Preliminary
Hydraulic Study Report
For
Ethanac Road Bridge over the San Jacinto River

***Prepared For*:**

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April 4, 2018

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INTRODUCTION

PROJECT OVERVIEW

Richland Communities has acquired the Riverwoods Specific Plan (SP) and approved Tentative Map located on the west side of the San Jacinto River, north side of the future alignment of Ethanac Road, City of Perris, California. Riverwoods SP along with two other approved tentative tract maps (TTM 33973 and 33900) located on the south side of the future Ethanac Road are all conditioned to build the Ethanac Road Bridge crossing the San Jacinto River.

Ethanac Road will form a major transportation corridor, both as a through route and as a main access to the Riverwoods SP. Ethanac Road is designated as a Transportation Uniform Mitigation Fee (TUMF) funded 184' right-of-way Arterial Expressway from State Route (SR) 74 to Ethanac Road (see Figure 1). The TUMF program is funded by fees collected from new development, and is used for improvements to roadways in the TUMF network.

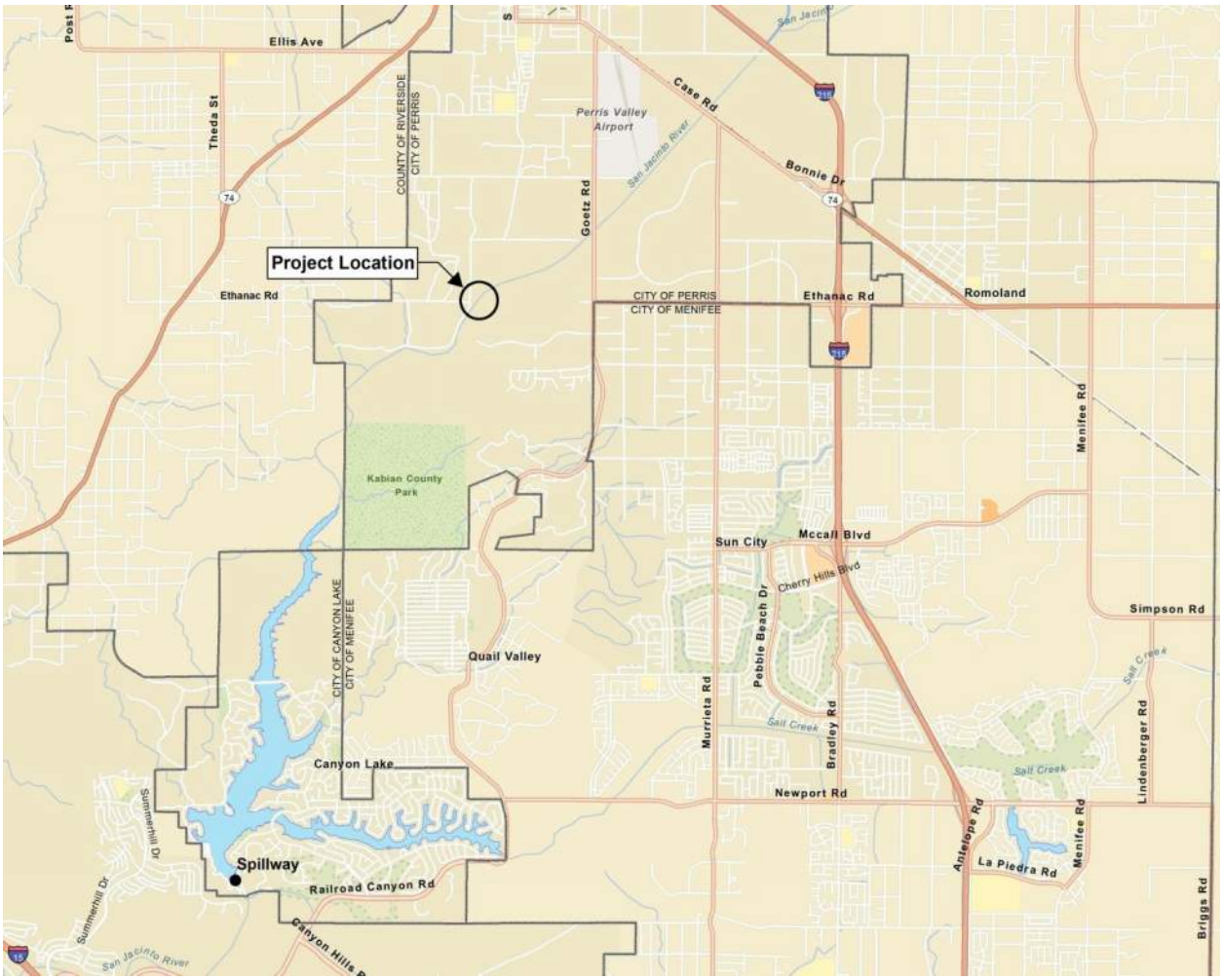

Figure 1: Project Vicinity Map

The purpose of this study is to provide hydrologic and hydraulic data for the design of Ethanac Road Bridge at San Jacinto River. San Jacinto River is under the jurisdiction of the Riverside County

Flood Control and Water Conservation District (RCFC&WCD) which has the responsibility to maintain the river. RCFC&WCD requires that the bridge structure adequately conveys the 1% annual chance flood (100-year flood).

The proposed bridge structure type is anticipated to be a Cast-In-Place Pre-Stressed (CIP-PS) 6'-10" thick box girder bridge deck, 450 feet in length between abutments, and skewed approximately 32 degrees with the river. The bridge will be supported on triple-column piers and two seat type cantilever abutments. Rock slope protection/cutoff walls extending to the depth of the potential scour will be provided to protect the abutment footings from scour. Alternatively, riprap could be used as a scour countermeasure to protect the pier foundation from scour and exposure.

The proposed bridge project includes channel improvements to the San Jacinto River upstream and downstream of Ethanac Road Bridge. Starting about 150 feet downstream of the bridge (river station 60321) a 450-foot bottom width with 2:1 side slopes, earthen channel and variable height (1-10 feet) is proposed. Seventy five feet upstream of the bridge, channel transitions to existing channel geometry to the downstream side of Goetz Road (see Exhibit 2). Longitudinal slope of the proposed channel improvements were based on the existing channel invert elevations at river station 58831 (d/s end of improvements) and at river station 71817 (approx. 2,000 feet d/s of Case Road). The bridge is designed to accommodate both interim and proposed San Jacinto River Master Plan configurations and flow rates. This project will incorporate an interim condition grading as described above. In the ultimate condition the channel will be deepened, but the width will be constant with the proposed bridge design.

II. HYDROLOGY

DESIGN DISCHARGE

100-year peak discharges for the San Jacinto River are shown in Table 1. These values were obtained from the Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) for Riverside County and Incorporated Areas, dated August 18, 2014 (Ref. 1).

Table 1: Summary of Peak Discharges for the San Jacinto River

Location	Drainage Area (sqmi)	10-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
Downstream of Wash D	701.9	1,200	12,000	24,500	70,000
At Gage Station	700.3	1,200	12,000	24,500	70,000
At Spillway	692.0	1,200	12,000	24,500	70,000
At I-215 Freeway	509.0	8,737	25,603	22,403	32,747
At Bridge Street	343.0	27,405	51,730	62,068	87,110

As shown in Figure 1, the proposed bridge location is located about halfway between the I-215 Freeway and the Railroad Canyon Reservoir Spillway. In order to approximate the 100-year discharge at the proposed bridge, the discharges between the two locations (22,403 cfs and

24,500 cfs) were used to determine an average discharge 100-year discharge of 23,450 cfs. Therefore to be in compliance with the City of Perris and FEMA floodplain development regulations, the hydraulic design of the bridge (including scour evaluation and design of erosion countermeasures) will be performed using the interpolated value of 23,450 cfs as the 100-year design discharge for Ethanac Road Bridge. The flow rate for the 500-year event to evaluate scour potential is 30,000 cfs, flow rate was obtained from FEMA's FIS.

Ultimately the San Jacinto River Master Plan will reduce the 100-year peak flow rate to approximately 15,000 cfs. It is reasoned that that since the bridge is designed to accommodate an interim condition with a higher flow rate and that the proposed bridge ultimate conditions will also accommodate a reduced flow rate and lowered channel invert.

III. HYDRAULIC ANALYSIS

DESIGN CRITERIA

The design of the proposed bridge must comply with certain regulations and criteria. The following sections explain the various hydraulic-related criteria pertinent to this project.

DESIGN FREQUENCY AND FREEBOARD

According to RCFC&WCD standard criteria, adequate vertical freeboard height must be provided between the water surface elevation for the design flood event and the low chord of the structure.

FEMA REGULATORY COMPLIANCE

The San Jacinto River reach of interest is designated by FEMA as a Zone AE Special Flood Hazard Area (SFHA). The Zone AE designation means that it is within the 100-year floodplain in which base flood elevations and flood hazard factors have been determined. Zone AE also have designated floodway areas, which are defined as the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year storm can be carried without substantial increases in flood heights. FEMA guidelines limit the water surface elevations/base flood elevations (BFEs) increase to 1.0 feet within a floodplain and 0.0 feet within a floodway.

Because the bridge abutments and pier columns encroach within the 100-year floodplain/floodway, FEMA and the City of Perris floodplain compliance requires that the proposed bridge would cause no more than a 1.0 foot rise in the water surface profile over natural (no-bridge) conditions.

SCOUR CONSIDERATION

Scour criteria for this project have been derived from the Federal Highway Administration document HEC-18, "Evaluating Scour at Bridges". The bridge should be designed to withstand and accommodate the predicted scour depth from a 100-year flood. This means that the design should meet all appropriate structural and geotechnical safety factors after removal of the streambed material to the predicted scour depth. The designers should consider the increased unsupported length of the piers and foundations. AASHTO Bridge design specifications require that a bridge be designed to prevent failure of the structure for a flood between 100-year and 500-year recurrence.

The scour analysis used HEC-18 methodology to calculate general, local, and long term scour for the interim channel conditions. The results in Table 2 indicate that only local scour occurs at abutment four. The abutments local scour to a maximum depth of 7.1 feet from the interim channel conditions. The abutment scour is limited by secondary armoring of class II backing rip-rap installed below the ultimate channel and the bedrock in which the abutments will be constructed. At the piers HEC-18 predicted local scour of 11.4 feet from the interim channel conditions. The pier scour is limited by the bedrock, with a maximum scour potential of 11.3 feet. As a secondary protection class II rip-rap will be placed below the ultimate channel at approximately 1396.8 feet. Ultimate scour will occur to an equivalent magnitude as the Interim scour. The secondary protection of rip-rap extends to the ultimate scour potential. The piers have an ultimate scour of 11.4 feet but each pier will have secondary armoring at approximately 1396.8 feet. At abutment 1 the ultimate scour will be limited by the secondary armoring of the channel side slopes 2-foot thick light class rip-rap. The ultimate scour for abutment four could extend to 1406.6 feet but the secondary protections of light class rip-rap extends to approximately 1400 feet.

Table 2: Summary of Interim Scour Depths for the Proposed Bridge

Location	Local Scour	Contraction Scour	Total Interim Scour	Interim Channel	Ultimate Channel	Bedrock	Bottom of Footing
	[feet]	[feet]	[feet]	[Elevation]			
Abut 1	1.7	1.15	2.9	1414.4	1414.4	1,406	1,404
Piers 2, 3	11.4*	-	11.3	1404.1	1397.3	1,395	1,390
Abut 4	7.1	-	7.1	1413.7	1413.7	1,395	1,404

*HEC RAS Model was not limited by the bedrock boundary, scour will be obstructed by bedrock.

RIVER HYDRAULICS

Steady-state hydraulic analysis of the San Jacinto River was performed using HEC-RAS v4.1.0, computer program developed by the Hydrologic Engineering Center of the U.S. Army Corps of Engineers. Figure 2 shows the HEC-RAS cross section locations within the vicinity of the proposed bridge.

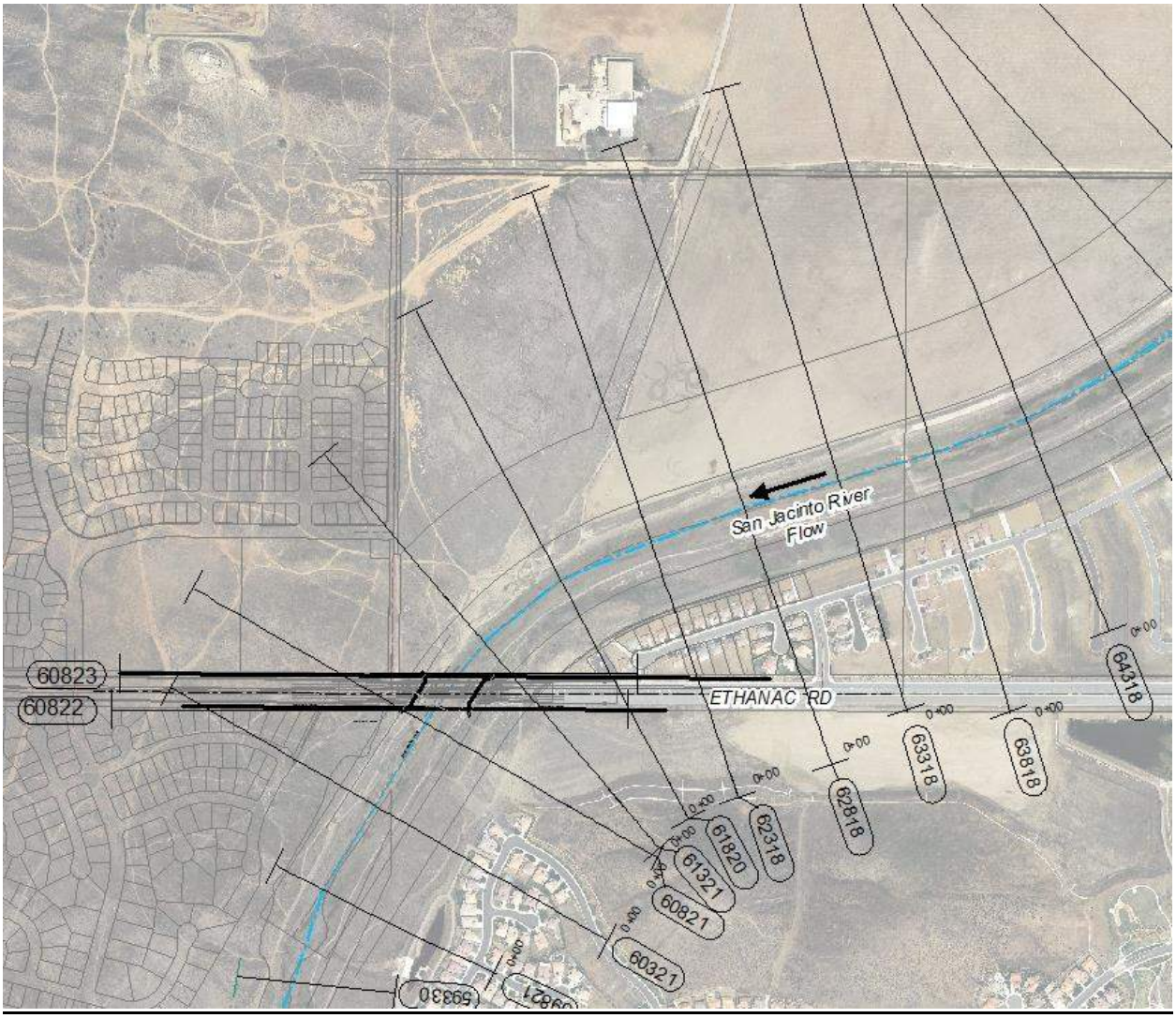

Figure 2: HEC-RAS model cross section locations

EXISTING CONDITION HYDRAULIC MODEL

The effective condition hydraulic (HEC-RAS) model used in establishing the San Jacinto River Base Flood Elevations (BFEs) as shown in August 18, 2014 Flood Insurance Study (FIS) for Riverside County was used as the existing condition model. The existing condition model upstream study limit was truncated to end at approximately 2,300 feet upstream of Goetz Road (river station 69317).

Channel and overbank manning's roughness coefficient were taken from the effective condition model. Appendix B contains the HEC-RAS hydraulic summary table results and cross section plots for existing conditions.

PROPOSED INTERIM CONDITION HYDRAULIC MODEL

The existing condition model was updated with the proposed bridge geometry and interim channel improvements. The proposed bridge is 450 feet in length between abutments, with a 6.83-foot box girder bridge deck, low chord elevation of 1419.18 at the bridge face, and skewed approximately 32 degrees with the river. It is a three span bridge supported on multiple-column piers with 6-foot diameter columns. Due to the skew angle of the bridge with the river flow direction, the bridge opening was hydraulically modeled as a 444-foot bottom width, 450 feet wide at the top (including 5 foot wide benches at the abutments), 2:1 side slopes, two rows of 3 6-foot diameter columns, with an assumed 2 feet of debris accumulation each side, and bridge deck width of 94 feet as measured in the direction of flow.

HEC-RAS cross sections 58831 to 65817 were modified with the proposed channel grading per channel improvement plans (Exhibit 2). Upstream of Ethanac Road to Goetz Road, channel improvement consists of a 444-foot wide bottom, 2:1 side slopes, and variable height of 10 to 15 feet, earthen trapezoidal channel. The improved channel sections used a manning's roughness coefficient 0.035.

Results of the proposed interim condition hydraulic analysis indicated an upstream water surface elevation of 1419.15, resulting in 0.03 in freeboard. Due to the bridge type, the location of minimum free board is at the abutments, the maximum freeboard is at the channel centerline.

Appendix B contains the HEC-RAS hydraulic summary table results and cross section plots for the proposed conditions.

PROPOSED ULTIMATE CONDITION HYDRAULIC MODEL

The ultimate channel is approximately 7.62 feet lower than the interim channel geometry. The results show for the proposed ultimate condition the hydraulic analysis indicated an upstream water surface elevation of 1416.85, resulting in approximately 2.33 feet of freeboard at the upstream bridge face.

COMPARISON OF WATER SURFACE PROFILES FOR FEMA COMPLIANCE

The results of the proposed condition HEC-RAS hydraulic model using the 100-year FEMA discharge indicate that the proposed condition would result in a lower flood profile as compared to the existing condition FEMA profile for stations 58831 to the upstream limit of study at 69317. Downstream of station 58831 to the downstream limit of study at station 53850 the maximum rise in the water surface profile is within 0.2 feet for the Interim condition, which meets FEMA guidelines. It should be noted that the FEMA effective condition model uses the unsteady flow option of the HEC-RAS program which results a varying discharge based on the inflow hydrographs and channel storage which resulted in a lower discharge for the lower reach than the steady-state design discharge used in the proposed condition hydraulic analysis.

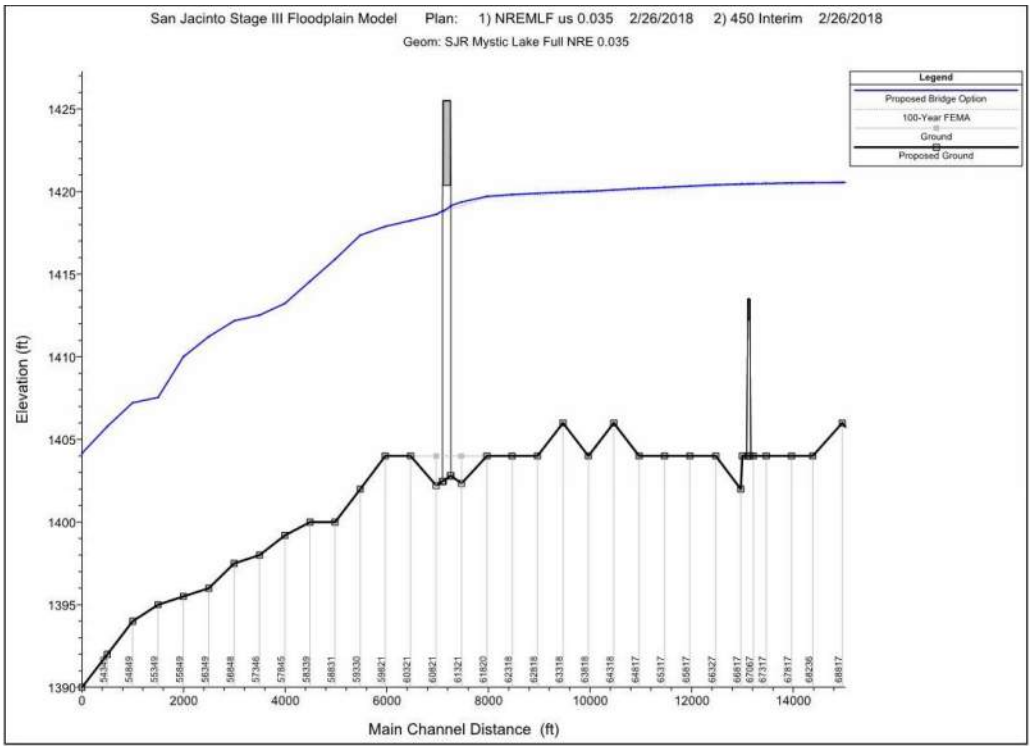

Figure 3: Comparison of the Existing FEMA Effective Condition Model and Proposed Condition 100-Year Water Surface Profiles

IV. REFERENCES

1. Federal Emergency Management Agency (FEMA), Flood Insurance Study, August 18, 2014, Riverside County, California and Incorporated Areas

2. Federal Highway Administration, 2001, "Evaluating Scour at Bridges, U.S. Department of Transportation, Federal Highway Administration, Hydraulic Engineering Circular No. 18, Fourth Edition, Washington, D.C.

3. Leighton and Associates, 2018. "Geotechnical Exploration Report
Proposed Ethanac Road Bridge Over San Jacinto River Perris, California", February 23, 2018

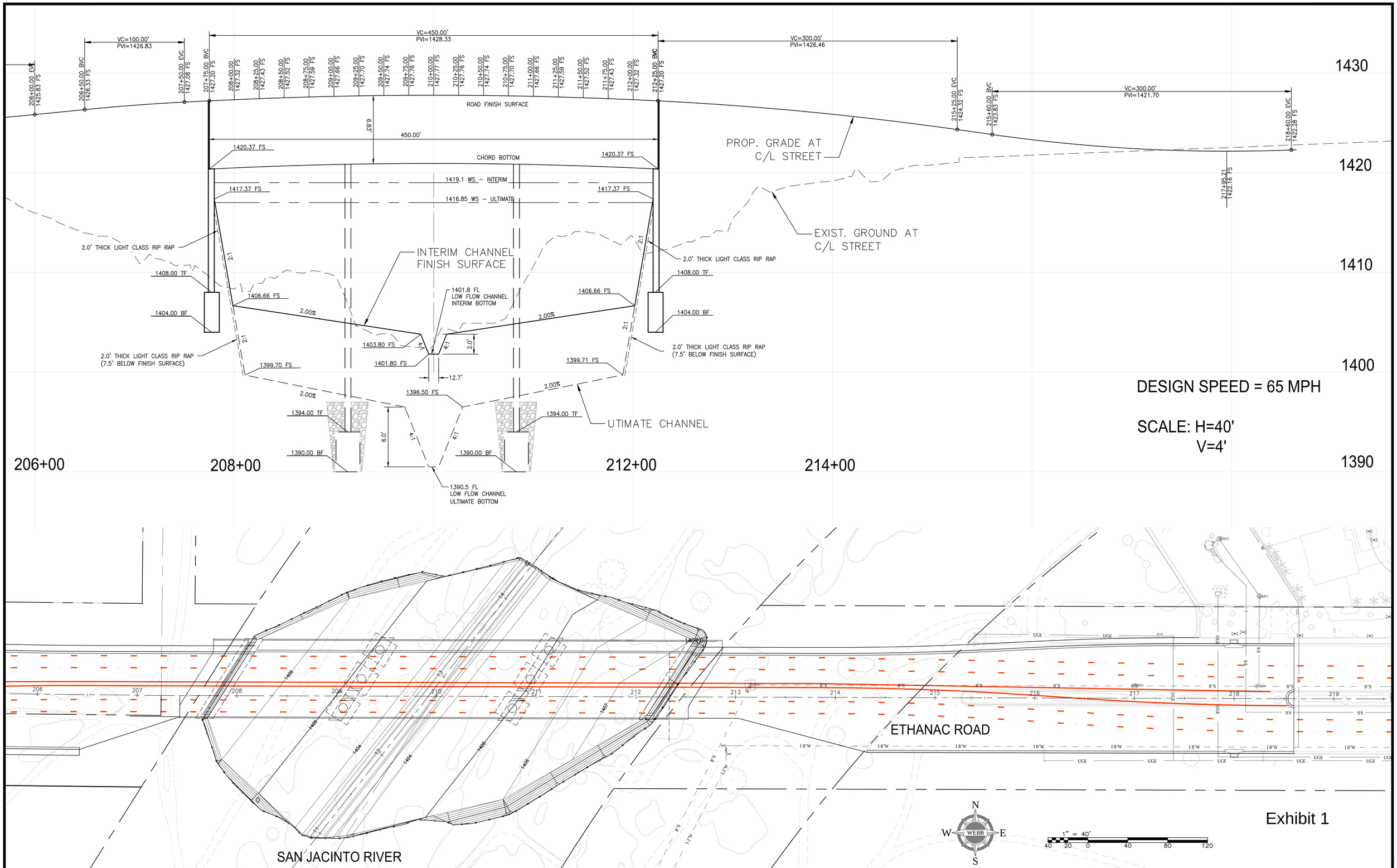

Exhibit 1

\\Elsinore\wo2\2015\15-0203\Drawings\Design\15-0203-C-ST SURFACE.dwg

GEOMETRIC APPROVAL DRAWING 4/4/18

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ENGINEERING CONSULTANTS
3788 McCRAY STREET
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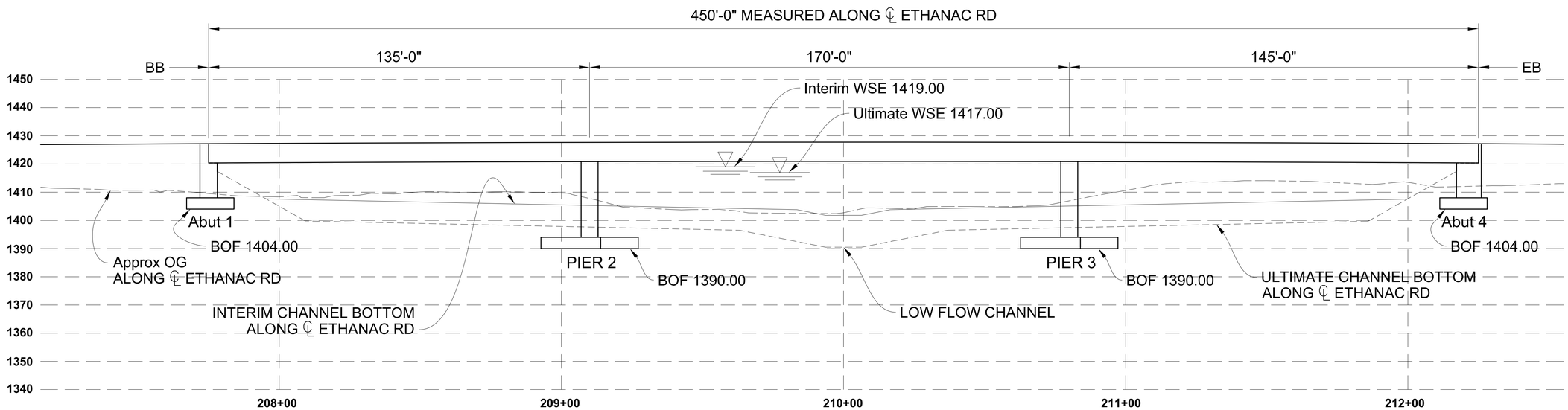
DIST.	COUNTY	ROUTE	POST MILES TOTAL PROJECT
8	RIV	--	_____

City of Perris
101 N. D Street
Perris, CA 92570

CNS Engineers, Inc.
11870 Pierce Street, Suite 265
Riverside, CA 92505



ELEVATION

1" = 20'

Exhibit 2

DESIGNED BY	Q. Nguyen	DATE	02/25/2016
DRAWN BY	N. Li	DATE	02/25/2016
CHECKED BY	J. Lu	DATE	02/25/2016
APPROVED	--	DATE	--

JAMES LU
PROJECT ENGINEER

ETHANAC ROAD BRIDGE OVER SAN JACINTO RIVER

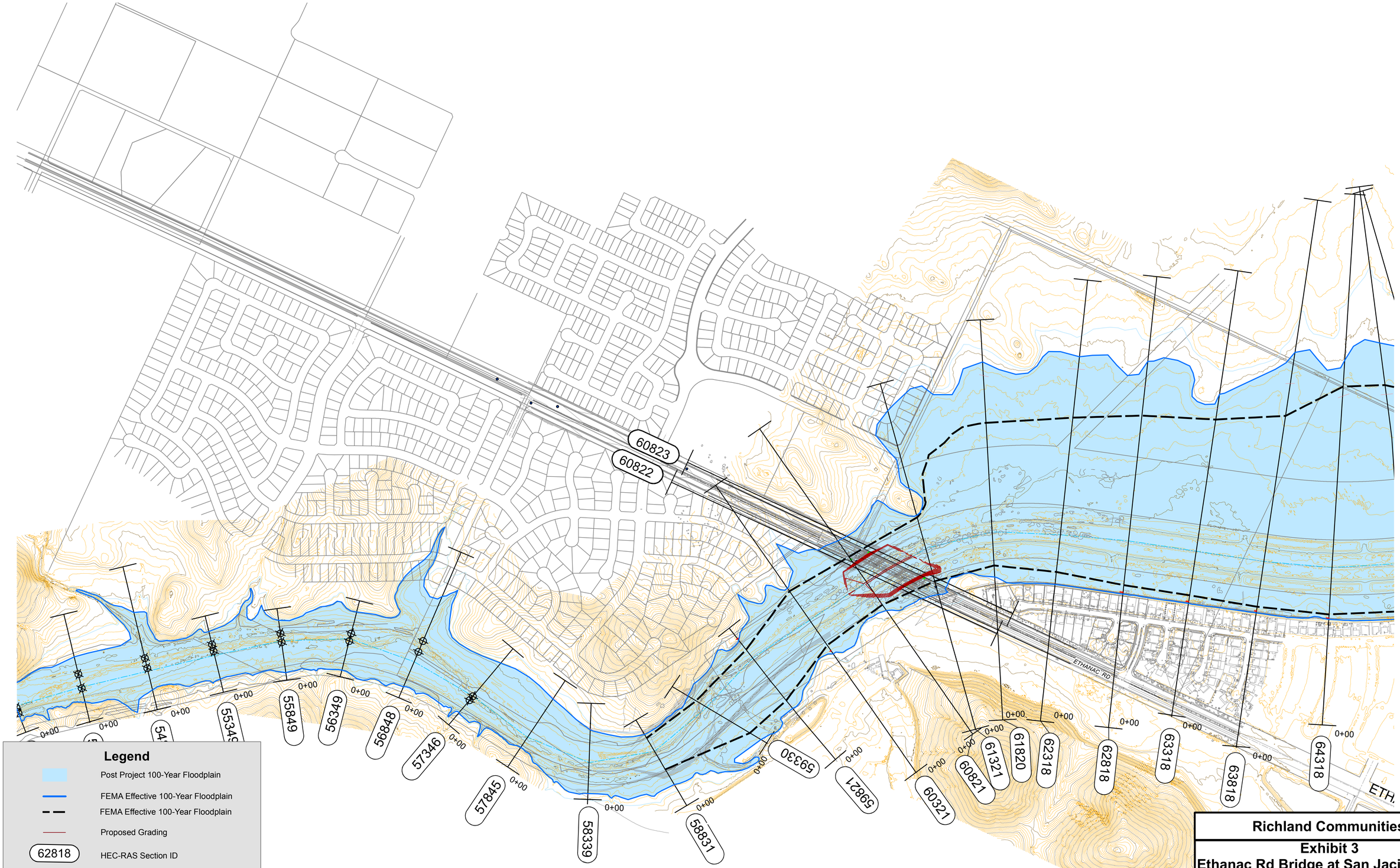
LONGITUDINAL SECTION

BRIDGE NO.	56C-XXXX	CU	--
SCALE:	AS SHOWN	EA	--

PREPARED FOR THE CITY OF PERRIS

USERNAME => JustinNguyen DATE PLOTTED => 02/15/2018 TIME PLOTTED => 15:45

FILE => W:\15003 Ethanac Rd Br over San Jacinto River\CADD\TSR\20171019\Elevation.dwg



G:\2015\15-0203 GIS\Updated Flood Plan Map.mxd; Map created 16 Mar 2018

Richland Communities

Exhibit 3
Ethanac Rd Bridge at San Jacinto River
100-Year Floodplain Map

SCALE:	1" = 250'
DATE:	02/28/2018
DESIGNED:	J O'Rourke
CHECKED:	
PLN CK REF:	1
F.B.	

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W.O. 15-0203

SHEET 1 OF 1 SHEETS

DWG. NO.: 16-0085\Updated Flood Plan Map

APPENDIX A

FEMA
Flood Insurance Study
Table 1: Summary of Discharges

Table 4: Summary of Peak Discharges (continued)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-percent annual chance	2-percent annual chance	1-percent annual chance	0.2-percent annual chance
SALT CREEK TRIBUTARY					
At State Street	7.0	500	1,700	2,800	7,000
SAN GORGONIO RIVER					
At San Gorgonio River - Banning Levee	22.4	2,400	8,000	12,000	28,000
SALT CREEK TRIBUTARY					
At State Street	7.0	500	1,700	2,800	7,000
SAN GORGONIO RIVER					
At San Gorgonio River - Banning Levee	22.4	2,400	8,000	12,000	28,000
SAN JACINTO RIVER [9]					
Downstream of Wash D	701.9	1,200	12,000	24,500	70,000
At Gage Station	700.3	1,200	12,000	24,500	70,000
At Spillway	692.0	1,200	12,000	24,500 [2]	70,000
At I-215 Freeway	509.0	8,737 [10]	25,603 [10]	22,403 [10]	32,747 [10]
At Bridge Street	343.0	27,405 [10]	51,730 [10]	62,068 [10]	87,110 [10]
SANTA ANA RIVER					
At Hamner Avenue	963.0	22,000	102,000	175,000	340,000

[9] Excludes 18 square miles above Pidgeon Pass and Perris Drive

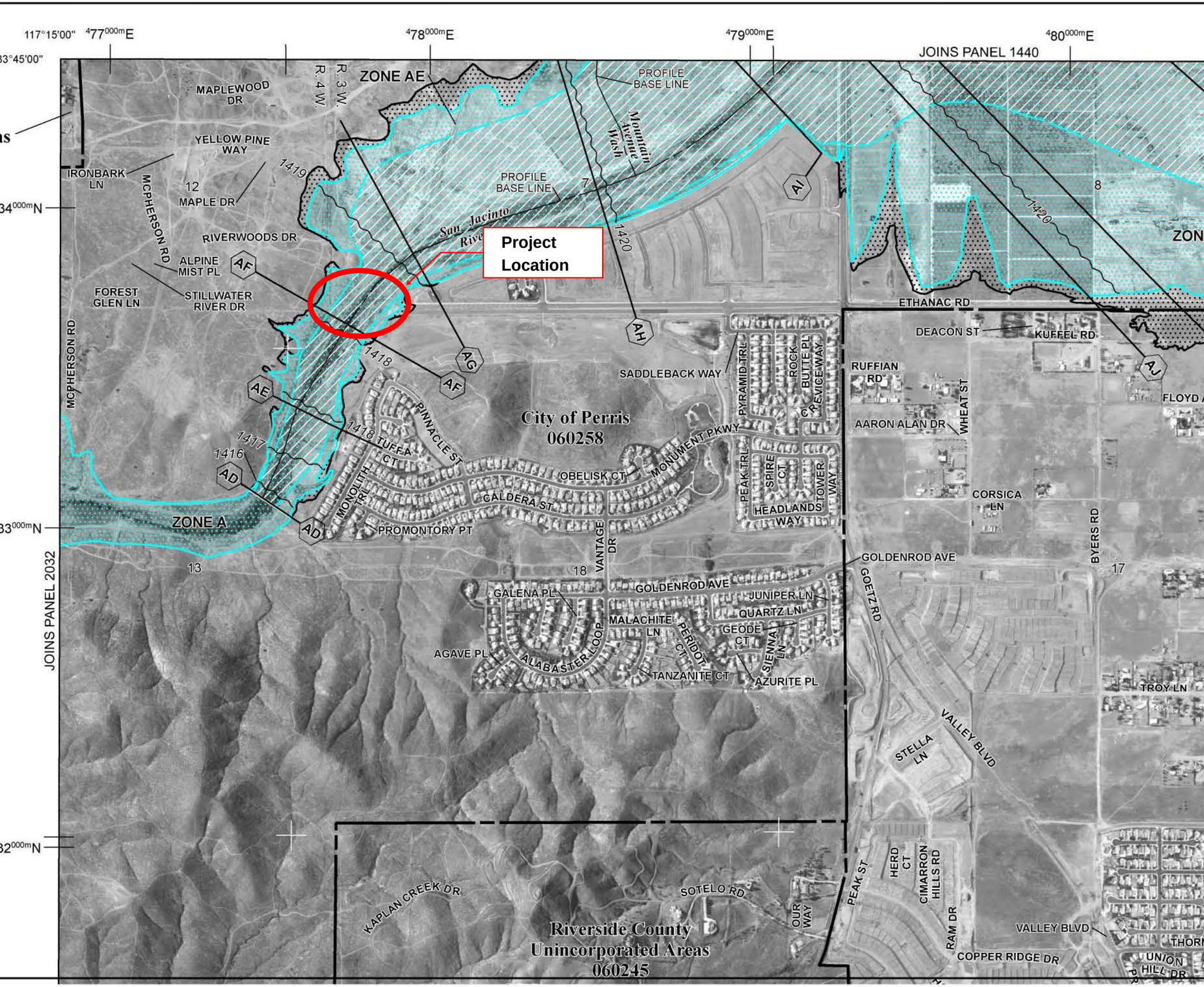
[2] Peak discharge provided by Riverside County Flood Control and Water Conservation District

[10] Represents flow rate at peak stage (elevation) at this location for updated unsteady San Jacinto River model. San Jacinto unit hydrograph data downstream of Bridge St. to mouth of Railroad Canyon, used in unsteady hydraulic analysis for this reach, found in Section 10 "1st Revision"

* Data not available

APPENDIX B

FEMA
Flood Insurance Rate Map (FIRM)
Panel No. 06065C2055H



MAP SCALE 1" = 1000'

500 0 500 1,000 1,500 2,000 FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2055H

FIRM

FLOOD INSURANCE RATE MAP

RIVERSIDE COUNTY, CALIFORNIA

AND INCORPORATED AREAS

PANEL 2055 OF 3805

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CANYON LAKE, CITY OF	060753	2055	H
MENIFEE, CITY OF	060176	2055	H
PERRIS, CITY OF	060258	2055	H
RIVERSIDE COUNTY UNINCORPORATED AREAS	060245	2055	H

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
06065C2055H

MAP REVISED
AUGUST 18, 2014

Federal Emergency Management Agency

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

APPENDIX C

HEC-RAS Model Files
FEMA Effective (Existing) Condition

FEMA Floodway Data Table

FEMA Effective Condition HEC-RAS Results

HEC-RAS Plan: NREMLF us 0.035 River: SJR Stage III Reach: 4 Profile: Max WS

Reach	River Sta	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)	
4	53850	22058.22	1390.00	1404.73	1401.24	1405.91	0.002004	9.67	2598.38	283.59	0.49
4	54349	22055.83	1392.00	1405.90		1406.88	0.001803	9.22	3026.36	428.20	0.48
4	54849	22052.73	1394.00	1407.02		1407.64	0.001489	8.16	3752.98	591.29	0.43
4	55349	22048.58	1395.00	1407.50		1409.30	0.004354	13.87	2231.29	363.91	0.73
4	55849	22045.43	1395.50	1409.72		1410.80	0.002049	10.44	2866.81	386.70	0.51
4	56349	22043.46	1396.00	1410.86		1411.61	0.001522	8.94	3341.70	439.25	0.44
4	56848	22035.93	1397.50	1411.78		1412.19	0.000926	6.54	4622.55	718.11	0.34
4	57346	22027.01	1398.00	1412.11		1412.91	0.001845	9.65	3259.75	477.81	0.48
4	57845	22021.66	1399.20	1412.85		1414.20	0.002928	12.32	2651.00	425.07	0.61
4	58339	22015.21	1400.00	1414.31		1415.45	0.002305	11.09	2914.28	466.37	0.54
4	58831	22007.30	1400.00	1415.55		1416.52	0.002051	10.96	3009.37	431.06	0.51
4	59330	22079.81	1402.00	1416.88		1417.42	0.001348	8.43	3982.16	621.71	0.41
4	59821	22094.60	1404.00	1417.49		1417.90	0.000889	6.70	4586.85	655.21	0.34
4	60321	22107.46	1404.00	1417.85		1418.35	0.000862	6.46	4226.11	586.05	0.33
4	60821	22119.01	1404.00	1418.27		1418.79	0.000878	6.64	4247.90	620.61	0.33
4	61321	22138.22	1404.00	1418.72		1419.13	0.000568	5.80	4727.06	1117.48	0.28
4	61820	22161.87	1404.00	1419.15		1419.23	0.000163	2.89	10454.85	1570.46	0.14
4	62318	22179.52	1404.00	1419.23		1419.30	0.000159	2.92	11170.02	1707.83	0.14
4	62818	22191.03	1404.00	1419.31		1419.38	0.000150	2.62	11347.33	1713.09	0.14
4	63318	22194.79	1406.00	1419.38		1419.45	0.000137	2.52	11396.37	1546.36	0.13
4	63818	22189.34	1404.00	1419.45		1419.54	0.000195	3.08	10749.28	1926.87	0.16
4	64318	22167.96	1406.00	1419.54		1419.63	0.000198	3.02	10736.52	1899.66	0.16
4	64817	22121.62	1404.00	1419.64		1419.72	0.000153	2.77	11714.73	2026.65	0.14
4	65317	22043.79	1404.00	1419.72		1419.79	0.000151	2.71	11701.19	1992.39	0.14
4	65817	22063.23	1404.00	1419.79		1419.86	0.000147	2.59	11926.88	2355.26	0.14
4	66327	22256.38	1404.00	1419.88		1419.91	0.000075	1.92	16390.08	4340.28	0.10
4	66817	22606.64	1402.00	1419.93		1419.95	0.000067	1.95	19824.77	5793.72	0.09
4	66847	22629.71	1404.00	1419.94		1419.95	0.000039	1.50	23293.59	3801.72	0.07
4	66966	Bridge									
4	67067	21125.22	1404.00	1419.97	1415.08	1419.98	0.000049	1.50	21653.28	4798.28	0.08
4	67317	21326.76	1404.00	1419.97		1419.99	0.000058	1.59	20744.00	6478.09	0.08
4	67817	21659.08	1404.00	1419.99		1420.01	0.000030	1.14	27009.56	6893.82	0.06
4	68236	22114.19	1404.00	1420.01		1420.01	0.000015	0.84	37130.10	9271.65	0.04
4	68817	21998.58	1406.00	1420.02		1420.02	0.000016	0.83	37987.61	8896.97	0.04
4	69317	21946.27	1404.00	1420.03		1420.03	0.000011	0.63	45387.03	8963.89	0.04
4	69817	21927.23	1404.00	1420.03		1420.04	0.000008	0.70	51312.64	9304.95	0.03

APPENDIX D

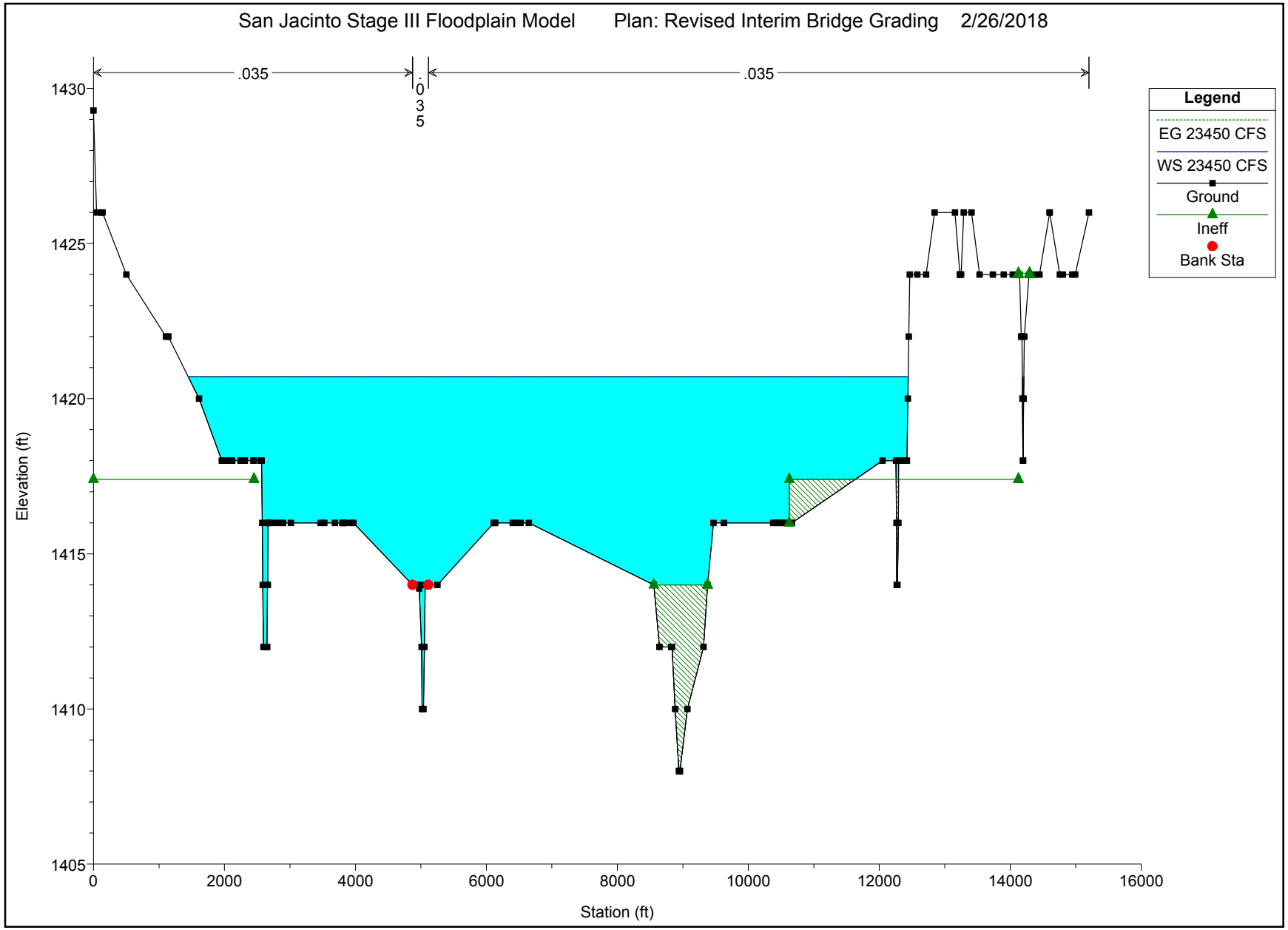
HEC-RAS Model Files
Proposed Interim Condition

HEC-RAS Plan: 450 Interim River: SJR Stage III Reach: 4 Profile: 23450 CFS

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)	
4	80328	23450 CFS	23450.00	1410.00	1420.71		1420.71	0.000014	0.61	52221.81	11016.82	0.04
4	79828	23450 CFS	23450.00	1408.00	1420.70		1420.70	0.000013	0.63	54677.35	12041.51	0.04
4	79328	23450 CFS	23450.00	1406.00	1420.69		1420.70	0.000016	0.62	51003.02	11999.67	0.04
4	78828	23450 CFS	23450.00	1406.00	1420.68		1420.69	0.000021	0.81	44549.42	10711.76	0.05
4	78328	23450 CFS	23450.00	1406.00	1420.67		1420.68	0.000018	0.70	48692.30	11749.34	0.04
4	77828	23450 CFS	23450.00	1406.00	1420.66	1414.36	1420.67	0.000016	0.95	49258.04	10906.26	0.05
4	77718		Mult Open									
4	77494	23450 CFS	23450.00	1406.00	1420.64		1420.65	0.000014	0.74	49467.24	10345.63	0.04
4	76818	23450 CFS	23450.00	1406.00	1420.64		1420.64	0.000009	0.53	58511.37	11404.85	0.03
4	76318	23450 CFS	23450.00	1404.00	1420.63		1420.63	0.000010	0.55	56892.55	11209.96	0.03
4	75818	23450 CFS	23450.00	1404.00	1420.63		1420.63	0.000010	0.55	57842.98	12782.83	0.03
4	75318	23450 CFS	23450.00	1406.00	1420.62		1420.62	0.000010	0.61	56094.21	12024.25	0.03
4	74818	23450 CFS	23450.00	1404.00	1420.62		1420.62	0.000011	0.65	55400.89	11681.43	0.04
4	74268	23450 CFS	23450.00	1404.00	1420.61		1420.61	0.000013	0.72	51255.68	11297.10	0.04
4	73997	23450 CFS	23450.00	1406.00	1420.61		1420.61	0.000016	0.72	48131.48	11297.79	0.04
4	73918	23450 CFS	23450.00	1404.00	1420.60	1416.35	1420.61	0.000015	0.83	48540.25	11534.16	0.04
4	73867		Bridge									
4	73782	23450 CFS	23450.00	1404.00	1420.60	1415.41	1420.60	0.000007	0.58	60216.70	11533.71	0.03
4	73373	23450 CFS	23450.00	1406.00	1420.60	1415.40	1420.60	0.000010	0.61	53727.02	9589.91	0.03
4	72817	23450 CFS	23450.00	1406.00	1420.59	1415.40	1420.59	0.000012	0.66	51354.65	11060.92	0.04
4	72317	23450 CFS	23450.00	1406.00	1420.58	1415.31	1420.59	0.000012	0.69	50550.88	10789.34	0.04
4	71817	23450 CFS	23450.00	1404.00	1420.58	1414.57	1420.58	0.000012	0.71	49352.90	10664.13	0.04
4	71317	23450 CFS	23450.00	1404.00	1420.57	1414.52	1420.58	0.000012	0.69	48588.09	10692.62	0.04
4	70817	23450 CFS	23450.00	1404.00	1420.57	1413.61	1420.57	0.000011	0.68	50486.34	10809.88	0.04
4	70317	23450 CFS	23450.00	1404.00	1420.56		1420.56	0.000010	0.68	51990.38	9627.45	0.03
4	69817	23450 CFS	23450.00	1404.00	1420.56	1409.98	1420.56	0.000007	0.68	55388.37	9390.06	0.03
4	69317	23450 CFS	23450.00	1404.00	1420.55		1420.56	0.000010	0.61	49276.39	9156.08	0.03
4	68817	23450 CFS	23450.00	1406.00	1420.54		1420.55	0.000014	0.80	41354.55	9035.78	0.04
4	68236	23450 CFS	23450.00	1404.00	1420.54	1410.37	1420.54	0.000013	0.82	40086.59	9397.28	0.04
4	67817	23450 CFS	23450.00	1404.00	1420.52		1420.53	0.000028	1.14	29407.74	8136.81	0.06
4	67317	23450 CFS	23450.00	1404.00	1420.49		1420.51	0.000053	1.56	22877.18	6576.80	0.08
4	67067	23450 CFS	23450.00	1404.00	1420.48	1415.18	1420.50	0.000047	1.52	23644.07	4976.69	0.08
4	66966		Bridge									
4	66847	23450 CFS	23450.00	1404.00	1420.46	1413.53	1420.48	0.000035	1.46	25241.85	4064.83	0.07
4	66817	23450 CFS	23450.00	1402.00	1420.46	1413.98	1420.48	0.000055	1.81	21703.07	5967.73	0.09
4	66327	23450 CFS	23450.00	1404.00	1420.41	1413.06	1420.45	0.000066	1.86	17733.41	4905.04	0.09
4	65817	23450 CFS	23450.00	1404.00	1420.33		1420.40	0.000131	2.53	13026.25	2456.54	0.13
4	65317	23450 CFS	23450.00	1404.00	1420.26		1420.33	0.000136	2.64	12817.91	2090.71	0.13
4	64817	23450 CFS	23450.00	1404.00	1420.19		1420.26	0.000138	2.70	12868.35	2173.19	0.13
4	64318	23450 CFS	23450.00	1406.00	1420.11		1420.19	0.000177	2.96	11829.27	2059.12	0.15

HEC-RAS Plan: 450 Interim River: SJR Stage III Reach: 4 Profile: 23450 CFS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
4	63818	23450 CFS	23450.00	1404.00	1420.02		1420.10	0.000167	2.94	11874.87	1987.68	0.15
4	63318	23450 CFS	23450.00	1406.00	1419.96		1420.03	0.000123	2.47	12305.32	1586.19	0.13
4	62818	23450 CFS	23450.00	1404.00	1419.90		1419.96	0.000134	2.56	12369.72	1783.96	0.13
4	62318	23450 CFS	23450.00	1404.00	1419.82		1419.89	0.000139	2.81	12195.10	1750.05	0.14
4	61820	23450 CFS	23450.00	1404.00	1419.71	1412.61	1419.81	0.000155	2.91	9636.24	1630.37	0.14
4	61321	23450 CFS	23450.00	1402.34	1419.36	1411.83	1419.67	0.000389	5.09	5499.97	602.58	0.23
4	60823	23450 CFS	23450.00	1402.81	1419.15	1410.89	1419.55	0.000484	5.06	4643.52	449.61	0.25
4	60822.5		Bridge									
4	60822	23450 CFS	23450.00	1402.46	1418.83		1419.35	0.000670	5.74	4081.85	332.82	0.29
4	60821	23450 CFS	23450.00	1402.21	1418.61		1419.22	0.000847	6.35	3953.03	625.01	0.32
4	60321	23450 CFS	23450.00	1404.00	1418.24		1418.75	0.000839	6.51	4458.57	595.50	0.33
4	59821	23450 CFS	23450.00	1404.00	1417.89		1418.30	0.000854	6.72	4850.86	667.20	0.33
4	59330	23450 CFS	23450.00	1402.00	1417.36		1417.88	0.001237	8.27	4284.93	637.32	0.40
4	58831	23450 CFS	23450.00	1400.00	1415.90		1416.89	0.002044	11.12	3162.41	441.70	0.51
4	58339	23450 CFS	23450.00	1400.00	1414.57		1415.77	0.002366	11.38	3039.37	479.81	0.55
4	57845	23450 CFS	23450.00	1399.20	1413.24		1414.57	0.002828	12.35	2814.92	435.42	0.60
4	57346	23450 CFS	23450.00	1398.00	1412.52		1413.32	0.001787	9.70	3458.13	491.54	0.48
4	56848	23450 CFS	23450.00	1397.50	1412.18		1412.59	0.000895	6.58	4910.50	743.21	0.34
4	56349	23450 CFS	23450.00	1396.00	1411.23		1412.00	0.001492	9.01	3505.86	443.19	0.44
4	55849	23450 CFS	23450.00	1395.50	1410.01		1411.14	0.002089	10.70	2980.44	393.48	0.52
4	55349	23450 CFS	23450.00	1395.00	1407.54		1409.55	0.004816	14.63	2248.76	364.60	0.77
4	54849	23450 CFS	23450.00	1394.00	1407.23		1407.88	0.001539	8.40	3875.14	597.96	0.44
4	54349	23450 CFS	23450.00	1392.00	1405.79		1406.93	0.002125	9.95	2980.78	426.21	0.52
4	53850	23450 CFS	23450.00	1390.00	1404.17	1401.48	1405.68	0.002755	10.98	2439.50	282.19	0.57


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 23450 CFS
WS 23450 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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Station (ft)
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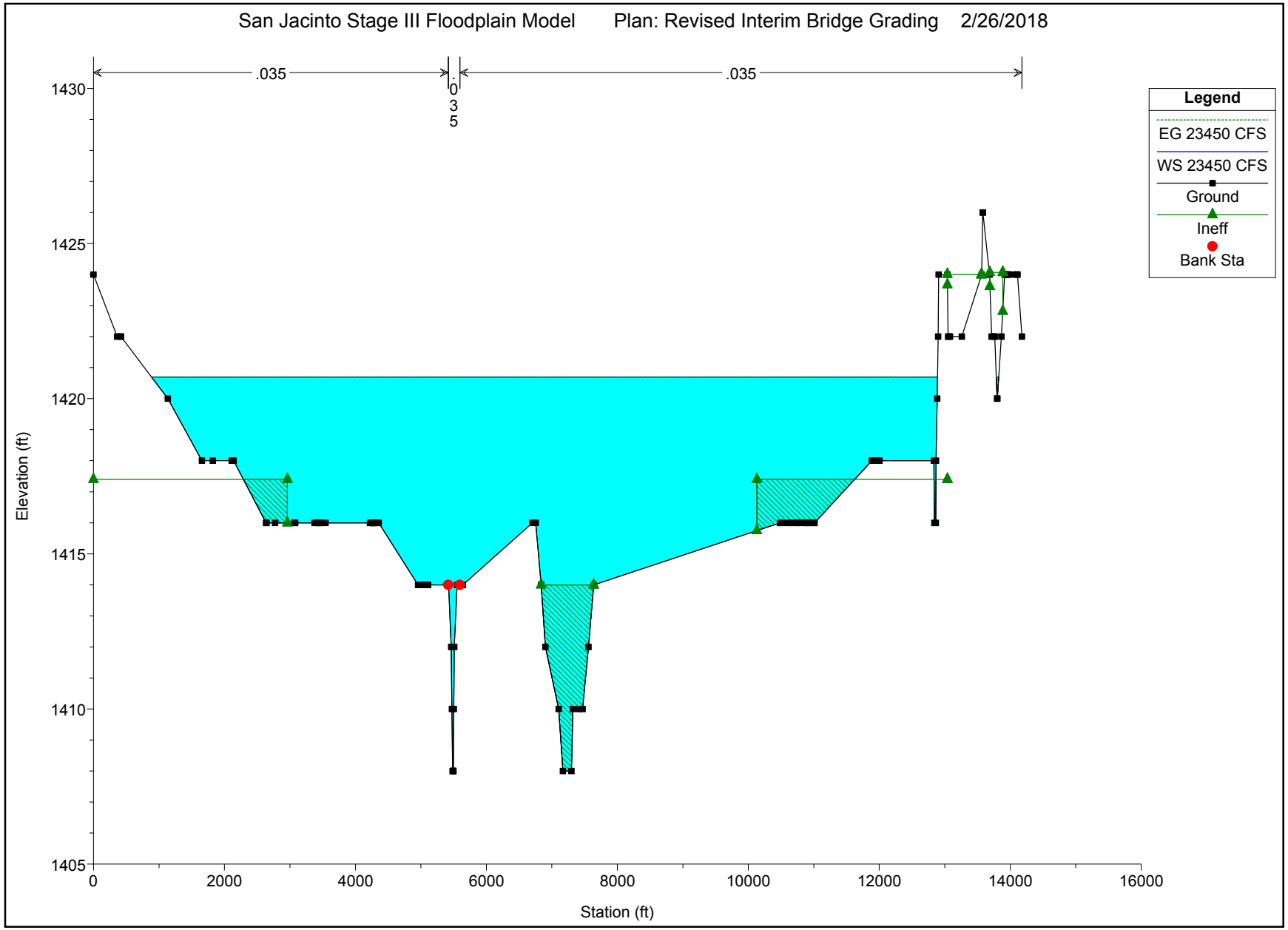
San Jacinto Stage III Floodplain Model
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2/26/2018
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Legend
EG 23450 CFS
WS 23450 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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Station (ft)
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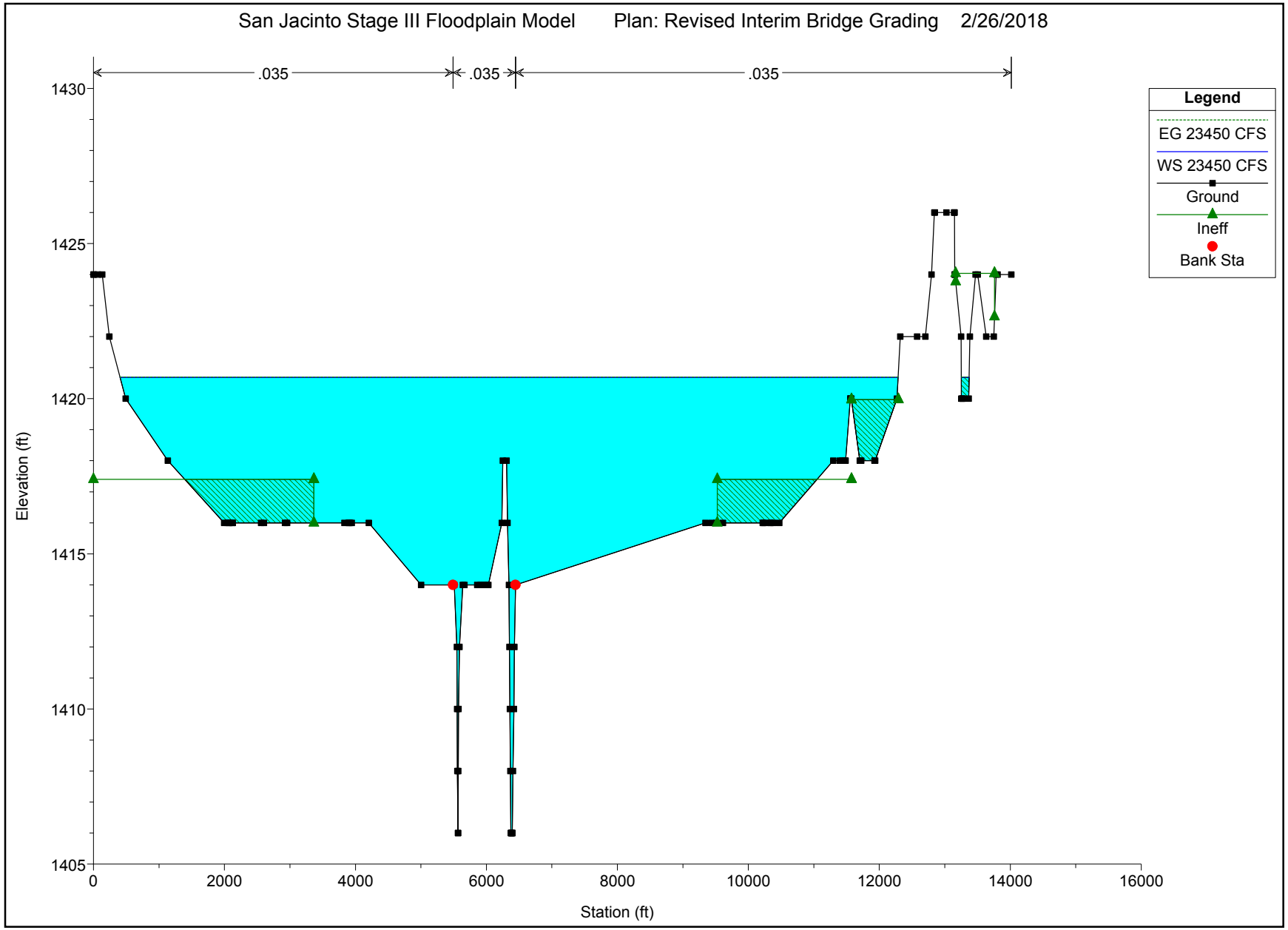
San Jacinto Stage III Floodplain Model
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2/26/2018
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Legend
EG 23450 CFS
WS 23450 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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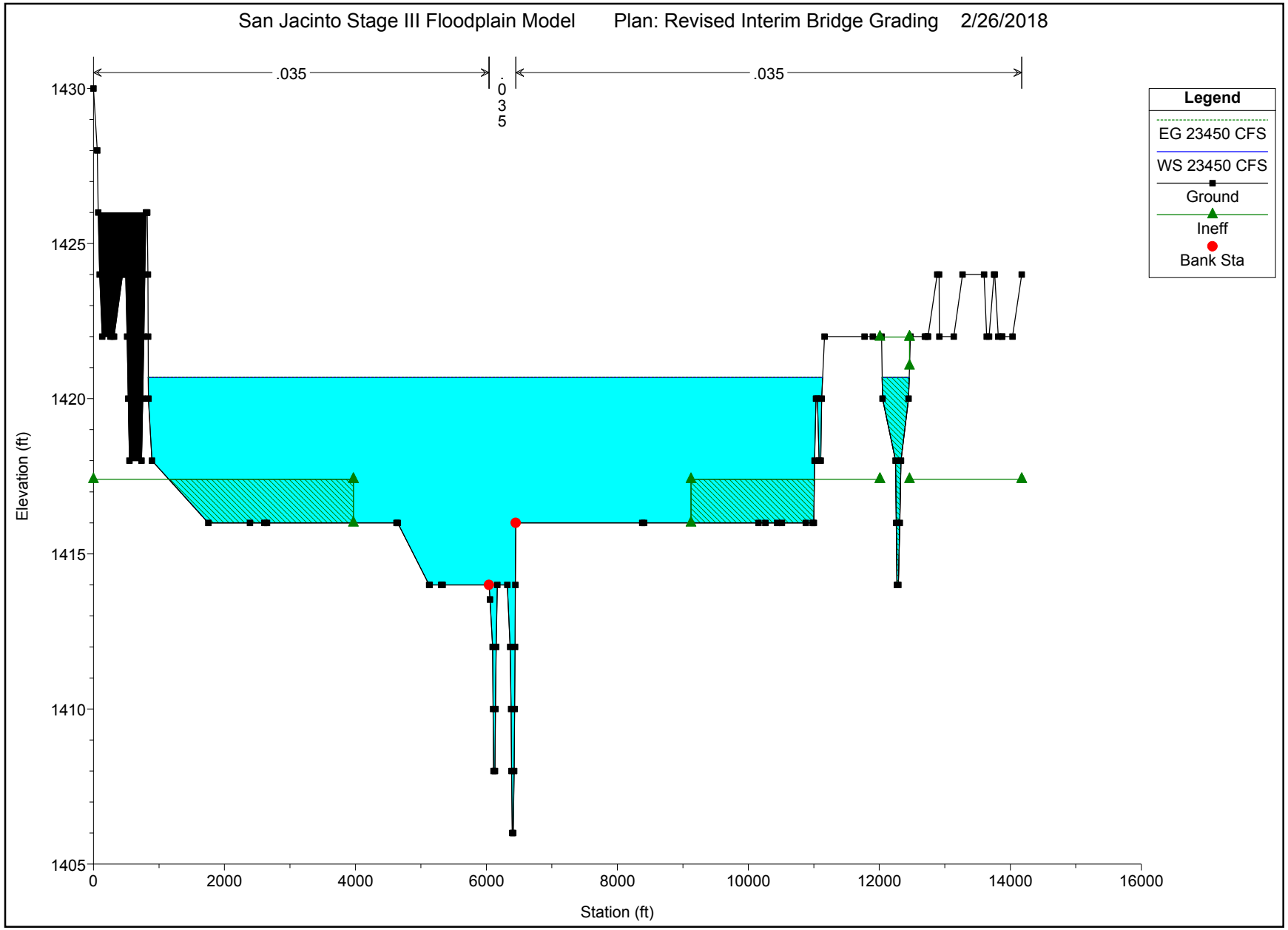
Station (ft)


