960.00	6242.00	6247.90	6247.90	6250.01	0.005143	12.26	101.15	28.96	0.95
CH01	1008	Sand Creek	960.00	6242.00	6248.45	6247.79	6249.34	0.002236	8.72	239.78	156.77	0.64
CH01	1007	Sand Creek	960.00	6242.00	6248.35	6247.31	6249.28	0.002057	8.88	241.12	147.13	0.63
CH01	1006	Sand Creek	960.00	6242.00	6248.71	6247.91	6249.08	0.000994	6.40	388.97	184.89	0.44
CH01	1005	Sand Creek	960.00	6242.00	6248.74	6246.43	6249.05	0.000682	5.13	369.46	171.59	0.36
CH01	1004	Sand Creek	960.00	6242.00	6248.84	6244.62	6249.00	0.000243	3.34	350.24	73.51	0.23
CH01	1003.56		Culvert									
CH01	1003	Sand Creek	960.00	6239.00	6245.27		6245.29	0.000041	1.23	850.57	165.37	0.09
CH01	1002	Sand Creek	960.00	6240.00	6243.55	6243.55	6245.12	0.005805	10.53	111.04	39.07	0.99
CH01	1001	Sand Creek	960.00	6239.00	6243.01	6242.69	6244.34	0.004180	9.45	114.97	36.54	0.84
CH01	1000	Sand Creek	960.00	6239.00	6242.51	6242.51	6244.10	0.005927	10.29	102.60	35.96	0.98

APPENDIX C

REFERENCE MATERIALS

Federal Emergency Management Agency

Washington, D.C. 20472

JAN 3 0 2007

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Sallie Clark
Chair, El Paso County
Board of Commissioners
27 East Vermijo Avenue
Colorado Springs, CO 80903

IN REPLY REFER TO:
Case No.: 05-08-0368P
Community Name: El Paso County, CO
Community No.: 080059
Effective Date of This Revision: MAY 2 3 2007

Dear Ms. Clark:

The Flood Insurance Study report and Flood Insurance Rate Map for your community have been revised by this Letter of Map Revision (LOMR). Please use the enclosed annotated map panel(s) revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals issued in your community.

Additional documents are enclosed which provide information regarding this LOMR. Please see the List of Enclosures below to determine which documents are included. Other attachments specific to this request may be included as referenced in the Determination Document. If you have any questions regarding floodplain management regulations for your community or the National Flood Insurance Program (NFIP) in general, please contact the Consultation Coordination Officer for your community. If you have any technical questions regarding this LOMR, please contact the Director, Federal Insurance and Mitigation Division of the Department of Homeland Security's Federal Emergency Management Agency (FEMA) in Denver, Colorado, at (303) 235-4830, or the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Sincerely,

Patrick, F. Sacbibit, P.E., CFM, Project Engineer
Engineering Management Section
Mitigation Division

For: William R. Blanton Jr., CFM, Chief
Engineering Management Section
Mitigation Division

List of Enclosures:

Letter of Map Revision Determination Document
Annotated Flood Insurance Rate Map
Annotated Flood Insurance Study Report

cc: The Honorable Lionel Rivera
Mayor, City of Colorado Springs

[redacted]
Regional Floodplain Administrator
Pikes Peak Regional Building Department

[redacted]
J. F. Sato and Associates, Inc.

[redacted]
Engineering and Surveying, Inc.

 | Issue Date: JAN 3 0 2007 | Effective Date: MAY 2 3 2007 | Case No.: 05-08-0368P | LOMR-APP

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	El Paso County Colorado (Unincorporated Areas)	CHANNELIZATION CULVERT	FLOODWAY HYDRAULIC ANALYSIS NEW TOPOGRAPHIC DATA BASEMAP CHANGES
	COMMUNITY NO.: 080059		
IDENTIFIER	Sand Creek Center Tributary and East Fork LOMR	APPROXIMATE LATITUDE & LONGITUDE: 38.846, -104.720 SOURCE: USGS QUADRANGLE DATUM: NAD 27	

ANNOTATED MAPPING ENCLOSURES			ANNOTATED STUDY ENCLOSURES
TYPE: FIRM*	NO.: 08041C0752 F	DATE: March 17, 1997	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: August 23, 1999
TYPE: FIRM	NO.: 08041C0753 F	DATE: March 17, 1997	PROFILE(S): 206P
TYPE: FIRM	NO.: 08041C0754 F	DATE: March 17, 1997	FLOODWAY DATA TABLE: 5

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

FLOODING SOURCE(S) & REVISED REACH(ES)

Sand Creek Center Tributary – from approximately 1,350 feet upstream of East Frontage Road to just upstream of Galley Road

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Sand Creek Center Tributary	Zone AE	Zone AE	YES	YES
	Floodway	Floodway	YES	YES
	BFEs*	BFEs	NONE	YES
	Zone X (shaded)	Zone X (shaded)	YES	YES

* BFEs - Base Flood Elevations

DETERMINATION

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

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Patrick F. Sacbibit, P.E., CFM, Project Engineer
Engineering Management Section
Mitigation Division

109770 10.3.1.05080368 102-I-A-C

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

OTHER COMMUNITIES AFFECTED BY THIS REVISION

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

AFFECTED MAP PANELS			AFFECTED PORTIONS OF THE FLOOD INSURANCE STUDY REPORT
TYPE: FIRM	NO.: 08041C0753 F	DATE: March 17, 1997	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: August 23, 1999
TYPE: FIRM	NO.: 08041C0754 F	DATE: March 17, 1997	PROFILE(S): 205P, 206P, 209P, and 210P FLOODWAY DATA TABLE: 5

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Patrick F. Sacbibit, P.E., CFM, Project Engineer
Engineering Management Section
Mitigation Division

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

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

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

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

COMMUNITY REMINDERS

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

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

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

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Patrick F. Sacbibit, P.E., CFM, Project Engineer
Engineering Management Section
Mitigation Division

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

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

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

STATUS OF THE COMMUNITY NFIP MAPS

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

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Patrick F. Sacbibit, P.E., CFM, Project Engineer
Engineering Management Section
Mitigation Division

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

PUBLIC NOTIFICATION

FLOODING SOURCE	LOCATION OF REFERENCED ELEVATION	BFE (FEET NGVD 29)		MAP PANEL NUMBER(S)
		EFFECTIVE	REVISED	
Sand Creek Center Tributary	Approximately 1,350 feet upstream of East Frontage Road	6,170	6,165	08041C0753 F
	Just downstream of Terminal Avenue	6,216	6,213	08041C0754 F

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

A notice of changes will be published in the *Federal Register*. This information also will be published in your local newspaper on or about the dates listed below.

LOCAL NEWSPAPER Name: *El Paso County News*
Dates: 02/14/2007 02/21/2007

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Patrick F. Sacbibit, P.E., CFM, Project Engineer
Engineering Management Section
Mitigation Division

CHANGES ARE MADE IN DETERMINATIONS OF BASE FLOOD ELEVATIONS FOR THE CITY OF COLORADO SPRINGS AND THE UNINCORPORATED AREAS OF EL PASO COUNTY, COLORADO, UNDER THE NATIONAL FLOOD INSURANCE PROGRAM

On March 17, 1997, the Department of Homeland Security's Federal Emergency Management Agency identified Special Flood Hazard Areas (SFHAs) in the City of Colorado Springs and in the unincorporated areas of El Paso County, Colorado, through issuance of a Flood Insurance Rate Map (FIRM). The Mitigation Division has determined that modification of the elevations of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) for certain locations in these communities is appropriate. The modified Base Flood Elevations (BFEs) revise the FIRM for the communities.

The changes are being made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (Public Law 93-234) and are in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, Public Law 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65.

A hydraulic analysis was performed to incorporate new topographic data for Sand Creek Center Tributary from just upstream of Airport Road to just upstream of Galley Road and for Sand Creek East Fork from approximately 970 feet downstream of Powers Boulevard to just downstream of Stewart Avenue. This has resulted in a revised delineation of the regulatory floodway, increases and decreases in SFHA width, and increased and decreased BFEs for both aforementioned flooding sources. The table below indicates existing and modified BFEs for selected locations along the affected lengths of the flooding source(s) cited above.

Location	Existing BFE (feet)*	Modified BFE (feet)*
Sand Creek Center Tributary:		
[1]Approximately 150 feet upstream of Airport Road	6,109	6,108
[1]Approximately 1,250 feet upstream of East Frontage Road	6,168	6,164
[2]Approximately 1,350 feet upstream of East Frontage Road	6,170	6,165
[2]Just downstream of Terminal Avenue	6,216	6,213
Sand Creek East Fork:		
[1]Approximately 810 feet downstream of Powers Boulevard	6,099	6,096
[1]Approximately 140 feet downstream of Stewart Avenue	6,206	6,205

*National Geodetic Vertical Datum, rounded to nearest whole foot
[1]City of Colorado Springs
[2]Unincorporated areas of El Paso County

Under the above-mentioned Acts of 1968 and 1973, the Mitigation Division must develop criteria for floodplain management. To participate in the National Flood Insurance Program (NFIP), the community must use the modified BFEs to administer the floodplain management measures of the NFIP. These modified BFEs will also be used to calculate the appropriate flood insurance premium rates for new buildings and their contents and for the second layer of insurance on existing buildings and contents.

Upon the second publication of notice of these changes in this newspaper, any person has 90 days in which he or she can request, through the Chief Executive Officer of the community, that the Mitigation Division reconsider the determination. Any request for reconsideration must be based on knowledge of

changed conditions or new scientific or technical data. All interested parties are on notice that until the 90-day period elapses, the Mitigation Division's determination to modify the BFEs may itself be changed.

