SANBAG Redlands Passenger Rail Project

Job Name: Hydraulic Impact Analysis – Santa Ana River Bridge 3.4
Job Number: 170063
Client: SANBAG
Consultant: HDR Engineering, Inc.

This report and the analysis and design calculations contained herein have been prepared under the supervision of the following Registered Civil Engineer:

_____ February 2014

Mark Seits, P.E. Date
CA 41103

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1. Purpose

The rail from historic Warm Creek (that portion of Warm Creek that was not combined with East Twin Creek and Warm Creek Improvements) to Mill Creek Zanja is proposed to be improved as part of the Redlands Passenger Rail Project (RPRP) (see Exhibit 1).This report covers the hydraulic impacts for AT&SF Bridge 3.4 (Bridge 3.4), which is a railroad crossing over Santa Ana River. The improvements are proposed to reconstruct the bridge from its existing freight-only operation to current standards required for regular passenger rail operations. As part of this project, recommendations, including hydraulic analysis, are being provided to assist in this process.

The purpose of the hydraulic modeling is to: (1) to analyze the existing hydraulic condition of the Santa Ana River to establish current conditions considering Federal Emergency Management Agency (FEMA) models and updated site conditions; (2) evaluate the hydraulic impact on the rail from proposed Bridge 3.4; and (3) evaluate the potential hydraulic impacts of proposed Bridge 3.4 on the proposed passenger rail.

2. Background

The RPRP will design a double track alignment for passenger and freight service from the proposed San Bernardino Transit Center east to the University of Redlands. The Redlands Corridor Strategic Plan (RCSP) was developed by San Bernardino Associated Governments (SANBAG) to address the transportation needs of the Redlands Corridor, assess the capability of transit service and multimodal improvements to meet mobility needs, and describe a course of action to implement transit service in the Redlands Corridor in a cost-effective manner. The first phase of the RCSP calls for the development of a passenger rail service operating between the San Bernardino Transit Center and the University of Redlands, a distance of approximately nine miles. Exhibit 1 shows the overall project.

The general hydraulic modeling approach was to initially review hydraulic models from FEMA to examine flooding conditions in the Santa Ana River reach with Bridge 3.4. Exhibit 2 shows the limits of the analysis. A revised hydraulic model was developed of the project area based on the additional information obtained to model existing and proposed conditions through the bridge and to evaluate the relative changes in water surface for a 100-year flood. The proposed bridge will be designed per structure, constructability, and geotechnical and hydraulic issues.

The Santa Ana River model reach in this study is located between River Mile (RM) 28.3 to RM 29.64, from approximately 1,660 feet downstream of AT&SF Bridge 3.4 to 700 feet upstream of Tippecanoe Avenue (see Exhibit 2). Total reach length is approximately 7,000 feet. The reach is a soft-bottom channel with riprap side slopes. Figure 1 shows Bridge 3.4 downstream face in the Santa Ana River. Figure 2 shows the rail on existing Bridge 3.4. Hydraulic analyses are required to evaluate the existing and proposed bridges to determine if they meet current design requirements. There are three structures in the reach, as shown below in Table 1.

Table 1: Structures in Santa Ana River Reach

Structure	Approximate Location (RM)
AT&SF Railroad Bridge 3.4	28.62
Orange Show Road	29.06
Tippecanoe Avenue	29.51

The existing effective FEMA model for the Santa Ana River was obtained and used as the base model. The model was revised based upon information contained in the WRC (2003) report prepared to model proposed river trail improvements. Modeling of the Santa Ana River and Bridge 3.4 was conducted using the U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center River Analysis System (HEC-RAS v4.1) program. All reference topography is based on the NGVD 1929 datum.

The standard freeboard criteria selected for the bridge (in the following priority) are shown below. For this project, because the 50-year flow rate is not available, only the 100-year flow rate was evaluated.

1. 100-year water surface elevation below low chord;
2. 100-year energy grade line (EGL) elevation below top of subgrade and 50-year water surface [hydraulic grade line (HGL)] elevation below low chord;
3. 50-year water surface (HGL) elevation below low chord; and
4. No increase of water surface elevations within project area.

Figure 1: Santa Ana River, AT&SF Bridge 3.4 Downstream Face

A draft FEMA "no rise" certificate is included within this report. Bridge 3.4 is within a FEMA floodway and therefore this certification is required to document that no change to 100-year base flood elevation will occur due to bridge replacement.

This report presents hydraulic analysis results; however, it does contain some assumptions and approximations. Prior to 100% design, the assumptions and approximations made within this report should be verified. Primarily, these include the proposed bridge geometry.

Figure 2: Existing AT&SF Bridge 3.4

3. Hydrology

The 100-year flowrate for the Santa Ana River tabulated in the San Bernardino County Flood Insurance Study (FIS) is 113,000 cfs upstream of Warm Creek. The 100-year Santa Ana River flow rate contained in the effective FEMA model and in the WRC report and model are less. The flowrate of 113,000 cfs is believed to be the flowrate before the construction of Seven Oaks dam upstream of the reach. The 100-year flowrate in Santa Ana River FEMA and WRC model are the same and are verified with "Santa Ana River Trail Hydraulic Design and Analysis" and "Santa Ana River Mainstream Project, Feature Design Memorandum No. 2" reports. The 100-year flowrates in the FEMA model are shown in Table 2 and indicate a flow change location just downstream of Bridge 3.4. The 100-year discharge at Bridge 3.4 is 33,000 cfs and was used for this evaluation.

Table 2: Hydrology - Flowrates

Channel Reach (River Mile)	100-Year Flood Discharge (cfs)
RM 27.91 to RM 28.57	36,500
RM 28.58 to RM 33.27	33,000
Note: Flowrates are in cubic feet per second (cfs)	

4. Hydraulic Modeling

4.1 Modeling Overview

Hydraulic modeling was conducted using the USACE HEC-RAS (v.4.1) program. The existing FEMA effective model was available in HEC-2 format for the Santa Ana River reach. The FEMA effective models were broken into several reaches. Bridge 3.4 is located in the reach from River Mile (RM) 28.30 to 29.64, which covers from downstream of Bridge 3.4 to upstream of Tippecanoe Bridge. The HEC-2 model was originally modeled in July 1987, then revised in January 1990. There are two structures in the model –Bridge 3.4 and Tippecanoe Bridge. Bridge 3.4 is located at RM 28.615.

The original HEC-2 model does not include the Orange Show Bridge. Also, bridge piers were modeled as one pier with the total pier width in the HEC-2 model. WRC Consulting Services prepared "Santa Ana River Trail, Alabama Street to Waterman Avenue, Hydraulic Design and Analysis" in 2003 and updated the original effective model. The WRC model reach ranges from RM 26.98 to 33.37. There are three models in the WRC report:

- ***Model 1*** – Original FEMA effective HEC-2 model prepared by the USACE.
- ***Model 2*** – Converted Model 1 to the HEC-RAS format, added an additional bridge at Orange Show Road, revised bridge pier data to match existing, and added channel geometry from RM 28.10 to 29.51 based on as-built plan data.
- ***Model 3*** – Prepared from Model 2 for the proposed trail ramps and removed them from flow conveyance.

Only a hard copy of the WRC report was available. Digital copies of the HEC-RAS models described in the report were not available. Since the report has tabulation of the HEC-RAS input and output data, HDR first converted the effective FEMA HEC-2 model to HEC-RAS format, then revised the HEC-RAS model per the WRC report Model 2 input data printout to duplicate Model 2. The bridge pier widths were revised again based on the as-built/survey data in the WRC report. This HEC-RAS model was then used to address the impact of the proposed improvements to Bridge 3.4. The 100-year flowrate was used to compare between the existing bridge and the proposed condition to see if the proposed condition has any hydraulic impacts.

4.2 Model Inputs

4.2.1 FEMA Effective Model

The effective HEC-2 model was obtained from FEMA. The original model was run with the HEC-2 (v.1991) program. The digital model files were provided by FEMA. Model results are shown in Table 7. The floodplain boundaries are shown on FEMA Flood Insurance Rate Map (FIRM) panel 06071C8684H. See Exhibit 4: FEMA FIRM 06071C8684H.

4.2.2 Duplicate Effective Model (HEC-2)

The HEC-2 model provided by FEMA was run by HDR using the HEC-2 (1991) program. The results run by HDR match the FEMA Effective model results and the WRC Model 1 results. As explained, Model 1 in the WRC report is the same model as the FEMA Effective Model prepared by the U.S. Army Corps of Engineers.

4.2.3 Corrected Effective Model (HEC-RAS)

The Duplicate Effective HEC-2 model was imported to HEC-RAS (v4.1). Water surface results match exactly just downstream of Bridge 3.4 but are over 4 feet lower in the HEC-RAS model just upstream of the bridge as shown in Table 7. The discrepancy is attributed to differences in the way that HEC-2 and HEC-RAS are computing bridge hydraulic losses. The Corrected Effective Model was then developed based on the information available in WRC report. Model 2 in WRC report added an additional bridge at Orange Show Road, added channel geometry from River Mile (RM) 28.10 to 29.51, and revised pier data at all bridges.

As explained, the WRC HEC-RAS digital model was not available, but the input and output of the HEC-RAS model were contained in the WRC report. The Corrected Effective HEC-RAS model HDR created was intended to duplicate the WRC Model 2. The results between the duplicate HEC-RAS model and the output from the WRC report were compared. The results agreed and the differences are within 0.01 feet. Some modeling detail notes include:

- Manning's *n* values were kept the same as in the effective FEMA model (overbank=0.075, channel=0.04).
- Ineffective flow areas were added to cross-sections as needed.
- The bridges were modeled using the Highest Energy Answer for low flow and the pressure/weir option for high flow.
- The downstream boundary condition used known water surface, it was kept from the HEC-2 model.
- The model was run under subcritical flow conditions.
- Note that several cross sections downstream of Bridge 3.4 and one cross section upstream do not have enough ground geometry to contain the water in the cross section. Geometry revisions were not made to these cross sections.

4.2.4 Existing Conditions Model (HEC-RAS)

WRC completed survey and as-built plans review for Bridge 3.4. The actual pier width is 6.5 feet compared to 7.6 feet used in WRC Model 2 and in the Corrected Effective HEC-RAS model. The pier width was adjusted to 6.5 feet and this revised model was named the Existing Conditions Model. The pier width for Orange Show Rd and Tippecanoe Ave Bridge were not changed. The actual pier width for Orange Show Rd Bridge and Tippecanoe Ave Bridge is 1.6 feet. Considering 2 feet debris on each side of the pier, the resulting pier width is approximately the same as in WRC Model 2. The Existing Conditions Model was used to evaluate the hydraulics for the existing and proposed conditions. In summary:

- Existing bridge geometry was kept the same for all bridges, except the pier width for Bridge 3.4 was corrected to 6.5 feet per WRC survey/as-built review.
- Per the discussion in the FIS, the Santa Ana River has medium debris potential. Since Bridge 3.4 pier size is over six feet, pier debris accumulation was not applied following typical procedures used by the Los Angeles District USACE.

4.2.5 Proposed Condition Bridge Model (HEC-RAS)

Proposed condition channel geometry and modeling approach for Bridge 3.4 are identical to the existing conditions bridge model for all cross sections outside of the bridge area. A total of two bridge alternatives were analyzed. Bridge alternative design plans can be found at Exhibit 5. The model was modified as following:

- Two alternatives were proposed for Bridge 3.4 replacement. Proposed conditions for Bridge 3.4 were taken from the design plans.
- For Offline Alternative, the proposed design includes a W40X431 steel beam with five piers. The total span is 366.75 feet. The abutments were assumed to be sloped at a 2:1 inclination to meet grade at the channel bottom. Bridge profile was assumed to be steel beam with concrete tie, subgrade and rails.
- For In-line Alternative, the proposed design includes a W40X431 steel beam with five piers. The total span is 372.08 feet. The abutments were assumed to be sloped at a 2:1 inclination to meet grade at the channel bottom. Bridge profile was assumed to be steel beam with concrete tie, subgrade and rails.
- The proposed condition survey was based on NAVD 88 vertical datum. The Corpscon program was used to convert elevations in NAVD 88 to NGVD 29. The conversion relationship of NAVD 88 – NGVD 29 = 2.5 feet was used based on the proposed bridge location (N34.07515, W117.2721).

4.3 Model Results

Table 3 shows the Existing Conditions Model hydraulic results for Cross Section 28.62 upstream of Bridge 3.4. Figure 3 shows the profile of the existing AT&SF Bridge. Figure 4

shows the cross section view of the existing Bridge 3.4 and Figure 5 shows the cross-section view of the Offline Alternative bridge. The In-line Alternative bridge is generally similar to Offline Alternative. The model exhibits for the existing and proposed condition profile and cross sections can be found in Attachment 1.

Table 3: Existing Conditions Model Results for Cross-Section 28.62 (Upstream of Bridge 3.4)

	100-Year
WSE	1017.19 ft
EGL	1018.79 ft
VCH	10.18 ft/s

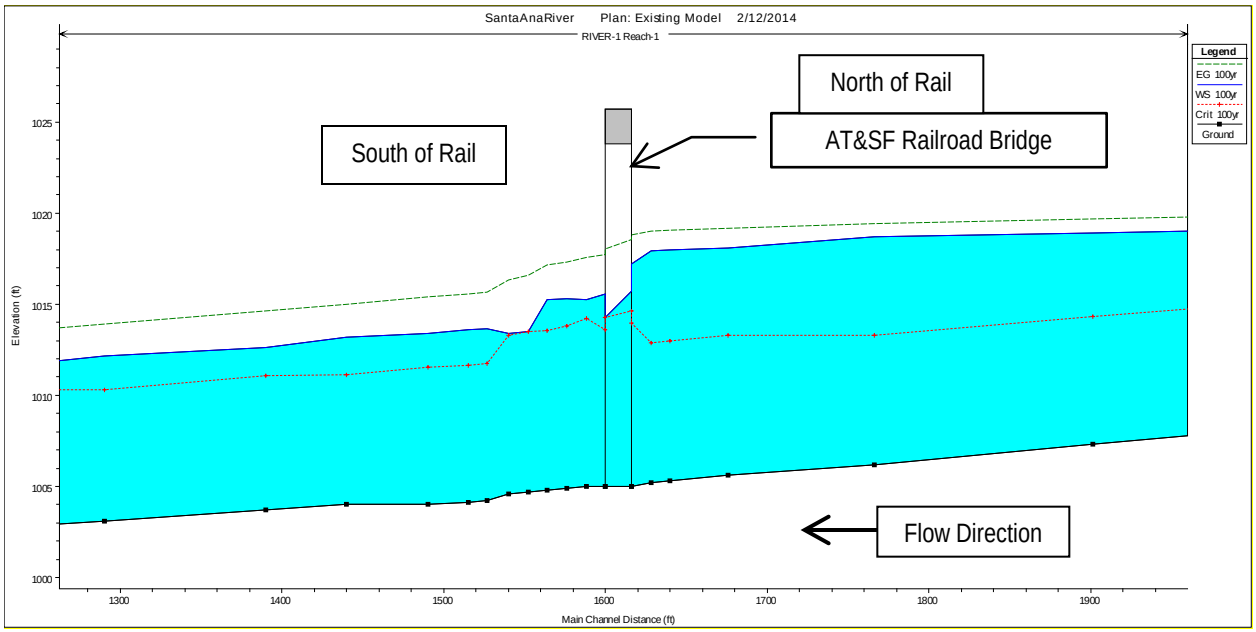
WSE = water surface elevation, EGL = energy grade line elevation, VCH = main channel average velocity. All elevations are NGVD 1929.

The results obtained from 100-year flow rate analysis of Bridge 3.4 are shown in Table 4. Full hydraulic model results are shown in Attachment 2 (Hydraulic Analysis Results).

Table 4: AT&SF Bridge 3.4 (28.617) Hydraulic Results

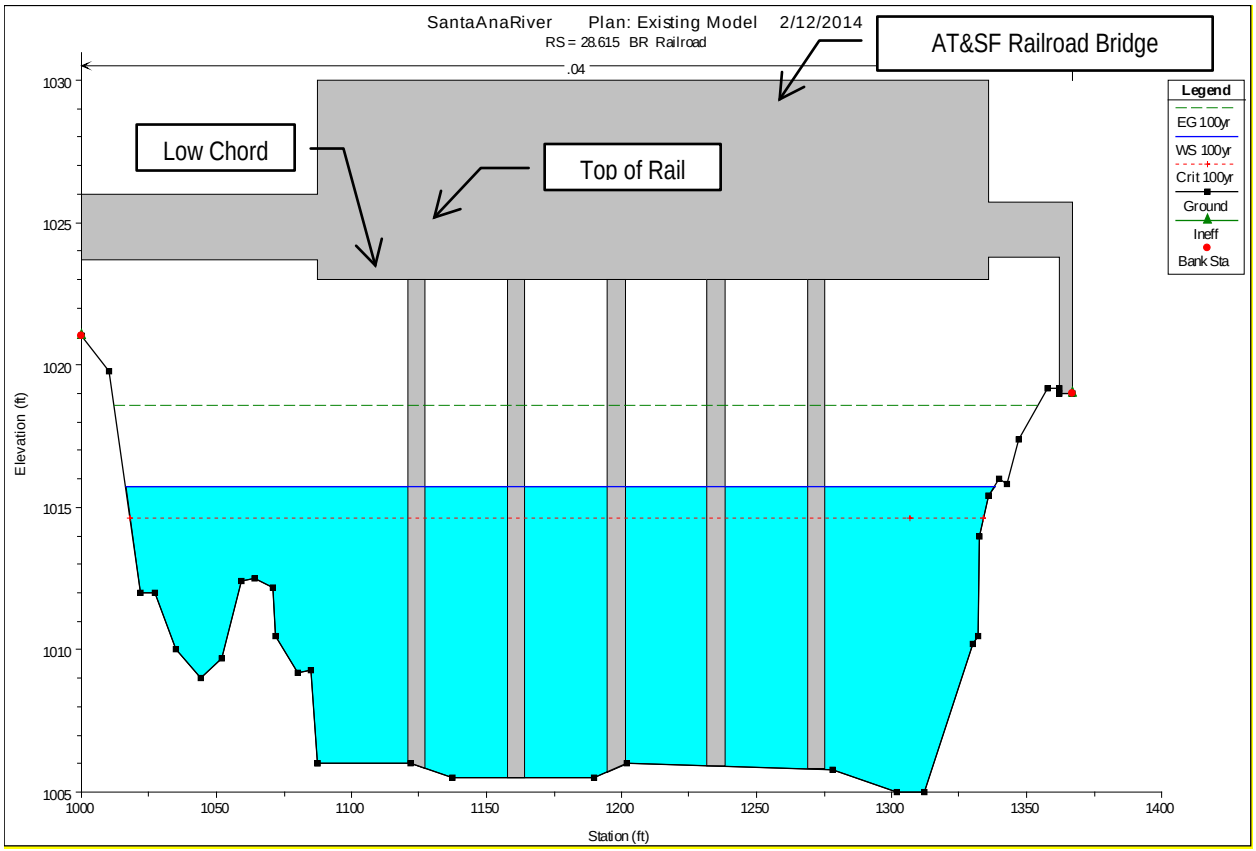
		Existing Bridge	**Offline Alternative**	**In-line Alternative**
100-Yr event	WSE	1017.19 ft	1017.12 ft	1017.09 ft
	EGL	1018.79 ft	1018.42 ft	1018.40 ft
	Velocity	15.6 ft/s	11.43 ft/s	11.43 ft/s
	Froude #	0.82	0.68	0.67

WSE = water surface elevation; EGL = energy grade line elevation; VCH = main channel average velocity; All elevations are NGVD 1929.



EG = energy grade line (ft), WS = water surface (ft), yr = year

Figure 3: Profile of Existing Condition



EG = energy grade line (ft), WS = water surface (ft), yr = year

Figure 4: Cross-Section of Existing Conditions Upstream of Bridge 3.4

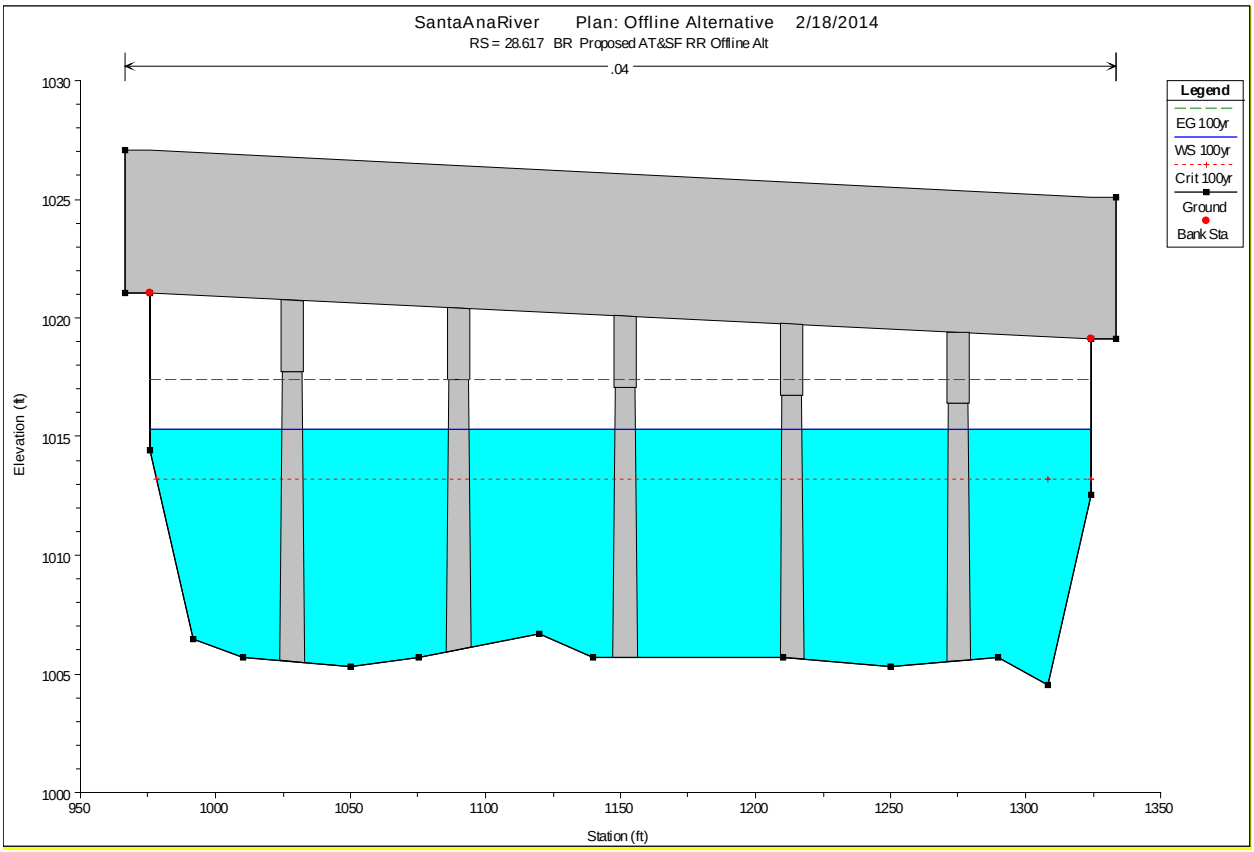


Figure 5: Cross-Section of Proposed Conditions Upstream Face of Bridge 3.4 (Offline Alternative)

The freeboard criteria selected for the bridge (in the following priority) are presented below in Table 5 and Table 6 for Offline Alternative and In-line Alternative, respectively. The 100-year EGL is below the top of subgrade, meeting 100 year criteria, and also below the low chord, therefore meeting 50-year criteria by default. The alternatives meet all criteria.

Table 5: Hydraulic Freeboard Criteria (Offline Alternative)

Criterion	Standard	Proposed Model Results	Criterion Met?
1. 100-yr WSE < Low Chord	Low Chord = 1019.12	100-yr WSE = 1017.12	Yes
2. 100-yr EGL < Top of SBGD	Top of SBGD = 1022.15	100-yr EGL = 1018.42	Yes
3. Proposed WSE ≤ Existing WSE	Existing 100-yr WSE = 1017.19	Proposed 100-yr WSE = 1017.12	Yes
WSE = water surface elevation (ft); EGL = energy grade line elevation (ft); SBGD = subgrade. All elevations are NGVD 1929.			

Table 6: Hydraulic Freeboard Criteria (In-line Alternative)

Criterion	Standard	Proposed Model Results	Criterion Met?
1. 100-yr WSE < Low Chord	Low Chord = 1019.12	100-yr WSE = 1017.09	Yes
2. 100-yr EGL < Top of SBGD	Top of SBGD = 1022.15	100-yr EGL = 1018.40	Yes
3. Proposed WSE ≤ Existing WSE	Existing 100-yr WSE = 1017.19	Proposed 100-yr WSE = 1017.09	Yes
WSE = water surface elevation (ft); EGL = energy grade line elevation (ft); SBGD = subgrade. All elevations are NGVD 1929.			

The results of the hydraulic analysis upstream and downstream of the Bridge 3.4 are shown in Table 7. For both Alternatives, the results show no rise in the study reach.

Table 7: Hydraulic Analysis Results (ft, NGVD29)

River Station	*FEMA Effective HEC-2*	*Duplicate Effective HEC-RAS*	*Corrected Effective*	*Existing*	*Offline Alternative*	*In-Line Alternative*	*Offline Alt-Existing*	*In-Line Alt-Existing*
29.01	1025.27	1025.14	1025.01	1025.01	1025.01	1025.01	0	0
28.95	1024.34	1023.97	1023.97	1023.97	1023.97	1023.97	0	0
28.84	1023.16	1021.56	1021.55	1021.51	1021.4	1021.4	-0.11	-0.11
28.737	1022.57	1019.79	1019.75	1019.65	1019.2	1019.18	-0.45	-0.47
28.673	1022.27	1019.09	1019.04	1018.9	1018.26	1018.24	-0.64	-0.66
28.647	1022.18	1018.9	1018.85	1018.7	1018.02	1017.99	-0.68	-0.71
28.63	1021.92	1018.34	1018.28	1018.1	1017.26	1017.23	-0.84	-0.87
28.626	-	-	-	1017.98	1017.12	1017.09	-0.86	-0.89
28.624	1021.84	1018.23	1018.17	1017.97	-	-	-	-
28.622	1021.81	1018.19	1018.13	1017.93	-	-	-	-
28.62	1021.63	1017.53	1017.46	1017.19	-	-	-	-
28.615/28.617				Railroad Bridge				
28.61	1015.58	1015.58	1015.58	1015.58	1015.28	1015.28	-0.3	-0.3
28.608	1015.30	1015.29	1015.28	1015.28	1015.28	1015.28	0	0
28.606	1015.32	1015.3	1015.29	1015.29	1015.29	1015.29	0	0
28.604	1015.30	1015.28	1015.27	1015.27	1015.27	1015.27	0	0
28.602	1013.49	1013.52	1013.52	1013.52	1013.52	1013.52	0	0
28.6	1013.41	1013.38	1013.38	1013.38	1013.38	1013.38	0	0
28.597	1013.67	1013.65	1013.65	1013.65	1013.65	1013.65	0	0
28.595	1013.61	1013.59	1013.59	1013.59	1013.59	1013.59	0	0
28.59	1013.38	1013.37	1013.37	1013.37	1013.37	1013.37	0	0
28.58	1013.22	1013.21	1013.21	1013.21	1013.21	1013.21	0	0

5. Conclusions

Using the data and resources available, the hydraulic conditions for both existing and proposed conditions were modeled for Bridge 3.4. The results of the modeling indicate that the proposed bridge improvements result in a slightly lower water surface and velocity; the proposed bridge will meet freeboard criteria. A draft FEMA "No-Rise" Certificate was completed for the proposed bridge. It will be finalized after the preferred alternative is selected.

6. References

Federal Emergency Management Agency (FEMA). 1987. FEMA Effective Model for Santa Ana River. HEC-2 format.

Federal Emergency Management Agency. 2008. Flood Insurance Study, San Bernardino County, California.

Federal Emergency Management Agency. 2008. San Bernardino County Flood Insurance Study.

HDR, Inc. 2012. SANBAG Redlands Passenger Rail Project Plans.

National Geodetic Survey. 1991. North American Vertical Datum (NAVD) 88.

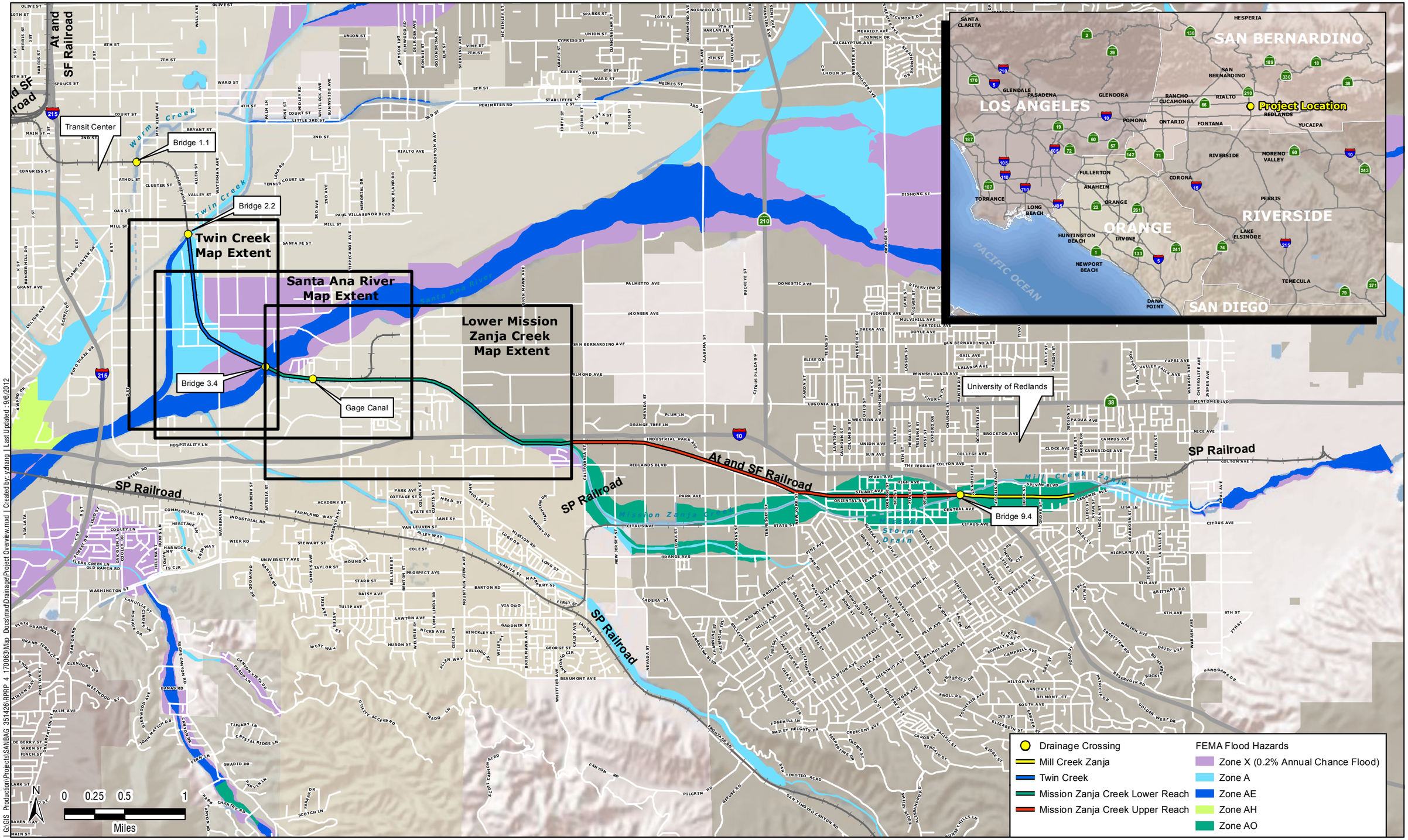
National Geodetic Survey. 1929. National Geodetic Vertical Datum (NGVD) 29.

U.S. Army Corps of Engineers (USACE). 1991. Santa Ana River Mainstream Project, CA. Feature Design Memorandum No. 2, Seven Oaks Dam Floodway Delineation (including 500-Year and Seven Oaks Dam Failure Floodplains) Report and Plates.

U.S. Army Corps of Engineers. 2010. HEC-RAS v.4.1 User's Manual and Technical Reference Manual

WRC Consulting Services, Inc. 2003. Santa Ana River Trail, Alabama Street to Waterman Avenue, Hydraulic Design and Analysis.