San Jacinto Stage III Floodplain Model
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Legend
EG 23450 CFS
WS 23450 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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Station (ft)
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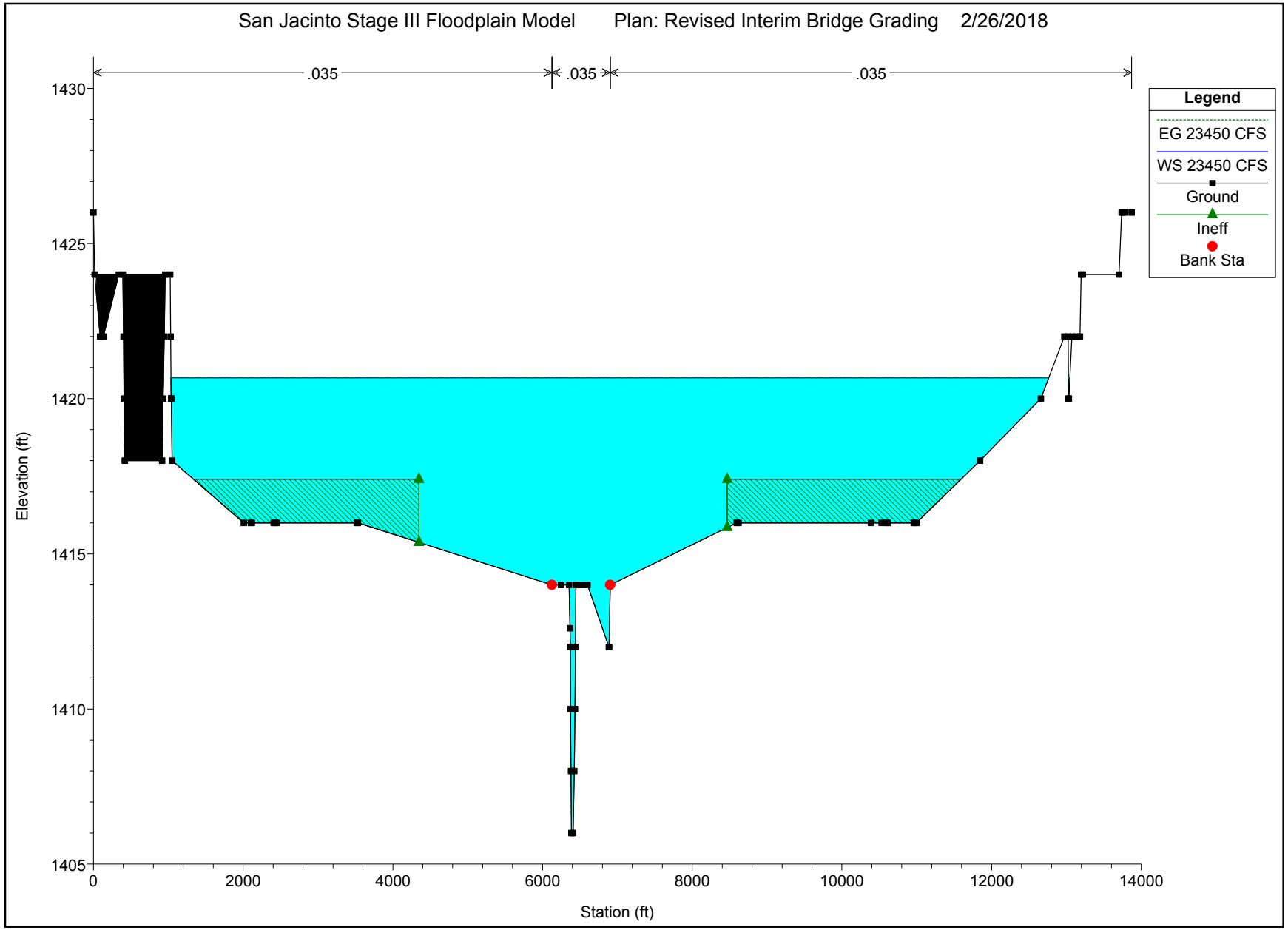
San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018
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Legend
EG 23450 CFS
WS 23450 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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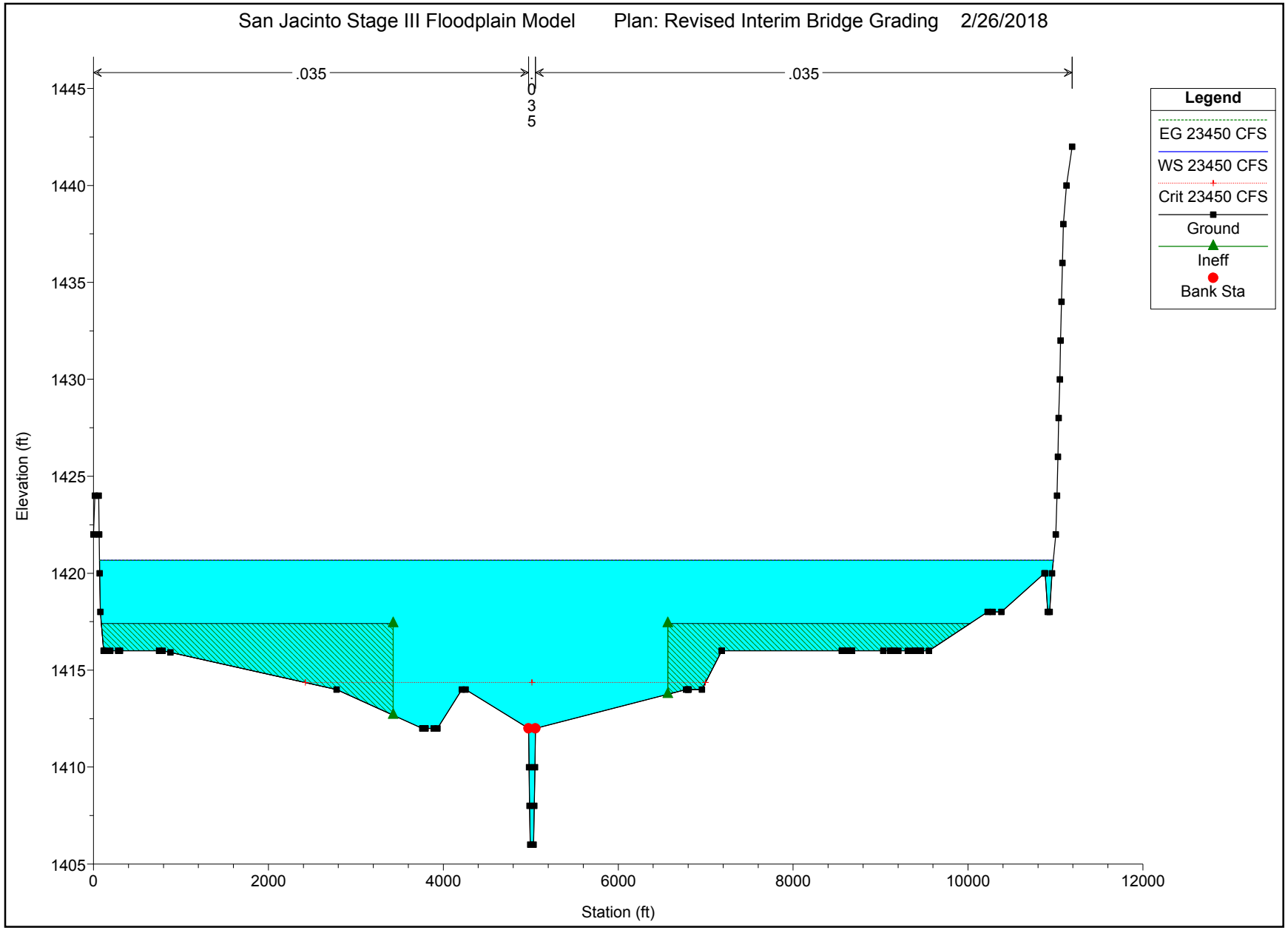
8000
10000
12000
14000
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
.035
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Legend
EG 23450 CFS
WS 23450 CFS
Crit 23450 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
1445
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1410
1405
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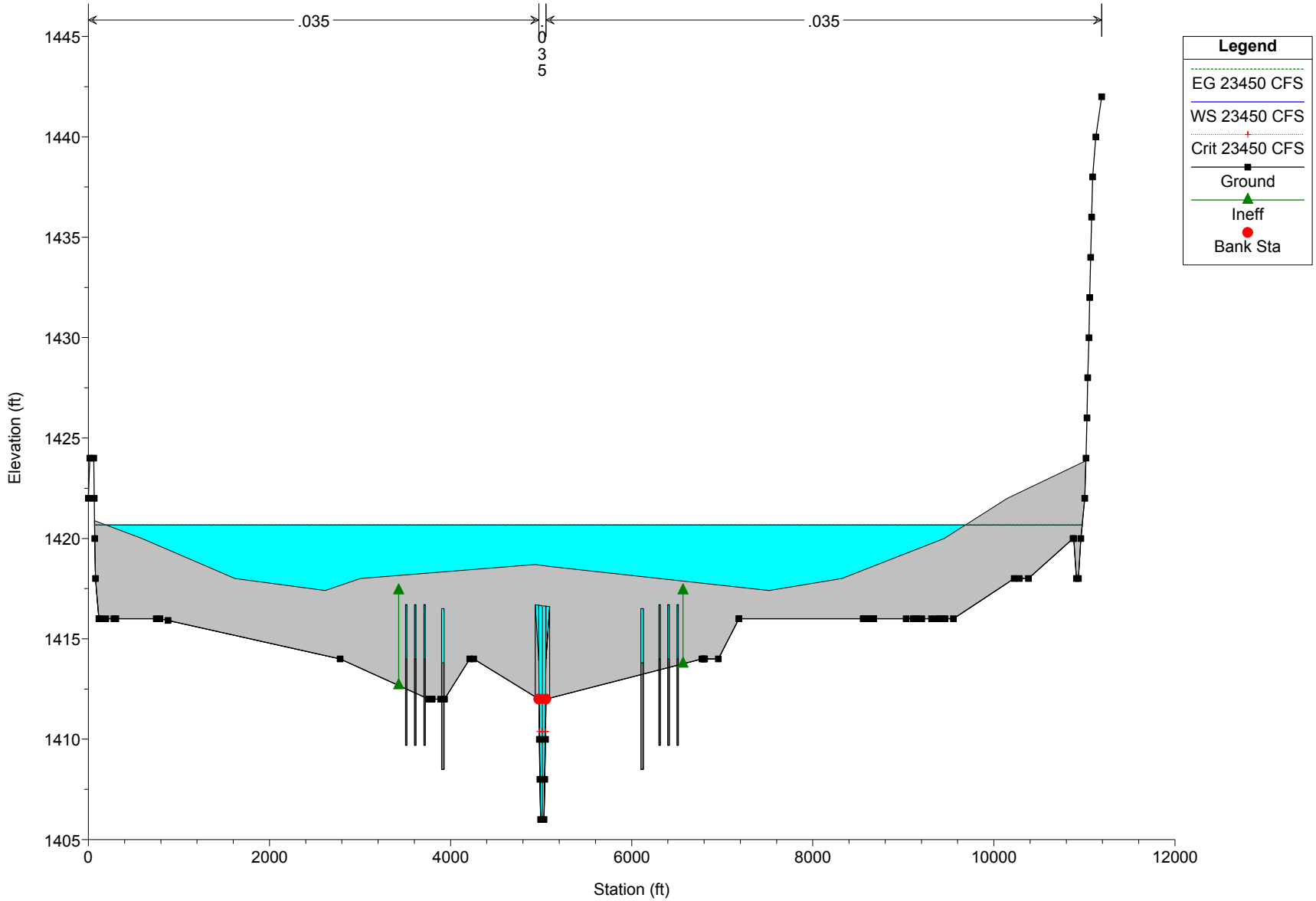
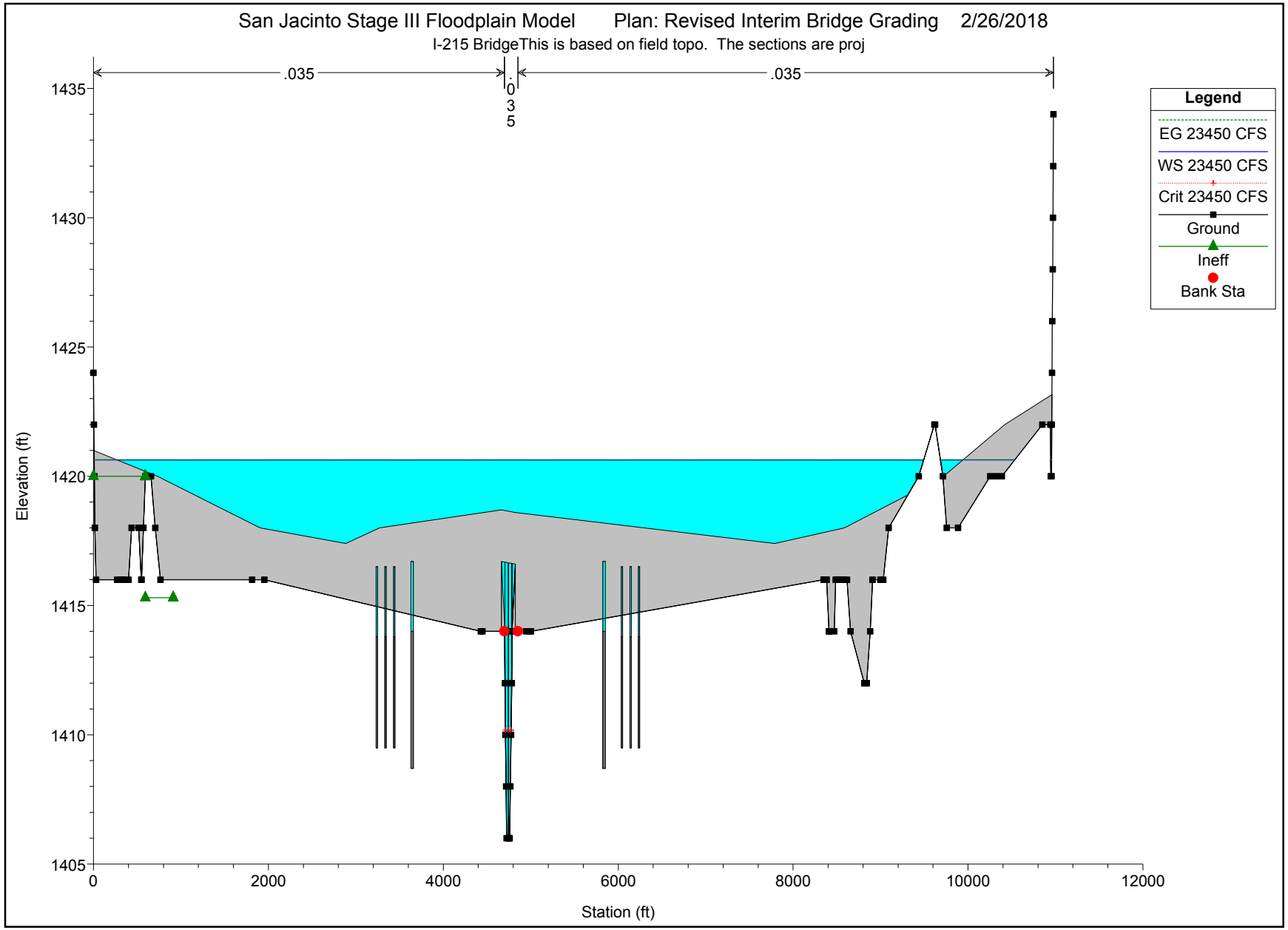
12000
Station (ft)

San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018

I-215 BridgeThis is based on field topo. The sections are proj




San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
I-215 BridgeThis is based on field topo. The sections are proj
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EG 23450 CFS
WS 23450 CFS
Crit 23450 CFS
Ground
Ineff
Bank Sta
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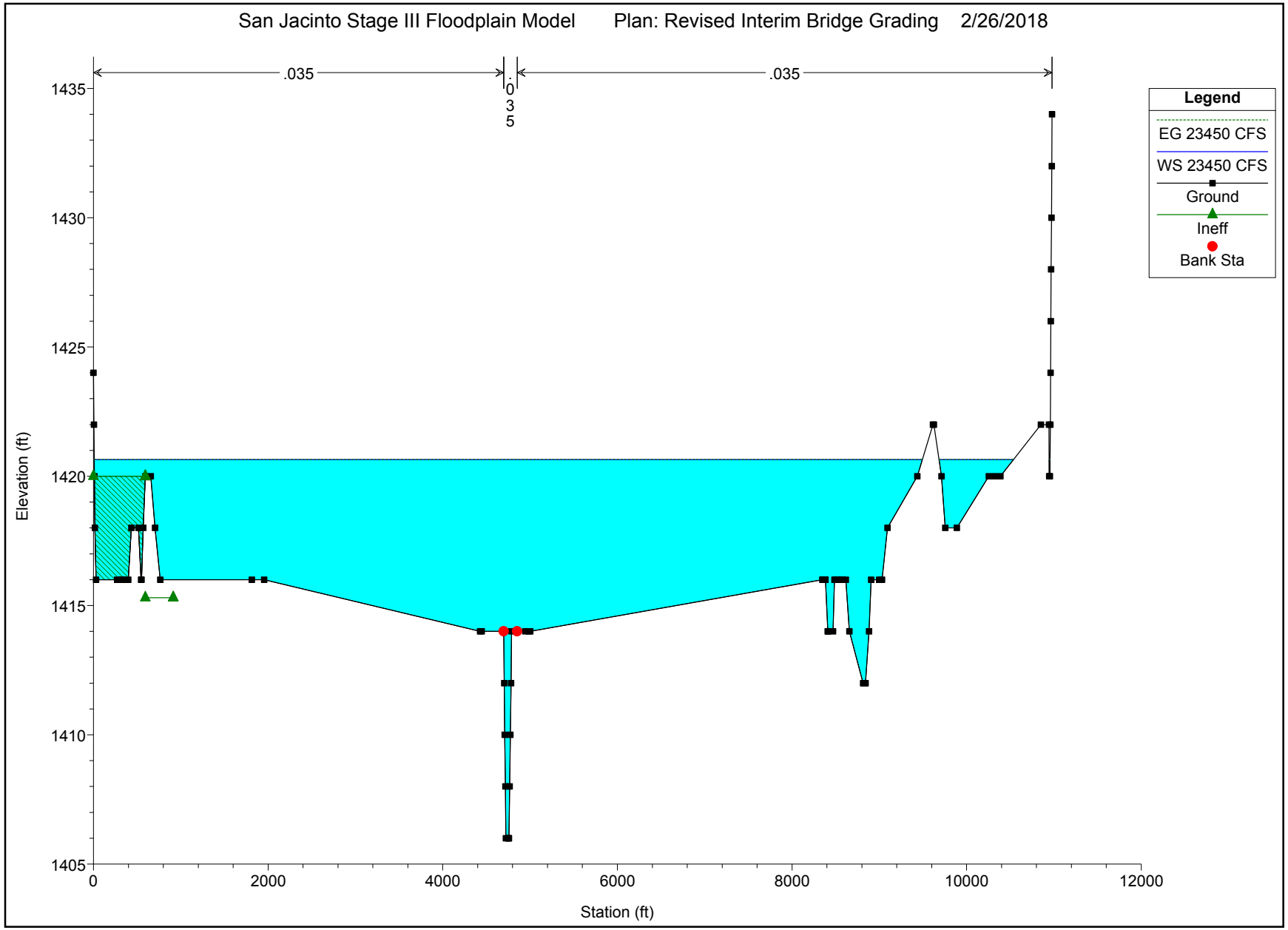
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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WS 23450 CFS
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Ineff
Bank Sta
Elevation (ft)
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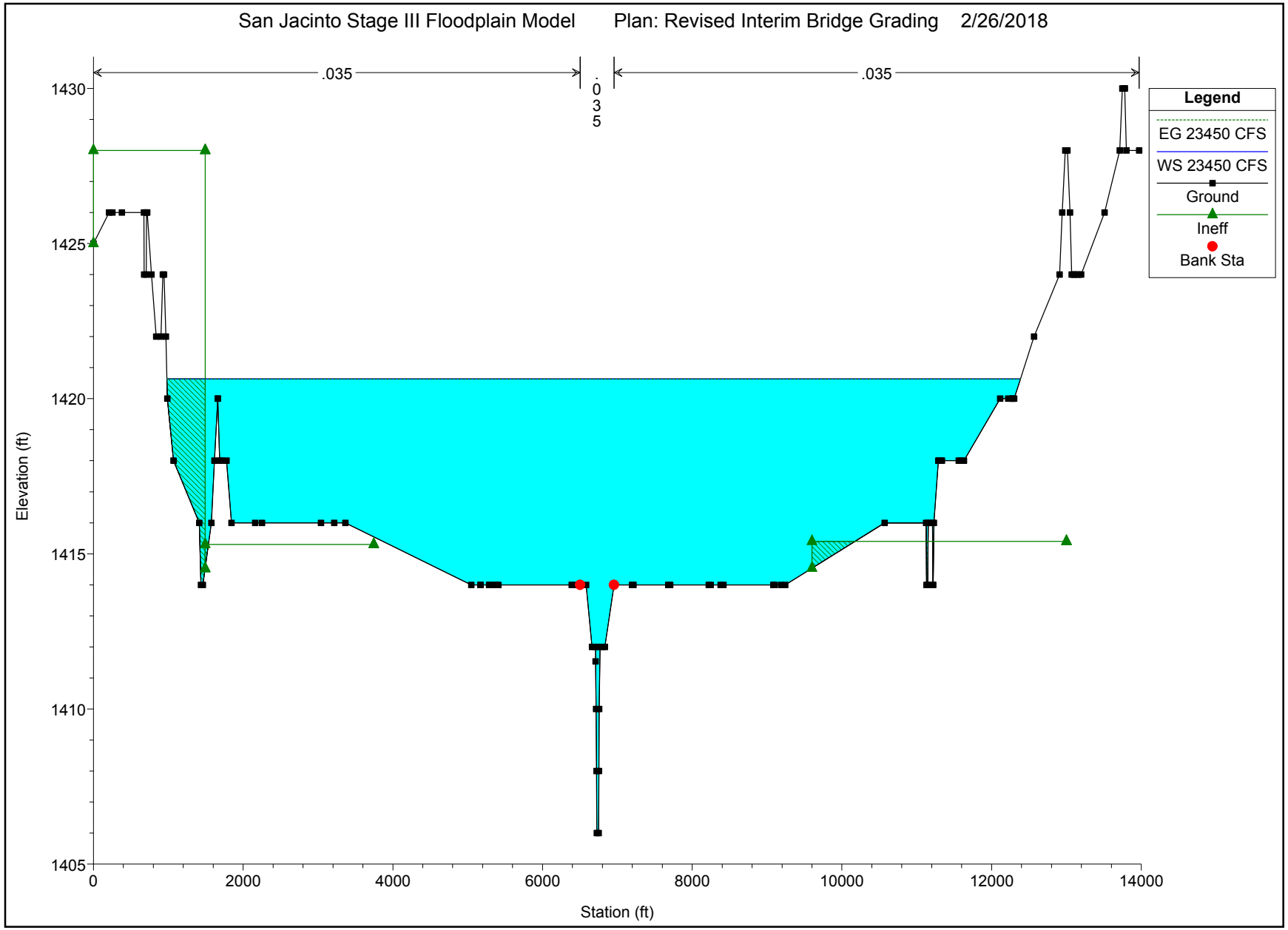
Station (ft)


San Jacinto Stage III Floodplain Model
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Legend
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WS 23450 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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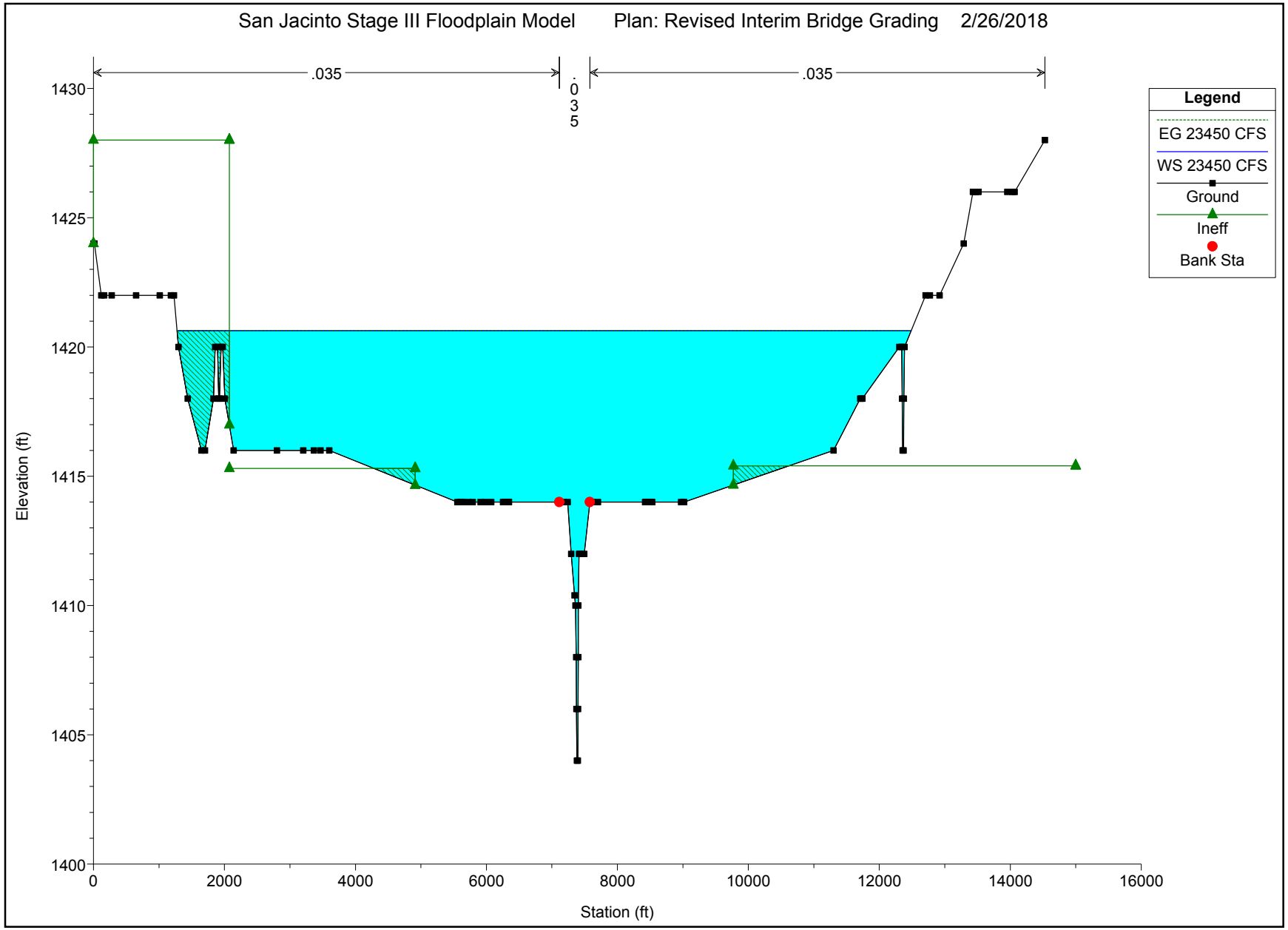
Station (ft)