Any person having knowledge or wishing to comment on these changes should immediately notify:

The Honorable Sallie Clark
Chair, El Paso County
Board of Commissioners
27 East Vermijo Avenue
Colorado Springs, CO 80903

OR

The Honorable Lionel Rivera
Mayor, City of Colorado Springs
P.O. Box 1575
Colorado Springs, CO 80901

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NGVD)		
Sand Creek East Fork								
A	1,100	100	455	11.9	6,038.7	6,038.7	6,038.7	0.0
B	2,400	100	446	12.2	6,054.3	6,054.3	6,054.3	0.0
C	3,330	100	450	12.0	6,069.9	6,069.9	6,069.9	0.0
D	4,240	100	449	12.1	6,085.1	6,085.1	6,085.1	0.0
E	4,870	102	446	12.0	6,095.1	6,095.1	6,095.1	0.0
F	6,188	70	489	10.9	6,118.5	6,118.5	6,118.5	0.0
G	7,403	71	396	13.5	6,136.0	6,136.0	6,136.0	0.0
H	7,931	148	507	10.5	6,158.8	6,158.8	6,158.8	0.0
I	8,943	98	444	12.0	6,169.0	6,169.0	6,169.0	0.0
J	9,666	86	423	12.6	6,177.0	6,177.0	6,177.0	0.0
K	10,721	81	415	12.8	6,193.3	6,193.3	6,193.3	0.0
L	11,347	166	526	10.1	6,207.3	6,207.3	6,207.3	0.0
M	11,375	173	632	8.4	6,207.9	6,207.9	6,207.9	0.0
N	12,610	367	699	7.6	6,228.8	6,228.8	6,228.9	0.1
O	13,720	188	570	10.0	6,241.7	6,241.7	6,241.7	0.0
P	14,805	125	479	11.1	6,257.9	6,257.9	6,257.9	0.0
Q	14,885	125	601	8.9	6,259.9	6,259.9	6,259.9	1.0
R	15,850	228	582	9.2	6,268.7	6,268.7	6,268.7	0.0
S	16,325	300	678	7.9	6,277.3	6,277.3	6,277.5	0.2
T	16,995	321	690	7.7	6,291.4	6,291.4	6,292.0	0.6
U	17,065	326	667	8.0	6,291.4	6,291.4	6,292.1	0.7
V	17,915	388	1,598	3.3	6,293.4	6,293.4	6,294.0	0.6
W	18,995	367	683	7.8	6,307.2	6,307.2	6,307.6	0.4
X	20,525	413	706	7.5	6,326.4	6,326.4	6,327.1	0.7
Y	22,125	255	620	8.6	6,348.7	6,348.7	6,348.8	0.1
Z	23,105	397	706	7.6	6,359.9	6,359.9	6,359.9	0.0
AA	24,835	431	705	7.4	6,383.7	6,383.7	6,383.7	0.0
AB	26,505	353	667	7.8	6,401.0	6,401.0	6,401.5	0.5

Revised Data

Revised by LOMR dated OCT 07 2004

[1] Feet above confluence with Sand Creek

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

EL PASO COUNTY, CO

AND INCORPORATED AREAS

FLOODWAY DATA

SAND CREEK EAST FORK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET (NGVD))	WITH FLOODWAY (FEET (NGVD))	INCREASE
Sand Creek Center Tributary				Revised Data				
A	940	40	92	8.6	6,106.5	6,106.5	6,106.5	0.0
B	990	40	118	6.7	6,107.2	6,107.2	6,107.2	0.0
C	2,238	91	120	6.6	6,120.2	6,120.2	6,120.2	0.0
D	3,948	46	95	8.0	6,138.3	6,138.3	6,138.3	0.0
E	4,547	170	159	4.8	6,147.4	6,147.4	6,147.4	0.0
F	5,539	52	97	7.8	6,156.8	6,156.8	6,156.8	0.0
G	7,191	63	104	7.3	6,176.2	6,176.2	6,176.2	0.0
H	7,940	52	98	7.8	6,189.6	6,189.6	6,189.6	0.0
I	8,527	40	97	7.7	6,197.6	6,197.6	6,197.6	0.0
J	9,366	17	42	9.0	6,213.4	6,213.4	6,213.4	0.0
K	10,055	232	278	4.0	6,221.9	6,221.9	6,221.9	0.0
L	10,627	539	469	2.4	6,230.6	6,230.6	6,230.6	0.0
M	11,321	31	79	9.1	6,241.1	6,241.1	6,241.1	0.0
N	11,648	60	99	7.3	6,244.6	6,244.6	6,245.4	0.8
O	12,840	29	85	9.6	6,253.8	6,253.8	6,253.8	0.0
P	13,730	27	83	9.9	6,273.6	6,273.6	6,273.6	0.0
Q	14,592	26	68	9.3	6,299.7	6,299.7	6,299.7	0.0
R	14,670	40	61	6.9	6,304.2	6,304.2	6,305.2	1.0
S	15,050	20	63	10.1	6,307.6	6,307.6	6,308.1	0.5
T	15,460	25	68	9.5	6,310.8	6,310.8	6,311.4	0.6
U	15,750	20	41	7.8	6,319.6	6,319.6	6,319.6	0.0
V	16,670	20	39	8.1	6,346.0	6,346.0	6,346.0	0.0

