I-80/SR 65 Interchange Project
Placer County, California

Bridge Design and Location Hydraulic Study Report

03-Pla-80-1.9/6.1
03-Pla-65-R4.8/R7.3
EA 03-4E3200

Prepared for:

PLACER COUNTY TRANSPORTATION PLANNING AGENCY

CH2MHILL

Prepared by:

WRECO

January 2015

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Submitted to:
Placer County Transportation Planning Agency

This report has been prepared by or under the supervision of the following Registered Engineer. The Registered Civil Engineer attests to the technical information contained herein and has judged the qualifications of any technical specialists providing engineering data upon which recommendations, conclusions, and decisions are based.

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Registered Civil Engineer

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Executive Summary

The Interstate 80/State Route 65 (I-80/SR 65) Interchange (Project) is within Placer County, in and near the cities of Roseville, Rocklin, and Lincoln. The Project proposes to construct up to 4.2 miles of improvements along the I-80 corridor and 2.5 miles of improvements along the SR 65 corridor.

Three build alternatives are proposed to add capacity, a bi-directional High-Occupancy Vehicle (HOV) system, and high-speed connections. Local and regional circulation and access would be improved, as would weaving conditions along I-80 between Eureka Road/Atlantic Street and Taylor Road and along SR 65 between the I-80/SR 65 Interchange and Galleria Boulevard/Stanford Ranch Road. Other improvements would include widening the East Roseville Viaduct, replacing the Taylor Road Overcrossing, and realigning the existing eastbound (EB) I-80 to NB SR 65 loop connector.

Alternative 1 would improve spacing and vehicle lane-weaving movements between interchanges on I-80. The two existing Taylor Road interchange ramps would be relocated to the east and reconstructed in a Type L-11/L-12 interchange configuration, providing two additional ramp connections and improving access between the local streets and freeway system. The interchange would be positioned within the I-80/SR 65 interchange footprint and utilize portions of the existing EB I-80 to northbound (NB) SR 65 loop connector as well as the existing southbound (SB) SR 65 to EB I-80 connector. The existing Taylor Road interchange ramps would be removed, and the area would be regraded.

Alternative 2 would improve spacing and vehicle lane-weaving movements between interchanges on I-80 by collecting and redirecting EB ramp traffic onto a collector-distributor ramp system. The collector-distributor system would provide EB access to Taylor Road and from Eureka Road at the Atlantic Street/Eureka Road interchange and would restrict local traffic from leaving or entering I-80 mainline until after the critical weave area between Eureka Road and the I-80/SR 65 interchange. The two existing Taylor Road interchange ramps would remain in their current location but would be reconfigured to accommodate the surrounding improvements.

Similar to Alternative 2, Alternative 3 would improve spacing and vehicle lane-weaving movements between interchanges on I-80 by collecting EB Eureka Road on-ramp traffic. Weaving on I-80 would be significantly improved because ramp traffic would be redirected to a collector-distributor ramp system and restricted from entering and exiting I-80 mainline until after the critical weave area between Eureka Road and the I-80/SR 65 interchange. Unique to Alternative 3, the two existing Taylor Road interchange ramps would be eliminated, and access to the Taylor Road area would be accommodated by the adjacent local interchanges at the Atlantic Street/Eureka Road, Rocklin Road, and Galleria Boulevard/Stanford Ranch Road interchanges. The connector ramps serving I-80 and SR 65 (SW, EN, SE, WN, and HOV) are the same between Alternatives 2 and 3.

The analysis in this technical study assumes the currently proposed design alternatives, which include standard piers spaced evenly apart, to support the Eastbound I-80 to

Northbound SR 65 connector (Alternative 1) and Collector-Distributor ramp (Alternatives 2 and 3). The initial geometry and spacing assumptions required that piers be placed in the wetted portions of the channel.

Concurrent with the development of this technical study, the Project team has consulted with Caltrans and relevant resource agencies to identify design options to minimize and/or avoid impacts to listed species and riverine habitat within Secret Ravine. Based on these meetings, the Project team has designed an outrigger concept and/or shifted the bent spacing, which enables the placement of the bridge foundation outside of the channel.

Although not specifically analyzed in this study, the revised design constitutes either an A) improved condition over that analyzed, or B) a condition similar to that analyzed. Therefore, a separate analysis of the revised design is not included in this study.

This report intends to document the hydrology, hydraulics, floodplain risk assessment, and scour assessments of the Project.

The proposed Project is adjacent to several bodies of water. The following table presents cumulative list of creeks and streams through and adjacent to I-80 and SR 65 within the Project limits.

Existing Waterways of I-80 and SR65

Stream Name	Crossing Type	Approximate Station(s)
Antelope Creek	Bridge	126+00 (SR 65)
Highland Ravine	Culvert	191+00 (SR 65)
Miners Ravine	Bridge	58+90, 60+75, and 62+00 (I-80)
Secret Ravine	Longitudinal	113+30, 137+80, 145+90, 164+50, and 109+05 – 111+05 (I-80)
Tributary to South Branch of Pleasant Grove Creek	Culvert	156+35 (SKEW 121º), 162+72 (SKEW 78º), 168+25 (SKEW 64º), and 174+00 (SR65)
Sucker Ravine	Culvert	195+40 (I-80)

Source: FEMA and USGS

As a basis of the hydrologic study, design flows provided by the Federal Emergency Management Agency (FEMA) and Placer County Flood Control and Water Conservation District (PCFCWCD) were obtained. The highest of the 100- and 50-year discharge values of those reported in the FIS or the updated PCFCWCD report were later used in the hydraulic modeling and floodplain assessment of bridge structures proposed for improvement and replacement by the Project. The following table summarizes the 50-year and 100-year flow rates of Antelope Creek, Secret Ravine and Miners Ravine obtained from the two sources.

Creek Flow Rates for 50-year and 100-year Discharges

Stream	50-year Discharge Value (cfs)		100-year Discharge Value (cfs)	
	FEMA (2001)	PCFCWCD (2011)	FEMA (2001)	PCFCWCD (2011)
Antelope Creek	2,380	3,418	3,080	4,095
Secret Ravine	3,800	4,415	4,200	4,697
Miners Ravine	7,000	6,402	7,840	7,322

The Hydrologic Engineering Center River Analysis System (HEC-RAS) Version 4.1.0, which is hydraulic modeling software developed by the U.S. Army Corps of Engineers (USACE), was used to perform the hydraulic modeling of the existing and proposed bridge structures over stream crossings within the Project limits. Accordingly, the East Roseville Viaduct at Antelope Creek and E80/N65 (EN) and S65/E80 (SE) connectors at Secret Ravine; and the I-80 bridge at Miners Ravine were modeled.

The Project site is within 100-year base flood zones designated by FEMA at the modeled structures located at Antelope Creek, Secret Ravine and Miners Ravine. Based on the hydraulic analyses, the water surface elevations (WSEs) of the modeled bridge structure in the proposed conditions would not be significantly higher compared to existing conditions.

Antelope Creek, Secret Ravine and Miners Ravine are streams regulated by the Central Valley Flood Protection Board (CVFPB). An *Application for a Central Valley Control Board Encroachment Permit* and an *Environmental Assessment Questionnaire for Applications for Central Valley Flood Protection Board Encroachment Permit* will be required for work done within the Project's floodways/floodplains. This permits will be submitted to CVFPB during the design phase prior to construction.

All existing and proposed bridges within the Project limits meet the Federal Highway Administration (FHWA), California Department of Transportation's (Caltrans) criterion of passing the 100-year design discharge under the bridge, or the 50-year design discharge with 2 feet of freeboard to allow the passage of drift and debris that could be carried to the site during an extreme storm event. In addition, all existing and proposed bridges meet CVFPB's freeboard criteria of passing the 100-year design discharge under the bridge with 2 feet of freeboard.

The scour analyses were evaluated following the criteria described in the FHWA's Hydraulic Engineering Circular No. 18 (HEC-18), *Evaluating Scour at Bridges* (Fifth Edition). Total scour is the sum of local scour, contraction scour, and long-term bed elevation change.

Based on the Project's Structures Preliminary Geotechnical Report prepared by Blackburn Consulting, the soil at the East Roseville Viaduct bridge at Antelope Creek; EN and SE connectors at Secret Ravine; and the Miners Ravine bridge and ramps at Miners Ravine are scour resistant.

The sizing of rock slope protection (RSP) was determined by the FHWA's Hydraulic Engineering Circular No. 23 (HEC-23), *Bridge Scour and Stream Instability Countermeasures*. The RSP layer thicknesses were calculated per the *California Bank and Shore Rock Slope Protection Design* guideline (FHWA, 2009).

The Project will cause encroachments from the bridge widening at Antelope Creek and Miners Ravine; I-80/SR 65 Connector replacement bridges over Secret Ravine and a ramp re-alignment near Miners Ravine. There will be longitudinal encroachments at Secret Ravine and Miners Ravine as a result of the proposed actions. Antelope Creek, Secret Ravine and Miners Ravine will also have encroachments on their floodways due to proposed bent locations of the bridge structures over these creeks. However, the Project will not support potentially incompatible floodplain development or cause traffic interruptions, and longitudinal encroachments will be minimal. There will be minimal WSE changes caused by the Project.

Acronyms

ADT	average daily traffic
APC	alternative plastic pipe
BFE	Base Flood Elevation
BIR	Bridge Inspection Report
BMP	best management practice
Caltrans	California Department of Transportation
CFR	Code of Federal Regulations
CSP	corrugated steel pipe
DWR	California Department of Water Resources
CVFPB`	Central Valley Flood Protection Board
EB	Eastbound
EN Connector	E80/N65 Connector
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
HEC-18	Hydrologic Engineering Circular No. 18
HEC-RAS	Hydrologic Engineering Centers River Analysis System
HOV	High-Occupancy Vehicle
HAS	hydrologic sub-area
NB	Northbound
NFIP	National Flood Insurance Program
NGVD 29	National Geodetic Vertical Datum of 1929
NAVD 88	North American Vertical Datum of 1988
PCTPA	Placer County Transportation Planning Agency
PCFCWD	Placer County Flood Control and Water Conservation District
PM	Post Mile
Project	I-80/SR-65 Interchange
RCP	reinforced concrete pipe
RSP	Rock Slope Protection
SB	Southbound
SE Connector	S65/E80 Connector
TWG	Technical Working Group
TSM	Traffic System Management
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WB	Westbound
WSE	water surface elevations

1 GENERAL DESCRIPTION

1.1 Project Description

The California Department of Transportation (Caltrans), in cooperation with the Placer County Transportation Planning Agency (PCTPA), Placer County, and the cities of Roseville, Rocklin, and Lincoln, proposes to improve the Interstate 80/State Route 65 (I-80/SR 65) Interchange in Placer County, California.

The I-80/SR 65 Interchange Project (Project) is located in Placer County in the cities of Roseville and Rocklin at the I-80/SR 65 Interchange. The Project limits include I-80 from the Douglas Boulevard Interchange to the Rocklin Road Interchange (post miles [PM] 1.9 to 6.1) and SR 65 from the I-80 junction to the Pleasant Grove Boulevard Interchange (PM R4.8 to R7.3). The existing I-80/SR 65 Interchange is a type F-6 freeway-to-freeway interchange. See Figure 1 and Figure 2 for Project location and vicinity maps, respectively.

The purpose of the Project is to reduce future traffic congestion, improve operations and safety, and comply with current Caltrans and local agency design standards.

Three build alternatives are under consideration and were designed to satisfy the purpose and need, while avoiding or minimizing environmental impacts.

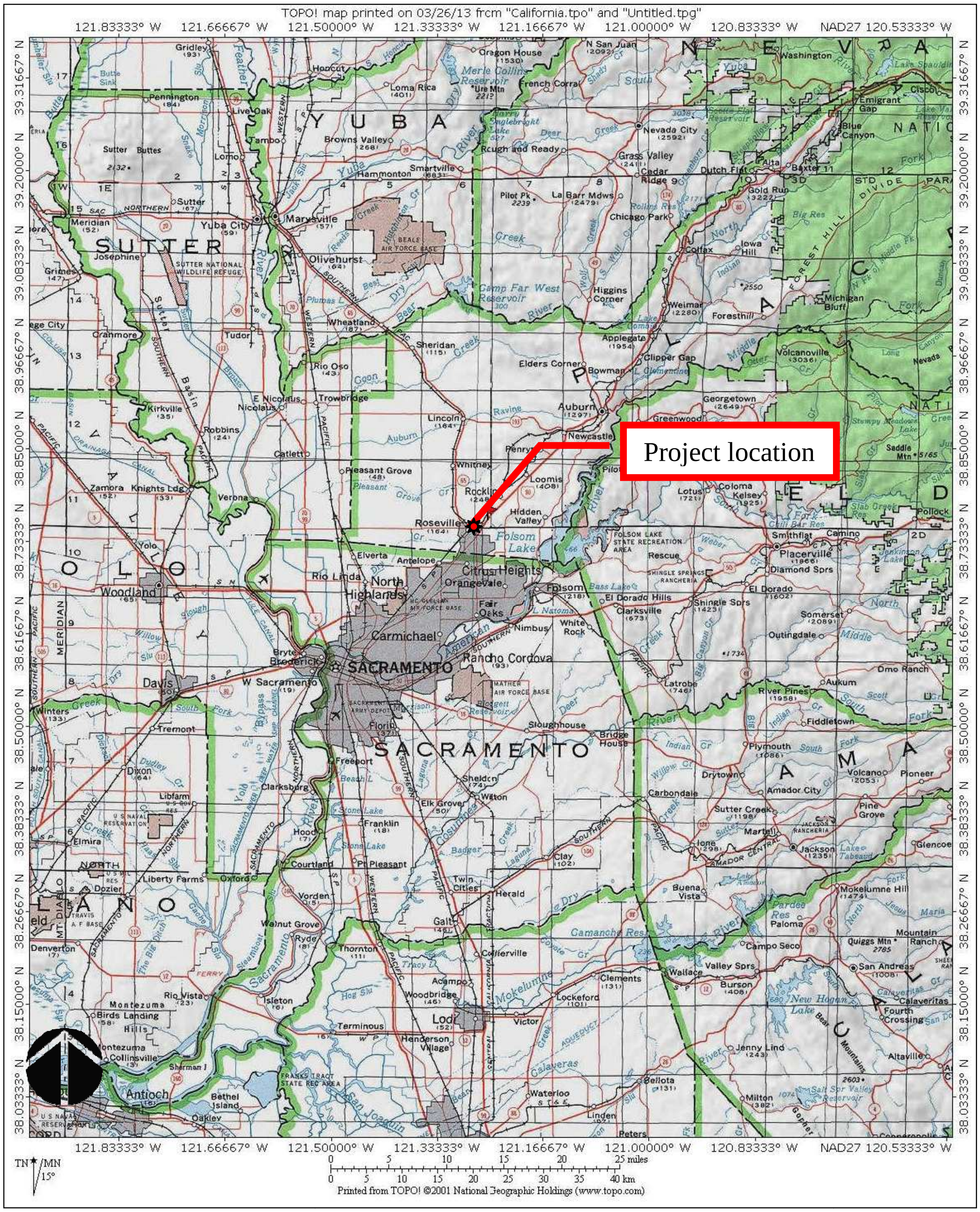

Figure 1. Location Map

Source: United States Geological Survey

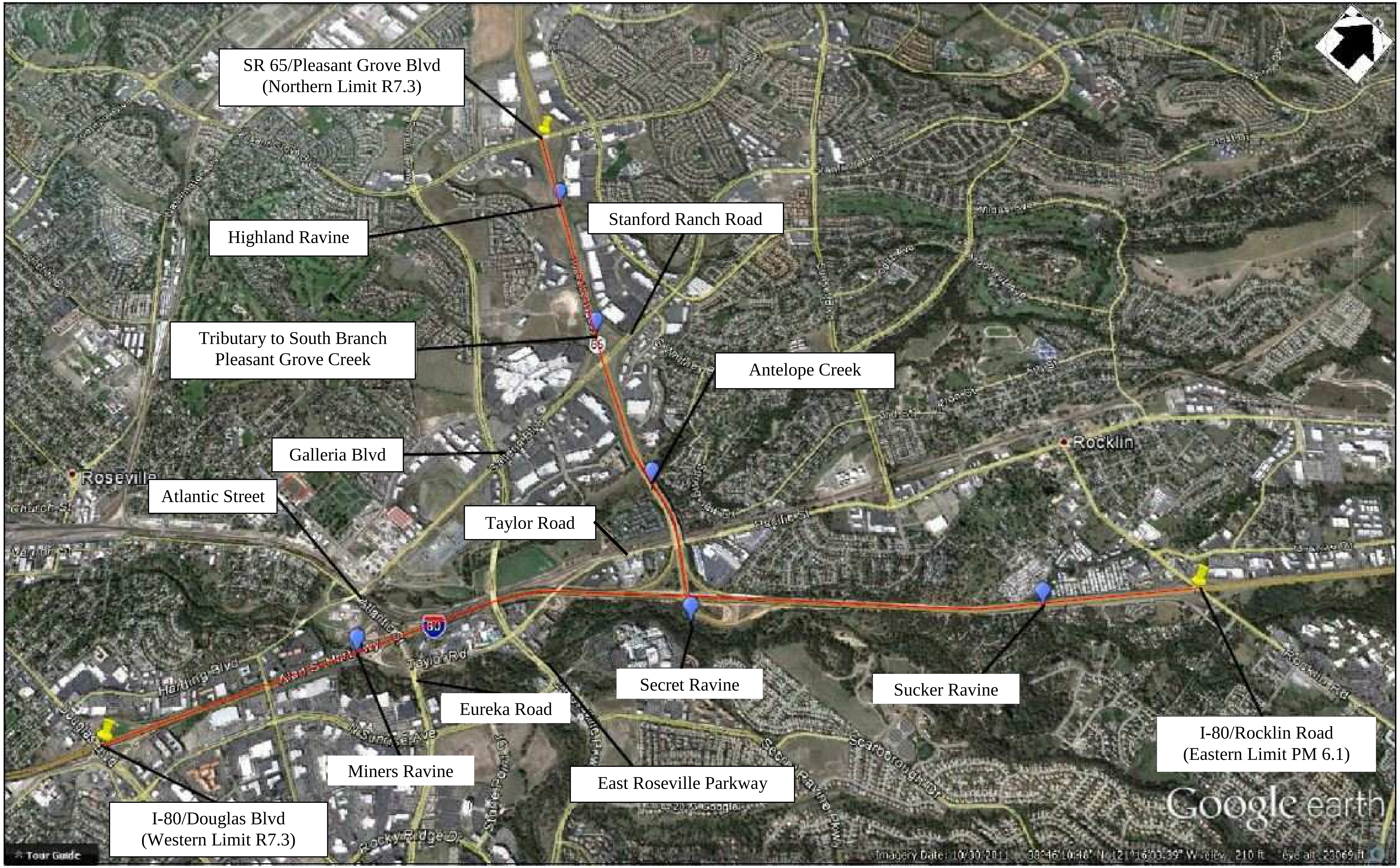

Figure 2. Vicinity Map

Source: Google Earth

1.1.1 Build Alternatives

All of the build alternatives propose to add capacity, a bidirectional high-occupancy vehicle (HOV) system, and high-speed connector ramps. Local and regional circulation and access would be improved, as would vehicle lane-weaving conditions along I-80 between Eureka Road/Atlantic Street and Taylor Road and along SR 65 between the I-80/SR 65 interchange and Galleria Boulevard/Stanford Ranch Road. Other improvements would include widening the East Roseville Viaduct, replacing the Taylor Road overcrossing, and realigning the existing eastbound (EB) I-80 to northbound (NB) SR 65 loop connector.

The alternatives under consideration are:

- Build Alternative 1—Taylor Road Full Access Interchange
- Build Alternative 2—Collector–Distributor System Ramps
- Build Alternative 3—Taylor Road Interchange Eliminated

Alternative 1 would improve spacing and vehicle lane-weaving movements between interchanges on I-80. The two existing Taylor Road interchange ramps would be relocated to the east and reconstructed in a Type L-11/L-12 interchange configuration, providing two additional ramp connections and improving access between the local streets and freeway system. The interchange would be positioned within the I-80/SR 65 interchange footprint and utilize portions of the existing EB I-80 to NB SR 65 loop connector as well as the existing southbound (SB) SR 65 to EB I-80 connector. The existing Taylor Road interchange ramps would be removed, and the area would be regraded. (Figure 3)

Alternative 2 would improve spacing and vehicle lane-weaving movements between interchanges on I-80 by collecting and redirecting EB ramp traffic onto a collector-distributor ramp system. The collector-distributor system would provide EB access to Taylor Road and from Eureka Road at the Atlantic Street/Eureka Road interchange and would restrict local traffic from leaving or entering I-80 mainline until after the critical weave area between Eureka Road and the I-80/SR 65 interchange. The two existing Taylor Road interchange ramps would remain in their current location but would be reconfigured to accommodate the surrounding improvements. (Figure 4)

Similar to Alternative 2, Alternative 3 would improve spacing and vehicle lane-weaving movements between interchanges on I-80 by collecting EB Eureka Road on-ramp traffic. Weaving on I-80 would be significantly improved because ramp traffic would be redirected to a collector-distributor ramp system and restricted from entering and exiting I-80 mainline until after the critical weave area between Eureka Road and the I-80/SR 65 interchange. Unique to Alternative 3, the two existing Taylor Road interchange ramps would be eliminated, and access to the Taylor Road area would be accommodated by the adjacent local interchanges at the Atlantic Street/Eureka Road, Rocklin Road, and Galleria Boulevard/Stanford Ranch Road interchanges. The connector ramps serving I-

80 and SR 65 (SW, EN, SE, WN, and HOV) are the same between Alternatives 2 and 3. (See Figure 5).

1.1.2 Transportation System Management

This alternative includes ramp metering, HOV bypass lanes, traffic signal coordination, transit options, and bicycle and pedestrian facilities in order to improve the transportation system at the I-80/SR 65 interchange. However, the transportation system management (TSM) measures alone could not satisfy the purpose and need of the project. This alternative has been eliminated, but the TSM features have been incorporated into the build alternatives for this project.

1.1.3 No-Build Alternative

This alternative would not make any improvements to the I-80/SR 65 interchange or adjacent transportation facilities to satisfy the purpose and need. HOV and auxiliary lanes proposed on SR 65 north of Galleria Boulevard/Stanford Ranch Road, and other local improvements separately proposed and identified in the Metropolitan Transportation Plan, would be implemented according to their proposed schedules.

1.1.4 Outrigger Concept/Shifted Bent Spacing

The analysis in this technical study assumes the currently proposed design alternatives, which include standard piers spaced evenly apart, to support the Eastbound I-80 to Northbound SR 65 connector (Alternative 1) and Collector-Distributor ramp (Alternatives 2 and 3). The initial geometry and spacing assumptions required that piers be placed in the wetted portions of the channel.

Concurrent with the development of this technical study, the Project team has consulted with Caltrans and relevant resource agencies to identify design options to minimize and/or avoid impacts to listed species and riverine habitat within Secret Ravine. Based on these meetings, the Project team has designed an outrigger concept and/or shifted the bent spacing, which enables the placement of the bridge foundation outside of the channel.

Although not specifically analyzed in this study, the revised design constitutes either an A) improved condition over that analyzed, or B) a condition similar to that analyzed. Therefore, a separate analysis of the revised design is not included in this study.

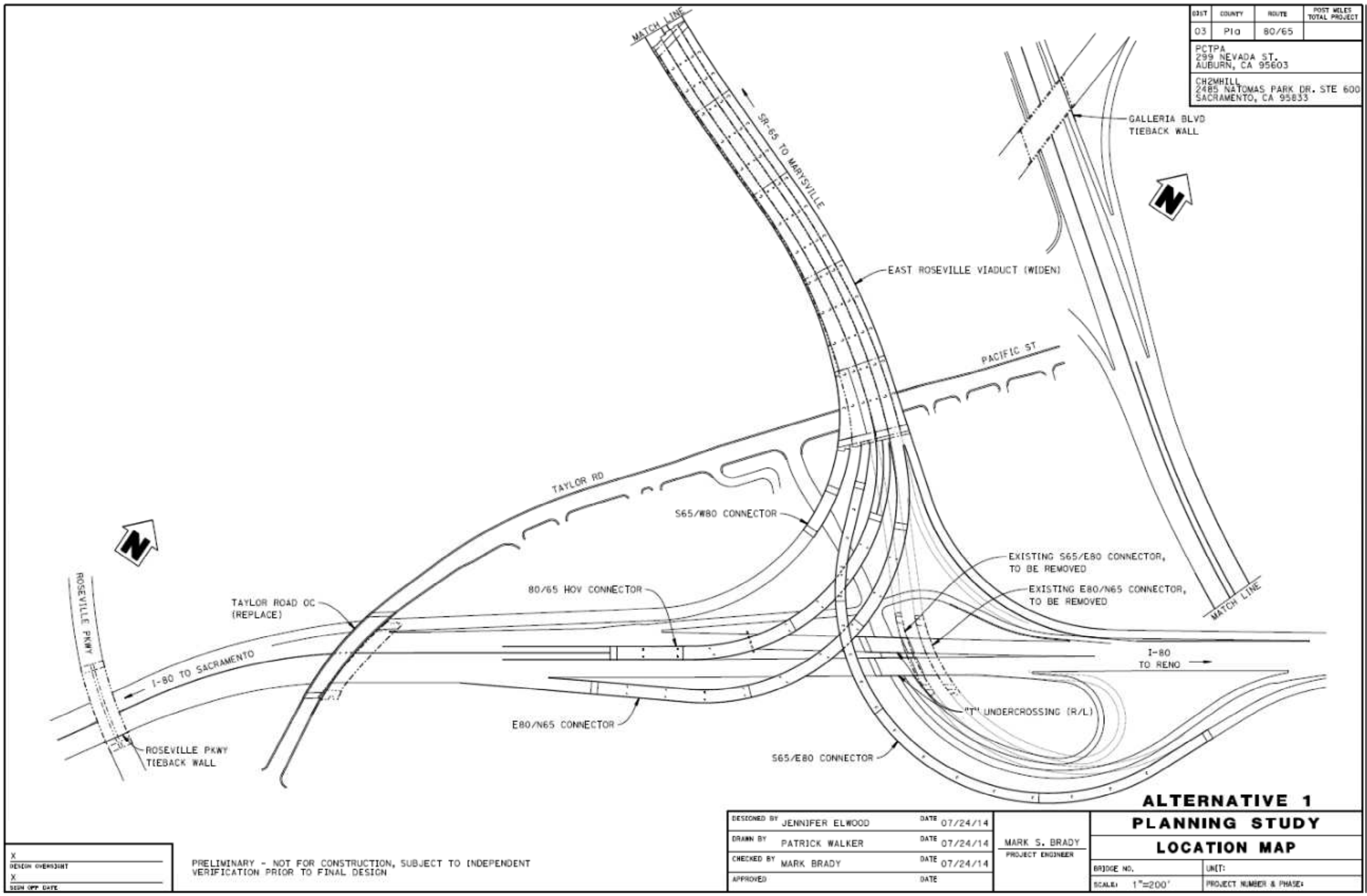

Figure 3. Alternative 1 Layout

Source: CH2M Hill

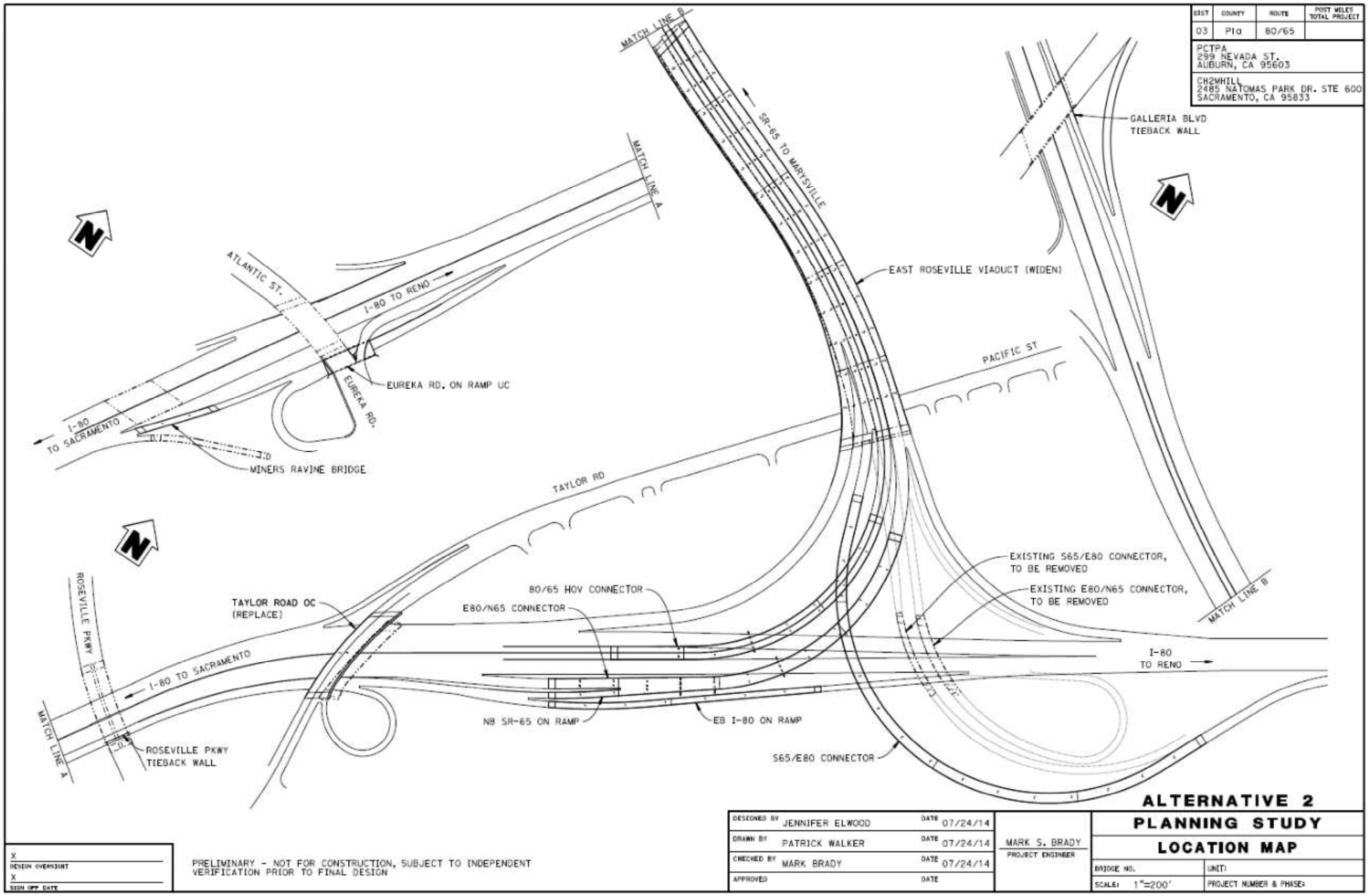

Figure 4. Alternative 2 Layout

Source: CH2M Hill

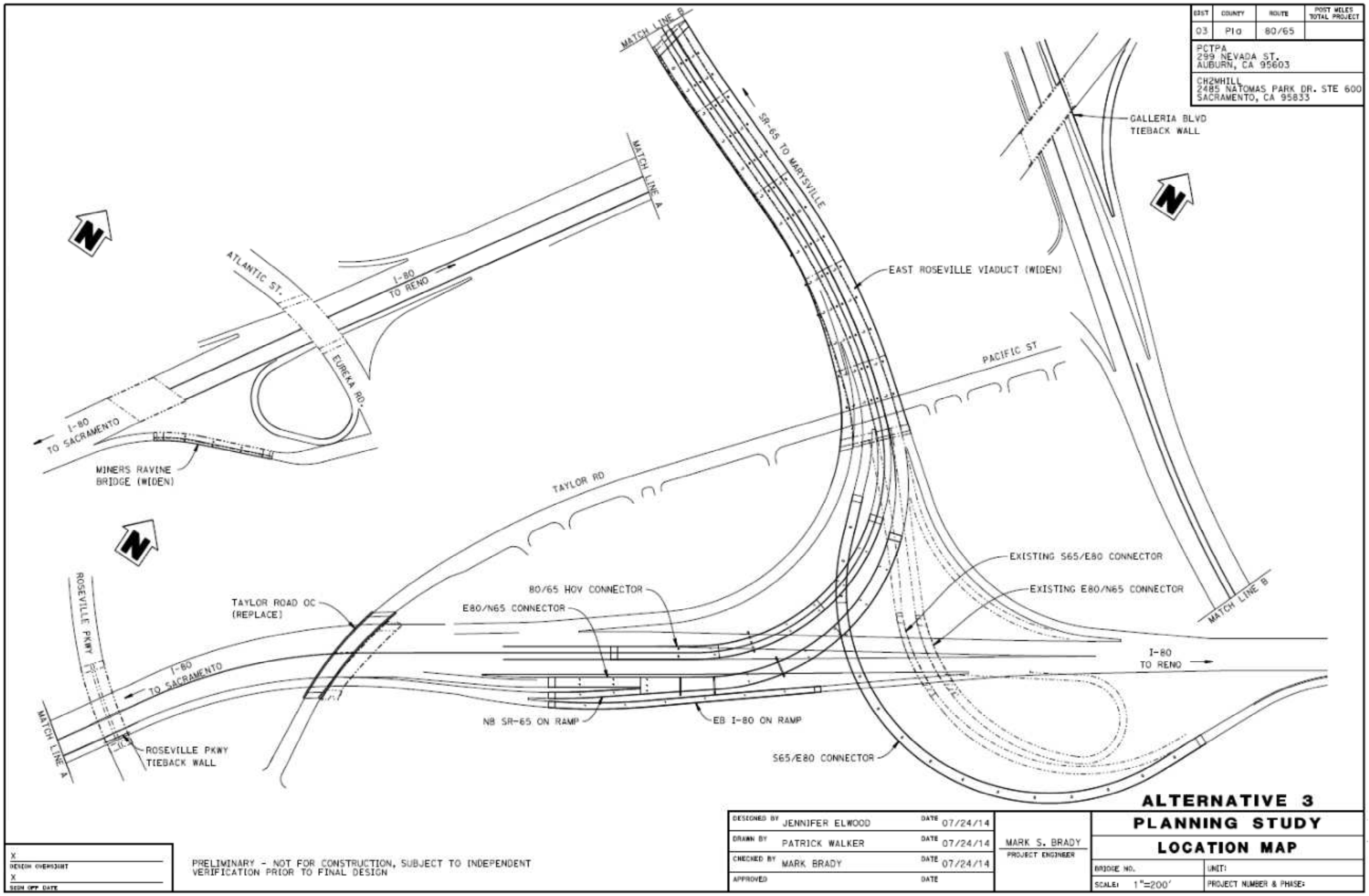

Figure 5. Alternative 3 Layout

Source: CH2M Hill

1.2 Key Tasks

The Project has six waterways that cross the Project limits. The purpose of this report is to document the Project's impacts to the water surface elevations (WSEs). Key tasks performed for this study include review of available hydrologic data, hydraulic analyses to determine design WSEs and impacts to the floodway and floodplains of the East Roseville Viaduct bridge at Antelope Creek, the EB I-80 on-ramp and EN and SE connectors at Secret Ravine, and the Miners Ravine bridge and ramps at Miners Ravine. Fill impacts to the Miners Ravine floodplain were addressed. Scour analyses to estimate potential scour depths and rock slope protection (RSP) calculations were also performed.

1.3 Design Criteria

1.3.1 Hydrologic Design Criteria

Federal and local documents were researched to obtain discharge values of streams that cross roadways and bridges within the Project limits. Two sources were used to obtain discharge values:

1. Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) No. 06061CV001 for Placer County (effective November 21, 2001)
2. Placer County's hydrologic study of the Dry Creek watershed: *Update to the Dry Creek Watershed Flood Control Plan* (2011)

1.3.2 Hydraulic Design Criteria

The hydraulic design of all alternatives would follow the Federal Highway Administration's (FHWA's), Caltrans', and the Central Valley Flood Protection Board (CVFPB) criteria. The FHWA criterion for the hydraulic design of bridges is that they be designed to pass the 2% probability of annual exceedance flow (50-year recurrence interval design discharge) with adequate freeboard, where practicable, to account for debris and bedload. Two feet of freeboard is commonly used in bridge designs. Per CVFPB freeboard criteria, the bridge should also be designed to pass the 1% probability of annual exceedance flow with 2 ft of freeboard.

1.3.3 Scour Design Criteria

The evaluation of potential scour at the proposed bridges followed the criteria described in the FHWA's Hydraulic Engineering Circular No. 18 (HEC-18), *Evaluating Scour at Bridges* (Fifth Edition). The evaluation of potential scour was based on the 100-year design discharge hydraulic characteristics. The total scour was estimated based upon the cumulative effects of the long-term bed elevation change, general (contraction) scour, and local scour.

1.3.4 Rock Slope Protection Design Criteria

Two procedures for determining RSP design were considered: the FHWA's Hydraulic Engineering Circular No. 23 (HEC-23), *Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance* (Third Edition)

(September 2009), and Caltrans' *California Bank and Shore Rock Slope Protection Design* (Third Edition) (October 2000).

1.4 Regulatory Setting

1.4.1 Executive Order 11988

Executive Order 11988 (Floodplain Management) directs all federal agencies to avoid, to the extent possible, long- and short-term adverse impacts associated with the occupancy and modification of floodplains, and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. Requirements for compliance are outlined in Title 23, Code of Federal Regulations, Part 650, Subpart A (23 CFR 650A) titled "Location and Hydraulic Design of Encroachment on Floodplains."

If the preferred alternative involves significant encroachment onto the floodplain, the final environmental document (final environmental impact statement or finding of no significant impact) must include:

- The reasons why the proposed action must be located in the floodplain;
- The alternatives considered and why they were not practicable; and
- A statement indicating whether the action conforms to applicable State or local floodplain protection standards.

Additionally, Title 44, Section 60.3(d)(3) of the Code of Federal Regulations (CFR), states that a community shall "prohibit encroachments, including fill, new construction, substantial improvements, and other development within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the base flood discharge."

1.4.2 California's National Flood Insurance Program

FEMA is the nationwide administrator of the National Flood Insurance Program (NFIP), which is a program that was established by the National Flood Insurance Act of 1968 to protect lives and property, and to reduce the financial burden of providing disaster assistance. Under the NFIP, FEMA has the lead responsibility for flood hazard assessment and mitigation, and it offers federally backed flood insurance to homeowners, renters, and business owners in communities that choose to participate in the program. FEMA has adopted the 100-year floodplain as the base flood standard for the NFIP. FEMA is also concerned with construction that would be within a 500-year floodplain for proposed projects that are considered "critical actions," which are defined as any activities where even a slight chance of flooding is too great. FEMA issues the Flood Insurance Rate Maps (FIRMs) for communities that participate in the NFIP. These FIRMs present delineations of flood hazard zones.

In California, nearly all of the State's flood-prone communities participate in the NFIP, which is locally administered by the California Department of Water Resources' (DWR)

Division of Flood Management. Under California's NFIP, communities have a mutual agreement with the State and Federal government to regulate floodplain development according to certain criteria and standards, which is further detailed in the NFIP. Typically, each county (or community) has an FIS, which is used to locally develop FIRMs and Base Flood Elevations (BFE).

1.4.3 Central Valley Flood Protection Board

The Central Valley Flood Protection Board requires applications to be filled for all proposed encroachments within the floodways under the CVFPB's jurisdiction. Antelope Creek, Secret Ravine and Miners Ravine are streams regulated by CVFPB jurisdiction. The following permits will be required by the CVFPB:

- *Application for a Central Valley Control Board Encroachment Permi*t
- *Environmental Assessment Questionnaire for Applications for Central Valley Flood Protection Board Encroachment*

1.5 Geographic References

All elevations listed in the FEMA FIRMs, FIS and other elevations listed in this report are based on National Geodetic Vertical Datum of 1929 (NGVD 29). All Project drawings are based on North American Vertical Datum of 1988 (NAVD 88).

1.6 Traffic

SR 65 and I-80 are major highways used for emergency supply or evacuation, emergency vehicle access, school buses, and mail delivery. Additionally, the Miners Ravine bridge off-ramp to Eureka Road over Miners Ravine and the proposed I-80/SR 65 connectors (EN and SE connectors) will be used for emergency supply or evacuation, emergency vehicle access, school buses, and mail delivery. However, practical detours are available and can be made available during construction.

A 2013 traffic analysis report compiled by Fehr and Peers provided average daily traffic (ADT) values for different scenarios and locations within the Project limits. Table 1 provides a summary of the present and projected ADT values.

Table 1. Project Average Daily Traffic Values

Roadway	Segment	Existing (2009)	Cumulative No-Build (2040)	Cumulative Build (2040)
I-80	Between Douglas Blvd and Eureka Rd	155,000	197,400	204,200
	Between Eureka Rd and Taylor Rd	158,731	203,800	217,800
	Between Taylor Rd and SR 65	150,000	194,200	213,000
	Between SR 65 and Rocklin Rd	109,598	139,500	137,300

SR 65	Between I-80 and Galleria Blvd	106,055	151,500	155,600
	Between Galleria Blvd and Pleasant Grove Blvd	104,418	159,100	154,800

1.6.1 Project Phasing and Proposed Access during Construction

The contractor would utilize any area within Caltrans right-of-way and the Project limits for staging and access during the various phases. For constructability purposes and to ease maintenance of traffic during construction, the following phasing approach is proposed for the Project and would be similar for all three build alternatives:

Phase 1 - Northbound SR 65

1A: Construct the inside widening of the East Roseville Viaduct and shift NB traffic to the inside.

1B: Realign and widen the westbound (WB) I-80 to NB SR 65 connector and widen WB I-80 near the connector approach. Widen the outside NB East Roseville Viaduct and perform NB SR 65 widening. Modify the NB Galleria Boulevard/Stanford Ranch Road ramps to accommodate the mainline widening, and construct the retaining wall under the Galleria Boulevard/Stanford Ranch Road overcrossing. Shift NB traffic to the outside portion of the East Roseville Viaduct.

Phase 2 - Southbound to Eastbound and Eastbound to Northbound Connector Ramps

2A: Construct the SB SR 65 to EB I-80 connector ramp. Shift traffic onto the new connector to allow removal of the existing SB SR 65 to EB I-80 connector, including existing abutments, piers, and roadway approaches.

2B: Construct EB I-80 to NB SR 65 connector ramp with temporary conforms to EB I-80. Shift traffic onto new flyover structure to allow removal or reconfiguration of existing EB I-80 to NB SR 65 loop connector. Remove the existing EB I-80 to NB SR 65 structure, including existing abutments, columns, and roadway approaches.

Phase 3 - I-80 and Southbound SR 65

3A: Construct the western portion of the new Taylor Road overcrossing and temporary conforms along Taylor Road at each approach roadway as well as ramps to maintain traffic at all times on Taylor Road. Shift traffic onto the new portion of the bridge and remove the existing overcrossing. Construct the remaining portion of the Taylor Road overcrossing and open the entire bridge to traffic.

3B: Perform I-80 mainline widening and associated retaining walls. Realign and widen SB SR 65 to WB I-80 connector ramp and modify Eureka Road/Atlantic Street interchange ramps to accommodate mainline widening.

3C: Shift SB traffic to inside of East Roseville Viaduct. Widen the outside SB East Roseville Viaduct and perform SB SR 65 mainline widening. Modify the SB Galleria Boulevard/Stanford Ranch Road interchange ramps and SB Pleasant Grove Boulevard On-Ramp to accommodate the mainline widening.

3D: Perform Taylor Road roadway improvements and modify Taylor Road ramps according to each particular alternative. Remove any existing pavement not used for the realignment and regrade.

Phase 4 - HOV Connector

Construct HOV direct connector ramp and conform to future SR 65 Capacity and Operational Improvements Project.

2 DESCRIPTION OF WATERSHED

The offsite watersheds of the waterways crossing the Project were preliminarily delineated based on United States Geological Survey (USGS) topographic maps and USGS StreamStats. The crossings have drainage areas of up to 21.6 square miles (sq mi), as listed in Table 2. All the creeks flow in a general southwesterly direction within their watersheds. Antelope Creek, Miners Ravine, and Secret Ravine have the largest watersheds. Secret Ravine runs longitudinally along Interstate 80, but the Project may impact it because of its close vicinity. The offsite watersheds are included in Figure 6.

Table 2. Preliminary Offsite Watershed Drainage Areas

Waterway	Approximate Drainage Area (sq mi)
Antelope Creek	14.1
Highland Ravine	1.3
Miners Ravine	20.0 (41.6 including Secret Ravine)
Secret Ravine	21.6
Sucker Ravine	2.9
Tributary to South Branch Pleasant Grove	0.1

Source: USGS

2.1 Land Use

The City of Rocklin *General Plan* (November 2012) identifies the land use along I-80 and SR 65 within the city limits as medium density residential and recreation/conservation with some low density residential, retail commercial, medium-high density residential, high density residential, and business professional. The City of Rocklin website states that the city has a current population of 58,295.

The City of Rocklin *General Plan* 2025 (April 2013) identifies the land use along I-80 and SR 65 within the city limits as community commercial, regional commercial, and business professional, with some general industrial, open space, parks and recreation, and high density residential. The 2010 United States Census reported that Roseville had a population of 118,800.

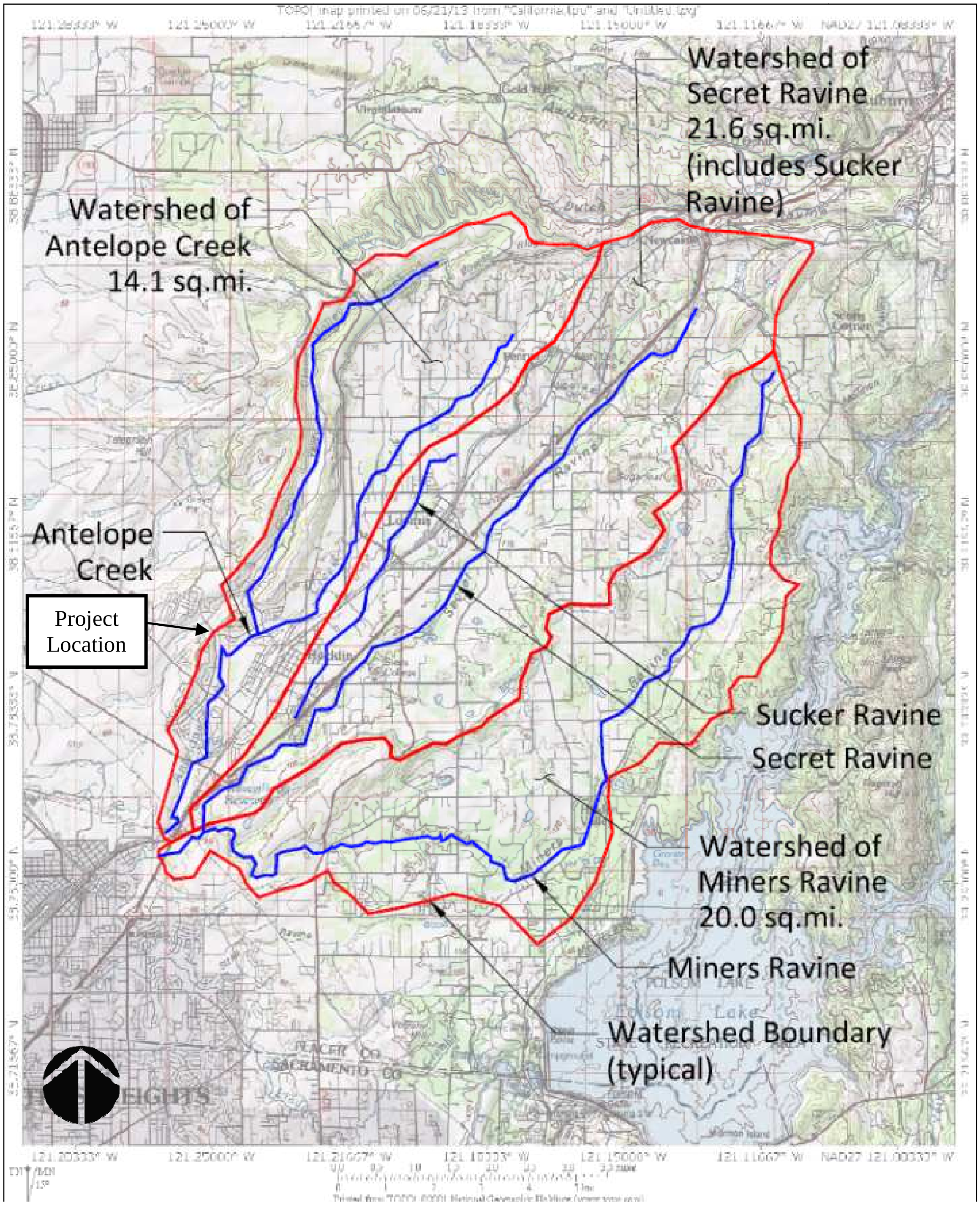

Figure 6. Major Offsite Watersheds

Source: USGS

3 DESCRIPTION OF STREAMS AND SITES

A list of creek and stream crossings within the proposed Project limits was created using FEMA maps, USGS topographic maps, Oakland Museum of California watershed maps, and aerial photographs. The six creeks crossing within the Project limits are Miners Ravine, Secret Ravine, Sucker Ravine, Antelope Creek, a tributary to South Branch Pleasant Grove Creek, and Highland Ravine (see Figure 2). There are 15 large stormwater crossings within the Project limits that drain to the six direct receiving waterways. The sizes and types of these crossings are listed in Table 3. The crossings were located by reviewing as-built record drawings.

Table 3. Existing I-80 and SR 65 Waterways

Streams	Structure	Alignment & Approximate Station(s)	Drainage Facility	Culvert Construction	Bridge Number
Miners Ravine	I-80 WB On-Ramp	N/A	Bridge	-	19 0056 K
	I-80	“B” Line 60+75	Bridge	-	19 0056
	I-80 EB Off-Ramp	“E1” Line 12+50	Bridge	-	19 0056 S
Secret Ravine	I-80	“B” Line 113+30	36" RCP	Before 1985	N/A
	SE Connector	N/A	30" X 172' APC	1985	N/A
	I-80	“B” Line 145+90	30" RCP	Before 1985	N/A
	I-80	“B” Line 164+50	36" RCP	Before 1985	N/A
	SW Coonector	“SW” Line 109+05 - 111+05	36" APC	1985	N/A
Tributary to South Branch Pleasant Grove Creek	SR-65	“A5” Line 156+35 SKEW 121° 30'	48" APC	1985	N/A
	SR-65	“A5” Line 162+72 SKEW 78°	48" APC	1985	N/A
	SR-65	“A5” Line 168+25 SKEW 64°	36" APC	1985	N/A
	SR-65	“A5” Line 174+00	30" APC	1985	N/A
Sucker Ravine	I-80	“B” Line 195+40	96" CSP	Before 1999	N/A
Antelope Creek	SR-65	“A5” Line 126+00	Bridge	-	19-152 R/L
Highland Ravine	SR-65	“A5” Line 191+00	72” Double RCP	Unknown	N/A

Notes: 1. N/A = Alignment information is not available because there are no proposed structures at these locations
2. RCP = reinforced concrete pipe
3. APC = alternative plastic pipe
4. CSP = corrugated steel pipe

The Tributary to South Branch of Pleasant Grove Creek, Sucker Ravine and Highland Ravine crossings are not reviewed in detail in this study. The floodplain impacts of the Project would be minimal at these locations due to the conveyance of flow through culverts. Nonetheless, the geographic locations of all the stream crossings within the Project limits are provided in the following section.

3.1 Stream Crossing Geographic Locations

The geographic coordinates of the stream crossings within the Project limits are provided in Table 4.

Table 4. Stream Geographic Locations

Streams	Latitude	Longitude
Highland Ravine	38.7836	121.2783
Tributary to South Branch of Pleasant Grove Creek	38.7772	121.2684
Antelope Creek	38.7732	121.2562
Secret Ravine	38.7683	121.2489
Miners Ravine	38.7559	121.2630
Sucker Ravine	38.7821	121.2294

Highland Ravine crosses SR 65 approximately 0.4 mi southeast (toward the I-80/SR 65 Interchange) of Pleasant Grove Boulevard. The stream crosses SR 65 twice but only once within the Project limits. The South Branch of Pleasant Grove Creek crosses SR 65 farther southeast of Highland Ravine just before the Galleria Boulevard overcrossing (see Figure 7 for the stream crossing locations). The Highland Ravine crossing, a double 72-in. culvert, is shown in Photo 1.

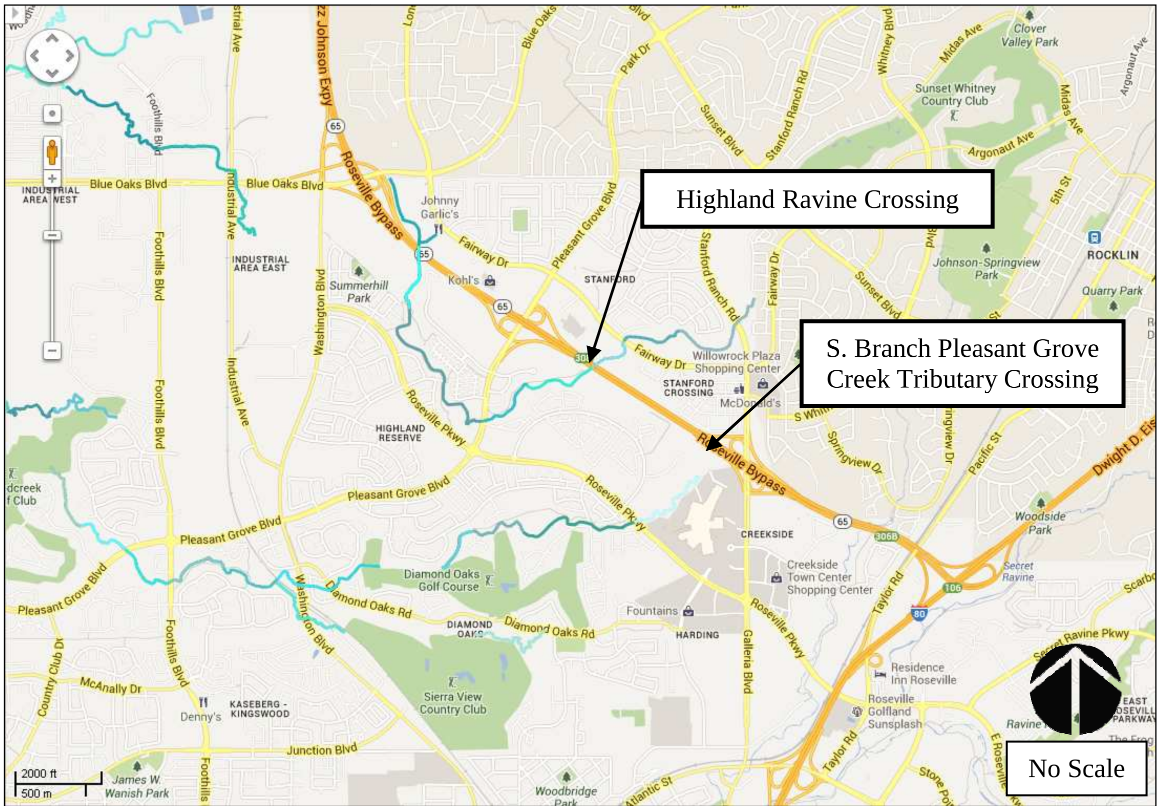

Figure 7. Highland Ravine and the Tributary to South Branch Pleasant Grove Creek Crossings

Antelope Creek crosses SR 65 at East Roseville Viaduct bridge immediately west of Taylor Road and the I-80/SR 65 Interchange. Secret Ravine mostly flows parallel to I-80 within the Project limits from the Taylor overcrossing, which is located 0.2 mi north of Roseville Parkway on I-80 to the Project's northern limits at Rocklin Road. Miners Ravine crosses I-80 immediately south of Atlantic Street approximately at the Eureka Road off-ramp (see Figure 8 for the Antelope Creek, Secret Ravine, and Miners Ravine crossings and locations). The Antelope Creek and Miners Ravine crossings are shown in Photo 2 and Photo 3, respectively.

Photo 1. Eastbound SR 65 Highland Ravine

Photo 2. Eastbound SR 65 Antelope Creek

Photo 3. Eastbound I-80 Miners Ravine

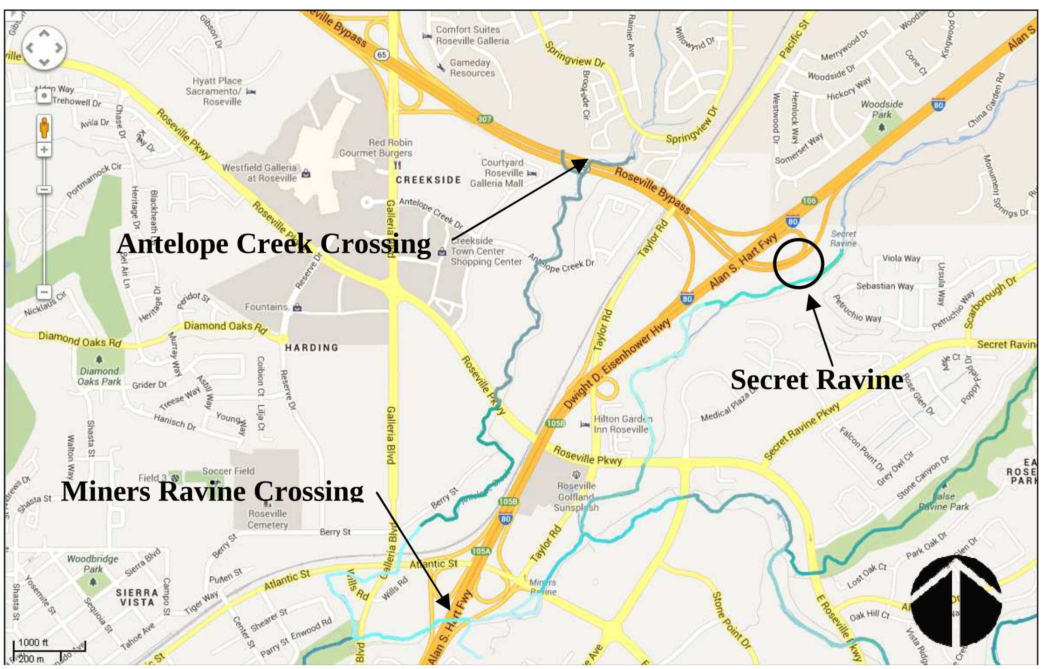

Figure 8. Antelope Creek Crossing, Miners Ravine Crossings and Secret Ravine

The Sucker Ravine crossing is located near the northern limits of the Project at Rocklin Road. Sucker Ravine flows in the southwesterly direction, crossing beneath Rocklin Road between Granite Drive and Shaw Court. Further downstream, Sucker Ravine crosses beneath Lake Side Drive and Oakridge Street before being conveyed in a culvert beneath I-80 towards Secret Ravine. This culvert is located about 0.61 miles southwest of the Rocklin Rd Undercrossing. Sucker Ravine crosses I-80 to flow into Secret Ravine immediately east of the I-80 roadway (see Figure 9 for the Sucker Ravine crossing location). The Sucker Ravine crossing is shown in Photo 4.

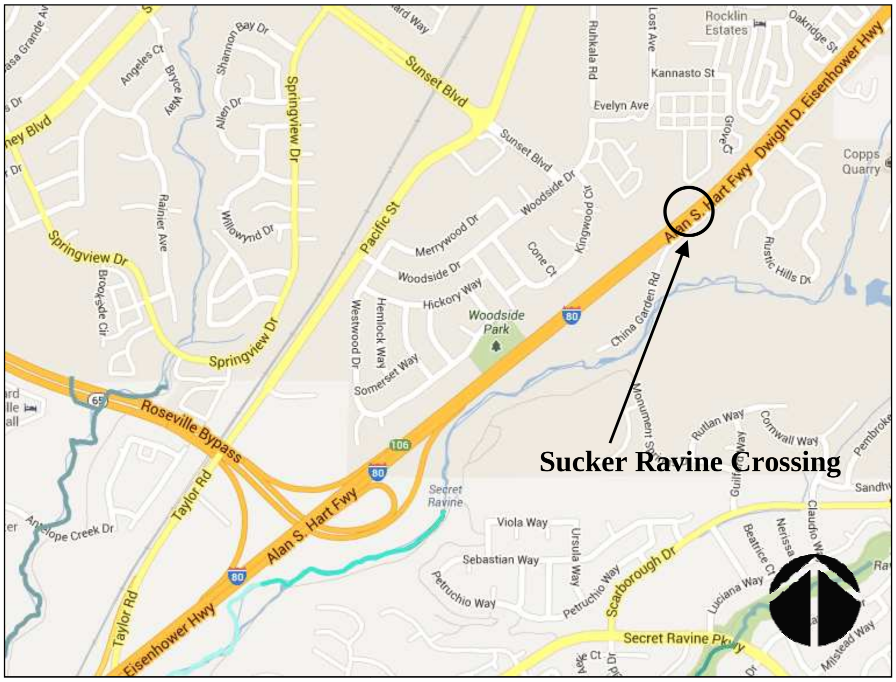

Figure 9. Sucker Ravine Crossing

Photo 4. Eastbound I-80 Sucker Ravine

4 HYDROLOGY

The hydrology of the Project area was reviewed using information obtained from Caltrans' *Water Quality Planning Tool*, FEMA and the Water Conservation District (PCFCWCD). Caltrans' Water Quality Planning Tool was used to obtain the regional watershed information. FEMA's FIS and FIRMs for Placer County and Incorporated Areas were researched to obtain discharge values of streams crossing bridge structures within the Project limits, namely Antelope Creek, Secret Ravine, and Miners Ravine. The FIRMs are provided in Appendix A. The PCFCWCD's report, *Update to the Dry Creek Watershed Flood Control Plan* (2011) was used to determine updated flood discharge values of the pertinent streams.

4.1 Regional Hydrology

I-80 and SR 65 within the Project limits cross two hydrologic sub-areas (HSA): Lower American (HSA #519.21) and Pleasant Grove (HSA #519.22), within one hydrologic unit (see Table 5). Lower American includes Antelope Creek, Miners Ravine, Secret Ravine, and Sucker Ravine. Pleasant Grove includes Highland Ravine and the tributary to South Branch Pleasant Grove Creek. The *Water Quality Planning Tool* shows that there are three HSAs; this is hydrologically incorrect because Secret Ravine is a tributary to Miners Ravine, which in turn is a tributary to Dry Creek. A map identifying the hydrologic units is included in Figure 10.

Table 5. Hydrologic Units within the Project Limits

Post Mile Limits	Hydrologic Unit	Hydrologic Sub-area	HSA Number
I-80 PM 1.9-4.81 and SR 65 PM R4.8-R5.58	Valley-American	Lower American	519.21
SR-65 PM R5.58-R7.3	Valley-American	Pleasant Grove	519.22

Source: Caltrans 2013

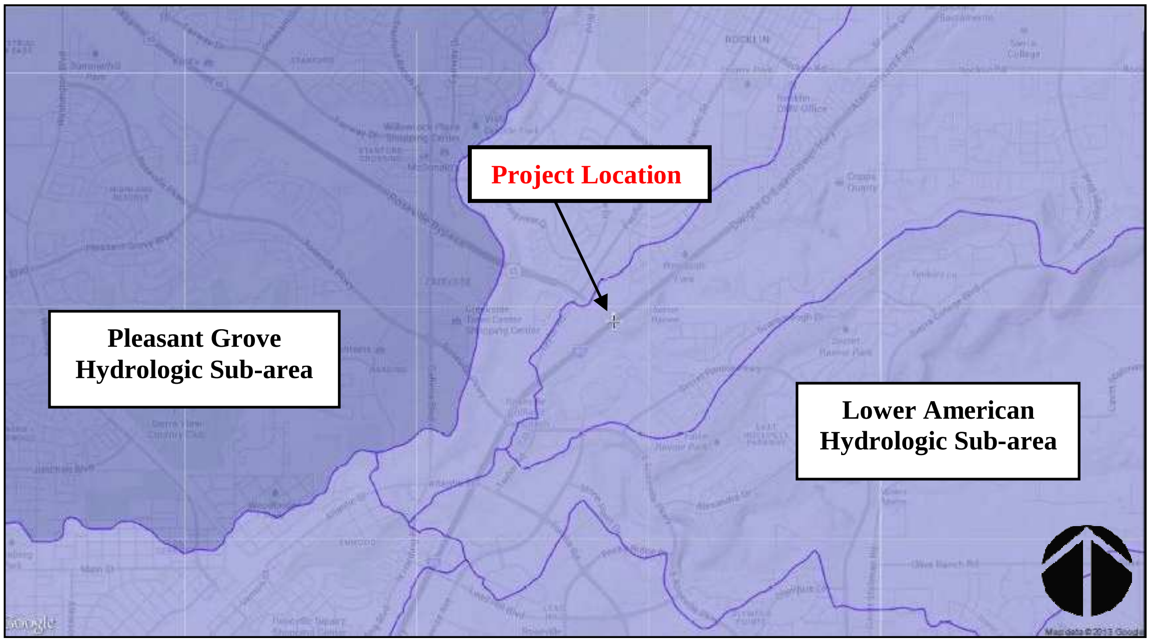

Figure 10. Valley-American Hydrologic Sub-areas

4.2 Federal Emergency Management Agency Data

Discharge values for Antelope Creek, Secret Ravine, and Miners Ravine were obtained from FEMA's FIS (FEMA 2001) data for Placer County and Incorporated Areas were used to determine floodway and floodplain designations in the Project area (see Figure 11 for the Project flood zone delineation maps and Appendix A for FIRMs). The FIRMs show that the Project sites at Antelope Creek, Secret Ravine, and Miners Ravine are located within a designated Zone AE region. Zone AE is a 100-year floodplain designation with BFEs determined. The FIRMs also show a floodway designation at these locations. The Sucker Ravine crossing I-80 is designated as a Zone AO, which represents areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 ft. The remaining Project area is located within a Zone X region, which is a designation pertaining to areas of flood with a recurrence interval of 500 years or more.

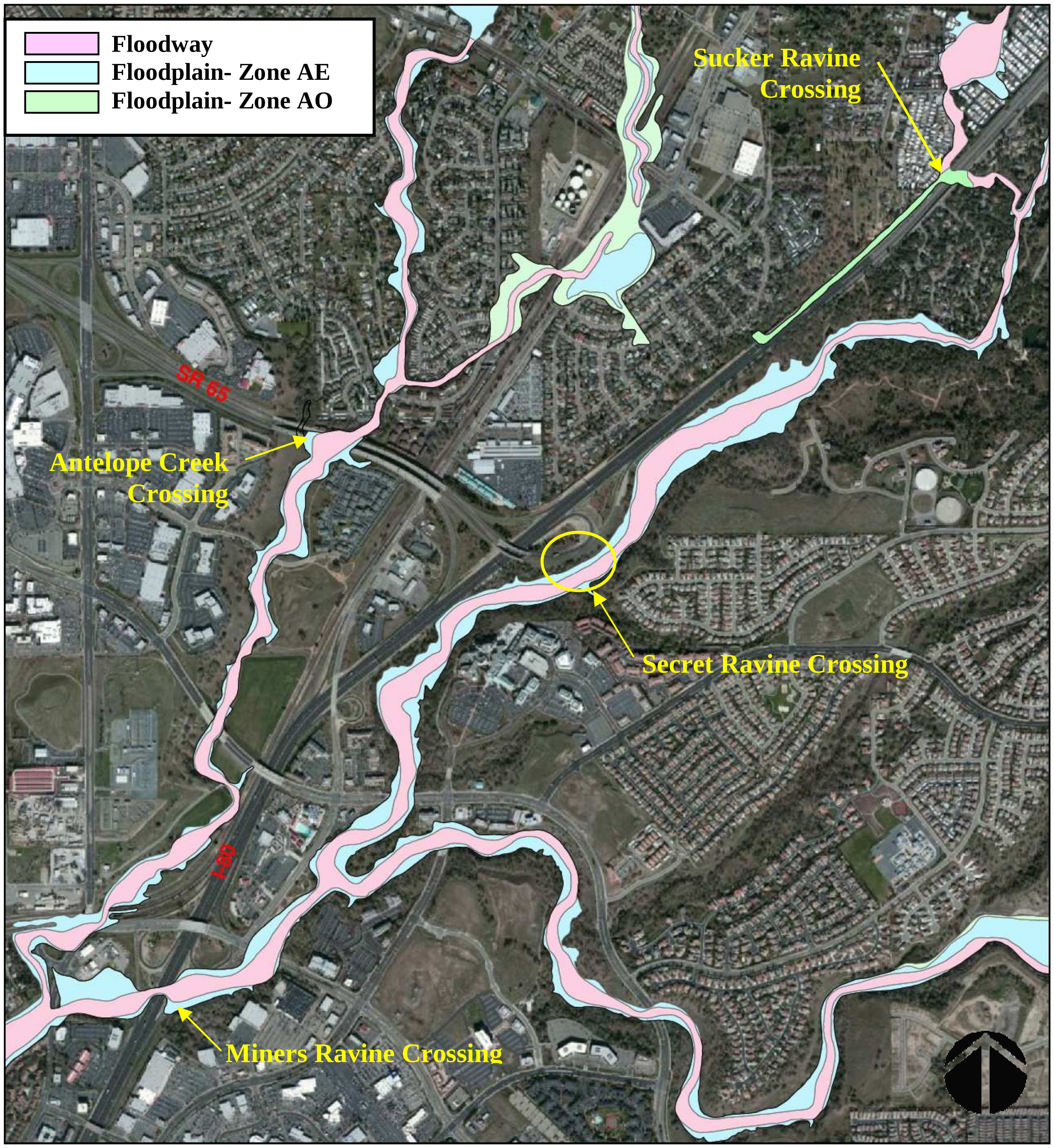

Figure 11. Project Flood Zone Delineation Map

4.3 Design Discharge Summary

Discharge values for Antelope Creek, Secret Ravine, and Miners Ravine obtained from FEMA and the PCFCWCD are summarized in Table 6 and Table 7. The discharge values were obtained for locations listed on the FIS and PCFCWCD's report closest to the stream crossings: SR 65 for Antelope Creek, the SE Connector for Secret Ravine, and I-80 for Miners Ravine. The highest 100- and 50-year discharge values of those reported in the FIS and the values in the updated PCFCWCD report were used for the hydraulic modeling to be conservative. Antelope Creek and Secret Ravine HEC-RAS models use the PCFCWCD Report's discharge values. Miners Ravine HEC-RAS model uses FEMA FIS' discharge values.

Table 6. Summary of 50-year Discharge Values

Stream	50-year Discharge Value (cfs)	
	FEMA (2001)	PCFCWCD Report (2011)
Antelope Creek	2,380	3,418
Secret Ravine	3,800	4,415
Miners Ravine	7,000	6,402

Note: cfs = cubic foot per second

Table 7. Summary of 100-year Discharge Values

Stream	100-year Discharge Value (cfs)	
	FEMA (2001)	PCFCWCD Report (2011)
Antelope Creek	3,080	4,095
Secret Ravine	4,200	4,697
Miners Ravine	7,840	7,322

4.4 Hydrologic Stability

The PCFCWCD presented multiple projected land use scenarios to determine discharge values. The discharge values selected for the hydraulic analysis of this report are from the most conservative scenario (scenario 7), which uses a future unmitigated model to determine discharge values of various recurrence intervals. Therefore, the hydrologic findings based on this scenario are considered to be stable.

5 DESCRIPTION OF BRIDGE STRUCTURES

5.1 East Roseville Viaduct Bridge at Antelope Creek

5.1.1 Existing Condition

Antelope Creek flows in a southwesterly direction at the East Roseville Viaduct bridge. The existing East Roseville Viaduct bridge structures were built in 1987. The bridge has a 41.8-ft-wide NB structure (Bridge No. 19-0152 R) and 53.8-ft-wide SB structure (Bridge No. 19-0152 L). The existing NB and SB East Roseville Viaduct bridge structures do not have a median connector (see Figure 12 for the bridge aerial photo and Photo 2 for the site photo). The 2,044-ft-long structures are continuous, 14-span, cast-in-place, box-girder bridges with open end seat type abutments and reinforced concrete bents. The as-built drawings dated August 6, 1987, are provided in Figure 13.

Figure 12. Existing East Roseville Viaduct Bridge at Antelope Creek

5.1.2 Proposed Condition

The proposed East Roseville Viaduct bridge will also be a 14-span, cast-in-place, concrete box-girder bridge for all build alternatives. The existing parallel structures will be widened on both sides and will require additional piers to support the widened sections. The SB structure will be widened by a minimum of 6.5 ft for all alternatives. The NB structure will be widened by a minimum of 14.7 ft for all alternatives. The two structures will be closed by a 56.5-ft-wide median connector for all build alternatives. The additional piers would be placed parallel to the existing piers along the entire length of the viaduct. Figure 14, Figure 15, Figure 16, Figure 17, Figure 18, and Figure 19 include the proposed bridge Planning Study for Alternative 1, Alternative 2, and Alternative 3 respectively.

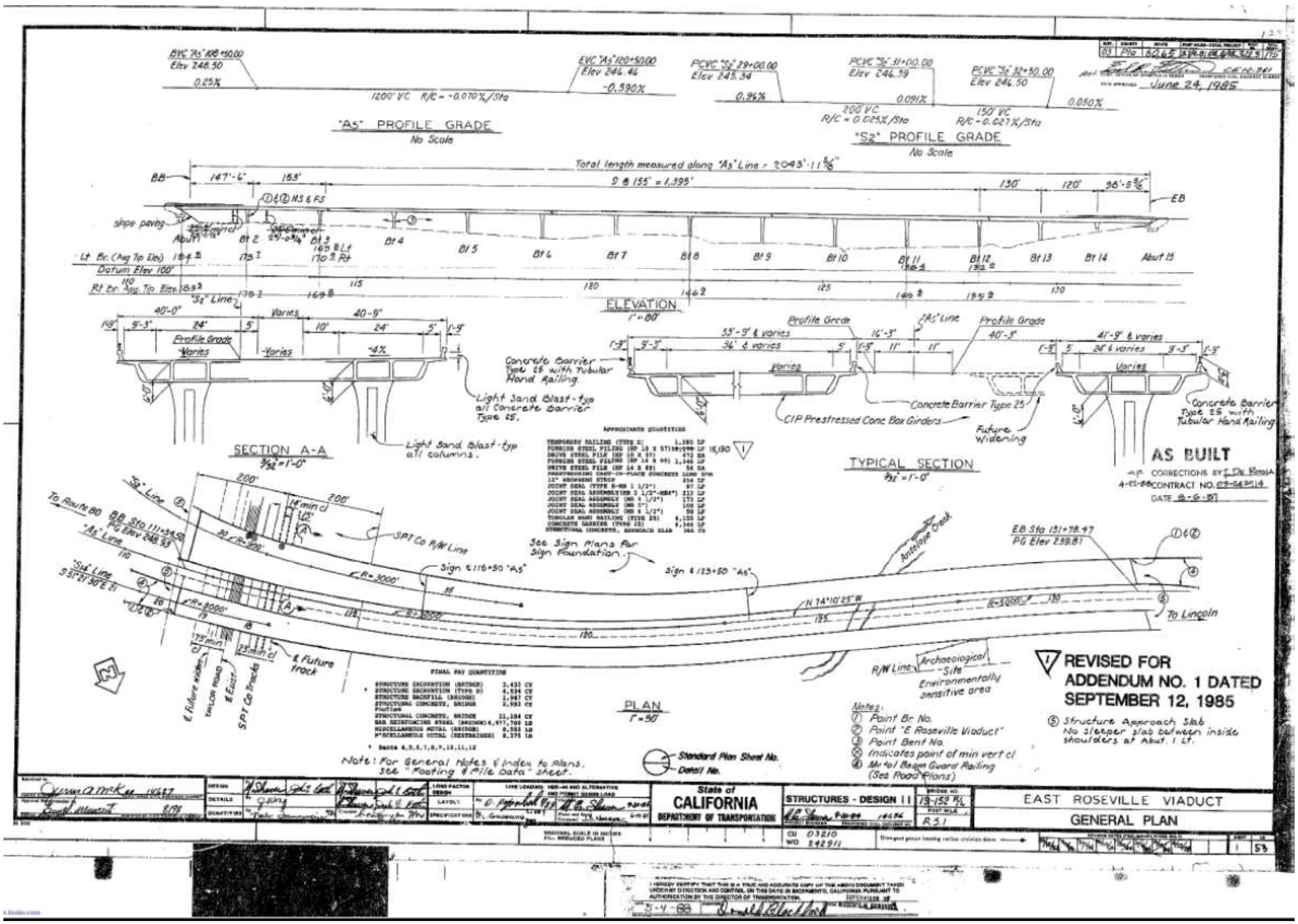

Figure 13. East Roseville Viaduct NB and SB Structures As-built Plan (1987)

Source: Caltrans

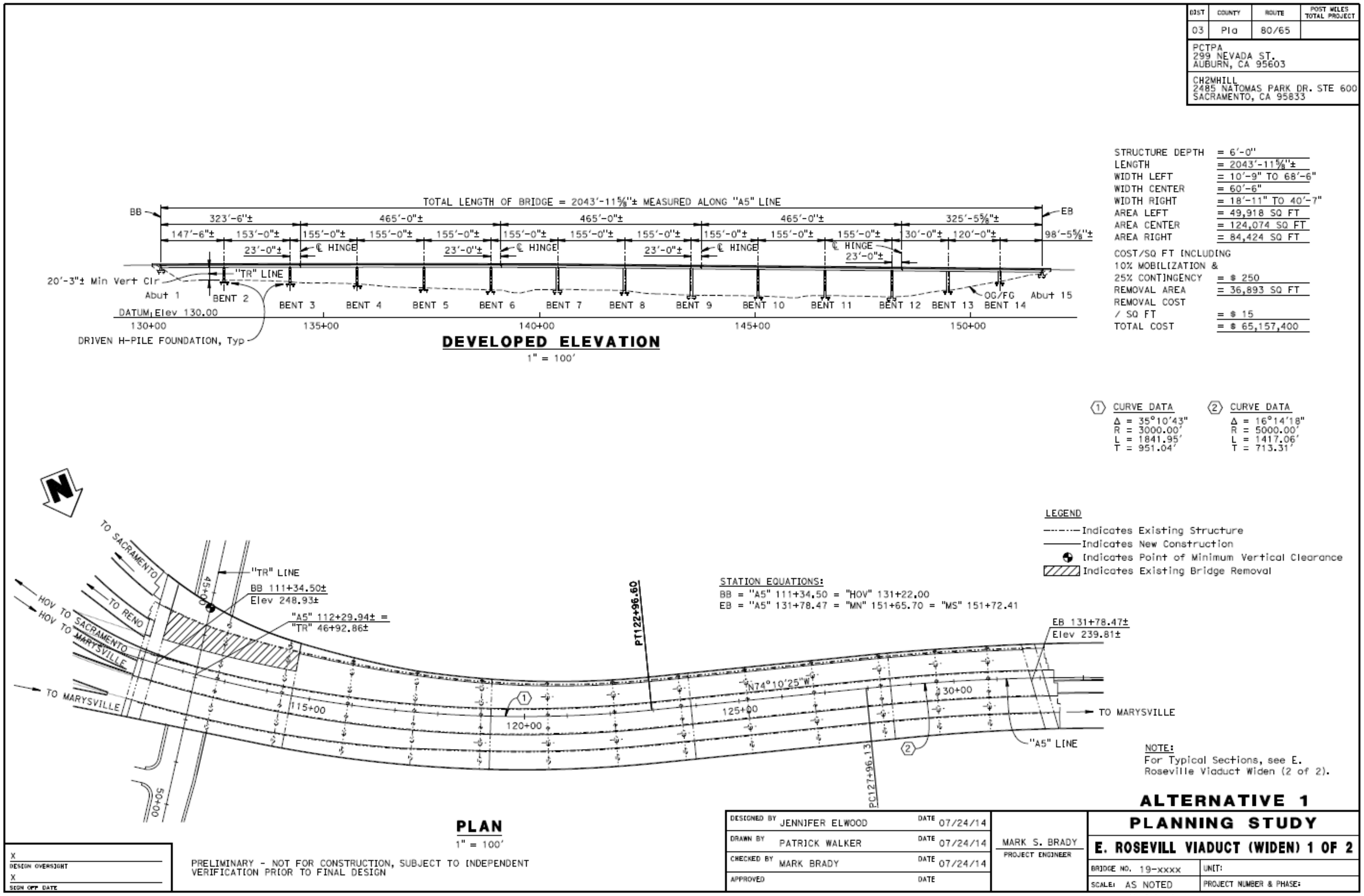

Figure 14. East Roseville Viaduct Proposed Bridge Plan (Alternative 1) (1 of 2)

Source: CH2M Hill

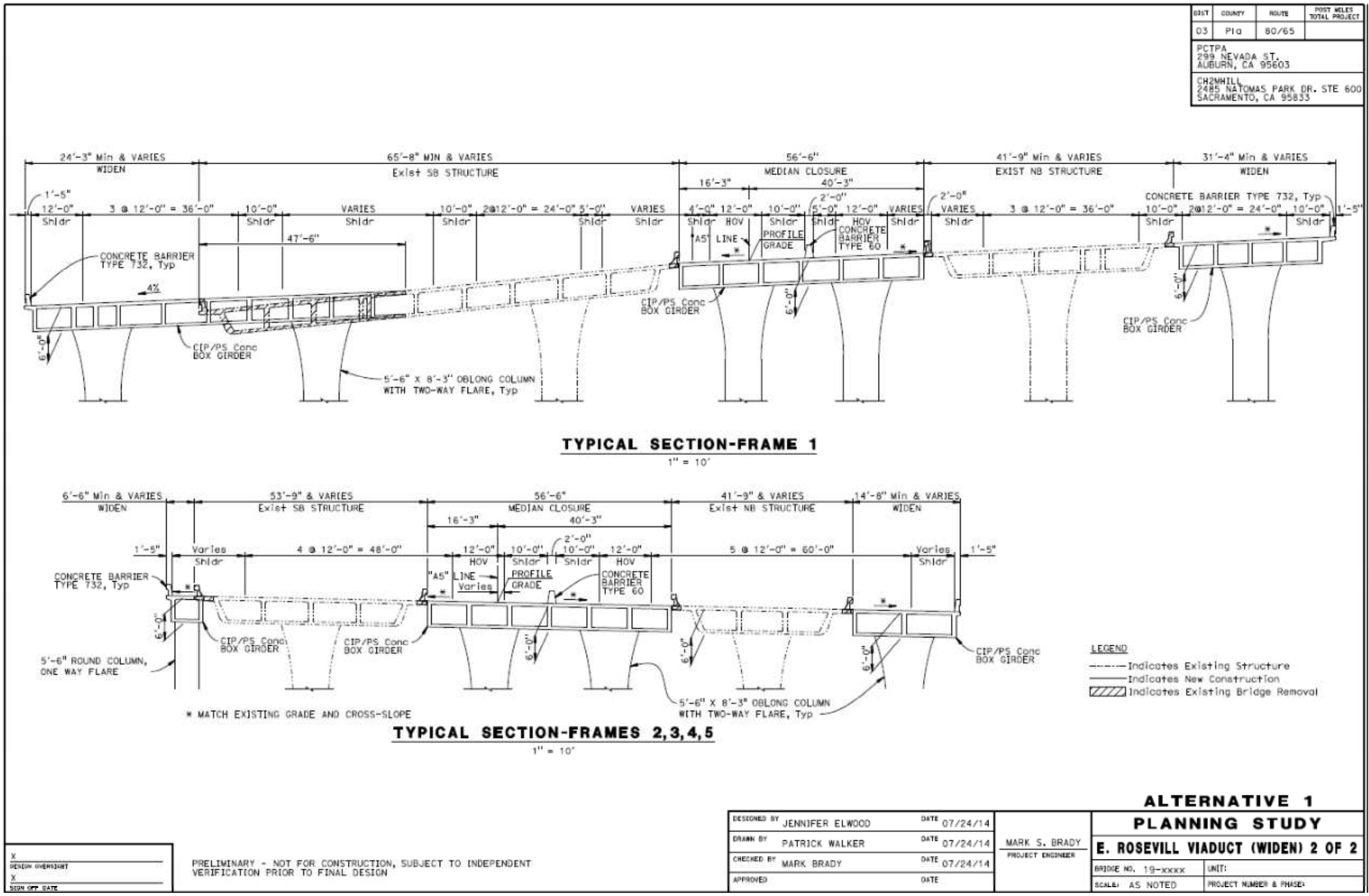

Figure 15. East Roseville Viaduct Proposed Bridge Plan (Alternative 1) (2 of 2)

Source: CH2M Hill

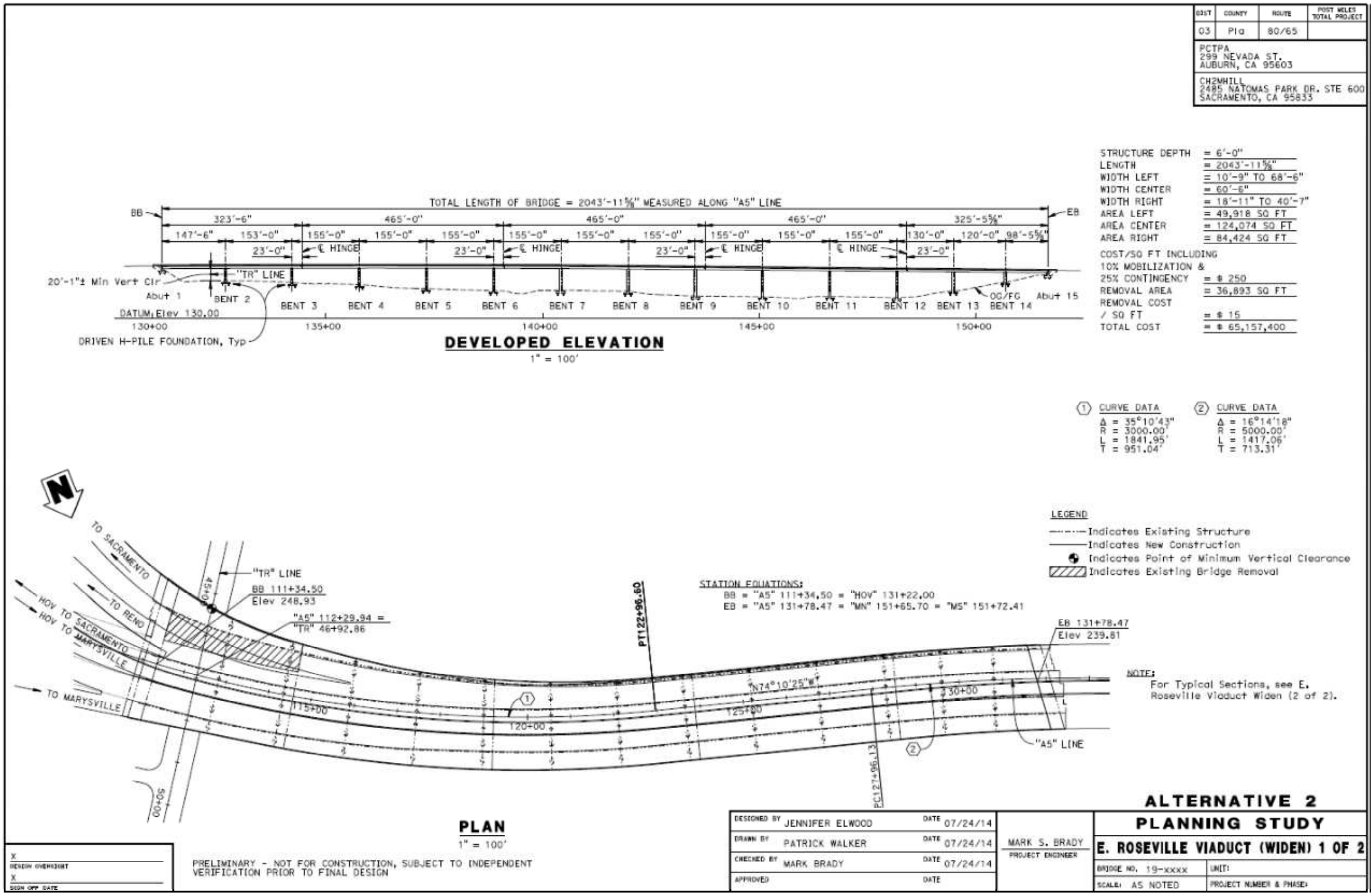

Figure 16. East Roseville Viaduct Proposed Bridge Plan (Alternative 2) (1 of 2)

Source: CH2M Hill

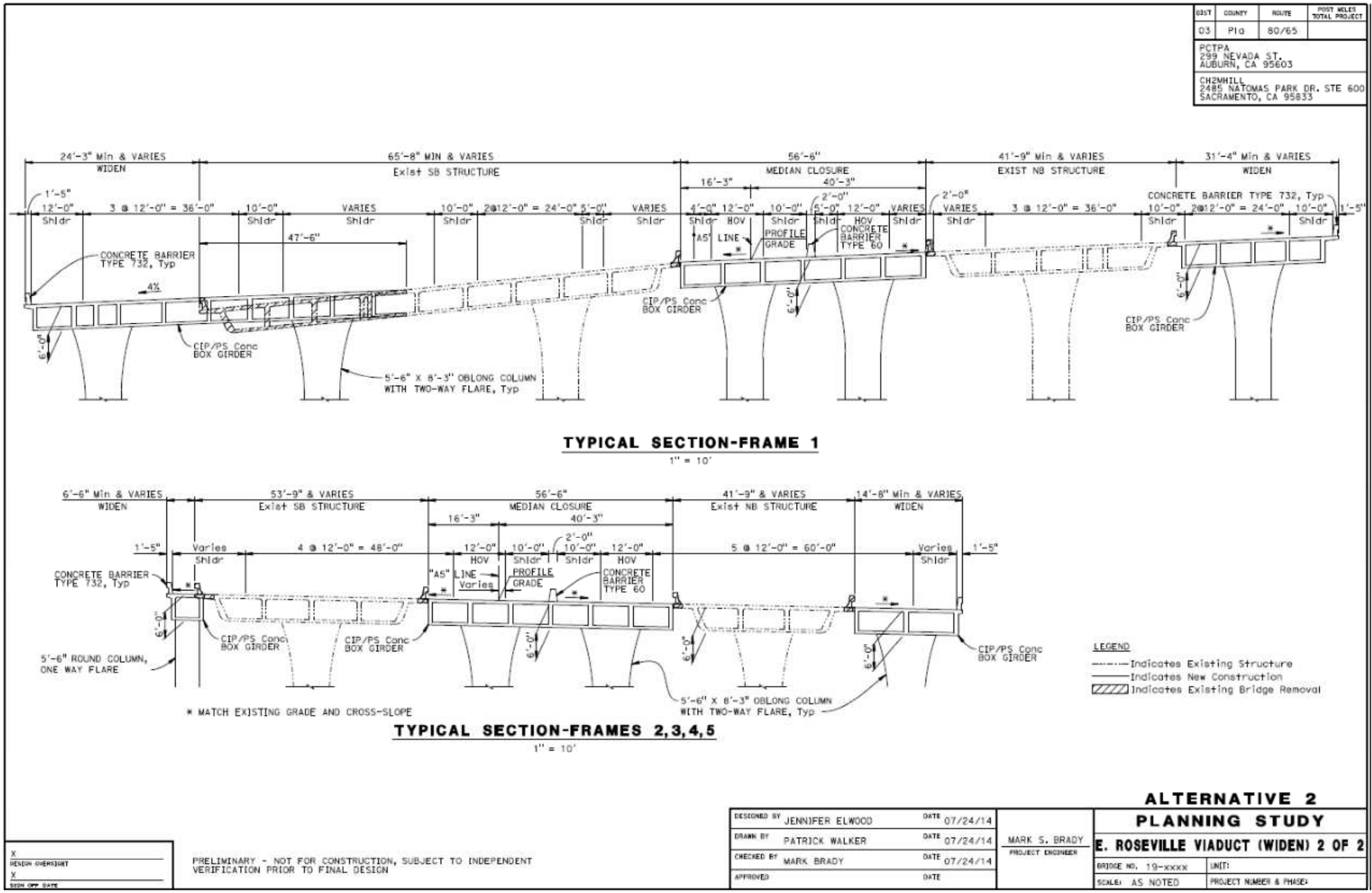

Figure 17. East Roseville Viaduct Proposed Bridge Plan (Alternative 2) (2 of 2)

Source: CH2M Hill

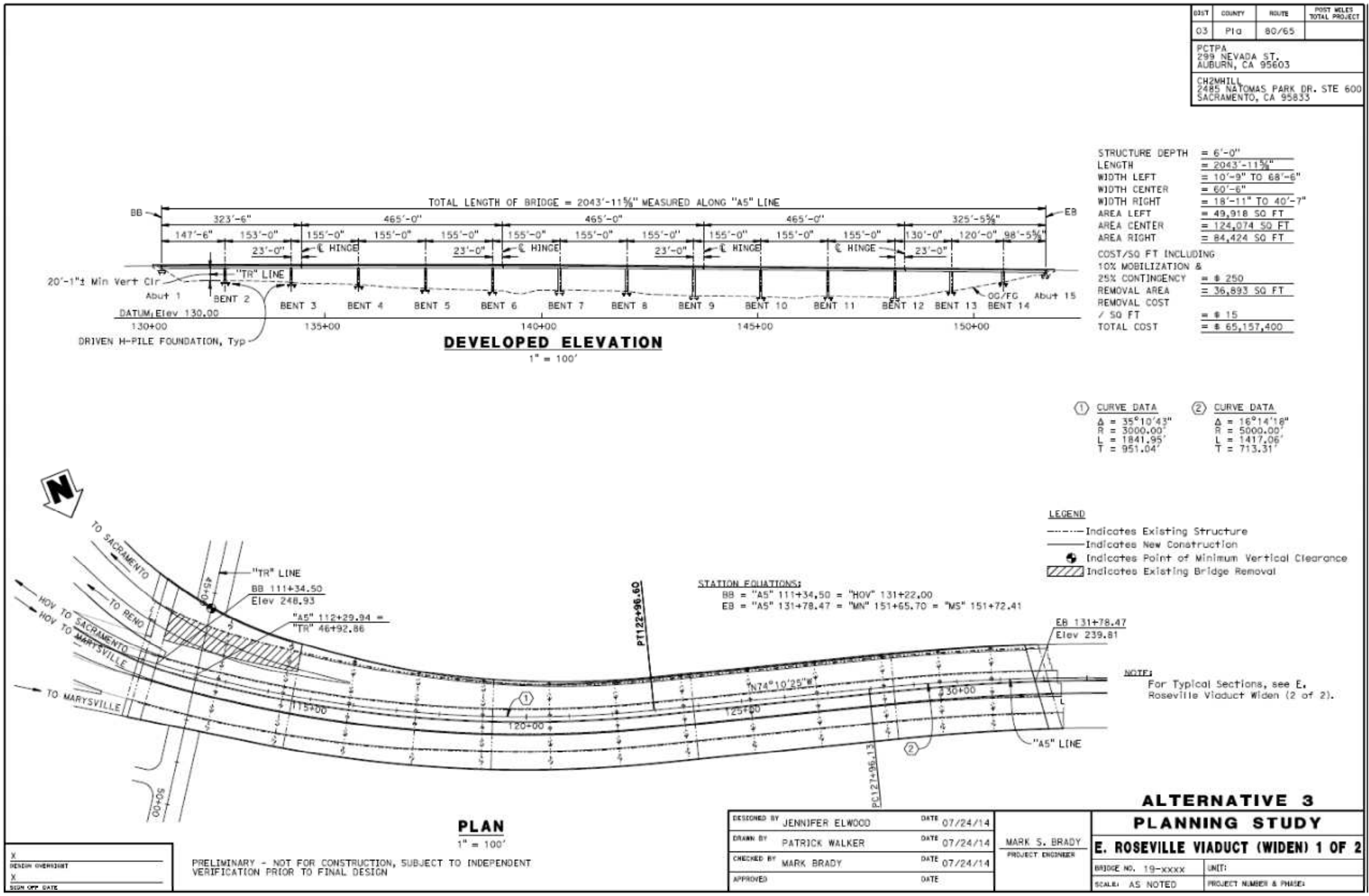

Figure 18. East Roseville Viaduct Proposed Bridge Plan (Alternative 3) (1 of 2)

Source: CH2M Hill

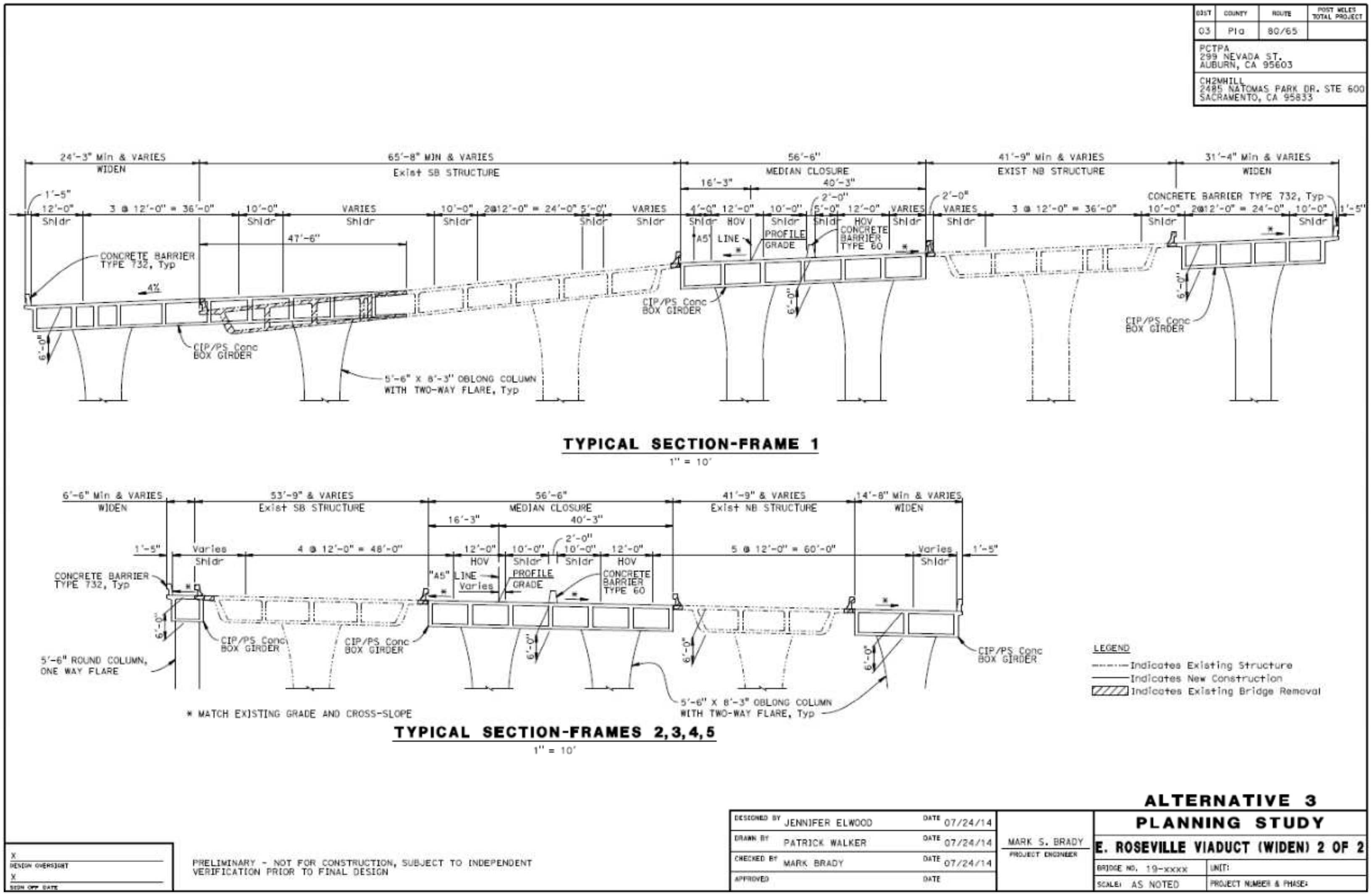

Figure 19. East Roseville Viaduct Proposed Bridge Plan (Alternative 2) (2 of 2)

Source: CH2M Hill

5.2 EN and SE I-80/SR 65 Connectors and EB I-80 On-Ramp at Secret Ravine

5.2.1 Existing Condition

Secret Ravine flows in a southwesterly direction approximately parallel to the existing I-80 roadway for the majority of the Project limits along I-80 particularly near the I-80/SR 65 Interchange.

In the existing condition, Secret Ravine flows adjacent to the current EN and SE connectors, and the connectors do not span the stream or its floodplain (see Figure 20 for the existing connectors at Secret Ravine).

Figure 20. Existing I-80/SR 65 Connectors at Secret Ravine

The existing EN Connector (Bridge No. 19-0151R) has a similar configuration as the existing SE Connector (Bridge No. 19-0151L). The structures are continuous, two-span, cast-in-place, box-girder bridges on reinforced concrete column bents and reinforced concrete seat abutments. The existing EN Connector bridge is approximately 42 ft wide and 302 ft long. The existing SE Connector bridge is approximately 30 ft wide and 312 ft long (see Figure 21 for the as-built plans).

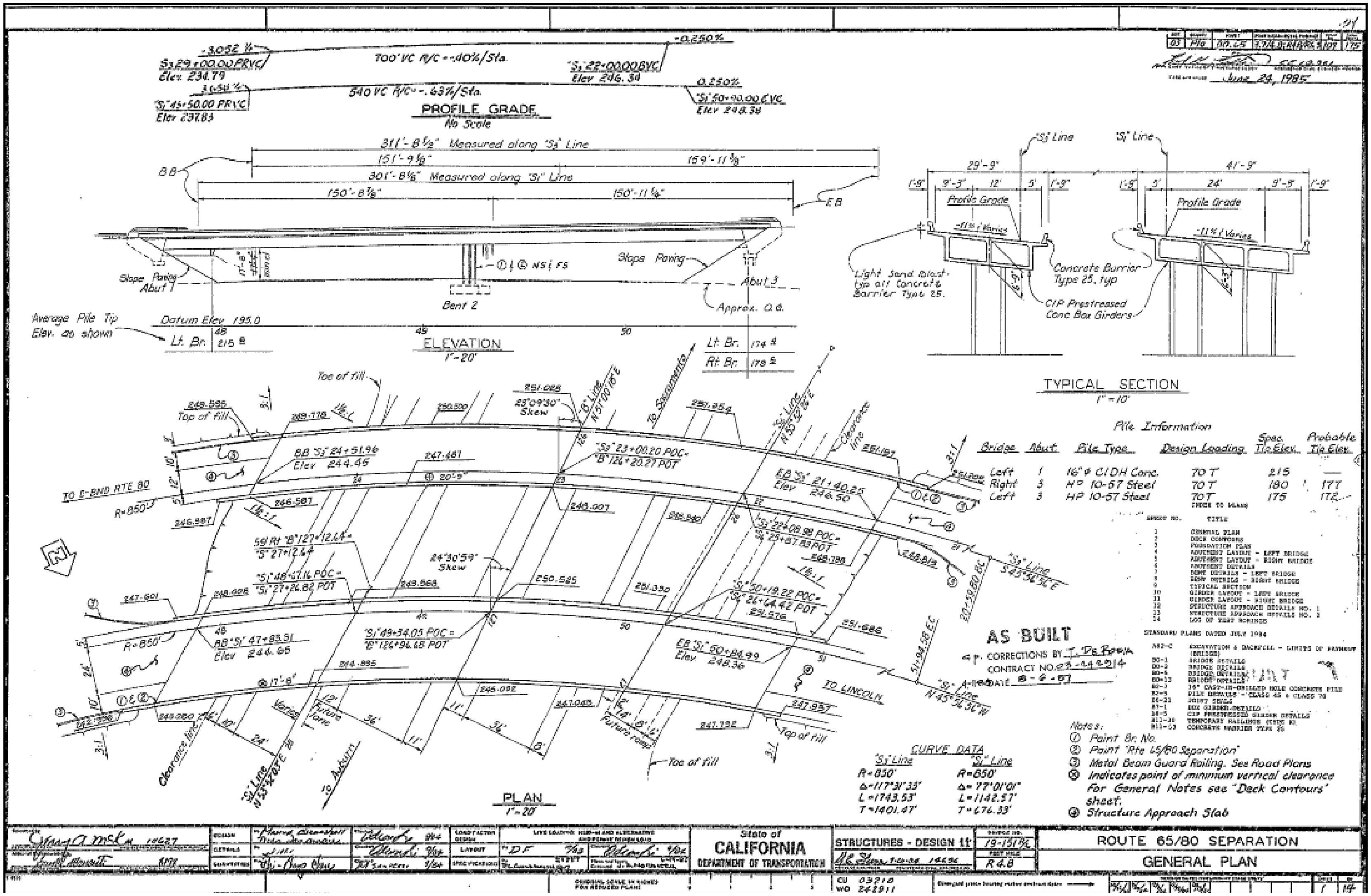

Figure 21. I-80/SR 65 Interchange EN and SE Connectors As-built Plans (1987)

Source: Caltrans

5.2.2 Proposed Condition

For all build alternatives, the proposed EN Connector will span Secret Ravine before returning to fill to conform with the WN connector, while the proposed SE Connector will span the Secret Ravine floodplain. The encroachment caused by the different alternatives is provided in Figure 22 and Figure 23.