San Jacinto Stage III Floodplain Model
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2/26/2018
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Legend
EG 23450 CFS
WS 23450 CFS
Ground
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Bank Sta
Elevation (ft)
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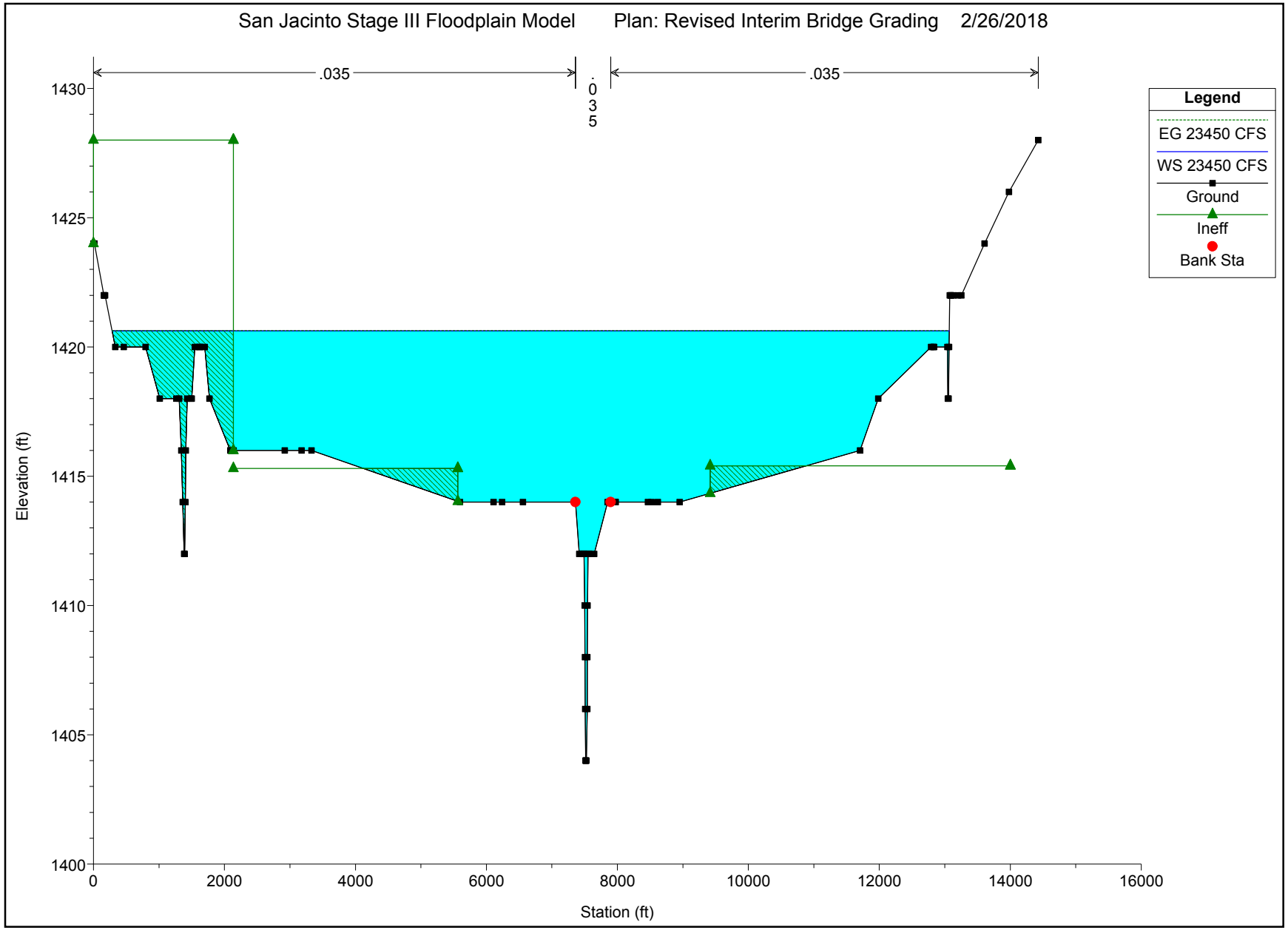
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 23450 CFS
WS 23450 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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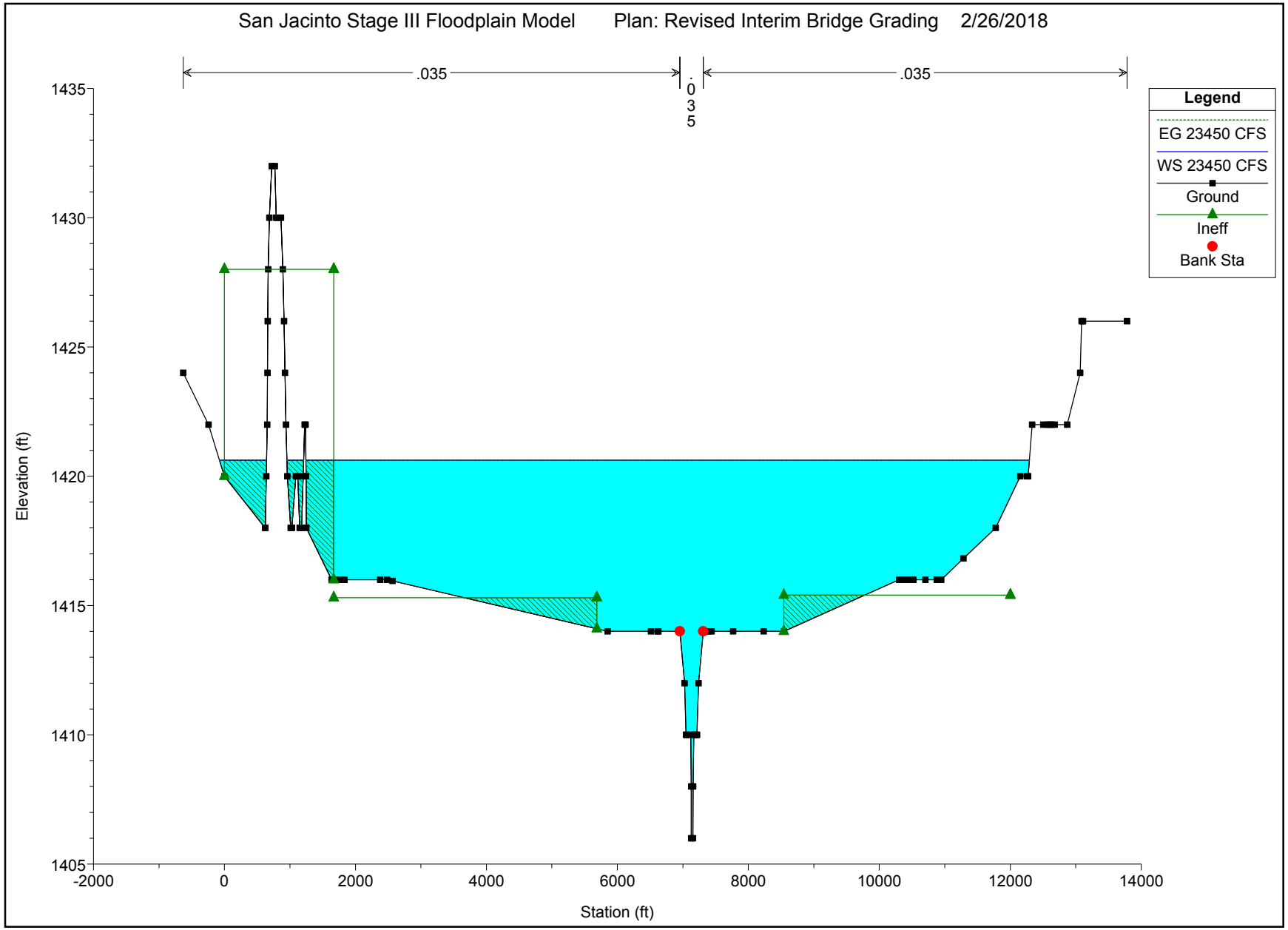
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 23450 CFS
WS 23450 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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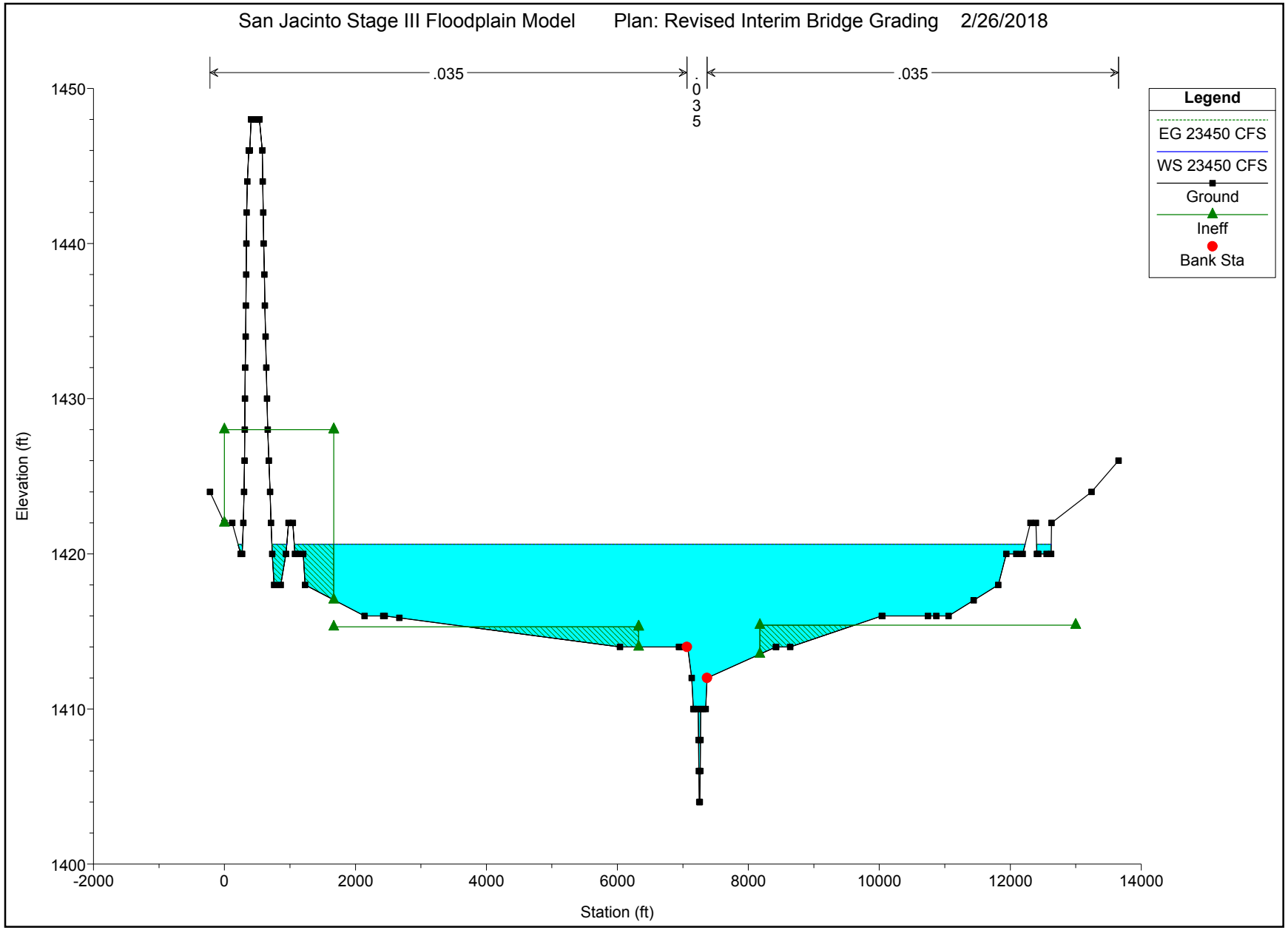
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
.035
.035
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Legend
EG 23450 CFS
WS 23450 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
1450
1440
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-2000
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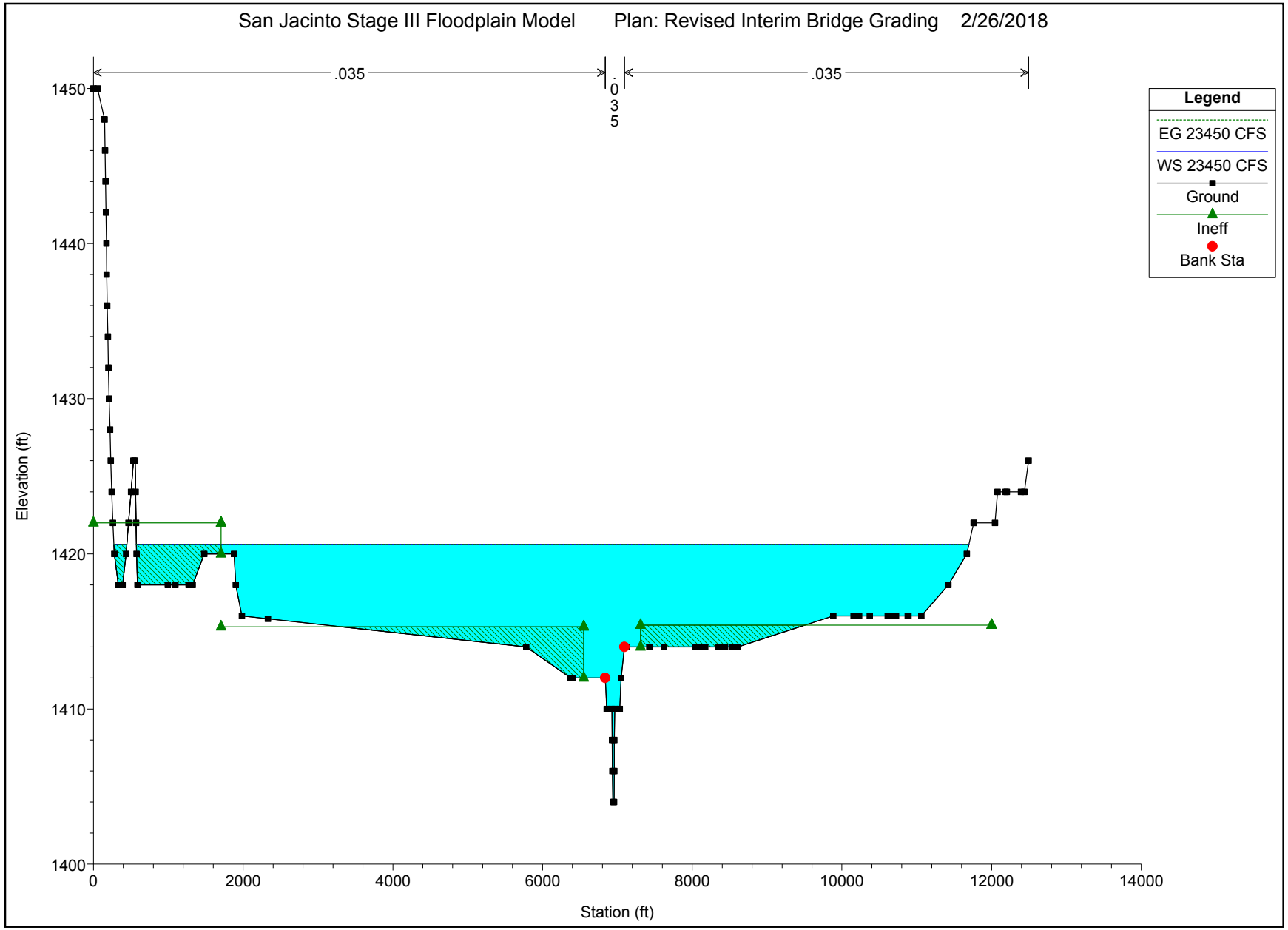
2000
4000
6000
8000
10000
12000
14000
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
.035
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Legend
EG 23450 CFS
WS 23450 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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10000
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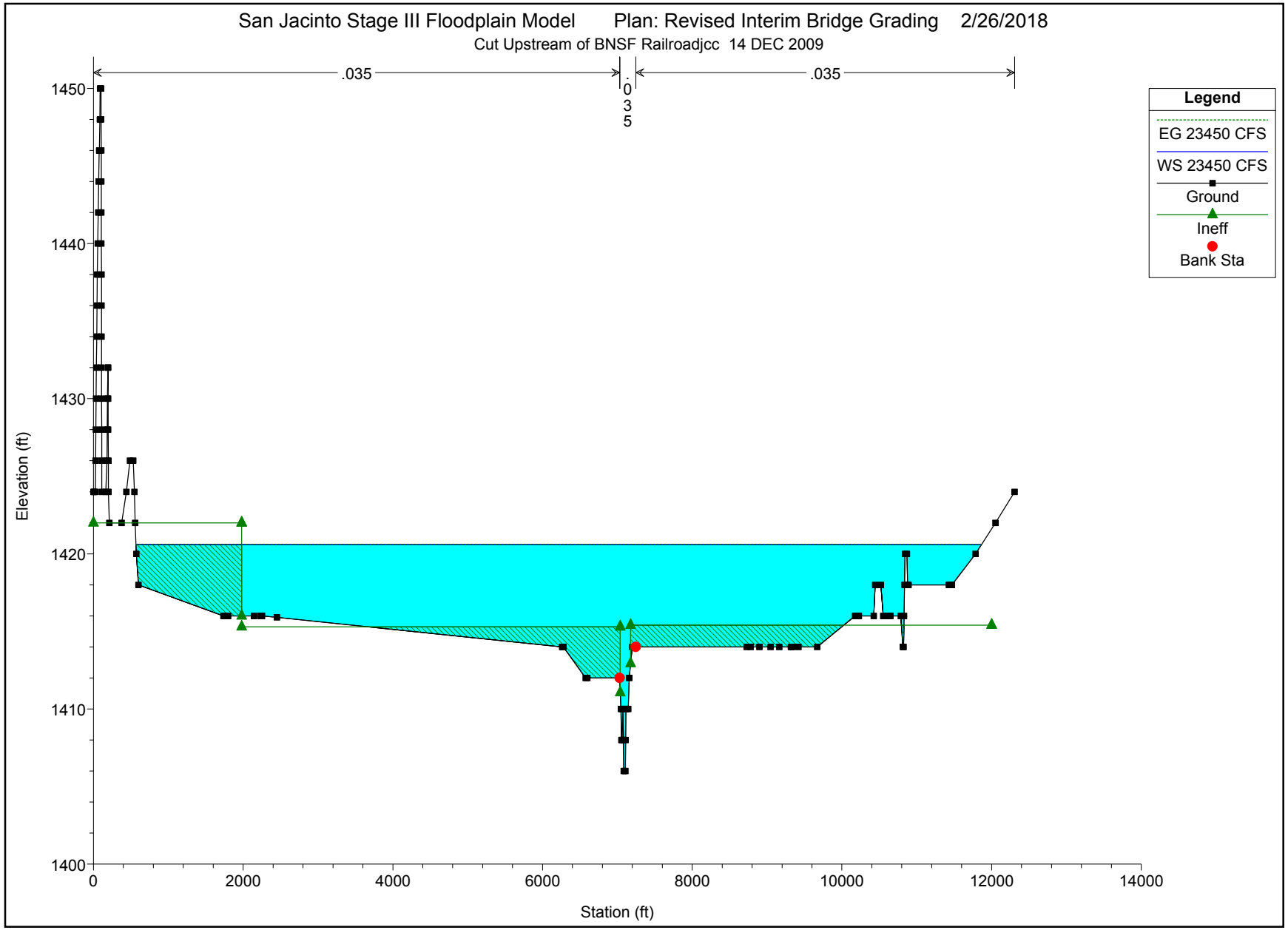
14000
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
Cut Upstream of BNSF Railroadjcc 14 DEC 2009
.035
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Legend
EG 23450 CFS
WS 23450 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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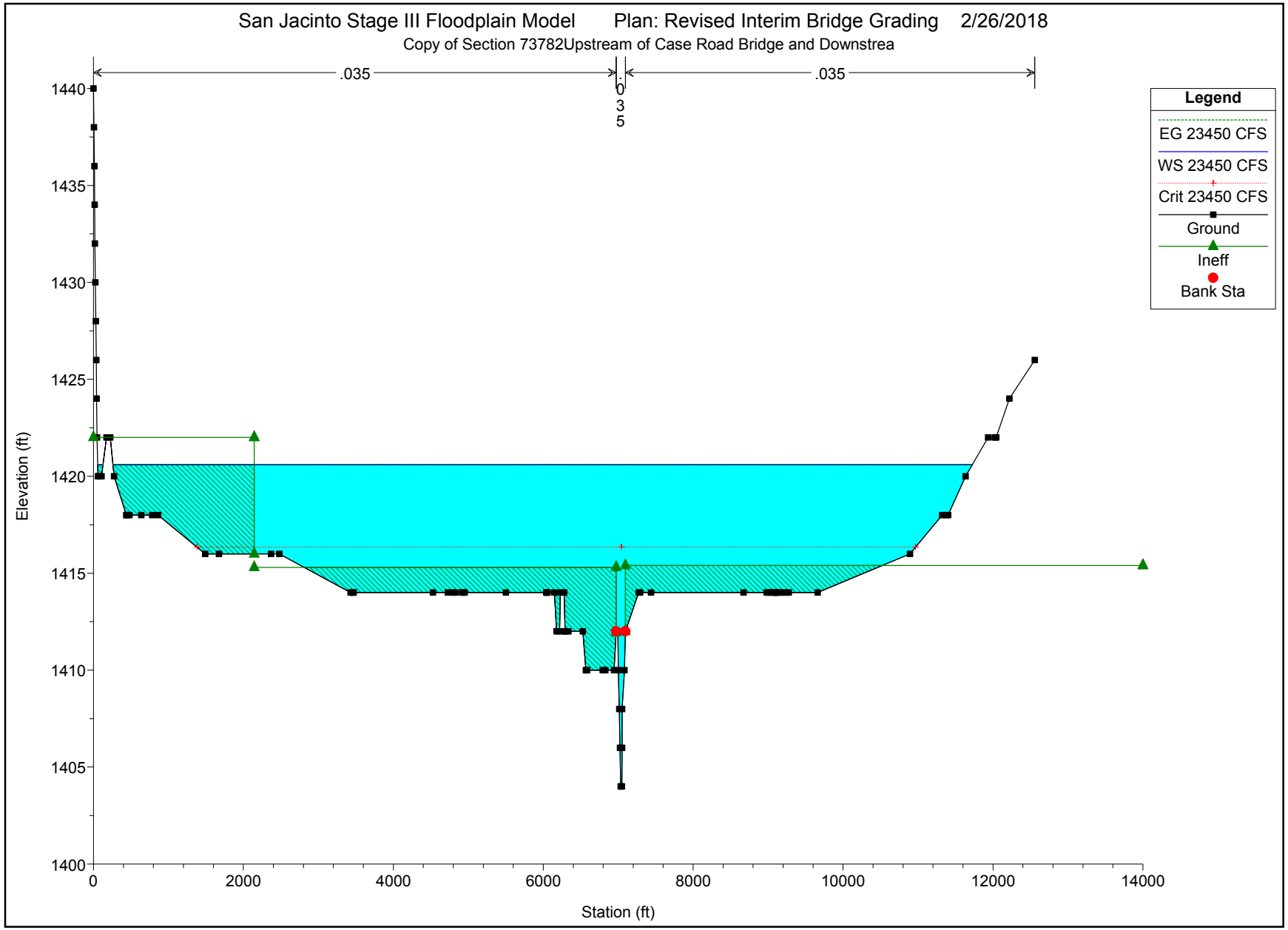
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
Copy of Section 73782Upstream of Case Road Bridge and Downstrea
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Legend
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Crit 23450 CFS
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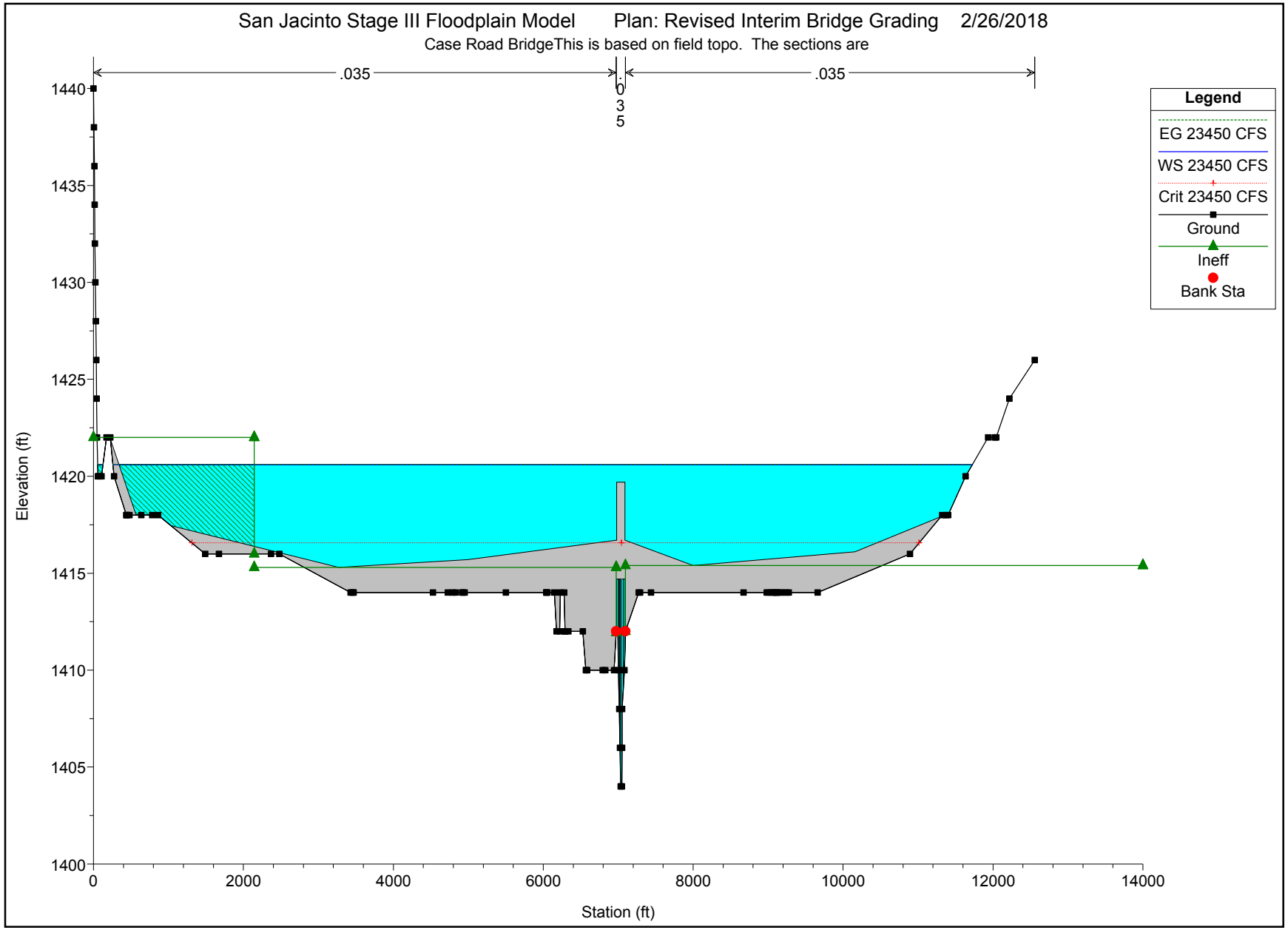
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
Case Road BridgeThis is based on field topo. The sections are
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Legend
EG 23450 CFS
WS 23450 CFS
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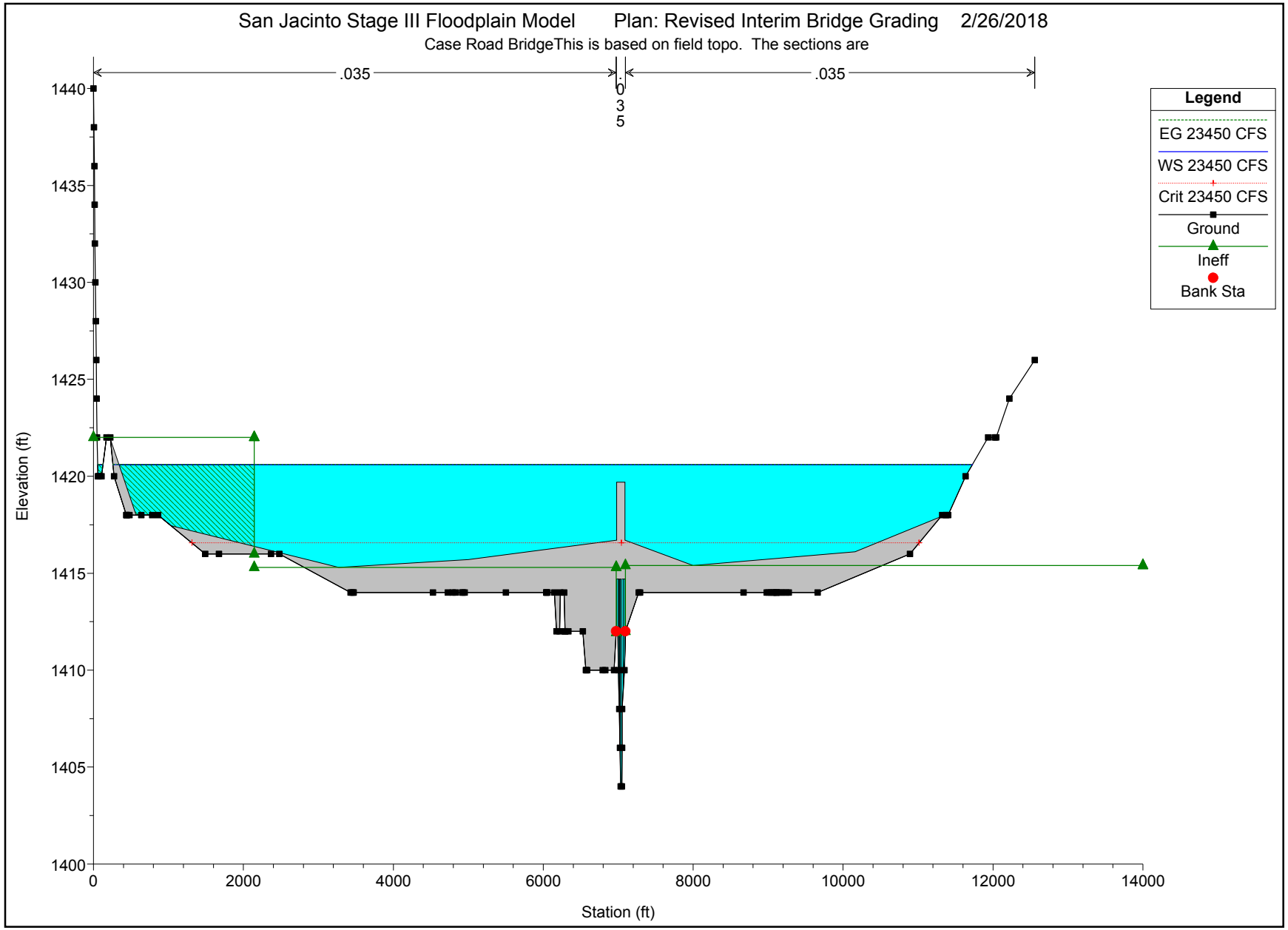
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
Case Road BridgeThis is based on field topo. The sections are
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Legend
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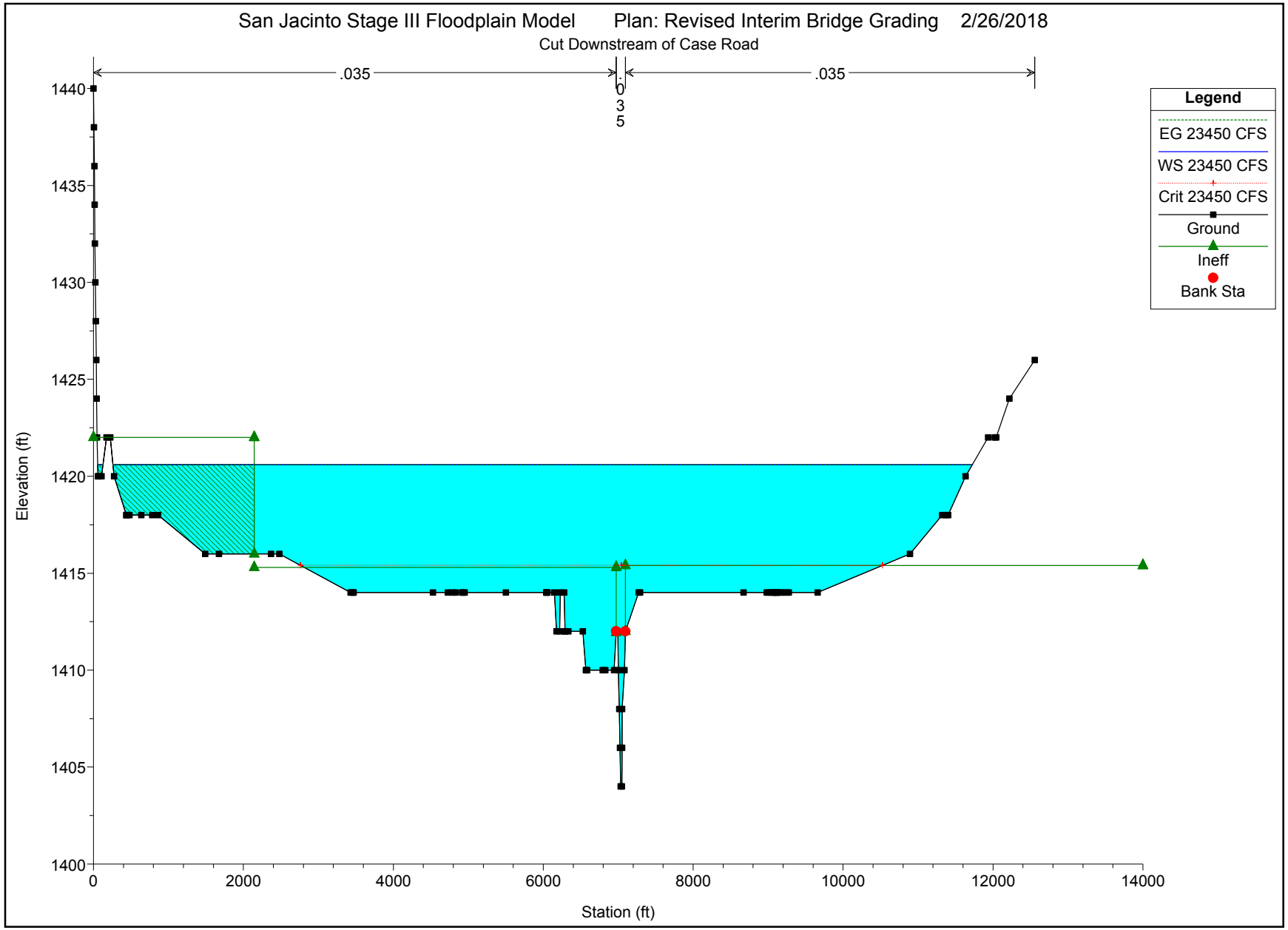
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
Cut Downstream of Case Road
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Legend
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WS 23450 CFS
Crit 23450 CFS
Ground
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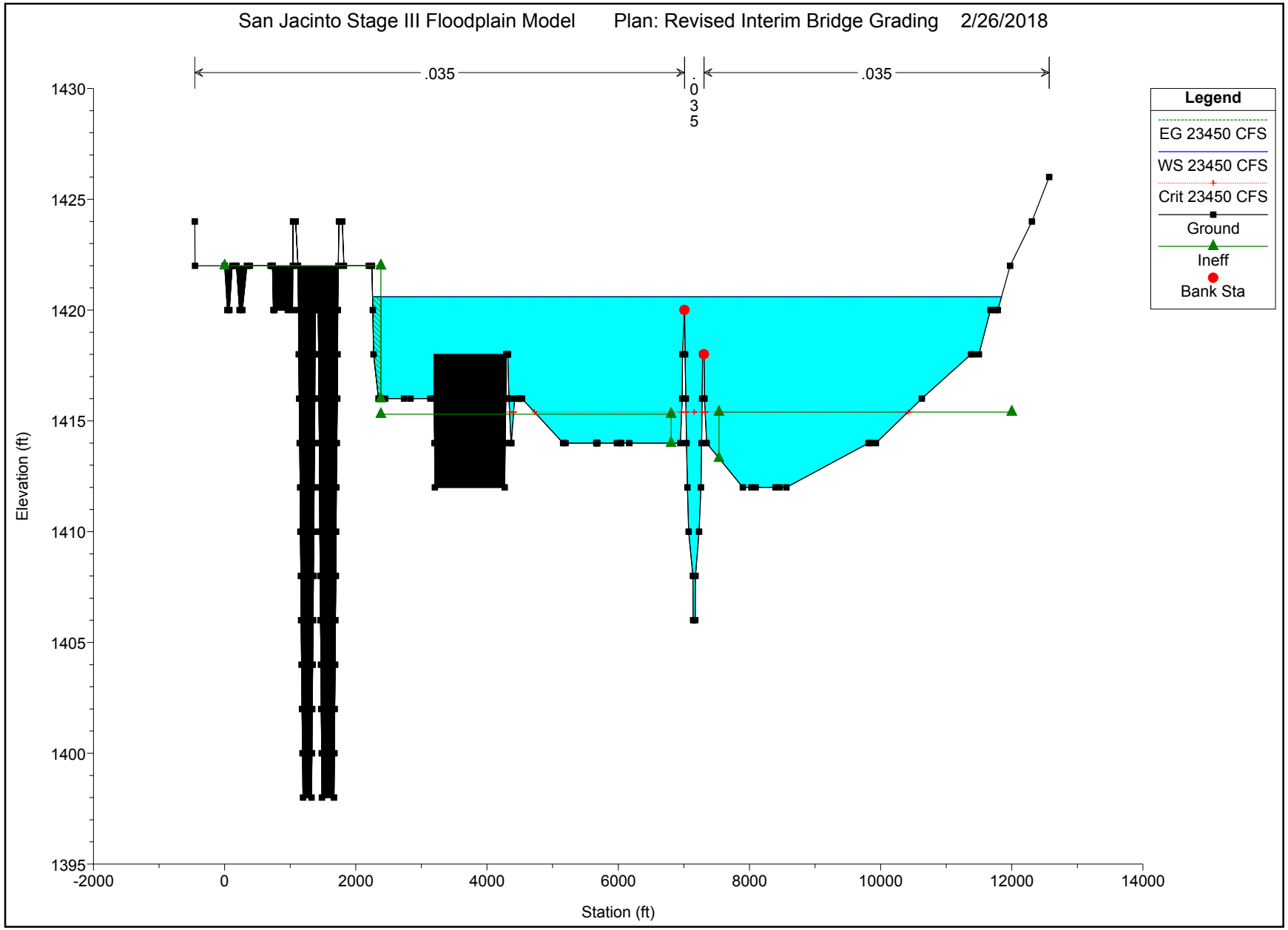
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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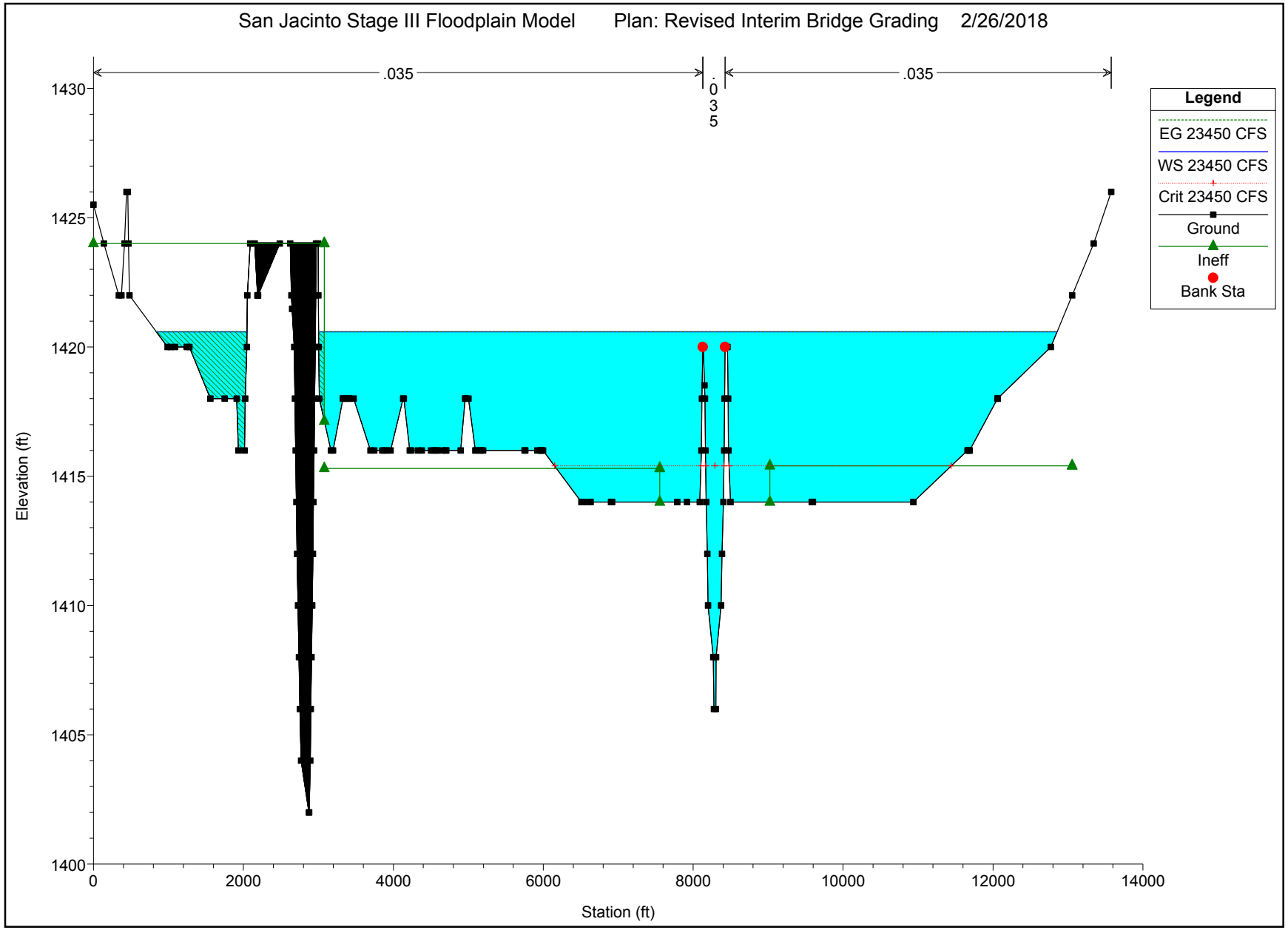
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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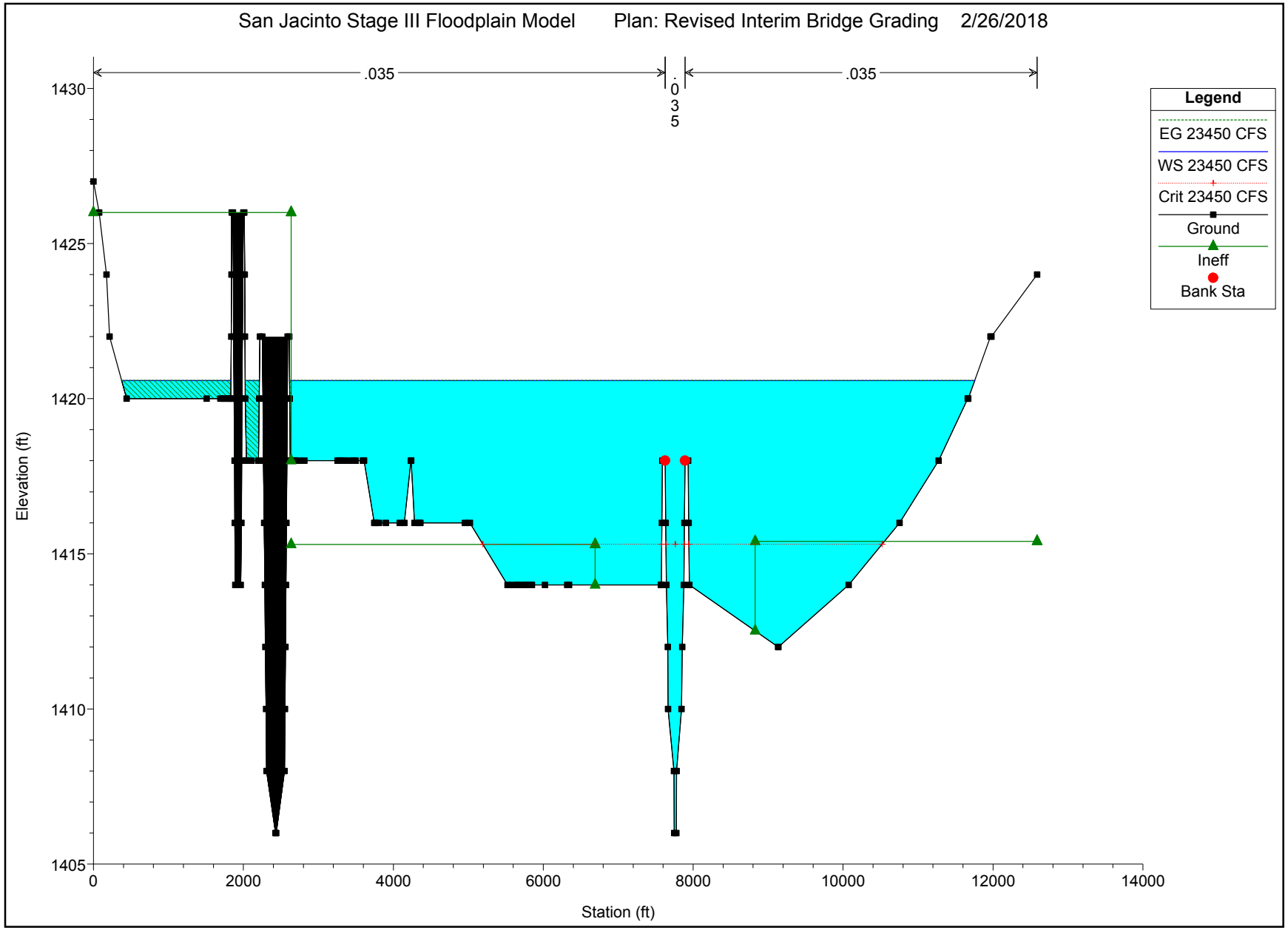
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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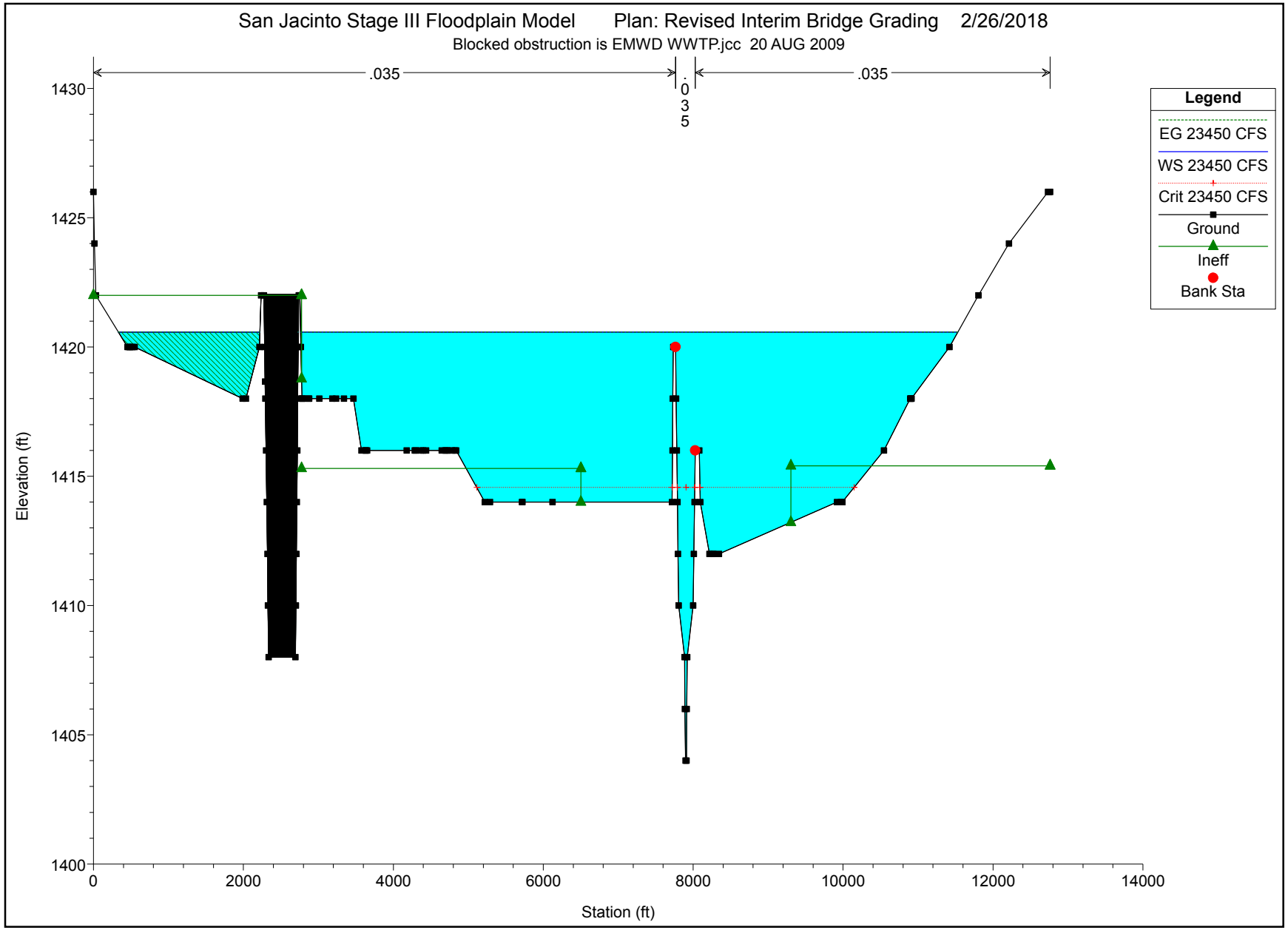
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
Blocked obstruction is EMWD WWTP.jcc 20 AUG 2009
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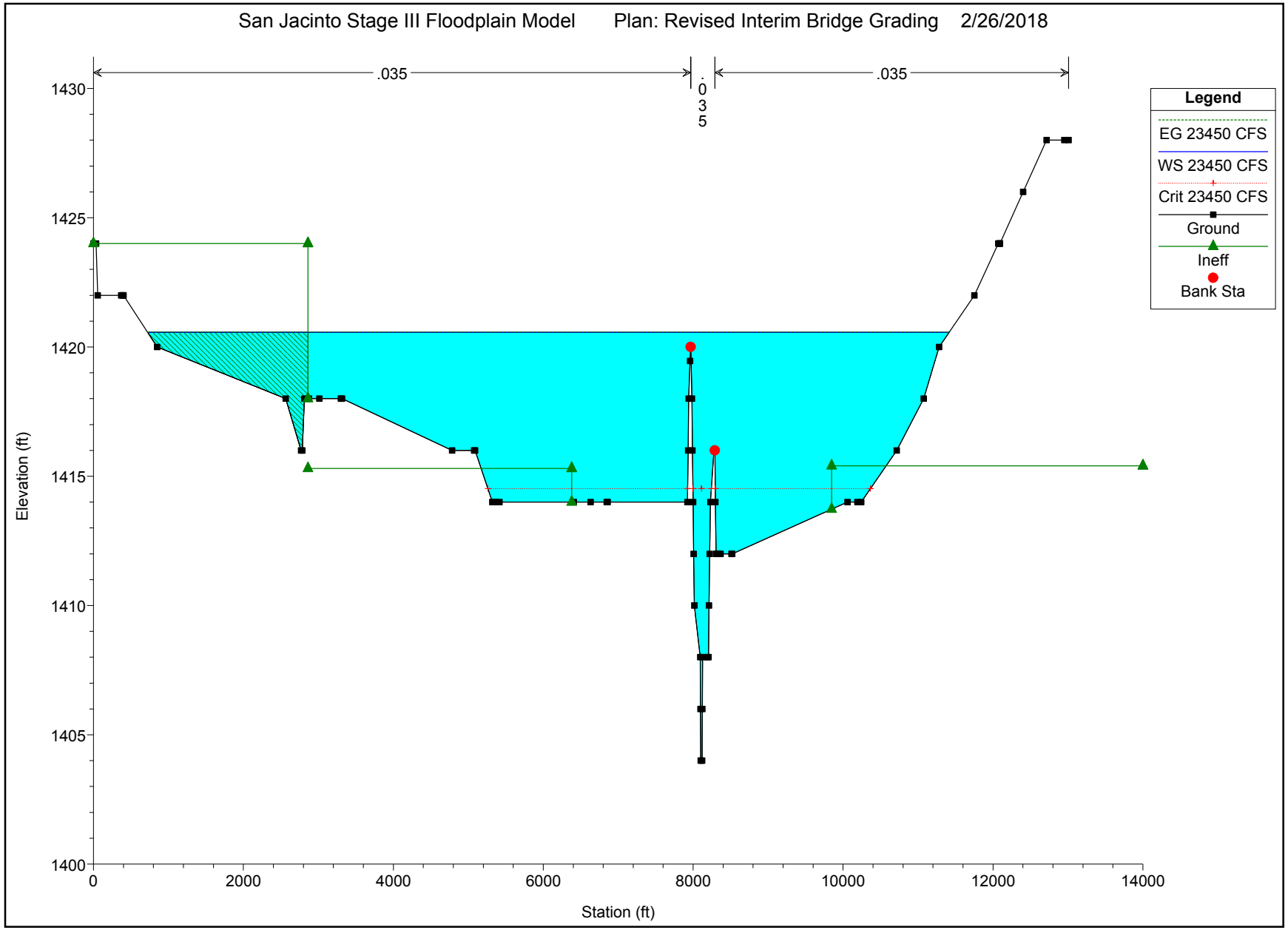
San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018
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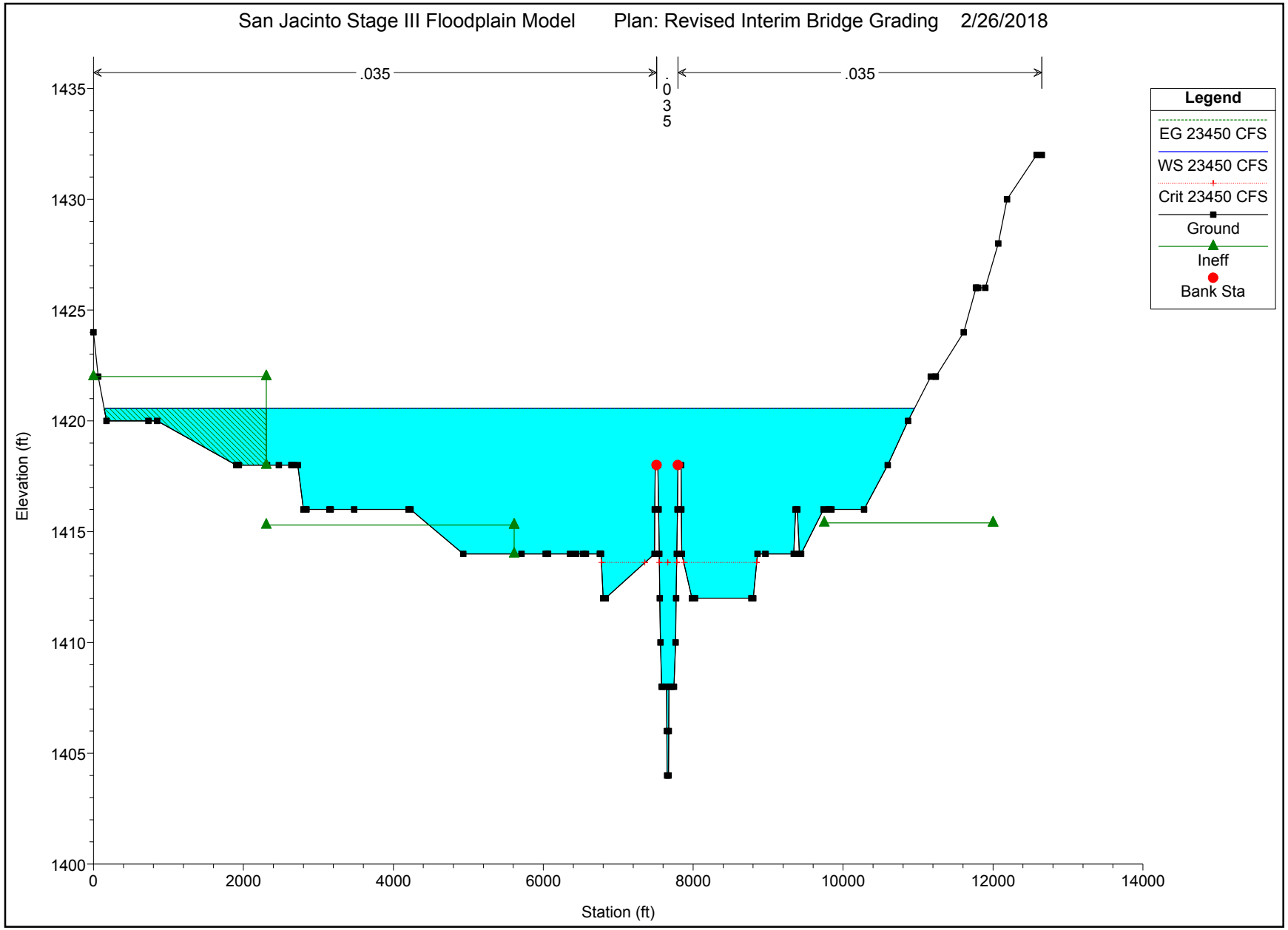
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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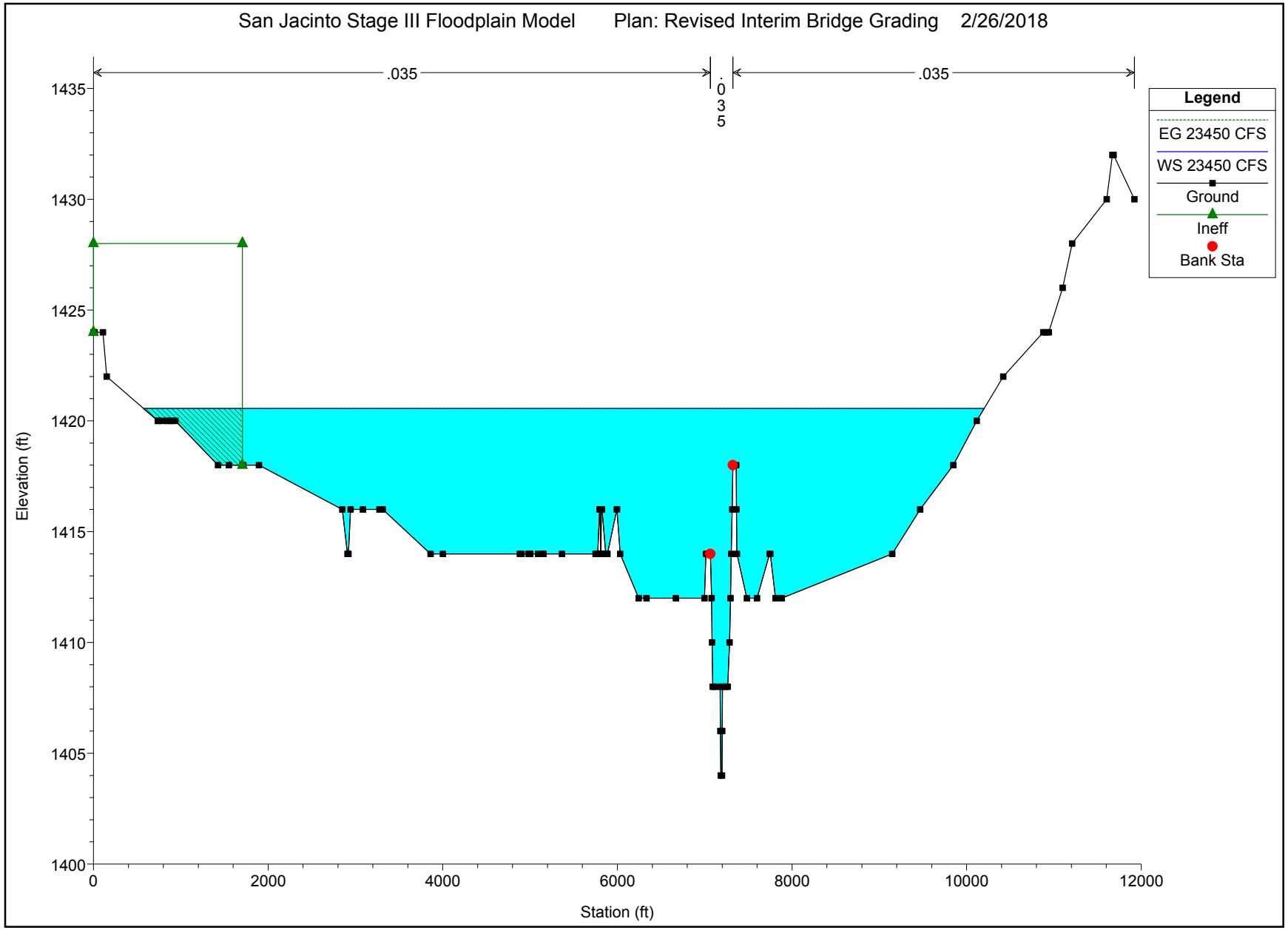
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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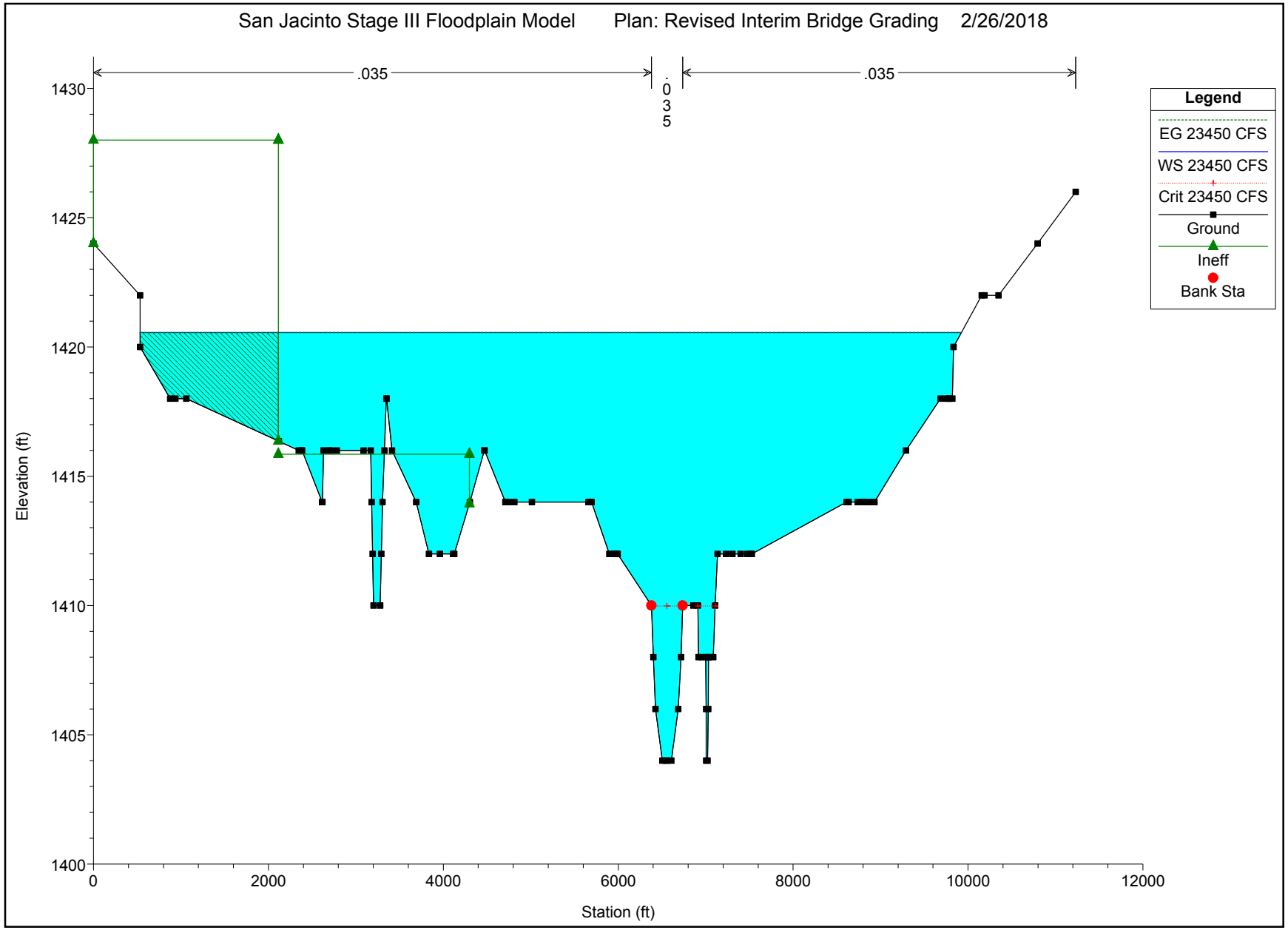
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
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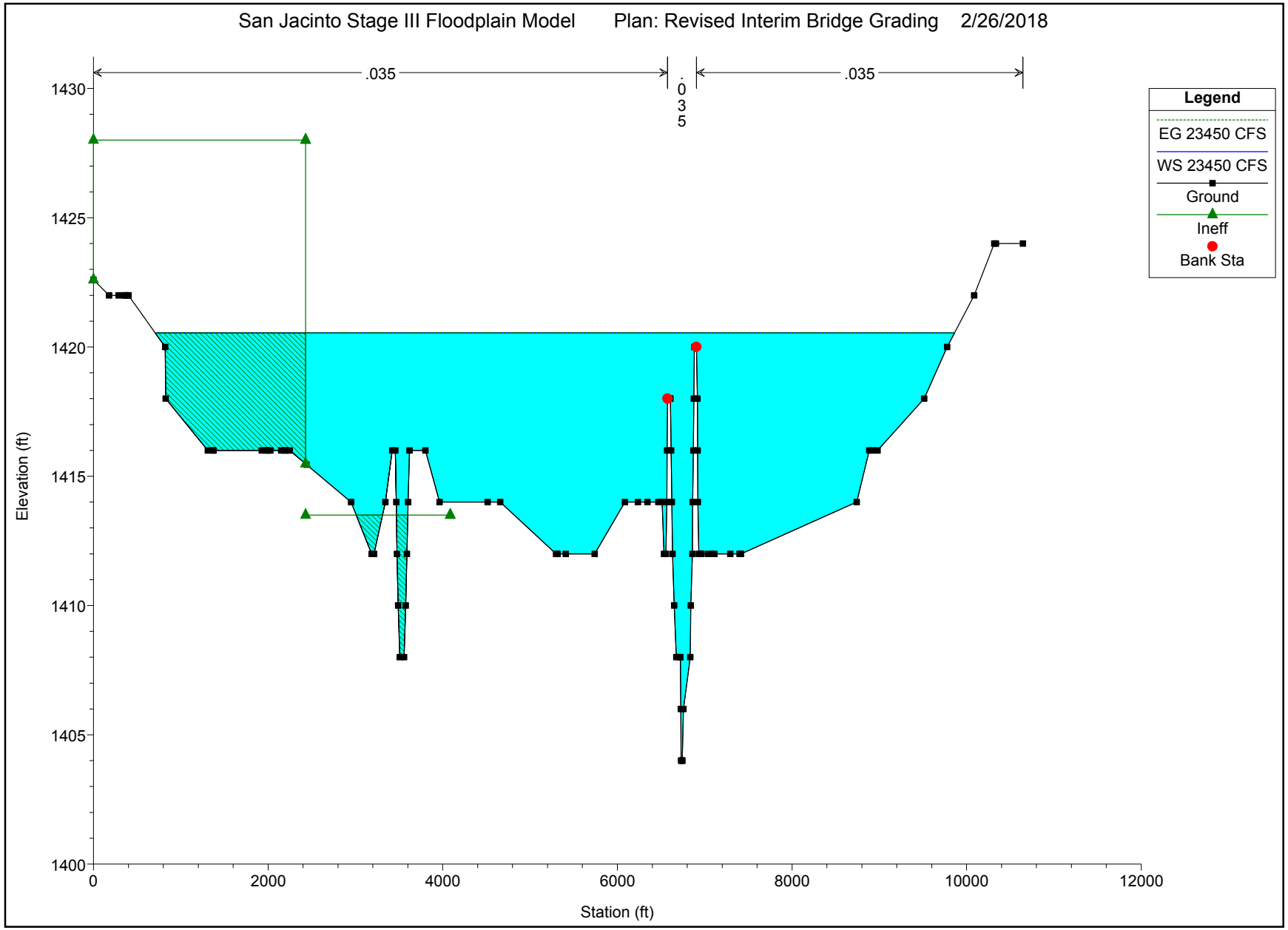
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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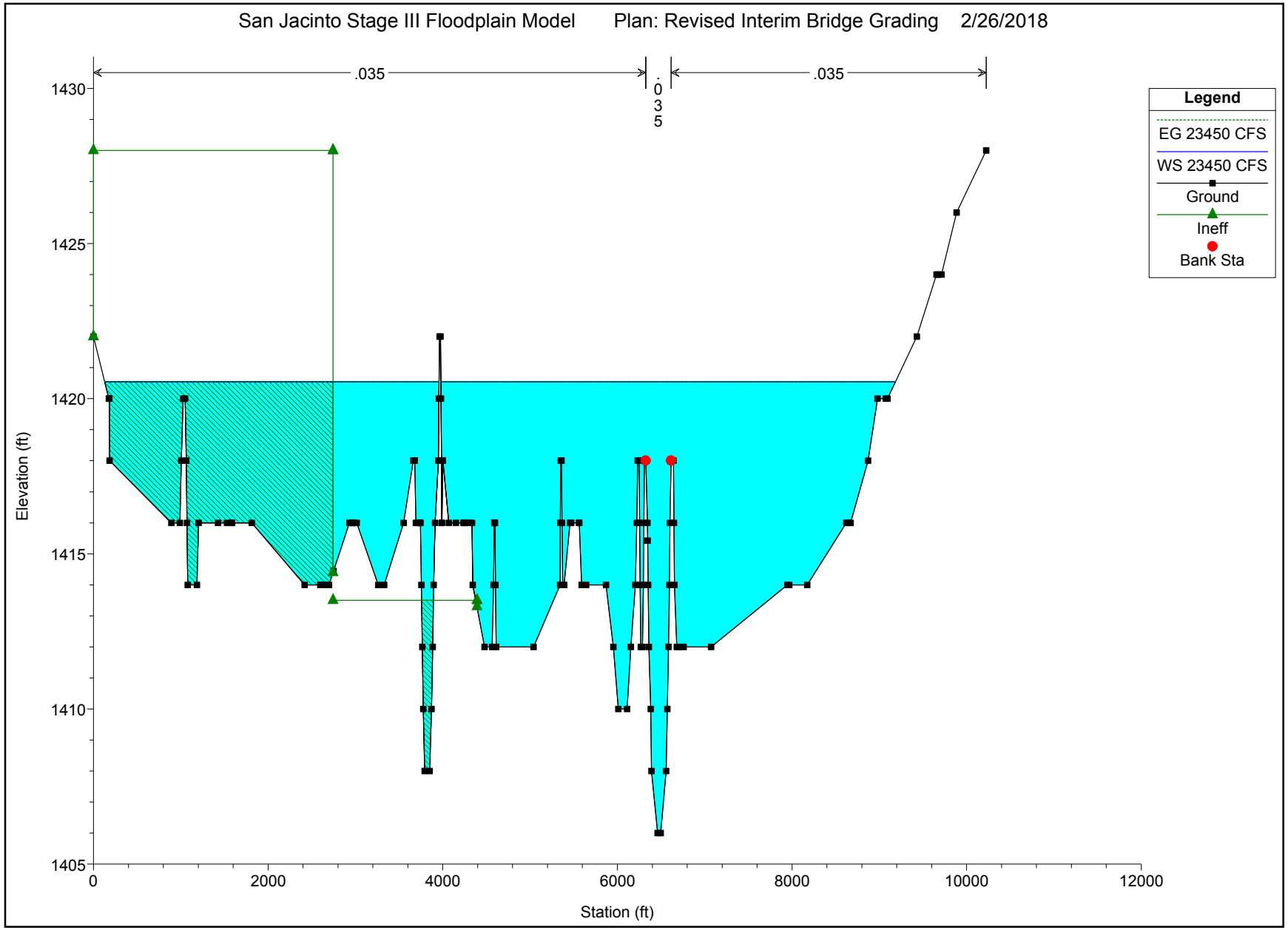
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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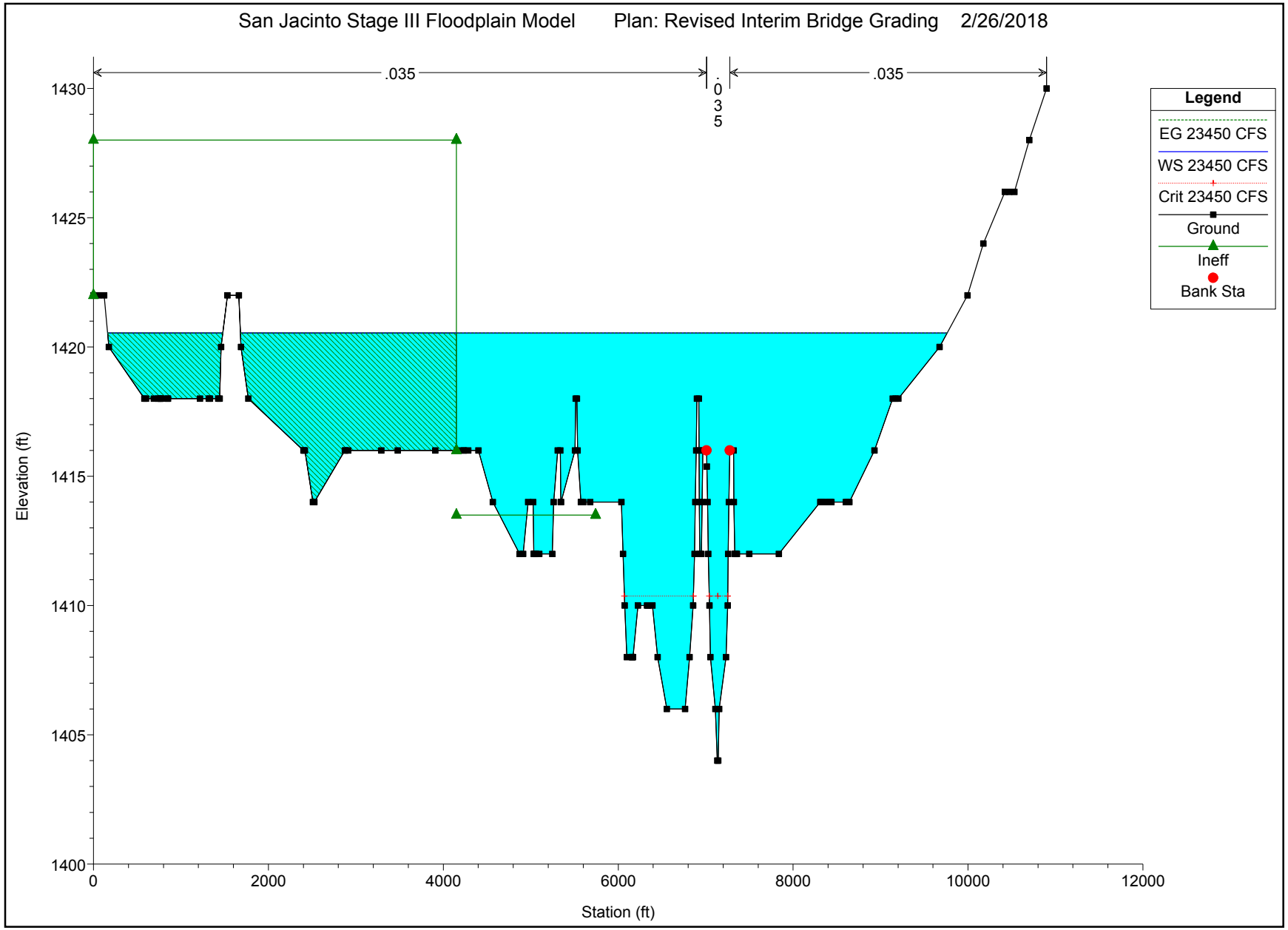
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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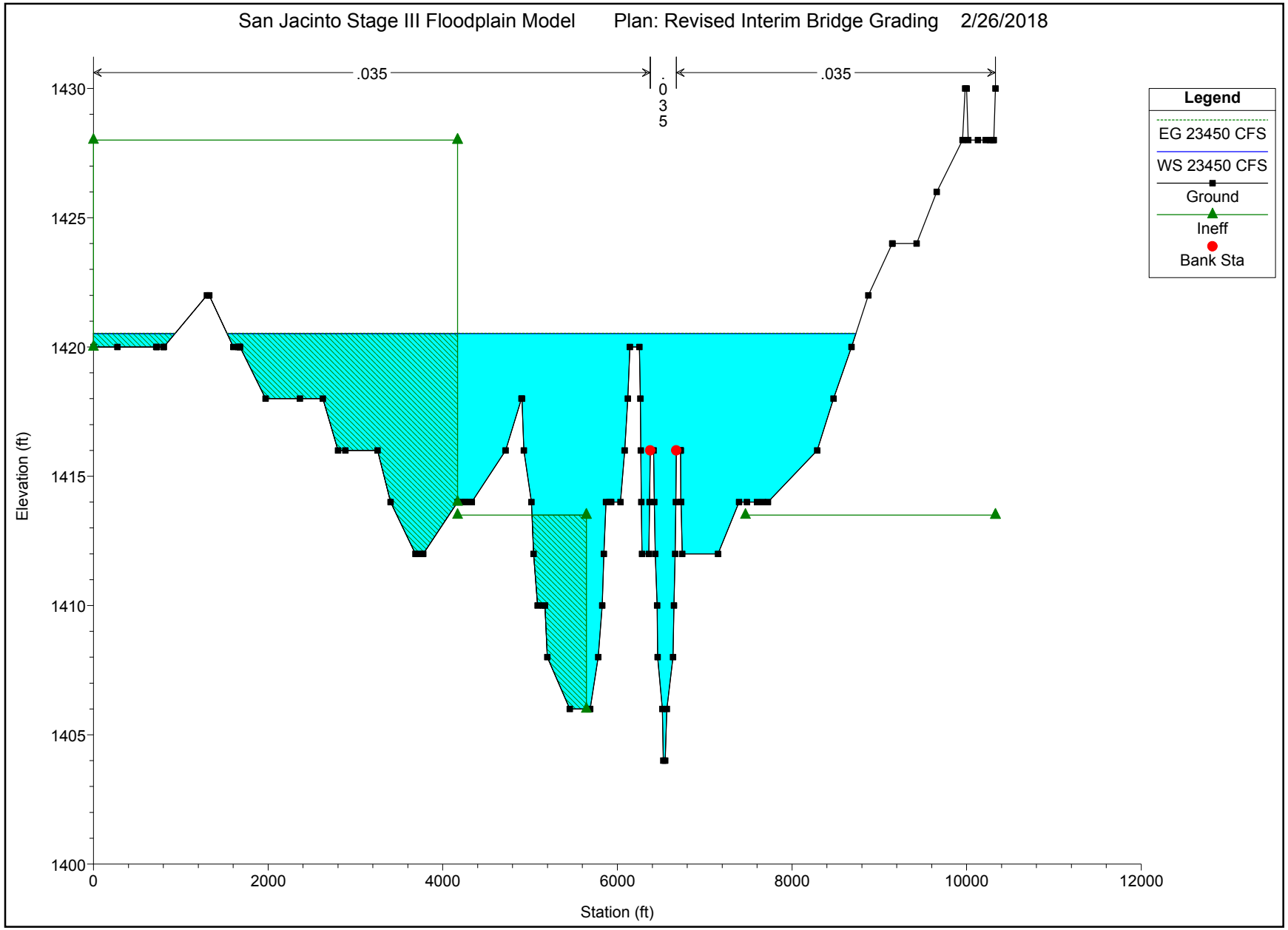
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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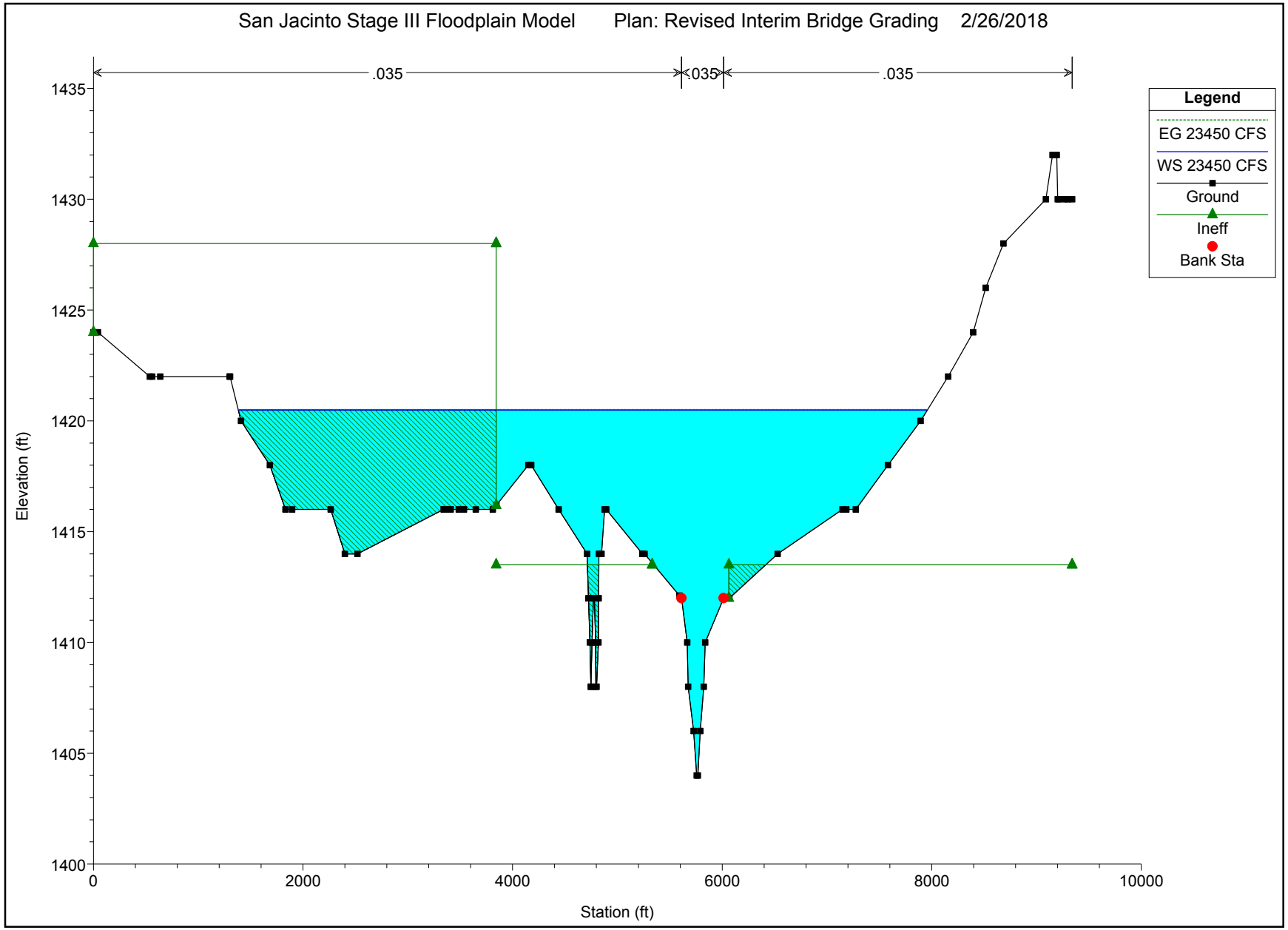
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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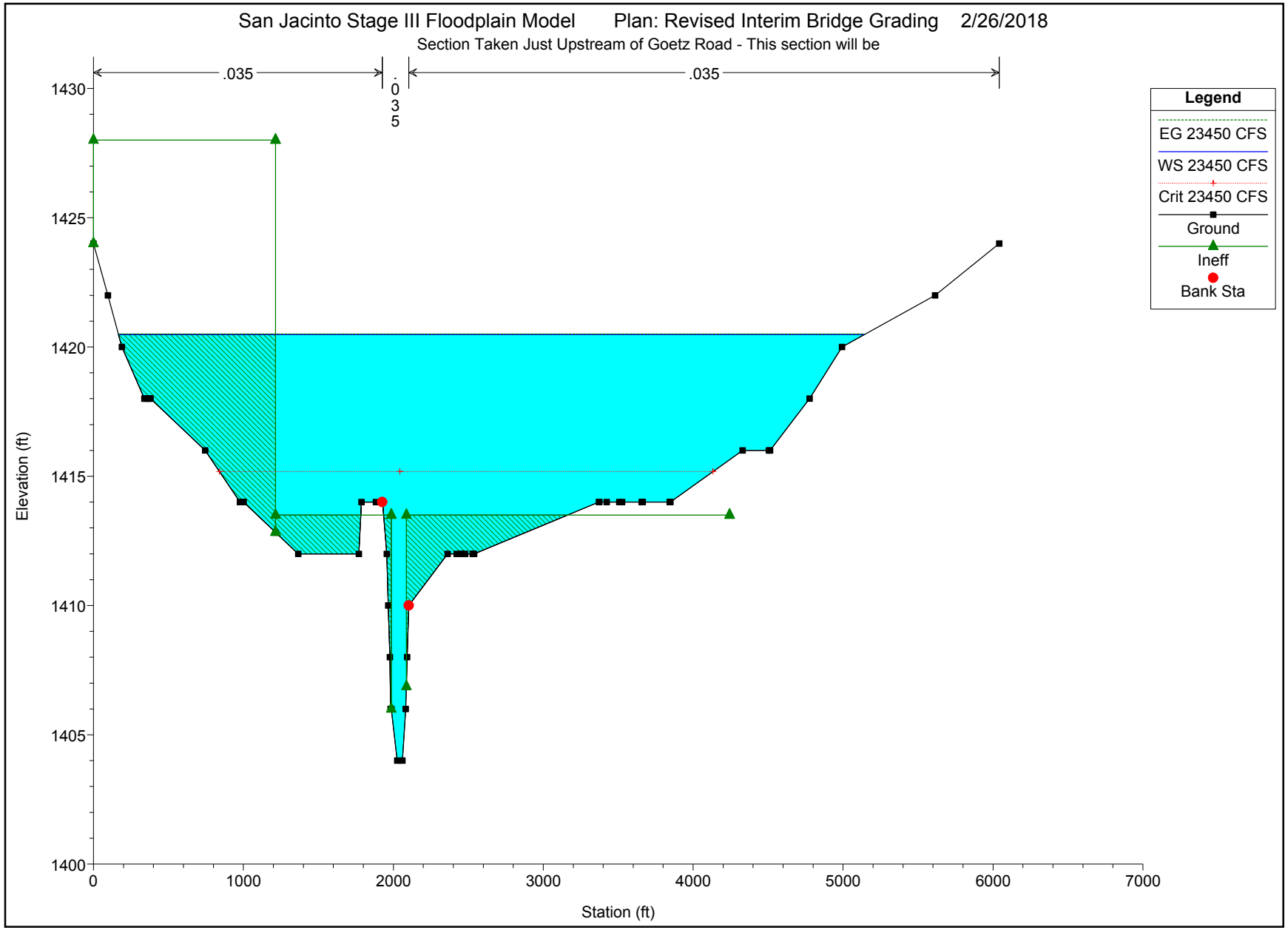
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
Section Taken Just Upstream of Goetz Road - This section will be
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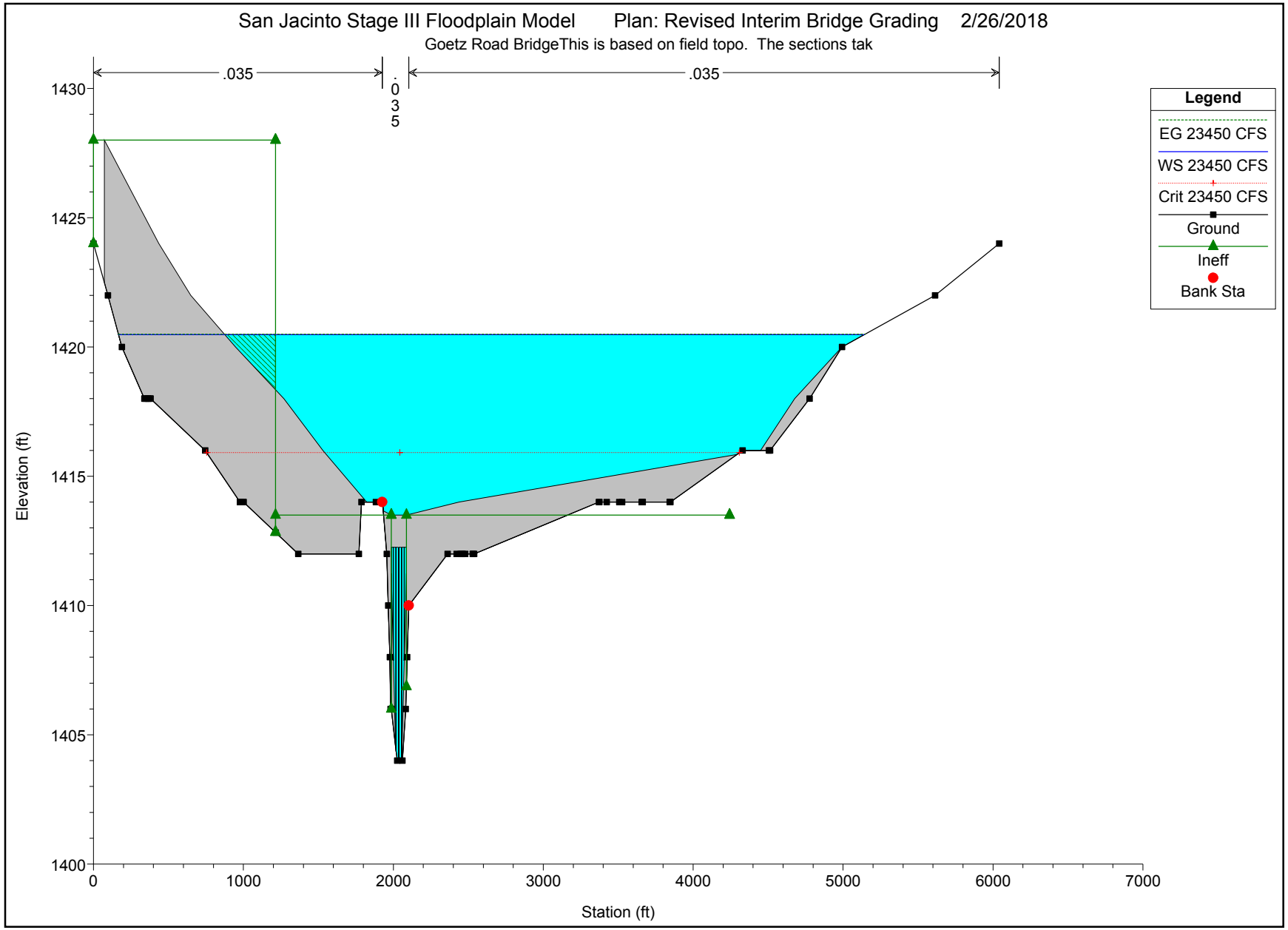
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
Goetz Road BridgeThis is based on field topo. The sections tak
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Legend
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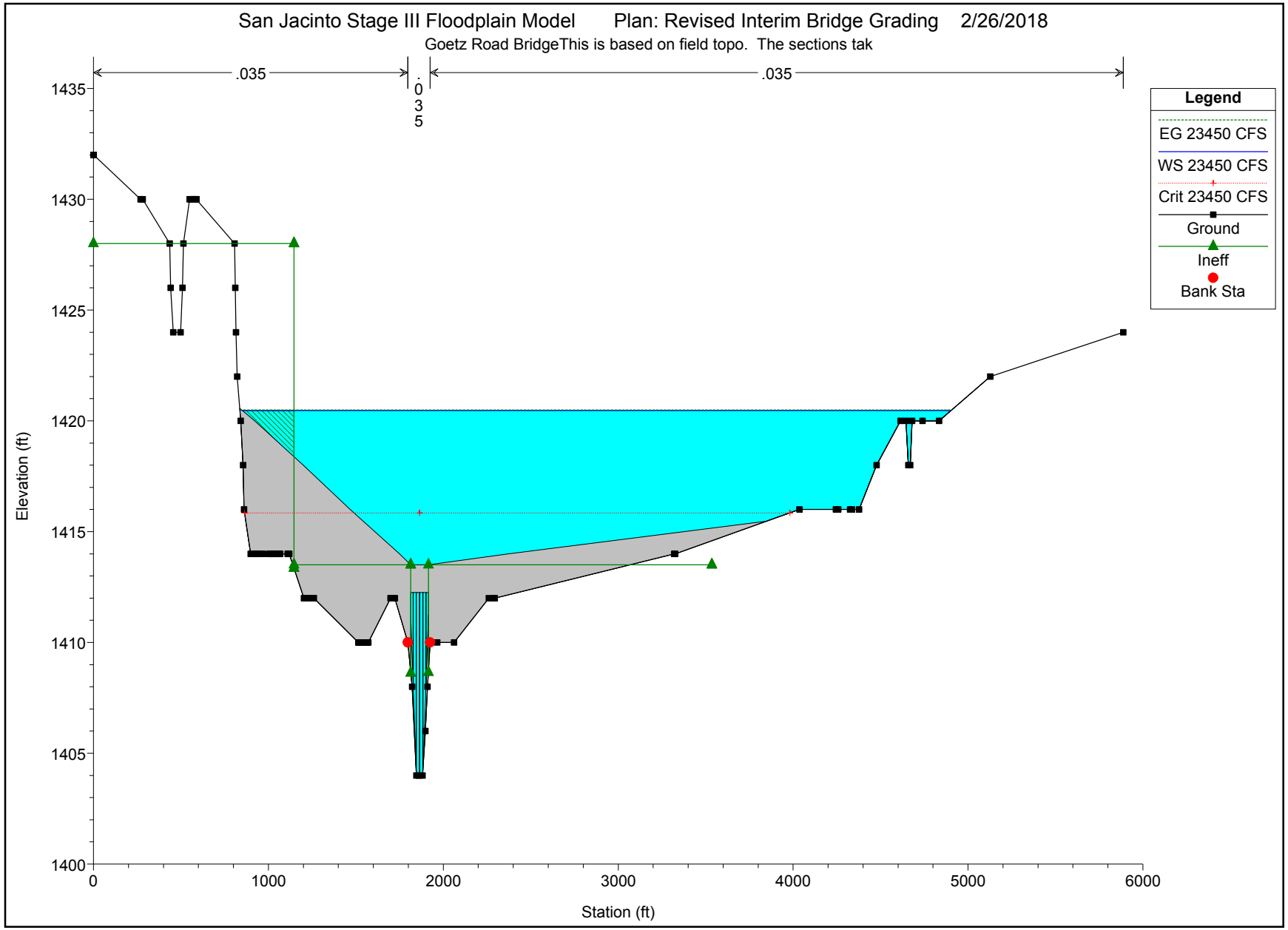
San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018
Goetz Road BridgeThis is based on field topo. The sections tak
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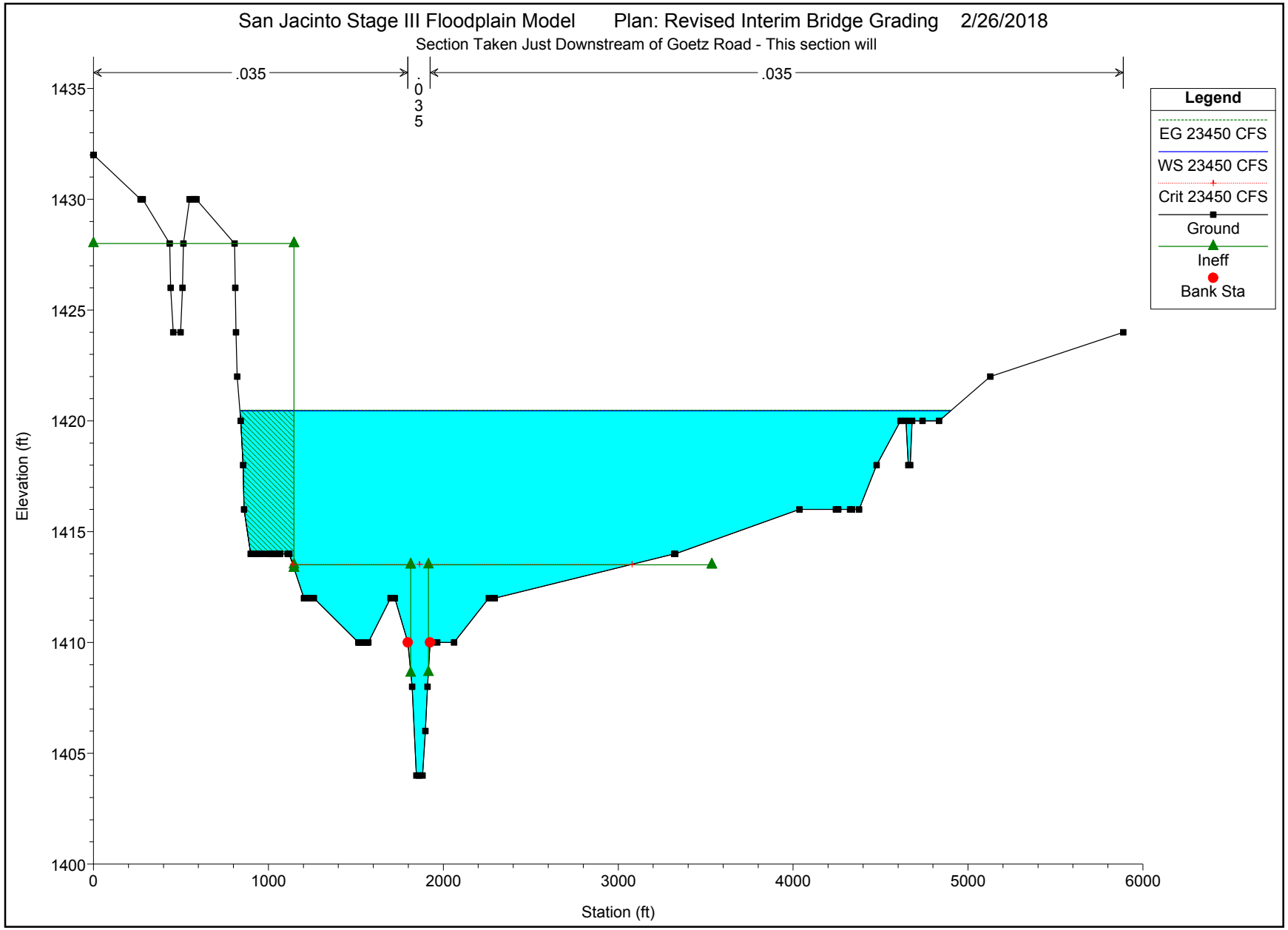
San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018
Section Taken Just Downstream of Goetz Road - This section will
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Crit 23450 CFS
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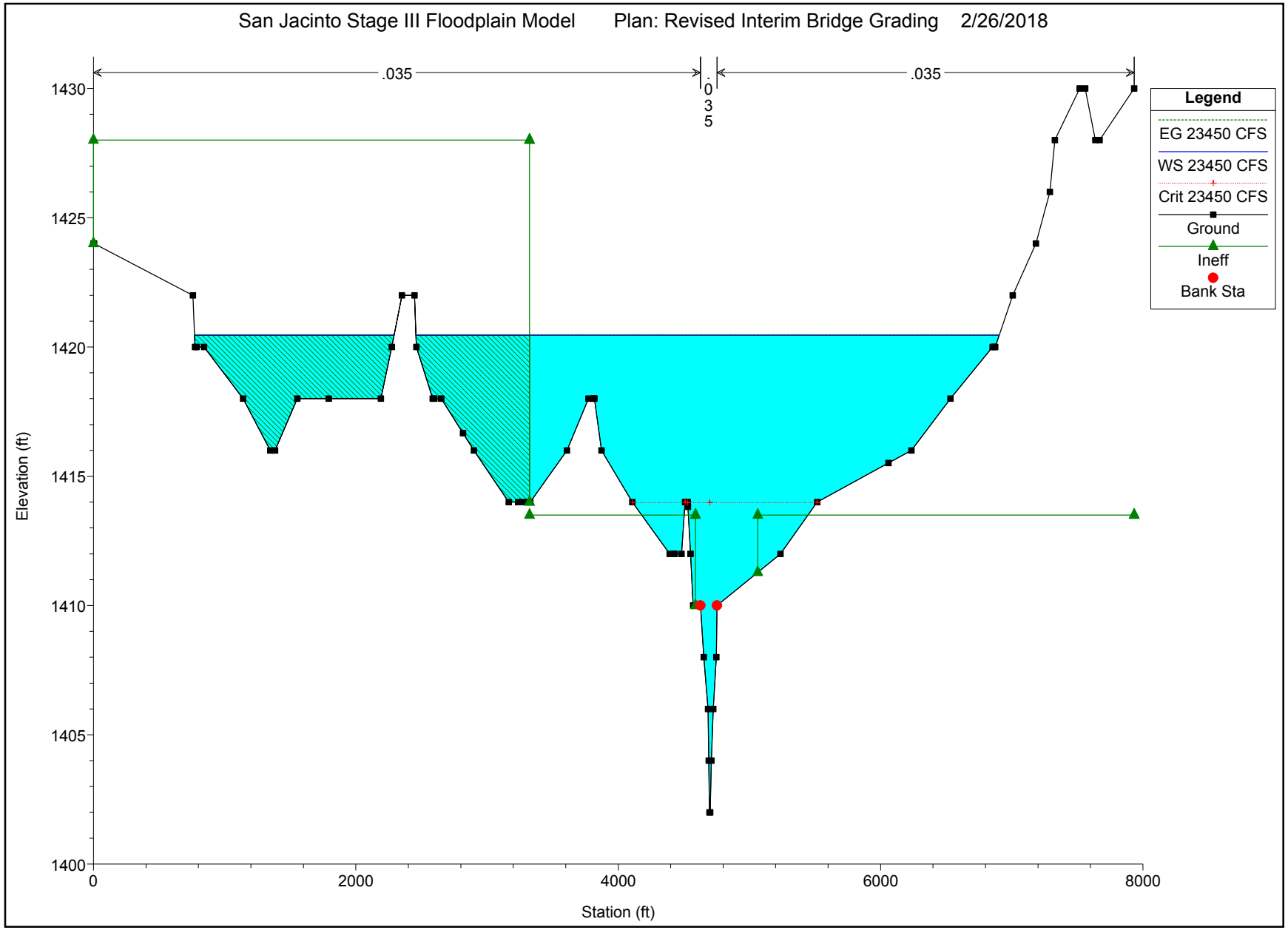
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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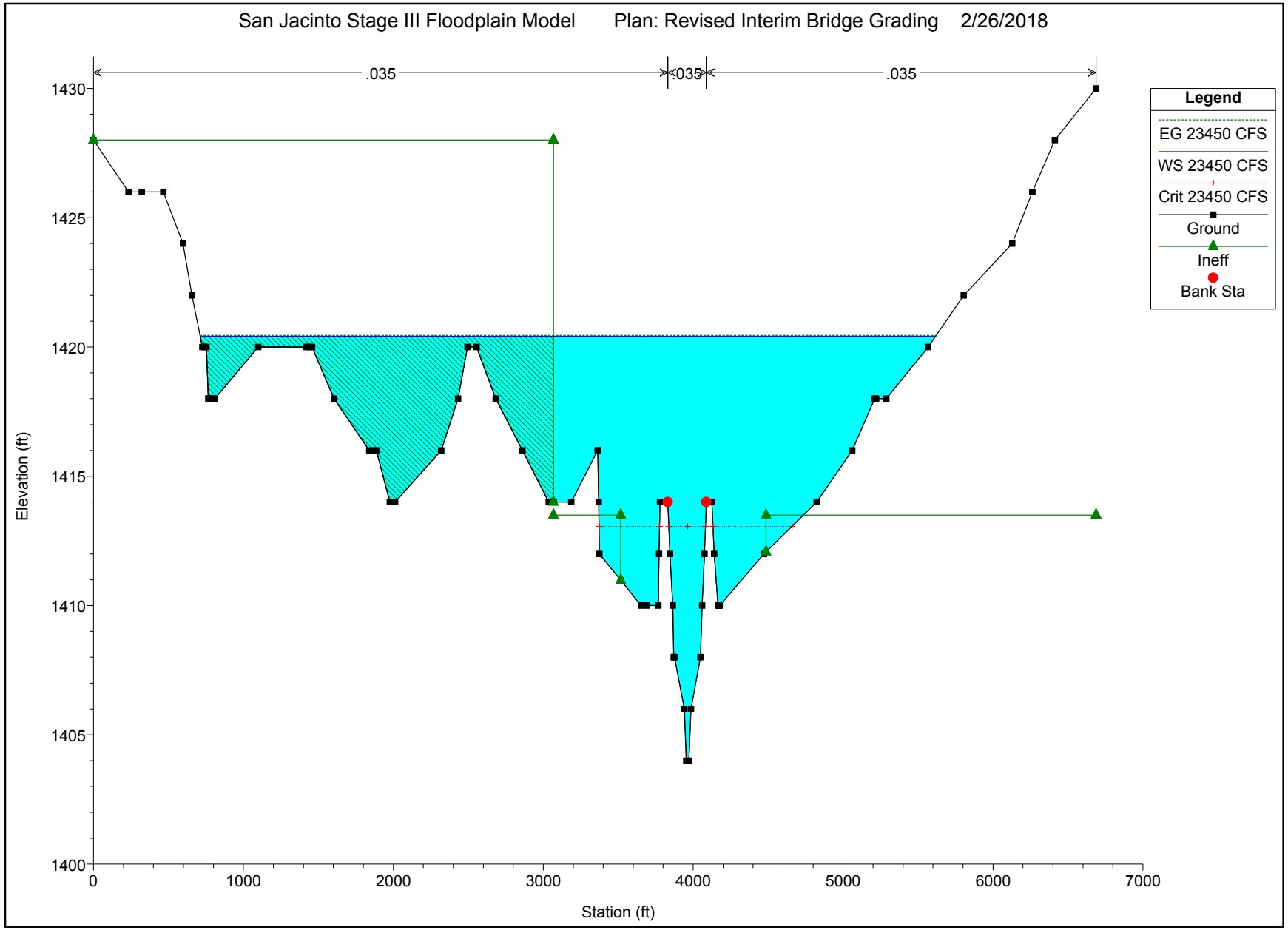
San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018
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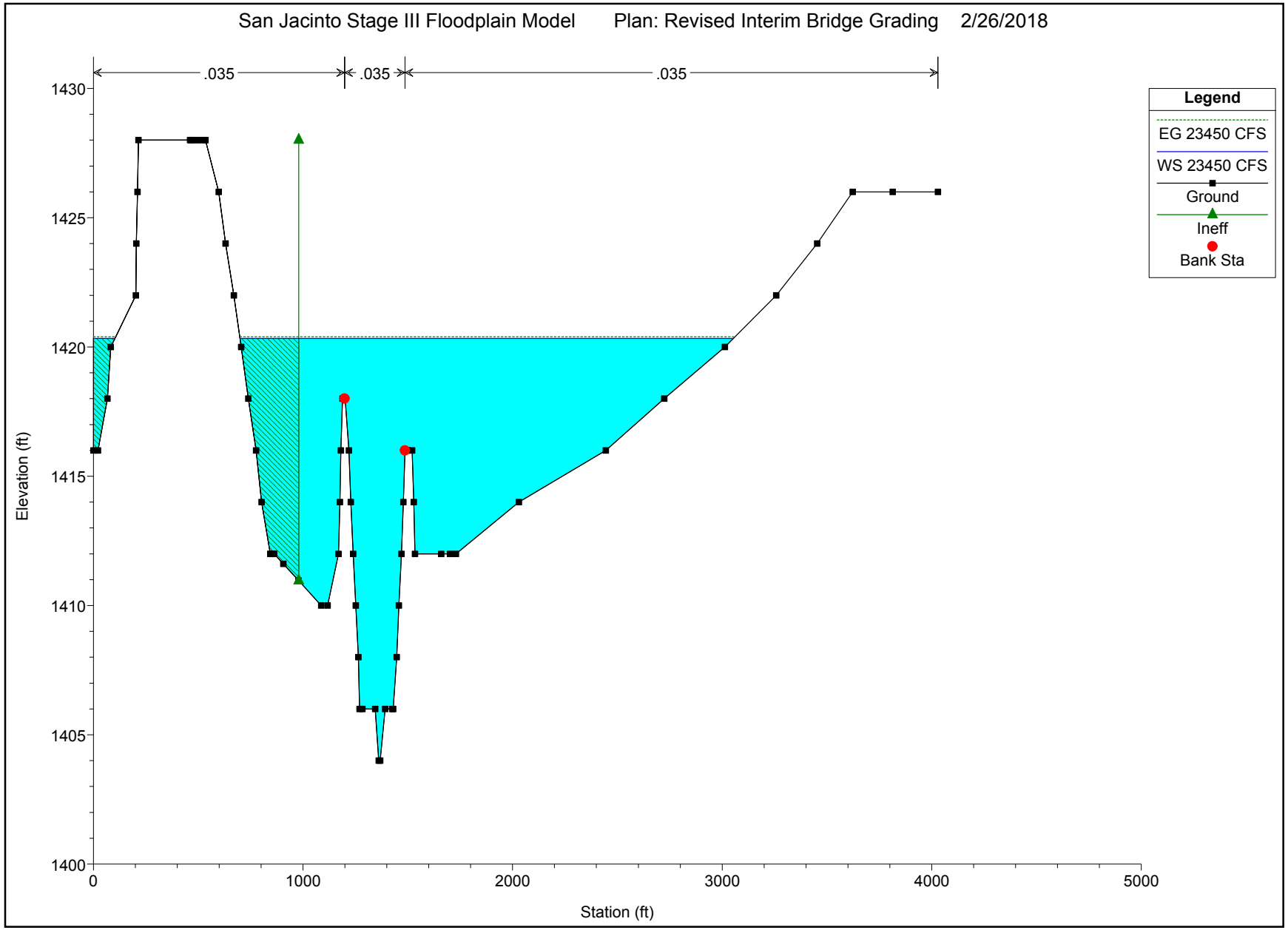
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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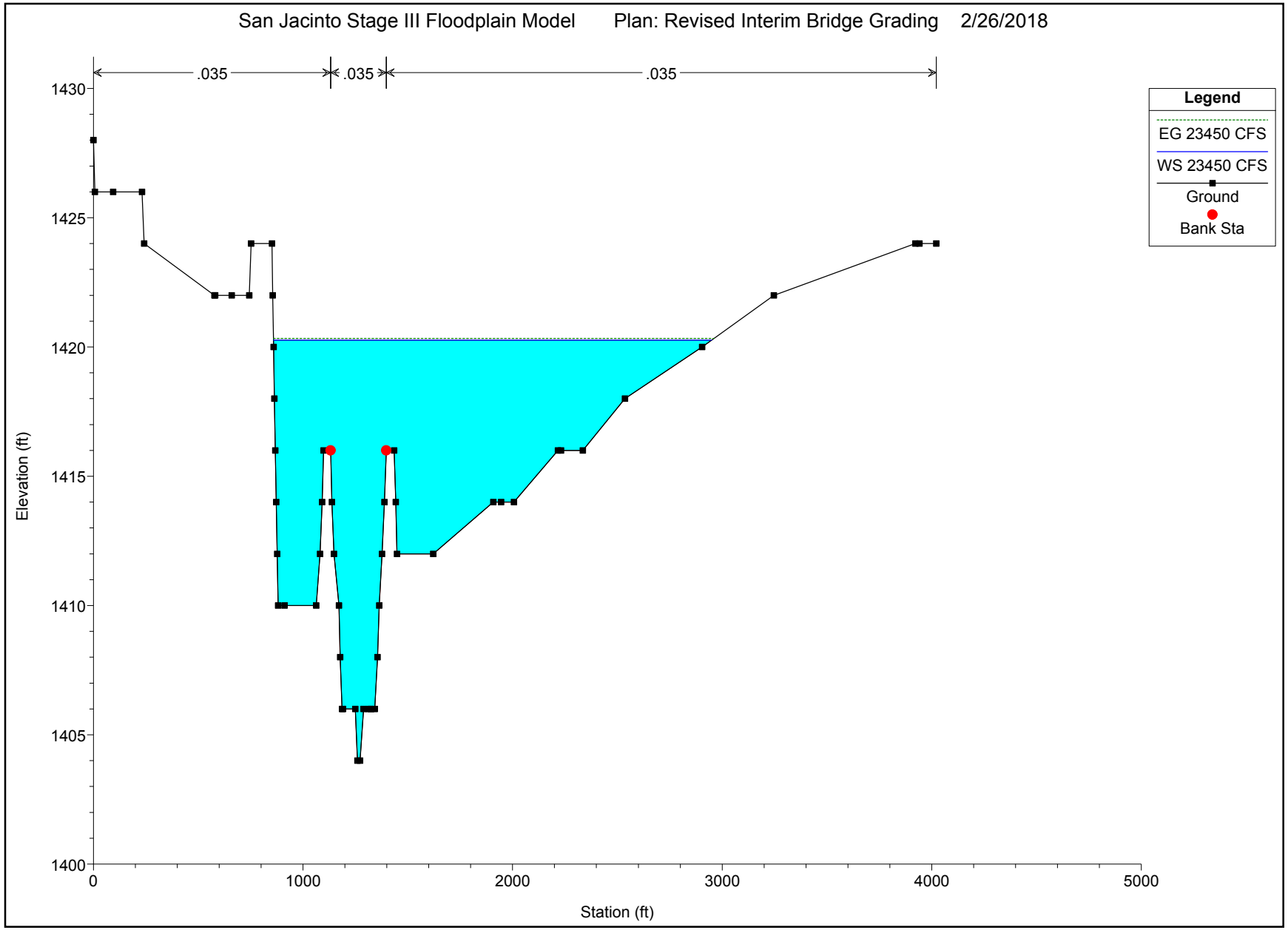
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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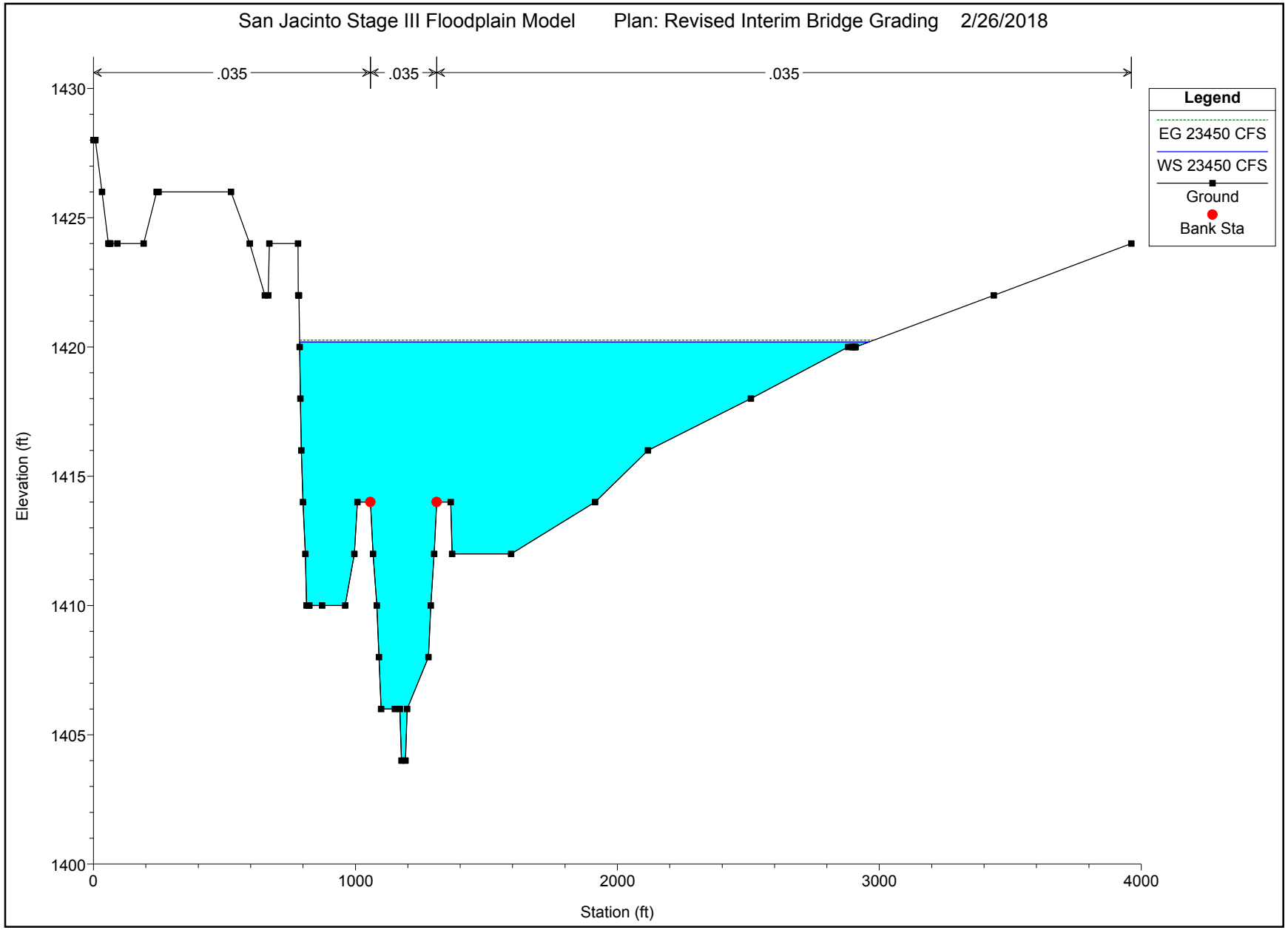
San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018
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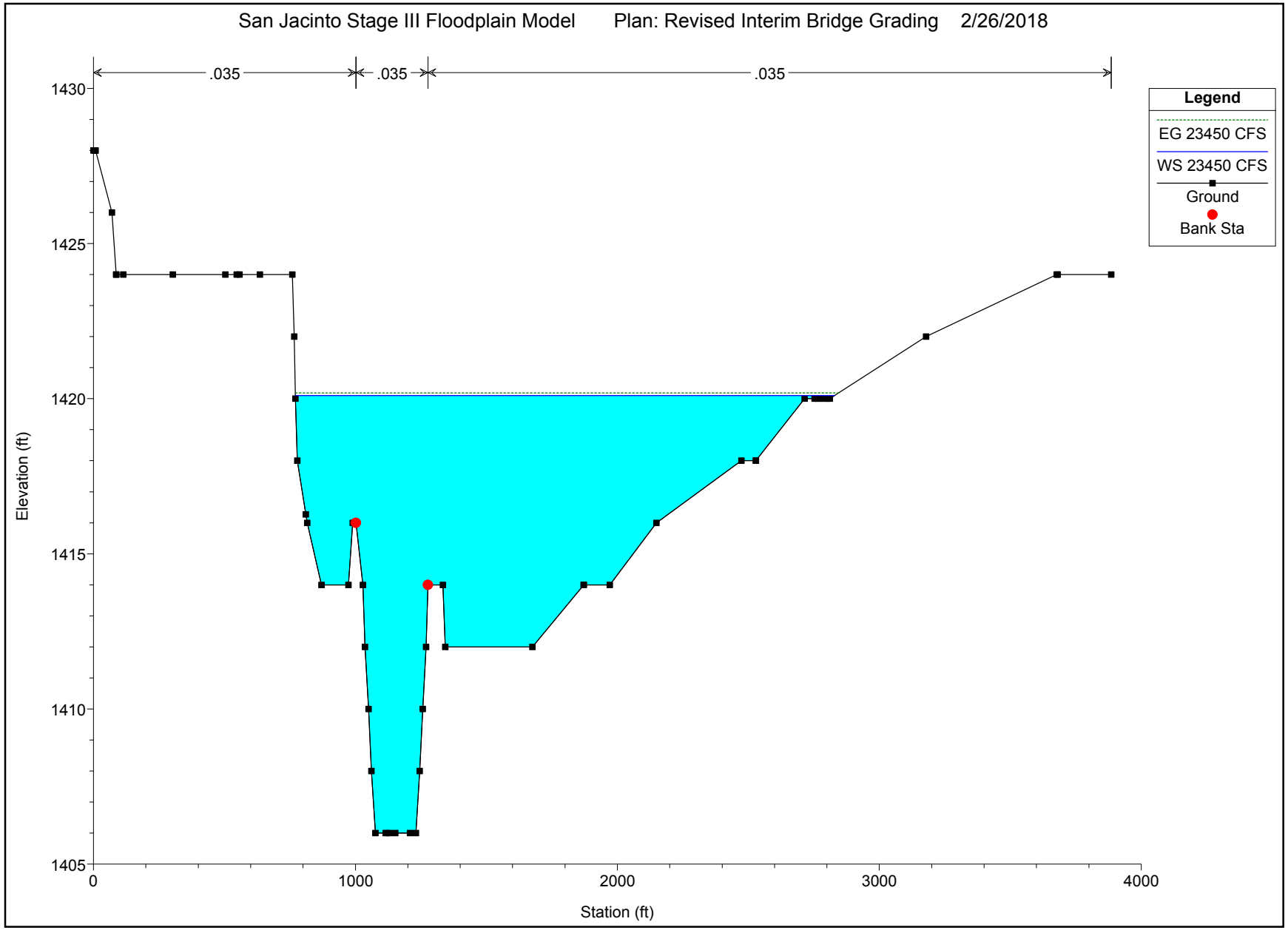
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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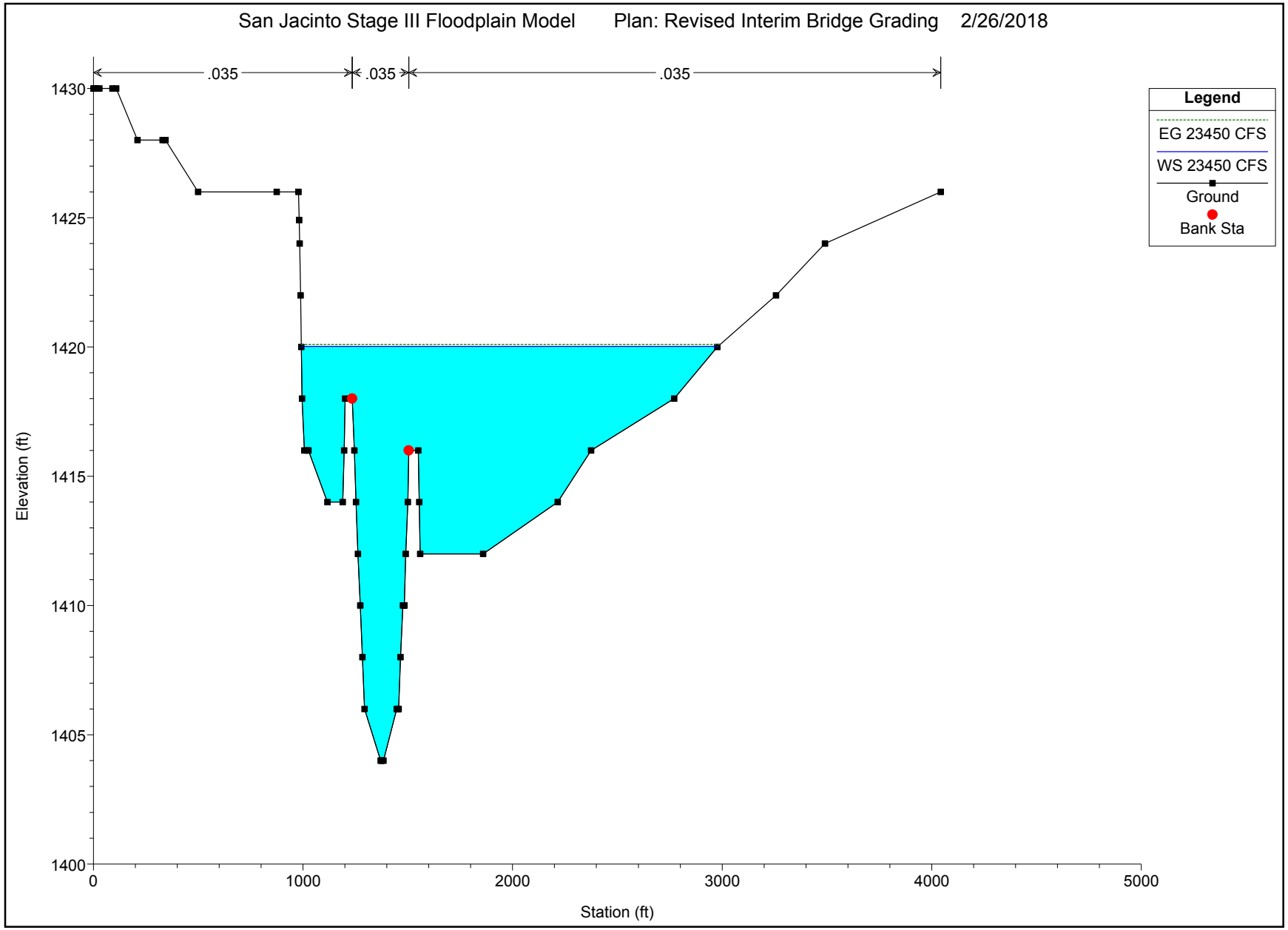
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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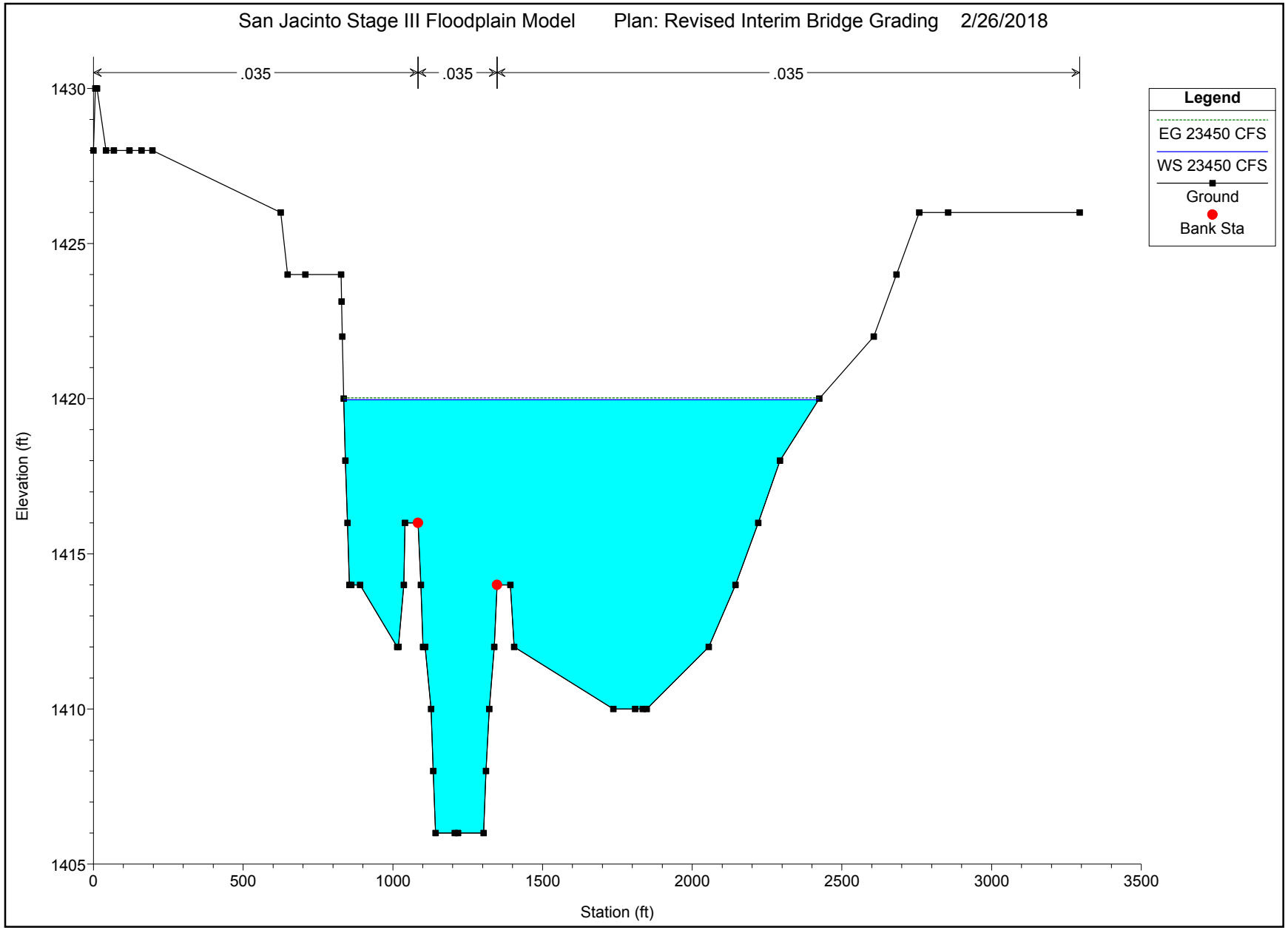
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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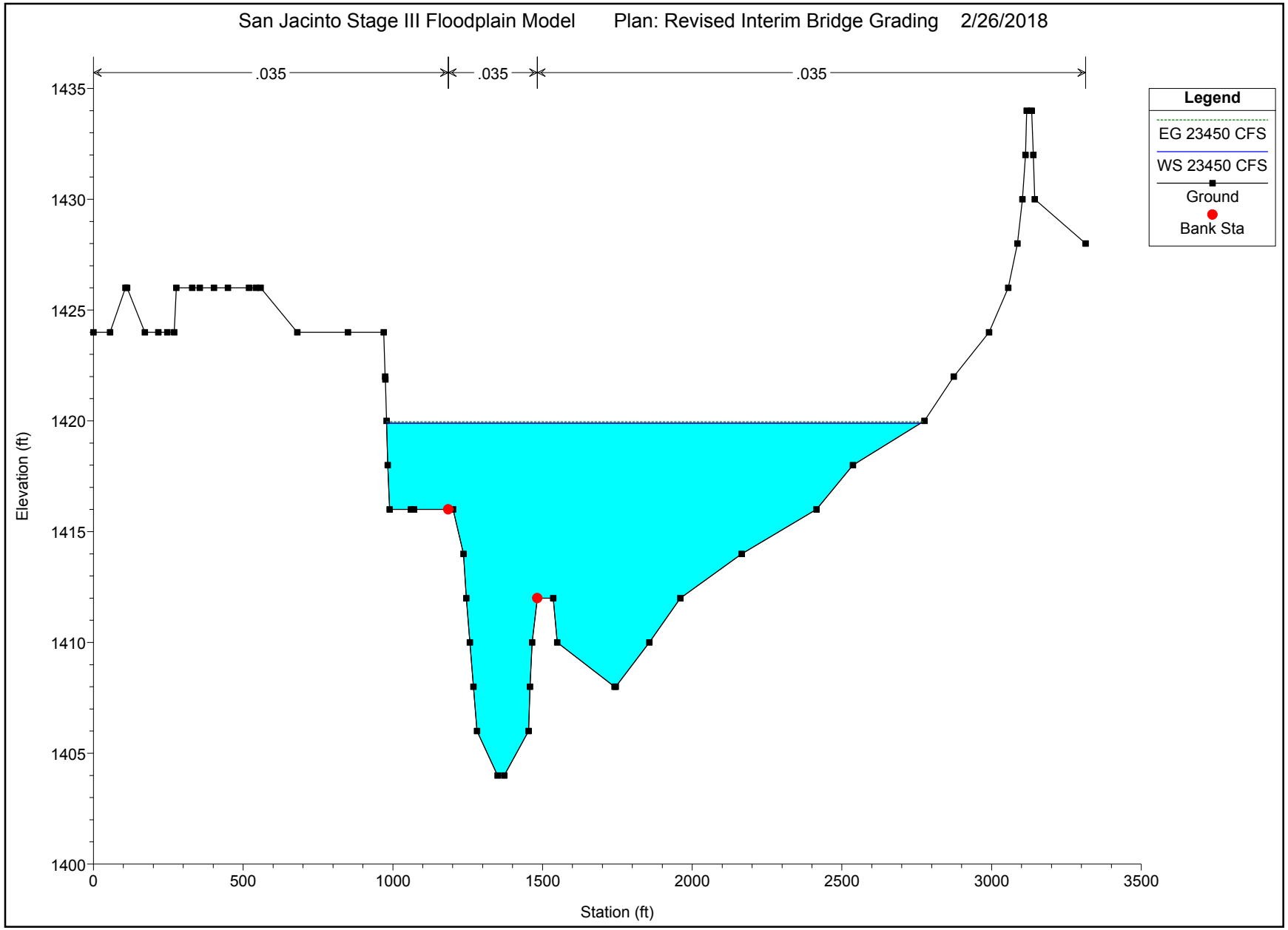
EG 23450 CFS
WS 23450 CFS
Ground
Bank Sta
Elevation (ft)
1430
1425
1420
1415
1410
1405
0
500
1000
1500
2000
2500
3000
3500
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
.035
.035
.035
Legend
EG 23450 CFS
WS 23450 CFS
Ground
Bank Sta
Elevation (ft)
1435
1430
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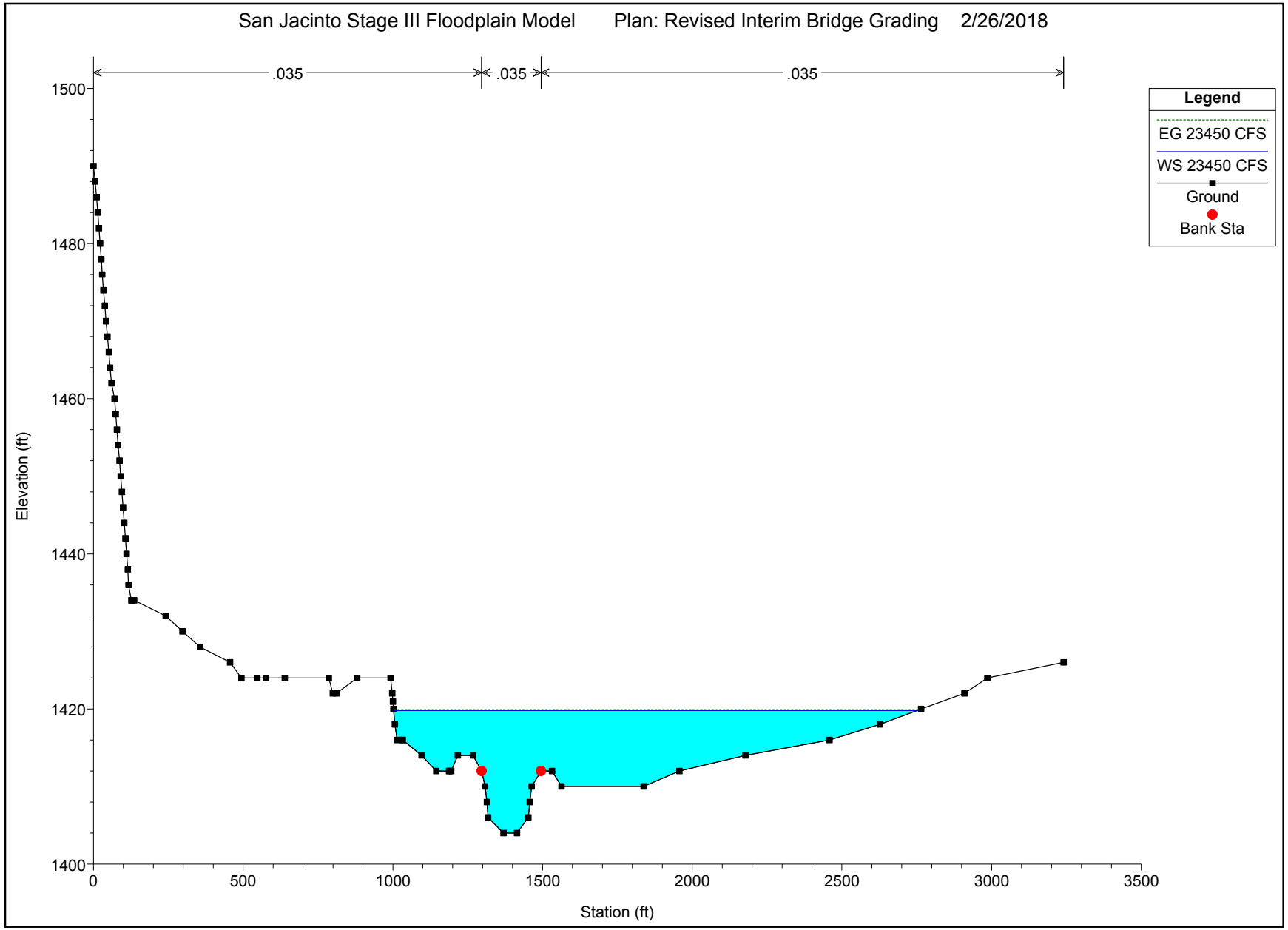
Station (ft)