Flow rate = 792 cfs

Flow rate = 822 cfs

[1] Feet Above confluence with Sand Creek East Fork

TABLE 5

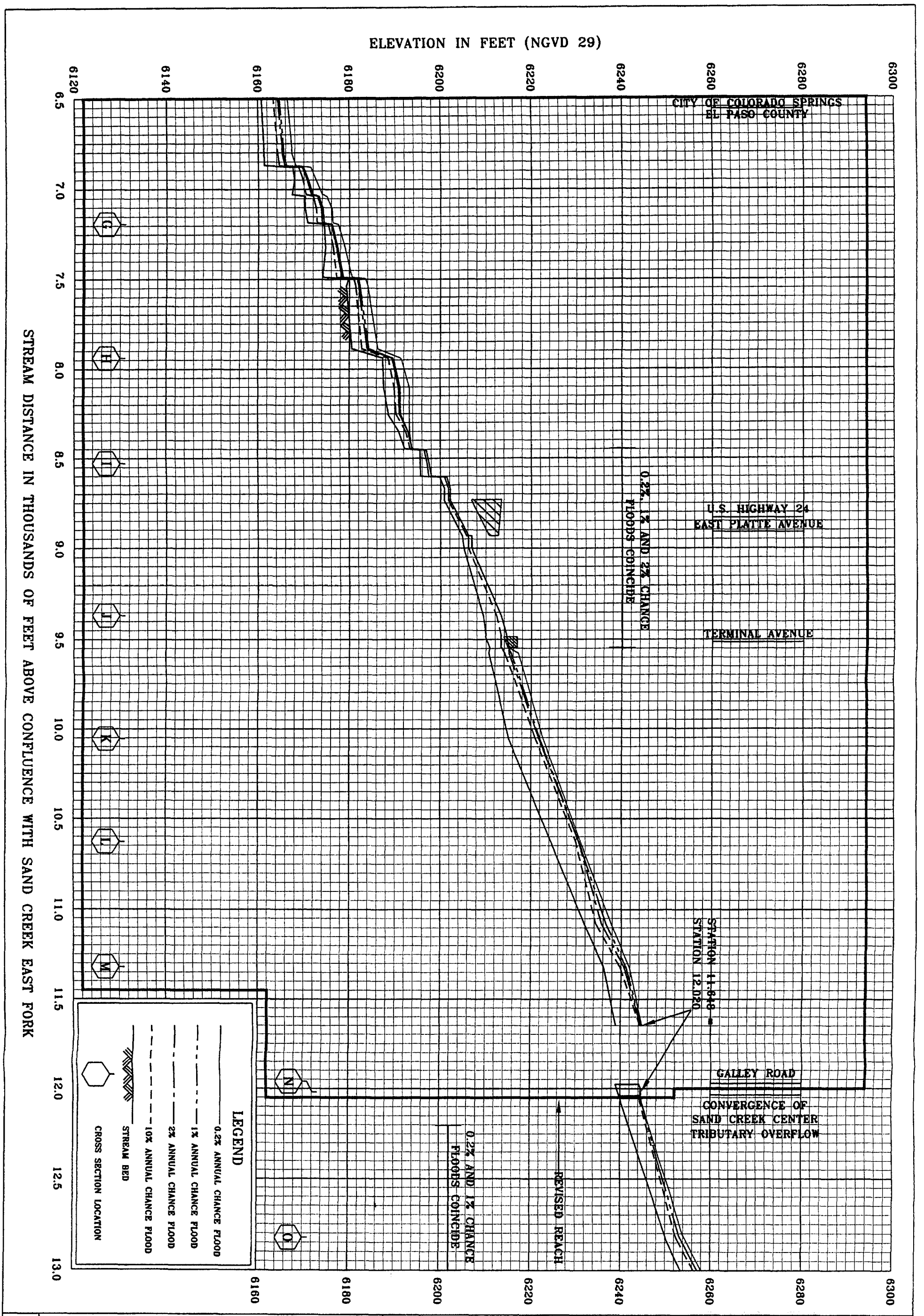
FEDERAL EMERGENCY MANAGEMENT AGENCY

EL PASO COUNTY, CO

AND INCORPORATED AREAS

FLOODWAY DATA

Sand Creek Center Tributary



206P

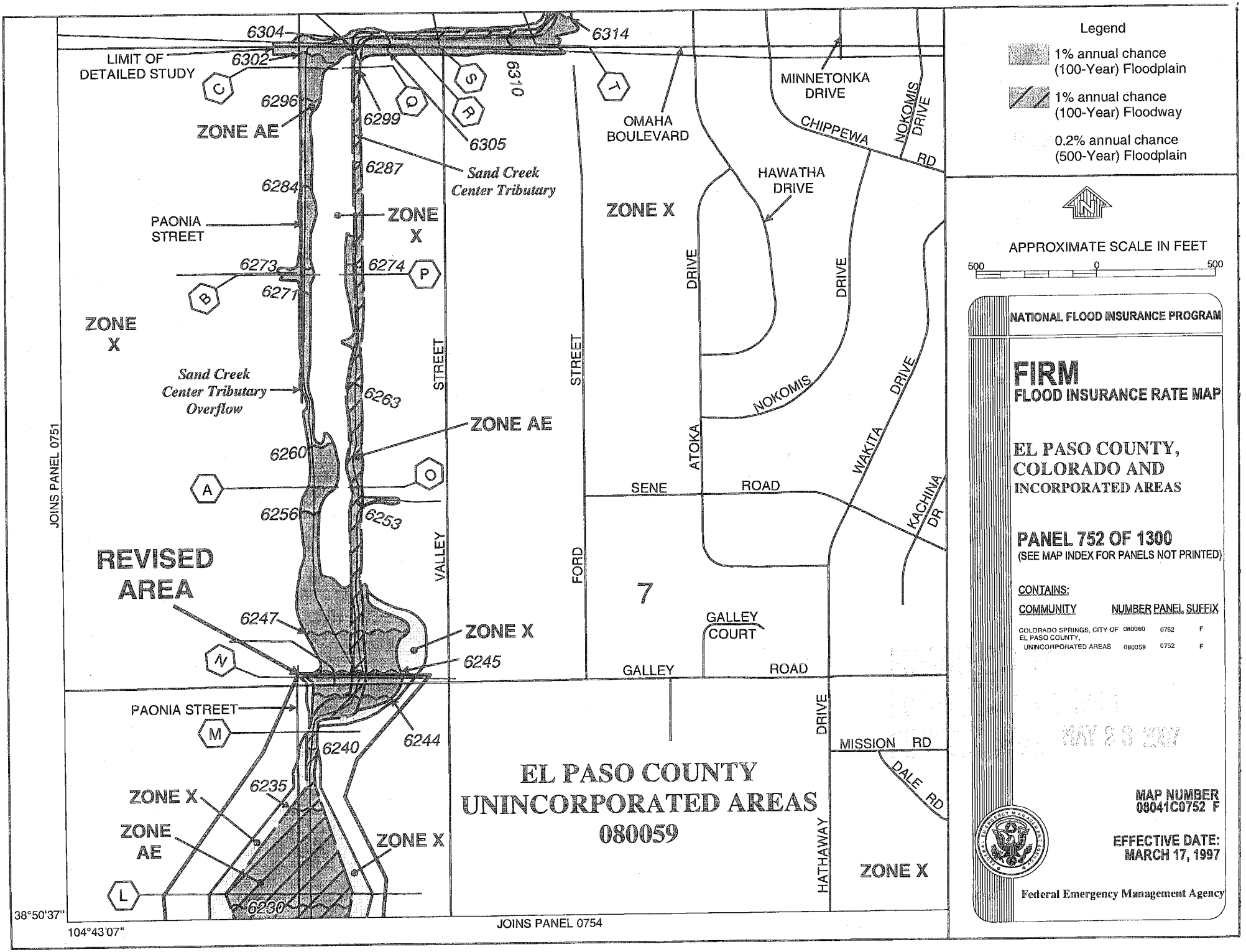
FEDERAL EMERGENCY MANAGEMENT AGENCY

EL PASO COUNTY, CO
AND INCORPORATED AREAS

FLOOD PROFILES

SAND CREEK CENTER TRIBUTARY

MAY 23 2007



Legend

1% annual chance (100-Year) Floodplain

1% annual chance (100-Year) Floodway

0.2% annual chance (500-Year) Floodplain

APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 752 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0752	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0752	F

MAY 2 3 2007

MAP NUMBER
08041C0752 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

Legend

1% annual chance (100-Year) Floodplain

1% annual chance (100-Year) Floodway

0.2% annual chance (500-Year) Floodplain

APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 753 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0753	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0753	F

REVISED TO REFLECT LOMR EFFECTIVE MAY 23 2007

MAP NUMBER
08041C0753 F

EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

EL PASO COUNTY UNINCORPORATED AREAS 080059

CITY OF COLORADO SPRINGS 080060

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 14 SOUTH, RANGE 65 WEST AND TOWNSHIP 14 SOUTH, RANGE 66 WEST.

REVISED AREA

REVISED AREA

0.2% ANNUAL CHANCE FLOOD DISCHARGE CONTAINED IN CULVERT

0.2% ANNUAL CHANCE FLOOD DISCHARGE CONTAINED IN CULVERT

0.2% ANNUAL CHANCE FLOOD DISCHARGE CONTAINED IN CULVERT

JOINS PANEL 0754

ZONE X
ZONE AE
ZONE A
ZONE AH
ZONE AO
ZONE AI
6181
6176
6175
6170
6165
6160
6156
6152
6177
6173
6172
6170
6167
6166
6165
6164
6161
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6141
6117
6112
6108
6106
6102
6098
6095
6090
6085
6080
6075
6070
6062
6105
6109
6100
6112
6119
6129
6124
6134
6138
6158
6139
6118
Sand Creek Center Tributary
Sand Creek East Fork
EL PASO COUNTY
CITY OF COLORADO SPRINGS
BABCOCK ROAD
EAST PLATTE AVENUE
PIKES PEAK ROAD
KARR ROAD
TROY HILL ROAD
AIRPORT ROAD
BOULEVARD
FRONTAGE ROAD
NOLTE DRIVE NORTH
CITA LN
CITA DRIVE
IVOR DRIVE
BADGER DRIVE
HOOSIER DRIVE
NOLTE CT
NORDIC DRIVE
POWERS
Bridge
12
13
18
19
24
7
R66W
R65W

104°43'07"
38°50'37"
JOINS PANEL 0752
JOINS PANEL 0753

ZONE X
ZONE AE
6227
6223
K
6216
PAONIA STREET
ZONE X
6213
J
0.2% ANNUAL CHANCE FLOOD DISCHARGE CONTAINED IN CULVERT
6211
6207
ZONE X
EAST PLATTE AVENUE
AMELIA STREET
VALLEY STREET
FORD STREET
TERMINAL AVENUE
HATHAWAY DRIVE
STREET
24
7

EL PASO COUNTY
UNINCORPORATED AREAS
080059

6201
6196
6202
6198
0.2% ANNUAL CHANCE FLOOD DISCHARGE CONTAINED IN CULVERT
ZONE X
6192
I
H
6194
6184
6190
6185
ZONE AE
REVISED AREA
6182
6179
Sand Creek Center Tributary

ZONE X
P
6258
6255
6250
6246
ZONE X
ZONE X
ZONE AE
6238
6241
O
ZONE X

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 14 SOUTH, RANGE 65 WEST.

EAST BIJOU STREET
EL PASO COUNTY
CITY OF COLORADO SPRINGS
6234
6229
N
6225
6220
ZONE X
ZONE X

AREA REVISED BY LOMR DATED OCTOBER 7, 2004
Sand Creek East Fork
6213
6217
CORPORATE LIMITS
18
L
M
6208
ZONE X
ZONE X
ZONE X
6206
6204
6201
STEWART AVENUE
ZONE X
6198
K
6190
6194
ZONE AE
6187
6182
J
6177
ZONE X
REVISED AREA
GOODFELLOW STREET
PAINE STREET
ENT STREET
STREET
ZONE X
Sand Creek East Fork
ZONE X
I
6167
ZONE X
6161
ZONE X
PAINE AVENUE
OTIS STREET
TRUAX
HAMILTON AVENUE
PETERSON BOULEVARD
CITY OF COLORADO SPRINGS
080060
19

Legend

1% annual chance (100-Year) Floodplain

1% annual chance (100-Year) Floodway

0.2% annual chance (500-Year) Floodplain

APPROXIMATE SCALE IN FEET
500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 754 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0754	F
EL PASO COUNTY, UNINCORPORATED AREAS	080059	0754	F

REVISED TO REFLECT LOMR EFFECTIVE MAY 23 2007

MAP NUMBER
08041C0754 F

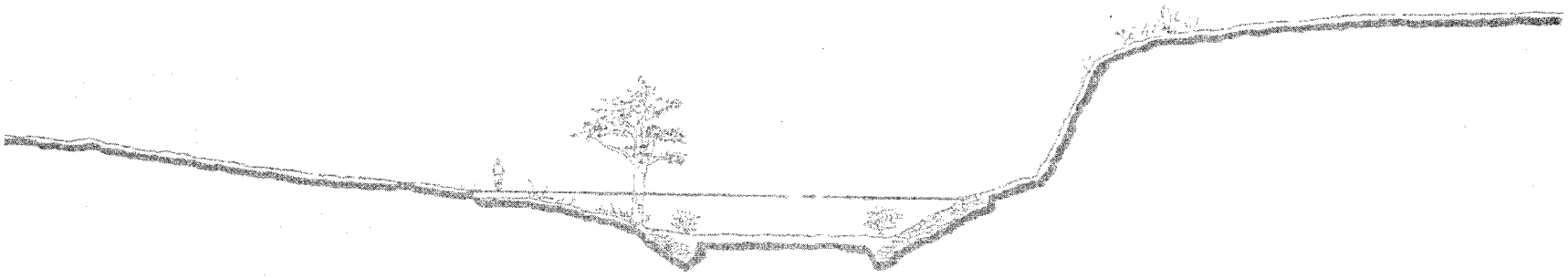
EFFECTIVE DATE:
MARCH 17, 1997

Federal Emergency Management Agency

SAND CREEK DRAINAGE BASIN PLANNING STUDY

PRELIMINARY DESIGN REPORT

CITY OF COLORADO SPRINGS, EL PASO COUNTY, COLORADO



PREPARED FOR:

City of Colorado Springs
Department of Comprehensive Planning, Development and Finance
Engineering Division
30 S. Nevada
Colorado Springs, Colorado 80903

PREPARED BY:

Kiowa Engineering Corporation
1011 North Weber
Colorado Springs, CO 80903

SAND CREEK
DRAINAGE BASIN PLANNING STUDY

PRELIMINARY DESIGN REPORT

Prepared for:

City of Colorado Springs
Department of Comprehensive Planning, Development And Finance
Engineering Division - MAIL CODE 435
P.O. Box 1575
Colorado Springs, CO 80901-1575

Prepared by:

Kiowa Engineering Corporation
1001 North Weber #200
Colorado Springs, CO 80903

KIOWA Project No. 90.04.09
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JANUARY 1993
Revised APRIL 1993
Revised FEBRUARY 1995
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Resolution No. 189-95

A RESOLUTION ADOPTING THE SAND CREEK DRAINAGE BASIN PLANNING STUDY AND ESTABLISHING A DRAINAGE FEE, A DETENTION POND CAPITAL FEE, A DETENTION POND LAND FEE, AND AN ARTERIAL BRIDGE FEE FOR THE BASIN.