Exhibit 1: RPRP Project Overview



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Project Overview

EXHIBIT 1

SANBAG | Redlands Passenger Rail Project | Hydraulic Impact Report

Exhibit 2: Santa Ana River Reach Limits

| Path:G:\GIS_Production\Projects\SANBAG_351426\RPRP_4_170063\Map_Docs\mxd\Drainage\SAR93.mxd | Created by: VZhang | Last Updated : 01-24-12

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Santa Ana River

EXHIBIT 2

SANBAG | Redlands Passenger Rail Project | Santa Ana River Report

Exhibit 3: Modeling Overview–Cross-Sections

Exhibit 3 – Modeling Overview – Cross Sections

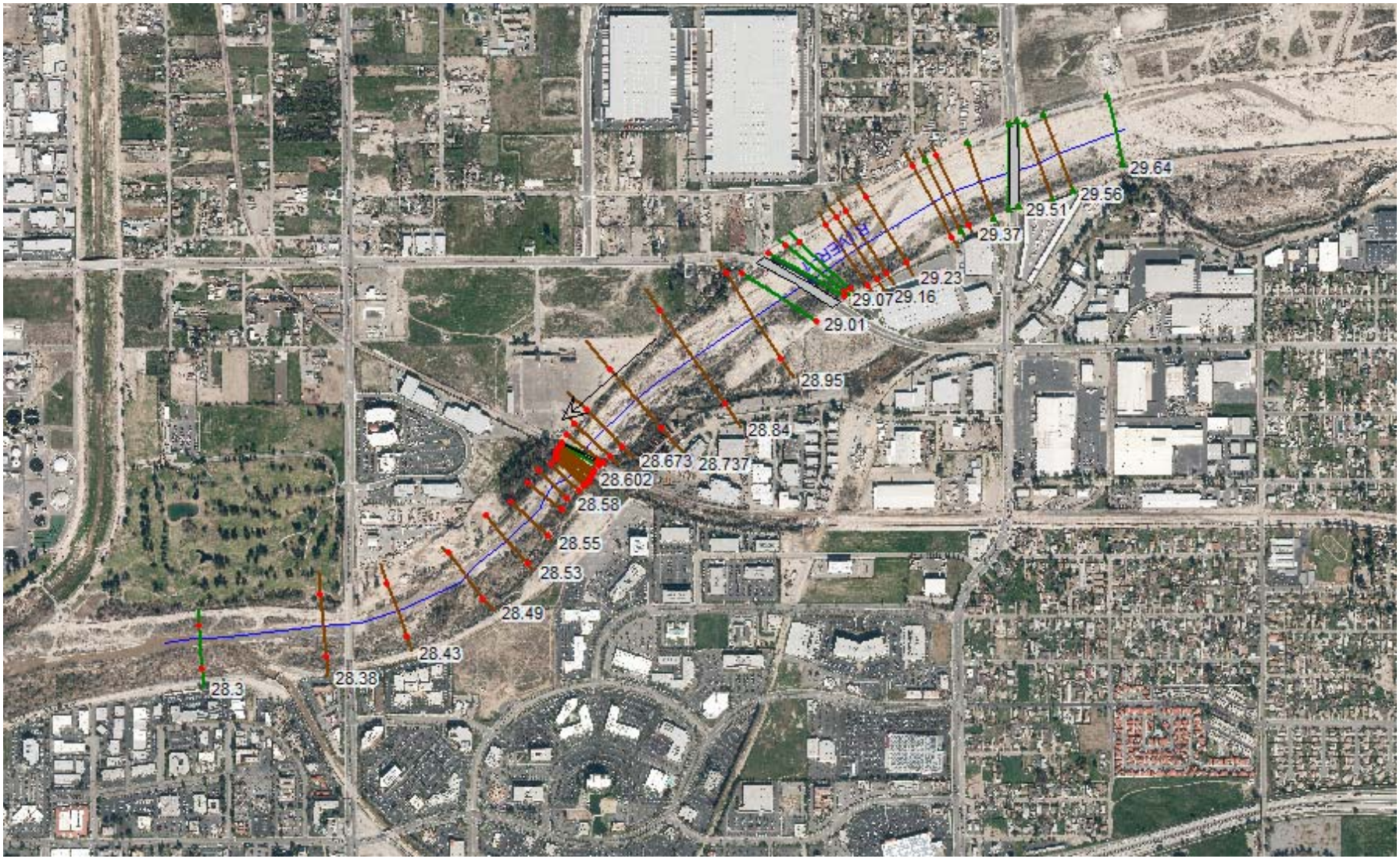
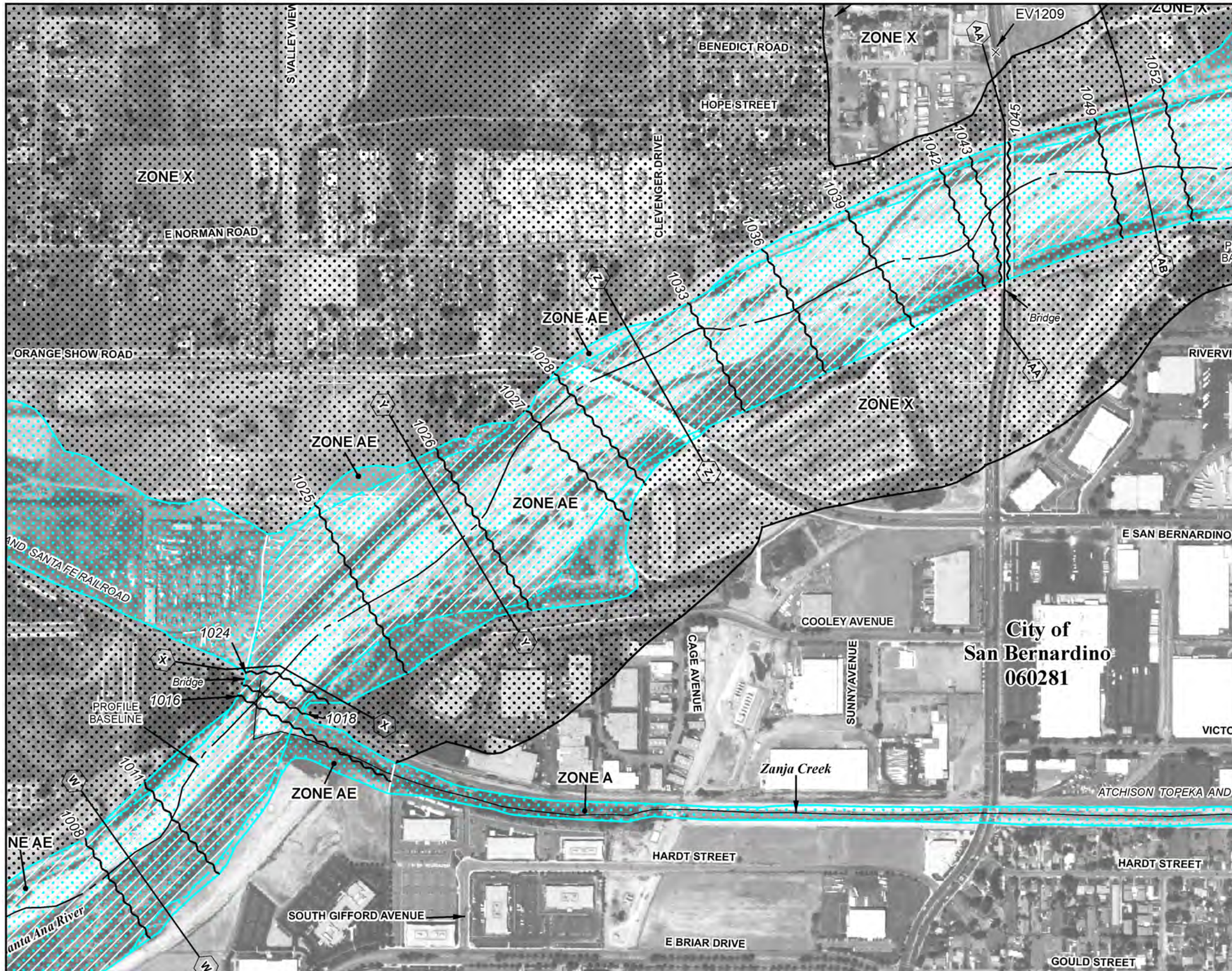


Exhibit 4: FEMA FIRM 06071C Panel 8684H



ional Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

50 0 500 1000 FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 8684H

FIRM

FLOOD INSURANCE RATE MAP

SAN BERNARDINO COUNTY, CALIFORNIA

AND INCORPORATED AREAS

PANEL 8684 OF 9400

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
LOMA LINDA, CITY OF	065042	8684	H
SAN BERNARDINO, CITY OF	060281	8684	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.

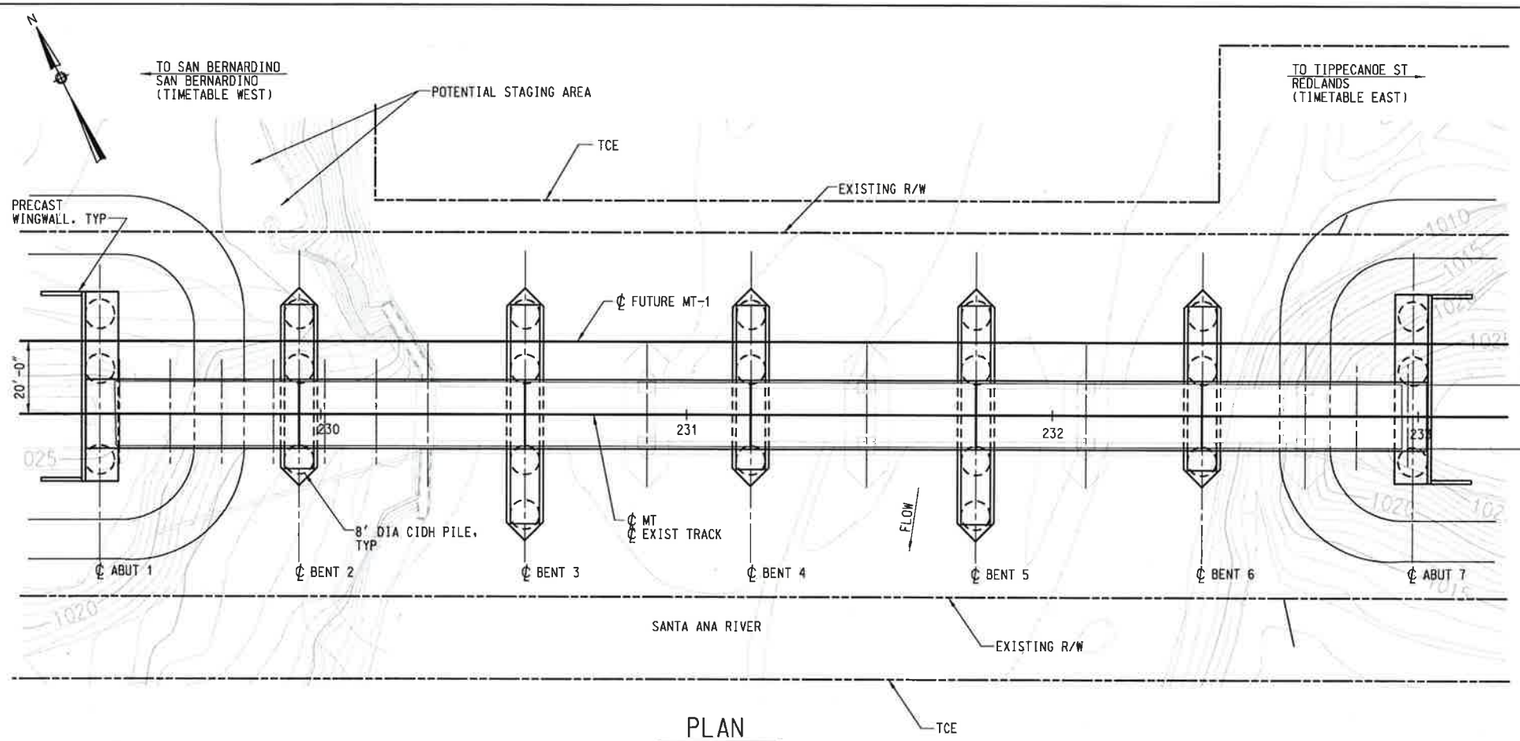
MAP NUMBER
06071C8684H

MAP REVISED
AUGUST 28, 2008

Federal Emergency Management Agency

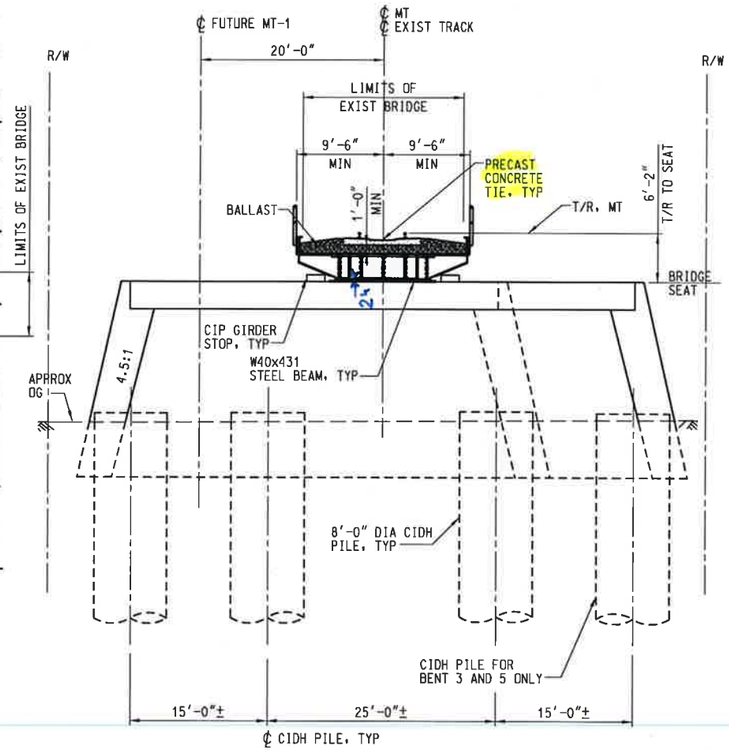
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program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

Exhibit 5: Proposed Bridge Alternative Plans



PLAN

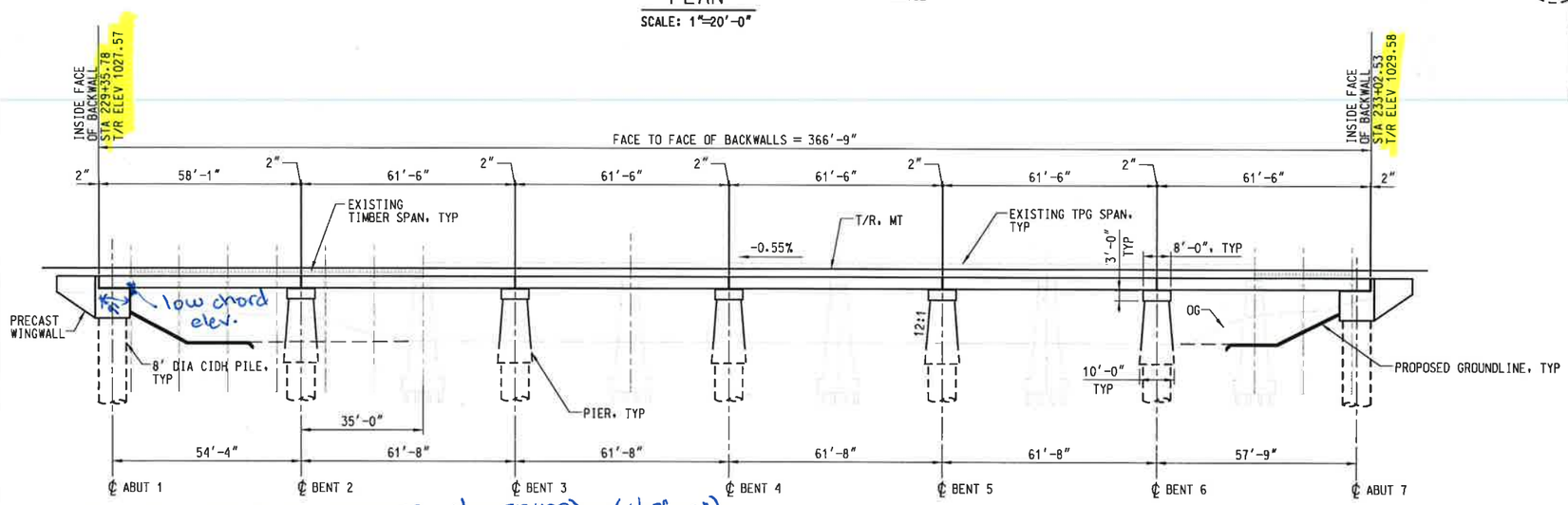
SCALE: 1"=20'-0"



* SEE PLAN FOR TCE.

TYPICAL SECTION

SCALE: 1/8"=1'-0"



low chord elevation = (1027.57 + 9'x0.55/100) - (6'-2" -2")
= 1021.62'

ELEVATION

SCALE: 1"=20'-0"

LEGEND

- EXISTING STRUCTURE
- NEW STRUCTURE

REV.	DATE		BY	SUB.	APP.

DESIGNED BY V. TRUONG/J. ZHU
DRAWN BY R. ZHAO
CHECKED BY B. REZNIKOV
APPROVED BY M. BORAKS
DATE FEB 2013

Governments SANBAG Working Together — SAN BERNARDINO ASSOCIATED GOVERNMENTS

HDR Engineering, Inc. — ONE COMPANY Many Solutions

SUBMITTED: _____ PROJECT MANAGER

APPROVED: _____

30% SUBMITTAL
NOT FOR CONSTRUCTION

REDLANDS PASSENGER RAIL PROJECT

OFFLINE ALTERNATIVE
BRIDGE 3.4
GENERAL PLAN

CONTRACT NO.
DRAWING NO. SB-06301
REVISION | SHEET NO.
SCALE AS NOTED

2/5/2014 5:39:31 PM
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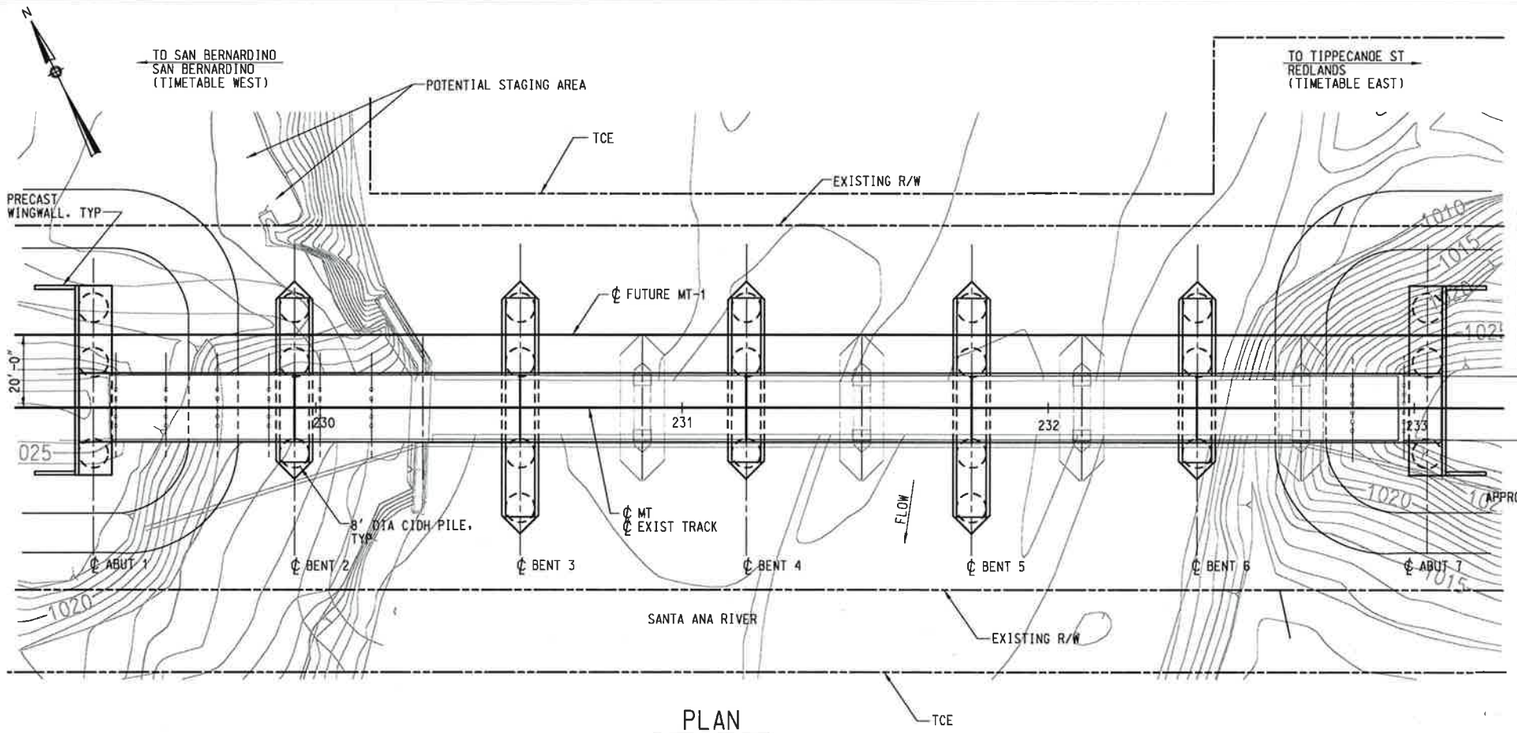
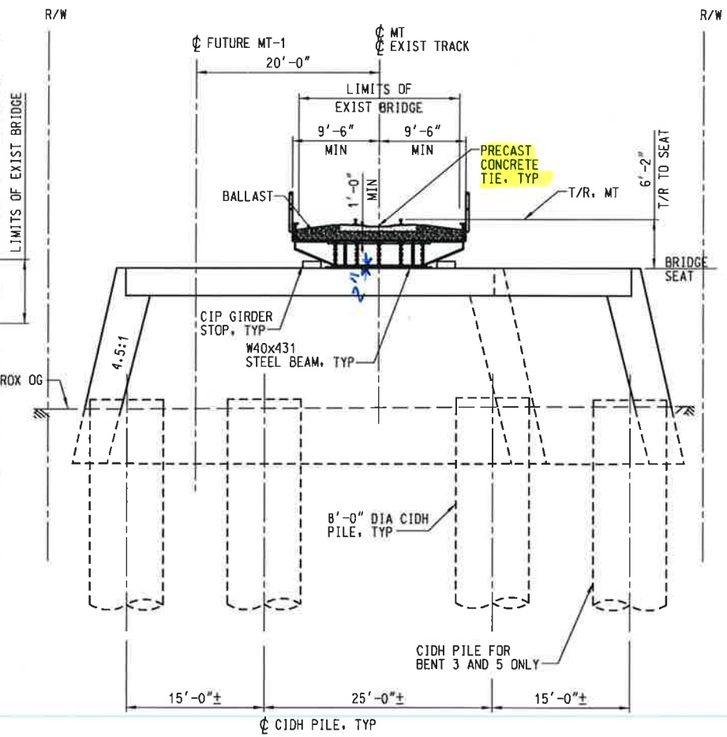
ngrenado



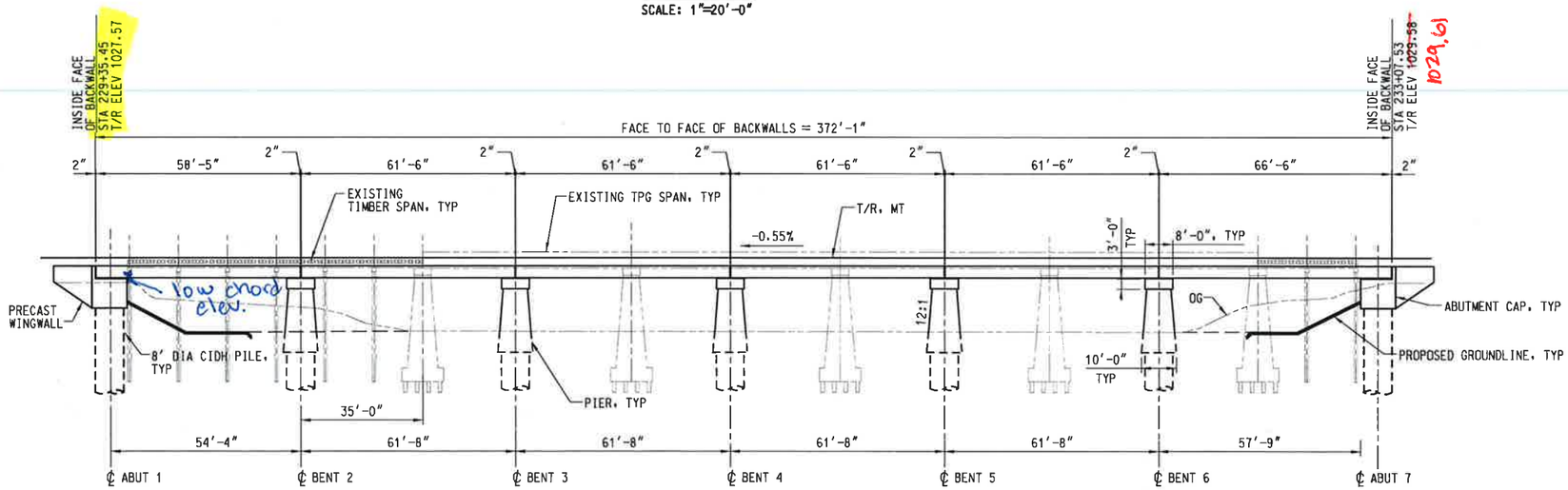
PLAN

SCALE: 1"=20'-0"



TYPICAL SECTION

SCALE: 1/8"=1'-0"



low chord elevation = 1021.62'

ELEVATION

SCALE: 1"=20'-0"

LEGEND

- EXISTING STRUCTURE
- NEW STRUCTURE

REV.	DATE		BY	SUB.	APP.

DESIGNED BY V. TRUONG/J. ZHU
DRAWN BY R. ZHAO
CHECKED BY B. REZNIKOV
APPROVED BY M. BORAKS
DATE FEB 2013

Governments SANBAG Working Together — SAN BERNARDINO ASSOCIATED GOVERNMENTS

HDR Engineering, Inc. — ONE COMPANY Many Solutions

SUBMITTED: _____ PROJECT MANAGER

APPROVED: _____

30% SUBMITTAL
NOT FOR CONSTRUCTION

REDLANDS PASSENGER RAIL PROJECT

IN-LINE ALTERNATIVE
BRIDGE 3.4
GENERAL PLAN

CONTRACT NO.
DRAWING NO. SB-06304
REVISION | SHEET NO.
SCALE AS NOTED

2/5/2014 5:40:40 PM mgranado
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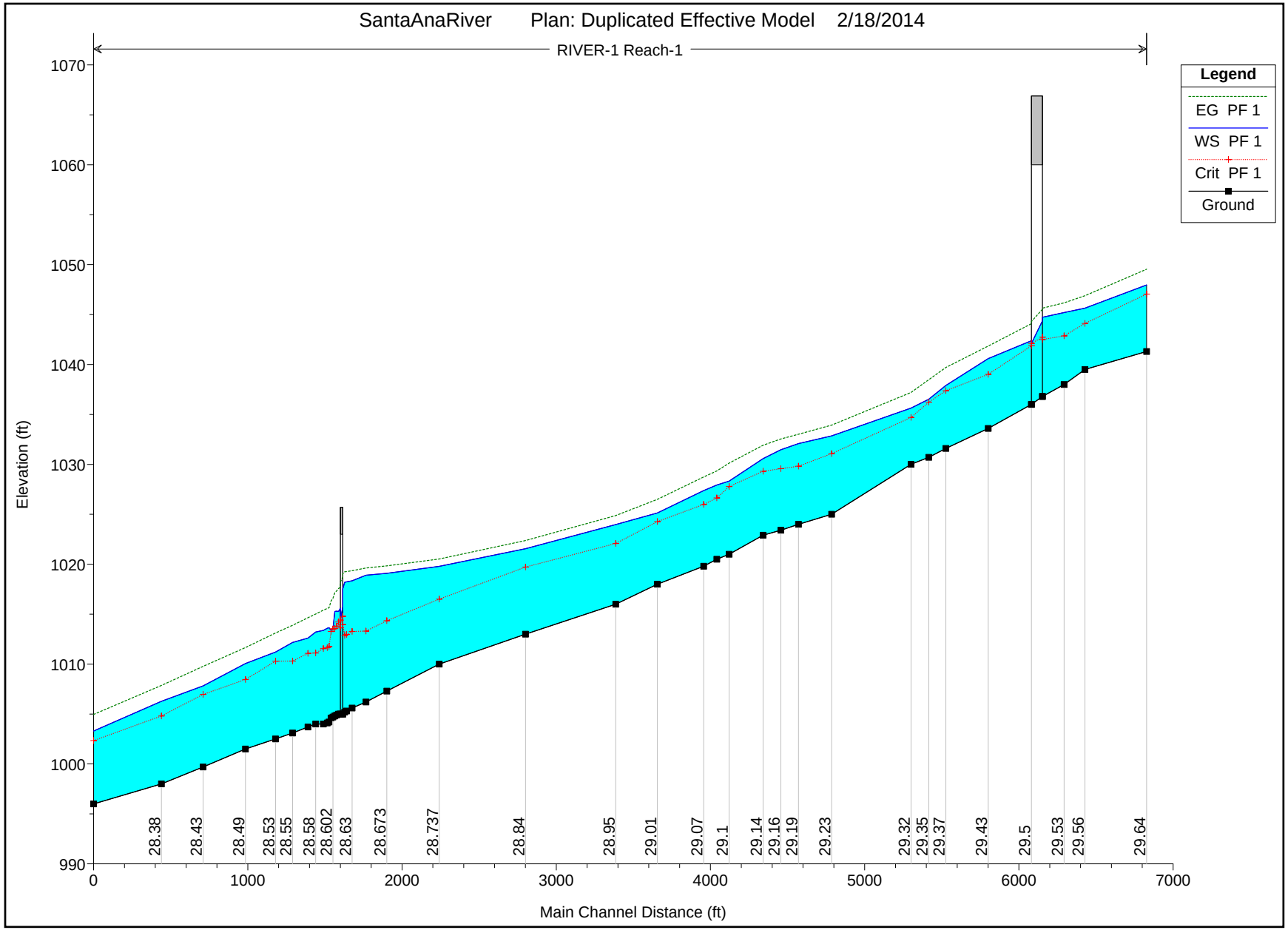
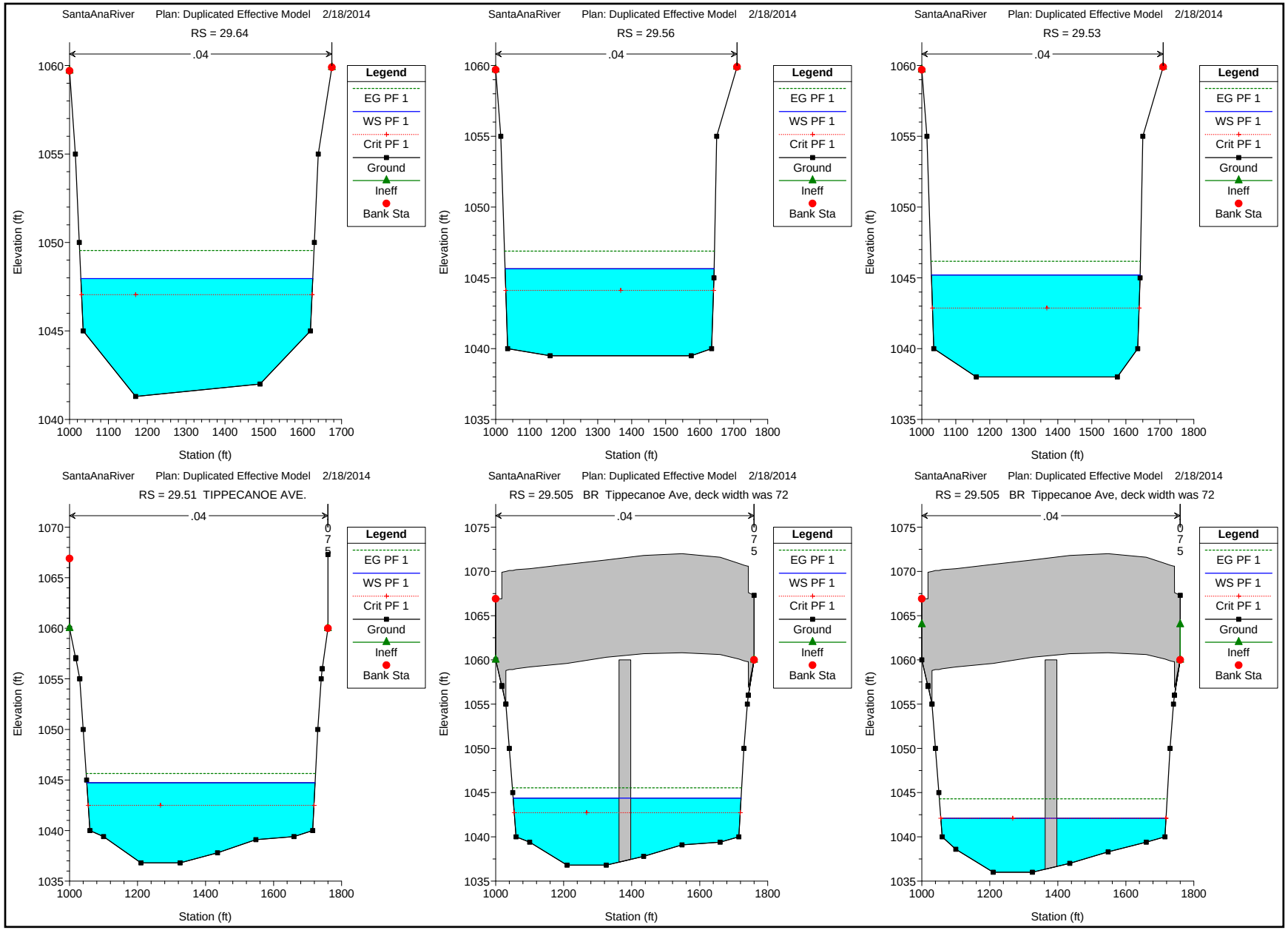
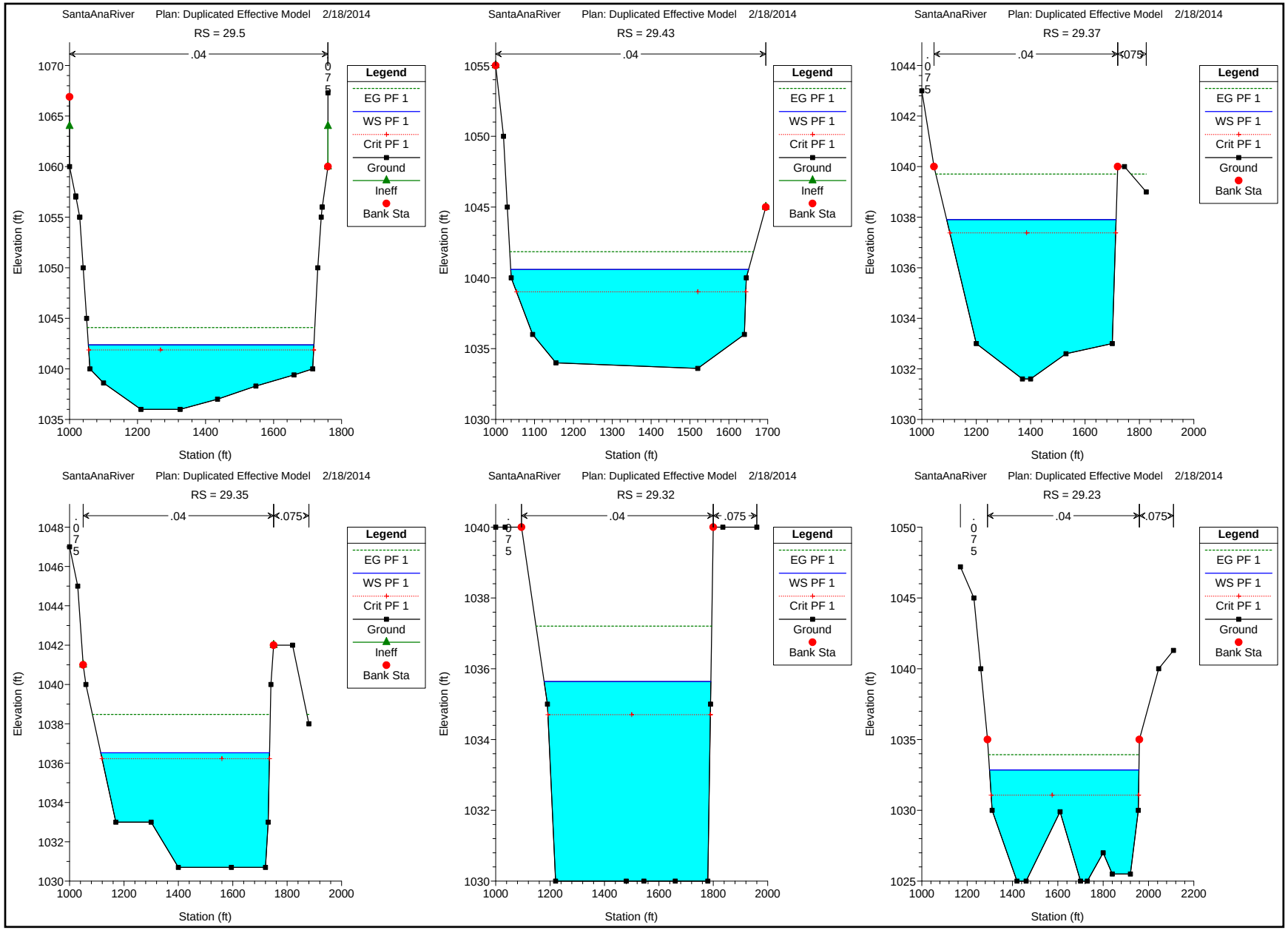
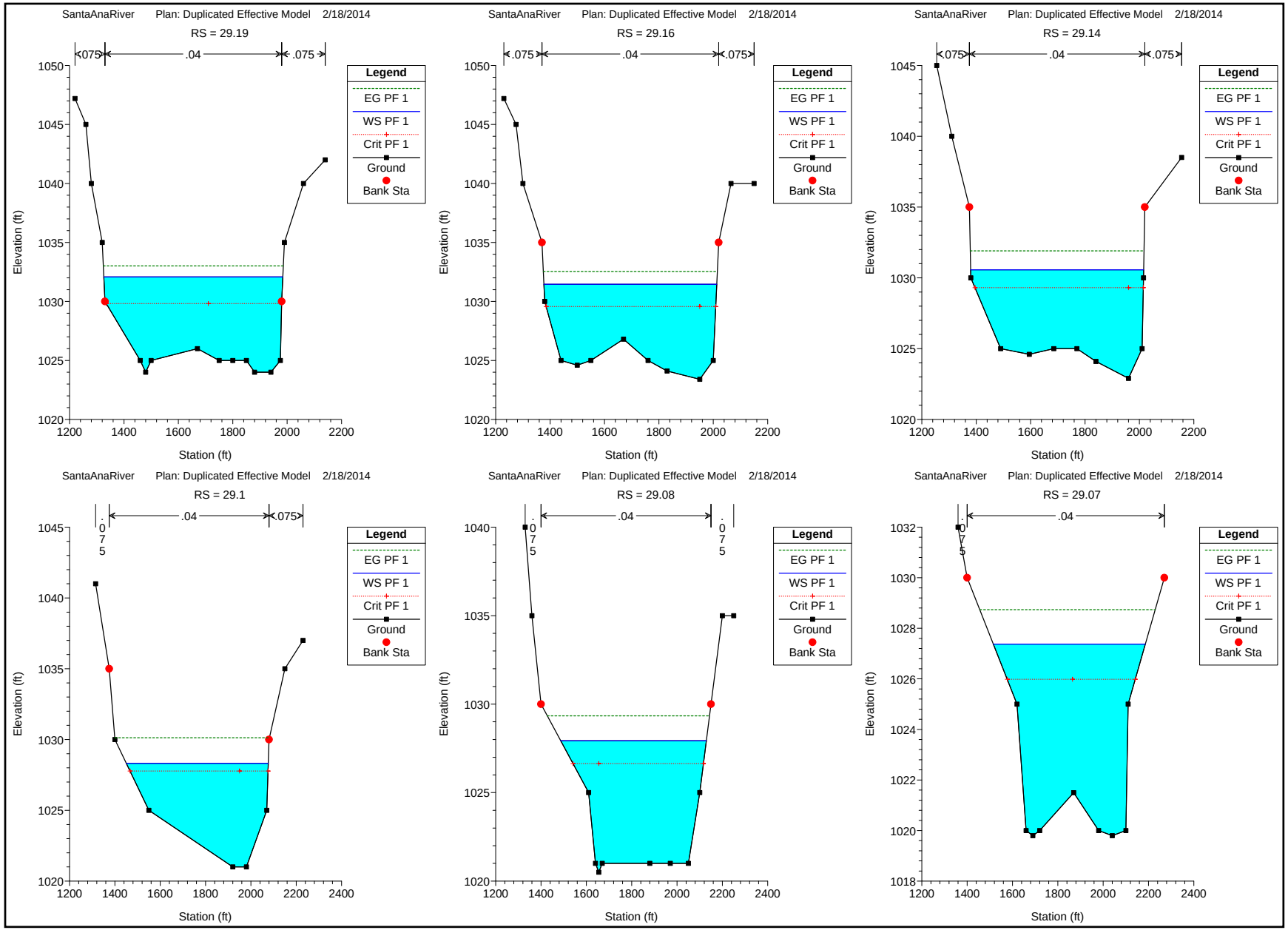
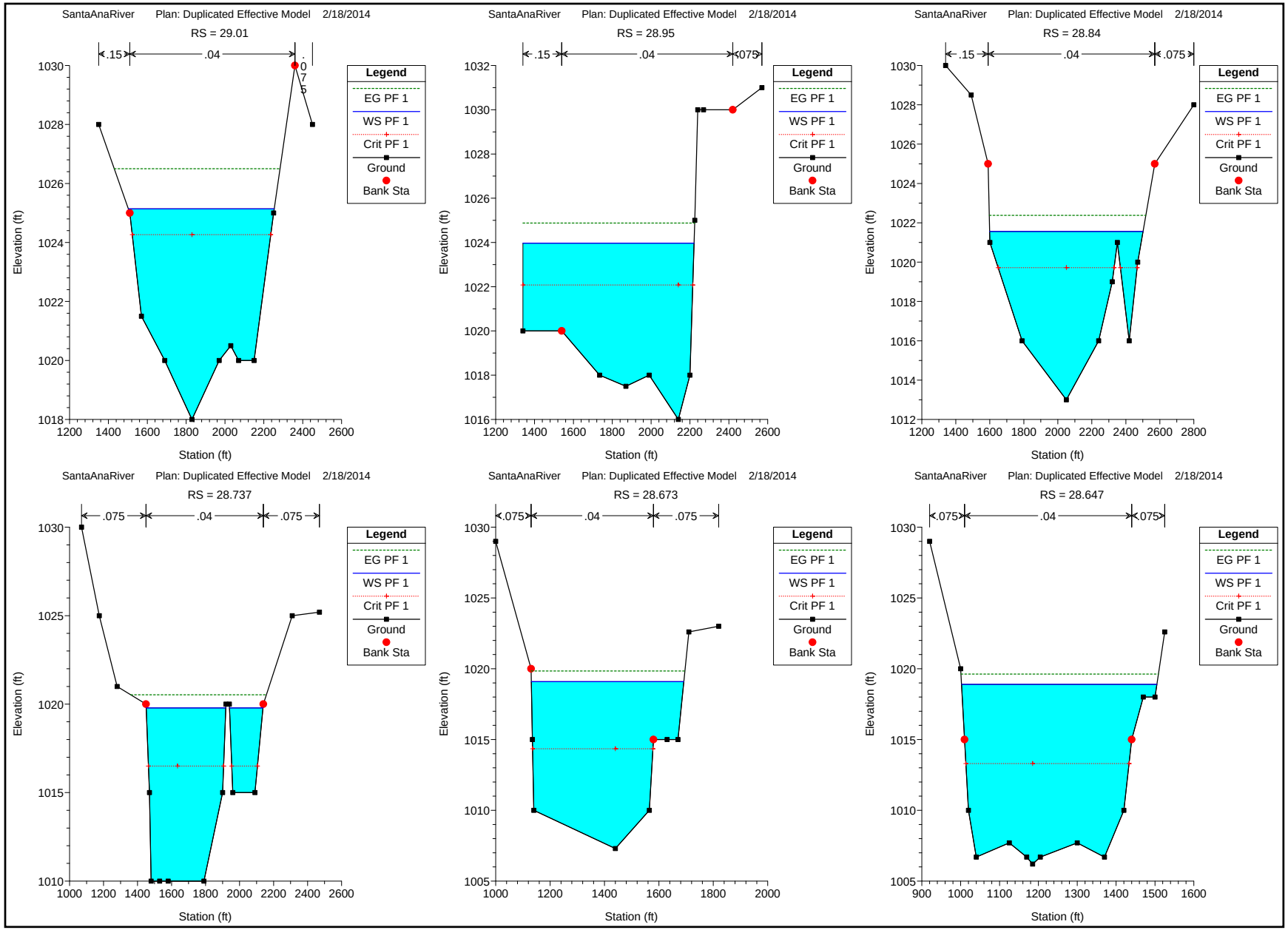
Attachment 1 - HEC-RAS Modeling Exhibits