San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018
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Legend
EG 23450 CFS
WS 23450 CFS
Ground
Bank Sta
Elevation (ft)
1500
1480
1460
1440
1420
1400
0
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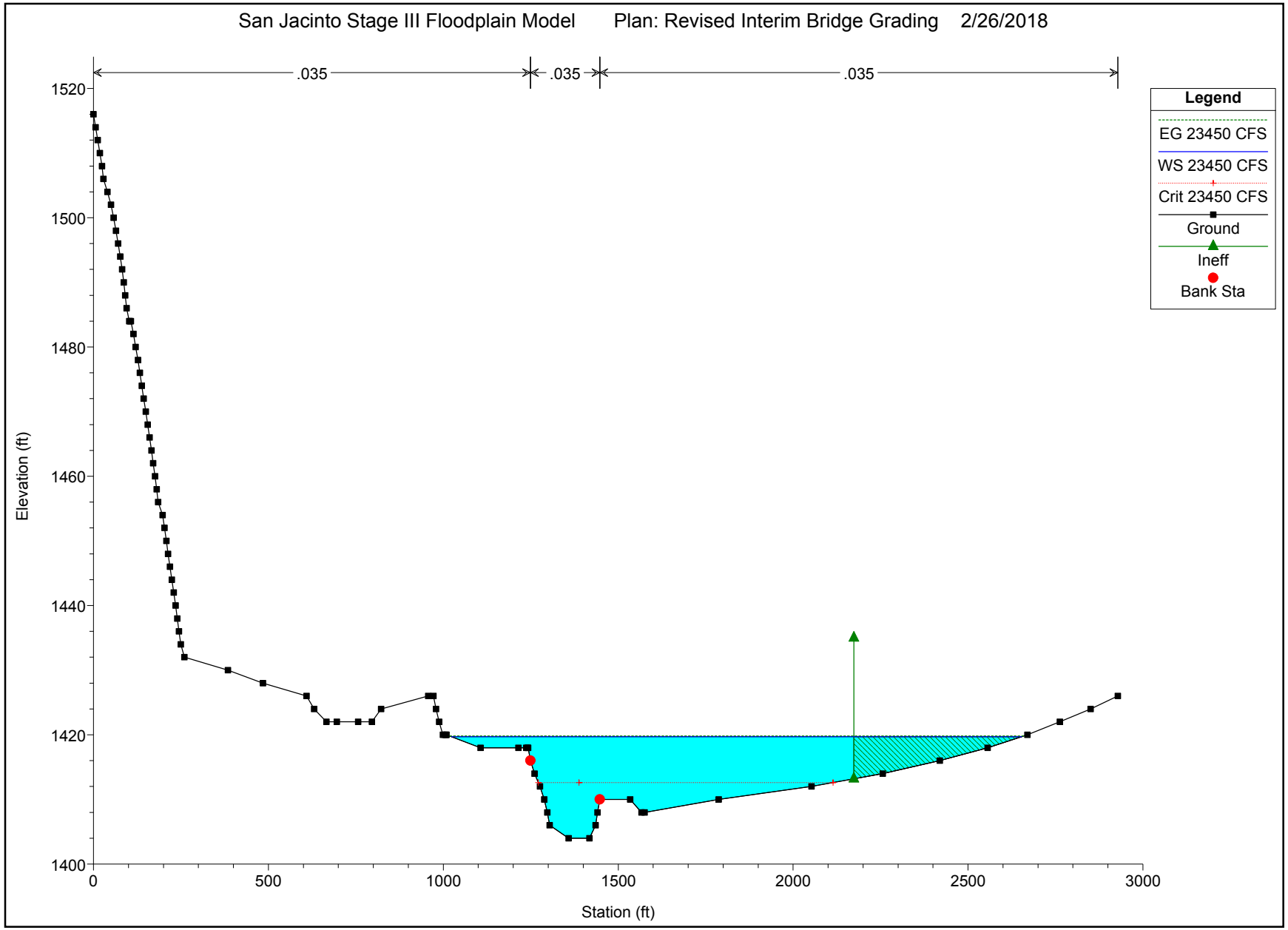
1000
1500
2000
2500
3000
3500
Station (ft)


San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018
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.035
Legend
EG 23450 CFS
WS 23450 CFS
Crit 23450 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
1520
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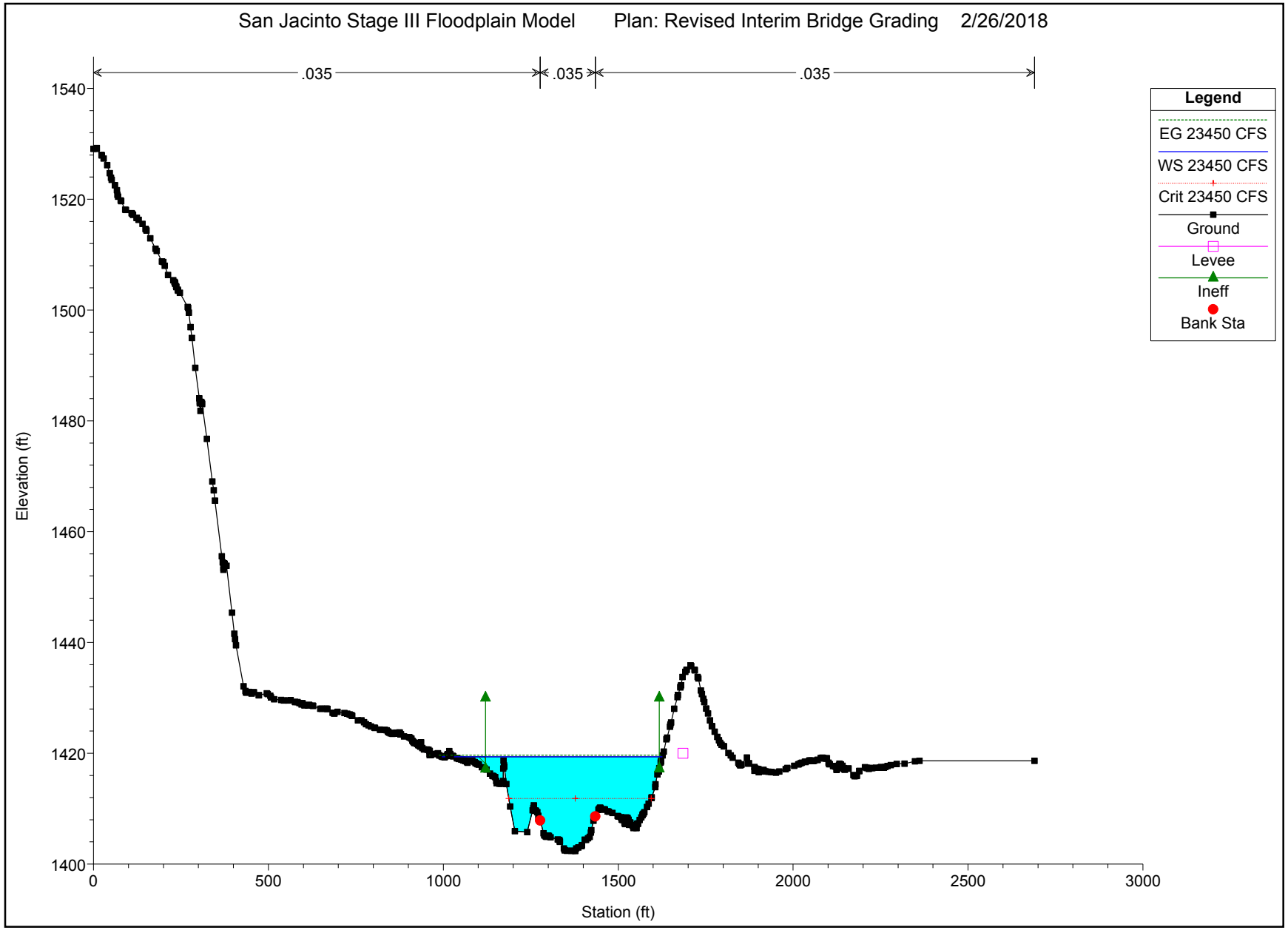
1480
1460
1440
1420
1400
0
500
1000
1500
2000
2500
3000
Station (ft)


San Jacinto Stage III Floodplain Model
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2/26/2018
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Legend
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WS 23450 CFS
Crit 23450 CFS
Ground
Levee
Ineff
Bank Sta
Elevation (ft)
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1500
1480
1460
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1400
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1000
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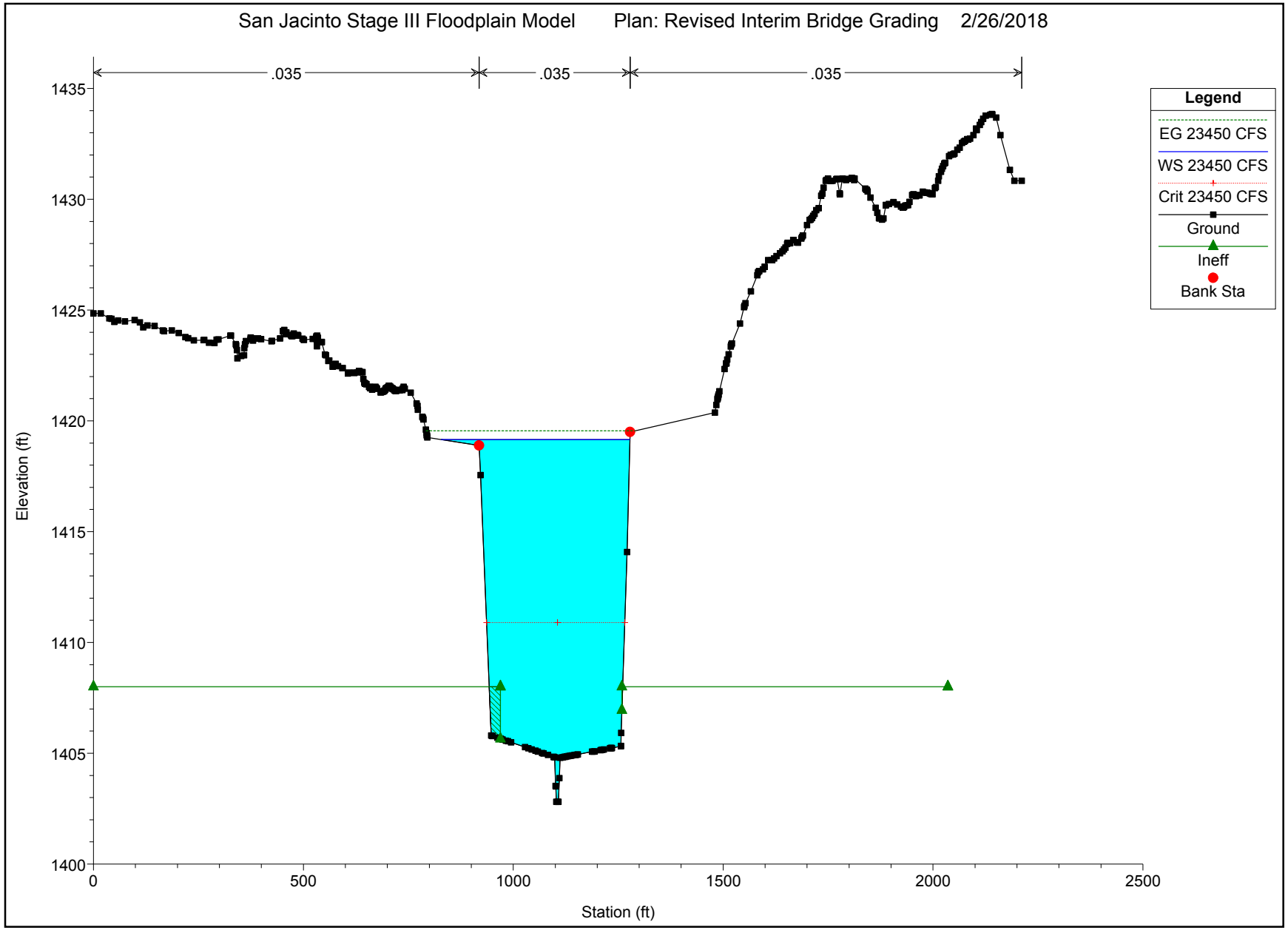
2000
2500
3000
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 23450 CFS
WS 23450 CFS
Crit 23450 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
1435
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1405
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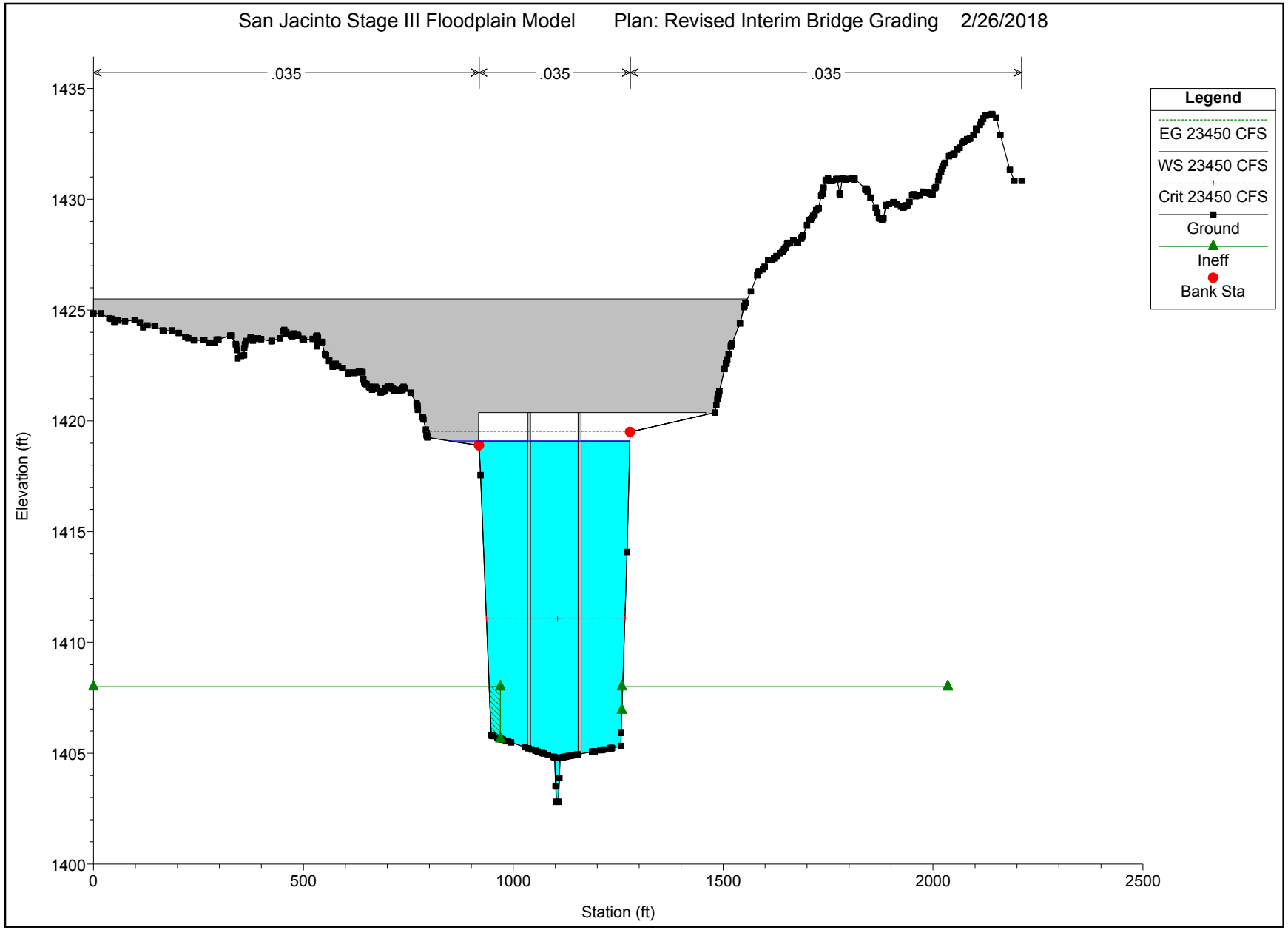
1500
2000
2500
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 23450 CFS
WS 23450 CFS
Crit 23450 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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1405
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0
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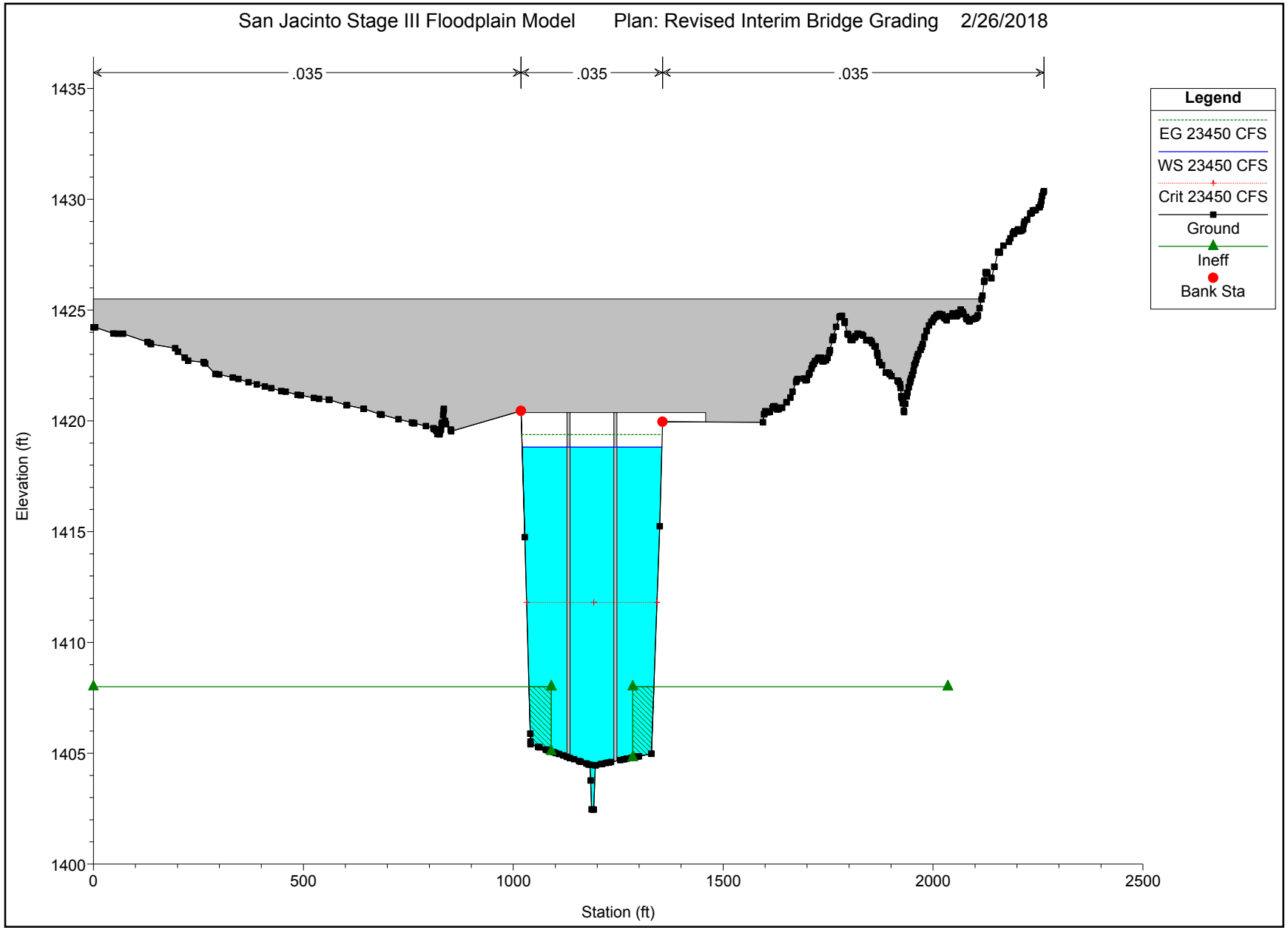
1000
1500
2000
2500
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 23450 CFS
WS 23450 CFS
Crit 23450 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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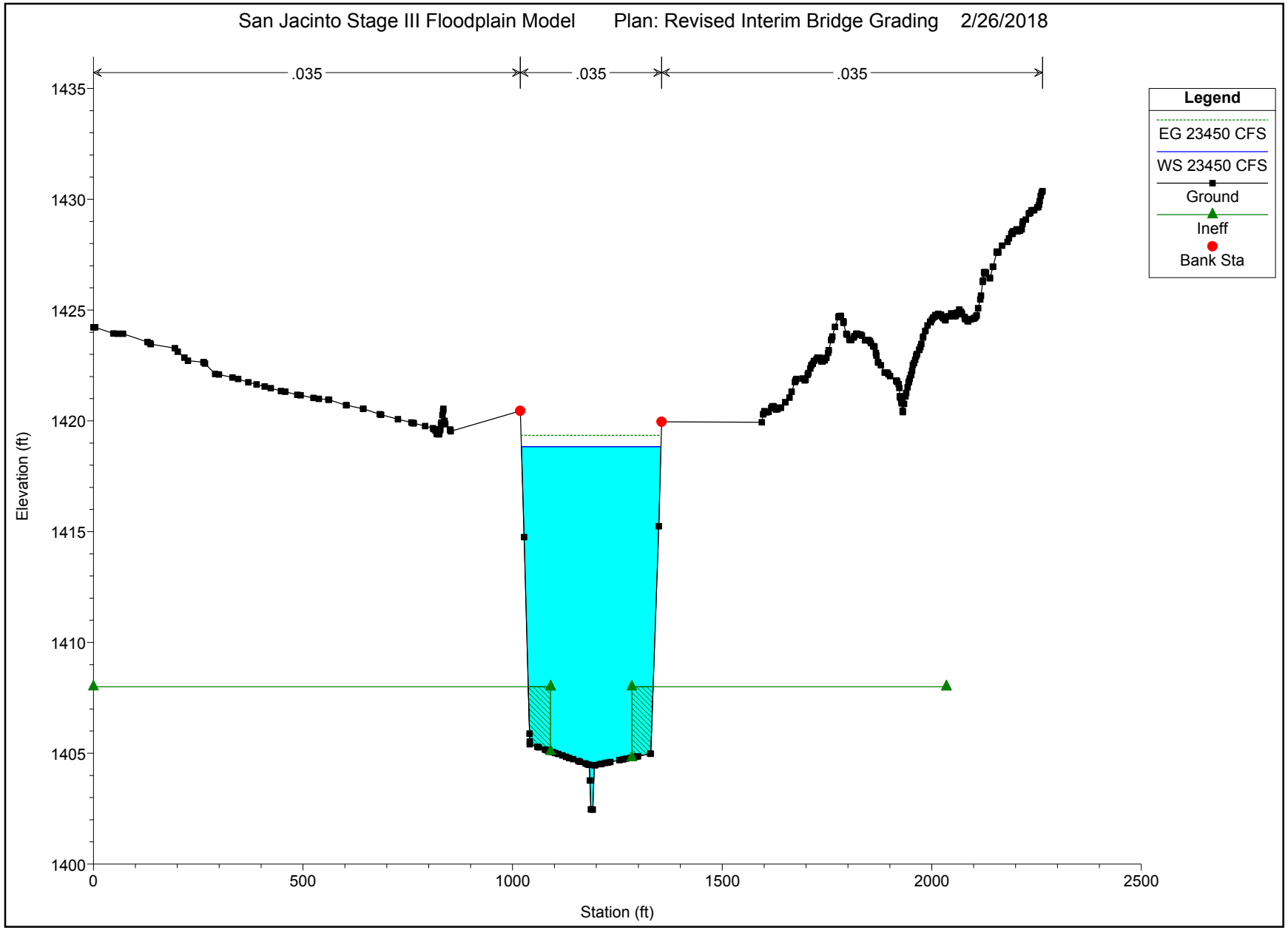
2000
2500
Station (ft)


San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018
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Legend
EG 23450 CFS
WS 23450 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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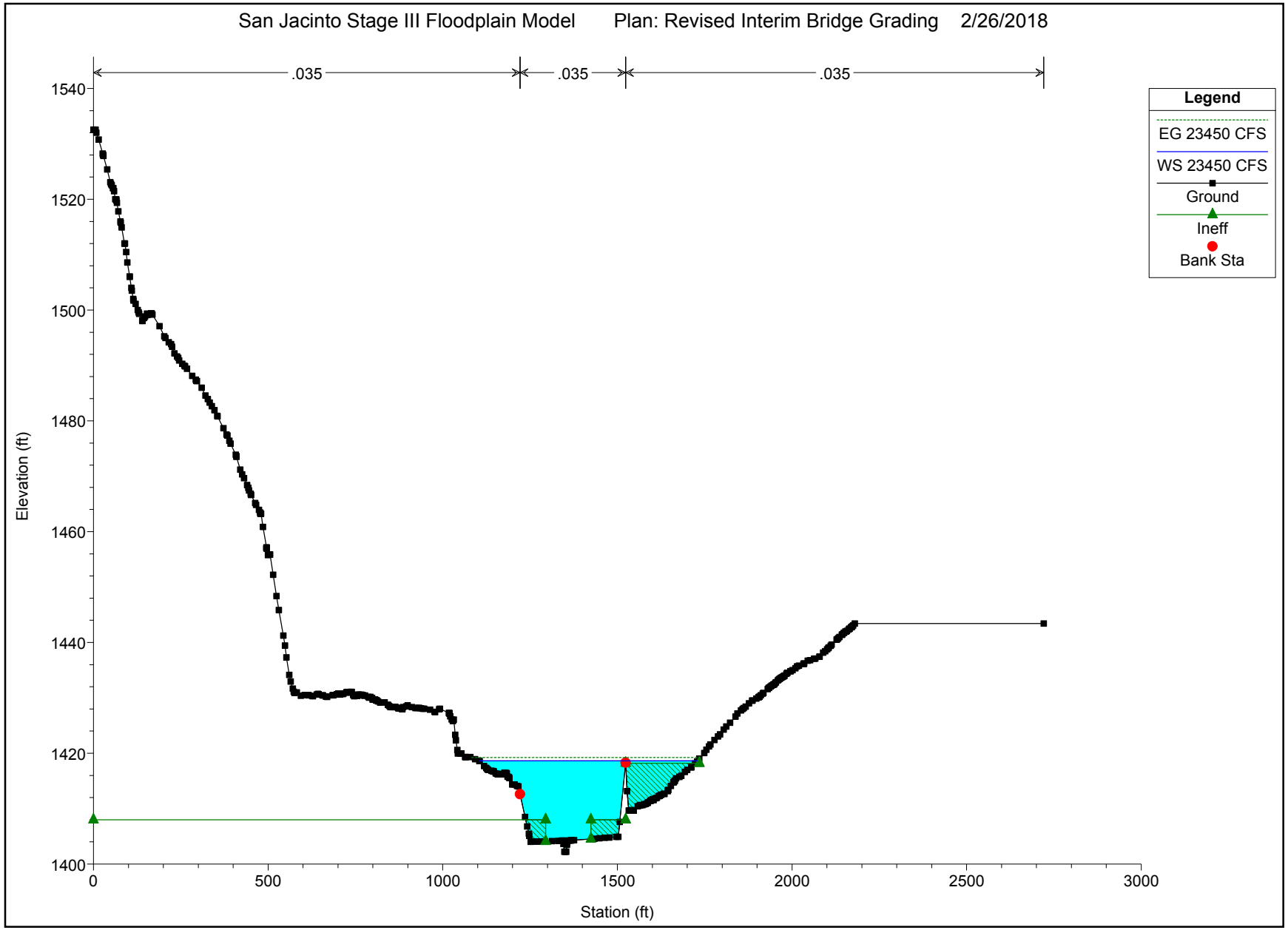
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
.035
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.035
Legend
EG 23450 CFS
WS 23450 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
1540
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1480
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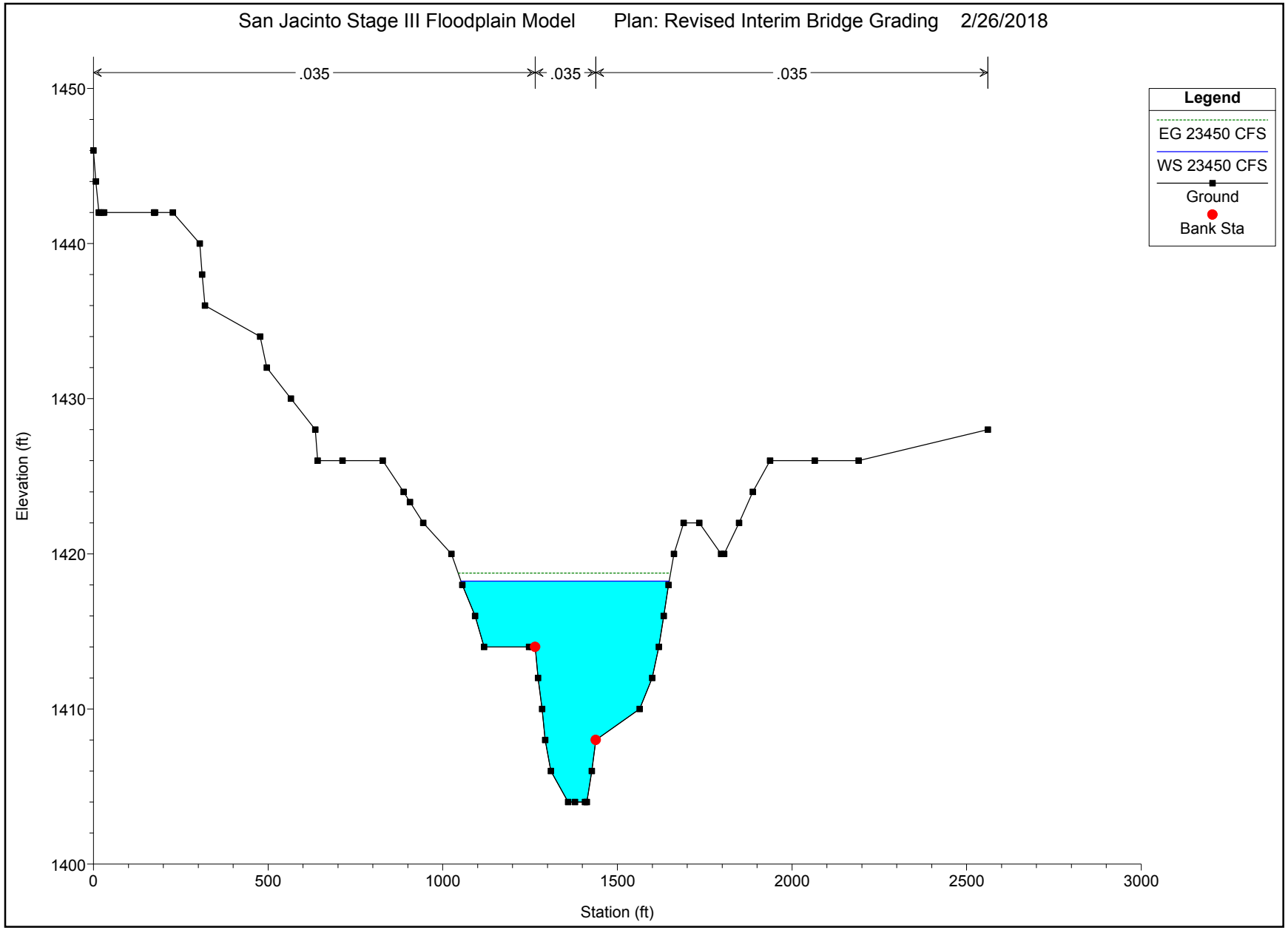
2500
3000
Station (ft)


San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018
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.035
Legend
EG 23450 CFS
WS 23450 CFS
Ground
Bank Sta
Elevation (ft)
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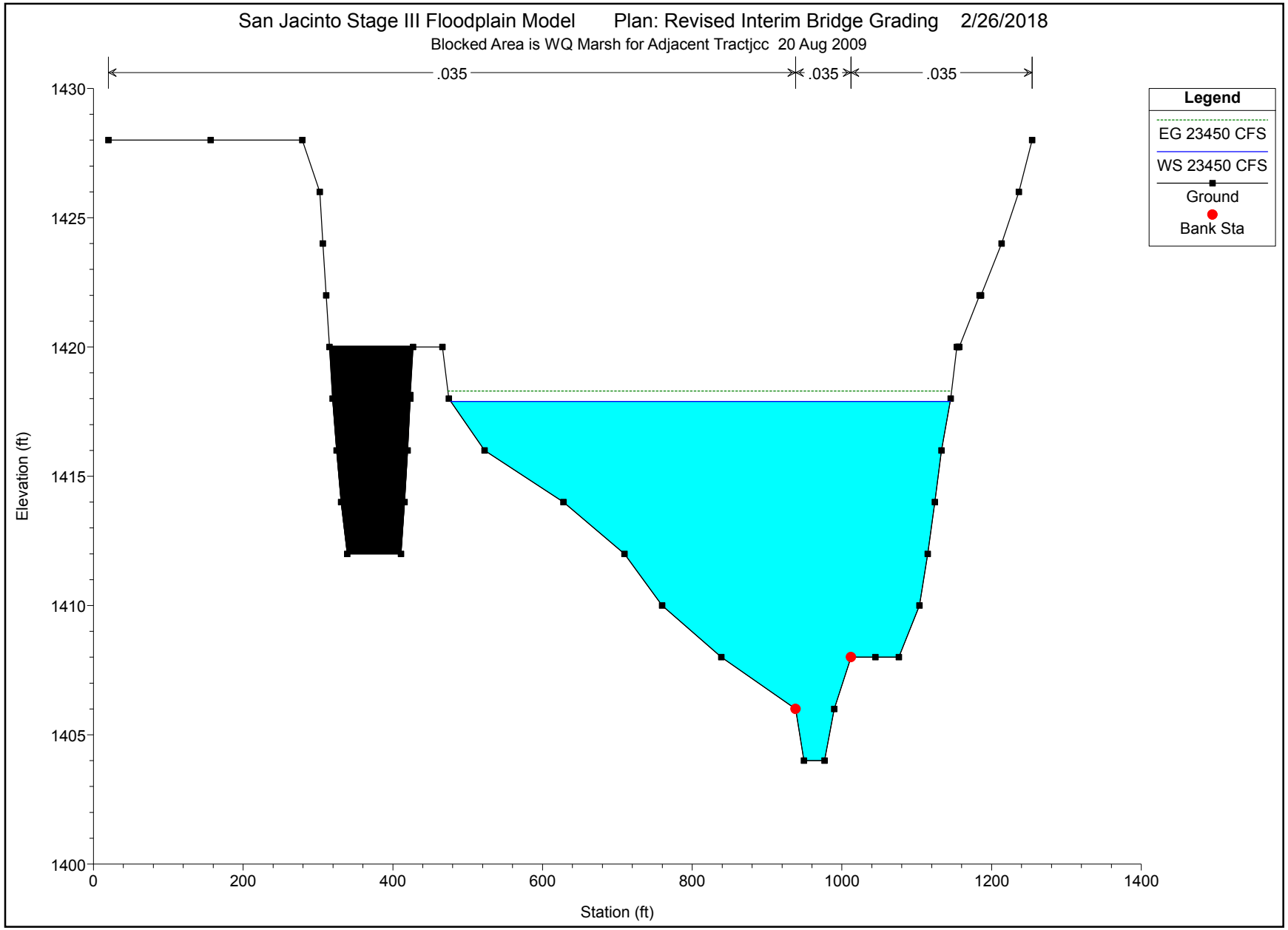
Station (ft)


San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018
Blocked Area is WQ Marsh for Adjacent Tractjcc 20 Aug 2009
.035
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.035
Legend
EG 23450 CFS
WS 23450 CFS
Ground
Bank Sta
Elevation (ft)
1430
1425
1420
1415
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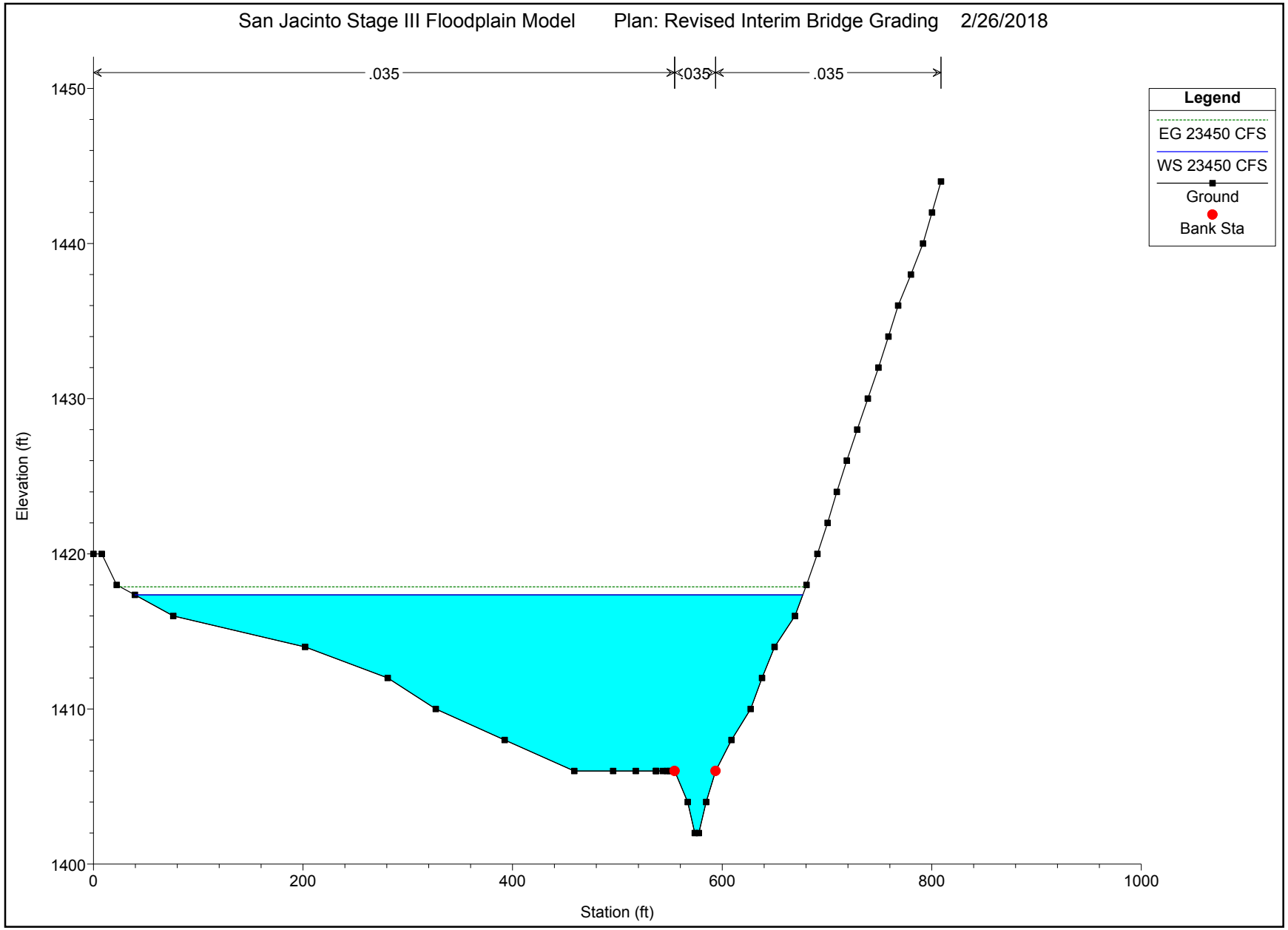
1400
0
200
400
600
800
1000
1200
1400
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
.035
.035
.035
Legend
EG 23450 CFS
WS 23450 CFS
Ground
Bank Sta
Elevation (ft)
1450
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1420
1410
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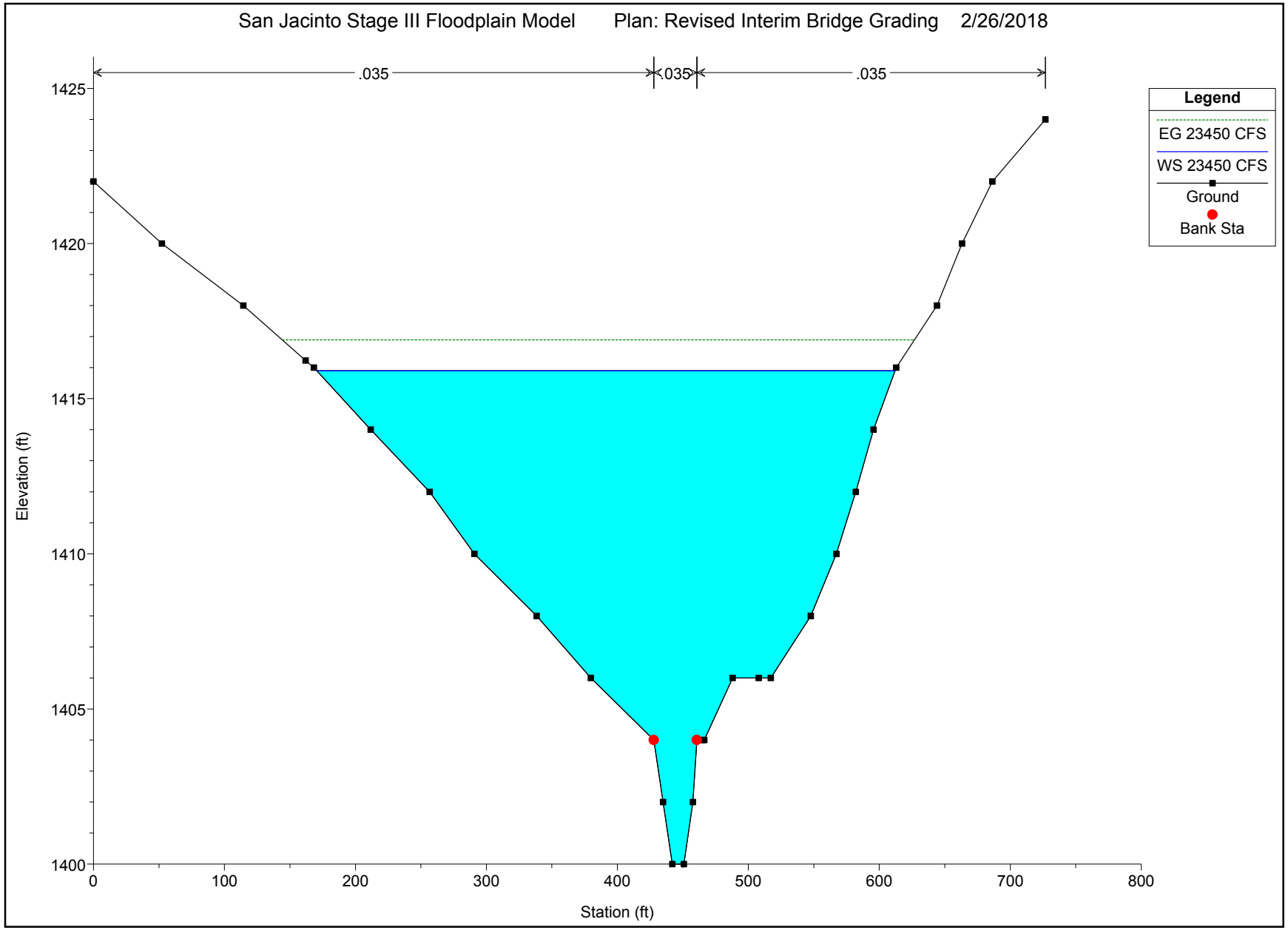
0
200
400
600
800
1000
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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.035
.035
Legend
EG 23450 CFS
WS 23450 CFS
Ground
Bank Sta
Elevation (ft)
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0
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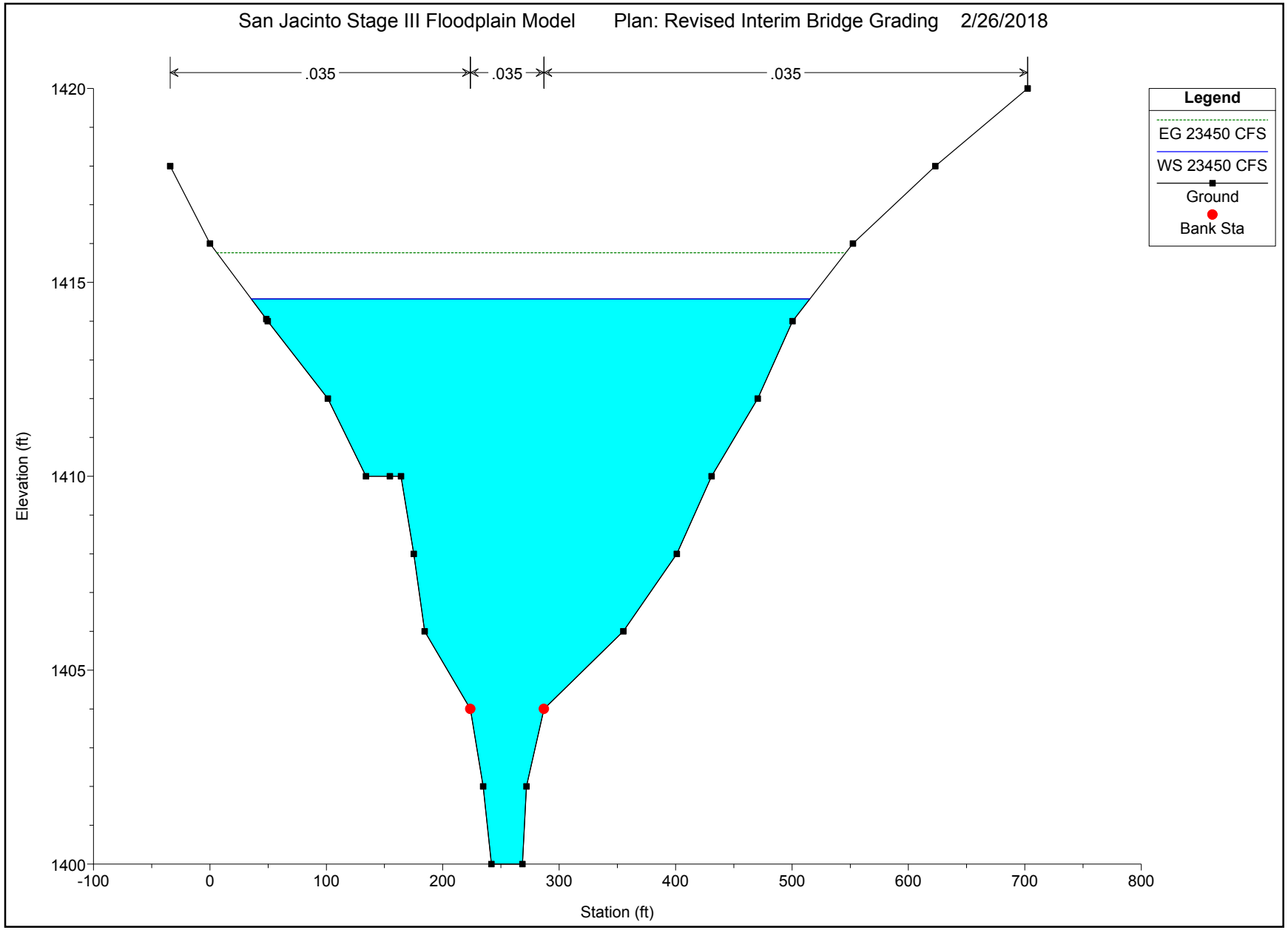
400
500
600
700
800
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 23450 CFS
WS 23450 CFS
Ground
Bank Sta
Elevation (ft)
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100
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400
500
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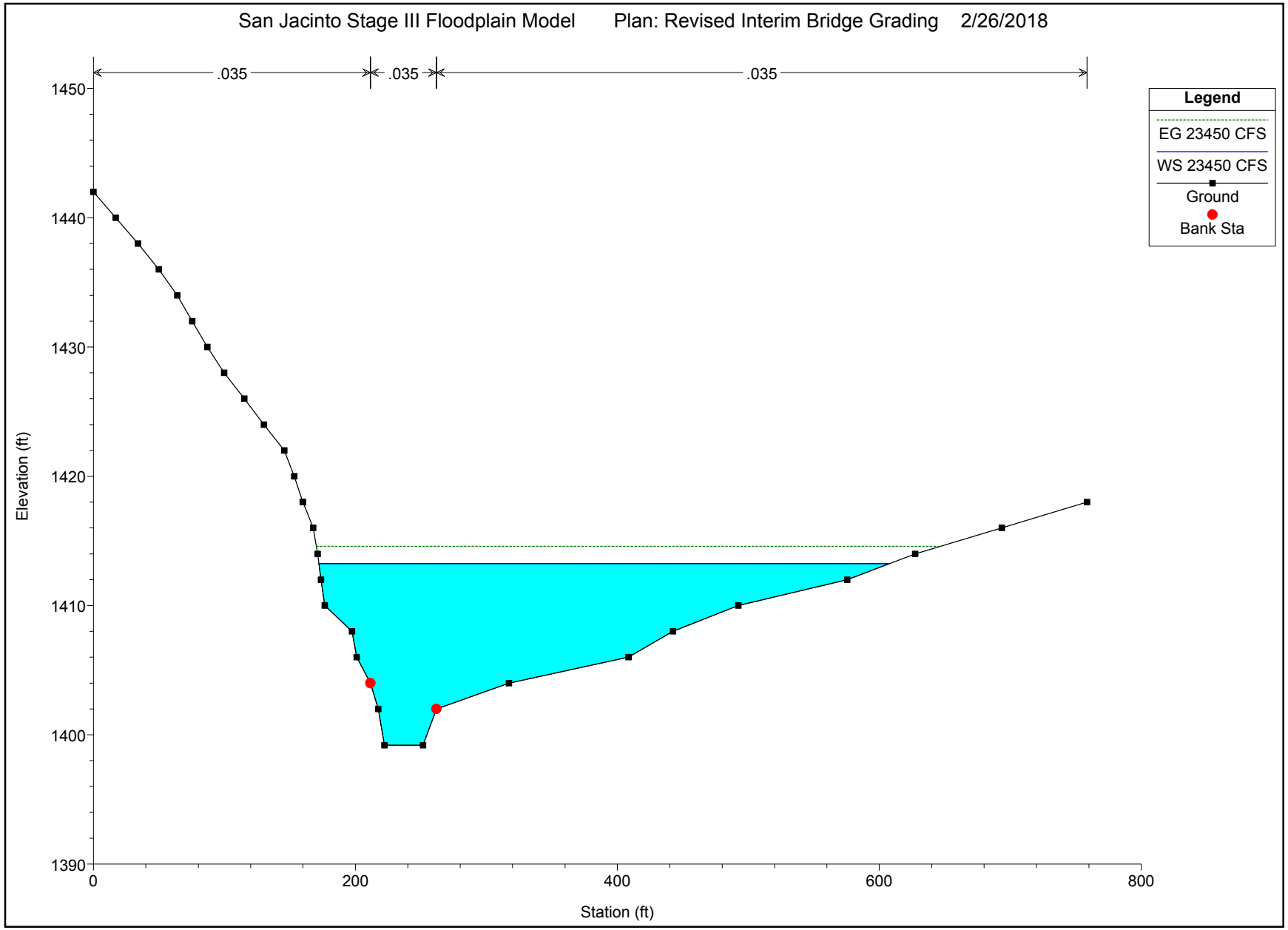
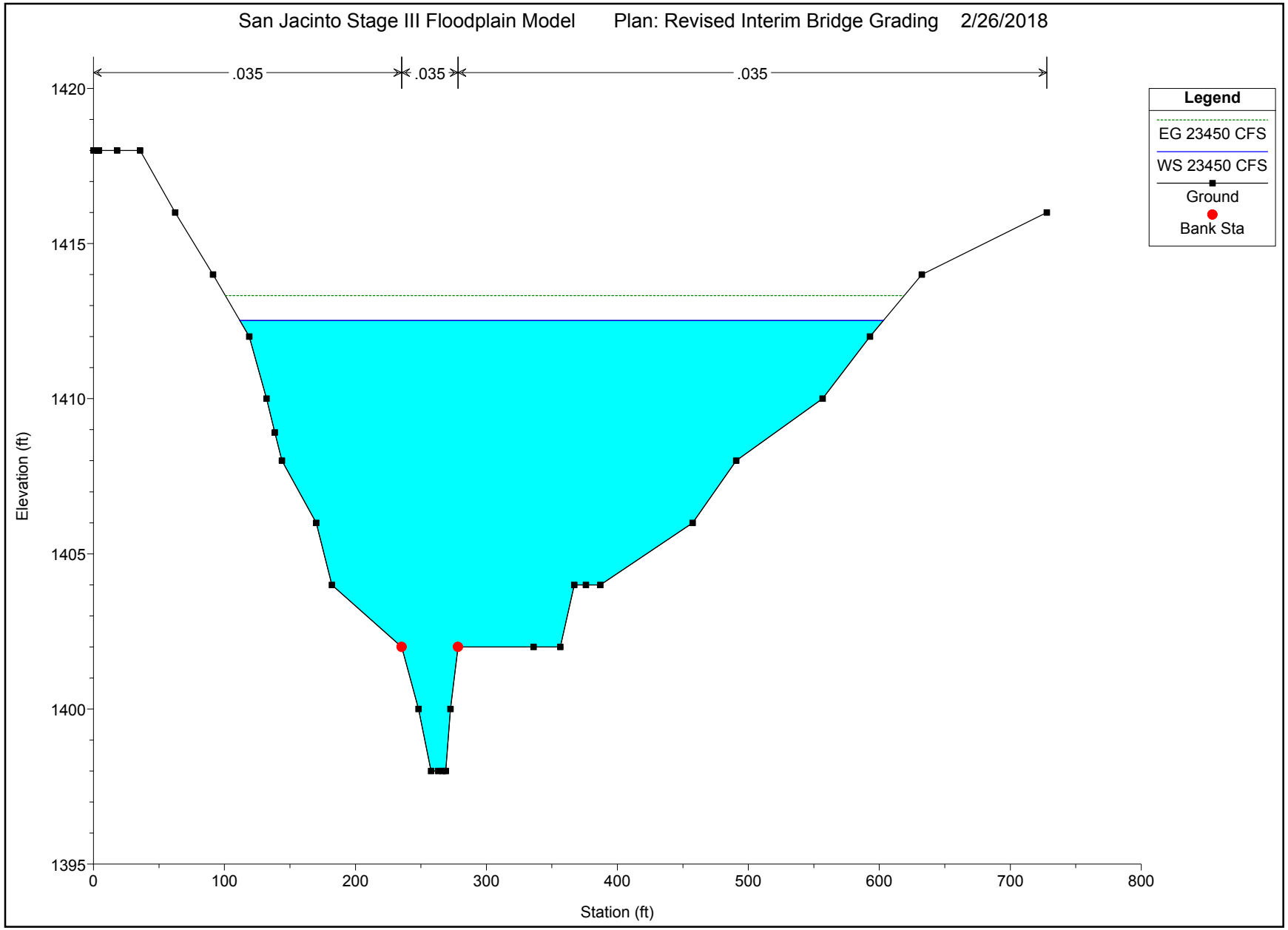
700
800
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
.035
.035
.035
Legend
EG 23450 CFS
WS 23450 CFS
Ground
Bank Sta
Elevation (ft)
1450
1440
1430
1420
1410
1400
1390
0
200
400
600
800
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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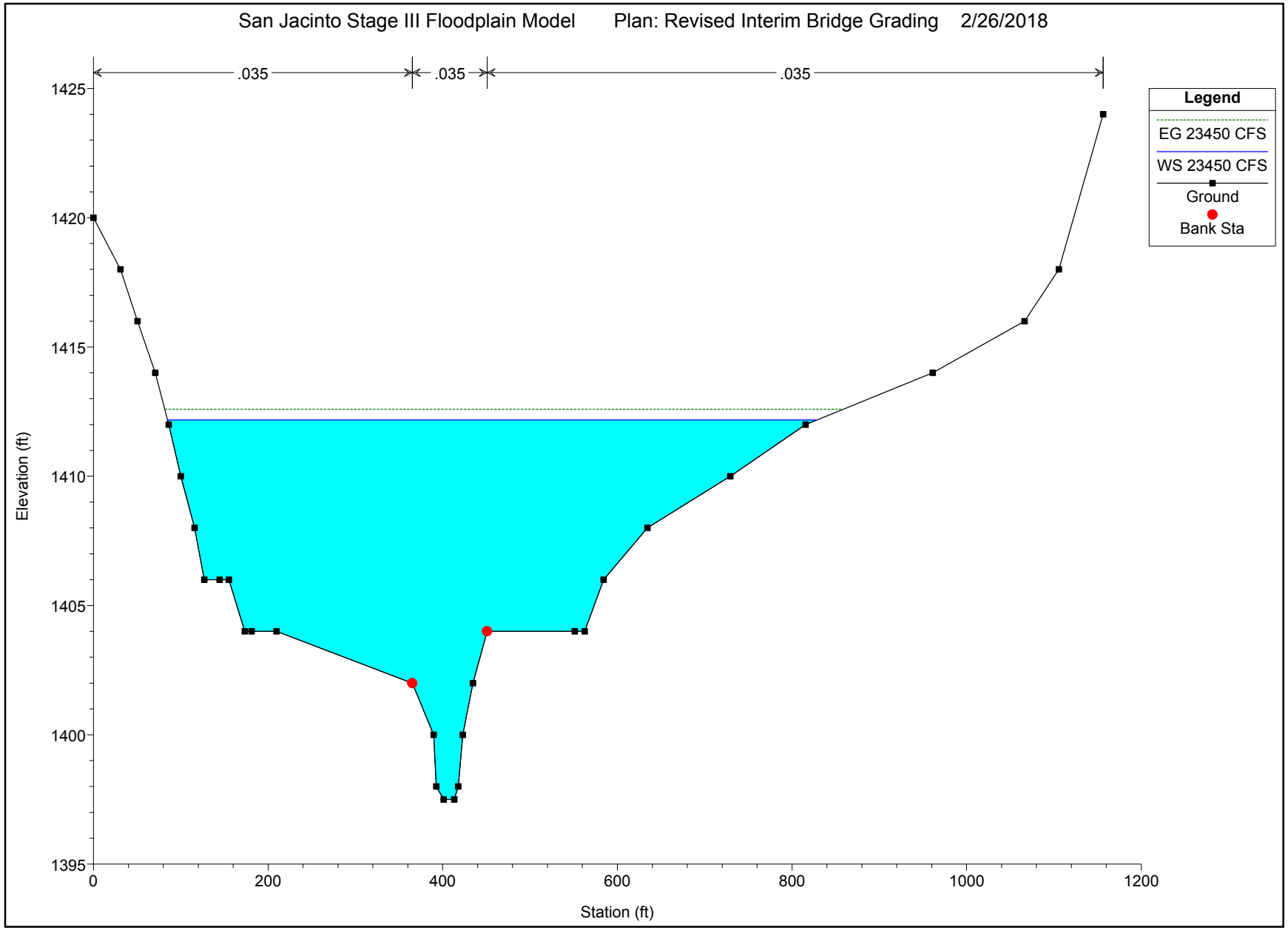
.035
.035
Legend
EG 23450 CFS
WS 23450 CFS
Ground
Bank Sta
Elevation (ft)
1420
1415
1410
1405
1400
1395
0
100
200
300
400
500
600
700
800
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 23450 CFS
WS 23450 CFS
Ground
Bank Sta
Elevation (ft)
1425
1420
1415
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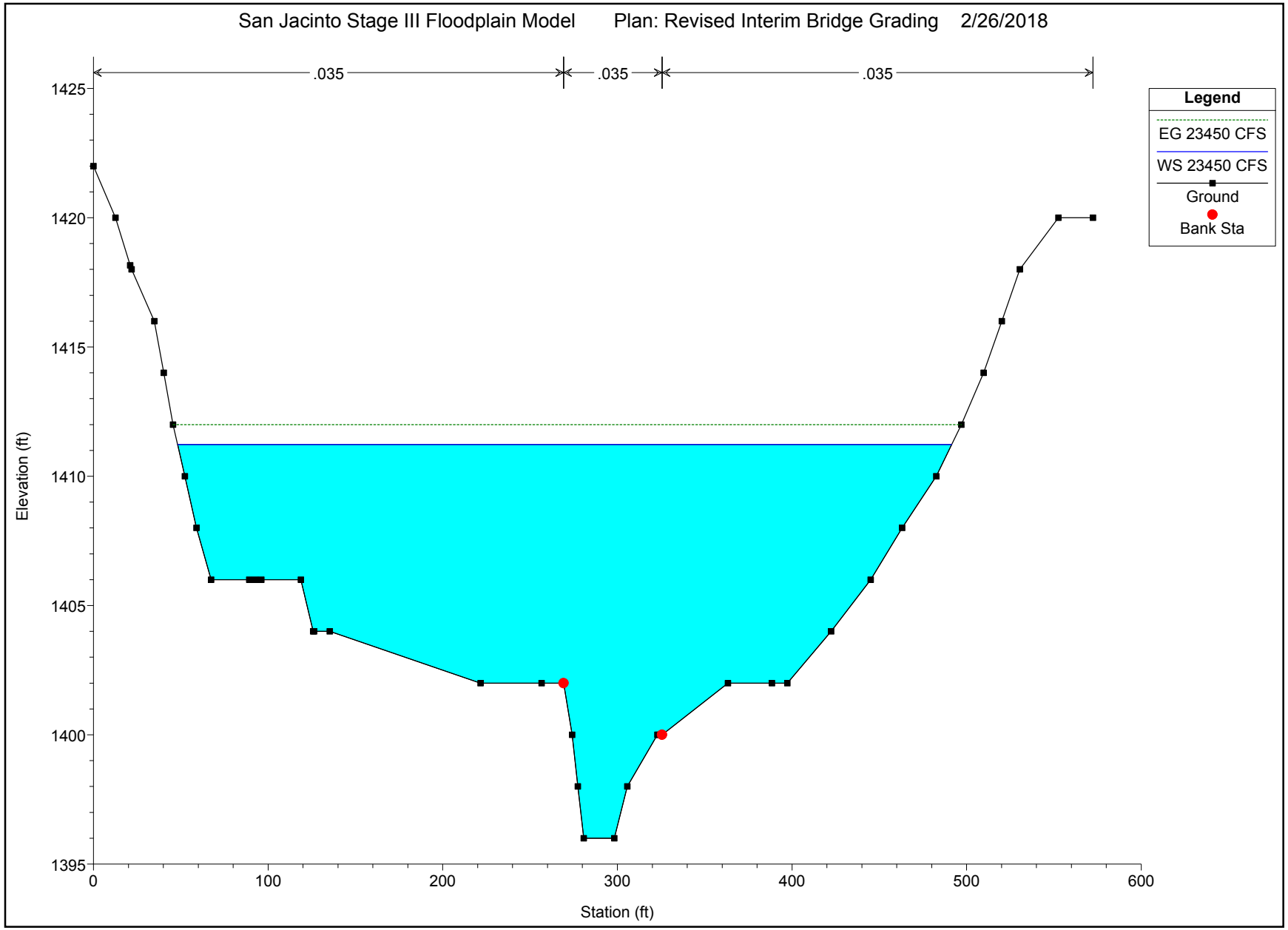
200
400
600
800
1000
1200
Station (ft)