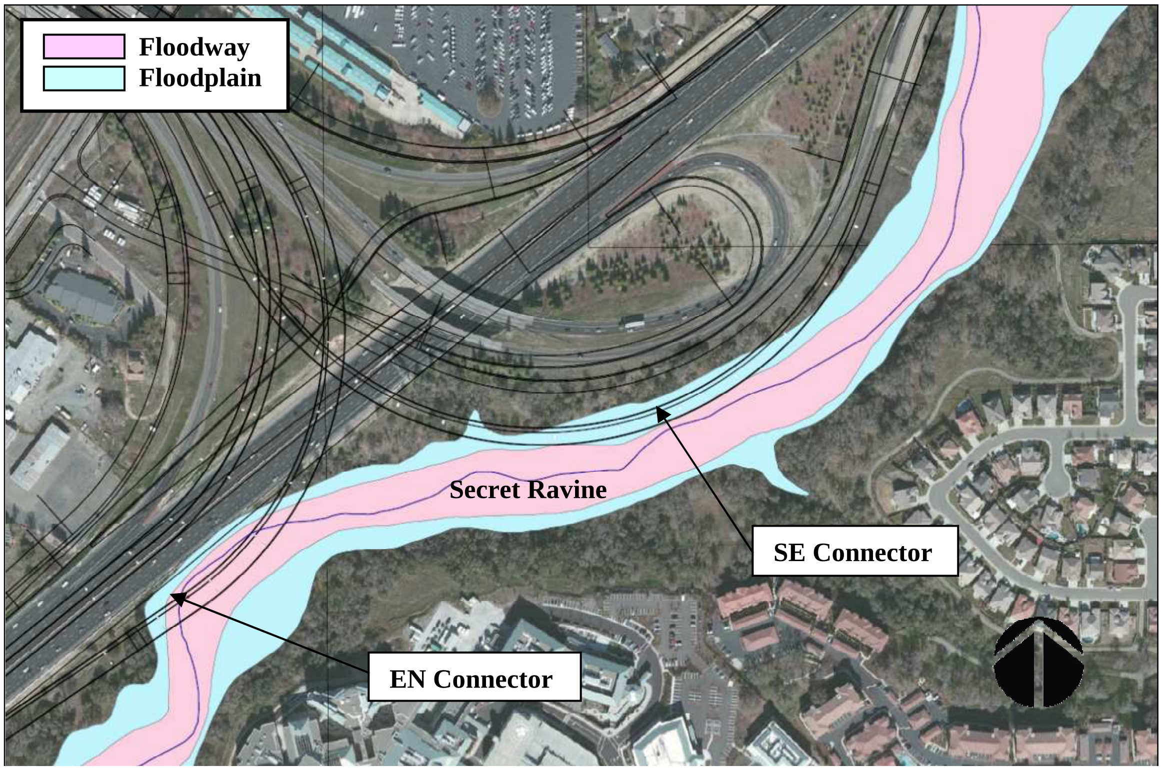

Figure 22. Proposed I-80/SR 65 Interchange Connectors at Secret Ravine (Alternative 1)

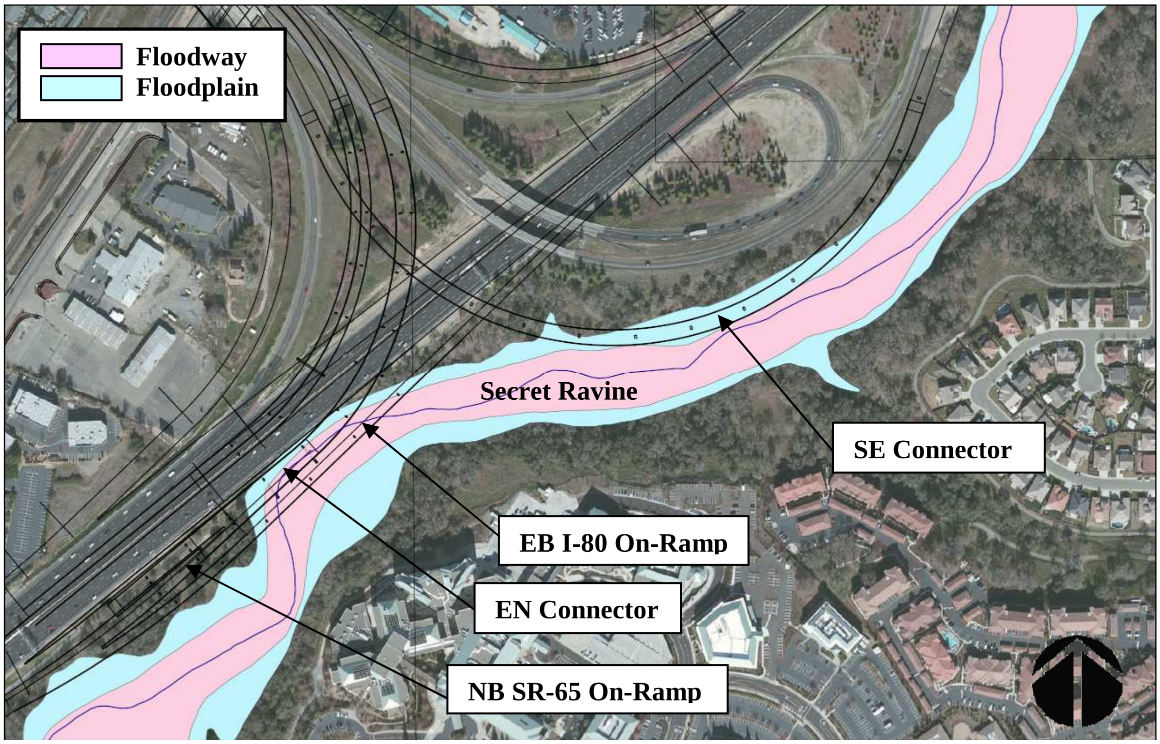

Figure 23. Proposed I-80/SR 65 Interchange Connectors at Secret Ravine (Alternatives 2 & 3)

The EN and SE connectors are cast-in-place, concrete, box-girder bridges for all the build alternatives. For Alternative 1, the EN Connector is approximately 60.8 ft wide and 1,765 ft long. For Alternatives 2 and 3, the EN Connector width varies from 48.8 ft to 94.8 ft and has a length of 1,845 ft. The SE Connector bridge has an approximate width of 48.8 ft for all the build alternatives. The lengths of the alternatives are 2,750 ft (Alternative 2), and 2,648 ft (Alternative 3). The proposed connector plans for each alternative are shown in Figure 24, Figure 25, Figure 26, Figure 27, Figure 28, Figure 29, Figure 30, Figure 31, Figure 32, and Figure 33.

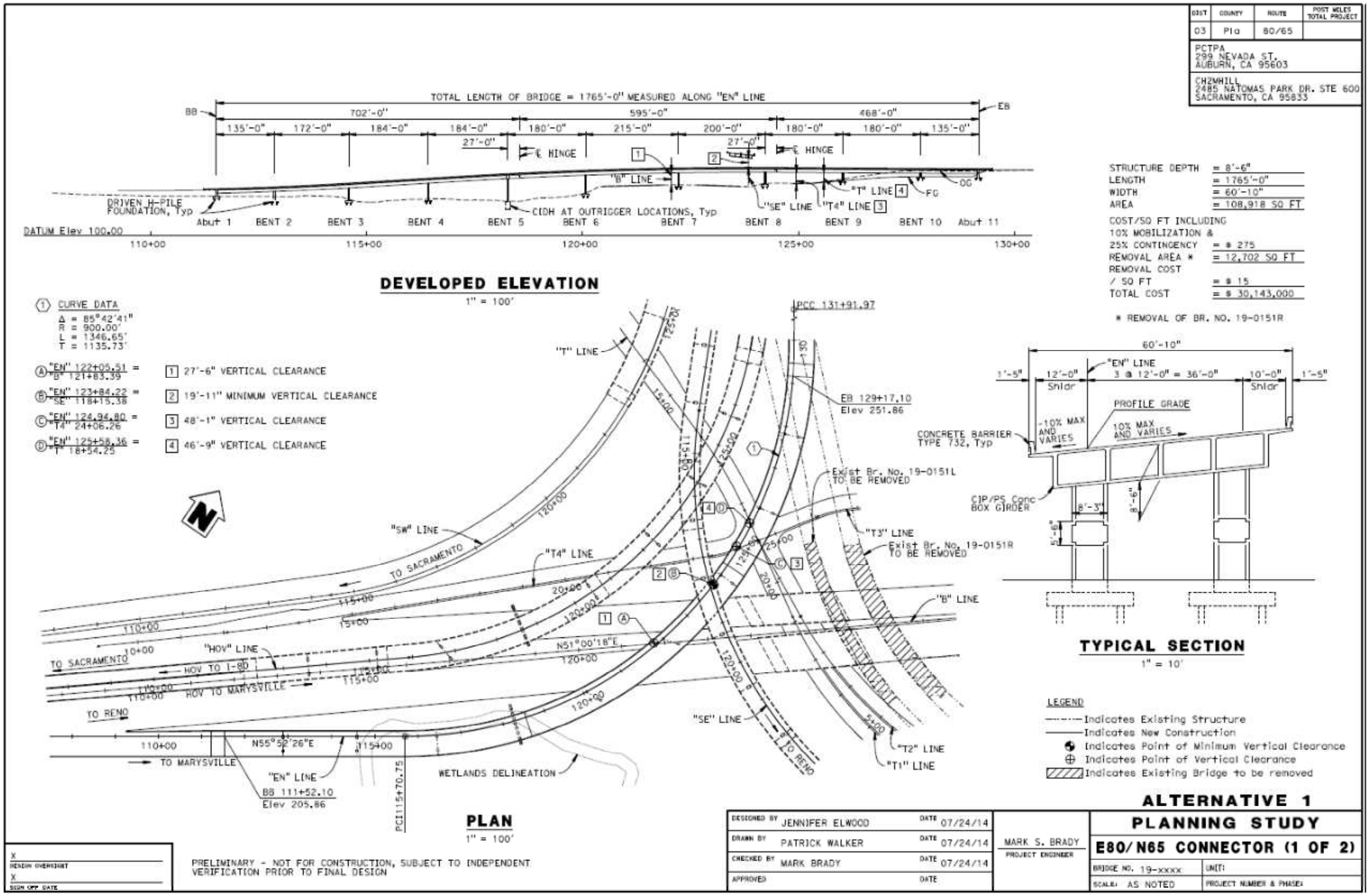

Figure 24. Proposed EN Connector Plan (Alternative 1) (1 of 2)

Source: CH2M Hill

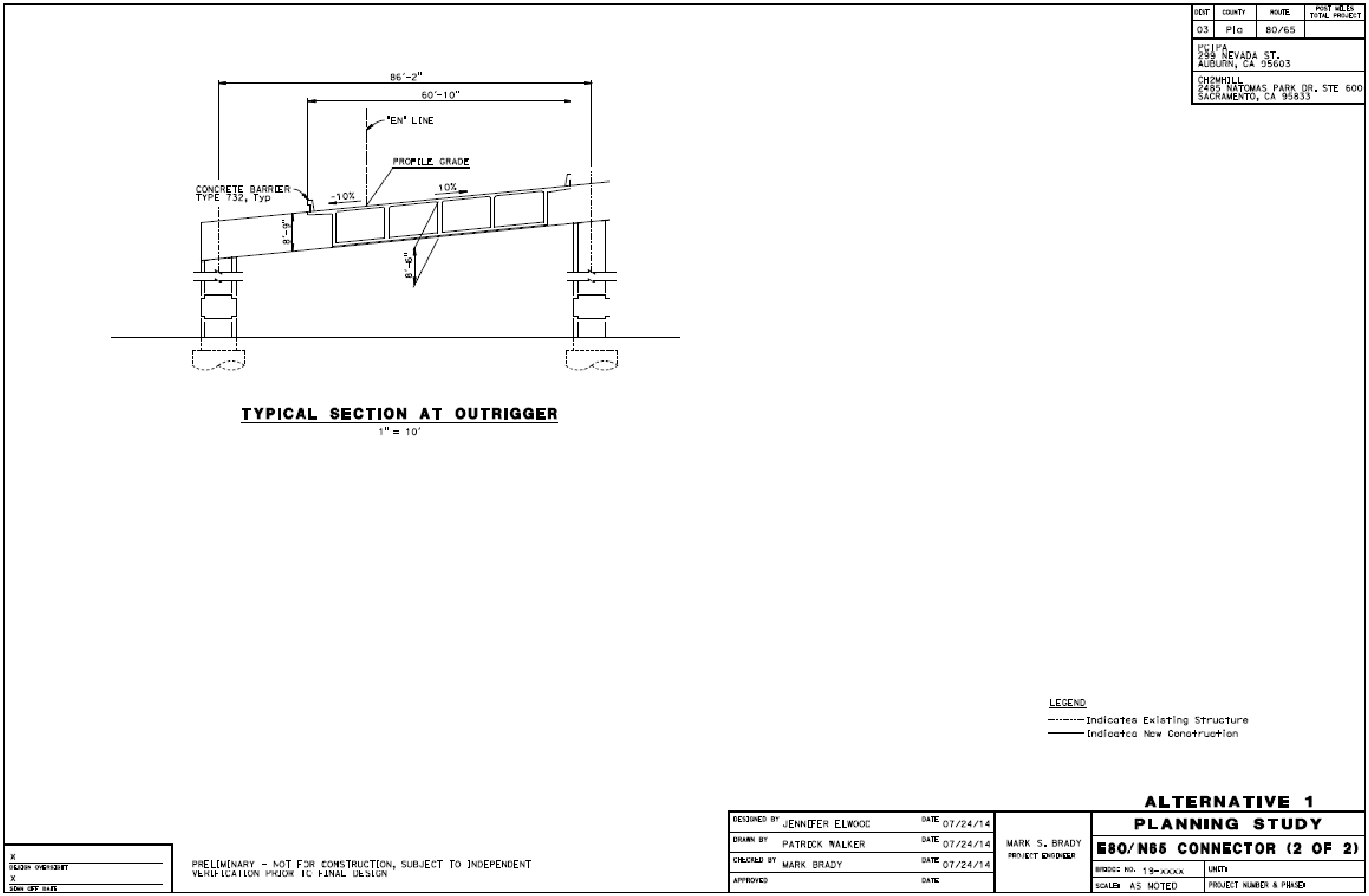

Figure 25. Proposed EN Connector Plan (Alternative 1) (2 of 2)

Source: CH2M Hill

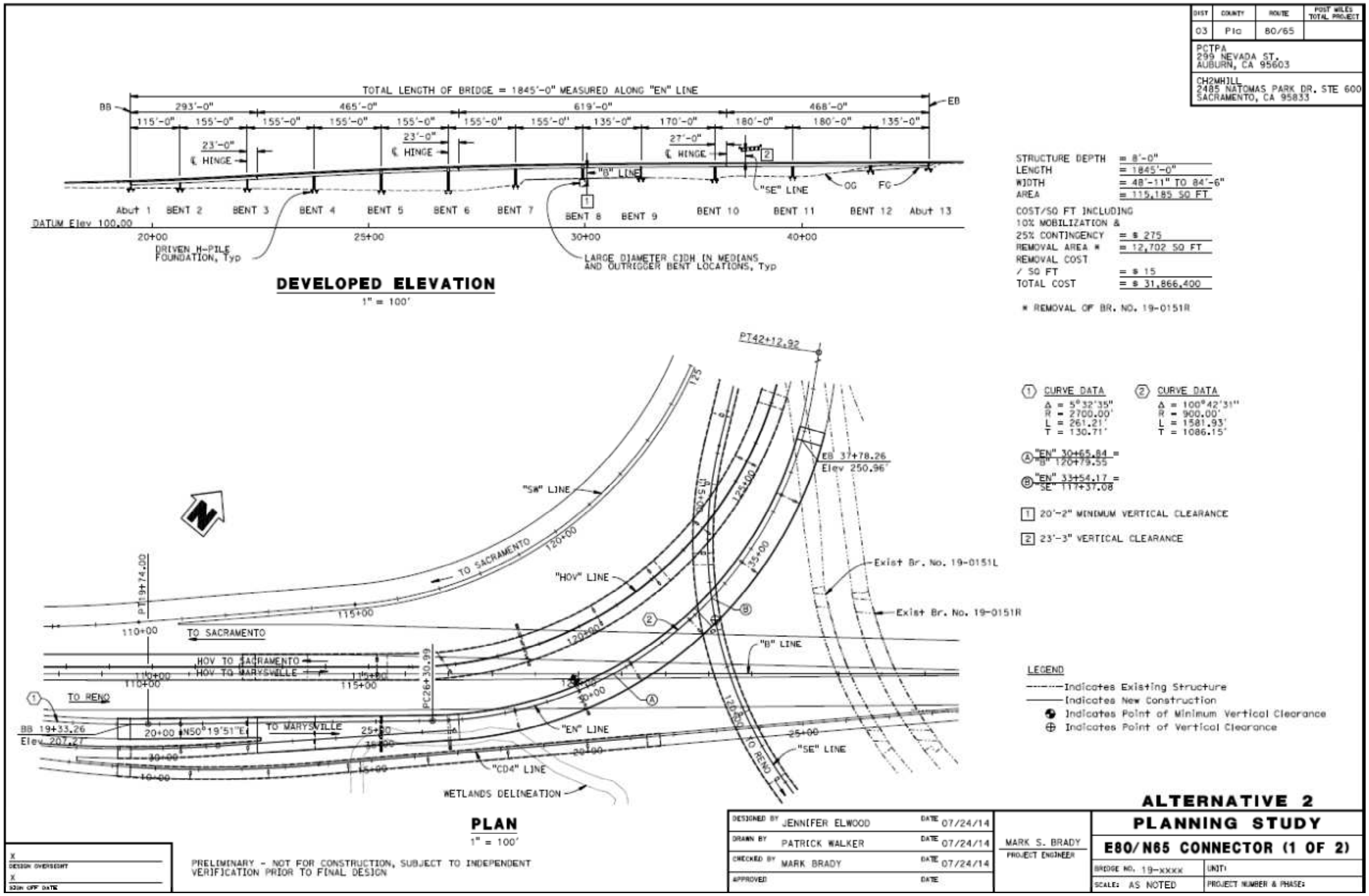

Figure 26. Proposed EN Connector Plan (Alternative 2) (1 of 2)

Source: CH2M Hill

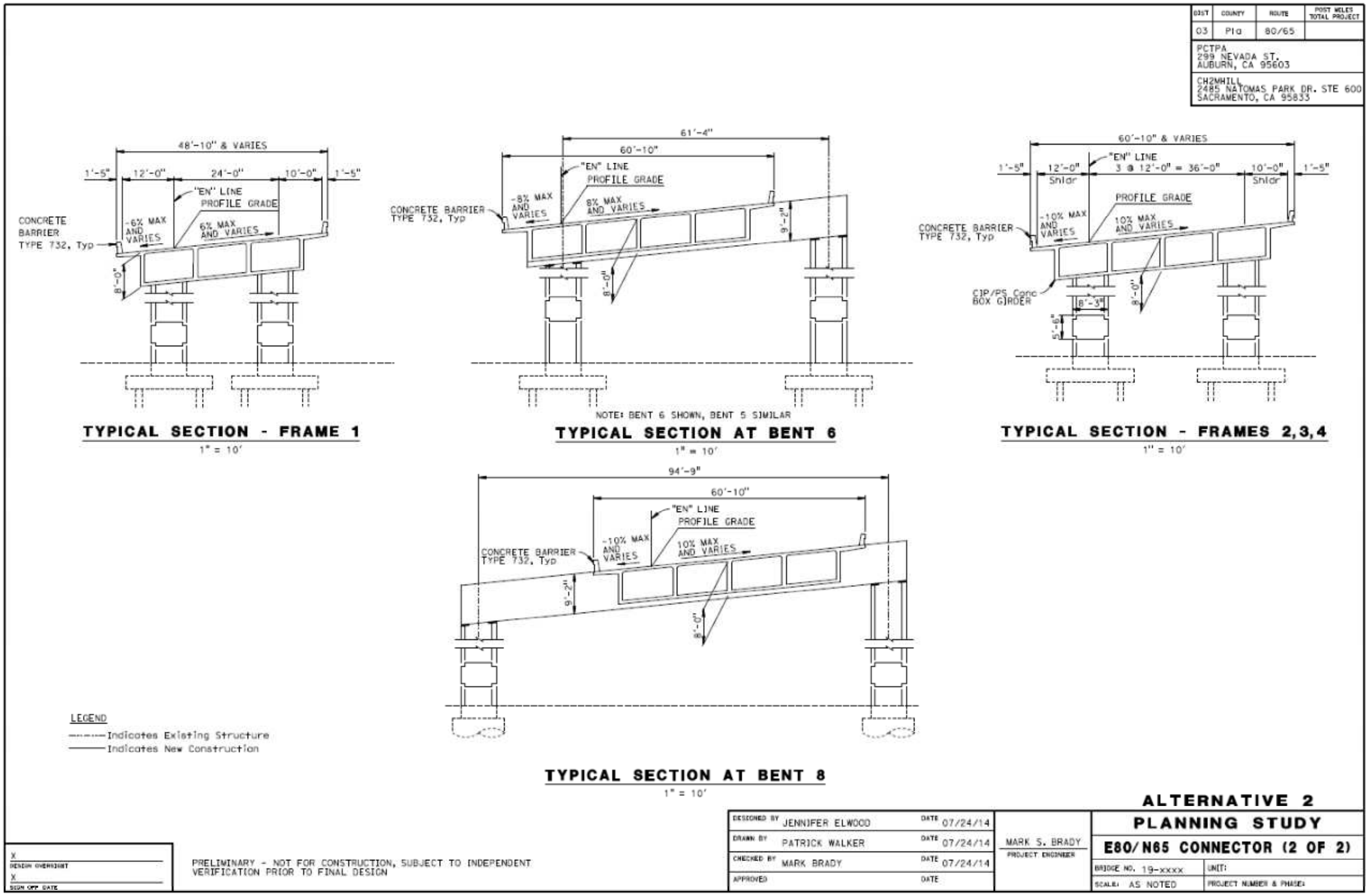

Figure 27. Proposed EN Connector Plan (Alternative 2) (2 of 2)

Source: CH2M Hill

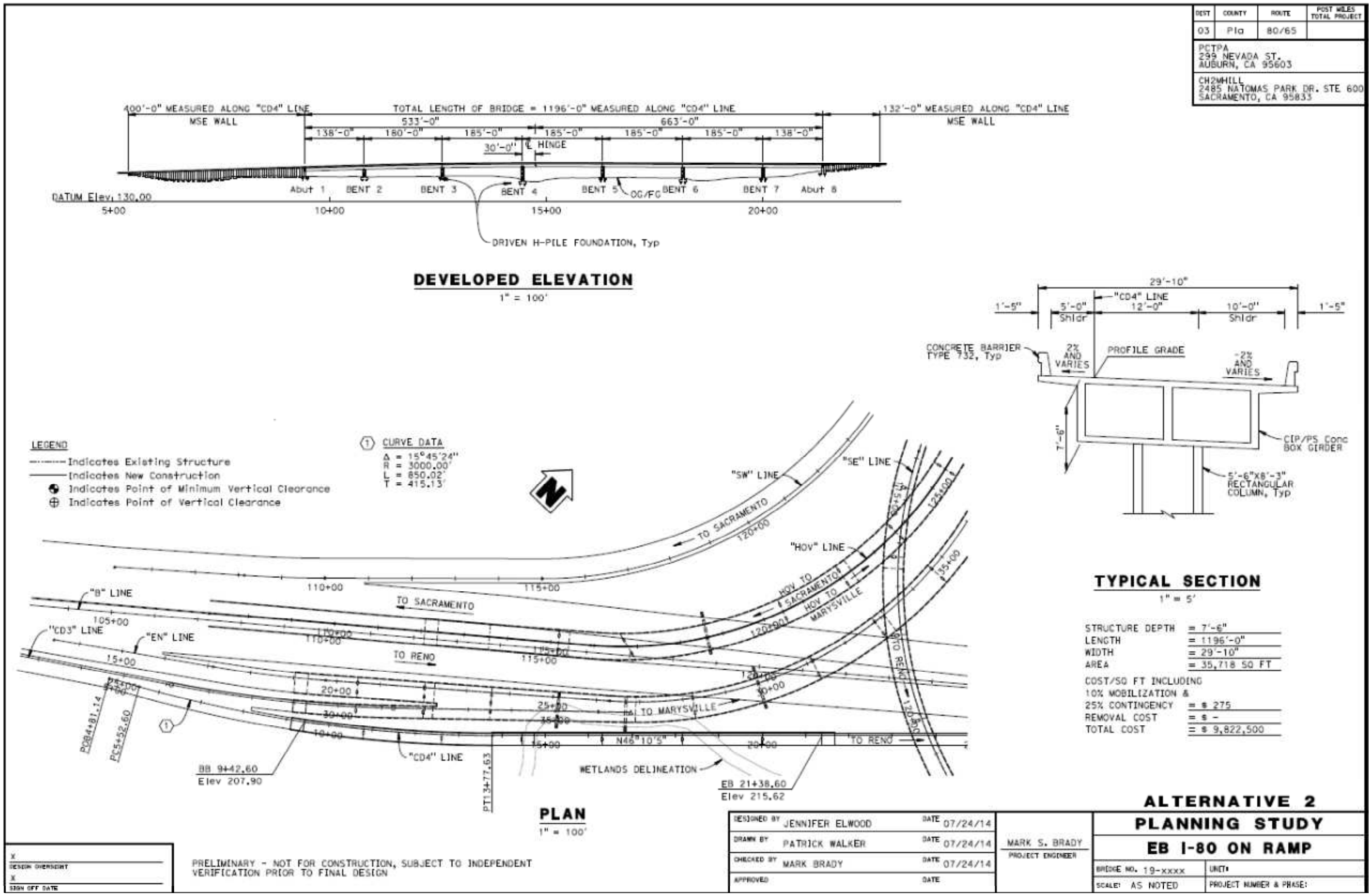

Figure 28. Proposed EB On-Ramp Plan (Alternative 2)

Source: CH2M Hill

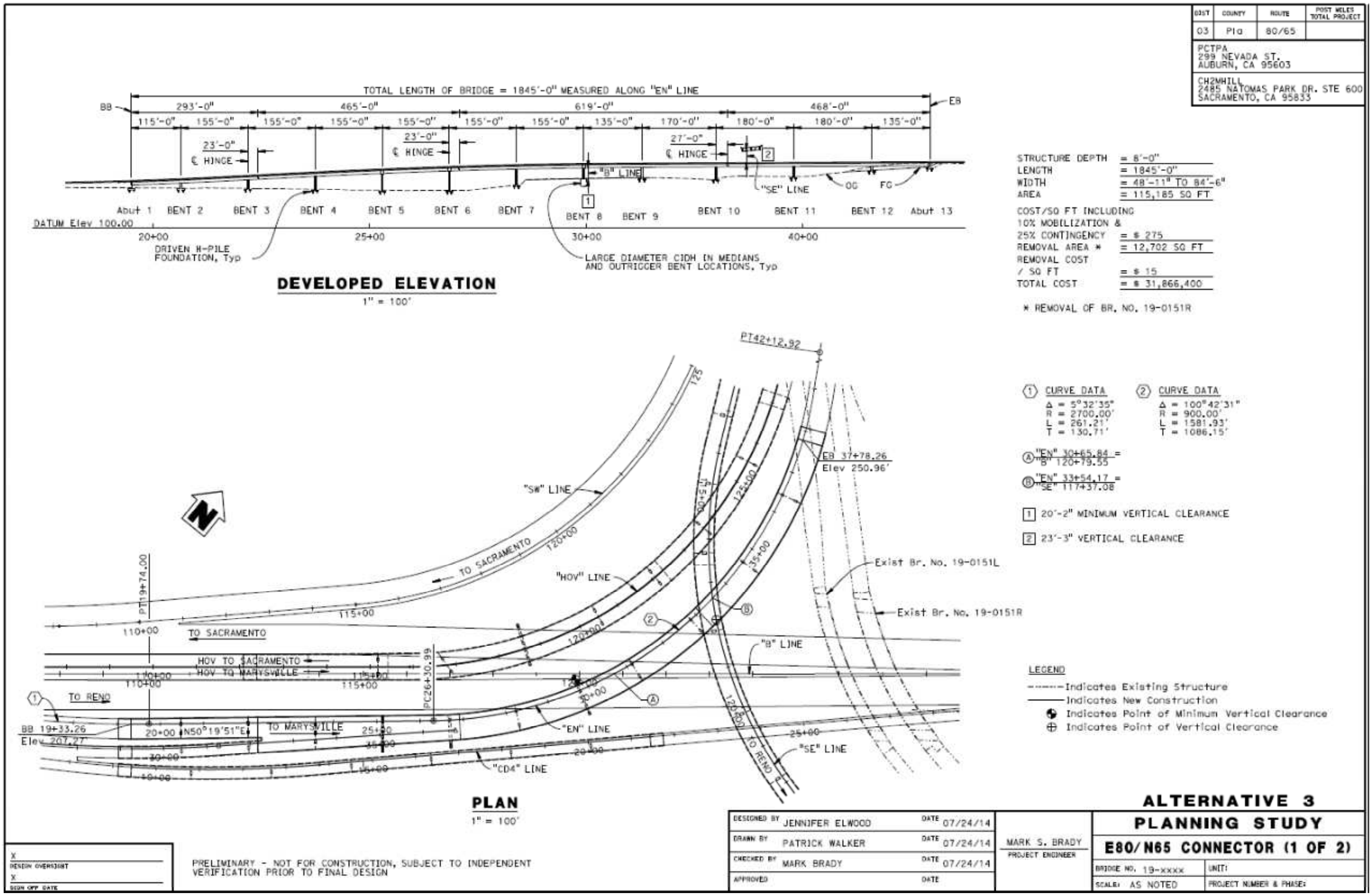

Figure 29. Proposed EN Connector Plan (Alternative 3) (1 of 2)

Source: CH2M Hill

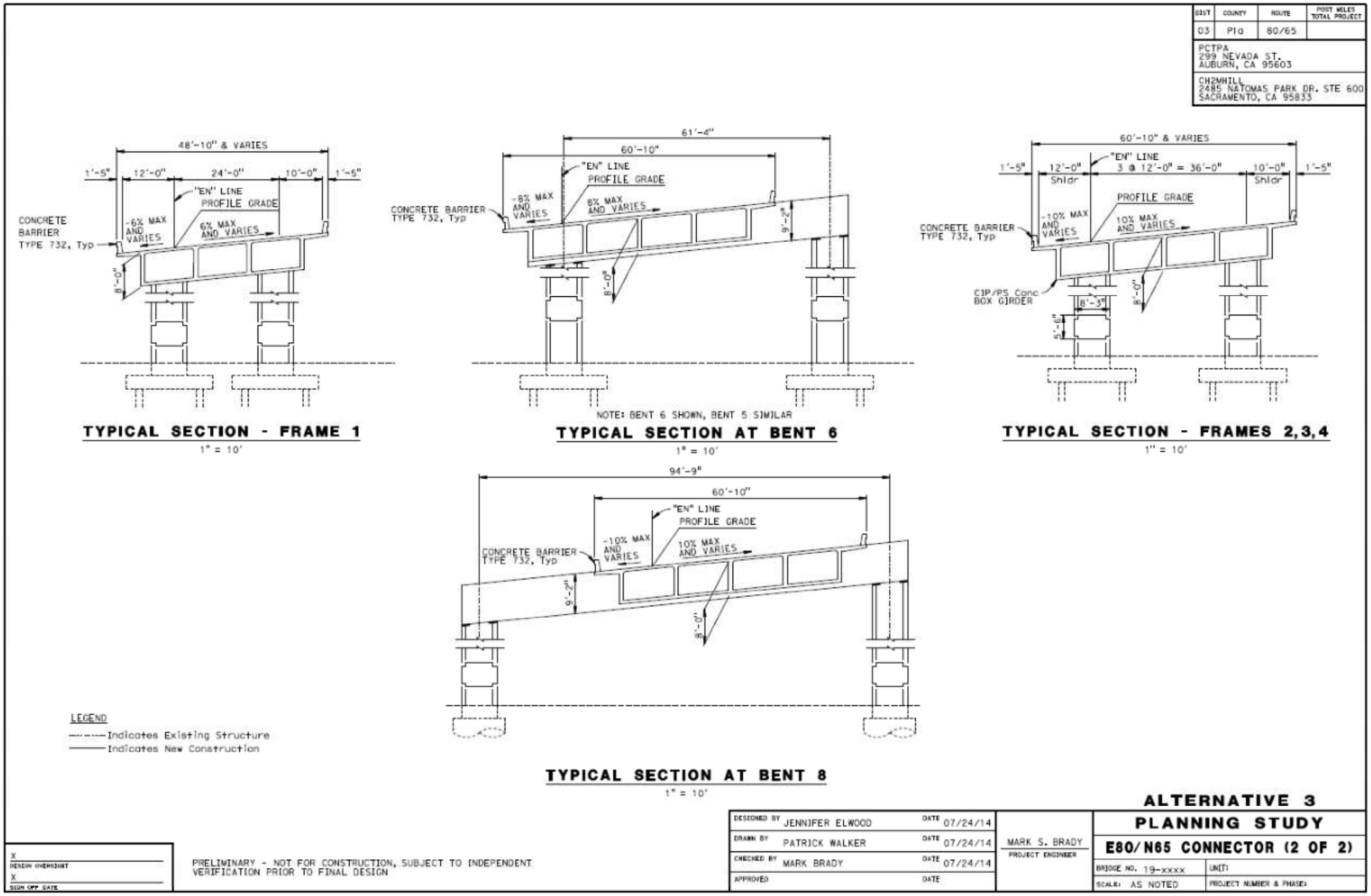

Figure 30. Proposed EN Connector Plan (Alternative 3) (2 of 2)

Source: CH2M Hill

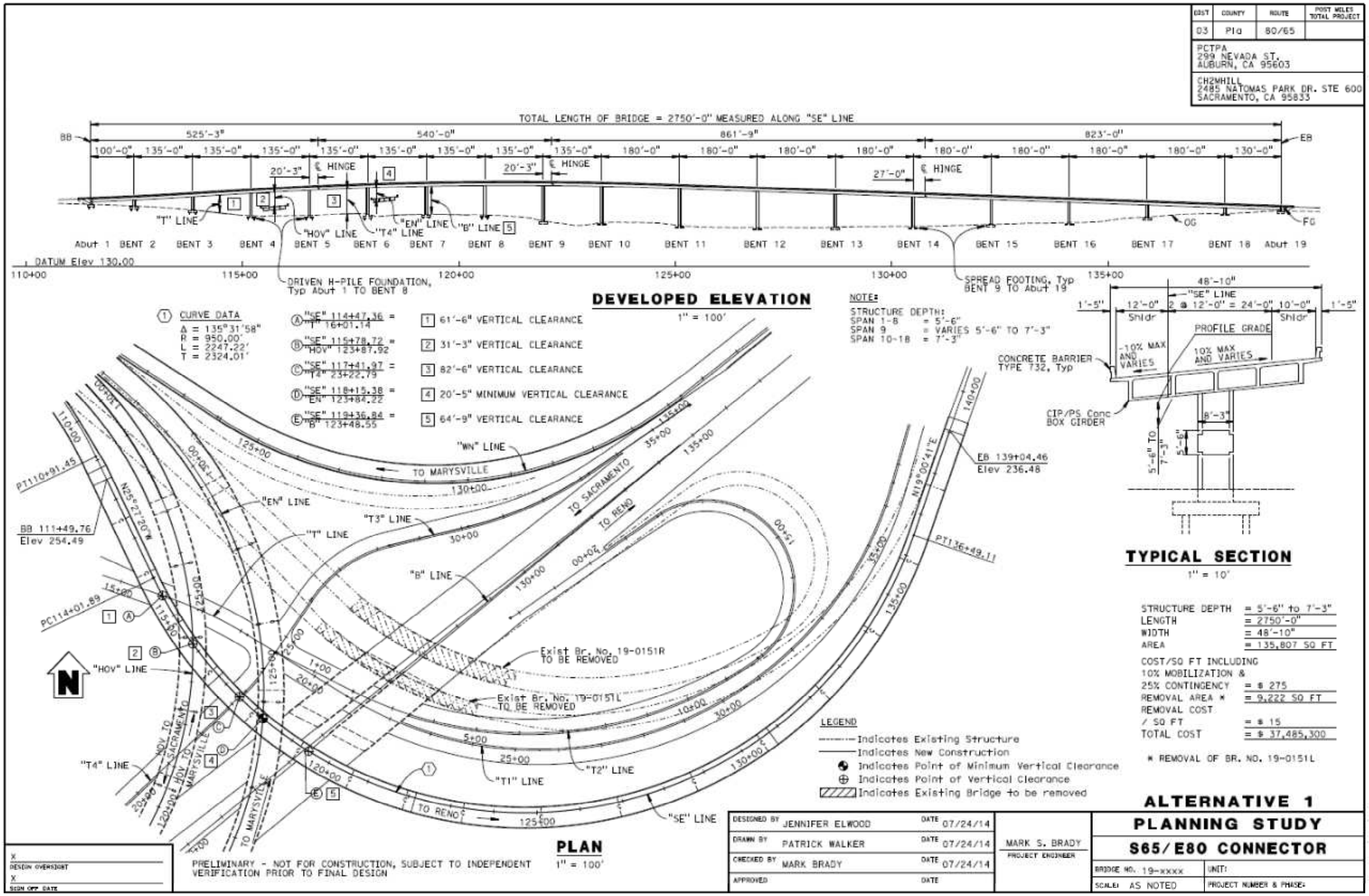

Figure 31. Proposed SE Connector Plan (Alternative 1)

Source: CH2M Hill

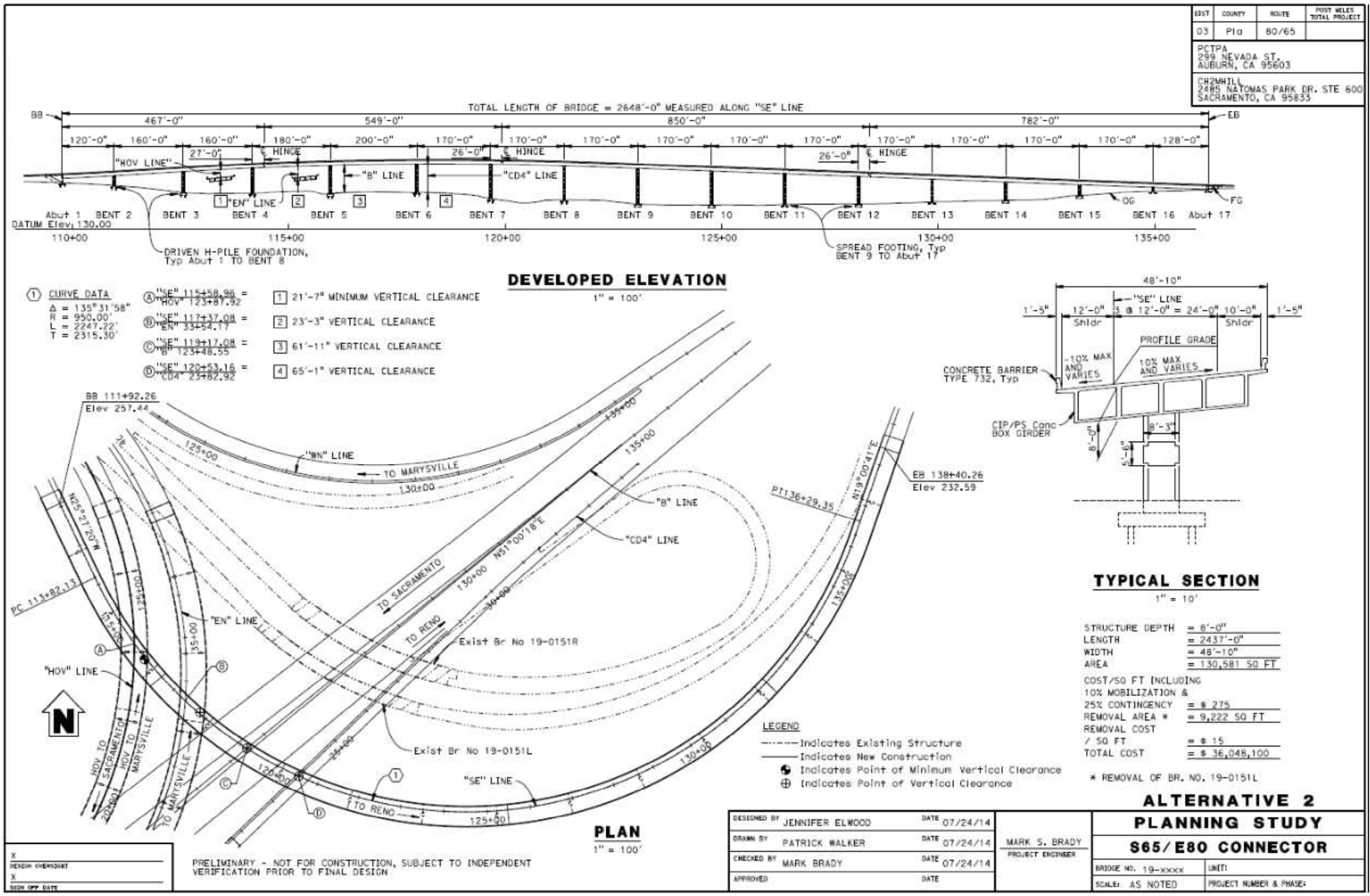

Figure 32. Proposed SE Connector Plan (Alternative 2)

Source: CH2M Hill

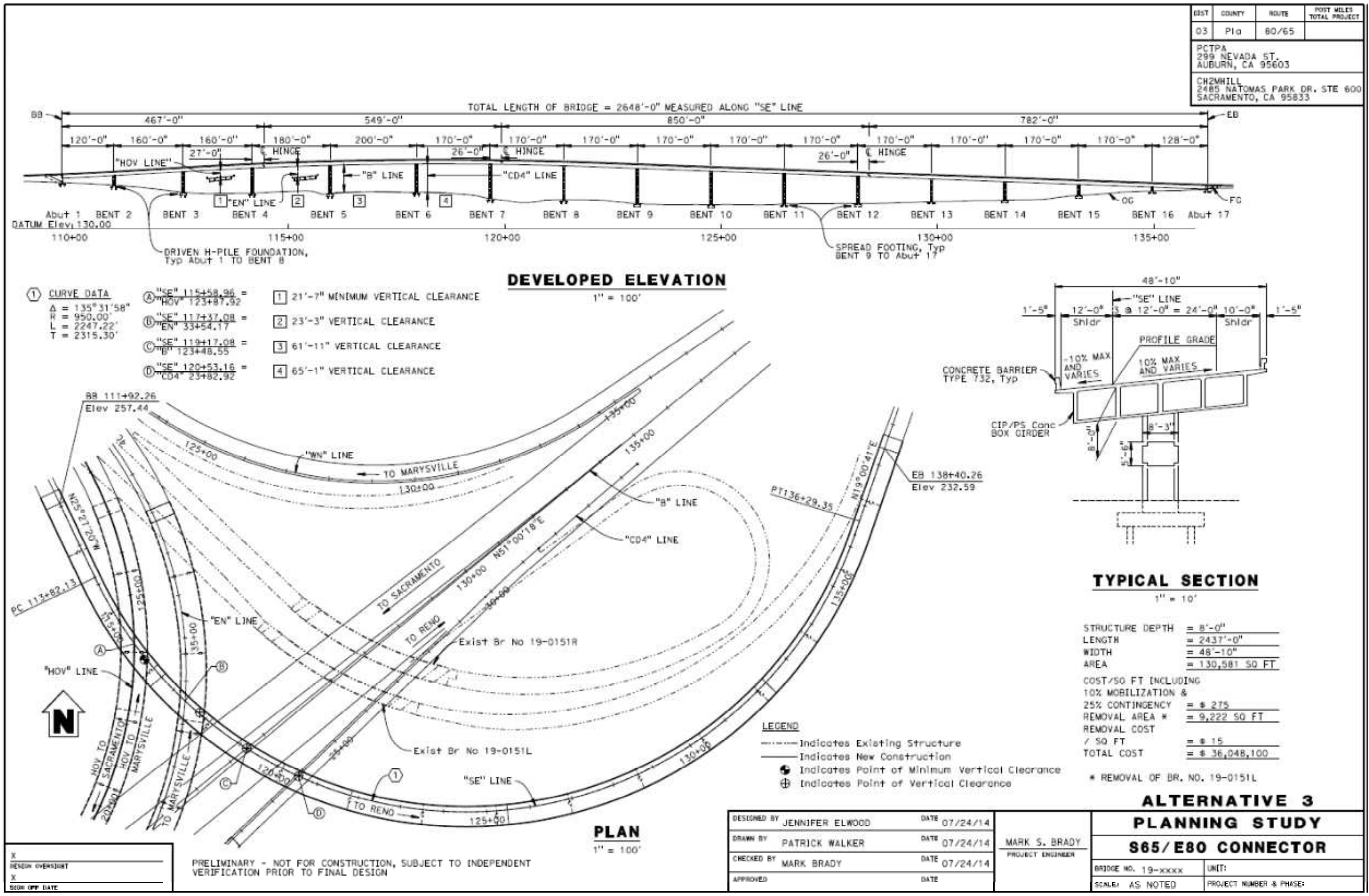

Figure 33. Proposed SE Connector Plan (Alternative 3)

Source: CH2M Hill

5.3 Miners Ravine at Miners Ravine Bridge and Ramps

5.3.1 Existing Condition

Miners Ravine flows in a westerly direction crossing under the Miners Ravine bridge after crossing under the I-80 off-ramp to Eureka Road bridge located farther upstream (see Figure 34 for the Project site aerial image).

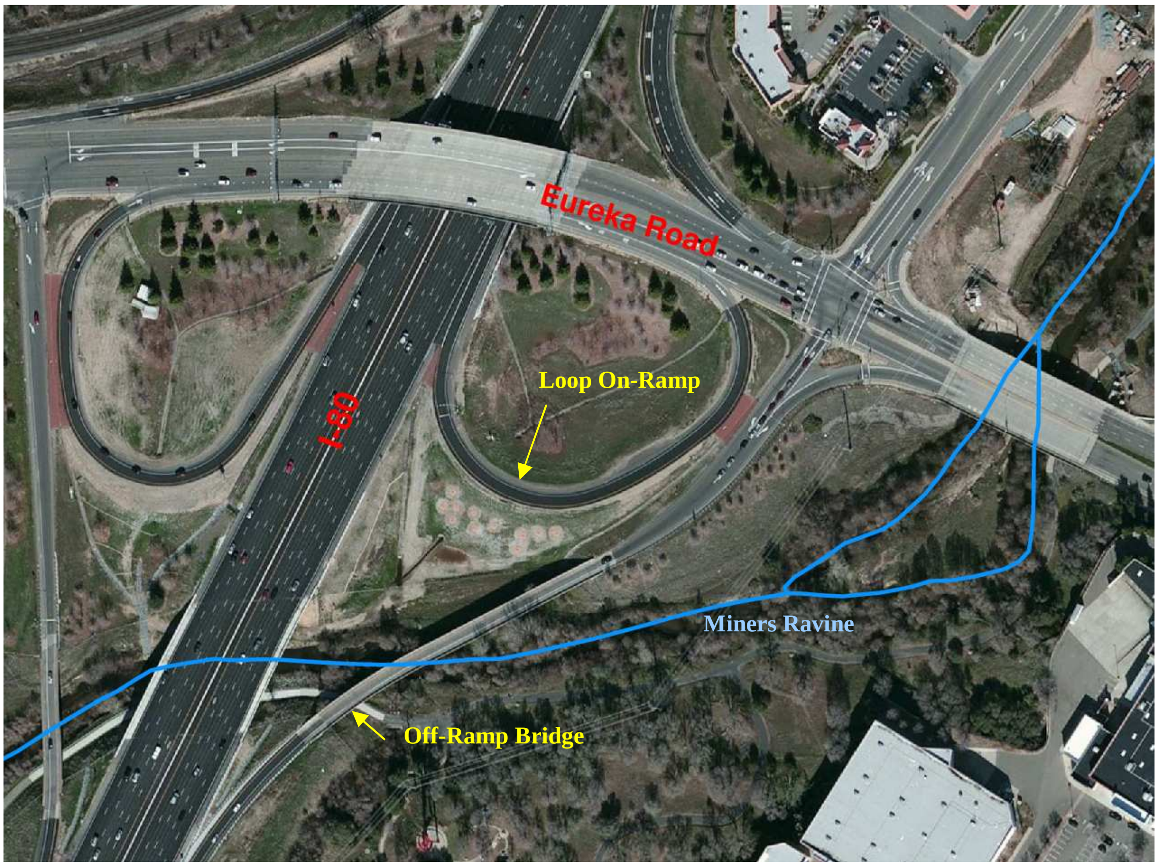

Figure 34. Existing I-80 Bridge and Eureka Ramps at Miners Ravine

The existing I-80 bridge (Bridge No. 19-056) over Miners Ravine was built in 1954. It is a three-span, continuous, reinforced concrete, "T" Beam girder bridge. The bridge has reinforced concrete, 3-ft by 3-ft square bents and reinforced concrete open end seat type abutments on steel piles. It is 136 ft wide and 232 ft long (see Figure 35 for the as-built plan).

The existing Eureka Road off-ramp bridge (Bridge No. 19-056 S) is a cast-in-place, concrete box-girder bridge with a width of 27.5 ft and a length of 470.5 ft. It has single 5.5 column bents that provide a four-span opening (see Photo 5 for the site photo and Figure 36 for the as-built plan).

Photo 5. I-80 Off-Ramp to Eureka Road Bridge at Miners Ravine

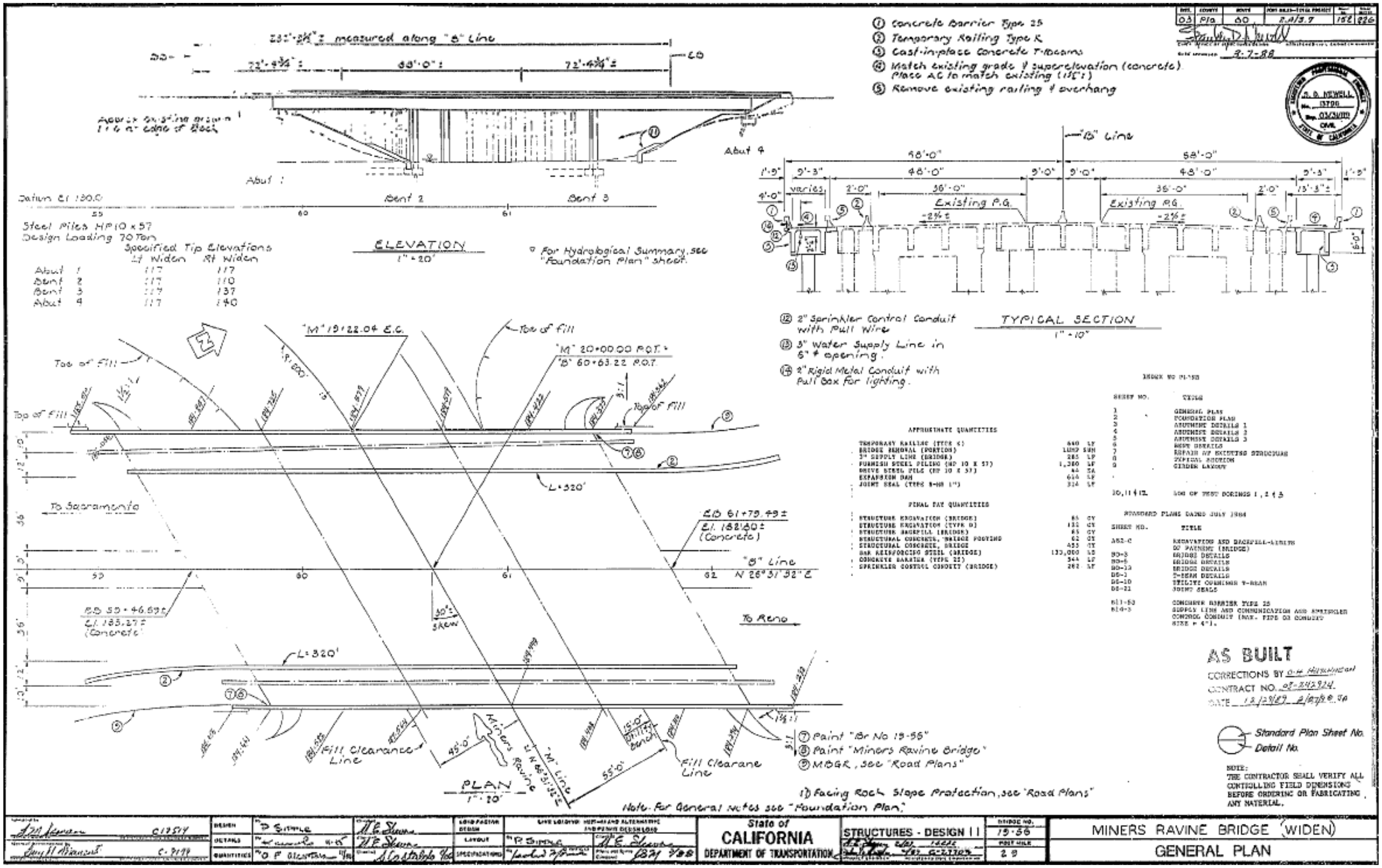

Figure 35. Miners Ravine Bridge at Miners Ravine As-built Plan (1988)

Source: Caltrans

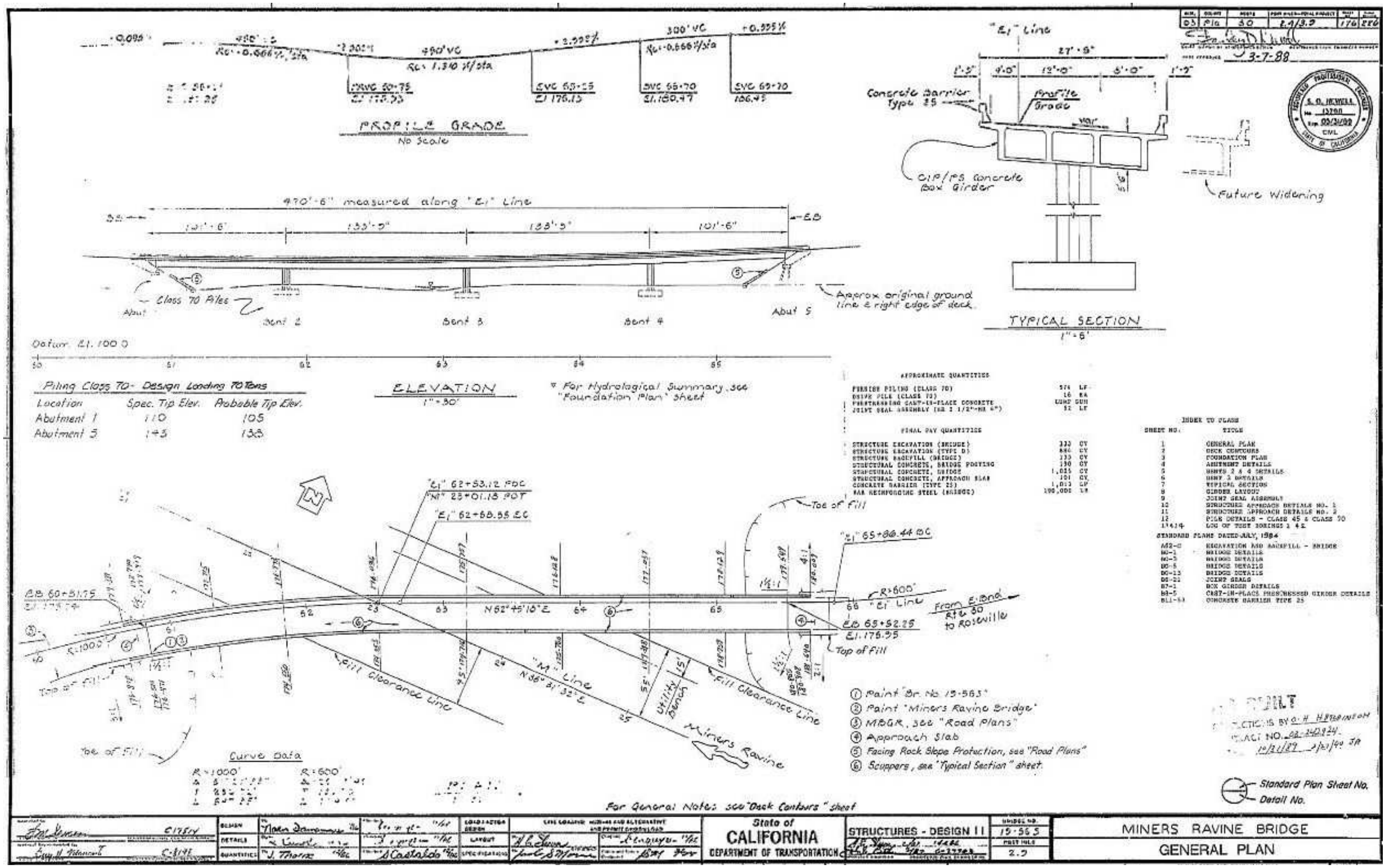

Figure 36. I-80 Off-Ramp to Eureka Road at Miners Ravine As-built Plan (1988)

Source: Caltrans

5.3.2 Proposed Condition

All build alternatives propose to realign the I-80 loop on-ramp from Eureka Road into the Miners Ravine floodplain (see Figure 37, Figure 38, and Figure 39 for the on-ramp re-alignment encroachment on the Miners Ravine floodplain/floodway).

For Alternative 2, a new ramp would diverge from the existing EB Eureka Road off-ramp and would require a new bridge over Miners Ravine as shown on the proposed bridge Planning Study provided in Figure 40. The EB Eureka Road ramps would be reconfigured to tie in to the collector-distributor ramp system instead of the I-80 mainline.

Alternative 3 proposes to widen the Eureka Road off-ramp bridge by approximately 11.8 ft at the upstream face of the existing bridge. A segment of the existing bridge will be removed as shown on the proposed bridge Planning Study provided in Figure 41.

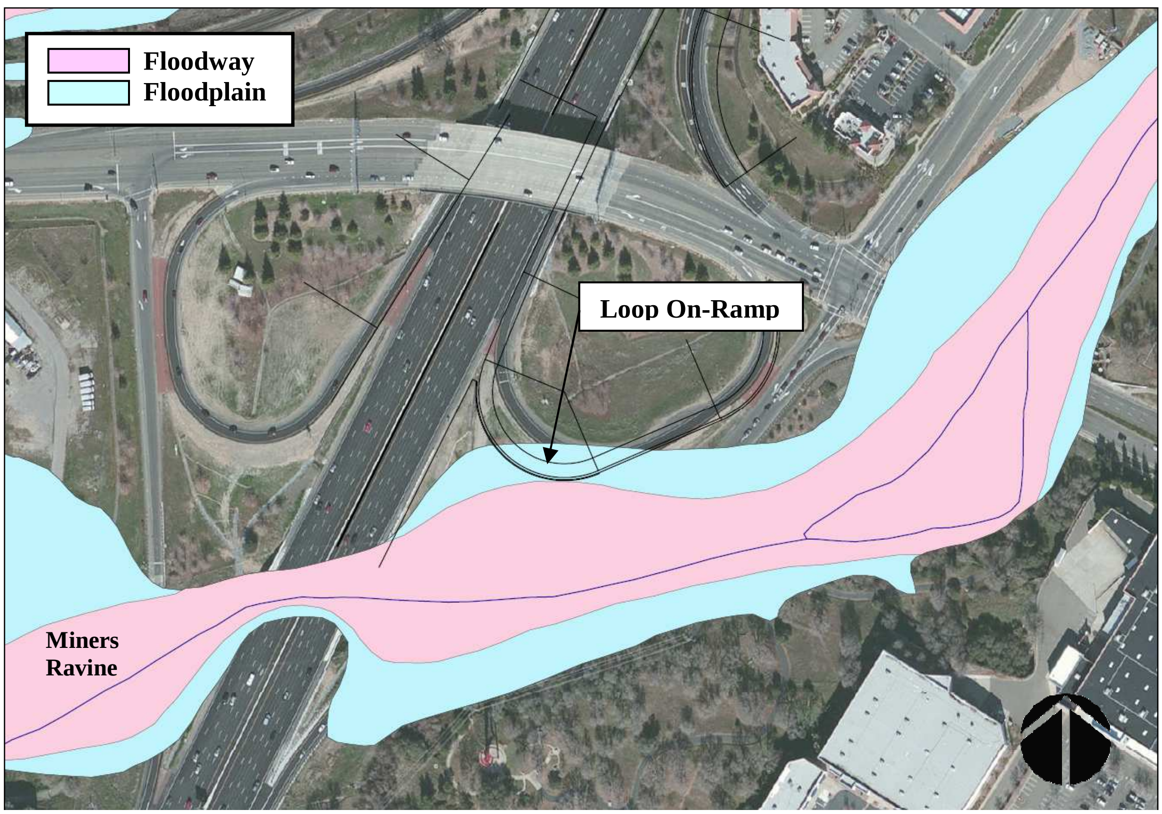

Figure 37. Proposed I-80 Loop On-Ramp from Eureka Road and Miners Ravine Bridge (Alternative 1)

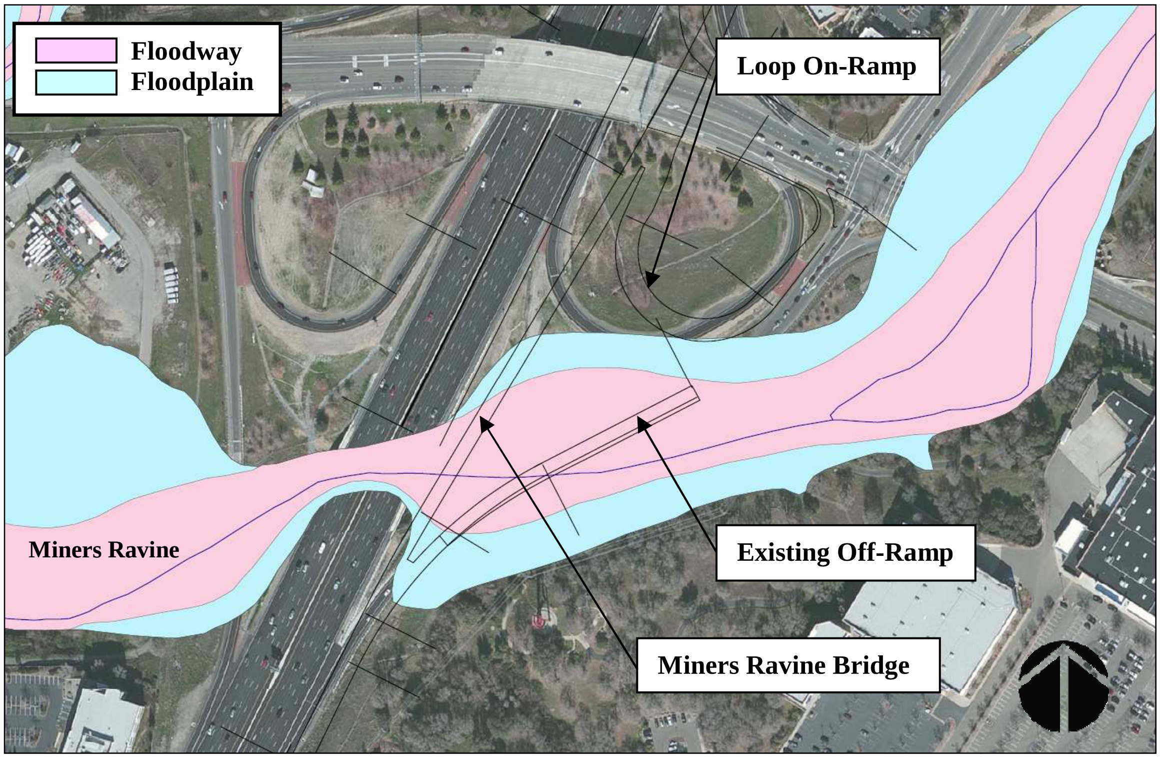

Figure 38. Proposed I-80 Loop On-Ramp from Eureka Road and Miners Ravine Bridge (Alternative 2)

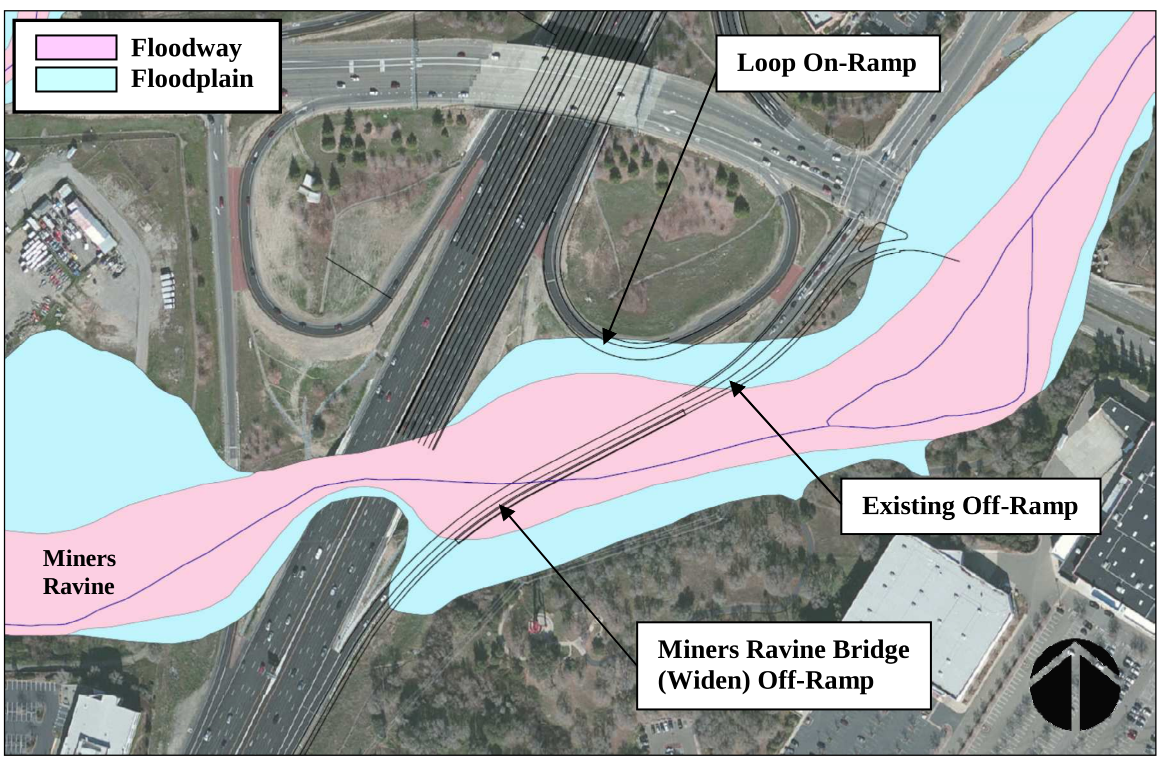

Figure 39. Proposed I-80 Loop On-Ramp from Eureka Road and Miners Ravine Bridge (Alternative 3)

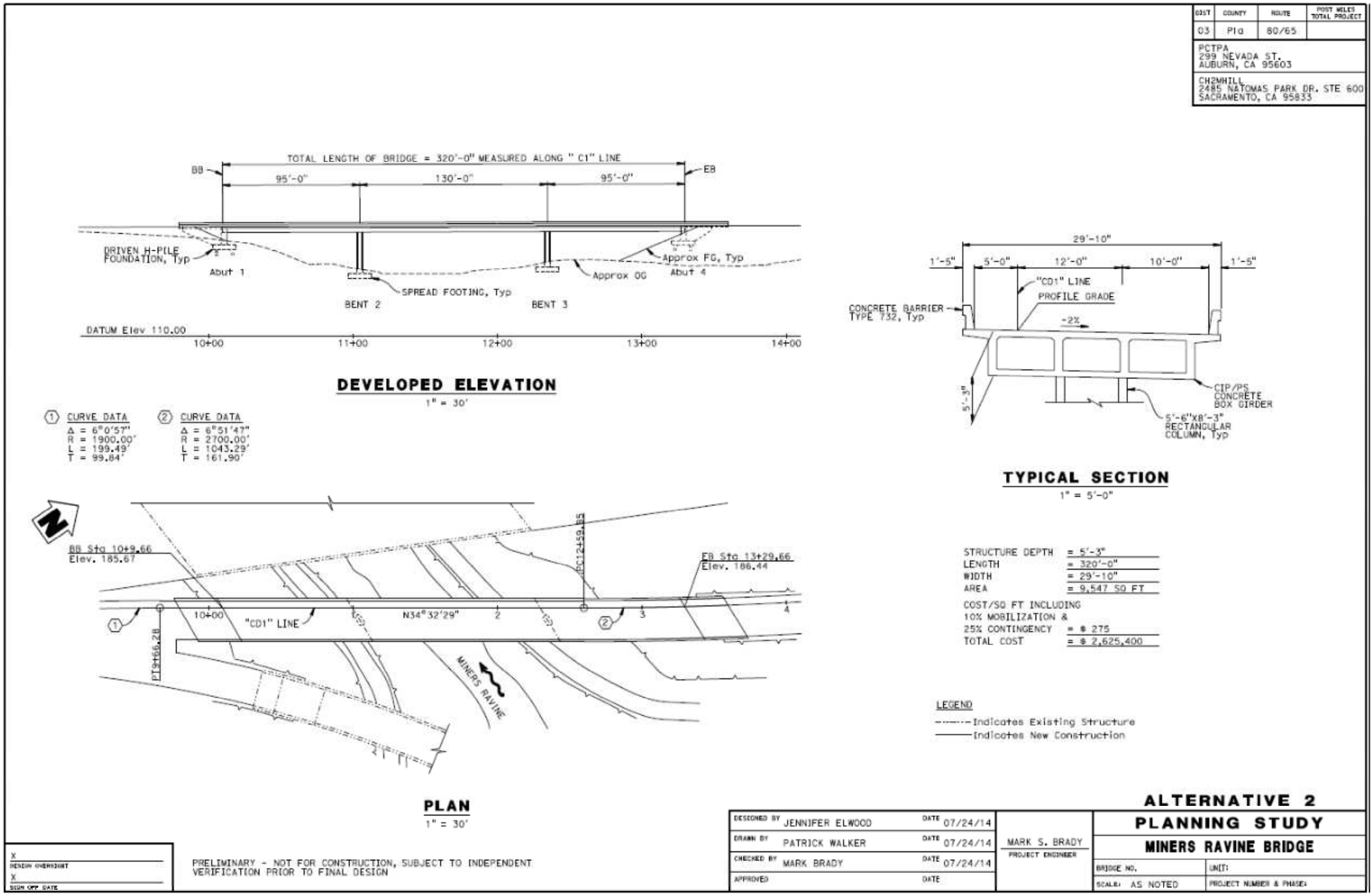

Figure 40. Proposed Miners Ravine Bridge at Miners Ravine Planning Study (Alternative 2)

Source: Caltrans

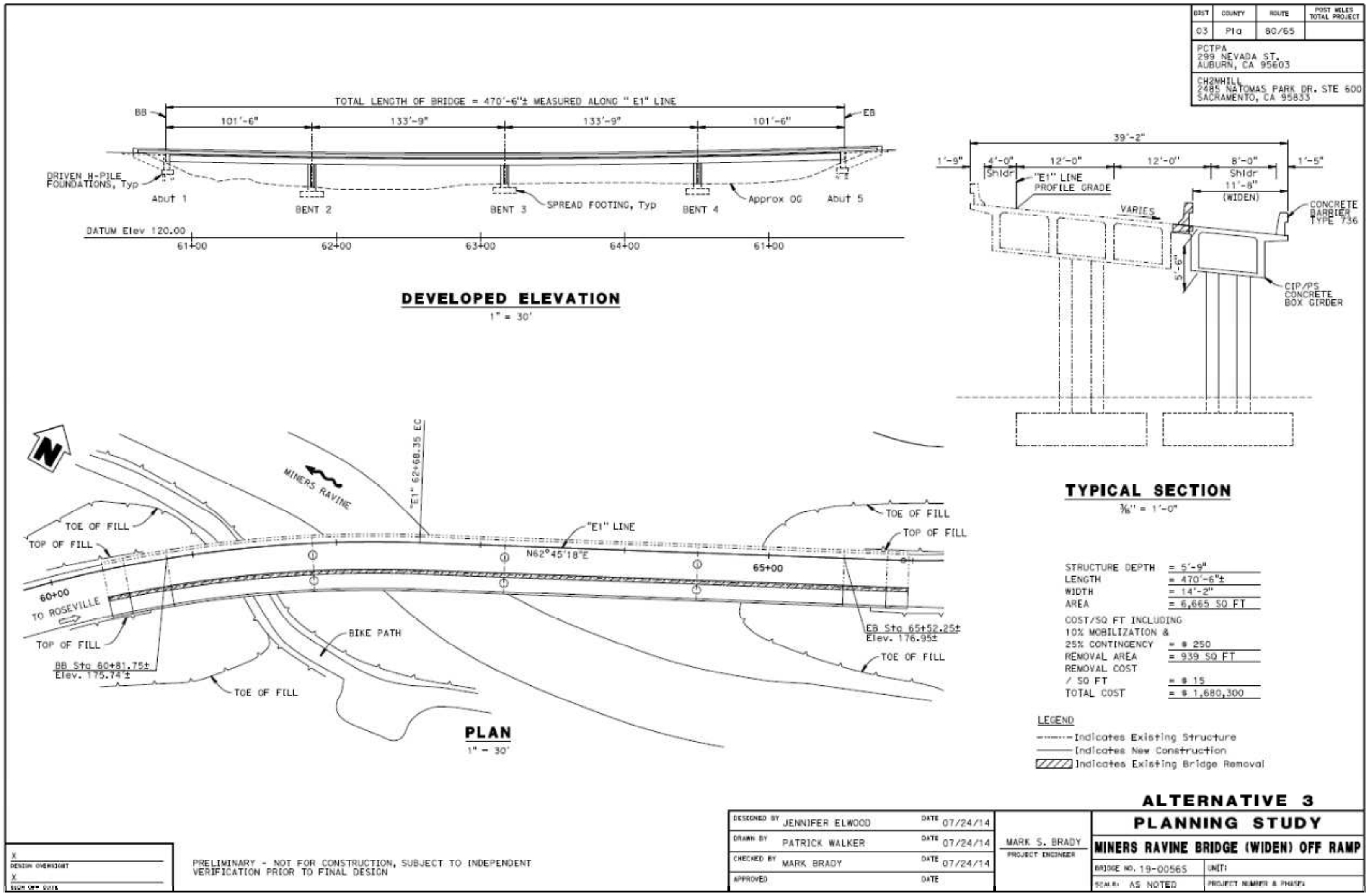

Figure 41. Proposed Miners Ravine (Widen) Off-Ramp to Eureka Road Bridge Planning Study (Alternative 3)

Source: Caltrans

6 HYDRAULIC ANALYSIS

The hydraulics at various sites within the Project limits were evaluated using the Hydrologic Engineering Centers River Analysis System (HEC-RAS) Version 4.1.0, which is hydraulic modeling software developed by the U.S. Army Corps of Engineers (USACE). The steady state analyses, based on the PCFCWCD's hydraulic model of the Dry Creek watershed, were performed for the existing and proposed conditions of the bridges that are within a FEMA designated floodway to calculate the potential impacts of the Project. The bridge structures within the Project limits that were modeled included East Roseville Viaduct bridge at Antelope Creek, the EN and SE connectors at Secret Ravine, and the Miners Ravine bridge and Eureka Road ramps at Miners Ravine.

6.1 East Roseville Viaduct at Antelope Creek

The cross sections and ground profile used in the modeling of East Roseville Viaduct were developed from PCFCWCD's model. The existing bridge structure design was modeled based on Caltrans as-built drawings dated 1987. The water surface profile plots, water profile tables, and channel cross sections are included in Appendix B.1 for the modeled existing and proposed bridges.

6.1.1 Cross Section Data

A total of seven cross sections for the existing condition and six for the proposed alternatives were used to model the East Roseville Viaduct bridge at Antelope Creek. The additional cross section incorporated in the existing model between the NB and SB structures was removed in the proposed bridge models as a result of the median closure, which will join the two structures into one widened bridge.

6.1.2 Model Boundary Condition

Known WSEs were obtained from Placer County's effective HEC-RAS model. The WSE refers to the National Geodetic Vertical Datum of 1929 (NGVD 29). A WSE of 173.9 ft was selected as the downstream boundary condition for the 100-year flow. A known WSE of 171.5 ft was selected as the downstream boundary condition for the 50-year flow.

6.1.3 Manning's Roughness Coefficients

Manning's roughness coefficients were used in the model to represent the frictional energy losses in the flow. The Manning's roughness coefficients were obtained from PCFCWCD's model. The range of roughness values used for the main channel was 0.035 to 0.075 and the range of roughness values used for the overbanks was 0.04 to 0.08. . It is assumed that PCFCWCD's model roughness coefficient values reflect present hydraulic conditions.

6.1.4 Expansion and Contraction Coefficients

Expansion and contraction coefficients are used in the hydraulic model to estimate hydraulic losses at transitions between cross sections. The expansion and contraction coefficients used in the channel were 0.3 and 0.1, respectively. These values represent a channel with gradual transitions between cross sections. The expansion and contraction coefficients used in the vicinity of the bridge were 0.5 and 0.3, respectively. These values represent the flow interference caused by the bridge structure.

6.1.5 Water Surface Elevations

The WSE results determined for the existing and proposed models are summarized in Table 8. Figure 42 shows the bents encroaching on the Antelope Creek floodway and floodplain. The modeling results show that there is no significant increase in WSE as a result of the improvements proposed at this location.

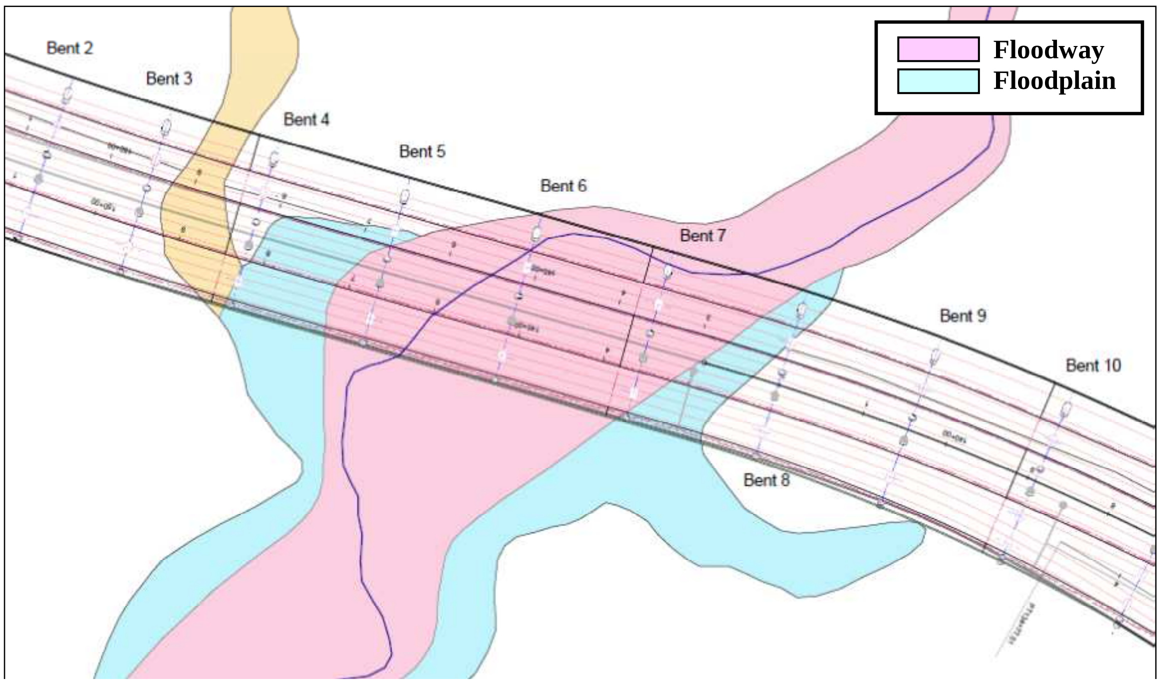

Figure 42. East Roseville Viaduct Bridge Encroachments on Antelope Creek Floodplain/Floodway (All Alternatives)

6.1.6 Freeboard

The lowest soffit elevation for the existing and proposed East Roseville Viaduct bridges is 239.3 ft (NGVD 29). The amount of available freeboard is summarized in Table 8.

Caltrans' freeboard requirements of 2 ft above the 50-year flow or conveying the 100-year flow and CVFPB freeboard requirement of 2ft above the 100-year flow would be met by all of the alternatives.

Table 8. WSE of Existing and Proposed Bridges at Antelope Creek

Bridge	Location	50-year (ft NGVD 29)		100-year (ft NGVD 29)	
		WSE	Freeboard	WSE	Freeboard
Existing Bridge	Upstream Face of Structure	172.46	66.84	174.49	64.81
	Downstream Face of Structure	174.22	65.08	174.36	64.94
Alternative 1, Alternative 2 & Alternative 3	Upstream Face of Structure	172.39	66.91	174.44	64.86
	Downstream Face of Structure	172.23	67.07	174.36	64.94

6.1.7 Upstream Flow Velocities

The flow velocities around the proposed bridges are the same for the different alternatives (see Table 9). The velocities at the bridges are higher than the velocities upstream and downstream of the bridges as determined by the constriction of the bridge opening. However, the flows are approximately the same for the different alternatives, likely due to the same number of spans and openings between bents.

Table 9. Antelope Creek Flow Velocities

Location	Velocity (ft per second)					
	Existing		Proposed Alternative 1		Proposed Alternative 2 and 3	
	50-year	100-year	50-year	100-year	50-year	100-year
Upstream of Structure	4.02	3.58	4.07	3.60	4.06	3.60
Upstream Face of Structure	4.53	4.04	4.59	4.07	4.58	4.07
Downstream Face of Structure	3.43	3.00	3.42	3.00	3.42	3.00
Downstream of Structure	3.43	2.75	3.43	2.75	3.43	2.75

6.2 EN and SE Connectors at Secret Ravine

A hydraulic model of the Dry Creek watershed developed by the PCFCWCD was used to model the proposed EN and SE Interchange connectors. The existing connectors do not encroach on the Secret Ravine floodplain. However, the proposed connectors have bents that will encroach on the floodway and floodplain. The impacts caused by the proposed build alternatives were estimated using the modeling developed for Secret Ravine in the vicinity of the connector encroachments. The water surface profile plots, water profile summary tables, and channel cross sections are included in Appendix B.2 for the modeled existing and proposed bridges.

6.2.1 Cross Section Data

A total of 46 cross sections were used to model the existing and proposed conditions for Alternative 1, and 56 cross sections were used to model the existing and proposed conditions for Alternative 2 and Alternative 3 of the I-80/SR 65 connectors at Secret Ravine.

6.2.2 Model Boundary Condition

Known WSEs were obtained from Placer County's effective HEC-RAS model. The WSE refers to the National Geodetic Vertical Datum of 1929 (NGVD 29). A WSE of 183.1 ft was selected as the downstream boundary condition for the 100-year flow. A known WSE of 181.5 ft was selected as the downstream boundary condition for the 50-year flow.

6.2.3 Manning's Roughness Coefficients

The Manning's roughness coefficients were obtained from the PCFCWCD model and were found to be consistent with the values used by FEMA in the effective FIS hydraulic study. Roughness values of 0.07 for the main channel and 0.1 for the overbanks were used. . It is assumed that PCFCWCD's model roughness coefficient values reflect present hydraulic conditions.

6.2.4 Expansion and Contraction Coefficients

The expansion and contraction coefficients used in the channel were 0.3 and 0.1, respectively. These values represent a channel with gradual transitions between cross sections. The expansion and contraction coefficients used in the vicinity of the bridge were 0.5 and 0.3, respectively. These values represent the flow interference caused by the bridge structure.

6.2.5 Water Surface Elevations

The following tables (Table 10, Table 11, Table 12, and Table 13) summarize the WSE changes caused by bent encroachments on the Secret Ravine floodplain/floodways (Figure 43, Figure 44, Figure 45, and Figure 46 show the Secret Ravine floodplain/floodway encroachment caused by the build alternatives). The pier with the higher WSE from the cross sections is reported in the summary tables. Refer to Figure 24, Figure 26, and Figure 29 for the EN Connector Planning Studies, and Figure 31, Figure 32 and Figure 33 for the SE Connector Planning Studies proposed for each alternative.

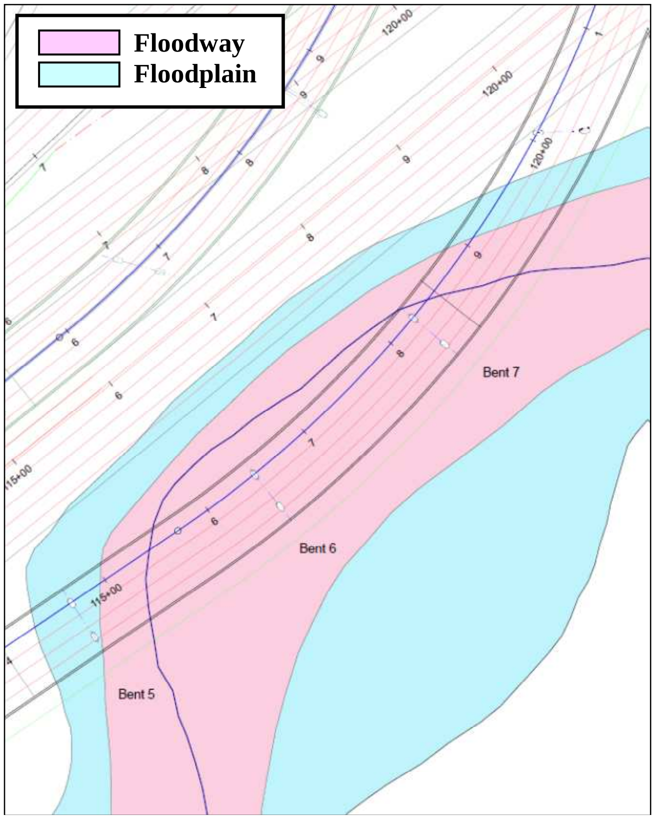

Figure 43. EN Connector Encroachments on Secret Ravine Floodplain/Floodway (Alternative 1)

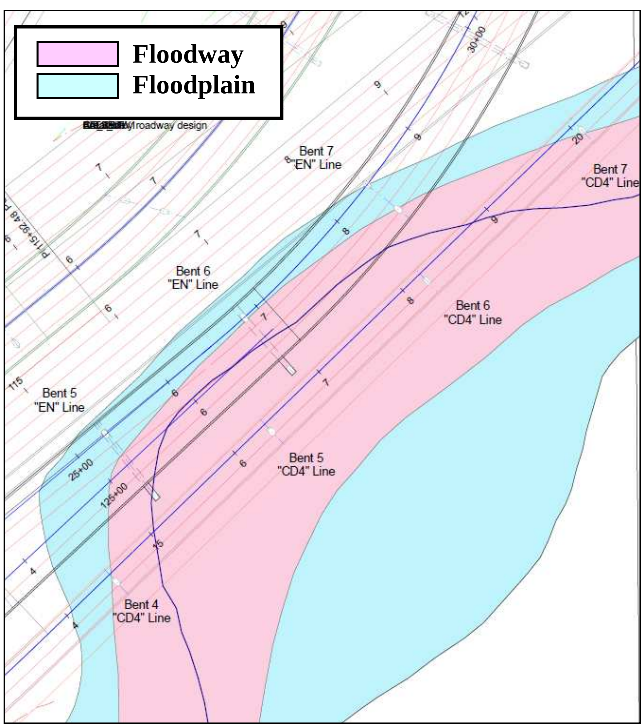

Figure 44. EN Connector Encroachments on Secret Ravine Floodplain/Floodway (Alternatives 2 and 3)

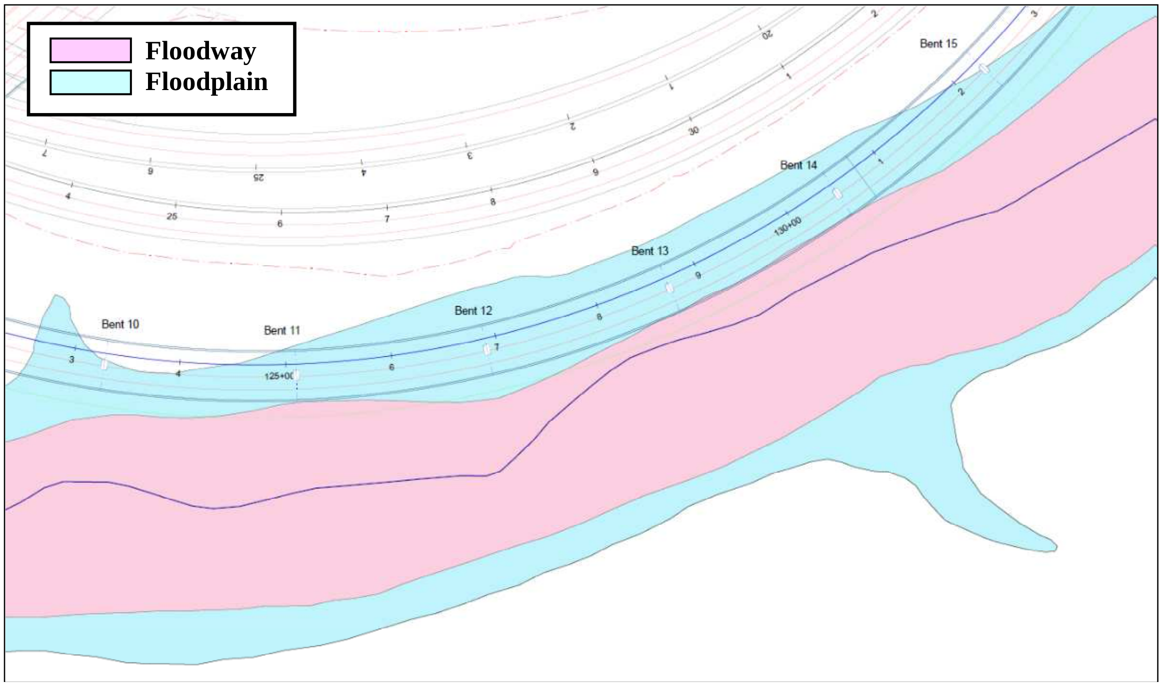

Figure 45. SE Connector Encroachments on Secret Ravine Floodplain/Floodway (Alternative 1)

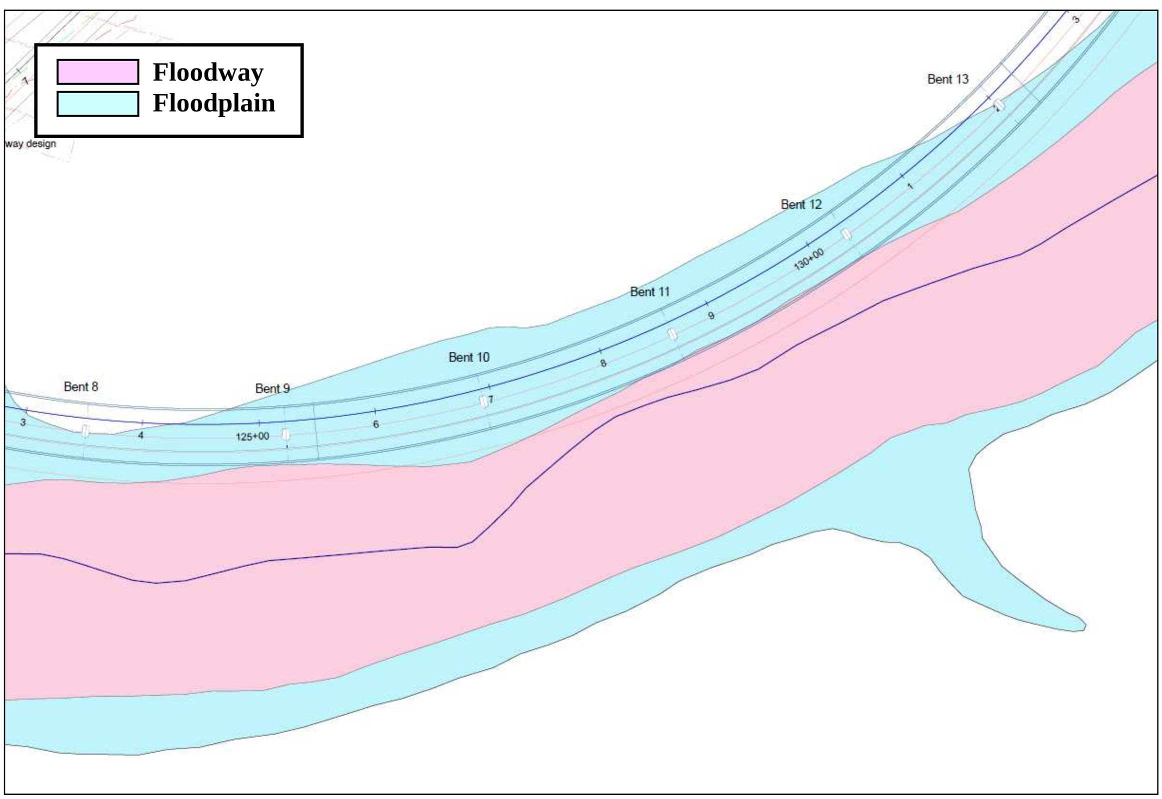

Figure 46. SE Connector Encroachments on Secret Ravine Floodplain/Floodway (Alternatives 2 and 3)

Table 10. 50-year WSE of Existing and Proposed Bridges at Secret Ravine (Alternative 1)

Structure	Bent	River Station	50-year (ft NGVD 29)			
			Existing WSE	Freeboard	Proposed WSE	Freeboard
EN Connector	5SE	3620.38	183.87	N/A	183.89	48.87
	5NW	3646.17	184.07	N/A	184.10	48.66
	6	3782.96	184.82	N/A	184.88	47.88
	7NW	3926.63	185.56	N/A	185.49	47.27
	7SE	3944.57	185.72	N/A	185.84	46.92
SE Connector	10	4874.59	188.98	N/A	189.01	58.47
	11	5054.59	189.76	N/A	189.77	57.69
	12	5234.59	190.49	N/A	190.51	56.97
	13	5414.59	191.05	N/A	191.08	56.41
	14	5594.59	191.54	N/A	191.59	55.92
	15	5774.59	191.82	N/A	191.87	55.65

Note: N/A- Freeboard is not available because there are no existing bridges over Secret Ravine at these locations.

Table 11. 100-year WSE of Existing and Proposed Bridges at Secret Ravine (Alternative 1)

Structure	Bent	River Station	100-year (ft NGVD 29)			
			Existing WSE	Freeboard	Proposed WSE	Freeboard
EN Connector	5SE	3620.38	184.24	N/A	184.25	48.51
	5NW	3646.17	184.40	N/A	184.43	48.33
	6	3782.96	185.10	N/A	185.15	47.61
	7NW	3926.63	185.79	N/A	185.73	47.03
	7SE	3944.57	185.95	N/A	186.07	46.69
SE Connector	10	4874.59	189.22	N/A	189.25	58.22
	11	5054.59	190.00	N/A	190.01	57.46
	12	5234.59	190.73	N/A	190.75	56.72
	13	5414.59	191.29	N/A	191.32	56.15
	14	5594.59	191.78	N/A	191.83	55.64
	15	5774.59	192.06	N/A	192.11	55.36

Note: N/A- Freeboard is not available because there are no existing bridges over Secret Ravine at these locations.

Table 12. 50-year WSE of Existing and Proposed Bridges at Secret Ravine (Alternatives 2 and 3)

Structure	Bent	River Station	50-yr WSE (ft NGVD-29)			
			Existing	Freeboard	Proposed	Freeboard
EB I-80 On-Ramp	4	3525.80	183.07	N/A	183.11	32.34
EN Connector	5SE	3597.97	183.77	N/A	183.85	31.60
	5NW	3674.57	184.31	N/A	184.36	31.09
EB I-80 On-Ramp	5	3804.85	184.93	N/A	185.01	30.44
EN Connector	6NW	3838.72	185.08	N/A	185.14	30.31
	6SE	3848.98	185.13	N/A	185.23	30.22
	7NW	3979.42	186.11	N/A	186.15	29.30
	7SE	3995.05	186.31	N/A	186.37	29.08
EB I-80 On-Ramp	6	3997.66	186.34	N/A	186.41	29.04
	7	4156.60	186.92	N/A	186.98	28.47
SE Connector	8	4894.02	189.06	N/A	189.07	48.43
	9	5074.02	189.85	N/A	189.85	47.65
	10	5250.63	190.56	N/A	190.58	46.92
	11	5426.73	191.10	N/A	191.12	46.38
	12	5597.02	191.56	N/A	191.61	45.89
	13	5767.30	191.81	N/A	191.87	45.63

Note: N/A- Freeboard is not available because there are no existing bridges over Secret Ravine at these locations.

Table 13. 100-year WSE of Existing and Proposed Bridges at Secret Ravine (Alternatives 2 and 3)

Structure	Bent	River Station	100-yr WSE (ft NGVD-29)			
			Existing	Freeboard	Proposed	Freeboard
EB I-80 On-Ramp	4	3525.80	183.64	N/A	183.67	31.78
EN Connector	5SE	3597.97	184.15	N/A	184.22	31.23
	5NW	3674.57	184.61	N/A	184.67	30.78
EB I-80 On-Ramp	5	3804.85	185.20	N/A	185.27	30.18
EN Connector	6NW	3838.72	185.33	N/A	185.39	30.06
	6SE	3848.98	185.38	N/A	185.48	29.97
	7NW	3979.42	186.34	N/A	186.38	29.07
	7SE	3995.05	186.53	N/A	186.60	28.85
EB I-80 On-Ramp	6	3997.66	186.56	N/A	186.63	28.82
	7	4156.60	187.14	N/A	187.20	28.25
SE Connector	8	4894.02	189.30	N/A	189.31	48.19
	9	5074.02	190.09	N/A	190.09	47.41
	10	5250.63	190.80	N/A	190.81	46.69
	11	5426.73	191.33	N/A	191.35	46.15
	12	5597.02	191.80	N/A	191.85	45.65
	13	5767.30	192.05	N/A	192.12	45.38

Note: N/A- Freeboard is not available because there are no existing bridges over Secret Ravine at these locations

6.2.6 Freeboard

The lowest soffit elevation for the proposed EN Connector bridge used to determine the amount of available freeboard was 232.76 ft (NGVD 29) for Alternative 1 and 215.45 ft (NGVD 29) for Alternatives 2 and 3. The lowest soffit elevation used for the proposed SE Connector bridge is 247.47 ft (NGVD 29) for Alternative 1 and 237.50 ft (NGVD 29) for Alternative 2 and 3. The freeboards of the bridges are summarized in Table 10, Table 11, Table 12, and Table 13 for each flood recurrence interval and the different alternatives.

Caltrans' and CVFPB's freeboard requirements of 2 ft above the 50-year flow or conveying the 100-year flow will be met by all the alternatives.

6.2.7 Upstream Flow Velocities

The flow velocities are provided in Table 14 for Alternative 1 and Table 15 for Alternatives 2 and 3. The tables show that there is a general slight increase in the velocities due to the added bents of the EN and SE connectors proposed by all the build alternatives.

Table 14. Alternative 1 Secret Ravine Flow Velocities

Structure	Bent	River Station	Velocity (ft per second)			
			Existing		Proposed Alternative 1	
			50-year	100-year	50-year	100-year
EN Connector	5SE	3620.38	6.0	5.8	6.3	6.1
	5NW	3646.17	5.8	5.7	6.0	5.9
	6	3782.96	5.2	5.3	5.2	5.2
	7NW	3926.63	6.3	6.4	7.2	7.3
	7SE	3944.57	6.2	6.2	6.3	6.4
SE Connector	10	4874.59	5.5	5.6	5.5	5.6
	11	5054.59	5.5	5.6	5.6	5.7
	12	5234.59	5.1	5.2	5.4	5.5
	13	5414.59	4.7	4.7	4.9	5.0
	14	5594.59	3.5	3.6	3.5	3.6
	15	5774.59	4.3	4.4	4.3	4.4

Table 15. Alternatives 2 and 3 Secret Ravine Flow Velocities

Structure	Bent	River Station	Velocity (ft per second)			
			Existing		Proposed Alternatives 2 and 3	
			50-year	100-year	50-year	100-year
EB I-80 On-Ramp	4	3525.80	6.8	6.2	6.8	6.1
EN Connector	5SE	3597.97	6.1	5.9	6.0	5.8
	5NW	3674.57	5.5	5.5	5.5	5.5
EB I-80 On-Ramp	5	3804.85	5.4	5.5	5.3	5.4
EN Connector	6NW	3838.72	5.7	5.8	6.0	6.1
	6SE	3848.98	5.8	5.9	5.8	5.9
	7NW	3979.42	5.6	5.6	5.7	5.8
	7SE	3995.05	4.9	5.0	5.0	5.1
EB I-80 On-Ramp	6	3997.66	4.8	4.9	4.8	4.9
	7	4156.60	4.8	4.9	4.7	4.8
SE Connector	8	4894.02	5.6	5.7	5.7	5.8
	9	5074.02	5.4	5.5	5.6	5.7
	10	5250.63	5.0	5.1	5.3	5.4
	11	5426.73	4.6	4.7	4.9	5.0
	12	5597.02	3.4	3.5	3.6	3.7
	13	5767.30	4.2	4.3	4.3	4.4

6.3 Miners Ravine Bridge and Ramps at Miners Ravine

The PCFCWCD's hydraulic model of the Dry Creek watershed was used to model the proposed Miners Ravine bridge over Miners Ravine widening, the I-80 off-ramp to Eureka Road bridge over Miners Ravine widening, and the I-80 loop on-ramp from Eureka Road near Miners Ravine realignment. After coordinating with the County, WRECO modified the County-provided HEC-RAS model for the I-80 bridge over Miners Ravine location based on the existing site conditions. PCDCWCD's hydraulic model design flows were lower than FEMA FIS's design flows; therefore, WRECO used FEMA FIS's design flows to be conservative.

The Miners Ravine Bridge and the Miners Ravine Bridge (Widen) Off-Ramp, alternatives 2 and 3, were not modeled as bridge structures. This approach was taken to capture the impacts due to the realignment of the loop on-ramp to Eureka Road and the amount of sufficient available freeboard available at the off-ramp bridge. The water surface profile plots, hydraulic summary tables, and channel cross sections are included in Appendix B.3 for the modeled existing and proposed bridges.

6.3.1 Cross Section Data

A total of 33 cross sections were used to model the existing and proposed conditions.

6.3.2 Model Boundary Condition

Due to lack of water surface information for the 50-year event from FEMA FIS, a normal depth slope of 0.006 ft/ft, which corresponds to a WSE 153.3 ft for the 100-year event and a WSE of 152.8 ft for the 50-year event, was used as a boundary condition. The normal depth slope was determined using the ground profile of the channel in the proximities of the Project improvements.

6.3.3 Manning's Roughness Coefficients

The Manning's roughness coefficients from the PCFCWCD's model were used. The values vary along the different locations of the modeled reach and can be obtained from the HEC-RAS outputs provided in Appendix B.3. The roughness values for the Miners Ravine bridge and modeled ramp locations were 0.055 for the left overbank, 0.04 for the right overbank and 0.05 for the main channel. It is assumed that PCFCWCD's model roughness coefficient values reflect present hydraulic conditions.

6.3.4 Expansion and Contraction Coefficients

The expansion and contraction coefficients used in the channel were 0.3 and 0.1, respectively. These values represent a channel with gradual transitions between cross sections. The expansion and contraction coefficients used in the vicinity of the bridge were 0.5 and 0.3, respectively. These values represent the flow interference caused by the bridge structure.

6.3.5 Ineffective Flow Areas

The ineffective flow areas represent areas in the cross section that can contain water that is not conveyed. Ineffective flow areas were included in the HEC-RAS model to describe the portion of the proposed bridges river cross sections in which water will pond but the velocity of the water, in the downstream direction, is close or equal to zero. The floodplain encroachment of proposed loop onramps to eastbound State Route (SR-80) is taken into account in the permanent ineffective flow areas of Alternative 1 and Alternative 3 bridges.

6.3.6 Water Surface Elevations

The WSEs for the existing and proposed build alternatives are summarized in Table 16 to Table 21. There is a decrease at the bents and abutments of the Miners Ravine bridge and Miners Ravine bridge (widen) off-ramp as a result of increased channel flow velocity at the proposed abutments and bents by the build alternatives (see Figure 47, Figure 48 and Figure 49 for the bent and loop ramp encroachment overlays on the Miners Ravine floodplain/floodway). There is no change in WSE at the upstream face of the Miners Ravine bridge. The results include the impacts from the realignment of the loop on-ramp from Eureka Road.

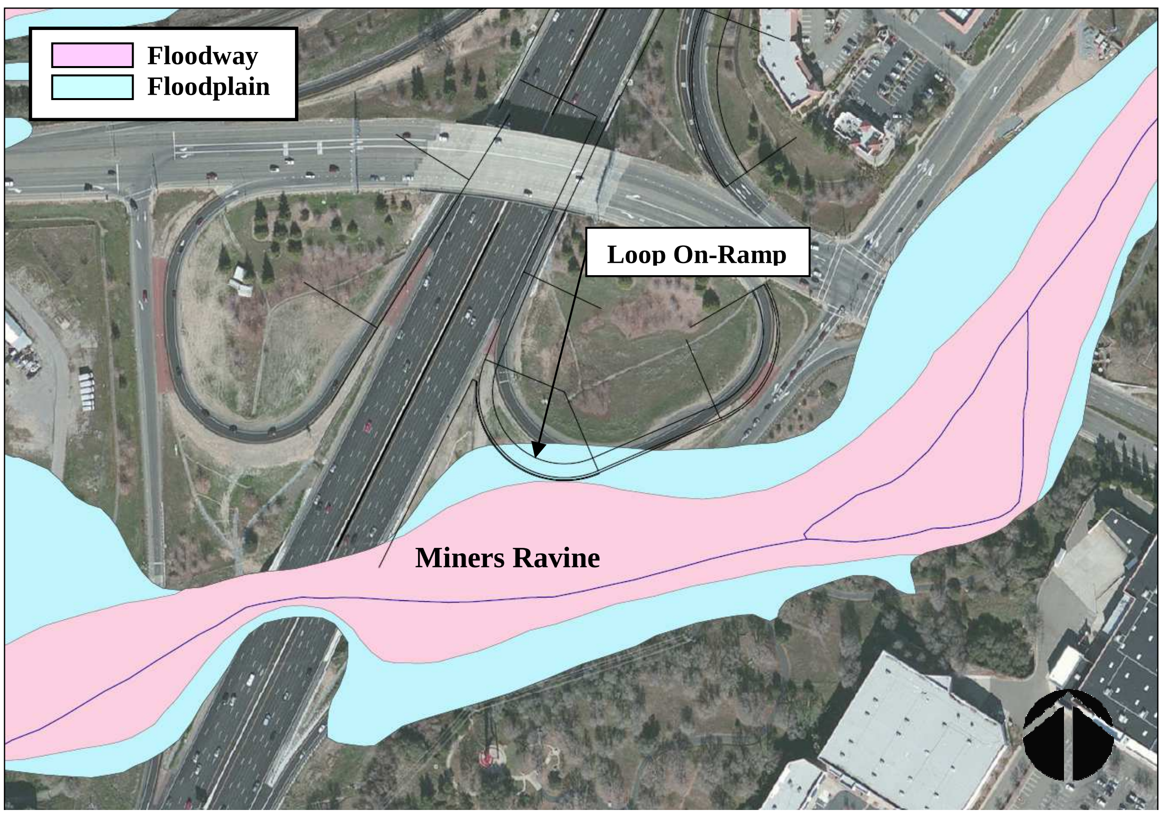

Figure 47. I-80 Eureka Road On-ramp Encroachments on Miners Ravine Floodplain (Alternative 1)

Table 16. 50-year WSE of Existing and Proposed Bridges at Miners Ravine (Alternative 1)

Structure	Bent/ Abutment	River Station	50-year WSE (ft NGVD 29)			
			Existing	Freeboard	Alt 1	Freeboard
	-	218.00	159.46	N/A	159.46	N/A
I-80 Bridge	-	219.00	159.38	23.42	159.38	23.42
	-	220.00	160.66	22.14	160.66	22.14
	-	221.00	160.94	N/A	160.94	N/A
Existing Miners Ravine Bridge Off-Ramp	-	223.33	161.50	14.24	161.50	14.24
	-	224.31	161.61	14.13	161.61	14.13
	-	226.00	161.72	14.02	161.72	14.02
	-	228.00	162.00	13.74	162.00	13.74
	-	229.10	162.46	13.28	162.46	13.28

Note: N/A- Freeboard is not available because the corresponding cross section is not located at a bridge.

Table 17. 100-year WSE of Existing and Proposed Bridges at Miners Ravine (Alternative 1)

Structure	Bent/ Abutment	River Station	100-year WSE (ft NGVD 29)			
			Existing	Freeboard	Alt 1	Freeboard
	-	218.00	159.89	N/A	159.89	N/A
I-80 Bridge	-	219.00	159.81	22.99	159.81	22.99
	-	220.00	161.21	21.59	161.21	21.59
	-	221.00	161.52	N/A	161.52	N/A
Existing Miners Ravine Bridge Off-Ramp	-	223.33	162.12	13.62	162.12	13.62
	-	224.31	162.22	13.52	162.22	13.52
	-	226.00	162.33	13.41	162.33	13.41
	-	228.00	162.61	13.13	162.61	13.13
	-	229.10	163.04	12.70	163.04	12.70

Note: N/A- Freeboard is not available because the corresponding cross section is not located at a bridge.