WHEREAS, the City Engineering Division of the City of Colorado Springs Department of Planning and Development has reviewed the Sand Creek Drainage Basin Planning Study as prepared by Kiowa Engineering Corporation, Colorado Springs, Colorado dated November 2, 1995, and

WHEREAS, the City/County Drainage Board has recommended approval of the above study at their November 2, 1995, meeting;

WHEREAS, the Sand Creek Drainage Basin includes unplatted land within the City limits;

NOW THEREFORE, BE IT RESOLVED by the City Council of the City of Colorado Springs:

Section 1. That the Sand Creek Drainage Basin Planning Study, dated November 1995, by Kiowa Engineering Corporation is adopted for use. City Engineering will utilize that study to assist in evaluating subdivision drainage reports.

Section 2. That a Sand Creek Drainage Basin Fee be established as $4,895/acre, that a Sand Creek Detention Pond Capital Fee be established as $1,213/acre, that a Sand Creek Detention Pond Land Fee be established as $167/acre, and that a Sand Creek Arterial Bridge Fee be established as $323/acre, as part of.

Dated at Colorado Springs, Colorado, this 28th day of November, 1995.

Mayor

ATTEST:

City Clerk

ENGINEER'S STATEMENT:

The attached SAND CREEK DRAINAGE BASIN PLANNING STUDY report was 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 City for drainage reports. I accept responsibility for any liability caused by any negligent acts, errors and omissions on my part in preparing this report.

Kiowa Engineering Corporation, 1011 North Weber St., Suite 200, Colorado Springs, CO 80903

Registered Engineer # 19510

Date 7/20/96

I. INTRODUCTION

Authorization

The preliminary design of the drainageway and roadway crossing facilities within the Sand Creek Drainage Basin was authorized under the terms of Agreement Number 90-85 between the City of Colorado Springs (City) and Kiowa Engineering Corporation. The agreement was approved by the Colorado Springs City Council, April 10, 1990. Subsequent to this agreement, a change order to the contract to allow for the inclusion of technical information contained in the draft East Fork Sand Creek Drainage Basin Planning Study was approved July, 1993.

Purpose and Scope

The purpose of the study is to identify feasible stormwater management plans to satisfy the existing and future needs within the Sand Creek Drainage Basin. The Sand Creek basin is to be referred to throughout this study and is inclusive of the Sand Creek mainstem and East Fork Sand Creek watersheds. The specific scope of work for this study included the following tasks:

1. Meet with the City to: insure compliance with the services required by this agreement, obtain existing data and general information from participating entities, solicit desires of participating entities and other interested agencies or groups in order to develop alternate plans, procure current information relative to development plans in the basin, procure information relative to right-of-way limitations, proposed stormwater projects, potential hazards due to flooding, and avoid duplication of effort whenever possible by utilizing existing information available from other agencies.
2. Contact the City, County, individuals, and other agencies who have knowledge and/or interest in the study area.
3. Utilize City policies and criteria and applicable information wherever possible.
4. Perform hydraulic and hydrologic analyses within the study area.
5. Identify environmental setting of basin.
6. Identify existing and potential drainage and/or flooding problems.
7. Develop improvement alternatives to reduce existing and potential flooding problems, and to mitigate the impact of stormwater runoff upon environmentally significant areas along the drainageway(s).
8. Examine the operation and maintenance aspects of feasible alternatives.
9. Conduct an economic analysis of each alternative.
10. Recommend and prepare a preliminary design for a selected alternative plan.
11. Develop drainage and bridge fees for the basin.
12. Prepare a written report discussing all items examined in the study.
13. Conduct presentations to public and private entities in order to define project goals, and to involve agencies with specific interest to help define feasible alternatives.

Summary of Data Obtained

Listed below are the technical reports collected for the review as part of preparing this study:

1. Soil Survey for El Paso County, Colorado, dated June 1981.
2. "City of Colorado Springs/El Paso County Drainage Criteria Manual", prepared by City of Colorado Springs, El Paso County, and HDR Infrastructure, Inc., dated May 1987.
3. "Flood Insurance Studies for Colorado Springs, and El Paso County, Colorado", prepared by the Federal Emergency Management Agency (FEMA), revised 1989.
4. Flood Insurance Restudy, Hydrology Report and Hydrologic Analyses, prepared by RCI, Inc., 1989.
5. Sand Creek Drainage Basin Planning Study prepared by Simons, Li & Associates, Inc., dated July, 1985.
6. Flood Hazard Analysis, Sand Creek, City of Colorado Springs and El Paso County, Colorado, prepared by the Soil Conservation Service, dated December, 1973.
7. Banning-Lewis Ranch Master Drainage Plan, prepared by MSM Consultants, Inc., dated June 1981.
8. Sand Creek Drainage Basin Study, prepared by United Planning and Engineering Company, October, 1977.
9. Draft East Fork Sand Creek Drainage Basin Planning Study, prepared by Kiowa Engineering Corporation, January, 1989.
10. Drainage Basin Inventory, Sand Creek Drainage Basin, prepared by Oliver E. Watts, P.E., June 1990.

In addition to the above listed reports there were a number of drainage study reports, sketch plans, preliminary and final design drawings, land use and zoning maps, development

plans, and existing drainage facility maps that were collected from the City, County, and other local agencies.

Reports which were prepared previous to the preliminary design report include the "Sand Creek Drainage Basin Planning Study Hydrology Report," and the "Sand Creek Drainage Basin Planning Study Development of Alternatives Report." These reports were prepared as part of the overall planning effort and have been referred to throughout this report. The Hydrology Report summarized peak flow data for existing and future basin development conditions without improvements in the basin, and established the base line hydrologic conditions from which the alternative planning then proceeded. The Development of Alternatives report evaluated the various combinations of drainageway improvements for the basin, taking into account environmental, cost, construction, right-of-way, maintenance and implementation factors for each feasible alternate plan. These reports are on file with the City Engineering Division, as well as technical addenda for each report. Both of these reports covered only the mainstem of the Sand Creek Basin. The similar information prepared for the draft East Fork Sand Creek Drainage Basin Planning Study has been summarized in this preliminary design report.

Mapping and Surveying

Mapping used in the planning effort for the mainstem of Sand Creek consisted of USGS 7-1/2 minute quadrangles, and 2-foot contour interval, 1-inch to 200-foot scale planimetric topographic maps. For the area of the basin north of Woodmen Road, aerial topographic mapping was compiled in May 1990. For the balance of the basin, the City of Colorado Springs Department of Public Utilities provided topographic mapping compiled from aerial photographs dated 1989. This mapping has been prepared as part of the Facility Inventory Management System (FIMS). The aerial topographic mapping was used in the drainage inventory, hydrologic/hydraulic analyses, and in the alternative planning phases of this project. All topographic mapping was based upon USGS vertical datum.

For the East Fork Sand Creek basin, mapping from the FIMS office and two-foot contour interval topography prepared in 1987 for the Banning-Lewis Ranch property were used in the preparation of the preliminary design. Where topographic mapping was not available, USGS quadrangle maps were used.

Stream cross-section data was obtained from the aerial mapping described above. These sections were verified against the cross-sections compiled in the 1986 City of Colorado Springs Flood Insurance Study (FIS), wherever possible.

Drainageway site inspections were conducted throughout the study area, and photographs were taken documenting the key drainage features.

The following general conditions have been placed upon the use of the FIMS topographic mapping:

-- Use of these products is restricted to the project for which the FIMS products are provided.

-- Only the body content found within the neatline of the borrowed maps may appear in any report/publication developed for your study. Also, the labeling that appears on any photographs provided shall not appear in any such report/publication.

-- All FIMS' products provided to contractors involved in the subject study shall be retrieved by your department upon conclusion of the study and either returned to FIMS or destroyed.

-- The report(s) developed in which the FIMS' products are used shall include the following disclaimer statement:

"The maps and photographs included in this report were developed for purposes of the Colorado Springs Department of Utilities and are for internal use only. The Colorado Springs Department of Utilities makes no warranty, expressed or implied, as to the completeness, accuracy, or content of such products or any reproductions thereof. Any other use is not recommended and occurs at the risk of the user; such user is solely responsible and/or liable for the use of such products.

Original maps and photographs are the property of the Colorado Springs Department of Utilities. All rights are reserved. These maps and photographs or any associated record may not, wholly or in part, be reproduced, stored, or transmitted in any form or by any means, electronic, mechanical, photocopying, or otherwise, without the express prior written permission of the Colorado Springs Department of Utilities.

Regardless of the existence of purported copies of these official maps and photographs which may from time to time be made or published, there is only one set of official maps and photographs, which are those kept and maintained by the Colorado Springs Department of Utilities."

Project Coordination

Throughout the course of the study, meetings were held with representatives of City, County, State, and Federal agencies with an interest in drainageway planning in general. The primary reason for the coordination effort was to obtain technical information and to identify concerns with regard to the development of drainageway facilities within the basin. During the course of preparing the Development of Alternatives report, the planning constraints and concepts were discussed with the agencies and interested individuals and their input used to refine the feasible alternatives and to eventually identify a recommended drainageway plan for further design evaluation. The complete mailing list and project correspondence is contained in Appendix A of this report.

Coordination with a similar list of agencies and individuals was conducted during the preparation of the draft East Fork Sand Creek Drainage Basin Planning study. This study was authorized and conducted for Aries Properties, Inc. Meetings with state and federal agencies, the City and the County were involved in a series of meetings during the development of the alternative planning concepts and the preliminary design for the East Fork Sand Creek basin.