San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018
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.035
Legend
EG 23450 CFS
WS 23450 CFS
Ground
Bank Sta
Elevation (ft)
1425
1420
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1395
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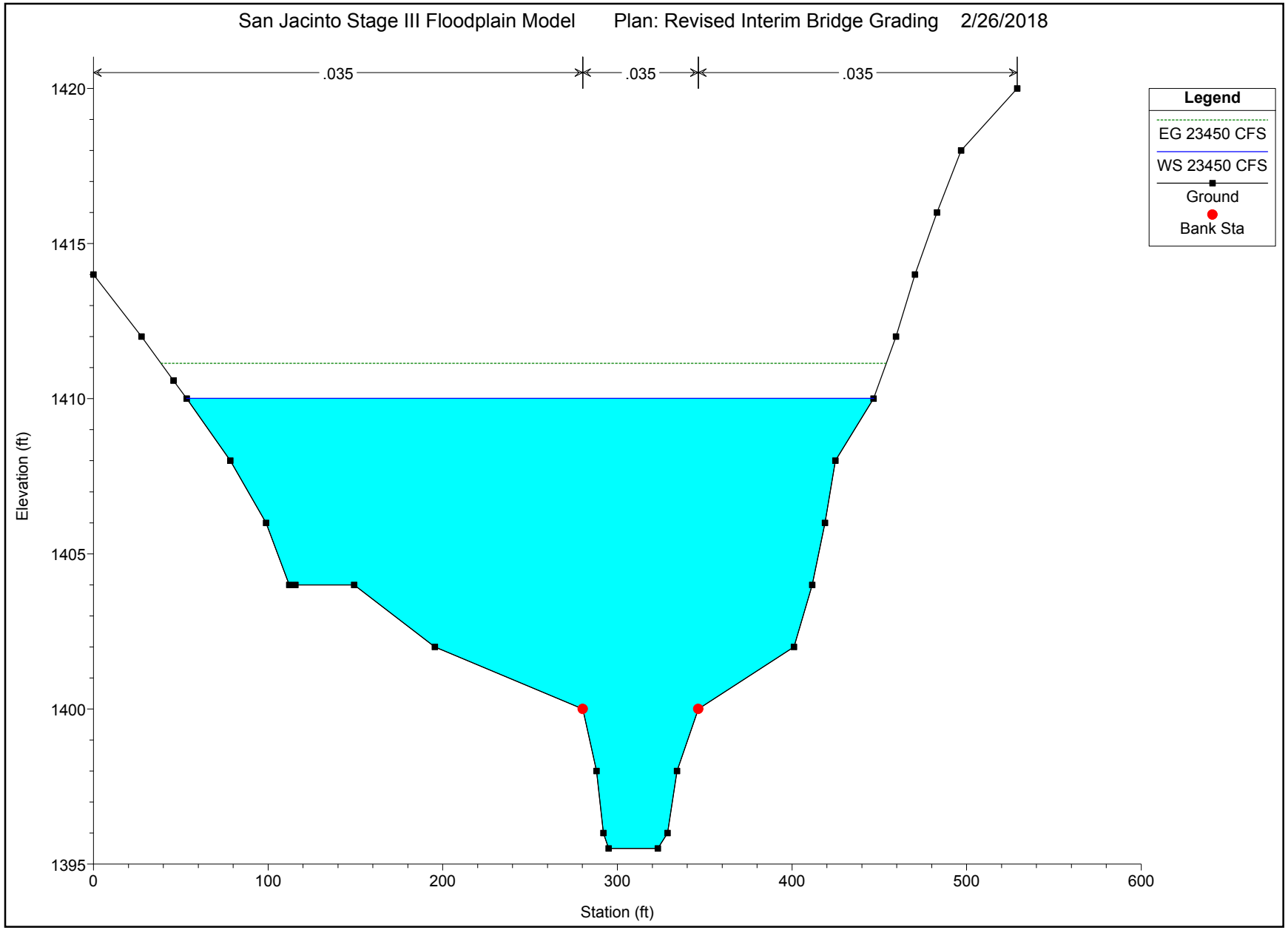
100
200
300
400
500
600
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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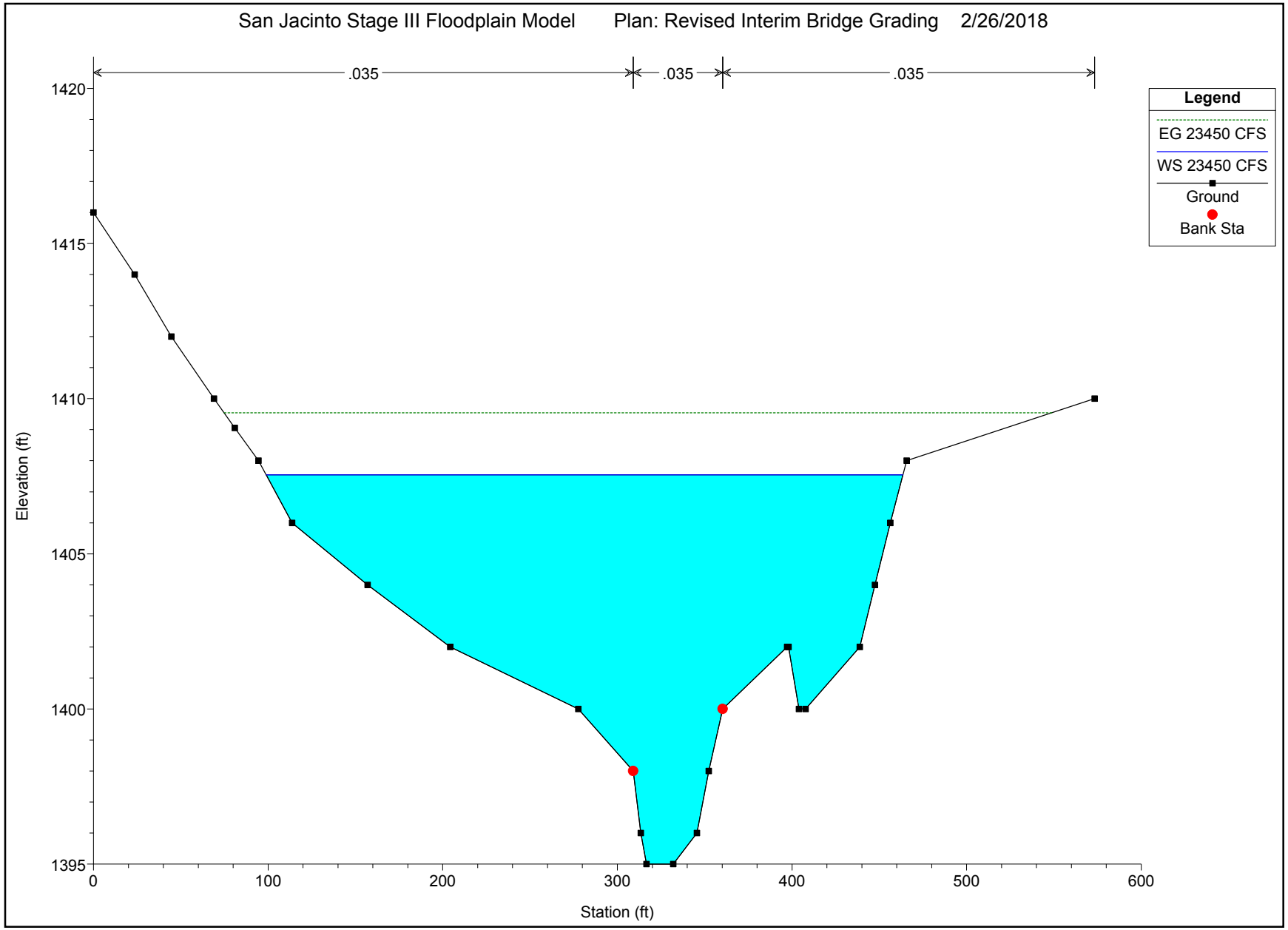
.035
.035
Legend
EG 23450 CFS
WS 23450 CFS
Ground
Bank Sta
Elevation (ft)
1420
1415
1410
1405
1400
1395
0
100
200
300
400
500
600
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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.035
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Legend
EG 23450 CFS
WS 23450 CFS
Ground
Bank Sta
Elevation (ft)
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1410
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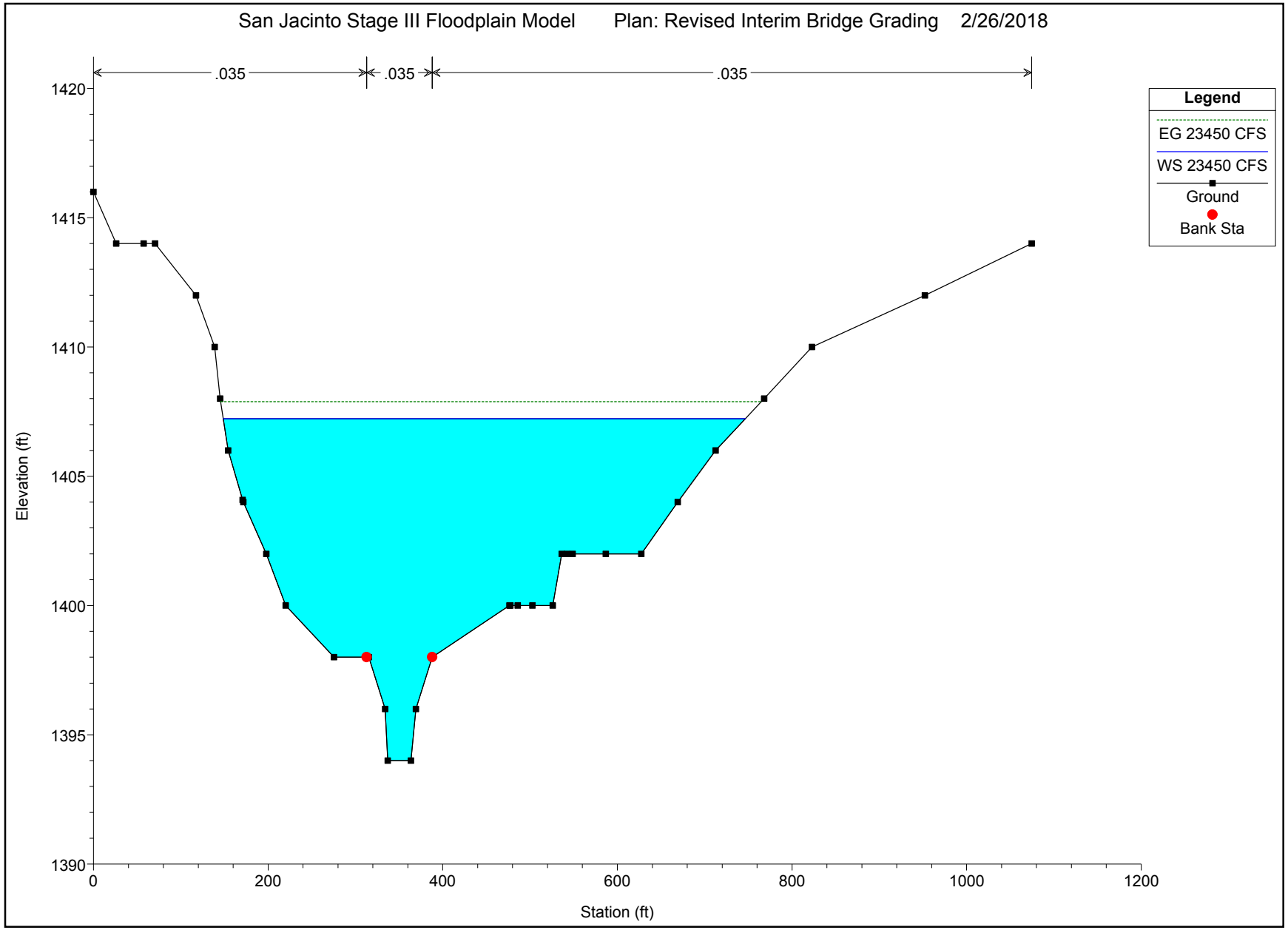
1400
1395
0
100
200
300
400
500
600
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
.035
.035
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Legend
EG 23450 CFS
WS 23450 CFS
Ground
Bank Sta
Elevation (ft)
1420
1415
1410
1405
1400
1395
1390
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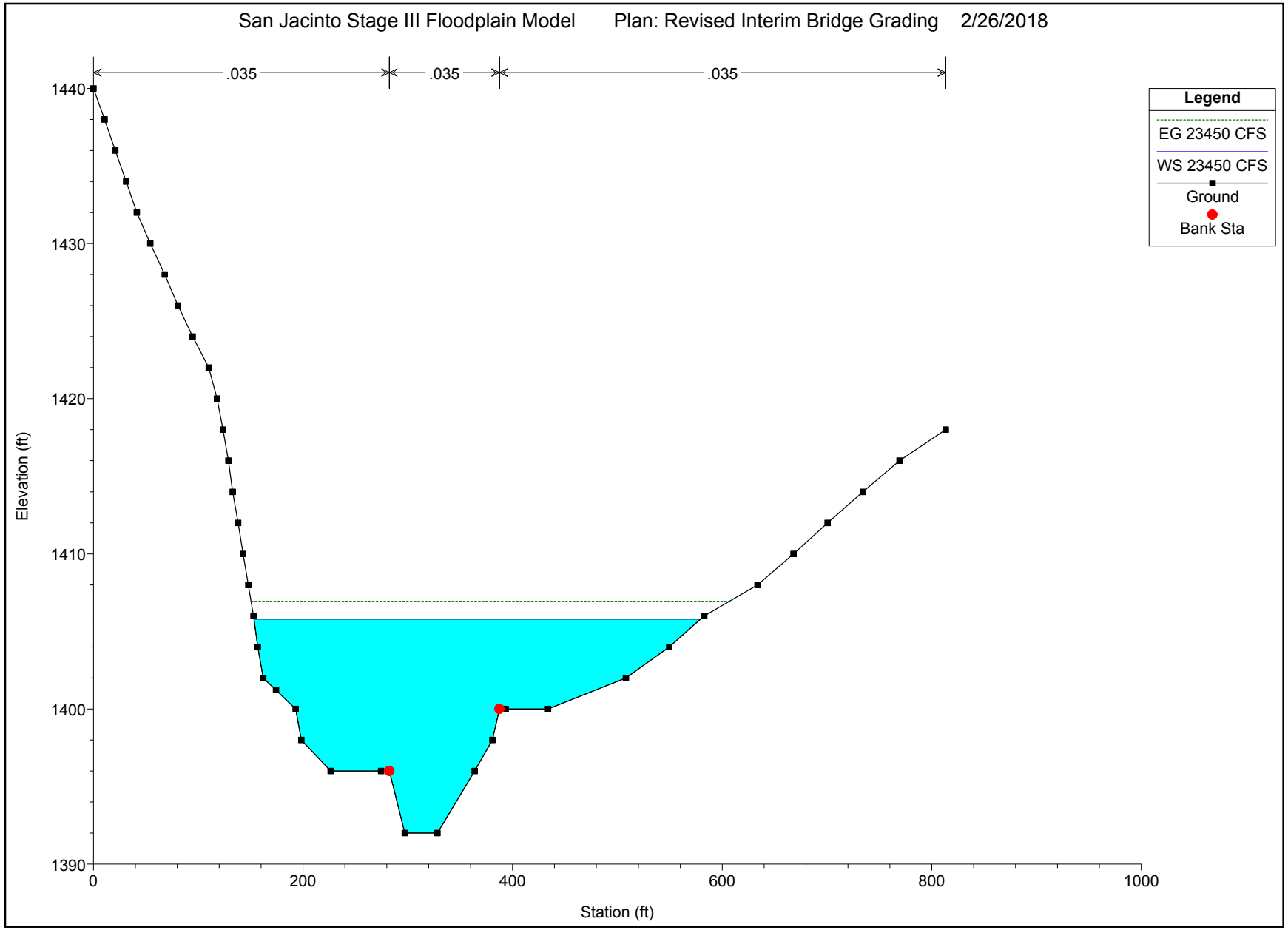
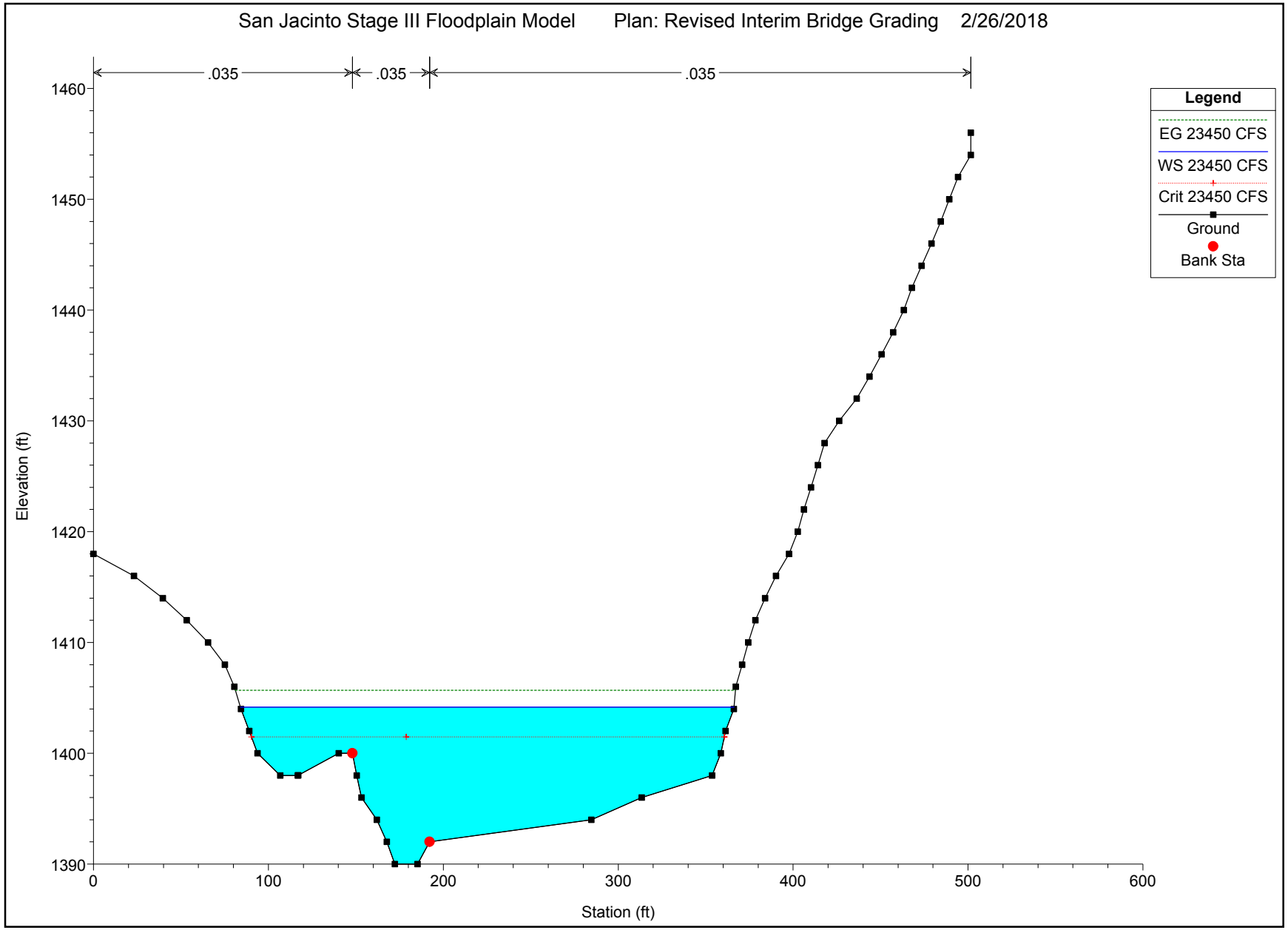
200
400
600
800
1000
1200
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
.035
.035
.035
Legend
EG 23450 CFS
WS 23450 CFS
Ground
Bank Sta
Elevation (ft)
1440
1430
1420
1410
1400
1390
0
200
400
600
800
1000
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
.035
.035
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Legend
EG 23450 CFS
WS 23450 CFS
Crit 23450 CFS
Ground
Bank Sta
Elevation (ft)
1460
1450
1440
1430
1420
1410
1400
1390
0
100
200
300
400
500
600
Station (ft)

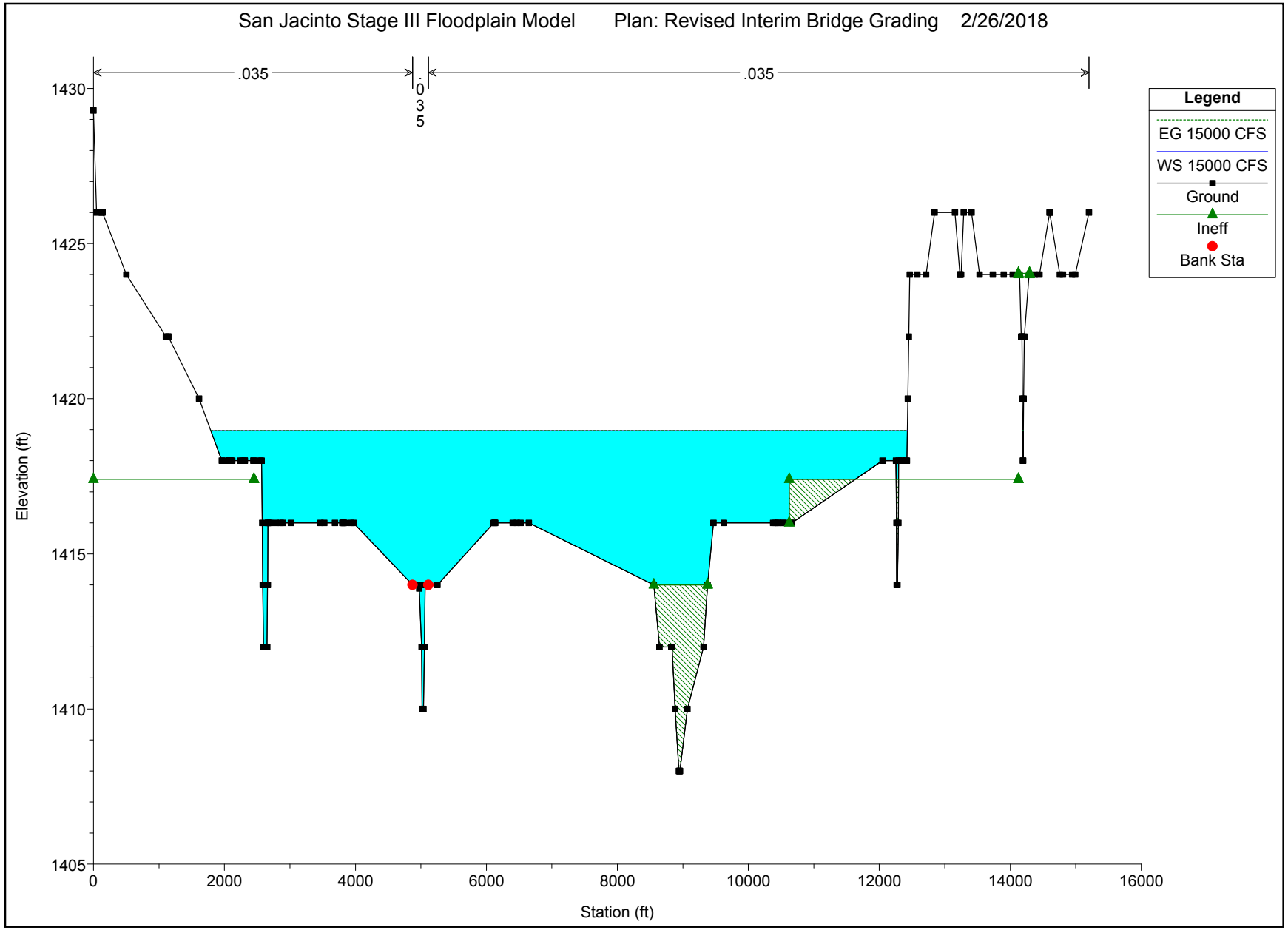
Ultimate Conditions

HEC-RAS Plan: 450 Interim River: SJR Stage III Reach: 4 Profile: 15000 CFS

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)	
4	80328	15000 CFS	15000.00	1410.00	1418.97		1418.97	0.000024	0.67	33434.03	10646.61	0.05
4	79828	15000 CFS	15000.00	1408.00	1418.96		1418.96	0.000024	0.73	34239.76	11467.60	0.05
4	79328	15000 CFS	15000.00	1406.00	1418.94		1418.95	0.000029	0.68	31281.92	11138.97	0.05
4	78828	15000 CFS	15000.00	1406.00	1418.92		1418.93	0.000045	1.02	26501.26	10426.78	0.07
4	78328	15000 CFS	15000.00	1406.00	1418.90		1418.91	0.000040	0.87	28312.35	11165.93	0.06
4	77828	15000 CFS	15000.00	1406.00	1418.88	1414.03	1418.89	0.000032	1.21	30046.96	10571.18	0.06
4	77718		Mult Open									
4	77494	15000 CFS	15000.00	1406.00	1418.44		1418.44	0.000029	0.88	28810.37	9255.26	0.06
4	76818	15000 CFS	15000.00	1406.00	1418.42		1418.42	0.000019	0.61	35194.04	10626.46	0.04
4	76318	15000 CFS	15000.00	1404.00	1418.41		1418.42	0.000019	0.63	34407.86	10338.46	0.04
4	75818	15000 CFS	15000.00	1404.00	1418.40		1418.41	0.000019	0.63	34467.51	10943.28	0.04
4	75318	15000 CFS	15000.00	1406.00	1418.39		1418.40	0.000023	0.77	32860.91	10808.53	0.05
4	74818	15000 CFS	15000.00	1404.00	1418.38		1418.38	0.000024	0.83	32216.15	10734.83	0.05
4	74268	15000 CFS	15000.00	1404.00	1418.36		1418.37	0.000030	0.94	29349.38	10412.66	0.06
4	73997	15000 CFS	15000.00	1406.00	1418.36		1418.36	0.000041	0.98	26318.14	10890.99	0.07
4	73918	15000 CFS	15000.00	1404.00	1418.35	1416.00	1418.36	0.000037	1.16	27301.63	11033.82	0.07
4	73867		Bridge									
4	73782	15000 CFS	15000.00	1404.00	1418.35	1415.31	1418.35	0.000012	0.66	38942.34	11032.64	0.04
4	73373	15000 CFS	15000.00	1406.00	1418.34	1415.03	1418.34	0.000019	0.71	32799.80	9228.91	0.05
4	72817	15000 CFS	15000.00	1406.00	1418.33	1415.15	1418.33	0.000026	0.86	29973.09	9601.66	0.05
4	72317	15000 CFS	15000.00	1406.00	1418.31	1414.68	1418.32	0.000023	0.83	30301.53	8877.53	0.05
4	71817	15000 CFS	15000.00	1404.00	1418.30	1413.86	1418.31	0.000022	0.84	30081.18	8449.82	0.05
4	71317	15000 CFS	15000.00	1404.00	1418.29	1413.89	1418.29	0.000024	0.82	29524.54	8747.97	0.05
4	70817	15000 CFS	15000.00	1404.00	1418.28	1413.41	1418.28	0.000021	0.80	31081.30	8875.38	0.05
4	70317	15000 CFS	15000.00	1404.00	1418.27		1418.27	0.000017	0.77	32902.57	8522.30	0.04
4	69817	15000 CFS	15000.00	1404.00	1418.26	1409.12	1418.27	0.000009	0.71	37671.32	8990.17	0.04
4	69317	15000 CFS	15000.00	1404.00	1418.26		1418.26	0.000015	0.67	32648.44	8681.57	0.04
4	68817	15000 CFS	15000.00	1406.00	1418.25		1418.25	0.000022	0.85	27089.86	8615.18	0.05
4	68236	15000 CFS	15000.00	1404.00	1418.24	1409.30	1418.24	0.000016	0.79	27722.23	8409.50	0.04
4	67817	15000 CFS	15000.00	1404.00	1418.22		1418.23	0.000040	1.17	19388.21	6418.84	0.07
4	67317	15000 CFS	15000.00	1404.00	1418.17		1418.20	0.000092	1.77	13717.37	5950.69	0.10
4	67067	15000 CFS	15000.00	1404.00	1418.16	1414.76	1418.18	0.000075	1.66	15003.43	4466.01	0.09
4	66966		Bridge									
4	66847	15000 CFS	15000.00	1404.00	1418.12	1413.51	1418.14	0.000044	1.44	17084.76	3643.43	0.07
4	66817	15000 CFS	15000.00	1402.00	1418.11	1413.07	1418.13	0.000086	2.00	13693.78	5041.06	0.10
4	66327	15000 CFS	15000.00	1404.00	1418.06	1412.26	1418.09	0.000080	1.77	12108.16	3505.87	0.10
4	65817	15000 CFS	15000.00	1404.00	1417.97		1418.03	0.000163	2.45	8509.81	2034.12	0.14
4	65317	15000 CFS	15000.00	1404.00	1417.88		1417.95	0.000164	2.52	8364.94	1661.18	0.14
4	64817	15000 CFS	15000.00	1404.00	1417.80		1417.87	0.000168	2.60	8298.15	1679.92	0.14
4	64318	15000 CFS	15000.00	1406.00	1417.68		1417.77	0.000240	2.96	7384.93	1637.47	0.17

HEC-RAS Plan: 450 Interim River: SJR Stage III Reach: 4 Profile: 15000 CFS (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
4	63818	15000 CFS	15000.00	1404.00	1417.56		1417.65	0.000236	3.05	7317.52	1648.85	0.17
4	63318	15000 CFS	15000.00	1406.00	1417.50		1417.55	0.000141	2.26	8595.93	1431.34	0.13
4	62818	15000 CFS	15000.00	1404.00	1417.41		1417.47	0.000155	2.36	8307.38	1516.66	0.13
4	62318	15000 CFS	15000.00	1404.00	1417.32		1417.39	0.000182	2.80	8038.40	1560.08	0.15
4	61820	15000 CFS	15000.00	1404.00	1417.22	1411.51	1417.30	0.000164	2.59	7013.32	1257.90	0.14
4	61321	15000 CFS	15000.00	1402.34	1416.97	1410.43	1417.17	0.000320	4.12	4313.96	488.63	0.20
4	60823	15000 CFS	15000.00	1402.81	1416.85	1409.46	1417.09	0.000367	3.94	3811.55	351.21	0.21
4	60822.5		Bridge									
4	60822	15000 CFS	15000.00	1402.46	1416.64		1416.95	0.000510	4.47	3357.49	326.36	0.25
4	60821	15000 CFS	15000.00	1402.21	1416.45		1416.85	0.000696	5.07	3010.89	528.84	0.29
4	60321	15000 CFS	15000.00	1404.00	1416.07		1416.47	0.000819	5.65	3222.03	541.88	0.31
4	59821	15000 CFS	15000.00	1404.00	1415.68		1416.02	0.000905	6.08	3450.73	592.16	0.33
4	59330	15000 CFS	15000.00	1402.00	1415.10		1415.56	0.001353	7.65	2946.09	527.90	0.40
4	58831	15000 CFS	15000.00	1400.00	1413.79		1414.58	0.001941	9.76	2296.39	377.76	0.49
4	58339	15000 CFS	15000.00	1400.00	1412.52		1413.50	0.002288	10.00	2150.13	390.39	0.53
4	57845	15000 CFS	15000.00	1399.20	1411.19		1412.32	0.002840	11.06	1984.49	366.78	0.58
4	57346	15000 CFS	15000.00	1398.00	1410.42		1411.07	0.001830	8.72	2486.38	434.89	0.47
4	56848	15000 CFS	15000.00	1397.50	1409.97		1410.32	0.000991	6.04	3401.81	627.19	0.34
4	56349	15000 CFS	15000.00	1396.00	1409.10		1409.70	0.001507	8.07	2586.63	418.38	0.43
4	55849	15000 CFS	15000.00	1395.50	1408.11		1408.91	0.001762	8.86	2275.91	349.12	0.46
4	55349	15000 CFS	15000.00	1395.00	1405.71		1407.43	0.005124	13.42	1604.97	335.02	0.77
4	54849	15000 CFS	15000.00	1394.00	1405.07		1405.66	0.001821	7.95	2656.86	529.76	0.46
4	54349	15000 CFS	15000.00	1392.00	1403.70		1404.63	0.002189	8.84	2128.95	385.63	0.51
4	53850	15000 CFS	15000.00	1390.00	1402.66	1399.66	1403.57	0.002002	8.53	2018.46	275.47	0.47


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 15000 CFS
WS 15000 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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Station (ft)
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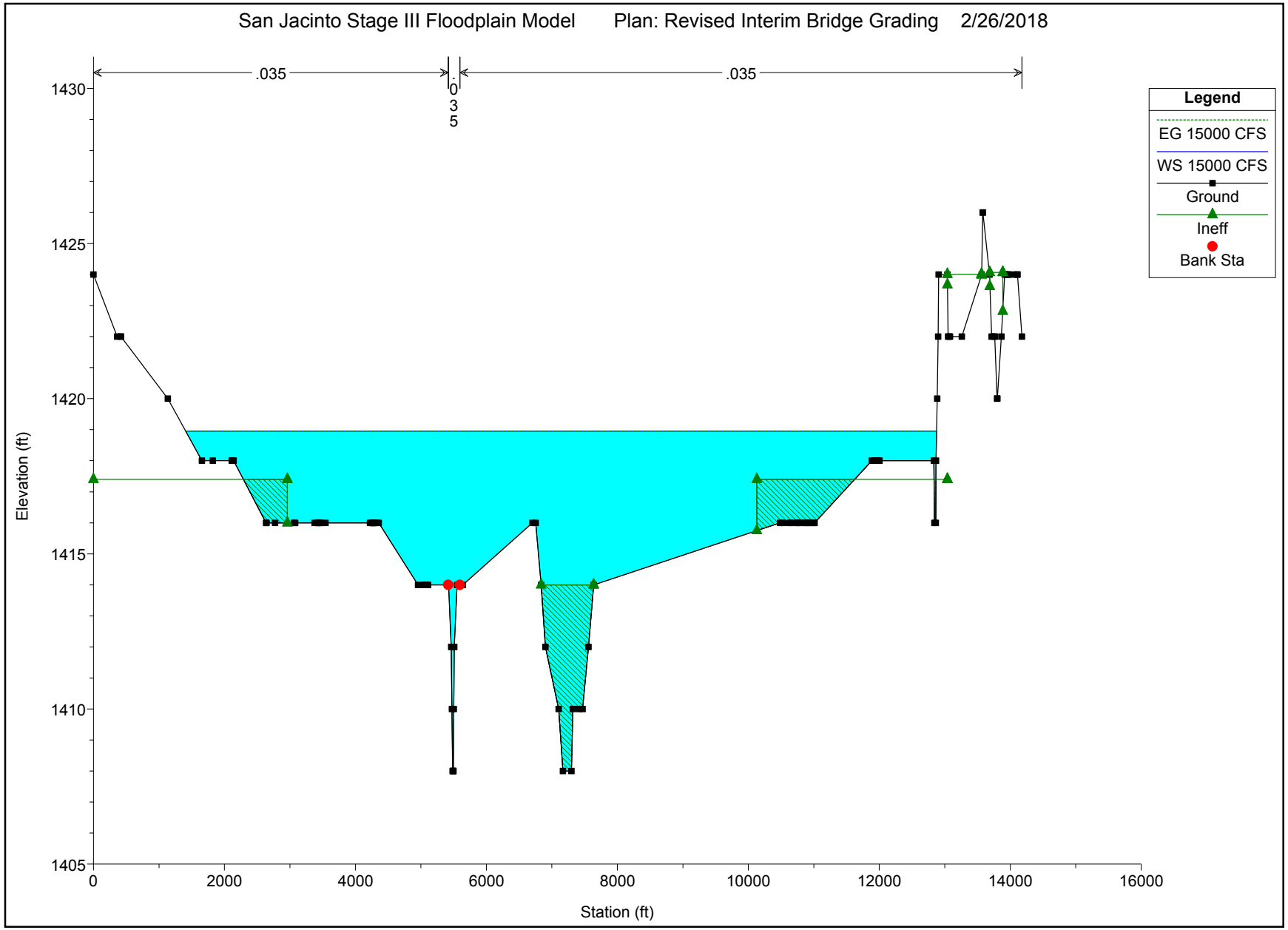
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 15000 CFS
WS 15000 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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Station (ft)
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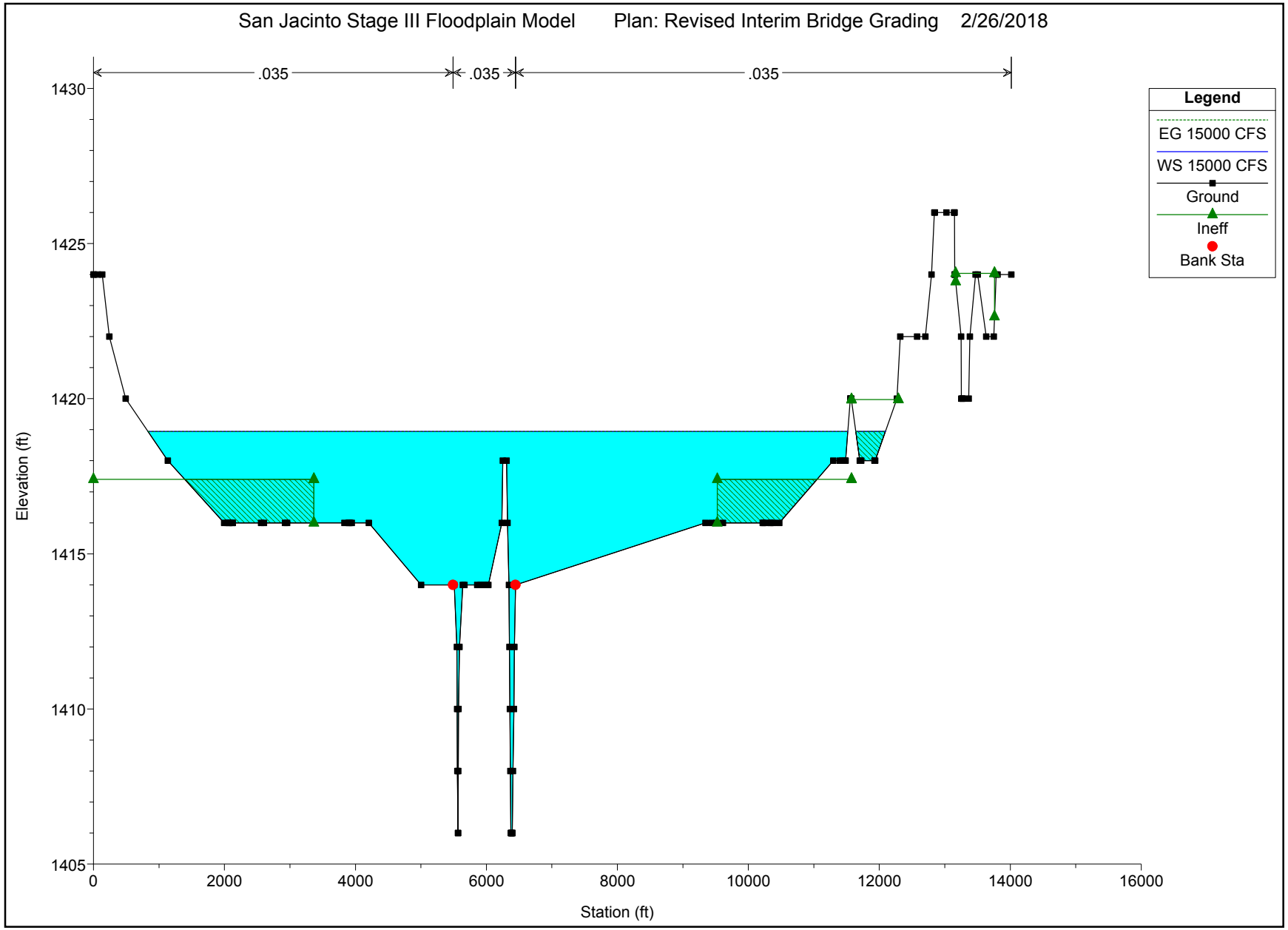
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 15000 CFS
WS 15000 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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Station (ft)
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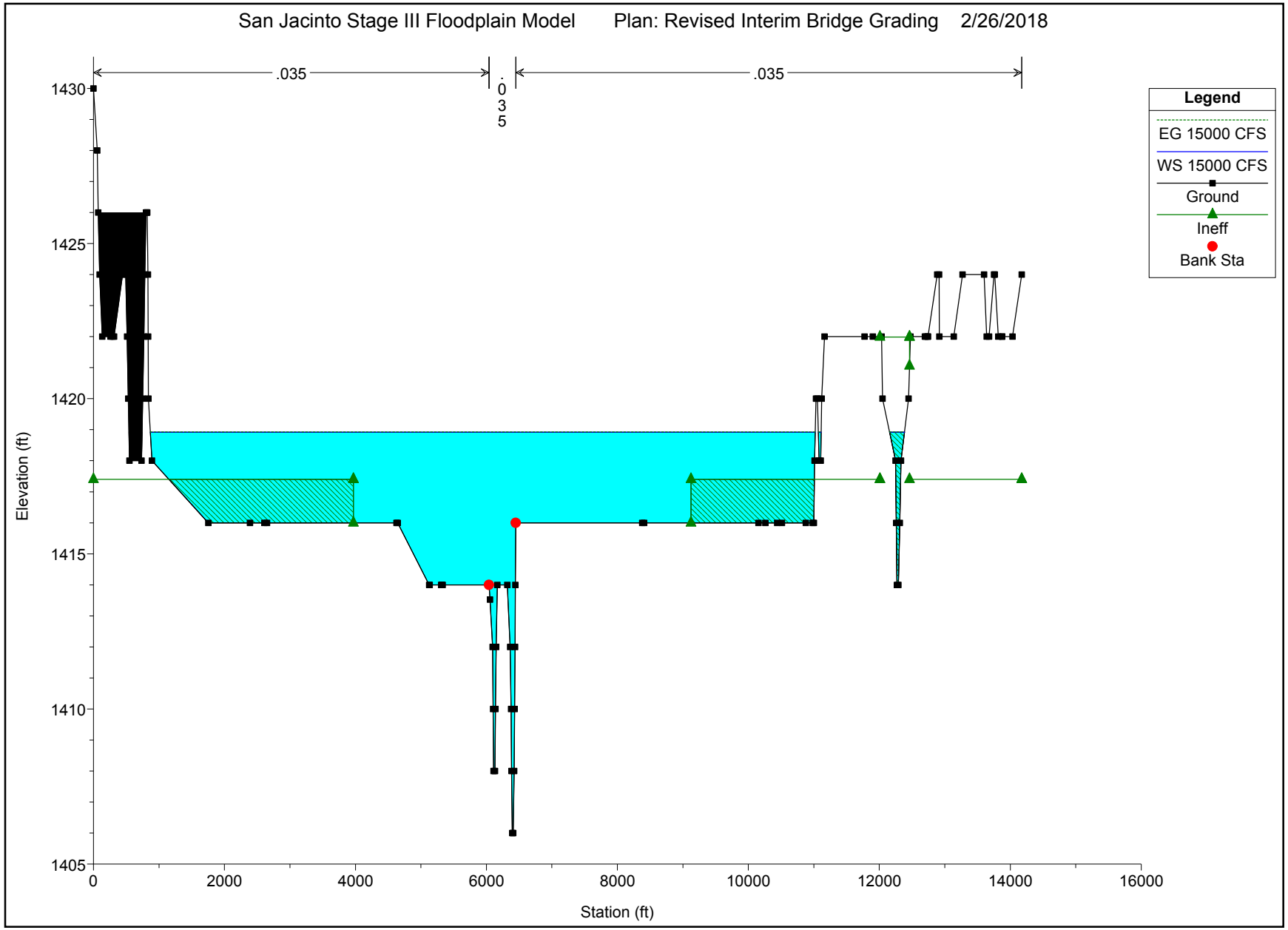
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 15000 CFS
WS 15000 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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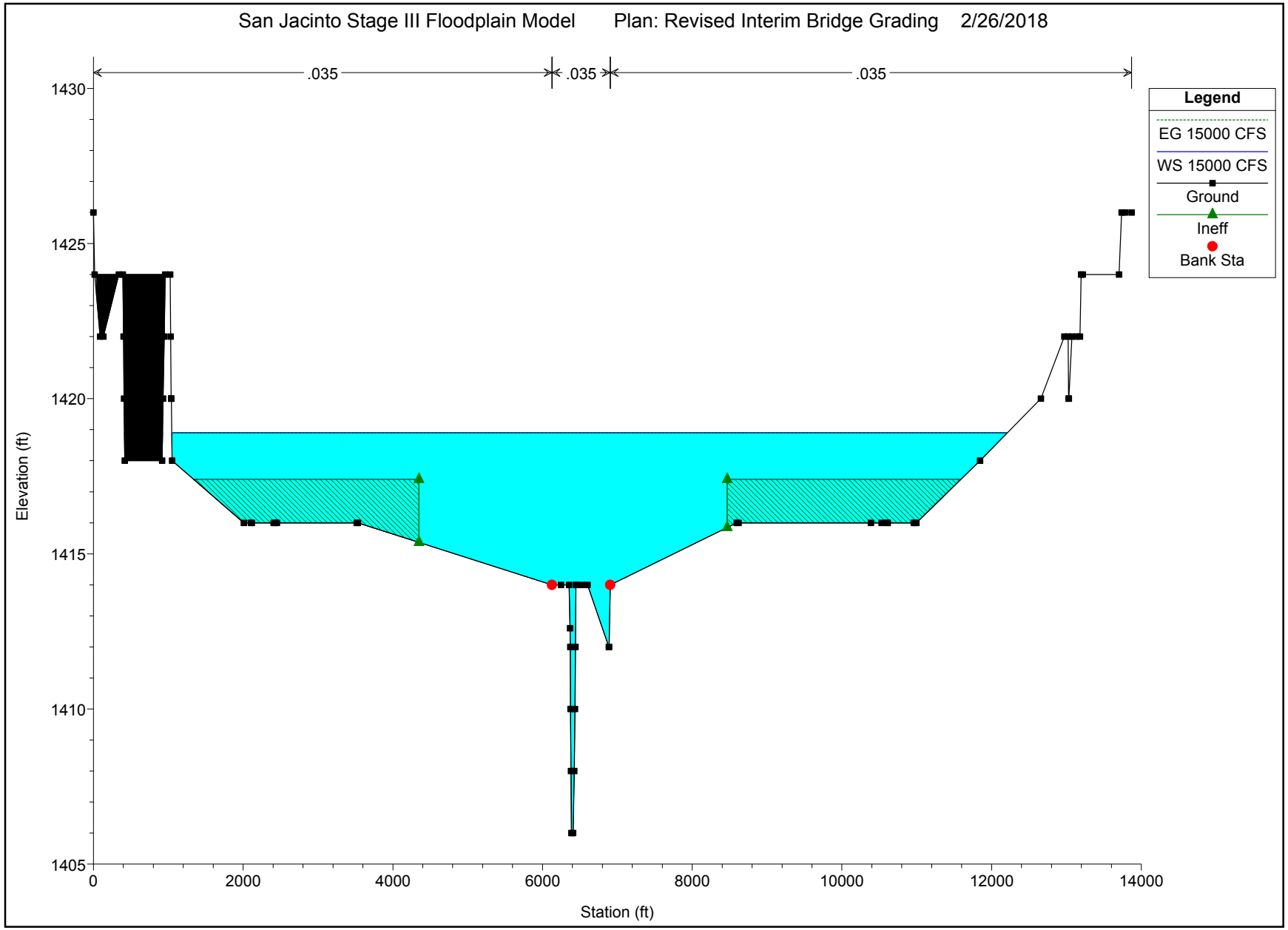
Station (ft)


San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018
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Legend
EG 15000 CFS
WS 15000 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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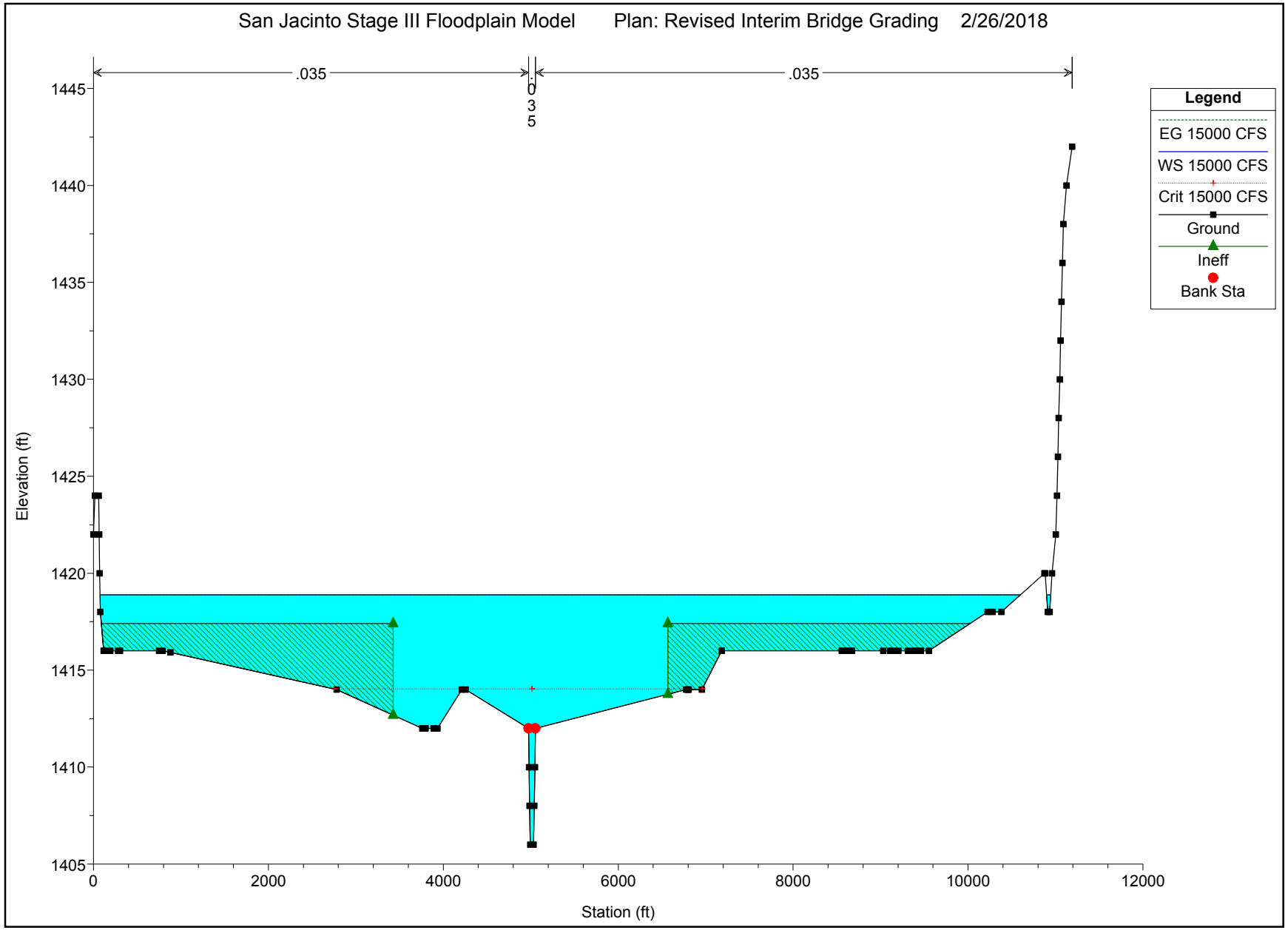
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 15000 CFS
WS 15000 CFS
Crit 15000 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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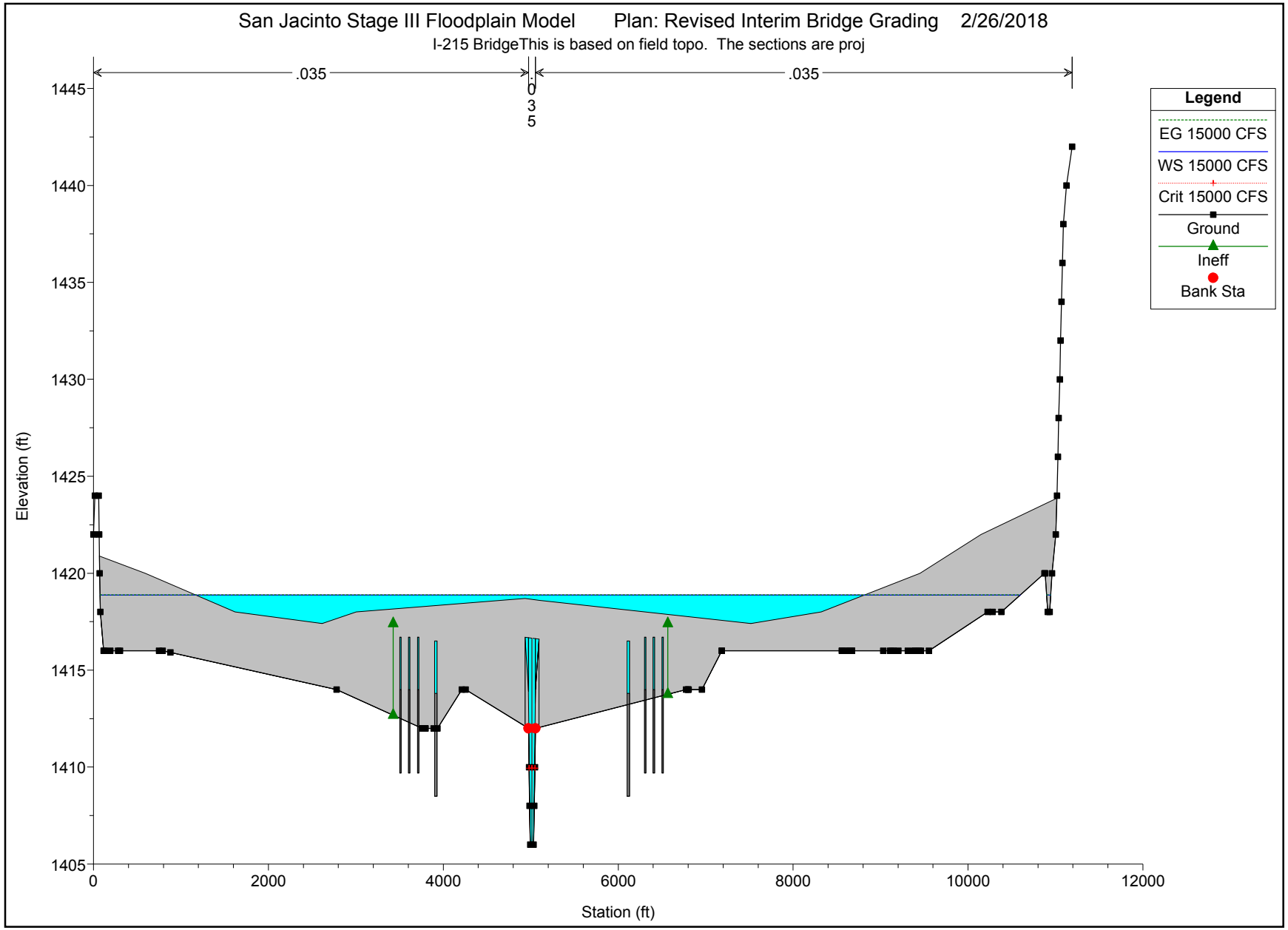
Station (ft)