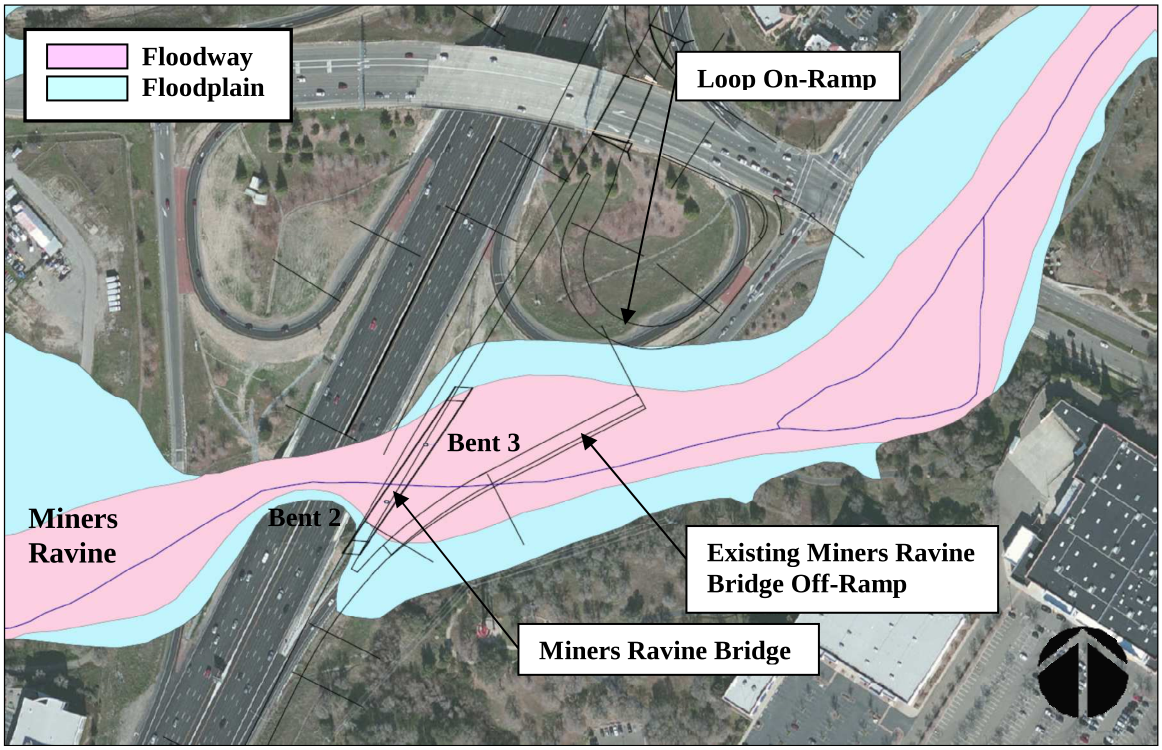

Figure 48. I-80 Eureka Road On-ramp and Miners Ravine Bridge Encroachments on Miners Ravine Floodway and/or Floodplain (Alternative 2)

Table 18. 50-year WSE of Existing and Proposed Bridges at Miners Ravine (Alternative 2)

Structure	Bent/ Abutment	River Station	50-year WSE (ft NGVD 29)			
			Existing	Freeboard	Alt 2	Freeboard
	-	218.00	159.46	N/A	159.46	N/A
I-80 Bridge	-	219.00	159.38	23.42	159.38	23.42
	-	220.00	160.66	22.14	160.66	22.14
	-	221.00	160.94	N/A	160.94	N/A
Miners Ravine Bridge	1	221.13	161.10	N/A	161.10	19.32
	2	222.00	161.53	N/A	161.50	18.92
	3	224.00	161.54	N/A	161.56	14.18
	4	224.50	161.53	N/A	161.57	14.17
Existing Miners Ravine Bridge Off-Ramp	-	226.0	161.71	14.03	161.69	14.05
	-	228.00	162.12	13.62	161.93	13.81
	-	228.28	162.84	12.90	162.73	13.01

Note: N/A- Freeboard is not available because the corresponding cross section is not located at a bridge.

Table 19. 100-year WSE of Existing and Proposed Bridges at Miners Ravine (Alternative 2)

Structure	Bent/ Abutment	River Station	100-year WSE (ft NGVD 29)			
			Existing	Freeboard	Alt 2	Freeboard
	-	218.00	159.89	N/A	159.89	N/A
I-80 Bridge	-	219.00	159.81	22.99	159.81	22.99
	-	220.00	161.21	21.59	161.21	21.59
	-	221.00	161.52	N/A	161.52	N/A
Miners Ravine Bridge	1	221.13	161.68	N/A	161.68	18.74
	2	222.00	162.15	N/A	162.12	18.30
	3	224.00	162.18	N/A	162.17	13.57
	4	224.50	162.15	N/A	162.19	13.55
Existing Miners Ravine Bridge Off-Ramp	-	226.0	162.33	13.41	162.31	13.43
	-	228.00	162.69	13.05	162.50	13.24
	-	228.28	163.40	12.34	163.28	12.46

Note: N/A- Freeboard is not available because the corresponding cross section is not located at a bridge.

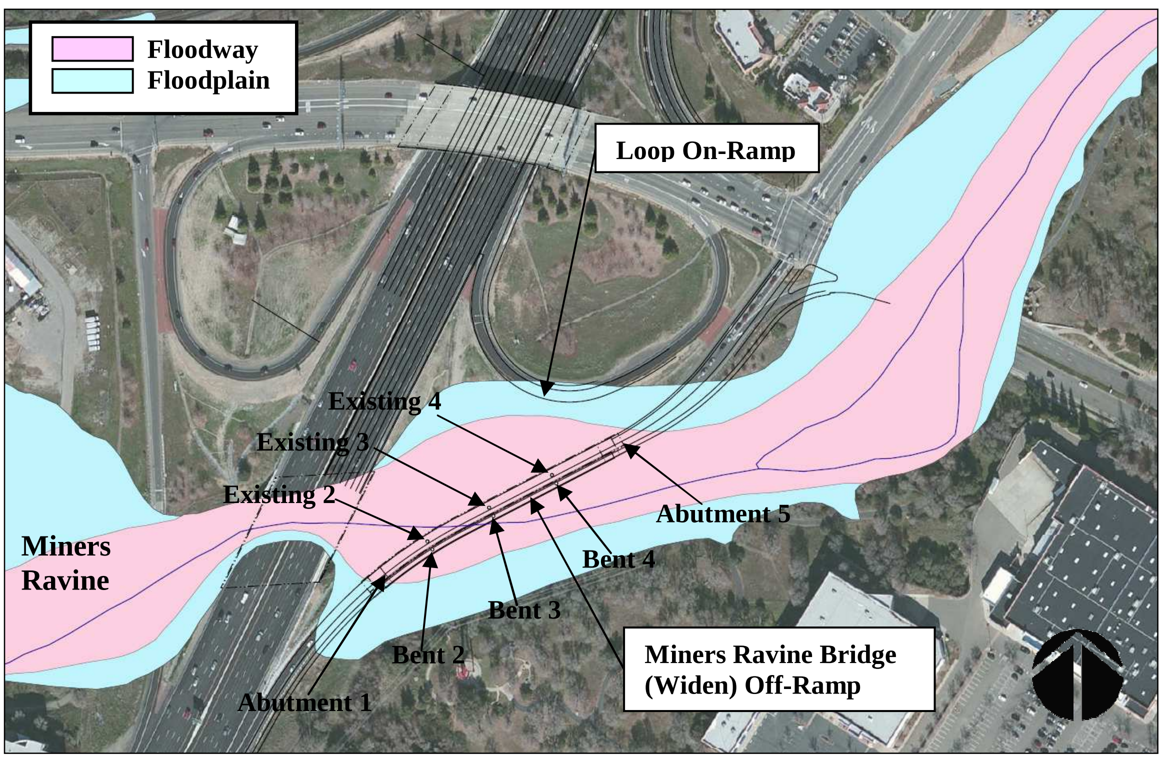

Figure 49. I-80 Eureka Road on-ramp and Miners Ravine Bridge (Widen) Encroachments on Miners Ravine Floodway and/or Floodplain (Alternative 3)

Table 20. 50-year WSE of Existing and Proposed Bridges at Miners Ravine (Alternative 3)

Structure	Bent/ Abutment	River Station	50-year WSE (ft NGVD 29)			
			Existing	Freeboard	Alt 3	Freeboard
	-	218.00	159.46	N/A	159.46	N/A
I-80 Bridge	-	219.00	159.38	23.42	159.38	23.42
	-	220.00	160.66	22.14	160.66	22.14
	-	221.00	160.94	N/A	160.94	N/A
		222.00	161.48	14.26	161.48	14.26
Miners Ravine Bridge (Widen) Off-Ramp	1	223.33	161.50	14.24	161.50	14.24
	2 (Existing)	224.31	161.61	14.13	161.61	14.13
	2	224.50	161.60	14.14	161.59	14.15
	3 (Existing)	226.00	161.72	14.02	161.73	14.01
	3	226.16	161.76	13.98	161.81	13.93
	4 (Existing)	228.00	162.00	13.74	162.07	13.67
	4	228.07	162.06	13.68	162.09	13.65
	5	229.10	162.46	13.28	162.52	13.22

Note: N/A- Freeboard is not available because the corresponding cross section is not located at a bridge.

Table 21. 100-year WSE of Existing and Proposed Bridges at Miners Ravine (Alternative 3)

Structure	Bent/ Abutment	River Station	100-year WSE (ft NGVD 29)			
			Existing	Freeboard	Alt 3	Freeboard
	-	218.00	159.89	N/A	159.89	N/A
I-80 Bridge	-	219.00	159.81	22.99	159.81	22.99
	-	220.00	161.21	21.59	161.21	21.59
	-	221.00	161.52	N/A	161.52	N/A
		222.00	162.10	13.64	162.10	13.64
Miners Ravine Bridge (Widen) Off-Ramp	1	223.33	162.12	13.62	162.12	13.62
	2 (Existing)	224.31	162.22	13.52	162.22	13.52
	2	224.50	162.21	13.53	162.20	13.54
	3 (Existing)	226.00	162.33	13.41	162.35	13.39
	3	226.16	162.37	13.37	162.43	13.31
	4 (Existing)	228.00	162.61	13.13	162.68	13.06
	4	228.07	162.66	13.08	162.69	13.05
	5	229.10	163.04	12.70	163.10	12.64

Note: N/A- Freeboard is not available because the corresponding cross section is not located at a bridge.

6.3.7 Freeboard

The freeboards of the bridges are summarized in Table 16 to Table 21 for each flood recurrence interval and the different alternatives.

Caltrans' freeboard requirements of 2 ft above the 50-year flow or conveying the 100-year flow will be met by all the alternatives sufficiently.

6.3.8 Upstream Flow Velocities

The velocities from the Eureka Road off-ramp abutment to cross sections located downstream of the Miners Ravine bridge are provided in Table 22. The velocities at the right abutment of the Eureka Road off-Ramp decrease in the proposed conditions, while the velocities at the downstream face of the Miners Ravine bridge increase.

Table 22. Miners Ravine Flow Velocities

River Station	Velocity (ft per second)							
	50-year				100-year			
	Existing	Alt. 1	Alt. 2	Alt. 3	Existing	Alt. 1	Alt. 2	Alt. 3
218.00	6.8	6.8	6.8	6.8	7.2	7.2	7.2	7.2
219.00	8.7	8.7	8.7	8.7	9.2	9.2	9.2	9.2
220.00	7.3	7.3	7.3	7.3	7.7	7.7	7.7	7.7
221.00	6.1	6.1	6.1	6.1	6.4	6.4	6.4	6.4
221.13	5.4	-	5.4	-	5.7	-	5.7	-
222.00	2.9	2.9	2.9	2.9	3.0	3.0	3.0	3.0
223.33	3.9	3.9	3.4	3.9	4.0	4.0	3.5	4.0
224.00	3.2	3.2	3.7	3.2	3.3	3.3	3.9	3.3
224.50	4.8	5.0	4.6	5.0	4.9	5.2	4.7	5.2
226.00	6.0	6.0	6.7	6.0	6.1	6.1	6.7	6.1
228.00	7.8	7.8	10.7	7.8	8.0	7.9	11.0	7.9
228.29	7.6	-	-	-	7.7	-	-	-
228.83	8.0	7.1	-	7.1	8.3	7.1	-	7.1

7 SCOUR

WRECO evaluated bridge scour per the criteria described in the FHWA HEC-18, *Evaluating Scour at Bridges* (Fifth Edition).

The minimum design criterion for bridge scour is the 100-year design storm. WRECO evaluated the scour potential for the proposed Project using the results of the steady state flow analysis from HEC-RAS.

Per the boring logs prepared for the Project, the soil at the site is sand and silty sand. Subsurface investigation and testing have not been performed in the current phase. Based on this description, a D_{50} equal to 0.2 mm has been assumed and used for the scour calculations. The Project-specific D_{50} would be used for calculation in the next phase when information is available.

7.1 Existing Channel Bed and Long-Term Bed Elevation Change

A Structures Preliminary Geotechnical Report of the Project site by Blackburn Consulting (June 2013) states that the waterways within the Project limits are expected to contain alluvium at and near the stream banks and active channel base. Alluvium likely consists of several feet of loose sand and gravel with some cobbles and boulders (see Appendix C.1 for the Project Geologic Map). Engineered embankment fill consisting of clay, silt, and gravel was also observed at a number of locations along the Project corridor.

The long-term bed elevation changes were estimated using information from the as-built plans of the proposed alternatives when sufficient information was available.

7.1.1 East Roseville Viaduct at Antelope Creek

The Project-specific geotechnical report states that at the East Roseville Viaduct, the main channel area (north end of the viaduct) consists of hard and/or dense cohesive soils within 5 to 8 ft of the ground surface based on a Caltrans as-built plan of 1987 (see Appendix C.2 for the 1987 Caltrans as-built's log boring test results). These soils are reported to be resistant to scour.

Additionally, a 2010 Caltrans bridge inspection report (BIR) for East Roseville Viaduct at Antelope Creek identifies the Antelope Creek channel as a meandering channel with a moderate slope and fine-graded bed. A Caltrans Foundation Recommendation Memorandum, dated 1984, identifies approximately the top 70 ft of the soil between Abutment 1 (the first eastern Abutment) and Bent 13 to be weakly cemented dense to very dense sands and hard silty clays. Below 70 ft in depth, predominantly very hard clays and very dense sands were encountered. From Bent 13 to Abutment 15 (the last western Abutment) only dense to very dense sands were encountered up to an approximate depth of 110 ft. In the swales and on the Antelope Creek floodplain, the surficial deposits may be loose to compact sands and soft to stiff clays.

Information on channel bed elevation changes was not found for the East Roseville Viaduct bridge channel. Due to this lack of sufficient information, a conclusion could not be made about the rate of change of the channel bed. However, the bridge should be monitored in the future for stream bed stability.

7.1.2 EN and SE Connectors at Secret Ravine

The Project specific geotechnical report states that at the EN and SE connectors, there is no available subsurface data where the connector would be adjacent to Secret Ravine. However, it is expected that at this location it is underlain (4 to 8 ft in depth) by scour-resistant rock of the Mehrten Formation at relatively shallow depths and possibly granitic rock at the east end. Existing embankment fill located adjacent to the creek bed would have a high scour potential.

Because there is no Caltrans BIR or Foundation Recommendation Memorandum for the location at the EN and SE connectors, a conclusion could not be made about the rate of change of the channel bed.

7.1.3 Miners Ravine Bridges at Miners Ravine

7.1.3.1 Miners Ravine Bridge

The Project-specific geotechnical report states that the as-built log of boring tests indicates that adjacent to the main channel, dense to very dense, sandy gravel and silt, and hard, volcanic breccia are present within 8 ft of the ground surface. These soils will generally be resistant to scour.

Miners Ravine channel bed at I-80 is described to be composed of sand, gravel, and cobbles, according to a 2011 Caltrans BIR. Boring sample tests (dated 1989) taken from the areas near the bridge faces also show that the surface soil is mainly made of sand (loose silty sand to dense sand with rounded gravel). See Appendix C.3 for boring sample test results.

A Caltrans BIR (02/17/2005) states that based on a scour evaluation performed using a previous hydraulic analysis, the bridge was determined not to be scour critical. The bridge foundations were determined to be stable for calculated scour conditions and scour within the limits of footings or piles. A comparison of channels dated 07/12/2012 from a Caltrans BIR shows a degradation of 8.5 ft of the stream channel thalweg from 1955 to 1992 (see Figure 50 for the stream bed elevation comparison).

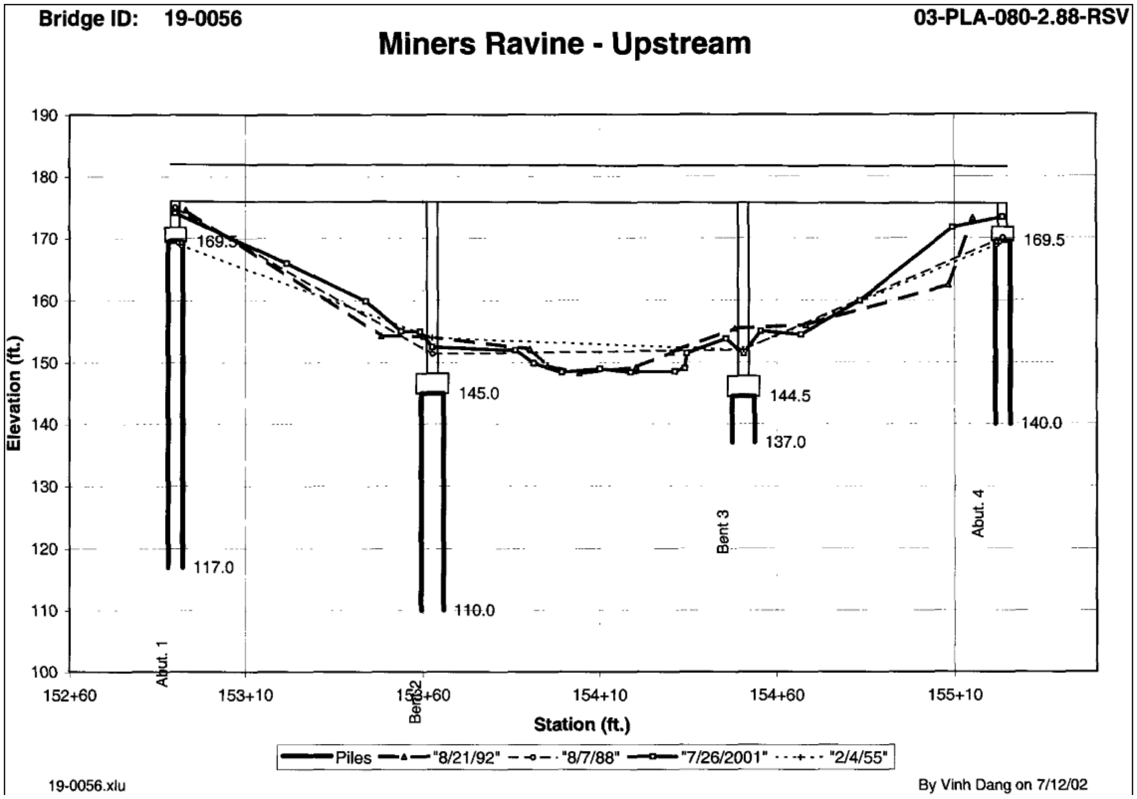

Figure 50. Miners Ravine at I-80 Stream Bed Elevation Comparison

Source: Caltrans BIR (2002)

7.1.3.2 Miners Ravine Off-Ramp to Eureka Road

Boring sample tests (dated 1989) obtained from a Caltrans BIR show that the soil found up to approximately 10 ft below the surface consists of mainly silty sand with some amounts of coarse sandy gravel (and cobble in some locations). Appendix C.4 provides boring sample test results. The long-term bed change calculated for the Miners Ravine bridge of 8.5 ft is considered to apply for this off-ramp.

7.2 Contraction Scour

Contraction scour occurs when the flow area of a stream at flood stage is reduced, either by natural contraction of the stream channel or by a bridge. It also occurs when overbank flow is forced back into the channel by roadway embankments at the approaches to a bridge. From the continuity equation, a decrease in flow area results in an increase in average velocity and bed shear stress through the contraction. Hence, there is an increase in erosive forces in the contracted section, and more bed material is removed from the contracted reach than is transported into the reach. This increase in transport of bed material from the reach lowers the natural bed elevation. As the bed elevation is lowered, the flow area increases. Thus, the velocity and shear stress decrease until relative equilibrium is reached; i.e., the quantity of bed material that is transported into the reach is equal to that removed from the reach, or the bed shear stress is decreased to a value such that no sediment is transported out of the reach. Contraction scour, in a natural channel or at a bridge crossing, involves removal of material from the bed across all or most of the channel width (FHWA 2001).

For cohesionless soils, contraction scour is classified to be clear-water or live-bed, and depends on the stream flow. Live-bed contraction scour occurs when the bed material upstream of the construction is in motion. Clear-water contraction scour occurs when the bed material is not in motion. To determine whether clear-water or live-bed contraction scour is occurring, the calculated average approach velocity is compared to the threshold velocity at which incipient motion of the bed material is expected (or the critical velocity, V_C). If V_C is greater than the mean channel velocity, clear-water scour will be assumed. The critical velocity was calculated using the following equation (Section 3.5.3.1, Equation 11).

$$V_c = K_u y^{1/6} D_{50}{}^{1/3}$$

Where:

V_c = critical velocity above which bed material size of D and smaller will be transported (ft/sec)
D = particle size for V_c (ft)
y = average depth of flow upstream of the bridge (ft)
D_{50} = particle size in a mixture of which 50 percent are smaller (ft)
K_u = 6.19 for SI units and 11.17 for English units

The Live-Bed Contraction Equation is given below:

$$\frac{y_2}{y_1} = \left(\frac{Q_2}{Q_1}\right)^{6/7} \left(\frac{W_1}{W_2}\right)^{k_1}$$

$y_s = y_2 - y_0$ = (average contraction scour depth)

Where:

y_s = Scour depth, ft
y_1 = Average depth in upstream main channel, ft
y_2 = Average depth in contracted section, ft
y_0 = Existing depth in the contracted section before scour, ft
Q_1 = Flow in the upstream channel transporting sediment, ft^3/s
Q_2 = Flow in contracted channel, ft^3/s
W_1 = Bottom width of the upstream main channel that is transporting bed material, ft
W_2 = Bottom width of main channel in contracted section less pier width(s), ft
k_1 = Exponent determined below

V^*/ω	k_1	Mode of Bed Material Transport
<0.50	0.59	Mostly contact bed material discharge
0.50 to 2.0	0.64	Some suspended bed material discharge

>2.0	0.69	Mostly suspended bed material discharge

$V^* = (\tau_0/\rho)^{1/2} = (gy_1S_1)^{1/2}$, shear velocity in the upstream section, ft/s

ω = Fall velocity of bed material based on the D_{50}, ft/s
g = Acceleration of gravity (32.2 ft/s^2)
S_1 = Slope of energy grade line of main channel, ft/ft
τ_0 = Shear stress on the bed, lb/ft^2
ρ = Density of water (1.94 slugs/ft^3)

The live-bed scour results are summarized in Table 23.

Table 23. Summary of Contraction Scour

Stream Name	Alternative 1			Alternatives 2 and 3		
	Location within Project	Contraction Scour Type	Contraction Scour (ft)	Location within Project	Contraction Scour Type	Contraction Scour (ft)
Antelope Creek	East Roseville Viaduct	Cohesive Material Scour	3.8	East Roseville Viaduct	Cohesive Material Scour	3.8
Secret Ravine	EN Connector	Cohesive Material Scour	5.8	EN Connector	Cohesive Material Scour	4.6
	SE Connector	Cohesive Material Scour	4.9	SE Connector	Cohesive Material Scour	5.0
	-	-	-	EB I-80 On-Ramp	Cohesive Material Scour	4.0
Miners Ravine	-	-	-	Miners Ravine bridge	Cohesive Material Scour	3.2
				Miners Ravine bridge (Widen) Off-Ramp	Cohesive Material Scour	7.6

7.3 Pier Scour

Pier scour is caused by the formation of vortices (known as a horseshoe vortex) at the pier base. The horseshoe vortex results from the pileup of water on the upstream surface of the pier and subsequent acceleration of the flow around the base of the pier.

The scour depth at the pier is estimated based on the pier design (shape and dimensions), flow characteristics (flow rate, local flow velocity at the pier, and local flow depth at the pier), and sediment particle size distribution. Scour depths at the piers were estimated assuming the pile caps and footings would not be exposed. An equation based on the Colorado State University (CSU) equation was used to estimate local pier scour. The equation predicts maximum scour depths and is given below:

$$\frac{y_s}{y_1} = 2K_1K_2K_3\left(\frac{a}{y_1}\right)^{0.65} Fr_1^{0.43}$$

Where:

- $y_s =$ Scour depth, ft
- $y_1 =$ Flow depth directly upstream of the pier, ft
- $K_1 =$ Correlation factor of pier nose shape (from Figure 7.3 and Table 7.1 of HEC-18)
- $K_2 =$ Correlation factor of angle of attack of flow (from Table 7.2 or Equation 7.4 of HEC-18)
- $K_3 =$ Correlation factor for bed condition (from Table 7.3 of HEC-18)
- $a =$ Pier width, ft
- $Fr_1 =$ Froude Number directly upstream of the pier = $V_1/(gy_1)^{1/2}$

The local pier scour was estimated assuming that the foundations of the piers will not be exposed, and scour depths are summarized in Table 24.

Table 24. Summary of Pier Scour

Stream Name	Alternative 1			Alternatives 2 and 3		
	Location within Project	Bent #	Pier Scour (ft)	Location within Project	Bent #	Pier Scour (ft)
Antelope Creek	East Roseville Viaduct	6	0	East Roseville Viaduct	6	0
		10	18.7		10	18.7
		11	31.0		11	31.0
Secret Ravine	EN Connector	5SE	16.4	EB I-80 On Ramp	4	15.9
		5NW	15.0	EN Connector	5SE	15.4
		6	13.1		5NW	14.5
		7NW	15.4		5	16.8
		7SE	16.5		6SE	17.0
		-	-		6NW	16.1
	SE Connector	10	16.6		7NW	15.0
		11	15.6		7SE	14.6
		12	15.2	EB I-80 On Ramp	6	14.3
		13	14.2		7	14.4
		14	11.2	SE Connector	8	16.6
		15	13.7		9	15.6
	-	-	-		10	12.9
	-	-	-		11	12.7
	-	-	-		12	11.2
	-	-	-		13	13.4
Miners Ravine	Miners Ravine Bridge	-	-	Miners Ravine Bridge	2	6.7
					3	9.9
				Miners Ravine Bridge (Widen) Off-Ramp	2	10.2
					3	12.7
					4	11.0

7.4 Abutment Scour

Abutment scour occurs when the bridge abutments block approaching flow. Abutment scour is commonly evaluated using either the Froehlich or HIRE live-bed scour equations. The HIRE equation is applicable when the ratio of the projected abutment length (the L parameter) to the flow depth (the y_1 parameter) is greater than 25. The Froehlich equation was used for this scour analysis because the ratio of the projected abutment length to the flow depth was less than 25. The Froehlich equation is given below:

$$y_s = y_a \left[2.27 K_1 K_2 \left(\frac{L'}{y_a} \right) Fr^{0.61} + 1 \right]$$

Where:

$y_s =$ scour depth, ft
$K_1 =$ abutment shape coefficient (from Table 7.1 of HEC-18)
$K_2 =$ coefficient for skew angle of abutment to flow
$L' =$ length of active flow obstructed by the embankment, ft
$Fr =$ Froude number, based on the velocity and depth adjacent to and upstream of the abutment
$y_a =$ average depth of flow at the abutment = A_e/L , ft
$L =$ length of embankment projected normal to the flow, ft
$A_e =$ flow area of the approach cross section obstructed by the embankment, sq ft

The local pier scour was estimated assuming that the foundations of the piers will not be exposed, and scour depths are summarized in Table 25.

Table 25. . Summary of Abutment Scour

Stream Name	**Alternative 1**			**Alternatives 2 and 3**		
	Location within Project	**Abut #**	**Pier Scour (ft)**	**Location within Project**	**Abut #**	**Pier Scour (ft)**
Miners Ravine	-	-	-	Miners Ravine Bridge	4	19.5
				Miners Ravine Bridge (Widen) Off-Ramp	1	22.4
					5	12.8

7.5 Total Scour and Scour Countermeasures

The total scour is the sum of the long-term bed change, contraction scour, pier scour and abutment scour. The estimated depths are summarized in Table 26 and the detailed calculations are provided in Appendix D.

Table 26. Summary of Total Scour (Alternative 1)

Stream Name	Location	Bent/ Abut #	Scour Depths (ft)				
			Long-Term Bed Elevation Change (ft)	Contraction Scour (ft)	Pier Scour (ft)	Abutment Scour (ft)	Total Scour (ft)
Antelope Creek	East Roseville Viaduct	6	N/A	3.8	0	-	3.8
		10			18.7	-	22.5
		11			31.0	-	34.8
Secret Ravine	EN Connector	5SE	N/A	5.8	16.4	-	22.2
		5NW			15.0	-	20.8
		6			13.1	-	18.9
		7NW			15.4	-	21.2
		7SE			16.5	-	22.3
	SE Connector	10	N/A	4.9	16.7	-	21.6
		11			16.6	-	21.5
		12			15.6	-	20.5
		13			15.2	-	20.1
		14			14.2	-	19.1
		15			11.2	-	16.1

Note: N/A- Not Applicable due to lack of sufficient information to make estimates

Table 27. Summary of Total Scour (Alternative 2)

Stream Name	Location	Bent/ Abut #	Scour Depths (ft)				
			Long-Term Bed Elevation Change (ft)	Contraction Scour (ft)	Pier Scour (ft)	Abutment Scour (ft)	Total Scour (ft)
Antelope Creek	East Roseville Viaduct	6	N/A	3.8	0	-	3.8
		10			18.7	-	22.5
		11			31.0	-	34.8
Secret Ravine	EB I-80 On Ramp	4	N/A	4.6	18.3	-	22.9
	EN Connector	5SE	N/A	5.0	14.5	-	19.5
		5NW			13.2	-	18.2
		5			17.0	-	22.0
		6SE			16.5	-	21.5
		6NW			13.9	-	18.9
		7NW			14.6	-	19.6
		7SE			16.0	-	21.0
	EB I-80 On Ramp	6		4.0	7.5	-	11.5
		7			18.3	-	22.3
	SE Connector	8	N/A	3.0	16.6	-	19.6
		9			15.6	-	1.6
		10			12.9	-	15.9
		11			12.7	-	15.7
		12			11.2	-	14.2
		13			13.4	-	16.4
Miners Ravine	Miners Ravine bridge	1	8.5	3.2	-	-	11.7
		2			6.6	-	18.3
		3			9.3	-	21.0
		4			-	19.5	31.2

Note: N/A- Not Applicable due to lack of sufficient information to make estimates

Table 28. Summary of Total Scour (Alternative 3)

Stream Name	Location	Bent/ Abut #	Scour Depths (ft)				
			Long-Term Bed Elevation Change (ft)	Contraction Scour (ft)	Pier Scour (ft)	Abutment Scour (ft)	Total Scour (ft)
Antelope Creek	East Roseville Viaduct	6	N/A	3.8	0	-	3.8
		10			18.7	-	22.5
		11			31.0	-	34.8
Secret Ravine	EB I-80 On Ramp	4	N/A	4.6	16.4	-	22.9
	EN Connector	5SE	N/A	5.0	18.3	-	19.5
		5NW			14.5	-	18.2
		5			13.2	-	22.0
		6SE			17.0	-	21.5
		6NW			16.5	-	18.9
		7NW			13.9	-	19.6
		7SE			14.6	-	21.0
	EB I-80 On Ramp	6		4.0	16.0	-	11.5
		7			7.5	-	22.3
	SE Connector	8	N/A	3	16.6	-	19.6
		9			15.6	-	1.6
		10			12.9	-	15.9
		11			12.7	-	15.7
		12			11.2	-	14.2
		13			13.4	-	16.4
Miners Ravine	Miners Ravine bridge	1	8.5	7.7	-	22.4	38.6
		2			10.2	-	26.4
		3			12.7	-	28.9
		4			11.0	-	27.2
		5			-	12.8	29.0

Note: N/A- Not Applicable due to lack of sufficient information to make estimates

The FHWA HEC-18 suggests that the top of pier footings be referenced to the thalweg of the channel and placed below the sum of the long-term bed elevation change and contraction scour. The bottom of the pier footings should be below the total scour line with all piers designed to the same elevation. This would help to minimize potential structural damage and undermining. The estimated scour depths assume that the material at the site is erodible.

8 ROCK SLOPE PROTECTION FOR EROSION PROTECTION AT SLOPE EMBANKMENTS

The need for RSP at the banks in the vicinity of the bridges was evaluated as an erosion countermeasure to address the increase in velocity upstream of the bridges. RSP generally consists of rocks placed along the channel banks to limit the effects of erosion. It is the most common type of scour countermeasure due to its general availability, ease of installation, and relatively low cost.

The sizing of RSP was determined by the FHWA's Hydraulic Engineering Circular No. 23 (HEC-23), *Bridge Scour and Stream Instability Countermeasures*. The RSP layer thicknesses were calculated per the *California Bank and Shore Rock Slope Protection Design* guideline (FHWA 2009). The recommendations are summarized in Table 29 and the calculations are included in Appendix E.

Table 29. RSP Recommendations Summary

Stream Name	Location within Project	RSP Class	Fabric Type	Placement Type	Outer Layer Thickness (ft)
Miners Ravine	Miners Ravine Bridge	Light	A	B	2.5
	Miners Ravine Bridge (Widen) Off-Ramp	¼ Ton	A	B	3.3

Based on *California Bank and Shore Rock Slope Protection Design* guideline (FHWA 2009) design recommendations, Miners Ravine Bridge (Widen) Off-Ramp 1/4 ton class RSP should include a backing layer of either Backing No. 1 or Backing No. 2. Backing No. 1 has a minimum layer thickness of 1.8 ft and Backing No. 2 has a minimum layer thickness of 1.25 ft.

9 ENVIRONMENTAL CONSEQUENCES AND PROJECT IMPACTS

9.1 Summary of Potential Encroachments

The FHWA defines a significant encroachment as a highway encroachment, and any direct support of likely base floodplain development, that would involve one or more of the following construction or flood-related impacts: 1) significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles or provides a community's only evacuation route; 2) a significant risk; or 3) a significant adverse impact on the natural and beneficial floodplain values (1994). The following sections discuss the potential impacts to the floodplain that result from the proposed action. The risk associated with implementation of the action is discussed in Section 9.2.

9.1.1 Potential Traffic Interruptions Due to the Proposed Action

The Project does not have significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles or provides a community's evacuation route. There is sufficient freeboard available for all the bridges over water ways (refer to Section 6 for detailed discussions on freeboard). The impacts to the floodplains within the Project area will not have a risk of causing significant effects on traffic flow.

9.1.2 Potential Impacts on Natural and Beneficial Floodplain Values

Note: This section will be included upon receipt of the biological study.

9.1.3 Support of Probable Incompatible Floodplain Development

As defined by the FHWA, the support of incompatible base floodplain development will encourage, allow, serve, or otherwise facilitate incompatible base floodplain development, such as commercial development or urban growth.

The proposed Project would mostly include widening of the existing roadways and bridge structures. New connectors proposed to be constructed at the I-80/SR 65 Interchange will only serve to connect the I-80 and SR 65 roadways, which would follow the existing alignments. Therefore, the Project would not create new access to developed or undeveloped land and hence, would not support incompatible floodplain development.

9.1.4 Longitudinal Encroachments

As defined by the FHWA, a longitudinal encroachment is an action within the limits of the base floodplain that is longitudinal to the normal direction of the floodplain.

A longitudinal encroachment is "[a]n encroachment that is parallel to the direction of flow. Example: A highway that runs along the edge of a river is, usually considered a longitudinal encroachment." The requirement for consideration of avoidance alternatives must be included in a Location Hydraulic Study by including an evaluation and a discussion of the practicability of alternatives to any significant encroachment or any support of incompatible floodplain development.

The Project would have longitudinal encroachments on the Secret Ravine and Miners Ravine base floodplains/floodways. Bents 5, 6, and 7 for Alternatives 1, 2 and 3 of the EN Connector bridge would encroach on the Secret Ravine floodway and floodplain. Bents 4, 5, 6 and 7 for Alternatives 2 and 3 of the EB I-80 on-ramp would encroach on the Secret Ravine floodway. Additionally, Bents 10, 11, 12, 13, 14 and 15 for Alternative 1 and Bents 8, 9, 10, 11, 12, and 13 for Alternative 2 and 3 of the SE connector bridge would encroach upon the Secret Ravine floodplain (see Figure 43 to Figure 46 for the floodplain/floodway delineation maps).

The longitudinal encroachment on the Miners Ravine floodway and floodplain would be caused by the proposed realignment of the I-80 loop on-ramp from Eureka Road (Alternative 1), Miners Ravine Bridge (Alternative 2), and Miners Ravine Bridge Widen (Alternative 3). The loop ramp realignment for all three alternatives are on fill and encroaches on the Miners Ravine floodplain. Bents 2 and 3, and abutment 4 for Alternative 2 of Miners Ravine Bridge would encroach on the Miners Ravine floodway. Abutments 1 and 5, and bents 2, 3, and 4 for Alternative 3 of Miners Ravine Bridge (widen) off-ramp would encroach on the Miners Ravine floodway.

9.2 Risk Associated with the Proposed Action

As defined by the FHWA, risk shall mean the consequences associated with the probability of flooding attributable to an encroachment. It shall include the potential for property loss and hazard to life during the service life of the bridge and roadway.

The potential risk associated with the implementation of the proposed action includes but is not limited to: 1) change in the amount of impervious area, 2) fill inside the floodplain, or 3) change in the 100-year WSE. See below for the discussion of potential risks associated with the Project at each affected stream crossing. The measures to minimize the potential floodplain impacts associated with the action are summarized in Section 10.

9.2.1 East Roseville Viaduct at Antelope Creek

The proposed widening of the NB and SB structures and to the construction of a median connector to join the two structures into a single bridge would result in an increase of impervious area.

Table 30 summarizes the existing and added impervious areas within the hydrologic units in the Project area. The hydrologic sub-areas are shown on Figure 10. Antelope Creek is located in the Lower American River hydrologic sub-area. The total added impervious area from the proposed Project is 31.7% increases in this hydrologic sub-area. However, the increase in impervious area would have insignificant effects on the watershed runoff given that the total hydrologic unit area is 136,960 acres, and the Antelope Creek sub-watershed is approximately 9,020 acres (14.1 sq mi).

The widening of the East Roseville Viaduct would not have a significant impact caused by fill on the floodplain. The hydraulic model results summarized in Table 8 show that the WSE increases resulting from the widening of the NB and SB bridge structures would be minimal and are considered insignificant. Bents proposed to be added along the existing bents 5, 6, and 7 would be in the floodway (see Figure 42 for the bent encroachments on the Antelope Creek floodplain/floodway). The risks associated with the encroachments caused by these bents are also not significant given the minimal increase in WSEs.

Table 30. Impervious Areas

Hydrologic Unit	Existing Impervious Area (acre)			Added Impervious Area (acre)		
	Alternative 1	Alternative 2	Alternative 3	Alternative 1	Alternative 2	Alternative 3
Valley American-Lower American	82	82	82	27	25	23
Valley American-Pleasant Grove	13	13	13	4	4	4
Total	95	95	95	31	29	27

9.2.2 EN and SE Connectors at Secret Ravine

The proposed EN and SE connectors at the I-80/SR 65 Interchange would result in added impervious area. These connectors are located in the Lower American River hydrologic sub-area. As mentioned in the Section 9.2.1, the total added impervious area from the proposed Project have insignificant effects on the watershed runoff given that the total hydrologic unit area of 136,960 acres and the Secret Ravine sub-watershed is approximately 13,820 acres (21.6 sq mi).

The increase in WSEs due to the bent obstructions in the floodway and floodplain are minimal and therefore, are not considered to have a significant risk (see Table 12 and Table 13 for the summary of WSE changes due to the proposed Alternatives 1, 2 and 3 at Secret Ravine).

9.2.3 Miners Ravine Bridge at Miners Ravine

The proposed widening of the Miners Ravine bridge and the off-ramp to Eureka Road bridge would cause an increase in impervious area. The bridges are located in the Lower American River hydrologic sub-area. Similar to the other modification impacts, the total added impervious area from the proposed Project would have insignificant effects on the watershed runoff given that the total hydrologic unit area of 136,960 acres and the Miners Ravine sub-watershed is approximately 12,800 acres (20 sq mi).

The increase to the WSEs caused by the widening of the Miners Ravine bridge and the off-ramp to Eureka Road bridge over Miners Ravine in addition to the realignment of the loop on-ramp from Eureka Road are minimal. Refer to Table 16, Table 18, and for the

Summary of the WSE changes along the stream. Therefore, the actions proposed by the Project at this site do not have a significant associated risk.

9.2.4 Other Sites within the Project Limits

Proposed changes to the remaining locations within the Project limit would generally involve widening of the I-80 and SR 65 roadways. The South Branch Pleasant Grove Creek Tributary and Highland Ravine are located in the Pleasant Grove Creek hydrologic sub-area. The added impervious area for the Project would be 2 acres (10% increase). Sucker Ravine is located in the Lower American River hydrologic sub-area. The locations at the South Branch Pleasant Grove Creek Tributary, Highland Ravine and Sucker Ravine crossings involve minimal risks caused by added impervious areas. For these locations, there is an insignificant change to the watershed runoff considering the size of their respective hydrologic units.

The Sucker Ravine crossing is located in a base floodplain while South Branch Pleasant Grove Creek Tributary and Highland Ravine are located within 500-year or greater flood zones. However, the effects to the WSEs at these stream crossings would have no impact as a result of the Project because the flow would be conveyed through culverts. The details of the hydraulic design will be discussed further in the Project Drainage Report.

10 AVOIDANCE, MINIMIZATION, AND/OR MITIGATION MEASURES

10.1 Minimize Floodplain Impacts

In order to minimize impacts to the Antelope Creek, Secret Ravine, and Miners Ravine floodplains by the proposed alternatives, the Project team would determine options to avoid any encroachment on the floodways and minimize roadway modifications that involve fill within the floodplains. The Project would also minimize encroachments of bridge structure bents on floodplains. With these minimization measures, the Project would have minimal to no impacts to the floodplains and floodways within the Project limits.

10.2 Restore and Preserve Natural and Beneficial Floodplain Values

Note: This section will be included upon receipt of the biological study.

10.3 Alternatives to Significant Encroachments

The FHWA defines a "significant encroachment" as a highway encroachment, and any direct support of likely base floodplain development, that will involve one or more of the following construction or flood-related impacts: 1) significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles or provides a community's only evacuation route; 2) a significant risk; or 3) a significant adverse impact on the natural and beneficial floodplain values (1994).

The Project would have no potential for traffic interruptions. Hydraulic analyses show that the Project would have minimal encroachment impacts on the Antelope Creek, Secret Ravine, or Miners Ravine floodplains.

The impacts to natural and beneficial floodplain values will be determined upon the receipt of the biological study. The Project team will determine minimization measures for the floodway encroachments caused by the Project, particularly on the Antelope Creek, Secret Ravine, and Miners Ravine floodways, and coordinate with FEMA to finalize minimization measures.

10.4 Alternatives to Longitudinal Encroachments

The Project would not have any longitudinal encroachment at the East Roseville Viaduct bridge structure. The widening of the East Roseville Viaduct bridge is normal to the direction of flow of Antelope Creek. The Project would have minimal encroachment impacts to Secret Ravine as a result of the interchange connector (EN and SE connector) bents and to Miners Ravine from the I-80 on-ramp loop roadway encroachment. Nonetheless, the Project team would determine minimization measures for the floodway encroachments resulting from the EN connector bents and loop on-ramp proposed realignment and coordinate with FEMA to finalize minimization measures.

10.5 Coordination with Local, State, and Federal Water Resources and Floodplain Management Agencies

Placer County Transportation Planning Agency would coordinate with Caltrans, PFCFWCD, CVFPB, and other local, state and federal water resources and floodplain management agencies as necessary during all aspects of the proposed Project.

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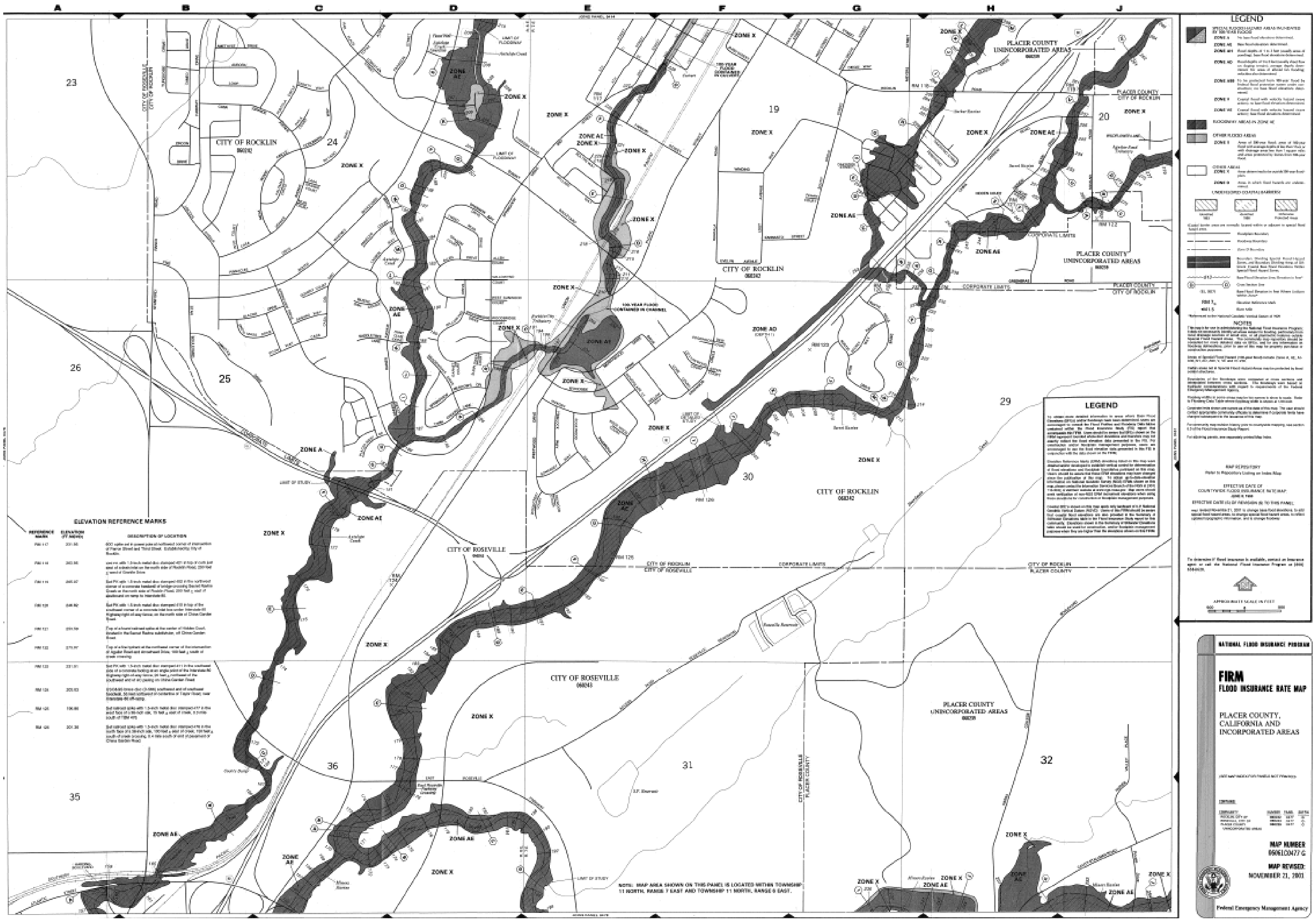
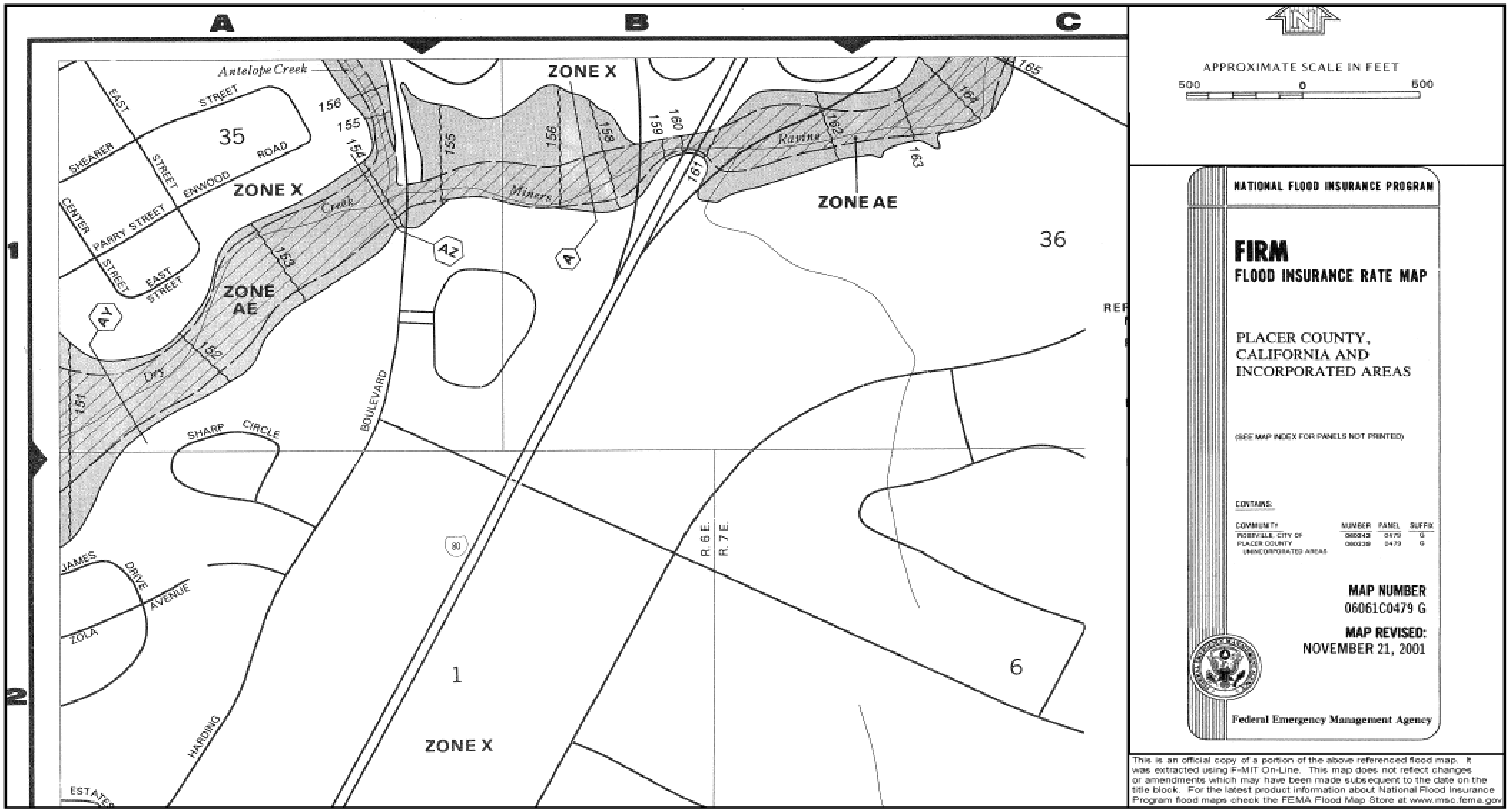
Appendix A Flood Insurance Rate Maps (FIRMS)

Appendix A.1 FIRM #06061C0477G



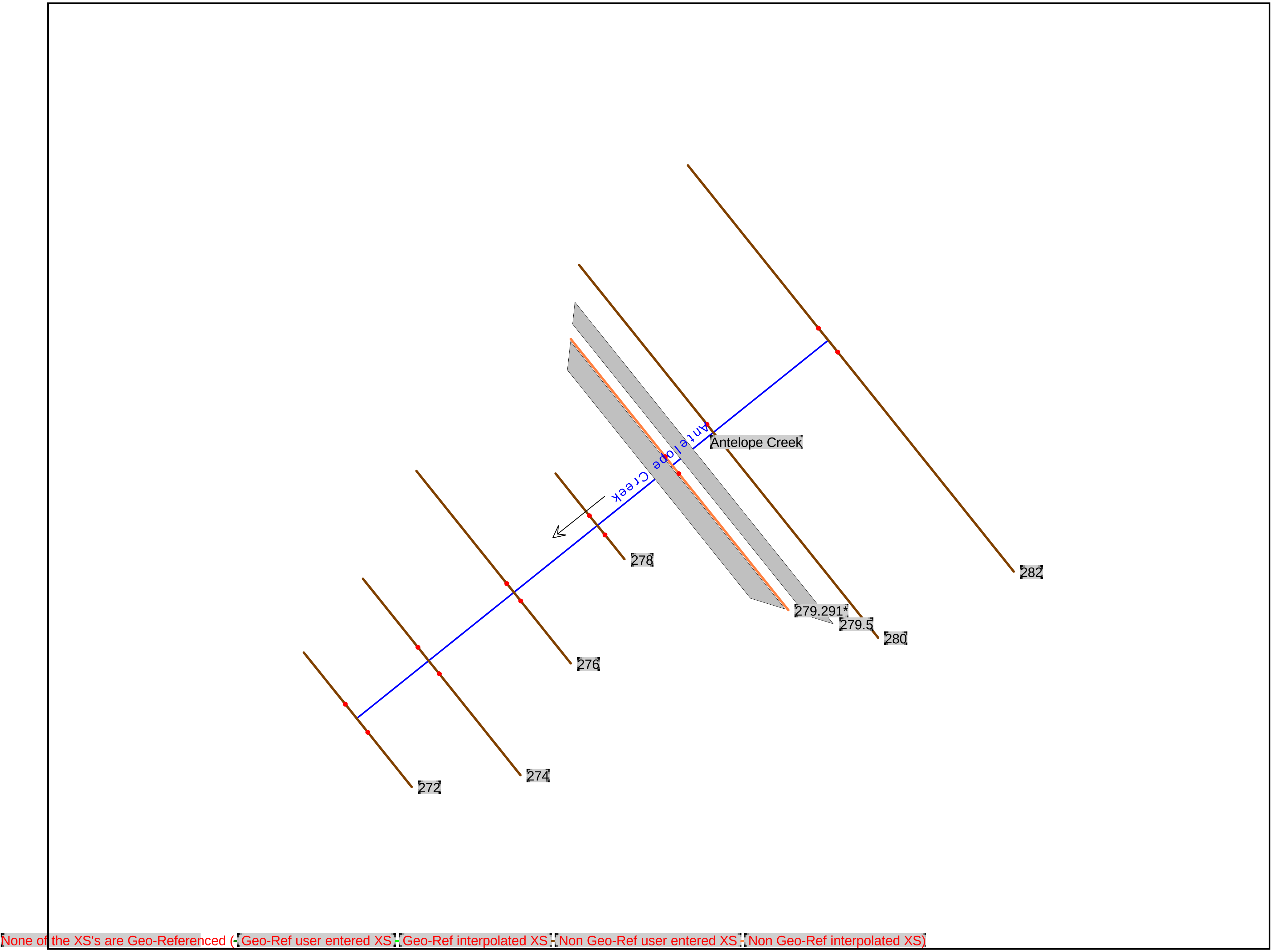
LEGEND
ELEVATION REFERENCE MARKS
CITY OF ROCKLIN
CITY OF ROSEVILLE
PLACER COUNTY UNINCORPORATED AREAS
ZONE X
ZONE AE
ZONE AO
100-YEAR FLOOD CONTAINED IN CHANNEL
CORPORATE LIMITS
23
24
25
26
19
20
29
30
31
32
35
36
NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 11 NORTH, RANGE 7 EAST AND TOWNSHIP 11 NORTH, RANGE 6 EAST.
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
PLACER COUNTY, CALIFORNIA AND INCORPORATED AREAS
MAP NUMBER
06061C0427 G
MAP REVISED:
NOVEMBER 21, 2001
Federal Emergency Management Agency

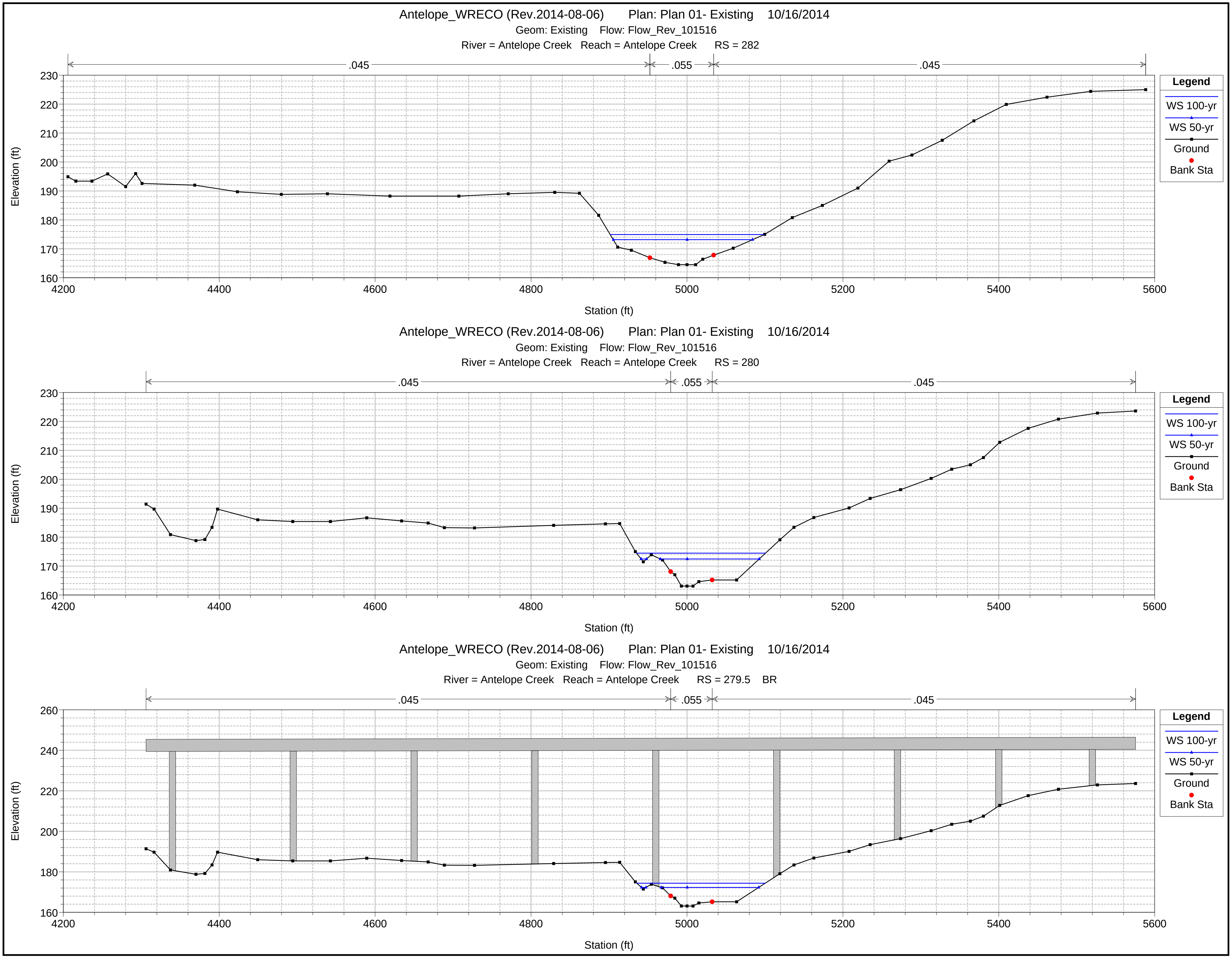
Appendix A.2 FIRM #06061C0479G


A
B
C
1
2
ZONE X
ZONE AE
ZONE X
ZONE AE
ZONE X
Antelope Creek
Miners Ravine
Dry Creek
35
36
1
6
EAST STREET
SHEARER STREET
ENWOOD ROAD
CENTER STREET
PARRY STREET
SHARP CIRCLE
BOULEVARD
JAMES DRIVE
ZOLA AVENUE
HARDING
R. 6 E.
R. 7 E.
APPROXIMATE SCALE IN FEET
500
0
500
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
PLACER COUNTY,
CALIFORNIA AND
INCORPORATED AREAS
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
MAP NUMBER
06061C0479 G
MAP REVISED:
NOVEMBER 21, 2001
Federal Emergency Management Agency
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Appendix B HEC-RAS Outputs

Appendix B.1 Antelope Creek HEC-RAS Outputs


Antelope Creek
Antelope Creek
272
274
276
278
279.291*
279.5
280
282
None of the XS's are Geo-Referenced (Geo-Ref user entered XS Geo-Ref interpolated XS Non Geo-Ref user entered XS Non Geo-Ref interpolated XS)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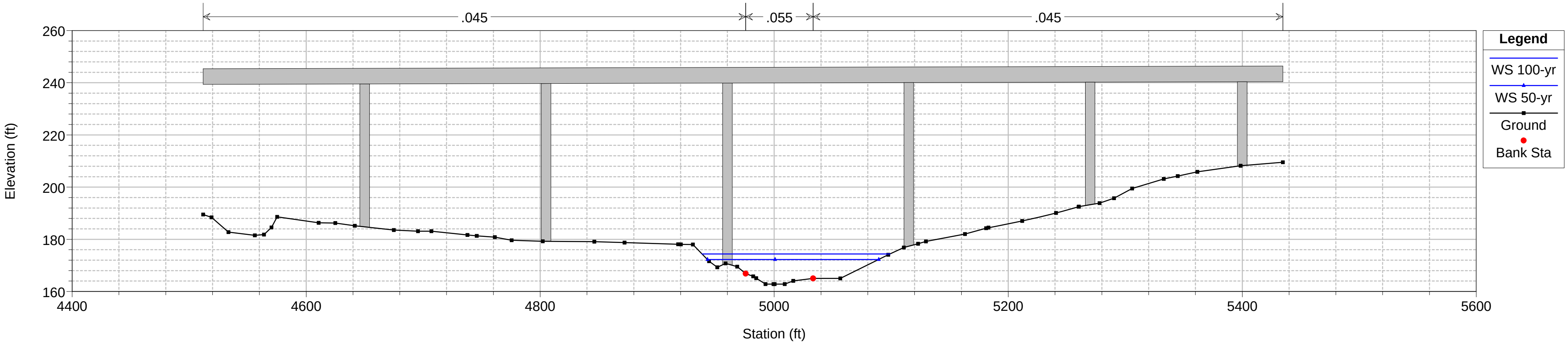
Geom: Existing Flow: Flow_Rev_101516
River = Antelope Creek Reach = Antelope Creek RS = 282
.045
.055
.045
Legend
WS 100-yr
WS 50-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
Antelope_WRECO (Rev.2014-08-06) Plan: Plan 01- Existing 10/16/2014
Geom: Existing Flow: Flow_Rev_101516
River = Antelope Creek Reach = Antelope Creek RS = 280
.045
.055
.045
Legend
WS 100-yr
WS 50-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
Antelope_WRECO (Rev.2014-08-06) Plan: Plan 01- Existing 10/16/2014
Geom: Existing Flow: Flow_Rev_101516
River = Antelope Creek Reach = Antelope Creek RS = 279.5 BR
.045
.055
.045
Legend
WS 100-yr
WS 50-yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

Antelope_WRECO (Rev.2014-08-06)   Plan: Plan 01- Existing   10/16/2014
Geom: Existing   Flow: Flow_Rev_101516
River = Antelope Creek   Reach = Antelope Creek   RS = 279.5   BR



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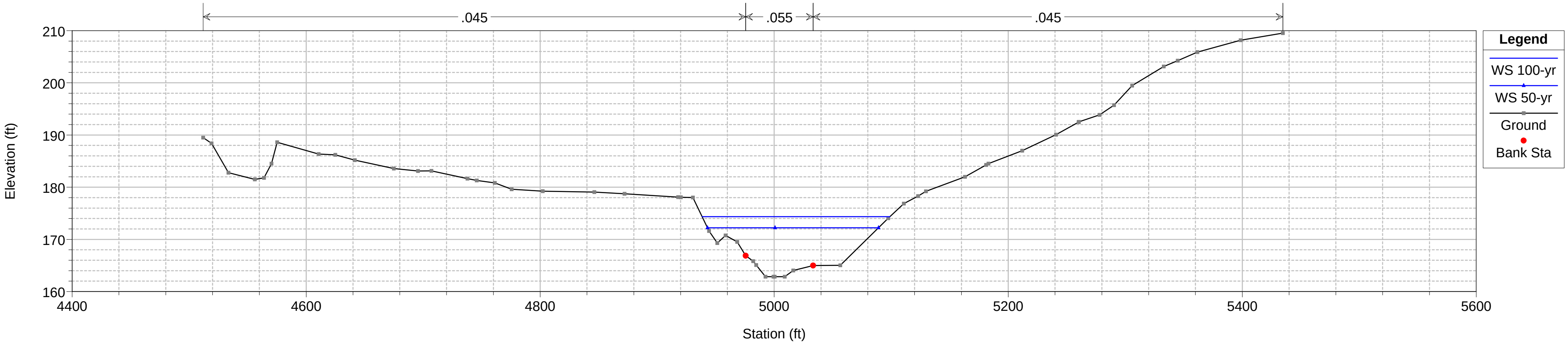

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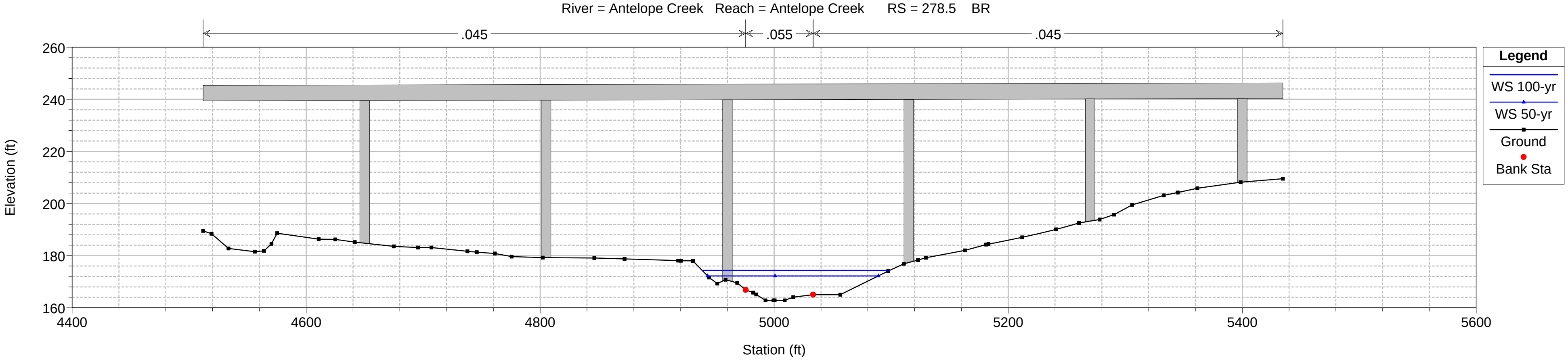

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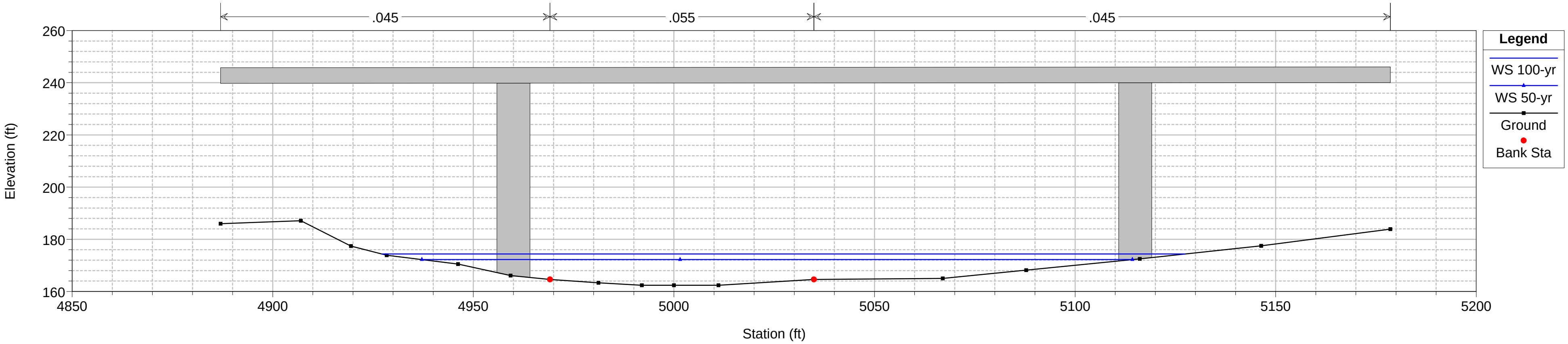

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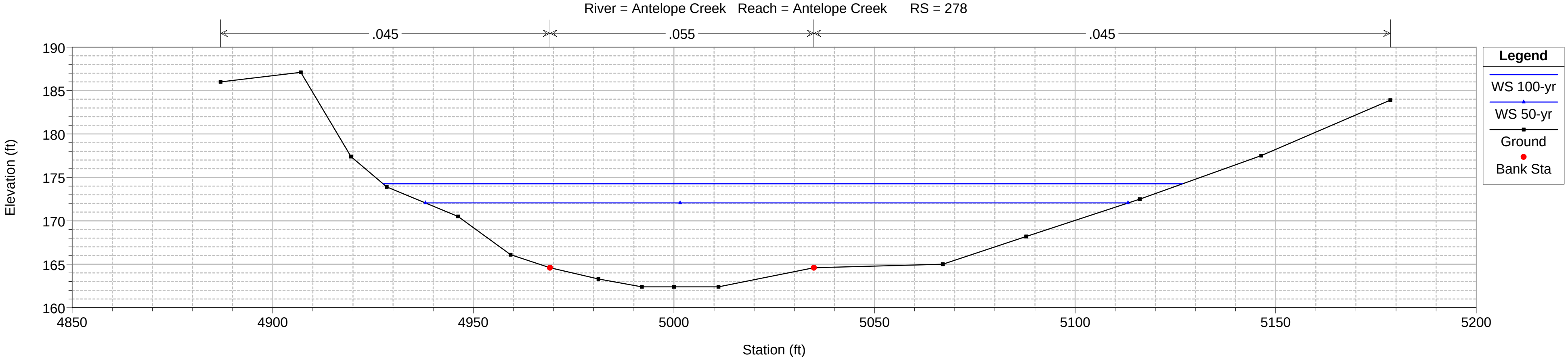

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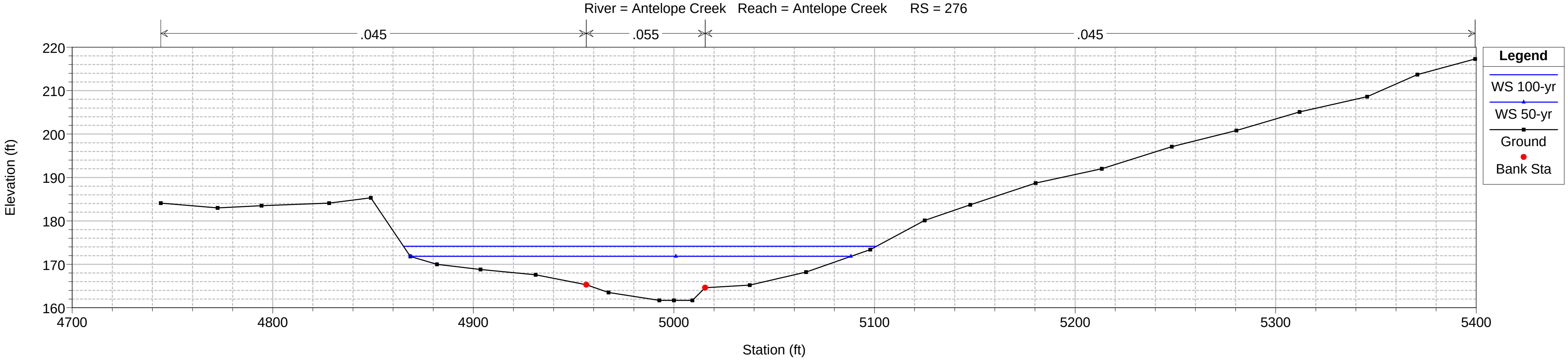

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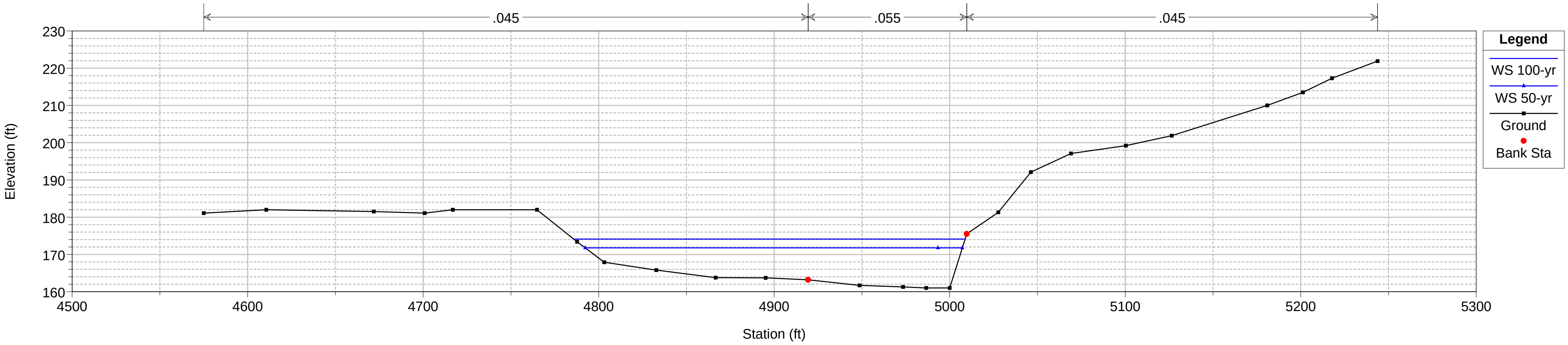
River = Antelope Creek   Reach = Antelope Creek   RS = 274



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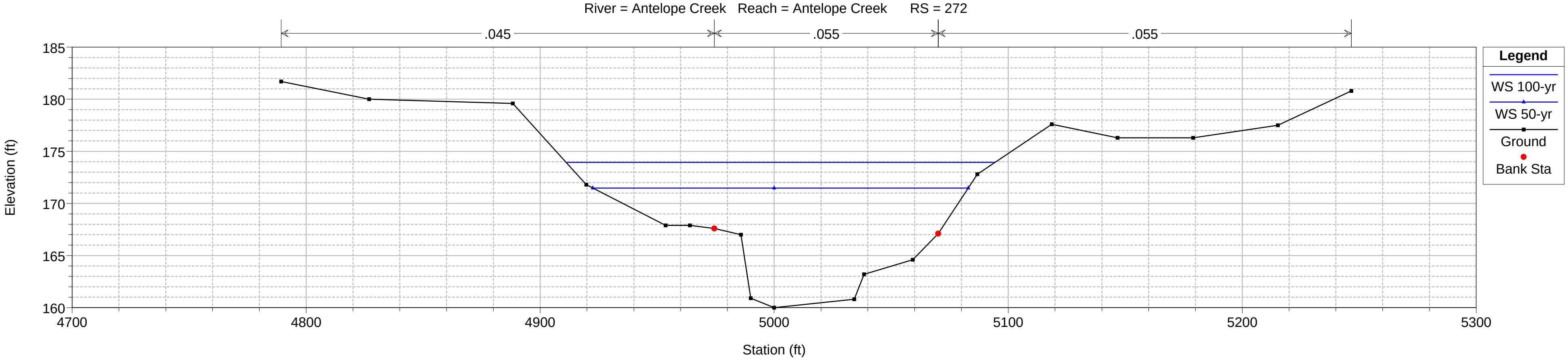

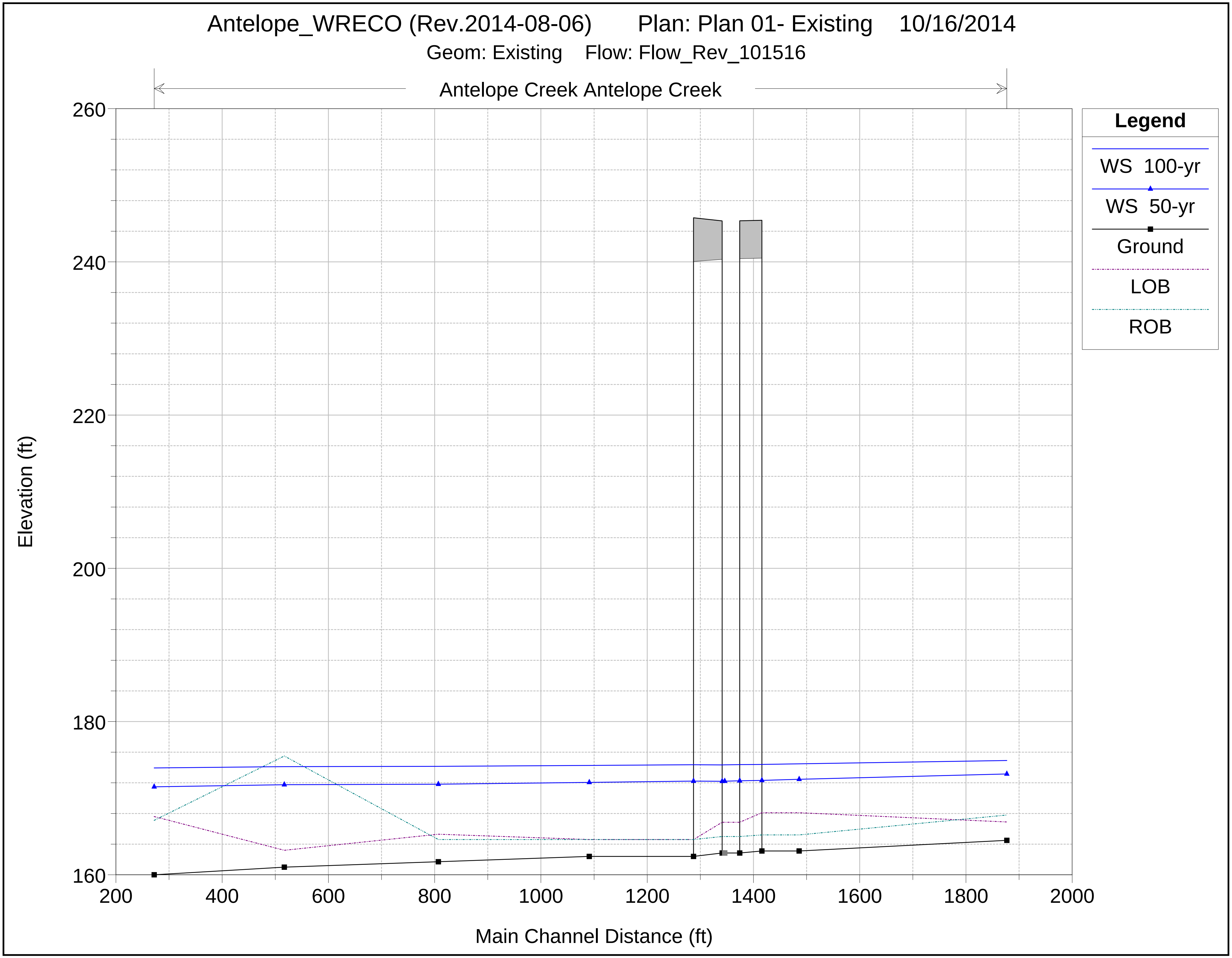
Antelope_WRECO (Rev.2014-08-06) Plan: Plan 01- Existing 10/16/2014
Geom: Existing Flow: Flow_Rev_101516
Antelope Creek Antelope Creek
Legend
WS 100-yr
WS 50-yr
Ground
LOB
ROB
Elevation (ft)
Main Channel Distance (ft)
260
240
220
200
180
160
200
400
600
800
1000
1200
1400
1600
1800
2000

HEC-RAS Plan: Antelp_Exist River: Antelope Creek Reach: Antelope Creek

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Antelope Creek	282	100-yr	4095.00	164.50	174.91		175.08	0.000891	3.58	1274.70	197.33	0.21
Antelope Creek	282	50-yr	3418.00	164.50	173.16		173.37	0.001478	4.02	945.25	178.67	0.26
Antelope Creek	280	100-yr	4095.00	163.10	174.49	168.87	174.72	0.001075	4.04	1091.63	165.48	0.23
Antelope Creek	280	50-yr	3418.00	163.10	172.46	168.40	172.77	0.001825	4.53	783.69	133.93	0.28
Antelope Creek	279.5		Bridge									
Antelope Creek	279.291*	100-yr	4095.00	162.85	174.36	168.57	174.56	0.000933	3.87	1160.20	160.47	0.21
Antelope Creek	279.291*	50-yr	3418.00	162.85	172.22	168.13	172.50	0.001690	4.46	832.79	146.09	0.28
Antelope Creek	278.5		Bridge									
Antelope Creek	278	100-yr	4095.00	162.40	174.27		174.39	0.000502	3.01	1517.38	199.35	0.16
Antelope Creek	278	50-yr	3418.00	162.40	172.06		172.21	0.000871	3.42	1102.44	175.14	0.20
Antelope Creek	276	100-yr	4095.00	161.70	174.16		174.25	0.000411	2.75	1709.78	235.82	0.14
Antelope Creek	276	50-yr	3418.00	161.70	171.83		171.97	0.000865	3.43	1176.86	219.65	0.20
Antelope Creek	274	100-yr	4095.00	161.00	174.12		174.17	0.000190	1.84	2197.54	222.99	0.09
Antelope Creek	274	50-yr	3418.00	161.00	171.75		171.82	0.000306	2.06	1679.95	214.86	0.12
Antelope Creek	272	100-yr	4095.00	160.00	173.95	166.32	174.09	0.000601	3.21	1410.61	183.37	0.17
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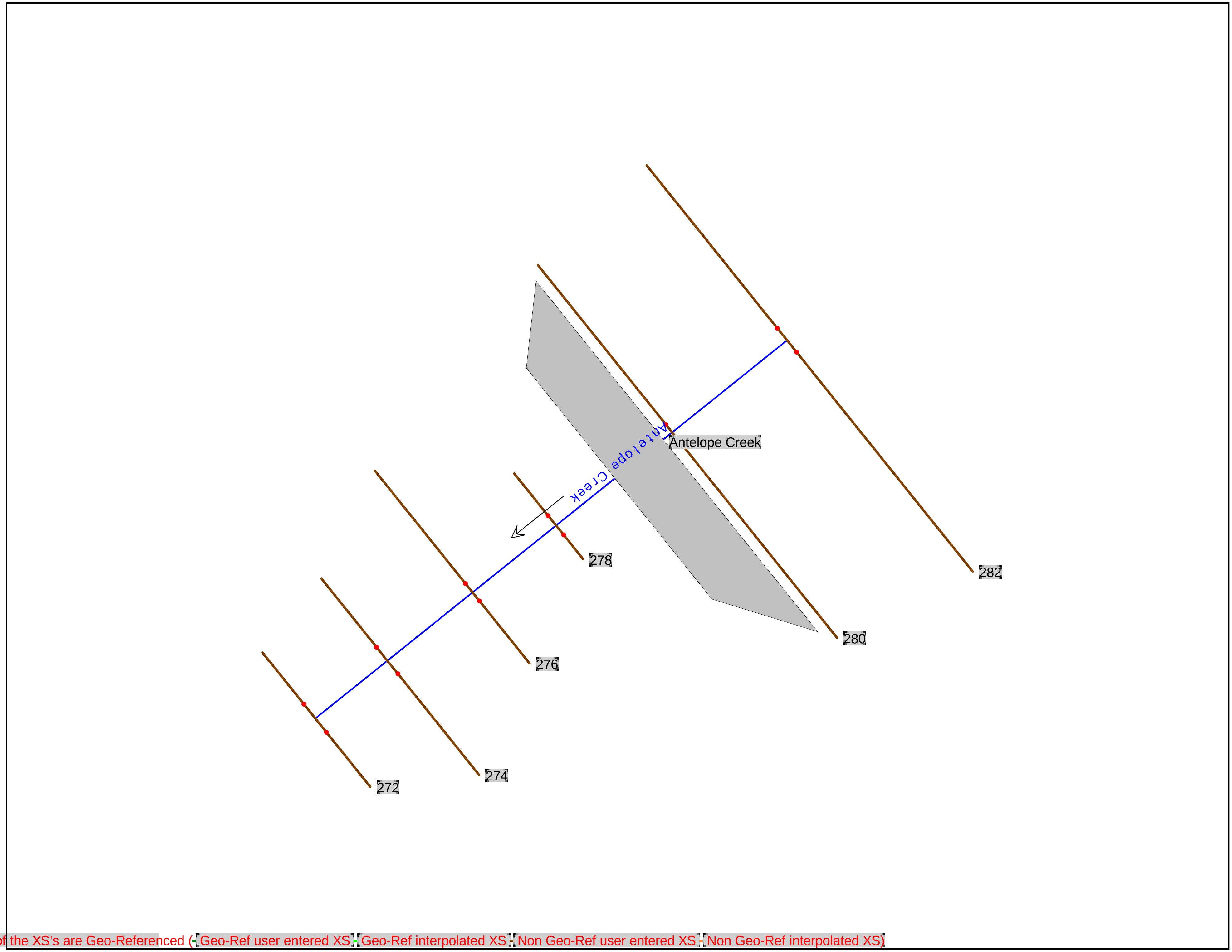
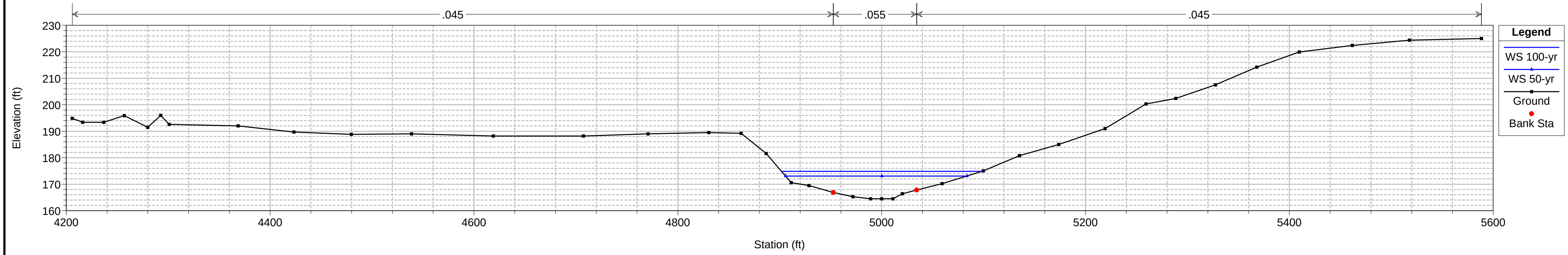
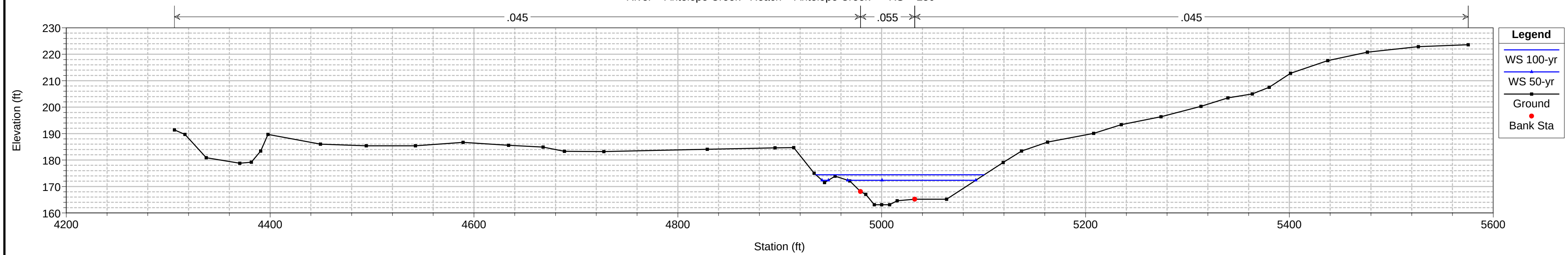


None of the XS's are Geo-Referenced (Geo-Ref user entered XS Geo-Ref interpolated XS Non Geo-Ref user entered XS Non Geo-Ref interpolated XS)

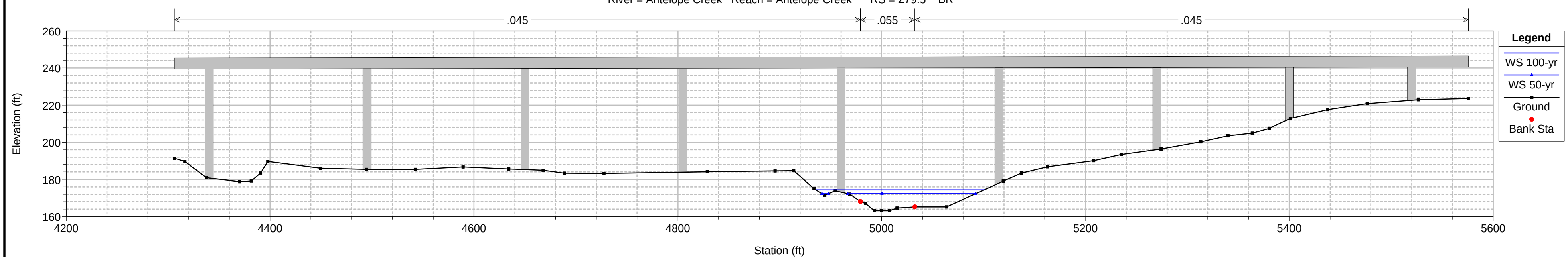
Antelope_WRECO (Rev.2014-08-06) Plan: Plan 02 (Alt. 1) 10/16/2014
Geom: Alternative 1 Flow: Flow_Rev_101516
River = Antelope Creek Reach = Antelope Creek RS = 282



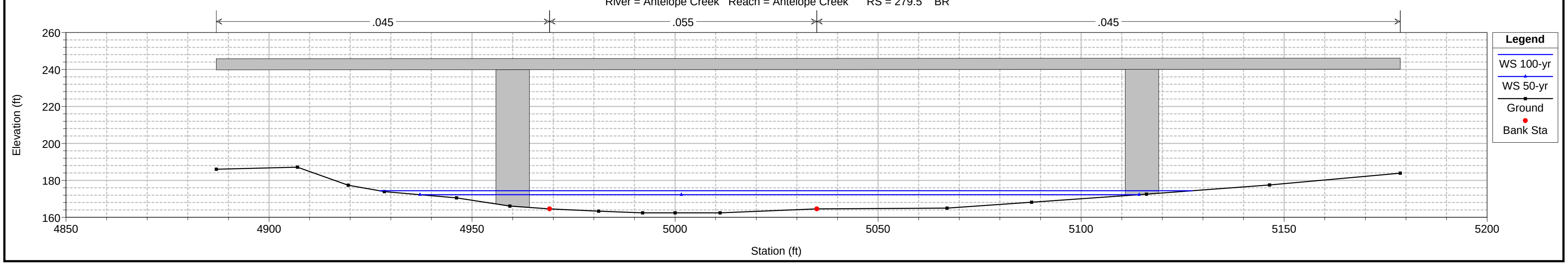
Antelope_WRECO (Rev.2014-08-06) Plan: Plan 02 (Alt. 1) 10/16/2014
Geom: Alternative 1 Flow: Flow_Rev_101516
River = Antelope Creek Reach = Antelope Creek RS = 280

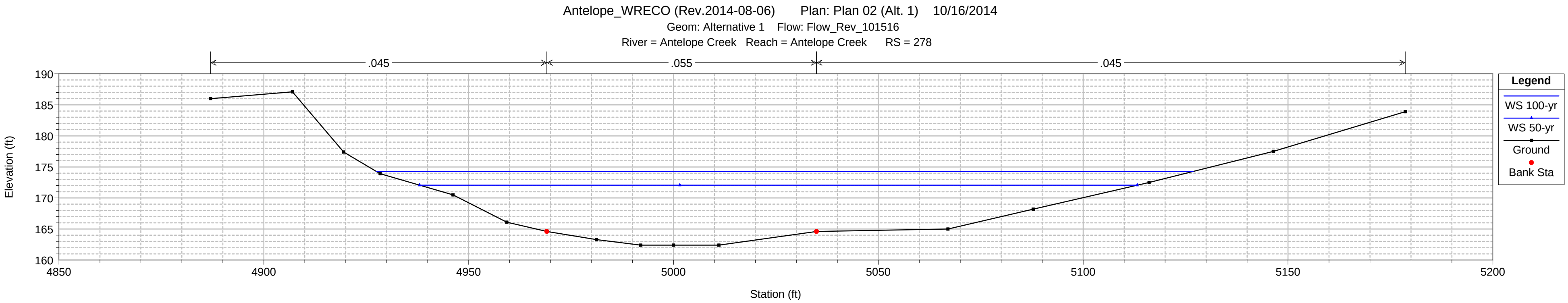


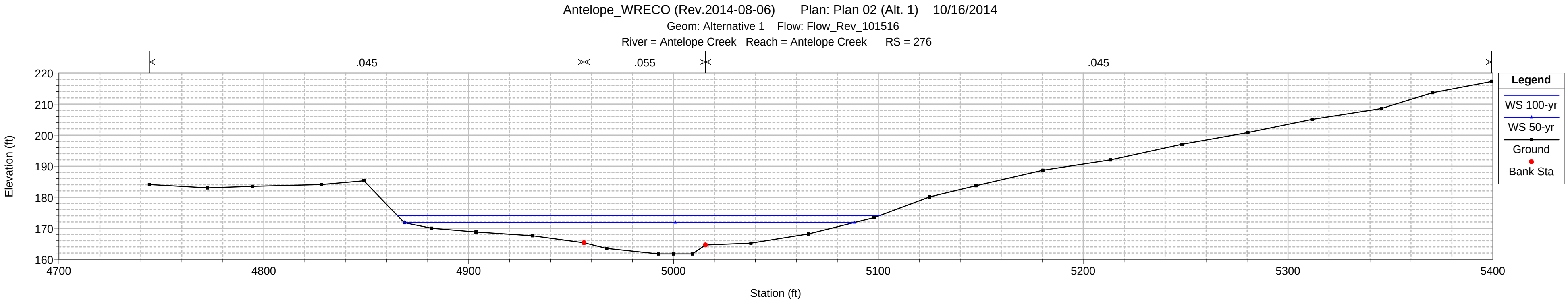
Antelope_WRECO (Rev.2014-08-06) Plan: Plan 02 (Alt. 1) 10/16/2014
Geom: Alternative 1 Flow: Flow_Rev_101516
River = Antelope Creek Reach = Antelope Creek RS = 279.5 BR

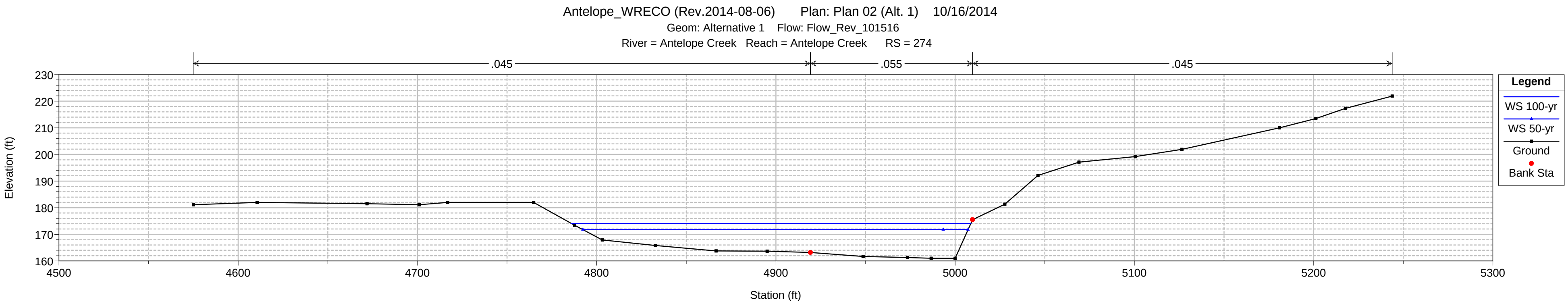


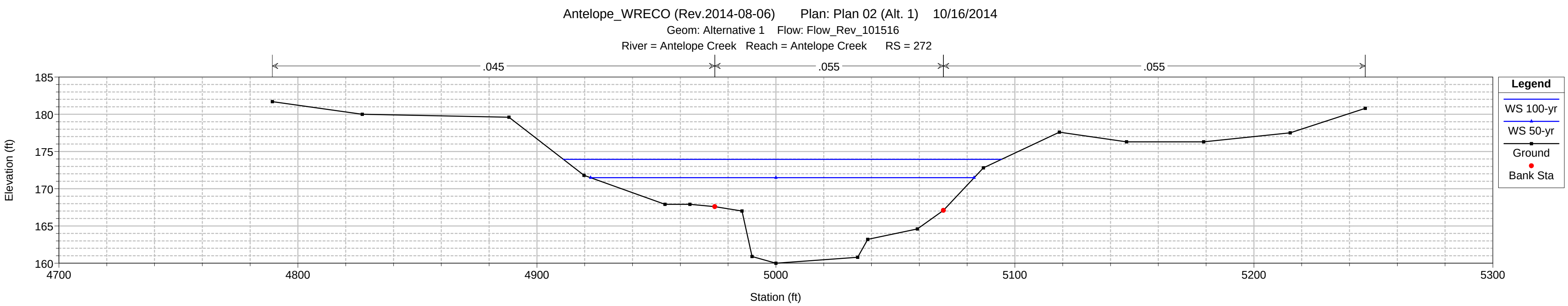
Antelope_WRECO (Rev.2014-08-06) Plan: Plan 02 (Alt. 1) 10/16/2014
Geom: Alternative 1 Flow: Flow_Rev_101516
River = Antelope Creek Reach = Antelope Creek RS = 279.5 BR

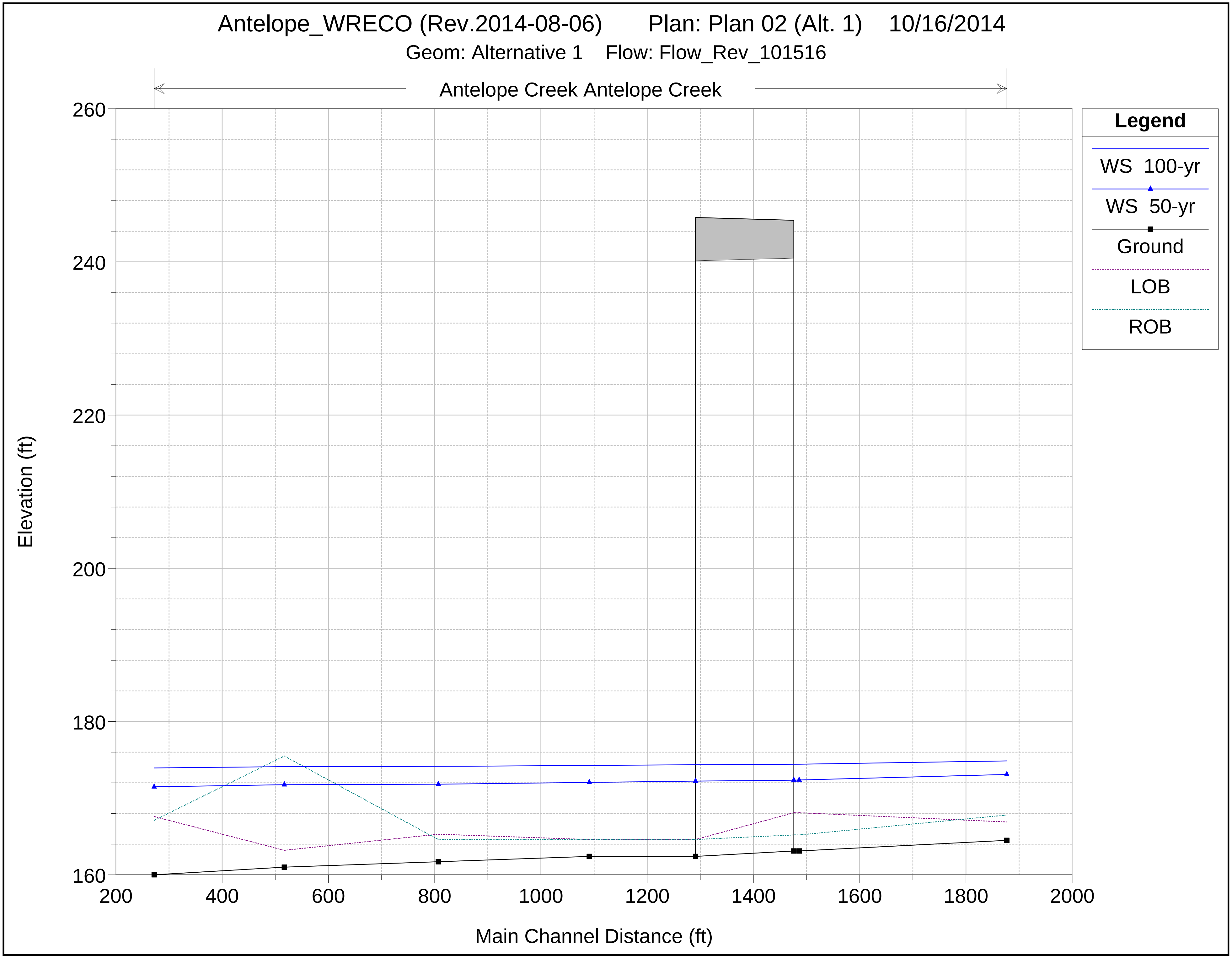



Antelope_WRECO (Rev.2014-08-06) Plan: Plan 02 (Alt. 1) 10/16/2014
Geom: Alternative 1 Flow: Flow_Rev_101516
River = Antelope Creek Reach = Antelope Creek RS = 278
.045
.055
.045
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
Ground
Bank Sta


Antelope_WRECO (Rev.2014-08-06) Plan: Plan 02 (Alt. 1) 10/16/2014
Geom: Alternative 1 Flow: Flow_Rev_101516
River = Antelope Creek Reach = Antelope Creek RS = 276
.045
.055
.045
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
Ground
Bank Sta


Antelope_WRECO (Rev.2014-08-06) Plan: Plan 02 (Alt. 1) 10/16/2014
Geom: Alternative 1 Flow: Flow_Rev_101516
River = Antelope Creek Reach = Antelope Creek RS = 274
.045
.055
.045
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
Ground
Bank Sta

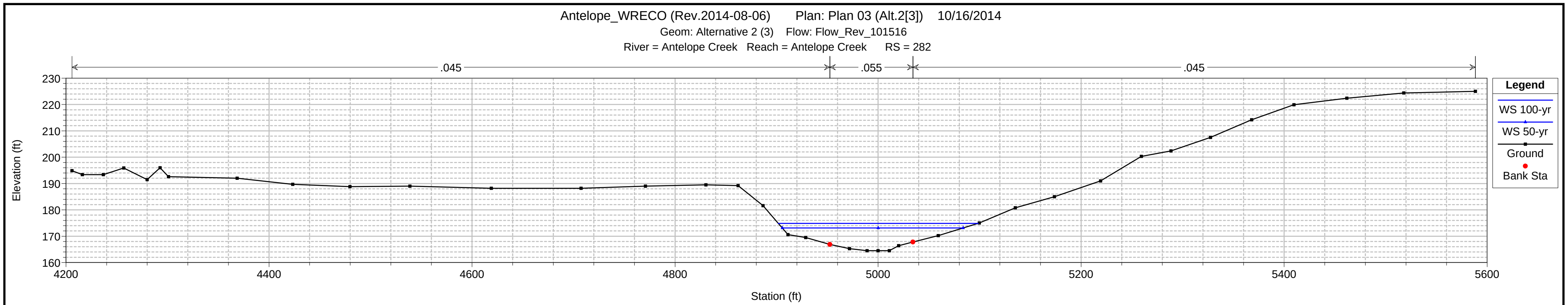

Antelope_WRECO (Rev.2014-08-06) Plan: Plan 02 (Alt. 1) 10/16/2014
Geom: Alternative 1 Flow: Flow_Rev_101516
River = Antelope Creek Reach = Antelope Creek RS = 272
.045
.055
.055
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
Ground
Bank Sta

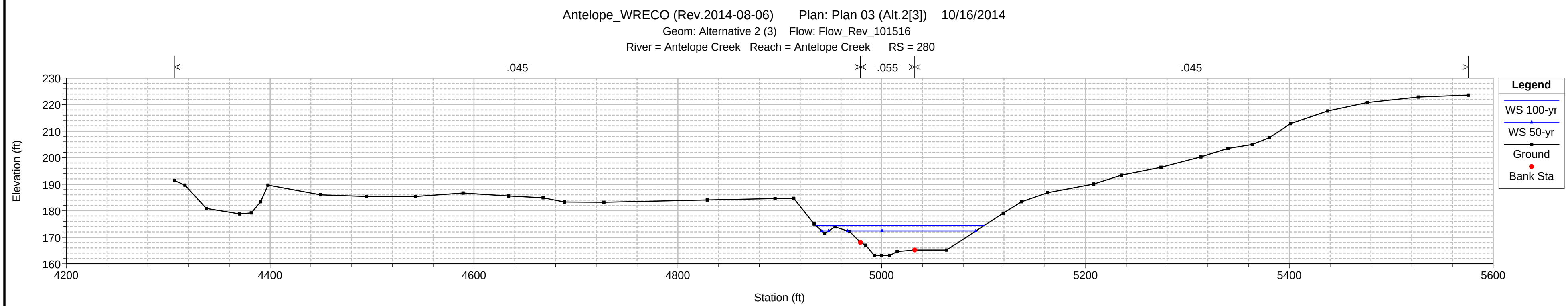


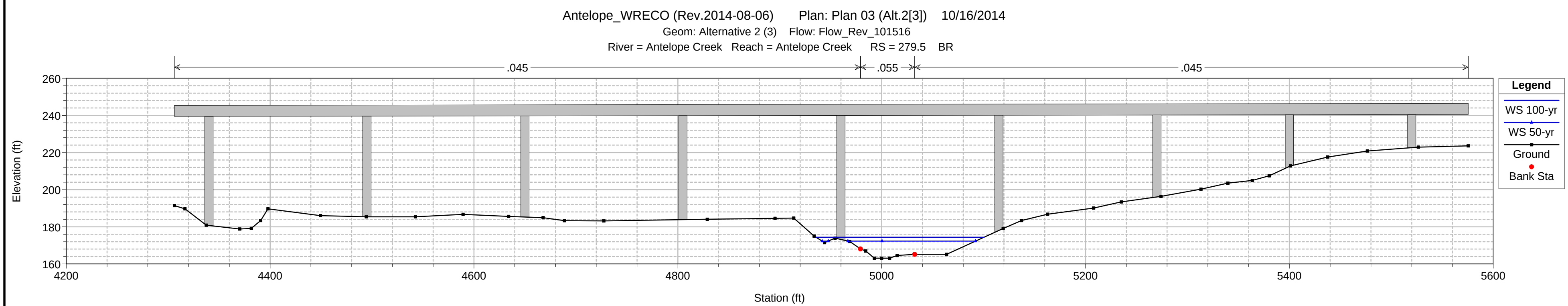
Antelope_WRECO (Rev.2014-08-06) Plan: Plan 02 (Alt. 1) 10/16/2014
Geom: Alternative 1 Flow: Flow_Rev_101516
Antelope Creek Antelope Creek
Legend
WS 100-yr
WS 50-yr
Ground
LOB
ROB
Elevation (ft)
260
240
220
200
180
160
200
400
600
800
1000
1200
1400
1600
1800
2000
Main Channel Distance (ft)

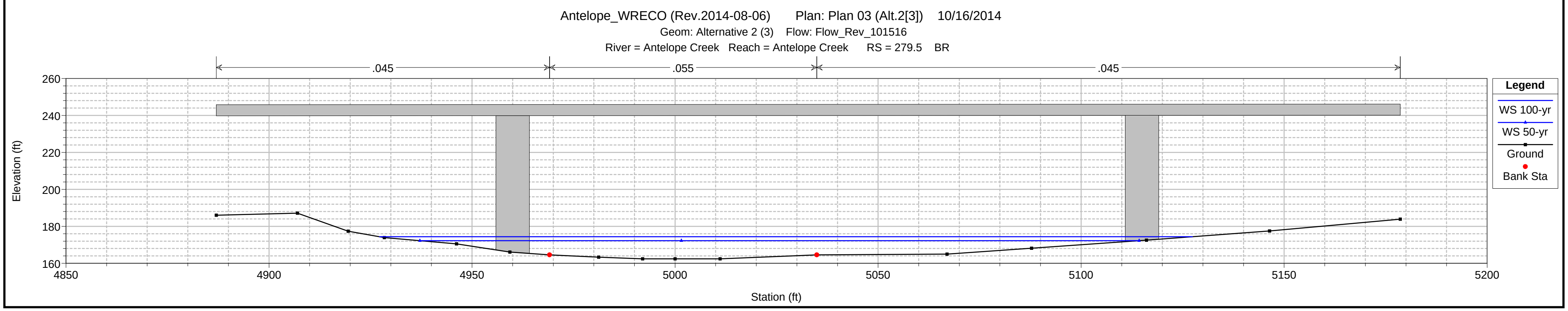
HEC-RAS Plan: Alt. 1   River: Antelope Creek   Reach: Antelope Creek