Acknowledgements

During the preparation of the study, several government agencies and interested individuals were routinely involved in the coordination activities. Representatives from the Colorado Division of Wildlife, U.S. Army Corps of Engineers (COE), and various City Departments provided valuable commentary during the development of the alternative plans. A listing of the individuals and agencies routinely coordinated with during the study has been presented below:

Name	Agency
Alan Morrice	El Paso County Department of Public Works
John Fisher	El Paso County Land Use Department
Sue Johnson	El Paso County Parks Department
Rick O'Connor	El Paso County Planning Department
Hugh King	City of Colorado Springs Street Division
Gary Haynes	City Engineering Division
Bruce Thorson	City Engineering Division
Ken Sampley	City Engineering Division
Steve Jacobsen	City Engineering Division
Christine Lytle	City Engineering Division
Bruce Goforth	Colorado Division of Wildlife
Dan Bunting	Regional Building Department
Sarah Fowler	Environmental Protection Agency
John Liou	Federal Emergency Management Agency
Dave Frick	RCI, Inc., Fort Collins, Colorado
Bill Noonan	U.S. Fish and Wildlife
Anita Culp	U.S. Army Corps of Engineers
John Maynard	Aiken/Audobon Society
John Covert	Palmer Foundation
Peter Kernkamp	City Planning Department
Jim Rees	Department of Planning and Development
Fred Mais	City Parks and Recreation
Diana Medina	City of Colorado Springs Department of Public Utilities Gas Division
Dan Tippie	City of Colorado Springs Department of Public Utilities Wastewater Division
Russ Nicklin	City of Colorado Springs Department of Public Utilities Water Division
Wes Tyson	City Attorney's Office

II. STUDY AREA DESCRIPTION

The Sand Creek drainage basin is a left-bank tributary to the Fountain Creek lying in the west-central portions of El Paso County. Sand Creek's drainage area at Fountain Creek is approximately 54 square miles of which approximately 18.8 square miles are inside the City of Colorado Springs corporate limits. The basin is divided into five major sub-basins, the Sand Creek mainstem, the East Fork Sand Creek, the Central Tributary to East Fork, the West Fork, and the East Fork Subtributary. Figure II-1 shows the location of the Sand Creek basin.

Basin Description

The Sand Creek basin covers a total of 54 square miles in unincorporated El Paso County and Colorado Springs, Colorado. Of this total, approximately 28 square miles is encompassed by the Sand Creek basin, and 26 square miles for the East Fork Sand Creek basin. The basin trends in generally a south to southwesterly direction, entering the Fountain Creek approximately two miles upstream of the Academy Boulevard bridge over Fountain Creek. Two main tributaries drain the basin, those being the mainstem of Sand Creek and East Fork Sand Creek. Development presence in most evident along the mainstream. At this time, approximately 25 percent of the basin is developed. This alternative evaluation focuses upon the Sand Creek basin only.

The maximum basin elevation is approximately 7,620 feet above mean sea level, and falls to approximately 5,790 feet at the confluence with Fountain Creek. The headwaters of the basin originate in the conifer covered areas of The Black Forest. The middle eastern portions of the basin are typified by rolling range land with fair to good vegetative cover associated with semi-arid climates.

Climate

This area of El Paso County can be described, in general as high plains, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry. Precipitation ranges from 14 to 16 inches per year, with the majority of this precipitation occurring in spring and summer in the form of rainfall. Thunderstorms are common during the summer months, and are typified by quick-moving low pressure cells which draw moisture from the Gulf of Mexico into the region. Average temperatures range from about 30^{o}F in the winter to 75^{o} in the summer. The relative humidity ranges from about 25 percent in the summer to 45 percent in the winter.

Soils and Geology

Soils within the Sand Creek basin vary between soil types A through D, as identified by the U. S. Department of Agriculture, Soil Conservation Service. The predominant soil groupings are in the Truckton and Bresser soil associations. The soils consist of deep, well drained soils that formed in alluvium and residium, derived from sedimentary rock. The soils have high to moderate infiltration rates, and are extremely susceptible to wind and water erosion where poor vegetation cover exists. In undeveloped areas, the predominance of Type A and B soils give this basin a lower runoff per unit area as compared to basins with soils dominated by Types C and D. Presented on Figure II-2 is the Hydrologic Soil distribution map for the Sand Creek basin.

Property Ownership and Impervious Land Densities

Property ownership along the major drainageway within the Sand Creek basin vary from public to private. Along the developed reaches, drainage right-of-ways and greenbelts have been dedicated during the development of the adjacent residential and commercial land. Where development has not occurred, the drainageways remain under private ownership with no delineated drainage right-of-way or easements. There are several public parks which abut the mainstem of Sand Creek. Roadway and utility easements abutting or crossing the major drainageways occur most frequently in the developed portions of the basin.

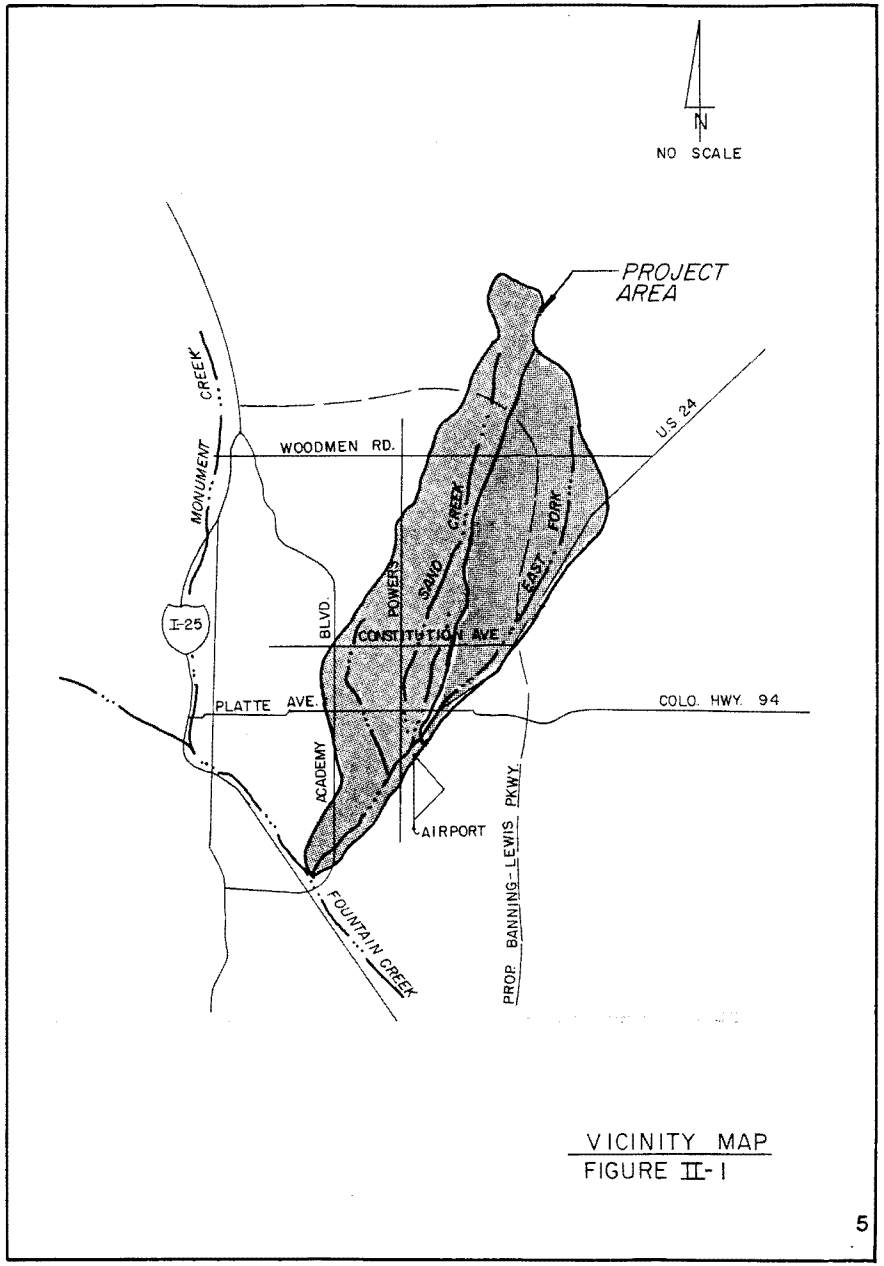
Land use information for the existing and future conditions were reviewed as part of the planning effort. This information is used in the hydrologic analysis to predict runoff rates and volumes for the purposes of facility evaluation. The identification of land uses abutting the drainageways is also useful in the identification of feasible plans for stabilization and aesthetic treatment of the creek. Presented on Figure II-3 is the proposed land use map used in the evaluation of impervious land densities discussed in the hydrologic section of this report. Figure II-3 is not intended to reflect the future zoning or land use policies of the City or the County.

The land use information within the Banning-Lewis Ranch property was obtained from Aries Properties during the time the draft East Fork Sand Creek Drainage Basin Planning Study was being prepared. The land use information was again reviewed with the City of Colorado Springs Department of Planning and was found to be appropriate for use in the estimation of hydrology for the East Fork Basin. The location of future arterial streets and roadways within

the Banning Lewis property were obtained from the Banning-Lewis Ranch master plan. The location of roadways offsite from the Banning Lewis-Ranch were obtained from the El Paso County Major Transportation Plan dated 1988.

Park Land and Open Space

An inventory of park land and public open space was prepared. Many times, the combination of the drainageway and adjacent park lands can be used to visually extend the limits of a park or open space. The drainageway can also act to link parks and other land uses within the basin if multiple use trails are incorporated into the channel section(s). The Sand Creek drainageway has been identified as a major trail corridor within the City of Colorado Springs Trails Plan. Park land designated within the Banning-Lewis Ranch master plan were taken into account during the siting of stormwater facilities within the Banning-Lewis property.