San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018
I-215 BridgeThis is based on field topo. The sections are proj
.035
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Legend
EG 15000 CFS
WS 15000 CFS
Crit 15000 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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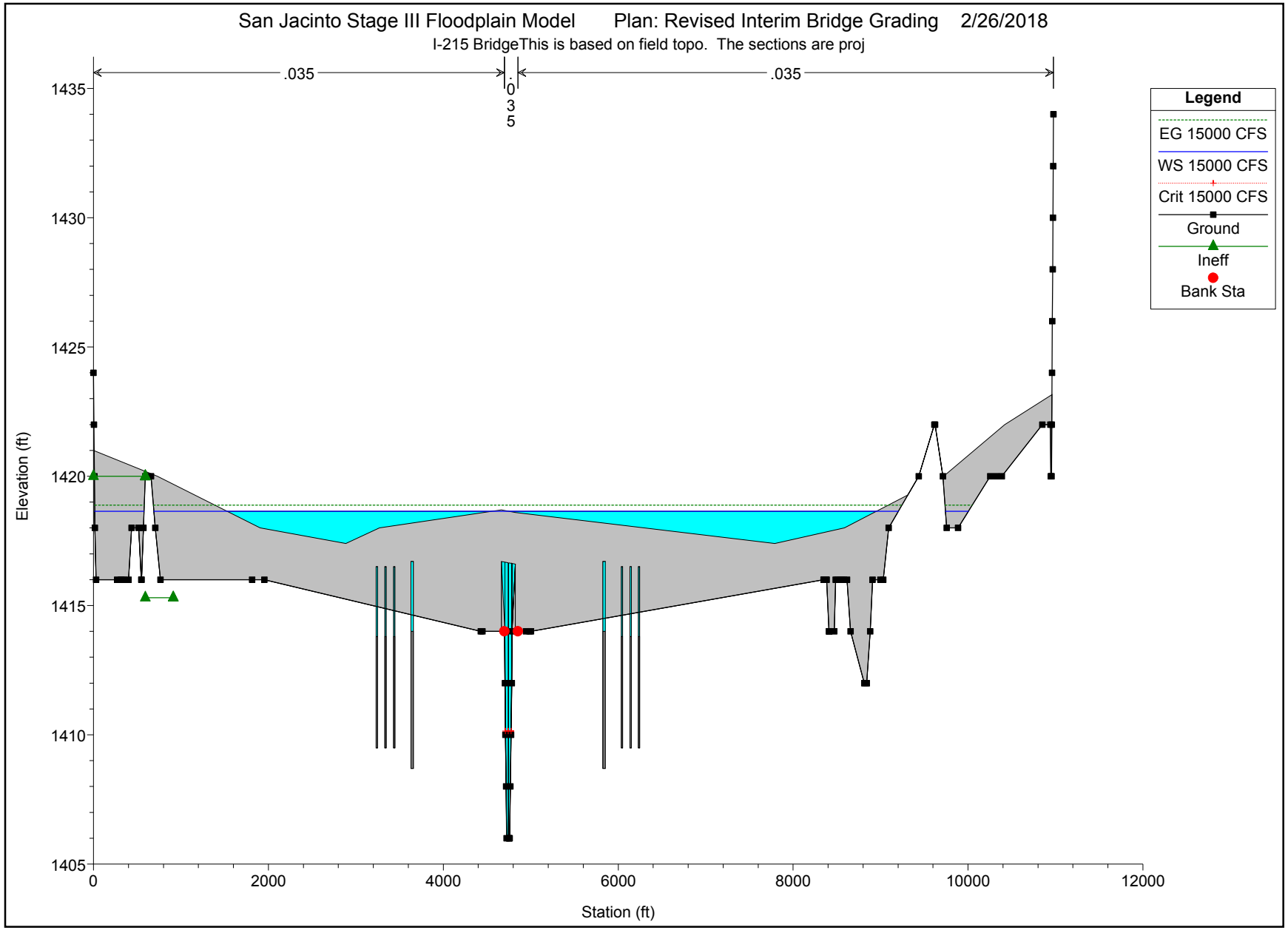
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
I-215 BridgeThis is based on field topo. The sections are proj
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Legend
EG 15000 CFS
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Crit 15000 CFS
Ground
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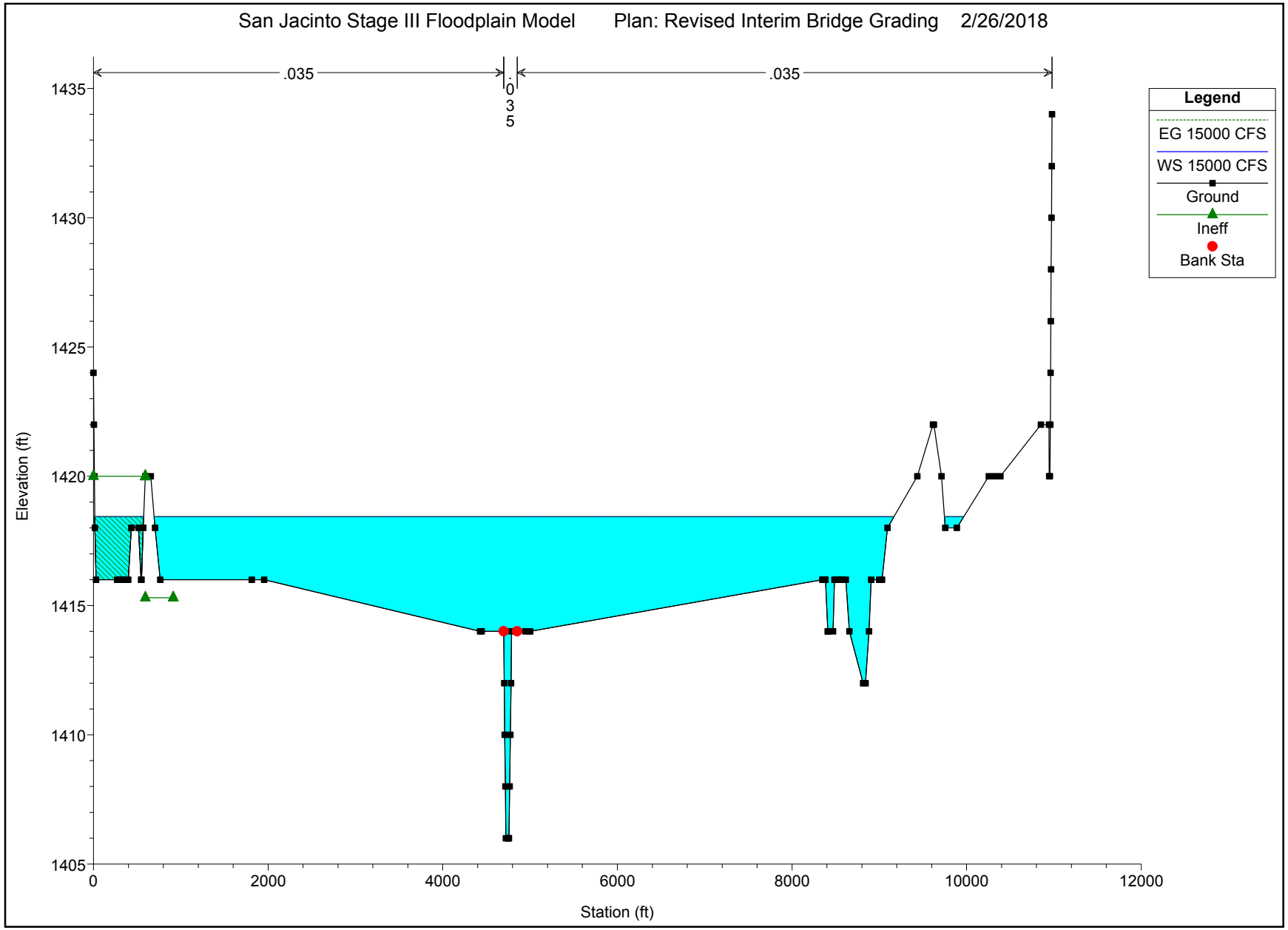
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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Ground
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Bank Sta
Elevation (ft)
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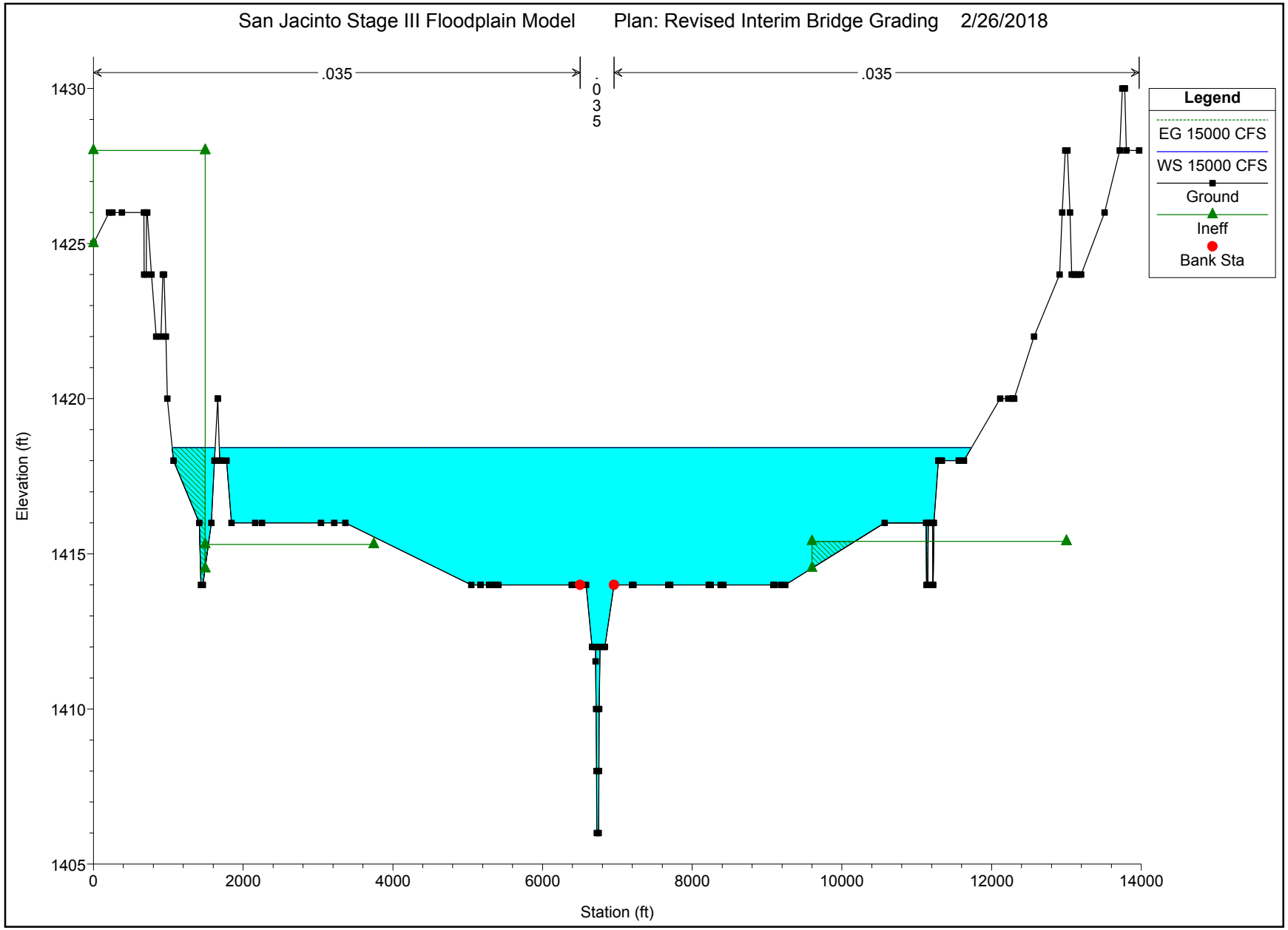
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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WS 15000 CFS
Ground
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Elevation (ft)
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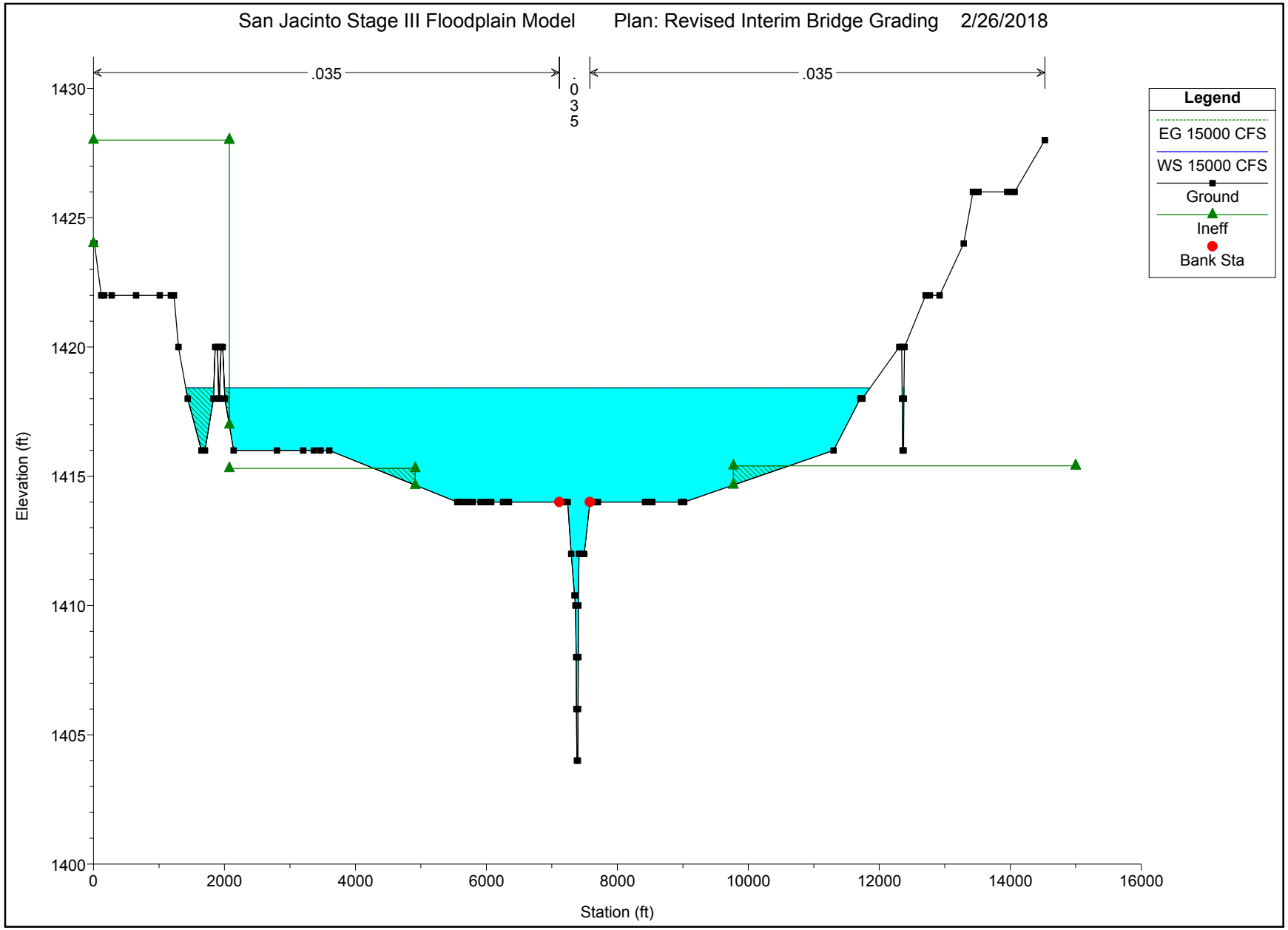
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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WS 15000 CFS
Ground
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Bank Sta
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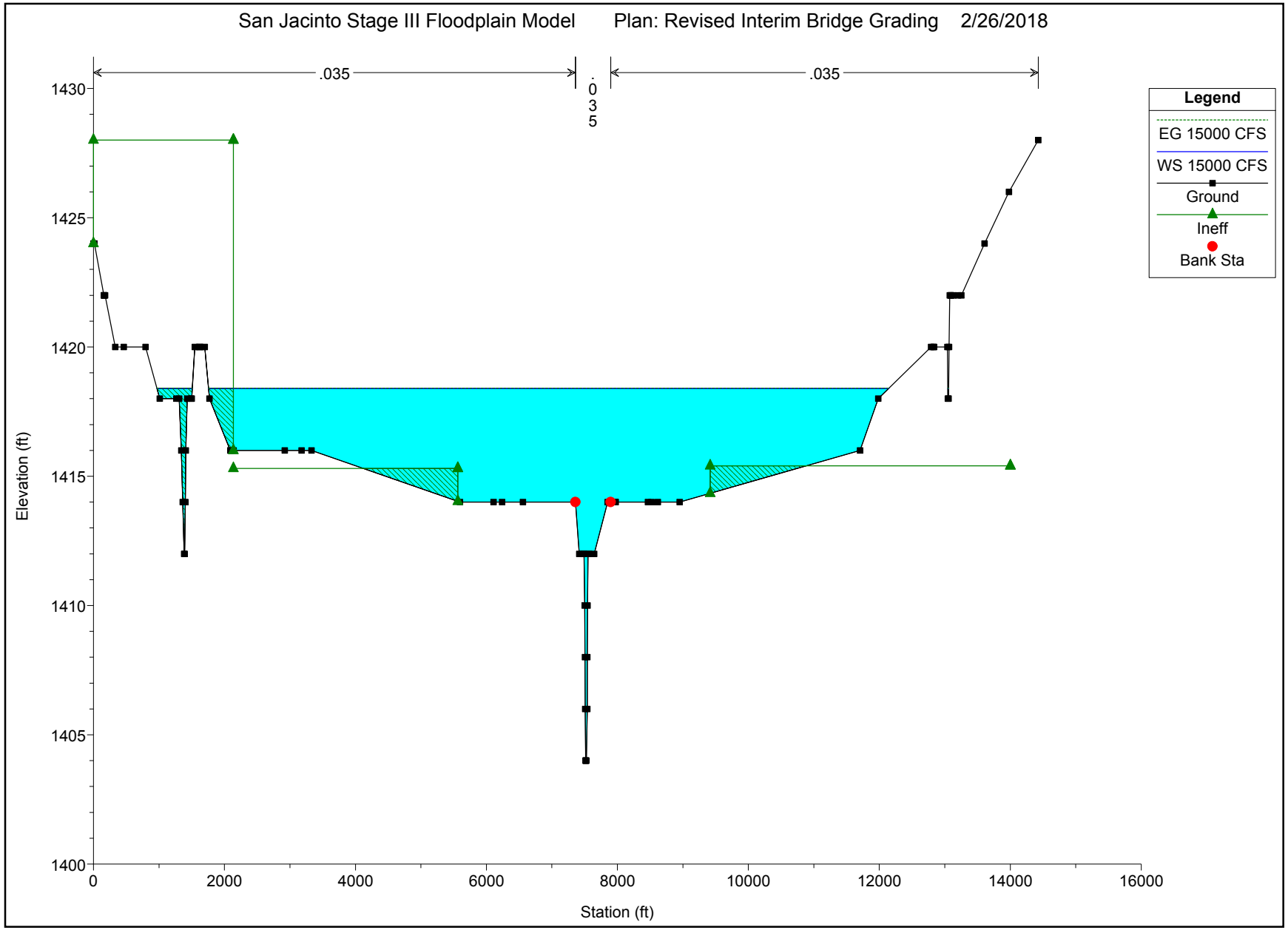
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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Elevation (ft)
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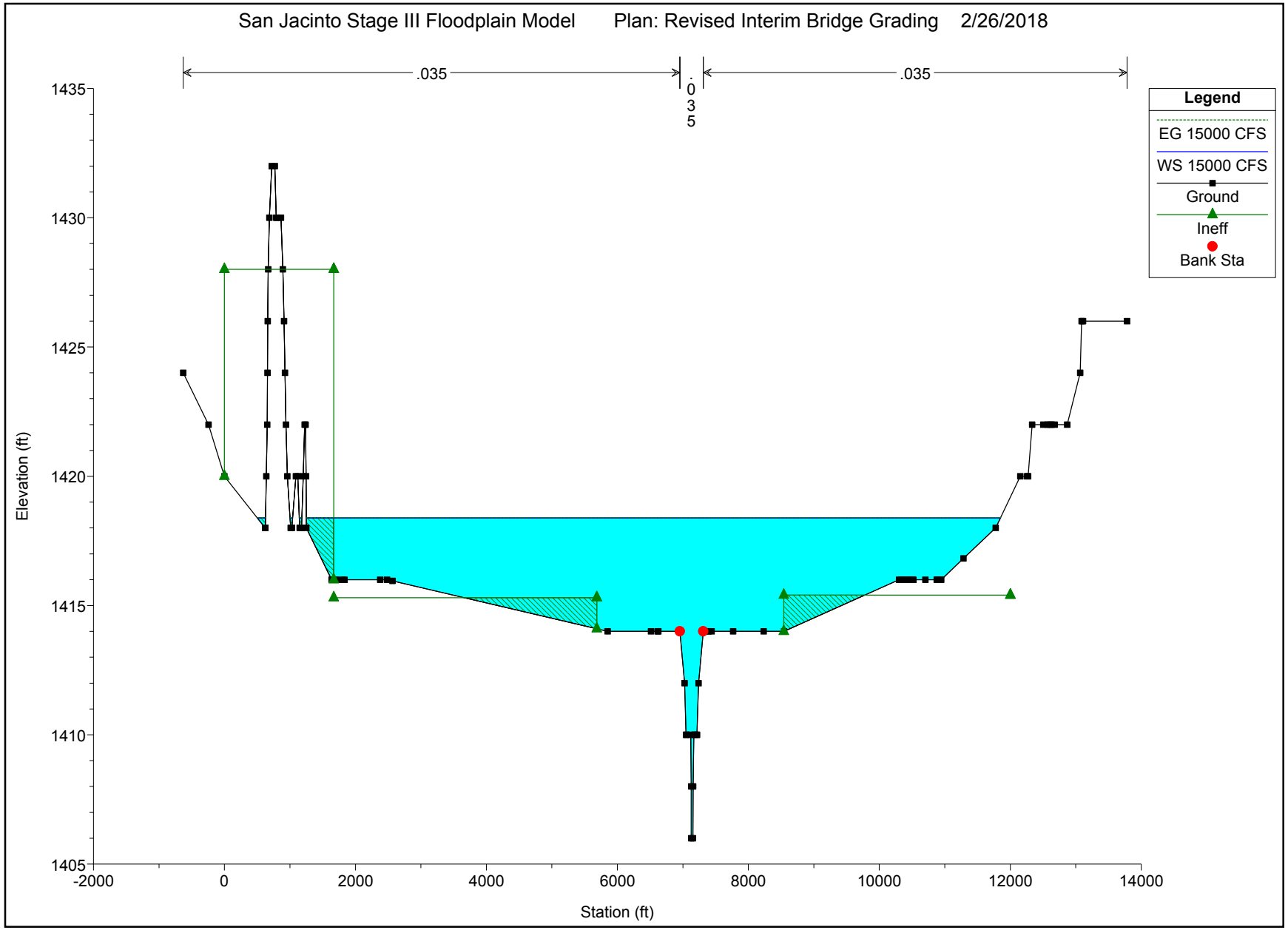
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 15000 CFS
WS 15000 CFS
Ground
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Bank Sta
Elevation (ft)
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Station (ft)
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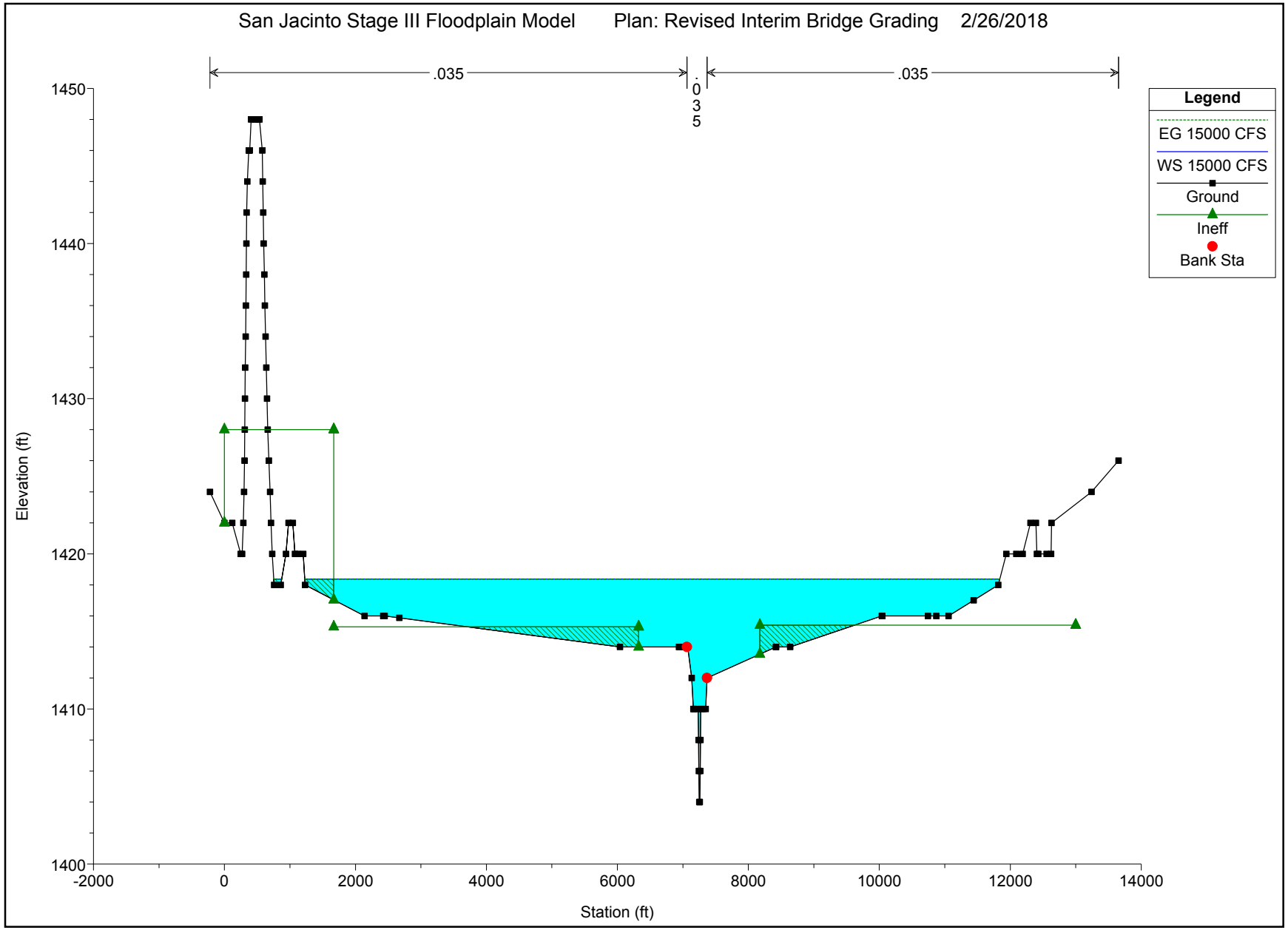
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
.035
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Legend
EG 15000 CFS
WS 15000 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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12000
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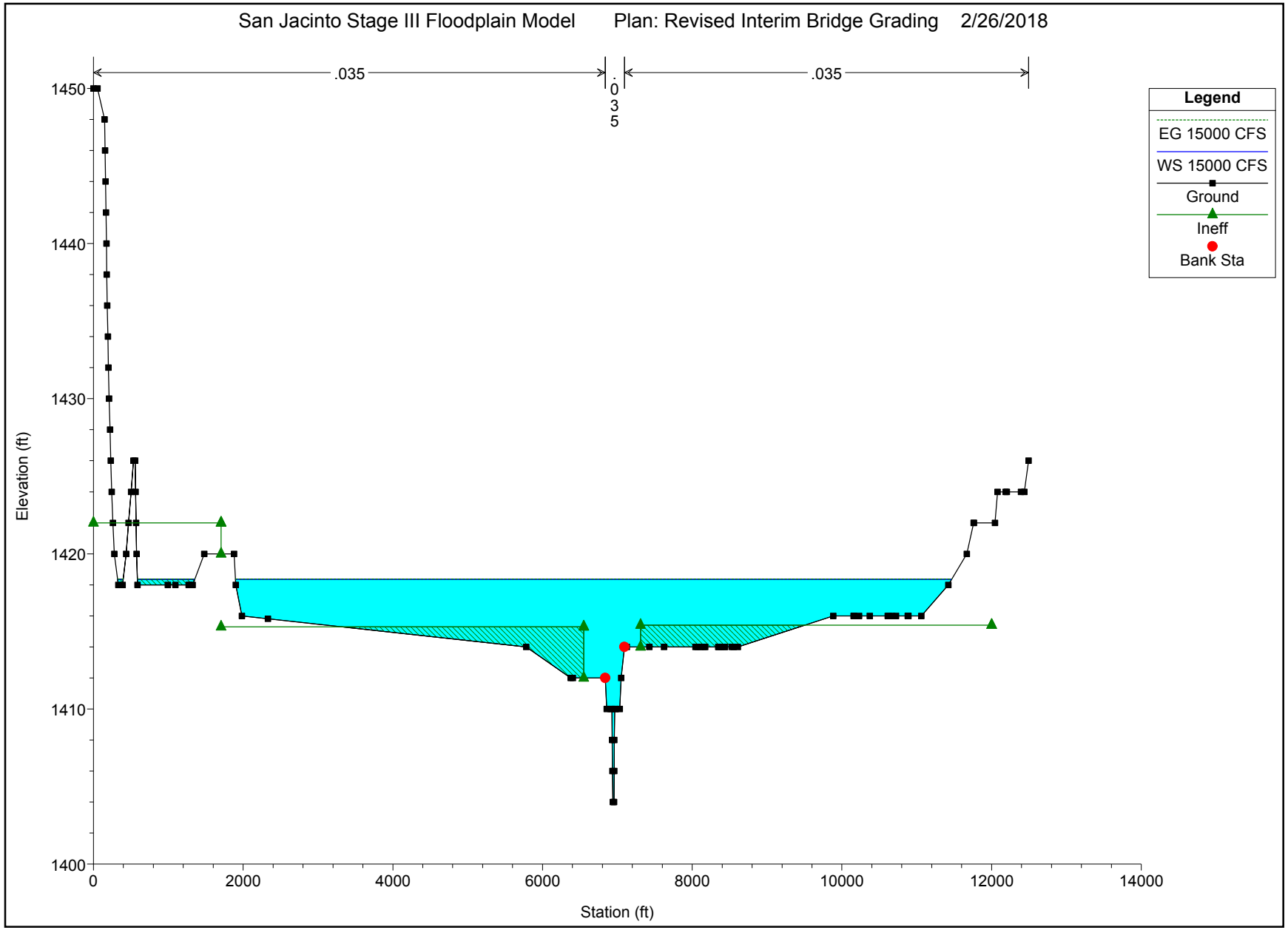
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 15000 CFS
WS 15000 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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Station (ft)
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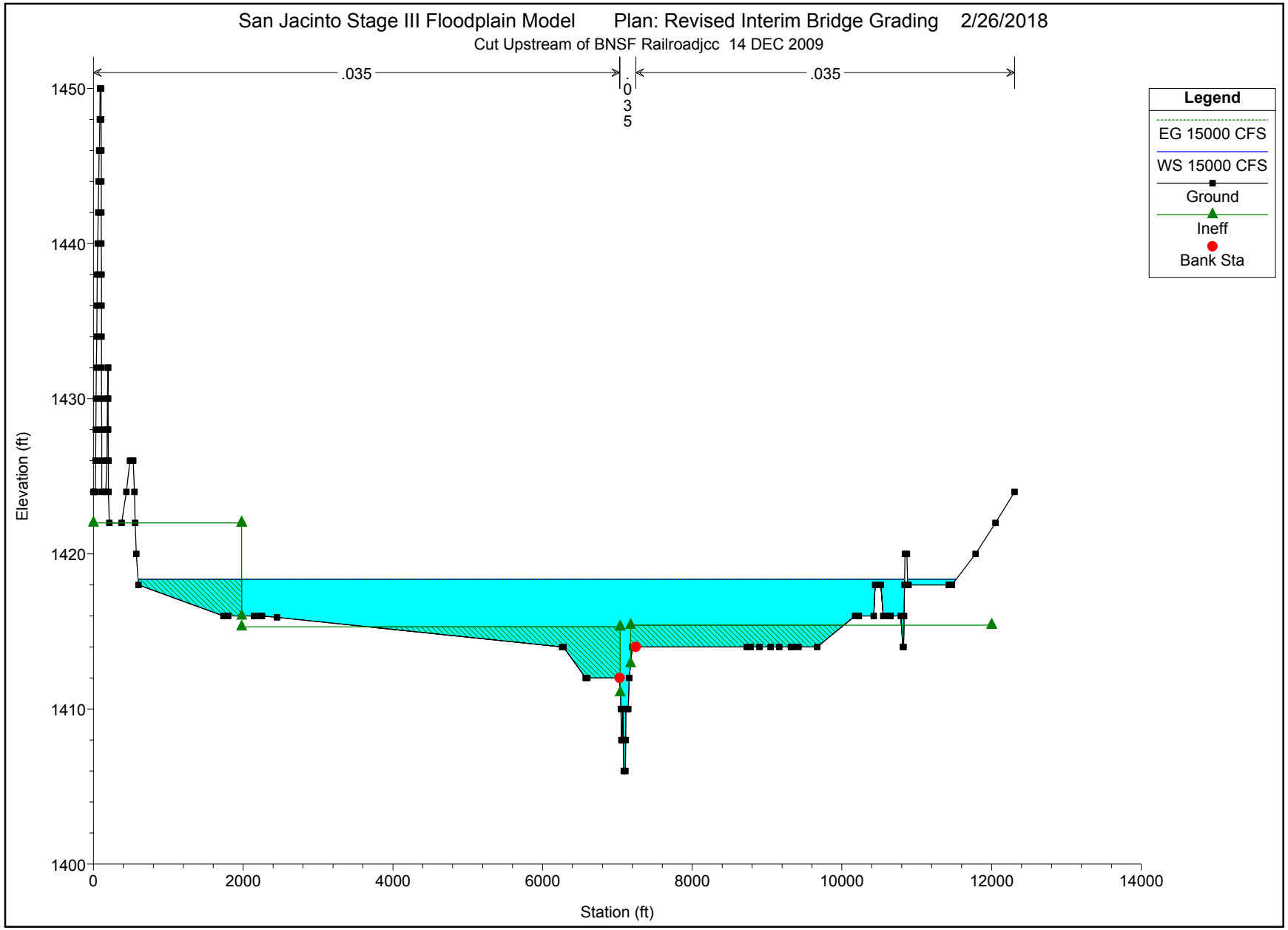
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
Cut Upstream of BNSF Railroadjcc 14 DEC 2009
.035
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Legend
EG 15000 CFS
WS 15000 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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1420
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0
2000
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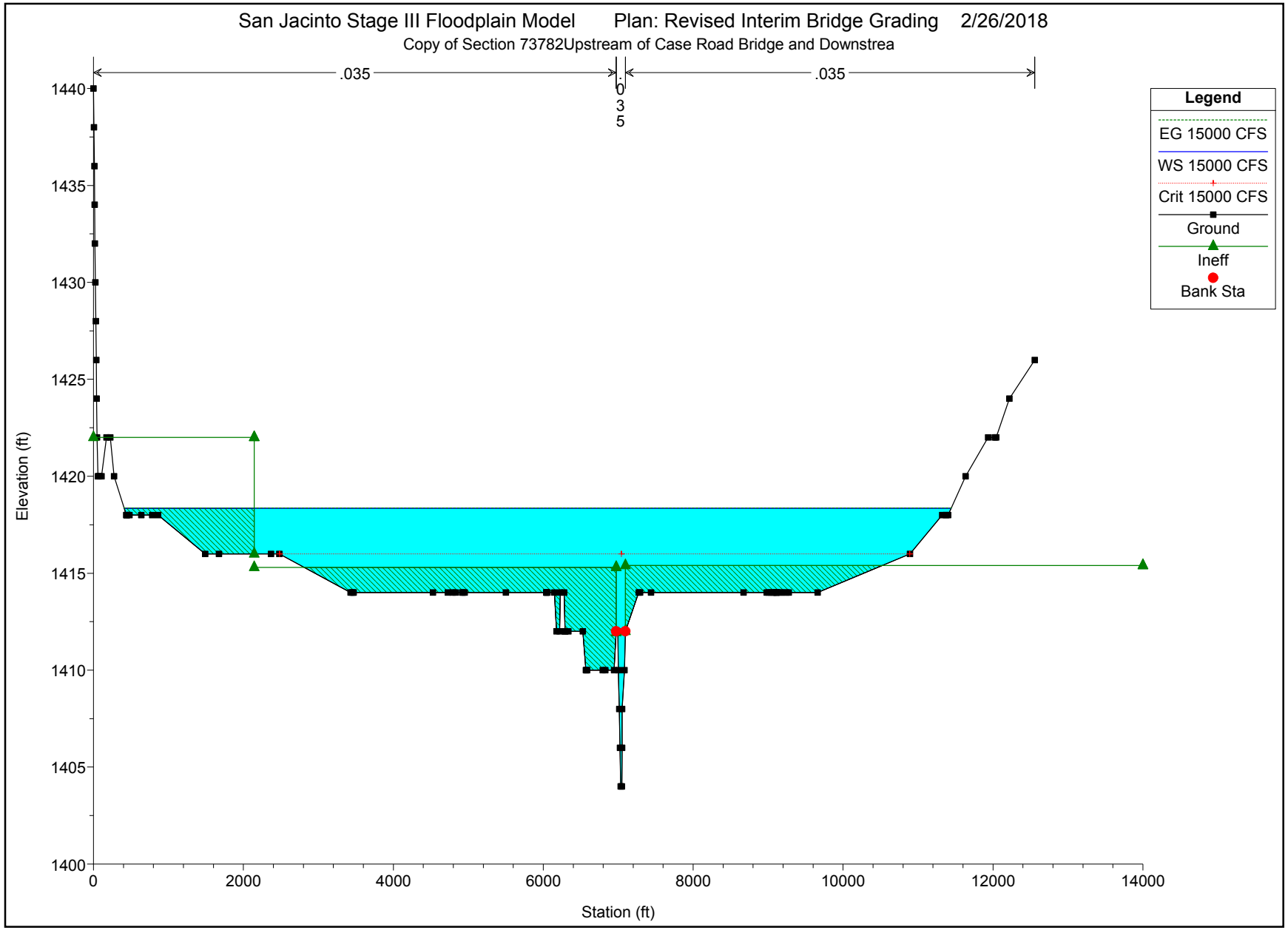
12000
14000
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
Copy of Section 73782Upstream of Case Road Bridge and Downstrea
.035
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Legend
EG 15000 CFS
WS 15000 CFS
Crit 15000 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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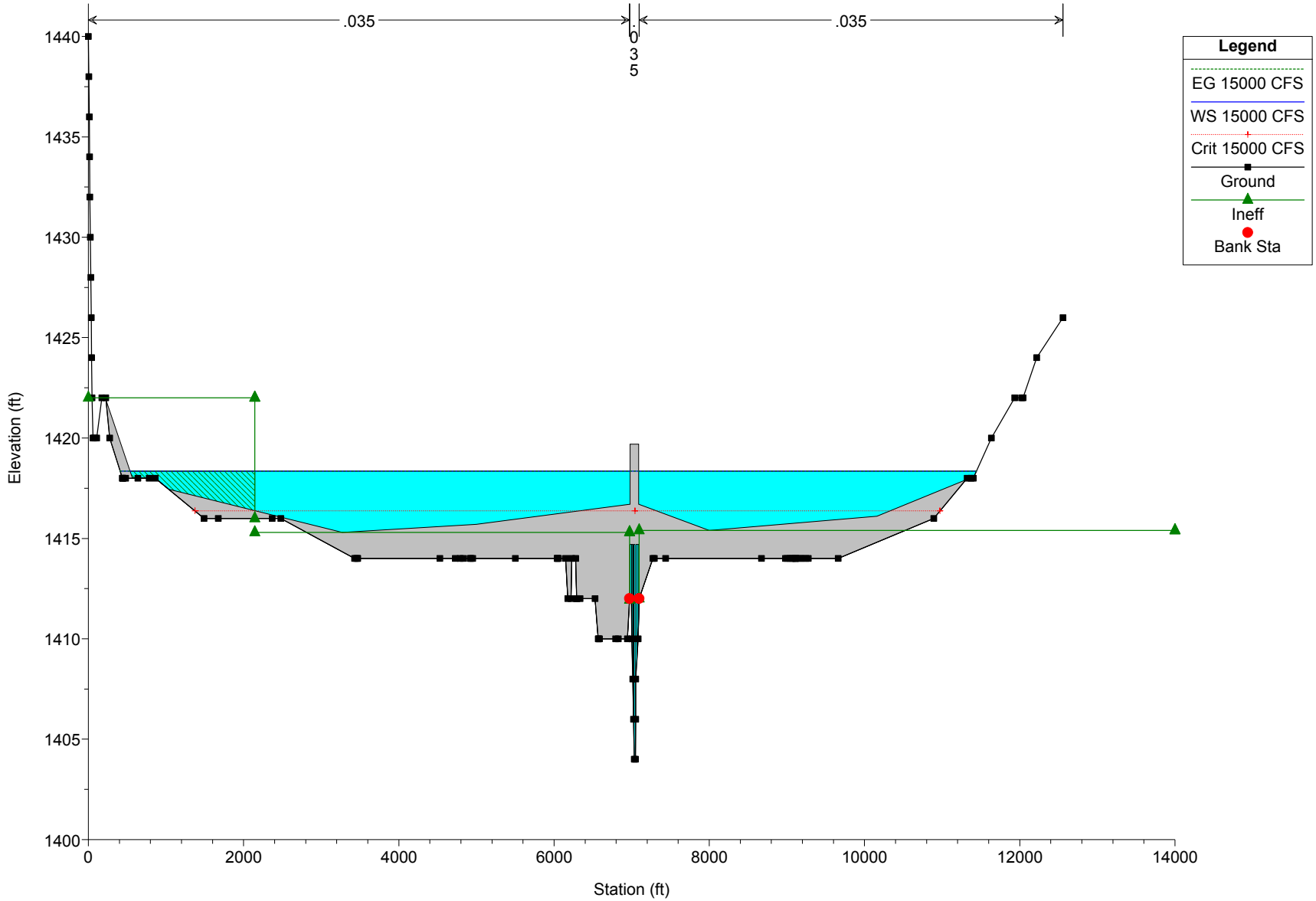
Station (ft)

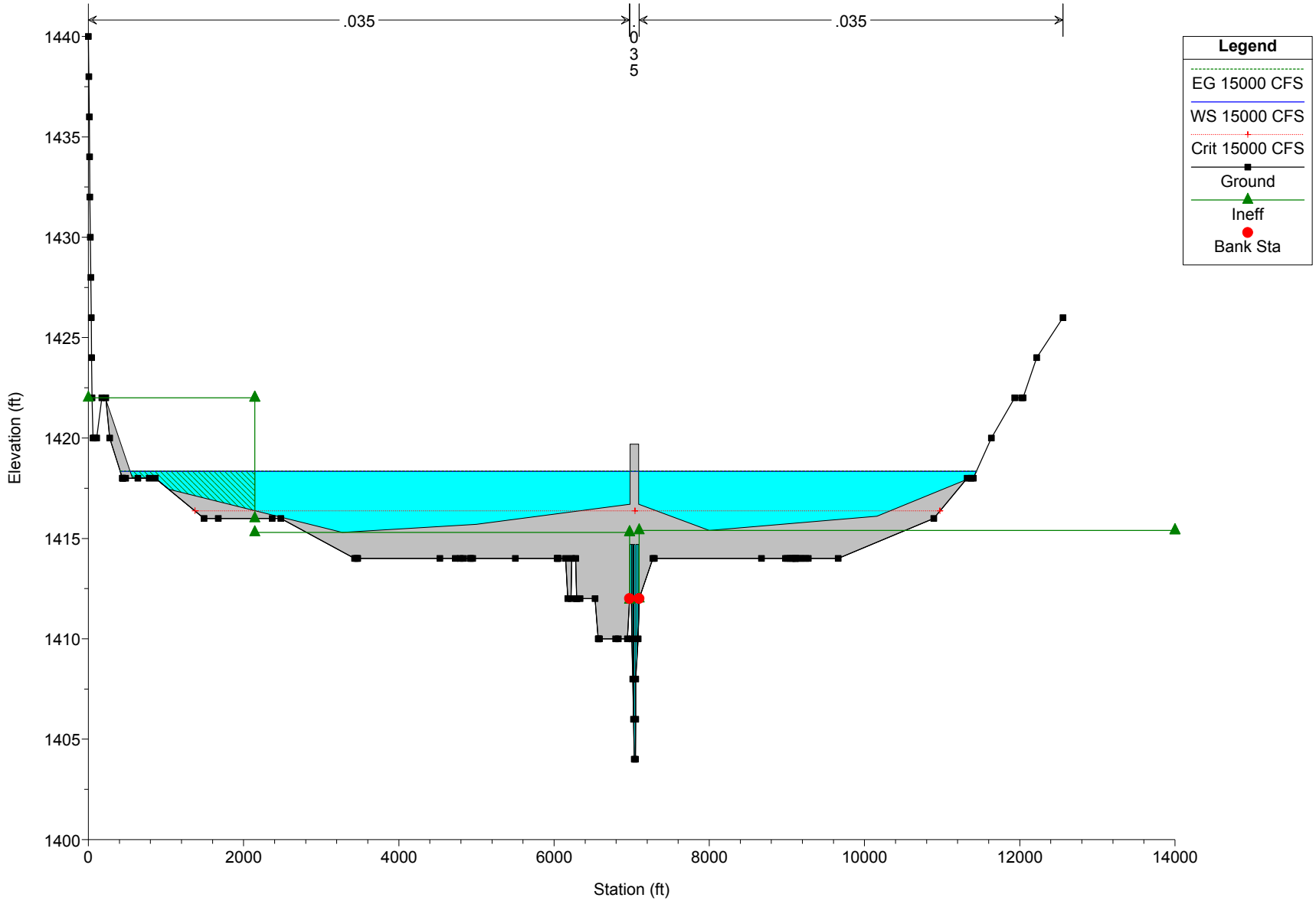
San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018

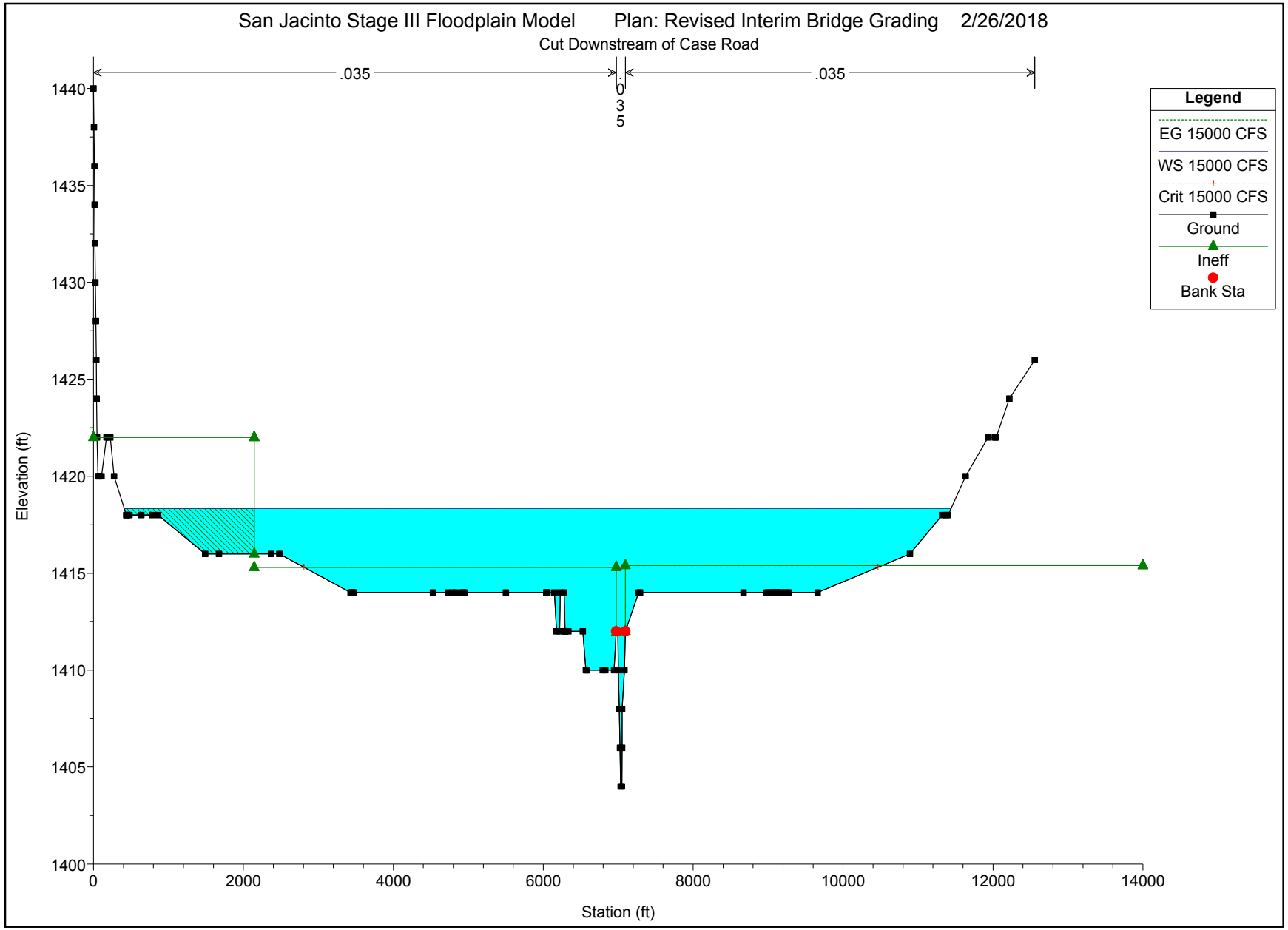
Case Road BridgeThis is based on field topo. The sections are



San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018

Case Road BridgeThis is based on field topo. The sections are




San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
Cut Downstream of Case Road
.035
.035
.035
Legend
EG 15000 CFS
WS 15000 CFS
Crit 15000 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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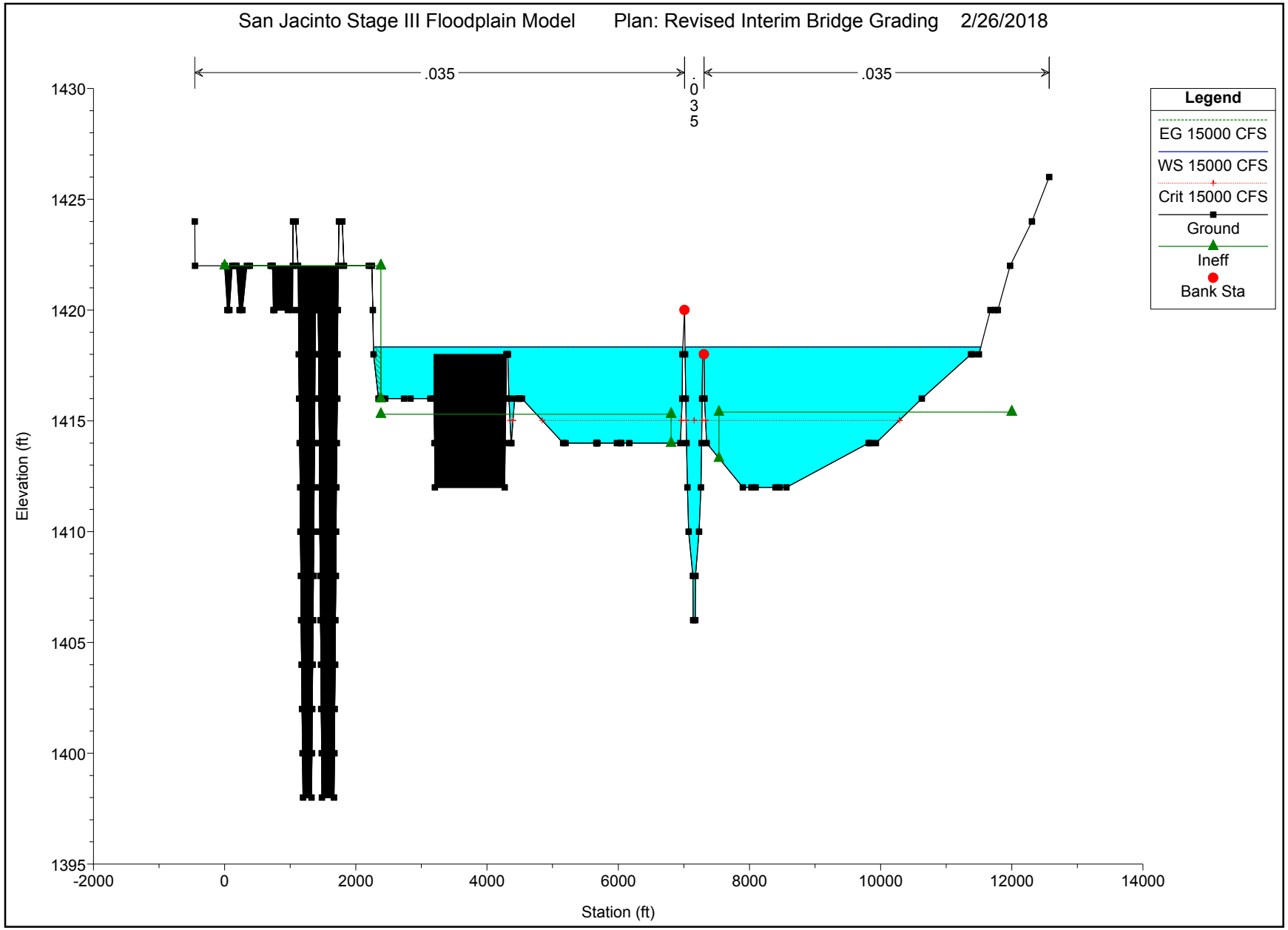
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
.035
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Legend
EG 15000 CFS
WS 15000 CFS
Crit 15000 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
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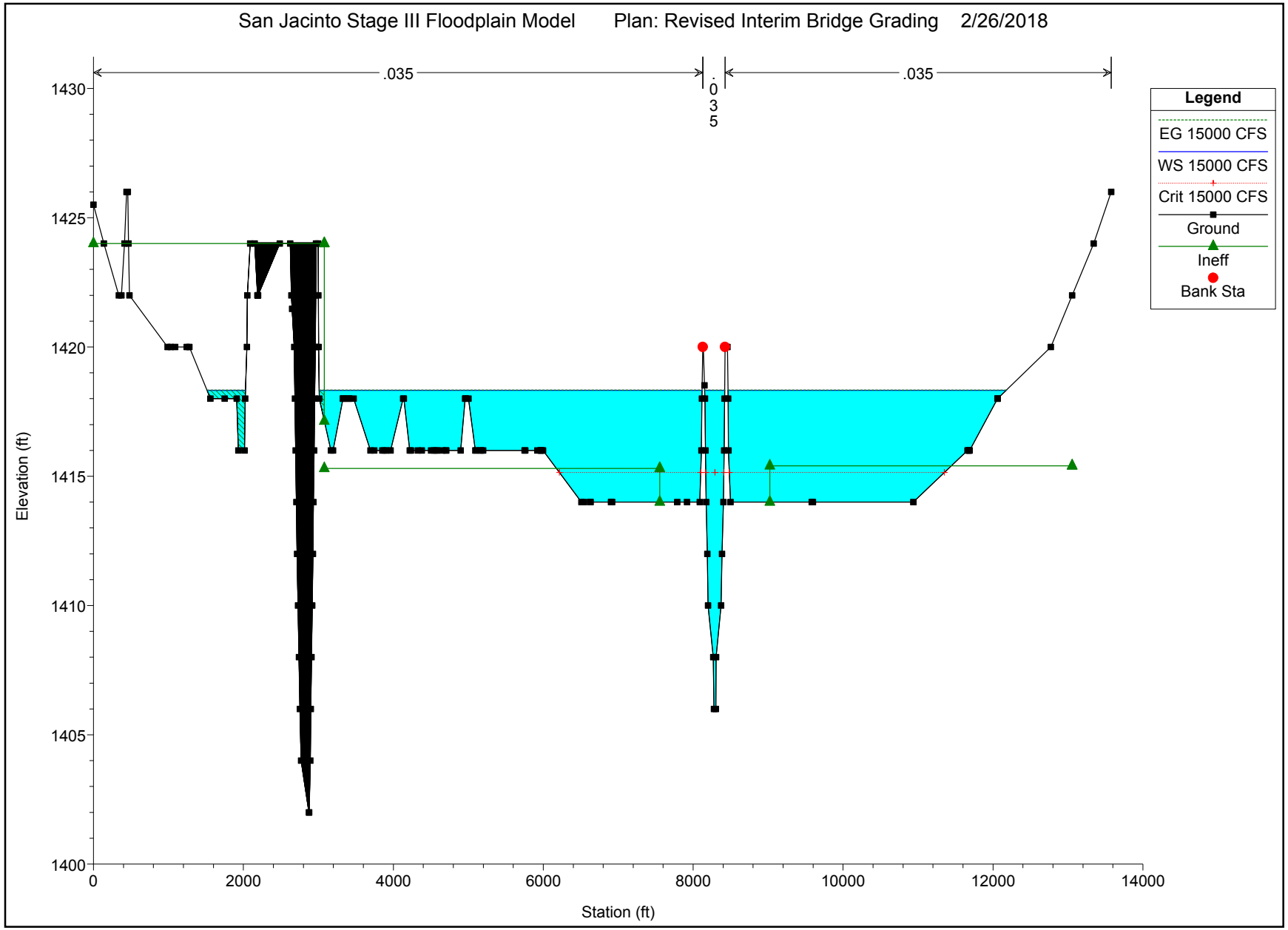
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
.035
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Legend
EG 15000 CFS
WS 15000 CFS
Crit 15000 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
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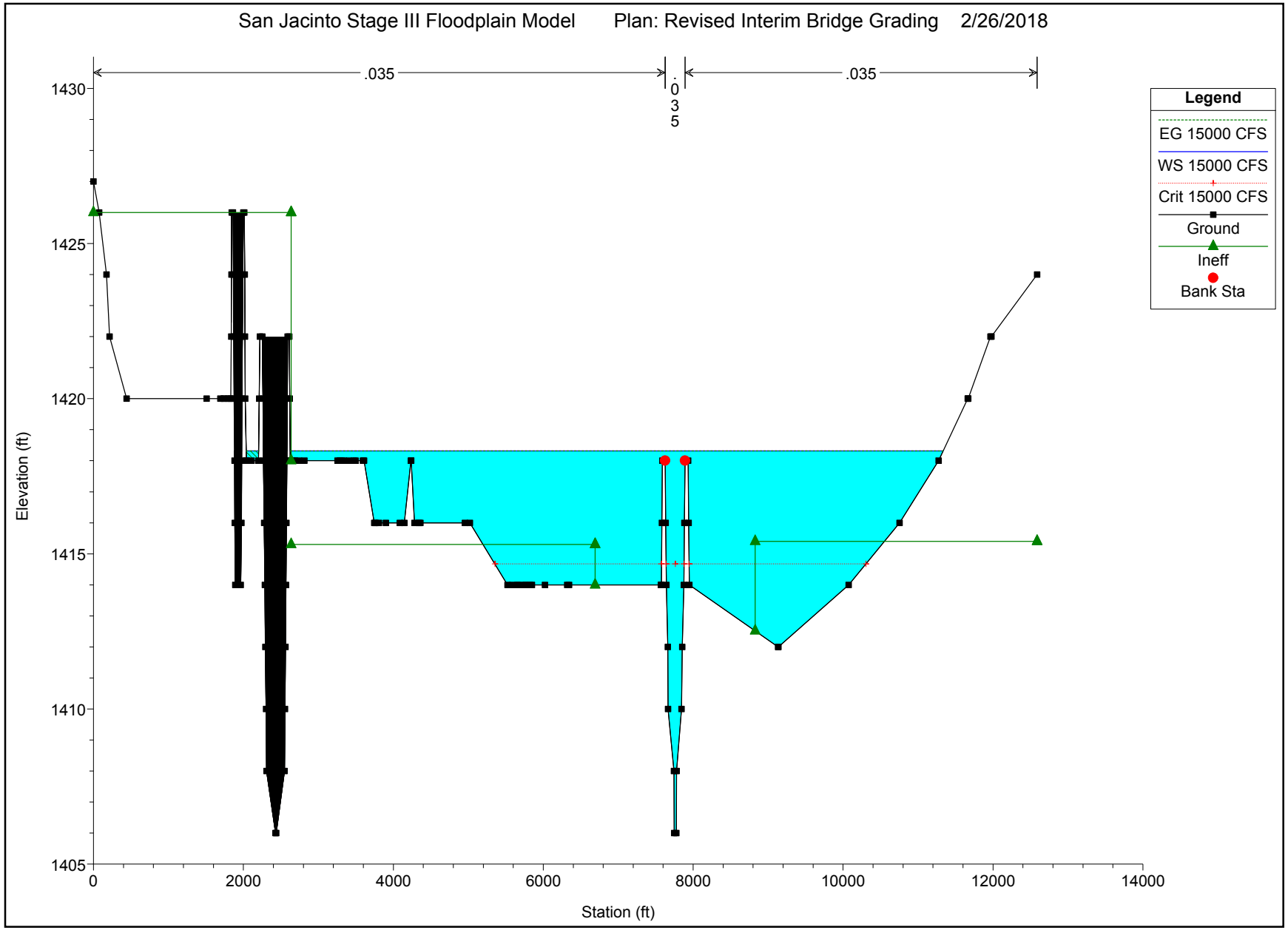
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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WS 15000 CFS
Crit 15000 CFS
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Elevation (ft)
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Station (ft)
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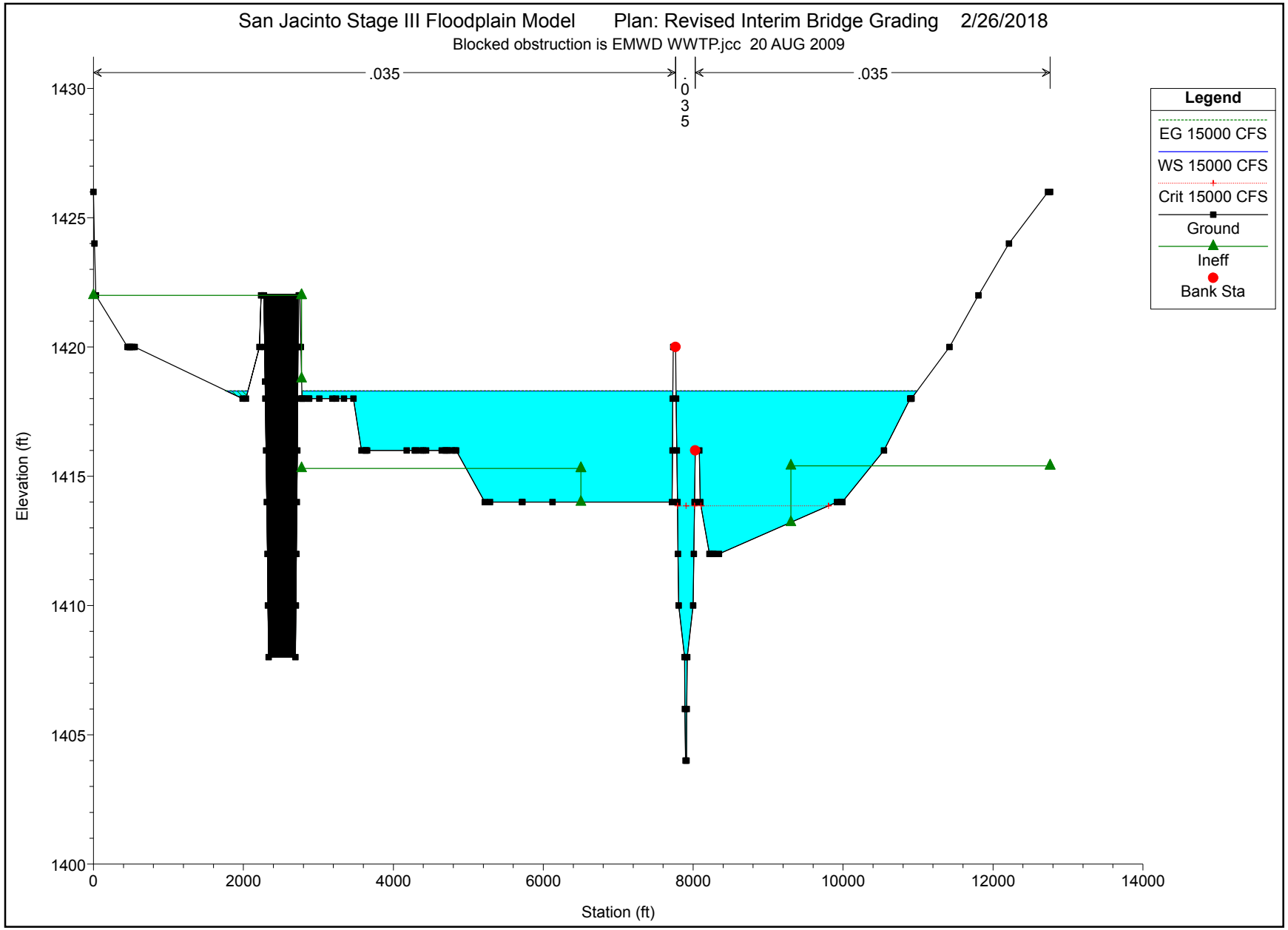
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
Blocked obstruction is EMWD WWTP.jcc 20 AUG 2009
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Legend
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Elevation (ft)
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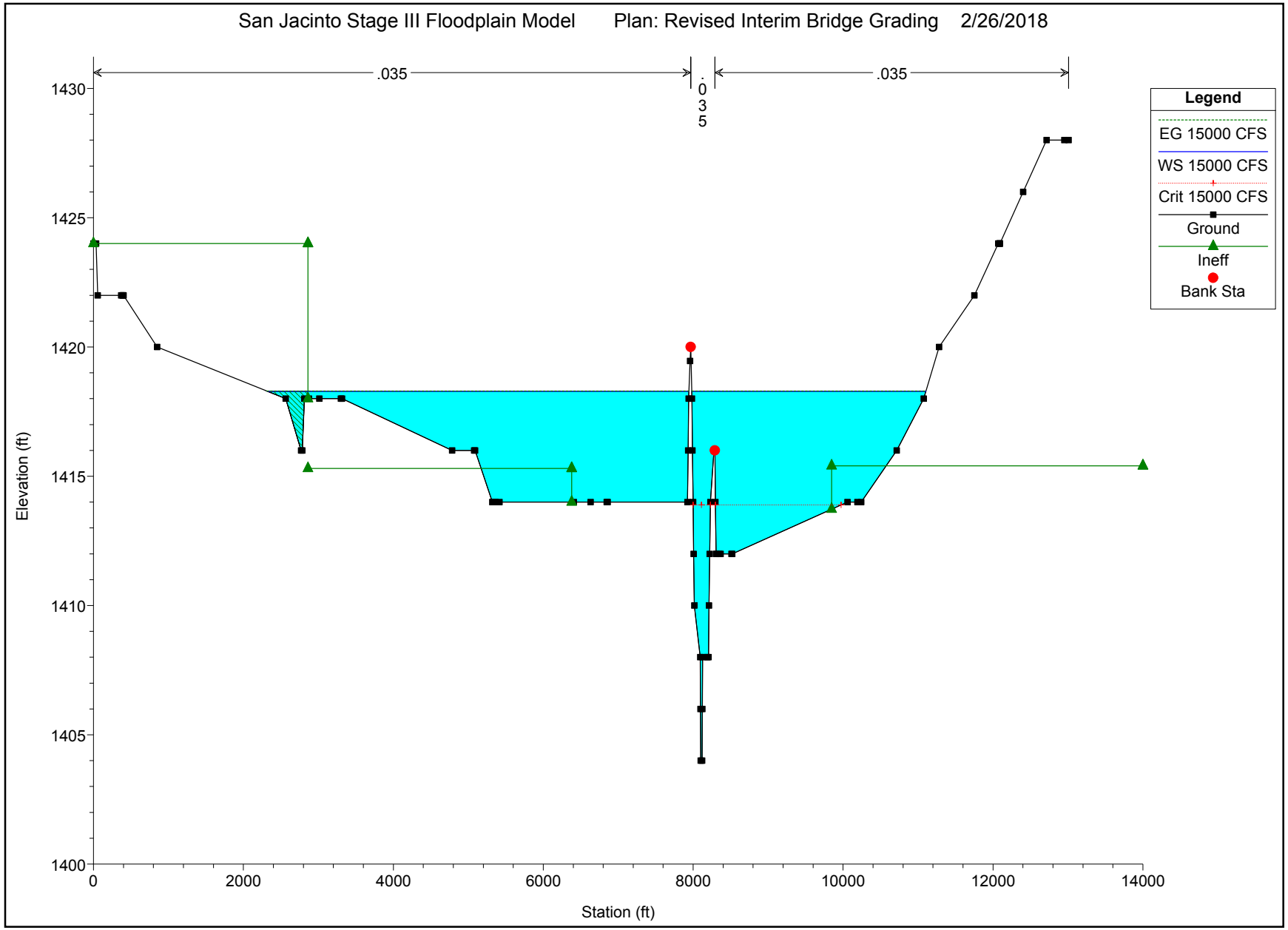
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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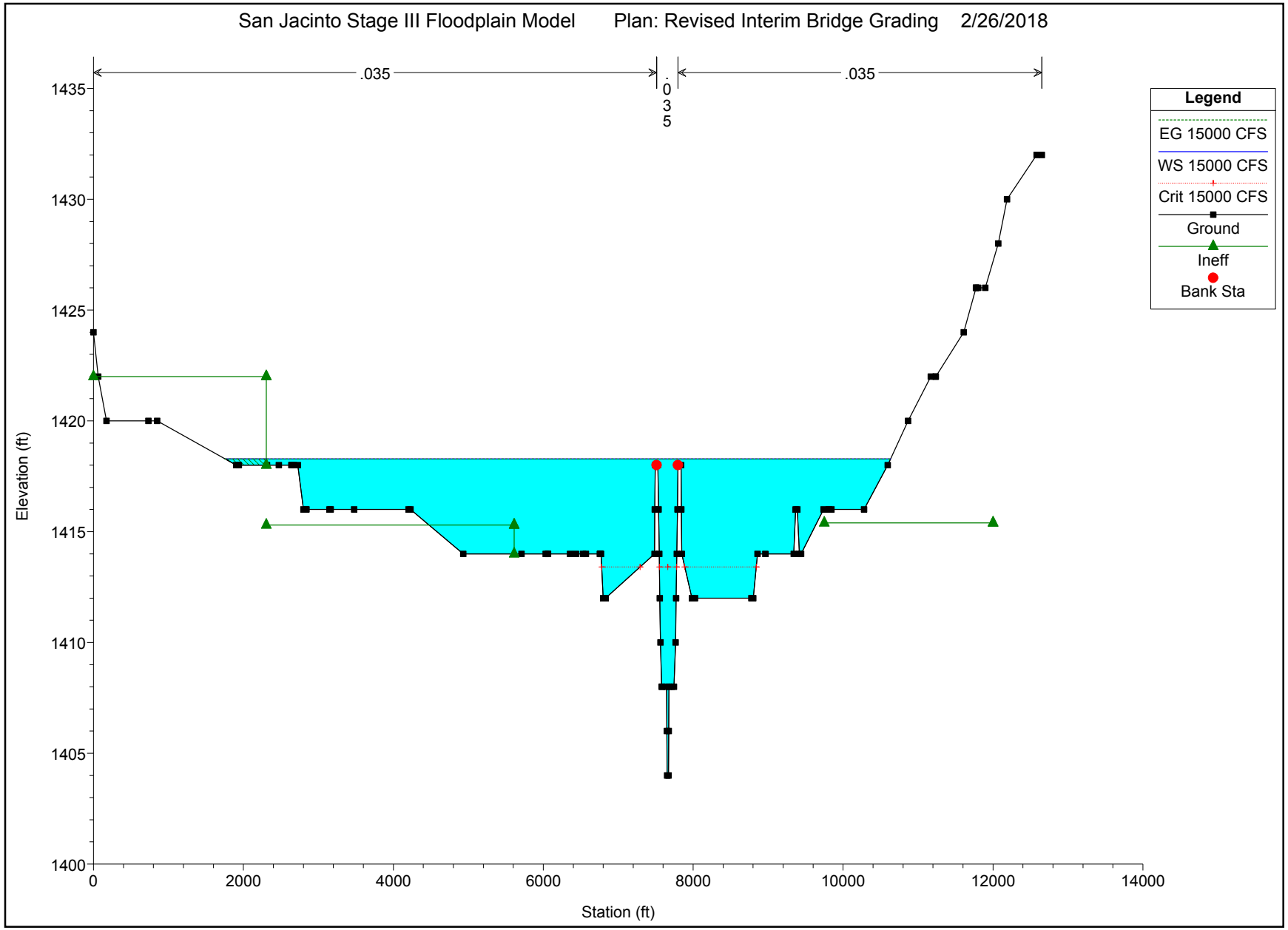
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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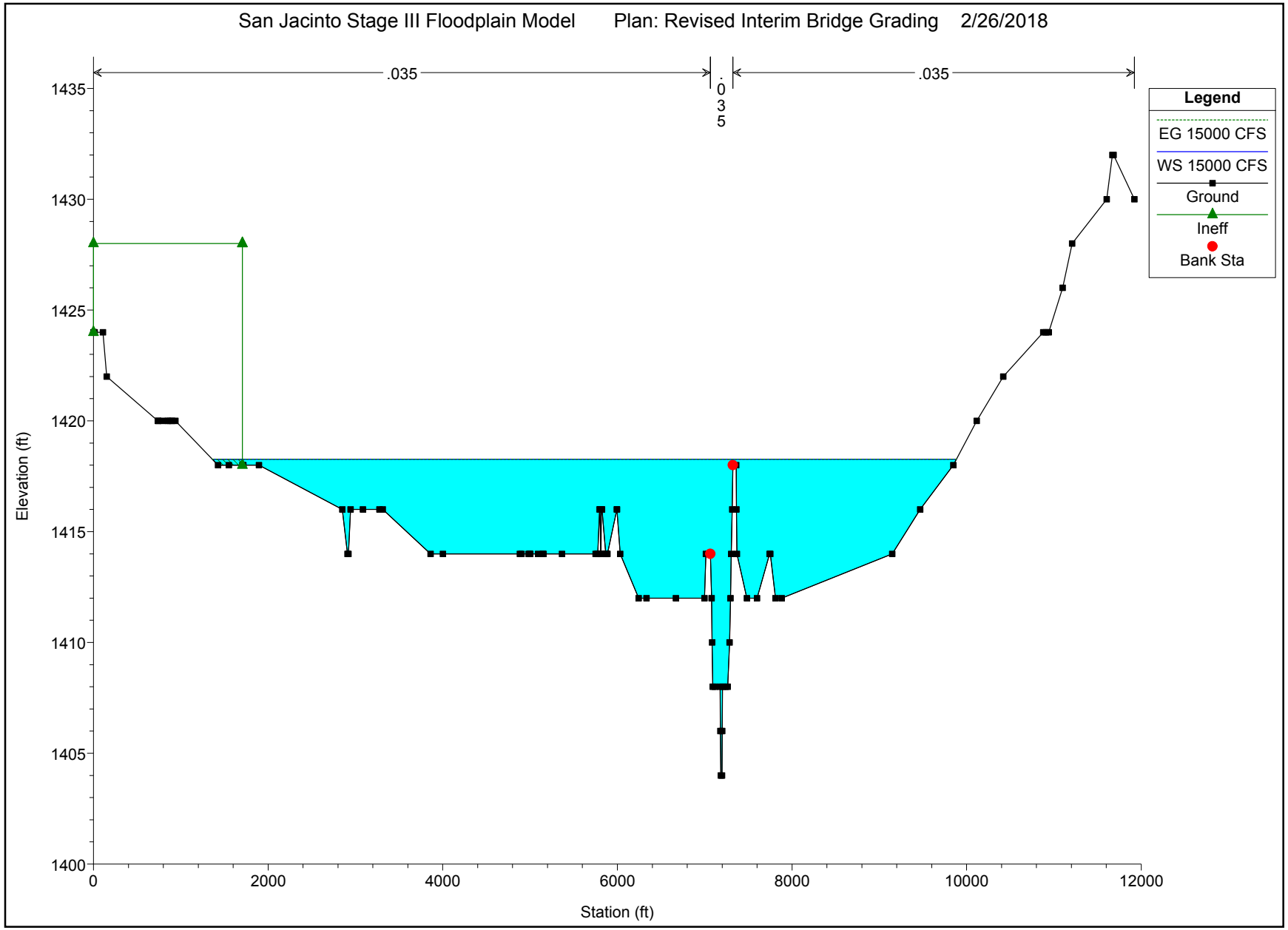
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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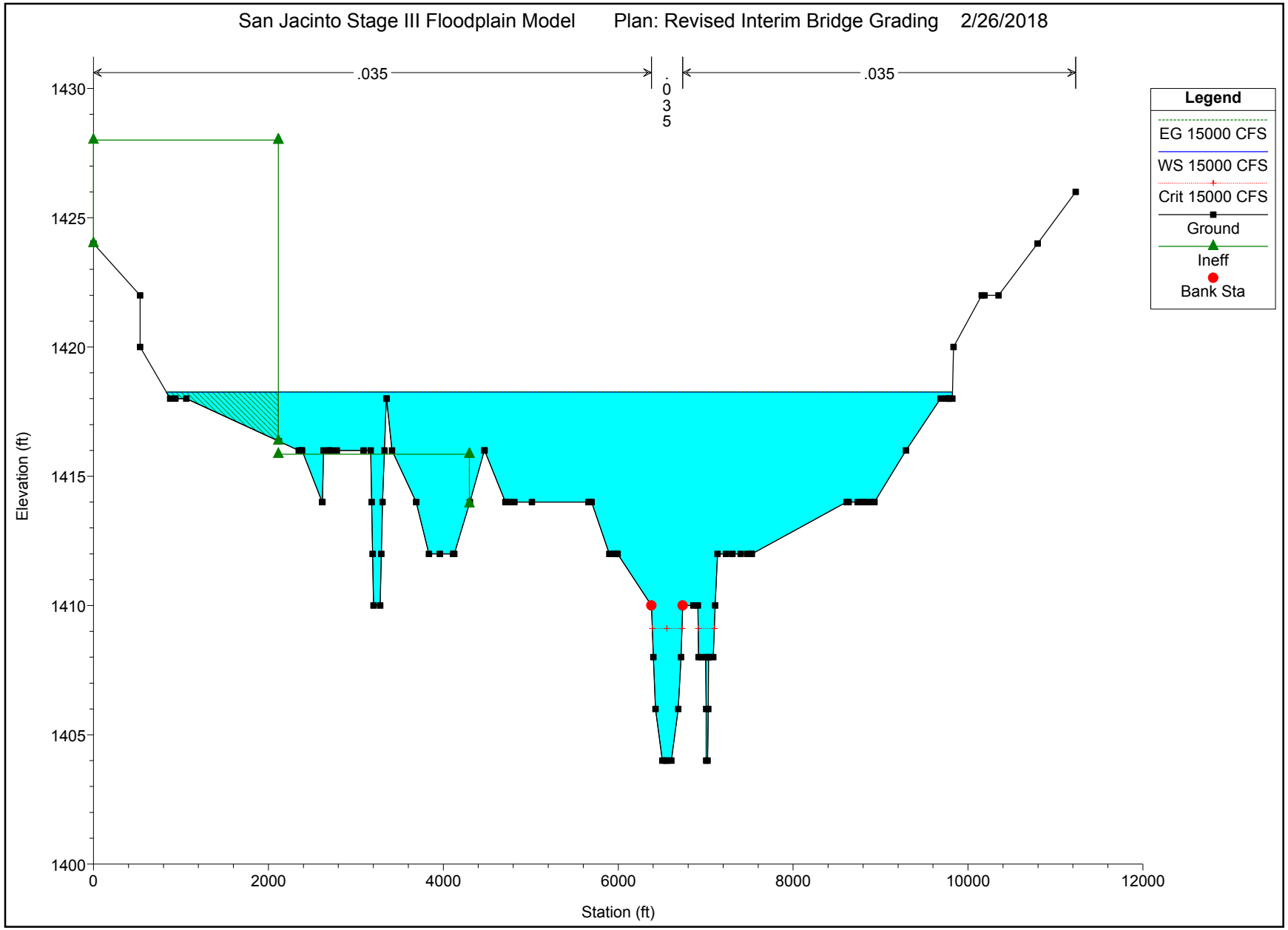
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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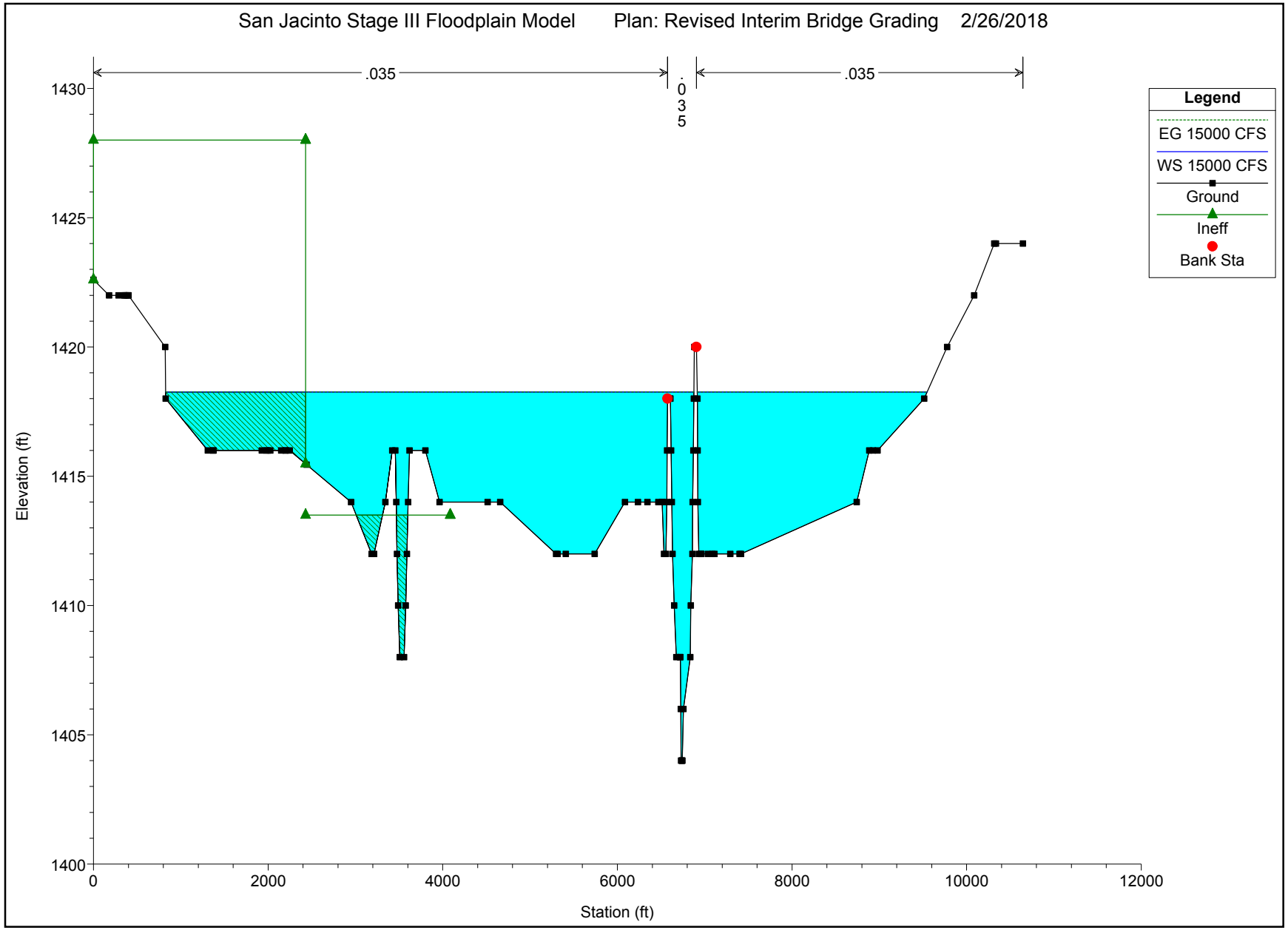
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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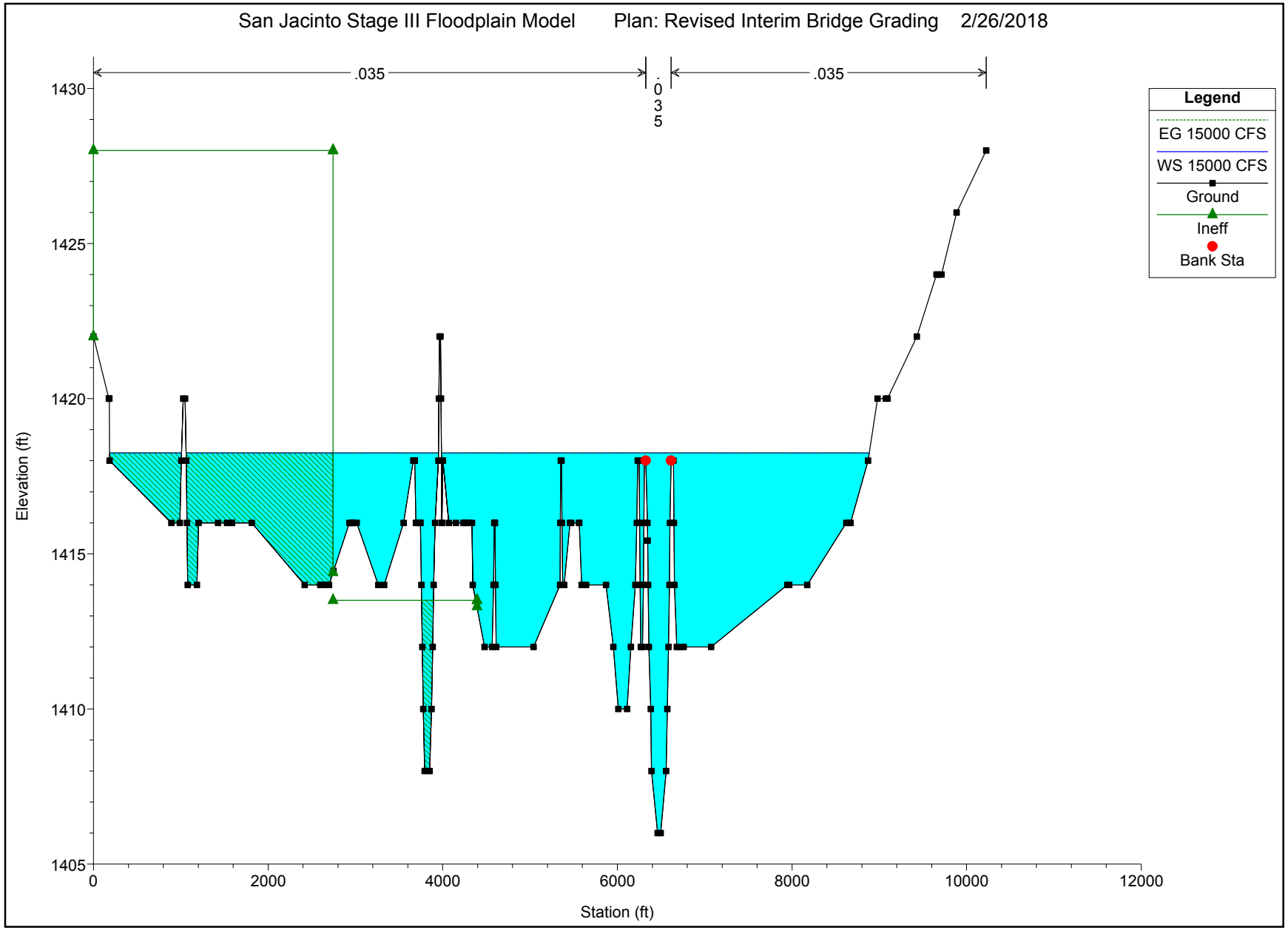
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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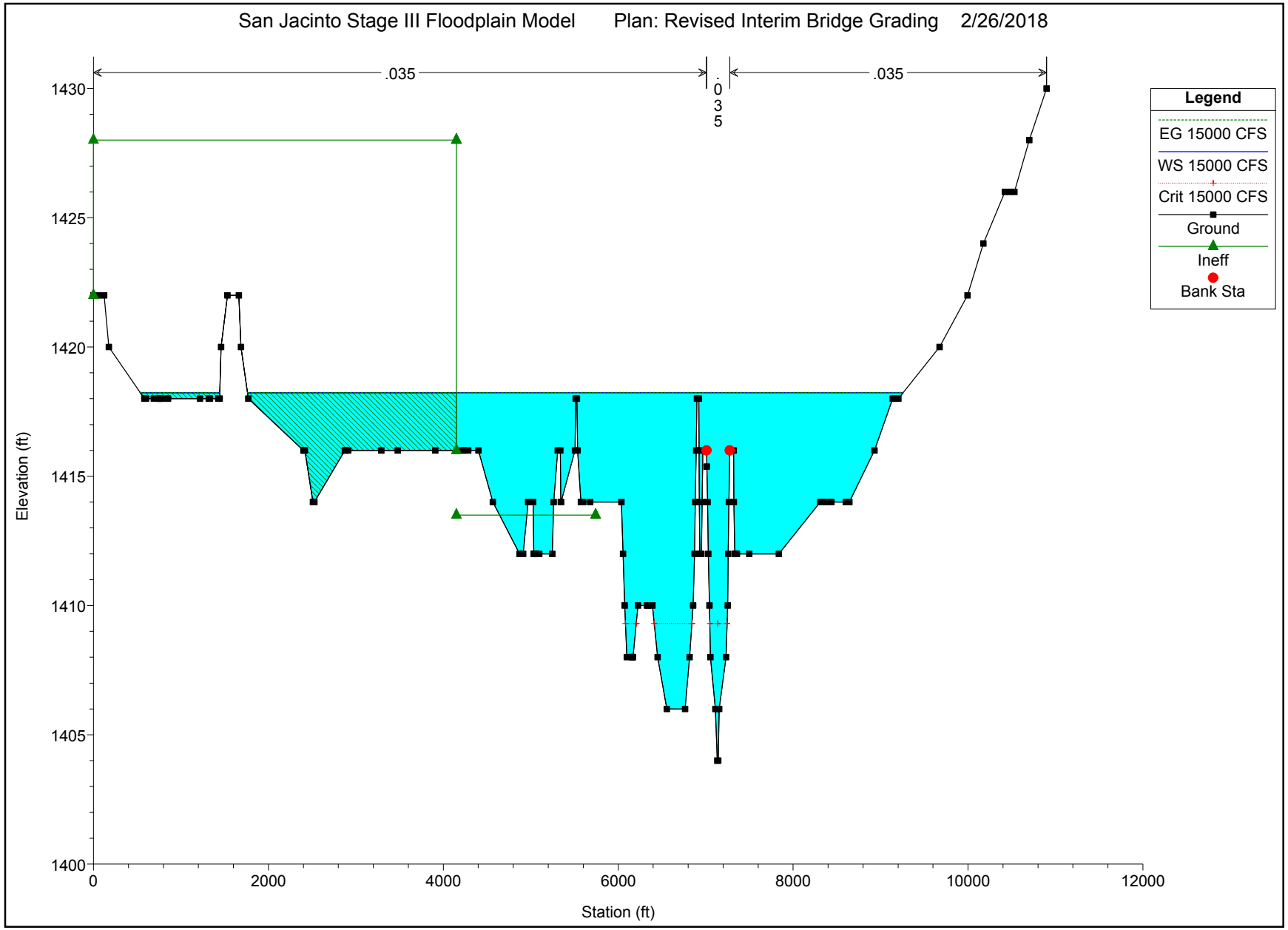
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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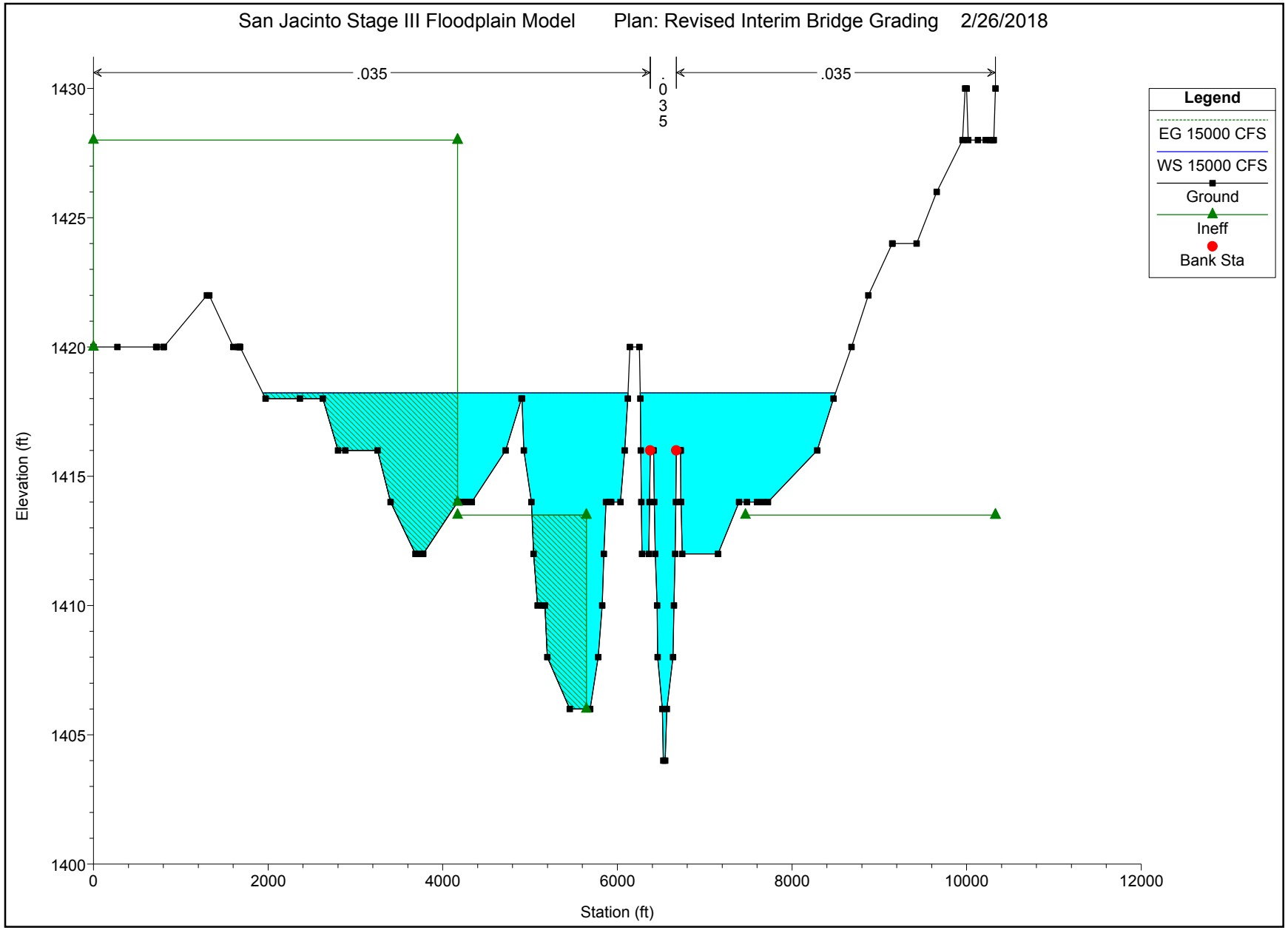
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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Ground
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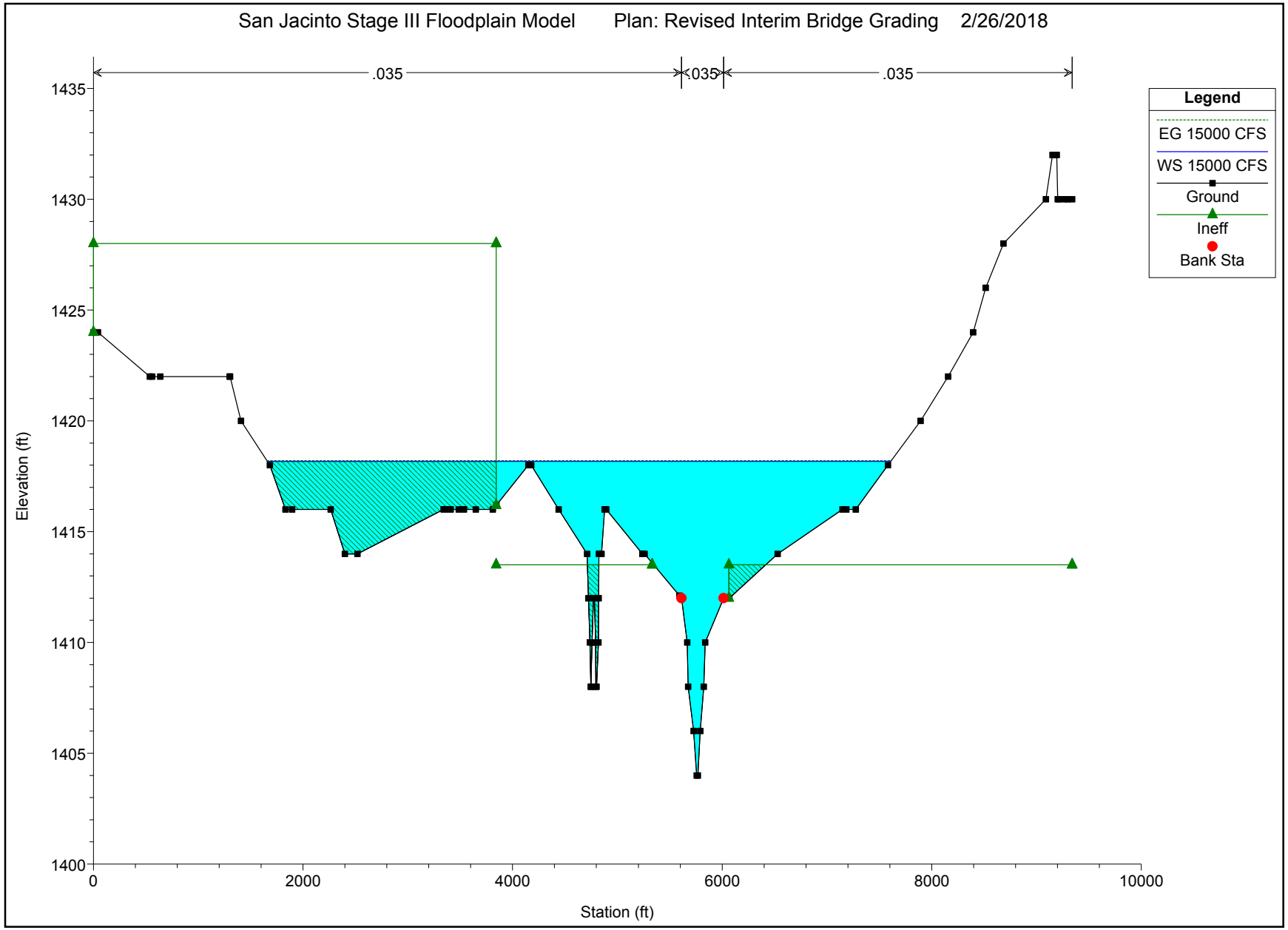
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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Elevation (ft)
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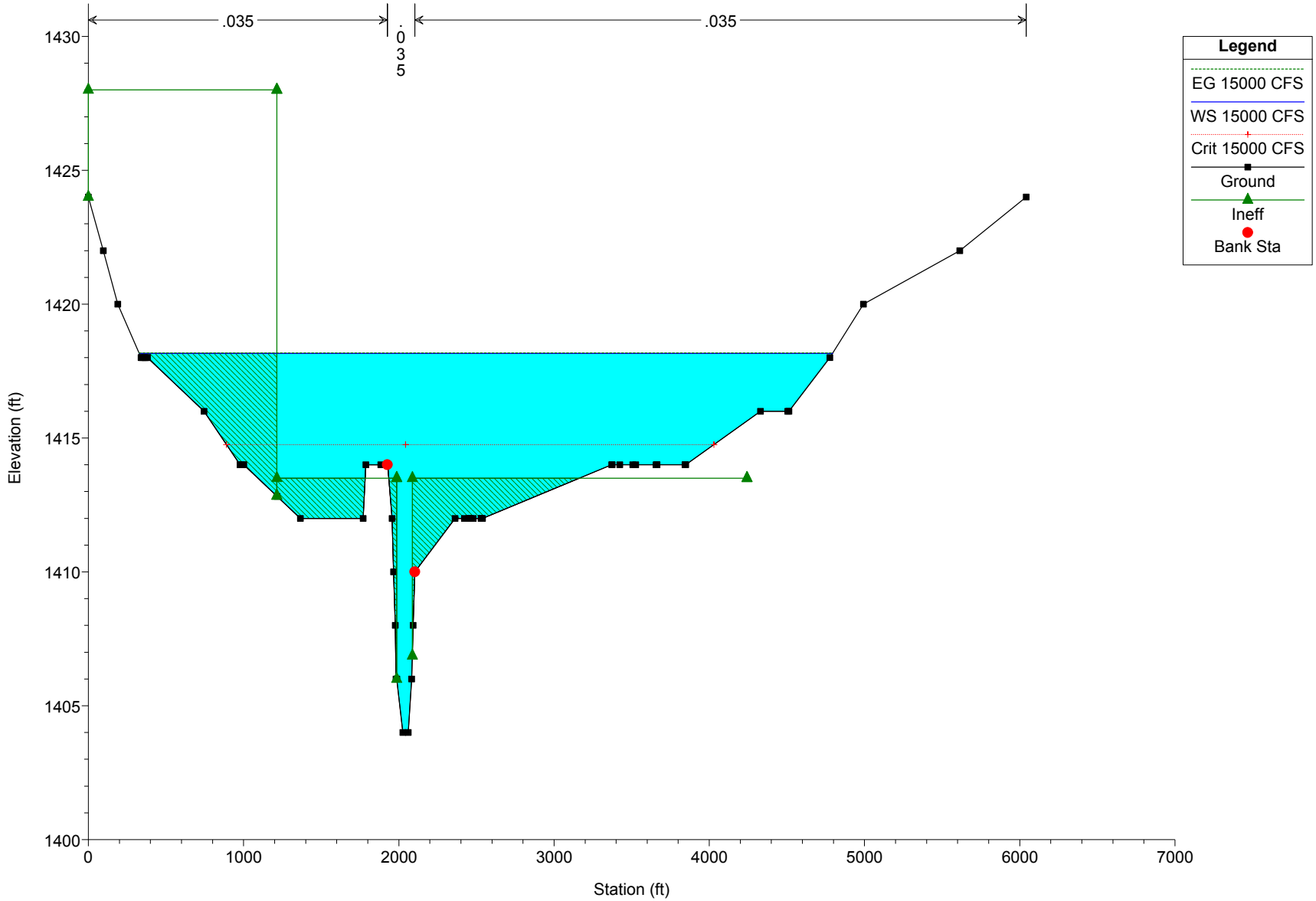
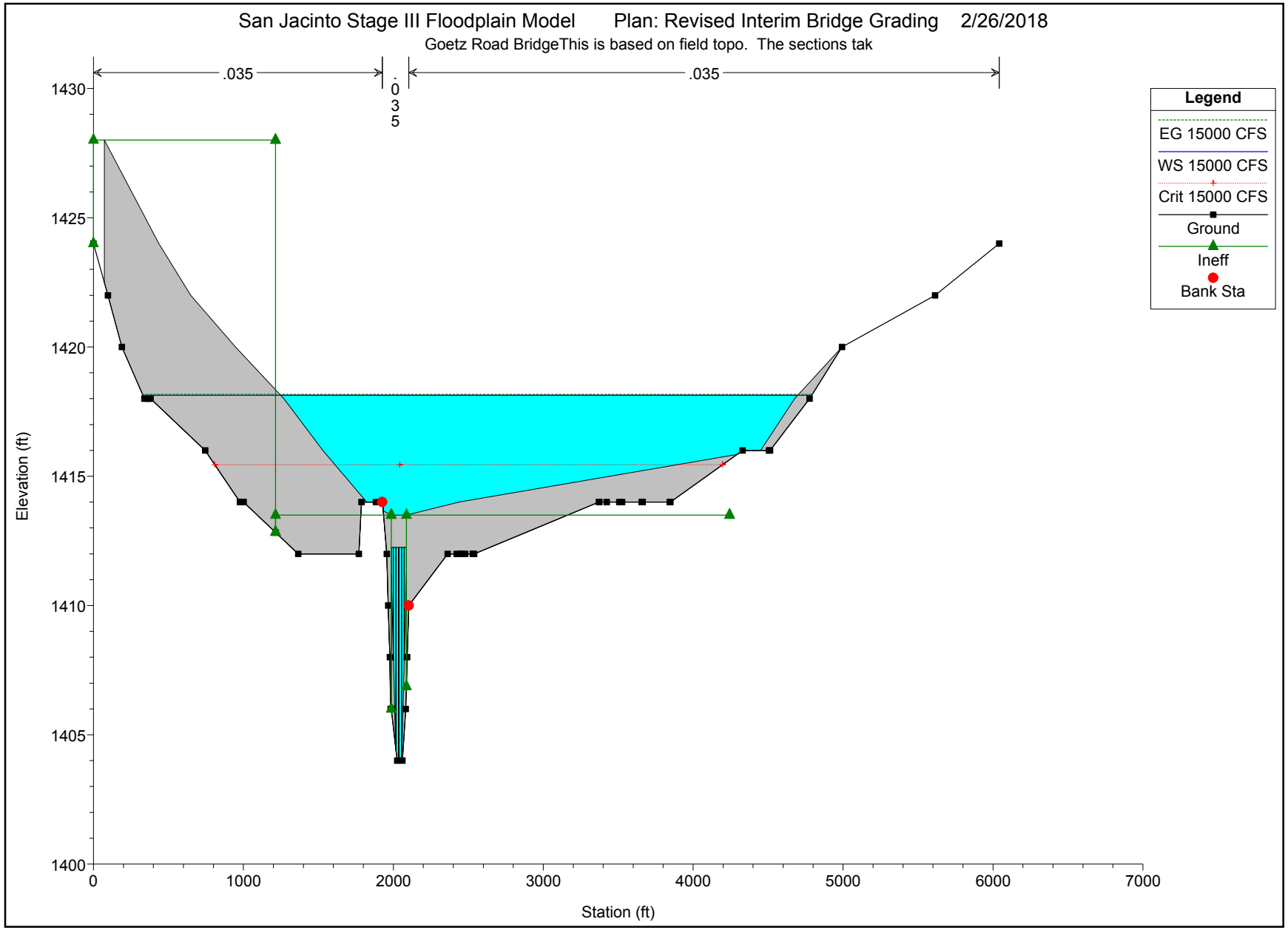
Station (ft)