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Antelope Creek	282	100-yr	4095.00	164.50	174.87		175.04	0.000908	3.60	1266.23	196.87	0.21
Antelope Creek	282	50-yr	3418.00	164.50	173.09		173.32	0.001530	4.07	934.07	178.01	0.26
Antelope Creek	280	100-yr	4095.00	163.10	174.43	168.87	174.67	0.001099	4.07	1083.07	165.12	0.23
Antelope Creek	280	50-yr	3418.00	163.10	172.37	168.40	172.69	0.001905	4.59	771.67	132.20	0.29
Antelope Creek	279.5		Bridge									
Antelope Creek	278	100-yr	4095.00	162.40	174.27		174.39	0.000502	3.01	1517.38	199.35	0.16
Antelope Creek	278	50-yr	3418.00	162.40	172.06		172.21	0.000871	3.42	1102.44	175.14	0.20
Antelope Creek	276	100-yr	4095.00	161.70	174.16		174.25	0.000411	2.75	1709.78	235.82	0.14
Antelope Creek	276	50-yr	3418.00	161.70	171.83		171.97	0.000865	3.43	1176.86	219.65	0.20
Antelope Creek	274	100-yr	4095.00	161.00	174.12		174.17	0.000190	1.84	2197.54	222.99	0.09
Antelope Creek	274	50-yr	3418.00	161.00	171.75		171.82	0.000306	2.06	1679.95	214.86	0.12
Antelope Creek	272	100-yr	4095.00	160.00	173.95	166.32	174.09	0.000601	3.21	1410.61	183.37	0.17
Antelope Creek	272	50-yr	3418.00	160.00	171.48	165.78	171.68	0.001150	3.75	987.19	160.45	0.22

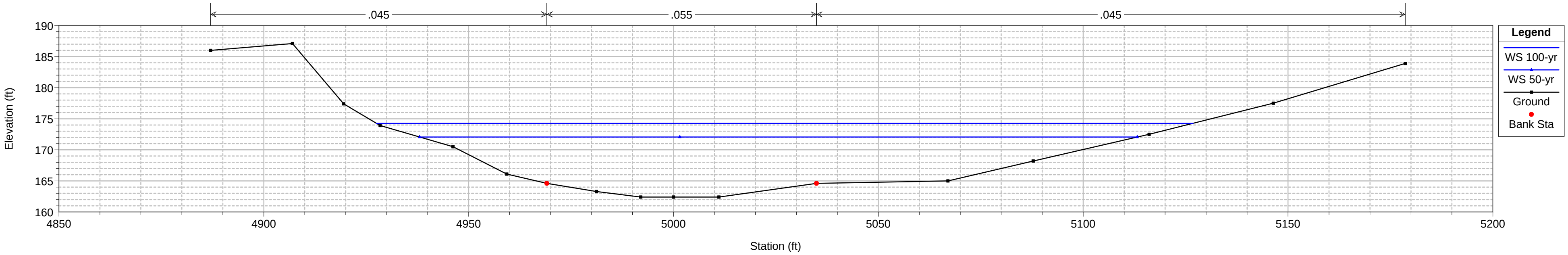

Antelope_WRECO (Rev.2014-08-06) Plan: Plan 03 (Alt.2[3]) 10/16/2014
Geom: Alternative 2 (3) Flow: Flow_Rev_101516
River = Antelope Creek Reach = Antelope Creek RS = 282
.045
.055
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
Ground
Bank Sta


Antelope_WRECO (Rev.2014-08-06) Plan: Plan 03 (Alt.2[3]) 10/16/2014
Geom: Alternative 2 (3) Flow: Flow_Rev_101516
River = Antelope Creek Reach = Antelope Creek RS = 280
.045
.055
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
Ground
Bank Sta

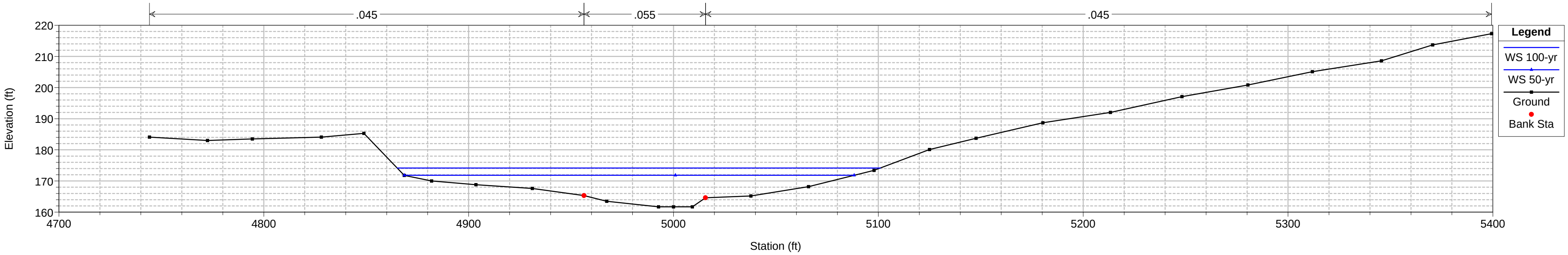

Antelope_WRECO (Rev.2014-08-06) Plan: Plan 03 (Alt.2[3]) 10/16/2014
Geom: Alternative 2 (3) Flow: Flow_Rev_101516
River = Antelope Creek Reach = Antelope Creek RS = 279.5 BR
.045
.055
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
Ground
Bank Sta


Antelope_WRECO (Rev.2014-08-06) Plan: Plan 03 (Alt.2[3]) 10/16/2014
Geom: Alternative 2 (3) Flow: Flow_Rev_101516
River = Antelope Creek Reach = Antelope Creek RS = 279.5 BR
.045
.055
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
Ground
Bank Sta

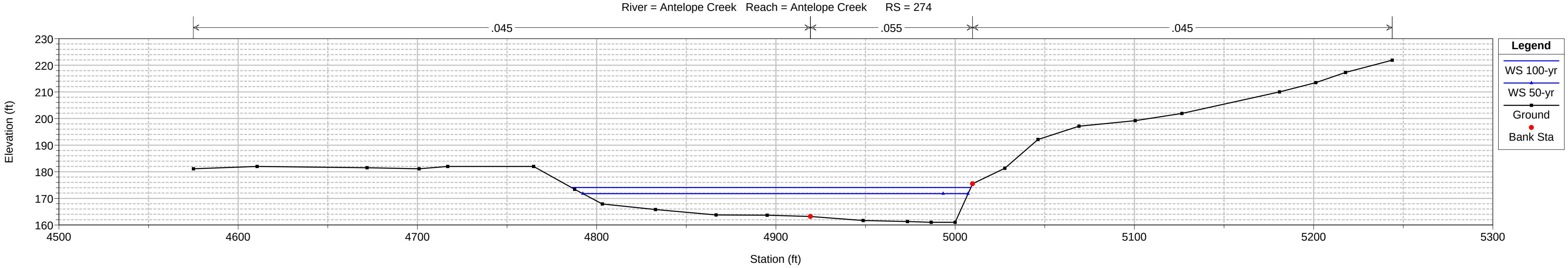
Antelope_WRECO (Rev.2014-08-06) Plan: Plan 03 (Alt.2[3]) 10/16/2014
Geom: Alternative 2 (3) Flow: Flow_Rev_101516
River = Antelope Creek Reach = Antelope Creek RS = 278



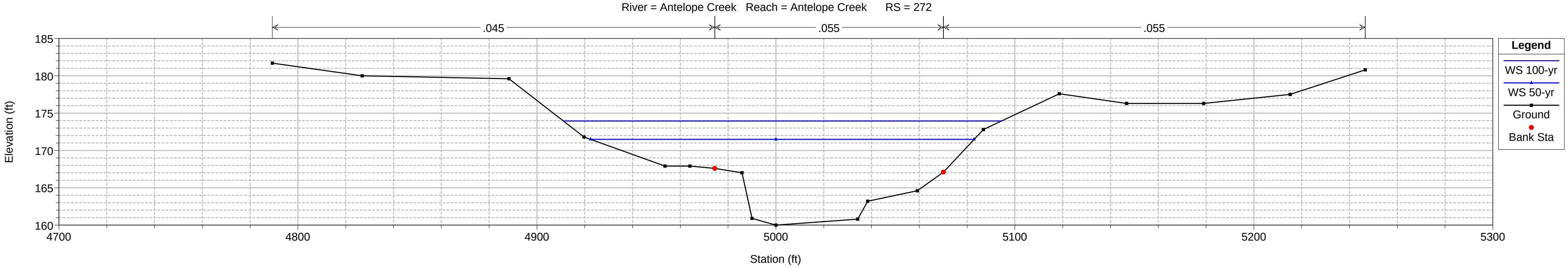
Antelope_WRECO (Rev.2014-08-06) Plan: Plan 03 (Alt.2[3]) 10/16/2014
Geom: Alternative 2 (3) Flow: Flow_Rev_101516
River = Antelope Creek Reach = Antelope Creek RS = 276



Antelope_WRECO (Rev.2014-08-06) Plan: Plan 03 (Alt.2[3]) 10/16/2014
Geom: Alternative 2 (3) Flow: Flow_Rev_101516
River = Antelope Creek Reach = Antelope Creek RS = 274



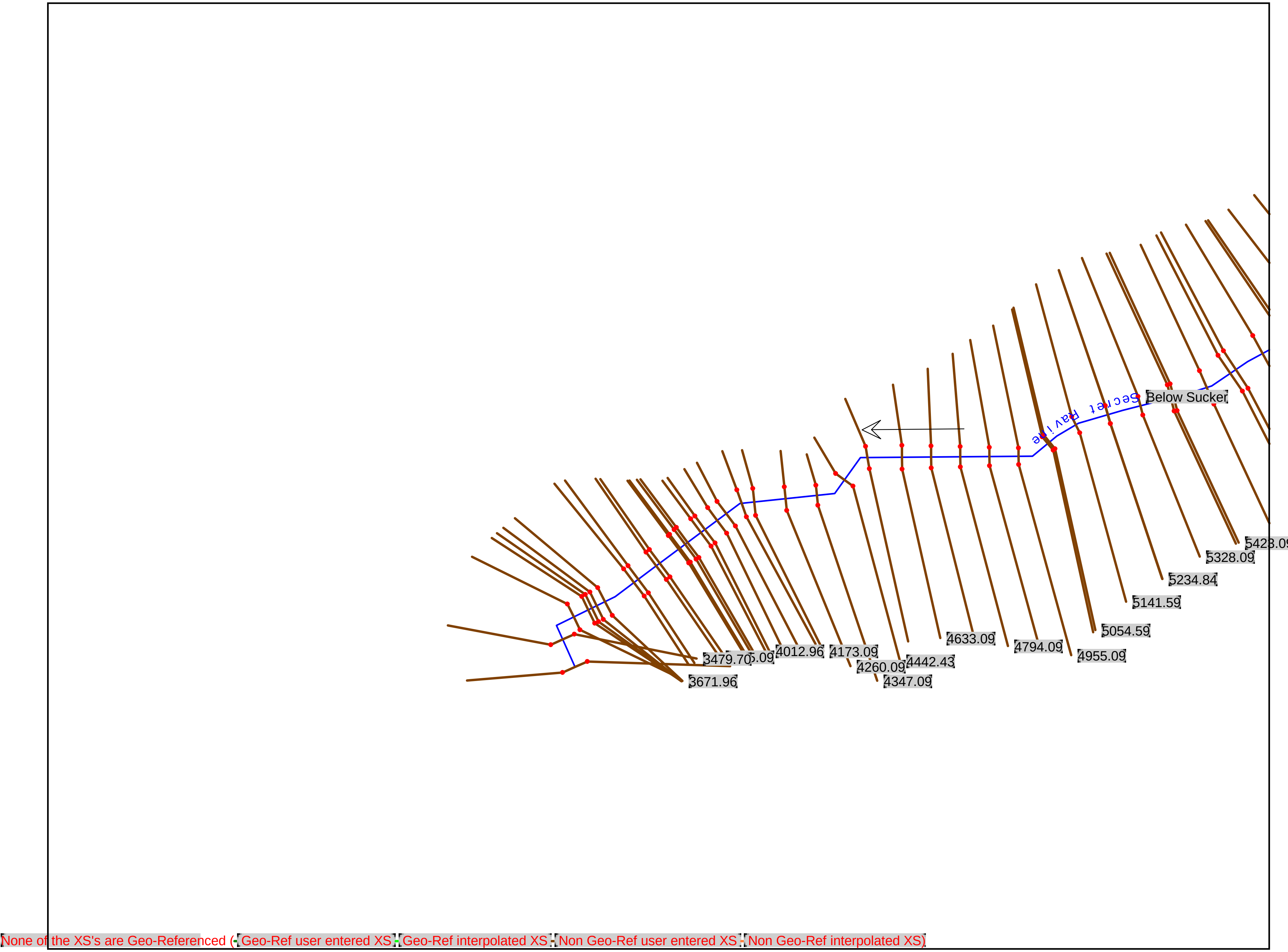
Antelope_WRECO (Rev.2014-08-06) Plan: Plan 03 (Alt.2[3]) 10/16/2014
Geom: Alternative 2 (3) Flow: Flow_Rev_101516
River = Antelope Creek Reach = Antelope Creek RS = 272



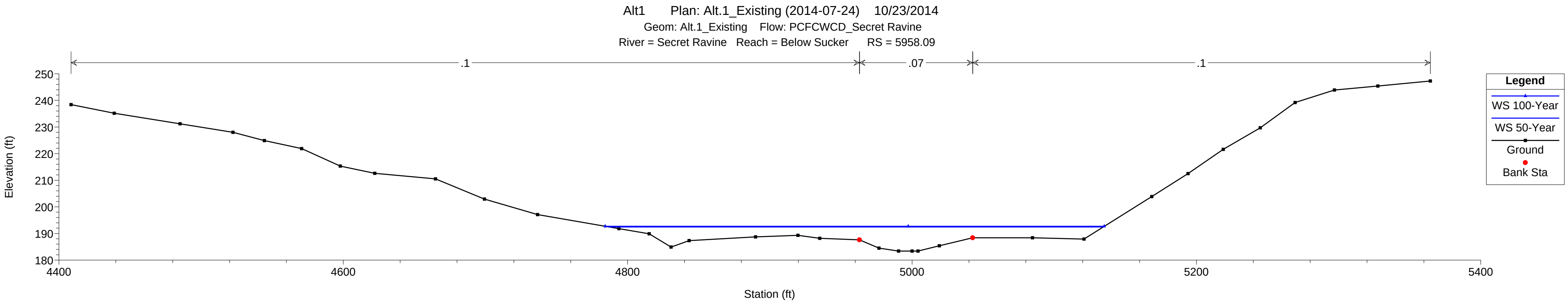
HEC-RAS Plan: Alt. 2 (3) River: Antelope Creek Reach: Antelope Creek

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Antelope Creek	282	100-yr	4095.00	164.50	174.87		175.05	0.000905	3.60	1267.67	196.95	0.21
Antelope Creek	282	50-yr	3418.00	164.50	173.11		173.33	0.001520	4.06	936.20	178.13	0.26
Antelope Creek	280	100-yr	4095.00	163.10	174.44	168.87	174.68	0.001095	4.07	1084.53	165.18	0.23
Antelope Creek	280	50-yr	3418.00	163.10	172.39	168.40	172.70	0.001890	4.58	773.96	132.53	0.29
Antelope Creek	279.5		Bridge									
Antelope Creek	278	100-yr	4095.00	162.40	174.27		174.39	0.000502	3.01	1517.38	199.35	0.16
Antelope Creek	278	50-yr	3418.00	162.40	172.06		172.21	0.000871	3.42	1102.44	175.14	0.20
Antelope Creek	276	100-yr	4095.00	161.70	174.16		174.25	0.000411	2.75	1709.78	235.82	0.14
Antelope Creek	276	50-yr	3418.00	161.70	171.83		171.97	0.000865	3.43	1176.86	219.65	0.20
Antelope Creek	274	100-yr	4095.00	161.00	174.12		174.17	0.000190	1.84	2197.54	222.99	0.09
Antelope Creek	274	50-yr	3418.00	161.00	171.75		171.82	0.000306	2.06	1679.95	214.86	0.12
Antelope Creek	272	100-yr	4095.00	160.00	173.95	166.32	174.09	0.000601	3.21	1410.61	183.37	0.17
Antelope Creek	272	50-yr	3418.00	160.00	171.48	165.78	171.68	0.001150	3.75	987.19	160.45	0.22

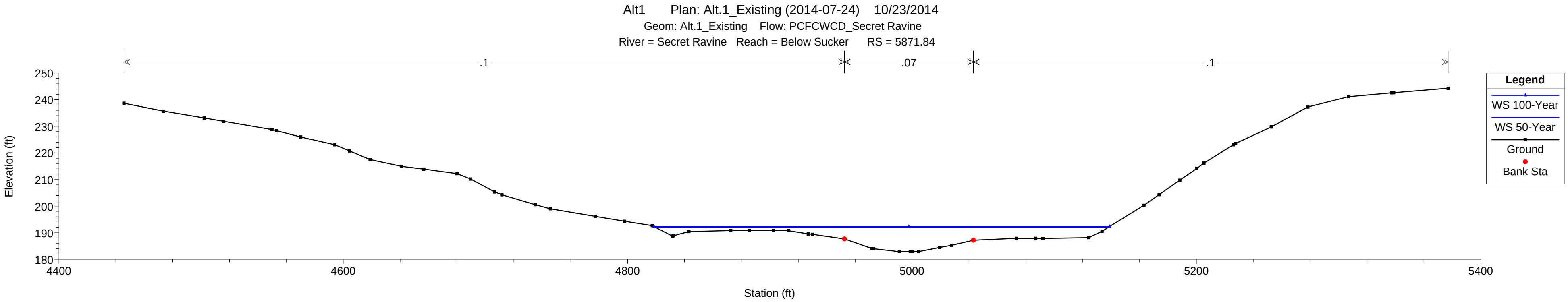
Appendix B.2 Secret Ravine HEC-RAS Outputs



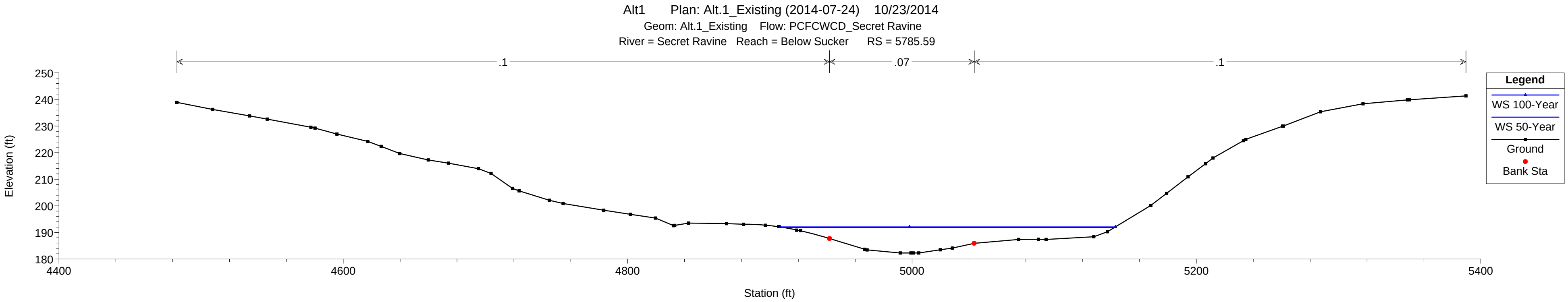
Secret Ravine
Below Sucker
5428.09
5328.09
5234.84
5141.59
5054.59
4955.09
4794.09
4633.09
4442.43
4347.09
4260.09
4173.09
4012.96
5.09
3479.70
3671.96
None of the XS's are Geo-Referenced (Geo-Ref user entered XS Geo-Ref interpolated XS Non Geo-Ref user entered XS Non Geo-Ref interpolated XS)



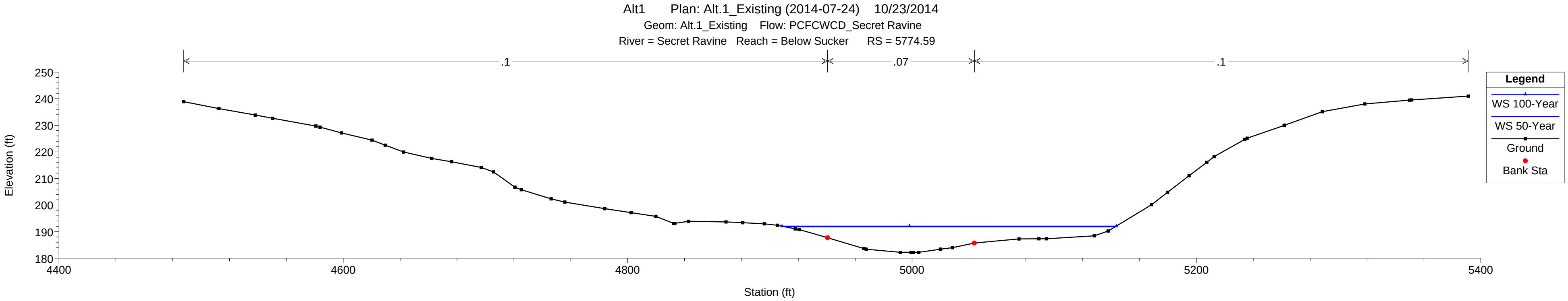
Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5958.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta



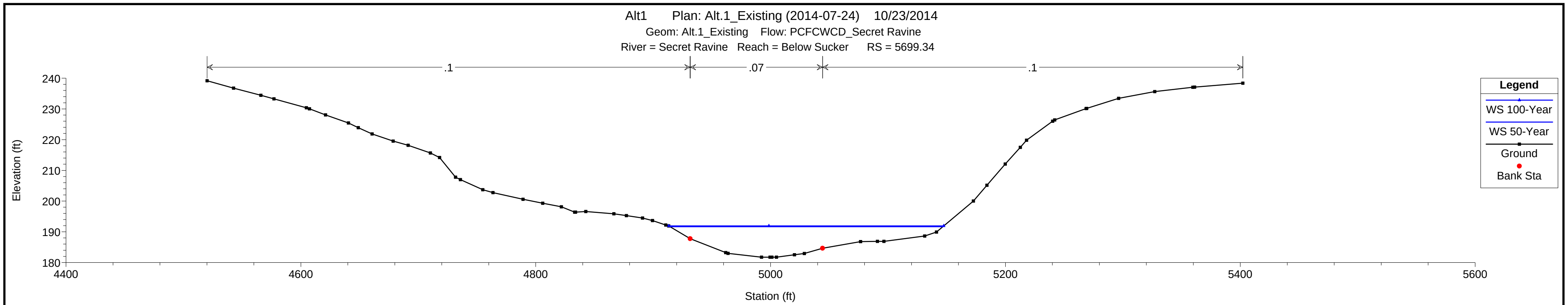
Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5871.84
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

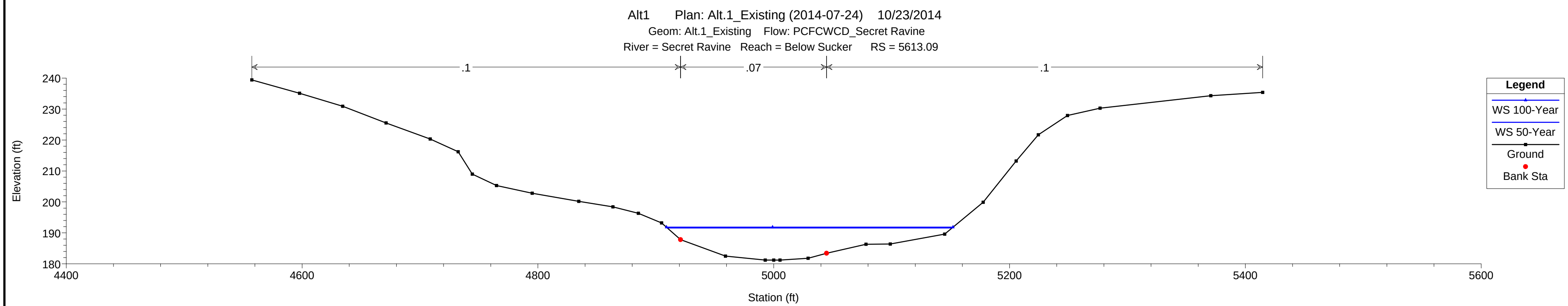


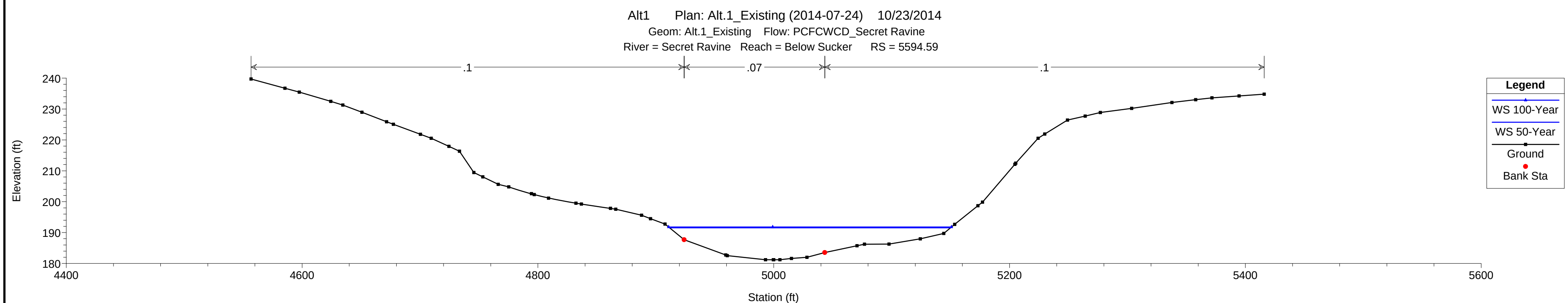
Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5785.59
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

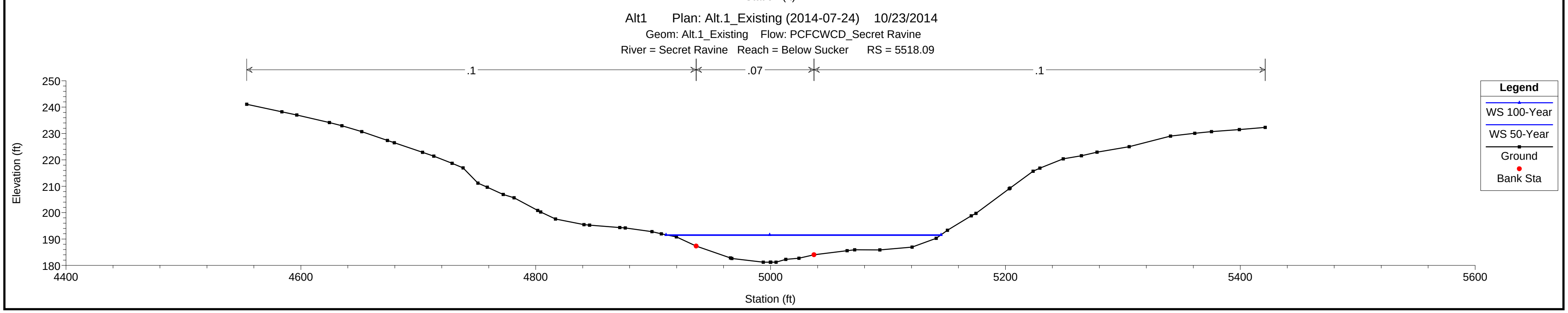


Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5774.59
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

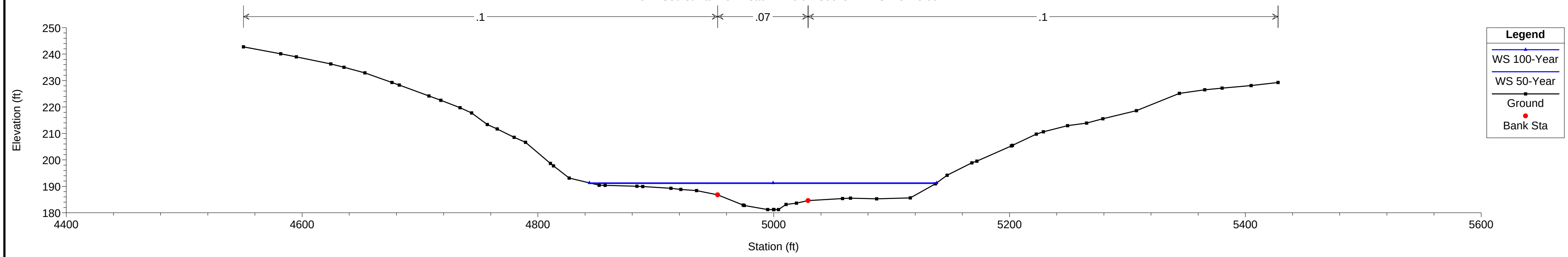

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5699.34
.1
.07
.1
Elevation (ft)
240
230
220
210
200
190
180
4400
4600
4800
5000
5200
5400
5600
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5613.09
.1
.07
.1
Elevation (ft)
240
230
220
210
200
190
180
4400
4600
4800
5000
5200
5400
5600
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

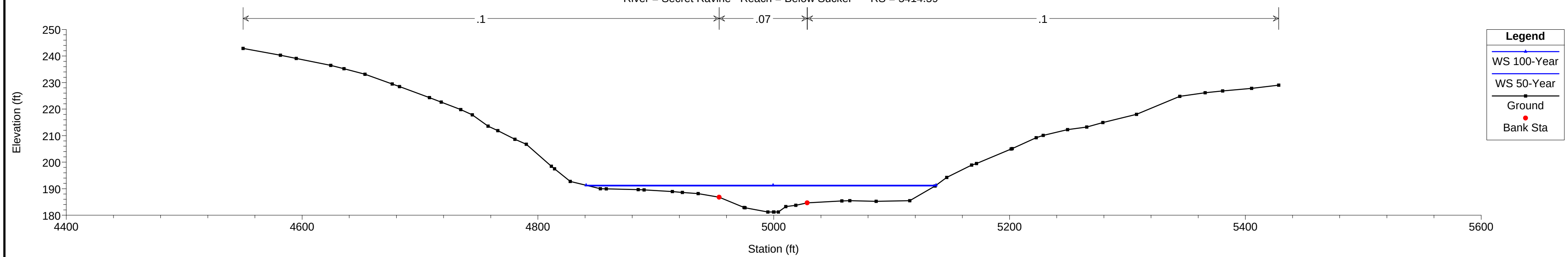

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5594.59
.1
.07
.1
Elevation (ft)
240
230
220
210
200
190
180
4400
4600
4800
5000
5200
5400
5600
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5518.09
.1
.07
.1
Elevation (ft)
250
240
230
220
210
200
190
180
4400
4600
4800
5000
5200
5400
5600
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

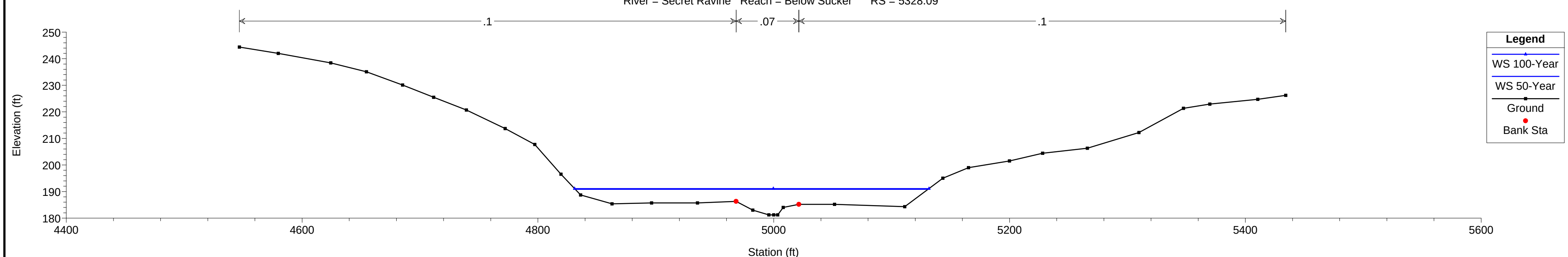
Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5423.09



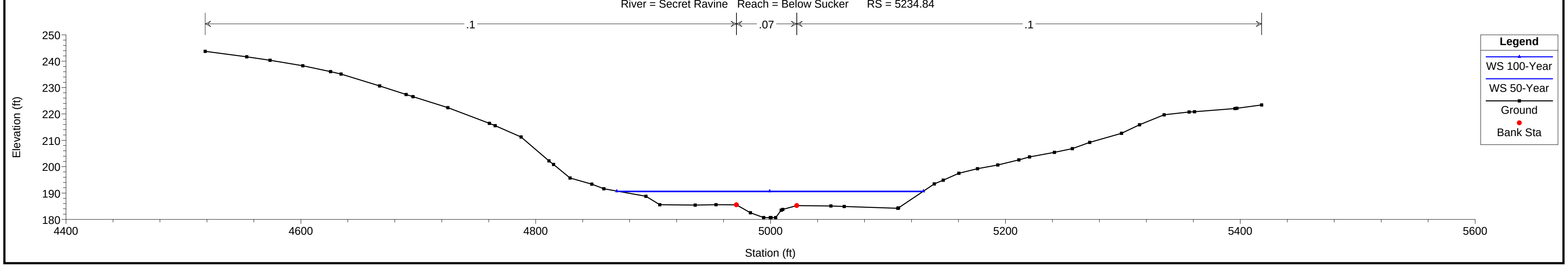
Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5414.59



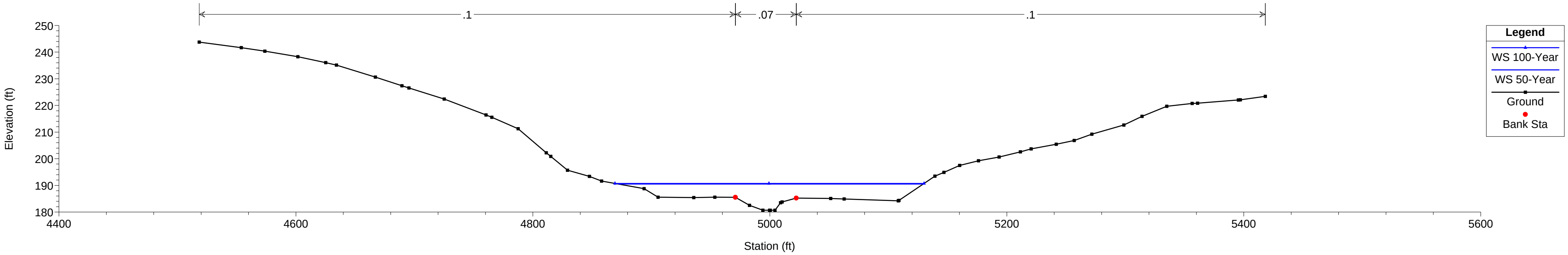
Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5328.09



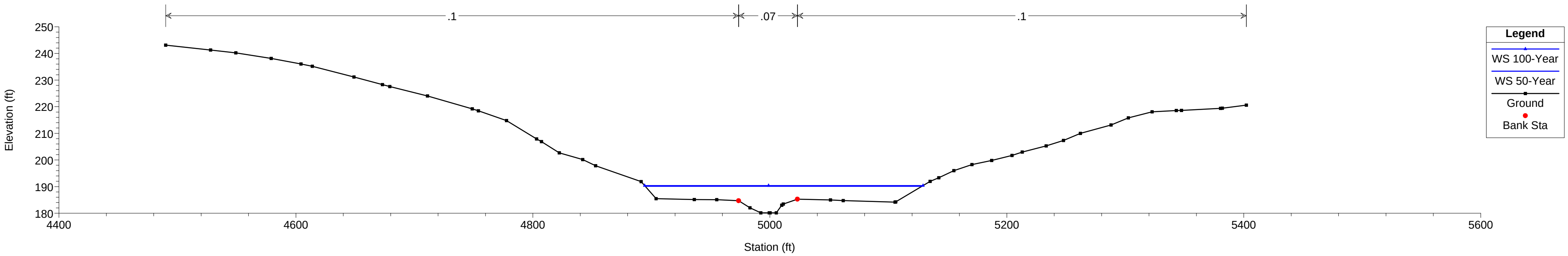
Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5234.84



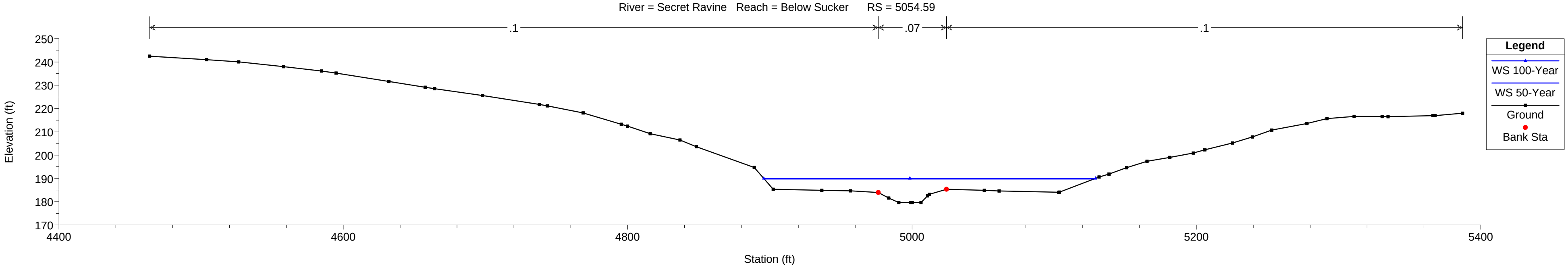
Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5234.59



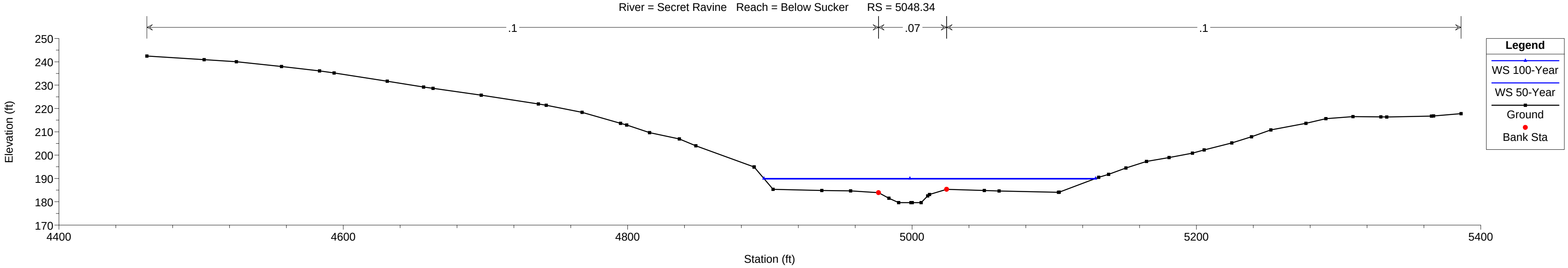
Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5141.59

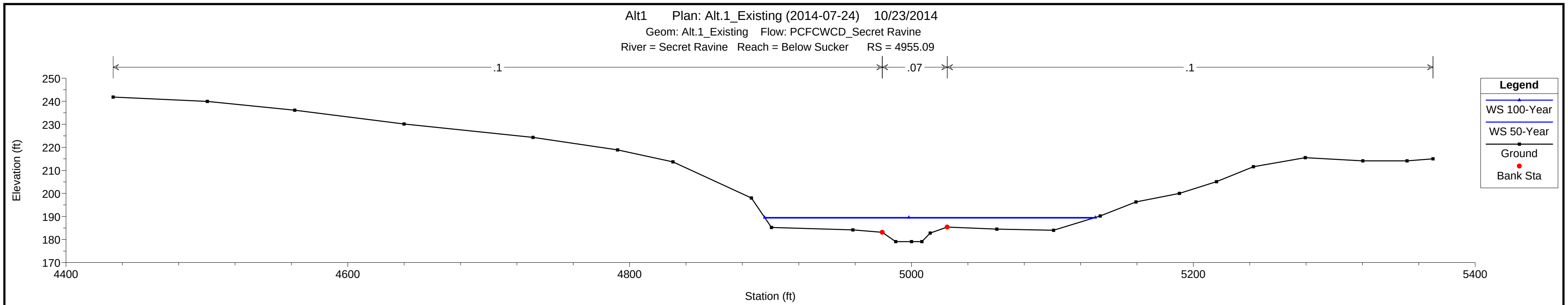


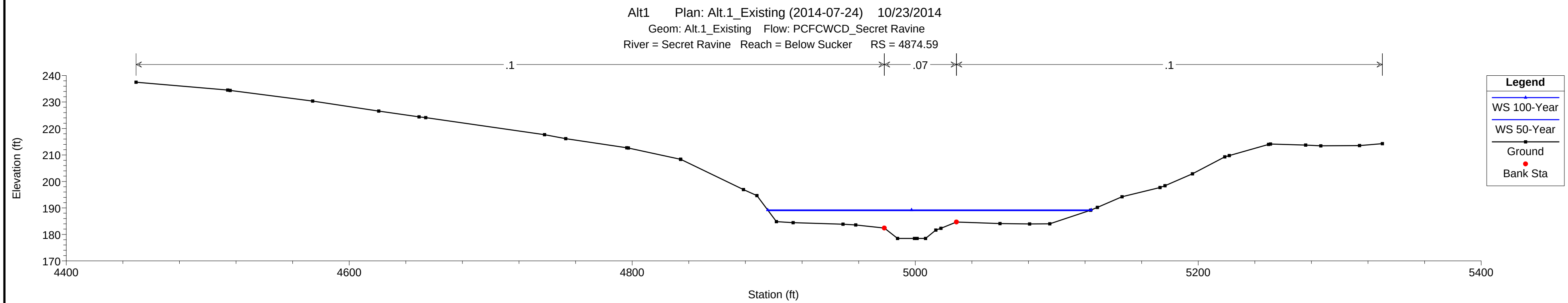
Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5054.59

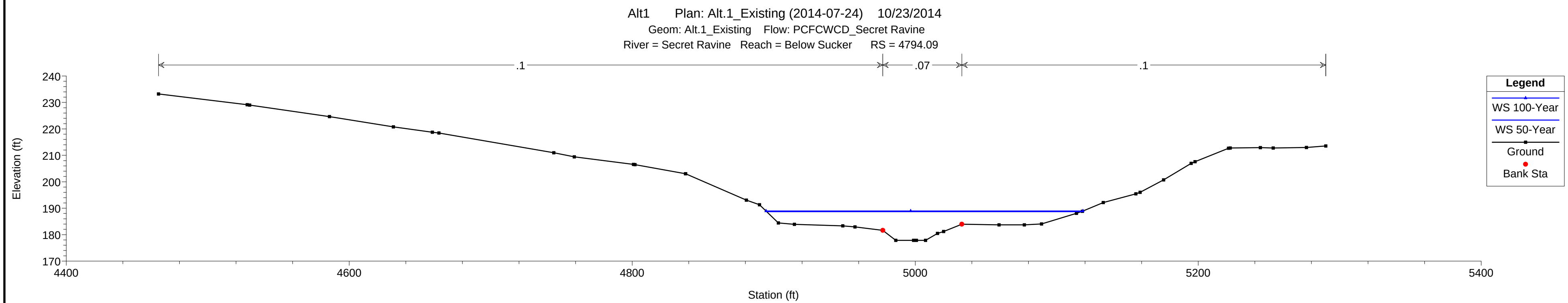


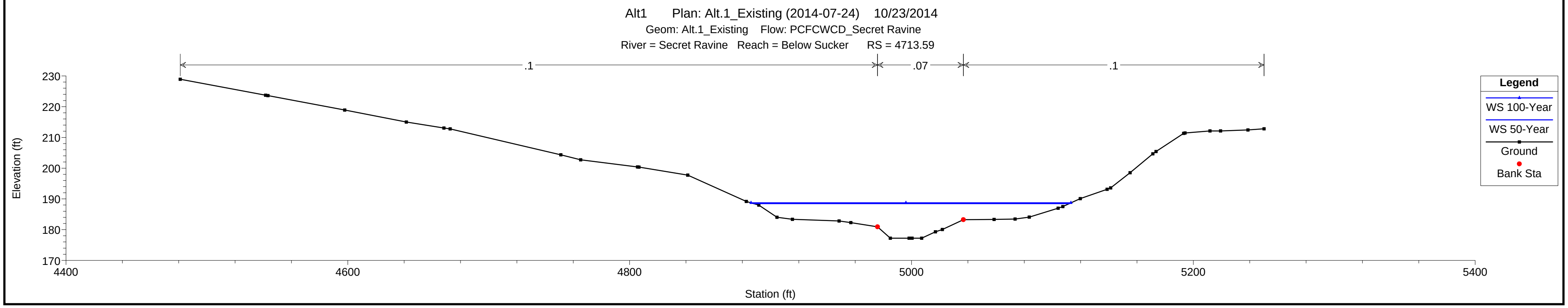
Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5048.34

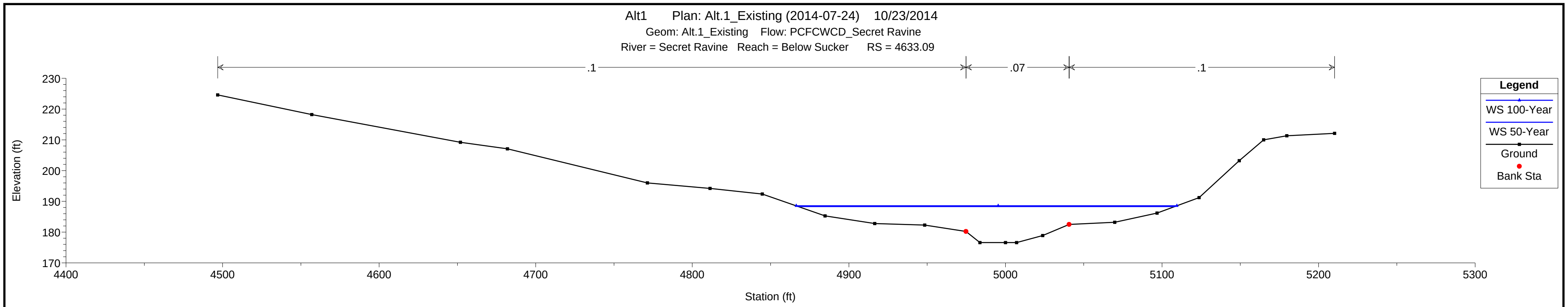


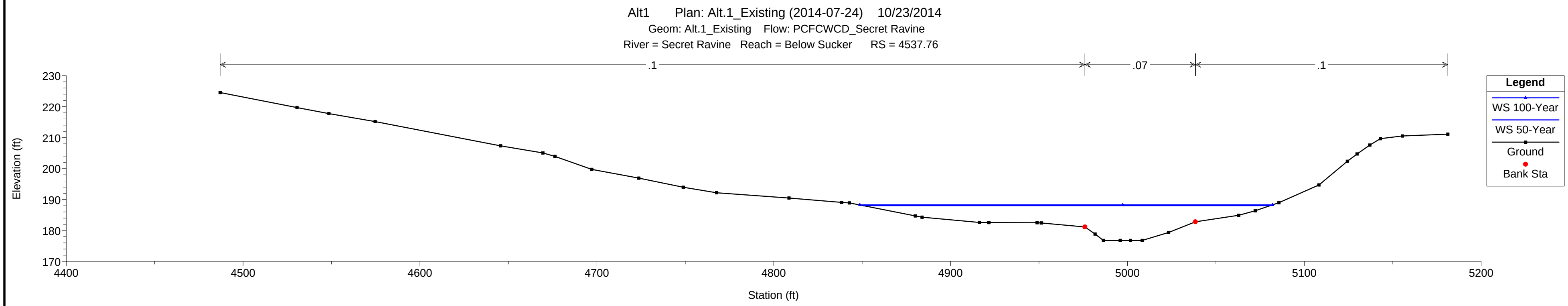

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4955.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

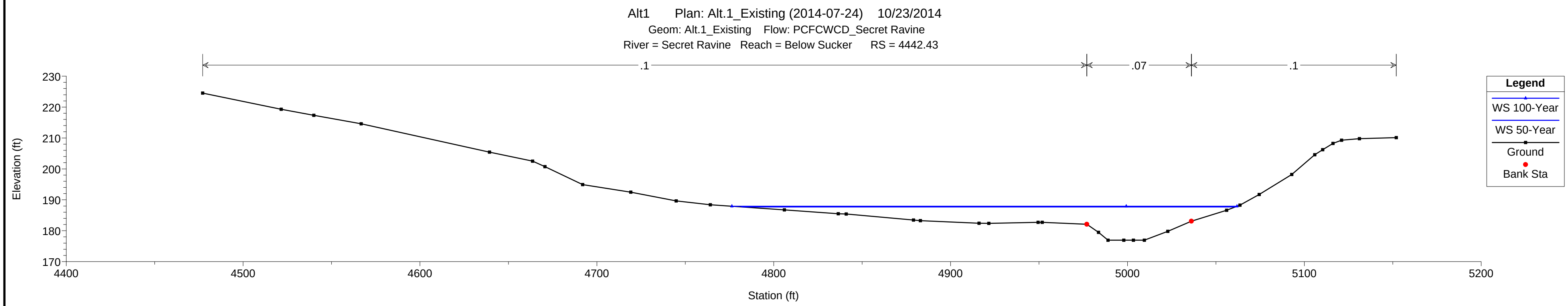

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4874.59
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

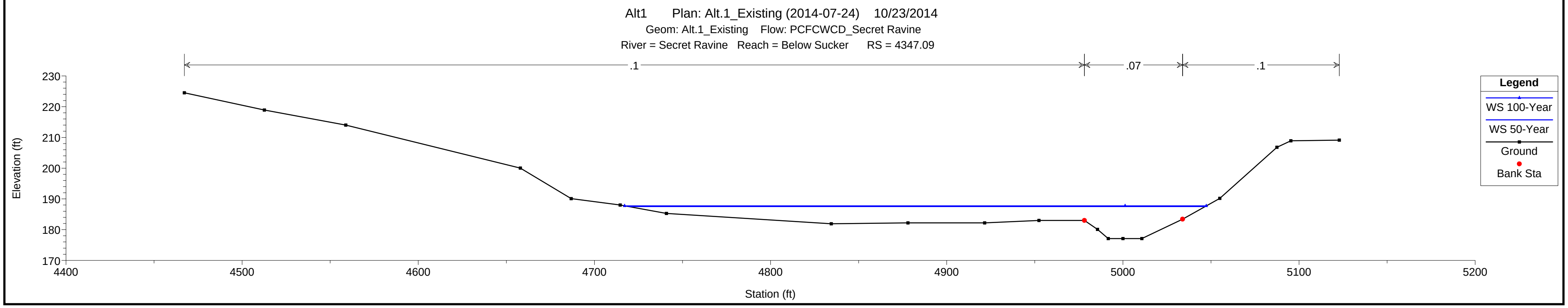

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4794.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

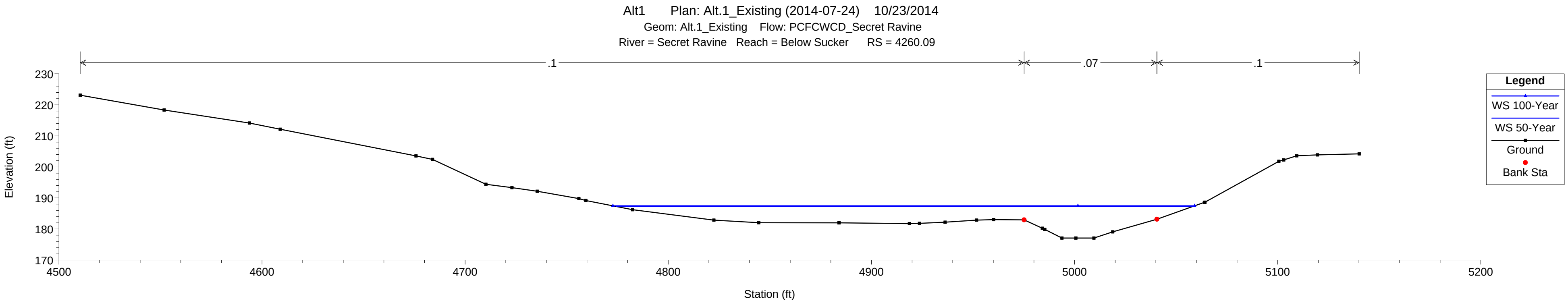

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4713.59
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

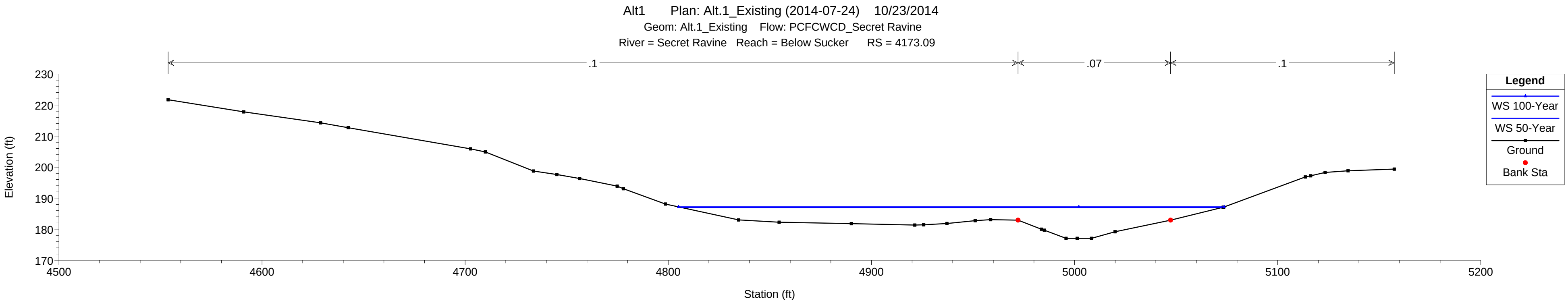

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4633.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

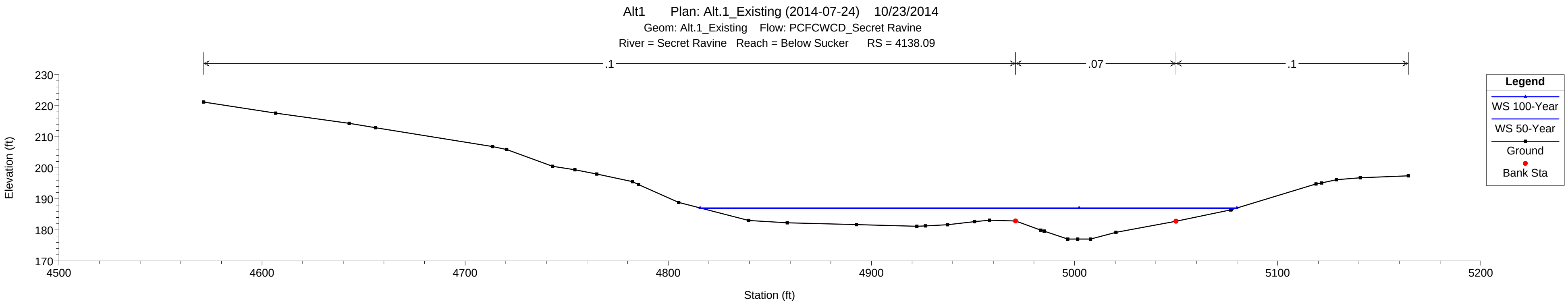

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4537.76
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

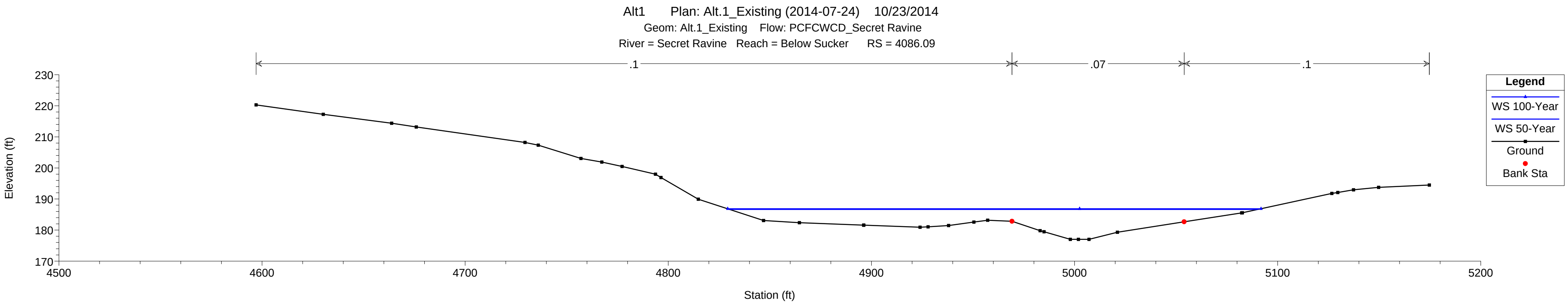

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4442.43
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4347.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

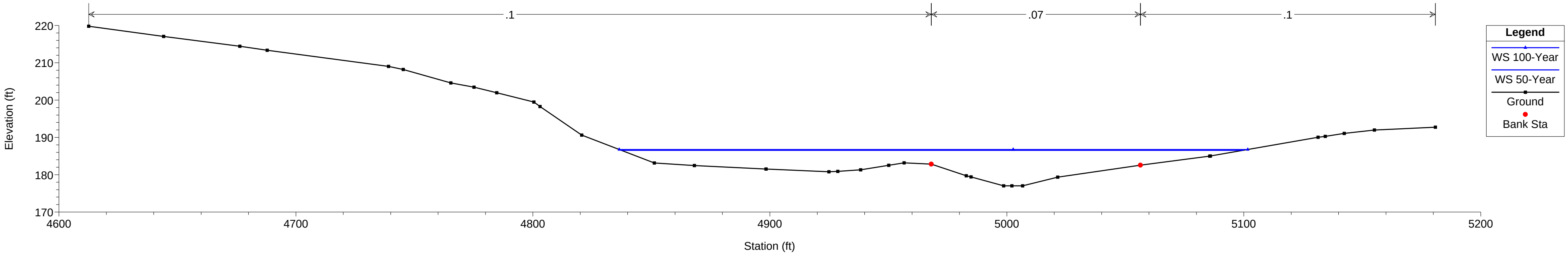

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4260.09
.1
.07
.1
Elevation (ft)
230
220
210
200
190
180
170
4500
4600
4700
4800
4900
5000
5100
5200
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4173.09
.1
.07
.1
Elevation (ft)
230
220
210
200
190
180
170
4500
4600
4700
4800
4900
5000
5100
5200
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

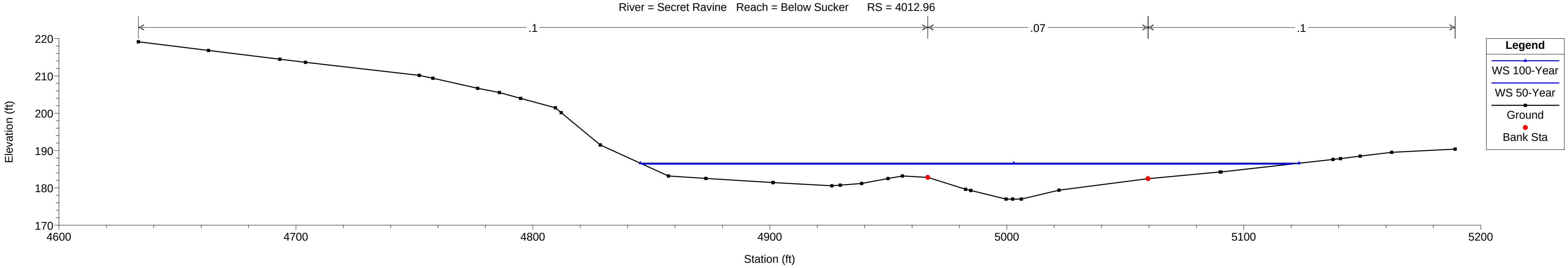

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4138.09
.1
.07
.1
Elevation (ft)
230
220
210
200
190
180
170
4500
4600
4700
4800
4900
5000
5100
5200
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4086.09
.1
.07
.1
Elevation (ft)
230
220
210
200
190
180
170
4500
4600
4700
4800
4900
5000
5100
5200
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

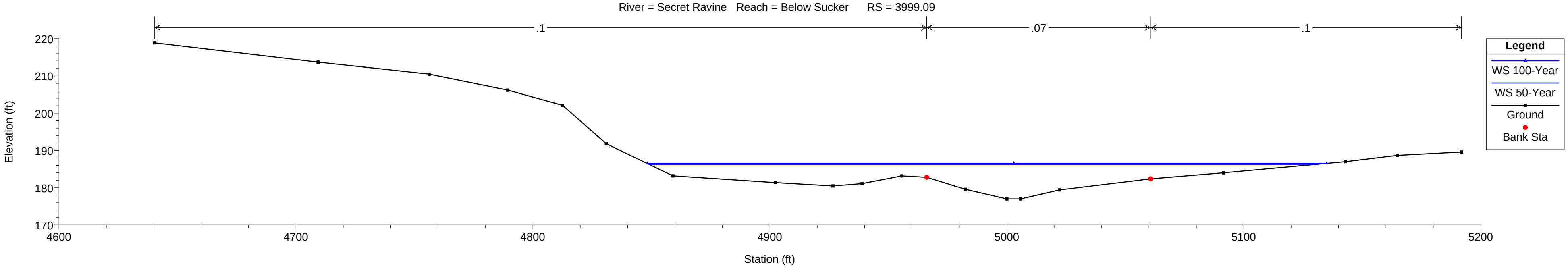
Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4054.96



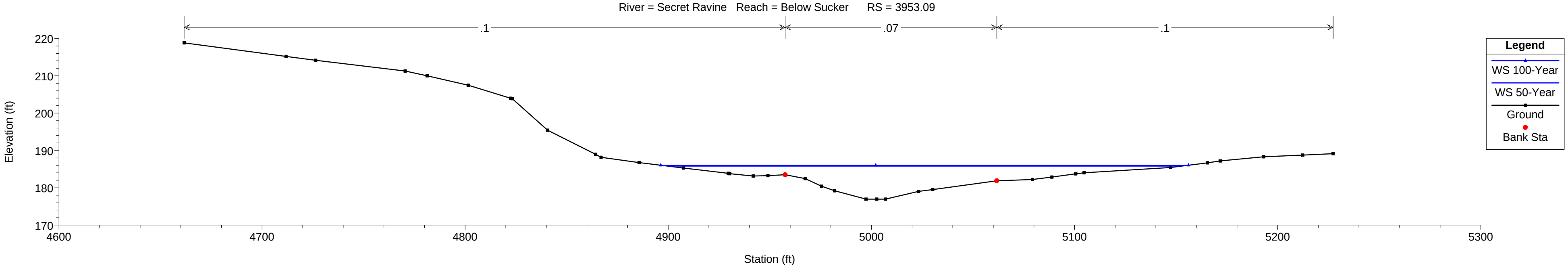
Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4012.96

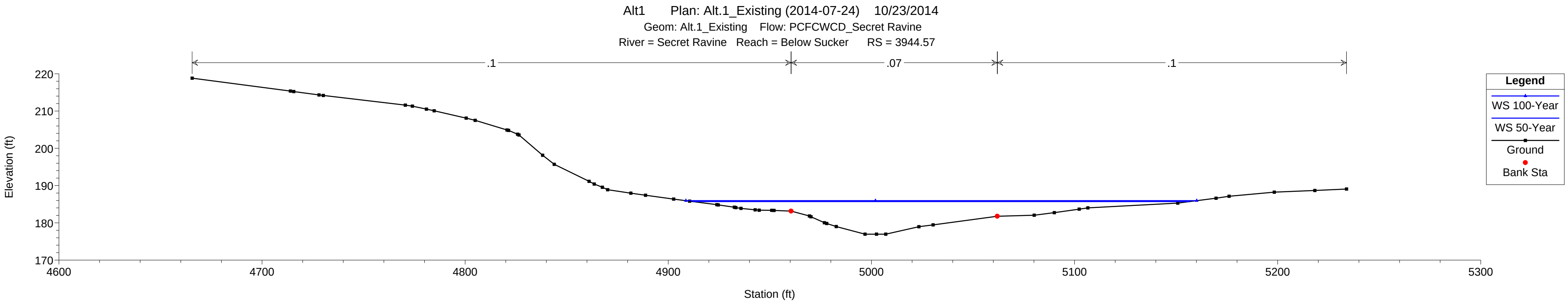


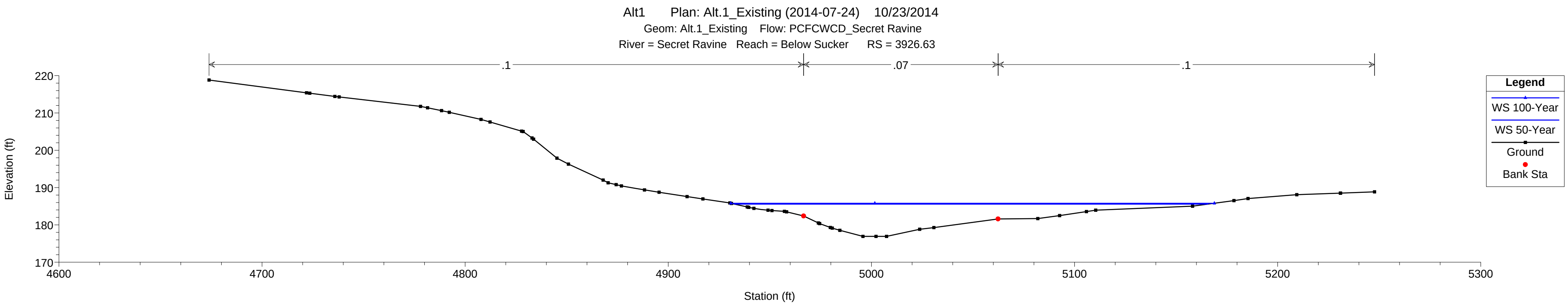
Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3999.09

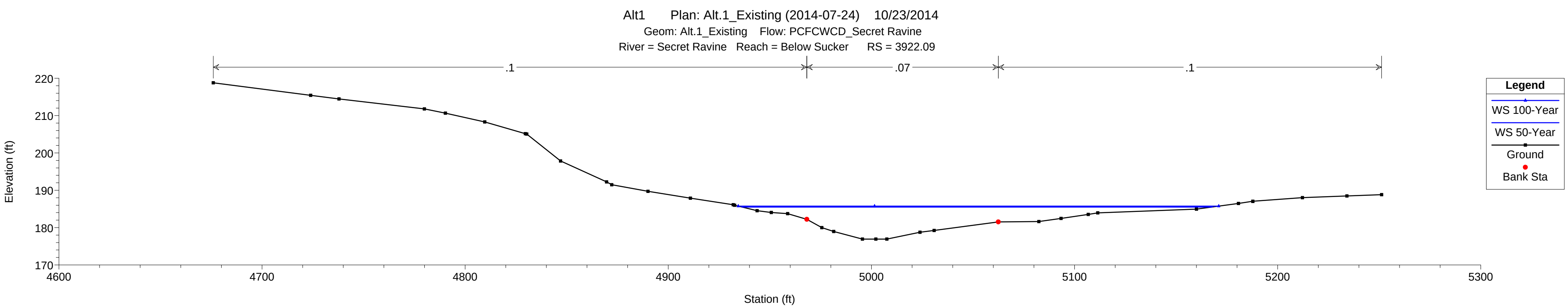


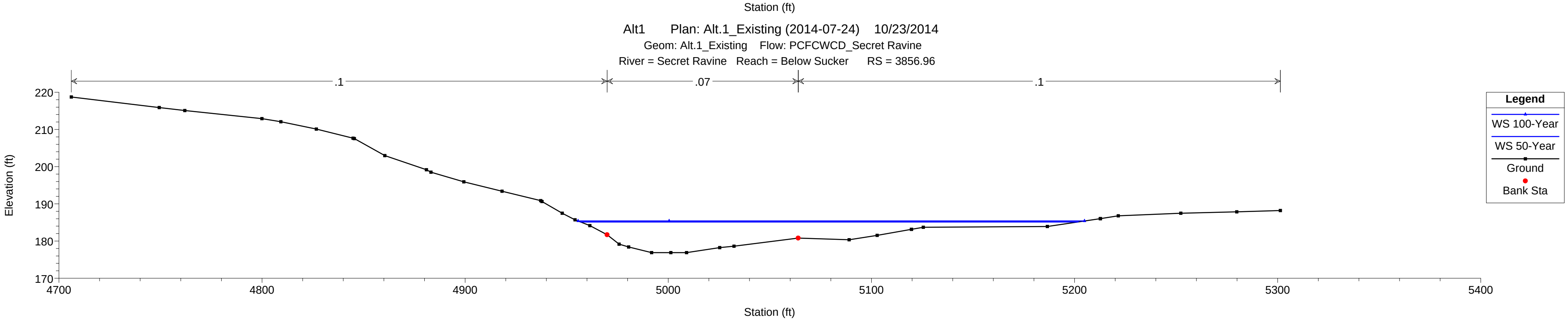
Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3953.09

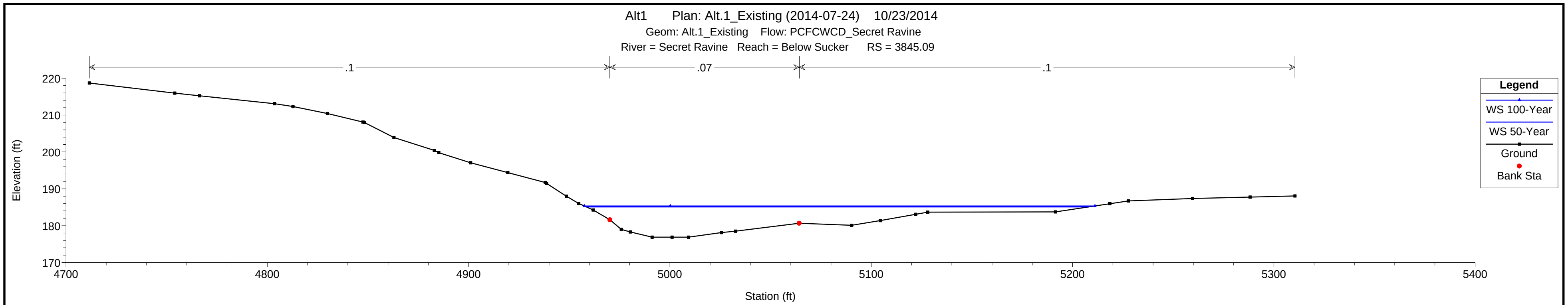


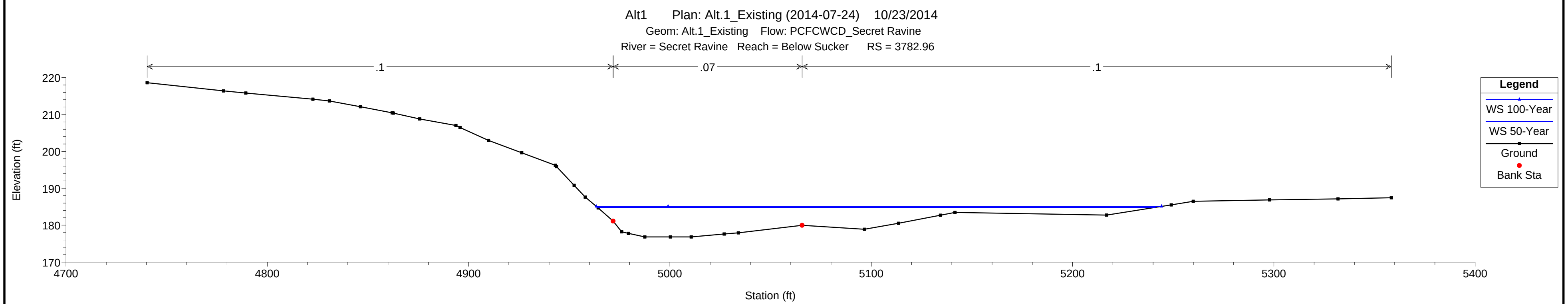

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3944.57
.1
.07
.1
Elevation (ft)
220
210
200
190
180
170
4600
4700
4800
4900
5000
5100
5200
5300
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

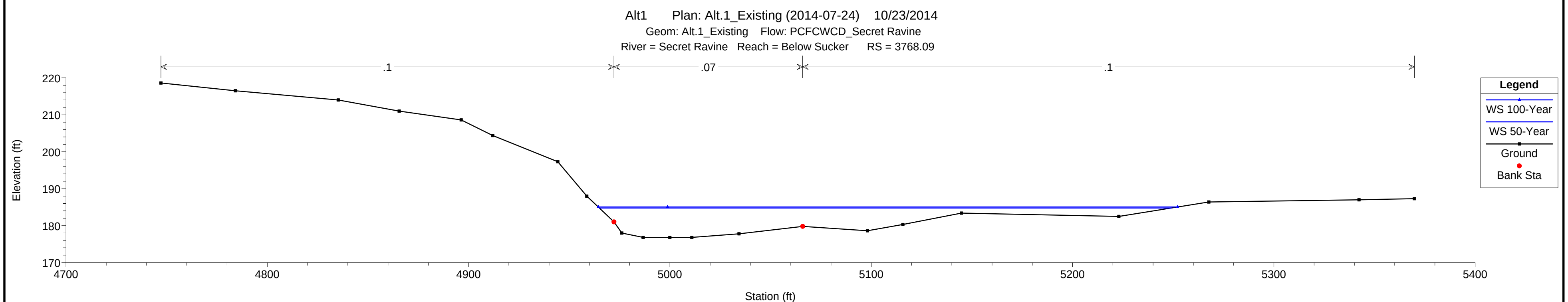

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3926.63
.1
.07
.1
Elevation (ft)
220
210
200
190
180
170
4600
4700
4800
4900
5000
5100
5200
5300
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

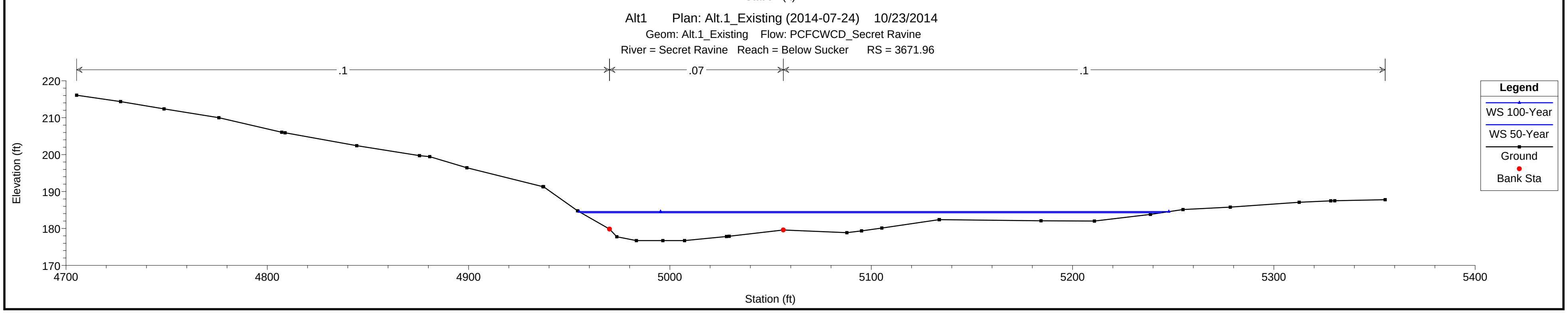

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3922.09
.1
.07
.1
Elevation (ft)
220
210
200
190
180
170
4600
4700
4800
4900
5000
5100
5200
5300
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

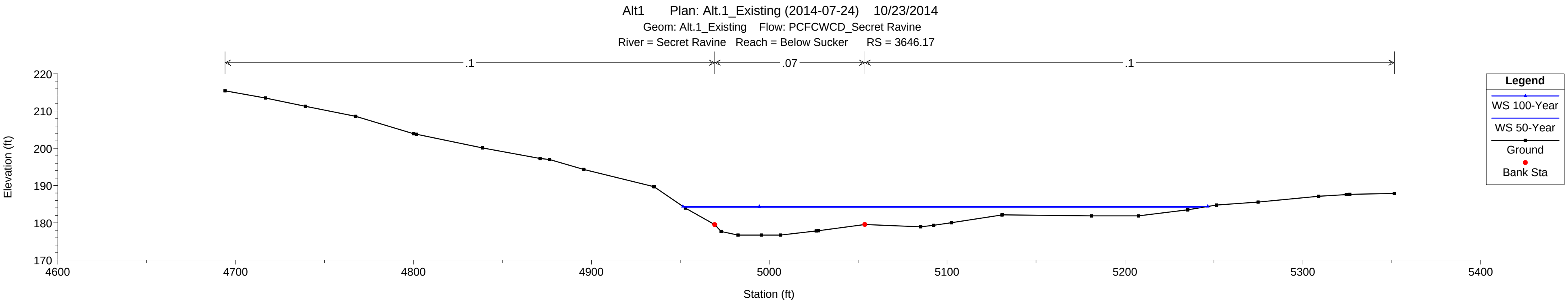

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3856.96
.1
.07
.1
Elevation (ft)
220
210
200
190
180
170
4700
4800
4900
5000
5100
5200
5300
5400
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

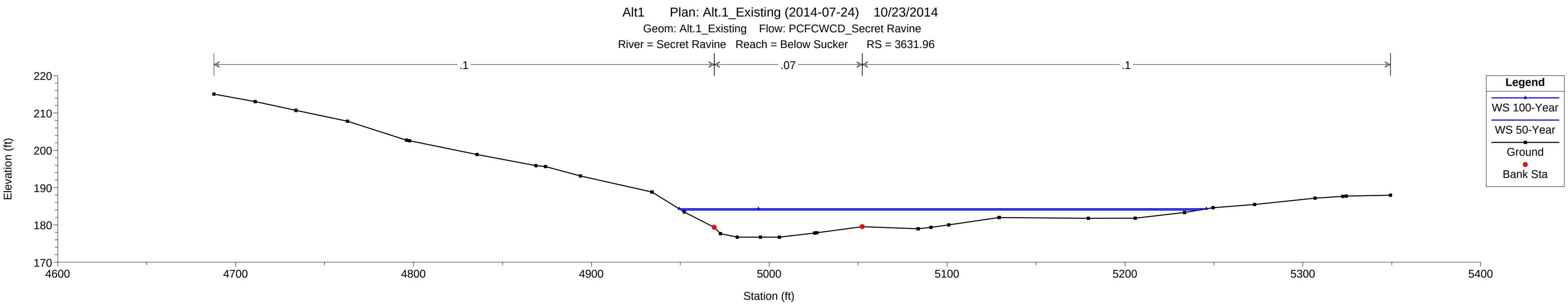

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3845.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

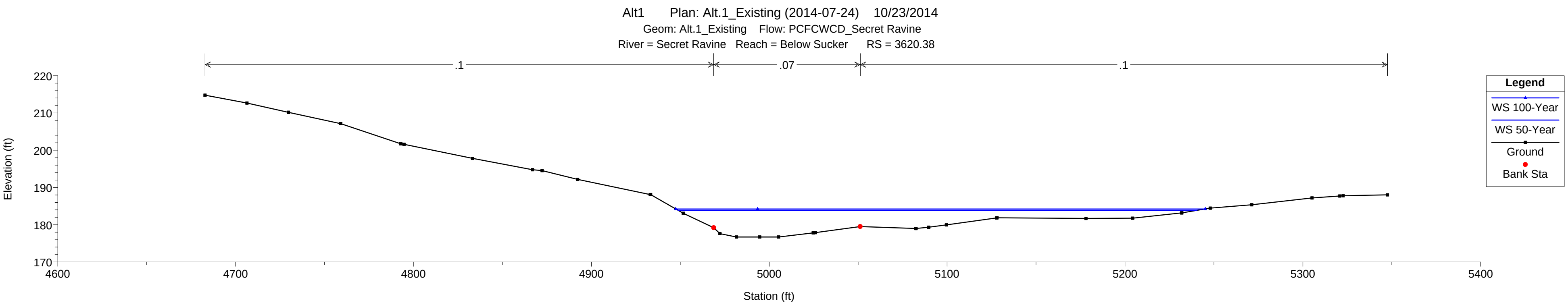

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3782.96
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

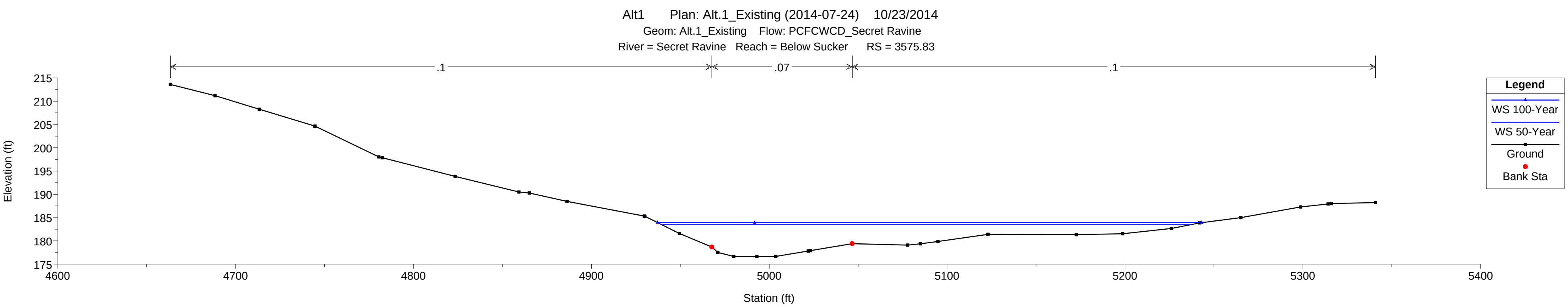

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3768.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

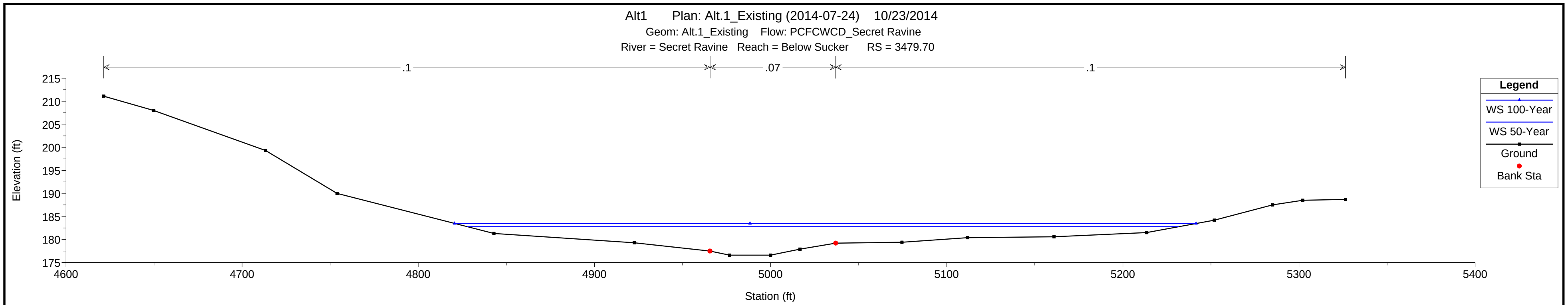

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3671.96
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

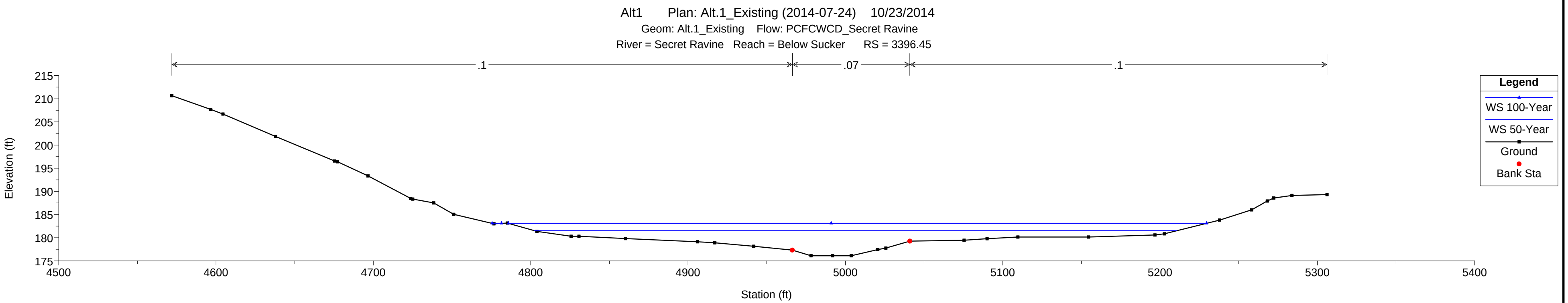

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3646.17
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

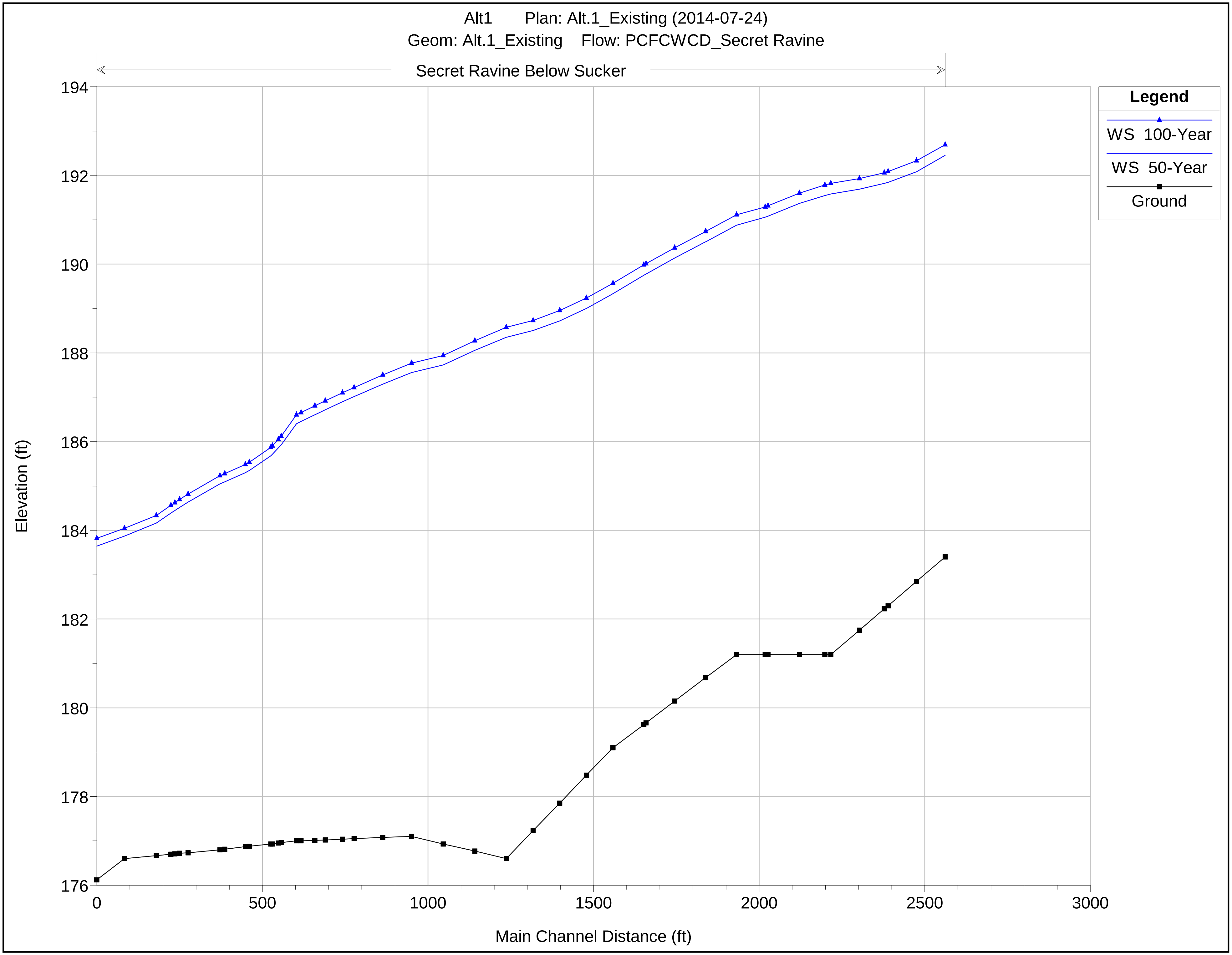

Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3631.96
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3620.38
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3575.83
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3479.70
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt1 Plan: Alt.1_Existing (2014-07-24) 10/23/2014
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3396.45
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta



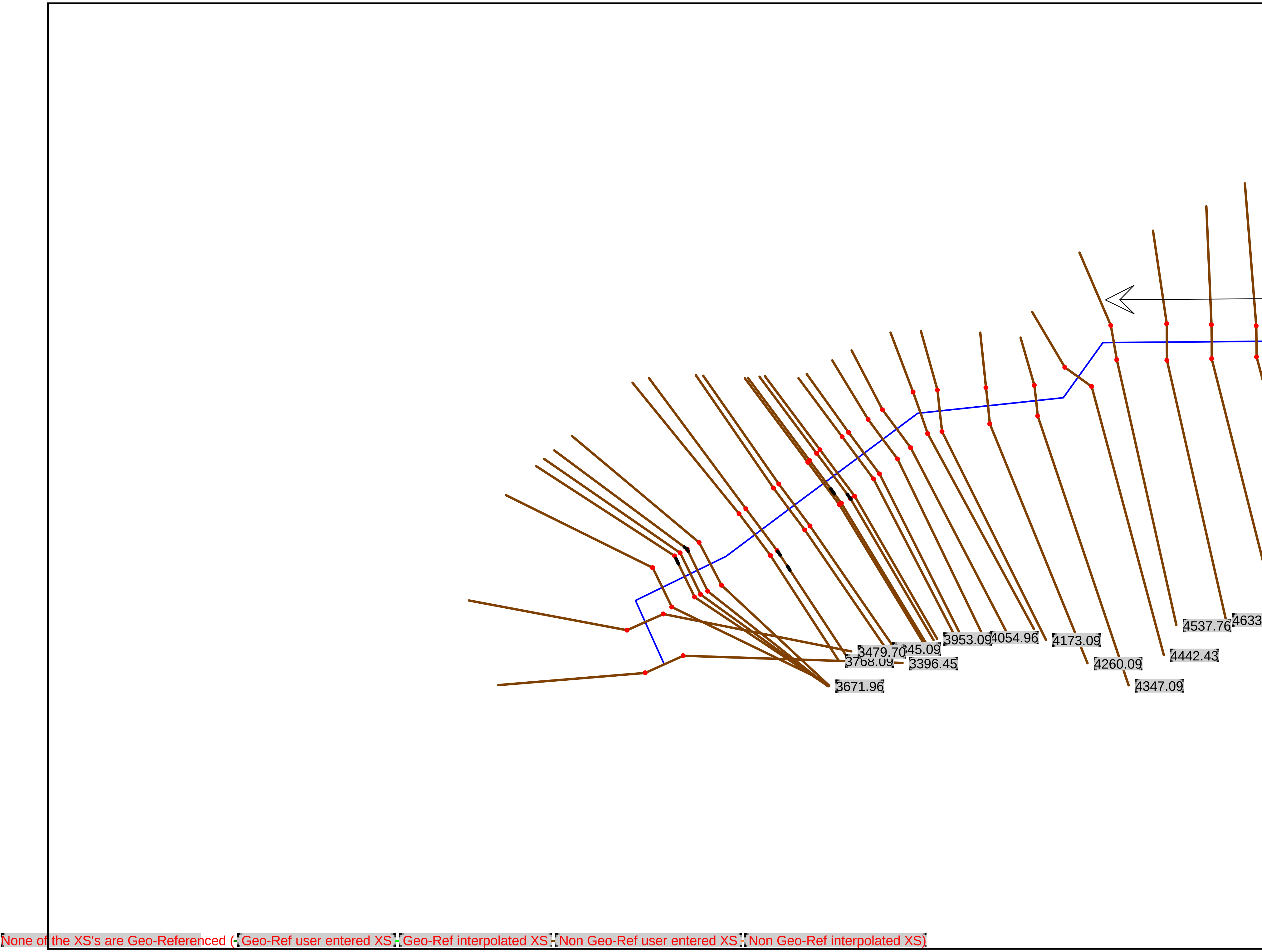
Alt1 Plan: Alt.1_Existing (2014-07-24)
Geom: Alt.1_Existing Flow: PCFCWCD_Secret Ravine
Secret Ravine Below Sucker
Legend
WS 100-Year
WS 50-Year
Ground
Elevation (ft)
Main Channel Distance (ft)
194
192
190
188
186
184
182
180
178
176
0
500
1000
1500
2000
2500
3000

HEC-RAS Plan: Alt.1(Ex)_140724 River: Secret Ravine Reach: Below Sucker

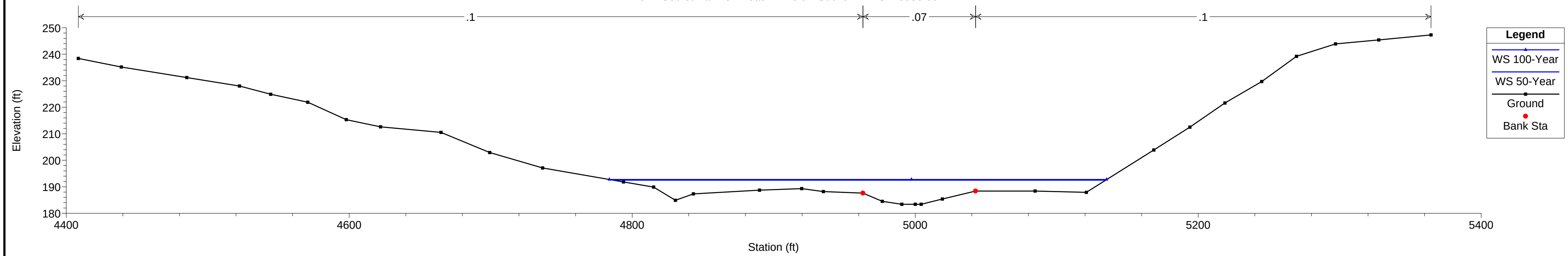
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Below Sucker	5958.09	50-Year	4415.00	183.40	192.45		192.63	0.002734	4.15	1627.55	347.73	0.27
Below Sucker	5958.09	100-Year	4697.00	183.40	192.69		192.87	0.002685	4.20	1710.93	351.01	0.27
Below Sucker	5871.84	50-Year	4415.00	182.85	192.08		192.36	0.003374	4.74	1322.53	318.84	0.30
Below Sucker	5871.84	100-Year	4697.00	182.85	192.33		192.60	0.003304	4.79	1400.72	320.46	0.30
Below Sucker	5785.59	50-Year	4415.00	182.30	191.84		192.09	0.002684	4.36	1280.51	232.65	0.27
Below Sucker	5785.59	100-Year	4697.00	182.30	192.09		192.34	0.002700	4.46	1336.90	235.67	0.27
Below Sucker	5774.59	50-Year	4415.00	182.23	191.82		192.06	0.002574	4.29	1296.76	232.20	0.27
Below Sucker	5774.59	100-Year	4697.00	182.23	192.06		192.31	0.002592	4.39	1353.00	235.15	0.27
Below Sucker	5699.34	50-Year	4415.00	181.75	191.69		191.88	0.001915	3.81	1429.02	232.38	0.23
Below Sucker	5699.34	100-Year	4697.00	181.75	191.93		192.13	0.001944	3.91	1484.84	234.17	0.24
Below Sucker	5613.09	50-Year	4415.00	181.20	191.58		191.73	0.001376	3.34	1609.76	241.55	0.20
Below Sucker	5613.09	100-Year	4697.00	181.20	191.82		191.98	0.001406	3.43	1667.31	243.01	0.20
Below Sucker	5594.59	50-Year	4415.00	181.20	191.55		191.70	0.001483	3.44	1570.28	238.35	0.21
Below Sucker	5594.59	100-Year	4697.00	181.20	191.78		191.95	0.001515	3.54	1626.85	239.86	0.21
Below Sucker	5518.09	50-Year	4415.00	181.20	191.37		191.57	0.002062	3.96	1416.04	230.98	0.24
Below Sucker	5518.09	100-Year	4697.00	181.20	191.60		191.81	0.002101	4.07	1469.97	234.21	0.24
Below Sucker	5423.09	50-Year	4415.00	181.20	191.08		191.32	0.003070	4.64	1352.56	291.64	0.29
Below Sucker	5423.09	100-Year	4697.00	181.20	191.31		191.56	0.003064	4.73	1420.98	294.55	0.29
Below Sucker	5414.59	50-Year	4415.00	181.20	191.06		191.30	0.003107	4.65	1369.83	293.92	0.29
Below Sucker	5414.59	100-Year	4697.00	181.20	191.29		191.54	0.003095	4.73	1438.91	296.81	0.29
Below Sucker	5328.09	50-Year	4415.00	181.20	190.88		191.02	0.002576	4.08	1650.77	299.41	0.26
Below Sucker	5328.09	100-Year	4697.00	181.20	191.11		191.26	0.002564	4.15	1721.52	300.63	0.26
Below Sucker	5234.84	50-Year	4415.00	180.68	190.50		190.74	0.003846	5.06	1338.32	257.45	0.32
Below Sucker	5234.84	100-Year	4697.00	180.68	190.74		190.98	0.003846	5.16	1398.79	261.18	0.32
Below Sucker	5234.59	50-Year	4415.00	180.68	190.50		190.74	0.003848	5.07	1337.73	257.25	0.32
Below Sucker	5234.59	100-Year	4697.00	180.68	190.73		190.98	0.003848	5.17	1398.16	260.97	0.32
Below Sucker	5141.59	50-Year	4415.00	180.15	190.14		190.39	0.004002	5.24	1277.65	233.63	0.33
Below Sucker	5141.59	100-Year	4697.00	180.15	190.37		190.64	0.004002	5.34	1332.19	234.96	0.33
Below Sucker	5054.59	50-Year	4415.00	179.66	189.78		190.06	0.004233	5.45	1246.51	232.04	0.34
Below Sucker	5054.59	100-Year	4697.00	179.66	190.01		190.30	0.004227	5.55	1300.84	233.39	0.34
Below Sucker	5048.34	50-Year	4415.00	179.62	189.75		190.03	0.004252	5.46	1244.38	232.03	0.34
Below Sucker	5048.34	100-Year	4697.00	179.62	189.98		190.27	0.004245	5.56	1298.73	233.38	0.34
Below Sucker	4955.09	50-Year	4415.00	179.10	189.34		189.64	0.004573	5.70	1212.38	233.27	0.35
Below Sucker	4955.09	100-Year	4697.00	179.10	189.57		189.88	0.004552	5.79	1267.60	234.79	0.35
Below Sucker	4874.59	50-Year	4415.00	178.48	189.00		189.30	0.003954	5.48	1230.81	227.20	0.33
Below Sucker	4874.59	100-Year	4697.00	178.48	189.23		189.54	0.003963	5.59	1284.45	228.73	0.33
Below Sucker	4794.09	50-Year	4415.00	177.85	188.72		189.01	0.003279	5.18	1269.03	222.48	0.30
Below Sucker	4794.09	100-Year	4697.00	177.85	188.95		189.25	0.003318	5.30	1320.85	224.05	0.31
Below Sucker	4713.59	50-Year	4415.00	177.23	188.50		188.76	0.002650	4.85	1333.50	224.46	0.28
Below Sucker	4713.59	100-Year	4697.00	177.23	188.73		189.00	0.002715	4.99	1384.66	227.23	0.28
Below Sucker	4633.09	50-Year	4415.00	176.60	188.35		188.57	0.001981	4.38	1476.24	240.81	0.24
Below Sucker	4633.09	100-Year	4697.00	176.60	188.57		188.80	0.002039	4.51	1530.16	243.27	0.25
Below Sucker	4537.76	50-Year	4415.00	176.77	188.06		188.34	0.002818	5.00	1293.15	230.68	0.28
Below Sucker	4537.76	100-Year	4697.00	176.77	188.27		188.57	0.002895	5.14	1342.72	233.66	0.29
Below Sucker	4442.43	50-Year	4415.00	176.93	187.73		188.05	0.003670	5.42	1284.49	280.10	0.32
Below Sucker	4442.43	100-Year	4697.00	176.93	187.94		188.27	0.003728	5.55	1344.03	286.43	0.32
Below Sucker	4347.09	50-Year	4415.00	177.10	187.56		187.73	0.002638	4.39	1632.73	327.88	0.27
Below Sucker	4347.09	100-Year	4697.00	177.10	187.77		187.95	0.002652	4.48	1702.52	330.60	0.27
Below Sucker	4260.09	50-Year	4415.00	177.08	187.29		187.51	0.003144	4.64	1436.34	284.27	0.29
Below Sucker	4260.09	100-Year	4697.00	177.08	187.50		187.73	0.003173	4.74	1495.69	286.79	0.29
Below Sucker	4173.09	50-Year	4415.00	177.05	187.02		187.25	0.003465	4.71	1340.96	266.65	0.30
Below Sucker	4173.09	100-Year	4697.00	177.05	187.22		187.47	0.003504	4.82	1395.54	269.13	0.31
Below Sucker	4138.09	50-Year	4415.00	177.04	186.90		187.14	0.003577	4.72	1314.47	262.54	0.31

HEC-RAS Plan: Alt.1(Ex)_140724 River: Secret Ravine Reach: Below Sucker (Continued)

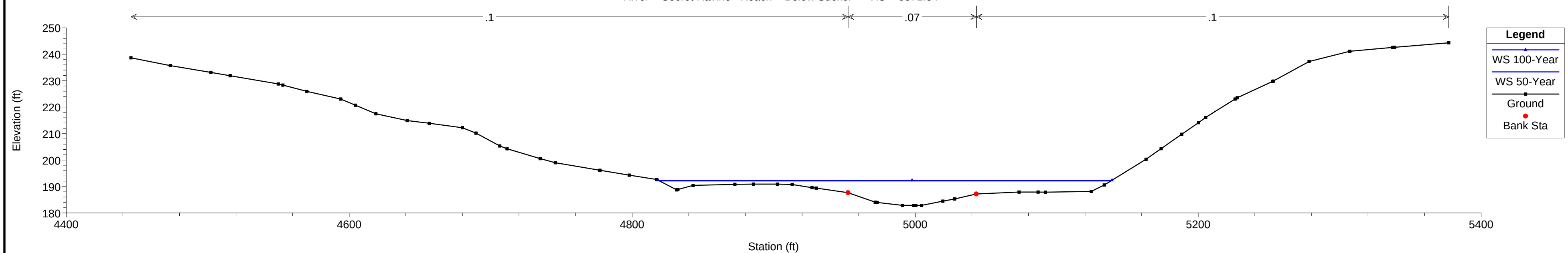
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Below Sucker	4138.09	100-Year	4697.00	177.04	187.10		187.36	0.003616	4.83	1367.81	264.76	0.31
Below Sucker	4086.09	50-Year	4415.00	177.02	186.72		186.97	0.003747	4.73	1283.76	260.83	0.31
Below Sucker	4086.09	100-Year	4697.00	177.02	186.92		187.18	0.003784	4.84	1336.25	263.18	0.32
Below Sucker	4054.96	50-Year	4415.00	177.01	186.61		186.86	0.003849	4.74	1271.52	263.34	0.32
Below Sucker	4054.96	100-Year	4697.00	177.01	186.81		187.07	0.003883	4.85	1324.31	265.96	0.32
Below Sucker	4012.96	50-Year	4415.00	177.00	186.45		186.71	0.003960	4.72	1270.78	275.43	0.32
Below Sucker	4012.96	100-Year	4697.00	177.00	186.65		186.92	0.003983	4.83	1325.99	278.93	0.32
Below Sucker	3999.09	50-Year	4415.00	177.00	186.40		186.66	0.003981	4.71	1278.47	284.04	0.32
Below Sucker	3999.09	100-Year	4697.00	177.00	186.60		186.87	0.003997	4.81	1335.49	288.11	0.32
Below Sucker	3953.09	50-Year	4415.00	176.96	185.93		186.41	0.006749	5.89	949.81	256.77	0.42
Below Sucker	3953.09	100-Year	4697.00	176.96	186.12		186.61	0.006747	6.01	999.98	262.45	0.42
Below Sucker	3944.57	50-Year	4415.00	176.95	185.86		186.35	0.006745	5.97	934.78	248.77	0.42
Below Sucker	3944.57	100-Year	4697.00	176.95	186.05		186.56	0.006766	6.10	982.92	254.20	0.42
Below Sucker	3926.63	50-Year	4415.00	176.93	185.71		186.23	0.006755	6.11	915.98	236.40	0.42
Below Sucker	3926.63	100-Year	4697.00	176.93	185.90		186.44	0.006808	6.25	960.92	240.39	0.42
Below Sucker	3922.09	50-Year	4415.00	176.93	185.68		186.20	0.006787	6.15	912.29	235.00	0.42
Below Sucker	3922.09	100-Year	4697.00	176.93	185.87		186.41	0.006845	6.29	956.82	238.99	0.42
Below Sucker	3856.96	50-Year	4415.00	176.88	185.35		185.78	0.005522	5.67	1020.79	248.61	0.38
Below Sucker	3856.96	100-Year	4697.00	176.88	185.54		185.98	0.005586	5.81	1067.31	251.78	0.39
Below Sucker	3845.09	50-Year	4415.00	176.87	185.30		185.71	0.005270	5.56	1048.83	253.14	0.37
Below Sucker	3845.09	100-Year	4697.00	176.87	185.49		185.91	0.005334	5.70	1096.10	256.15	0.38
Below Sucker	3782.96	50-Year	4415.00	176.81	185.09		185.39	0.003979	4.95	1228.38	280.75	0.33
Below Sucker	3782.96	100-Year	4697.00	176.81	185.28		185.59	0.004036	5.07	1280.57	283.30	0.33
Below Sucker	3768.09	50-Year	4415.00	176.80	185.05		185.33	0.003698	4.80	1278.42	287.83	0.31
Below Sucker	3768.09	100-Year	4697.00	176.80	185.23		185.53	0.003754	4.92	1331.82	290.30	0.32
Below Sucker	3671.96	50-Year	4415.00	176.73	184.64		184.94	0.004405	5.12	1240.37	294.21	0.34
Below Sucker	3671.96	100-Year	4697.00	176.73	184.82		185.13	0.004459	5.24	1293.41	296.97	0.35
Below Sucker	3646.17	50-Year	4415.00	176.72	184.52		184.83	0.004630	5.21	1232.06	296.87	0.35
Below Sucker	3646.17	100-Year	4697.00	176.72	184.69		185.02	0.004681	5.33	1285.24	299.64	0.35
Below Sucker	3631.96	50-Year	4415.00	176.71	184.45		184.76	0.004750	5.25	1228.87	298.56	0.35
Below Sucker	3631.96	100-Year	4697.00	176.71	184.62		184.95	0.004801	5.37	1282.12	301.60	0.36
Below Sucker	3620.38	50-Year	4415.00	176.70	184.39		184.70	0.004847	5.29	1227.08	300.22	0.36
Below Sucker	3620.38	100-Year	4697.00	176.70	184.57		184.89	0.004911	5.41	1280.25	304.45	0.36
Below Sucker	3575.83	50-Year	4415.00	176.67	184.16		184.48	0.005231	5.41	1228.58	311.99	0.37
Below Sucker	3575.83	100-Year	4697.00	176.67	184.34		184.67	0.005280	5.53	1283.47	316.49	0.37
Below Sucker	3479.70	50-Year	4415.00	176.60	183.87		184.03	0.003409	4.31	1689.74	430.56	0.30
Below Sucker	3479.70	100-Year	4697.00	176.60	184.05		184.21	0.003404	4.38	1766.88	434.91	0.30
Below Sucker	3396.45	50-Year	4415.00	176.12	183.64	181.09	183.78	0.002745	3.94	1865.67	467.26	0.27
Below Sucker	3396.45	100-Year	4697.00	176.12	183.82	181.17	183.96	0.002743	4.01	1949.76	471.57	0.27


3479.70
545.09
3953.09
4054.96
4173.09
3768.09
3396.45
3671.96
4260.09
4347.09
4442.43
4537.76
4633.09
None of the XS's are Geo-Referenced (Geo-Ref user entered XS Geo-Ref interpolated XS Non Geo-Ref user entered XS Non Geo-Ref interpolated XS)