VICINITY MAP
FIGURE II-1

TABLE IV-1: SUMMARY OF HYDRAULIC STRUCTURES - CROSSINGS
SAND CREEK DRAINAGE BASIN PLANNING STUDY

LOCATION	REACH #	SIZE	TYPE	CAPACITY EXISTING	CAPACITY FUTURE (1)	COMMENTS
Airport Road	CT-1	5-6'x8'	BOX CULVERT	ADEQUATE	ADEQUATE	
Pikes Peak Ave.	CT-1	NONE		INADEQUATE	INADEQUATE	POWERS BLVD. OVERTOPPED FREQUENTLY BETWEEN BIJOU ST. AND PIKES PEAK AVE.
Powers Blvd.	CT-1	VARIOUS	METAL PIPE	INADEQUATE	INADEQUATE	
Platte Ave (US 24)	CT-1	8'x4'	BOX CULVERT	INADEQUATE	INADEQUATE	APPROACH CHANNEL IN NEED OF REALIGNMENT
Terminal Avenue	CT-2	2-4'x8'	BOX CULVERT	INADEQUATE	INADEQUATE	
Galley Road	CT-2	3-42"x72"	METAL ARCH PIPE	INADEQUATE	INADEQUATE	
Omaha Boulevard	CT-2	2-36"x57"	METAL ARCH PIPE	INADEQUATE	INADEQUATE	
Powers Boulevard	EFSC-2	90' clear span	CONCRETE BRIDGE	ADEQUATE	ADEQUATE	NEW BRIDGE
Stewart Street	EFSC-2	140'	CONCRETE BRIDGE	ADEQUATE	ADEQUATE	
US 24/Platte Ave	EFSC-2	290'	CONCRETE AND TIMBER BRIDGE	ADEQUATE	ADEQUATE	LIMITED BANK PROTECTION AT INLET AND OUTLET OF BRIDGE
Peterson Road	EFSC-2	4-36"	METAL PIPE	INADEQUATE	INADEQUATE	
Marksheffel Road	EFSC-2	2-36"	METAL PIPE	INADEQUATE	INADEQUATE	

TABLE IV-2: SUMMARY OF HYDRAULIC STRUCTURES - CHANNELS
SAND CREEK DRAINAGE BASIN PLANNING STUDY

LOCATION FROM / TO	REACH #	DIMENSIONS TW (ft)	SS	DEPTH (ft)	TYPE	CAPACITY (1) ADQ	INADQ	COMMENTS
CENTER TRIBUTARY								
East Fork Sand Creek to Airport Road	CT-1	45	2:1	6	Riprap lined trapezoidal channel	X	X	Riprap has failed or is non-existent along some portions of this segment of the Center Tributary
Pikes Peak to Bijou St.	CT-1			N/A	Rubble lined ditches along Powers Blvd.			Flow passes over and along Powers Blvd. street section on a frequent basis. Road closures common.
Bijou St. to Platte Ave.	CT-1			N/A	Unlined, natural.			Overbanks vegetated, channel dry with sand invert, no. vegetation. Channel eroded at outlet of US24 culvert.
Platte Ave. to Terminal Ave.	CT-2	15-25	1:1	4-6	Trapezoidal concrete lined.	X		Channel has adequate capacity.
Terminal Avenue to Galley Road	CT-2	21	1:1	5	Trapezoidal concrete lined.	X		Channel has adequate capacity.
Galley Road to Paonia Ct. (ext)	CT-2	30-40	varies	4-5	Unimproved segment.		X	Channel is degraded and filled with debris. Poor maintainance access.
Paonia Ct. to Omaha Blvd.	CT-2	21	1:1	5	Trapezoidal concrete lined channel.	X		Maintainence access poor. Debris and trash in channel.
Omaha Blvd. to Palmer Park Blvd.	CT-2	19	1:1	4	"	X		Storm sewers outfall to channel near Palmer Park.

VI. DEVELOPMENT OF ALTERNATIVES AND RECOMMENDED PLAN

The concepts which are available for handling stormwater runoff within the Sand Creek basin have been presented and discussed in detail in the Sand Creek Drainage Basin Planning Study Development of Alternatives Report and the draft East Fork Sand Creek Drainage Basin Planning Study. The process of combining the various channel treatment options, detention schemes and roadway crossing structures into a contiguous plan for all of the reaches is presented in this chapter of the report. As a result of the evaluation of the flood control, environmental, open space, operations and maintenance, and implementation concerns within the Sand Creek basin, the following concepts were identified as having sufficient feasibility to warrant further evaluation and review:

Channel Concepts:	Floodplain Preservation Channelization, 10- or 100-year Selective Improvements
Detention:	Regional detention systems

Channel Concepts: The channel concepts listed above have been evaluated with respect to the parameters listed in the previous chapter. A concept's feasibility depends upon its impact, positive or negative, upon the evaluation parameters. ***The floodplain preservation*** concept has been considered to be the same as the ***"do-nothing"*** alternative. The floodplain preservation concept would involve the regulation of the floodplain limits, generally as depicted on the effective City of Colorado Springs and El Paso County Flood Insurance Rate Maps. Regulation of the floodplain so that future encroachments are minimized and the floodproofing of structures which are currently within the 100-year floodplain would presumably be the methods used to address the flood hazard concerns along Sand Creek. In the upper reaches of Sand Creek, the ownership or easements associated with the 100-year floodplain (or greater limits to allow for an erosion buffer zone) would be a primary issue in regards to implementation of such a concept. Detention in the upper reaches of the basin Sand Creek basin and in the East Fork Sand Creek basin will maintain the 100-year floodplain at existing limits within the lower reaches of Sand Creek. The "do-nothing" concept is feasible wherever the existing drainageway improvements are of adequate capacity to convey flood flows. ***Channelization*** would involve the lining of the Creek into a more confined flow area, and could be done for either the ***100-year or 10-year*** flood discharges. Several typical channel concepts have been presented. The primary bank lining material would probably be riprap. Grade control and/or drop structures would be required in a channelization concept so that the flood velocities could be controlled to a level requiring medium to heavy riprap. Soil cement offers an alternative to riprap and concrete for the construction of drops or grade control structures. Revegetation would occur wherever the native vegetation was disturbed by the channel construction. Willows at the toe of the riprap banks would be a minimum replacement. ***Selective linings*** would involve the construction of grade controls, drop structures, bank linings, storm sewer outlet control structures selectively sited to resist stream erosion or to reduce potential flooding damages. Areas of future concern such as at the outside bends of the creek, or at the outlets of bridges or culverts which will cross the drainageway would be subject to selective improvements.

Detention Concepts: The two general detention concepts evaluated were onsite versus regional detention. During the evaluation process, it was determined that the onsite detention concept has a low feasibility relative to a regional concept. This is because, (1) onsite detention has a unpredictable impact upon lowering peak discharges from urbanized areas to historic conditions (reference, Urbonas and Glidden, "Effect of Detention on Flows in Major Drainageways" ASCE Water Forum '81, 1981), (2) an onsite concept has little impact upon maintaining or enhancing water quality, (3) the number of onsite detention basins, their locations and size cannot be accurately determined in the undeveloped portions of the basin at this time, and (4) onsite detention would present a substantial maintenance responsibility to the jurisdictions involved. For these reasons the onsite detention concept was eliminated and regional detention basin concepts were developed. In the analysis of the channel concepts, regional detention facilities were assumed to be in place.

Channel Alternatives

Presented on Table VI-1 is a matrix of channel alternatives which were evaluated. All reaches of Sand Creek and the East Fork of Sand Creek had at least three alternatives analyzed. Presented on Tables VI-2 through VI-6 are comparative evaluations of the floodplain preservation (do-nothing), channelization and selective lining concepts, for the mainstem Sand Creek basin, by reach. The purpose of the evaluation process was to identify the relative advantages and disadvantages of each concept within each reach.

Presented on Figure VI-1 are the alternative channel concept plans for each reach of the East Fork Sand Creek Basin. Alternative 1, "prismatic or composite" channel shown on Figure VI-1 is synonymous with the "channelization" concept developed for the mainstem Sand Creek basin. Alternative 2, "stabilized floodplain section" shown on Figure VI-1 is synonymous with the "selective improvement" concept developed for the mainstem of Sand Creek. Floodplain preservation or the "do-nothing" concept was evaluated for all reaches of the East Fork.

For the channelization and selective improvement concepts, cost comparisons have been completed. Similarly, cost estimates for each of the detention concepts were developed. The cost of property acquisition for land lying outside of the 100-year floodplain limits and for detention basins will have to be accounted for during the calculation of the drainage basin fee for the Sand Creek basin. The cost evaluation and detailed discussion related to the various channelization and detention concepts are contained within the Sand Creek Drainage Basin Planning Study Development of Alternatives Report and the draft East Fork Sand Creek Drainage Basin Planning Study.

Impact Upon Habitat

For each of the channel alternatives evaluated within the mainstem Sand Creek basin an estimate of each alternative's potential for disturbance of the habitat was made. The acreages presented previously on Table V-1 for the Class I and Class II habitat zones were used in determining the extent of disturbance which a particular alternative may entail if implemented within a given reach. Since it is the goal of planning process to identify concepts which will avoid disturbances to the existing habitat wherever practical, alternatives which would have a greater level of disturbance compared to another must have provisions for mitigating the disturbance. Typical disturbances caused by channelization would include loss of native toe and/or bank vegetation, filling of historic floodplains which may contain wetland or riparian habitat, or degradation of water quality to downstream areas resulting from flow concentrations within unlined areas. Selective improvements could create very similar disturbances as channelization, however because the improvements can be selectively sited, avoidance of disturbances is easier to achieve. The floodplain preservation concept has the potential for disturbance to habitat. The loss of toe and bank vegetation can occur over time from natural erosion of the invert and banks which are unlined. This is currently the situation in Reach 1 of Sand Creek.

For those concepts requiring mitigation, the cost of habitat mitigation needs to be included in the total cost for a particular concept if a fair comparison is to be made. A comparison of the estimated potential disturbance acreages of the Class I and II habitat was made for each of the alternative channelization schemes. From this evaluation is was determined that the greatest total Class I and Class II habitat disturbance would result from the implementation of the 100-year channelization concept. The disturbances to the habitat could be mitigated by the re-establishment of the toe vegetation, and by replacing riparian habitat along the overbanks of the channel. The total disturbance for a 10-year channel concept is reduced from the case of the 100-year channel. Greater opportunities for habitat preservation and replacement are afforded by a 10-year concept since a residual 100-year floodplain would remain.

The least total disturbance acreage occurs for the floodplain preservation or a selective improvement concept. Some loss of habitat would occur naturally, mainly along the toe and at low channel benches due to the long-term degradation of the invert, and localized bank erosion. Water quality for the downstream reaches would not be improved by a floodplain preservation concept alone because of increasing rates of sediment transport due to increasing low flows and unlined banks and/or inverts. After a bank or invert failure, it would be anticipated that the native vegetation would eventually replace itself over a period of years.

Implementation of a selective improvement plan would result in a slight reduction in potential disturbance area as compared to the floodplain preservation concept. This is because selective improvements, if constructed prior to the onset of active bank and invert erosion, would prevent the loss of native habitat along the existing low flow banks and in floodplain areas. Disturbances due to construction could be better controlled with a selective improvement concept.