San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018

Section Taken Just Upstream of Goetz Road - This section will be




San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
Goetz Road BridgeThis is based on field topo. The sections tak
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Legend
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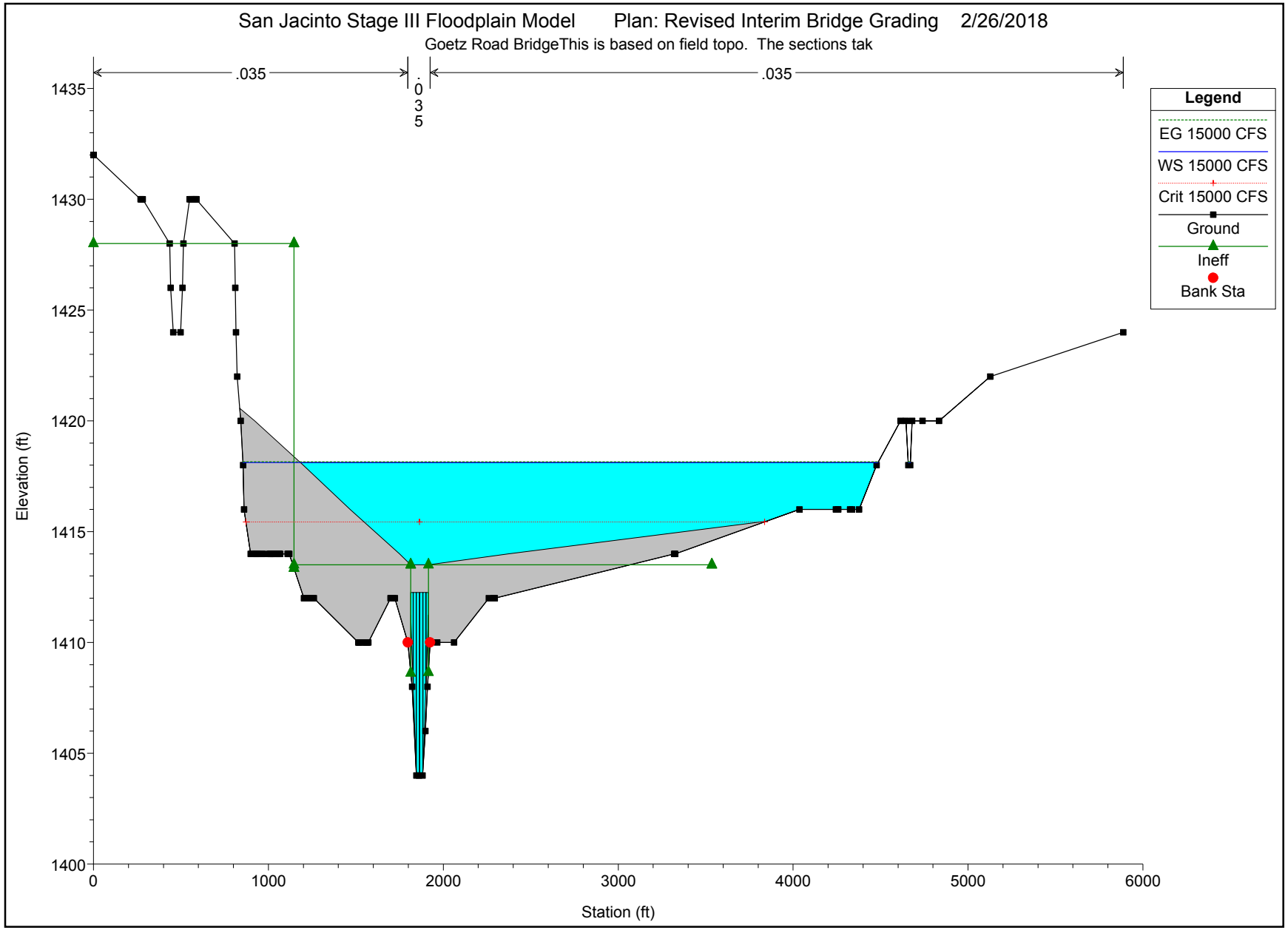
San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018
Goetz Road BridgeThis is based on field topo. The sections tak
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Legend
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Crit 15000 CFS
Ground
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Elevation (ft)
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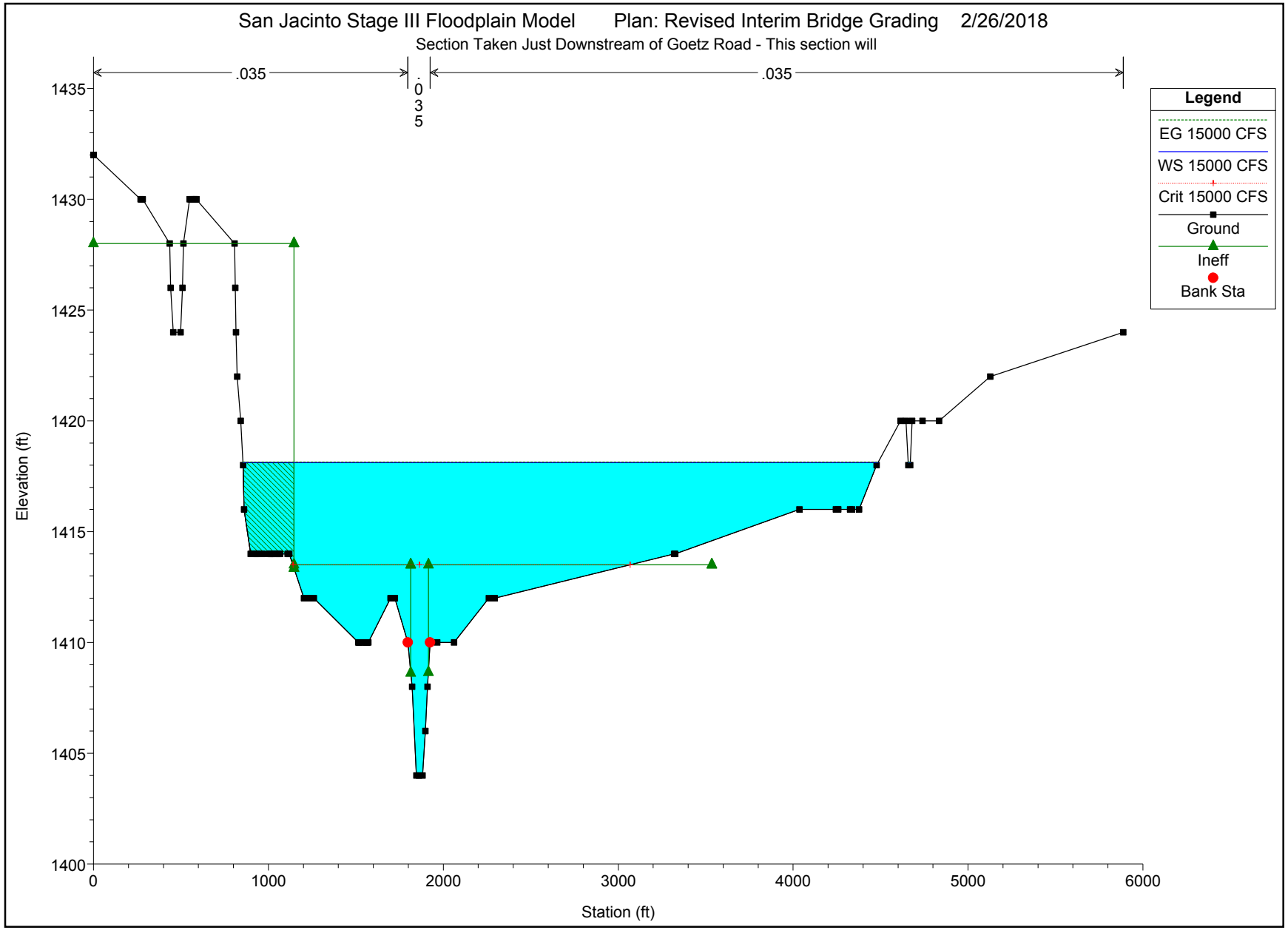
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
Section Taken Just Downstream of Goetz Road - This section will
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Legend
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WS 15000 CFS
Crit 15000 CFS
Ground
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Elevation (ft)
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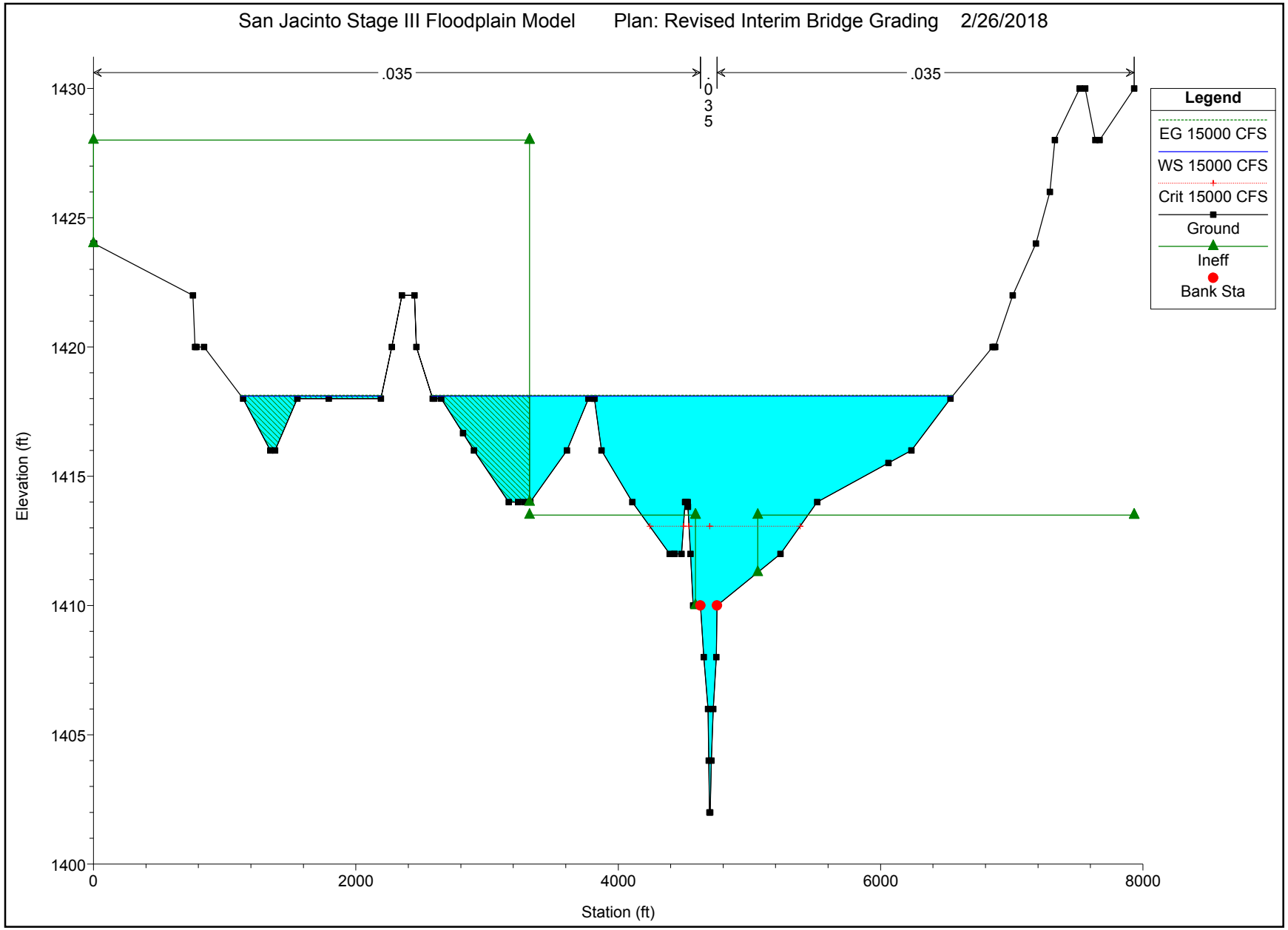
San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 15000 CFS
WS 15000 CFS
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Ground
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Elevation (ft)
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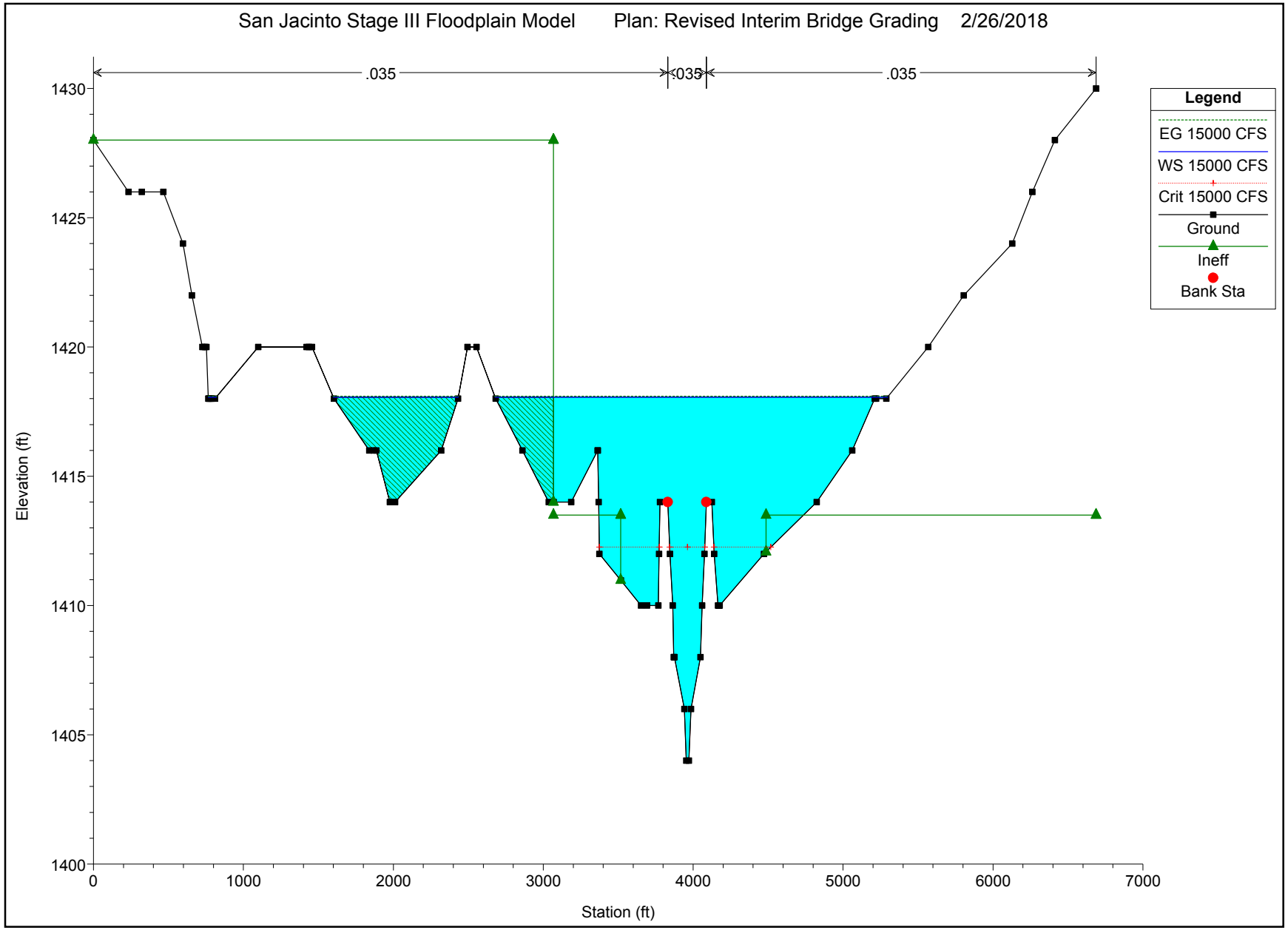
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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Elevation (ft)
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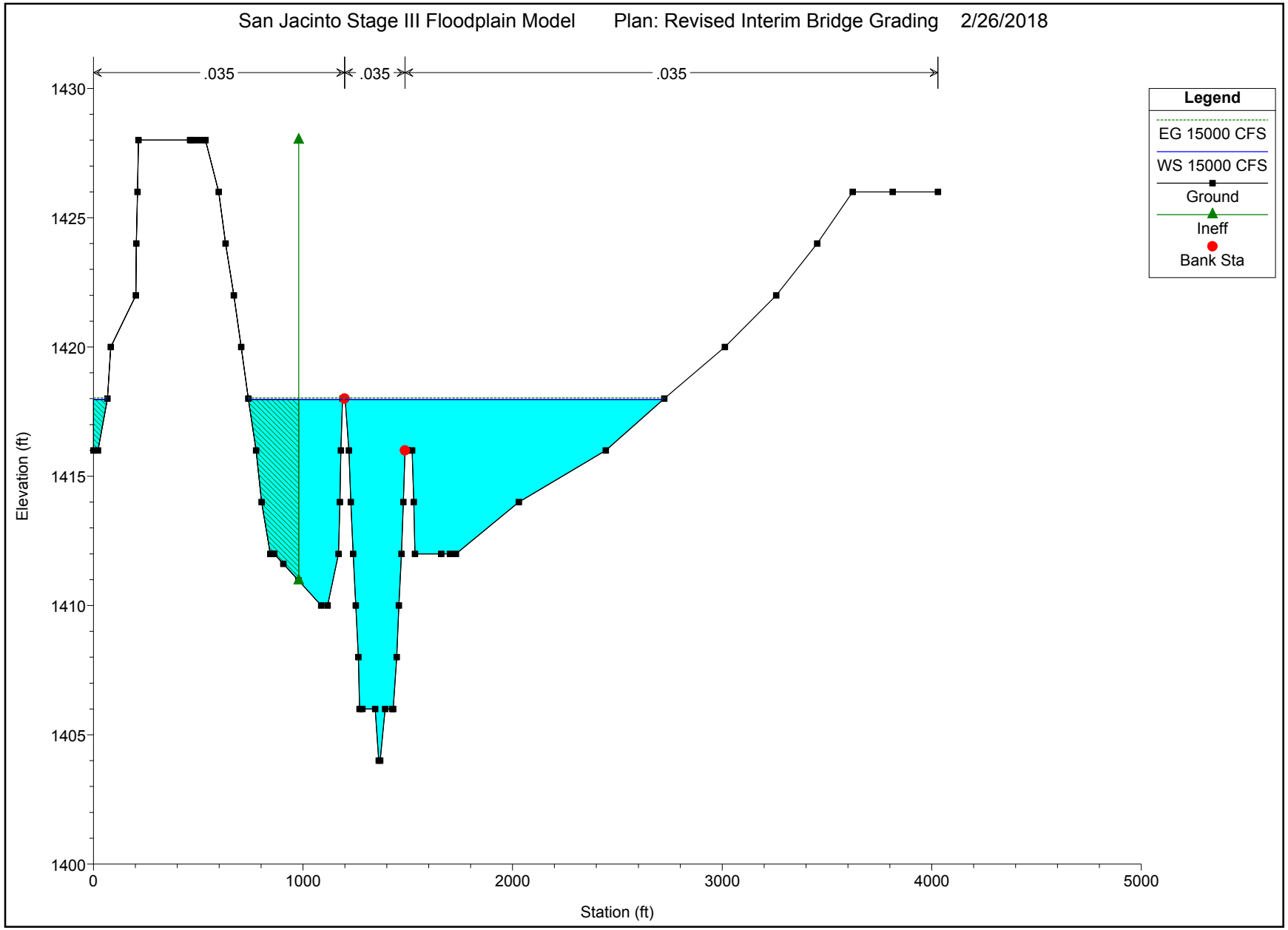
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 15000 CFS
WS 15000 CFS
Ground
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Bank Sta
Elevation (ft)
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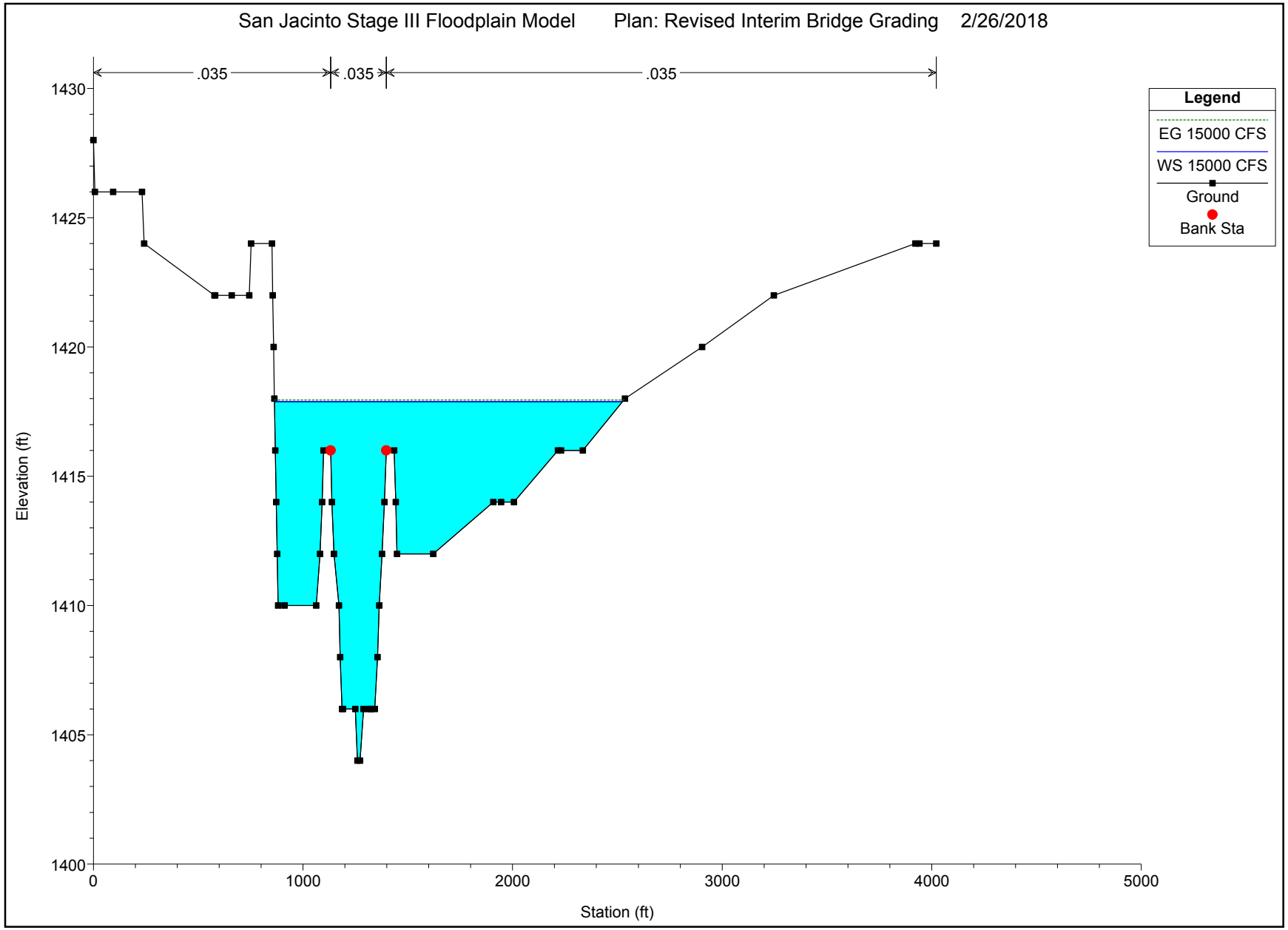
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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Ground
Bank Sta
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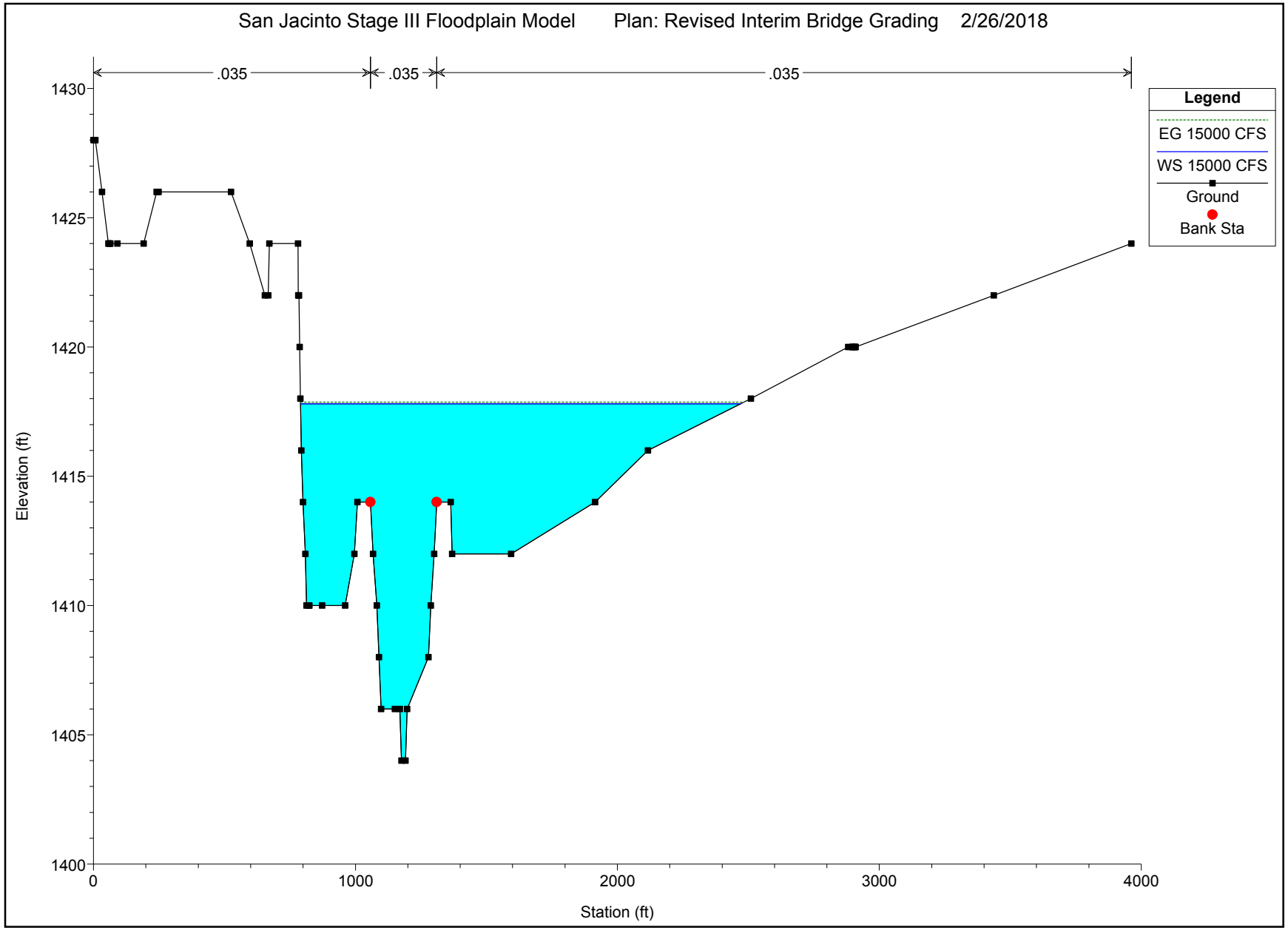
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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WS 15000 CFS
Ground
Bank Sta
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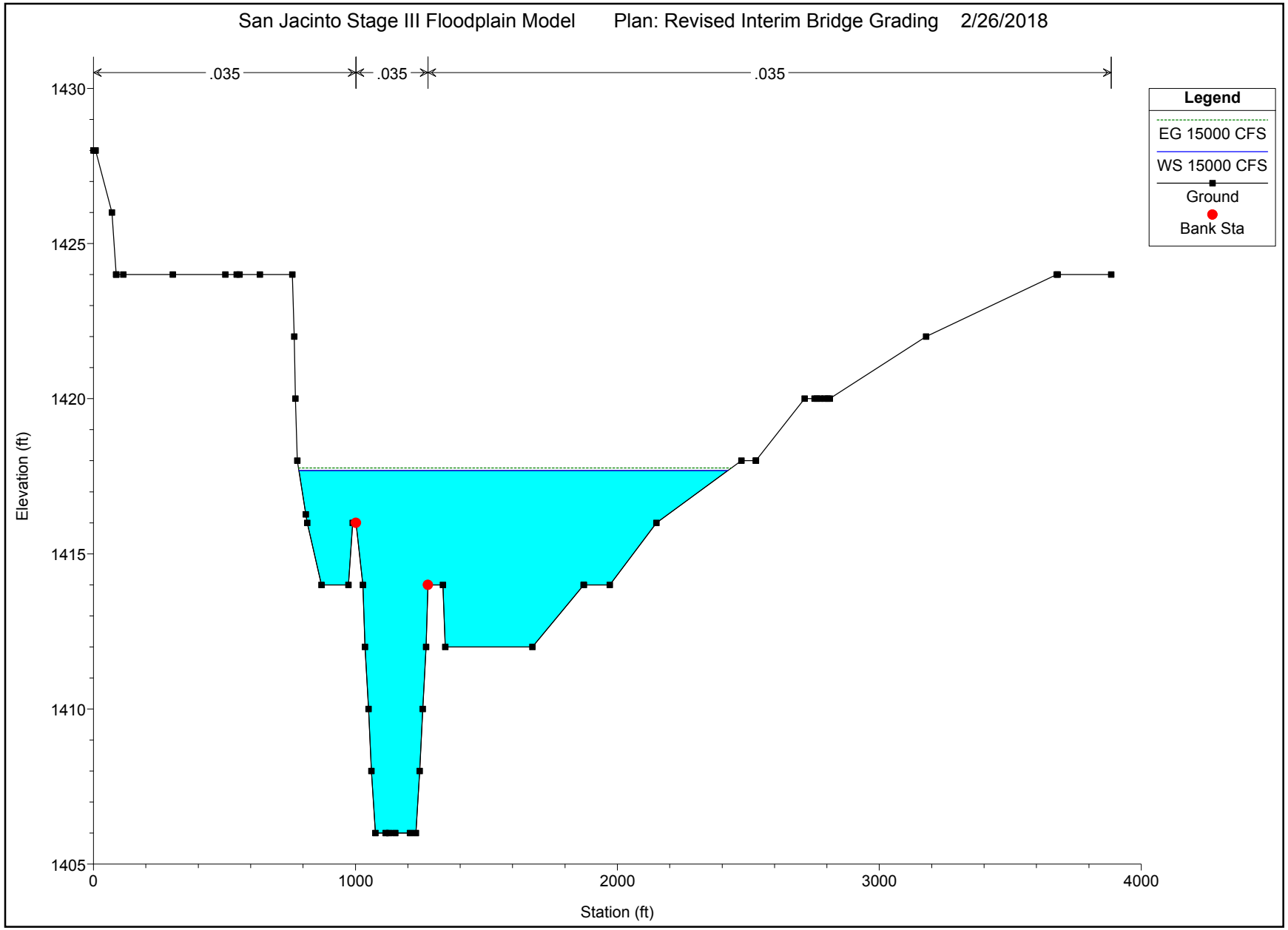
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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WS 15000 CFS
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Bank Sta
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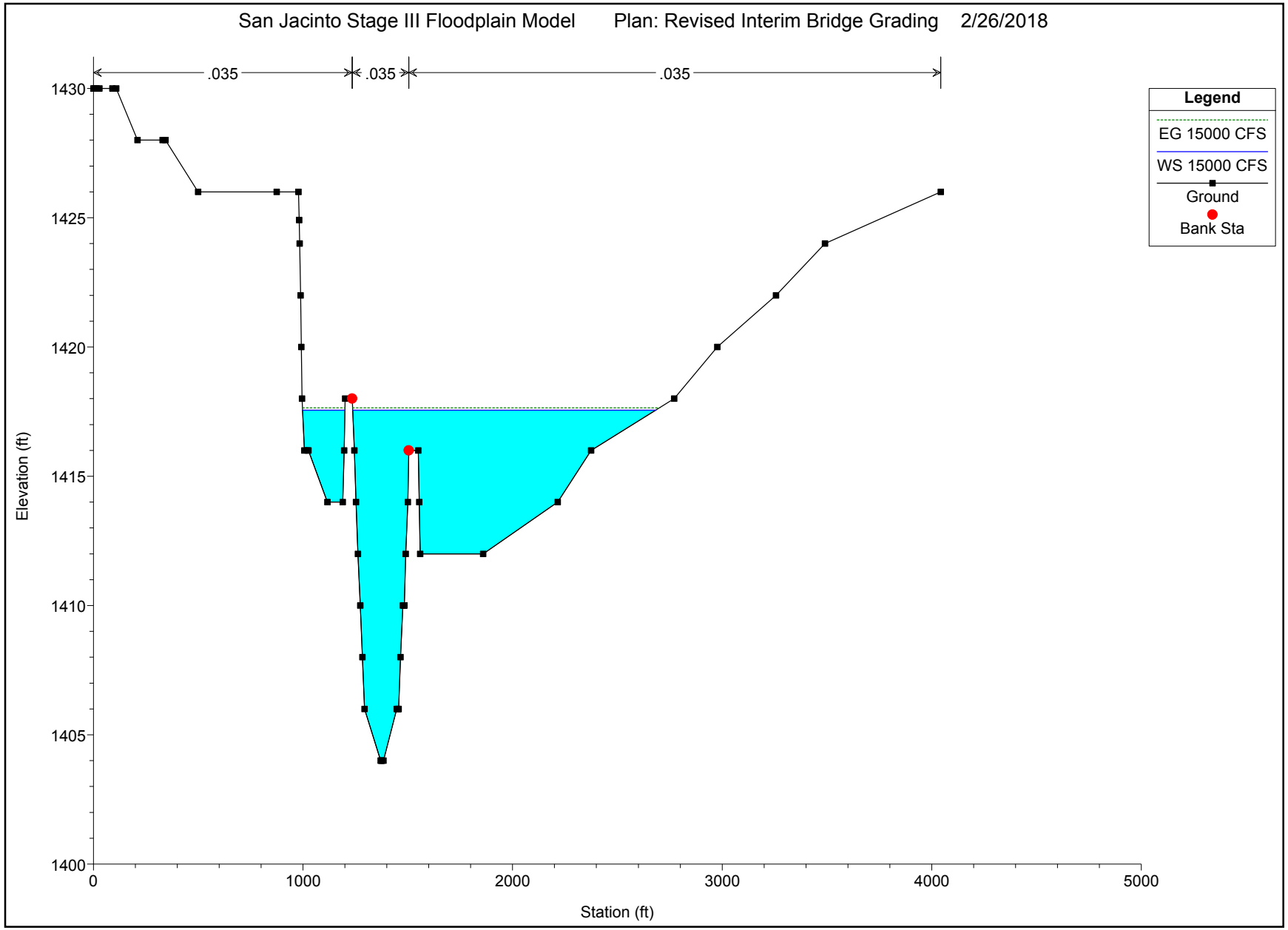
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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WS 15000 CFS
Ground
Bank Sta
Elevation (ft)
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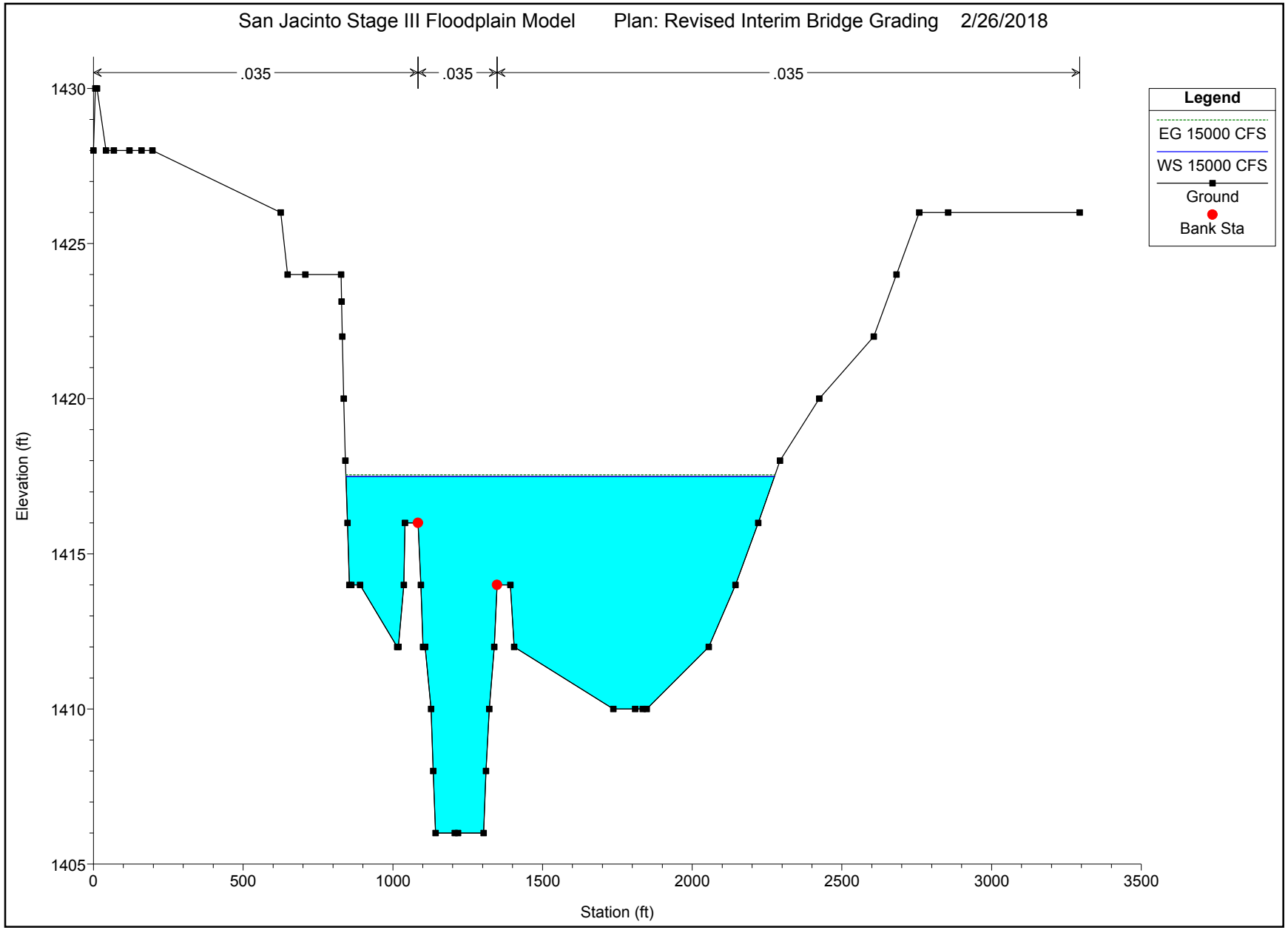
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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WS 15000 CFS
Ground
Bank Sta
Elevation (ft)
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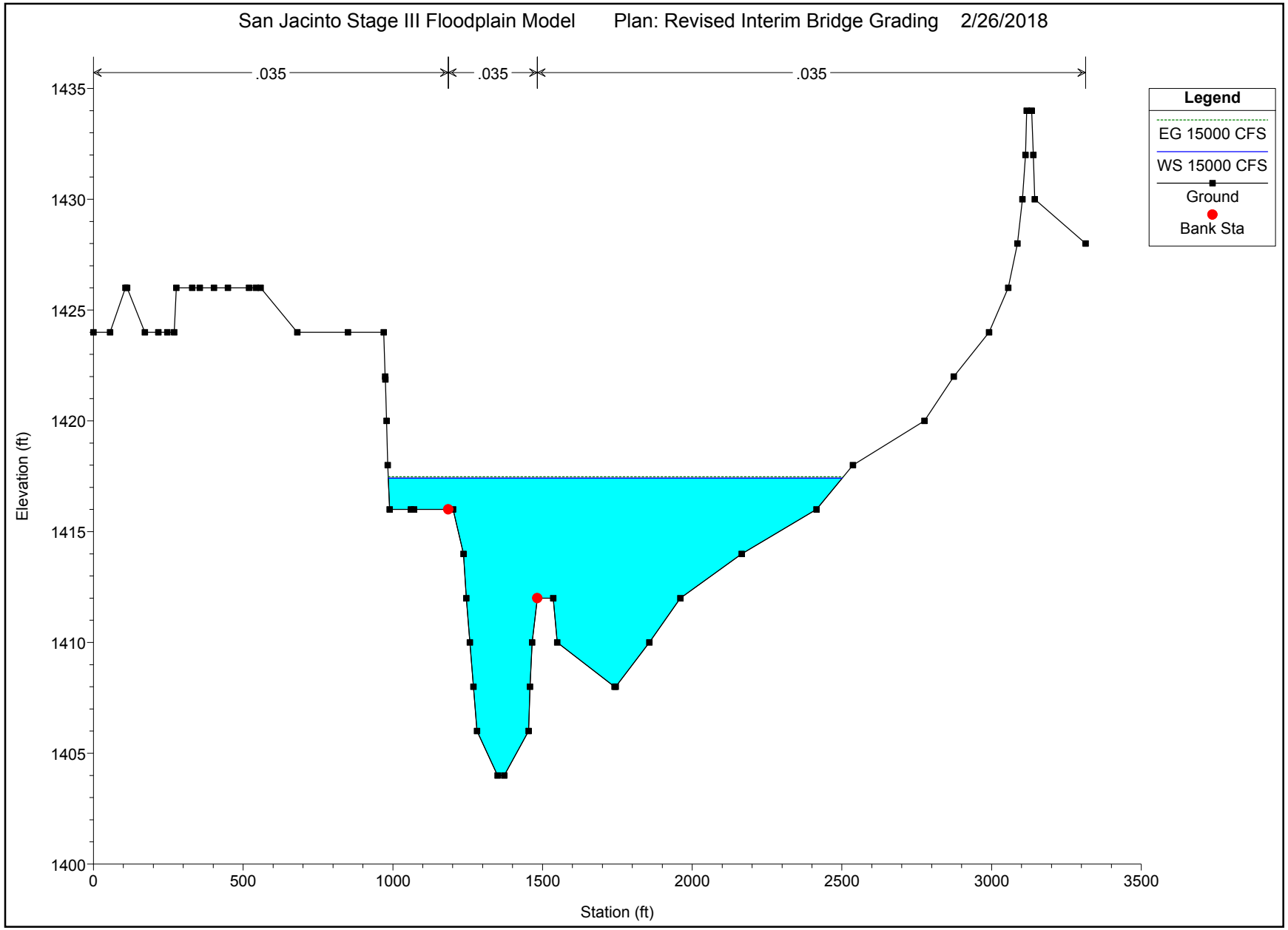
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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WS 15000 CFS
Ground
Bank Sta
Elevation (ft)
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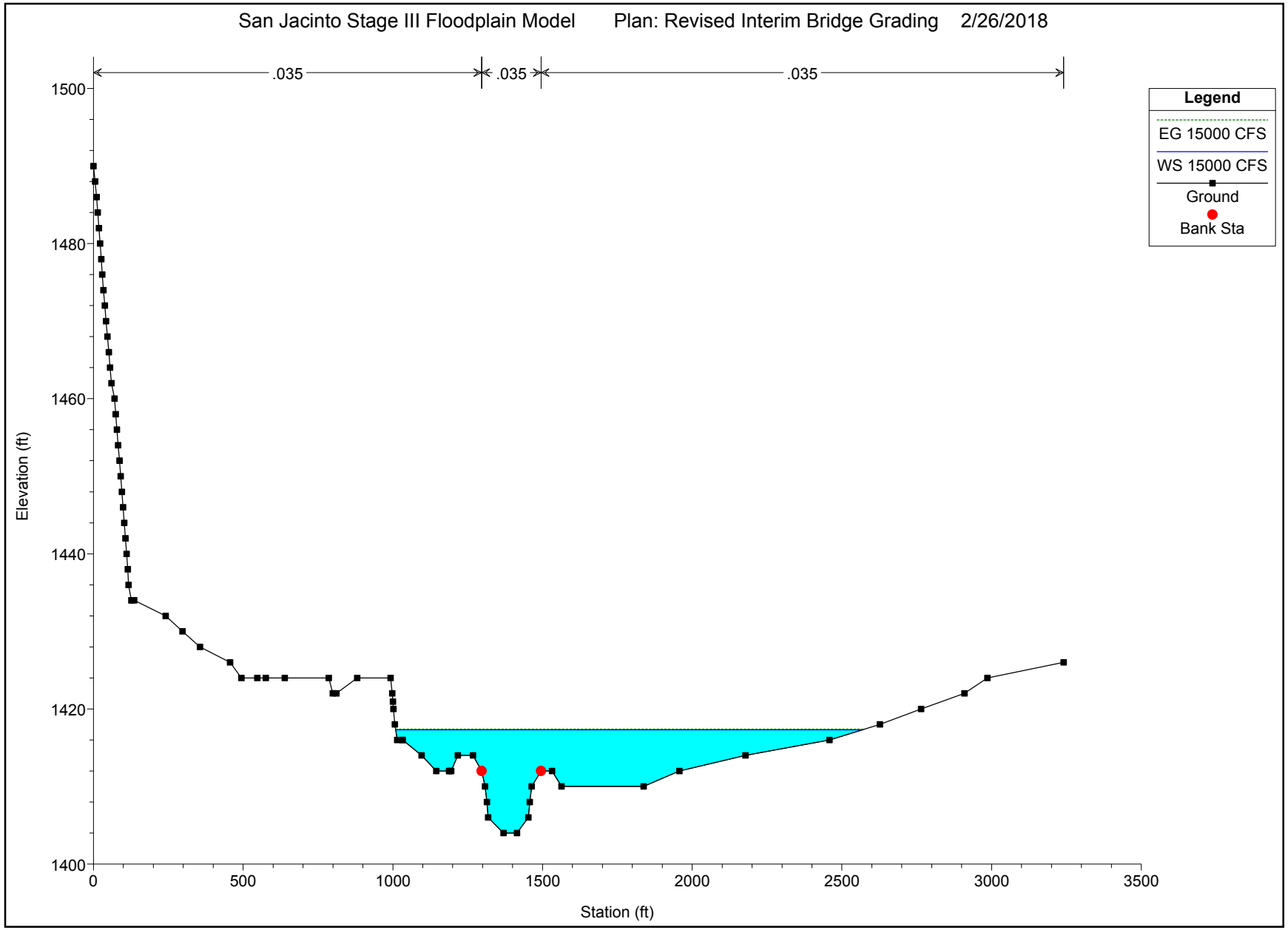
Station (ft)


San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018
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Legend
EG 15000 CFS
WS 15000 CFS
Ground
Bank Sta
Elevation (ft)
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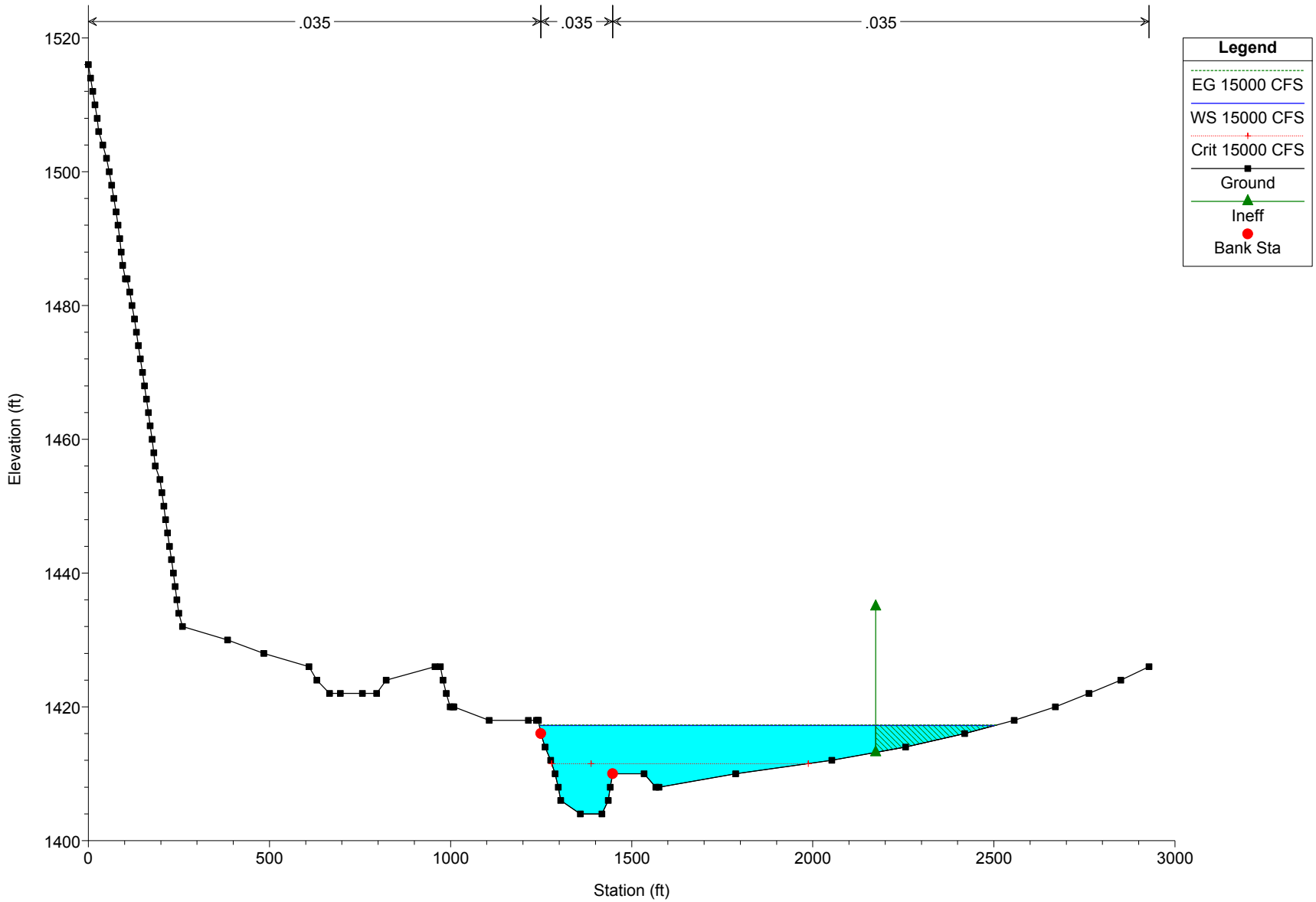
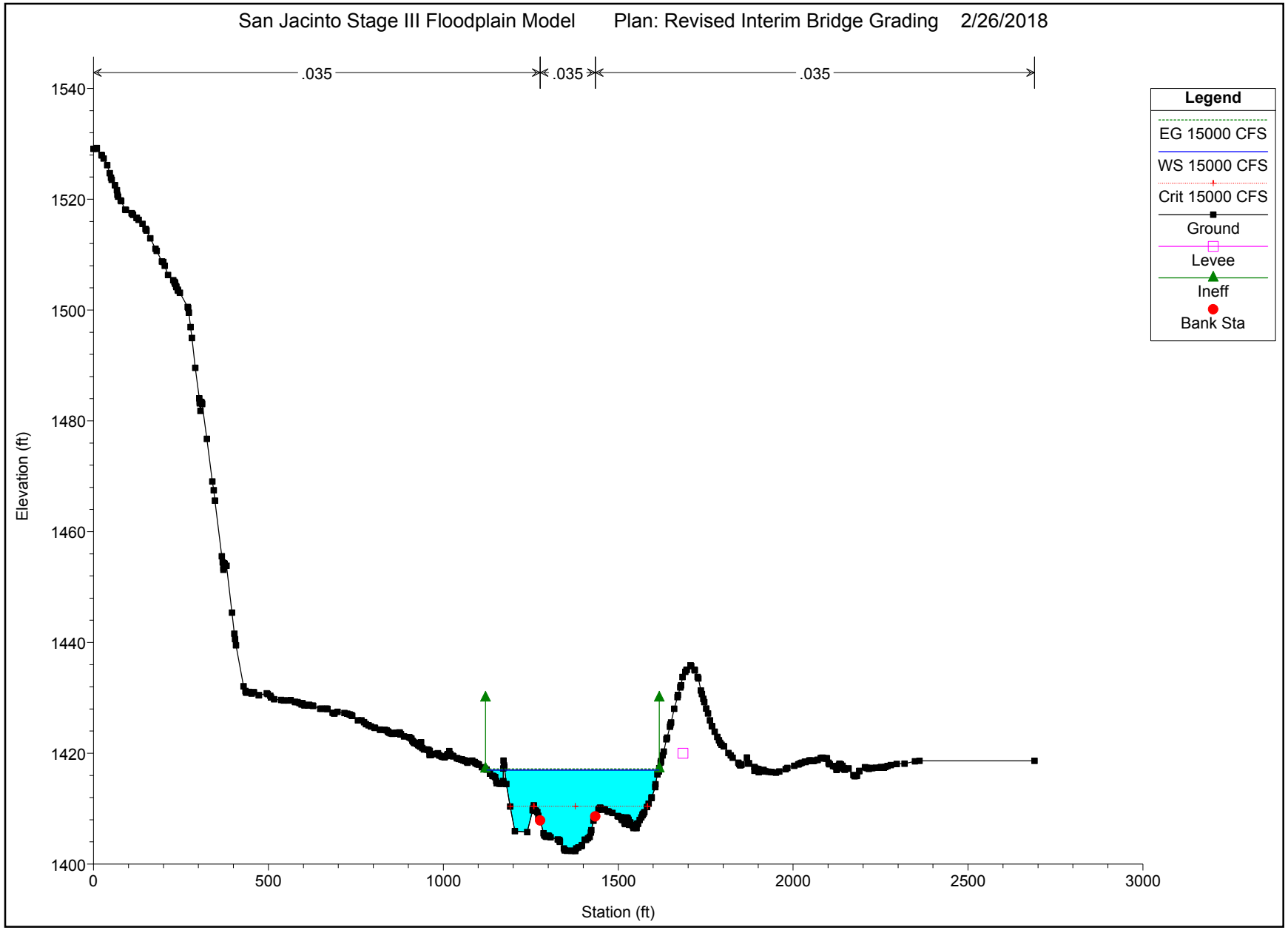
Station (ft)