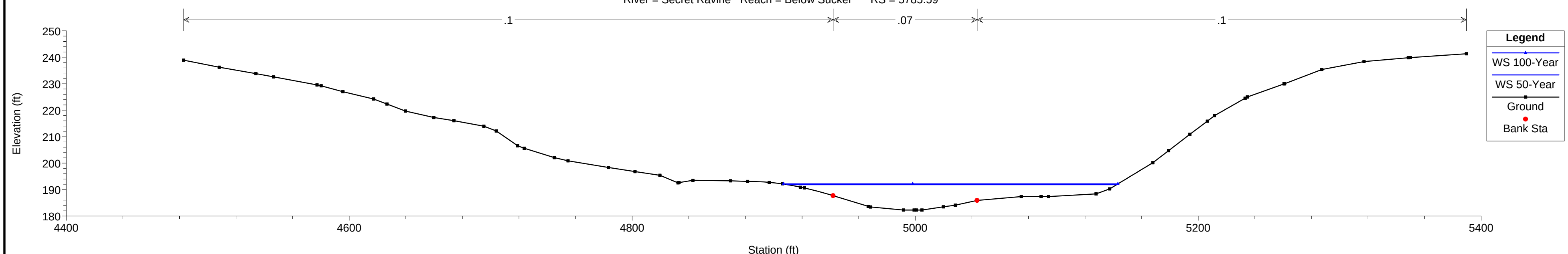
Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5958.09



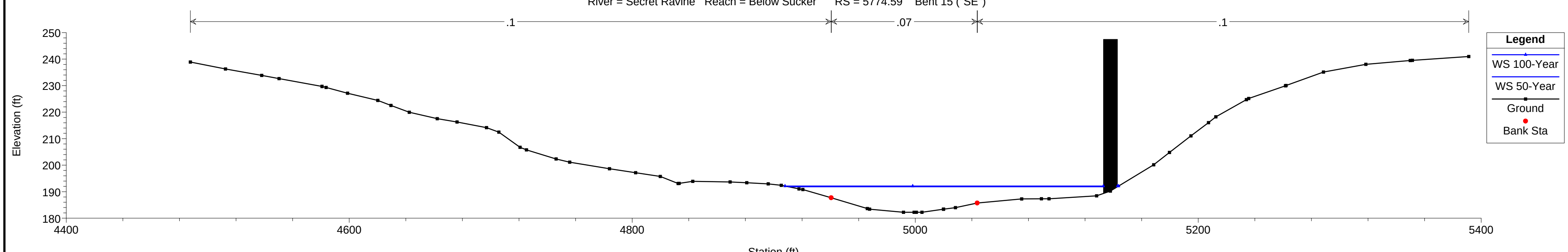
Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5871.84

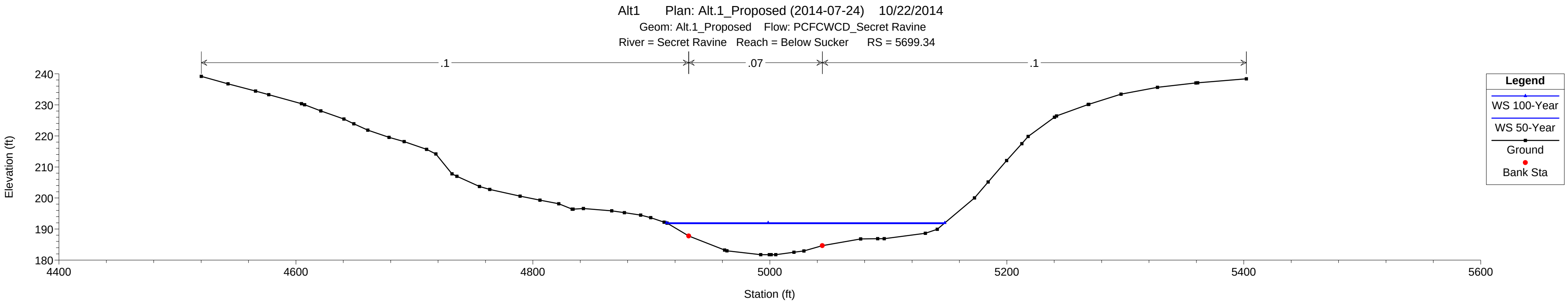


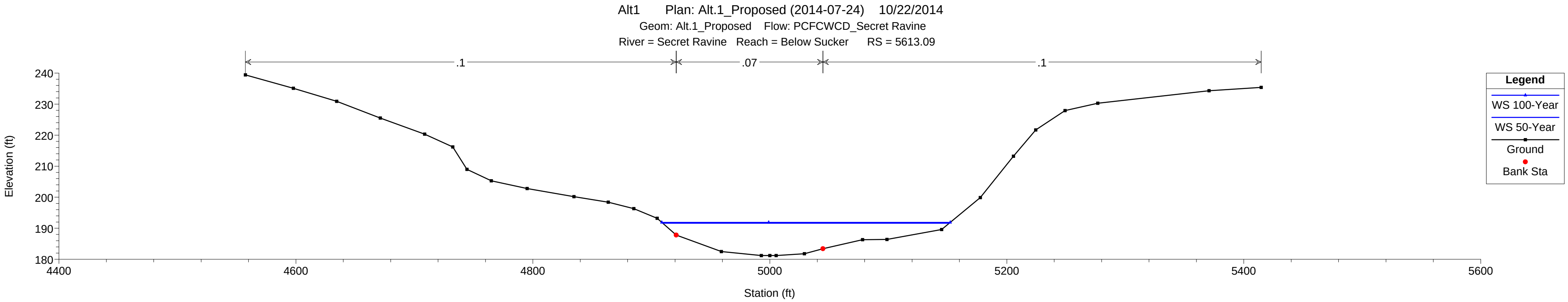
Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5785.59

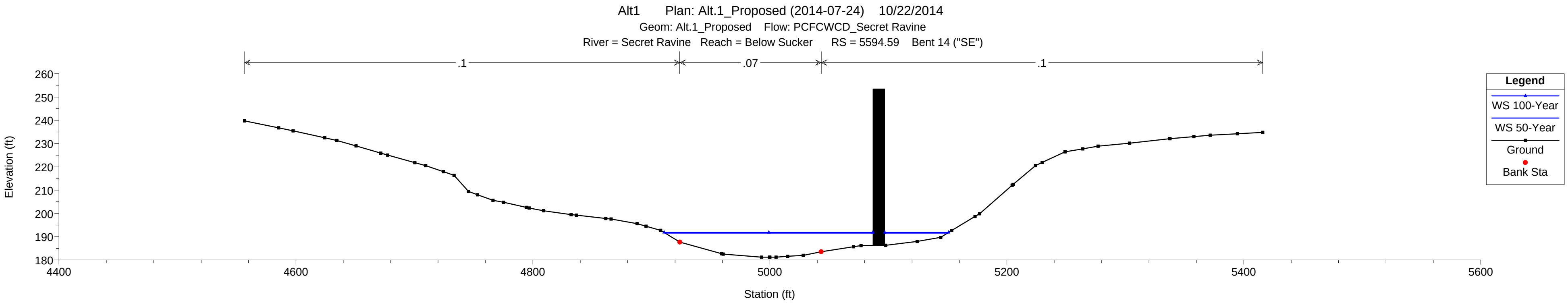


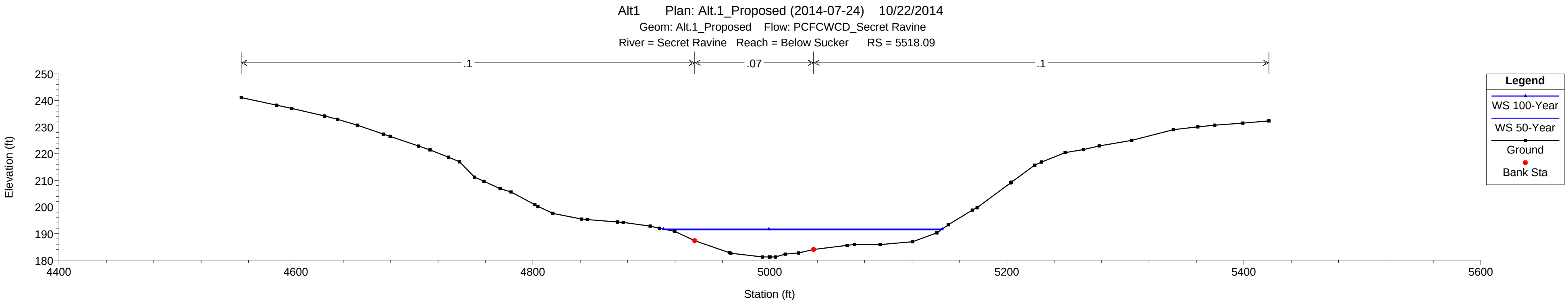
Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5774.59 Bent 15 ("SE")

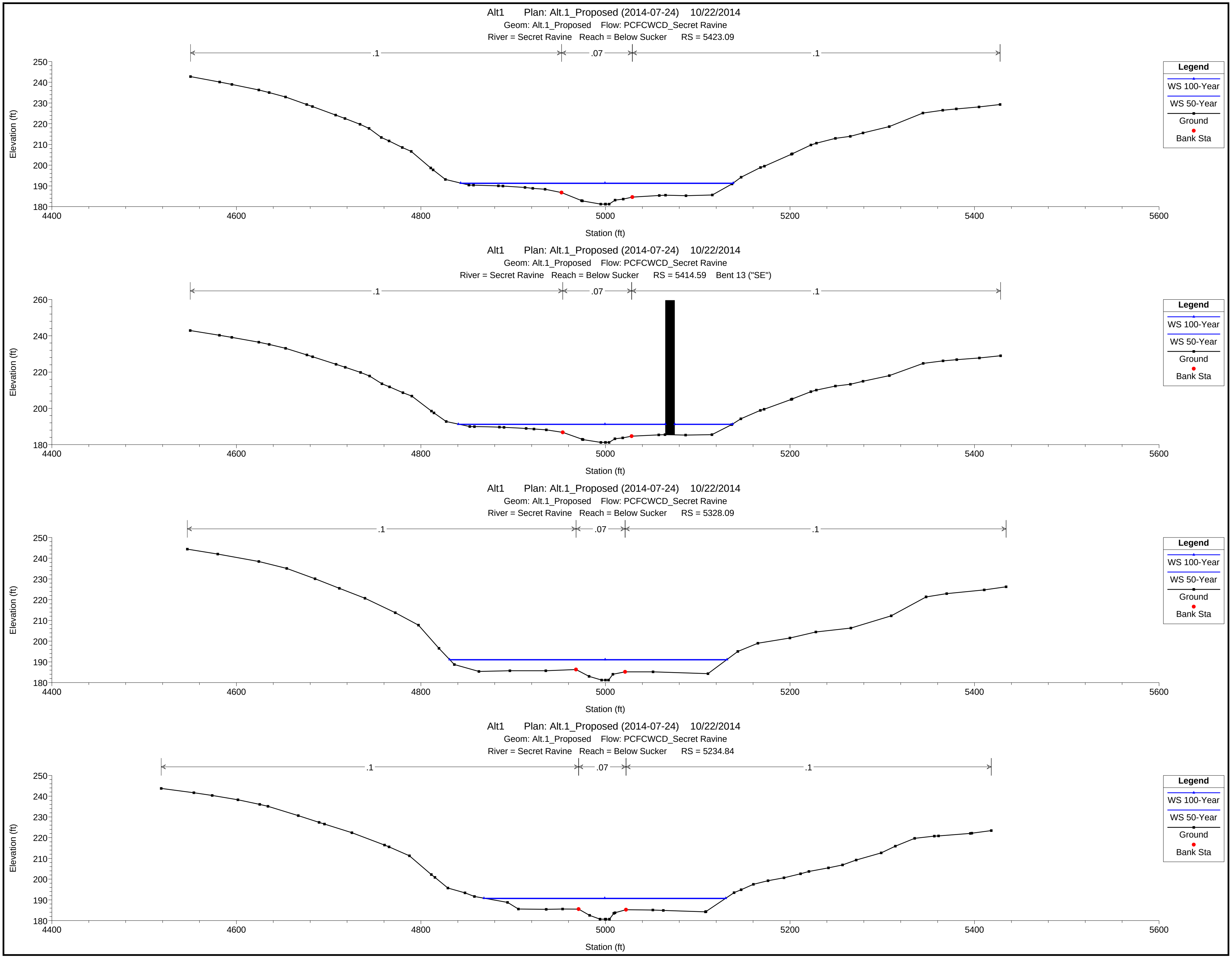


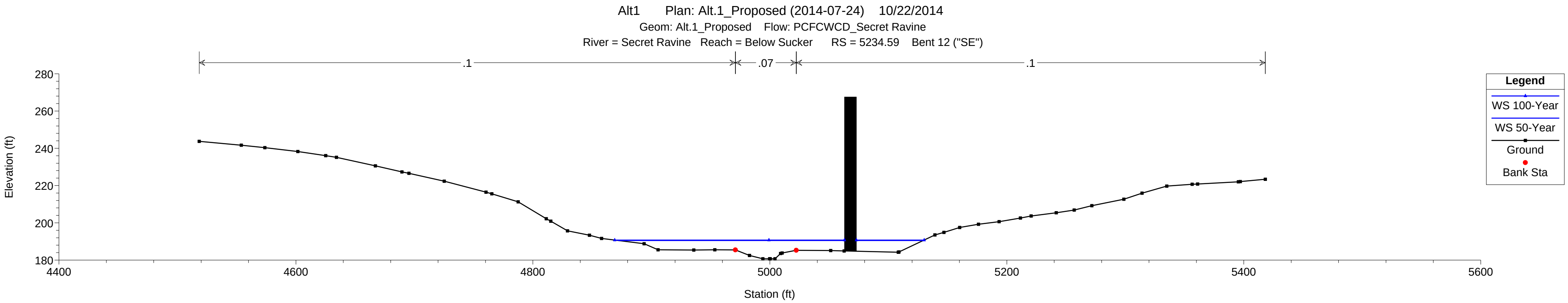

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5699.34
.1
.07
.1
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

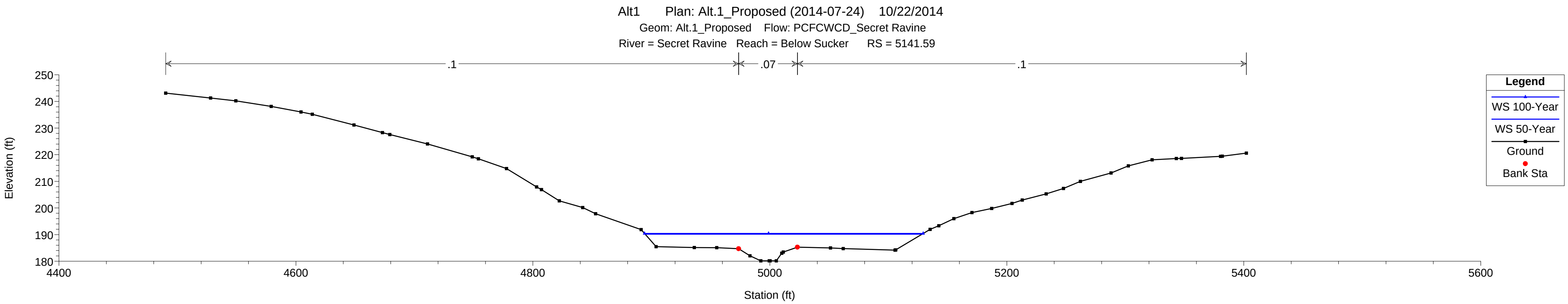

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5613.09
.1
.07
.1
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

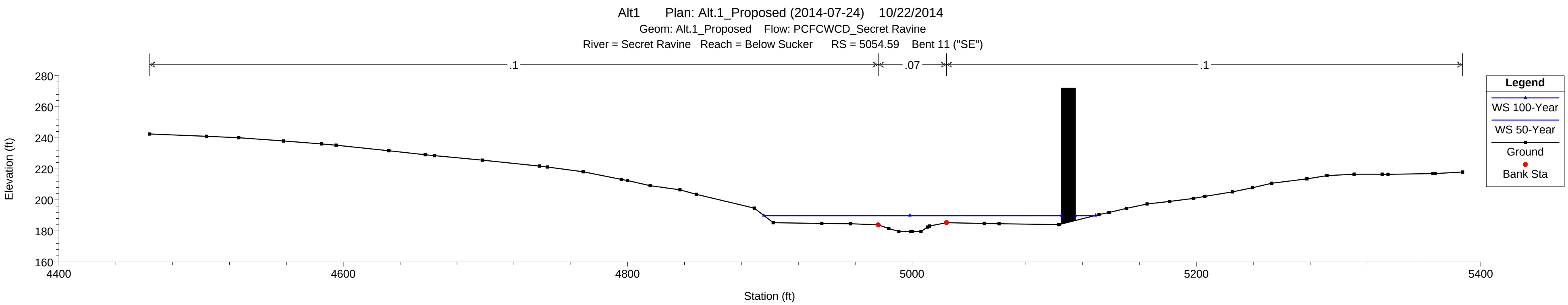

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5594.59 Bent 14 ("SE")
.1
.07
.1
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

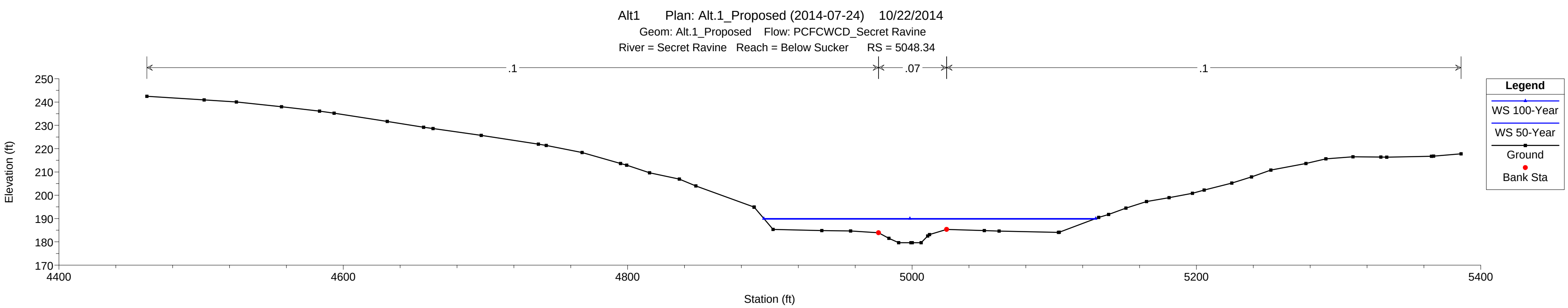

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5518.09
.1
.07
.1
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

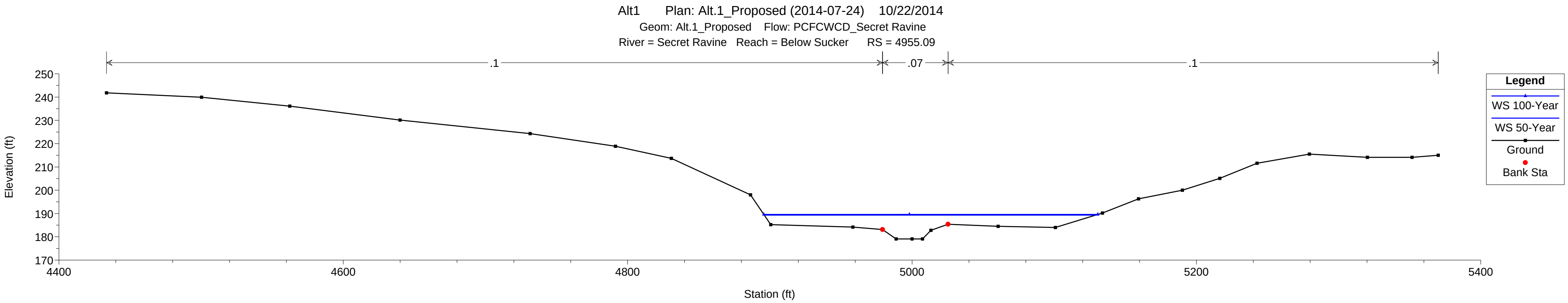

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5423.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5414.59 Bent 13 ("SE")
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5328.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5234.84
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

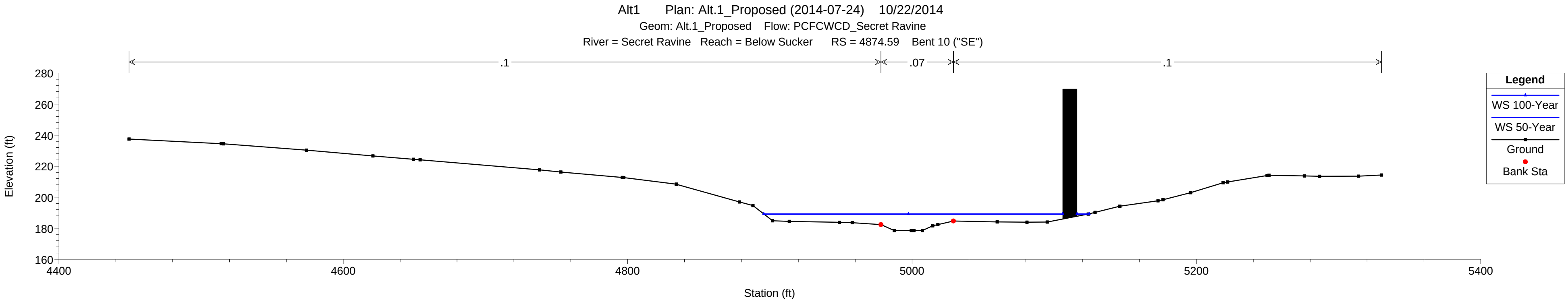

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5234.59 Bent 12 ("SE")
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

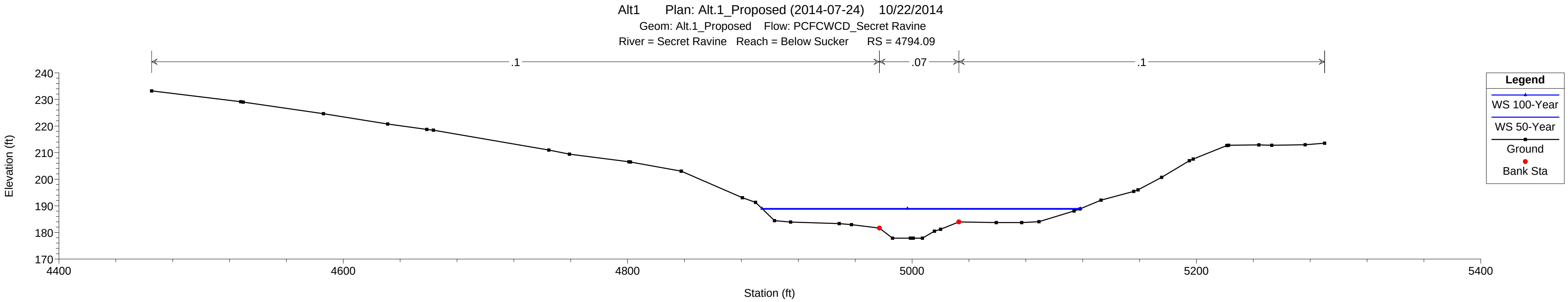

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5141.59
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

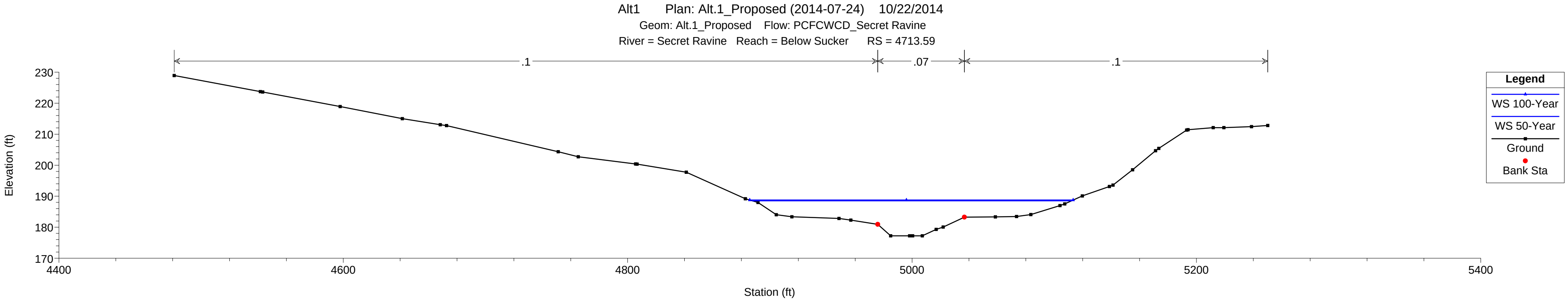

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5054.59 Bent 11 ("SE")
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

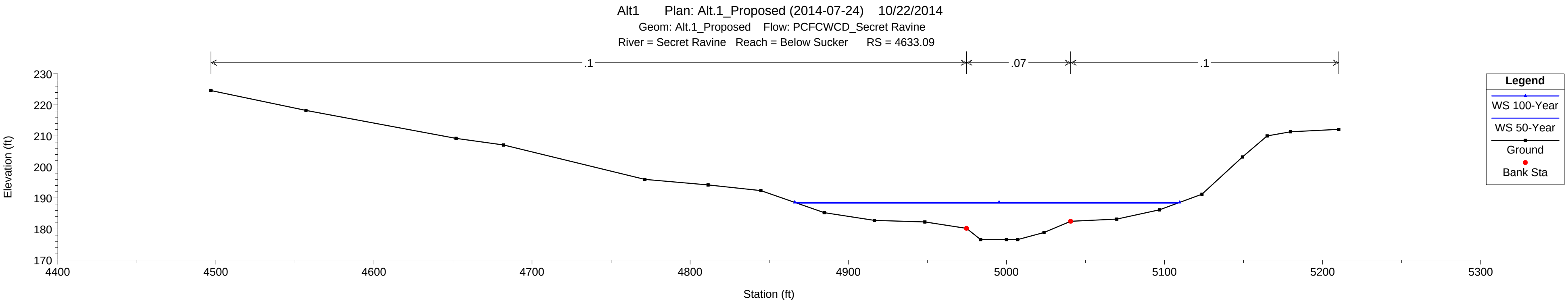

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5048.34
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

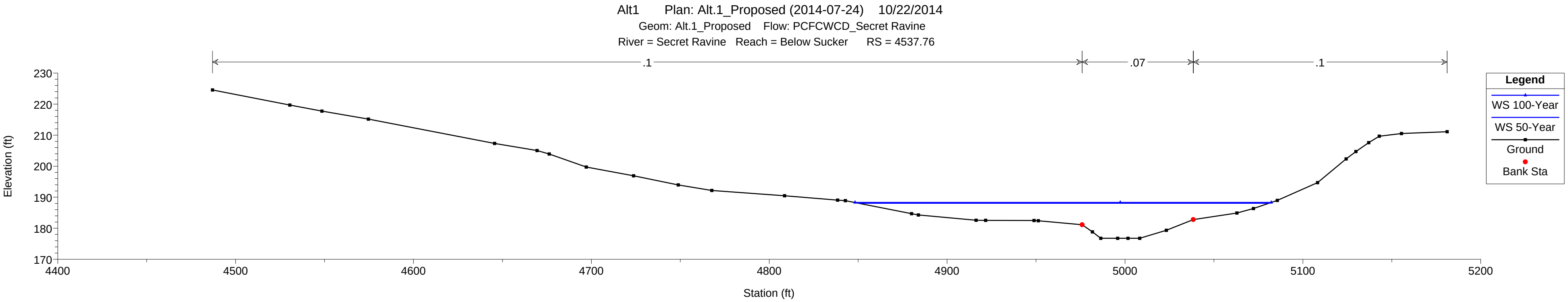

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4955.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

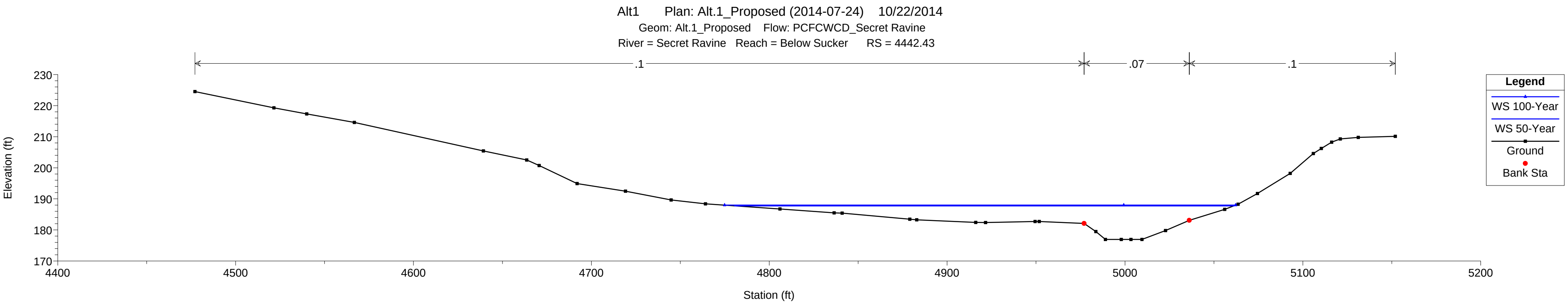

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4874.59 Bent 10 ("SE")
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

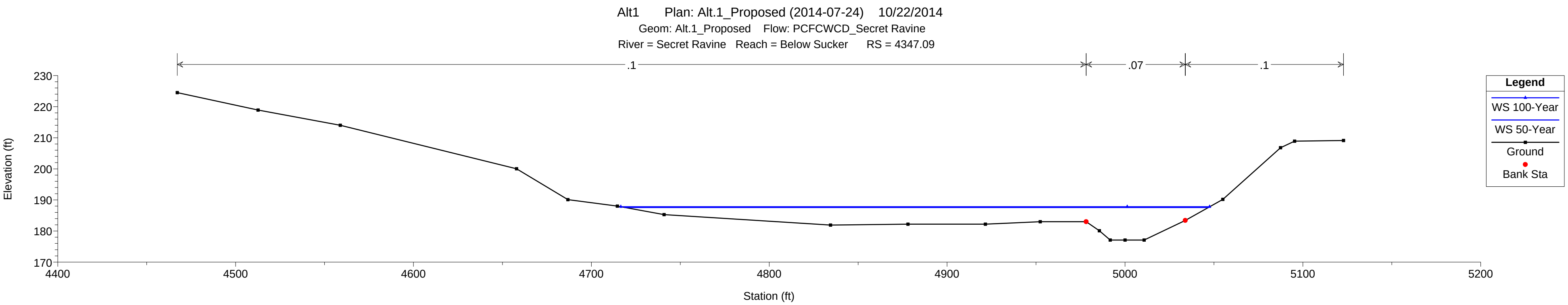

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4794.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

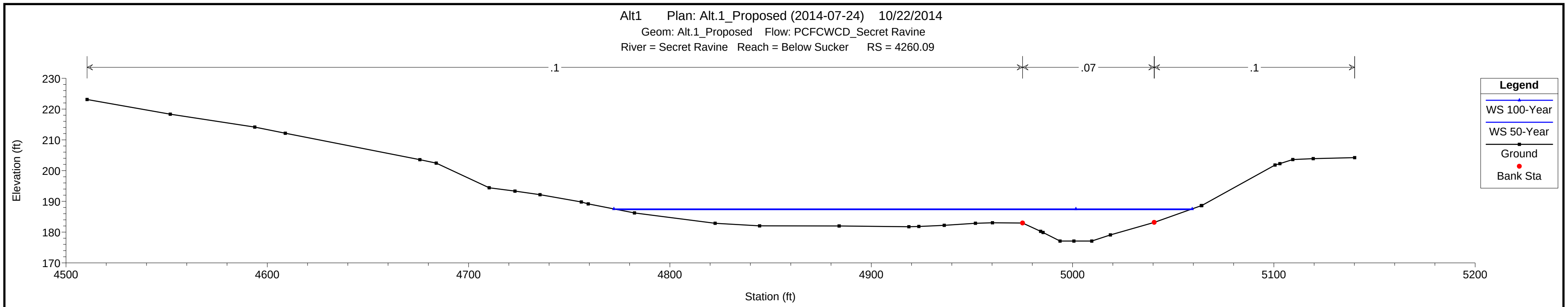

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4713.59
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

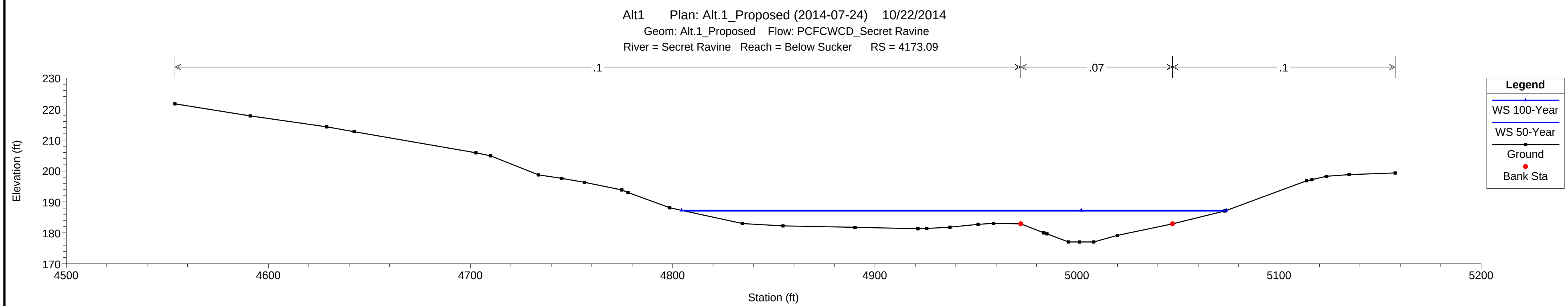

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4633.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

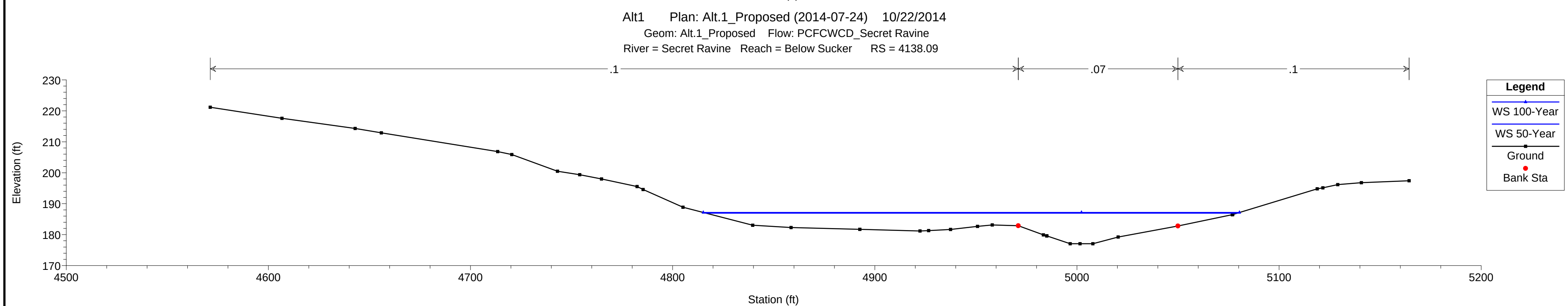

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4537.76
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

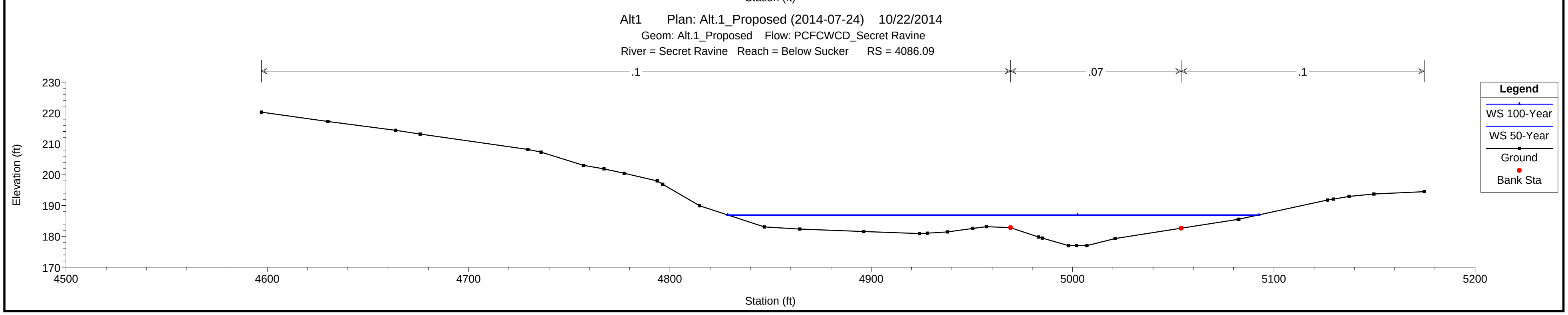

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4442.43
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

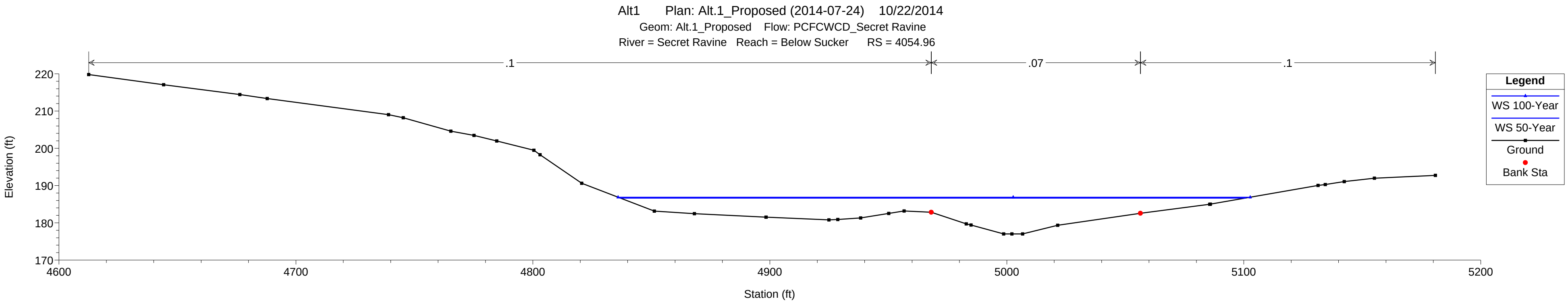

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4347.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

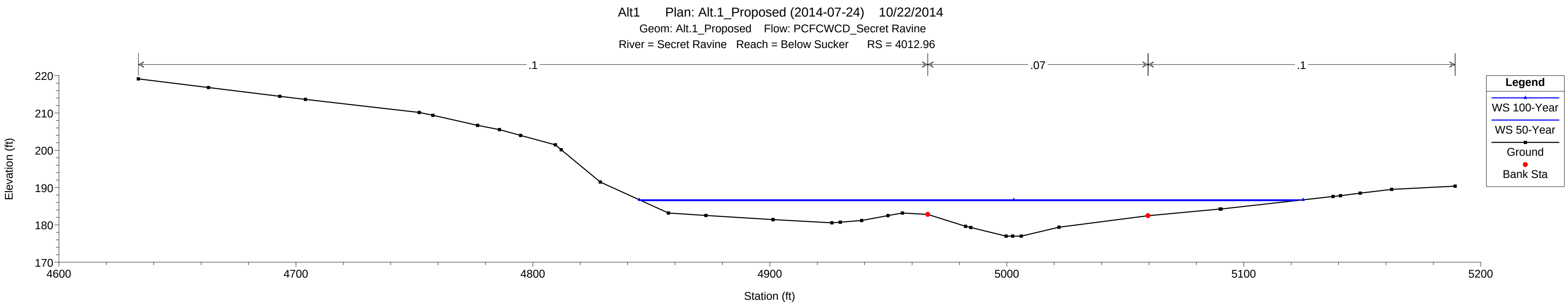

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4260.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

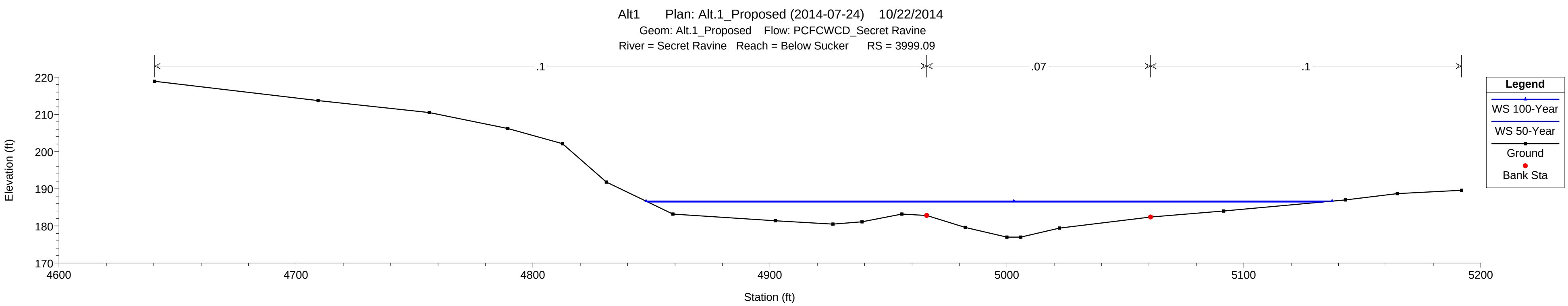

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4173.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

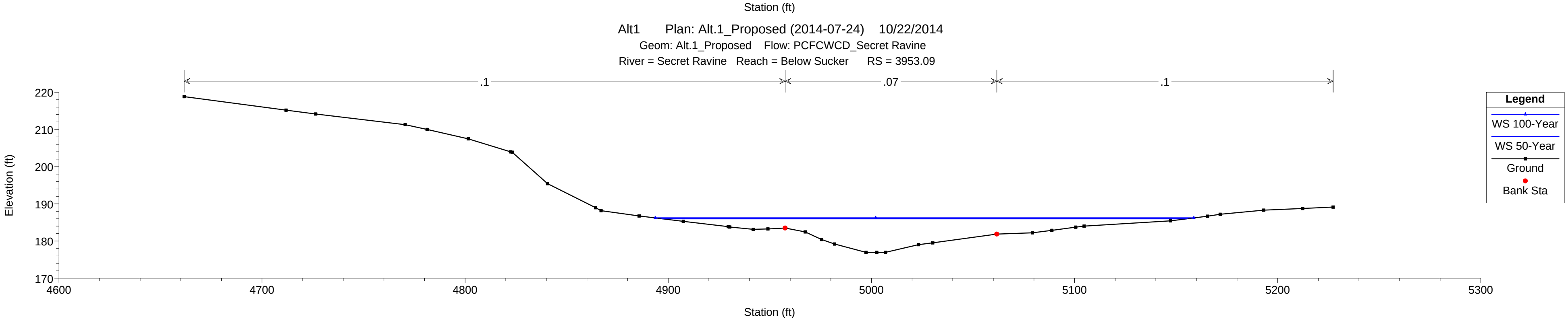

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4138.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

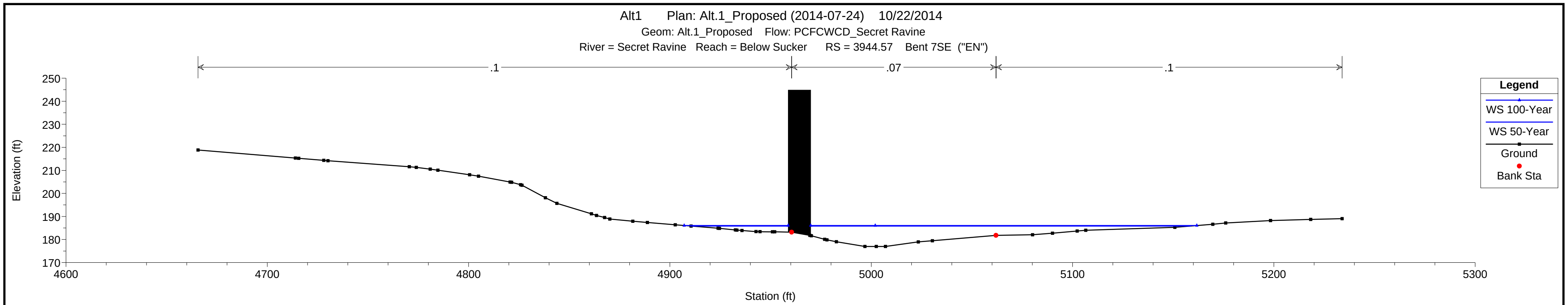

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4086.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

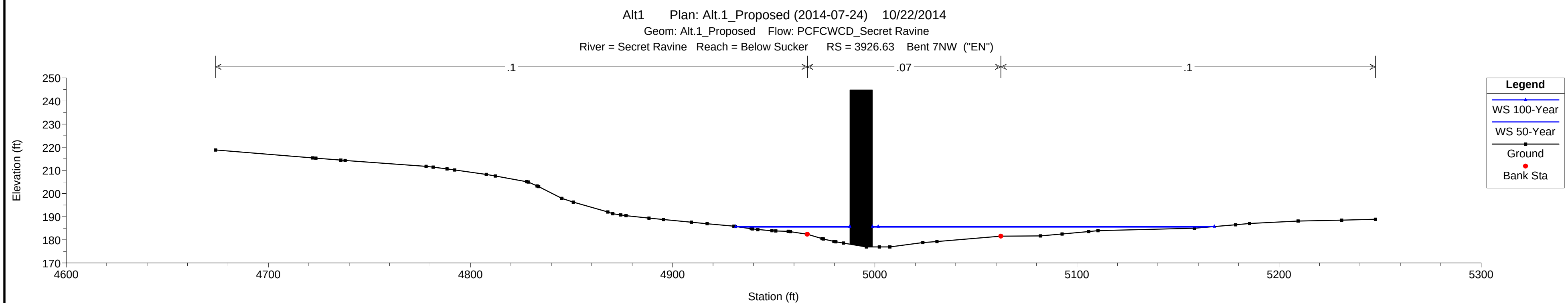

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4054.96
.1
.07
.1
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

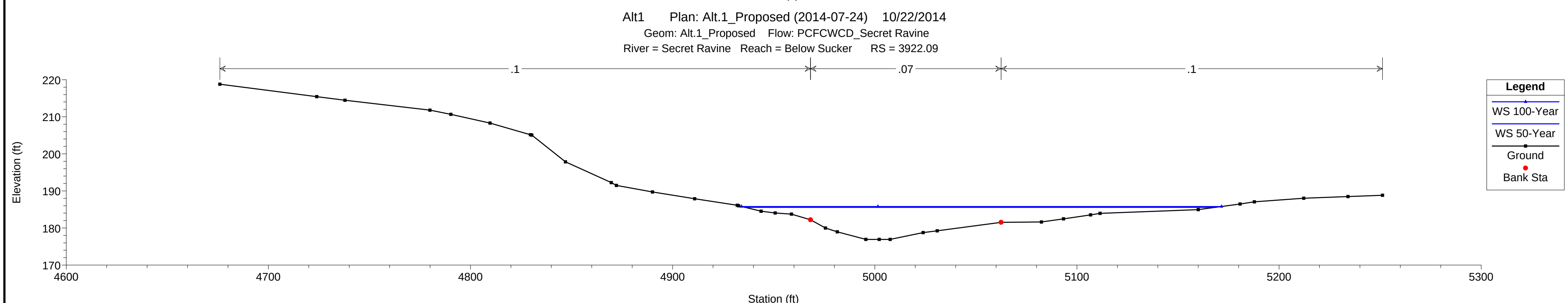

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4012.96
.1
.07
.1
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

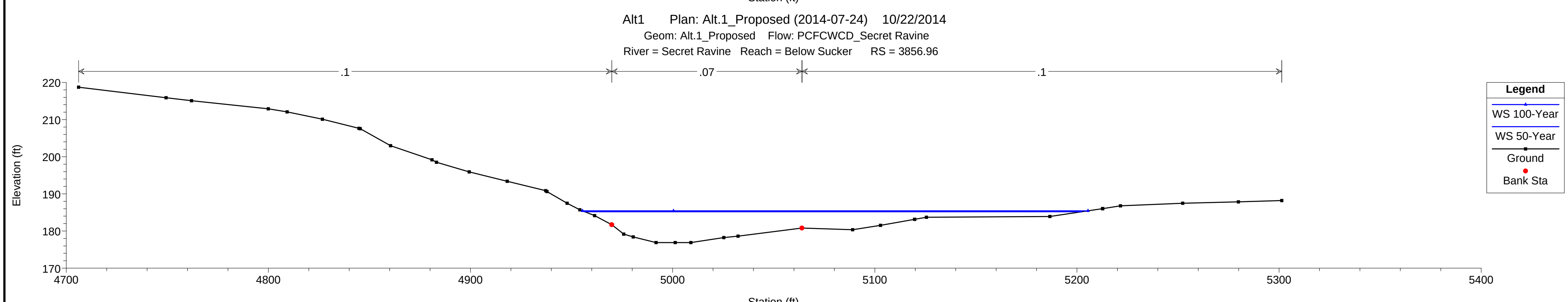

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3999.09
.1
.07
.1
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

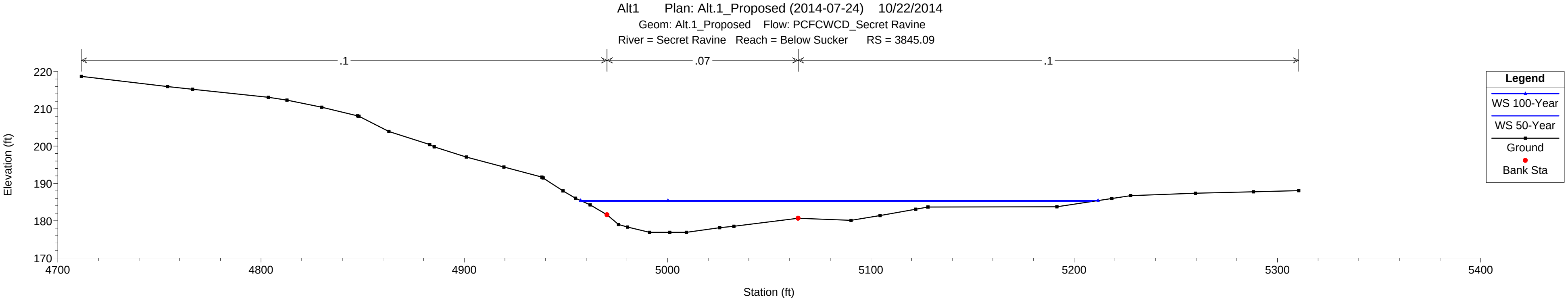

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3953.09
.1
.07
.1
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

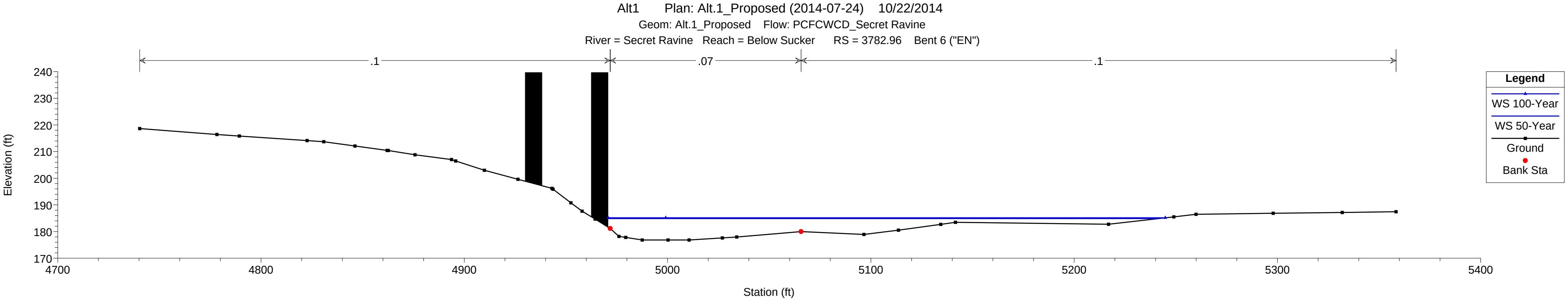

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3944.57 Bent 7SE ("EN")
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

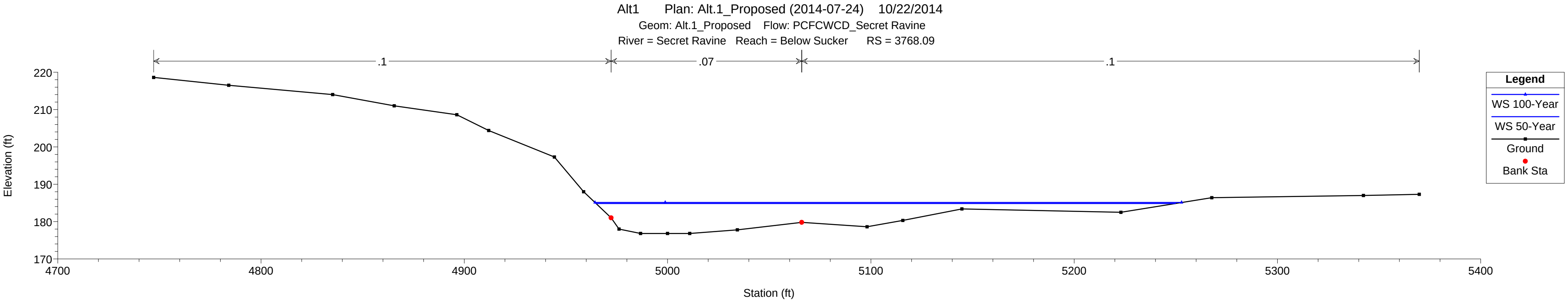

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3926.63 Bent 7NW ("EN")
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

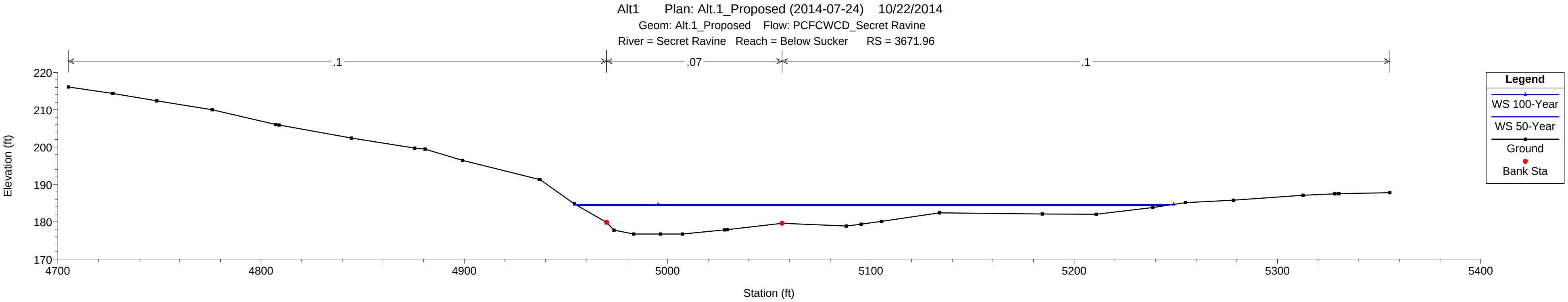

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3922.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3856.96
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

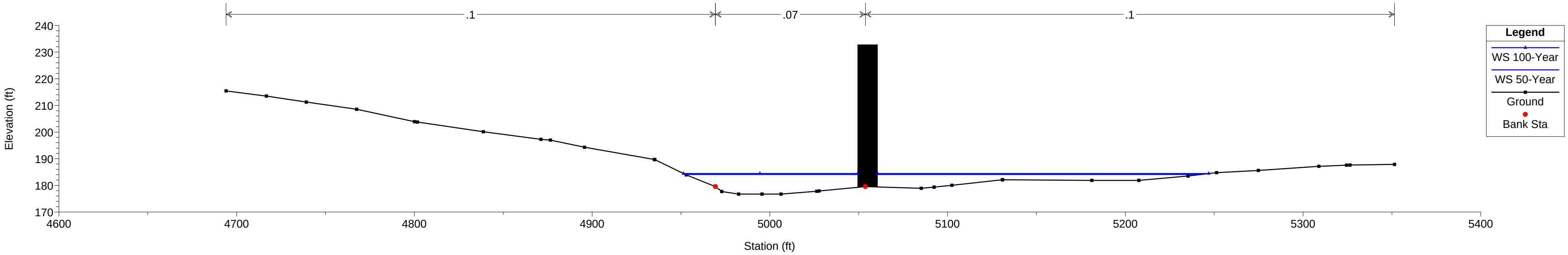

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3845.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3782.96 Bent 6 ("EN")
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

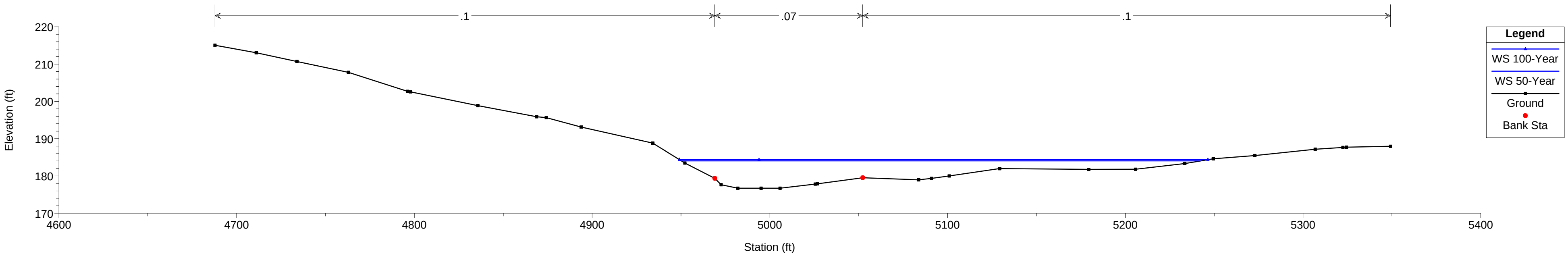

Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3768.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3671.96
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

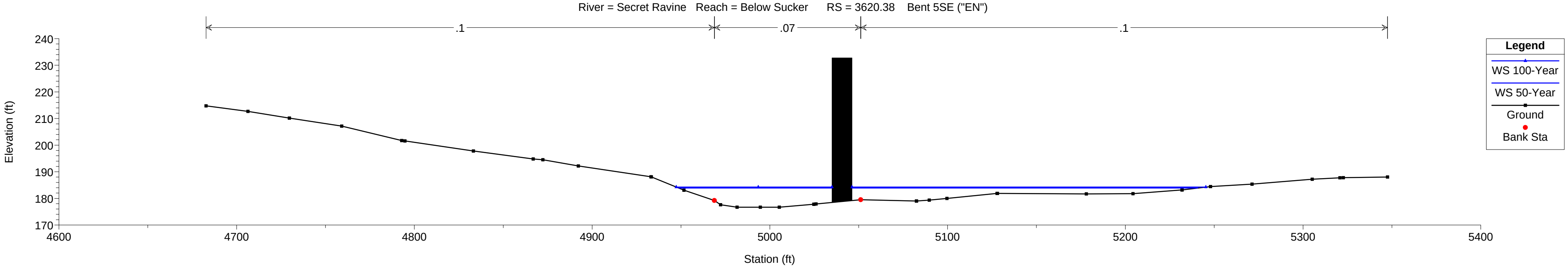
Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3646.17 Bent 5NW ("EN")



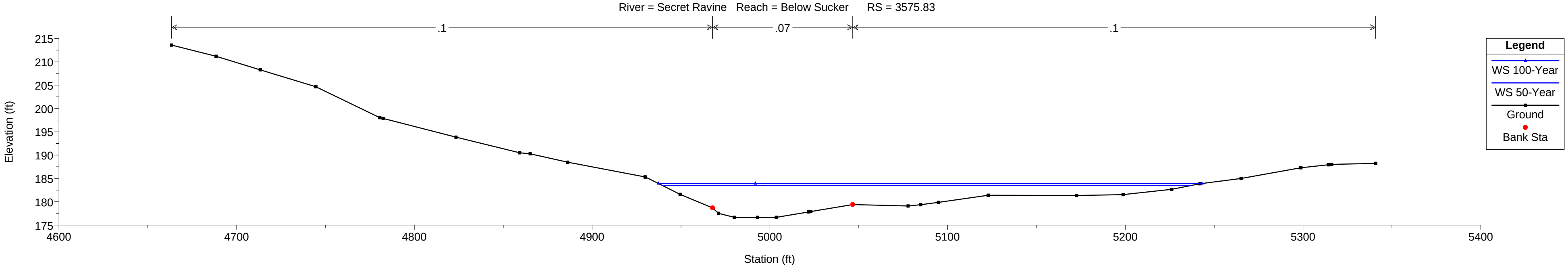
Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3631.96

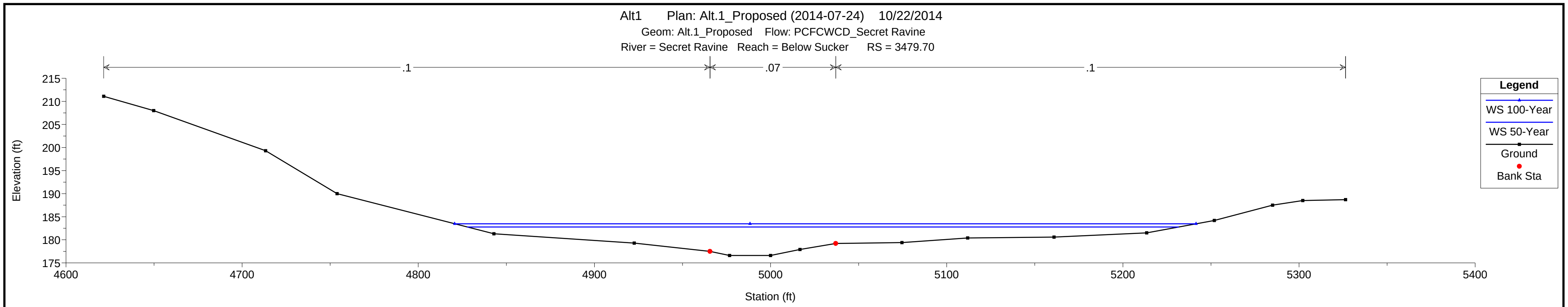


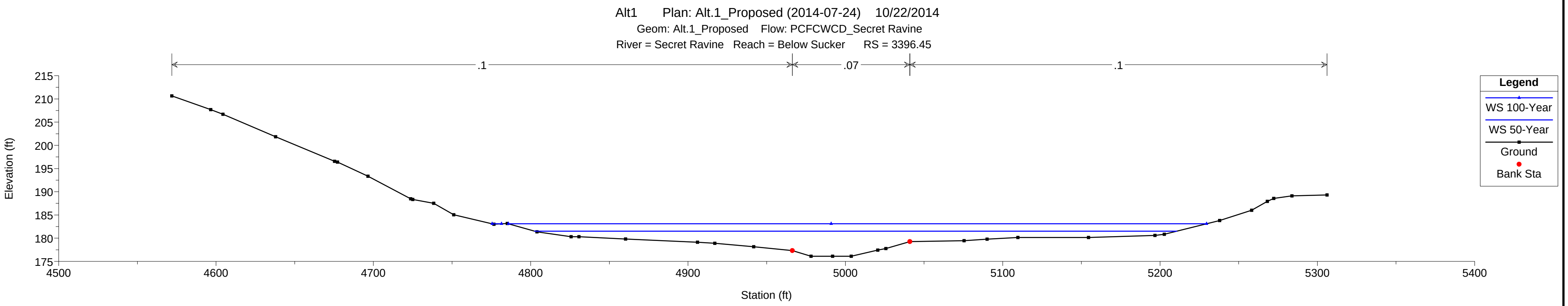
Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3620.38 Bent 5SE ("EN")

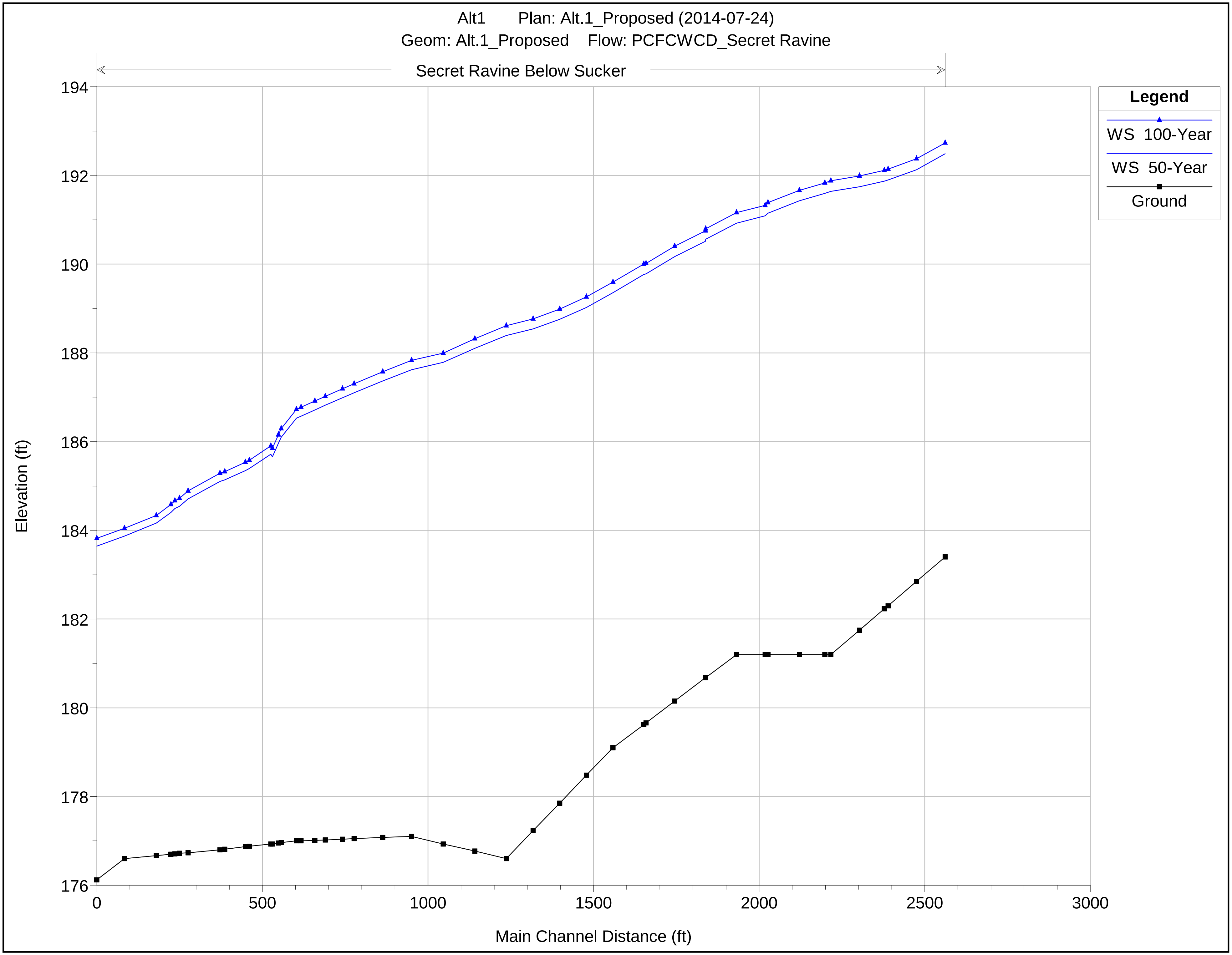


Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3575.83




Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3479.70
.1
.07
.1
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
215
210
205
200
195
190
185
180
175
4600
4700
4800
4900
5000
5100
5200
5300
5400


Alt1 Plan: Alt.1_Proposed (2014-07-24) 10/22/2014
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3396.45
.1
.07
.1
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)
215
210
205
200
195
190
185
180
175
4500
4600
4700
4800
4900
5000
5100
5200
5300
5400

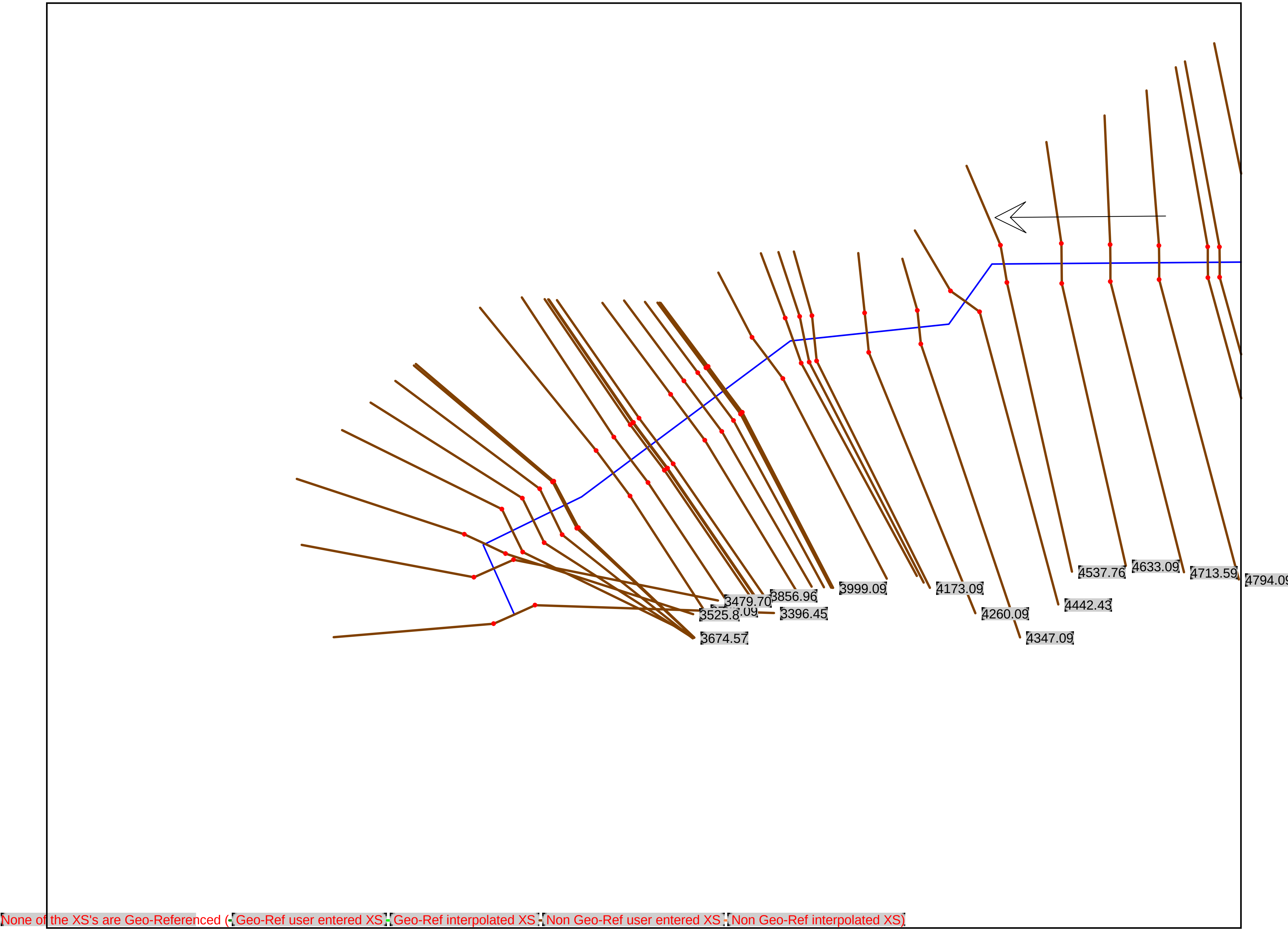

Alt1 Plan: Alt.1_Proposed (2014-07-24)
Geom: Alt.1_Proposed Flow: PCFCWCD_Secret Ravine
Secret Ravine Below Sucker
Legend
WS 100-Year
WS 50-Year
Ground
Elevation (ft)
194
192
190
188
186
184
182
180
178
176
0
500
1000
1500
2000
2500
3000
Main Channel Distance (ft)

HEC-RAS Plan: Alt.1_Rev.140724 River: Secret Ravine Reach: Below Sucker

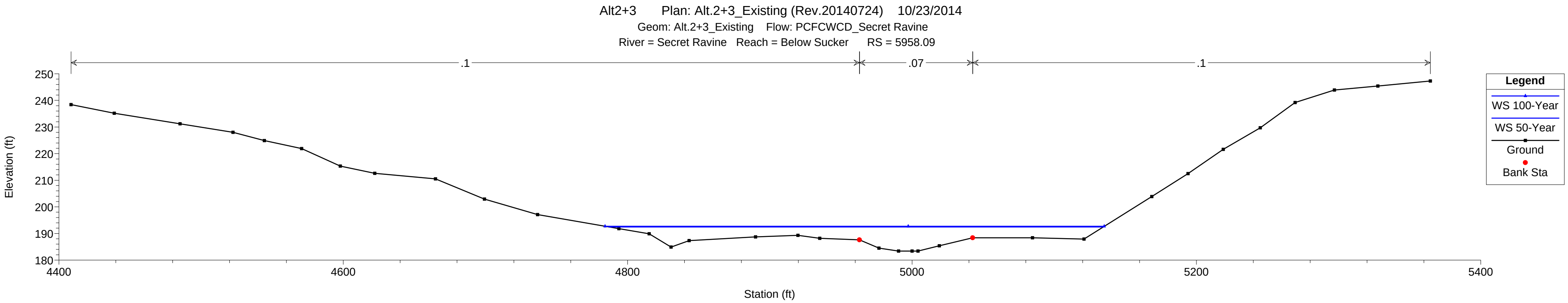
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Below Sucker	5958.09	50-Year	4415.00	183.40	192.49		192.66	0.002680	4.12	1639.14	348.18	0.27
Below Sucker	5958.09	100-Year	4697.00	183.40	192.73		192.90	0.002629	4.17	1723.66	351.51	0.27
Below Sucker	5871.84	50-Year	4415.00	182.85	192.13		192.39	0.003289	4.69	1336.04	319.12	0.30
Below Sucker	5871.84	100-Year	4697.00	182.85	192.37		192.64	0.003218	4.74	1415.30	320.76	0.30
Below Sucker	5785.59	50-Year	4415.00	182.30	191.89		192.14	0.002621	4.33	1291.59	233.25	0.27
Below Sucker	5785.59	100-Year	4697.00	182.30	192.14		192.39	0.002634	4.43	1348.94	236.31	0.27
Below Sucker	5774.59	50-Year	4415.00	182.23	191.87		192.11	0.002519	4.26	1293.09	222.78	0.26
Below Sucker	5774.59	100-Year	4697.00	182.23	192.11		192.36	0.002538	4.36	1347.75	225.77	0.27
Below Sucker	5699.34	50-Year	4415.00	181.75	191.74		191.93	0.001871	3.78	1440.93	232.77	0.23
Below Sucker	5699.34	100-Year	4697.00	181.75	191.98		192.18	0.001897	3.88	1497.65	234.83	0.23
Below Sucker	5613.09	50-Year	4415.00	181.20	191.64		191.78	0.001344	3.31	1622.78	241.89	0.20
Below Sucker	5613.09	100-Year	4697.00	181.20	191.88		192.03	0.001373	3.41	1681.29	243.37	0.20
Below Sucker	5594.59	50-Year	4415.00	181.20	191.59		191.75	0.001528	3.51	1527.16	228.62	0.21
Below Sucker	5594.59	100-Year	4697.00	181.20	191.83		192.00	0.001565	3.61	1581.95	230.15	0.21
Below Sucker	5518.09	50-Year	4415.00	181.20	191.42		191.62	0.002012	3.93	1428.61	231.74	0.24
Below Sucker	5518.09	100-Year	4697.00	181.20	191.66		191.86	0.002047	4.04	1483.59	235.02	0.24
Below Sucker	5423.09	50-Year	4415.00	181.20	191.14		191.38	0.002963	4.58	1371.44	292.45	0.29
Below Sucker	5423.09	100-Year	4697.00	181.20	191.38		191.63	0.002954	4.67	1441.27	295.41	0.29
Below Sucker	5414.59	50-Year	4415.00	181.20	191.08		191.35	0.003405	4.88	1321.01	284.25	0.31
Below Sucker	5414.59	100-Year	4697.00	181.20	191.32		191.60	0.003394	4.97	1388.69	287.17	0.31
Below Sucker	5328.09	50-Year	4415.00	181.20	190.92		191.06	0.002518	4.05	1663.01	299.62	0.26
Below Sucker	5328.09	100-Year	4697.00	181.20	191.16		191.30	0.002503	4.12	1734.97	300.86	0.26
Below Sucker	5234.84	50-Year	4415.00	180.68	190.55		190.79	0.003744	5.02	1351.22	258.25	0.32
Below Sucker	5234.84	100-Year	4697.00	180.68	190.79		191.03	0.003738	5.12	1413.04	262.05	0.32
Below Sucker	5234.59	50-Year	4415.00	180.68	190.51		190.78	0.004327	5.37	1283.08	247.39	0.34
Below Sucker	5234.59	100-Year	4697.00	180.68	190.75		191.03	0.004330	5.49	1341.89	251.16	0.34
Below Sucker	5141.59	50-Year	4415.00	180.15	190.16		190.42	0.003954	5.22	1282.94	233.76	0.33
Below Sucker	5141.59	100-Year	4697.00	180.15	190.40		190.66	0.003946	5.32	1338.52	235.12	0.33
Below Sucker	5054.59	50-Year	4415.00	179.66	189.77		190.07	0.004452	5.58	1203.11	222.00	0.35
Below Sucker	5054.59	100-Year	4697.00	179.66	190.01		190.31	0.004444	5.69	1255.88	223.37	0.35
Below Sucker	5048.34	50-Year	4415.00	179.62	189.76		190.04	0.004236	5.46	1245.91	232.06	0.34
Below Sucker	5048.34	100-Year	4697.00	179.62	189.99		190.28	0.004220	5.55	1301.27	233.44	0.34
Below Sucker	4955.09	50-Year	4415.00	179.10	189.34		189.65	0.004552	5.69	1214.39	233.33	0.35
Below Sucker	4955.09	100-Year	4697.00	179.10	189.59		189.90	0.004517	5.78	1270.91	234.88	0.35
Below Sucker	4874.59	50-Year	4415.00	178.48	189.01		189.31	0.003943	5.48	1210.90	217.25	0.33
Below Sucker	4874.59	100-Year	4697.00	178.48	189.25		189.56	0.003949	5.58	1263.40	218.81	0.33
Below Sucker	4794.09	50-Year	4415.00	177.85	188.73		189.02	0.003262	5.17	1271.52	222.55	0.30
Below Sucker	4794.09	100-Year	4697.00	177.85	188.97		189.26	0.003290	5.29	1324.86	224.16	0.31
Below Sucker	4713.59	50-Year	4415.00	177.23	188.52		188.77	0.002636	4.84	1336.28	224.61	0.28
Below Sucker	4713.59	100-Year	4697.00	177.23	188.75		189.02	0.002691	4.97	1389.18	227.47	0.28
Below Sucker	4633.09	50-Year	4415.00	176.60	188.36		188.58	0.001970	4.37	1479.45	240.96	0.24
Below Sucker	4633.09	100-Year	4697.00	176.60	188.60		188.82	0.002021	4.49	1535.35	243.50	0.25
Below Sucker	4537.76	50-Year	4415.00	176.77	188.07		188.36	0.002798	4.99	1296.70	230.89	0.28
Below Sucker	4537.76	100-Year	4697.00	176.77	188.30		188.59	0.002864	5.12	1348.42	234.00	0.29
Below Sucker	4442.43	50-Year	4415.00	176.93	187.75		188.06	0.003634	5.40	1289.79	280.67	0.32
Below Sucker	4442.43	100-Year	4697.00	176.93	187.97		188.30	0.003672	5.52	1352.63	287.33	0.32
Below Sucker	4347.09	50-Year	4415.00	177.10	187.58		187.75	0.002606	4.37	1639.73	328.15	0.27
Below Sucker	4347.09	100-Year	4697.00	177.10	187.80		187.98	0.002603	4.45	1713.65	331.03	0.27
Below Sucker	4260.09	50-Year	4415.00	177.08	187.32		187.53	0.003100	4.62	1443.41	284.58	0.29
Below Sucker	4260.09	100-Year	4697.00	177.08	187.54		187.76	0.003107	4.71	1506.91	287.27	0.29
Below Sucker	4173.09	50-Year	4415.00	177.05	187.05		187.28	0.003409	4.68	1348.79	267.04	0.30
Below Sucker	4173.09	100-Year	4697.00	177.05	187.27		187.51	0.003418	4.78	1407.95	269.65	0.30
Below Sucker	4138.09	50-Year	4415.00	177.04	186.93		187.17	0.003514	4.69	1322.78	262.89	0.31

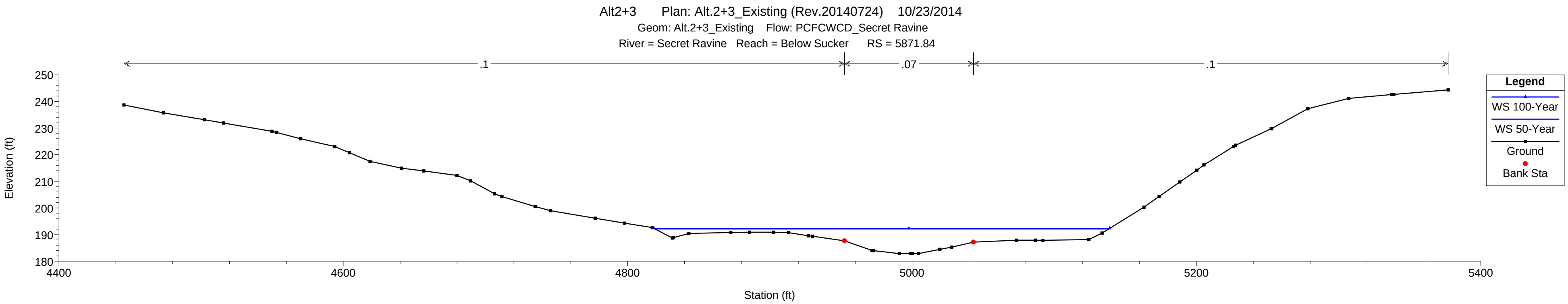
HEC-RAS Plan: Alt.1_Rev.140724 River: Secret Ravine Reach: Below Sucker (Continued)

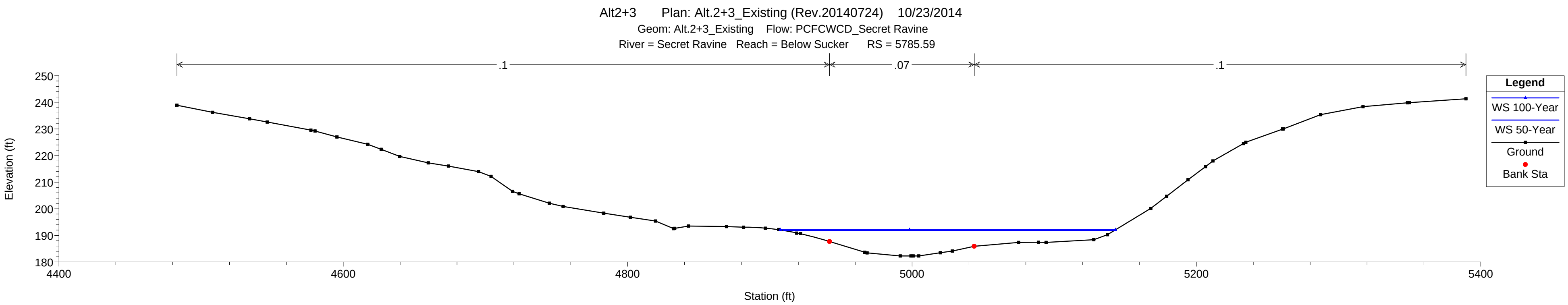
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Below Sucker	4138.09	100-Year	4697.00	177.04	187.15		187.40	0.003520	4.79	1380.77	265.30	0.31
Below Sucker	4086.09	50-Year	4415.00	177.02	186.75		187.00	0.003671	4.70	1293.03	261.25	0.31
Below Sucker	4086.09	100-Year	4697.00	177.02	186.97		187.23	0.003670	4.80	1350.68	263.83	0.31
Below Sucker	4054.96	50-Year	4415.00	177.01	186.64		186.90	0.003764	4.70	1281.62	263.84	0.31
Below Sucker	4054.96	100-Year	4697.00	177.01	186.86		187.13	0.003755	4.79	1340.00	266.74	0.32
Below Sucker	4012.96	50-Year	4415.00	177.00	186.50		186.75	0.003860	4.68	1282.52	276.18	0.32
Below Sucker	4012.96	100-Year	4697.00	177.00	186.72		186.98	0.003835	4.77	1344.23	280.08	0.32
Below Sucker	3999.09	50-Year	4415.00	177.00	186.45		186.70	0.003876	4.66	1291.01	284.94	0.32
Below Sucker	3999.09	100-Year	4697.00	177.00	186.67		186.93	0.003842	4.75	1354.98	289.49	0.32
Below Sucker	3953.09	50-Year	4415.00	176.96	185.99		186.45	0.006485	5.82	965.68	258.58	0.41
Below Sucker	3953.09	100-Year	4697.00	176.96	186.22		186.69	0.006361	5.90	1024.69	265.20	0.41
Below Sucker	3944.57	50-Year	4415.00	176.95	185.84		186.39	0.007462	6.28	894.42	237.16	0.43
Below Sucker	3944.57	100-Year	4697.00	176.95	186.07		186.62	0.007387	6.38	948.00	243.49	0.43
Below Sucker	3926.63	50-Year	4415.00	176.93	185.49		186.20	0.013161	7.24	771.72	220.20	0.52
Below Sucker	3926.63	100-Year	4697.00	176.93	185.73		186.44	0.012685	7.28	825.86	225.54	0.51
Below Sucker	3922.09	50-Year	4415.00	176.93	185.55		186.11	0.007339	6.31	883.12	232.35	0.44
Below Sucker	3922.09	100-Year	4697.00	176.93	185.79		186.35	0.007171	6.39	938.65	237.37	0.43
Below Sucker	3856.96	50-Year	4415.00	176.88	185.19		185.65	0.006112	5.87	980.19	245.81	0.40
Below Sucker	3856.96	100-Year	4697.00	176.88	185.44		185.90	0.005928	5.93	1042.46	250.09	0.40
Below Sucker	3845.09	50-Year	4415.00	176.87	185.13		185.57	0.005859	5.77	1005.72	250.36	0.39
Below Sucker	3845.09	100-Year	4697.00	176.87	185.38		185.82	0.005673	5.82	1069.80	254.48	0.39
Below Sucker	3782.96	50-Year	4415.00	176.81	184.88		185.22	0.004553	5.20	1159.25	271.06	0.35
Below Sucker	3782.96	100-Year	4697.00	176.81	185.15		185.49	0.004389	5.23	1231.74	274.15	0.34
Below Sucker	3768.09	50-Year	4415.00	176.80	184.84		185.15	0.004206	5.02	1217.62	284.99	0.33
Below Sucker	3768.09	100-Year	4697.00	176.80	185.11		185.42	0.004047	5.05	1294.74	288.59	0.33
Below Sucker	3671.96	50-Year	4415.00	176.73	184.34		184.69	0.005356	5.48	1152.18	289.54	0.37
Below Sucker	3671.96	100-Year	4697.00	176.73	184.64		184.98	0.004981	5.45	1240.88	294.24	0.36
Below Sucker	3646.17	50-Year	4415.00	176.72	184.10		184.53	0.007059	6.00	1058.99	279.27	0.41
Below Sucker	3646.17	100-Year	4697.00	176.72	184.43		184.83	0.006438	5.90	1151.53	284.37	0.40
Below Sucker	3631.96	50-Year	4415.00	176.71	184.03		184.42	0.006273	5.79	1106.78	291.98	0.40
Below Sucker	3631.96	100-Year	4697.00	176.71	184.37		184.74	0.005652	5.69	1206.04	297.34	0.39
Below Sucker	3620.38	50-Year	4415.00	176.70	183.89		184.33	0.008788	6.32	1021.16	280.82	0.44
Below Sucker	3620.38	100-Year	4697.00	176.70	184.25		184.66	0.007752	6.12	1124.48	286.74	0.41
Below Sucker	3575.83	50-Year	4415.00	176.67	183.48		183.95	0.008521	6.42	1020.64	297.27	0.46
Below Sucker	3575.83	100-Year	4697.00	176.67	183.92		184.33	0.006953	6.09	1155.27	305.89	0.42
Below Sucker	3479.70	50-Year	4415.00	176.60	182.77		183.10	0.008225	5.91	1231.02	403.66	0.45
Below Sucker	3479.70	100-Year	4697.00	176.60	183.47		183.71	0.005176	5.09	1521.44	420.89	0.36
Below Sucker	3396.45	50-Year	4415.00	176.12	181.50	181.09	182.12	0.017892	7.78	934.49	408.09	0.64
Below Sucker	3396.45	100-Year	4697.00	176.12	183.10	181.17	183.31	0.004547	4.79	1616.22	449.62	0.34

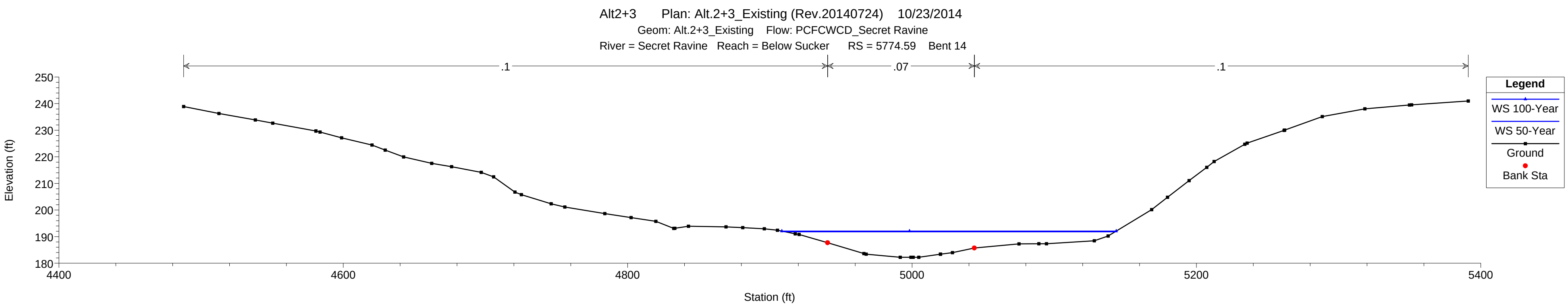


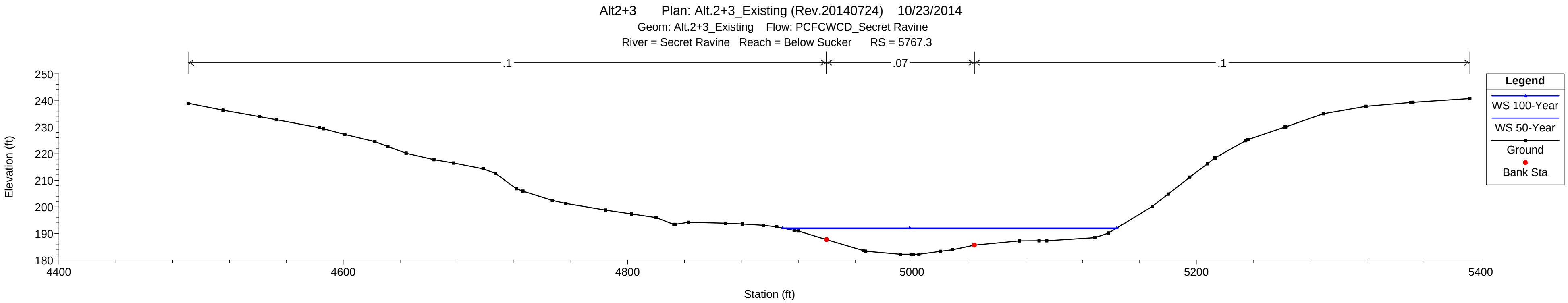
4537.76
4633.09
4713.59
3999.09
4173.09
3856.96
3479.70
4442.43
3525.8
3396.45
4260.09
3674.57
4347.09
None of the XS's are Geo-Referenced (Geo-Ref user entered XS - Geo-Ref interpolated XS - Non Geo-Ref user entered XS - Non Geo-Ref interpolated XS)

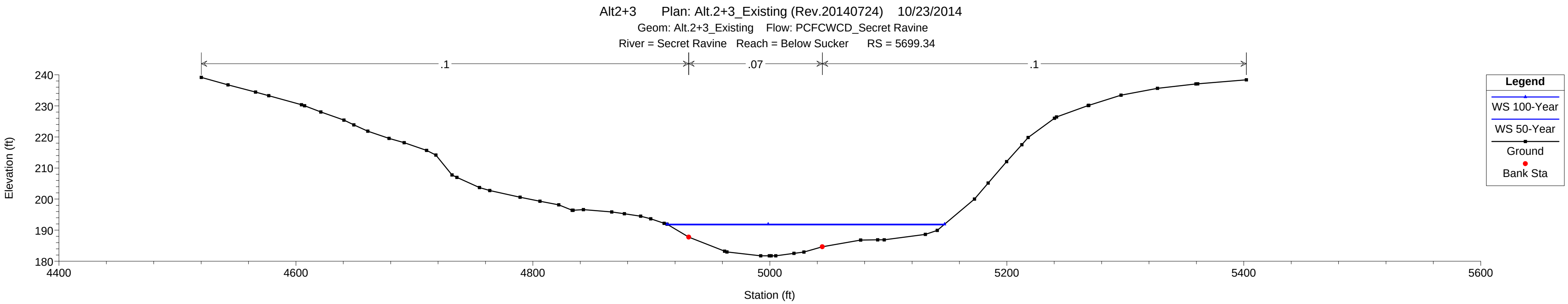

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5958.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

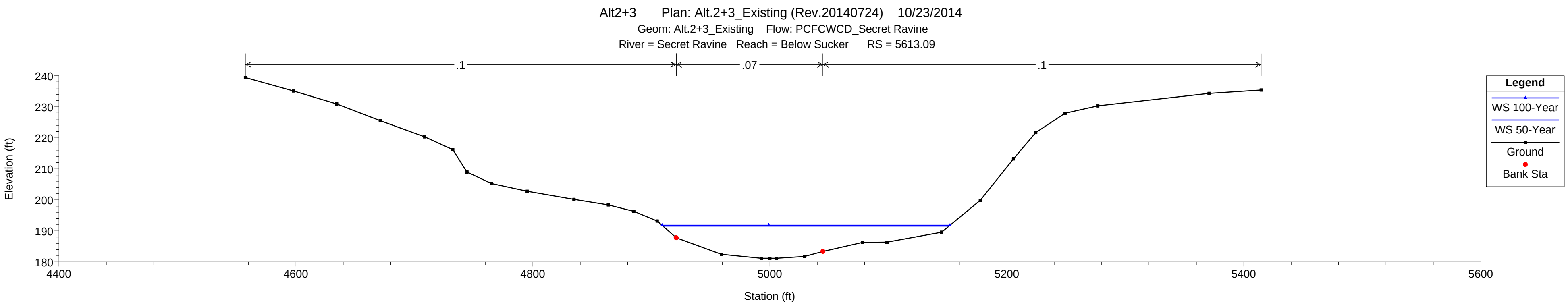

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5871.84
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

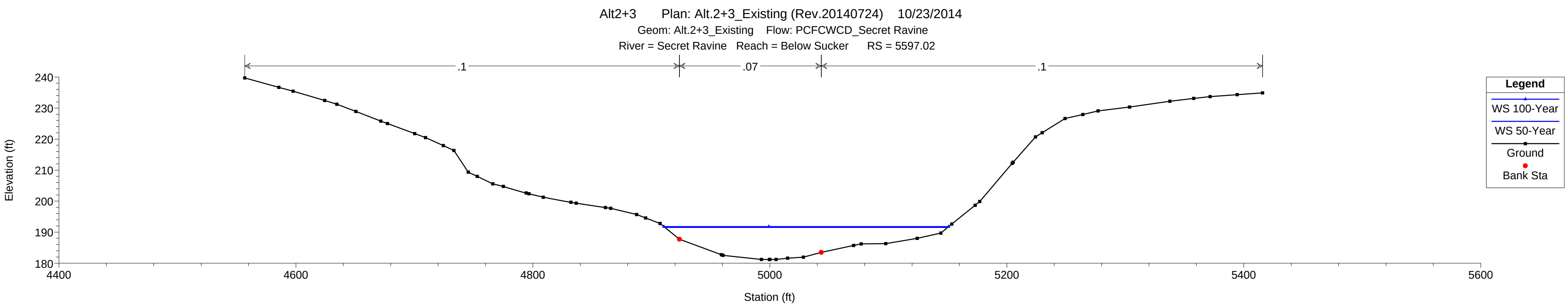

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5785.59
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5774.59 Bent 14
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

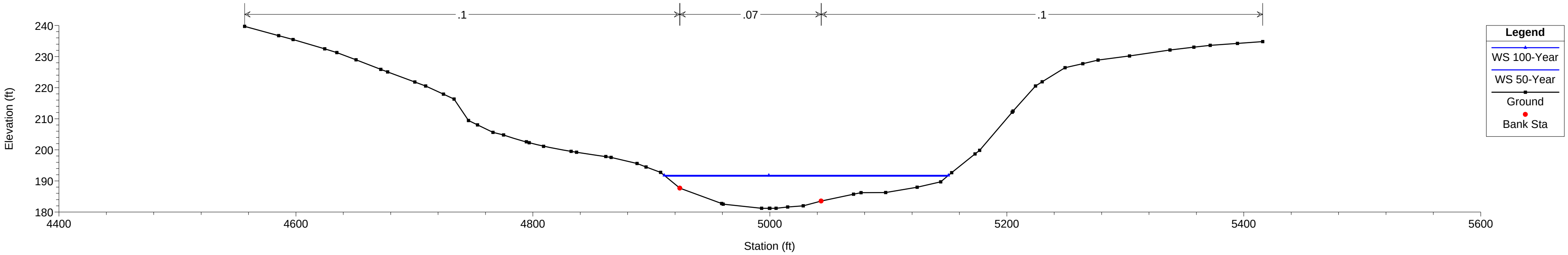

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5767.3
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5699.34
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

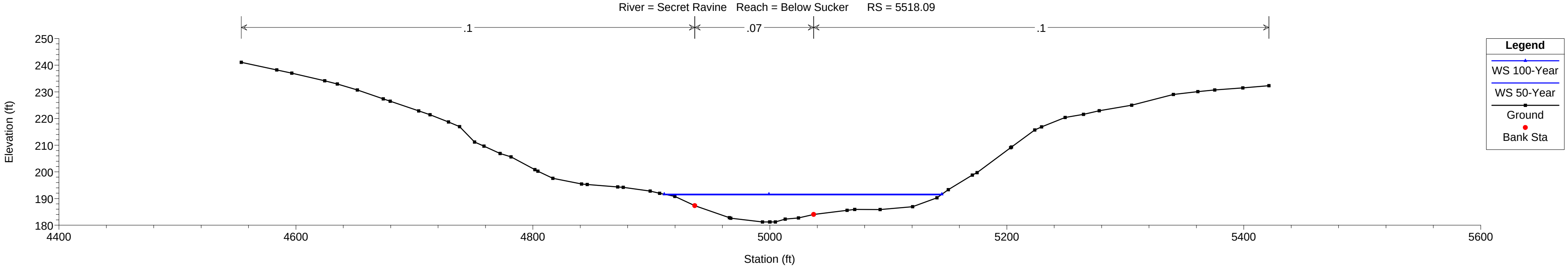

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5613.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5597.02
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

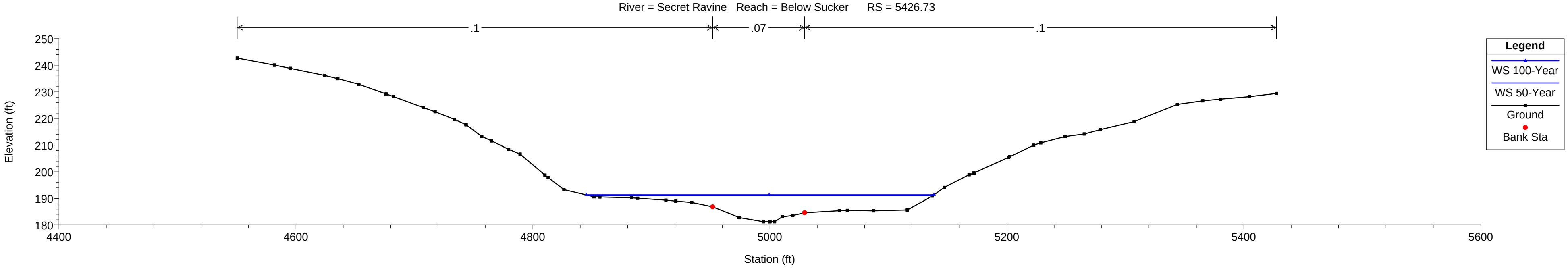
Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5594.59 Bent 13



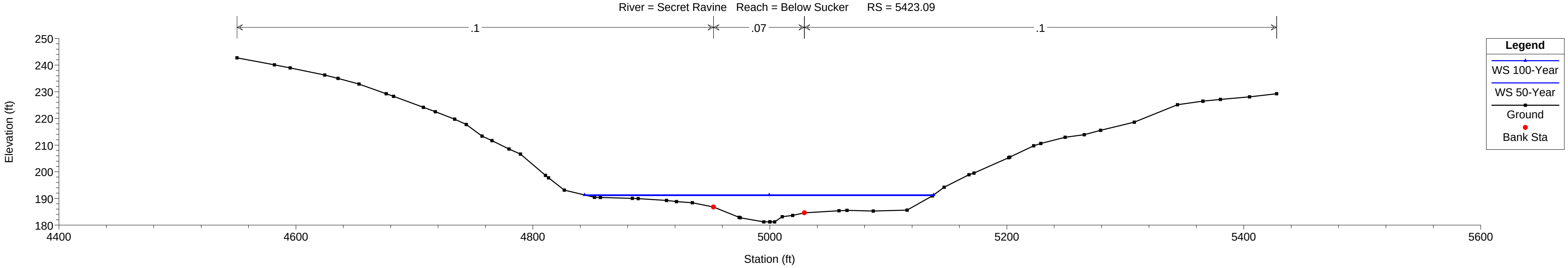
Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5518.09



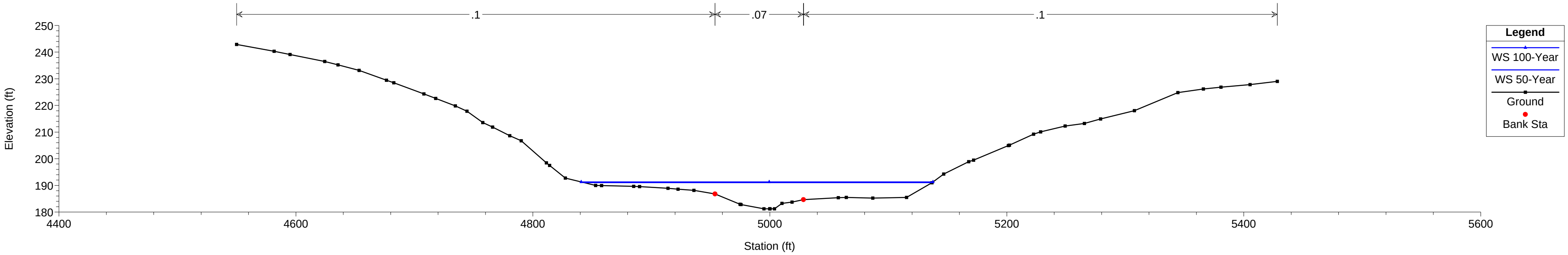
Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5426.73



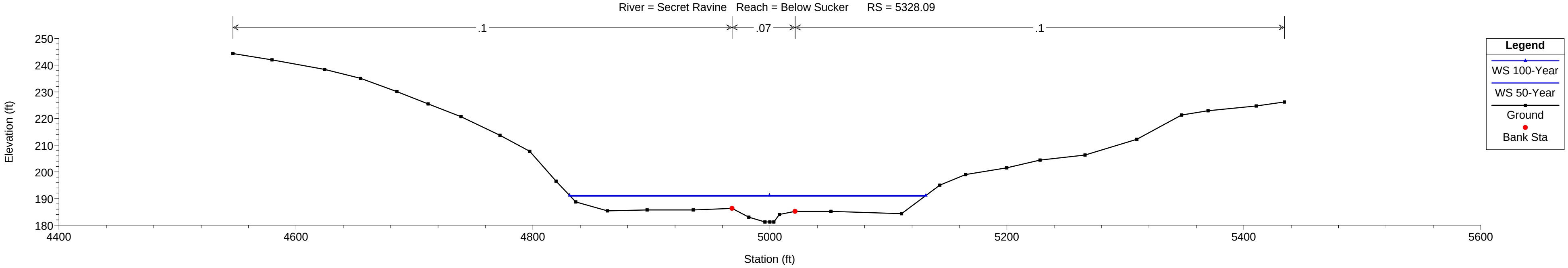
Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5423.09



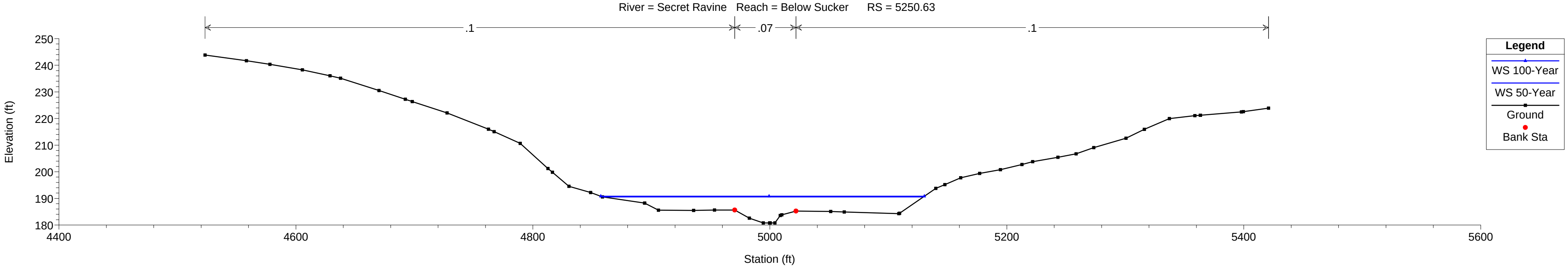
Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5414.59 Bent 12



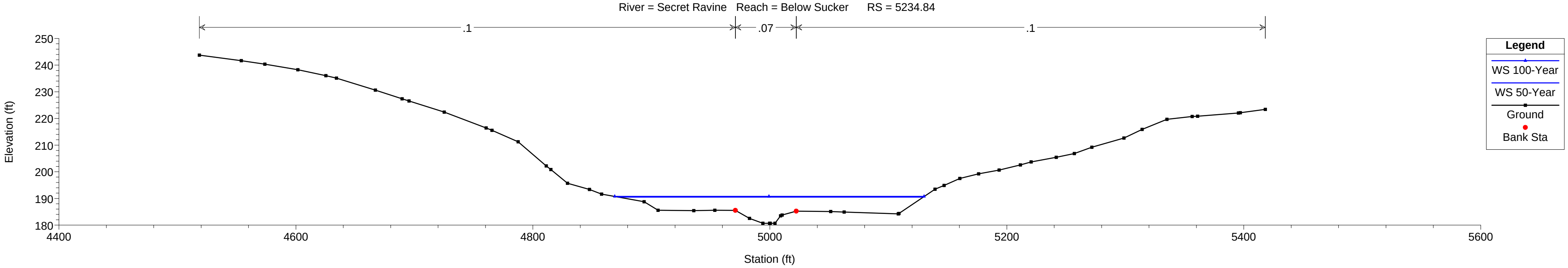
Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5328.09