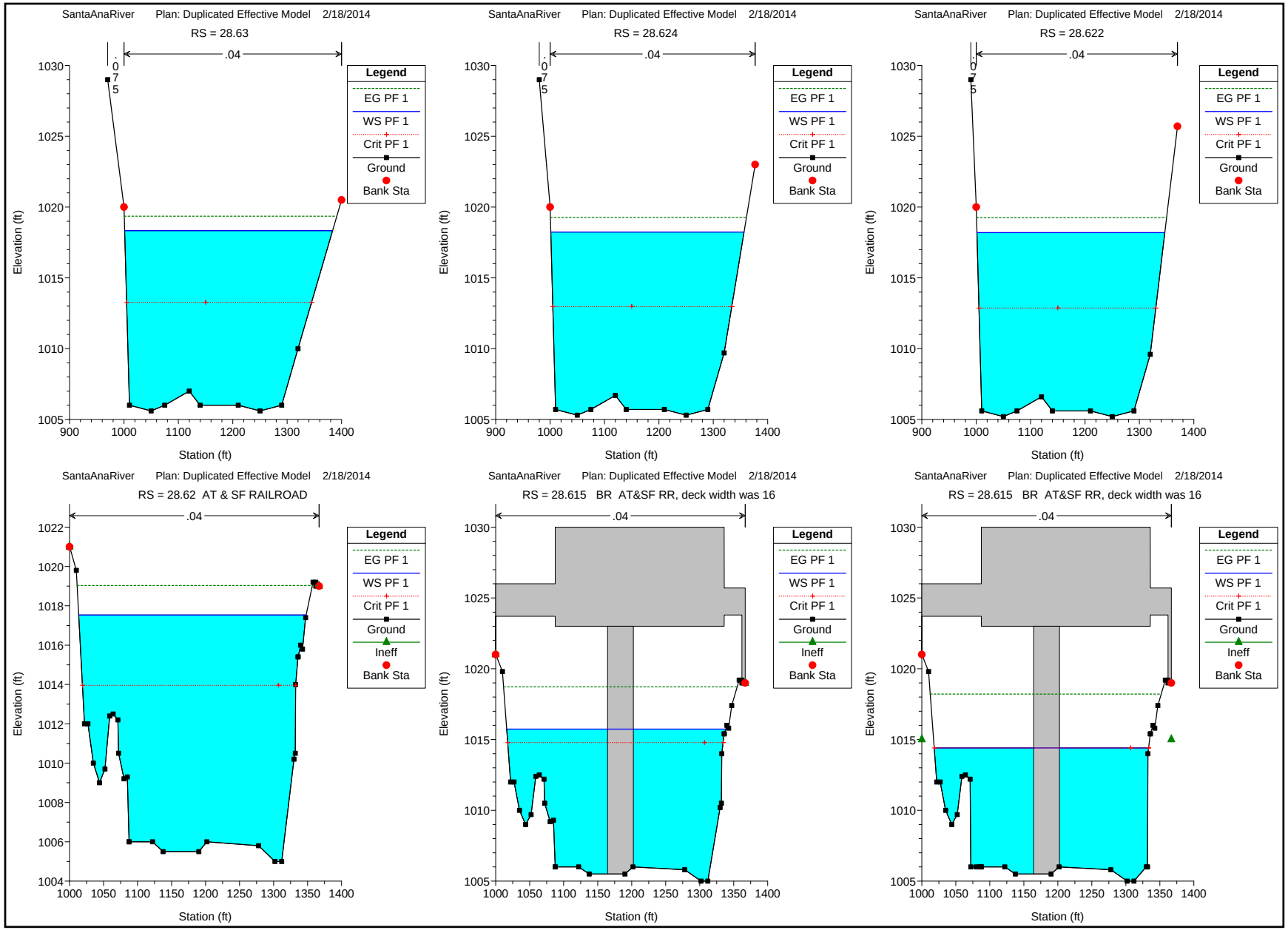

SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RIVER-1 Reach-1
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
1070
1060
1050
1040
1030
1020
1010
1000
990
0
1000
2000
3000
4000
5000
6000
7000
Main Channel Distance (ft)
28.38
28.43
28.49
28.53
28.55
28.58
28.602
28.63
28.673
28.737
28.84
28.95
29.01
29.07
29.1
29.14
29.16
29.19
29.23
29.32
29.35
29.37
29.43
29.5
29.53
29.56
29.64

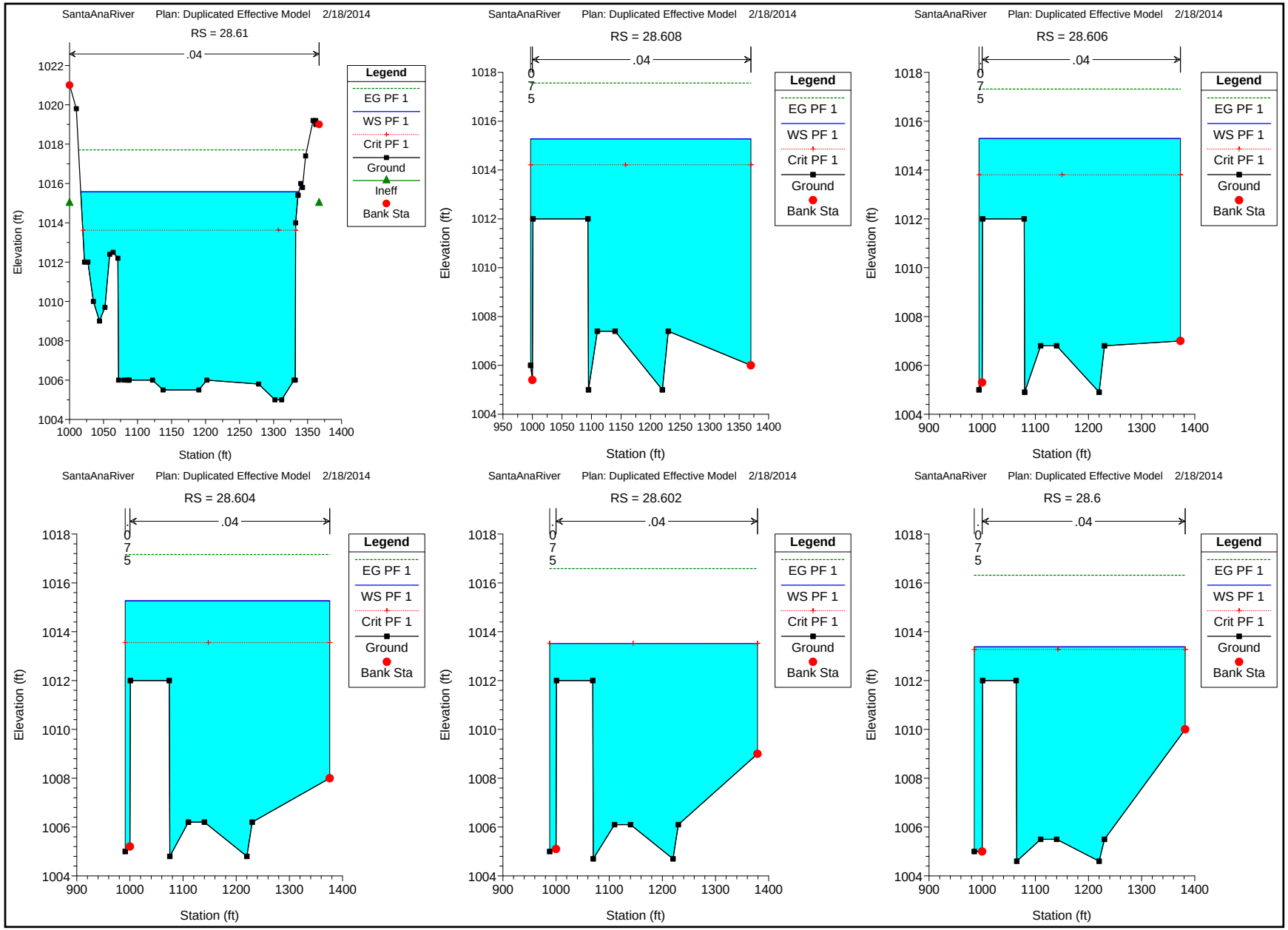

SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 29.64
RS = 29.56
RS = 29.53
RS = 29.51 TIPPECANOE AVE.
RS = 29.505 BR Tippecanoe Ave, deck width was 72
.04
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

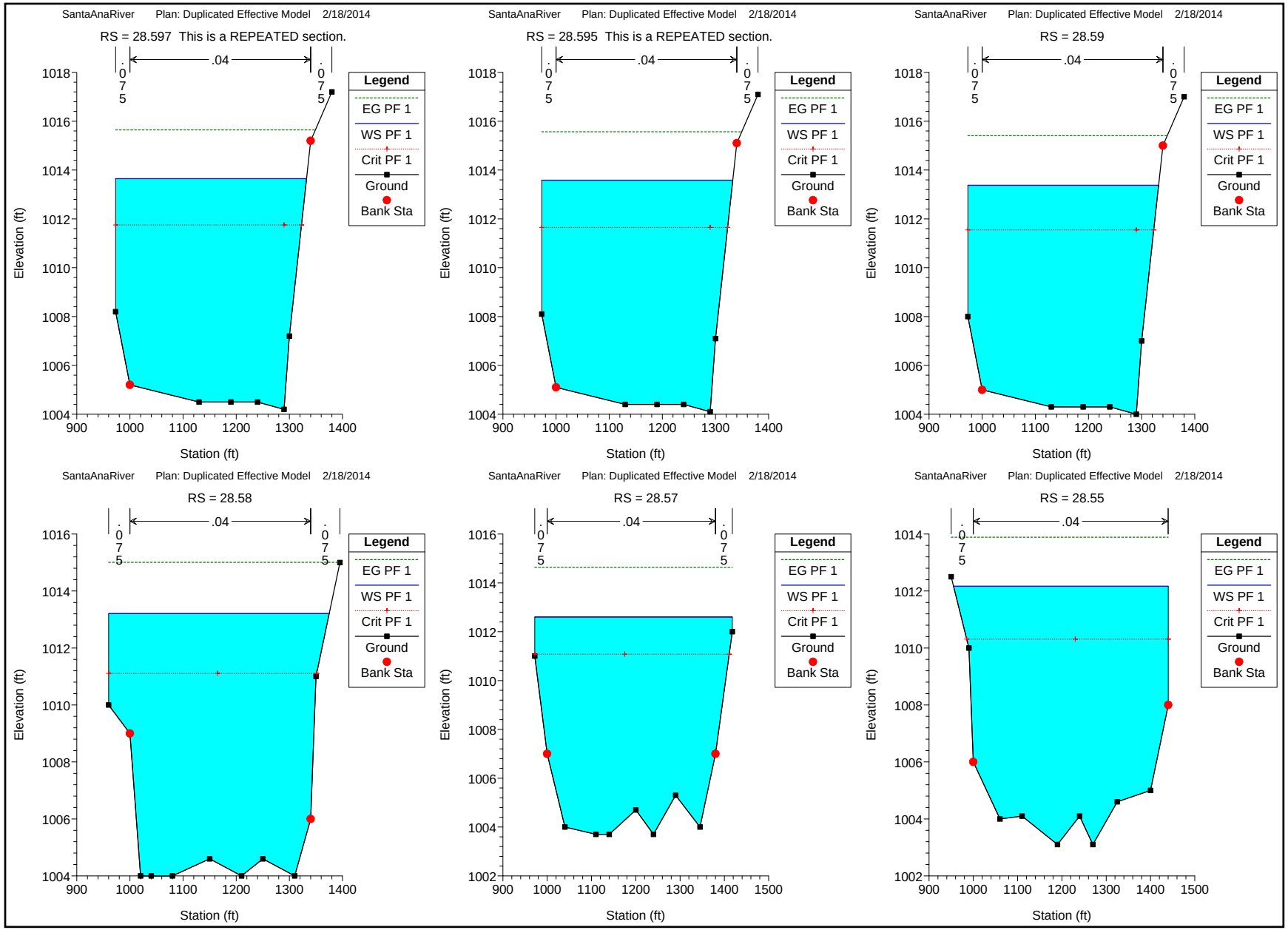

SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 29.5
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 29.43
.04
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 29.37
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 29.35
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 29.32
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 29.23
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

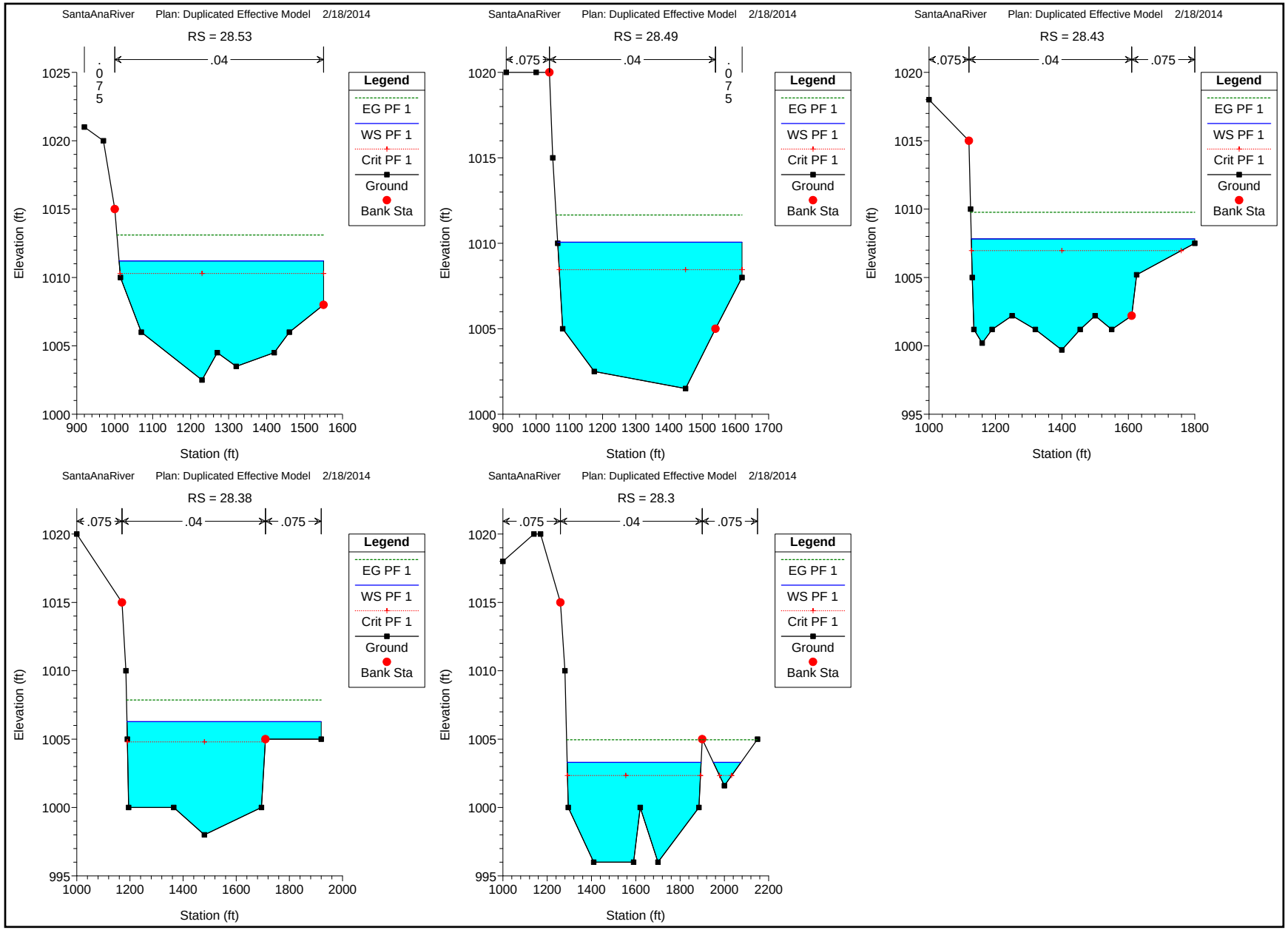

SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 29.19
.075
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 29.16
.075
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 29.14
.075
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 29.1
.075
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 29.08
.075
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 29.07
.075
.04
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

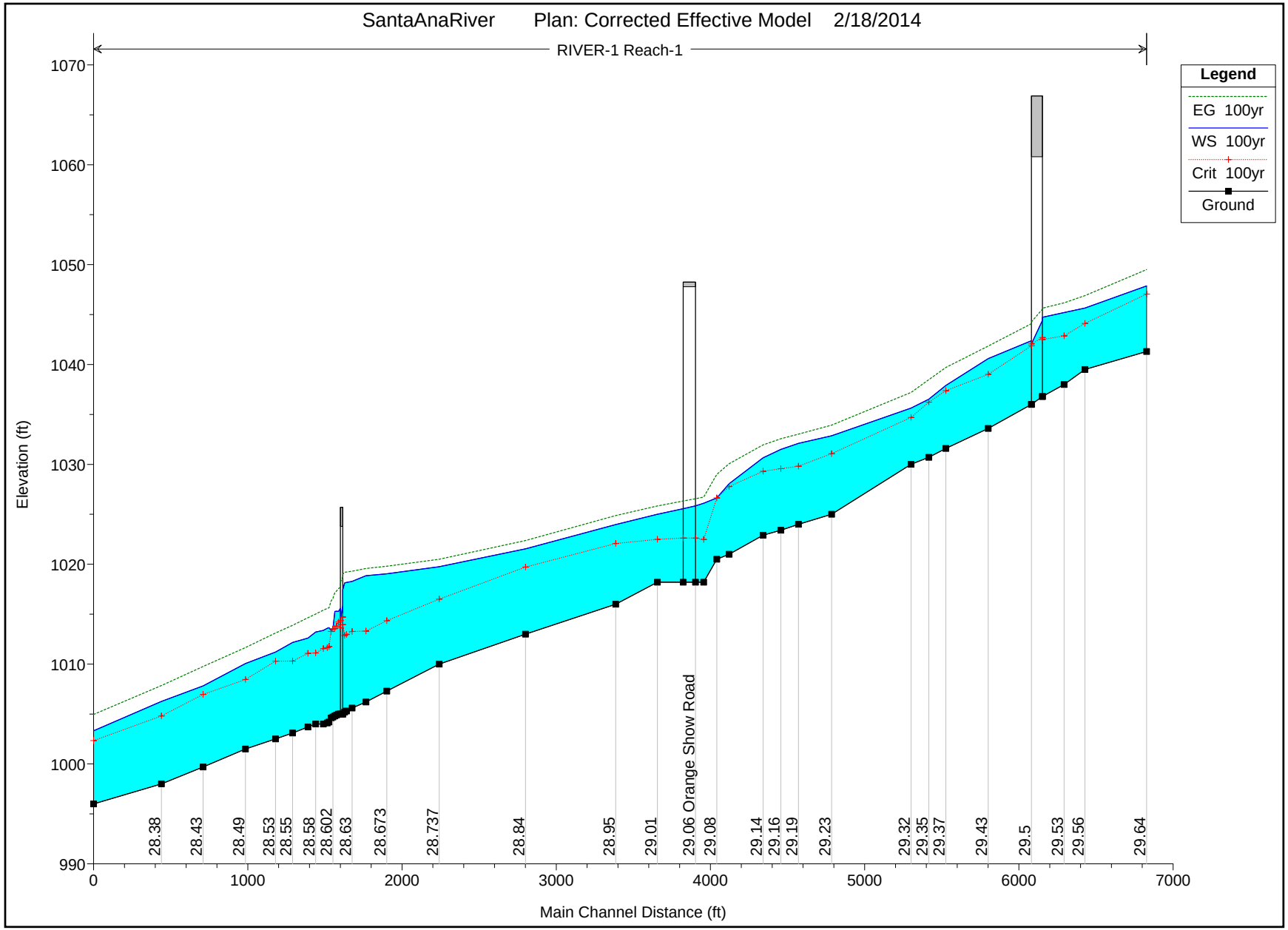

SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 29.01
.15
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 28.95
.15
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 28.84
.15
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 28.737
.075
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 28.673
.075
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 28.647
.075
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

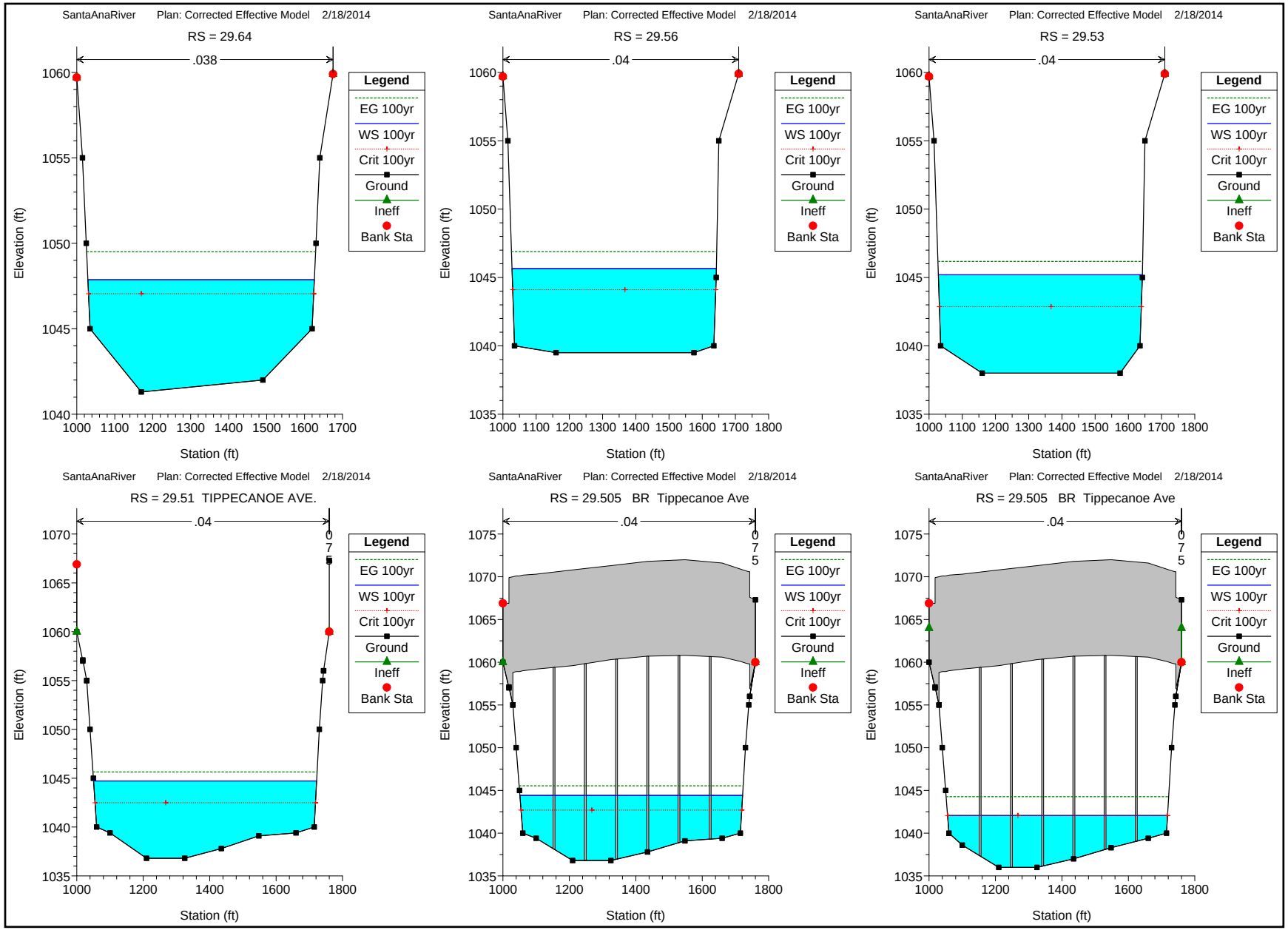

SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 28.63
RS = 28.624
RS = 28.622
RS = 28.62 AT & SF RAILROAD
RS = 28.615 BR AT&SF RR, deck width was 16
RS = 28.615 BR AT&SF RR, deck width was 16
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