San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018




San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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Crit 15000 CFS
Ground
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Elevation (ft)
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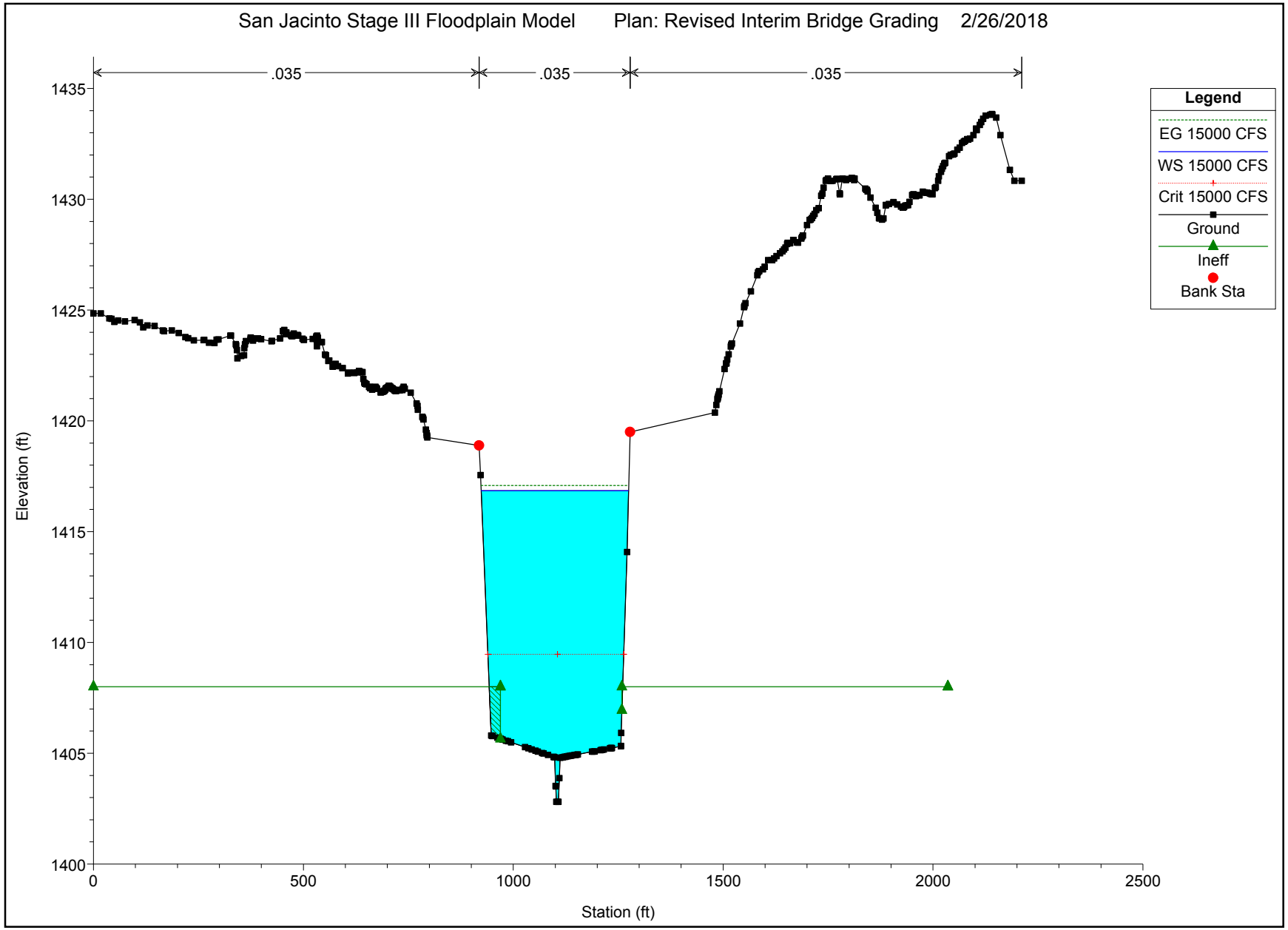
Station (ft)


San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018
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Elevation (ft)
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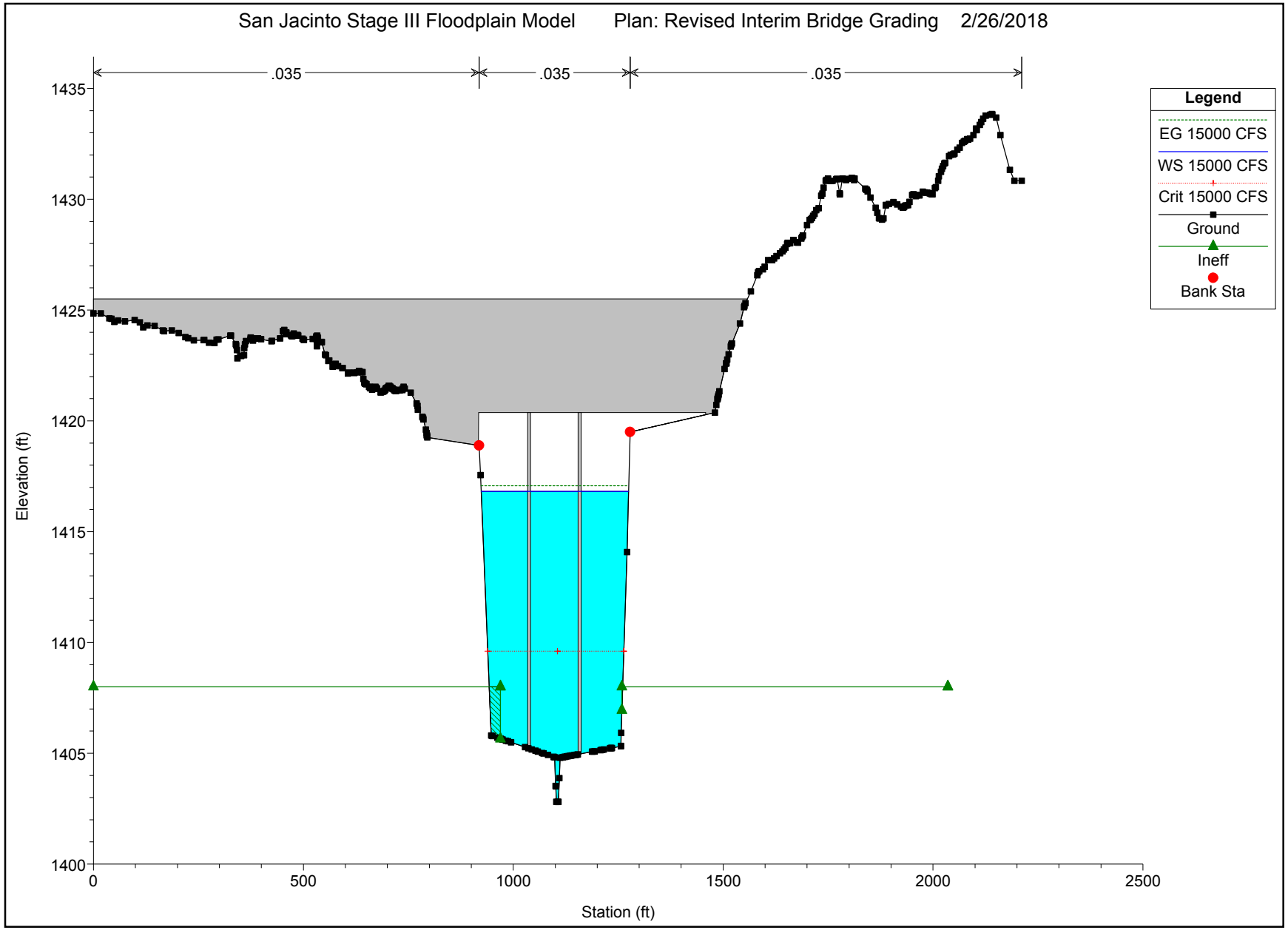
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 15000 CFS
WS 15000 CFS
Crit 15000 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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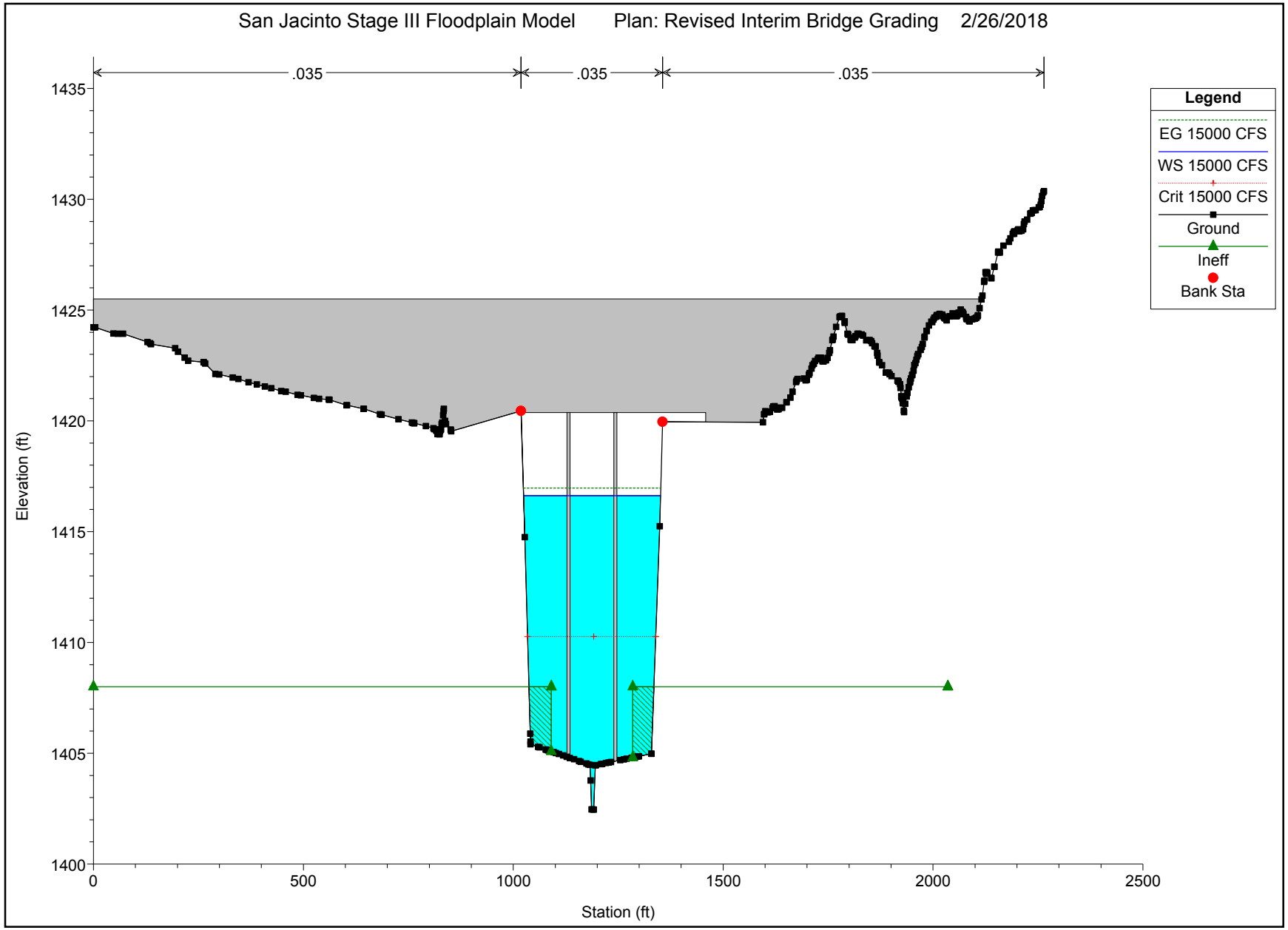
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
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WS 15000 CFS
Crit 15000 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
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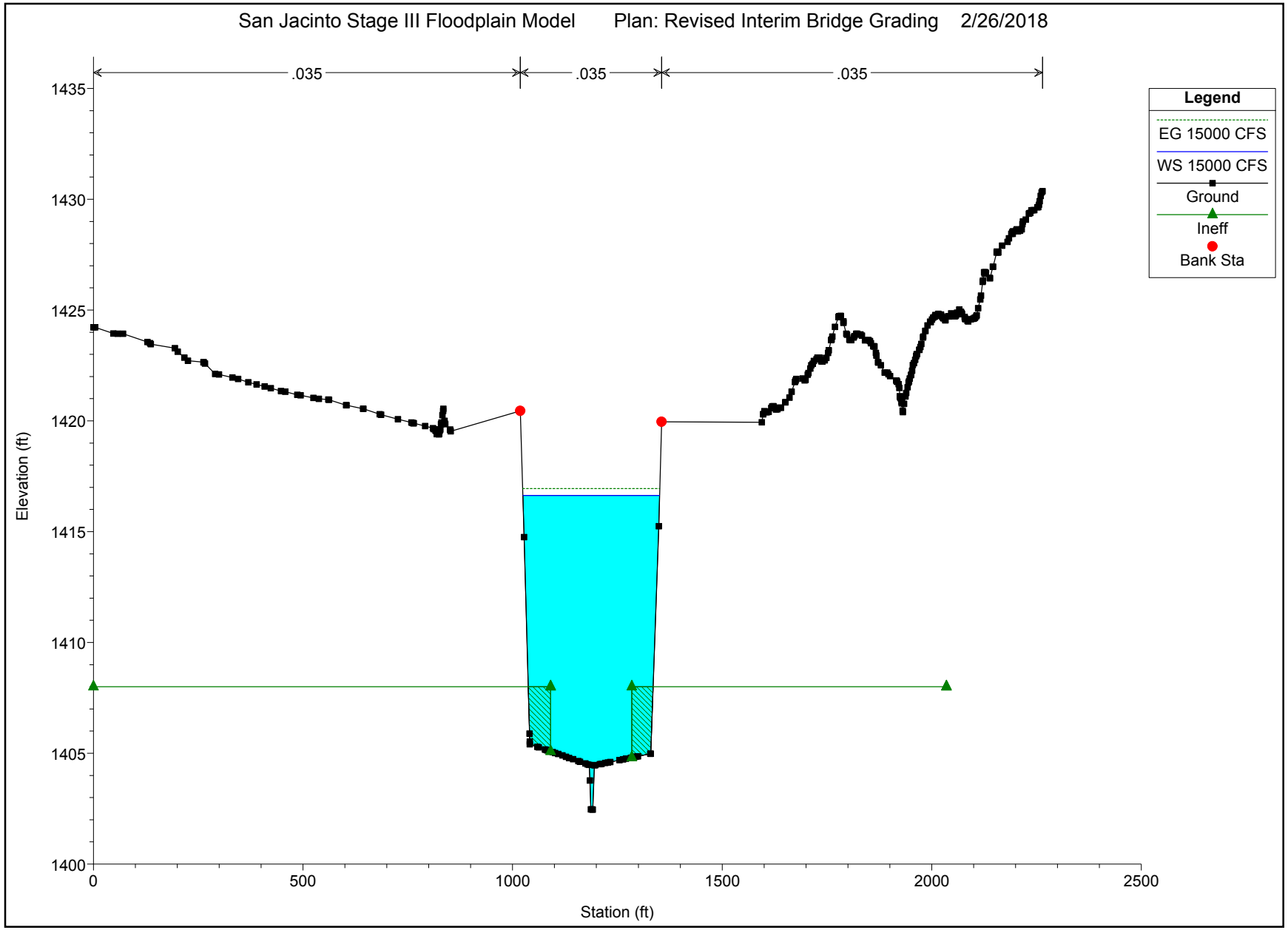
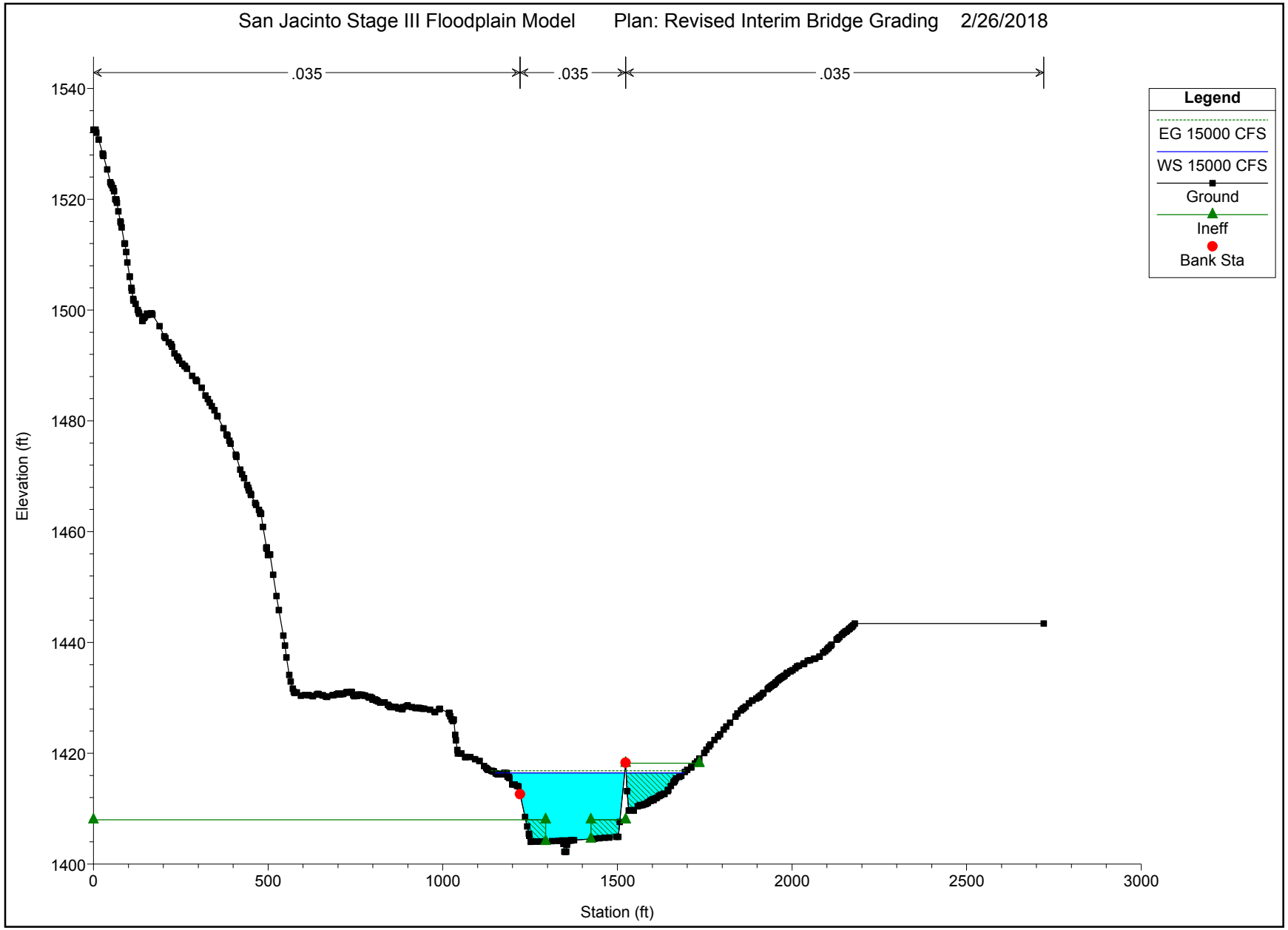
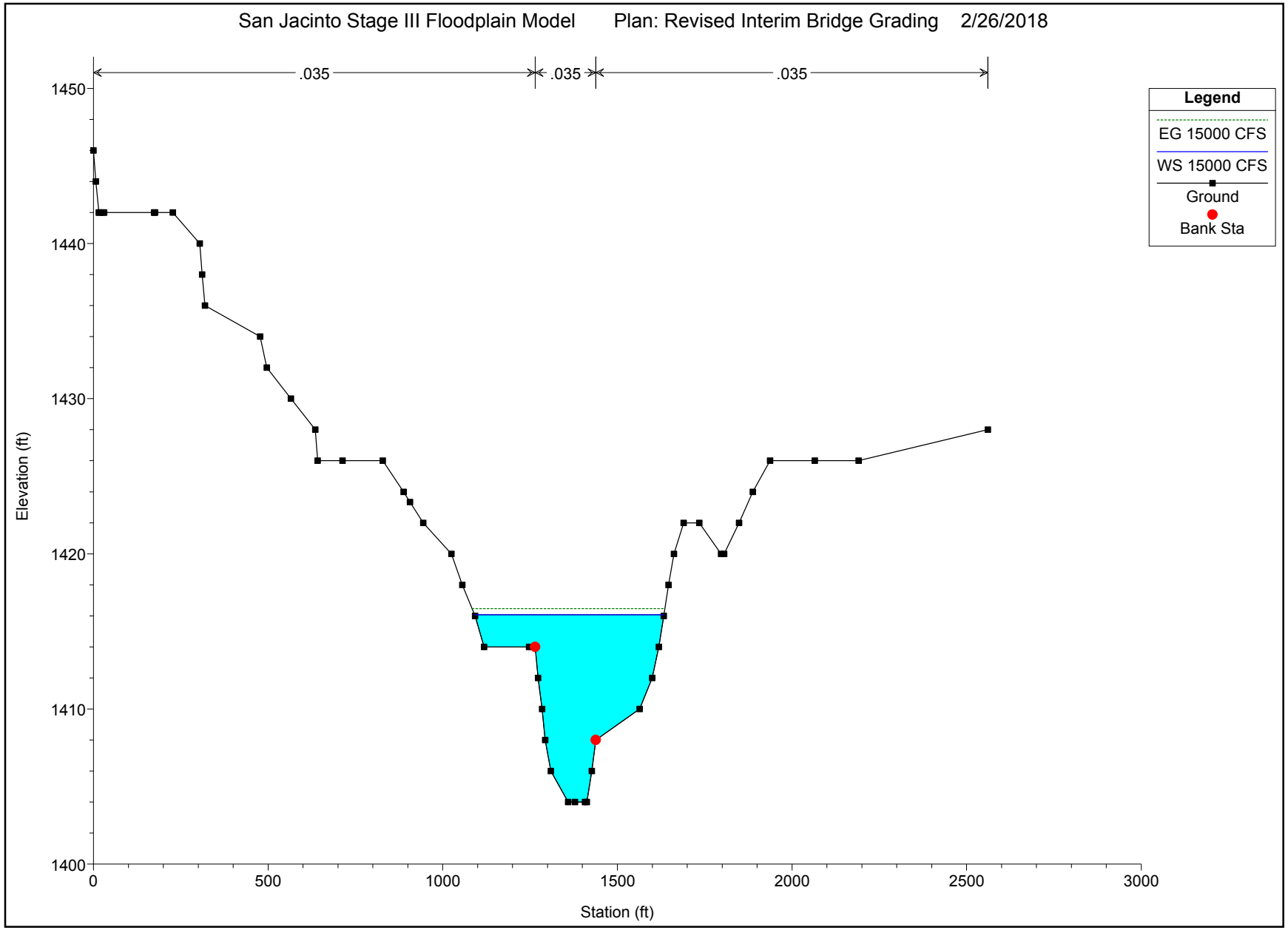
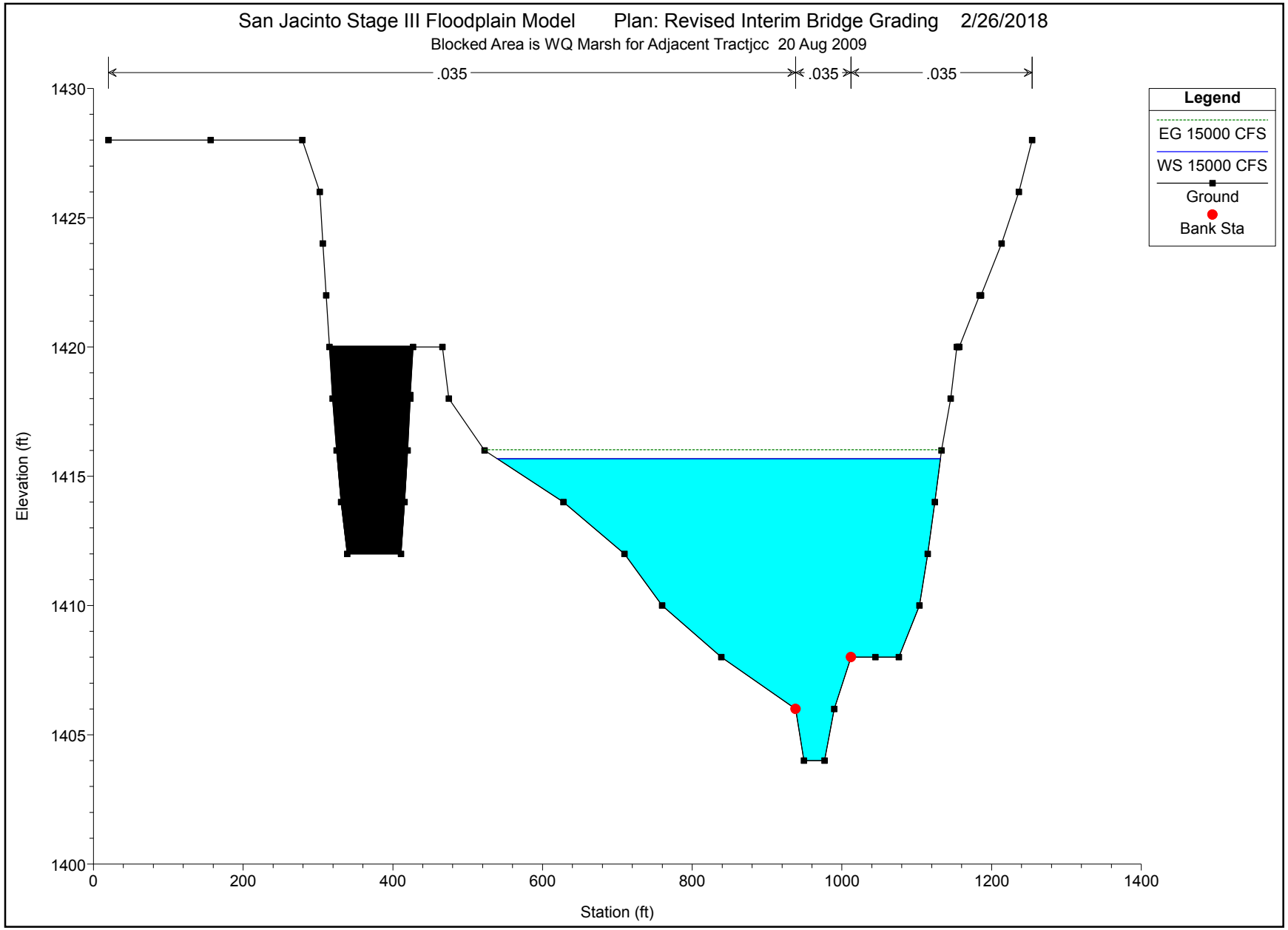
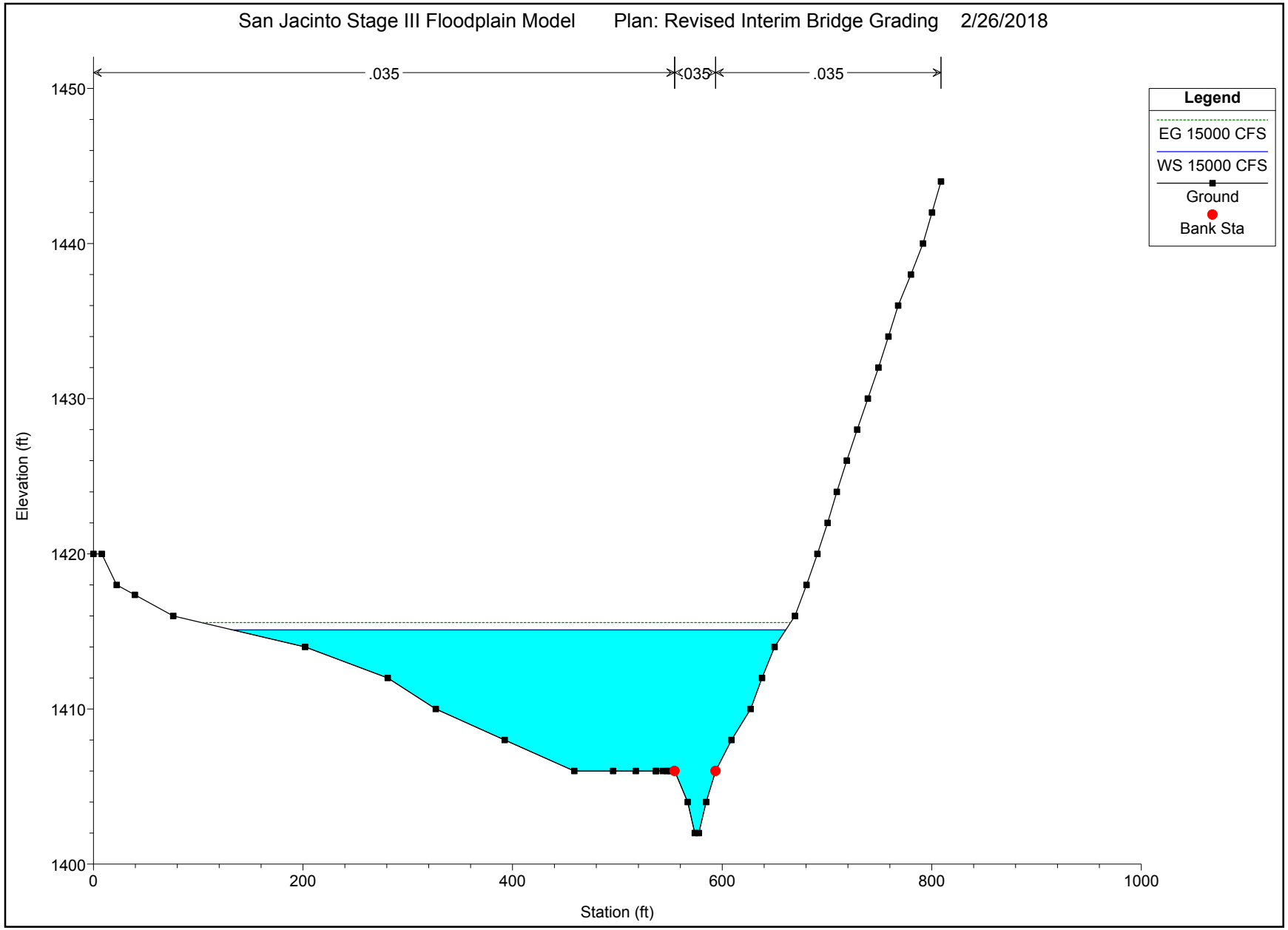
2500
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
.035
.035
.035
Legend
EG 15000 CFS
WS 15000 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
1435
1430
1425
1420
1415
1410
1405
1400
0
500
1000
1500
2000
2500
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
.035
.035
.035
Legend
EG 15000 CFS
WS 15000 CFS
Ground
Ineff
Bank Sta
Elevation (ft)
1540
1520
1500
1480
1460
1440
1420
1400
0
500
1000
1500
2000
2500
3000
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
.035
.035
.035
Legend
EG 15000 CFS
WS 15000 CFS
Ground
Bank Sta
Elevation (ft)
1450
1440
1430
1420
1410
1400
0
500
1000
1500
2000
2500
3000
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
Blocked Area is WQ Marsh for Adjacent Tractjcc 20 Aug 2009
.035
.035
.035
Legend
EG 15000 CFS
WS 15000 CFS
Ground
Bank Sta
Elevation (ft)
1430
1425
1420
1415
1410
1405
1400
0
200
400
600
800
1000
1200
1400
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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.035
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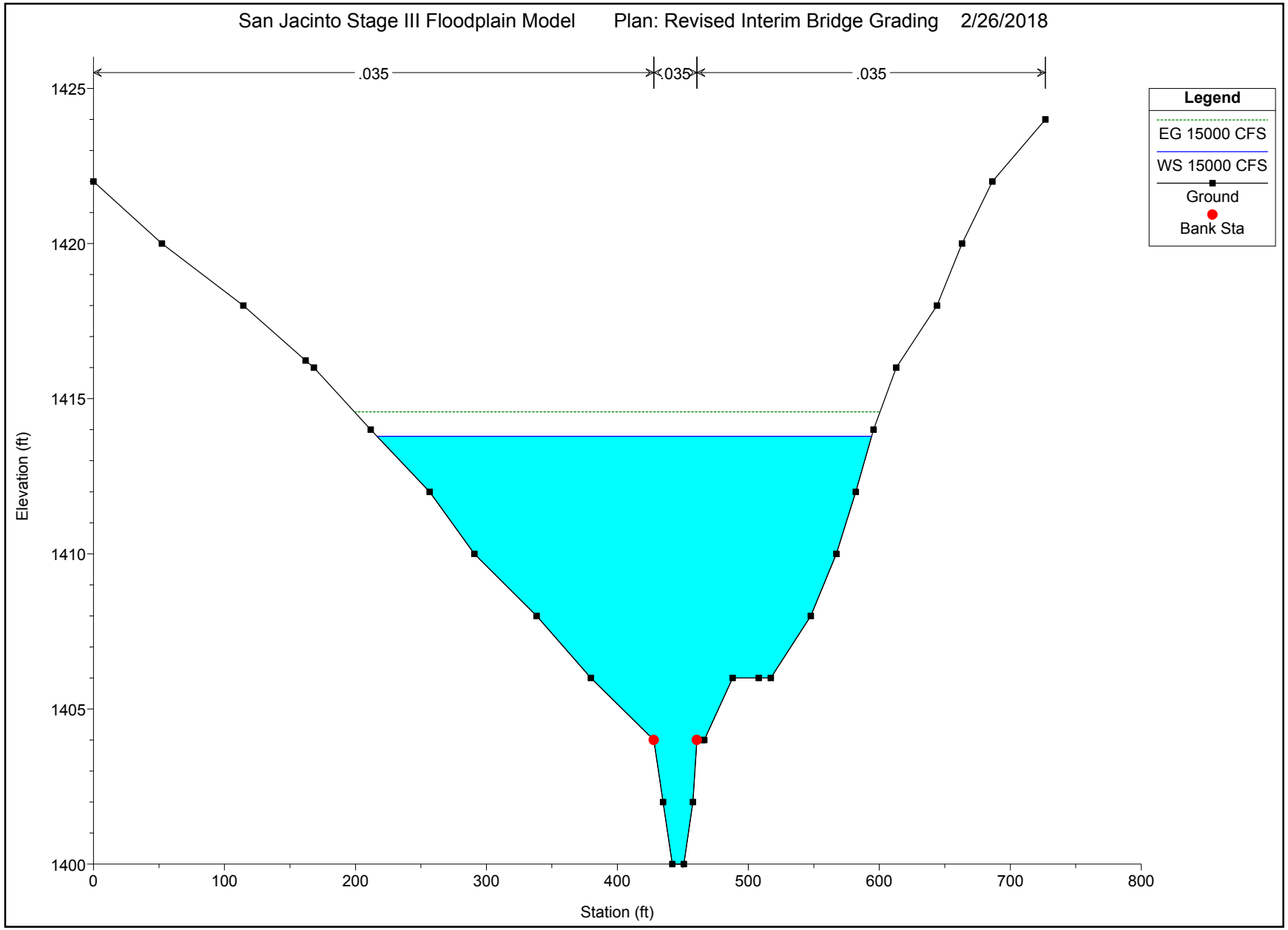
Legend
EG 15000 CFS
WS 15000 CFS
Ground
Bank Sta
Elevation (ft)
1450
1440
1430
1420
1410
1400
0
200
400
600
800
1000
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 15000 CFS
WS 15000 CFS
Ground
Bank Sta
Elevation (ft)
1425
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1415
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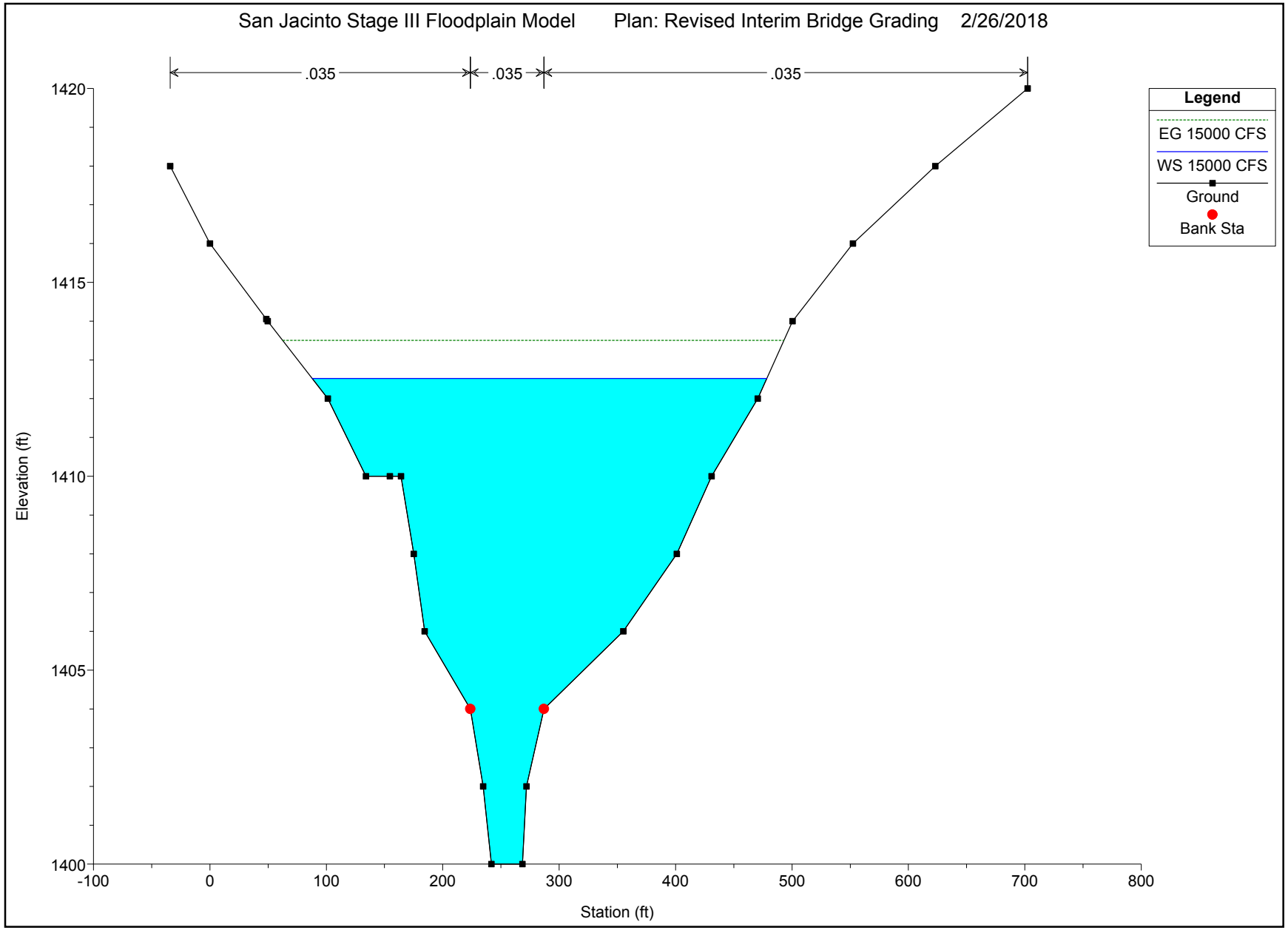
0
100
200
300
400
500
600
700
800
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 15000 CFS
WS 15000 CFS
Ground
Bank Sta
Elevation (ft)
1420
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1410
1405
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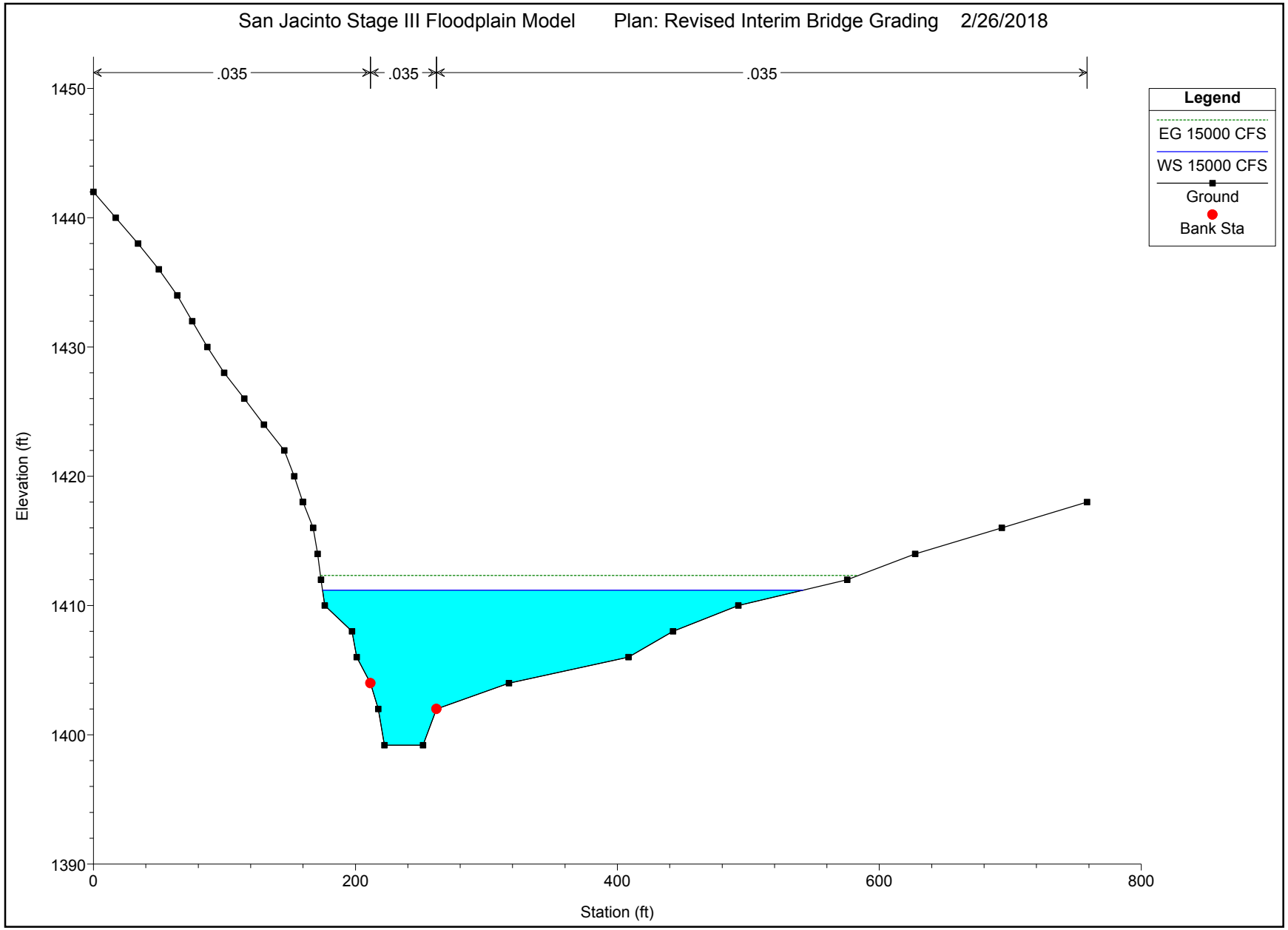
-100
0
100
200
300
400
500
600
700
800
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
.035
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Legend
EG 15000 CFS
WS 15000 CFS
Ground
Bank Sta
Elevation (ft)
1450
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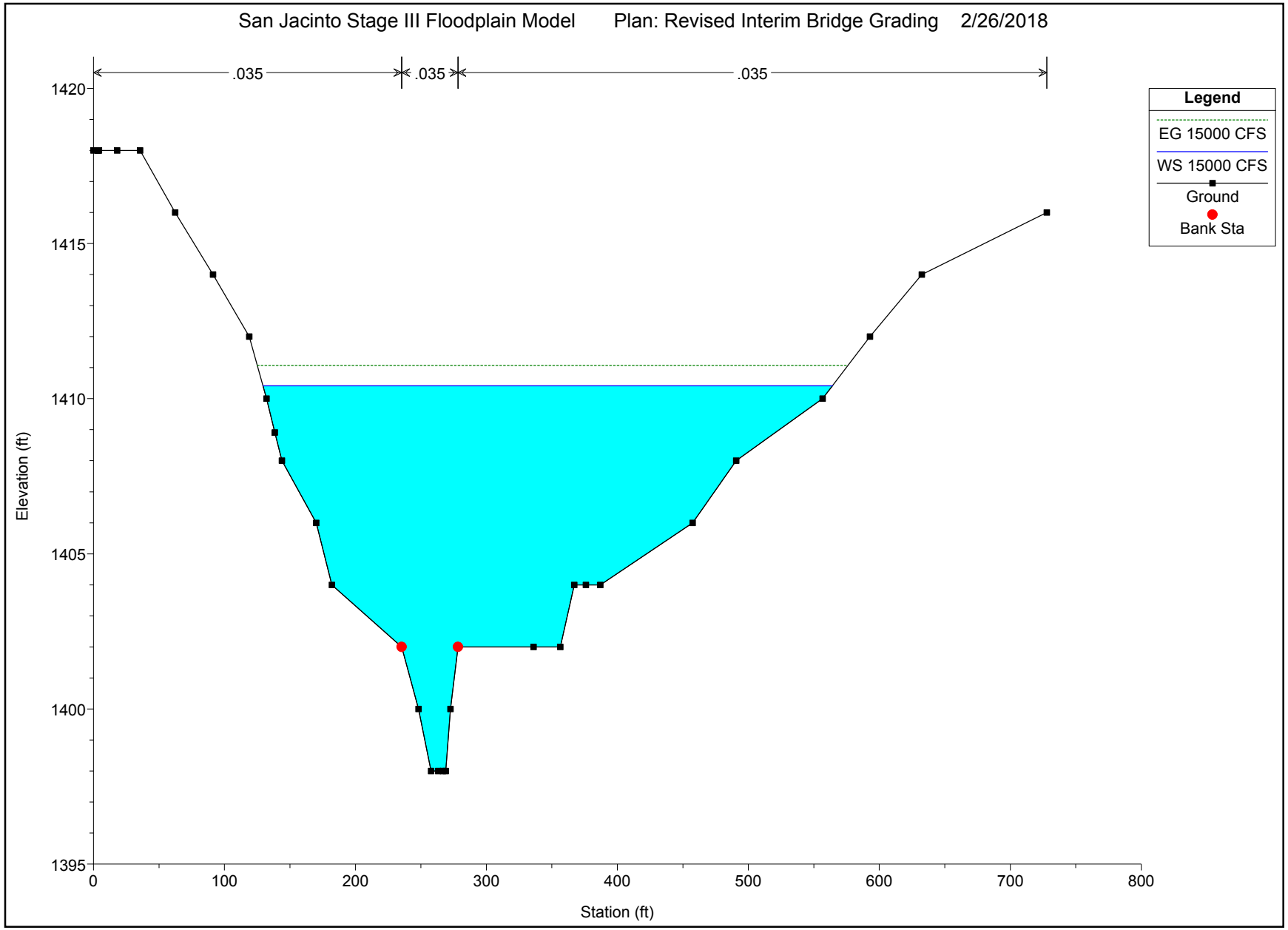
1420
1410
1400
1390
0
200
400
600
800
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
.035
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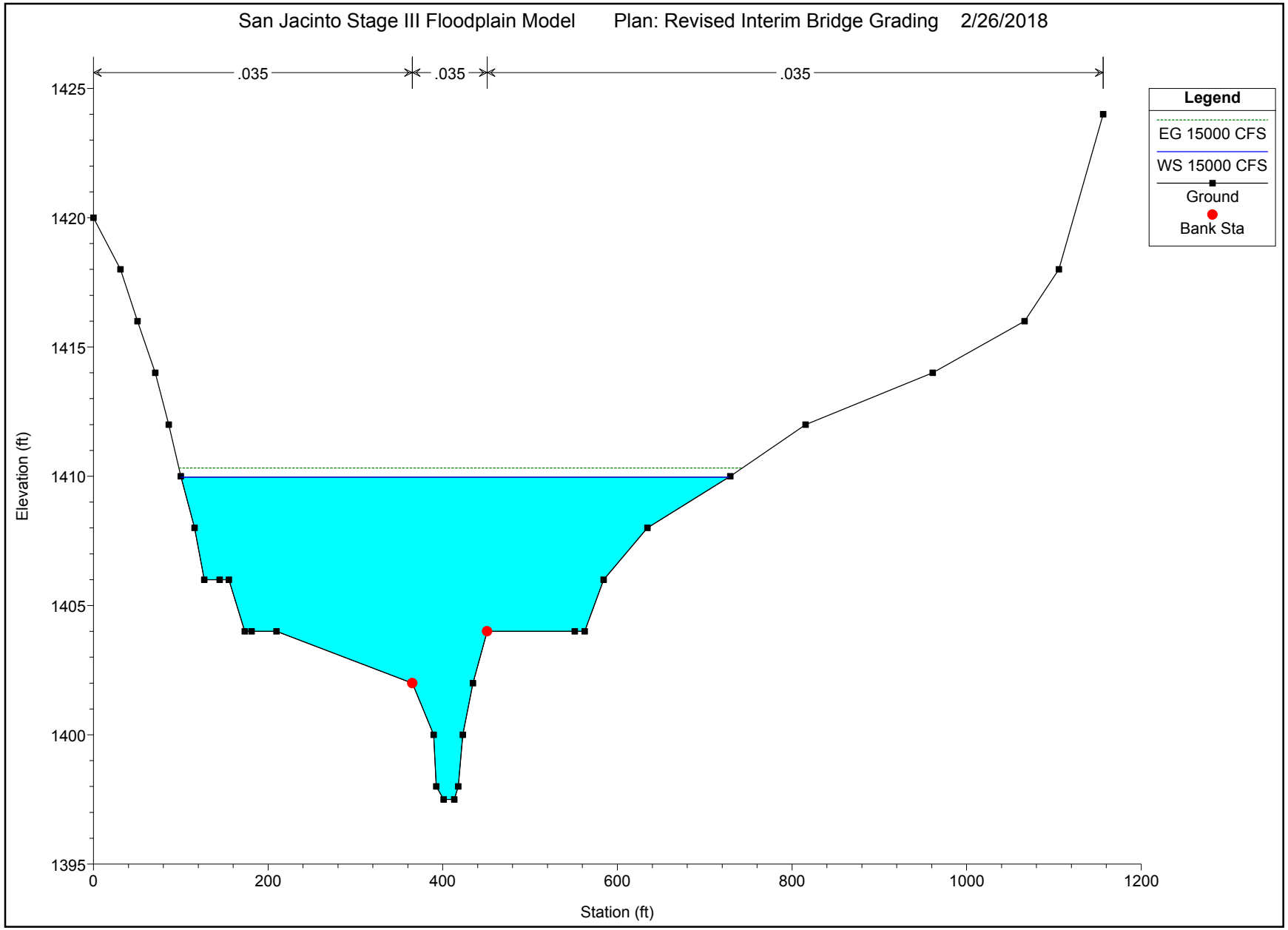
Legend
EG 15000 CFS
WS 15000 CFS
Ground
Bank Sta
Elevation (ft)
1420
1415
1410
1405
1400
1395
0
100
200
300
400
500
600
700
800
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 15000 CFS
WS 15000 CFS
Ground
Bank Sta
Elevation (ft)
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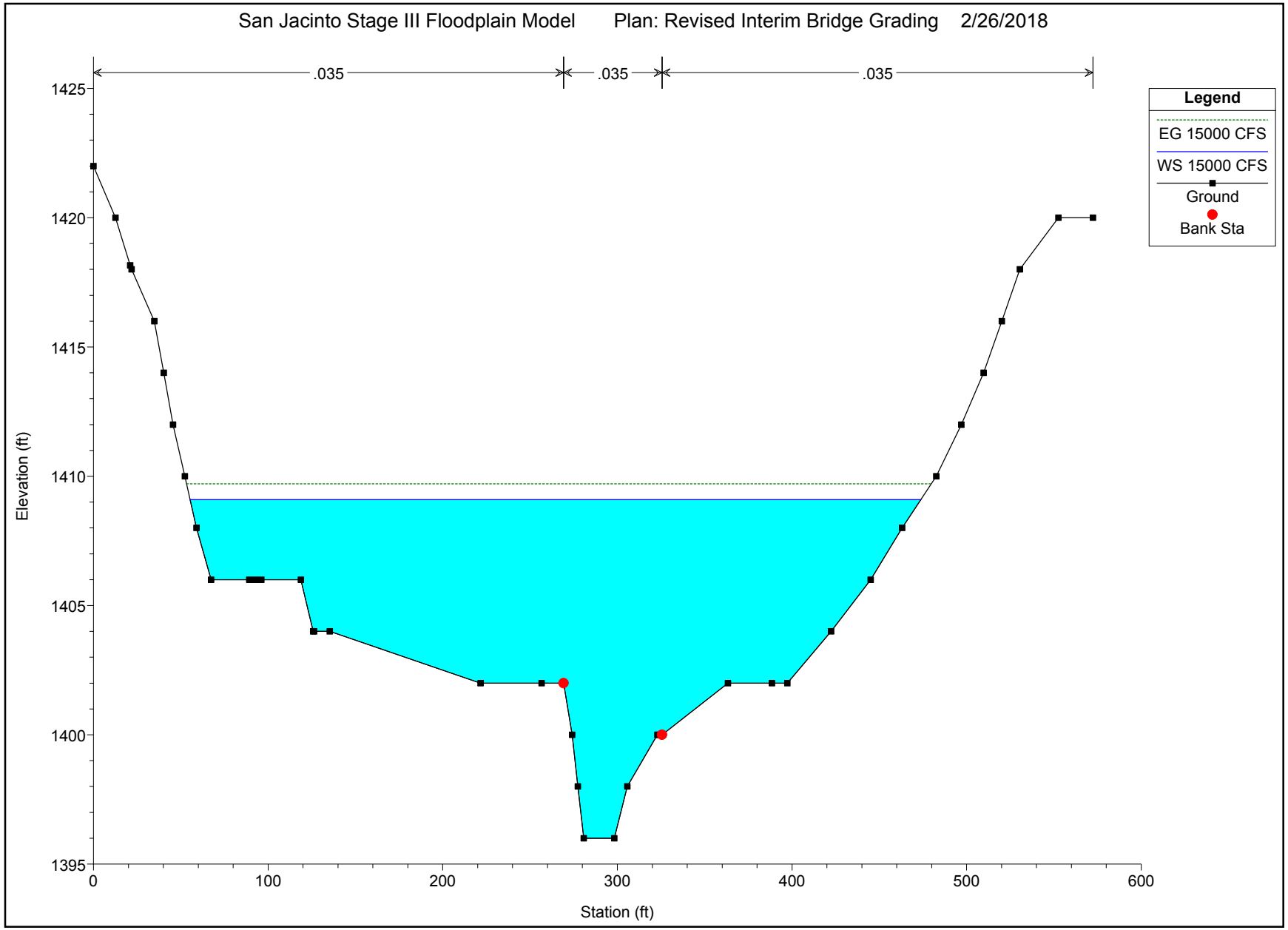
200
400
600
800
1000
1200
Station (ft)


San Jacinto Stage III Floodplain Model Plan: Revised Interim Bridge Grading 2/26/2018
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Legend
EG 15000 CFS
WS 15000 CFS
Ground
Bank Sta
Elevation (ft)
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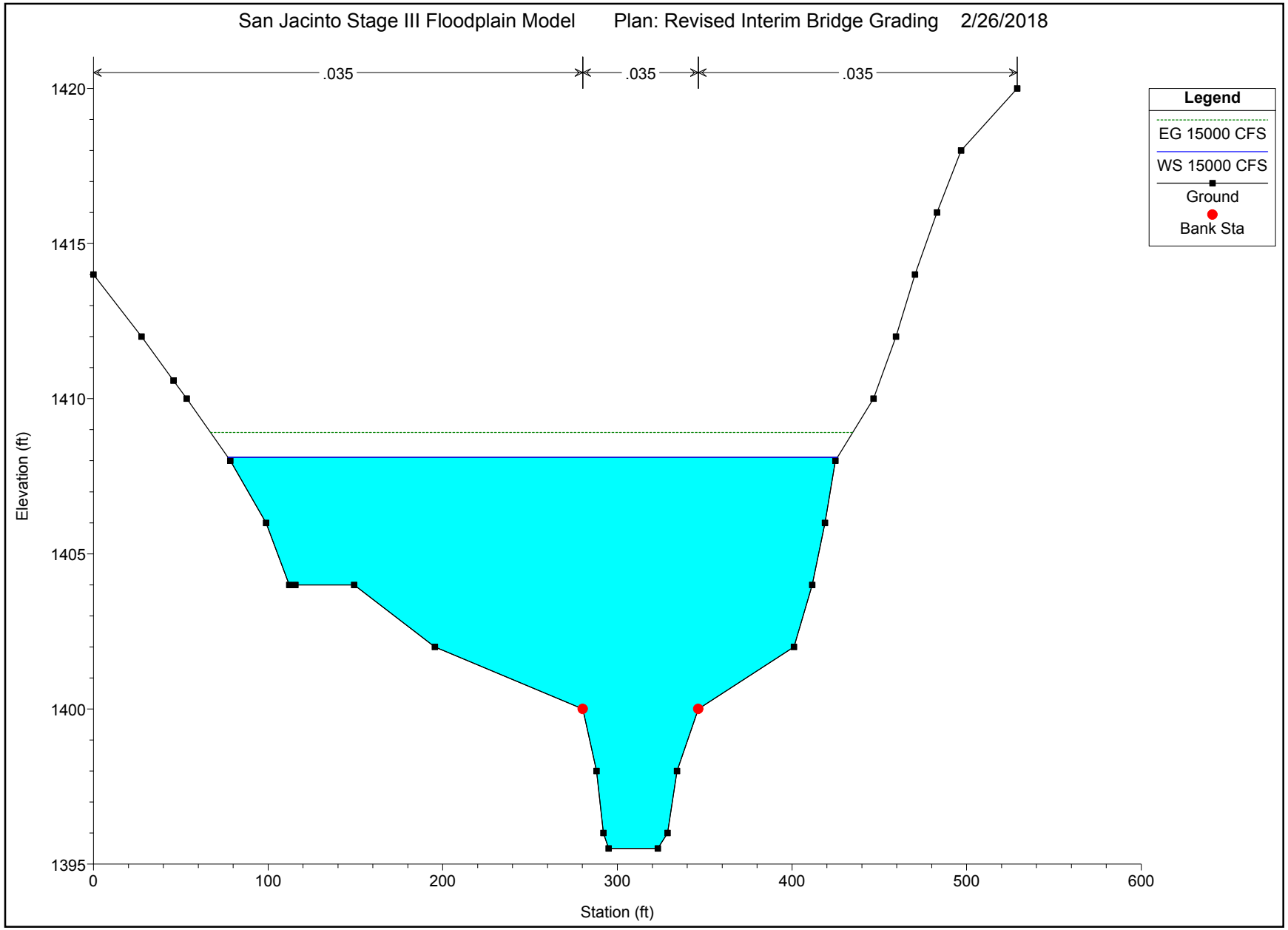
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 15000 CFS
WS 15000 CFS
Ground
Bank Sta
Elevation (ft)
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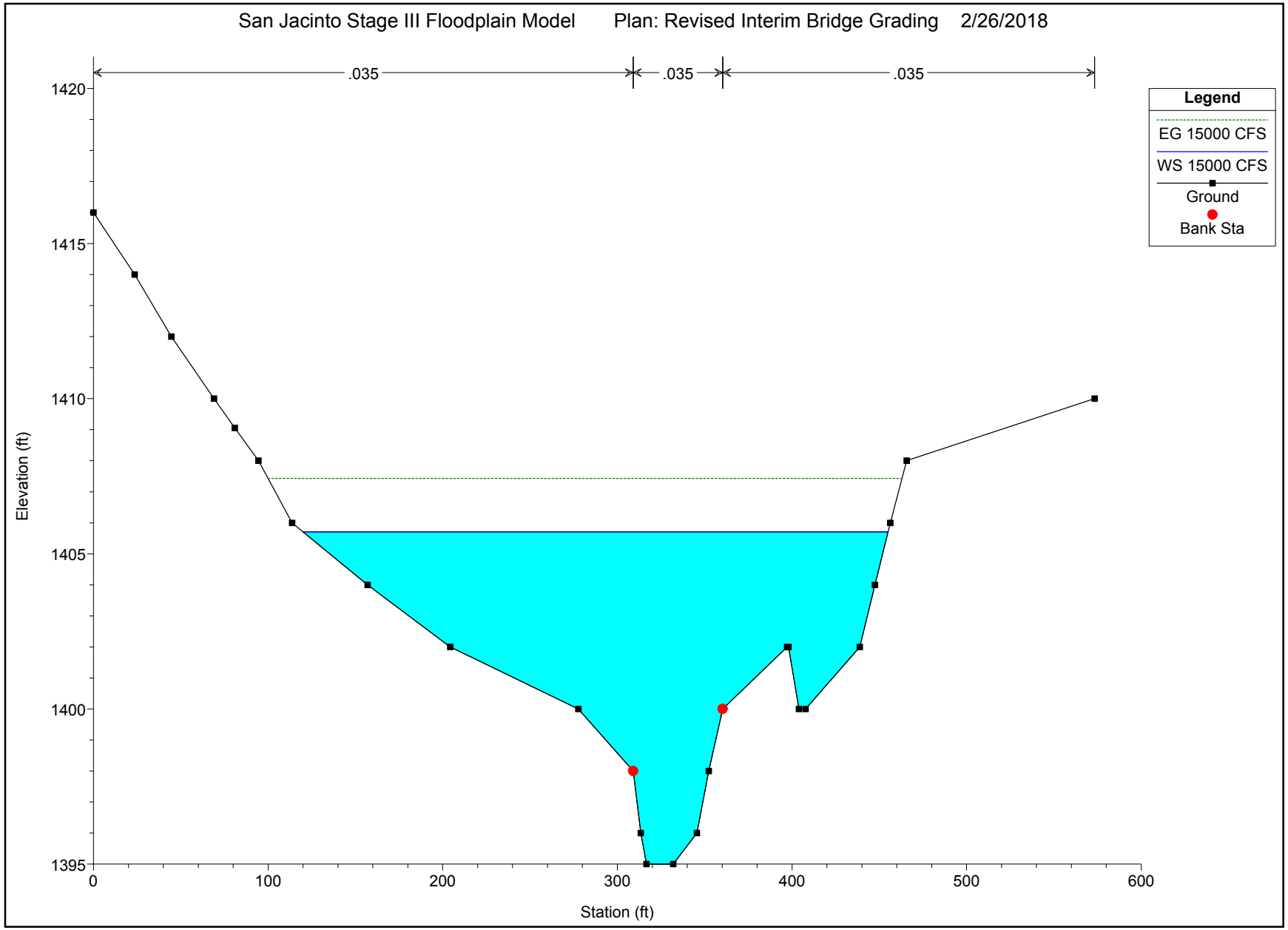
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 15000 CFS
WS 15000 CFS
Ground
Bank Sta
Elevation (ft)
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500
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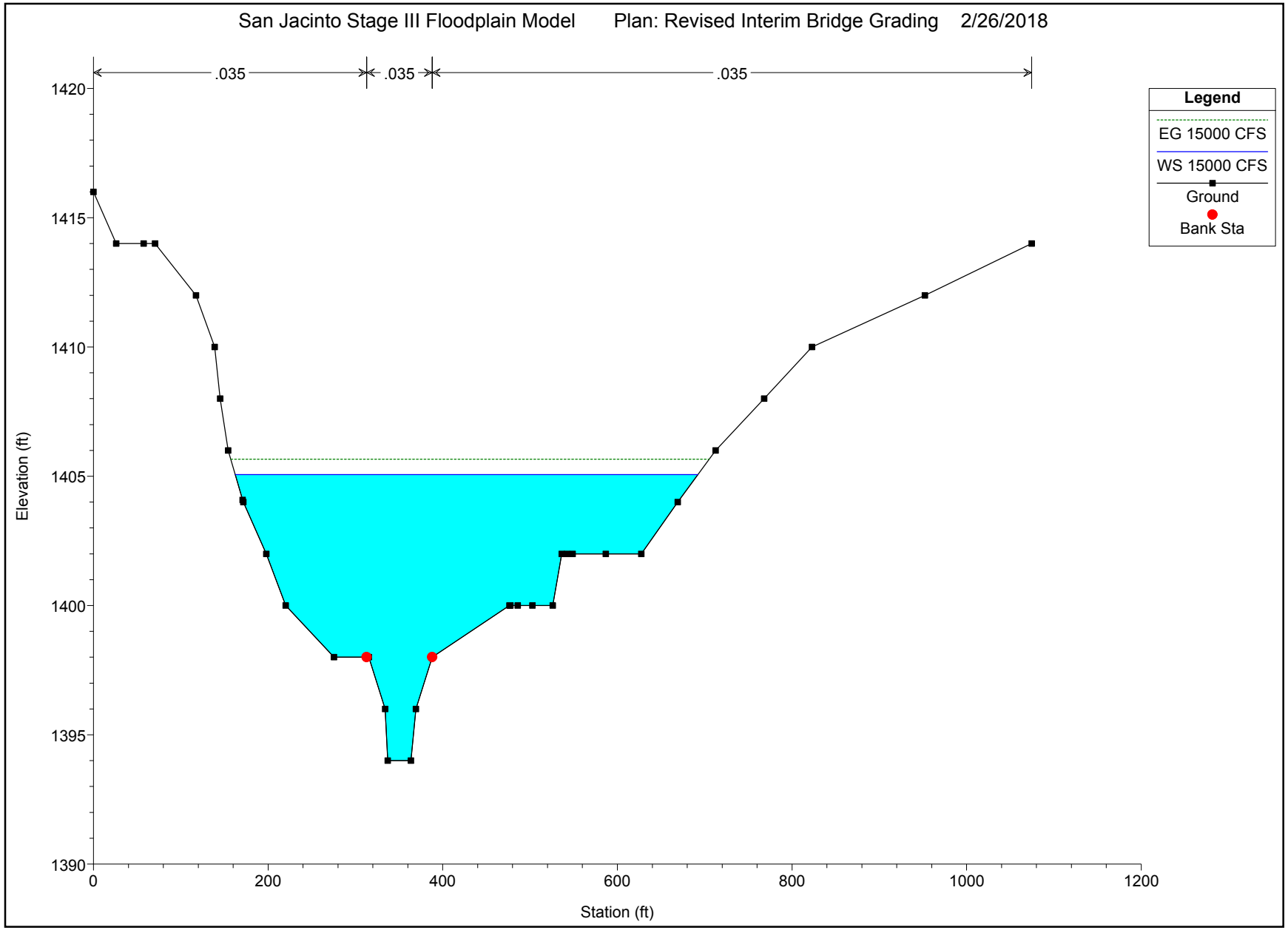
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
.035
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Legend
EG 15000 CFS
WS 15000 CFS
Ground
Bank Sta
Elevation (ft)
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1390
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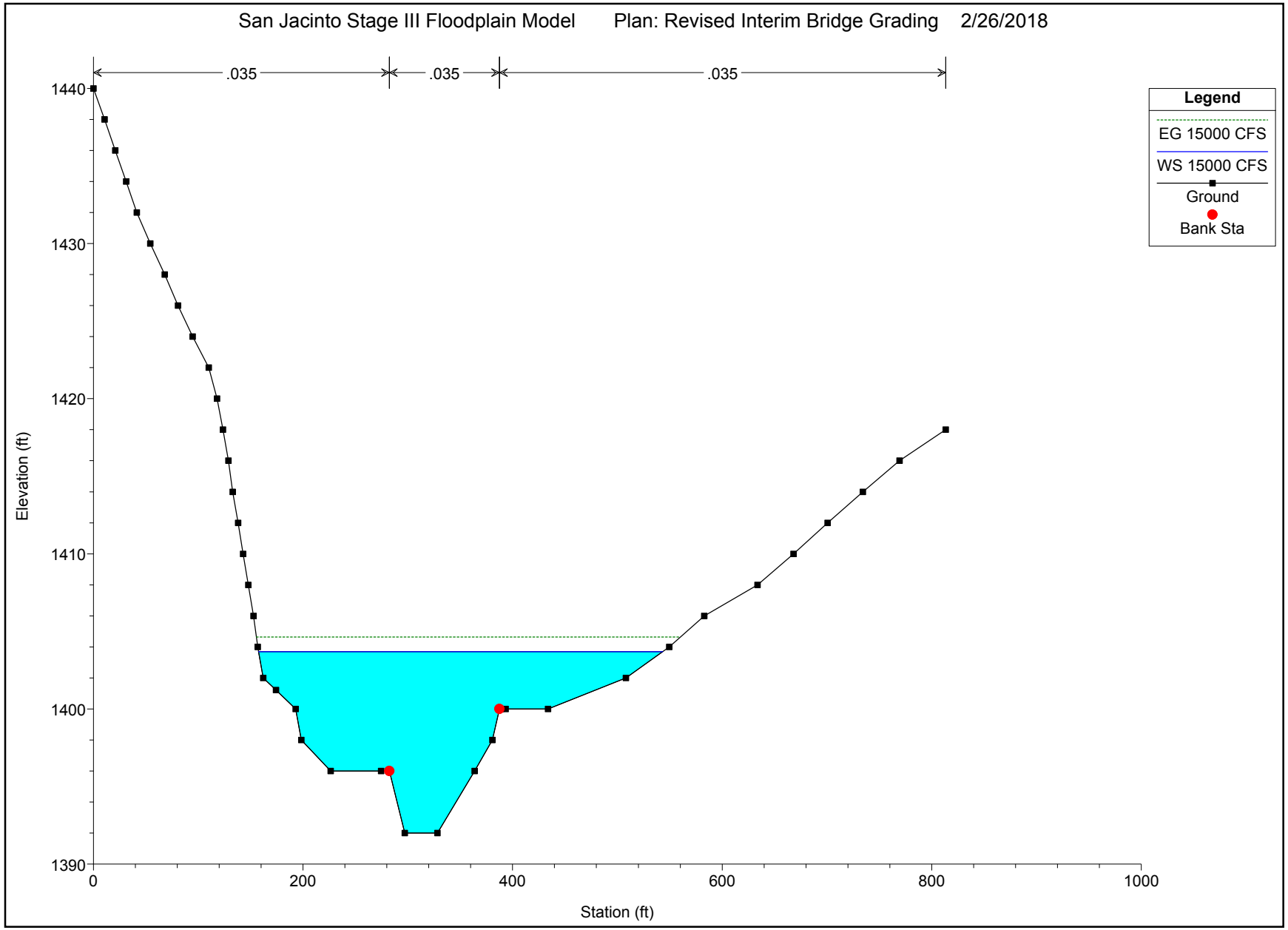
1200
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
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Legend
EG 15000 CFS
WS 15000 CFS
Ground
Bank Sta
Elevation (ft)
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1430
1420
1410
1400
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0
200
400
600
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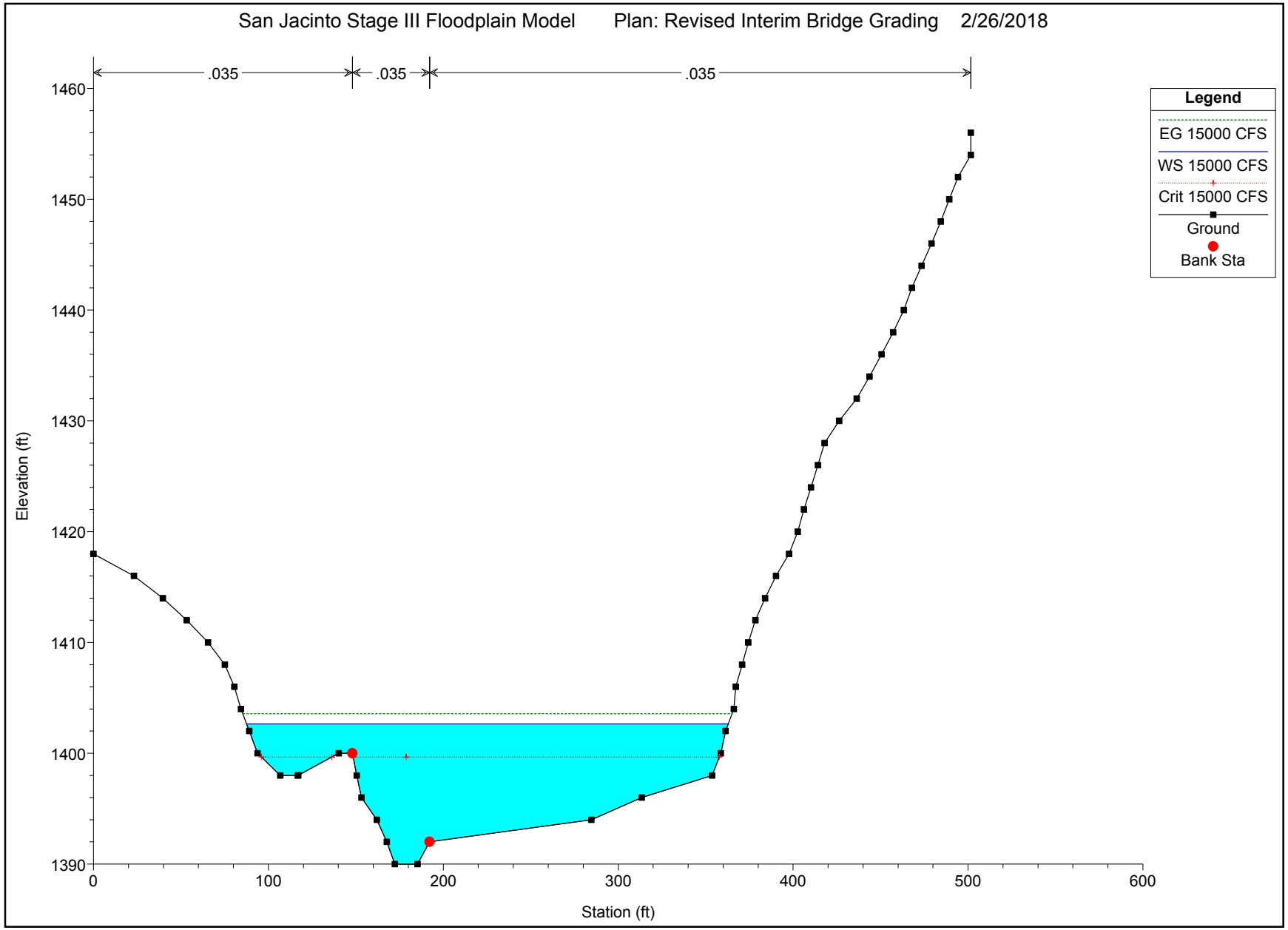
Station (ft)


San Jacinto Stage III Floodplain Model
Plan: Revised Interim Bridge Grading
2/26/2018
.035
.035
.035
Legend
EG 15000 CFS
WS 15000 CFS
Crit 15000 CFS
Ground
Bank Sta
Elevation (ft)
1460
1450
1440
1430
1420
1410
1400
1390
0
100
200
300
400
500
600
Station (ft)