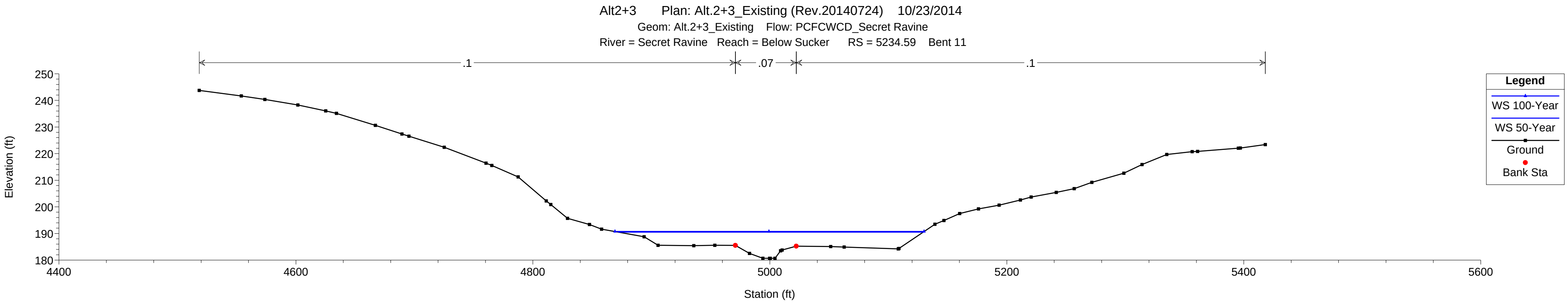


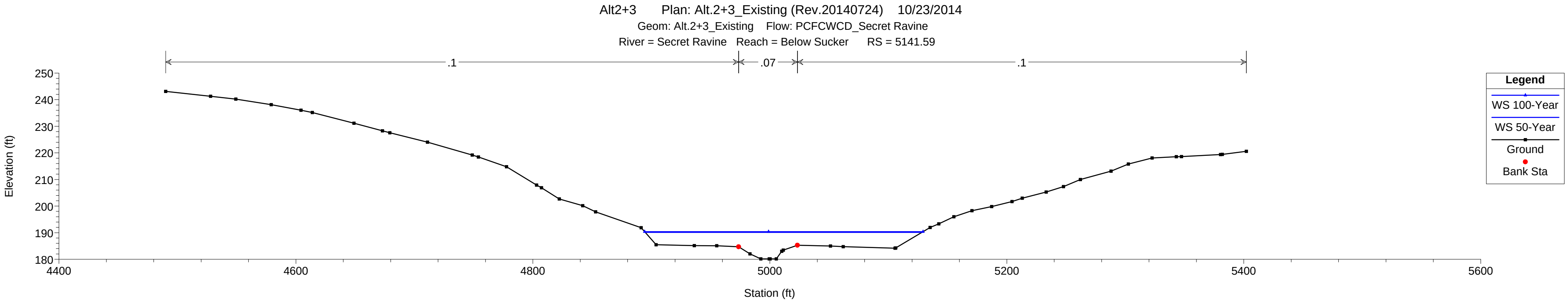
Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5250.63

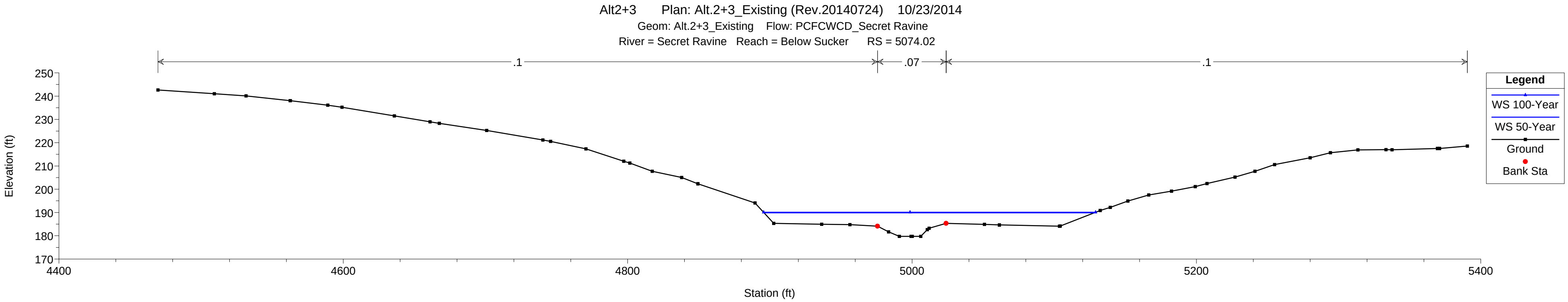


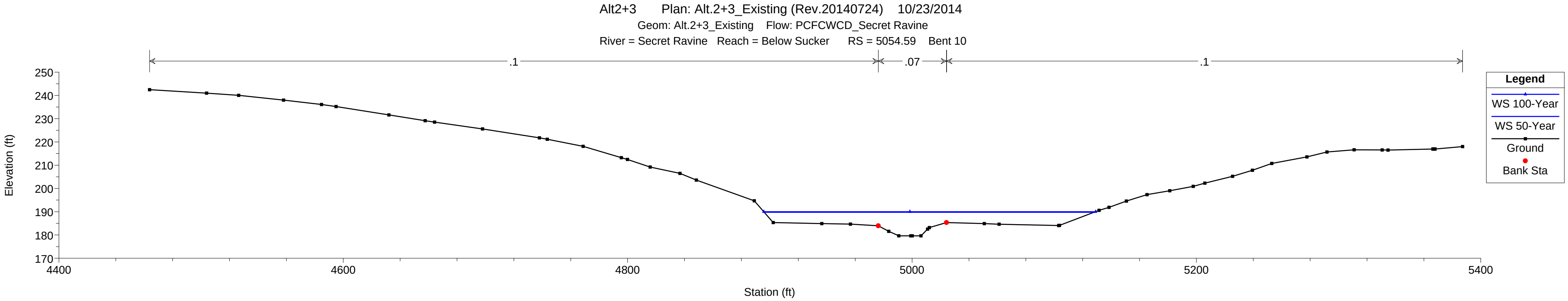
Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5234.84



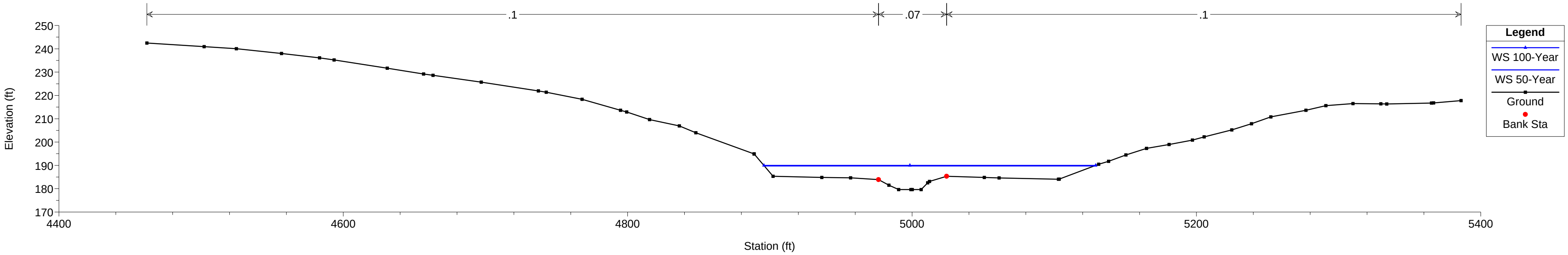

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5234.59 Bent 11
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5141.59
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

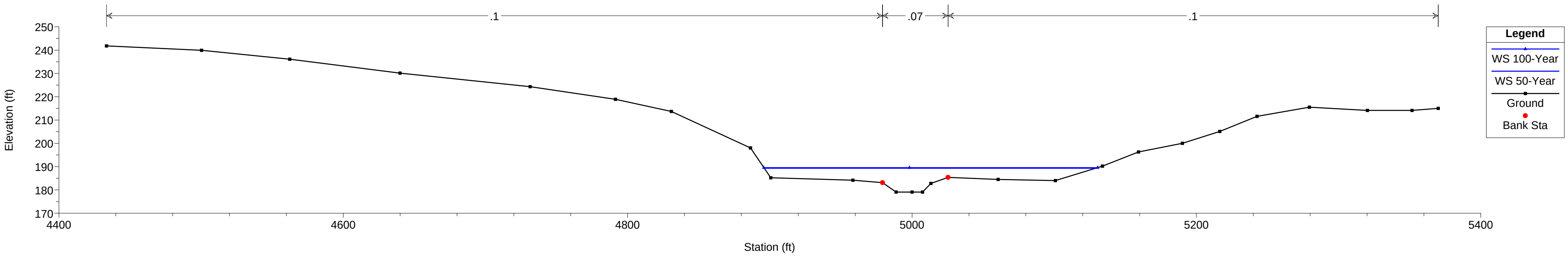

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5074.02
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5054.59 Bent 10
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

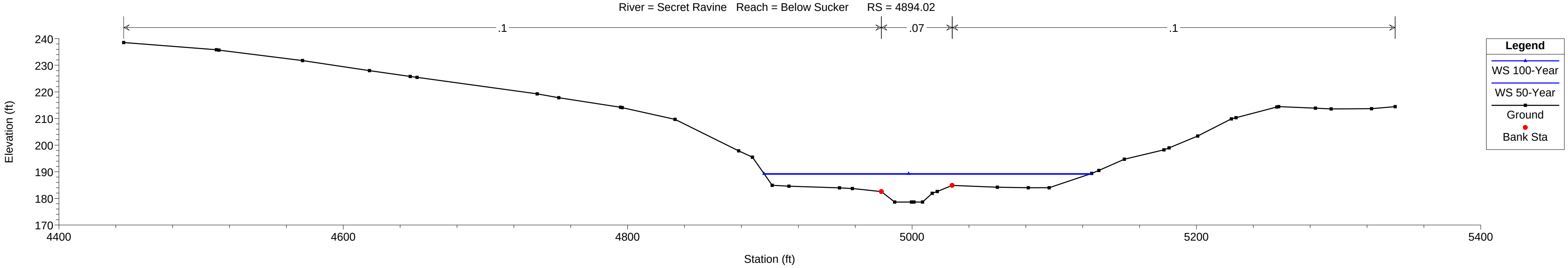
Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5048.34



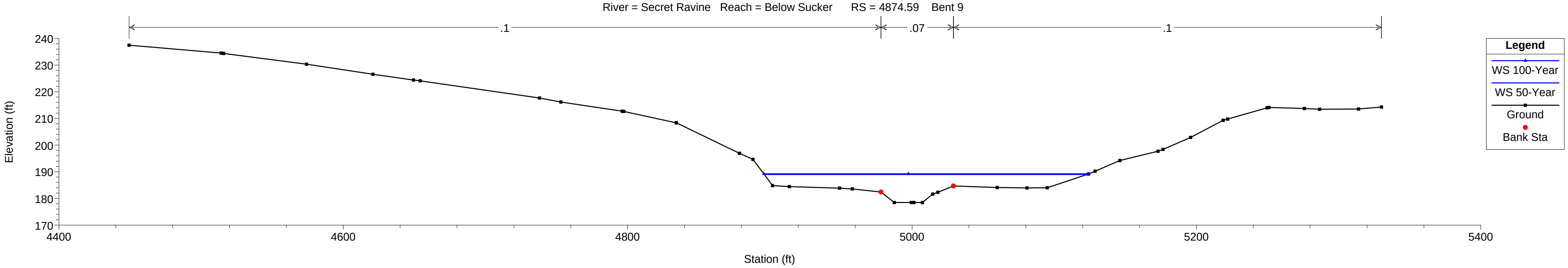
Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4955.09

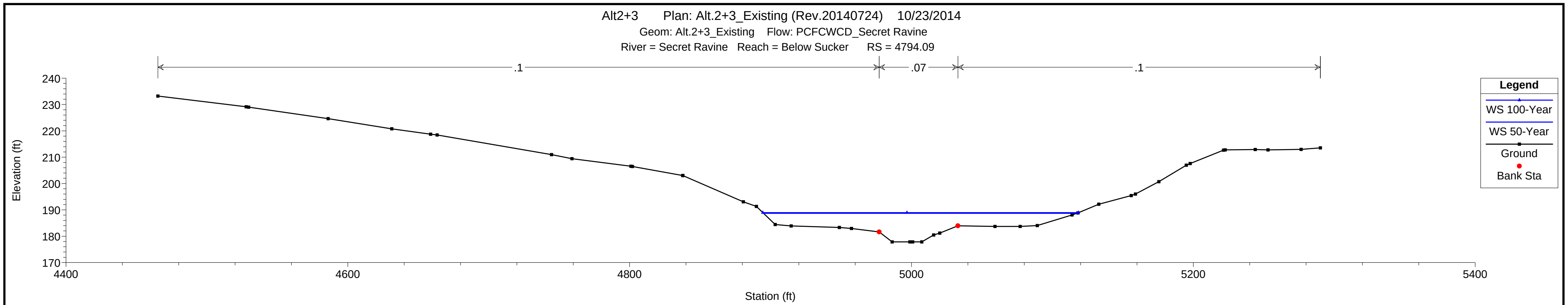


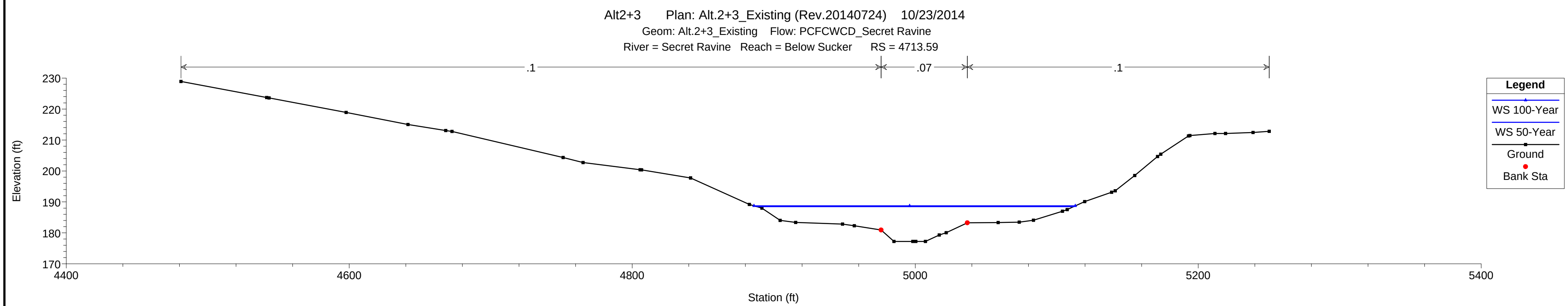
Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4894.02

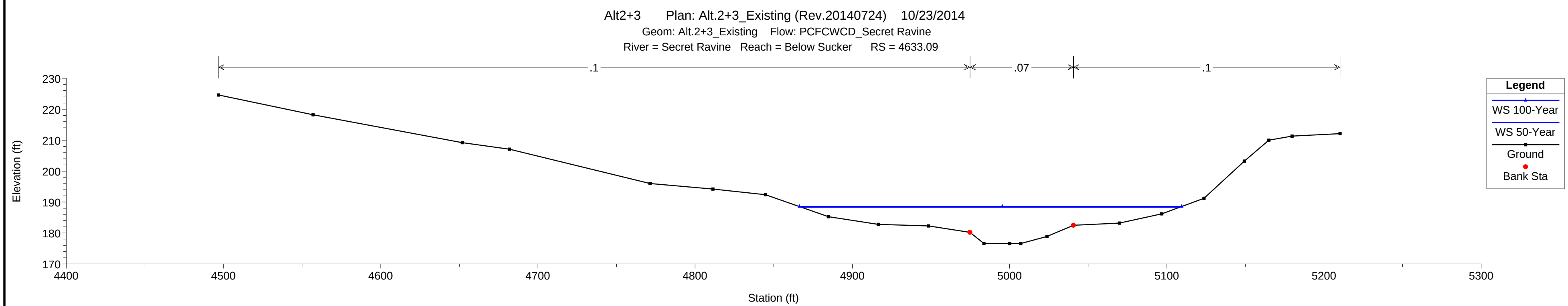


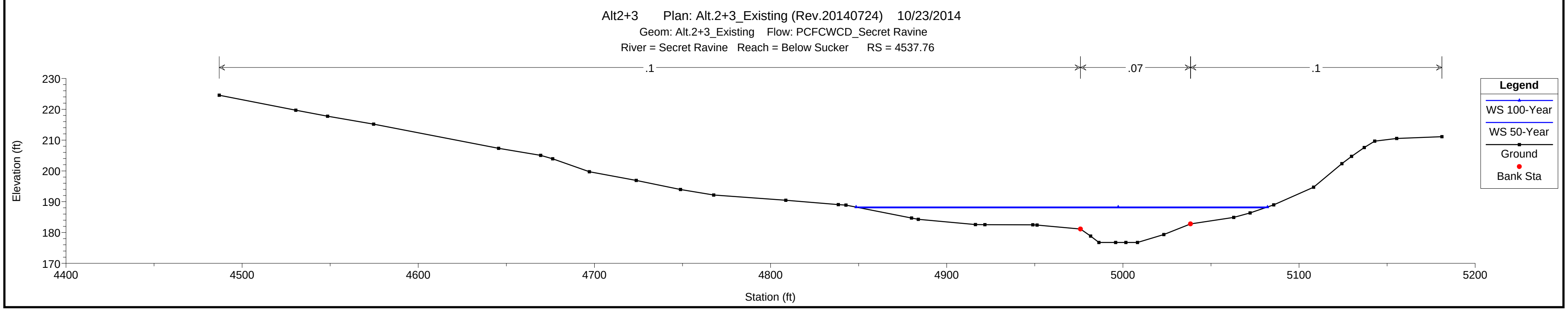
Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4874.59 Bent 9

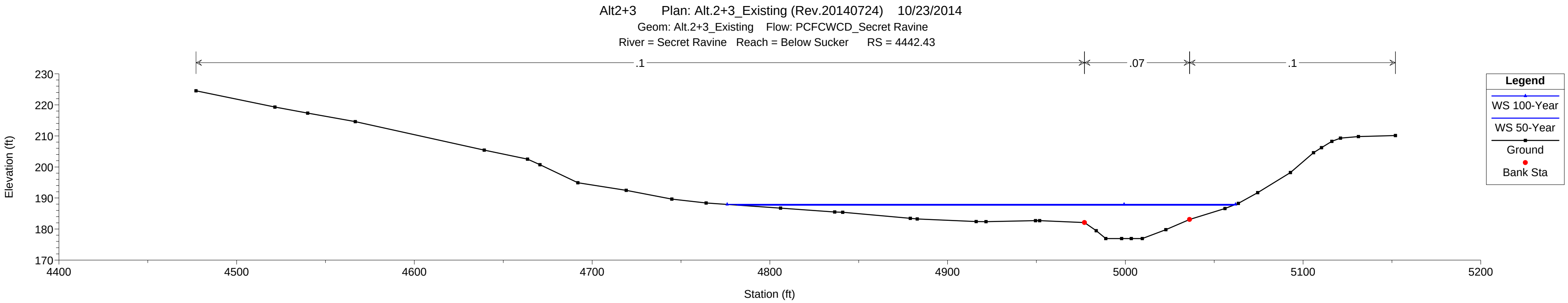


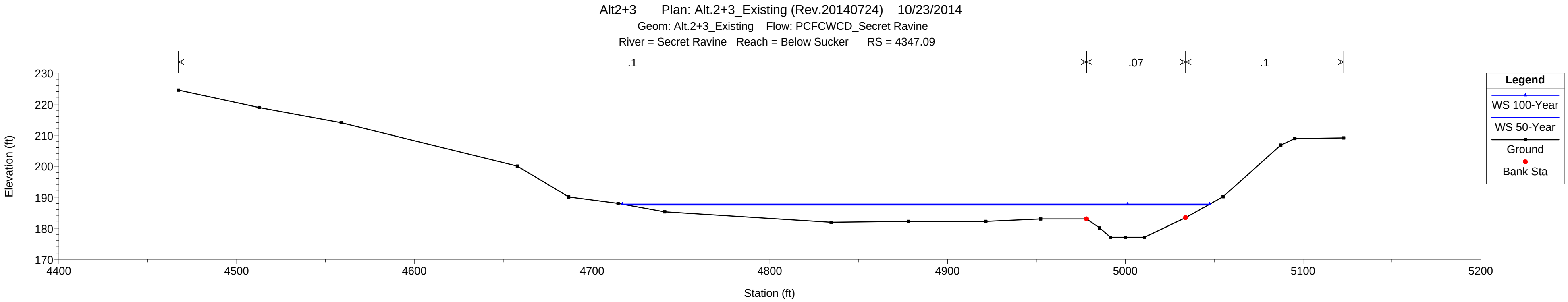

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4794.09
.1
.07
.1
Elevation (ft)
240
230
220
210
200
190
180
170
4400
4600
4800
5000
5200
5400
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

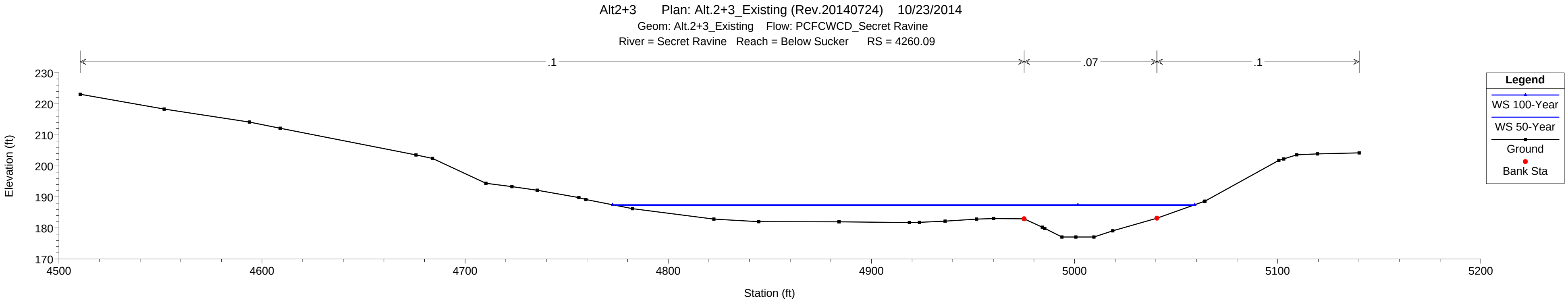

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4713.59
.1
.07
.1
Elevation (ft)
230
220
210
200
190
180
170
4400
4600
4800
5000
5200
5400
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

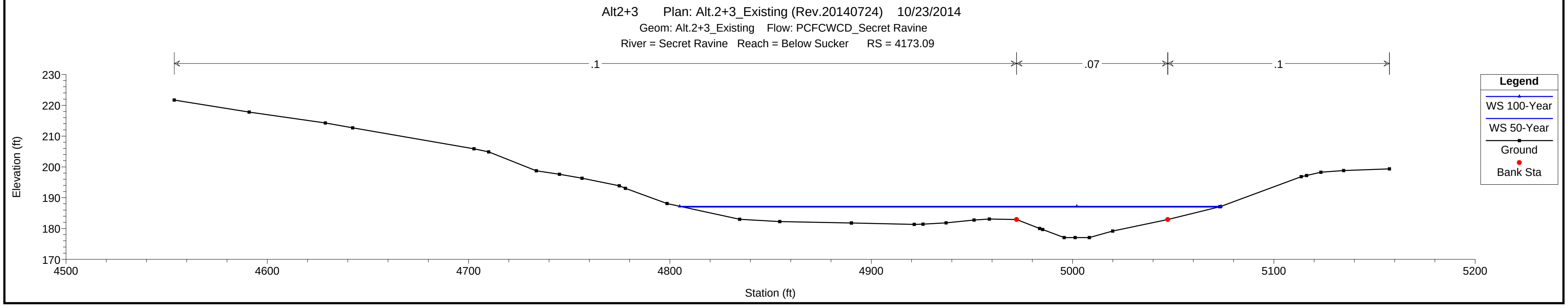

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4633.09
.1
.07
.1
Elevation (ft)
230
220
210
200
190
180
170
4400
4500
4600
4700
4800
4900
5000
5100
5200
5300
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

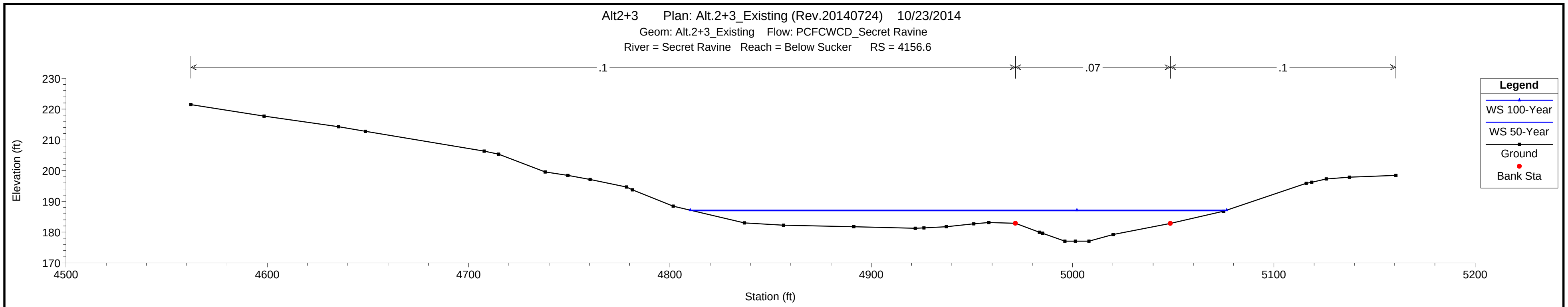

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4537.76
.1
.07
.1
Elevation (ft)
230
220
210
200
190
180
170
4400
4500
4600
4700
4800
4900
5000
5100
5200
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

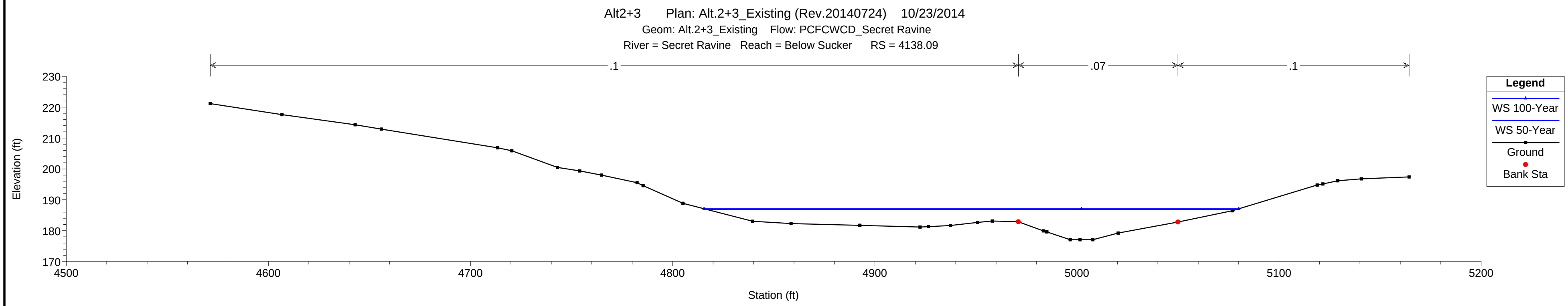

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4442.43
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

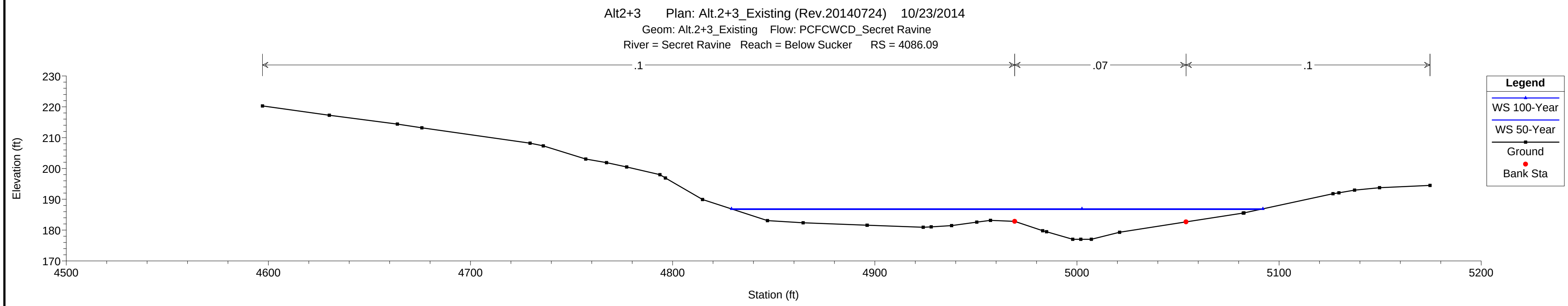

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4347.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

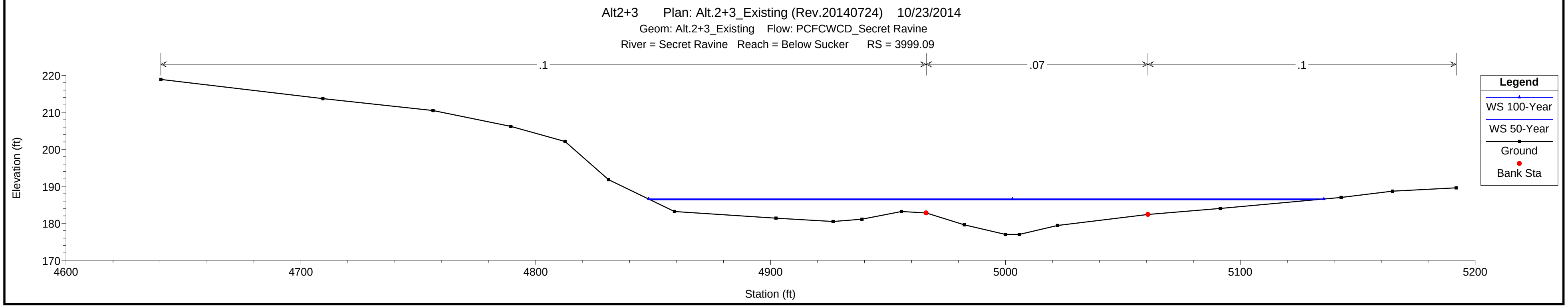

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4260.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4173.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

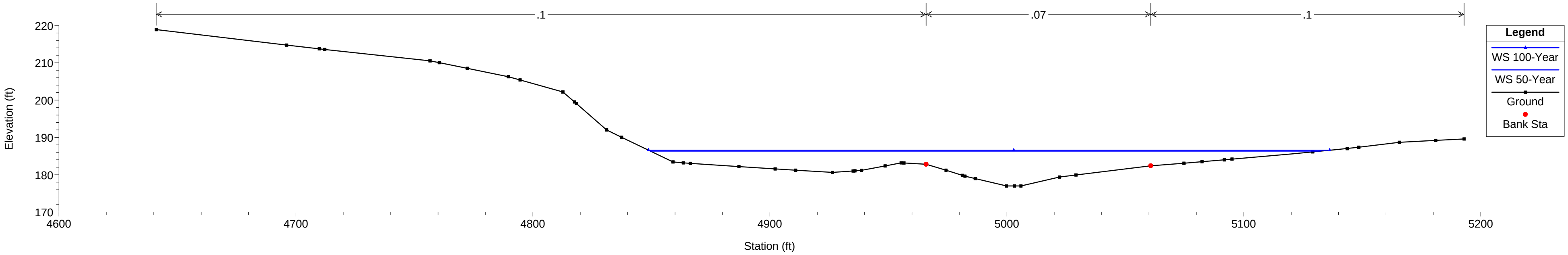

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4156.6
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4138.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

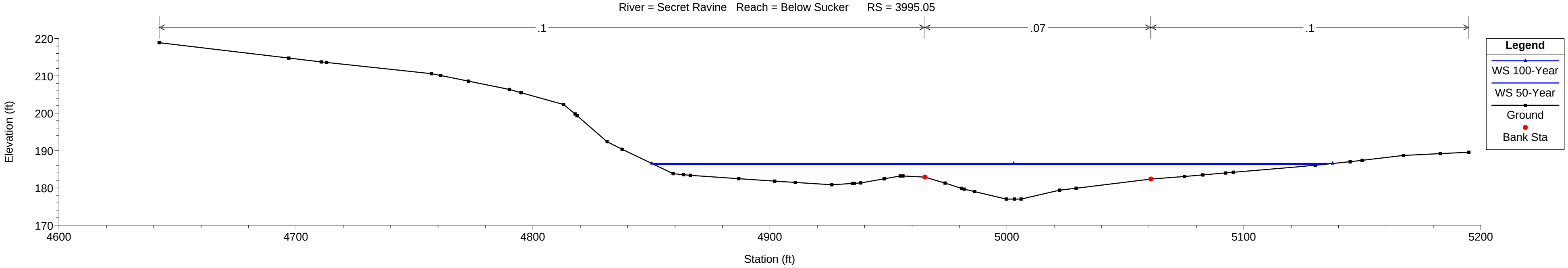

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4086.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3999.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

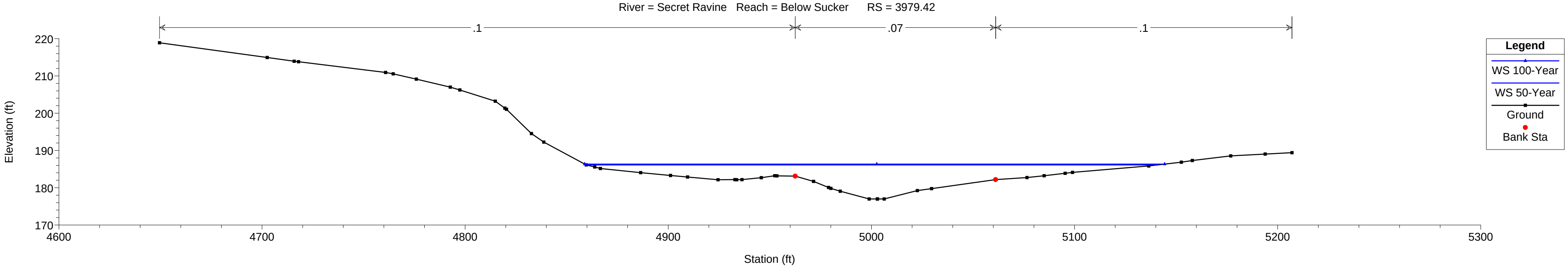
Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3997.66



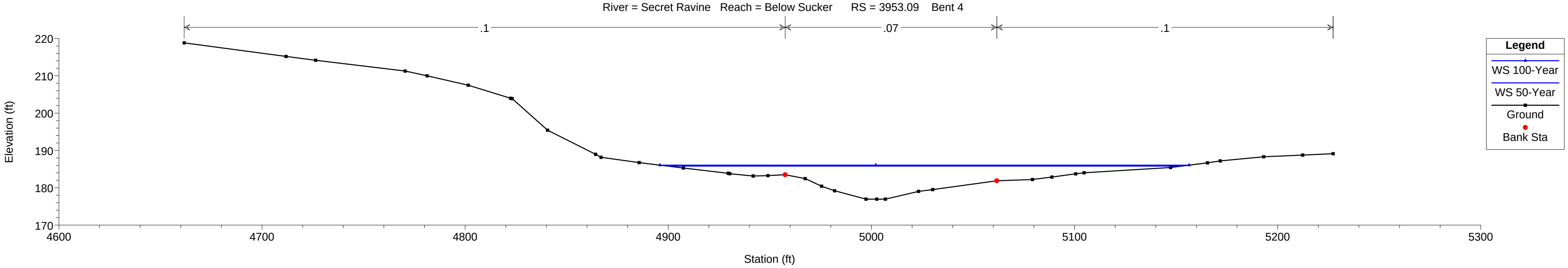
Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3995.05

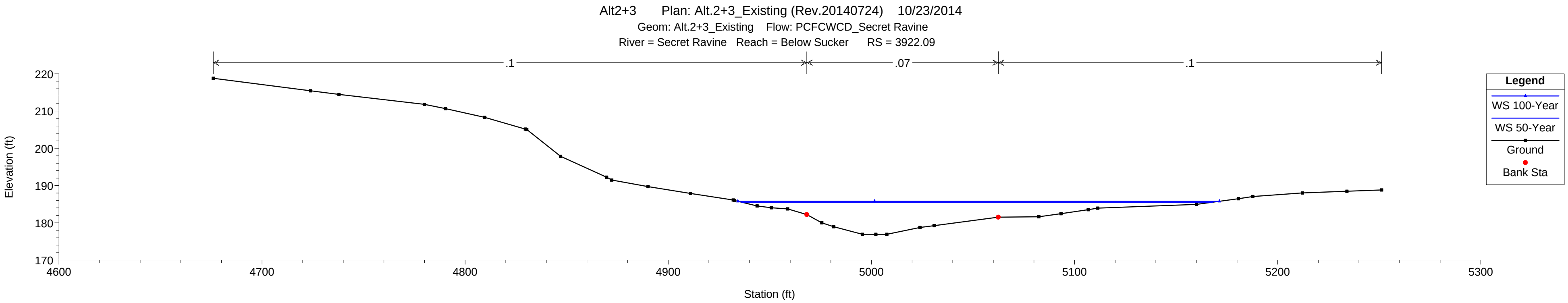


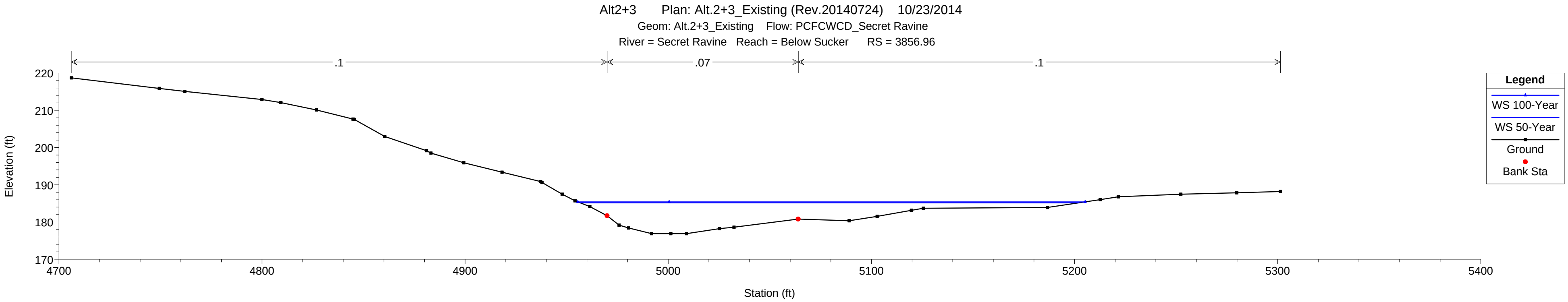
Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3979.42

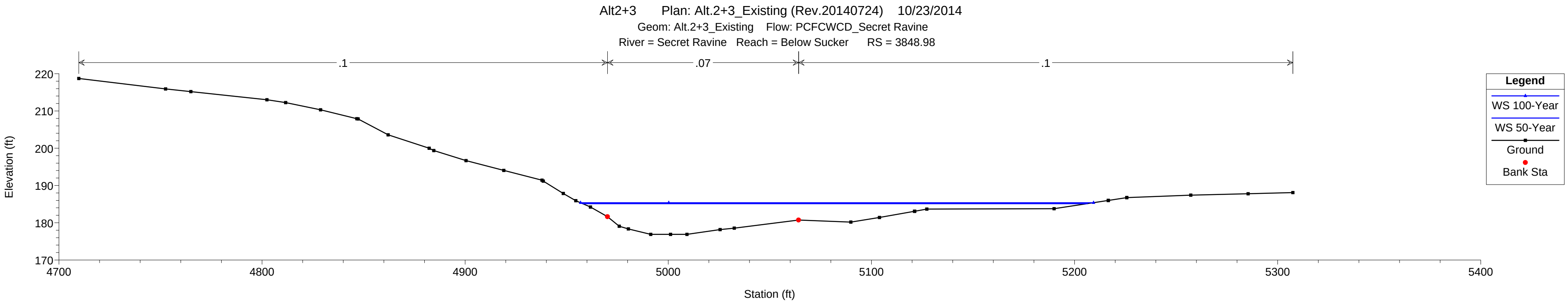


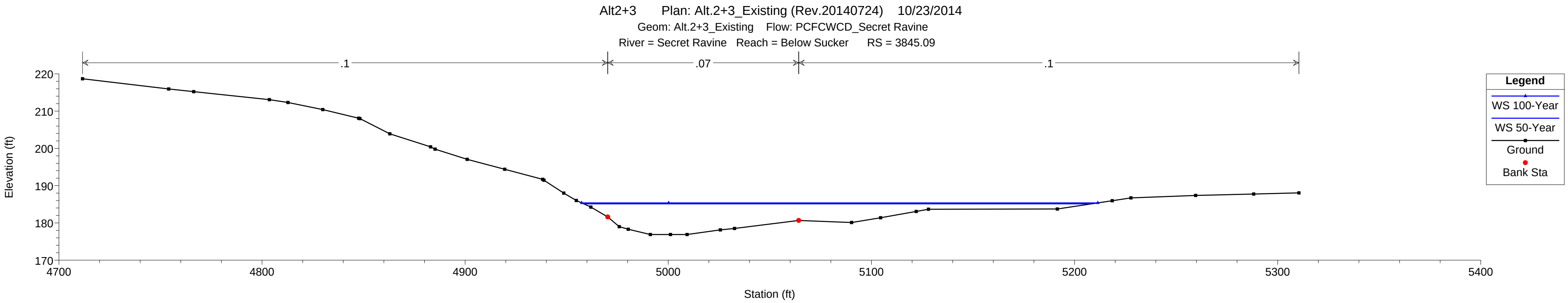
Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3953.09 Bent 4

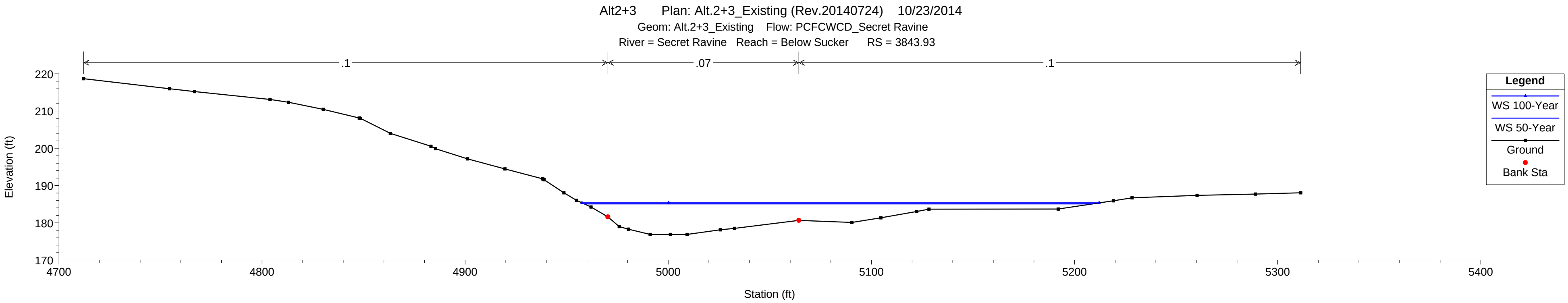


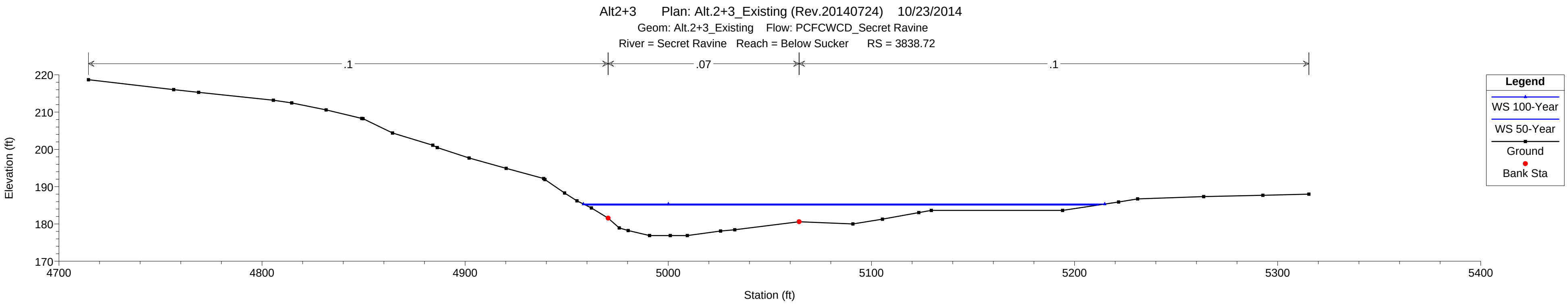

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3922.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

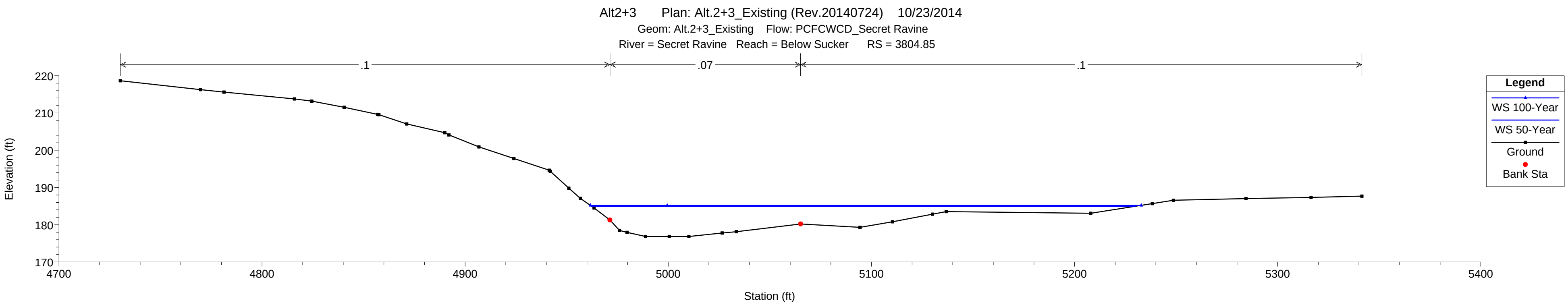

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3856.96
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

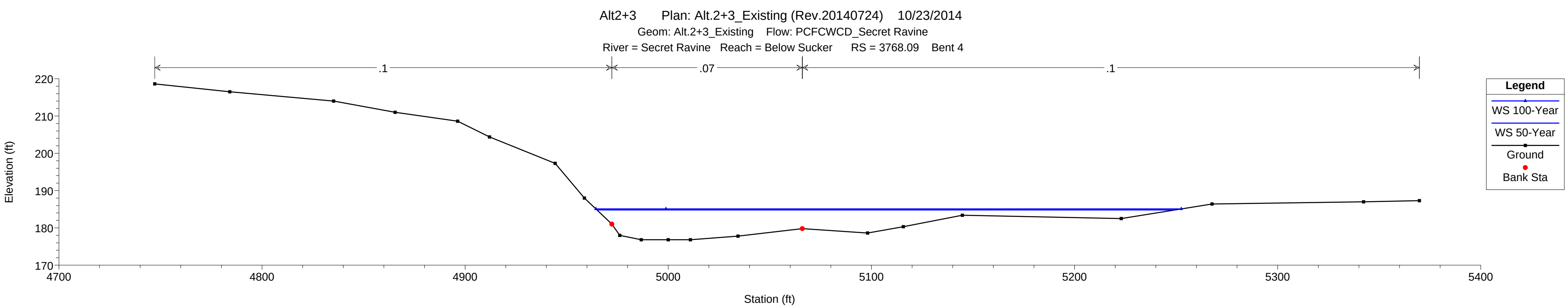

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3848.98
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

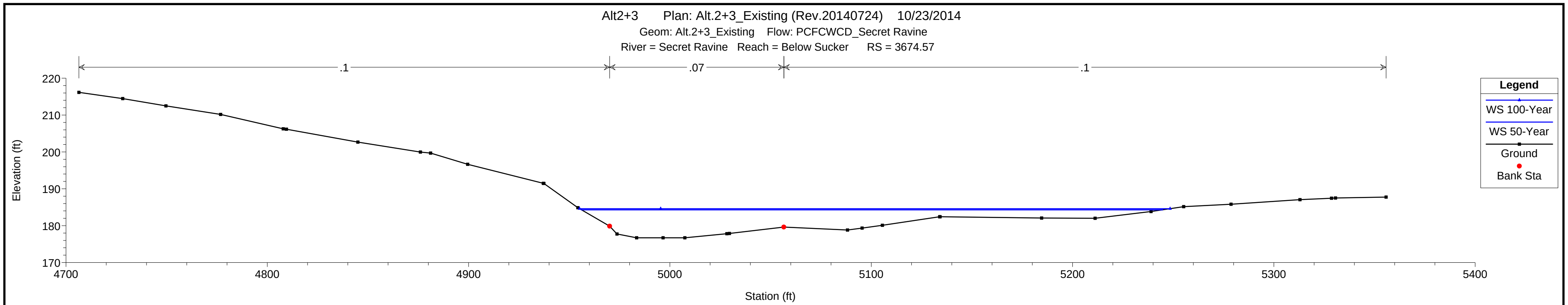

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3845.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

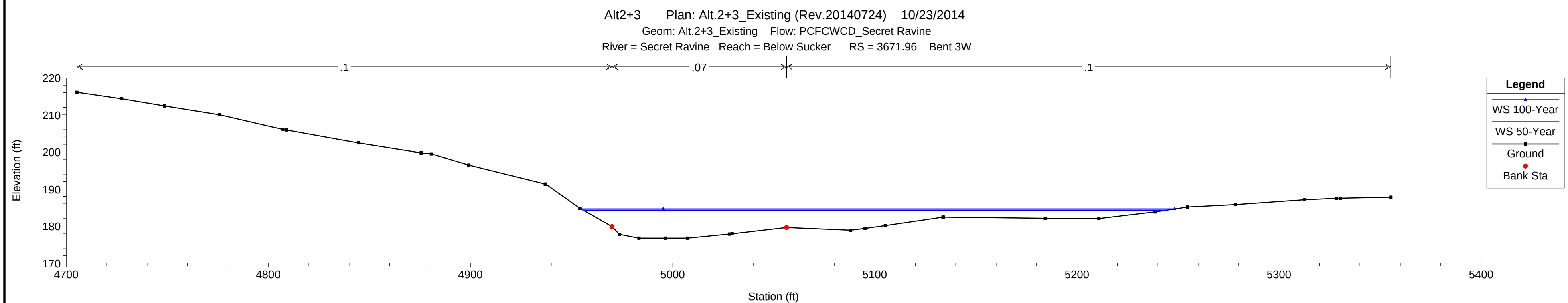

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3843.93
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

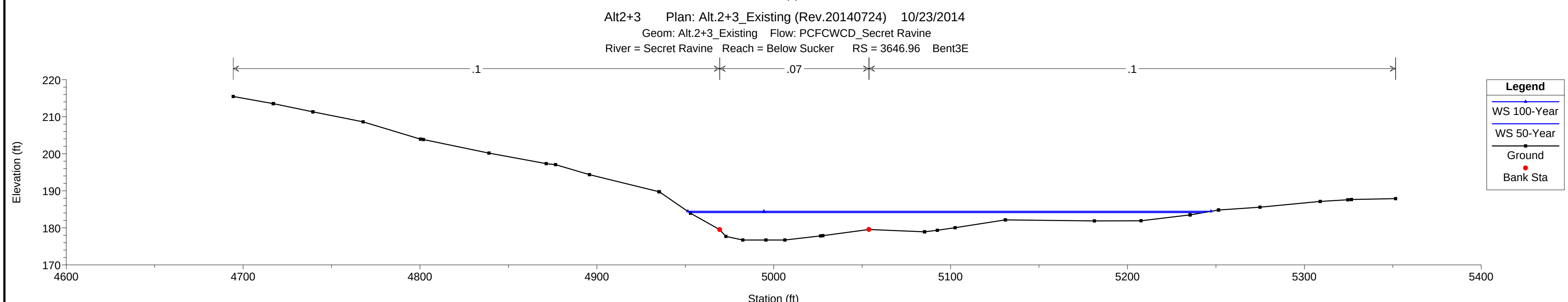

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3838.72
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

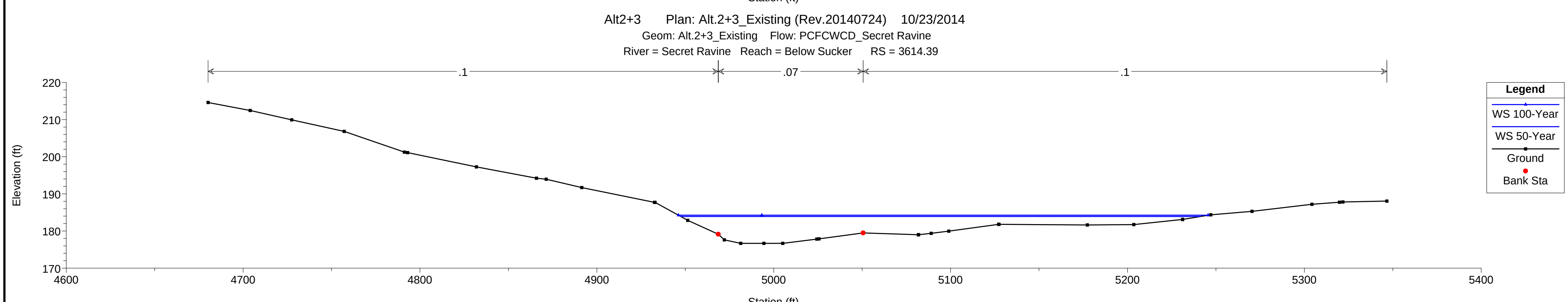

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3804.85
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

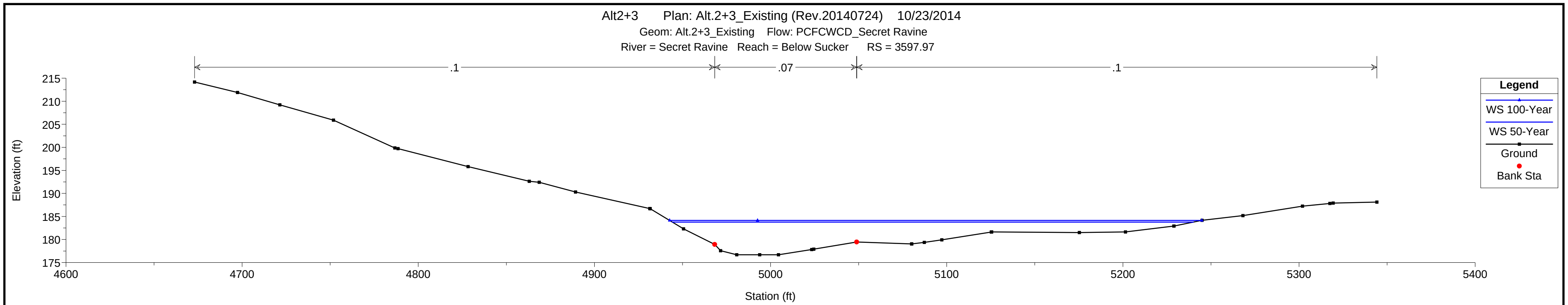

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3768.09 Bent 4
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3674.57
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

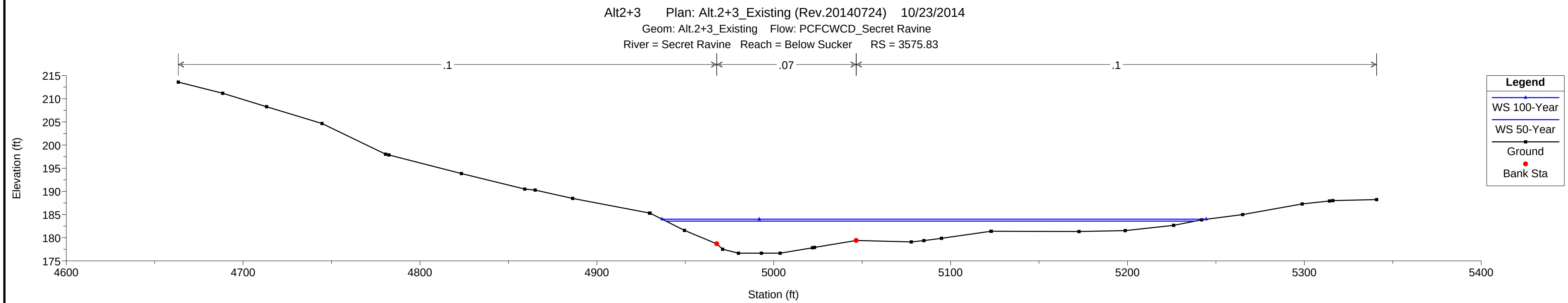

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3671.96 Bent 3W
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3646.96 Bent3E
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

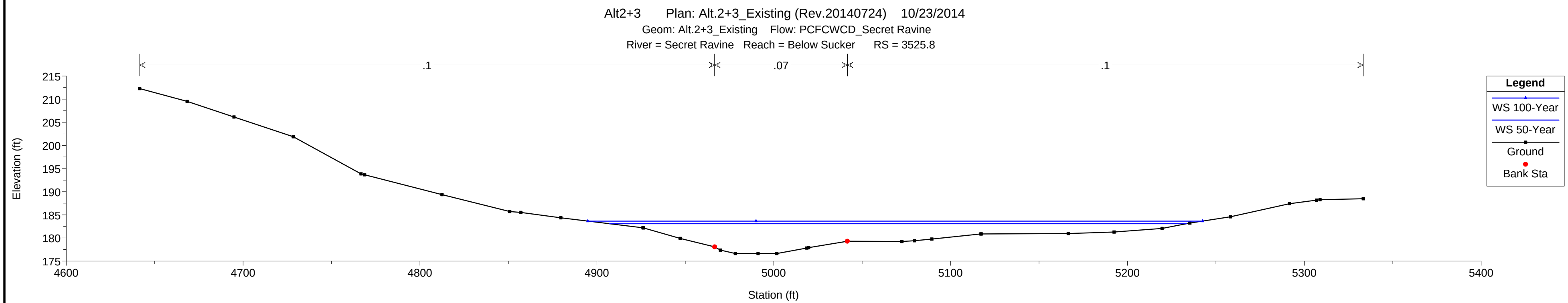

Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3614.39
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta



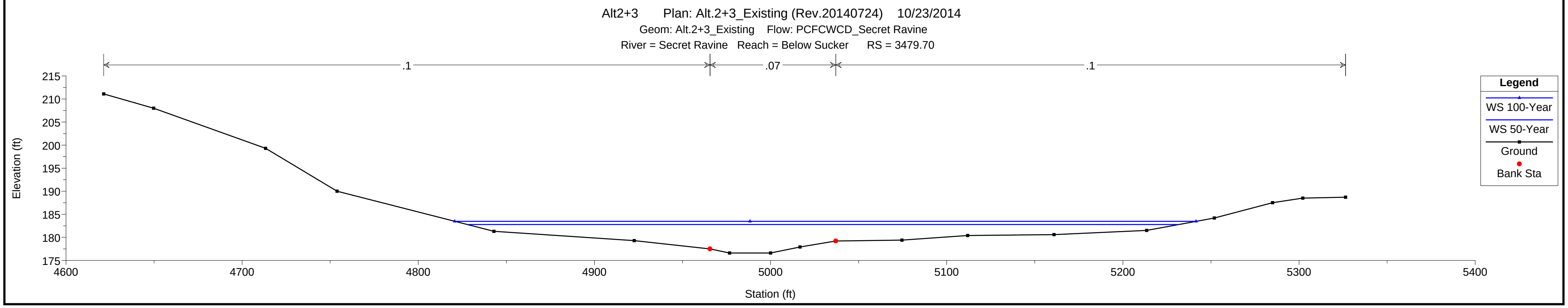
Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3597.97
.1
.07
.1
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)



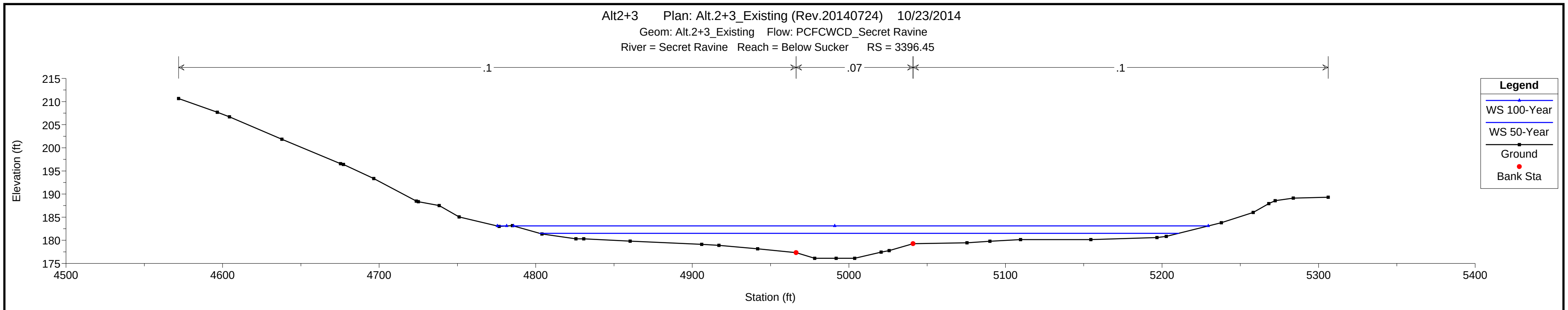
Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3575.83
.1
.07
.1
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)



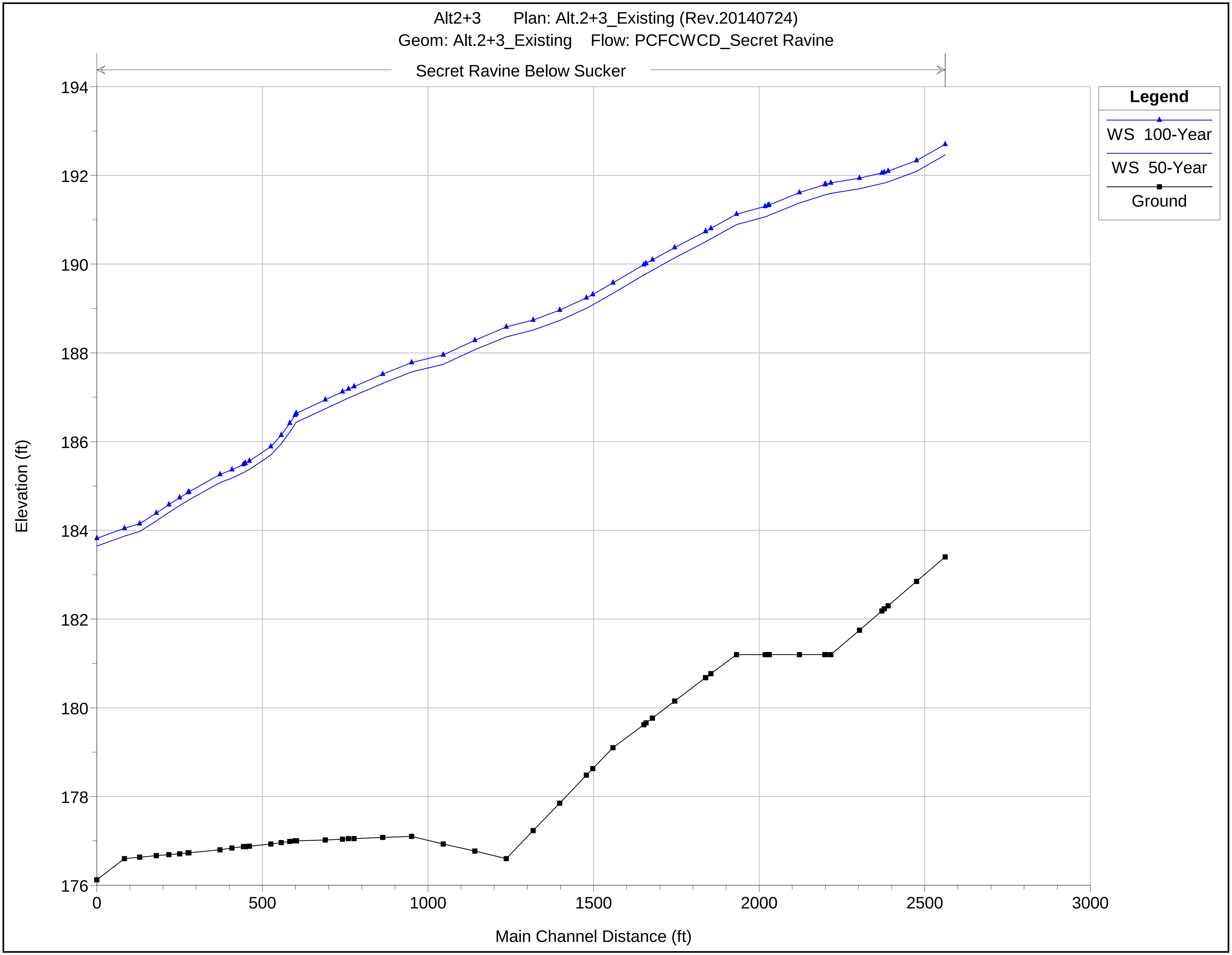
Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3525.8
.1
.07
.1
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)



Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3479.70
.1
.07
.1
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)



Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724) 10/23/2014
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3396.45
.1
.07
.1
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
215
210
205
200
195
190
185
180
175
4500
4600
4700
4800
4900
5000
5100
5200
5300
5400
Station (ft)



Alt2+3 Plan: Alt.2+3_Existing (Rev.20140724)
Geom: Alt.2+3_Existing Flow: PCFCWCD_Secret Ravine
Secret Ravine Below Sucker
Legend
WS 100-Year
WS 50-Year
Ground
Elevation (ft)
194
192
190
188
186
184
182
180
178
176
0
500
1000
1500
2000
2500
3000
Main Channel Distance (ft)

HEC-RAS Plan: Alt.2+3 Ex (Rev) River: Secret Ravine Reach: Below Sucker

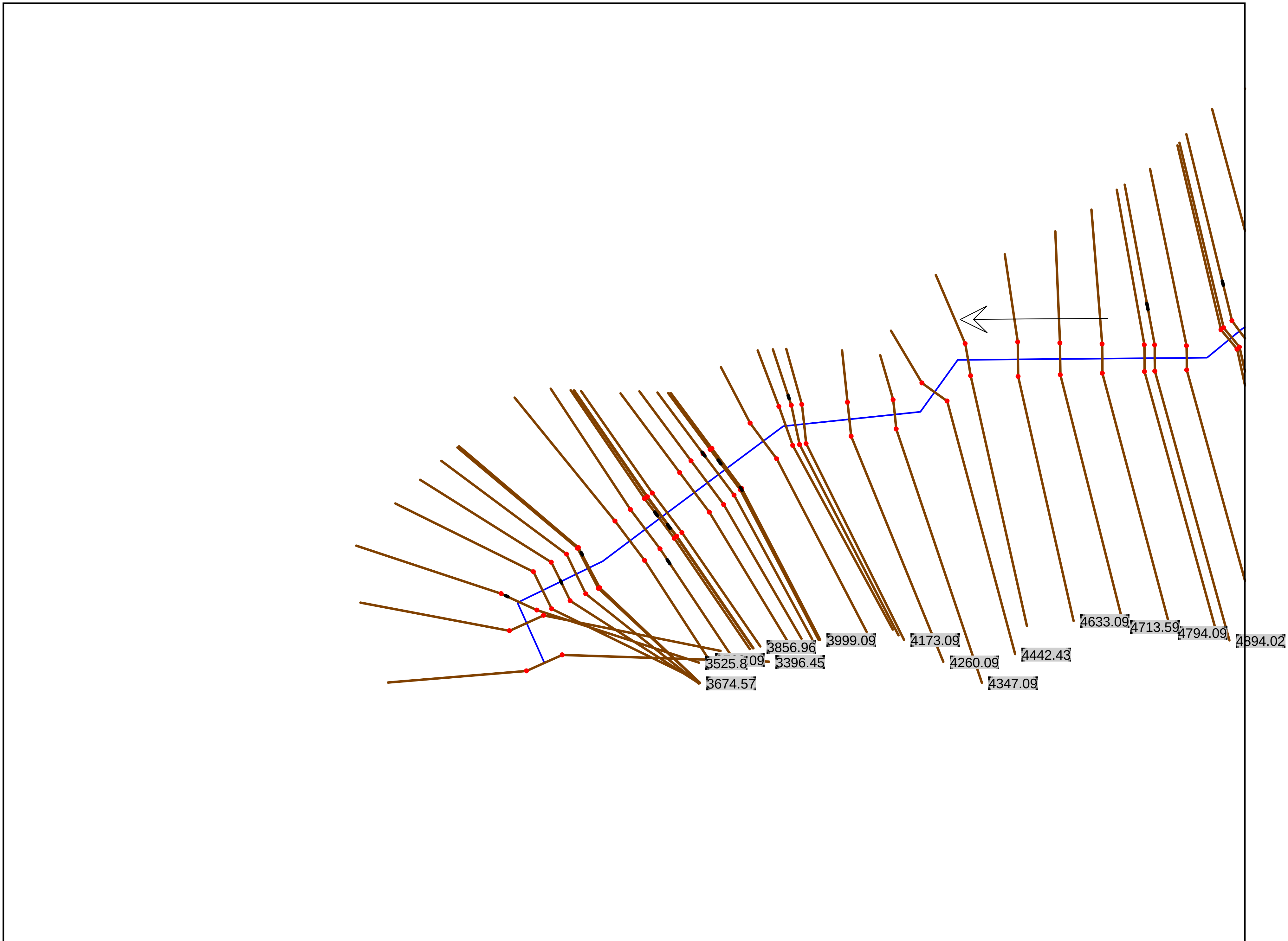
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Below Sucker	5958.09	50-Year	4415.00	183.40	192.46		192.63	0.002728	4.14	1628.89	347.78	0.27
Below Sucker	5958.09	100-Year	4697.00	183.40	192.70		192.87	0.002679	4.19	1712.39	351.07	0.27
Below Sucker	5871.84	50-Year	4415.00	182.85	192.09		192.36	0.003364	4.73	1324.09	318.88	0.30
Below Sucker	5871.84	100-Year	4697.00	182.85	192.33		192.61	0.003294	4.78	1402.39	320.50	0.30
Below Sucker	5785.59	50-Year	4415.00	182.30	191.85		192.10	0.002676	4.36	1281.79	232.72	0.27
Below Sucker	5785.59	100-Year	4697.00	182.30	192.09		192.35	0.002692	4.46	1338.29	235.74	0.27
Below Sucker	5774.59	50-Year	4415.00	182.23	191.83		192.07	0.002566	4.29	1298.05	232.27	0.27
Below Sucker	5774.59	100-Year	4697.00	182.23	192.07		192.32	0.002585	4.39	1354.39	235.23	0.27
Below Sucker	5767.3	50-Year	4415.00	182.18	191.81		192.05	0.002493	4.24	1309.59	232.08	0.26
Below Sucker	5767.3	100-Year	4697.00	182.18	192.05		192.30	0.002513	4.34	1365.85	235.01	0.27
Below Sucker	5699.34	50-Year	4415.00	181.75	191.70		191.89	0.001911	3.81	1430.31	232.42	0.23
Below Sucker	5699.34	100-Year	4697.00	181.75	191.94		192.14	0.001939	3.91	1486.23	234.24	0.24
Below Sucker	5613.09	50-Year	4415.00	181.20	191.59		191.74	0.001372	3.33	1611.17	241.59	0.20
Below Sucker	5613.09	100-Year	4697.00	181.20	191.83		191.98	0.001403	3.43	1668.83	243.05	0.20
Below Sucker	5597.02	50-Year	4415.00	181.20	191.56		191.71	0.001464	3.43	1577.18	238.81	0.20
Below Sucker	5597.02	100-Year	4697.00	181.20	191.80		191.96	0.001495	3.53	1633.99	240.32	0.21
Below Sucker	5594.59	50-Year	4415.00	181.20	191.55		191.71	0.001479	3.44	1571.74	238.39	0.21
Below Sucker	5594.59	100-Year	4697.00	181.20	191.79		191.96	0.001510	3.54	1628.42	239.91	0.21
Below Sucker	5518.09	50-Year	4415.00	181.20	191.38		191.57	0.002056	3.96	1417.57	231.07	0.24
Below Sucker	5518.09	100-Year	4697.00	181.20	191.61		191.82	0.002094	4.07	1471.63	234.31	0.24
Below Sucker	5426.73	50-Year	4415.00	181.20	191.10		191.34	0.003040	4.63	1347.47	290.74	0.29
Below Sucker	5426.73	100-Year	4697.00	181.20	191.33		191.58	0.003036	4.72	1415.77	293.66	0.29
Below Sucker	5423.09	50-Year	4415.00	181.20	191.09		191.33	0.003060	4.64	1354.20	291.71	0.29
Below Sucker	5423.09	100-Year	4697.00	181.20	191.32		191.57	0.003054	4.72	1422.77	294.63	0.29
Below Sucker	5414.59	50-Year	4415.00	181.20	191.06		191.30	0.003097	4.65	1371.51	293.99	0.29
Below Sucker	5414.59	100-Year	4697.00	181.20	191.30		191.54	0.003085	4.73	1440.74	296.88	0.29
Below Sucker	5328.09	50-Year	4415.00	181.20	190.88		191.03	0.002567	4.08	1652.68	299.45	0.26
Below Sucker	5328.09	100-Year	4697.00	181.20	191.12		191.27	0.002554	4.15	1723.58	300.67	0.26
Below Sucker	5250.63	50-Year	4415.00	180.77	190.56		190.80	0.003781	5.01	1367.95	270.90	0.32
Below Sucker	5250.63	100-Year	4697.00	180.77	190.80		191.04	0.003748	5.09	1432.41	273.12	0.32
Below Sucker	5234.84	50-Year	4415.00	180.68	190.50		190.74	0.003853	5.07	1337.38	257.39	0.32
Below Sucker	5234.84	100-Year	4697.00	180.68	190.73		190.98	0.003849	5.17	1398.31	261.15	0.32
Below Sucker	5234.59	50-Year	4415.00	180.68	190.50		190.74	0.003856	5.07	1336.80	257.19	0.32
Below Sucker	5234.59	100-Year	4697.00	180.68	190.73		190.98	0.003852	5.17	1397.68	260.94	0.32
Below Sucker	5141.59	50-Year	4415.00	180.15	190.13		190.39	0.004012	5.25	1276.59	233.60	0.33
Below Sucker	5141.59	100-Year	4697.00	180.15	190.37		190.63	0.004007	5.35	1331.65	234.95	0.33
Below Sucker	5074.02	50-Year	4415.00	179.77	189.85		190.13	0.004191	5.41	1251.92	232.14	0.34
Below Sucker	5074.02	100-Year	4697.00	179.77	190.09		190.37	0.004180	5.51	1306.85	233.49	0.34
Below Sucker	5054.59	50-Year	4415.00	179.66	189.77		190.05	0.004249	5.46	1244.95	232.00	0.34
Below Sucker	5054.59	100-Year	4697.00	179.66	190.01		190.29	0.004236	5.55	1299.94	233.36	0.34
Below Sucker	5048.34	50-Year	4415.00	179.62	189.74		190.02	0.004267	5.47	1242.79	231.99	0.34
Below Sucker	5048.34	100-Year	4697.00	179.62	189.98		190.27	0.004254	5.57	1297.81	233.35	0.34
Below Sucker	4955.09	50-Year	4415.00	179.10	189.33		189.63	0.004596	5.71	1210.29	233.21	0.35
Below Sucker	4955.09	100-Year	4697.00	179.10	189.57		189.88	0.004564	5.80	1266.41	234.76	0.35
Below Sucker	4894.02	50-Year	4415.00	178.63	189.06		189.37	0.004134	5.55	1222.14	228.45	0.34
Below Sucker	4894.02	100-Year	4697.00	178.63	189.30		189.62	0.004127	5.65	1277.21	230.10	0.34
Below Sucker	4874.59	50-Year	4415.00	178.48	188.99		189.29	0.003979	5.49	1228.09	227.11	0.33
Below Sucker	4874.59	100-Year	4697.00	178.48	189.23		189.54	0.003978	5.60	1282.80	228.68	0.33
Below Sucker	4794.09	50-Year	4415.00	177.85	188.71		188.99	0.003302	5.20	1265.94	222.38	0.30
Below Sucker	4794.09	100-Year	4697.00	177.85	188.95		189.24	0.003331	5.31	1318.98	224.00	0.31
Below Sucker	4713.59	50-Year	4415.00	177.23	188.49		188.75	0.002669	4.86	1330.03	224.27	0.28
Below Sucker	4713.59	100-Year	4697.00	177.23	188.72		188.99	0.002726	4.99	1382.55	227.11	0.28
Below Sucker	4633.09	50-Year	4415.00	176.60	188.33		188.55	0.001995	4.39	1472.23	240.63	0.24

HEC-RAS Plan: Alt.2+3 Ex (Rev) River: Secret Ravine Reach: Below Sucker (Continued)

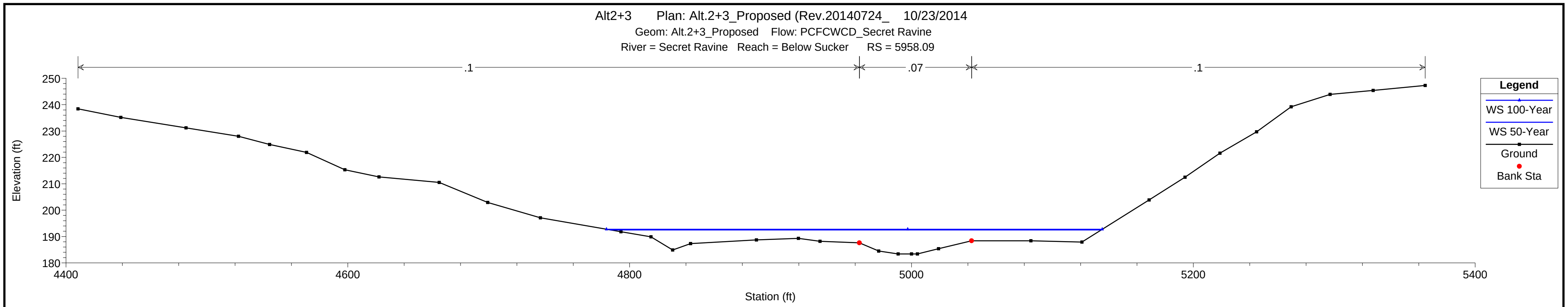
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Below Sucker	4633.09	100-Year	4697.00	176.60	188.56		188.79	0.002048	4.51	1527.72	243.16	0.25
Below Sucker	4537.76	50-Year	4415.00	176.77	188.04		188.33	0.002843	5.01	1288.72	230.41	0.29
Below Sucker	4537.76	100-Year	4697.00	176.77	188.26		188.56	0.002910	5.15	1340.01	233.50	0.29
Below Sucker	4442.43	50-Year	4415.00	176.93	187.71		188.03	0.003715	5.44	1277.86	279.39	0.32
Below Sucker	4442.43	100-Year	4697.00	176.93	187.93		188.26	0.003755	5.56	1339.94	286.00	0.32
Below Sucker	4347.09	50-Year	4415.00	177.10	187.53		187.71	0.002678	4.42	1623.94	327.53	0.27
Below Sucker	4347.09	100-Year	4697.00	177.10	187.75		187.93	0.002675	4.49	1697.22	330.39	0.27
Below Sucker	4260.09	50-Year	4415.00	177.08	187.26		187.48	0.003199	4.67	1427.45	283.90	0.29
Below Sucker	4260.09	100-Year	4697.00	177.08	187.48		187.71	0.003205	4.76	1490.34	286.57	0.30
Below Sucker	4173.09	50-Year	4415.00	177.05	186.98		187.22	0.003539	4.74	1331.06	266.15	0.31
Below Sucker	4173.09	100-Year	4697.00	177.05	187.20		187.45	0.003547	4.84	1389.61	268.88	0.31
Below Sucker	4156.6	50-Year	4415.00	177.05	186.92		187.17	0.003597	4.75	1317.59	264.09	0.31
Below Sucker	4156.6	100-Year	4697.00	177.05	187.14		187.40	0.003603	4.85	1375.62	266.50	0.31
Below Sucker	4138.09	50-Year	4415.00	177.04	186.86		187.11	0.003661	4.76	1303.79	262.10	0.31
Below Sucker	4138.09	100-Year	4697.00	177.04	187.08		187.33	0.003665	4.85	1361.35	264.49	0.31
Below Sucker	4086.09	50-Year	4415.00	177.02	186.67		186.93	0.003848	4.77	1271.77	260.29	0.32
Below Sucker	4086.09	100-Year	4697.00	177.02	186.89		187.16	0.003843	4.87	1329.02	262.86	0.32
Below Sucker	3999.09	50-Year	4415.00	177.00	186.35		186.61	0.004113	4.76	1263.33	282.95	0.33
Below Sucker	3999.09	100-Year	4697.00	177.00	186.57		186.84	0.004068	4.84	1327.02	287.51	0.33
Below Sucker	3997.66	50-Year	4415.00	177.00	186.34		186.61	0.004222	4.82	1248.94	282.87	0.33
Below Sucker	3997.66	100-Year	4697.00	177.00	186.56		186.84	0.004171	4.89	1312.68	287.42	0.33
Below Sucker	3995.05	50-Year	4415.00	177.00	186.31		186.60	0.004434	4.92	1222.31	282.72	0.34
Below Sucker	3995.05	100-Year	4697.00	177.00	186.53		186.83	0.004371	5.00	1286.16	287.25	0.34
Below Sucker	3979.42	50-Year	4415.00	176.99	186.11		186.51	0.005816	5.55	1072.13	281.04	0.39
Below Sucker	3979.42	100-Year	4697.00	176.99	186.34		186.74	0.005661	5.61	1137.14	285.49	0.38
Below Sucker	3953.09	50-Year	4415.00	176.96	185.82		186.33	0.007232	6.03	922.86	253.66	0.43
Below Sucker	3953.09	100-Year	4697.00	176.96	186.05		186.56	0.007045	6.10	982.24	260.45	0.43
Below Sucker	3922.09	50-Year	4415.00	176.93	185.54		186.09	0.007407	6.33	879.73	232.03	0.44
Below Sucker	3922.09	100-Year	4697.00	176.93	185.77		186.34	0.007243	6.41	934.79	237.03	0.44
Below Sucker	3856.96	50-Year	4415.00	176.88	185.17		185.63	0.006189	5.90	975.34	245.47	0.40
Below Sucker	3856.96	100-Year	4697.00	176.88	185.41		185.88	0.006006	5.95	1037.09	249.72	0.40
Below Sucker	3848.98	50-Year	4415.00	176.87	185.13		185.58	0.006016	5.83	992.23	248.47	0.40
Below Sucker	3848.98	100-Year	4697.00	176.87	185.38		185.83	0.005832	5.88	1055.19	252.60	0.39
Below Sucker	3845.09	50-Year	4415.00	176.87	185.11		185.55	0.005940	5.80	1000.22	250.01	0.39
Below Sucker	3845.09	100-Year	4697.00	176.87	185.36		185.81	0.005755	5.85	1063.79	254.10	0.39
Below Sucker	3843.93	50-Year	4415.00	176.87	185.10		185.54	0.005919	5.79	1002.57	250.48	0.39
Below Sucker	3843.93	100-Year	4697.00	176.87	185.35		185.80	0.005733	5.84	1066.33	254.56	0.39
Below Sucker	3838.72	50-Year	4415.00	176.87	185.08		185.51	0.005812	5.74	1014.04	252.62	0.39
Below Sucker	3838.72	100-Year	4697.00	176.87	185.33		185.77	0.005626	5.79	1078.64	256.66	0.39
Below Sucker	3804.85	50-Year	4415.00	176.84	184.93		185.31	0.005064	5.42	1100.01	267.40	0.36
Below Sucker	3804.85	100-Year	4697.00	176.84	185.20		185.57	0.004884	5.46	1170.30	271.16	0.36
Below Sucker	3768.09	50-Year	4415.00	176.80	184.81		185.12	0.004281	5.05	1209.42	284.60	0.34
Below Sucker	3768.09	100-Year	4697.00	176.80	185.08		185.39	0.004119	5.08	1286.11	288.19	0.33
Below Sucker	3674.57	50-Year	4415.00	176.73	184.31		184.67	0.005473	5.52	1141.44	288.70	0.38
Below Sucker	3674.57	100-Year	4697.00	176.73	184.61		184.96	0.005087	5.49	1229.62	293.37	0.37
Below Sucker	3671.96	50-Year	4415.00	176.73	184.29		184.66	0.005514	5.54	1139.55	288.87	0.38
Below Sucker	3671.96	100-Year	4697.00	176.73	184.60		184.95	0.005119	5.50	1228.19	293.57	0.37
Below Sucker	3646.96	50-Year	4415.00	176.71	184.13		184.51	0.005971	5.70	1118.73	290.76	0.39
Below Sucker	3646.96	100-Year	4697.00	176.71	184.45		184.82	0.005454	5.62	1212.97	295.75	0.38
Below Sucker	3614.39	50-Year	4415.00	176.69	183.90		184.31	0.006699	5.92	1089.88	293.70	0.41
Below Sucker	3614.39	100-Year	4697.00	176.69	184.25		184.63	0.005948	5.79	1194.29	299.55	0.39
Below Sucker	3597.97	50-Year	4415.00	176.68	183.77		184.19	0.007139	6.05	1074.78	295.71	0.43
Below Sucker	3597.97	100-Year	4697.00	176.68	184.15		184.53	0.006219	5.87	1186.13	302.12	0.40

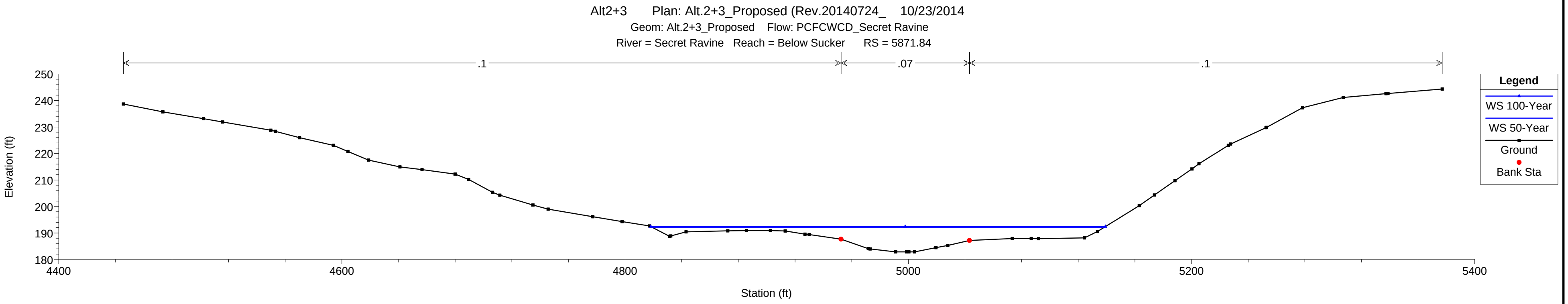
HEC-RAS Plan: Alt.2+3 Ex (Rev) River: Secret Ravine Reach: Below Sucker (Continued)

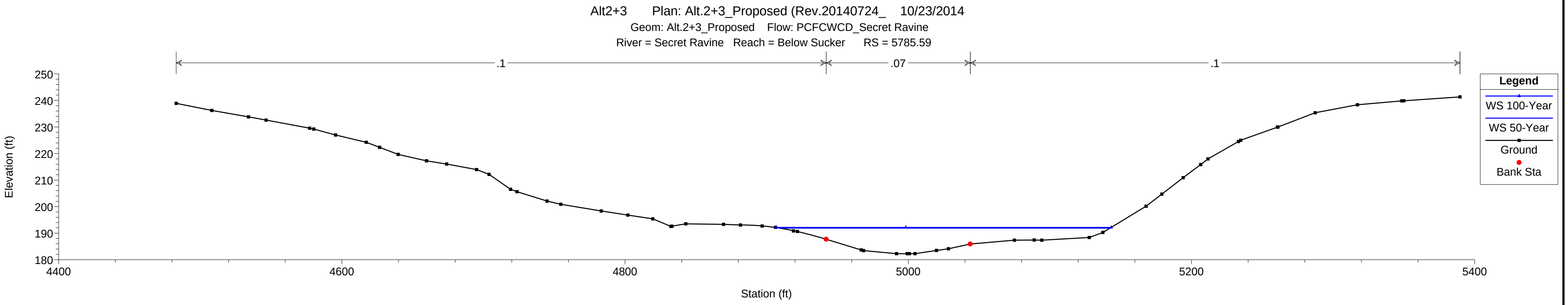
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Below Sucker	3575.83	50-Year	4415.00	176.67	183.58		184.02	0.007869	6.24	1051.95	299.20	0.45
Below Sucker	3575.83	100-Year	4697.00	176.67	183.99		184.39	0.006631	5.99	1176.43	307.66	0.41
Below Sucker	3525.8	50-Year	4415.00	176.63	183.07		183.57	0.010217	6.78	1009.82	326.32	0.50
Below Sucker	3525.8	100-Year	4697.00	176.63	183.64		184.04	0.007411	6.16	1202.23	347.73	0.44
Below Sucker	3479.70	50-Year	4415.00	176.60	182.77		183.10	0.008225	5.91	1231.02	403.66	0.45
Below Sucker	3479.70	100-Year	4697.00	176.60	183.47		183.71	0.005176	5.09	1521.44	420.89	0.36
Below Sucker	3396.45	50-Year	4415.00	176.12	181.50	181.09	182.12	0.017892	7.78	934.49	408.09	0.64
Below Sucker	3396.45	100-Year	4697.00	176.12	183.10	181.17	183.31	0.004547	4.79	1616.22	449.62	0.34

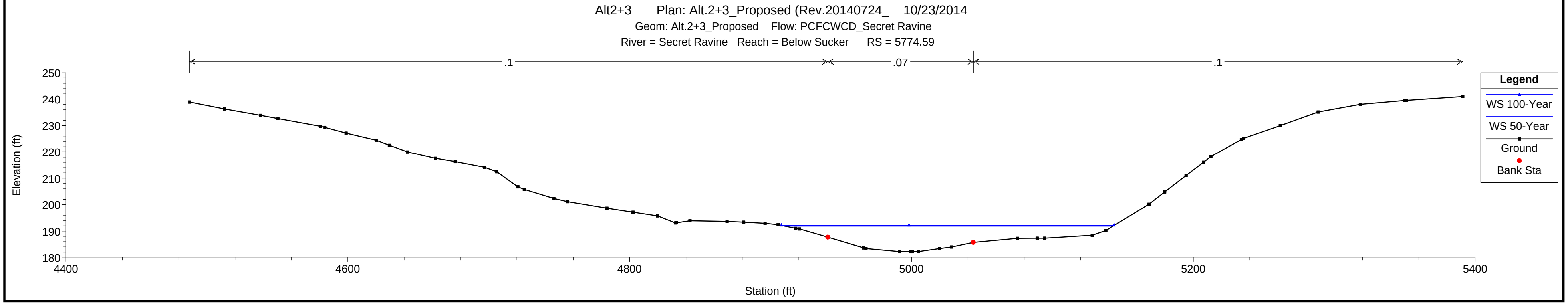


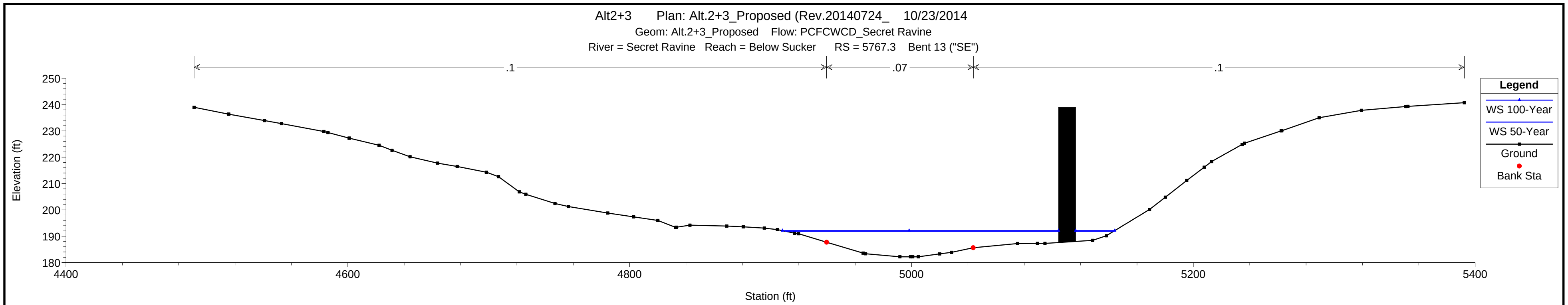
None of the XS's are Geo-Referenced (Geo-Ref user entered XS Geo-Ref interpolated XS Non Geo-Ref user entered XS Non Geo-Ref interpolated XS)

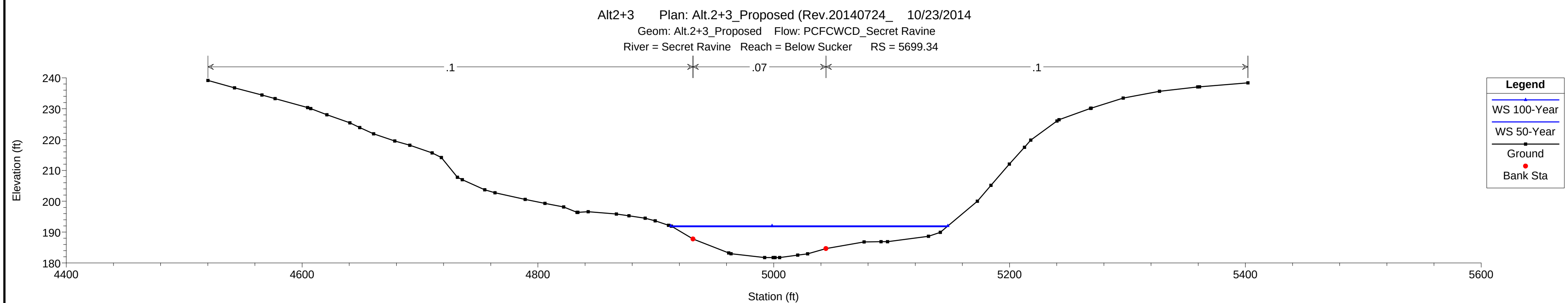

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5958.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

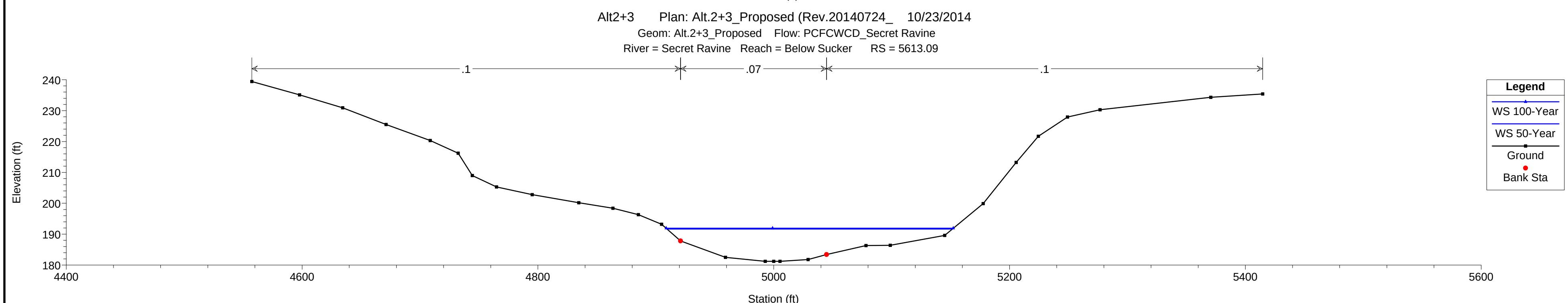

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5871.84
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

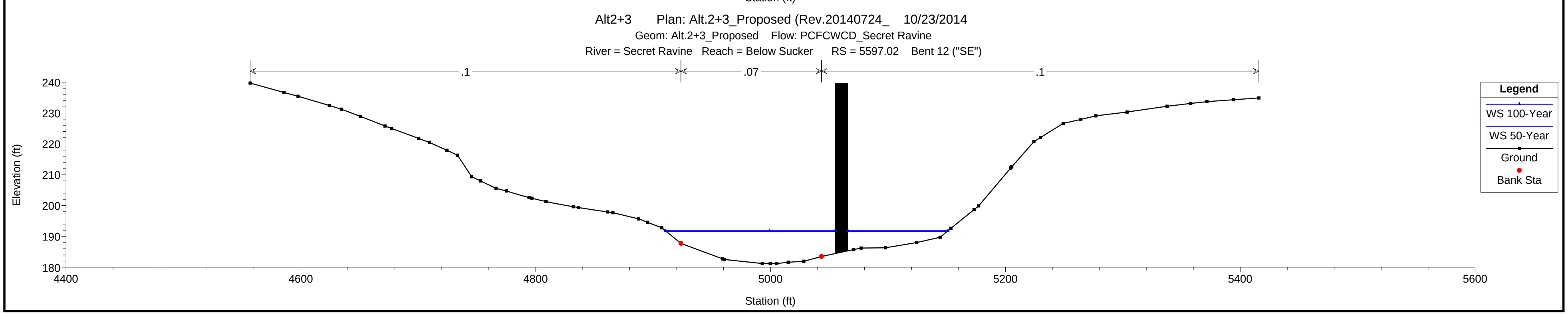

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5785.59
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

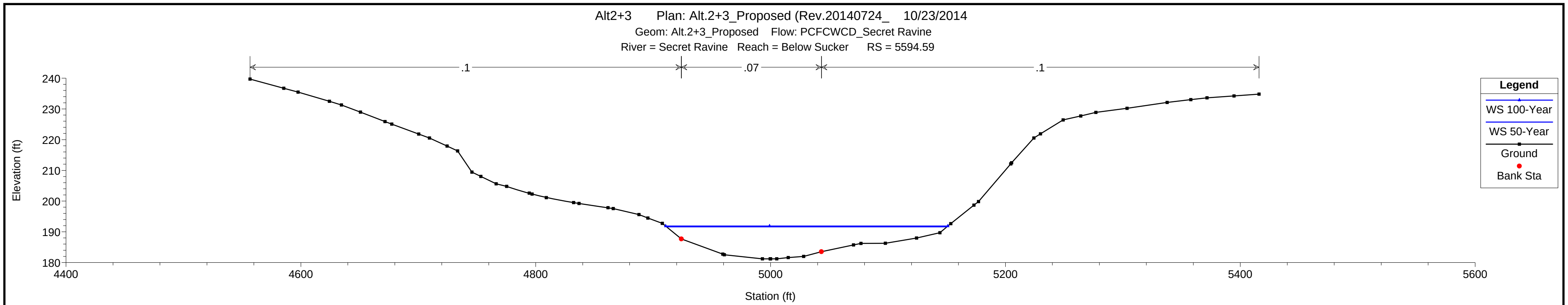

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5774.59
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

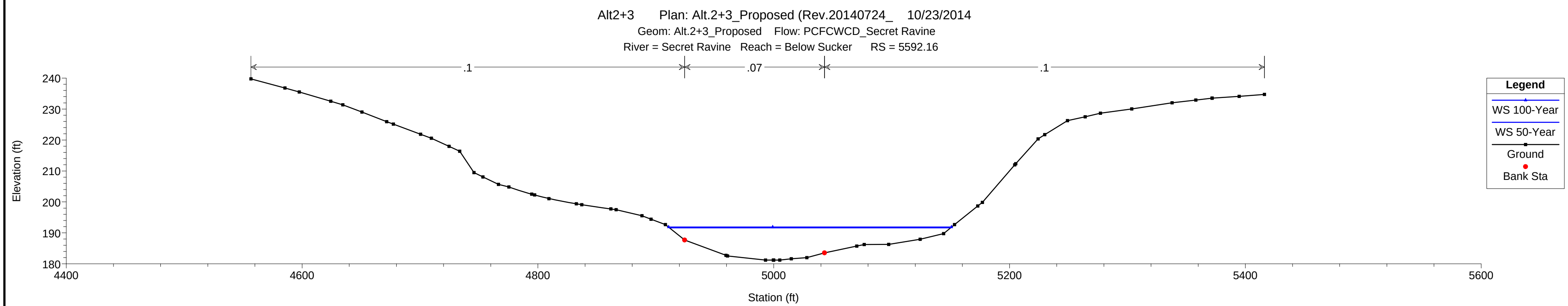

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5767.3 Bent 13 ("SE")
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

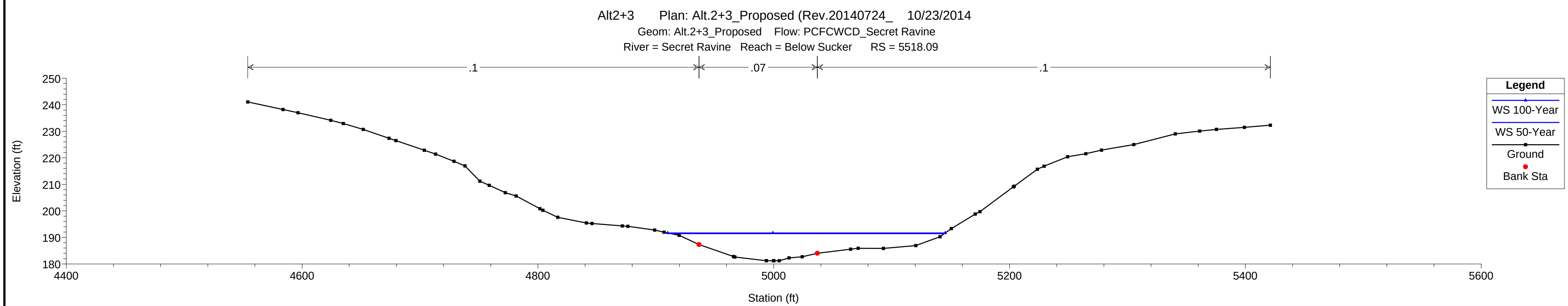

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5699.34
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

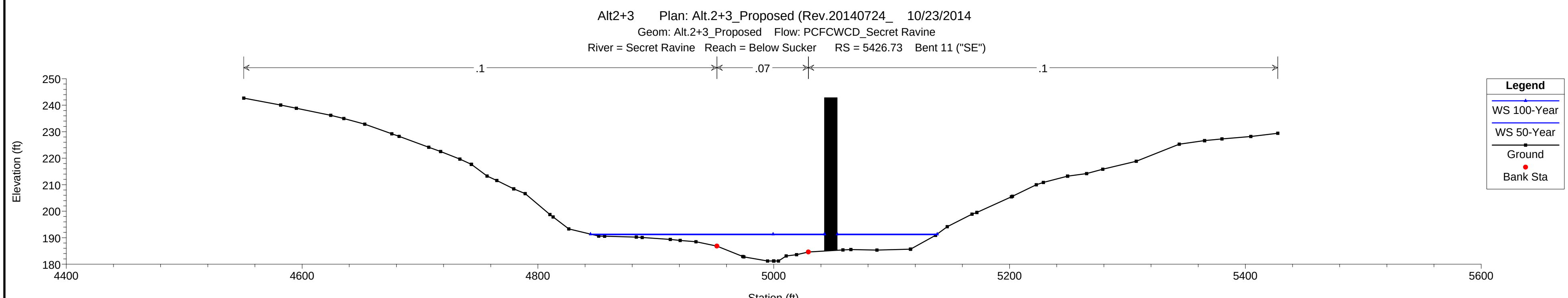

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5613.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5597.02 Bent 12 ("SE")
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

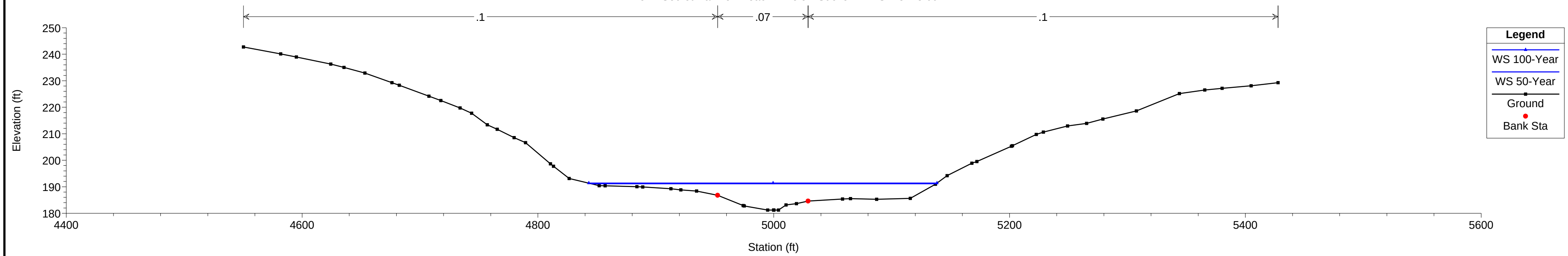

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5594.59
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5592.16
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

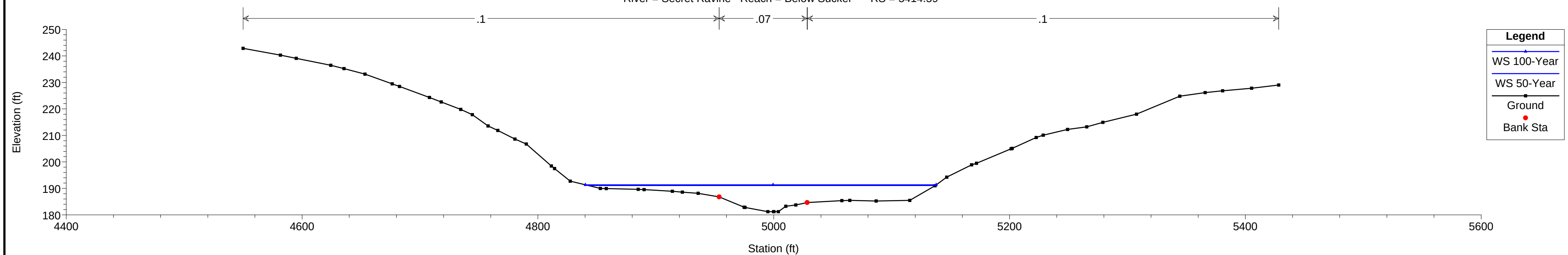

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5518.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5426.73 Bent 11 ("SE")
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

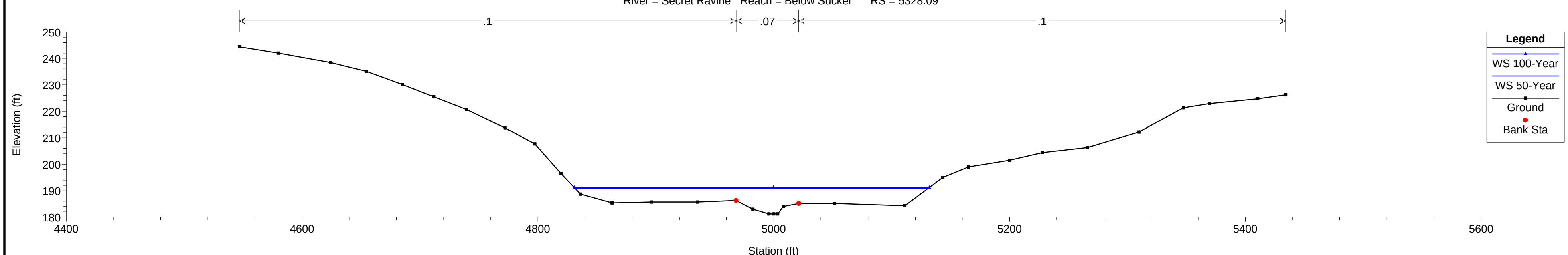
Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5423.09



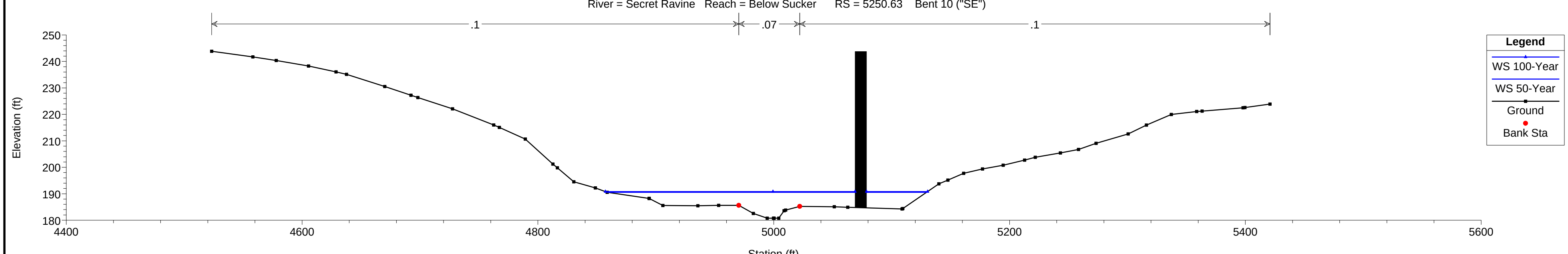
Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5414.59