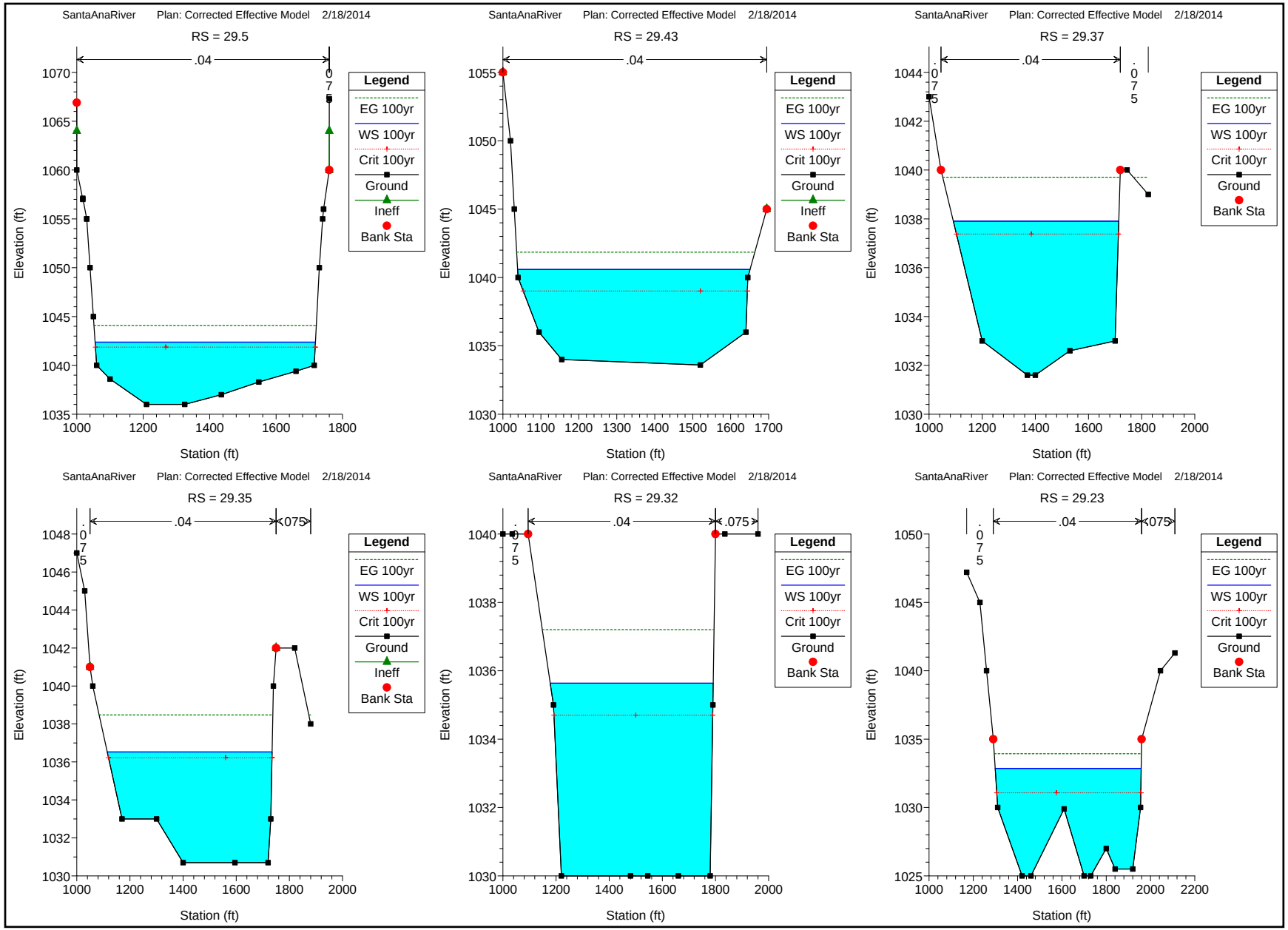

SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 28.61
RS = 28.608
RS = 28.606
RS = 28.604
RS = 28.602
RS = 28.6
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

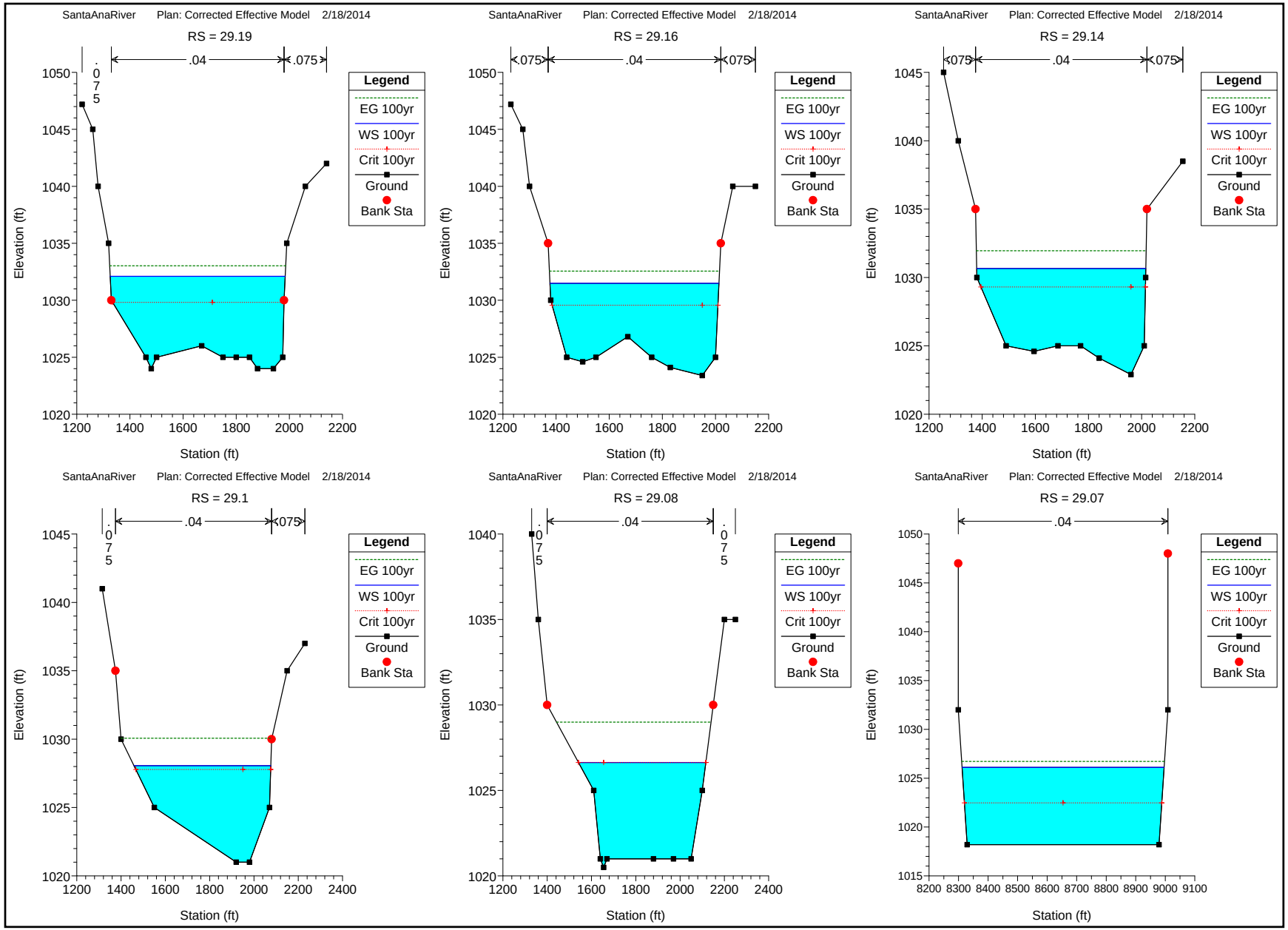

SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 28.597 This is a REPEATED section.
RS = 28.595 This is a REPEATED section.
RS = 28.59
RS = 28.58
RS = 28.57
RS = 28.55
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

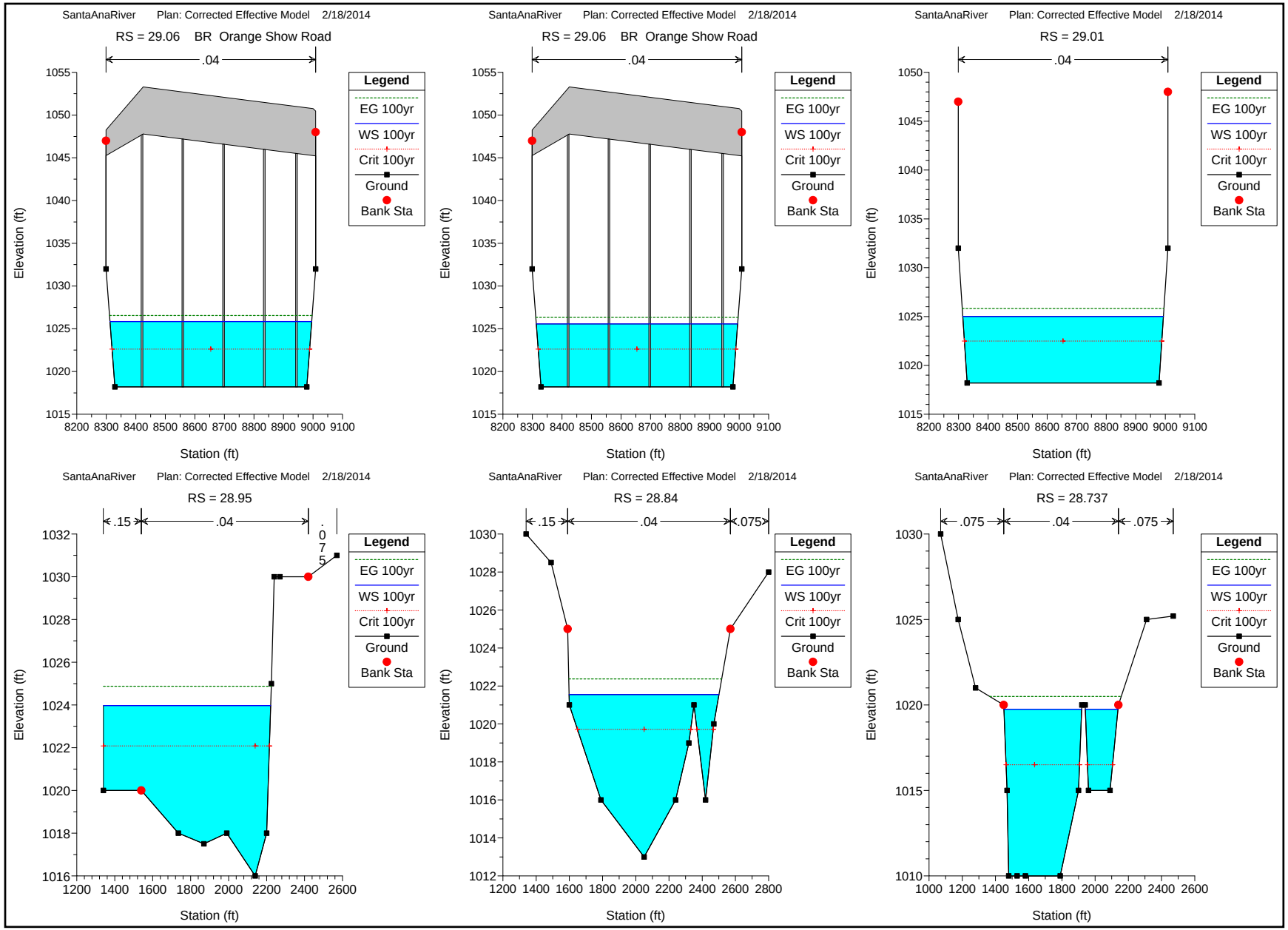

SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 28.53
.075
.04
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 28.49
.075
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 28.43
.075
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 28.38
.075
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Duplicated Effective Model 2/18/2014
RS = 28.3
.075
.04
.075
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)

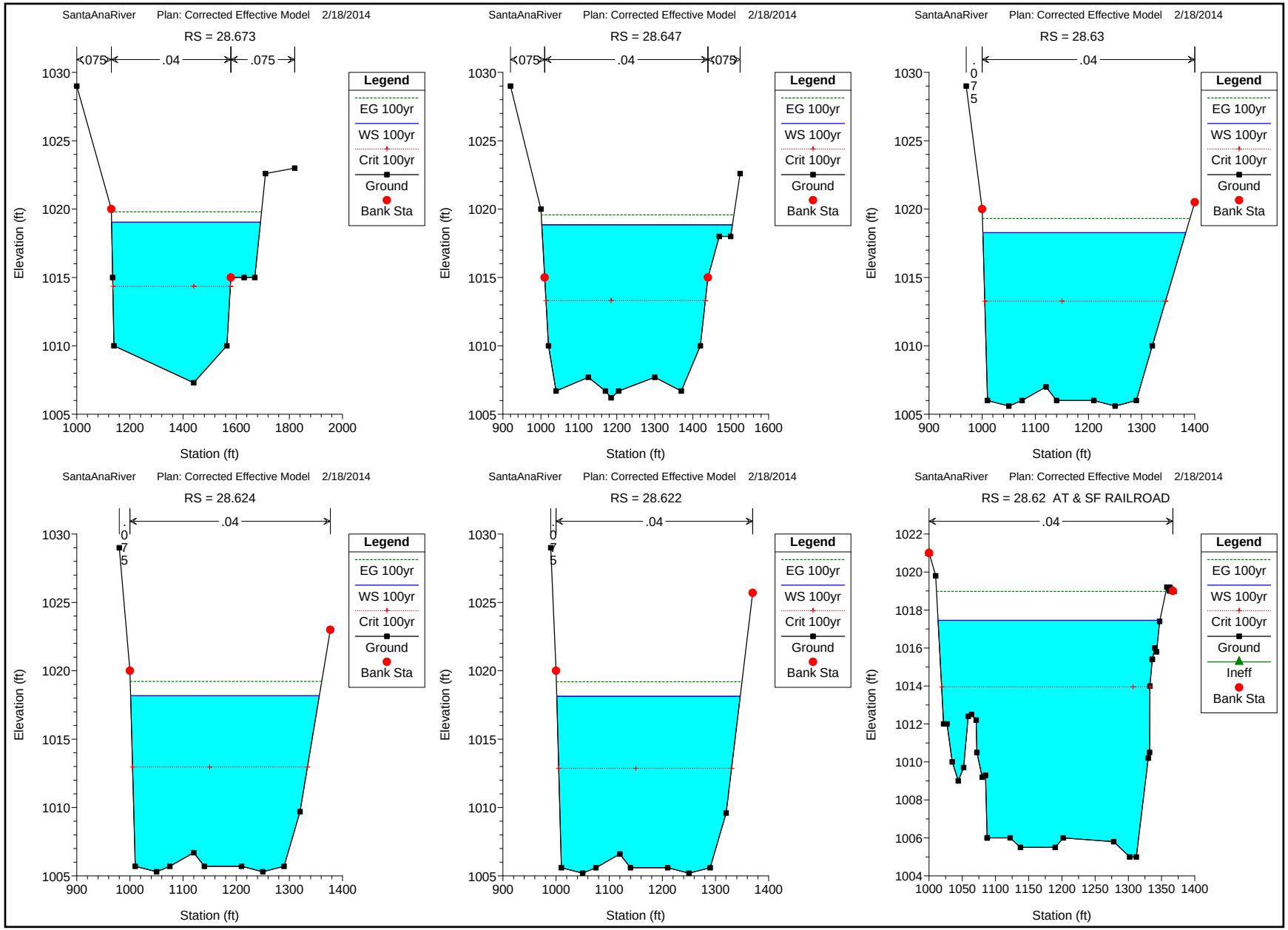

SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RIVER-1 Reach-1
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Elevation (ft)
Main Channel Distance (ft)
1070
1060
1050
1040
1030
1020
1010
1000
990
0
1000
2000
3000
4000
5000
6000
7000
28.38
28.43
28.49
28.53
28.55
28.58
28.602
28.63
28.673
28.737
28.84
28.95
29.01
29.06 Orange Show Road
29.08
29.14
29.16
29.19
29.23
29.32
29.35
29.37
29.43
29.5
29.53
29.56
29.64

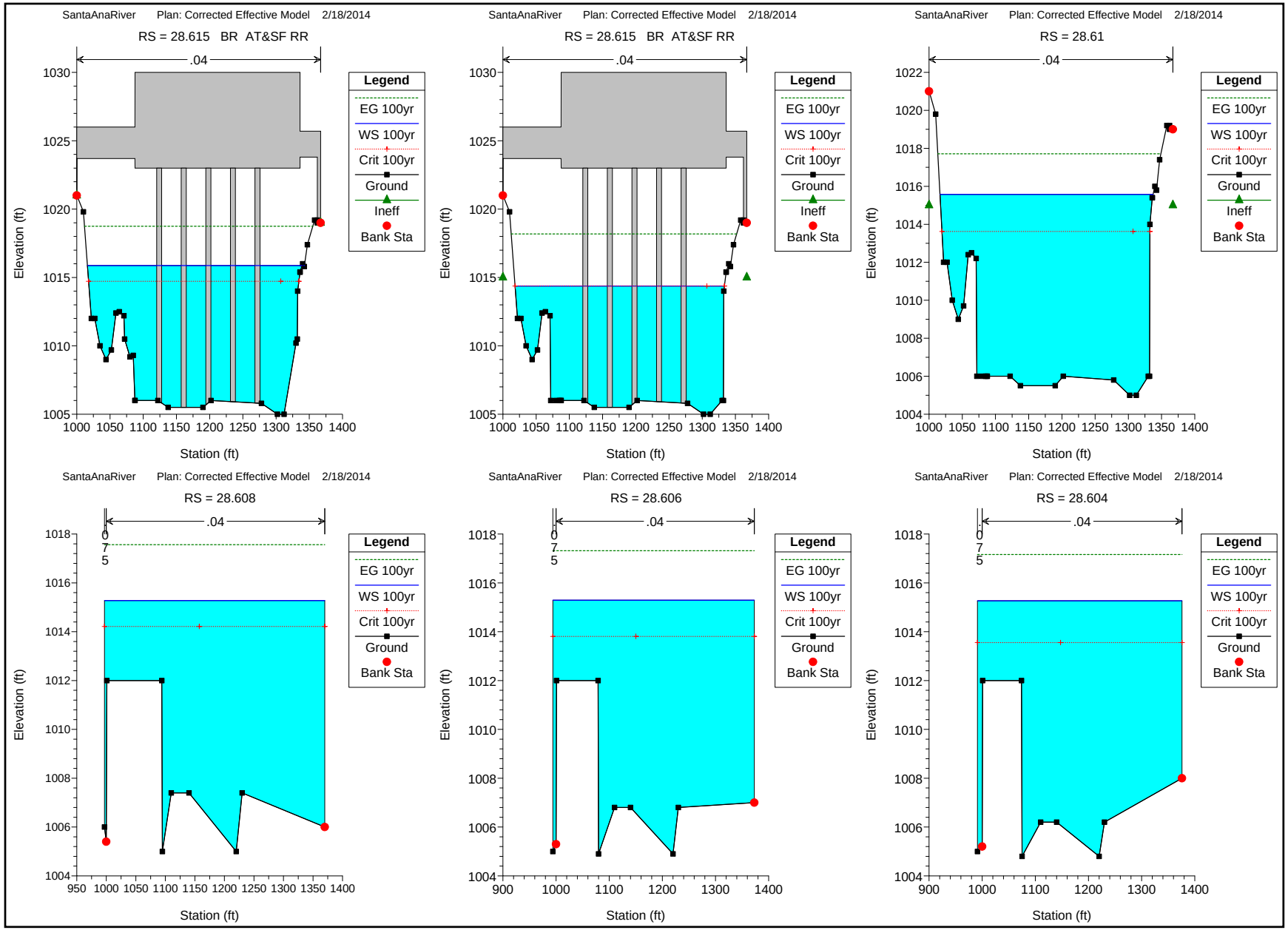

SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.64
.038
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.56
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.53
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.51 TIPPECANOE AVE.
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.505 BR Tippecanoe Ave
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.505 BR Tippecanoe Ave
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

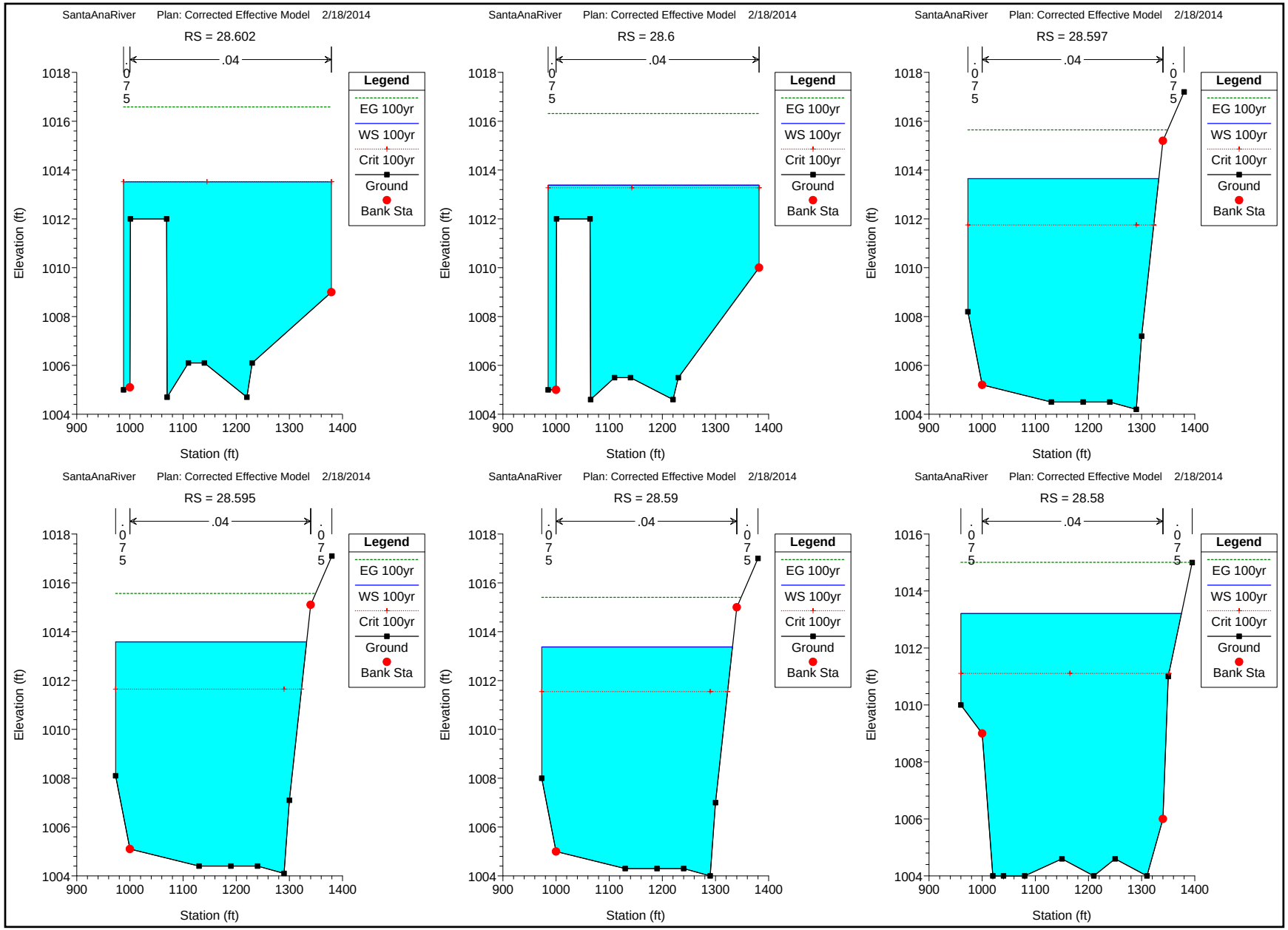

SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.5
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.43
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.37
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.35
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.32
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.23
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

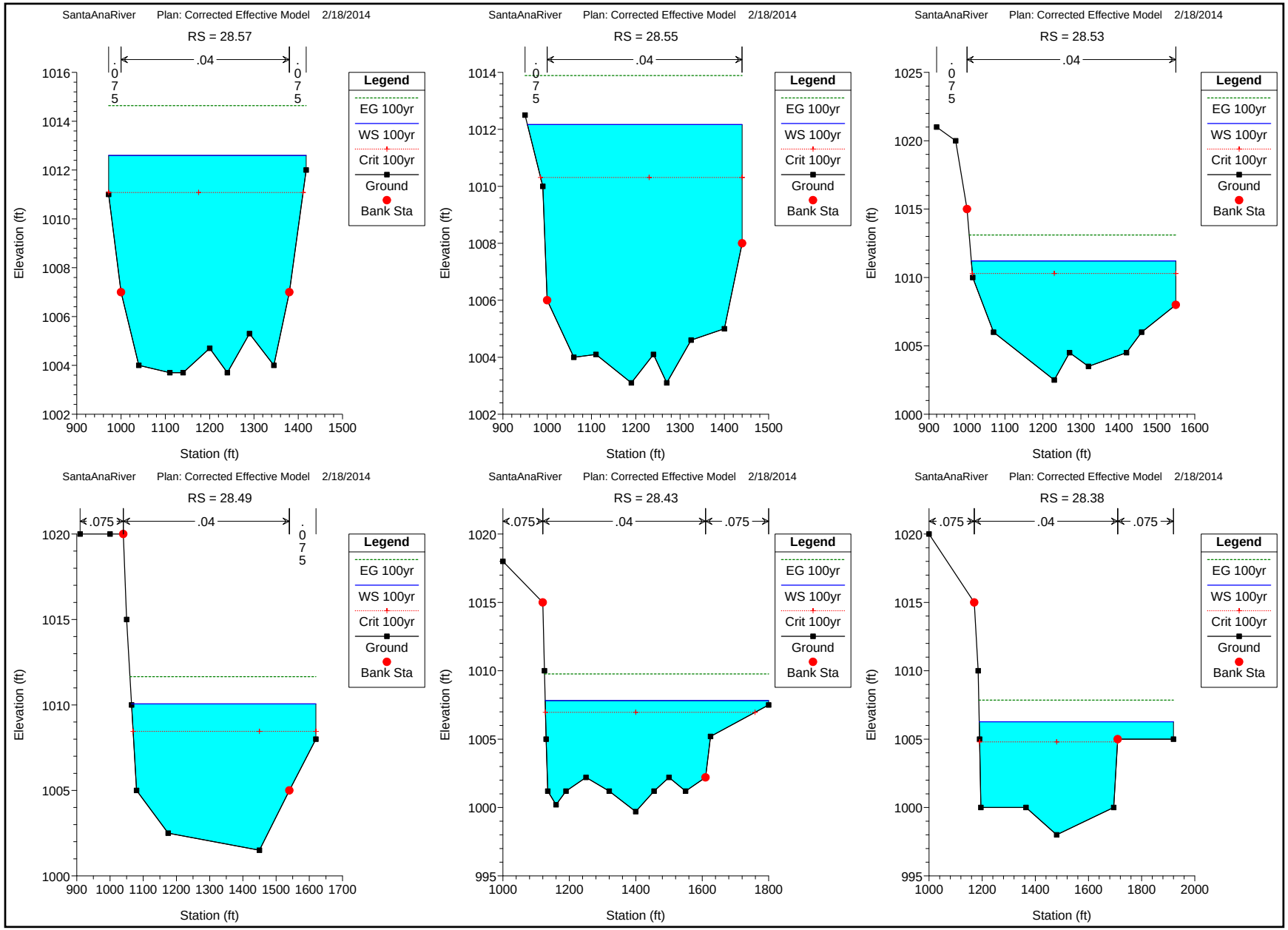

SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.19
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.16
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.14
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.1
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.08
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.07
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.06 BR Orange Show Road
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.06 BR Orange Show Road
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 29.01
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.95
.15
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.84
.15
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.737
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

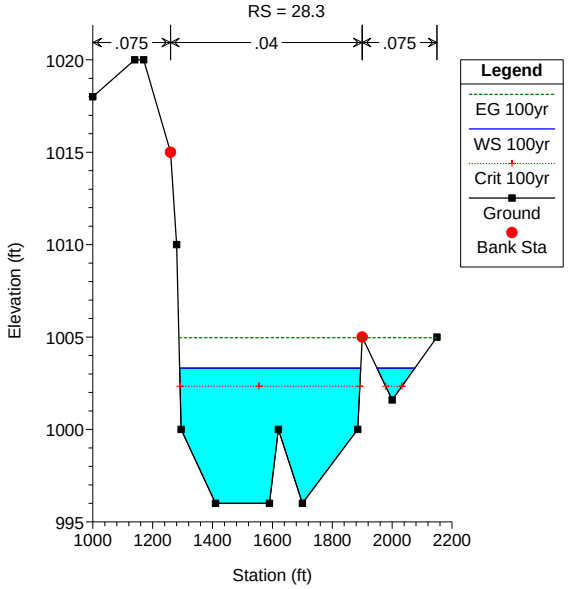

SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.673
.075 .04 .075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.647
.075 .04 .075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.63
.075 .04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.624
.075 .04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.622
.075 .04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.62 AT & SF RAILROAD
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

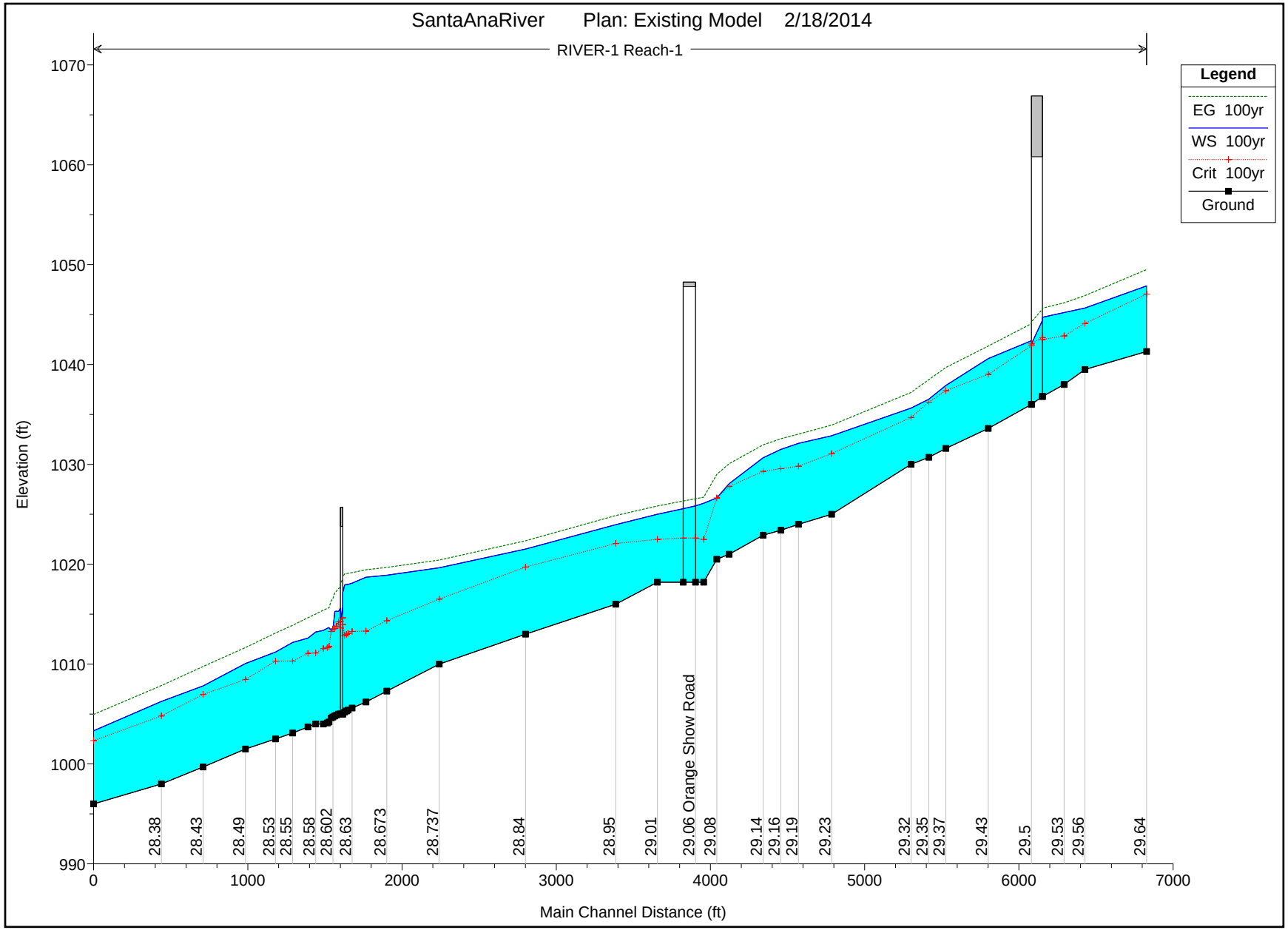

SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.615 BR AT&SF RR
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.615 BR AT&SF RR
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.61
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.608
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.606
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.604
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

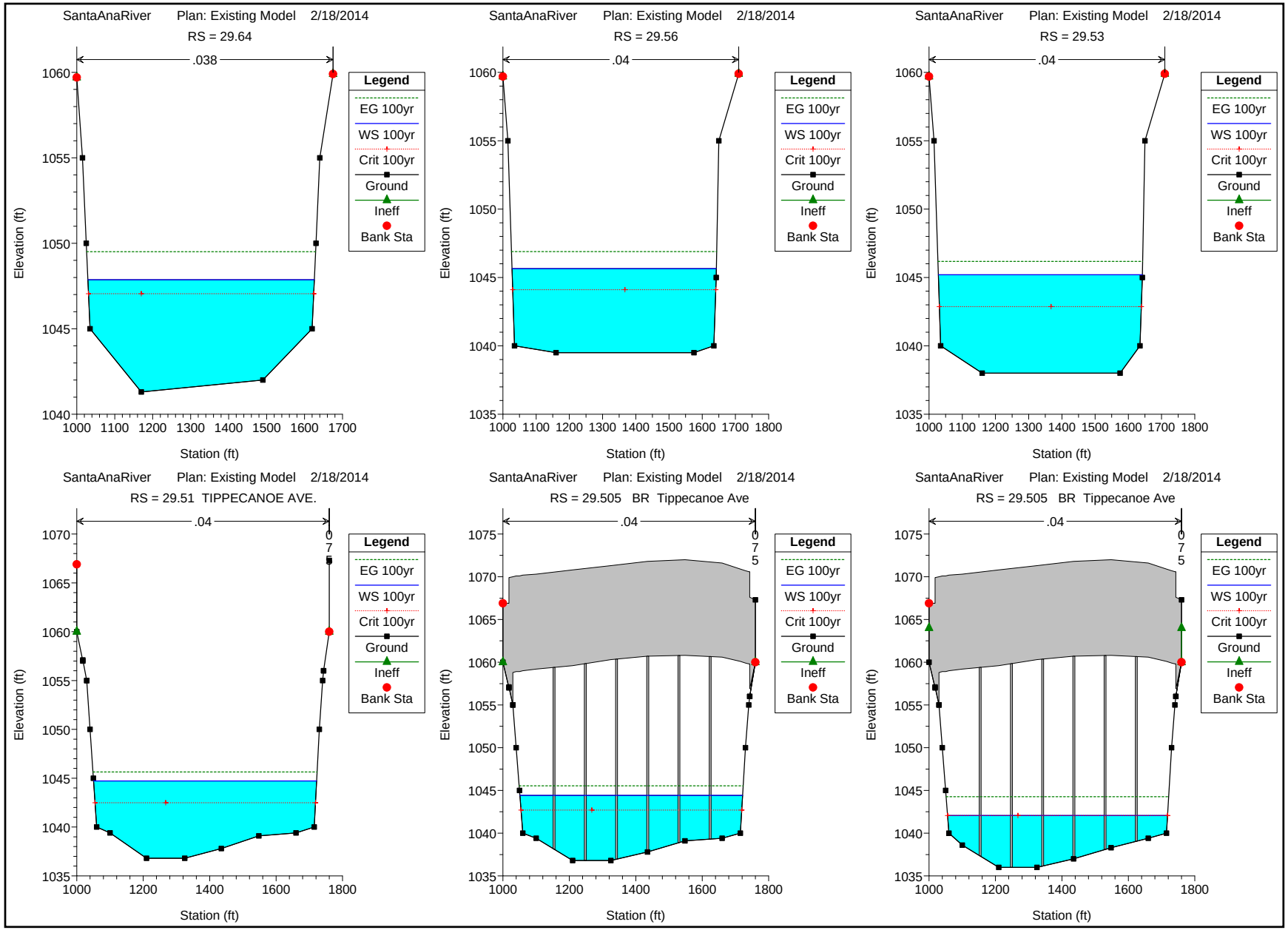

SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.602
RS = 28.6
RS = 28.597
RS = 28.595
RS = 28.59
RS = 28.58
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
1004
1006
1008
1010
1012
1014
1016
1018
900
1000
1100
1200
1300
1400