Though the above impacts were not specifically quantified for the East Fork basin, the relative advantages and disadvantages between the channelization concepts with regard to habitat impact for the East Fork are basically the same as for the mainstem Sand Creek. Since the East Fork basin is mostly undeveloped and the drainageways relatively unencroached at this time, there is an opportunity to select channel concepts which will result in little or no adverse impact to the existing habitat. In fact, some opportunity for enhancement of the habitat areas is possible in the future by developing channelization plans which will take advantage of the flood control, erosion control and water quality benefits that can be afforded by the natural floodplain zones and detention areas.

100-year peak discharge to levels. This will allow for the channel improvements to be constructed within the existing right-of way.

Reaches SC-5 and SC-6: A selective channel improvement concept has been recommended for these reaches. Detention in Reach SC-8 of the basin will maintain flows to historic peak discharge levels, however the low flows will increase in frequency and volume. For this reason it has been recommended to provide riprap channel linings at selective locations to at least the 10-year water surface and install grade controls. This will prevent the long-term degradation of the invert. A residual 100-year floodplain will remain and will offer opportunities for habitat replacement and open space preservation. Land adjacent to the drainageway is currently undeveloped or unplatted at this time which makes the feasibility of implementing this concept greater in comparison to the urbanized reaches of the creek.

Reaches SC-7 and SC-8: A selective improvement concept involving the localized lining of channel banks and grade control construction has been recommended for these reaches. The feasibility of this concept stems from the fact that flows will be reduced because of detention. Numerous individual rural ownerships cross the drainageway, however no habitable structures lie within the 100-year floodplain. Because of this, the economic feasibility of channelization concepts is low. Non-structural measures can be used to limit encroachments into floodprone areas. Additionally, the City of Colorado Springs Comprehensive plan recommends that the floodplains be maintained as open space. Potential habitat disturbances can be avoided with a selective plan, or simply replaced as part of the particular construction activity which caused the disturbance.

Reach SC-9: A floodplain preservation concept has been recommended for this reach. Little increase in urbanization is anticipated in this reach, and for this reason the existing drainageway is expected to remain stable. Localized improvements may be necessary to limit erosion caused by flow concentrations at culverts or storm sewers. Private ownership of the drainageway is anticipated to continue which lower the feasibility of channel concepts which require permanent right-of-ways or easements for construction and maintenance.

Reaches WF-1 through WF-3: A 100-year channel concept has been recommended for these reaches primarily because of the potential for flooding damages. Several roadway crossings are in need of replacement because of the flood hazard the constrictions create. Some open space enhancement potential exists for this concept since these reaches have been degraded visually by debris accumulation, bank sloughing and sedimentation. Little opportunity exists for widening the drainageway because the

Development of the Recommended Plan

Presented on Table VI-7 is a matrix representing the recommended plan for each major drainageway reach. The selection of a recommended channel treatment scheme has been based upon the qualitative and quantitative information presented in the Sand Creek Drainage Basin Planning Study Development of Alternatives report and the draft East Fork Sand Creek Drainage Basin Planning Study. Contained within the Technical Addendum to the Sand Creek Drainage Basin Planning Study Development of Alternatives report, is the alternative hydrologic, hydraulic and conceptual cost data used in the evaluation and comparison of each of the alternatives within the mainstem Sand Creek basin.

Discussion of Recommended Plan

The recommendation of a particular channel treatment or detention scheme has been based upon the qualitative and quantitative data presented. For each reach the flood hazard, environmental, cost, operations and maintenance and open space aspects of the drainageway were weighed for each alternative concept.

Reach SC-1: For this reach a 10-year channel section was recommended for further evaluation. With the implementation of regional detention in the upper basin, the 100-year floodplain will generally be confined within the existing banks, excepting at roadway crossings lacking 100-year capacity. It is recommended that a 10-year low flow channel be constructed within the invert of the existing channel through the construction of benches and sand bars. As urbanization continues towards the full development scenario, the base flow and annual flows will increase in volume and frequency. For this reason, the low flow area must be stabilized to protect the existing channel banks from undermining and subsequent bank sloughing. The benched areas offer an opportunity for habitat replacement and enhancement. At some locations within this reach, a residual 100-year floodplain will remain which will have to be regulated. The residual 100-year floodplain offers some potential for open space preservation and enhancement. This is particularly true in the portion of the reach downstream of Hancock Expressway.

Reaches SC-2 through SC-4: A 100-year channel concept has been recommended primarily because of the potential for flooding damages which exists in these reaches. Habitat disturbed by the construction of channel linings and grade control structures could be replaced along the channel toes and on the overbanks. The replacement of the Waynoka Road crossing will reduce the potential for flood damages in areas adjacent to these roadways. The detention within the upper reaches will limit the

drainageway is confined within narrow right-of-ways between existing urban developments.

Reaches CT-1 and CT-2: A 100-year channel concept has been recommended because of flood hazard considerations. Urbanization has altered and blocked the natural drainage path for the majority of these reaches. A limited amount of habitat native to the drainageways was found during the environmental review. Revegetation at the top of the channel banks and along the toe of the riprap banks offers some opportunity for open space visual enhancement. The existing flow path has been visually degraded by debris dumping, excessive sediment deposition and sloughing of unprotected banks.

Reach EFSC-1: A 100-year riprap channel has been proposed for this reach of the East Fork. This reach passes through predominantly developed portions of Colorado Springs. Along some segments of this reach riprap has been placed, however the integrity and the continuity of the riprap lining is poor and in need of replacement. Check and drop structures are also recommended within this reach. This reach will be impacted significantly in the future by long duration stormwater releases from the detention basins lying in the reaches upstream of Reach EFSC-2.

Reach EFSC-2: This reach passes through mostly undeveloped areas of Colorado Springs and El Paso County. New bridges are needed at Marksheffel Road, Peterson Road and at an un-named roadway within Peterson Air Force Base. From the confluence with the Center Tributary to Marksheffel Road a 100-year riprap channel concept is recommended. Above Marksheffel Road to the confluence with the East Fork Sub-tributary, a 10-year channel concept and with floodplain preservation is recommended. Channel drop structures and checks are also required to limit the future degradation of the invert. As with reach EFSC-1, this reach will be impacted by stormwater releases from the East Fork Sand Creek detention basins.

Reach EFSC-3: A 10-year riprap lined channel and 100-year floodplain preservation is recommended. Future stormwater discharges through this reach will be limited to historic levels by the upstream regional detention basins. Check structures are recommended to counteract the degrading effect of the long duration discharges from the upstream detention basins. The concept through this reach is to leave the channel bottom width at its current location, thereby limiting the encroachment of fill into the floodway.

Reach EFSC-4: The most significant feature of the recommended plans in this reach is regional detention basin EFSC-#1. This basin will be the lowest flow control point along the East Fork Creek acting to limit discharges to historic levels from the development within the Banning-Lewis Ranch. A 10-year riprap channel is recommended for the segments of the reach above and below detention basin EFSC-#1. Bridges will be required for proposed Stapleton Drive, Banning-Lewis Parkway and North Carefree Circle. This reach will pass through commercial and industrial areas. The incorporation of the future drainageway and detention basin into a linear open space use is recommended.

Reach EFSC-5: As with reach EFSC-4, the most significant feature of this reach is the EFSC-#2 region detention basin. This detention basin is located at an existing embankment which maintains a permanent pool. It is recommended that the detention basin be designed to maintain the permanent pool so that the water quality benefits of a "wet" basin are maximized. The recommended section is a 10-year riprap channel with 100-year floodplain preservation. Check and drop structures are recommended to flatten the gradient of the drainageway and to slow the developed stream velocities to manageable levels. This reach passes through commercial and single-family areas. As with reach EFSC-4, it is recommended that the drainageway and detention basin be incorporated into a linear open space use in the future. A 100-year bridge is needed at proposed Barnes Road.

Reach EFSC-6: This reach includes regional detention basin EFSC-#3. Similar to detention basin EFSC-#2, this detention basin has been sited at an existing embankment which maintains a permanent pool. The permanent pool should be maintained in the design of the regional basin as part of a water quality measure for the basin. A 10-year riprap channel with floodplain preservation is recommended for this reach. Channel drops and checks are recommended to limit the long-term degradation of the invert. A 100-year capacity bridge is required at future Bridlespur Road.

Reach EFSC-7: This reach contains detention basin EFSC-#4. This detention basin is a dry basin, and would be formed by the construction of an embankment and an outlet structure. The embankment and outlet structure could be combined with the roadway improvements for Birdlespur Road. A twin box culvert is proposed at future Bridlespur Road. A 10-year low flow channel and floodplain preservation concept is recommended from the detention basin to future Dublin Road. Above Dublin, a 100-year riprap channel is recommended, extending upstream to Woodmen Road.

Reach EFSC-8: This reach begins at Woodmen Road, and extends northward into the Black Forest area. The recommended improvements for this reach are selective riprap linings with grade control structures. A 100-year box culvert is recommended for Woodmen Road. A 100-year capacity box culvert is recommended for proposed Research Parkway.

Reach EFST-1: This reach begins at the confluence with the mainstem of East Fork Sand Creek, and extends northward to future Barnes Road. Contained in this reach is regional detention basin EFST-#1, located upstream of the existing Chicago and Rock Island railroad embankment. The recommended channel improvement is a 100-year riprap channel with grade control and drop structures, up to the outlet of EFST-#1 detention basin. Above the regional detention basin, a 10-year capacity low flow channel and grade control is recommended to Barnes Road. A 100-year capacity box culvert is recommended for proposed Barnes Road. The existing channel improvements within the Marksheffel Industrial Park which is located just south of the Chicago and Rock Island Railroad are recommended to remain.

Reach EFST-2: This reach begins at the proposed Barnes Road and extends northward to approximately 3/4-mile north of proposed Dublin Road. The recommended channel improvement is a 100-year riprap channel with drops, aligned parallel to future Stapleton Drive. Culverts with a 100-year capacity are recommended at future Bridlespur Road and Dublin Road.