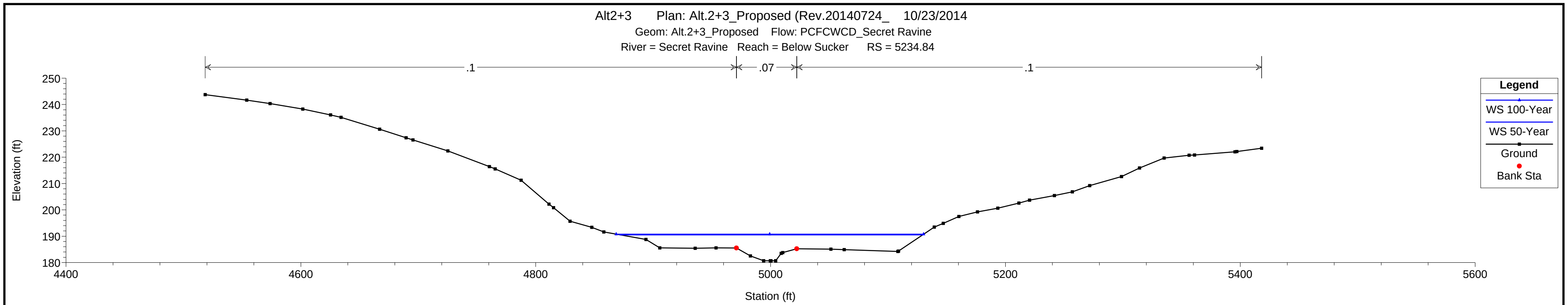


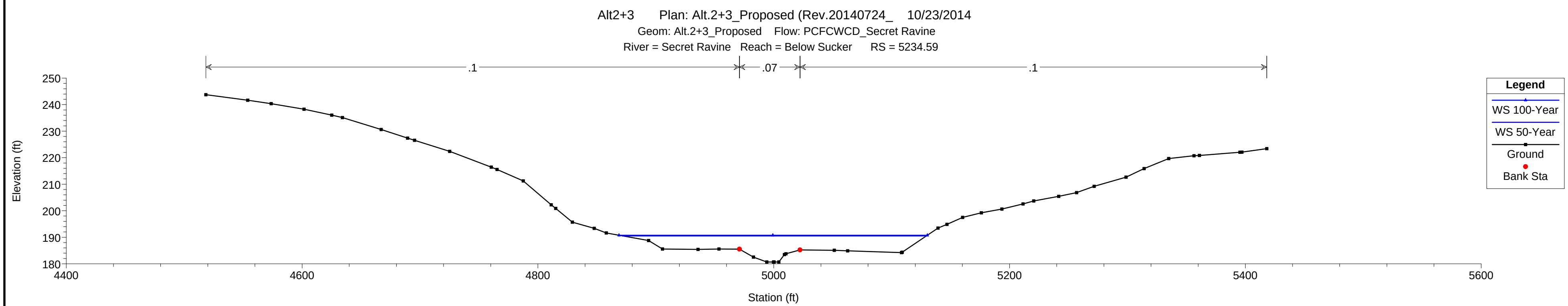
Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5328.09

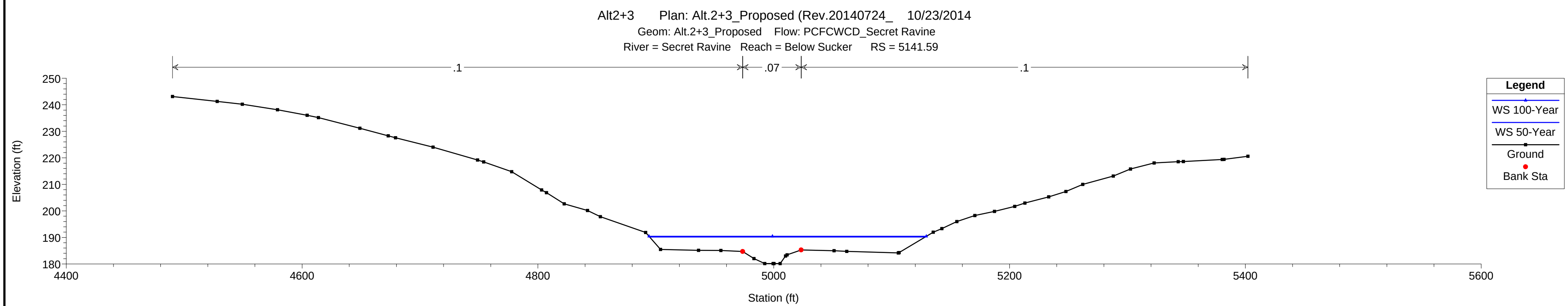


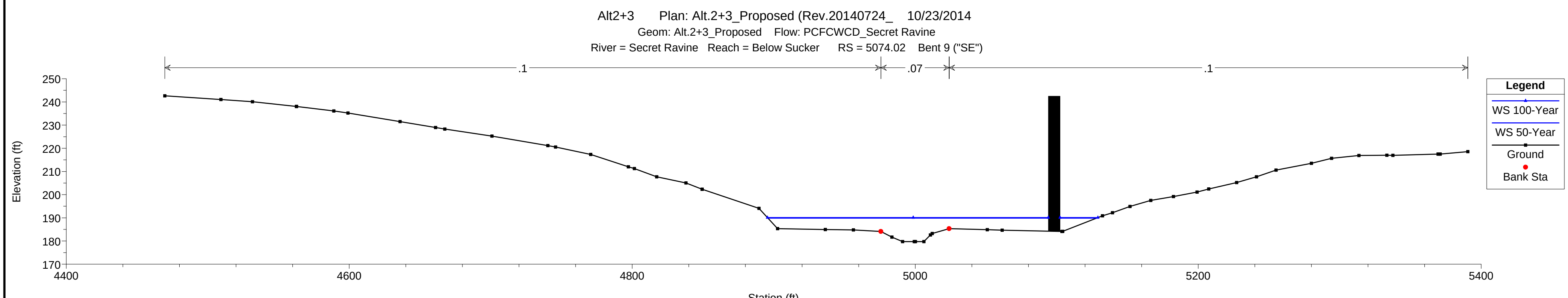
Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5250.63 Bent 10 ("SE")

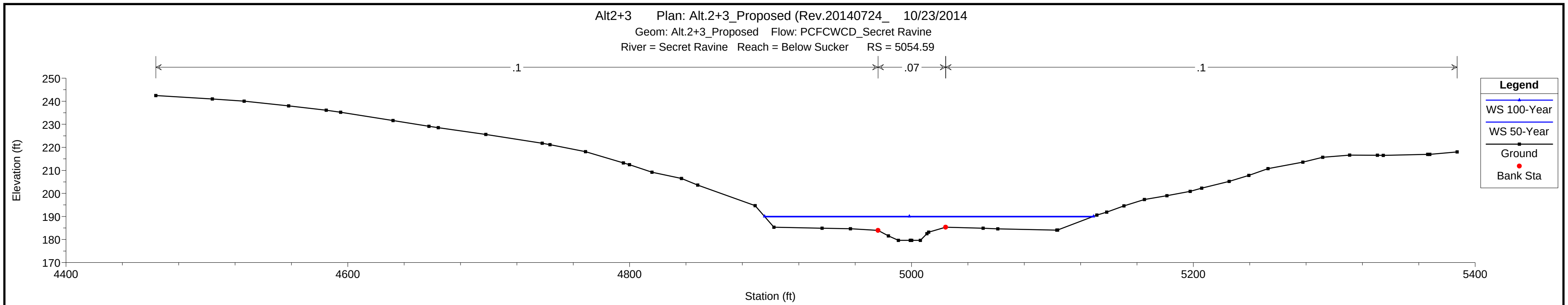


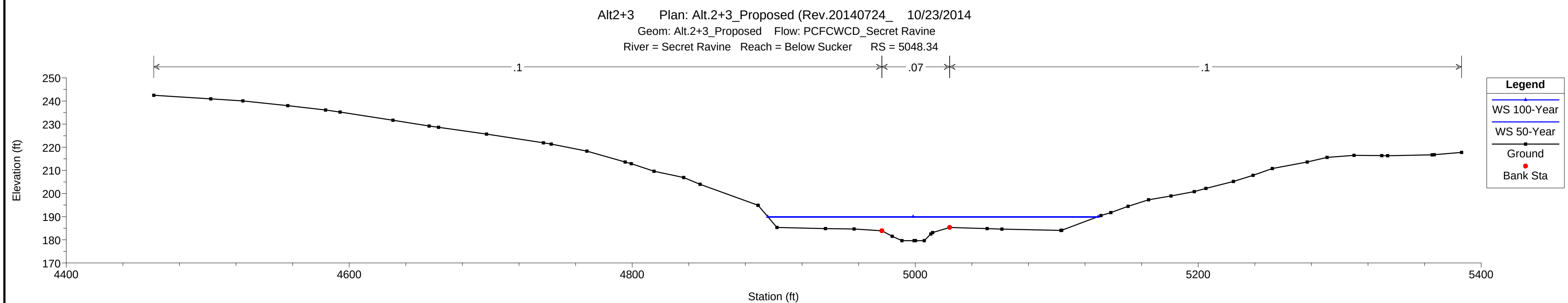

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5234.84
.1
.07
.1
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

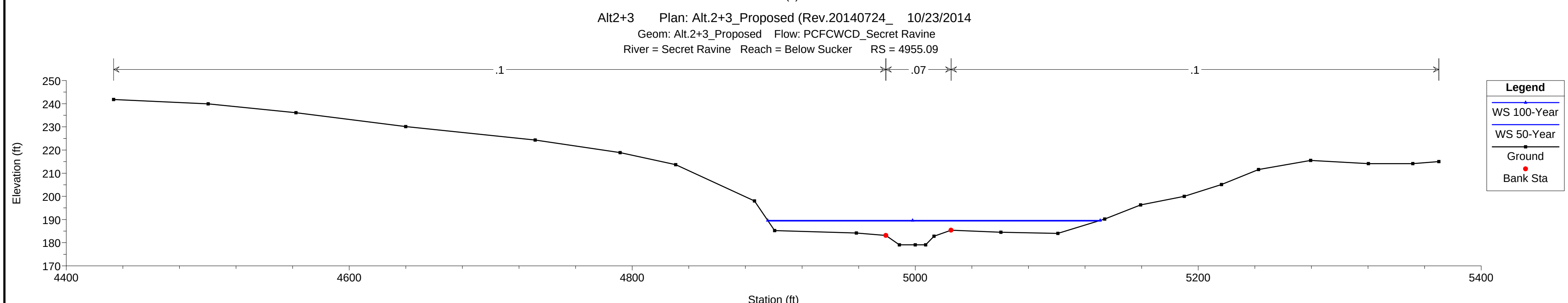

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5234.59
.1
.07
.1
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

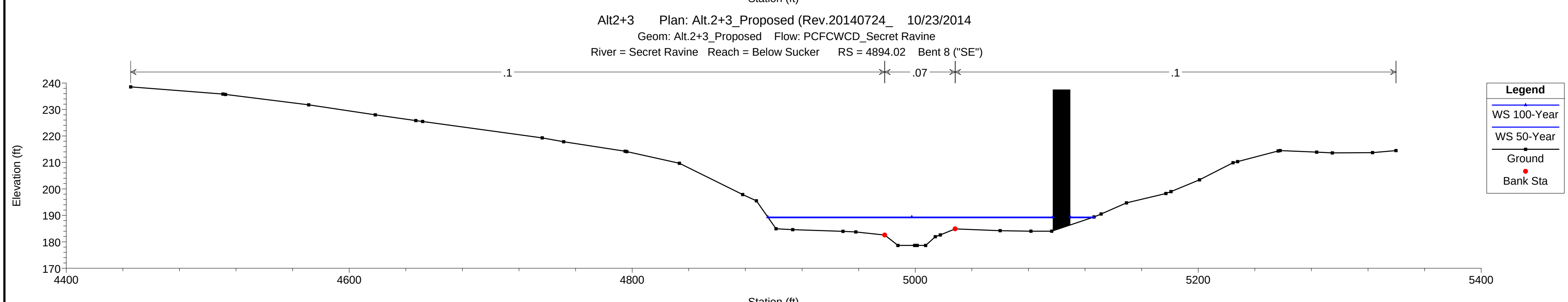

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5141.59
.1
.07
.1
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

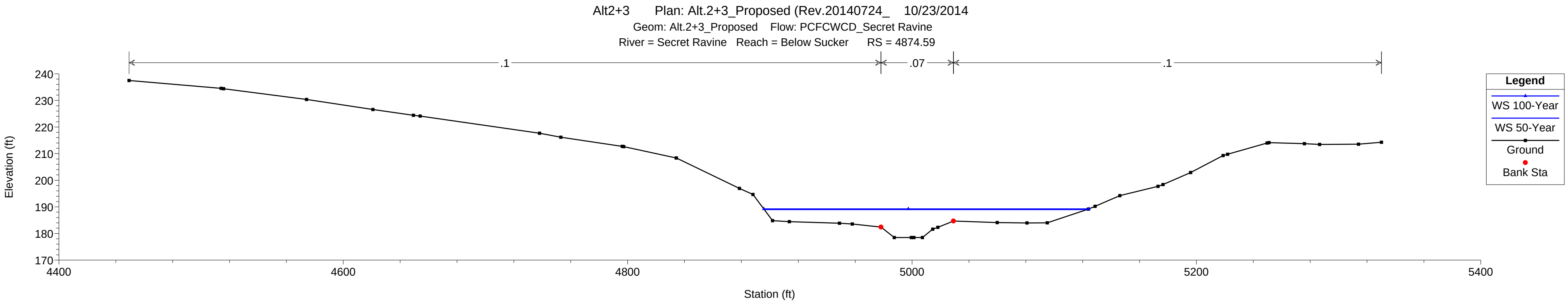

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5074.02 Bent 9 ("SE")
.1
.07
.1
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Elevation (ft)
Station (ft)

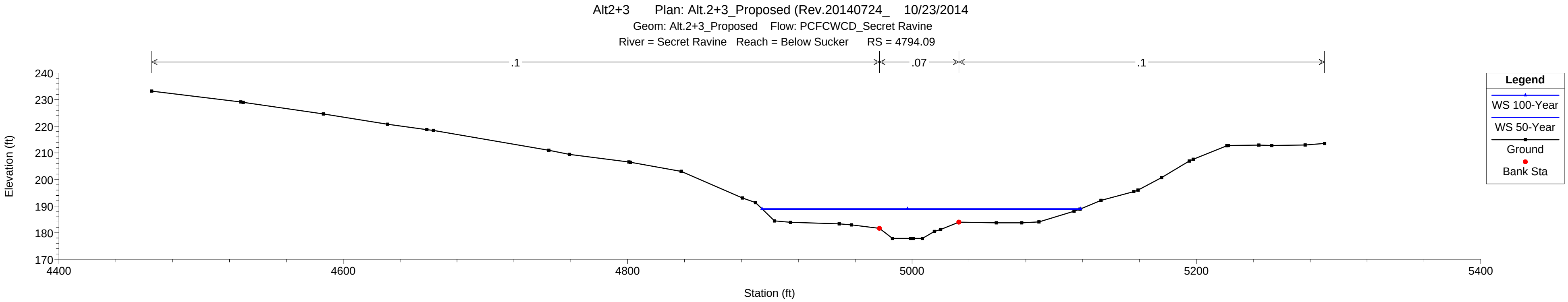

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5054.59
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

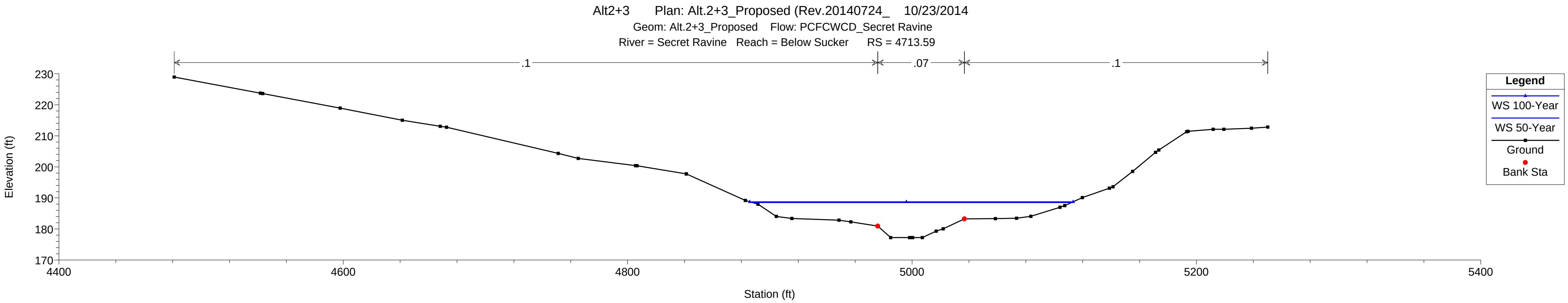

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 5048.34
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

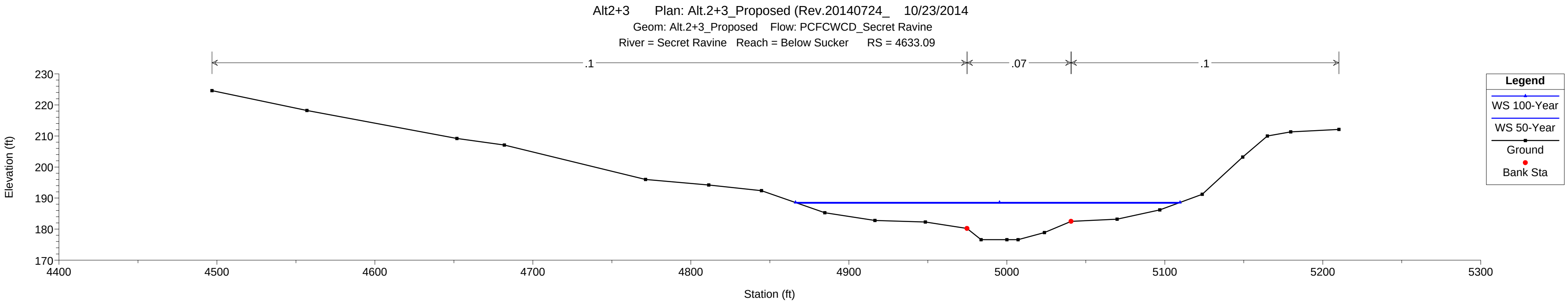

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4955.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

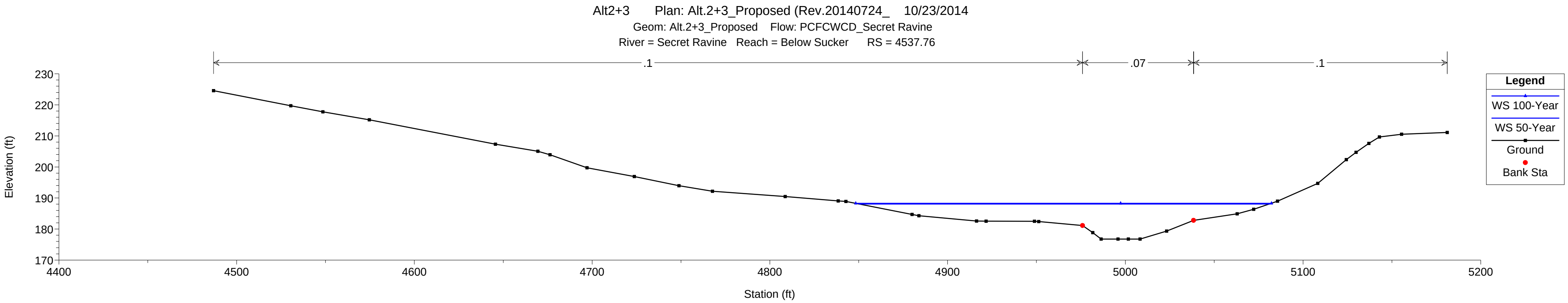

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4894.02 Bent 8 ("SE")
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

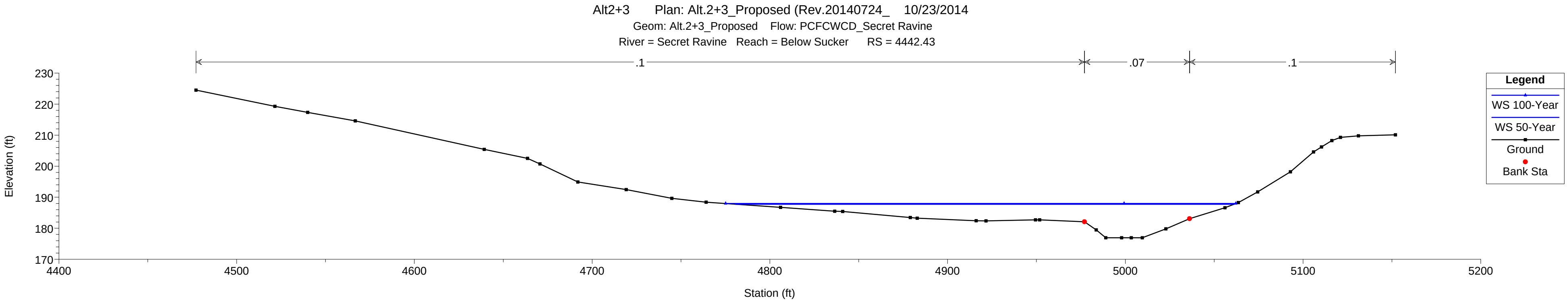

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4874.59
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

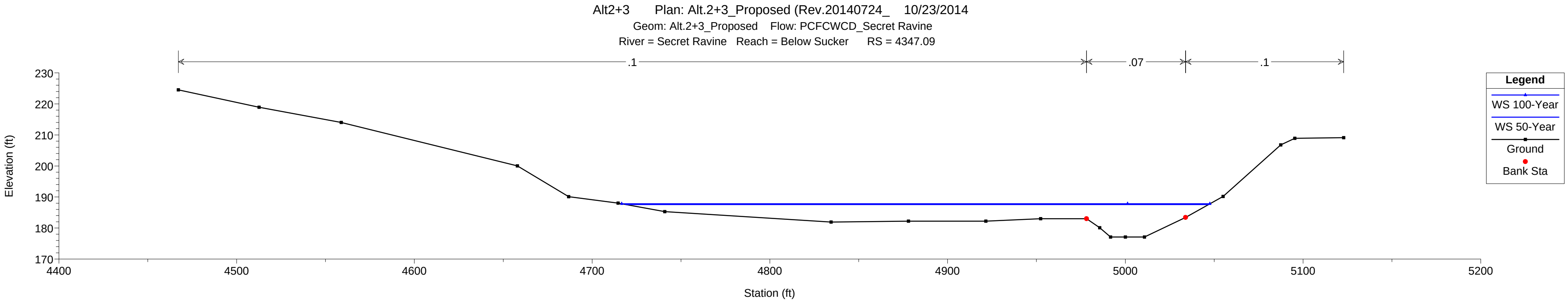

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4794.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

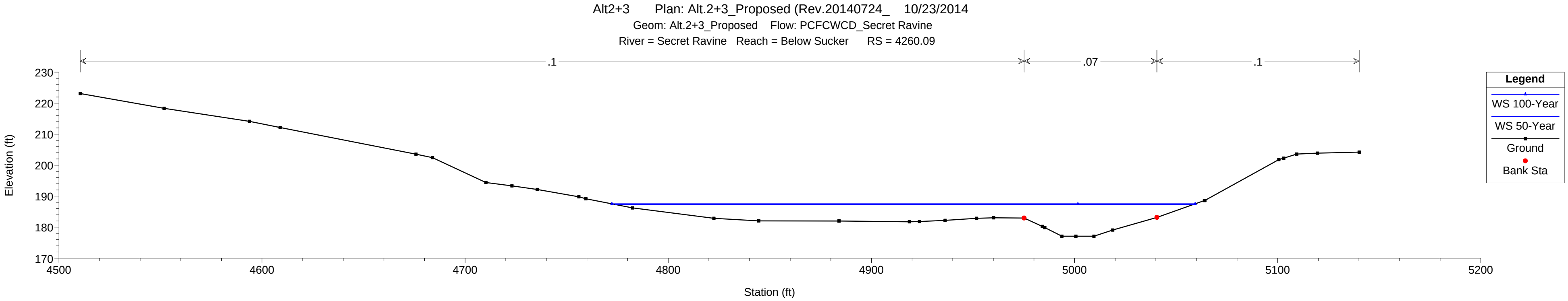

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4713.59
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

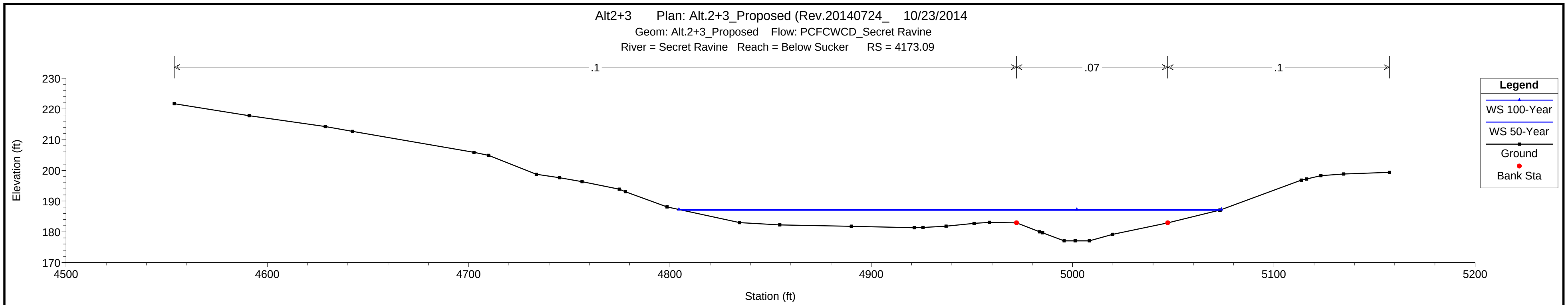

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4633.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

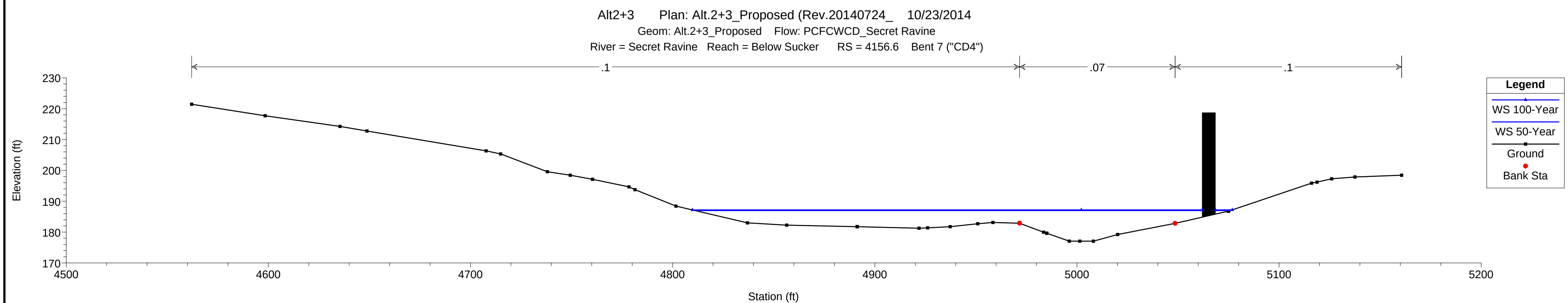

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4537.76
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

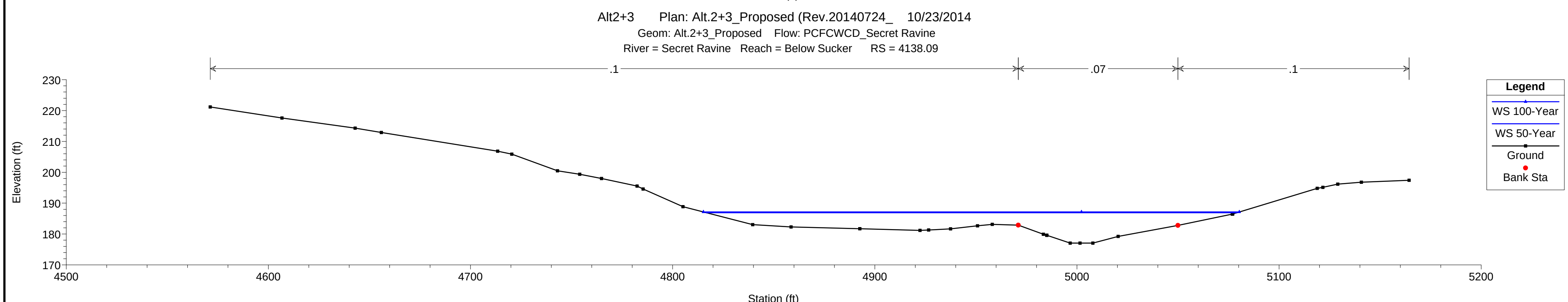

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4442.43
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

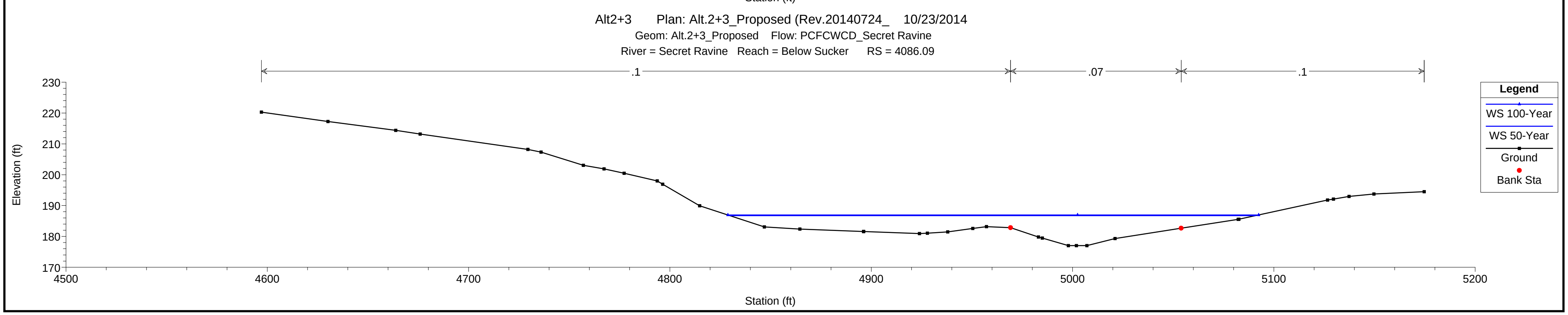

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4347.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

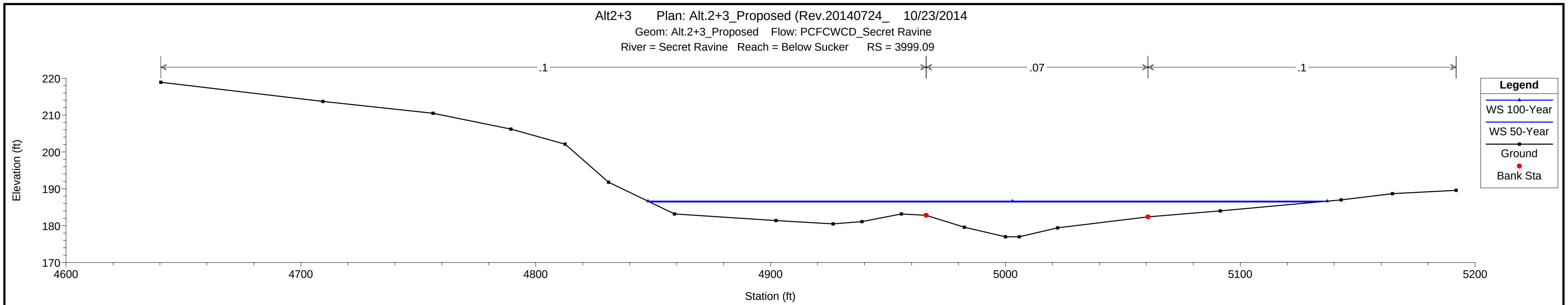

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4260.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

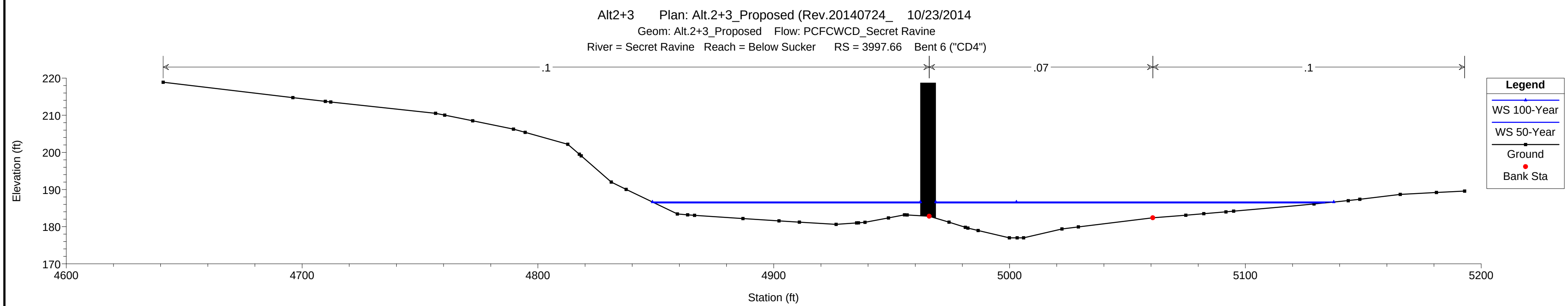

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4173.09
.1
.07
.1
Elevation (ft)
230
220
210
200
190
180
170
4500
4600
4700
4800
4900
5000
5100
5200
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

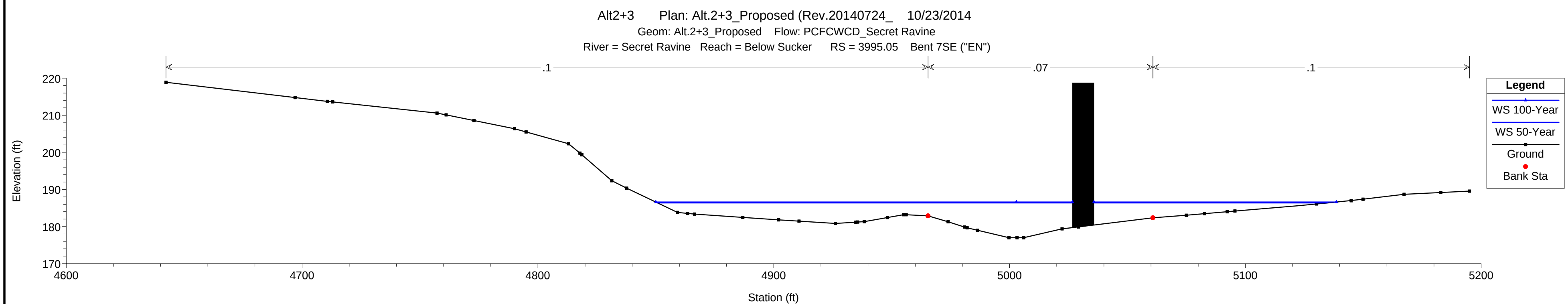

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4156.6 Bent 7 ("CD4")
.1
.07
.1
Elevation (ft)
230
220
210
200
190
180
170
4500
4600
4700
4800
4900
5000
5100
5200
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

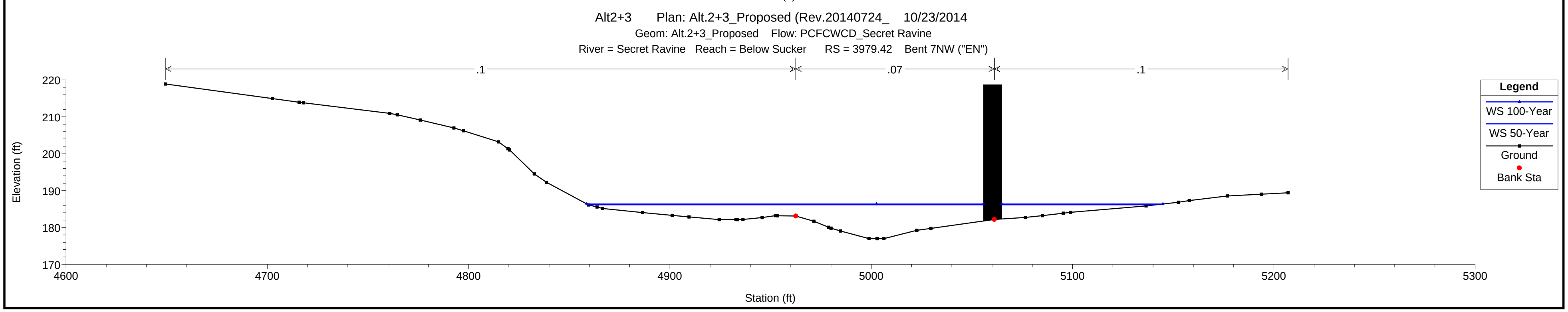

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4138.09
.1
.07
.1
Elevation (ft)
230
220
210
200
190
180
170
4500
4600
4700
4800
4900
5000
5100
5200
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 4086.09
.1
.07
.1
Elevation (ft)
230
220
210
200
190
180
170
4500
4600
4700
4800
4900
5000
5100
5200
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

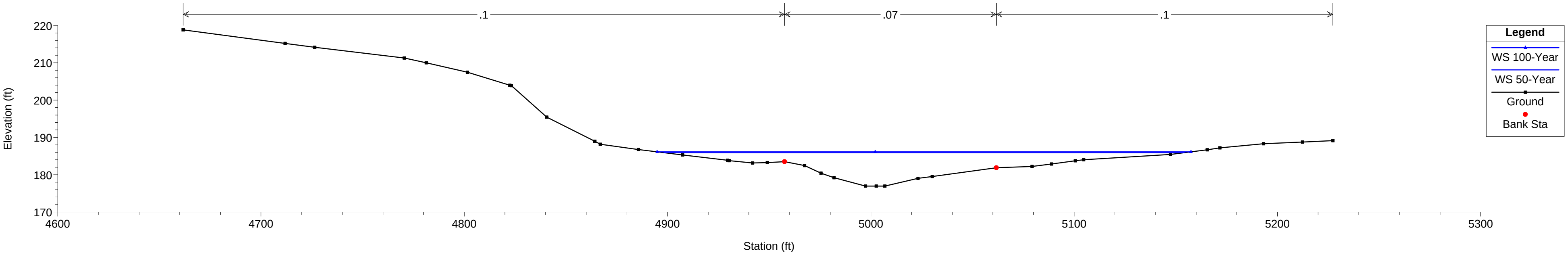

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3999.09
.1
.07
.1
Elevation (ft)
220
210
200
190
180
170
4600
4700
4800
4900
5000
5100
5200
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3997.66 Bent 6 ("CD4")
.1
.07
.1
Elevation (ft)
220
210
200
190
180
170
4600
4700
4800
4900
5000
5100
5200
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

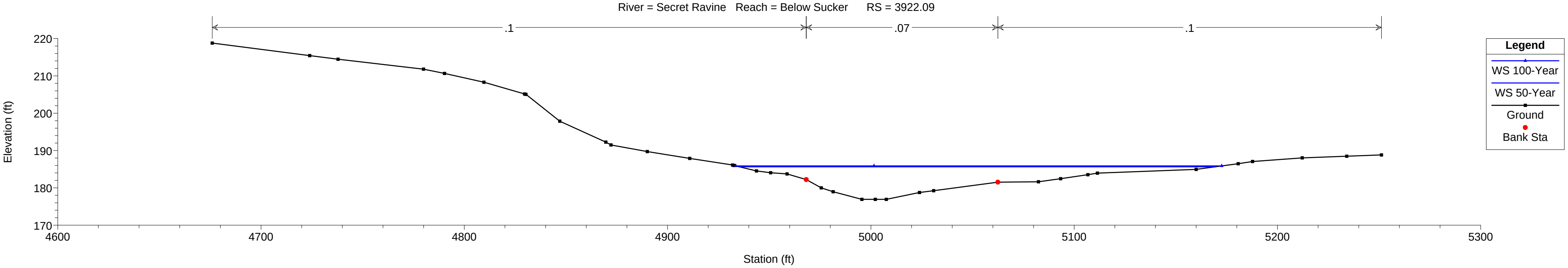

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3995.05 Bent 7SE ("EN")
.1
.07
.1
Elevation (ft)
220
210
200
190
180
170
4600
4700
4800
4900
5000
5100
5200
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3979.42 Bent 7NW ("EN")
.1
.07
.1
Elevation (ft)
220
210
200
190
180
170
4600
4700
4800
4900
5000
5100
5200
5300
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

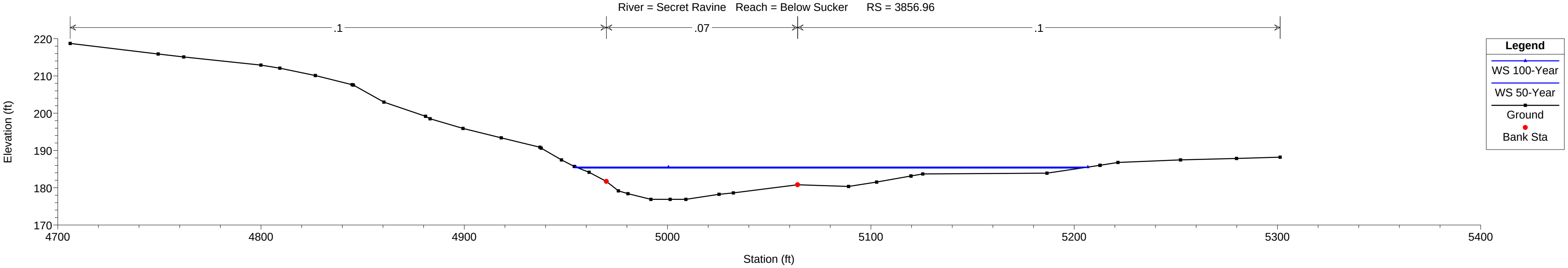
Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3953.09



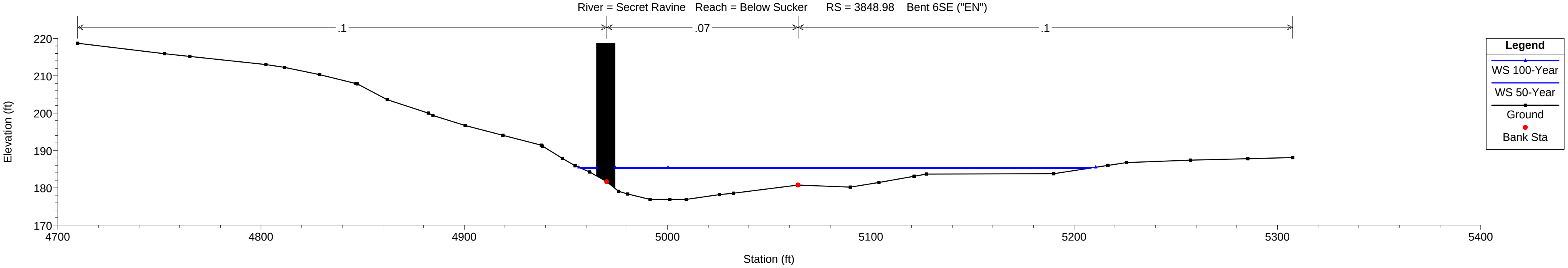
Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3922.09

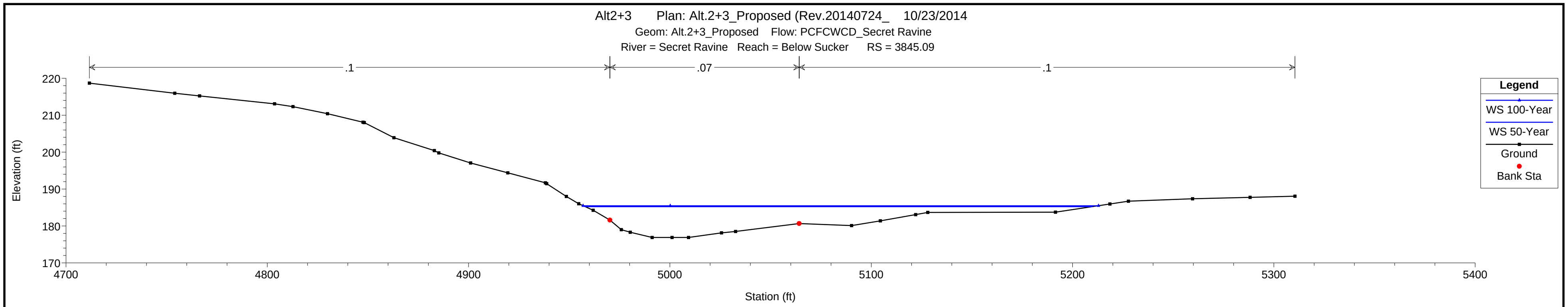


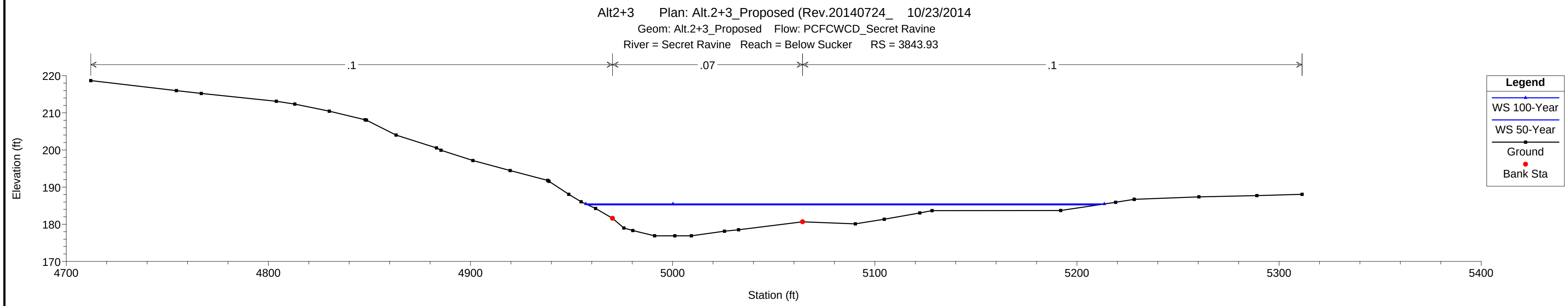
Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3856.96

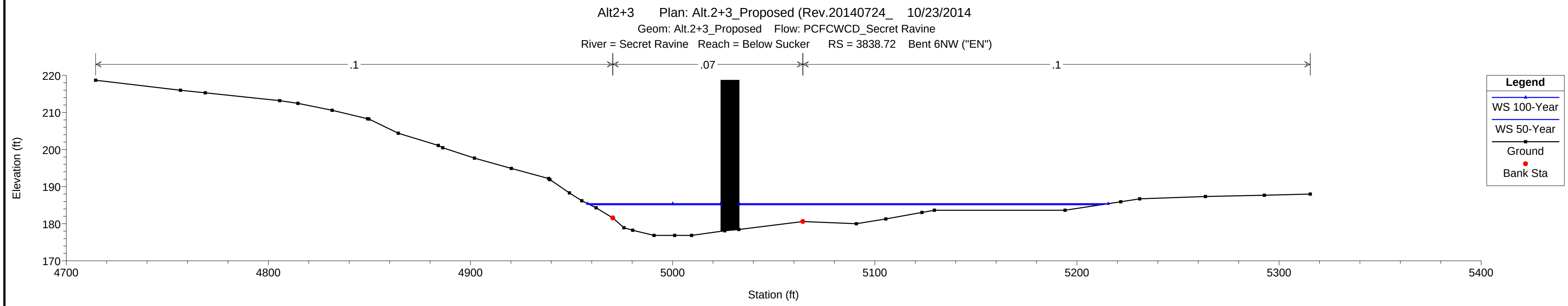


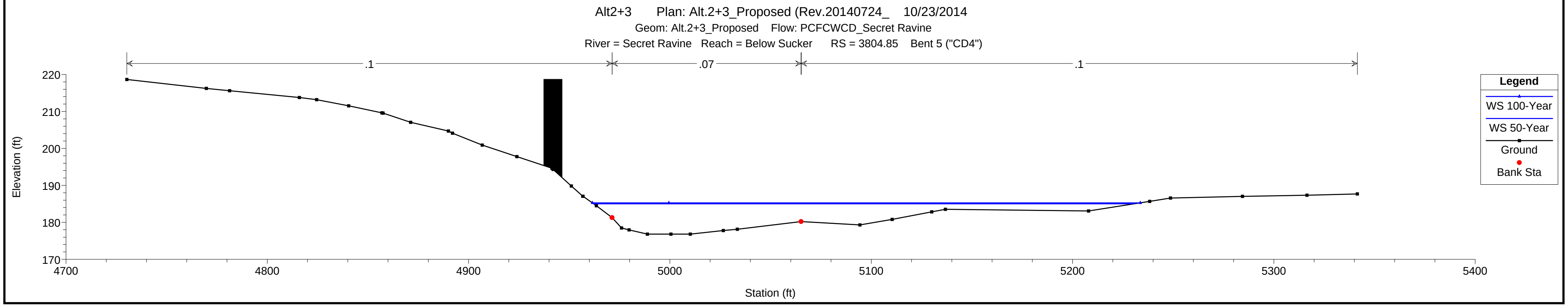
Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3848.98 Bent 6SE ("EN")

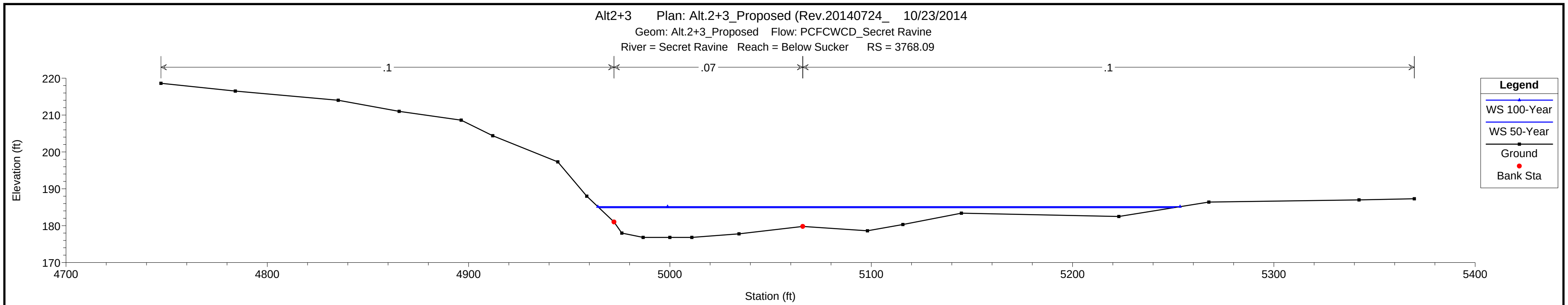



Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3845.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

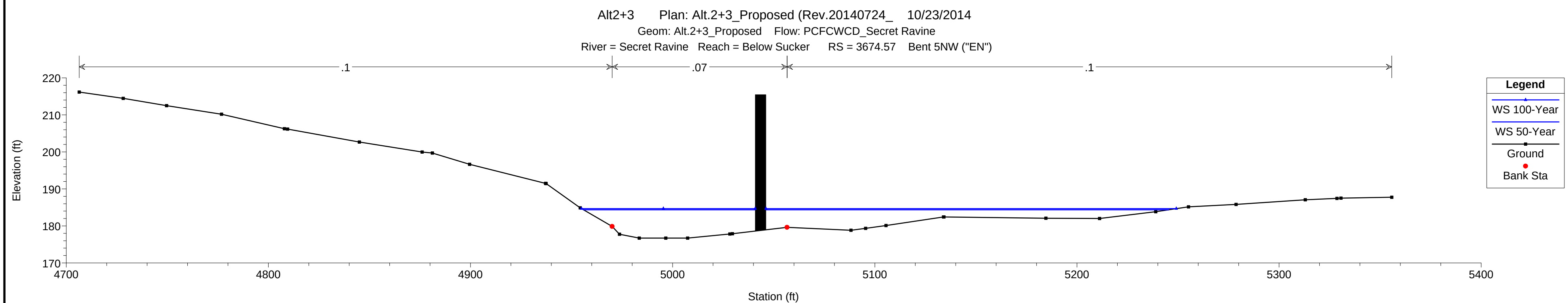

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3843.93
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3838.72 Bent 6NW ("EN")
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

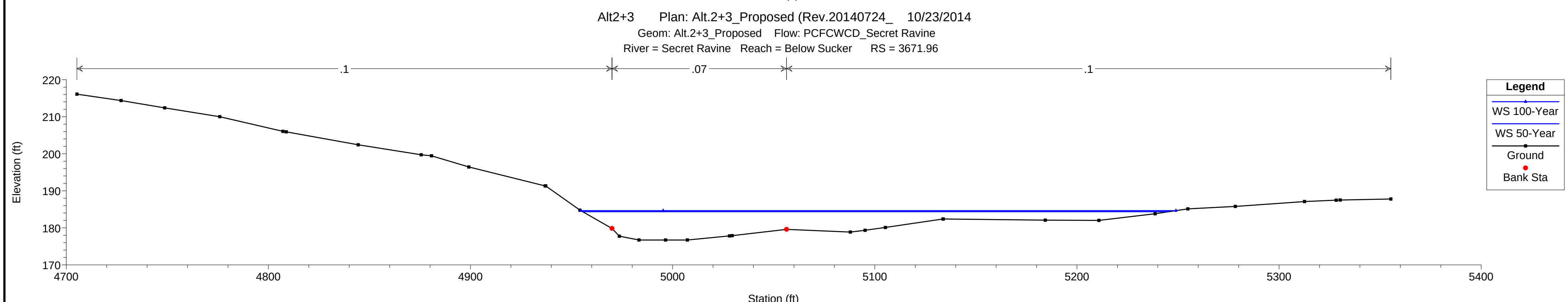

Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3804.85 Bent 5 ("CD4")
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta



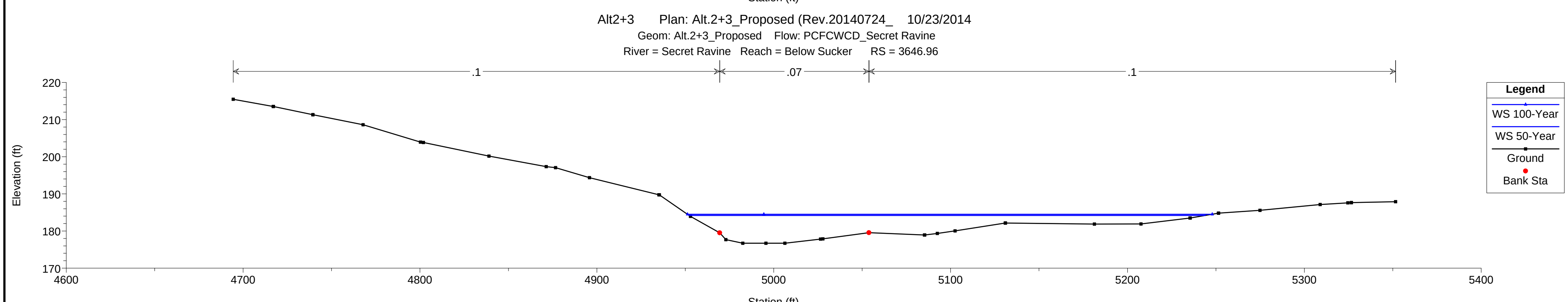
Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3768.09
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta



Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3674.57 Bent 5NW ("EN")
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

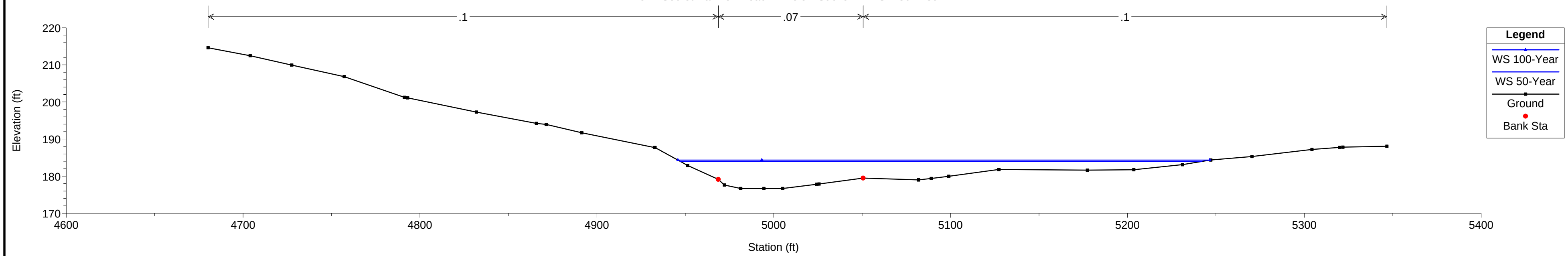


Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3671.96
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

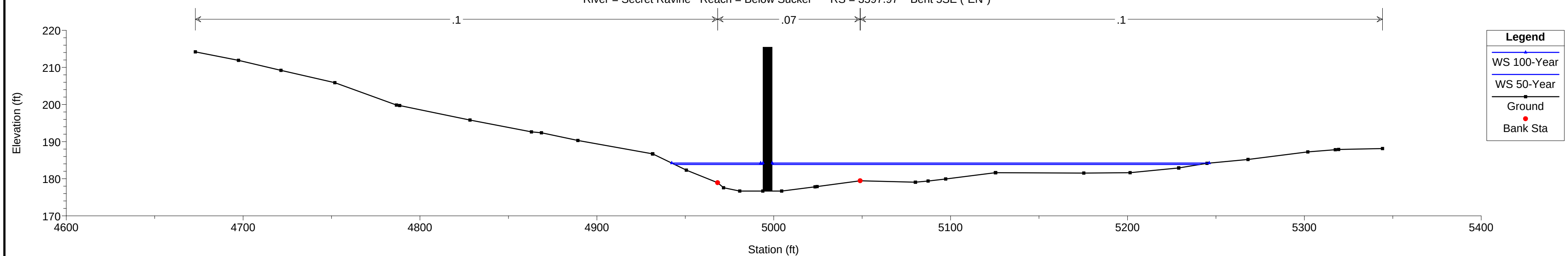


Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3646.96
.1
.07
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

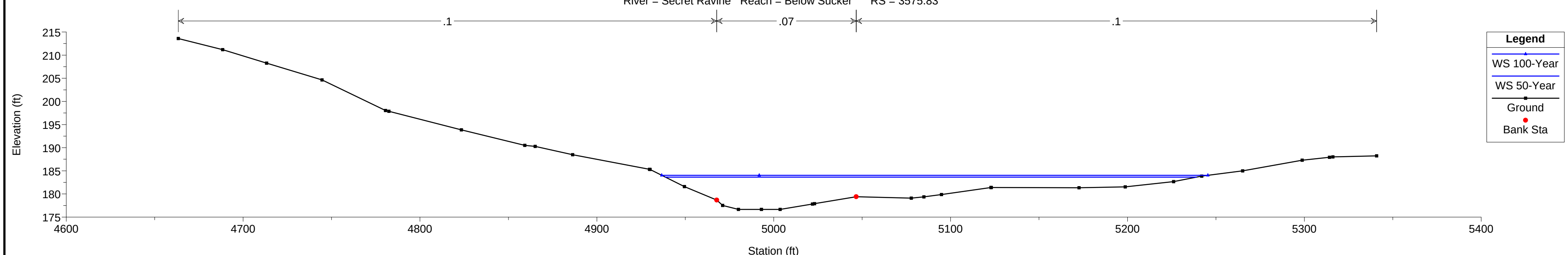
Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3614.39



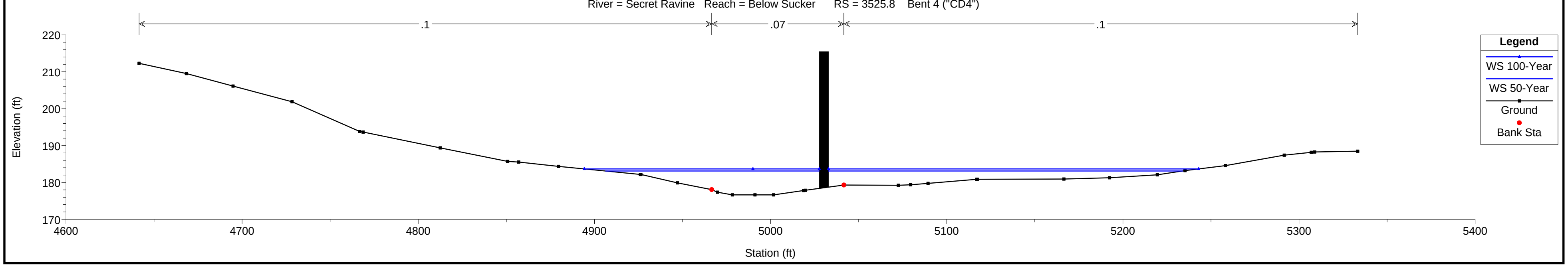
Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3597.97 Bent 5SE ("EN")



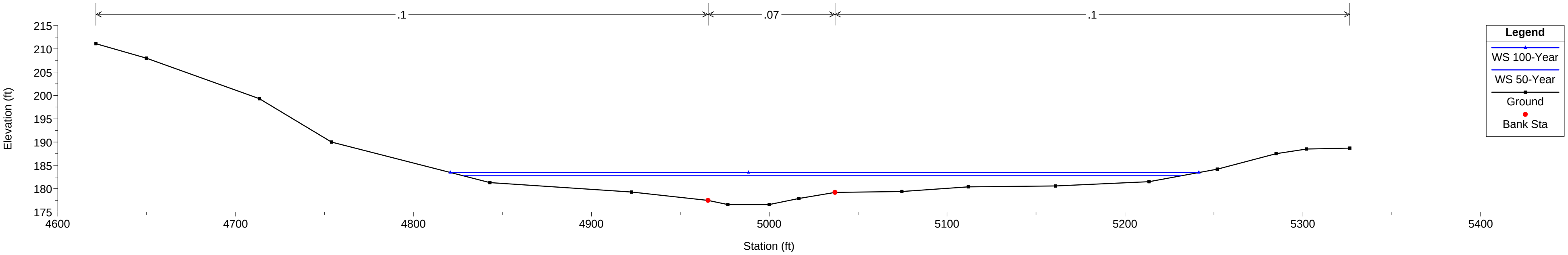
Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3575.83



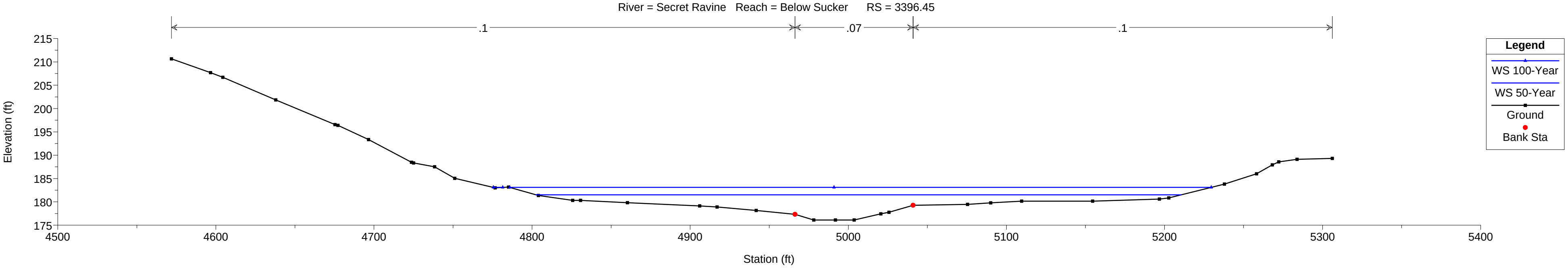
Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3525.8 Bent 4 ("CD4")

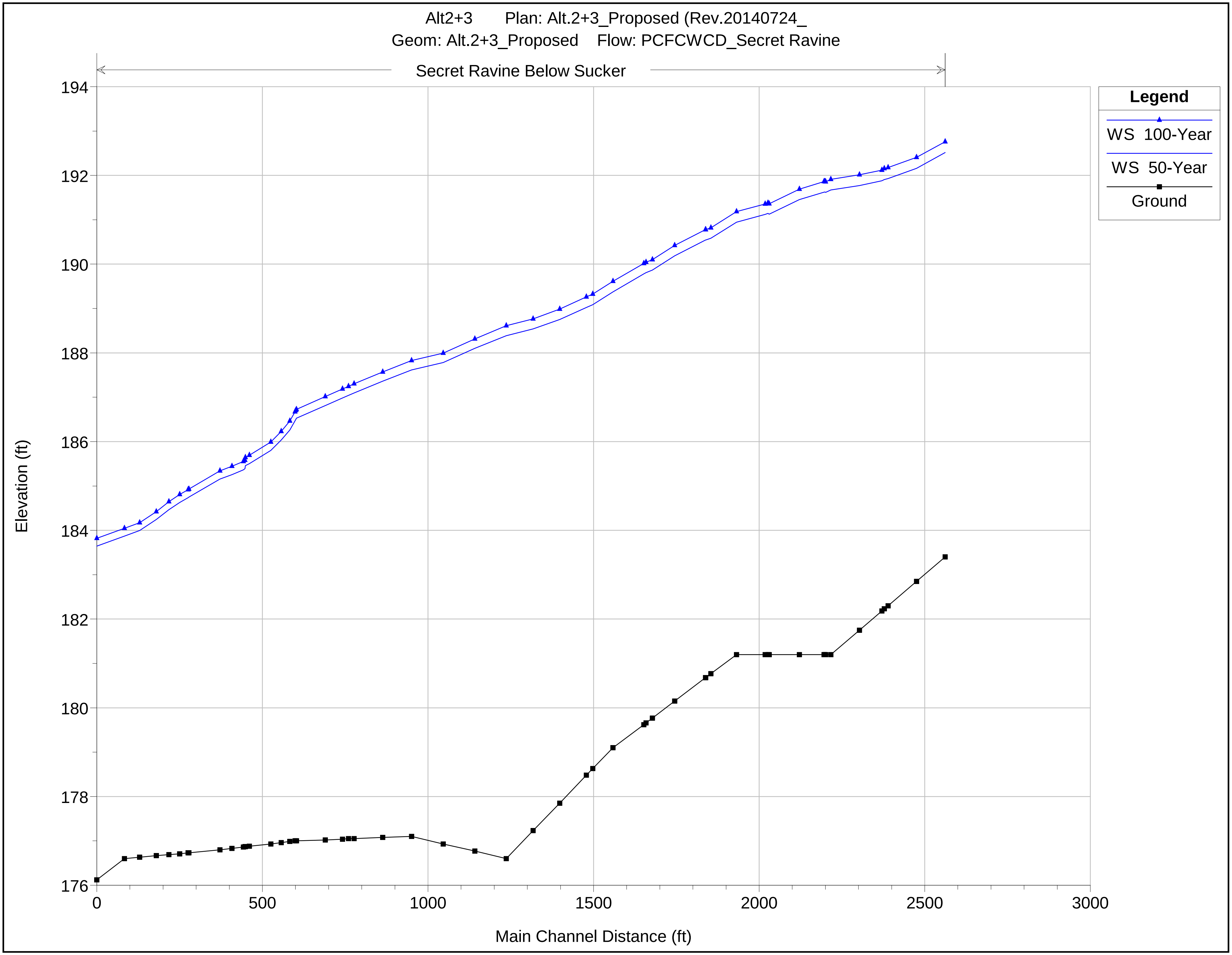


Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3479.70



Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_ 10/23/2014
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
River = Secret Ravine Reach = Below Sucker RS = 3396.45




Alt2+3 Plan: Alt.2+3_Proposed (Rev.20140724_
Geom: Alt.2+3_Proposed Flow: PCFCWCD_Secret Ravine
Secret Ravine Below Sucker
Legend
WS 100-Year
WS 50-Year
Ground
Elevation (ft)
Main Channel Distance (ft)
194
192
190
188
186
184
182
180
178
176
0
500
1000
1500
2000
2500
3000

HEC-RAS Plan: Alt.2+3_Rev14724 River: Secret Ravine Reach: Below Sucker

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)	
Below Sucker	5958.09	50-Year	4415.00	183.40	192.51		192.68	0.002640	4.10	1647.72	348.52	0.27
Below Sucker	5958.09	100-Year	4697.00	183.40	192.75		192.92	0.002590	4.15	1732.68	351.86	0.27
Below Sucker	5871.84	50-Year	4415.00	182.85	192.16		192.42	0.003229	4.66	1345.96	319.33	0.30
Below Sucker	5871.84	100-Year	4697.00	182.85	192.41		192.67	0.003159	4.71	1425.57	320.98	0.30
Below Sucker	5785.59	50-Year	4415.00	182.30	191.93		192.17	0.002577	4.30	1299.72	233.68	0.27
Below Sucker	5785.59	100-Year	4697.00	182.30	192.17		192.42	0.002589	4.40	1357.40	236.75	0.27
Below Sucker	5774.59	50-Year	4415.00	182.23	191.90		192.14	0.002471	4.23	1316.16	233.22	0.26
Below Sucker	5774.59	100-Year	4697.00	182.23	192.15		192.39	0.002486	4.33	1373.69	236.23	0.26
Below Sucker	5767.3	50-Year	4415.00	182.18	191.87		192.12	0.002536	4.30	1274.50	220.69	0.27
Below Sucker	5767.3	100-Year	4697.00	182.18	192.12		192.37	0.002564	4.41	1328.52	223.63	0.27
Below Sucker	5699.34	50-Year	4415.00	181.75	191.77		191.96	0.001848	3.77	1447.25	232.97	0.23
Below Sucker	5699.34	100-Year	4697.00	181.75	192.01		192.21	0.001874	3.87	1504.05	235.15	0.23
Below Sucker	5613.09	50-Year	4415.00	181.20	191.67		191.81	0.001327	3.30	1629.68	242.06	0.20
Below Sucker	5613.09	100-Year	4697.00	181.20	191.91		192.06	0.001356	3.39	1688.25	243.54	0.20
Below Sucker	5597.02	50-Year	4415.00	181.20	191.61		191.78	0.001564	3.56	1516.67	228.24	0.21
Below Sucker	5597.02	100-Year	4697.00	181.20	191.85		192.03	0.001601	3.66	1571.34	229.75	0.22
Below Sucker	5594.59	50-Year	4415.00	181.20	191.62		191.78	0.001435	3.41	1588.11	238.83	0.20
Below Sucker	5594.59	100-Year	4697.00	181.20	191.86		192.02	0.001465	3.51	1645.53	240.36	0.21
Below Sucker	5592.16	50-Year	4415.00	181.20	191.62		191.77	0.001449	3.42	1582.85	238.42	0.20
Below Sucker	5592.16	100-Year	4697.00	181.20	191.86		192.02	0.001480	3.52	1640.14	239.96	0.21
Below Sucker	5518.09	50-Year	4415.00	181.20	191.45		191.64	0.001987	3.91	1434.75	232.11	0.24
Below Sucker	5518.09	100-Year	4697.00	181.20	191.68		191.89	0.002023	4.02	1489.77	235.39	0.24
Below Sucker	5426.73	50-Year	4415.00	181.20	191.12		191.40	0.003394	4.90	1288.69	280.11	0.31
Below Sucker	5426.73	100-Year	4697.00	181.20	191.35		191.64	0.003394	4.99	1354.84	283.05	0.31
Below Sucker	5423.09	50-Year	4415.00	181.20	191.14		191.37	0.002977	4.59	1368.98	292.34	0.29
Below Sucker	5423.09	100-Year	4697.00	181.20	191.37		191.62	0.002970	4.68	1438.32	295.28	0.29
Below Sucker	5414.59	50-Year	4415.00	181.20	191.11		191.35	0.003010	4.60	1386.64	294.63	0.29
Below Sucker	5414.59	100-Year	4697.00	181.20	191.35		191.59	0.002998	4.68	1456.63	297.54	0.29
Below Sucker	5328.09	50-Year	4415.00	181.20	190.94		191.08	0.002487	4.03	1669.84	299.74	0.26
Below Sucker	5328.09	100-Year	4697.00	181.20	191.18		191.32	0.002475	4.10	1741.41	300.97	0.26
Below Sucker	5250.63	50-Year	4415.00	180.77	190.58		190.84	0.004244	5.31	1314.56	261.29	0.34
Below Sucker	5250.63	100-Year	4697.00	180.77	190.81		191.08	0.004211	5.40	1376.98	263.52	0.34
Below Sucker	5234.84	50-Year	4415.00	180.68	190.54		190.77	0.003778	5.03	1346.89	257.98	0.32
Below Sucker	5234.84	100-Year	4697.00	180.68	190.77		191.02	0.003771	5.13	1408.58	261.78	0.32
Below Sucker	5234.59	50-Year	4415.00	180.68	190.53		190.77	0.003780	5.03	1346.30	257.78	0.32
Below Sucker	5234.59	100-Year	4697.00	180.68	190.77		191.02	0.003774	5.13	1407.95	261.57	0.32
Below Sucker	5141.59	50-Year	4415.00	180.15	190.18		190.43	0.003914	5.20	1287.31	233.87	0.32
Below Sucker	5141.59	100-Year	4697.00	180.15	190.42		190.68	0.003907	5.30	1343.04	235.23	0.33
Below Sucker	5074.02	50-Year	4415.00	179.77	189.85		190.16	0.004556	5.64	1205.35	223.89	0.35
Below Sucker	5074.02	100-Year	4697.00	179.77	190.09		190.41	0.004546	5.74	1258.64	225.24	0.35
Below Sucker	5054.59	50-Year	4415.00	179.66	189.79		190.07	0.004195	5.43	1250.42	232.14	0.34
Below Sucker	5054.59	100-Year	4697.00	179.66	190.03		190.32	0.004179	5.53	1305.93	233.51	0.34
Below Sucker	5048.34	50-Year	4415.00	179.62	189.77		190.05	0.004212	5.45	1248.36	232.13	0.34
Below Sucker	5048.34	100-Year	4697.00	179.62	190.01		190.29	0.004195	5.54	1303.90	233.50	0.34
Below Sucker	4955.09	50-Year	4415.00	179.10	189.36		189.66	0.004517	5.67	1217.60	233.41	0.35
Below Sucker	4955.09	100-Year	4697.00	179.10	189.60		189.91	0.004482	5.76	1274.32	234.98	0.35
Below Sucker	4894.02	50-Year	4415.00	178.63	189.07		189.39	0.004307	5.67	1177.03	216.34	0.34
Below Sucker	4894.02	100-Year	4697.00	178.63	189.31		189.64	0.004308	5.78	1229.17	217.99	0.34
Below Sucker	4874.59	50-Year	4415.00	178.48	189.00		189.30	0.003942	5.48	1232.10	227.24	0.33
Below Sucker	4874.59	100-Year	4697.00	178.48	189.24		189.55	0.003941	5.58	1287.05	228.79	0.33
Below Sucker	4794.09	50-Year	4415.00	177.85	188.73		189.01	0.003269	5.18	1270.49	222.52	0.30
Below Sucker	4794.09	100-Year	4697.00	177.85	188.97		189.26	0.003297	5.29	1323.78	224.13	0.31
Below Sucker	4713.59	50-Year	4415.00	177.23	188.51		188.77	0.002642	4.84	1335.13	224.55	0.28

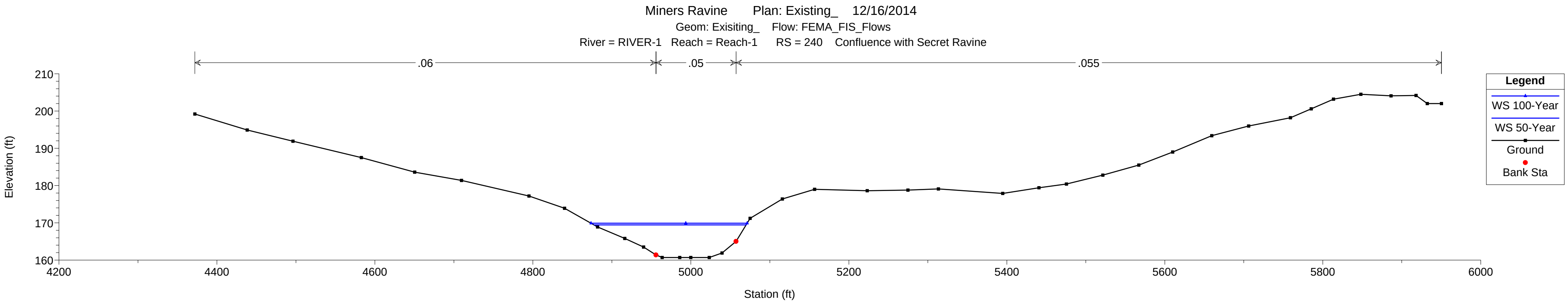
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Below Sucker	4713.59	100-Year	4697.00	177.23	188.74		189.02	0.002698	4.98	1387.96	227.41	0.28
Below Sucker	4633.09	50-Year	4415.00	176.60	188.36		188.57	0.001974	4.37	1478.12	240.90	0.24
Below Sucker	4633.09	100-Year	4697.00	176.60	188.59		188.82	0.002026	4.50	1533.95	243.44	0.25
Below Sucker	4537.76	50-Year	4415.00	176.77	188.07		188.35	0.002807	4.99	1295.24	230.80	0.28
Below Sucker	4537.76	100-Year	4697.00	176.77	188.29		188.59	0.002872	5.13	1346.87	233.91	0.29
Below Sucker	4442.43	50-Year	4415.00	176.93	187.74		188.06	0.003649	5.41	1287.61	280.44	0.32
Below Sucker	4442.43	100-Year	4697.00	176.93	187.96		188.29	0.003687	5.53	1350.30	287.08	0.32
Below Sucker	4347.09	50-Year	4415.00	177.10	187.57		187.74	0.002619	4.38	1636.85	328.04	0.27
Below Sucker	4347.09	100-Year	4697.00	177.10	187.79		187.97	0.002616	4.46	1710.64	330.91	0.27
Below Sucker	4260.09	50-Year	4415.00	177.08	187.31		187.52	0.003118	4.63	1440.50	284.45	0.29
Below Sucker	4260.09	100-Year	4697.00	177.08	187.53		187.75	0.003124	4.72	1503.87	287.14	0.29
Below Sucker	4173.09	50-Year	4415.00	177.05	187.03		187.27	0.003432	4.69	1345.58	266.88	0.30
Below Sucker	4173.09	100-Year	4697.00	177.05	187.25		187.50	0.003441	4.79	1404.61	269.51	0.31
Below Sucker	4156.6	50-Year	4415.00	177.05	186.98		187.22	0.003499	4.71	1321.41	258.18	0.31
Below Sucker	4156.6	100-Year	4697.00	177.05	187.20		187.45	0.003512	4.81	1378.31	260.60	0.31
Below Sucker	4138.09	50-Year	4415.00	177.04	186.92		187.16	0.003541	4.70	1319.14	262.74	0.31
Below Sucker	4138.09	100-Year	4697.00	177.04	187.14		187.39	0.003547	4.80	1377.14	265.15	0.31
Below Sucker	4086.09	50-Year	4415.00	177.02	186.74		186.99	0.003704	4.71	1288.96	261.07	0.31
Below Sucker	4086.09	100-Year	4697.00	177.02	186.96		187.22	0.003701	4.81	1346.63	263.65	0.31
Below Sucker	3999.09	50-Year	4415.00	177.00	186.43		186.69	0.003911	4.68	1286.71	284.63	0.32
Below Sucker	3999.09	100-Year	4697.00	177.00	186.66		186.92	0.003874	4.76	1350.90	289.20	0.32
Below Sucker	3997.66	50-Year	4415.00	177.00	186.41		186.68	0.004352	4.83	1245.46	277.81	0.33
Below Sucker	3997.66	100-Year	4697.00	177.00	186.63		186.91	0.004321	4.91	1308.10	282.36	0.33
Below Sucker	3995.05	50-Year	4415.00	177.00	186.37		186.67	0.005452	5.04	1183.06	274.91	0.34
Below Sucker	3995.05	100-Year	4697.00	177.00	186.60		186.90	0.005381	5.10	1245.65	279.48	0.34
Below Sucker	3979.42	50-Year	4415.00	176.99	186.15		186.56	0.006304	5.70	1045.11	272.65	0.39
Below Sucker	3979.42	100-Year	4697.00	176.99	186.38		186.80	0.006160	5.76	1108.32	277.08	0.39
Below Sucker	3953.09	50-Year	4415.00	176.96	185.90		186.38	0.006879	5.93	942.27	255.90	0.42
Below Sucker	3953.09	100-Year	4697.00	176.96	186.13		186.62	0.006714	6.00	1002.04	262.68	0.42
Below Sucker	3922.09	50-Year	4415.00	176.93	185.63		186.17	0.006978	6.21	901.83	234.05	0.43
Below Sucker	3922.09	100-Year	4697.00	176.93	185.87		186.41	0.006843	6.29	956.96	239.01	0.42
Below Sucker	3856.96	50-Year	4415.00	176.88	185.29		185.73	0.005720	5.74	1006.56	247.63	0.39
Below Sucker	3856.96	100-Year	4697.00	176.88	185.54		185.98	0.005582	5.80	1067.65	251.80	0.38
Below Sucker	3848.98	50-Year	4415.00	176.87	185.23		185.68	0.006243	5.84	986.15	241.09	0.39
Below Sucker	3848.98	100-Year	4697.00	176.87	185.48		185.93	0.006106	5.91	1046.08	245.14	0.39
Below Sucker	3845.09	50-Year	4415.00	176.87	185.23		185.65	0.005501	5.65	1031.20	252.01	0.38
Below Sucker	3845.09	100-Year	4697.00	176.87	185.48		185.90	0.005360	5.71	1093.97	256.01	0.38
Below Sucker	3843.93	50-Year	4415.00	176.87	185.22		185.64	0.005480	5.64	1033.70	252.49	0.38
Below Sucker	3843.93	100-Year	4697.00	176.87	185.47		185.89	0.005340	5.70	1096.64	256.49	0.38
Below Sucker	3838.72	50-Year	4415.00	176.86	185.14		185.60	0.007782	6.04	966.62	244.40	0.41
Below Sucker	3838.72	100-Year	4697.00	176.86	185.39		185.86	0.007533	6.07	1029.38	248.43	0.40
Below Sucker	3804.85	50-Year	4415.00	176.83	185.01		185.37	0.004838	5.34	1119.51	268.43	0.36
Below Sucker	3804.85	100-Year	4697.00	176.83	185.27		185.63	0.004678	5.38	1189.64	272.17	0.35
Below Sucker	3768.09	50-Year	4415.00	176.80	184.89		185.19	0.004080	4.97	1231.74	285.65	0.33
Below Sucker	3768.09	100-Year	4697.00	176.80	185.15		185.45	0.003939	5.00	1308.04	289.20	0.32
Below Sucker	3674.57	50-Year	4415.00	176.73	184.36		184.72	0.006329	5.53	1128.56	284.35	0.37
Below Sucker	3674.57	100-Year	4697.00	176.73	184.67		185.01	0.005910	5.47	1215.16	289.00	0.36
Below Sucker	3671.96	50-Year	4415.00	176.73	184.35		184.70	0.005306	5.47	1156.30	289.76	0.37
Below Sucker	3671.96	100-Year	4697.00	176.73	184.65		184.99	0.004945	5.43	1244.28	294.42	0.36
Below Sucker	3646.96	50-Year	4415.00	176.71	184.20		184.56	0.005707	5.61	1138.06	291.79	0.39
Below Sucker	3646.96	100-Year	4697.00	176.71	184.51		184.87	0.005242	5.54	1231.13	296.70	0.37
Below Sucker	3614.39	50-Year	4415.00	176.69	183.98		184.37	0.006336	5.81	1113.10	295.01	0.40
Below Sucker	3614.39	100-Year	4697.00	176.69	184.32		184.69	0.005675	5.69	1215.44	300.72	0.39

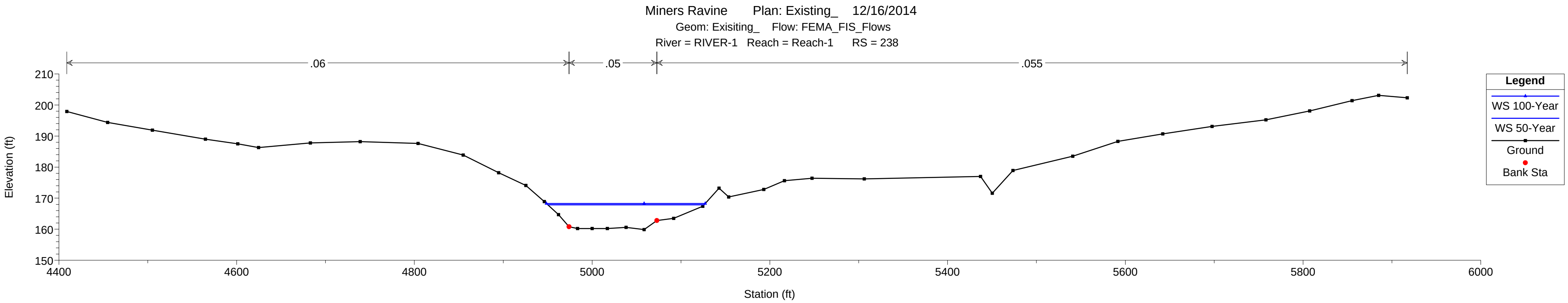
HEC-RAS Plan: Alt.2+3_Rev14724   River: Secret Ravine   Reach: Below Sucker (Continued)

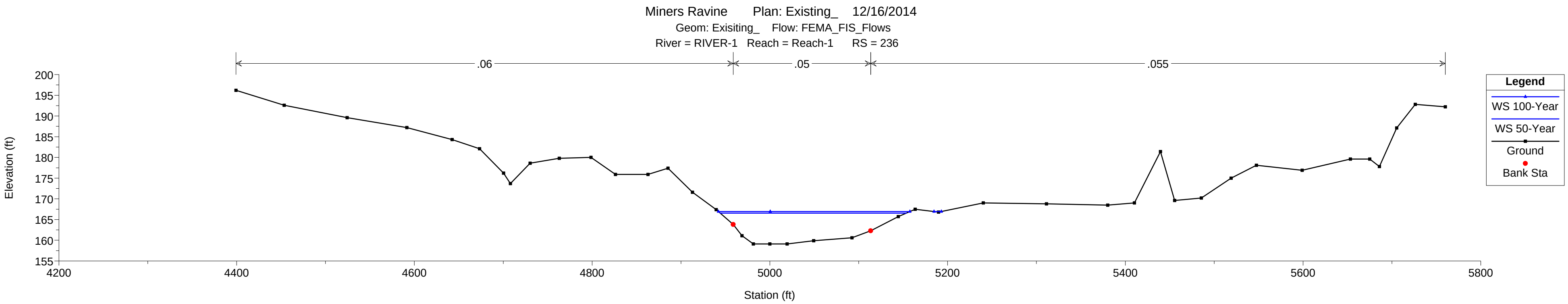
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Below Sucker	3597.97	50-Year	4415.00	176.68	183.85		184.24	0.008796	5.99	1059.41	291.77	0.42
Below Sucker	3597.97	100-Year	4697.00	176.68	184.22		184.58	0.007692	5.79	1168.10	298.67	0.40
Below Sucker	3575.83	50-Year	4415.00	176.67	183.64		184.06	0.007559	6.16	1068.10	300.19	0.44
Below Sucker	3575.83	100-Year	4697.00	176.67	184.04		184.42	0.006435	5.93	1190.03	308.80	0.41
Below Sucker	3525.8	50-Year	4415.00	176.63	183.11		183.59	0.011662	6.77	998.11	322.39	0.50
Below Sucker	3525.8	100-Year	4697.00	176.63	183.67		184.05	0.008556	6.11	1186.05	343.65	0.43
Below Sucker	3479.70	50-Year	4415.00	176.60	182.77		183.10	0.008225	5.91	1231.02	403.66	0.45
Below Sucker	3479.70	100-Year	4697.00	176.60	183.47		183.71	0.005176	5.09	1521.44	420.89	0.36
Below Sucker	3396.45	50-Year	4415.00	176.12	181.50	181.09	182.12	0.017892	7.78	934.49	408.09	0.64
Below Sucker	3396.45	100-Year	4697.00	176.12	183.10	181.17	183.31	0.004547	4.79	1616.22	449.62	0.34

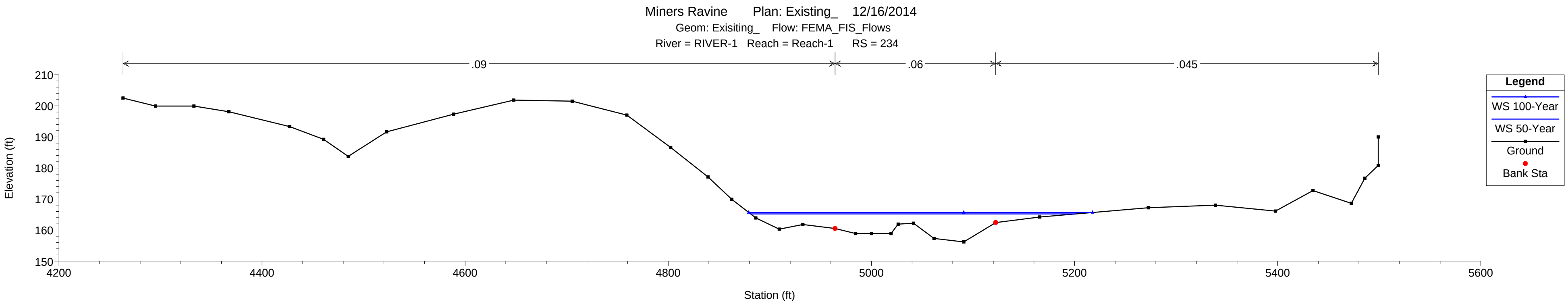
Appendix B.3 Miners Ravine HEC-RAS Outputs

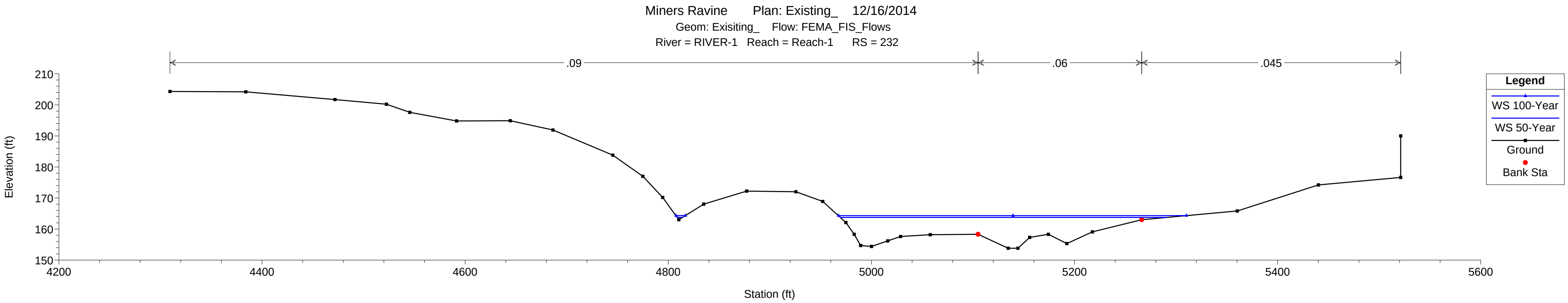
Reach-1
RIVER-1
189
190
191
204
206
208
210
212
218
219
221
222
224
224.667*
226
228.293*
230
232
234
236
238
240

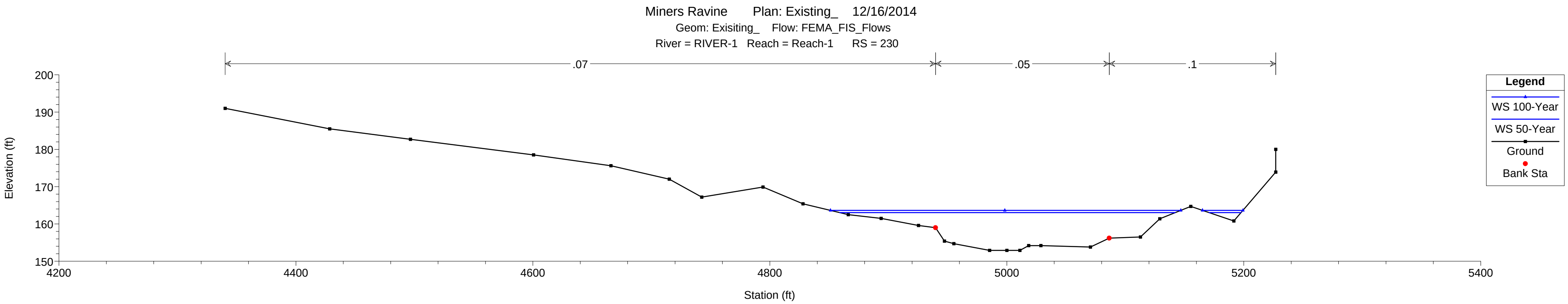

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 240 Confluence with Secret Ravine
.06
.05
.055
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

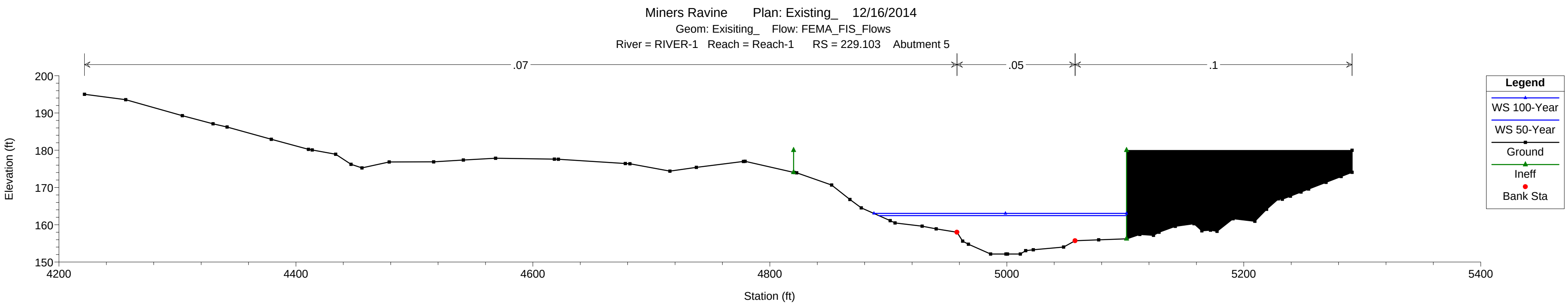

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 238
.06
.05
.055
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

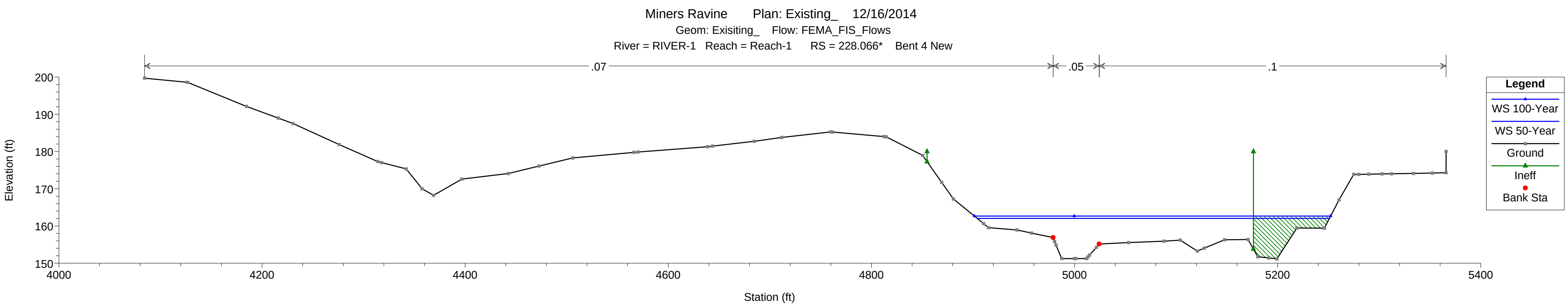

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 236
.06
.05
.055
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 234
.09
.06
.045
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

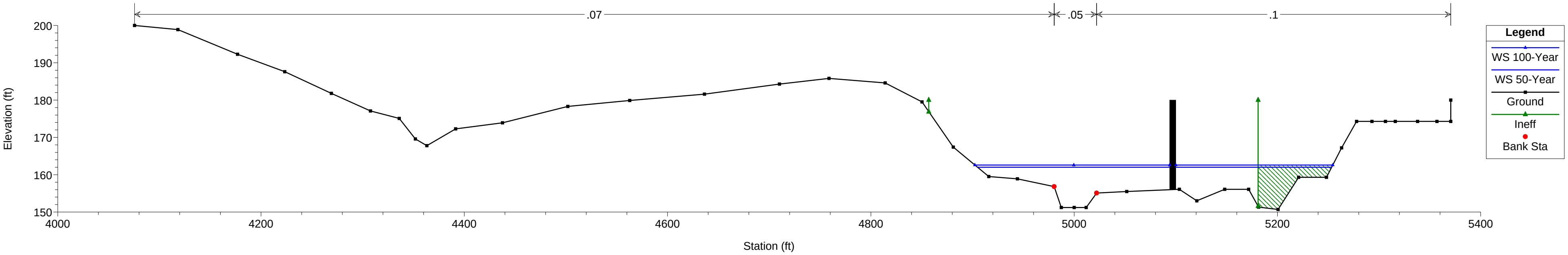

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 232
.09
.06
.045
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 230
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

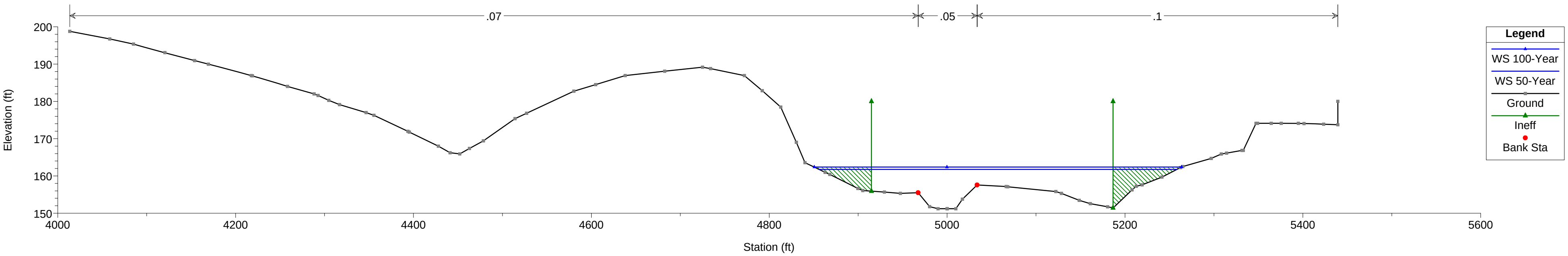

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 229.103 Abutment 5
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta


Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 228.066* Bent 4 New
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

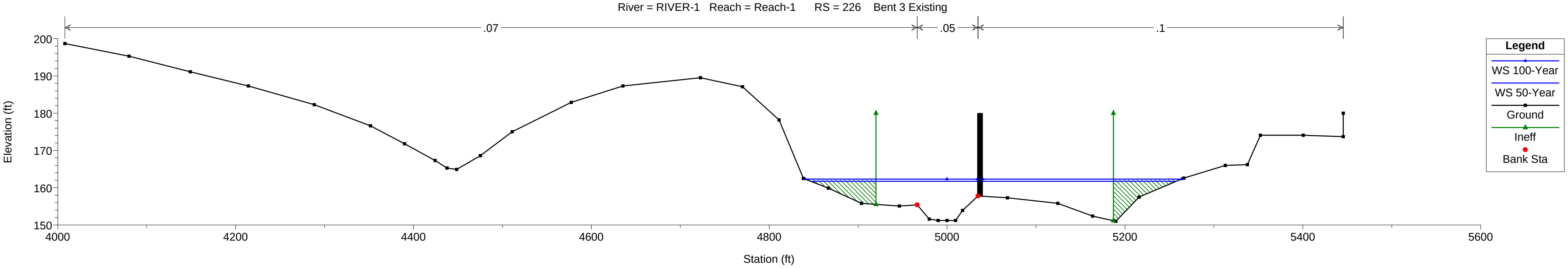
Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 228 Bent 4 Existing



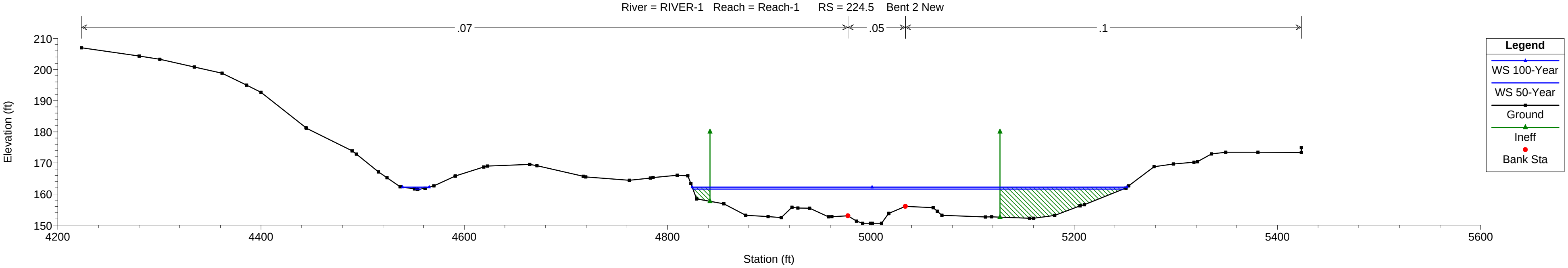
Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 226.161* Bent 3 New

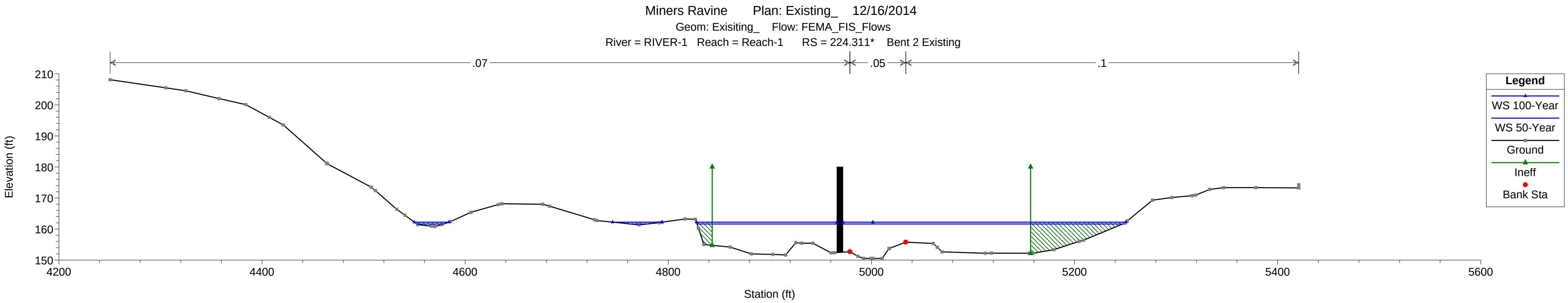


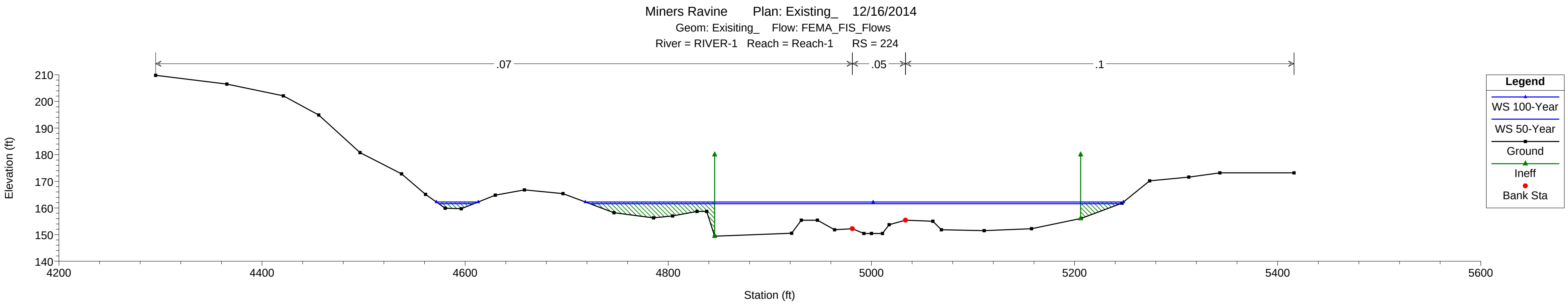
Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 226 Bent 3 Existing

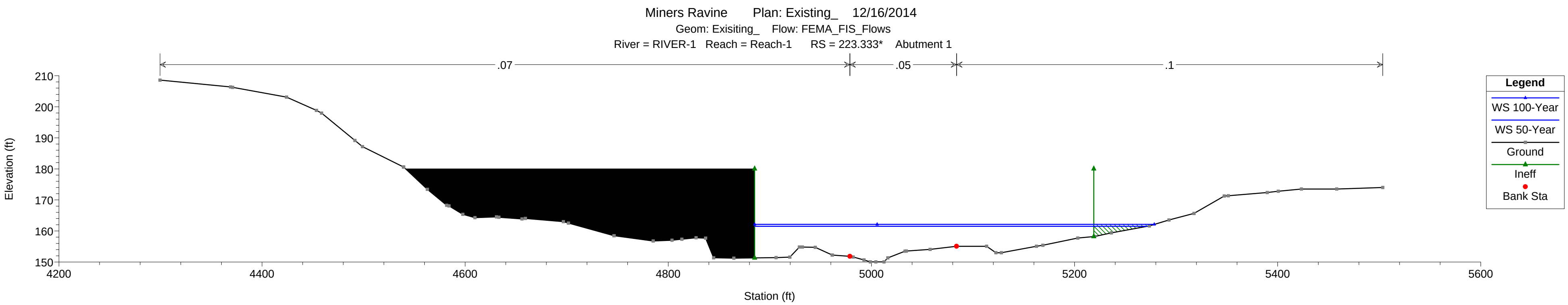


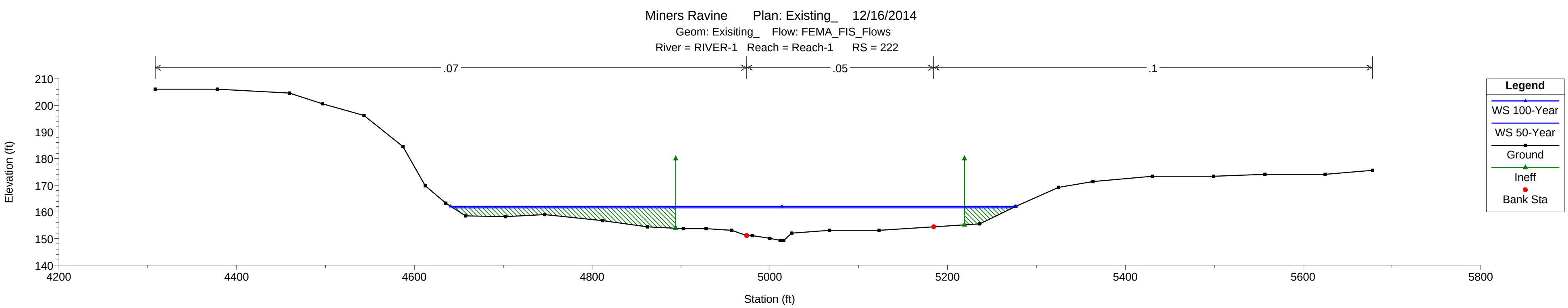
Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 224.5 Bent 2 New