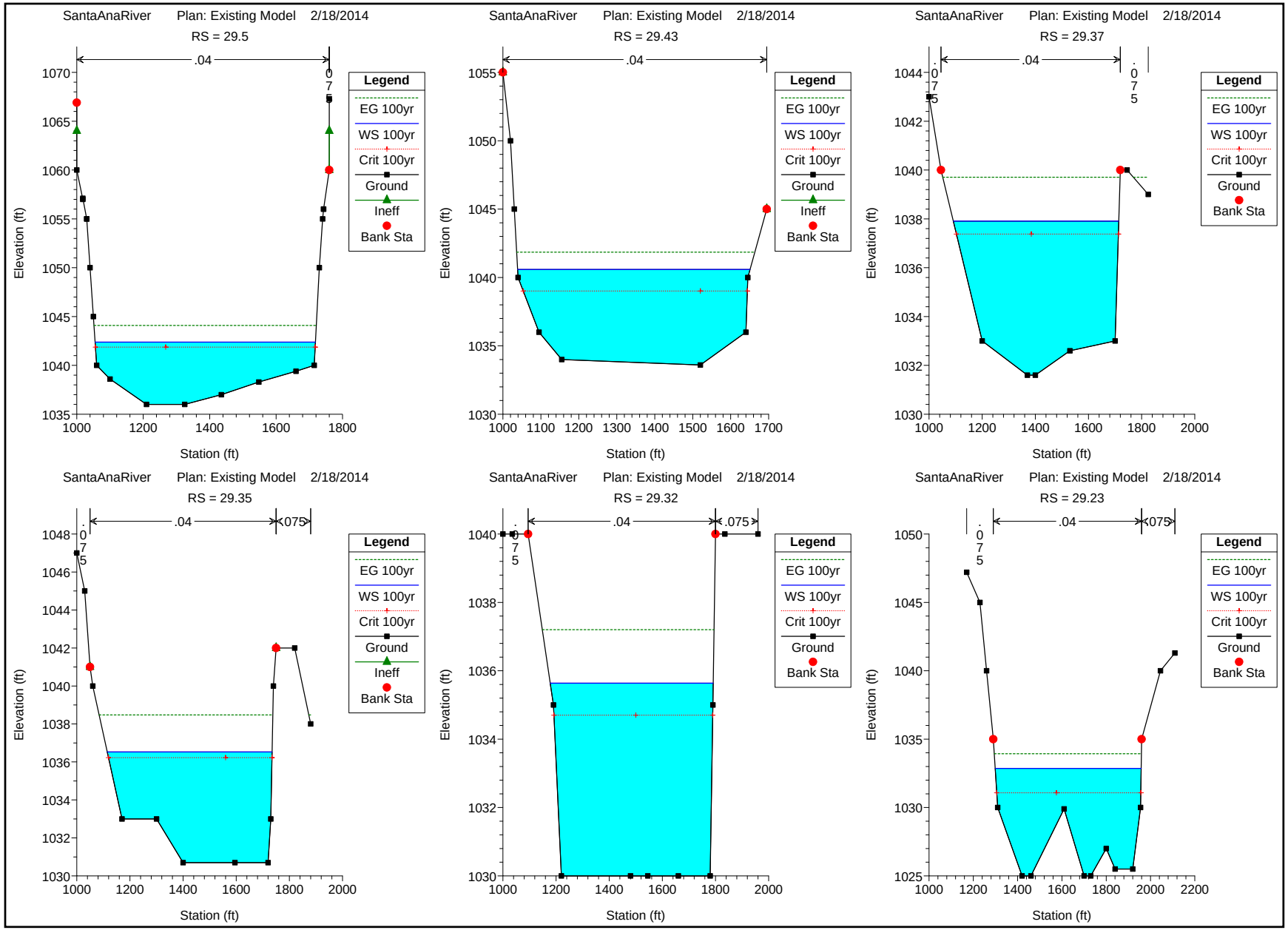

SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.57
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.55
.075
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.53
.075
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.49
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.43
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014
RS = 28.38
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

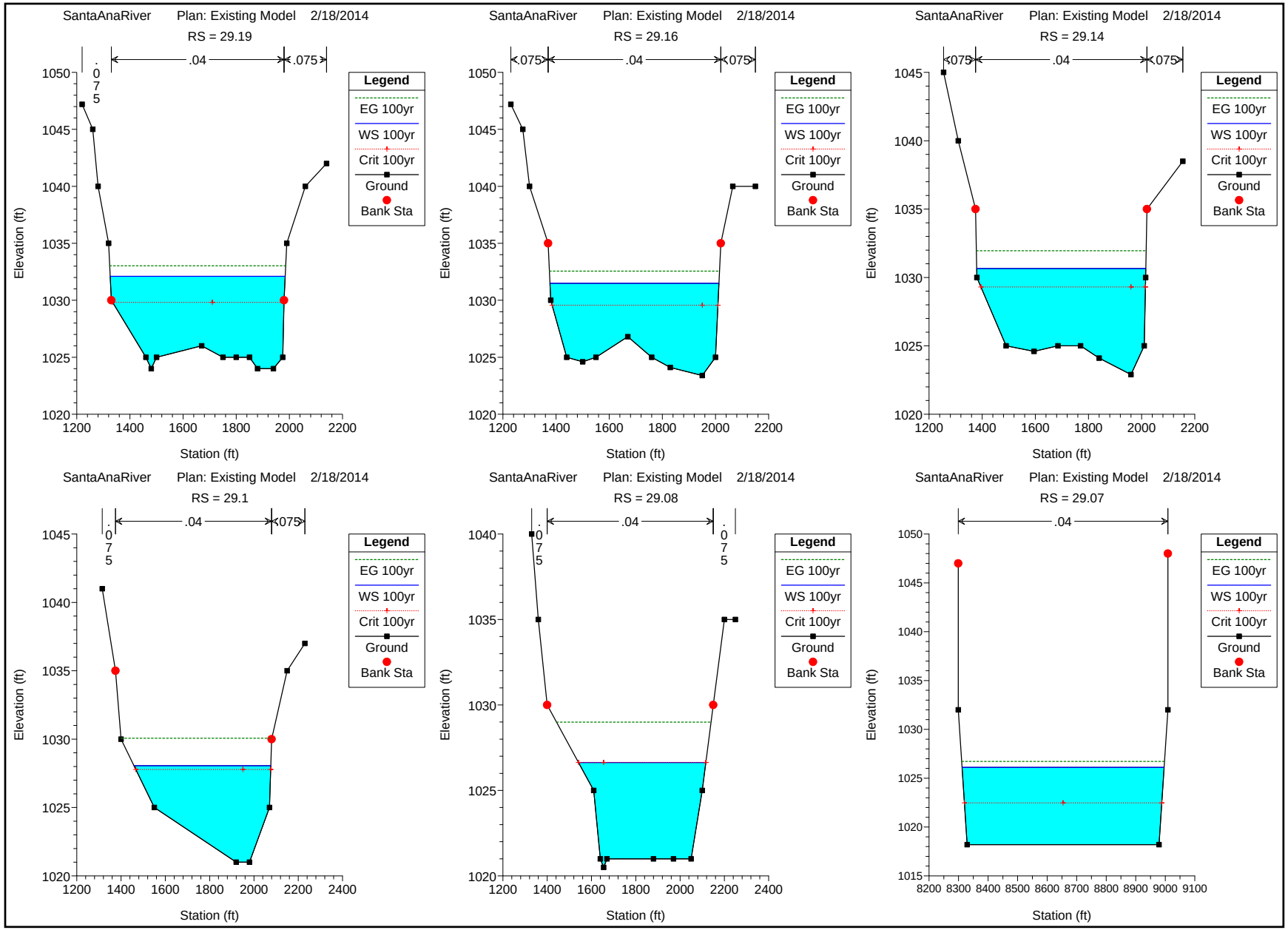
SantaAnaRiver Plan: Corrected Effective Model 2/18/2014

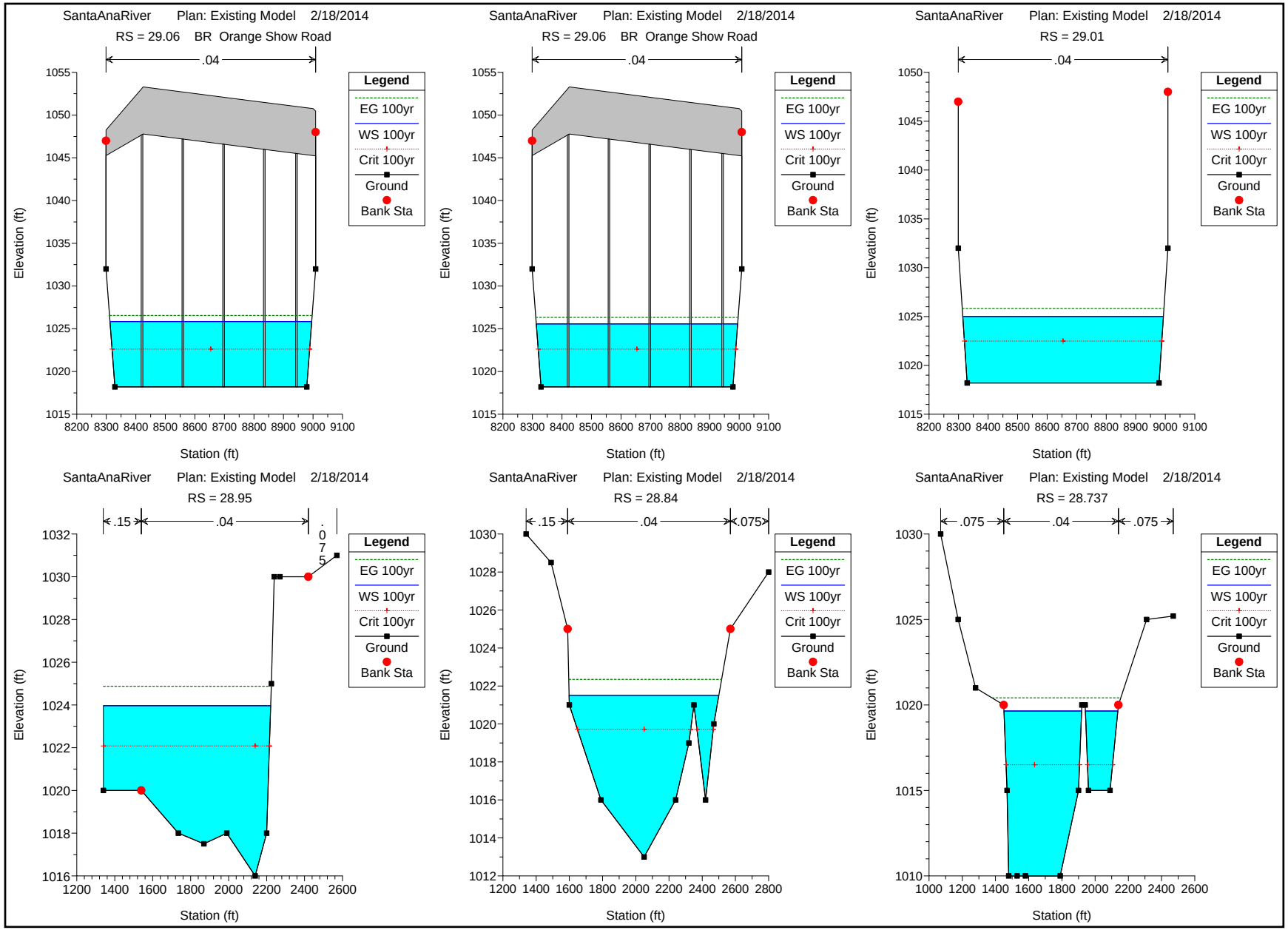


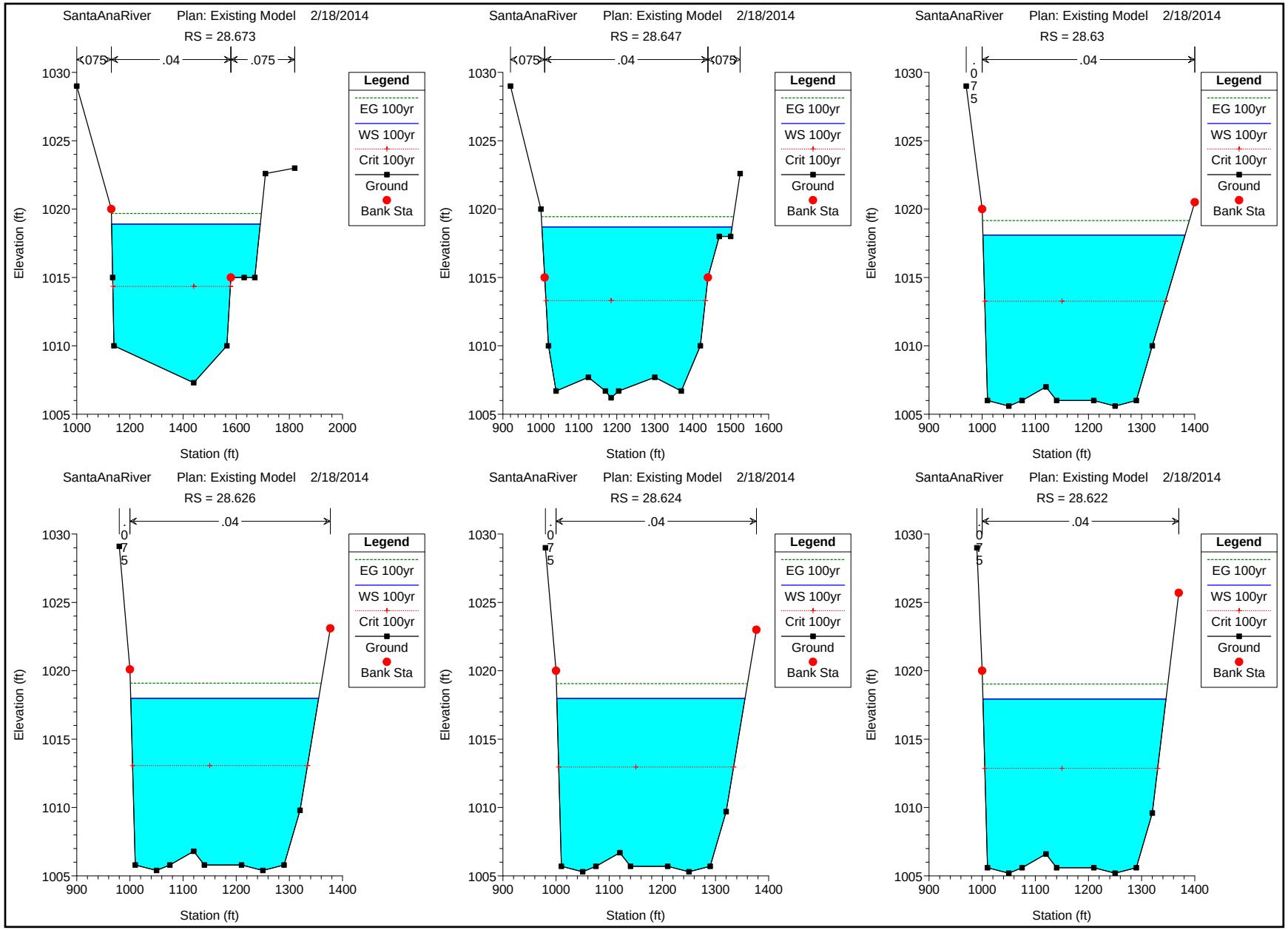

SantaAnaRiver Plan: Existing Model 2/18/2014
RIVER-1 Reach-1
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Elevation (ft)
Main Channel Distance (ft)
1070
1060
1050
1040
1030
1020
1010
1000
990
0
1000
2000
3000
4000
5000
6000
7000
28.38
28.43
28.49
28.53
28.55
28.58
28.602
28.63
28.673
28.737
28.84
28.95
29.01
29.06 Orange Show Road
29.08
29.14
29.16
29.19
29.23
29.32
29.35
29.37
29.43
29.5
29.53
29.56
29.64

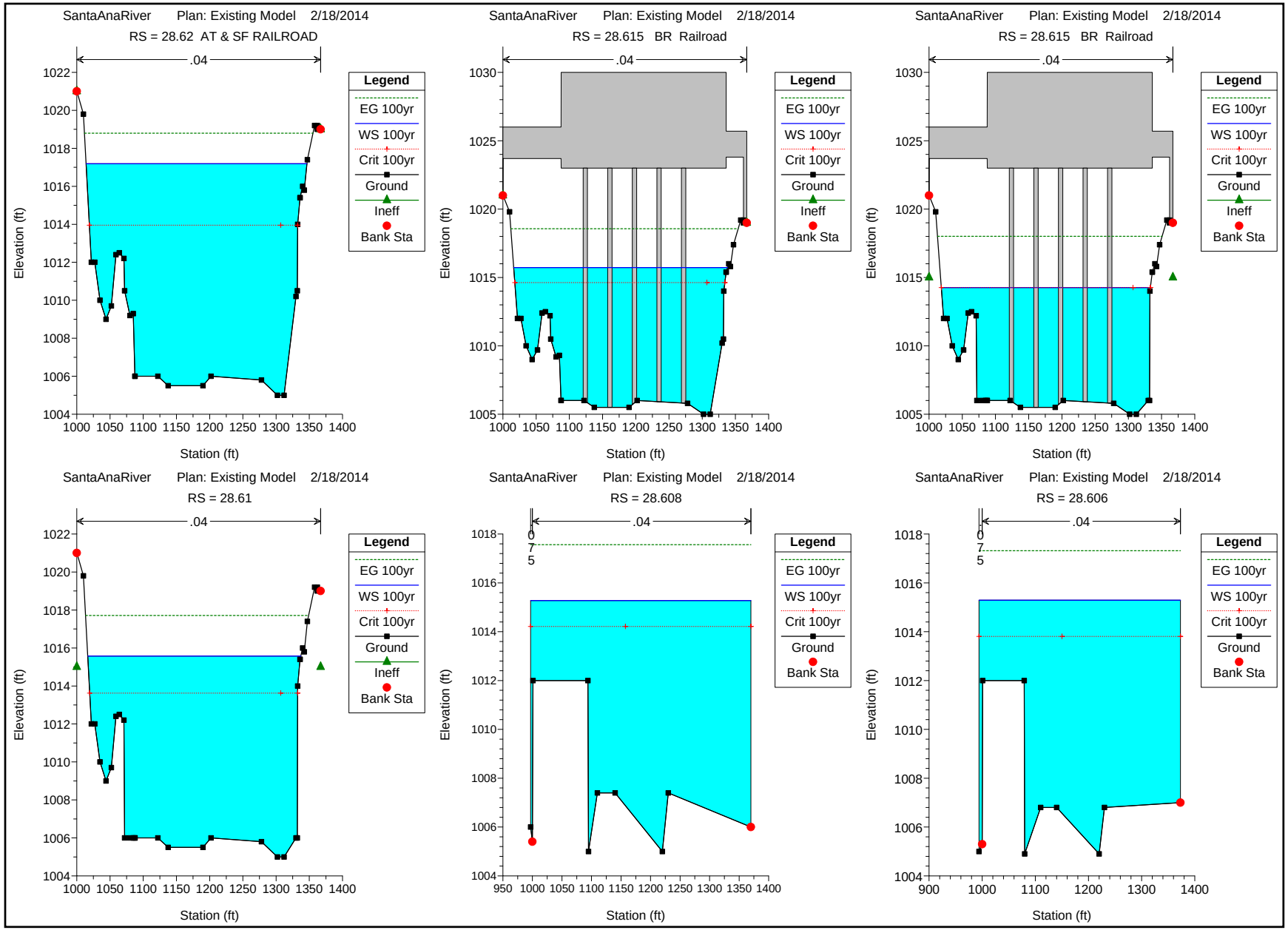

SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.64
.038
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.56
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.53
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.51 TIPPECANOE AVE.
.04
075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.505 BR Tippecanoe Ave
.04
075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.505 BR Tippecanoe Ave
.04
075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

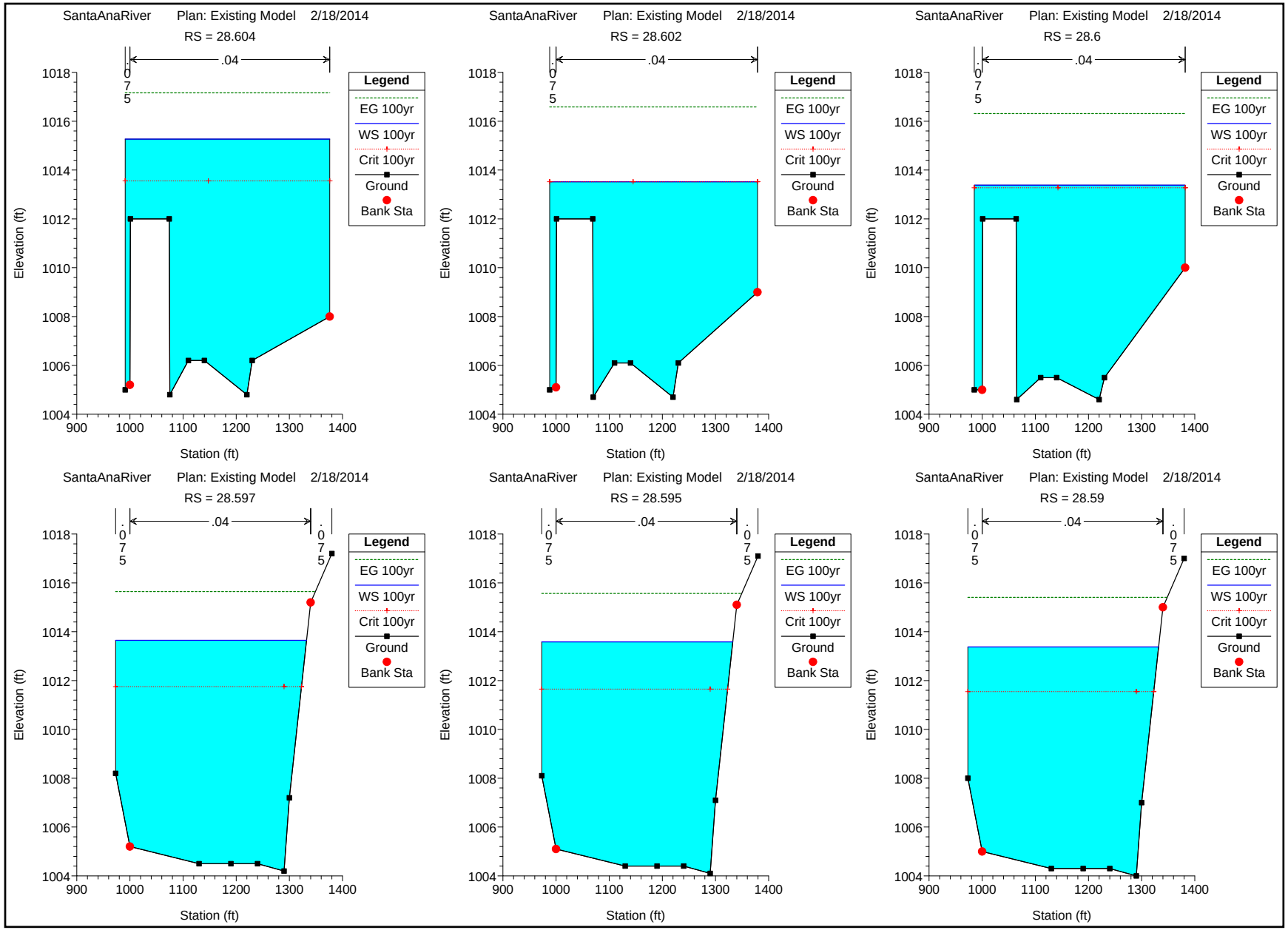

SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.5
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.43
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.37
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.35
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.32
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.23
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

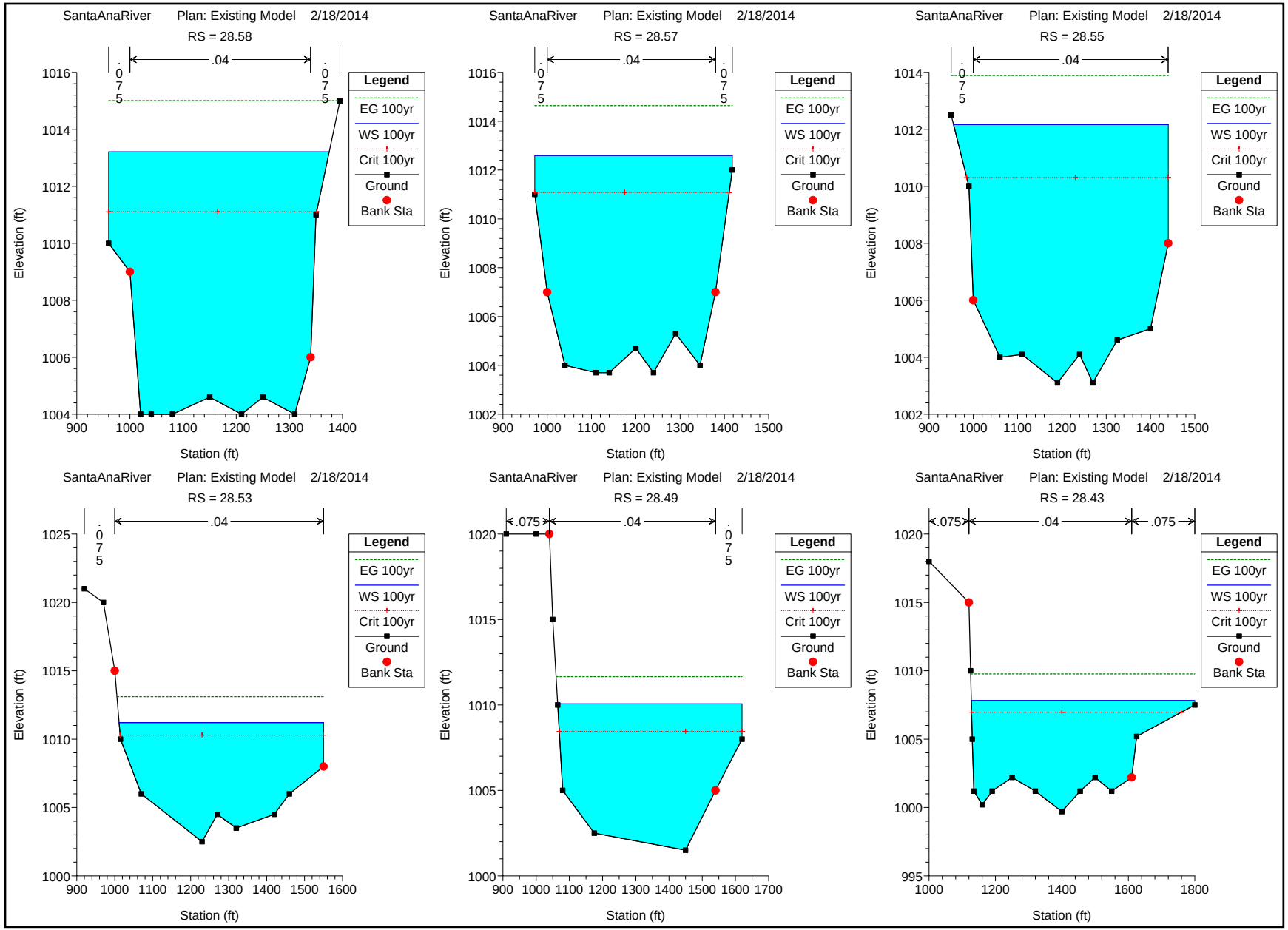

SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.19
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.16
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.14
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.1
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.08
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.07
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

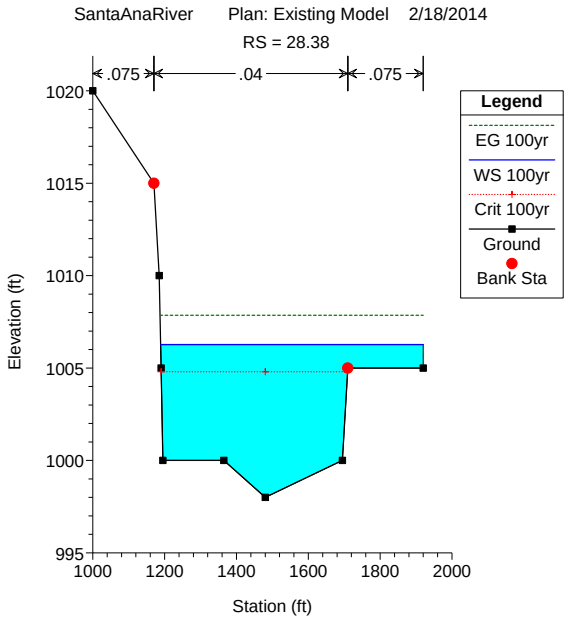

SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.06 BR Orange Show Road
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.06 BR Orange Show Road
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 29.01
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.95
.15
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.84
.15
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.737
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

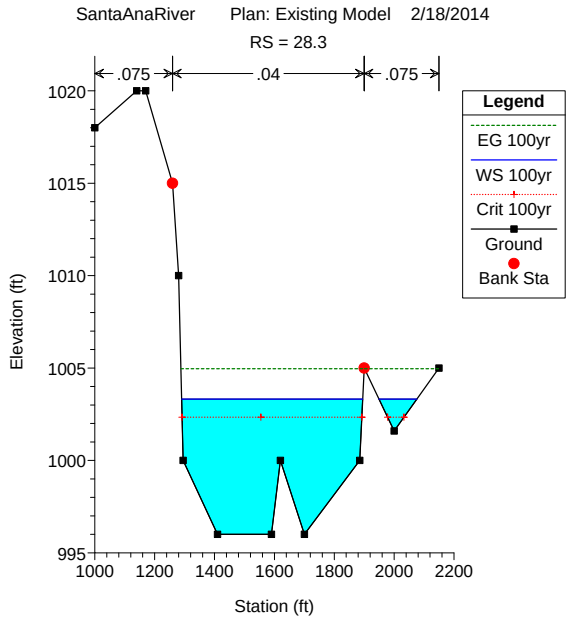

SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.673
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.647
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.63
.075
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.626
.075
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.624
.075
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.622
.075
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

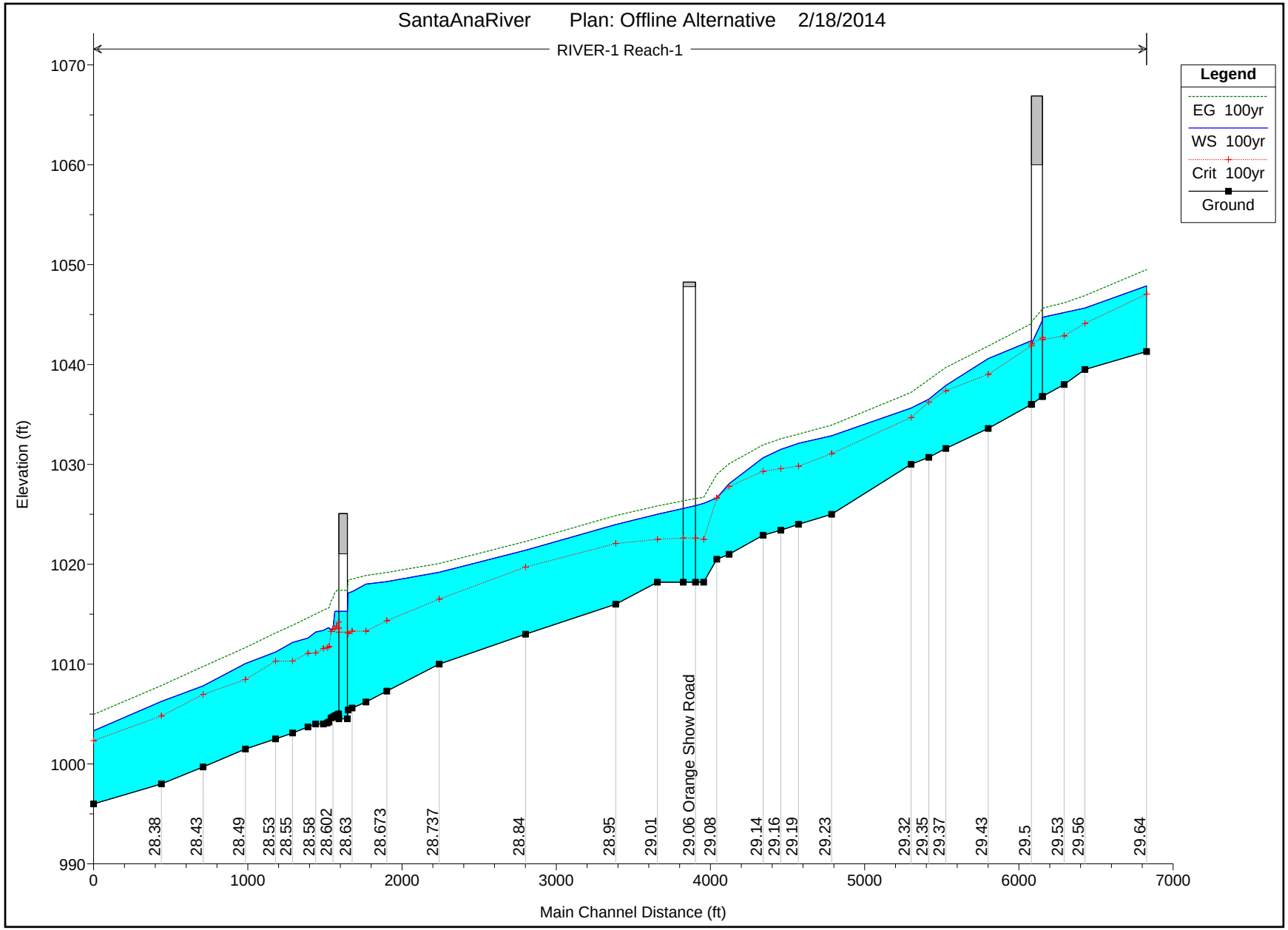

SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.62 AT & SF RAILROAD
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.615 BR Railroad
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.615 BR Railroad
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.61
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.608
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.606
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