Reach TR-1: This reach begins at the confluence with the East Fork Sub-tributary and extends northward through the Toy Ranches Subdivision, a rural subdivision within El Paso County. The recommended channel improvement is selective riprap linings with grade control. A new culvert is proposed at Tamlin Road and at future Bridlespur Road (existing Huber Road). The drainageway crosses through private property within the Toy Ranches subdivision, and easements will have to be obtained from property owners to construct and maintain the proposed channel improvements for this reach.

Reach TR-2: This reach begins at the confluence with reach TR-1, and extends northward through the Toy Ranches Subdivision. The recommended channel improvement is selective riprap linings with grade control. A new culvert is proposed at future Bridlespur Road. As with TR-1, the drainageway crosses through private property within the Toy Ranches subdivision, and easements will have to be obtained from property owners to construct and maintain the proposed channel improvements for this reach.

Reach TR-3: This reach begins at the north boundary of the Toy Ranches Subdivision. Regional detention basin TR-#1 is contained within this reach. This regional detention basin is needed in order to maintain future peak discharges which enter the Toy Ranches Subdivision to existing levels. The recommended channel improvement is selective riprap linings with grade control. A new culvert is proposed at future Dublin Road.

Reach EB-1: This reach of East Bierstadt Creek begins at the confluence with the mainstem of East Fork Sand Creek, just upstream of future Barnes Road. The recommended channel improvement is a 10-year riprap channel with 100-year floodplain preservation and grade control structures. This reach ends at the confluence with West Bierstadt Creek.

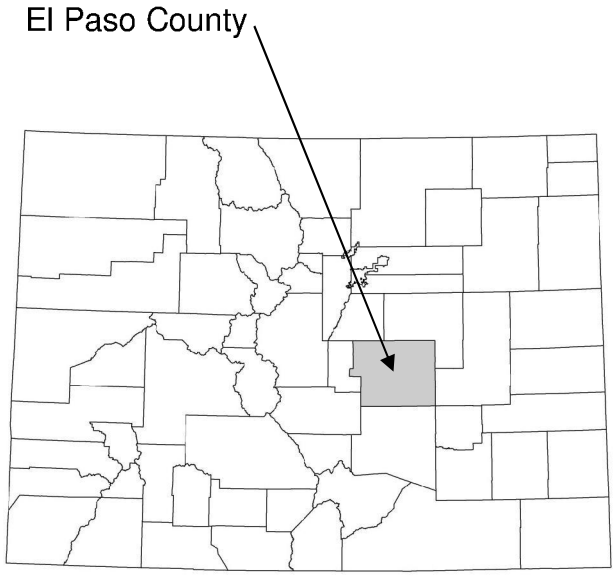
Reach EB-2: This reach begins at the confluence with West Bierstadt Creek, approximately 3/4-mile upstream of future Barnes Road. The recommended channel improvement is a 100-year riprap channel and drop structures. Culverts with a 100-year capacity are proposed at a future un-named arterial roadway and a future Bridlespur and Dublin roads. A new culvert is proposed under the existing Chicago Rock Island and Pacific railroad grade.

Reach WB-1: This reach begins at the confluence with East Bierstadt Creek and extends northward to the existing Chicago and Rock Island and Pacific railroad grade. The recommended channel improvement is a 100-year riprap channel and drop structures. Culverts with a 100-year capacity are proposed at a future un-named arterial roadway and a future Bridlespur Road.

Reach WB-2: This reach begins at the existing Chicago and Rock Island and Pacific railroad grade and extends northward to approximately one mile north of Woodmen Road. Below Woodmen Road, the recommended channel improvement is a 100-year riprap channel and drop structures. North of Woodmen Road, the recommended drainageway improvements are selective riprap banks with grade control structures. Culverts with a 100-year capacity are proposed at a future Dublin Road and at Woodmen Road.

FLOOD INSURANCE STUDY

EL PASO COUNTY, COLORADO, AND INCORPORATED AREAS



COMMUNITY NAME	COMMUNNITY NUMBER
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EL PASO COUNTY (UNINCORPORATED AREAS)	080059
FOUNTAIN, CITY OF	080061
GREEN MOUNTAIN FALLS, TOWN OF	080062
MANITOU SPRINGS, CITY OF	080063
MONUMENT, TOWN OF	080064
PALMER LAKE, TOWN OF	080065
RAMAH, TOWN OF	080066

Revised: December 7, 2018

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
08041CV007A

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) report may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Part or all of this FIS report may be revised and republished at any time. In addition, part of this FIS report may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS report. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current FIS report components.

This FIS report was revised on December 7, 2018. Users should refer to Section 10.0, Revisions Description, for further information. Section 10.0 is intended to present the most up-to-date information for specific portions of this FIS report. Therefore, users of this report should be aware that the information presented in Section 10.0 superseded information in Sections 1.0 through 9.0 of this FIS report.

Initial Countywide FIS Report Effective Date: March 17, 1997

First Revised Countywide FIS Report Effective Date: August 23, 1999 - to add base flood elevations, to add special flood hazard areas, and to change special flood hazard areas.

Second Revised Countywide FIS Report Effective Date: December 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

FEDERAL EMERGENCY MANAGEMENT AGENCY

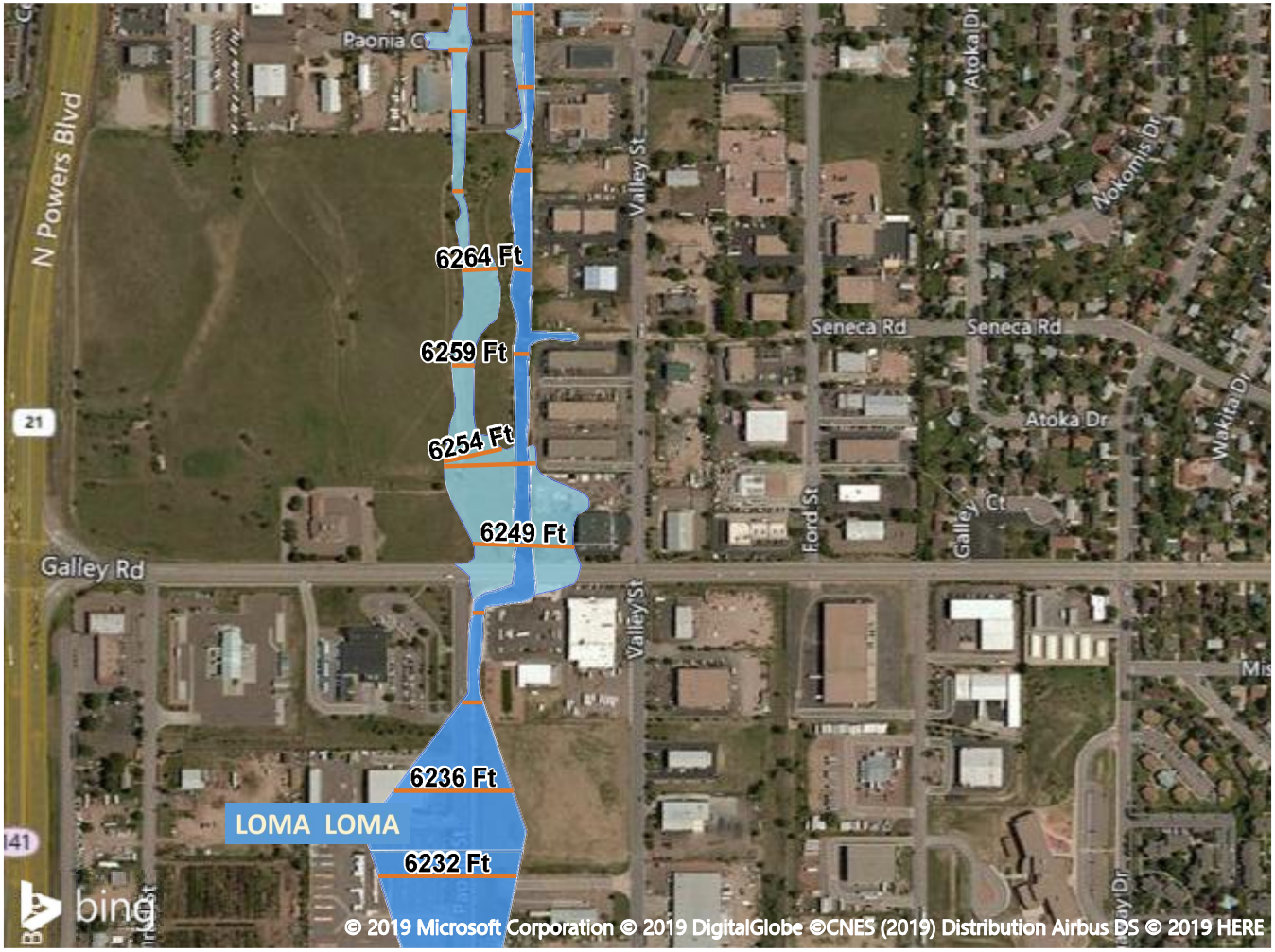
EL PASO COUNTY, CO

(AND INCORPORATED AREAS)

335P

FLOOD PROFILES

SAND CREEK CENTER TRIBUTARY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Channel Analysis-Sand Creek Center Tributary_V1.pdf Markup Summary

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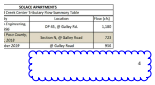

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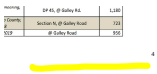

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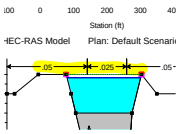

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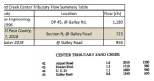

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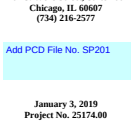

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Show the HEC-RAS Cross Sections
Show the Model alignment station

Overlay the FEMA appoved BFE sections

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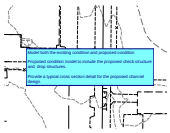
If no LOMR/CLOMR will be processed at this time then please include this analysis in the preliminary drainage report.



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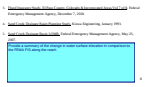
Model both the existing condition and proposed condition

Proposed condition model to include the proposed check structure and drop structures.

Provide a typical cross section detail for the proposed channel design.



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Provide a summary of the change in water surface elevation in comparison to the FEMA FIS along the reach

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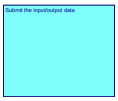

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Submit the input/output data