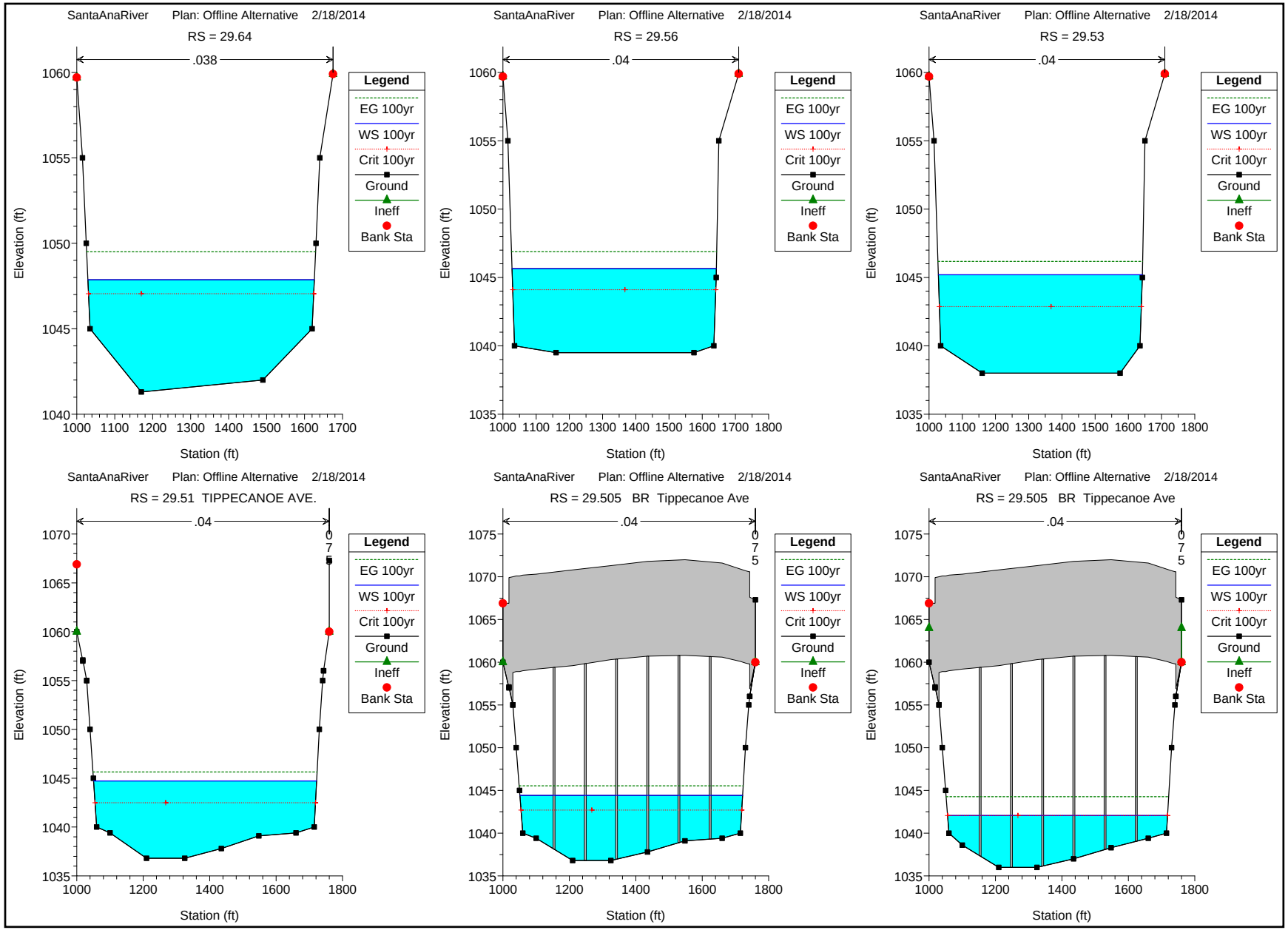

SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.604
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.602
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.6
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.597
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.595
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.59
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

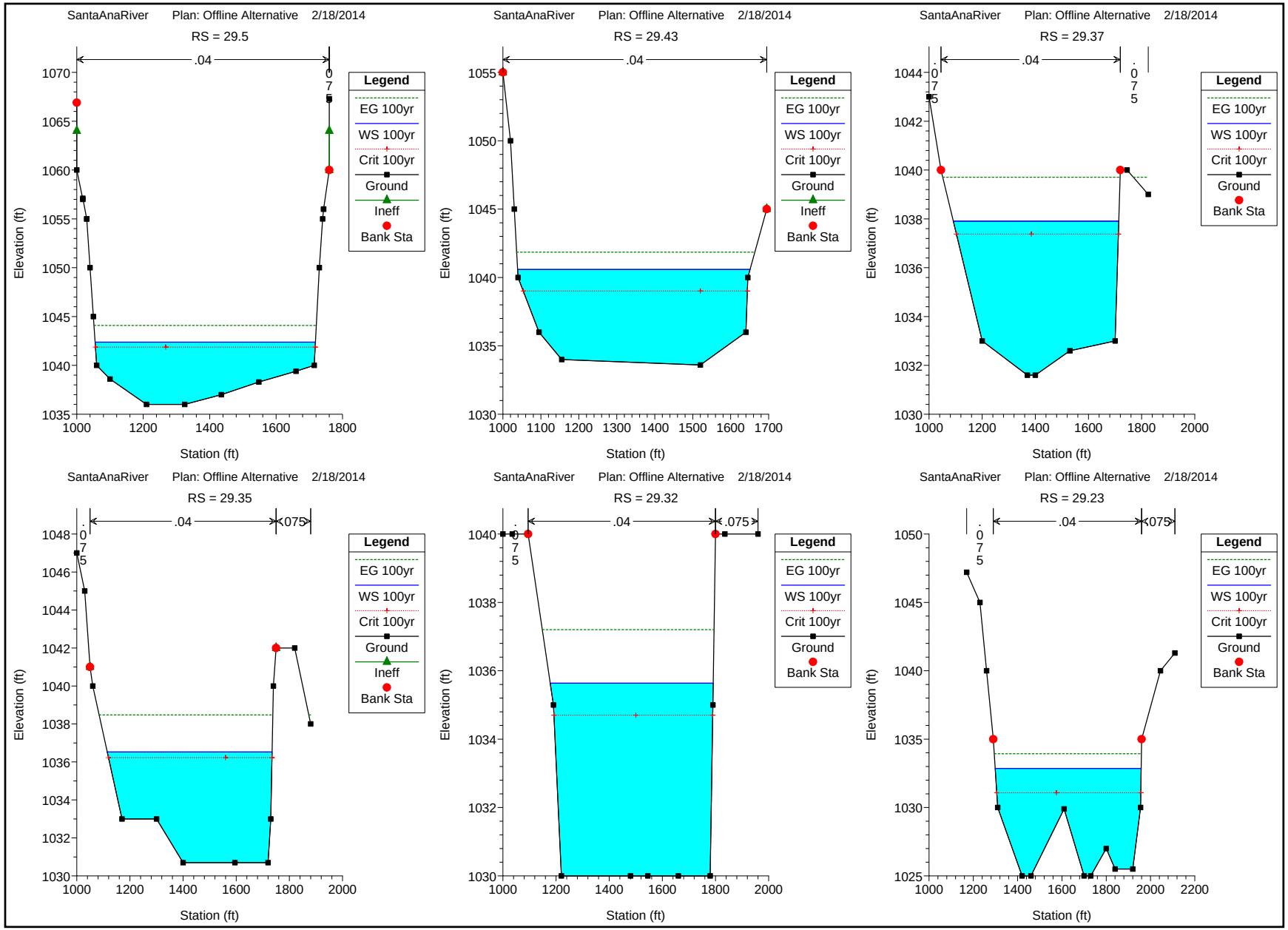

SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.58
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.57
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.55
.075
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.53
.075
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.49
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.43
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

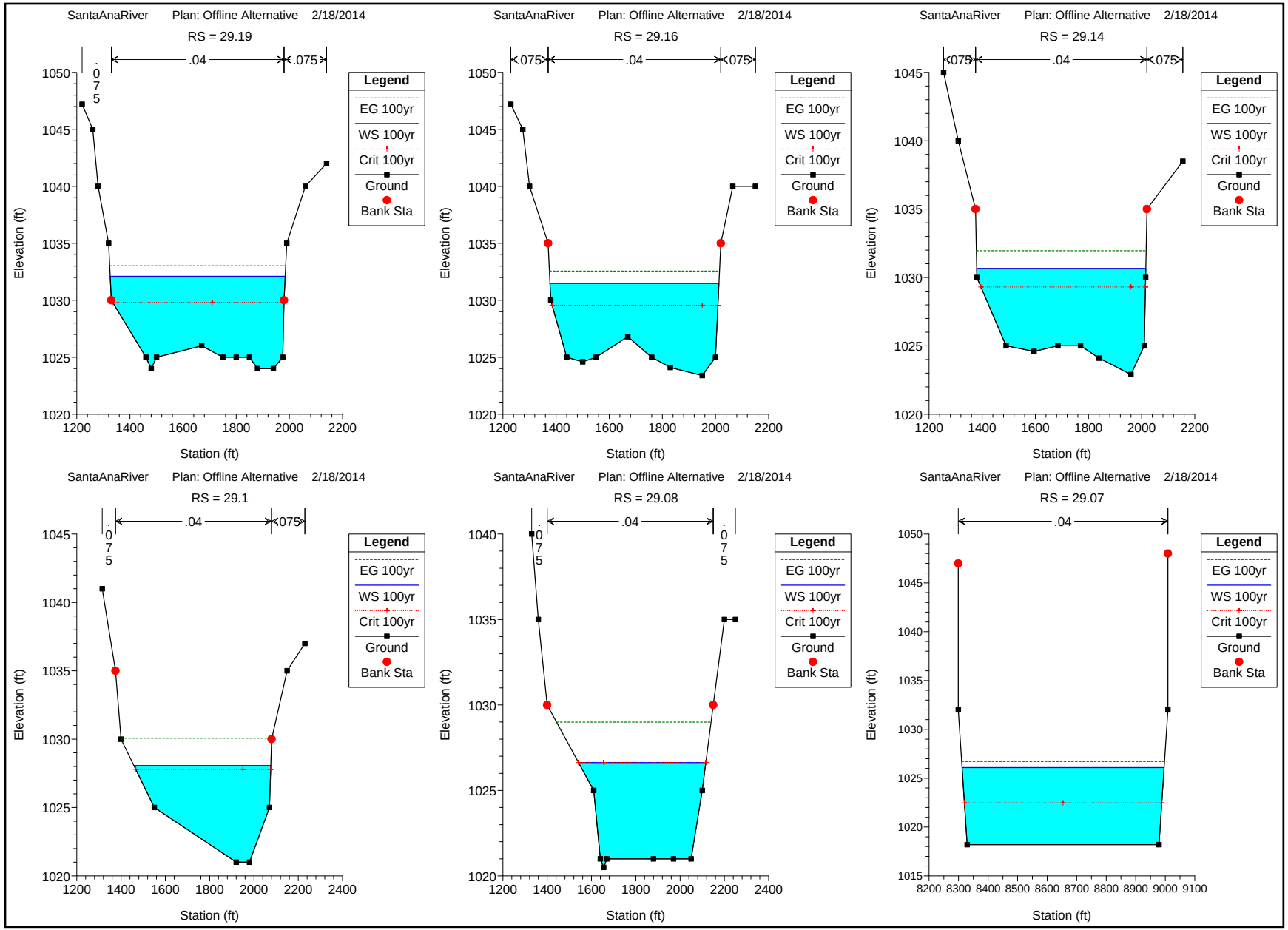

SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.38
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
1020
1015
1010
1005
1000
995
1000
1200
1400
1600
1800
2000

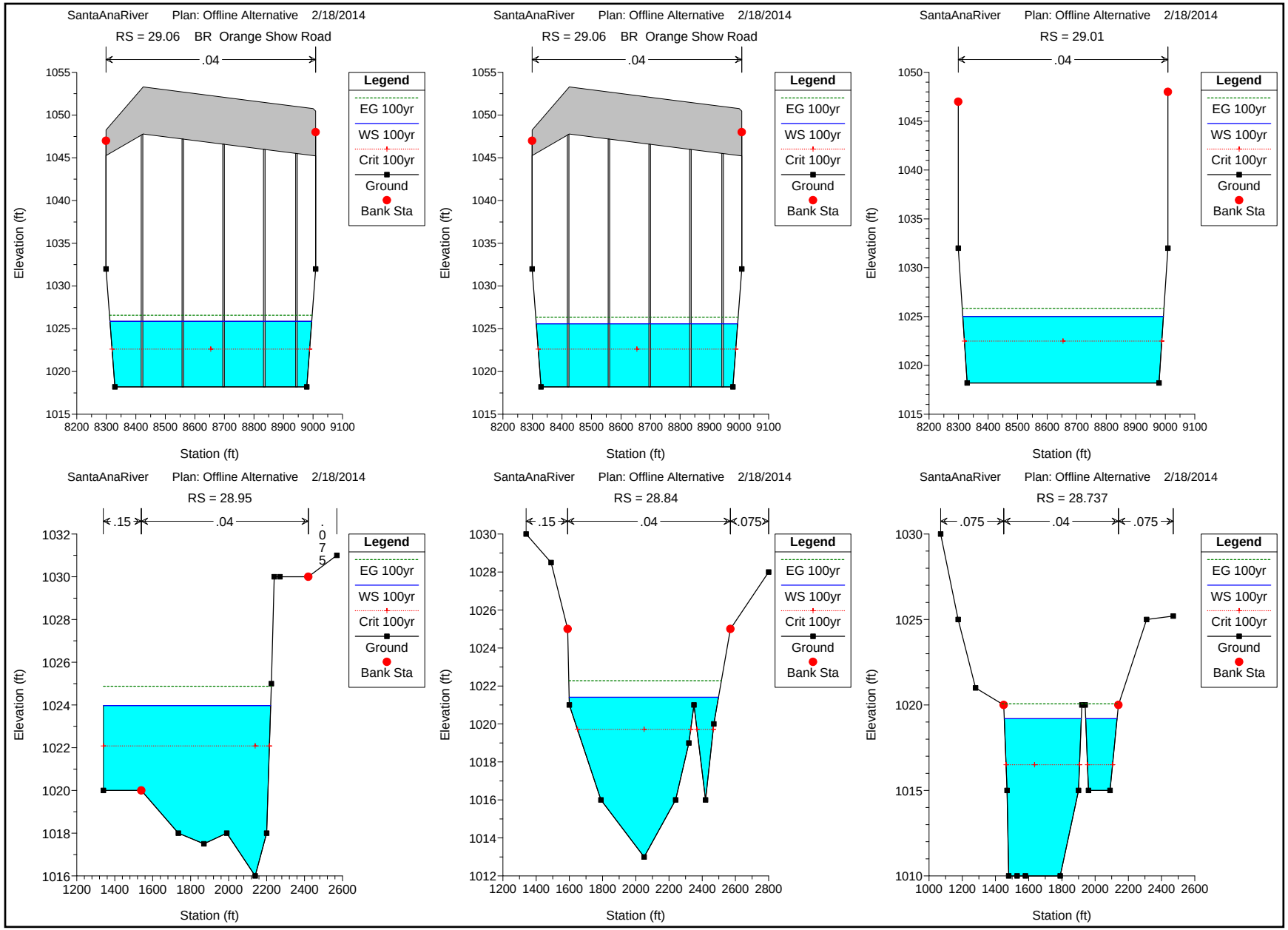

SantaAnaRiver Plan: Existing Model 2/18/2014
RS = 28.3
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
1020
1015
1010
1005
1000
995
1000
1200
1400
1600
1800
2000
2200

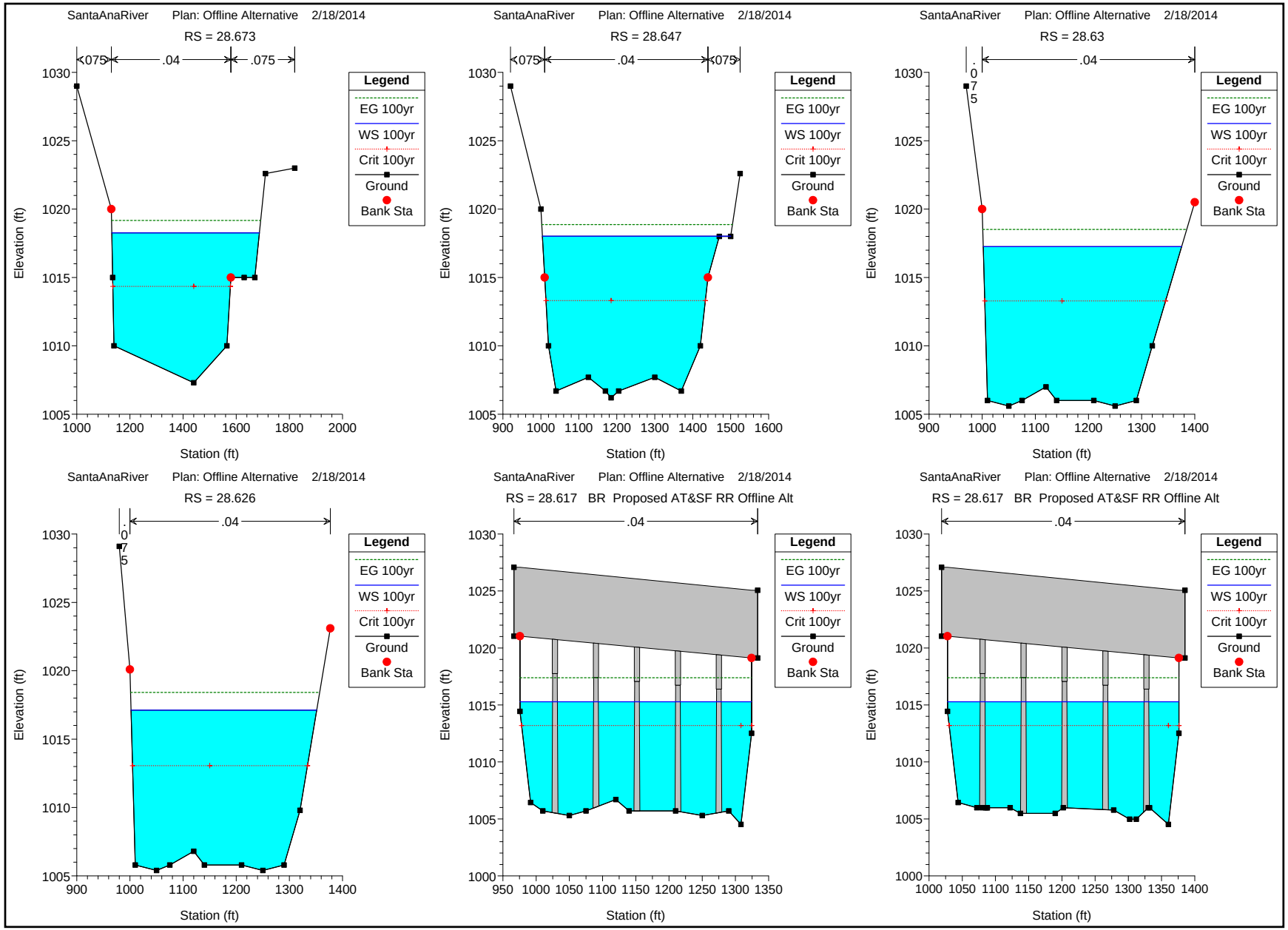

SantaAnaRiver Plan: Offline Alternative 2/18/2014
RIVER-1 Reach-1
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Elevation (ft)
Main Channel Distance (ft)
1070
1060
1050
1040
1030
1020
1010
1000
990
0
1000
2000
3000
4000
5000
6000
7000
28.38
28.43
28.49
28.53
28.55
28.58
28.602
28.63
28.673
28.737
28.84
28.95
29.01
29.06 Orange Show Road
29.08
29.14
29.16
29.19
29.23
29.32
29.35
29.37
29.43
29.5
29.53
29.56
29.64

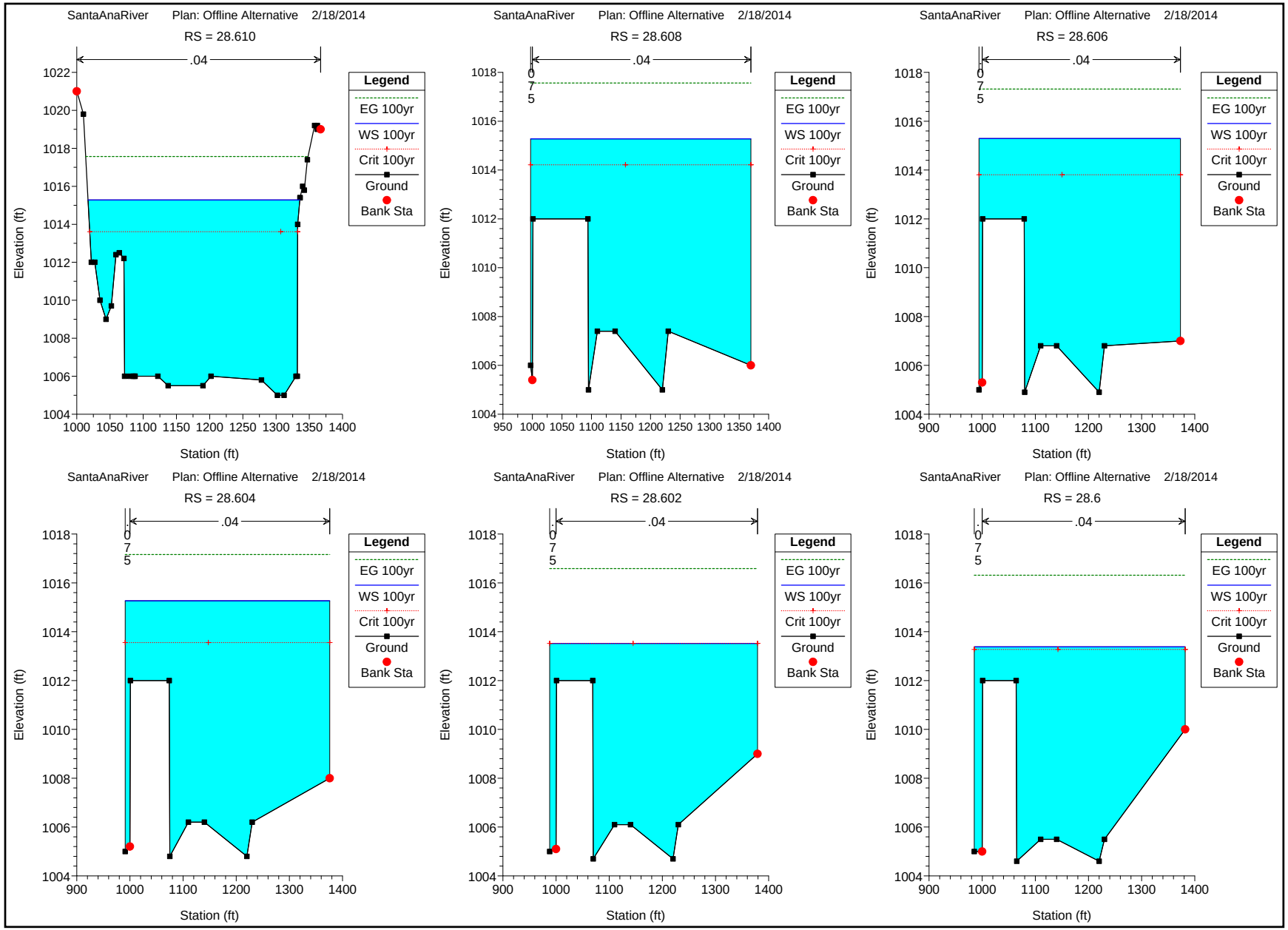

SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.64
.038
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.56
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.53
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.51 TIPPECANOE AVE.
.04
075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.505 BR Tippecanoe Ave
.04
075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.505 BR Tippecanoe Ave
.04
075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

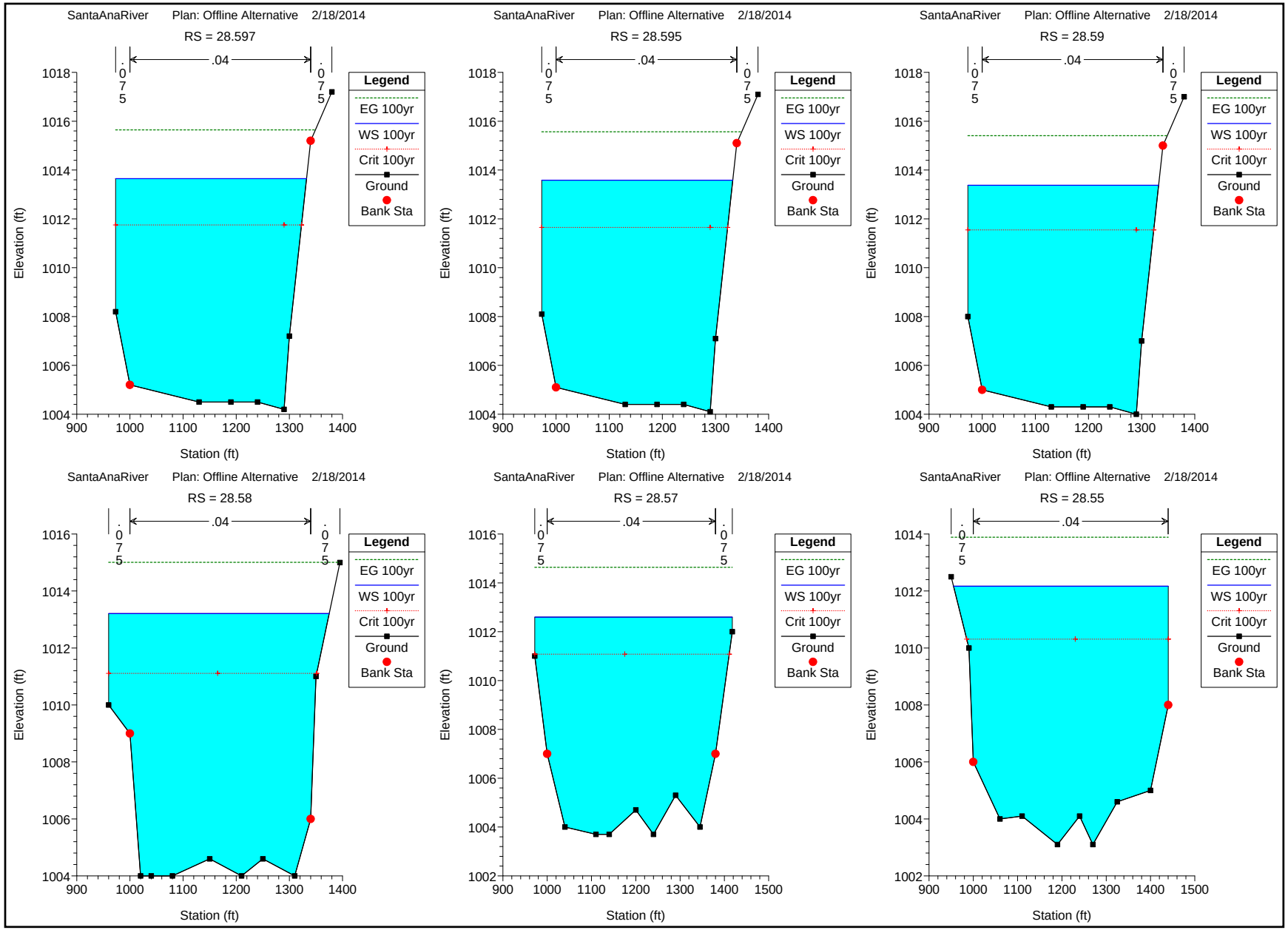

SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.5
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.43
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.37
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.35
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.32
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.23
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

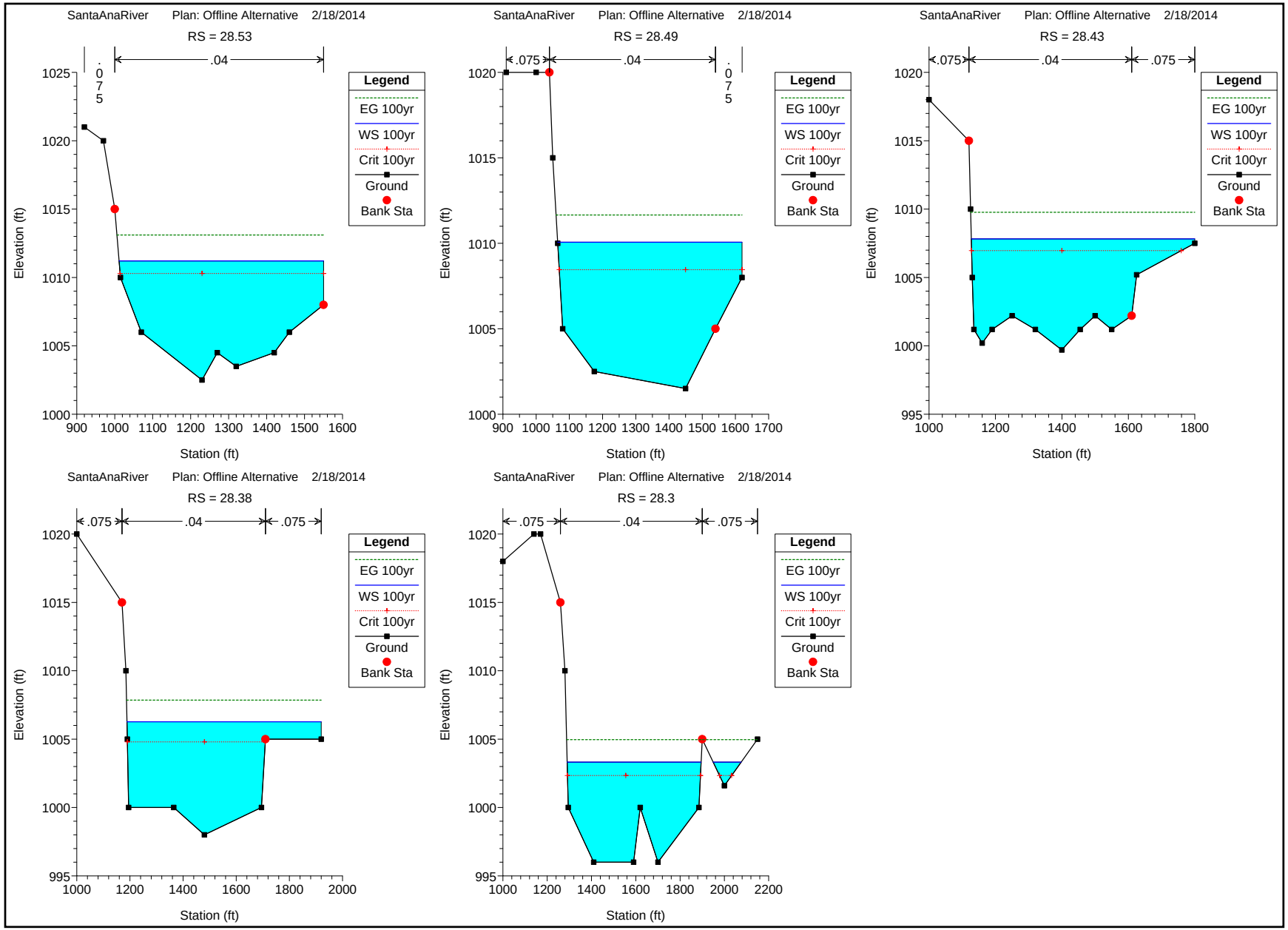

SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.19
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.16
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.14
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.1
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.08
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.07
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

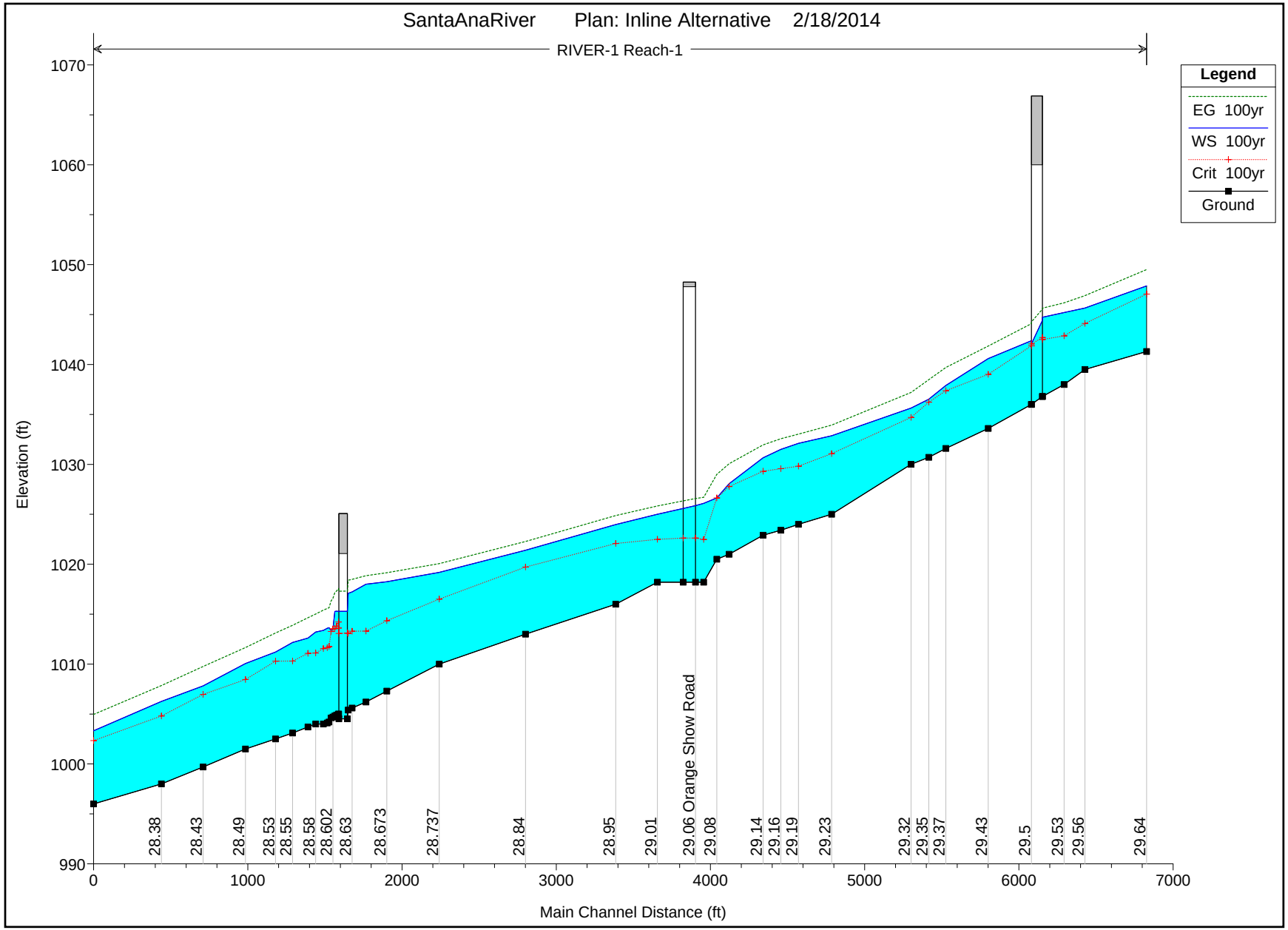

SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.06 BR Orange Show Road
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.06 BR Orange Show Road
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 29.01
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.95
.15
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.84
.15
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.737
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

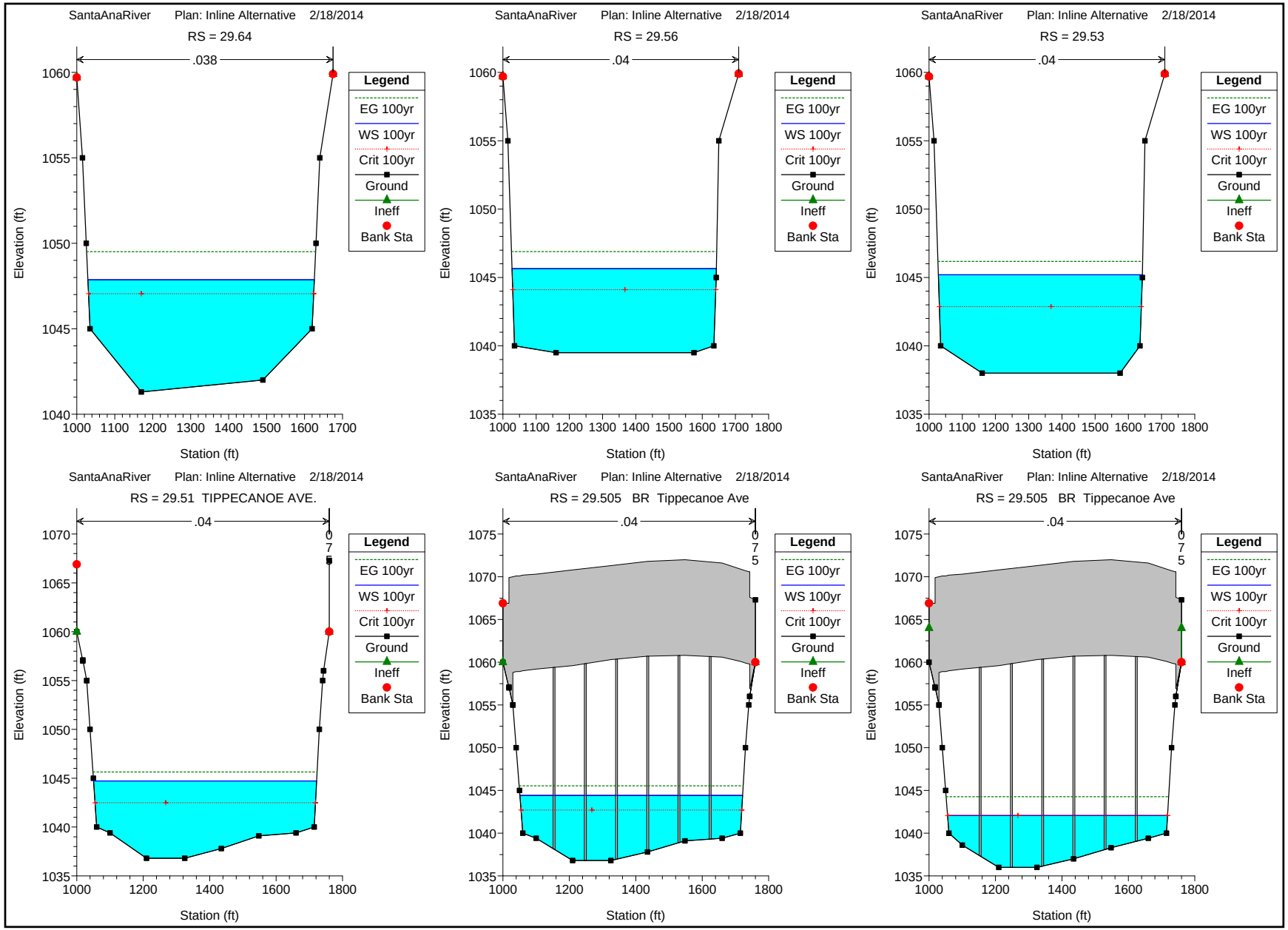

SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.673
.075 .04 .075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.647
.075 .04 .075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.63
.075 .04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.626
.075 .04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.617 BR Proposed AT&SF RR Offline Alt
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.617 BR Proposed AT&SF RR Offline Alt
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

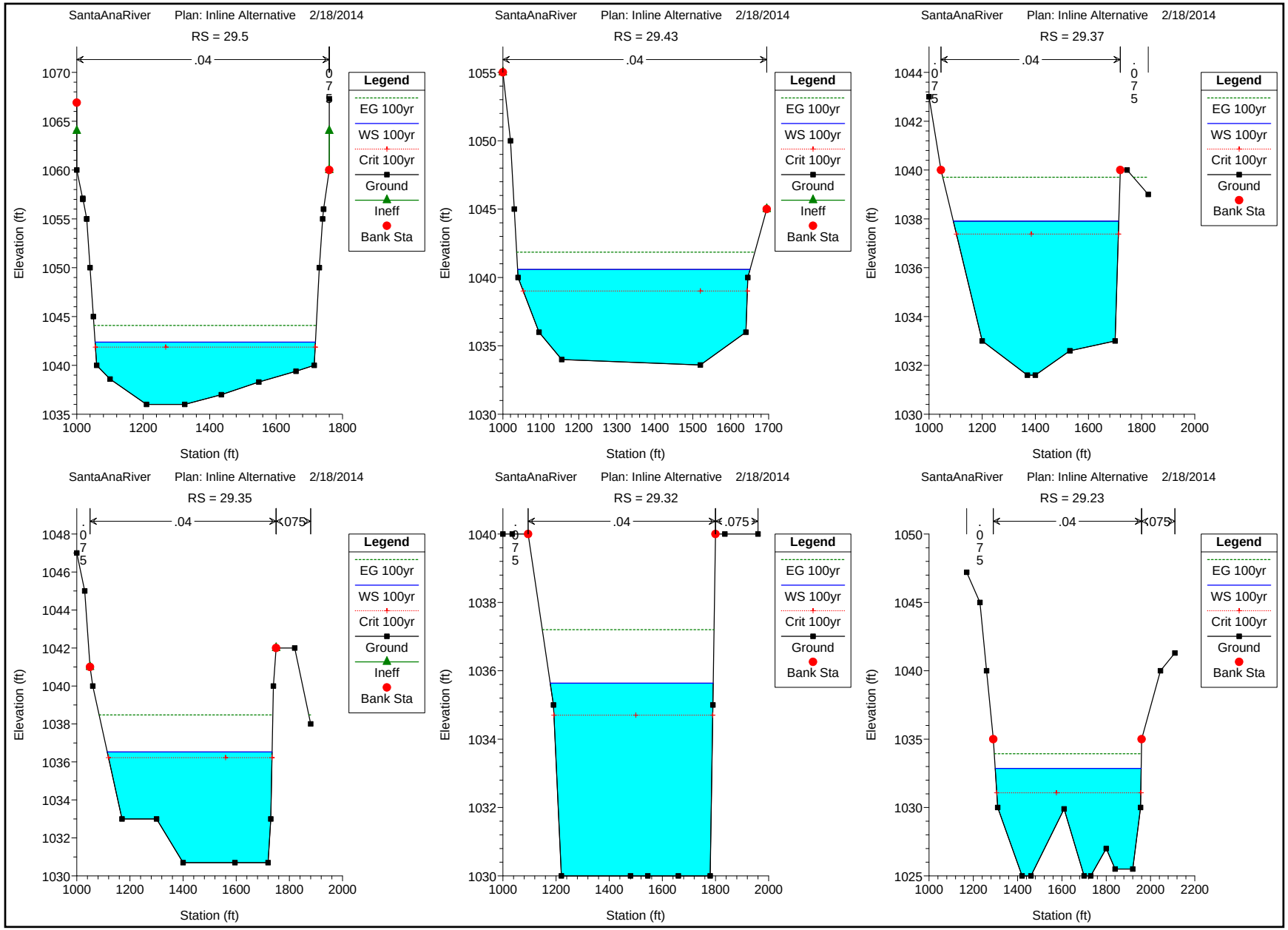

SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.610
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.608
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.606
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.604
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.602
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.6
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

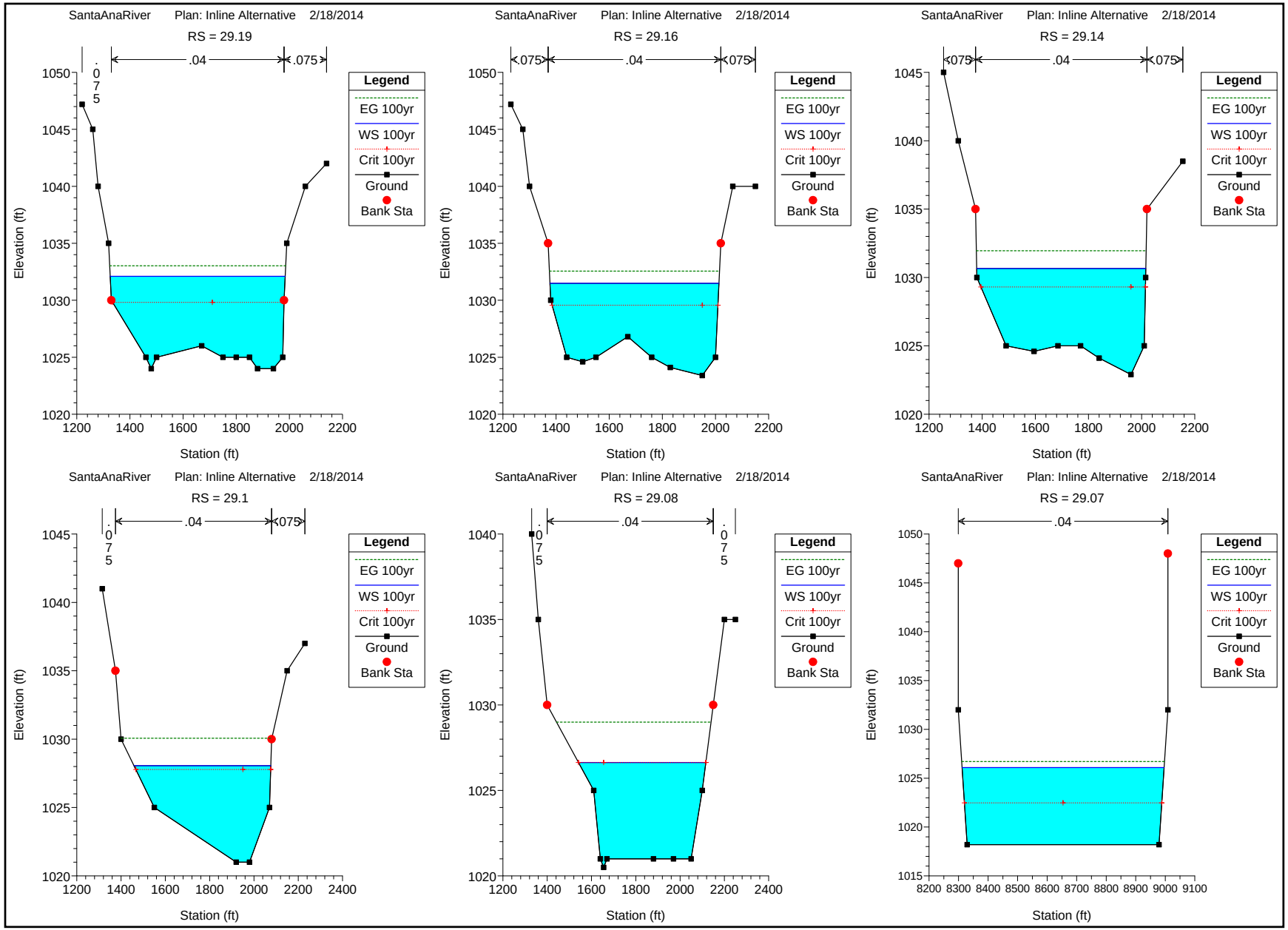

SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.597
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.595
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.59
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.58
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.57
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.55
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

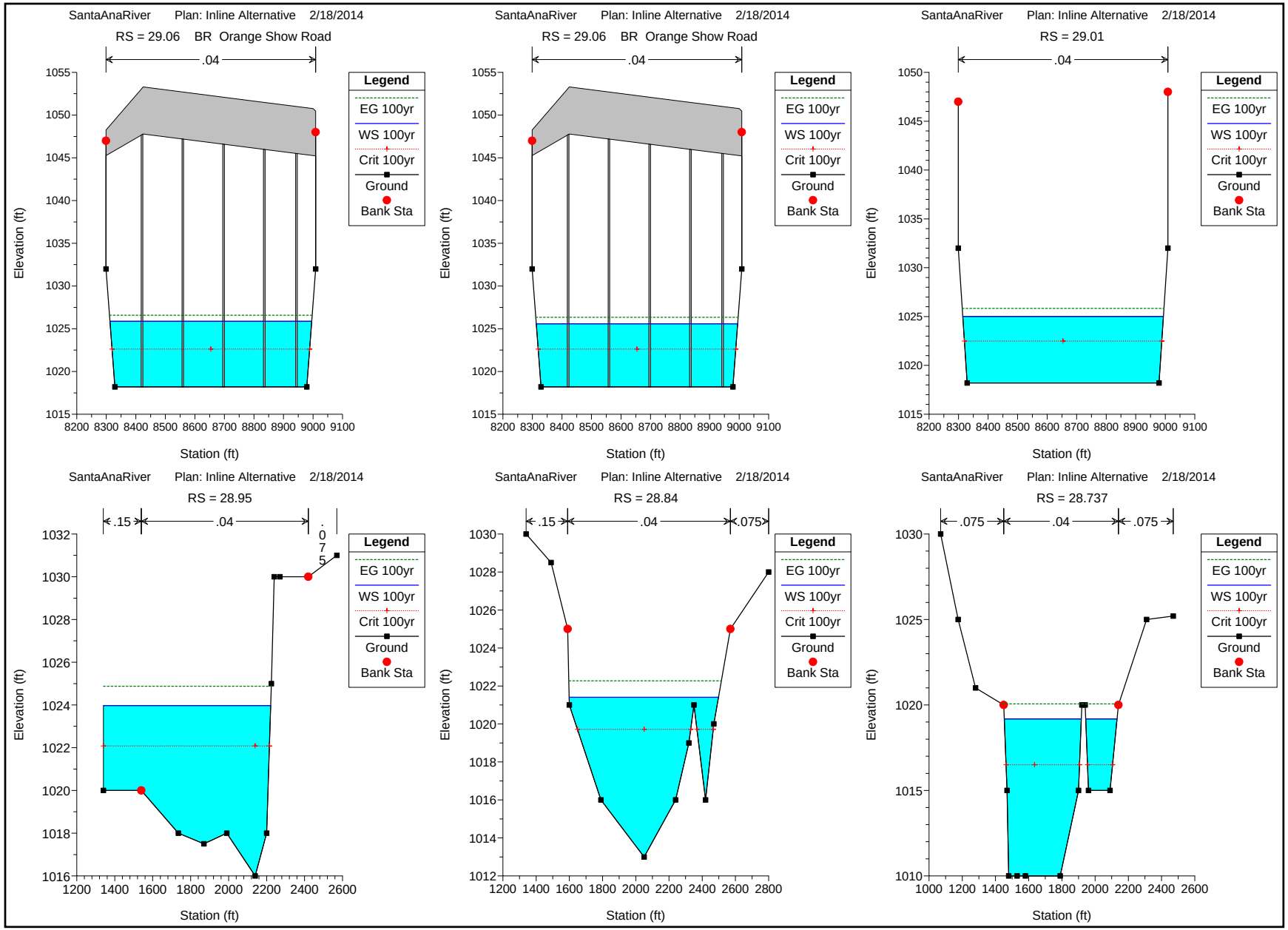

SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.53
.075
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.49
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.43
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.38
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Offline Alternative 2/18/2014
RS = 28.3
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

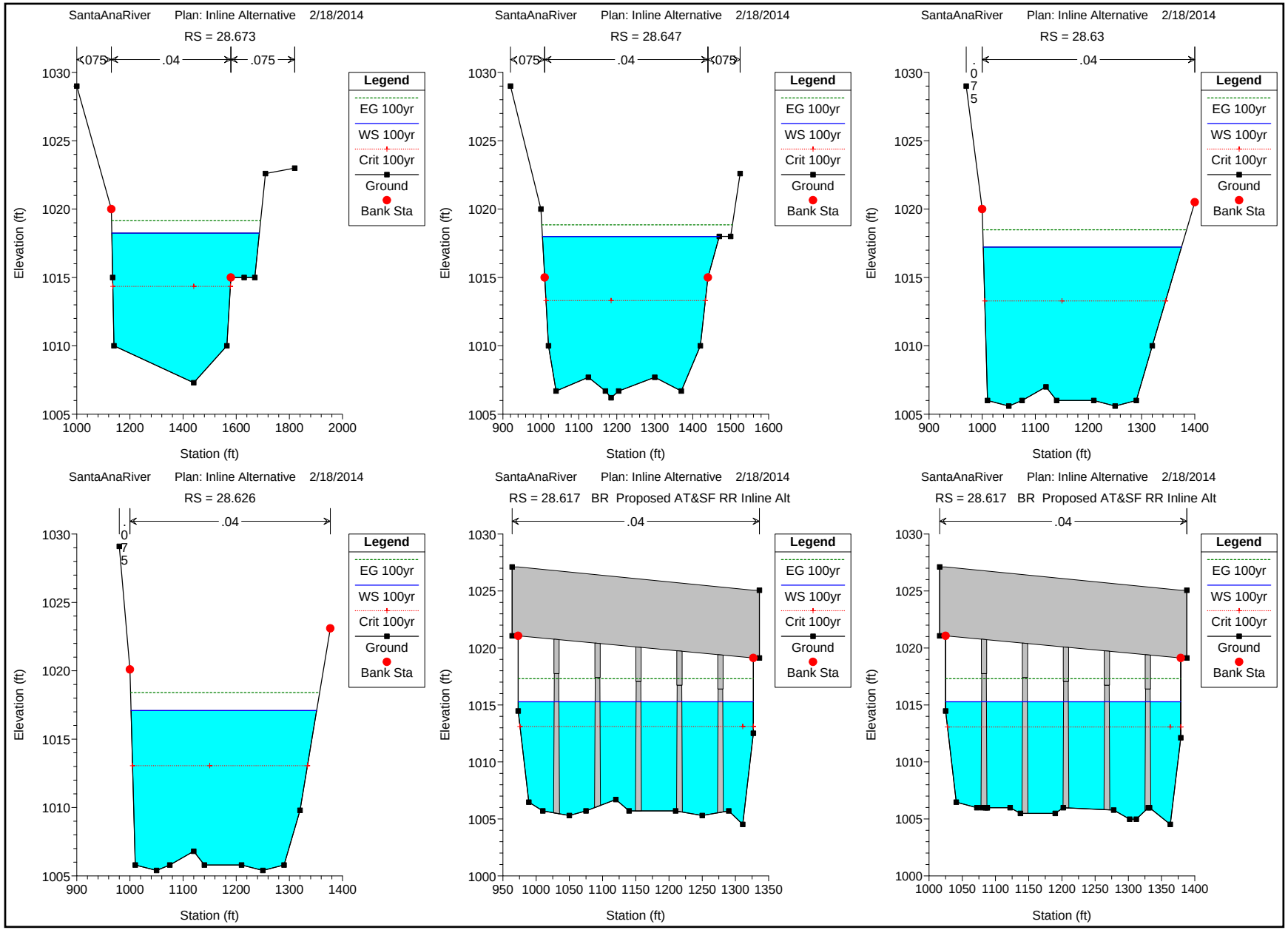

SantaAnaRiver Plan: Inline Alternative 2/18/2014
RIVER-1 Reach-1
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Elevation (ft)
Main Channel Distance (ft)
1070
1060
1050
1040
1030
1020
1010
1000
990
0
1000
2000
3000
4000
5000
6000
7000
28.38
28.43
28.49
28.53
28.55
28.58
28.602
28.63
28.673
28.737
28.84
28.95
29.01
29.06 Orange Show Road
29.08
29.14
29.16
29.19
29.23
29.32
29.35
29.37
29.43
29.5
29.53
29.56
29.64

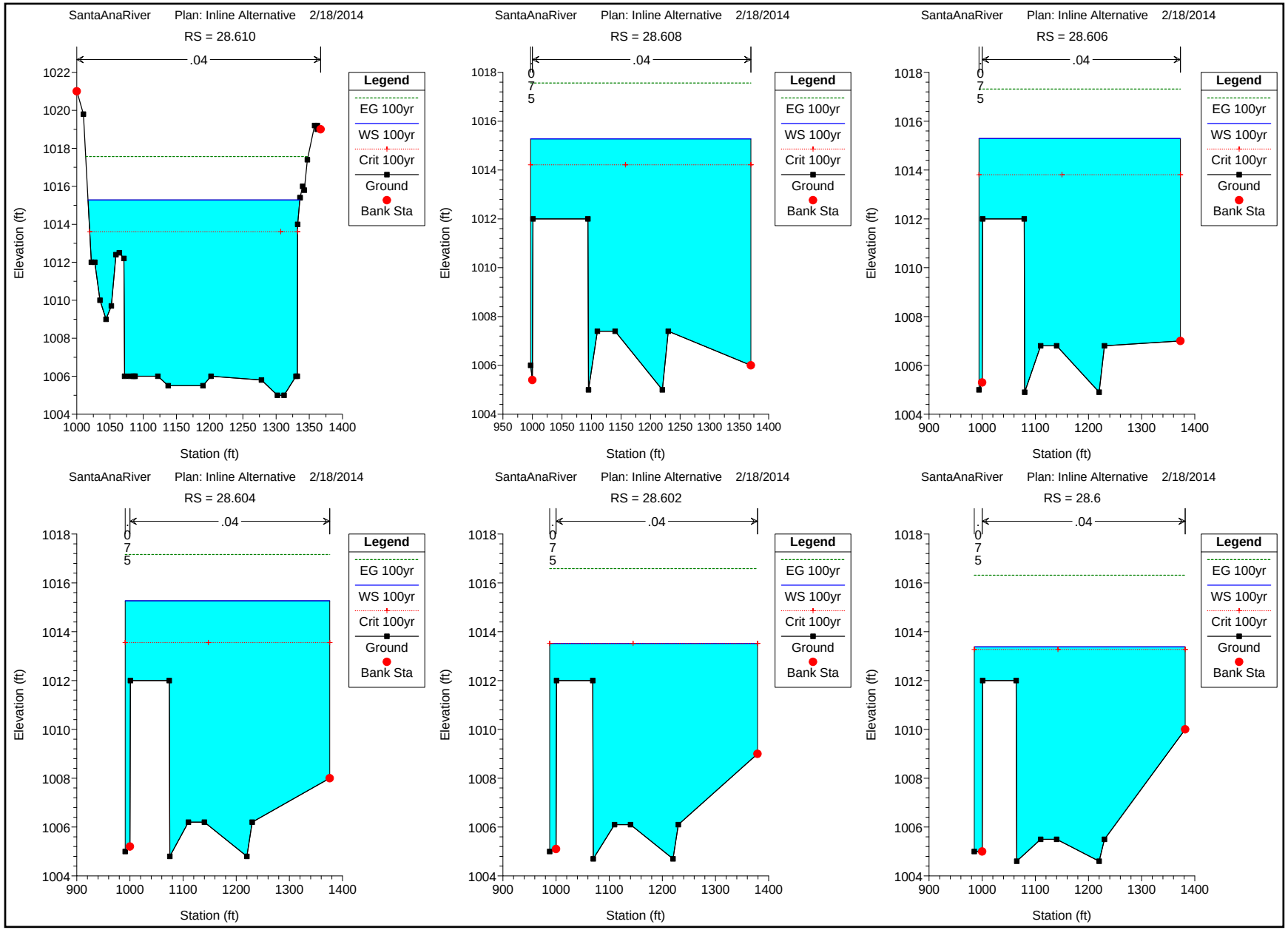

SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.64
.038
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.56
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.53
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.51 TIPPECANOE AVE.
.04
075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.505 BR Tippecanoe Ave
.04
075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.505 BR Tippecanoe Ave
.04
075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)


SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.5
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.43
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.37
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.35
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.32
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.23
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.19
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.16
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.14
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.1
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.08
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.07
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.06 BR Orange Show Road
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.06 BR Orange Show Road
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 29.01
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.95
.15
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.84
.15
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.737
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.673
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.647
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.63
.075
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.626
.075
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.617 BR Proposed AT&SF RR Inline Alt
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.617 BR Proposed AT&SF RR Inline Alt
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.610
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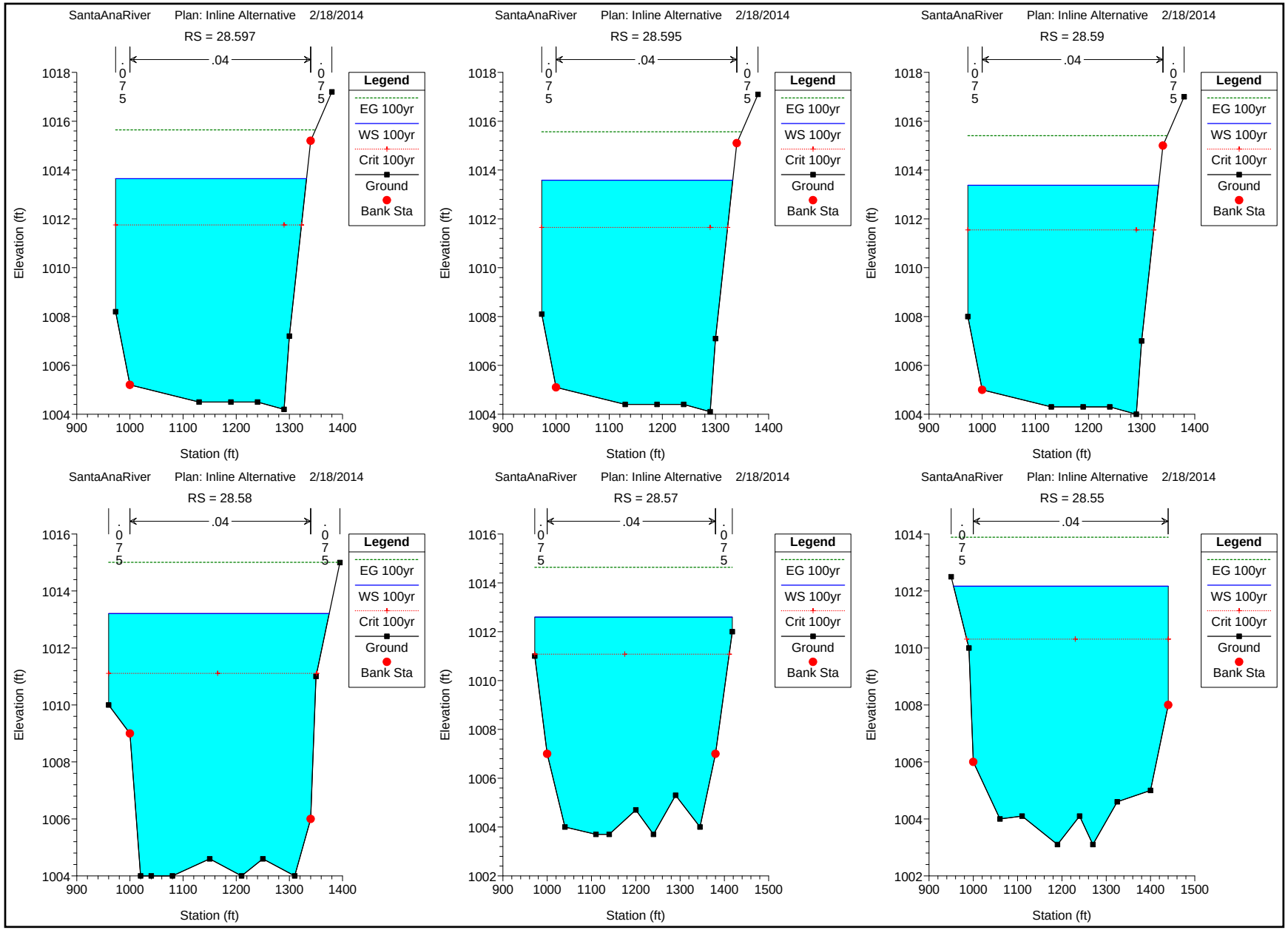
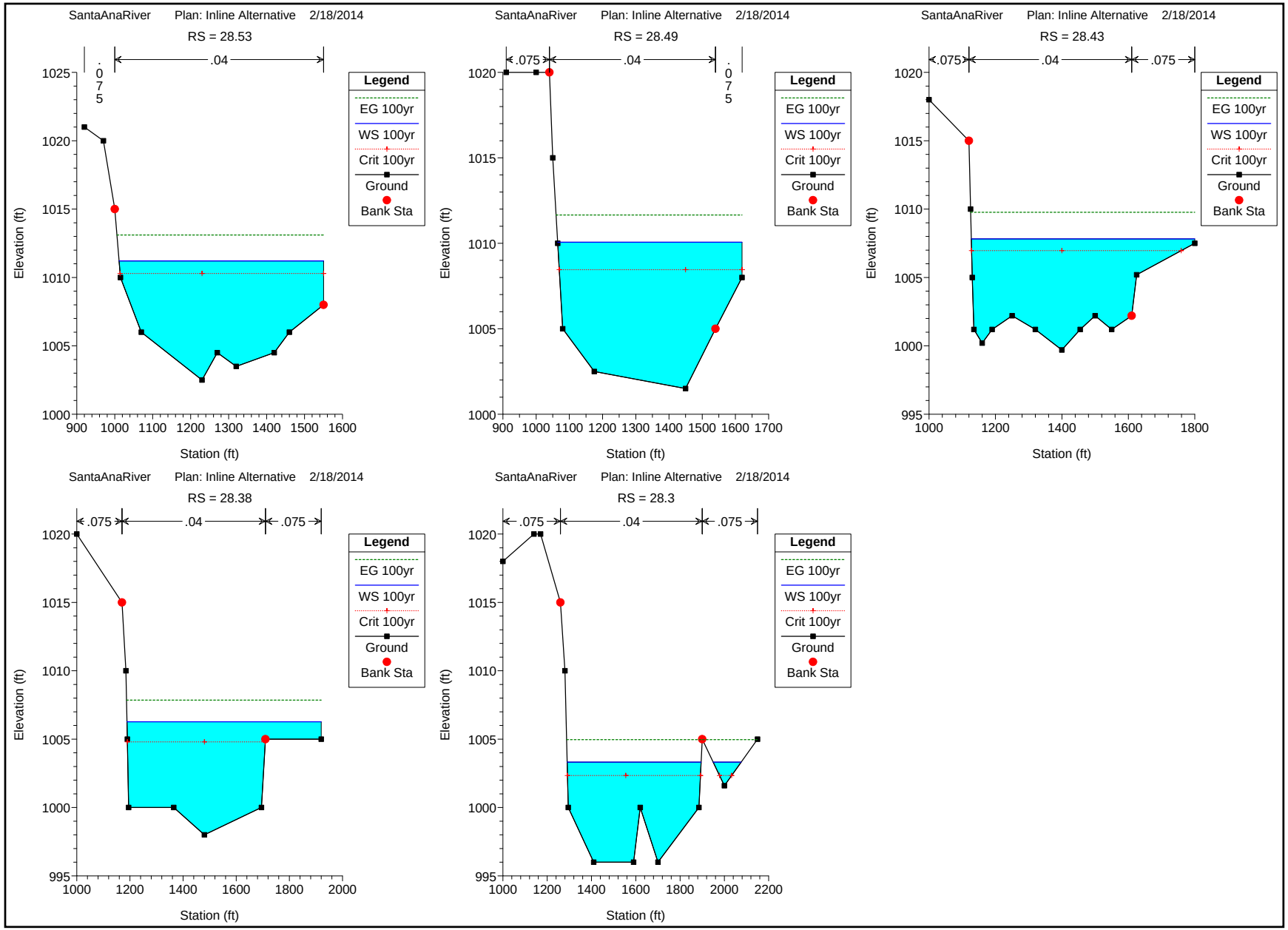
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.608
.04
0
7
5
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.606
.04
0
7
5
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.604
.04
0
7
5
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.602
.04
0
7
5
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.6
.04
0
7
5
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.597
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.595
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.59
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.58
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.57
.04
.075
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.55
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.53
.075
.04
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.49
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.43
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.38
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
SantaAnaRiver Plan: Inline Alternative 2/18/2014
RS = 28.3
.075
.04
.075
Legend
EG 100yr
WS 100yr
Crit 100yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

Attachment 2 – Hydraulic Analysis Results

HEC-RAS Plan: Dup Eff River: RIVER-1 Reach: Reach-1 Profile: PF 1

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)	
Reach-1	29.64	PF 1	33000.00	1041.30	1047.96	1047.05	1049.55	0.007688	10.10	3267.22	596.85	0.76
Reach-1	29.56	PF 1	33000.00	1039.50	1045.65	1044.11	1046.89	0.005387	8.96	3684.41	615.04	0.64
Reach-1	29.53	PF 1	33000.00	1038.00	1045.20	1042.87	1046.17	0.003554	7.91	4170.56	614.09	0.54
Reach-1	29.51	PF 1	33000.00	1036.80	1044.72	1042.49	1045.64	0.003625	7.69	4294.00	671.53	0.54
Reach-1	29.505		Bridge									
Reach-1	29.5	PF 1	33000.00	1036.00	1042.38	1041.88	1044.09	0.009995	10.48	3149.66	663.33	0.85
Reach-1	29.43	PF 1	33000.00	1033.60	1040.59	1039.01	1041.85	0.005416	9.00	3666.62	612.09	0.65
Reach-1	29.37	PF 1	33000.00	1031.60	1037.90	1037.38	1039.71	0.010053	10.77	3064.88	622.61	0.86
Reach-1	29.35	PF 1	33000.00	1030.70	1036.52	1036.23	1038.48	0.011476	11.22	2942.43	620.41	0.91
Reach-1	29.32	PF 1	33000.00	1030.00	1035.64	1034.70	1037.20	0.007810	10.04	3288.16	613.44	0.76
Reach-1	29.23	PF 1	33000.00	1025.00	1032.85	1031.07	1033.93	0.004612	8.32	3964.53	659.25	0.60
Reach-1	29.19	PF 1	33000.00	1024.00	1032.08	1029.82	1033.01	0.003585	7.76	4259.50	658.31	0.53
Reach-1	29.16	PF 1	33000.00	1023.40	1031.46	1029.57	1032.54	0.004434	8.35	3954.00	635.84	0.59
Reach-1	29.14	PF 1	33000.00	1022.90	1030.57	1029.30	1031.91	0.006344	9.29	3552.98	636.14	0.69
Reach-1	29.1	PF 1	33000.00	1021.00	1028.32	1027.78	1030.12	0.010139	10.77	3064.25	626.32	0.86
Reach-1	29.08	PF 1	33000.00	1020.50	1027.93	1026.64	1029.34	0.006933	9.51	3469.11	642.58	0.72
Reach-1	29.07	PF 1	33000.00	1019.80	1027.38	1025.98	1028.74	0.006960	9.36	3526.50	670.55	0.72
Reach-1	29.01	PF 1	33000.00	1018.00	1025.14	1024.26	1026.50	0.007981	9.36	3524.35	750.55	0.76
Reach-1	28.95	PF 1	33000.00	1016.00	1023.97	1022.08	1024.88	0.004036	7.78	4877.05	881.32	0.56
Reach-1	28.84	PF 1	33000.00	1013.00	1021.56	1019.72	1022.38	0.004427	7.26	4546.32	902.58	0.57
Reach-1	28.737	PF 1	33000.00	1010.00	1019.79	1016.50	1020.53	0.002501	6.90	4784.20	665.36	0.45
Reach-1	28.673	PF 1	33000.00	1007.30	1019.09	1014.35	1019.84	0.001647	7.04	4988.58	560.61	0.39
Reach-1	28.647	PF 1	33000.00	1006.20	1018.90	1013.31	1019.62	0.001356	6.83	4934.14	502.69	0.36
Reach-1	28.63	PF 1	33000.00	1005.60	1018.34	1013.27	1019.35	0.002067	8.09	4080.76	382.35	0.44
Reach-1	28.624	PF 1	33000.00	1005.30	1018.23	1012.97	1019.27	0.001959	8.18	4032.21	355.33	0.43
Reach-1	28.622	PF 1	33000.00	1005.20	1018.19	1012.87	1019.24	0.001927	8.23	4009.70	345.43	0.43
Reach-1	28.62	PF 1	33000.00	1005.00	1017.53	1013.96	1019.03	0.003353	9.83	3358.28	334.34	0.55
Reach-1	28.615		Bridge									
Reach-1	28.61	PF 1	33000.00	1005.00	1015.58	1013.62	1017.71	0.005847	11.72	2815.08	320.75	0.70
Reach-1	28.608	PF 1	33000.00	1005.00	1015.28	1014.21	1017.56	0.008124	12.15	2736.49	373.00	0.79
Reach-1	28.606	PF 1	33000.00	1004.90	1015.29	1013.81	1017.32	0.006773	11.46	2918.43	379.00	0.73
Reach-1	28.604	PF 1	33000.00	1004.80	1015.27	1013.55	1017.16	0.006161	11.10	3028.83	385.00	0.70
Reach-1	28.602	PF 1	33000.00	1004.70	1013.52	1013.52	1016.58	0.014065	14.16	2383.33	391.00	1.02
Reach-1	28.6	PF 1	33000.00	1004.60	1013.38	1013.27	1016.31	0.013356	13.88	2439.63	397.00	0.99
Reach-1	28.597	PF 1	33000.00	1004.20	1013.65	1011.75	1015.65	0.005596	11.48	2985.06	359.23	0.70
Reach-1	28.595	PF 1	33000.00	1004.10	1013.59	1011.65	1015.57	0.005512	11.42	2999.61	359.43	0.69
Reach-1	28.59	PF 1	33000.00	1004.00	1013.37	1011.55	1015.41	0.005751	11.58	2959.14	358.87	0.71
Reach-1	28.58	PF 1	33000.00	1004.00	1013.21	1011.11	1015.01	0.004741	10.86	3203.69	414.82	0.65
Reach-1	28.57	PF 1	36500.00	1003.70	1012.60	1011.08	1014.64	0.005922	11.56	3312.65	446.00	0.71
Reach-1	28.55	PF 1	36500.00	1003.10	1012.17	1010.31	1013.89	0.005260	10.55	3523.15	484.69	0.66
Reach-1	28.53	PF 1	36500.00	1002.50	1011.21	1010.29	1013.11	0.007997	11.07	3297.88	538.62	0.79
Reach-1	28.49	PF 1	36500.00	1001.50	1010.06	1008.46	1011.65	0.005397	10.25	3752.02	555.18	0.67
Reach-1	28.43	PF 1	36500.00	999.70	1007.82	1006.96	1009.77	0.007629	11.31	3477.74	672.82	0.78
Reach-1	28.38	PF 1	36500.00	998.00	1006.28	1004.80	1007.86	0.005863	10.16	3812.25	731.28	0.69
Reach-1	28.3	PF 1	36500.00	996.00	1003.30	1002.34	1004.96	0.007470	10.35	3617.75	729.85	0.76

HEC-RAS Plan: Corr Eff River: RIVER-1 Reach: Reach-1 Profile: 100yr

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)	
Reach-1	29.64	100yr	33000.00	1041.30	1047.87	1047.05	1049.51	0.007337	10.27	3212.01	596.48	0.78
Reach-1	29.56	100yr	33000.00	1039.50	1045.65	1044.11	1046.89	0.005383	8.95	3685.31	615.05	0.64
Reach-1	29.53	100yr	33000.00	1038.00	1045.20	1042.87	1046.17	0.003551	7.91	4171.84	614.09	0.53
Reach-1	29.51	100yr	33000.00	1036.80	1044.73	1042.49	1045.64	0.003619	7.68	4295.97	671.54	0.54
Reach-1	29.505		Bridge									
Reach-1	29.5	100yr	33000.00	1036.00	1042.38	1041.88	1044.09	0.009995	10.48	3149.66	663.33	0.85
Reach-1	29.43	100yr	33000.00	1033.60	1040.59	1039.01	1041.85	0.005416	9.00	3666.62	612.09	0.65
Reach-1	29.37	100yr	33000.00	1031.60	1037.91	1037.38	1039.71	0.010051	10.77	3065.04	622.62	0.86
Reach-1	29.35	100yr	33000.00	1030.70	1036.52	1036.23	1038.48	0.011479	11.22	2942.21	620.41	0.91
Reach-1	29.32	100yr	33000.00	1030.00	1035.64	1034.70	1037.20	0.007815	10.04	3287.56	613.41	0.76
Reach-1	29.23	100yr	33000.00	1025.00	1032.86	1031.07	1033.93	0.004581	8.31	3972.50	659.31	0.60
Reach-1	29.19	100yr	33000.00	1024.00	1032.10	1029.82	1033.03	0.003548	7.74	4273.08	658.40	0.53
Reach-1	29.16	100yr	33000.00	1023.40	1031.49	1029.57	1032.56	0.004358	8.30	3974.96	635.97	0.59
Reach-1	29.14	100yr	33000.00	1022.90	1030.66	1029.30	1031.96	0.006036	9.15	3606.95	636.31	0.68
Reach-1	29.1	100yr	33000.00	1021.00	1028.06	1027.78	1030.07	0.011944	11.37	2901.58	617.95	0.92
Reach-1	29.08	100yr	33000.00	1020.50	1026.64	1026.64	1028.99	0.014144	12.32	2679.49	575.14	1.01
Reach-1	29.07	100yr	33000.00	1018.20	1026.11	1022.48	1026.72	0.001873	6.25	5277.17	684.39	0.40
Reach-1	29.06		Bridge									
Reach-1	29.01	100yr	33000.00	1018.20	1025.01	1022.49	1025.83	0.003092	7.29	4526.32	679.60	0.50
Reach-1	28.95	100yr	33000.00	1016.00	1023.97	1022.08	1024.88	0.004038	7.78	4876.41	881.32	0.56
Reach-1	28.84	100yr	33000.00	1013.00	1021.55	1019.72	1022.37	0.004459	7.28	4535.80	902.32	0.57
Reach-1	28.737	100yr	33000.00	1010.00	1019.75	1016.50	1020.50	0.002538	6.93	4760.54	664.58	0.46
Reach-1	28.673	100yr	33000.00	1007.30	1019.04	1014.35	1019.80	0.001673	7.07	4962.66	560.32	0.39
Reach-1	28.647	100yr	33000.00	1006.20	1018.85	1013.31	1019.58	0.001376	6.86	4909.51	502.33	0.36
Reach-1	28.63	100yr	33000.00	1005.60	1018.28	1013.27	1019.31	0.002101	8.13	4058.79	381.87	0.44
Reach-1	28.624	100yr	33000.00	1005.30	1018.17	1012.97	1019.22	0.001991	8.23	4011.46	355.04	0.43
Reach-1	28.622	100yr	33000.00	1005.20	1018.13	1012.87	1019.20	0.001958	8.27	3989.42	345.20	0.43
Reach-1	28.62	100yr	33000.00	1005.00	1017.46	1013.96	1018.98	0.003432	9.90	3332.63	333.75	0.55
Reach-1	28.615		Bridge									
Reach-1	28.61	100yr	33000.00	1005.00	1015.58	1013.62	1017.71	0.005847	11.72	2815.08	320.75	0.70
Reach-1	28.608	100yr	33000.00	1005.00	1015.28	1014.21	1017.56	0.008124	12.15	2736.49	373.00	0.79
Reach-1	28.606	100yr	33000.00	1004.90	1015.29	1013.81	1017.32	0.006773	11.46	2918.43	379.00	0.73
Reach-1	28.604	100yr	33000.00	1004.80	1015.27	1013.55	1017.16	0.006161	11.10	3028.83	385.00	0.70
Reach-1	28.602	100yr	33000.00	1004.70	1013.52	1013.52	1016.58	0.014065	14.16	2383.33	391.00	1.02
Reach-1	28.6	100yr	33000.00	1004.60	1013.38	1013.27	1016.31	0.013357	13.88	2439.56	397.00	0.99
Reach-1	28.597	100yr	33000.00	1004.20	1013.65	1011.75	1015.65	0.005597	11.48	2985.02	359.23	0.70
Reach-1	28.595	100yr	33000.00	1004.10	1013.59	1011.65	1015.57	0.005512	11.42	2999.57	359.43	0.69
Reach-1	28.59	100yr	33000.00	1004.00	1013.37	1011.55	1015.41	0.005752	11.58	2959.12	358.87	0.71
Reach-1	28.58	100yr	33000.00	1004.00	1013.21	1011.11	1015.01	0.004741	10.86	3203.66	414.82	0.65
Reach-1	28.57	100yr	36500.00	1003.70	1012.60	1011.08	1014.64	0.005922	11.56	3312.57	446.00	0.71
Reach-1	28.55	100yr	36500.00	1003.10	1012.17	1010.31	1013.89	0.005260	10.55	3523.03	484.69	0.66
Reach-1	28.53	100yr	36500.00	1002.50	1011.21	1010.29	1013.11	0.007996	11.07	3298.01	538.62	0.79
Reach-1	28.49	100yr	36500.00	1001.50	1010.06	1008.46	1011.66	0.005396	10.25	3752.26	555.18	0.67
Reach-1	28.43	100yr	36500.00	999.70	1007.82	1006.96	1009.77	0.007633	11.31	3477.09	672.82	0.78
Reach-1	28.38	100yr	36500.00	998.00	1006.27	1004.80	1007.86	0.005885	10.18	3806.98	731.27	0.69
Reach-1	28.3	100yr	36500.00	996.00	1003.32	1002.34	1004.96	0.007384	10.31	3632.37	731.41	0.75

HEC-RAS Plan: Existing Model River: RIVER-1 Reach: Reach-1 Profile: 100yr

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)	
Reach-1	29.64	100yr	33000.00	1041.30	1047.87	1047.05	1049.51	0.007337	10.27	3212.01	596.48	0.78
Reach-1	29.56	100yr	33000.00	1039.50	1045.65	1044.11	1046.89	0.005383	8.95	3685.31	615.05	0.64
Reach-1	29.53	100yr	33000.00	1038.00	1045.20	1042.87	1046.17	0.003551	7.91	4171.84	614.09	0.53
Reach-1	29.51	100yr	33000.00	1036.80	1044.73	1042.49	1045.64	0.003619	7.68	4295.97	671.54	0.54
Reach-1	29.505		Bridge									
Reach-1	29.5	100yr	33000.00	1036.00	1042.38	1041.88	1044.09	0.009995	10.48	3149.66	663.33	0.85
Reach-1	29.43	100yr	33000.00	1033.60	1040.59	1039.01	1041.85	0.005416	9.00	3666.62	612.09	0.65
Reach-1	29.37	100yr	33000.00	1031.60	1037.91	1037.38	1039.71	0.010051	10.77	3065.04	622.62	0.86
Reach-1	29.35	100yr	33000.00	1030.70	1036.52	1036.23	1038.48	0.011479	11.22	2942.21	620.41	0.91
Reach-1	29.32	100yr	33000.00	1030.00	1035.64	1034.70	1037.20	0.007815	10.04	3287.56	613.41	0.76
Reach-1	29.23	100yr	33000.00	1025.00	1032.86	1031.07	1033.93	0.004581	8.31	3972.50	659.31	0.60
Reach-1	29.19	100yr	33000.00	1024.00	1032.10	1029.82	1033.03	0.003548	7.74	4273.08	658.40	0.53
Reach-1	29.16	100yr	33000.00	1023.40	1031.49	1029.57	1032.56	0.004358	8.30	3974.96	635.97	0.59
Reach-1	29.14	100yr	33000.00	1022.90	1030.66	1029.30	1031.96	0.006036	9.15	3606.95	636.31	0.68
Reach-1	29.1	100yr	33000.00	1021.00	1028.06	1027.78	1030.07	0.011944	11.37	2901.58	617.95	0.92
Reach-1	29.08	100yr	33000.00	1020.50	1026.64	1026.64	1028.99	0.014144	12.32	2679.49	575.14	1.01
Reach-1	29.07	100yr	33000.00	1018.20	1026.11	1022.48	1026.72	0.001873	6.25	5276.67	684.39	0.40
Reach-1	29.06		Bridge									
Reach-1	29.01	100yr	33000.00	1018.20	1025.01	1022.49	1025.83	0.003094	7.29	4525.33	679.60	0.50
Reach-1	28.95	100yr	33000.00	1016.00	1023.97	1022.08	1024.87	0.004045	7.79	4873.40	881.31	0.56
Reach-1	28.84	100yr	33000.00	1013.00	1021.51	1019.72	1022.35	0.004556	7.32	4505.19	901.56	0.58
Reach-1	28.737	100yr	33000.00	1010.00	1019.65	1016.50	1020.41	0.002658	7.04	4688.23	662.18	0.47
Reach-1	28.673	100yr	33000.00	1007.30	1018.90	1014.35	1019.68	0.001756	7.18	4882.28	559.42	0.40
Reach-1	28.647	100yr	33000.00	1006.20	1018.70	1013.31	1019.45	0.001442	6.95	4833.01	501.19	0.37
Reach-1	28.63	100yr	33000.00	1005.60	1018.10	1013.27	1019.16	0.002212	8.27	3989.93	380.36	0.45
Reach-1	28.626	100yr	33000.00	1005.40	1017.98	1013.07	1019.09	0.002158	8.44	3908.80	353.59	0.45
Reach-1	28.624	100yr	33000.00	1005.30	1017.97	1012.97	1019.06	0.002105	8.38	3940.23	354.04	0.44
Reach-1	28.622	100yr	33000.00	1005.20	1017.93	1012.87	1019.03	0.002069	8.42	3919.80	344.44	0.44
Reach-1	28.62	100yr	33000.00	1005.00	1017.19	1013.96	1018.79	0.003740	10.18	3241.99	332.37	0.57
Reach-1	28.615		Bridge									
Reach-1	28.61	100yr	33000.00	1005.00	1015.58	1013.62	1017.71	0.005847	11.72	2815.08	320.75	0.70
Reach-1	28.608	100yr	33000.00	1005.00	1015.28	1014.21	1017.56	0.008124	12.15	2736.49	373.00	0.79
Reach-1	28.606	100yr	33000.00	1004.90	1015.29	1013.81	1017.32	0.006773	11.46	2918.43	379.00	0.73
Reach-1	28.604	100yr	33000.00	1004.80	1015.27	1013.55	1017.16	0.006161	11.10	3028.83	385.00	0.70
Reach-1	28.602	100yr	33000.00	1004.70	1013.52	1013.52	1016.58	0.014065	14.16	2383.33	391.00	1.02
Reach-1	28.6	100yr	33000.00	1004.60	1013.38	1013.27	1016.31	0.013357	13.88	2439.56	397.00	0.99
Reach-1	28.597	100yr	33000.00	1004.20	1013.65	1011.75	1015.65	0.005597	11.48	2985.02	359.23	0.70
Reach-1	28.595	100yr	33000.00	1004.10	1013.59	1011.65	1015.57	0.005512	11.42	2999.57	359.43	0.69
Reach-1	28.59	100yr	33000.00	1004.00	1013.37	1011.55	1015.41	0.005752	11.58	2959.12	358.87	0.71
Reach-1	28.58	100yr	33000.00	1004.00	1013.21	1011.11	1015.01	0.004741	10.86	3203.66	414.82	0.65
Reach-1	28.57	100yr	36500.00	1003.70	1012.60	1011.08	1014.64	0.005922	11.56	3312.57	446.00	0.71
Reach-1	28.55	100yr	36500.00	1003.10	1012.17	1010.31	1013.89	0.005260	10.55	3523.03	484.69	0.66
Reach-1	28.53	100yr	36500.00	1002.50	1011.21	1010.29	1013.11	0.007996	11.07	3298.01	538.62	0.79
Reach-1	28.49	100yr	36500.00	1001.50	1010.06	1008.46	1011.66	0.005396	10.25	3752.26	555.18	0.67
Reach-1	28.43	100yr	36500.00	999.70	1007.82	1006.96	1009.77	0.007633	11.31	3477.09	672.82	0.78
Reach-1	28.38	100yr	36500.00	998.00	1006.27	1004.80	1007.86	0.005885	10.18	3806.98	731.27	0.69
Reach-1	28.3	100yr	36500.00	996.00	1003.32	1002.34	1004.96	0.007384	10.31	3632.37	731.41	0.75

HEC-RAS Plan: Offline Alt River: RIVER-1 Reach: Reach-1 Profile: 100yr

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)	
Reach-1	29.64	100yr	33000.00	1041.30	1047.87	1047.05	1049.51	0.007337	10.27	3212.01	596.48	0.78
Reach-1	29.56	100yr	33000.00	1039.50	1045.65	1044.11	1046.89	0.005383	8.95	3685.31	615.05	0.64
Reach-1	29.53	100yr	33000.00	1038.00	1045.20	1042.87	1046.17	0.003551	7.91	4171.84	614.09	0.53
Reach-1	29.51	100yr	33000.00	1036.80	1044.73	1042.49	1045.64	0.003619	7.68	4295.97	671.54	0.54
Reach-1	29.505		Bridge									
Reach-1	29.5	100yr	33000.00	1036.00	1042.38	1041.88	1044.09	0.009995	10.48	3149.66	663.33	0.85
Reach-1	29.43	100yr	33000.00	1033.60	1040.59	1039.01	1041.85	0.005416	9.00	3666.62	612.09	0.65
Reach-1	29.37	100yr	33000.00	1031.60	1037.91	1037.38	1039.71	0.010051	10.77	3065.04	622.62	0.86
Reach-1	29.35	100yr	33000.00	1030.70	1036.52	1036.23	1038.48	0.011479	11.22	2942.21	620.41	0.91
Reach-1	29.32	100yr	33000.00	1030.00	1035.64	1034.70	1037.20	0.007815	10.04	3287.56	613.41	0.76
Reach-1	29.23	100yr	33000.00	1025.00	1032.86	1031.07	1033.93	0.004581	8.31	3972.50	659.31	0.60
Reach-1	29.19	100yr	33000.00	1024.00	1032.10	1029.82	1033.03	0.003548	7.74	4273.08	658.40	0.53
Reach-1	29.16	100yr	33000.00	1023.40	1031.49	1029.57	1032.56	0.004358	8.30	3974.96	635.97	0.59
Reach-1	29.14	100yr	33000.00	1022.90	1030.66	1029.30	1031.96	0.006036	9.15	3606.95	636.31	0.68
Reach-1	29.1	100yr	33000.00	1021.00	1028.06	1027.78	1030.07	0.011944	11.37	2901.58	617.95	0.92
Reach-1	29.08	100yr	33000.00	1020.50	1026.64	1026.64	1028.99	0.014144	12.32	2679.49	575.14	1.01
Reach-1	29.07	100yr	33000.00	1018.20	1026.09	1022.48	1026.70	0.001888	6.27	5264.47	684.31	0.40
Reach-1	29.06		Bridge									
Reach-1	29.01	100yr	33000.00	1018.20	1025.01	1022.49	1025.83	0.003091	7.29	4526.74	679.61	0.50
Reach-1	28.95	100yr	33000.00	1016.00	1023.97	1022.08	1024.88	0.004034	7.78	4877.65	881.33	0.56
Reach-1	28.84	100yr	33000.00	1013.00	1021.40	1019.72	1022.28	0.004886	7.49	4406.61	899.10	0.60
Reach-1	28.737	100yr	33000.00	1010.00	1019.20	1016.50	1020.07	0.003236	7.51	4392.74	652.29	0.51
Reach-1	28.673	100yr	33000.00	1007.30	1018.26	1014.35	1019.17	0.002198	7.70	4527.80	555.44	0.44
Reach-1	28.647	100yr	33000.00	1006.20	1018.02	1013.31	1018.87	0.001792	7.43	4492.25	496.11	0.41
Reach-1	28.63	100yr	33000.00	1005.60	1017.26	1013.29	1018.51	0.002843	8.99	3671.72	373.32	0.51
Reach-1	28.626	100yr	33000.00	1005.40	1017.12	1013.06	1018.42	0.002774	9.15	3605.64	349.29	0.50
Reach-1	28.617		Bridge									
Reach-1	28.610	100yr	33000.00	1005.00	1015.28	1013.61	1017.57	0.006491	12.13	2721.36	318.76	0.73
Reach-1	28.608	100yr	33000.00	1005.00	1015.28	1014.21	1017.56	0.008124	12.15	2736.49	373.00	0.79
Reach-1	28.606	100yr	33000.00	1004.90	1015.29	1013.81	1017.32	0.006773	11.46	2918.43	379.00	0.73
Reach-1	28.604	100yr	33000.00	1004.80	1015.27	1013.55	1017.16	0.006161	11.10	3028.83	385.00	0.70
Reach-1	28.602	100yr	33000.00	1004.70	1013.52	1013.52	1016.58	0.014065	14.16	2383.33	391.00	1.02
Reach-1	28.6	100yr	33000.00	1004.60	1013.38	1013.27	1016.31	0.013357	13.88	2439.56	397.00	0.99
Reach-1	28.597	100yr	33000.00	1004.20	1013.65	1011.75	1015.65	0.005597	11.48	2985.02	359.23	0.70
Reach-1	28.595	100yr	33000.00	1004.10	1013.59	1011.65	1015.57	0.005512	11.42	2999.57	359.43	0.69
Reach-1	28.59	100yr	33000.00	1004.00	1013.37	1011.55	1015.41	0.005752	11.58	2959.12	358.87	0.71
Reach-1	28.58	100yr	33000.00	1004.00	1013.21	1011.11	1015.01	0.004741	10.86	3203.66	414.82	0.65
Reach-1	28.57	100yr	36500.00	1003.70	1012.60	1011.08	1014.64	0.005922	11.56	3312.57	446.00	0.71
Reach-1	28.55	100yr	36500.00	1003.10	1012.17	1010.31	1013.89	0.005260	10.55	3523.03	484.69	0.66
Reach-1	28.53	100yr	36500.00	1002.50	1011.21	1010.29	1013.11	0.007996	11.07	3298.01	538.62	0.79
Reach-1	28.49	100yr	36500.00	1001.50	1010.06	1008.46	1011.66	0.005396	10.25	3752.26	555.18	0.67
Reach-1	28.43	100yr	36500.00	999.70	1007.82	1006.96	1009.77	0.007633	11.31	3477.09	672.82	0.78
Reach-1	28.38	100yr	36500.00	998.00	1006.27	1004.80	1007.86	0.005885	10.18	3806.98	731.27	0.69
Reach-1	28.3	100yr	36500.00	996.00	1003.32	1002.34	1004.96	0.007384	10.31	3632.37	731.41	0.75

HEC-RAS Plan: Inline Alt River: RIVER-1 Reach: Reach-1 Profile: 100yr

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)	
Reach-1	29.64	100yr	33000.00	1041.30	1047.87	1047.05	1049.51	0.007337	10.27	3212.01	596.48	0.78
Reach-1	29.56	100yr	33000.00	1039.50	1045.65	1044.11	1046.89	0.005383	8.95	3685.31	615.05	0.64
Reach-1	29.53	100yr	33000.00	1038.00	1045.20	1042.87	1046.17	0.003551	7.91	4171.84	614.09	0.53
Reach-1	29.51	100yr	33000.00	1036.80	1044.73	1042.49	1045.64	0.003619	7.68	4295.97	671.54	0.54
Reach-1	29.505		Bridge									
Reach-1	29.5	100yr	33000.00	1036.00	1042.38	1041.88	1044.09	0.009995	10.48	3149.66	663.33	0.85
Reach-1	29.43	100yr	33000.00	1033.60	1040.59	1039.01	1041.85	0.005416	9.00	3666.62	612.09	0.65
Reach-1	29.37	100yr	33000.00	1031.60	1037.91	1037.38	1039.71	0.010051	10.77	3065.04	622.62	0.86
Reach-1	29.35	100yr	33000.00	1030.70	1036.52	1036.23	1038.48	0.011479	11.22	2942.21	620.41	0.91
Reach-1	29.32	100yr	33000.00	1030.00	1035.64	1034.70	1037.20	0.007815	10.04	3287.56	613.41	0.76
Reach-1	29.23	100yr	33000.00	1025.00	1032.86	1031.07	1033.93	0.004581	8.31	3972.50	659.31	0.60
Reach-1	29.19	100yr	33000.00	1024.00	1032.10	1029.82	1033.03	0.003548	7.74	4273.08	658.40	0.53
Reach-1	29.16	100yr	33000.00	1023.40	1031.49	1029.57	1032.56	0.004358	8.30	3974.96	635.97	0.59
Reach-1	29.14	100yr	33000.00	1022.90	1030.66	1029.30	1031.96	0.006036	9.15	3606.95	636.31	0.68
Reach-1	29.1	100yr	33000.00	1021.00	1028.06	1027.78	1030.07	0.011944	11.37	2901.58	617.95	0.92
Reach-1	29.08	100yr	33000.00	1020.50	1026.64	1026.64	1028.99	0.014144	12.32	2679.49	575.14	1.01
Reach-1	29.07	100yr	33000.00	1018.20	1026.09	1022.48	1026.70	0.001888	6.27	5264.47	684.31	0.40
Reach-1	29.06		Bridge									
Reach-1	29.01	100yr	33000.00	1018.20	1025.01	1022.49	1025.83	0.003091	7.29	4526.74	679.61	0.50
Reach-1	28.95	100yr	33000.00	1016.00	1023.97	1022.08	1024.88	0.004034	7.78	4877.65	881.33	0.56
Reach-1	28.84	100yr	33000.00	1013.00	1021.40	1019.72	1022.27	0.004892	7.49	4404.96	899.05	0.60
Reach-1	28.737	100yr	33000.00	1010.00	1019.18	1016.50	1020.06	0.003256	7.53	4383.75	651.99	0.51
Reach-1	28.673	100yr	33000.00	1007.30	1018.24	1014.35	1019.15	0.002214	7.72	4516.11	555.30	0.44
Reach-1	28.647	100yr	33000.00	1006.20	1017.99	1013.31	1018.85	0.001803	7.44	4481.56	465.92	0.41
Reach-1	28.63	100yr	33000.00	1005.60	1017.23	1013.29	1018.49	0.002871	9.02	3660.15	373.07	0.51
Reach-1	28.626	100yr	33000.00	1005.40	1017.09	1013.06	1018.40	0.002800	9.18	3594.54	349.13	0.50
Reach-1	28.617		Bridge									
Reach-1	28.610	100yr	33000.00	1005.00	1015.28	1013.61	1017.57	0.006493	12.13	2721.11	318.75	0.73
Reach-1	28.608	100yr	33000.00	1005.00	1015.28	1014.21	1017.56	0.008124	12.15	2736.49	373.00	0.79
Reach-1	28.606	100yr	33000.00	1004.90	1015.29	1013.81	1017.32	0.006773	11.46	2918.43	379.00	0.73
Reach-1	28.604	100yr	33000.00	1004.80	1015.27	1013.55	1017.16	0.006161	11.10	3028.83	385.00	0.70
Reach-1	28.602	100yr	33000.00	1004.70	1013.52	1013.52	1016.58	0.014065	14.16	2383.33	391.00	1.02
Reach-1	28.6	100yr	33000.00	1004.60	1013.38	1013.27	1016.31	0.013357	13.88	2439.56	397.00	0.99
Reach-1	28.597	100yr	33000.00	1004.20	1013.65	1011.75	1015.65	0.005597	11.48	2985.02	359.23	0.70
Reach-1	28.595	100yr	33000.00	1004.10	1013.59	1011.65	1015.57	0.005512	11.42	2999.57	359.43	0.69
Reach-1	28.59	100yr	33000.00	1004.00	1013.37	1011.55	1015.41	0.005752	11.58	2959.12	358.87	0.71
Reach-1	28.58	100yr	33000.00	1004.00	1013.21	1011.11	1015.01	0.004741	10.86	3203.66	414.82	0.65
Reach-1	28.57	100yr	36500.00	1003.70	1012.60	1011.08	1014.64	0.005922	11.56	3312.57	446.00	0.71
Reach-1	28.55	100yr	36500.00	1003.10	1012.17	1010.31	1013.89	0.005260	10.55	3523.03	484.69	0.66
Reach-1	28.53	100yr	36500.00	1002.50	1011.21	1010.29	1013.11	0.007996	11.07	3298.01	538.62	0.79
Reach-1	28.49	100yr	36500.00	1001.50	1010.06	1008.46	1011.66	0.005396	10.25	3752.26	555.18	0.67
Reach-1	28.43	100yr	36500.00	999.70	1007.82	1006.96	1009.77	0.007633	11.31	3477.09	672.82	0.78
Reach-1	28.38	100yr	36500.00	998.00	1006.27	1004.80	1007.86	0.005885	10.18	3806.98	731.27	0.69
Reach-1	28.3	100yr	36500.00	996.00	1003.32	1002.34	1004.96	0.007384	10.31	3632.37	731.41	0.75

Attachment 3 – Engineering "No Rise" Certificate

NATIONAL FLOOD INSURANCE PROGRAM
ENGINEERING "NO-RISE" CERTIFICATE

SITE INFORMATION

Community	San Bernardino Associated Governments (SANBAG)	County	San Bernardino County
Applicant	SANBAG	Date	08/30/12
Address	1170 W. 3rd St, San Bernardino, CA 92410	Engineer	Mark Seits, P.E., HDR Engineering, Inc.
		Address	8690 Balboa Ave, Suite 200, San Diego, CA 92123
Telephone	909-884-8276	Telephone	858-712-8312
Site Address/ Location	Santa Ana River Bridge 3.4 N34.07515 and W117.2721, California Coordinate System 1983 (ft), Zone 5	Township Section	

PROJECT INFORMATION

Description of Development: New bridge development with ties, subgrade and rails.

Type of Development: Filling ___ Grading _X_ Excavation _X__ Minor Improv ___
Substantial Improv _X_ New Construction ___ Other ___

FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

NFIP map(s) and panel(s) affected: FIRM Map Number- 06071C8684H
Effective date of map: August 28, 2008
Base Flood Elevation (feet): Existing 1017.19; Proposed 1017.12
Name of flooding source: Santa Ana River

CERTIFICATION

This is to certify that I am a duly qualified Professional Engineer licensed to practice in the State of California. I further certify that the attached engineering data supports the fact the proposed development in the floodway described above will not create any increase in the base flood elevations (100-year flood), floodway elevations and the floodway widths on Santa Ana River at published cross sections listed in the Flood Insurance Study for the above community dated August 28, 2008 and will not create any increase to the base flood elevations (100-year flood), floodway elevations and the floodway widths at unpublished cross-section in the vicinity of the proposed development.

Mark Seits, P.E. CERTIFIER'S NAME	CA 41103 LICENSE NUMBER
HDR Engineering, Inc. COMPANY NAME	
SIGNATURE	August 30, 2012 DATE

REGISTERED PROFESSIONAL ENGINEER
MARK H. SEITS
41103
EXP. 3-31-13
CIVIL
STATE OF CALIFORNIA

DRAFT

Attachment 4 – Digital Information (CD)