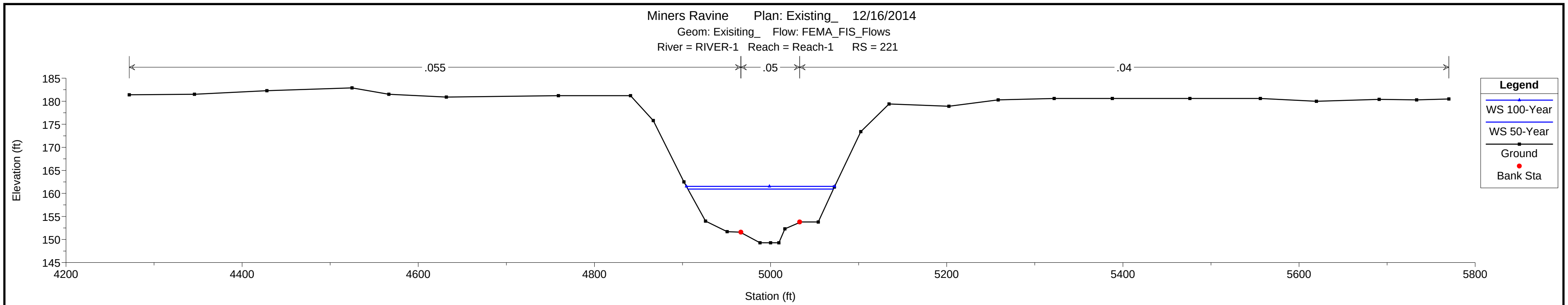


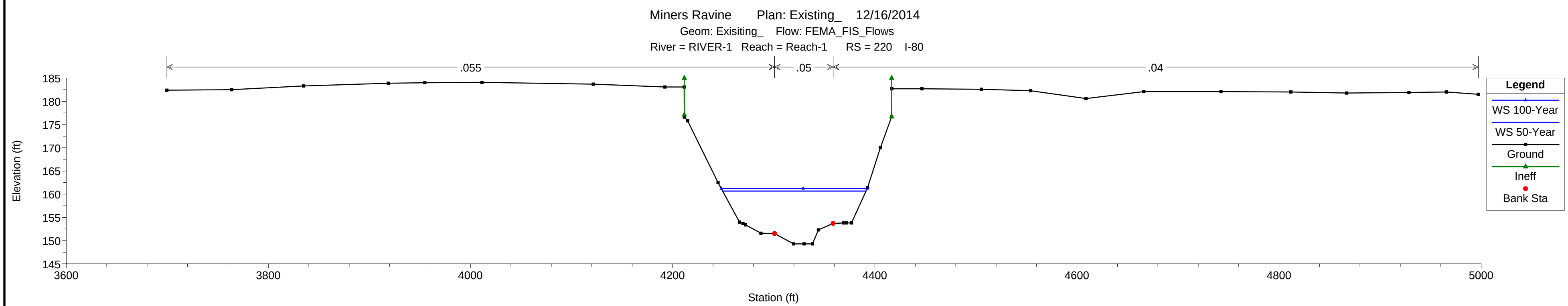

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 224.311* Bent 2 Existing
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

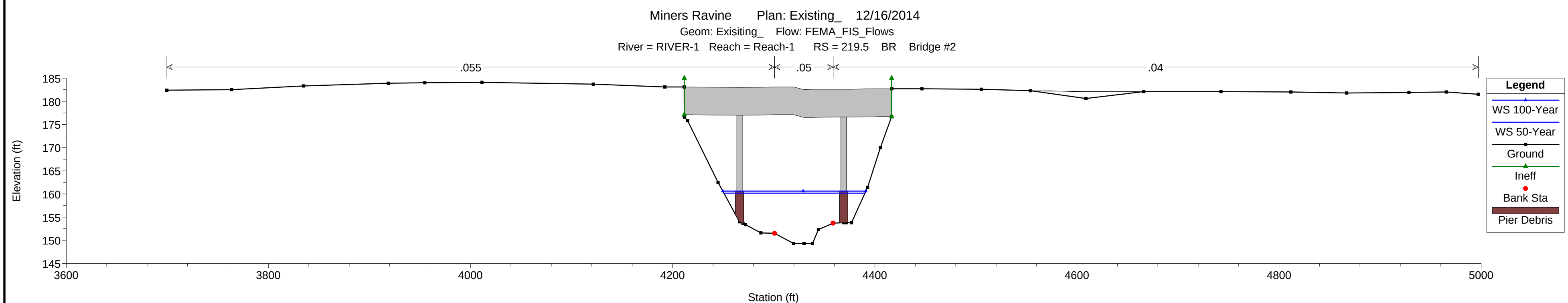

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 224
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

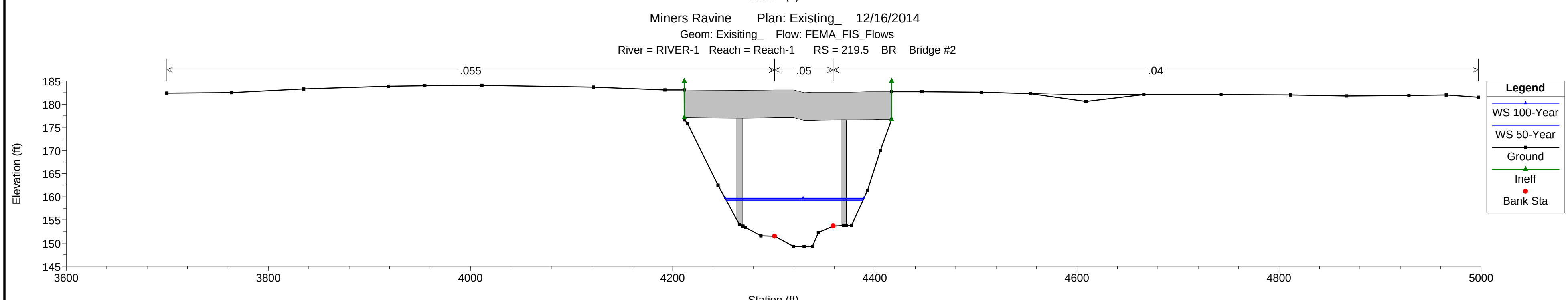

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 223.333* Abutment 1
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

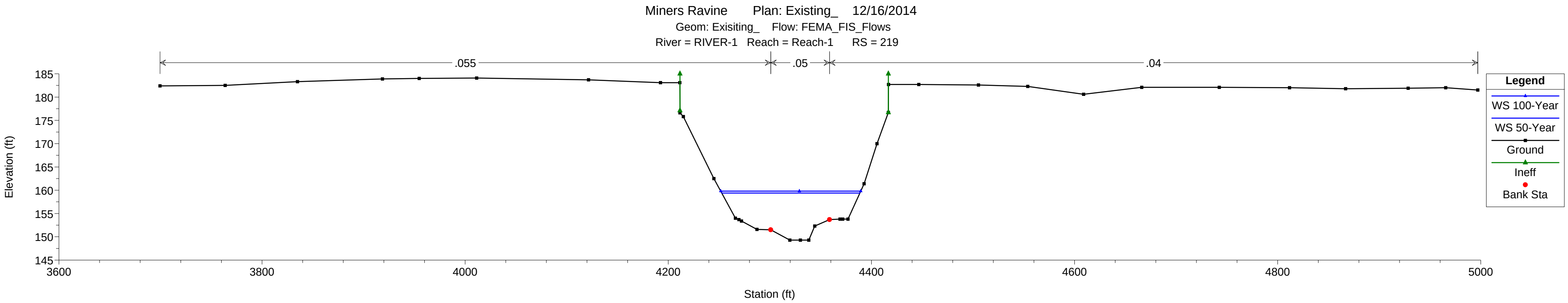

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 222
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

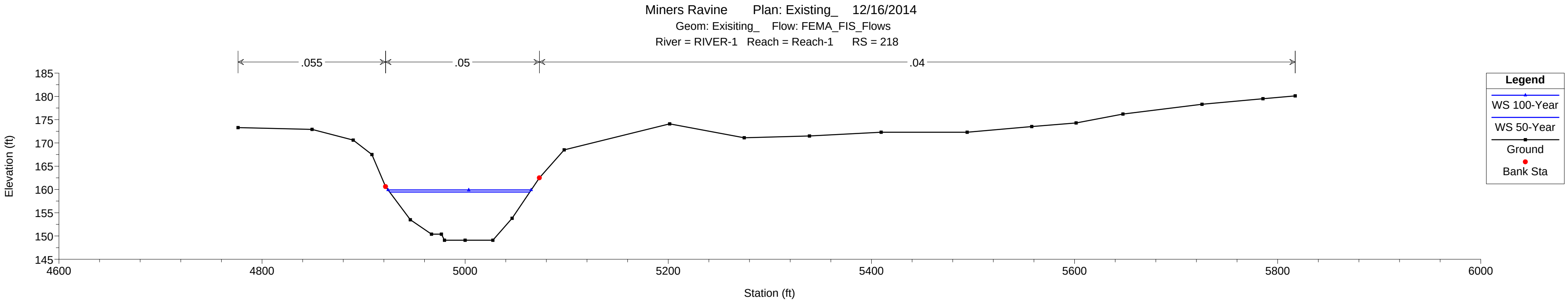

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 221
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

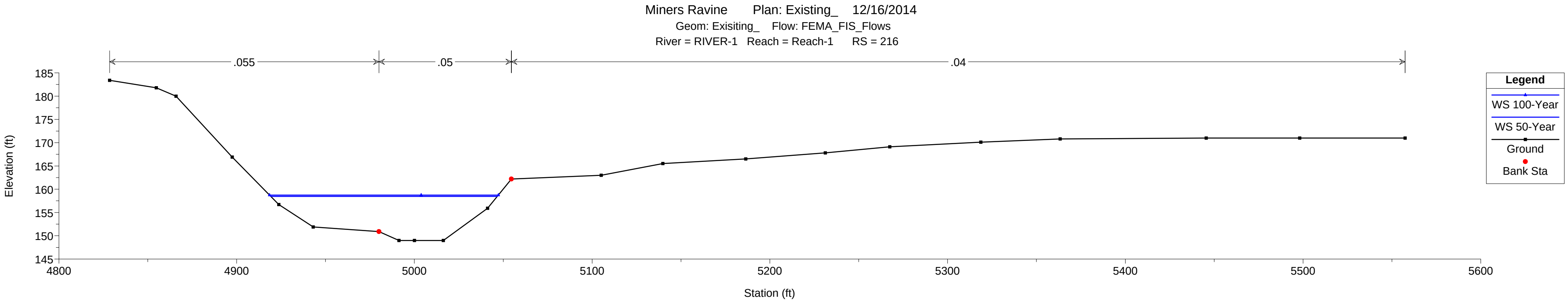

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 220 I-80
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

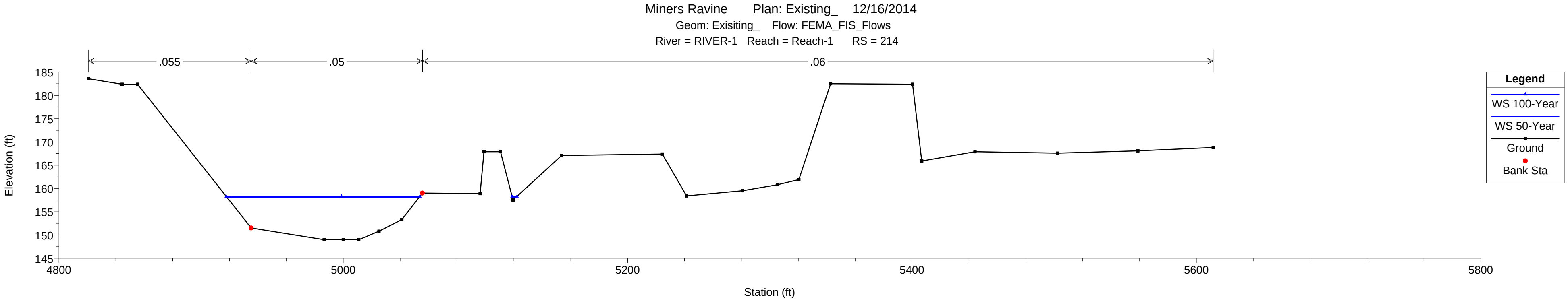

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 219.5 BR Bridge #2
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Pier Debris

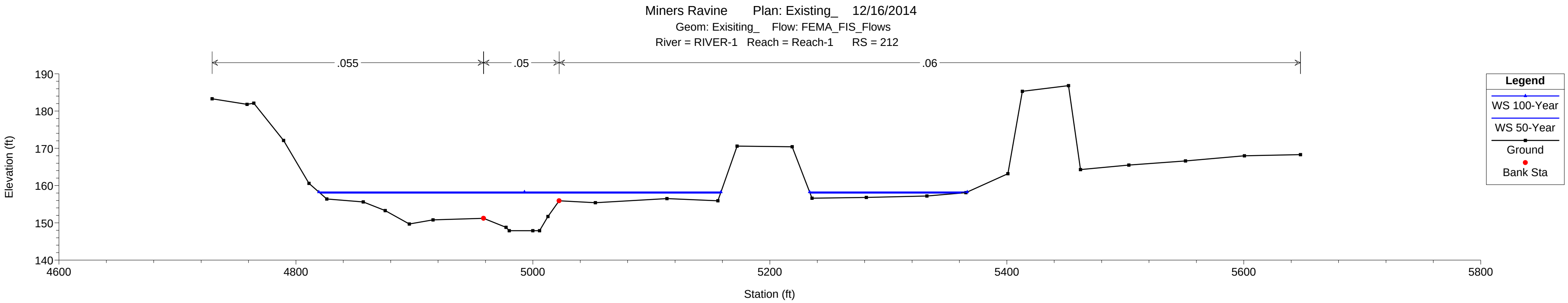

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 219.5 BR Bridge #2
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

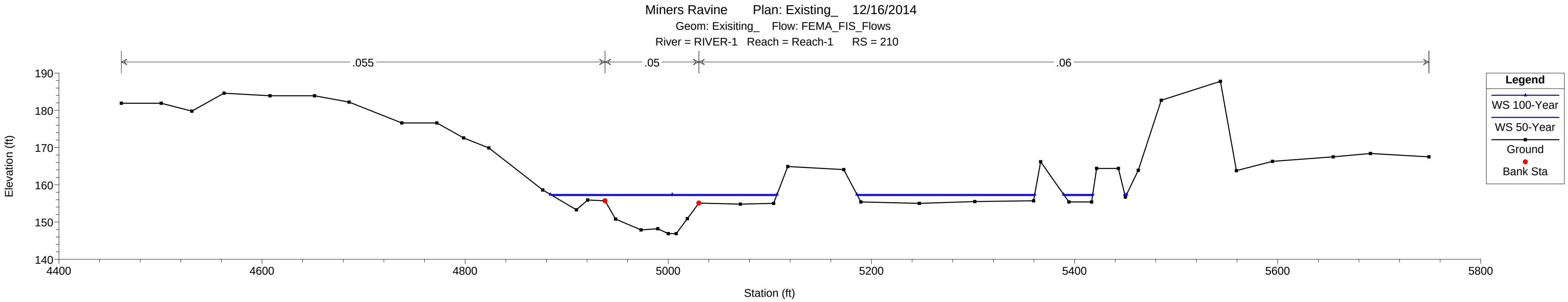

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 219
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

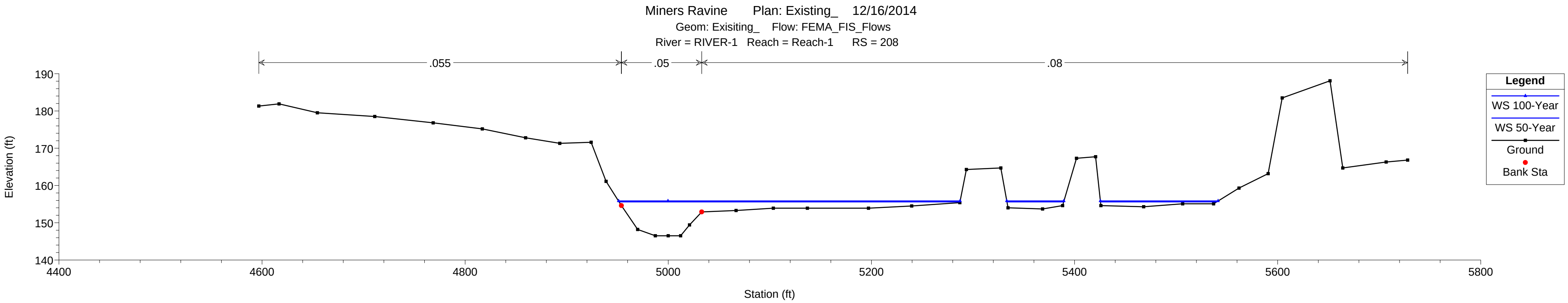

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 218
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

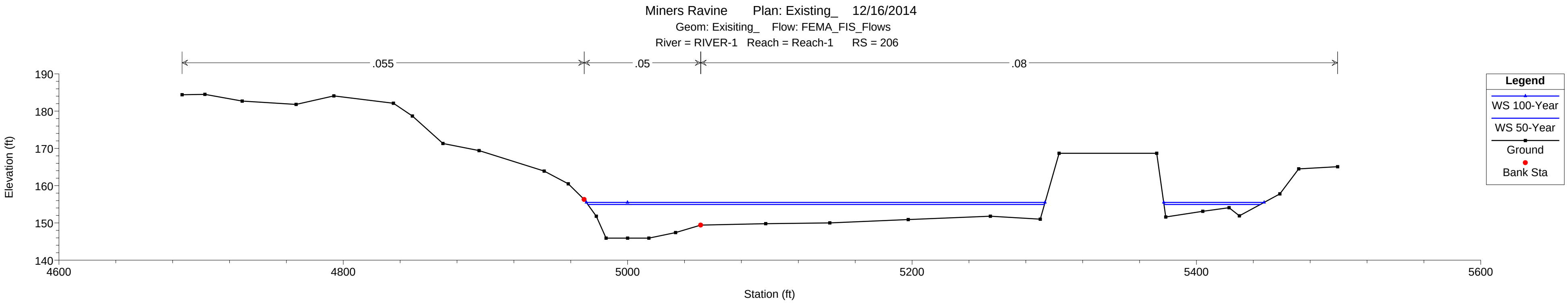

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 216
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

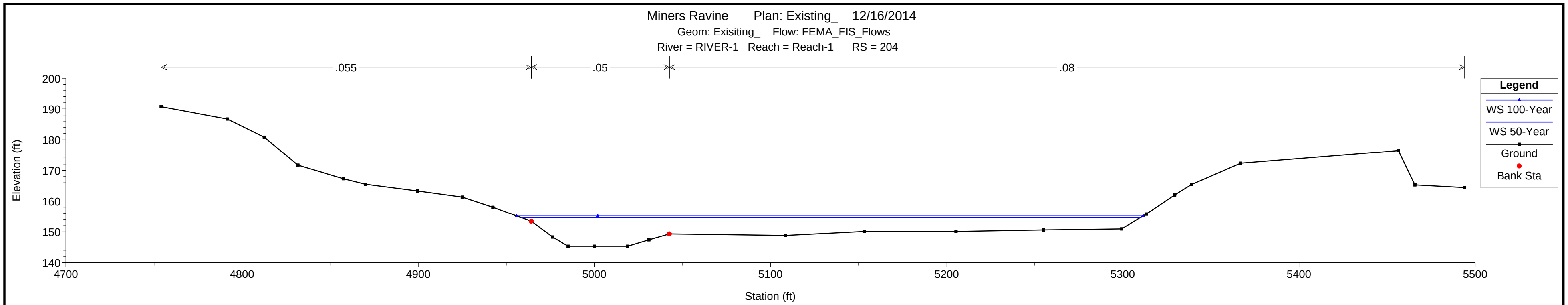

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 214
.055
.05
.06
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

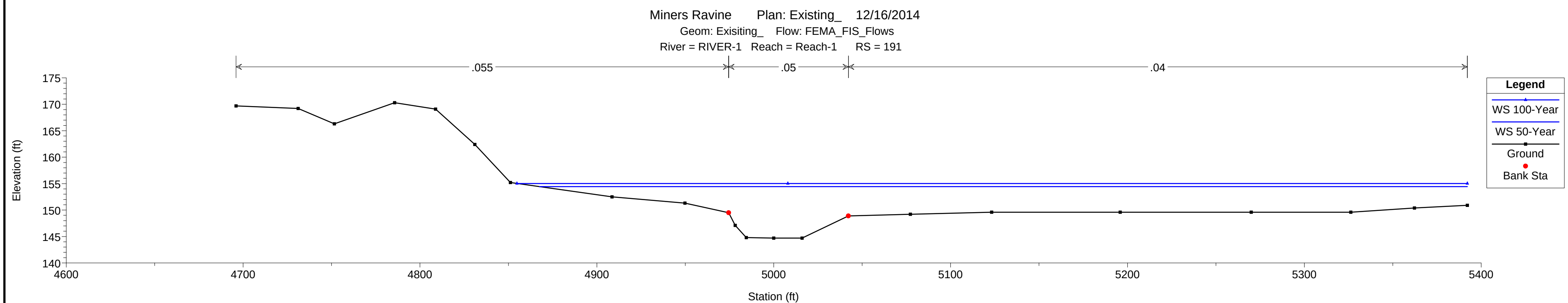

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 212
.055
.05
.06
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

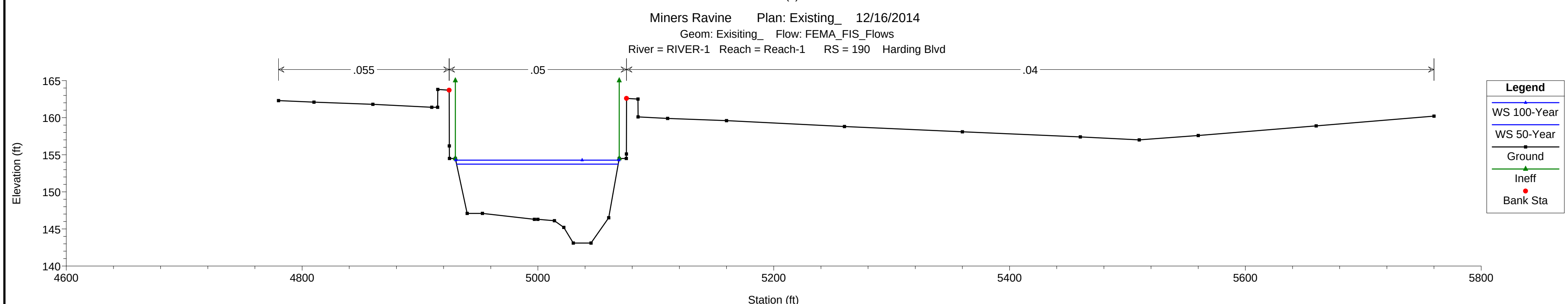

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 210
.055
.05
.06
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

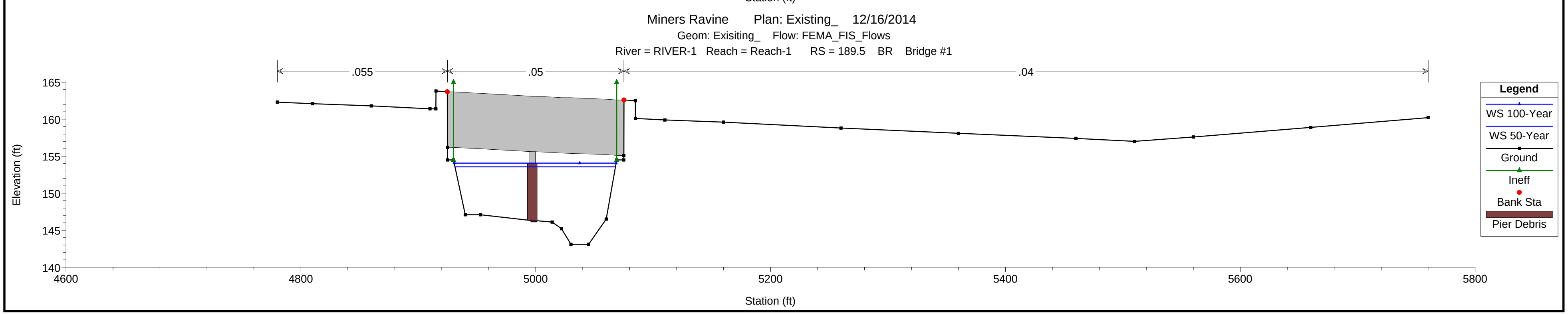

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 208
.055
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

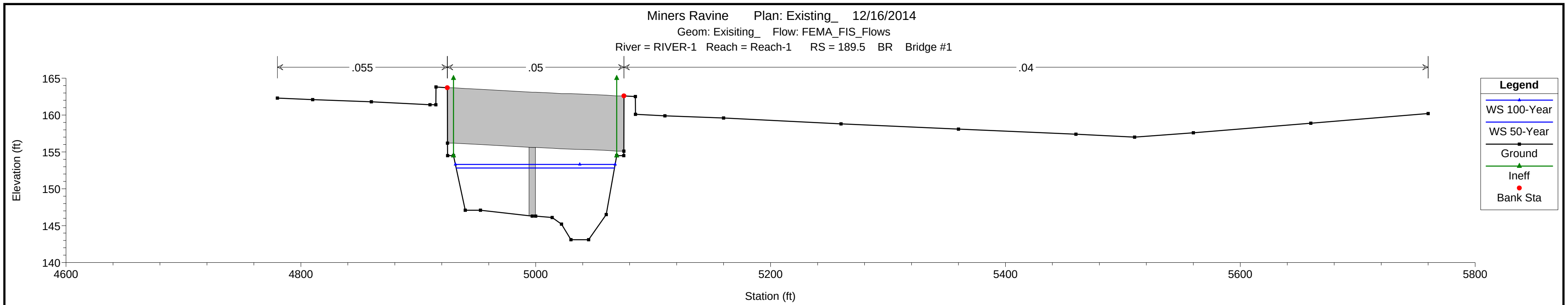

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 206
.055
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

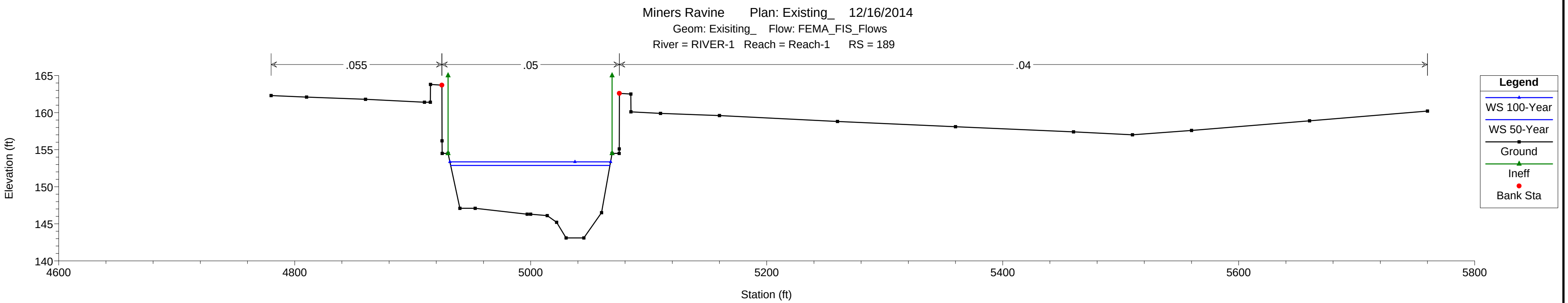

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 204
.055
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

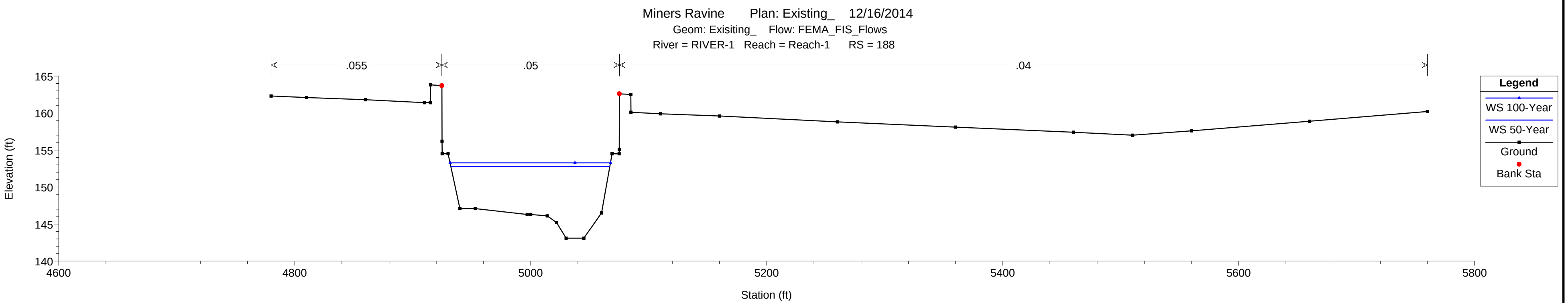

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 191
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

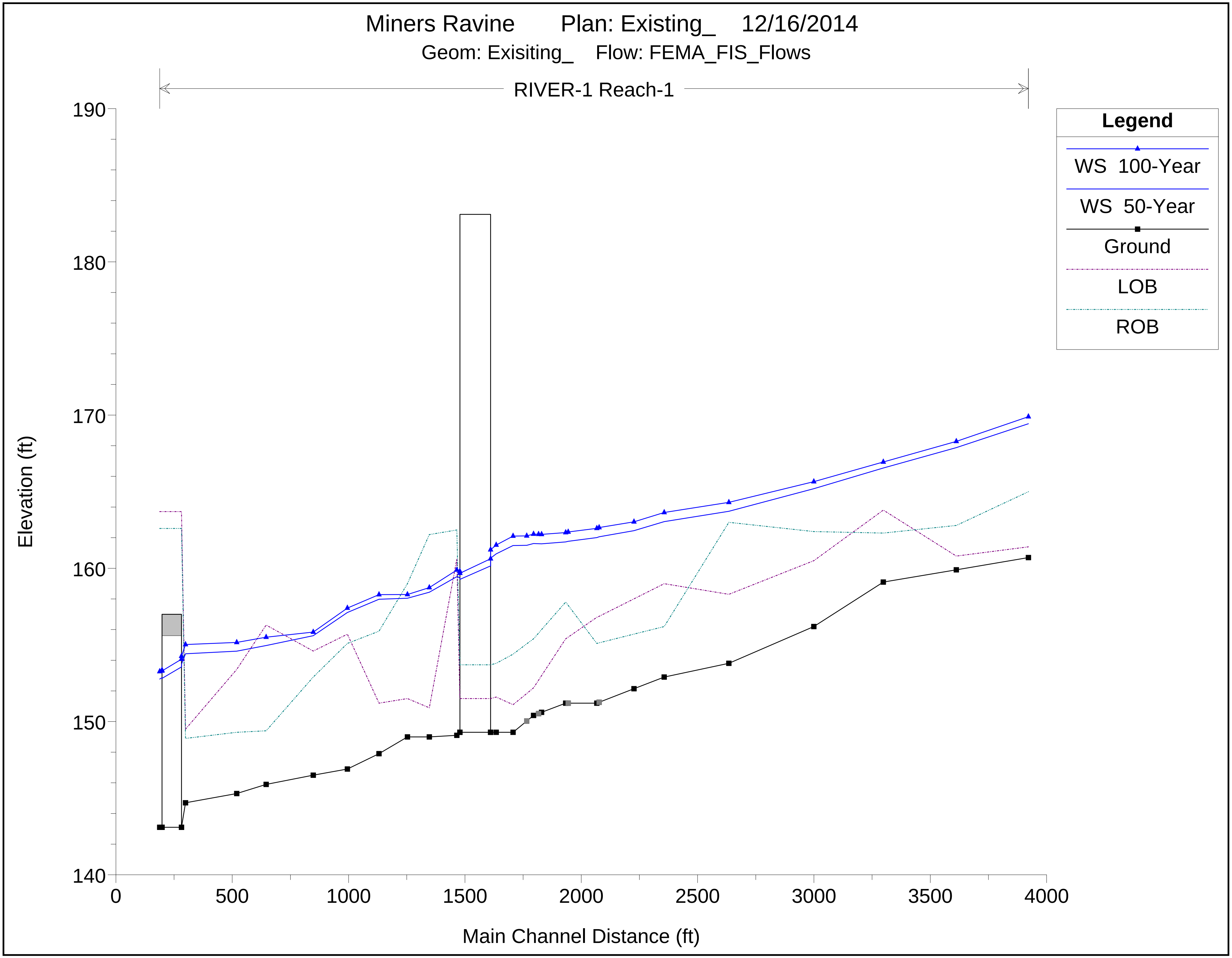

Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 190 Harding Blvd
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta


Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 189.5 BR Bridge #1
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Pier Debris


Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 189.5 BR Bridge #1
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta


Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 189
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta


Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 188
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta



Miners Ravine Plan: Existing_ 12/16/2014
Geom: Exisiting_ Flow: FEMA_FIS_Flows
RIVER-1 Reach-1
Legend
WS 100-Year
WS 50-Year
Ground
LOB
ROB
Elevation (ft)
Main Channel Distance (ft)
190
180
170
160
150
140
0
500
1000
1500
2000
2500
3000
3500
4000

HEC-RAS Plan: Existing_ River: RIVER-1 Reach: Reach-1

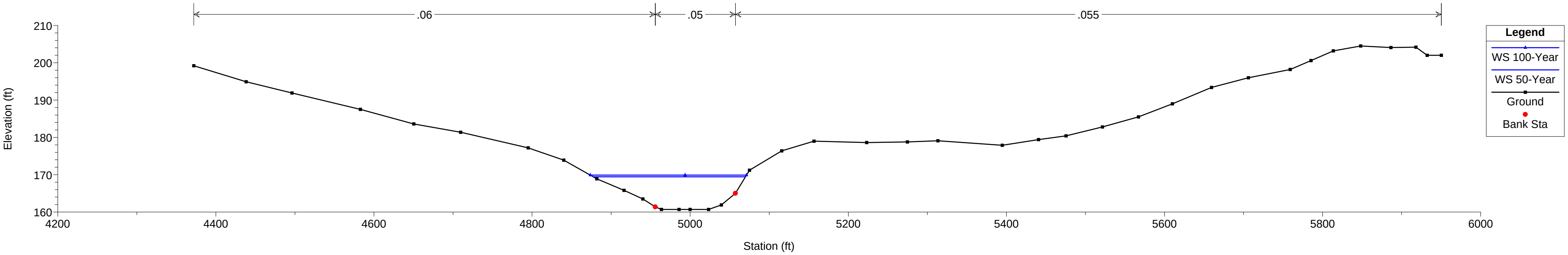
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	240	50-Year	7000.00	160.70	169.44		170.13	0.003528	7.12	1149.36	192.55	0.44
Reach-1	240	100-Year	7840.00	160.70	169.89		170.64	0.003592	7.45	1238.69	197.68	0.45
Reach-1	238	50-Year	7000.00	159.90	167.87		168.79	0.005211	8.15	983.06	175.91	0.53
Reach-1	238	100-Year	7840.00	159.90	168.28		169.28	0.005327	8.54	1055.22	178.74	0.54
Reach-1	236	50-Year	7000.00	159.10	166.55		167.23	0.004338	6.75	1098.23	209.35	0.47
Reach-1	236	100-Year	7840.00	159.10	166.94		167.69	0.004413	7.08	1181.61	223.85	0.48
Reach-1	234	50-Year	7000.00	156.20	165.20		165.70	0.005618	6.11	1356.10	320.36	0.44
Reach-1	234	100-Year	7840.00	156.20	165.66		166.17	0.005273	6.21	1507.02	338.50	0.43
Reach-1	232	50-Year	7000.00	153.80	163.72		163.99	0.003351	4.64	1782.78	326.25	0.34
Reach-1	232	100-Year	7840.00	153.80	164.31		164.58	0.003074	4.73	1980.10	351.89	0.33
Reach-1	230	50-Year	7000.00	152.90	163.04		163.38	0.001452	4.86	1760.62	310.08	0.29
Reach-1	230	100-Year	7840.00	152.90	163.64		164.00	0.001427	5.03	1951.56	329.84	0.29
Reach-1	229.103	50-Year	7000.00	152.14	162.46	158.75	163.05	0.002720	6.64	1351.01	209.04	0.39
Reach-1	229.103	100-Year	7840.00	152.14	163.04	159.14	163.67	0.002695	6.89	1472.54	213.14	0.39
Reach-1	228.066*	50-Year	7000.00	151.26	162.06	159.21	162.56	0.003343	7.59	1682.17	346.90	0.43
Reach-1	228.066*	100-Year	7840.00	151.26	162.66	159.65	163.17	0.003193	7.72	1847.15	350.77	0.42
Reach-1	228	50-Year	7000.00	151.20	162.00	159.10	162.52	0.003580	7.84	1686.63	342.46	0.44
Reach-1	228	100-Year	7840.00	151.20	162.61	159.57	163.13	0.003442	8.00	1849.71	346.25	0.44
Reach-1	226.161*	50-Year	7000.00	151.20	161.76	158.28	162.10	0.002284	5.96	1891.06	402.54	0.35
Reach-1	226.161*	100-Year	7840.00	151.20	162.37	158.52	162.72	0.002196	6.11	2057.16	413.00	0.35
Reach-1	226	50-Year	7000.00	151.20	161.72	158.24	162.07	0.002496	5.99	1831.20	404.73	0.36
Reach-1	226	100-Year	7840.00	151.20	162.33	158.50	162.70	0.002421	6.13	1990.92	417.36	0.35
Reach-1	224.5	50-Year	7000.00	150.60	161.60	156.78	161.80	0.001354	4.77	2249.29	428.94	0.28
Reach-1	224.5	100-Year	7840.00	150.60	162.21	156.97	162.43	0.001328	4.93	2425.33	453.92	0.28
Reach-1	224.311*	50-Year	7000.00	150.52	161.61	156.03	161.75	0.001040	4.21	2625.21	454.26	0.24
Reach-1	224.311*	100-Year	7840.00	150.52	162.22	156.23	162.38	0.001039	4.39	2815.26	500.19	0.24
Reach-1	224	50-Year	7000.00	150.40	161.62	154.46	161.70	0.000573	3.16	3347.33	557.62	0.18
Reach-1	224	100-Year	7840.00	150.40	162.24	154.71	162.33	0.000581	3.32	3570.66	571.01	0.18
Reach-1	223.333*	50-Year	7000.00	150.03	161.50	156.07	161.66	0.000928	3.87	2591.25	386.34	0.23
Reach-1	223.333*	100-Year	7840.00	150.03	162.12	156.30	162.29	0.000917	4.02	2796.95	393.51	0.23
Reach-1	222	50-Year	7000.00	149.30	161.48	155.46	161.60	0.000507	2.88	2776.91	629.38	0.17
Reach-1	222	100-Year	7840.00	149.30	162.10	155.67	162.22	0.000507	3.01	2977.40	636.04	0.17
Reach-1	221	50-Year	7000.00	149.30	160.94		161.42	0.001959	6.13	1306.26	165.21	0.34
Reach-1	221	100-Year	7840.00	149.30	161.52		162.04	0.001989	6.41	1402.02	168.26	0.34
Reach-1	220	50-Year	7000.00	149.30	160.66	156.92	161.34	0.002913	7.33	1093.23	141.79	0.41
Reach-1	220	100-Year	7840.00	149.30	161.21	157.30	161.96	0.002967	7.67	1172.13	144.31	0.42
Reach-1	219.5		Bridge									
Reach-1	219	50-Year	7000.00	149.30	159.38	156.92	160.36	0.004960	8.72	915.73	135.93	0.52
Reach-1	219	100-Year	7840.00	149.30	159.81	157.30	160.89	0.005174	9.19	973.63	137.87	0.54
Reach-1	218	50-Year	7000.00	149.10	159.46		160.17	0.003693	6.80	1029.61	138.16	0.44
Reach-1	218	100-Year	7840.00	149.10	159.89		160.69	0.003942	7.20	1089.61	140.96	0.46
Reach-1	216	50-Year	7000.00	149.00	158.44		159.59	0.007109	9.30	831.98	127.38	0.61
Reach-1	216	100-Year	7840.00	149.00	158.74		160.06	0.007809	9.94	870.33	128.79	0.64
Reach-1	214	50-Year	7000.00	149.00	158.05		158.99	0.005019	7.86	917.72	137.43	0.51
Reach-1	214	100-Year	7840.00	149.00	158.29		159.39	0.005670	8.51	951.22	139.73	0.55
Reach-1	212	50-Year	7000.00	147.90	157.98		158.38	0.002691	6.21	1641.13	465.09	0.38
Reach-1	212	100-Year	7840.00	147.90	158.28		158.71	0.002782	6.46	1783.41	472.57	0.39
Reach-1	210	50-Year	7000.00	146.90	157.12	156.26	157.86	0.004762	7.75	1307.35	424.26	0.50
Reach-1	210	100-Year	7840.00	146.90	157.41	156.55	158.18	0.004854	8.02	1430.22	428.88	0.50

HEC-RAS Plan: Existing_   River: RIVER-1   Reach: Reach-1 (Continued)

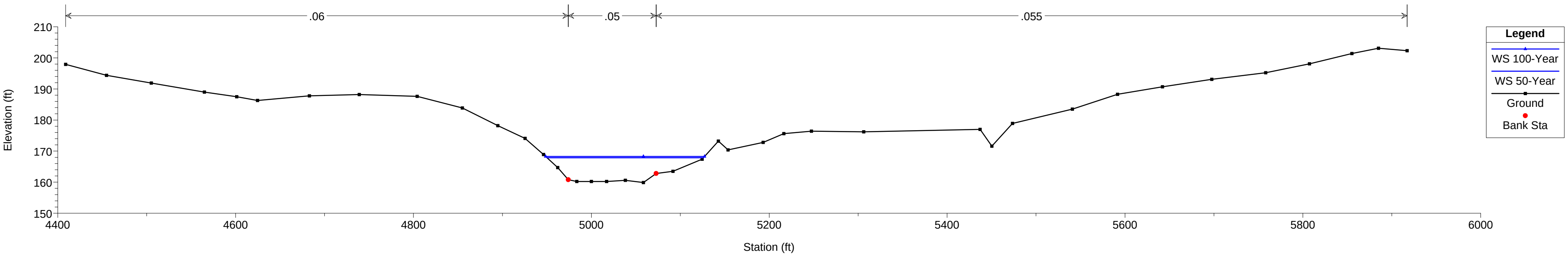
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	208	50-Year	7000.00	146.50	155.60	155.60	156.90	0.008934	10.14	1154.83	505.79	0.67
Reach-1	208	100-Year	7840.00	146.50	155.84	155.84	157.20	0.009242	10.54	1275.91	508.45	0.69
Reach-1	206	50-Year	7000.00	145.90	154.96		155.35	0.003266	6.35	1789.47	389.03	0.41
Reach-1	206	100-Year	7840.00	145.90	155.50		155.88	0.003009	6.32	2001.70	393.28	0.40
Reach-1	204	50-Year	7000.00	145.30	154.60		154.95	0.002832	6.05	1835.25	351.43	0.39
Reach-1	204	100-Year	7840.00	145.30	155.16		155.51	0.002611	6.09	2035.17	355.73	0.37
Reach-1	191	50-Year	7000.00	144.70	154.43		154.56	0.000738	3.34	2496.18	524.61	0.20
Reach-1	191	100-Year	7840.00	144.70	155.03		155.16	0.000645	3.26	2815.27	537.41	0.19
Reach-1	190	50-Year	7000.00	143.10	153.74	150.46	154.48	0.003892	6.87	1018.71	137.12	0.44
Reach-1	190	100-Year	7840.00	143.10	154.27	150.81	155.07	0.003944	7.18	1091.18	138.43	0.45
Reach-1	189.5		Bridge									
Reach-1	189	50-Year	7000.00	143.10	152.87	150.46	153.81	0.005740	7.78	899.52	134.95	0.53
Reach-1	189	100-Year	7840.00	143.10	153.36	150.81	154.38	0.005761	8.12	966.04	136.17	0.54
Reach-1	188	50-Year	7000.00	143.10	152.77	150.42	153.74	0.006001	7.89	886.84	134.72	0.54
Reach-1	188	100-Year	7840.00	143.10	153.26	150.78	154.31	0.006009	8.23	953.08	135.93	0.55

Reach-1
RIVER-1
240
238
236
234
232
230
228.293*
226
224.667*
224
222
221
219
218
212
210
208
206
204
191
190
189

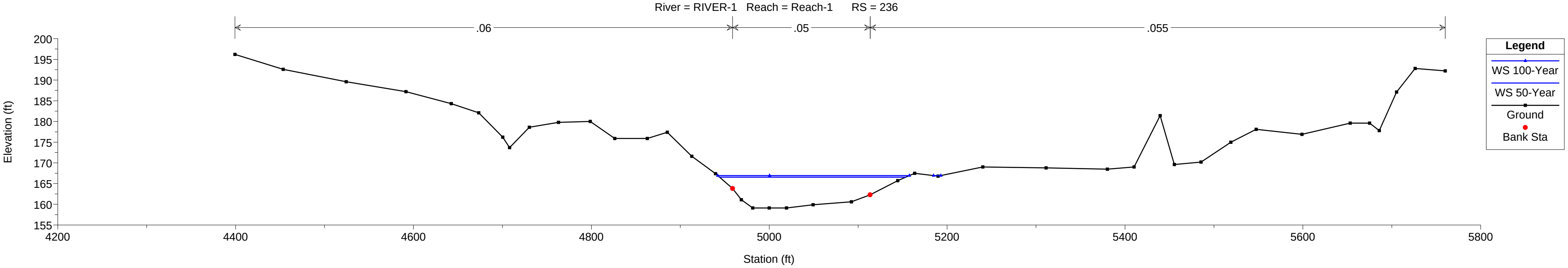
Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 240 Confluence with Secret Ravine



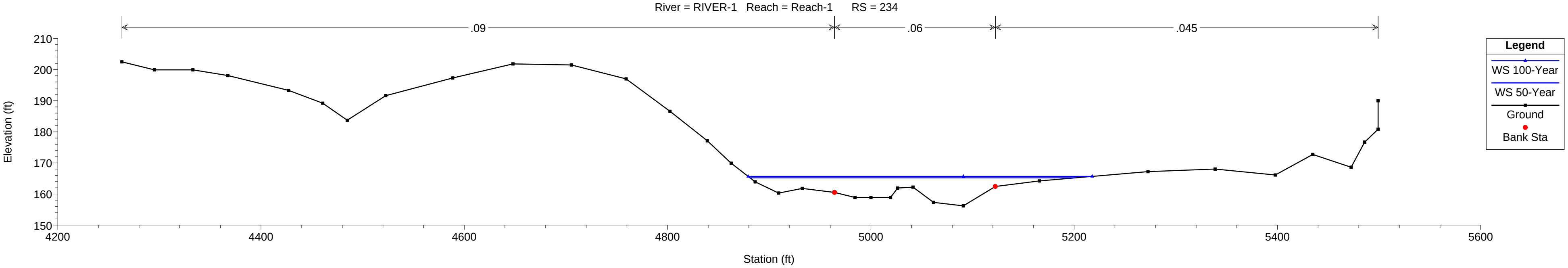
Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 238

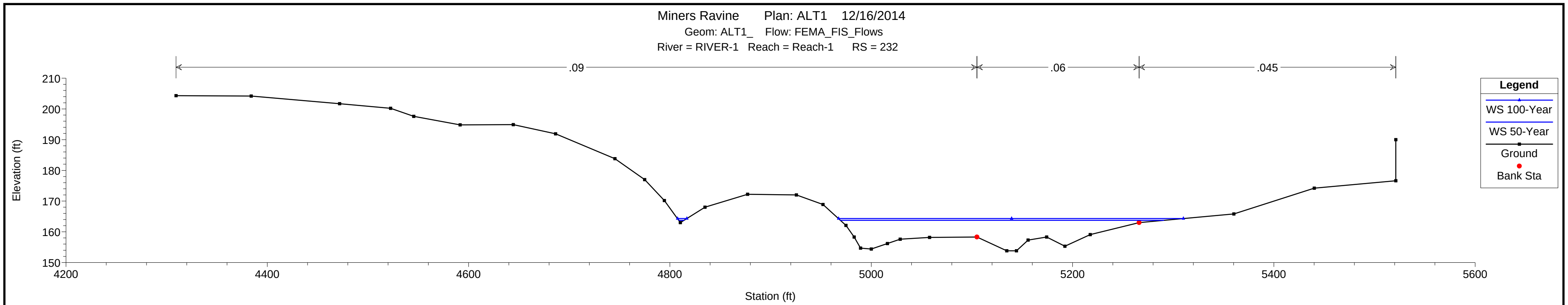


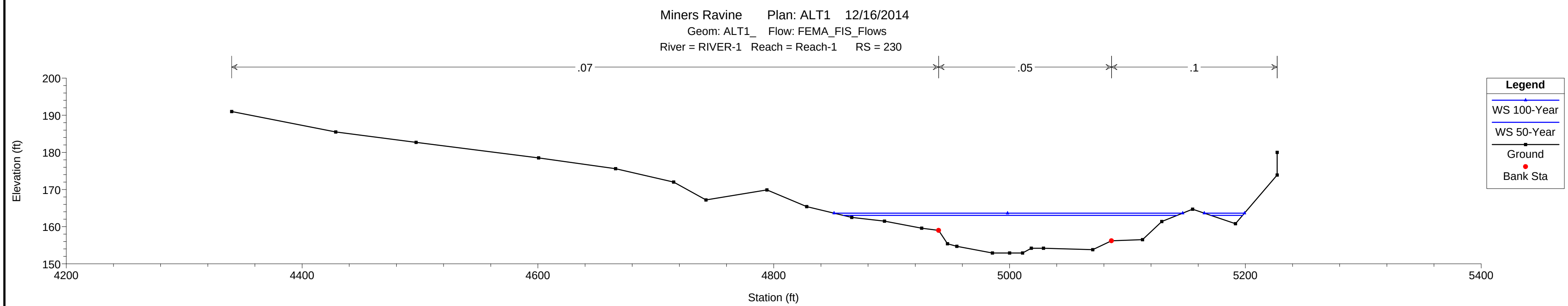
Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 236

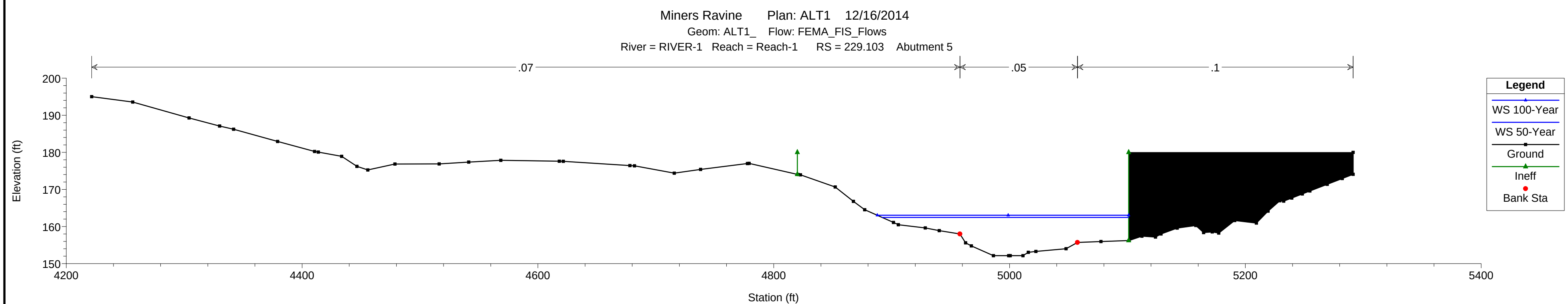


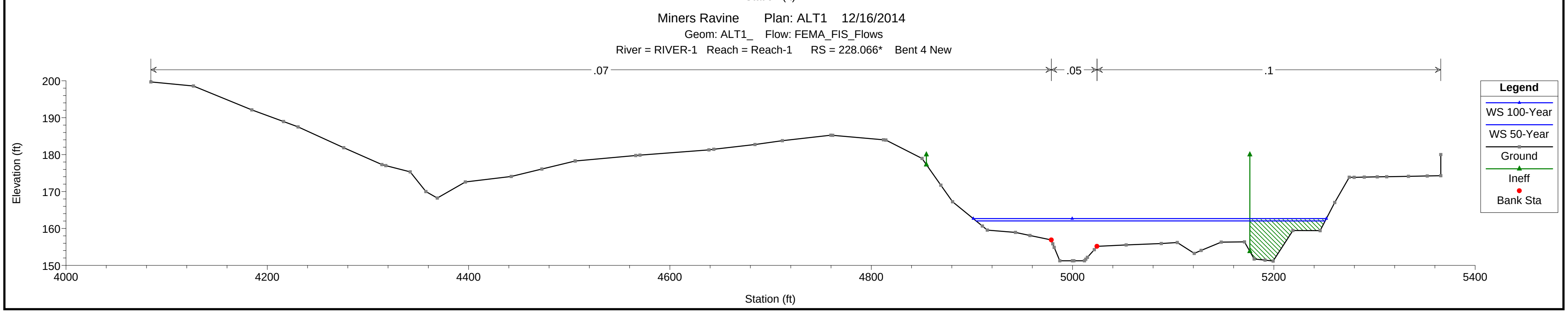
Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 234

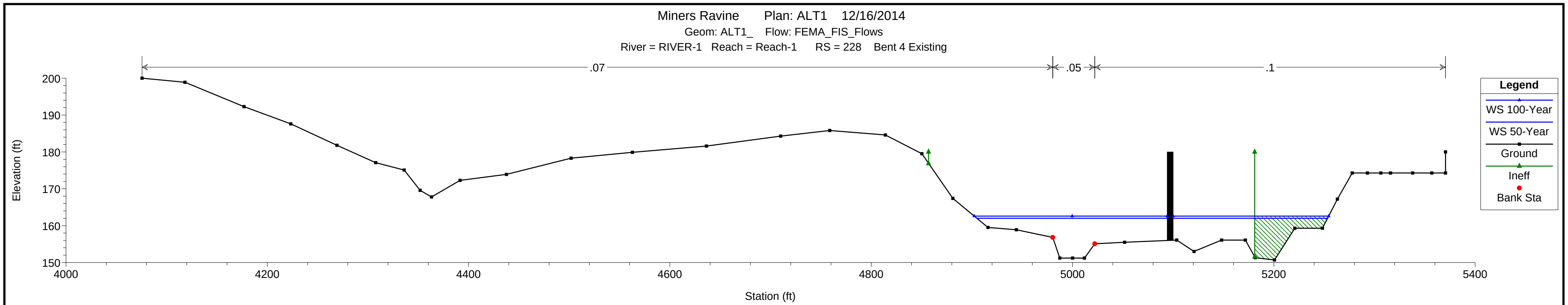


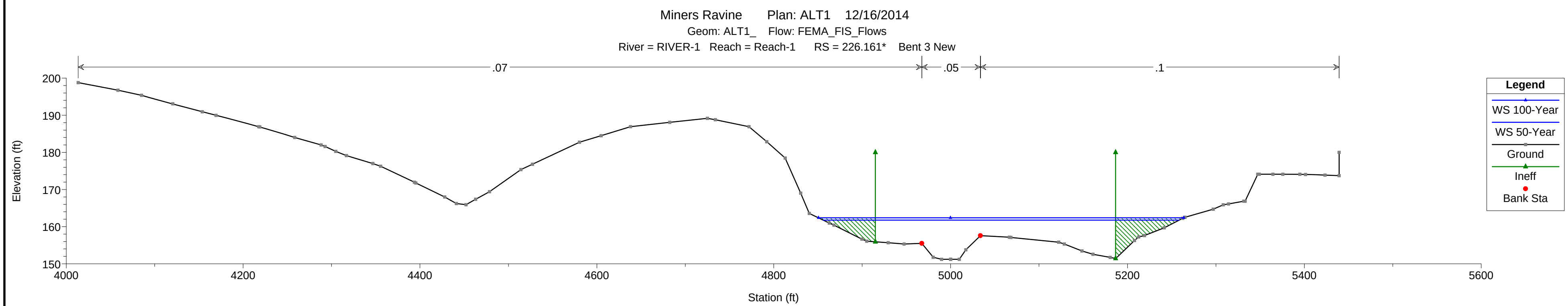

Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 232
.09
.06
.045
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

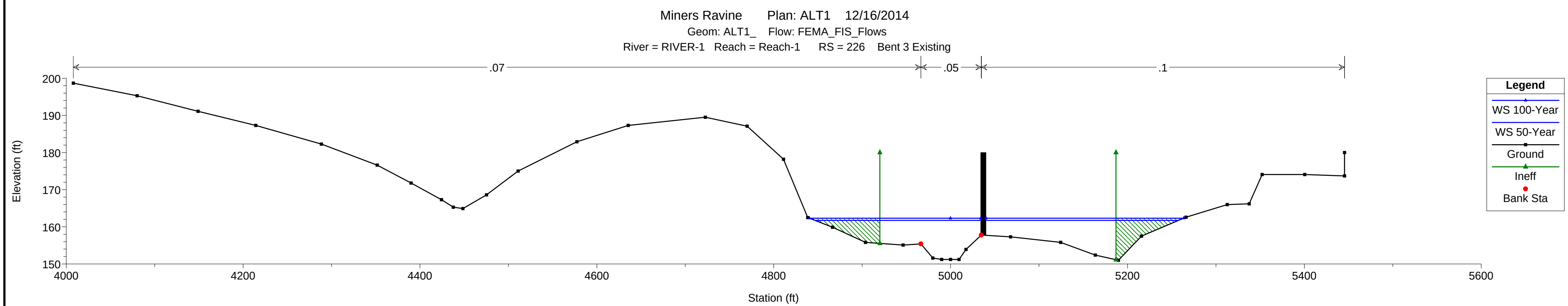

Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 230
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

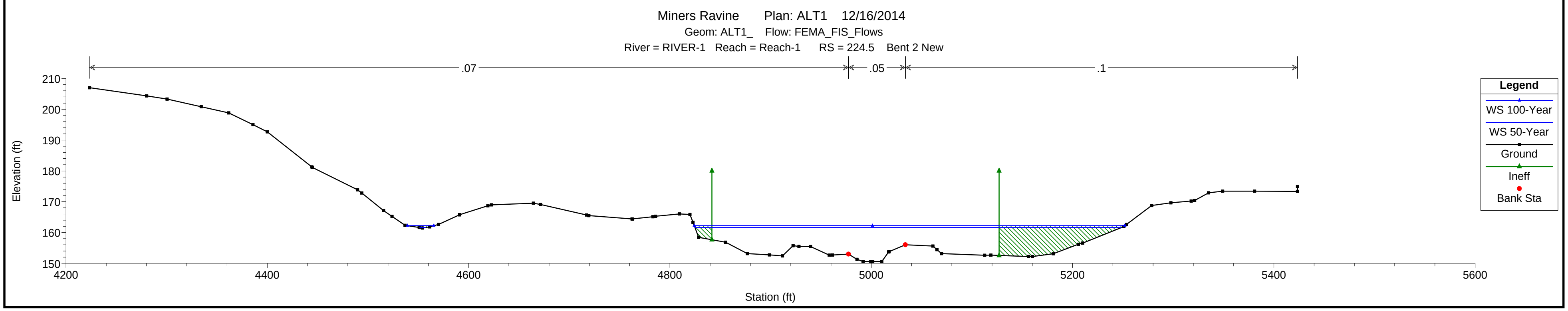

Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 229.103 Abutment 5
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

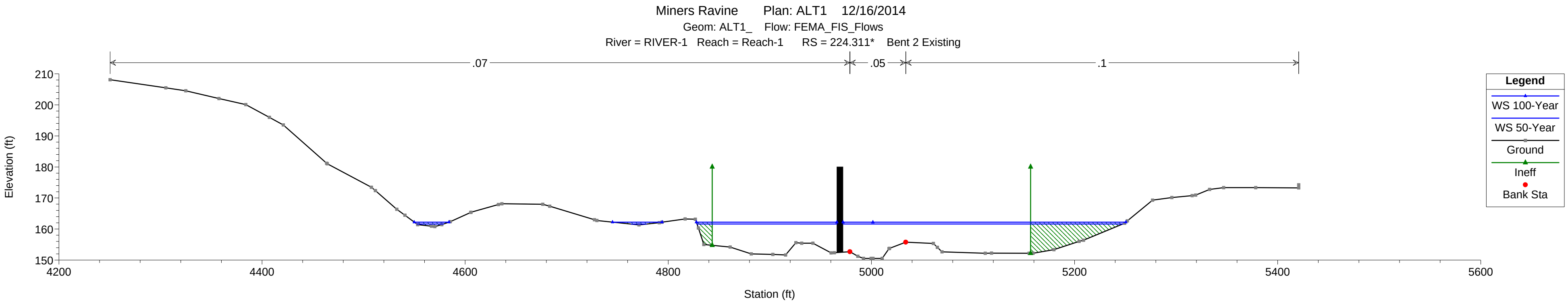

Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 228.066* Bent 4 New
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

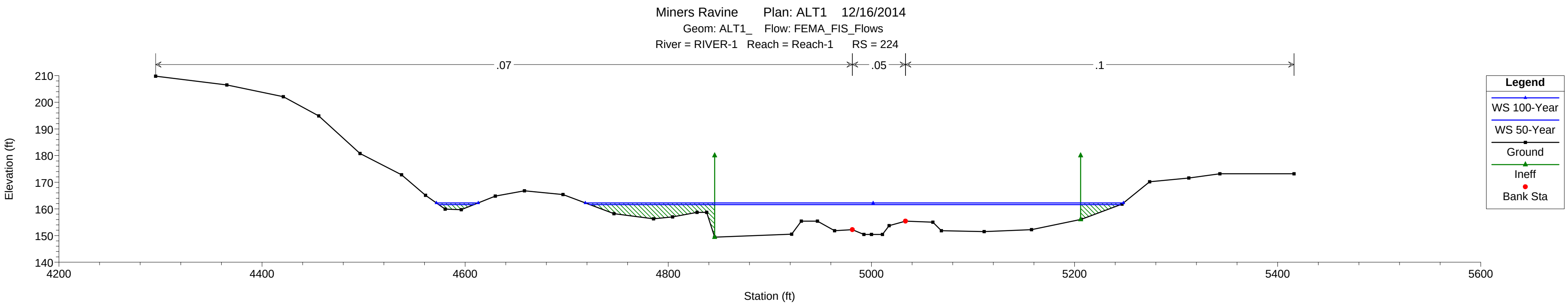

Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 228 Bent 4 Existing
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

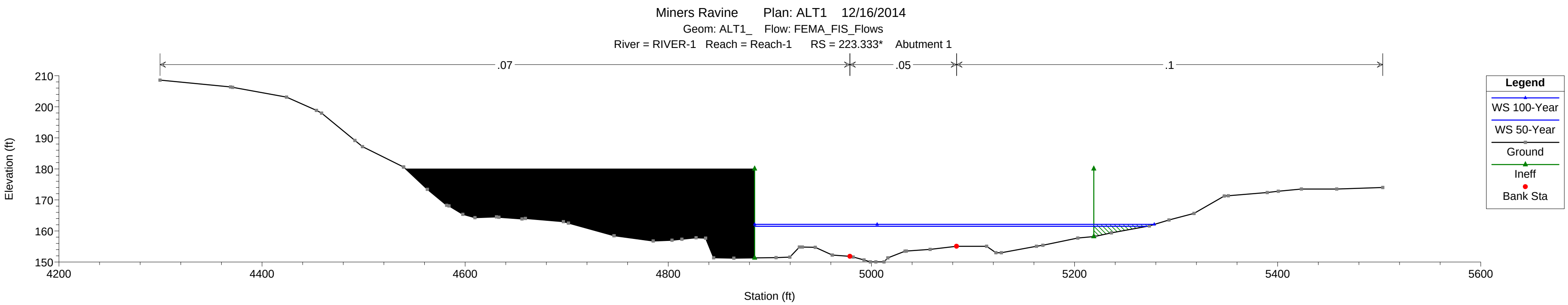

Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 226.161* Bent 3 New
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

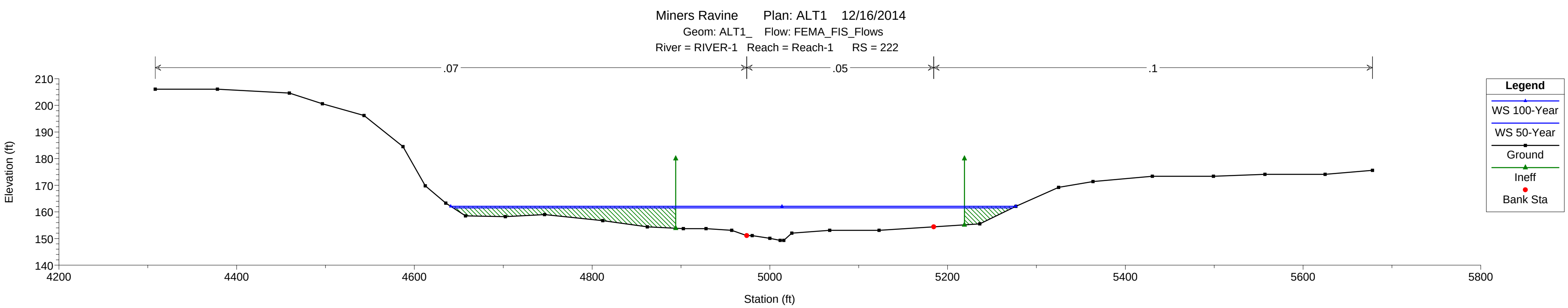

Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 226 Bent 3 Existing
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta


Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 224.5 Bent 2 New
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta


Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 224.311* Bent 2 Existing
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta


Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 224
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta


Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 223.333* Abutment 1
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta


Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 222
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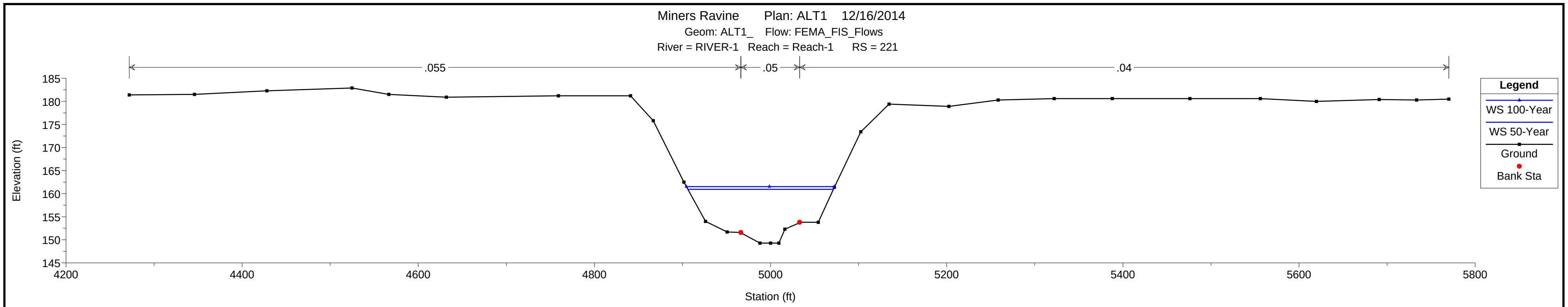
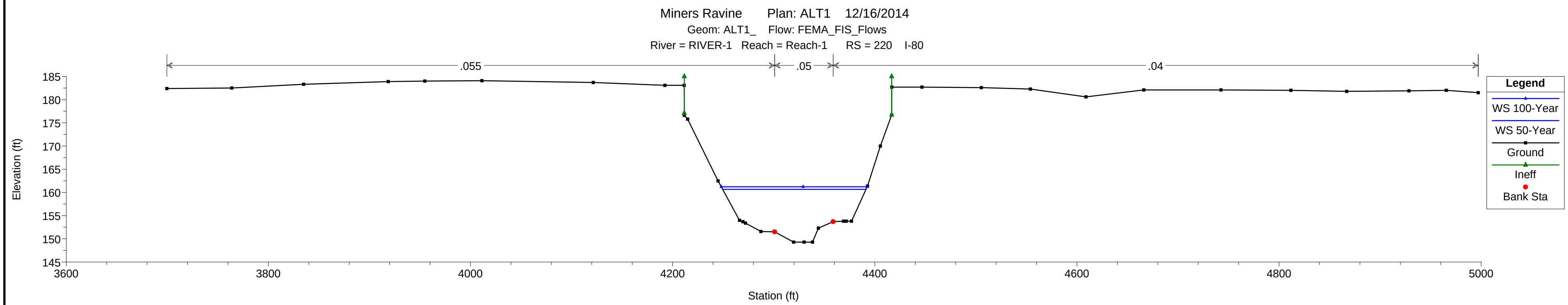
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta


Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 221
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta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Geom: ALT1_ Flow: FEMA_FIS_Flows
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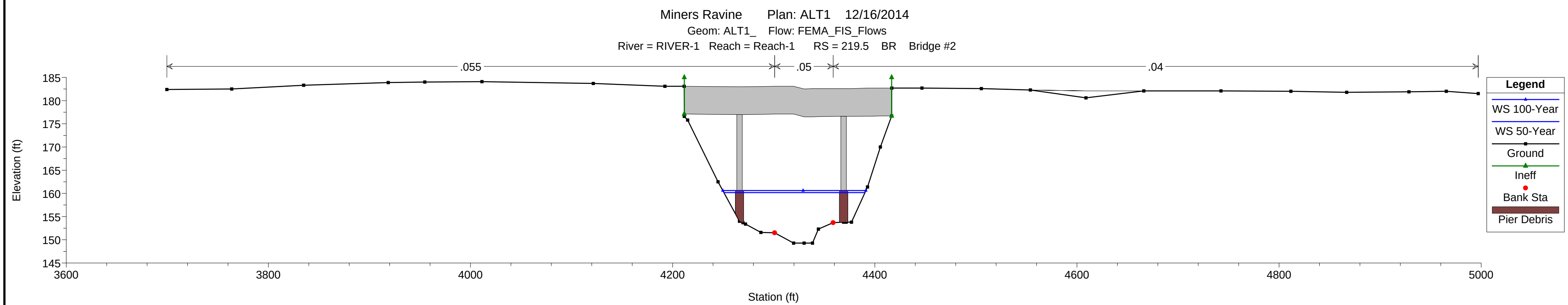
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta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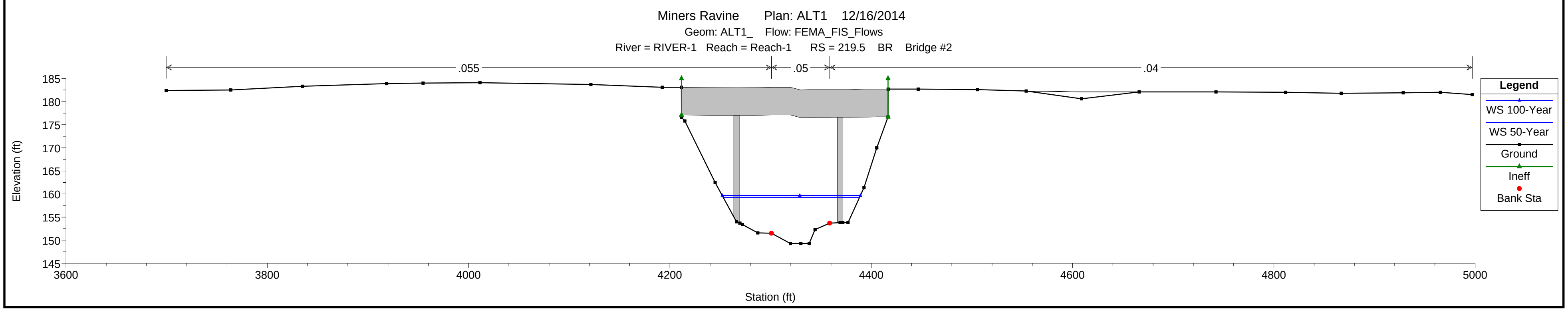
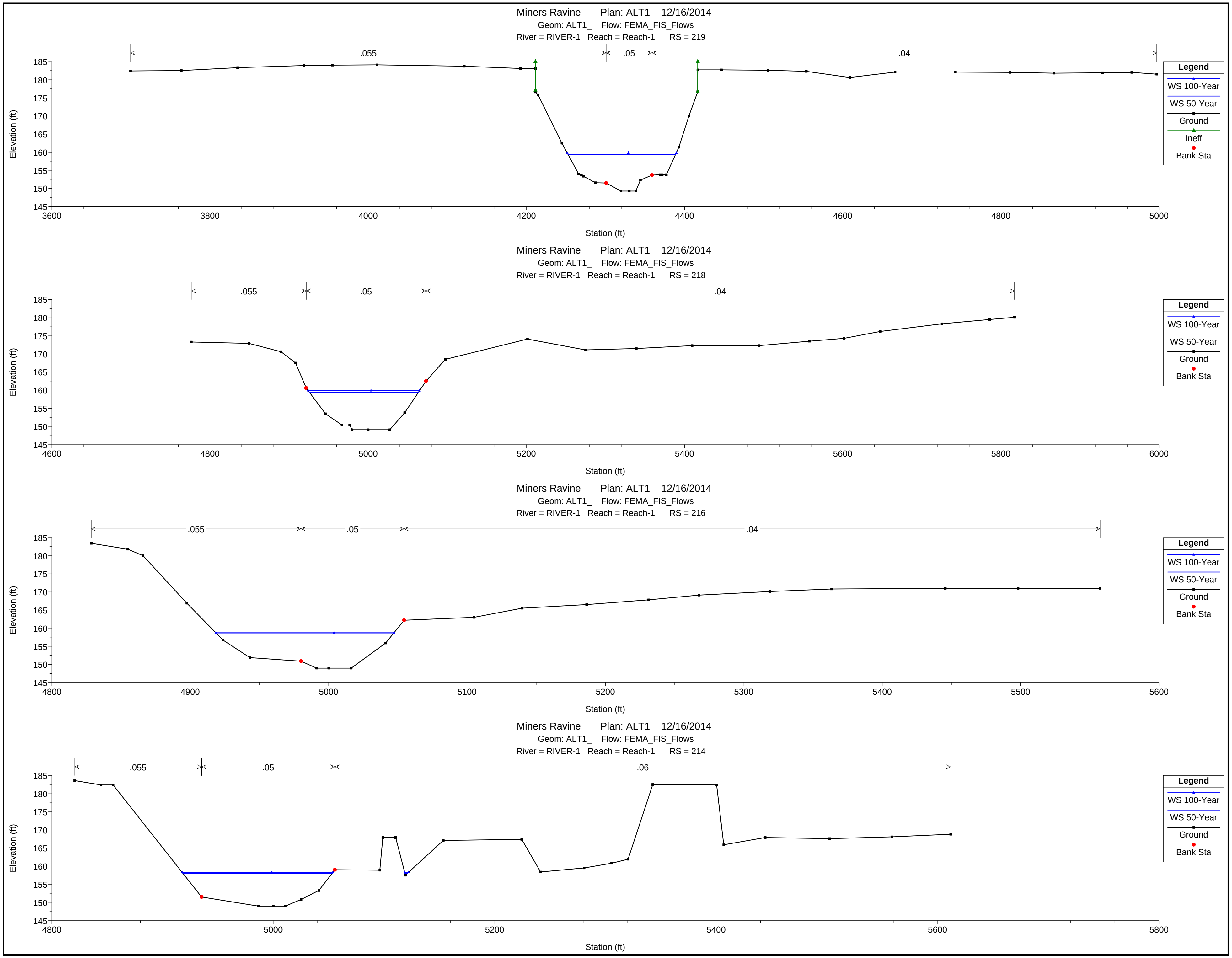
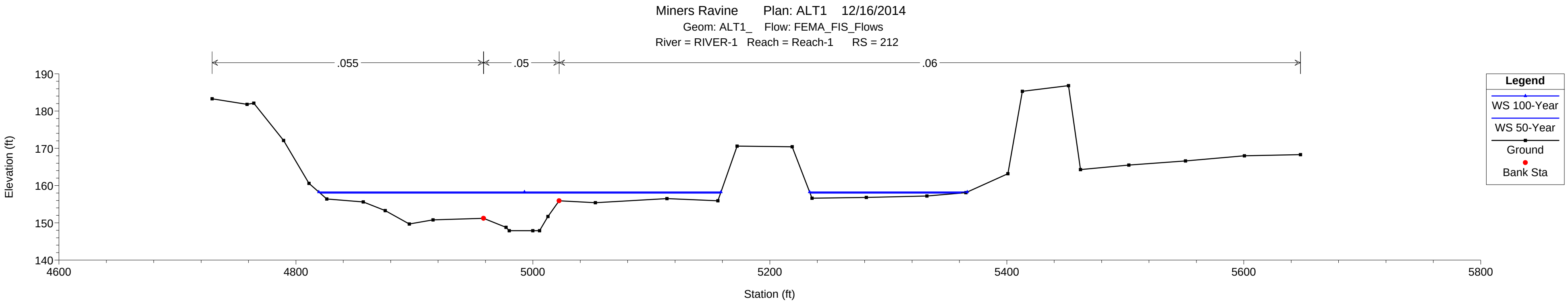
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 219.5 BR Bridge #2
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Pier Debris


Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 219.5 BR Bridge #2
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta


Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 219
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 218
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 216
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta
Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 214
.055
.05
.06
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta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Geom: ALT1_ Flow: FEMA_FIS_Flows
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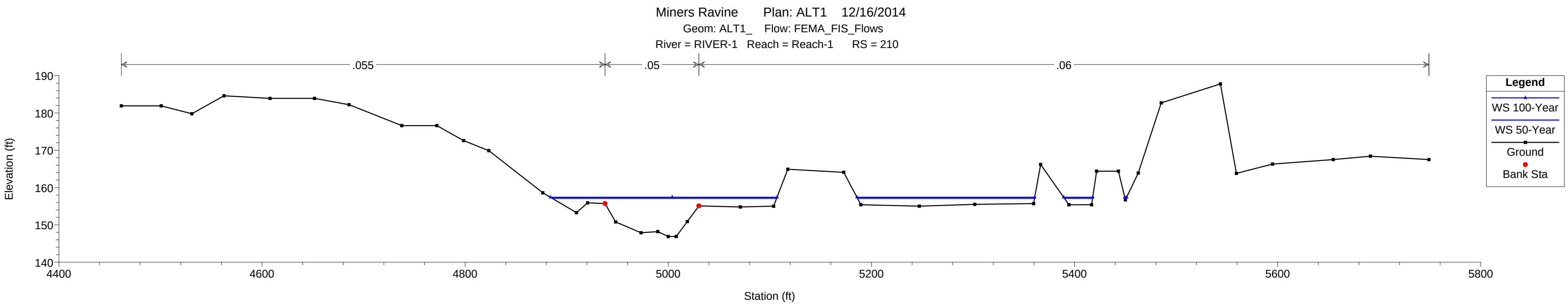
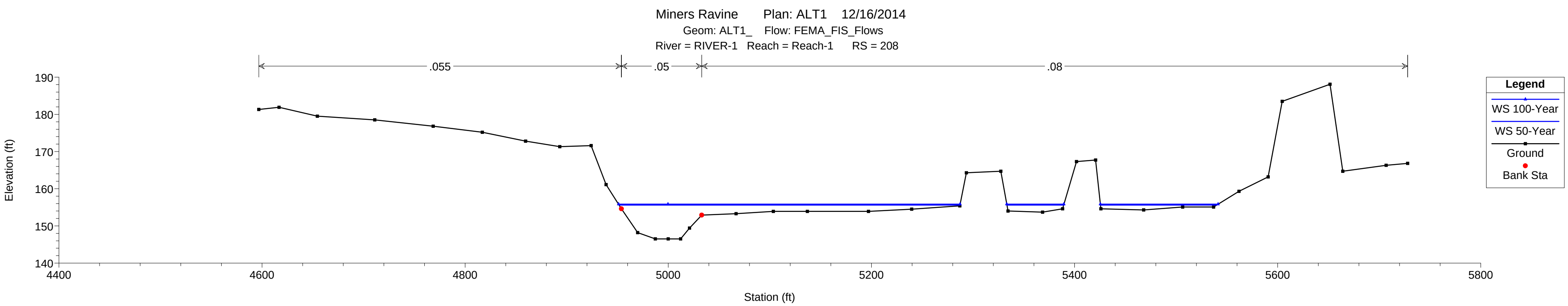
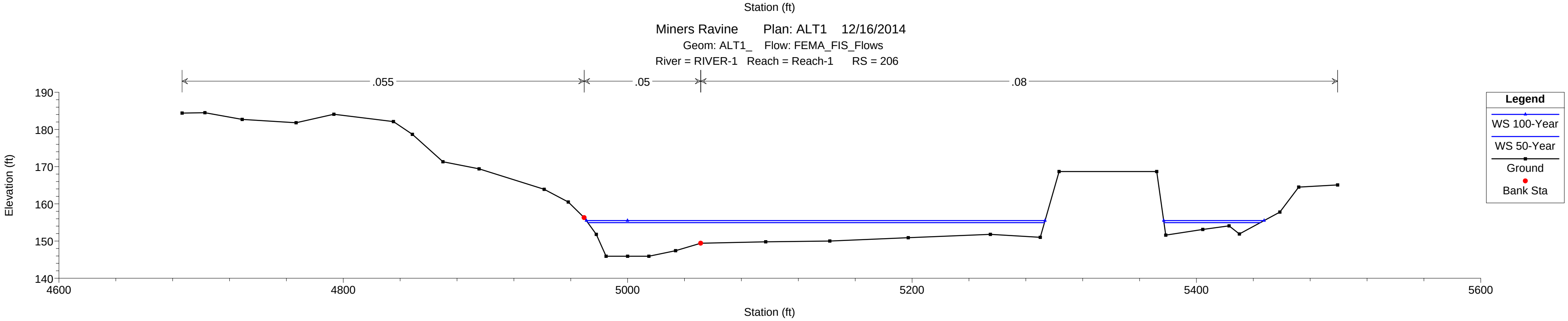
.05
.06
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 210
.055
.05
.06
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 208
.055
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 206
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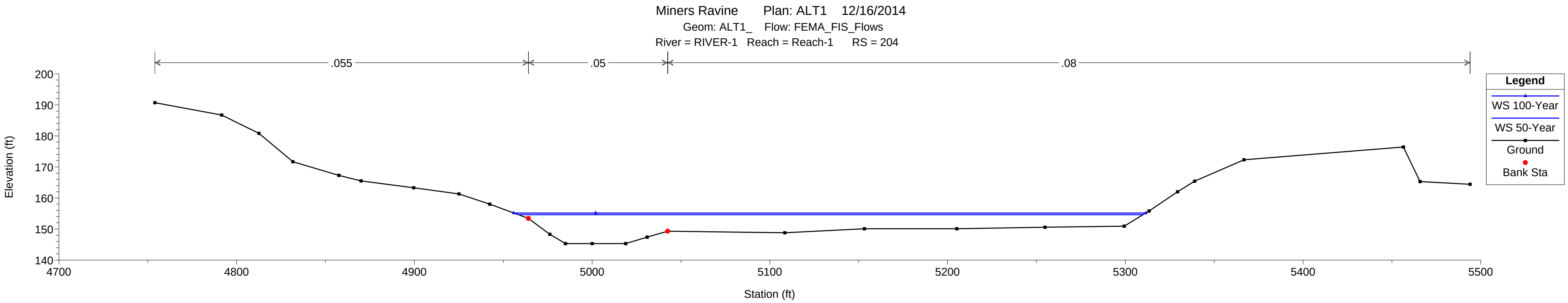
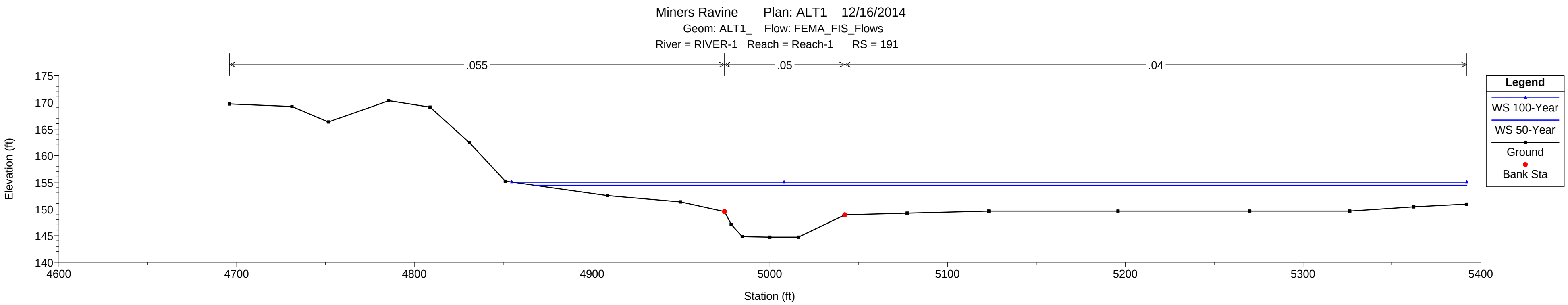
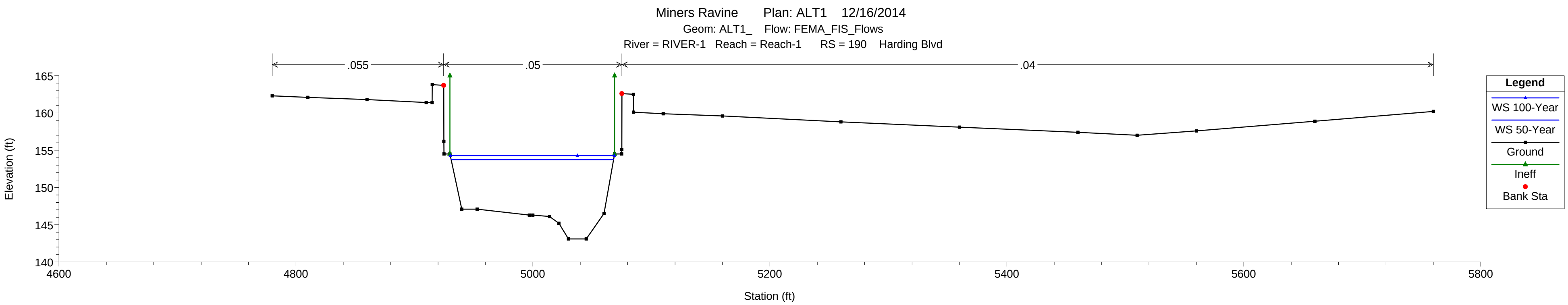
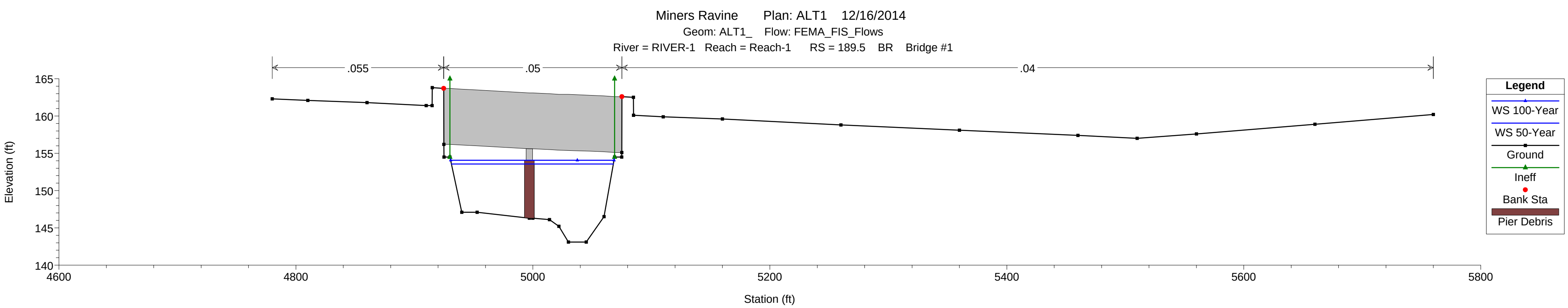
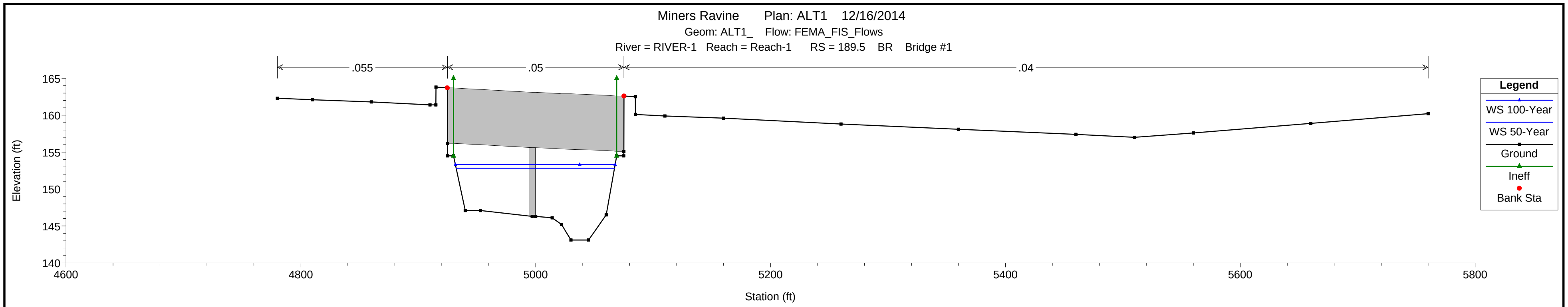
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

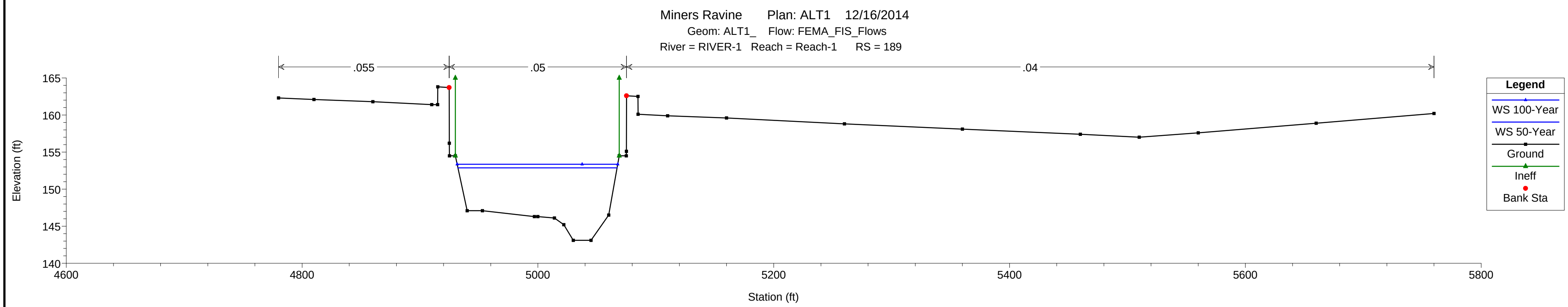

Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 204
.055
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

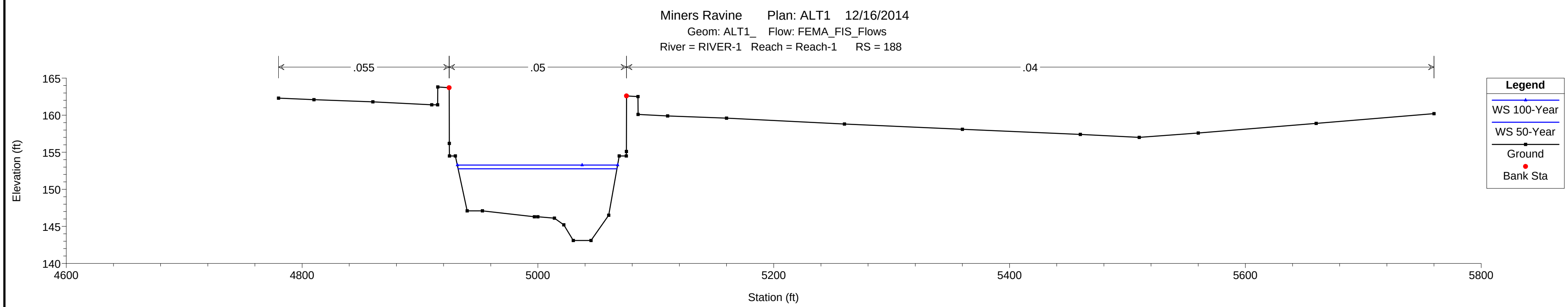

Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 191
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

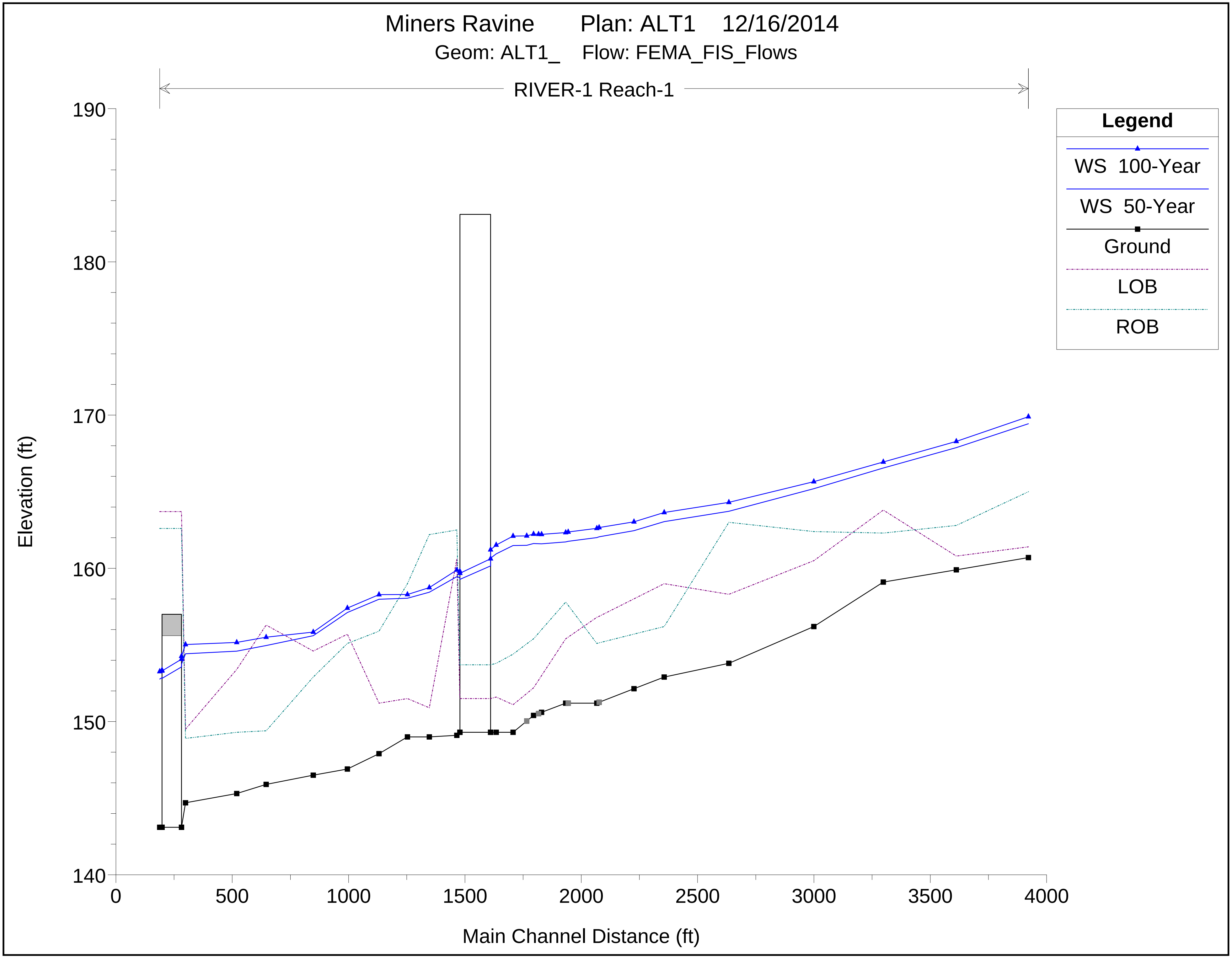

Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 190 Harding Blvd
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta


Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 189.5 BR Bridge #1
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Pier Debris


Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 189.5 BR Bridge #1
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta


Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 189
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta


Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 188
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

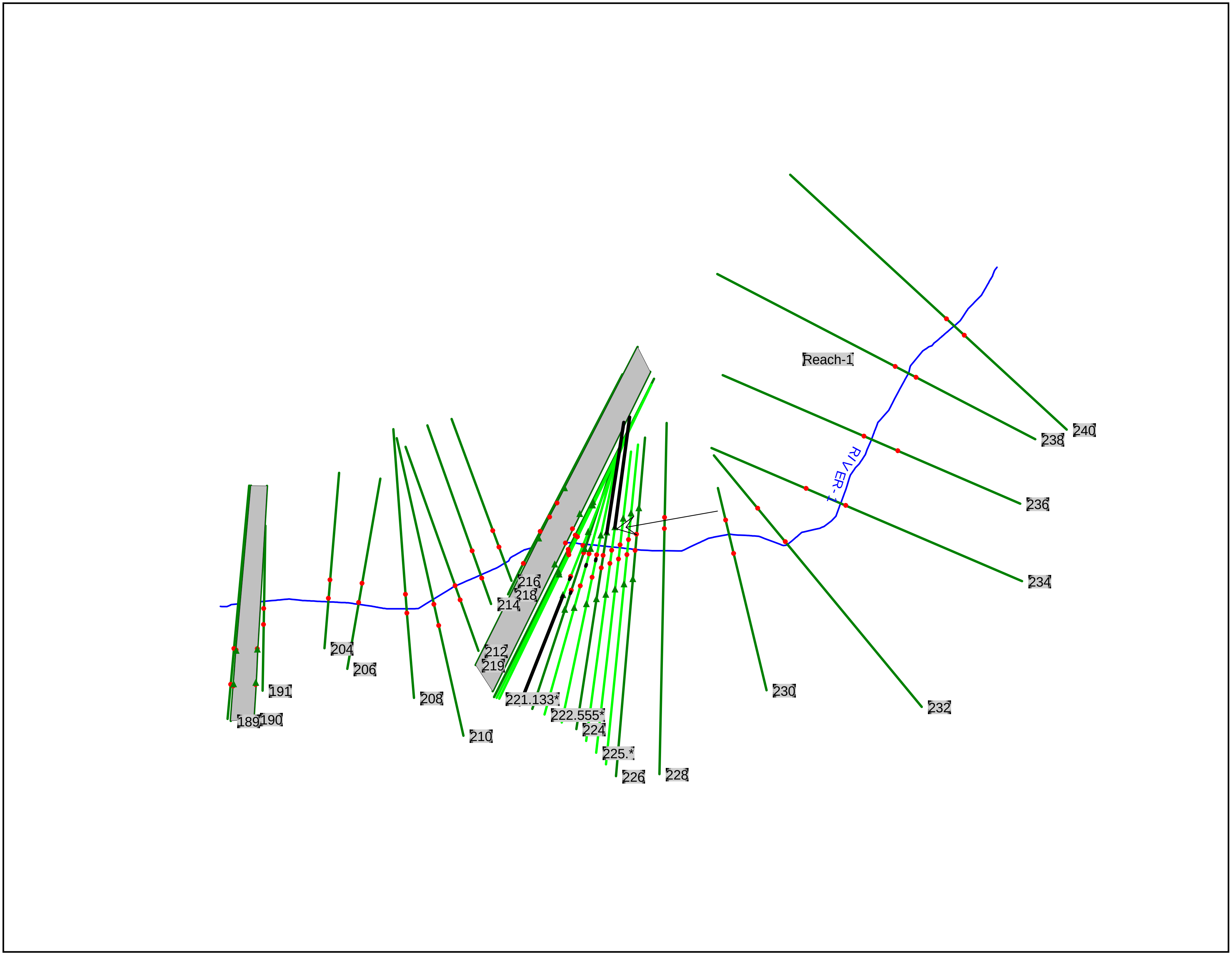

Miners Ravine Plan: ALT1 12/16/2014
Geom: ALT1_ Flow: FEMA_FIS_Flows
RIVER-1 Reach-1
Legend
WS 100-Year
WS 50-Year
Ground
LOB
ROB
Elevation (ft)
190
180
170
160
150
140
0
500
1000
1500
2000
2500
3000
3500
4000
Main Channel Distance (ft)

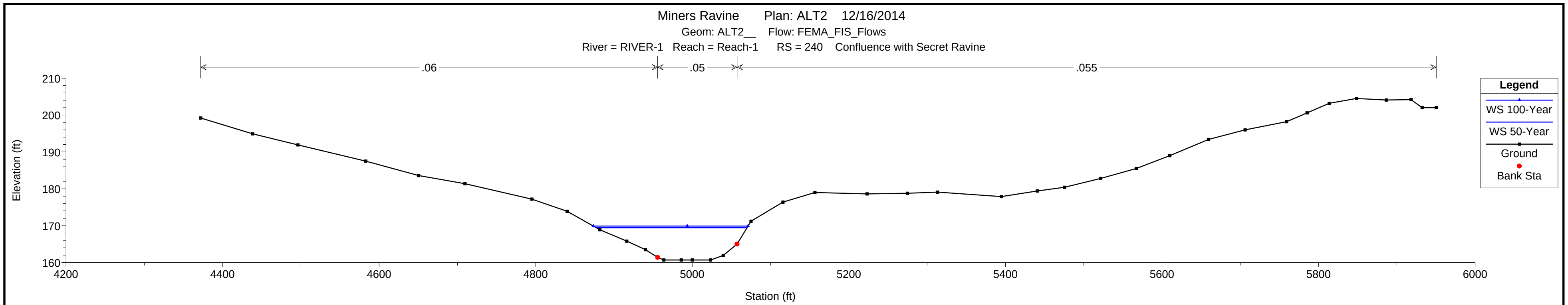
HEC-RAS Plan: ALT1 River: RIVER-1 Reach: Reach-1

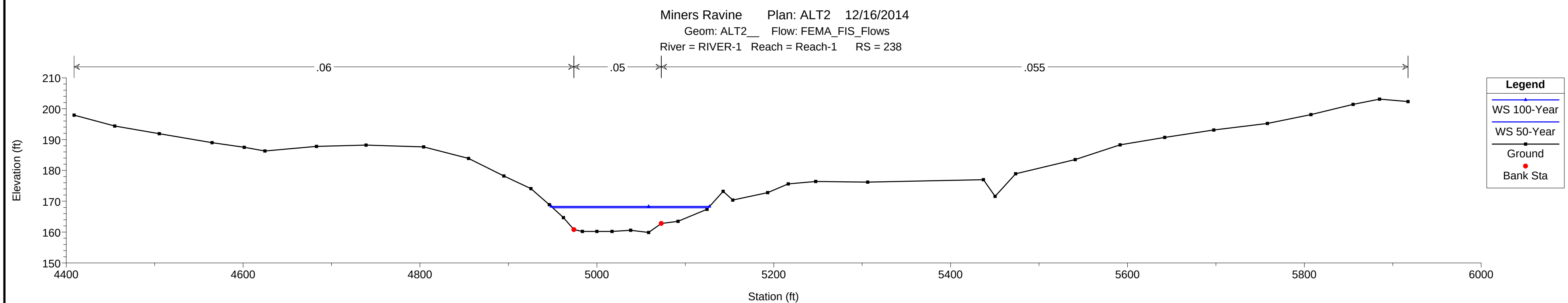
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	240	50-Year	7000.00	160.70	169.44		170.13	0.003528	7.12	1149.36	192.55	0.44
Reach-1	240	100-Year	7840.00	160.70	169.89		170.64	0.003592	7.45	1238.69	197.68	0.45
Reach-1	238	50-Year	7000.00	159.90	167.87		168.79	0.005211	8.15	983.06	175.91	0.53
Reach-1	238	100-Year	7840.00	159.90	168.28		169.28	0.005327	8.54	1055.22	178.74	0.54
Reach-1	236	50-Year	7000.00	159.10	166.55		167.23	0.004338	6.75	1098.23	209.35	0.47
Reach-1	236	100-Year	7840.00	159.10	166.94		167.69	0.004413	7.08	1181.61	223.85	0.48
Reach-1	234	50-Year	7000.00	156.20	165.20		165.70	0.005618	6.11	1356.10	320.36	0.44
Reach-1	234	100-Year	7840.00	156.20	165.66		166.17	0.005273	6.21	1507.02	338.50	0.43
Reach-1	232	50-Year	7000.00	153.80	163.72		163.99	0.003351	4.64	1782.78	326.25	0.34
Reach-1	232	100-Year	7840.00	153.80	164.31		164.58	0.003074	4.73	1980.10	351.89	0.33
Reach-1	230	50-Year	7000.00	152.90	163.04		163.38	0.001452	4.86	1760.62	310.08	0.29
Reach-1	230	100-Year	7840.00	152.90	163.64		164.00	0.001427	5.03	1951.56	329.84	0.29
Reach-1	229.103	50-Year	7000.00	152.14	162.46	158.75	163.05	0.002720	6.64	1351.01	209.04	0.39
Reach-1	229.103	100-Year	7840.00	152.14	163.04	159.14	163.67	0.002695	6.89	1472.54	213.14	0.39
Reach-1	228.066*	50-Year	7000.00	151.26	162.06	159.21	162.56	0.003343	7.59	1682.17	346.90	0.43
Reach-1	228.066*	100-Year	7840.00	151.26	162.66	159.65	163.17	0.003193	7.72	1847.15	350.77	0.42
Reach-1	228	50-Year	7000.00	151.20	162.00	159.10	162.52	0.003580	7.84	1686.63	342.46	0.44
Reach-1	228	100-Year	7840.00	151.20	162.61	159.57	163.13	0.003442	8.00	1849.71	346.25	0.44
Reach-1	226.161*	50-Year	7000.00	151.20	161.76	158.28	162.10	0.002284	5.96	1891.06	402.54	0.35
Reach-1	226.161*	100-Year	7840.00	151.20	162.37	158.52	162.72	0.002196	6.11	2057.16	413.00	0.35
Reach-1	226	50-Year	7000.00	151.20	161.72	158.24	162.07	0.002496	5.99	1831.20	404.73	0.36
Reach-1	226	100-Year	7840.00	151.20	162.33	158.50	162.70	0.002421	6.13	1990.92	417.36	0.35
Reach-1	224.5	50-Year	7000.00	150.60	161.60	156.78	161.80	0.001354	4.77	2249.29	428.94	0.28
Reach-1	224.5	100-Year	7840.00	150.60	162.21	156.97	162.43	0.001328	4.93	2425.33	453.92	0.28
Reach-1	224.311*	50-Year	7000.00	150.52	161.61	156.03	161.75	0.001040	4.21	2625.21	454.26	0.24
Reach-1	224.311*	100-Year	7840.00	150.52	162.22	156.23	162.38	0.001039	4.39	2815.26	500.19	0.24
Reach-1	224	50-Year	7000.00	150.40	161.62	154.46	161.70	0.000573	3.16	3347.33	557.62	0.18
Reach-1	224	100-Year	7840.00	150.40	162.24	154.71	162.33	0.000581	3.32	3570.66	571.01	0.18
Reach-1	223.333*	50-Year	7000.00	150.03	161.50	156.07	161.66	0.000928	3.87	2591.25	386.34	0.23
Reach-1	223.333*	100-Year	7840.00	150.03	162.12	156.30	162.29	0.000917	4.02	2796.95	393.51	0.23
Reach-1	222	50-Year	7000.00	149.30	161.48	155.46	161.60	0.000507	2.88	2776.91	629.38	0.17
Reach-1	222	100-Year	7840.00	149.30	162.10	155.67	162.22	0.000507	3.01	2977.40	636.04	0.17
Reach-1	221	50-Year	7000.00	149.30	160.94		161.42	0.001959	6.13	1306.26	165.21	0.34
Reach-1	221	100-Year	7840.00	149.30	161.52		162.04	0.001989	6.41	1402.02	168.26	0.34
Reach-1	220	50-Year	7000.00	149.30	160.66	156.92	161.34	0.002913	7.33	1093.23	141.79	0.41
Reach-1	220	100-Year	7840.00	149.30	161.21	157.30	161.96	0.002967	7.67	1172.13	144.31	0.42
Reach-1	219.5		Bridge									
Reach-1	219	50-Year	7000.00	149.30	159.38	156.92	160.36	0.004960	8.72	915.73	135.93	0.52
Reach-1	219	100-Year	7840.00	149.30	159.81	157.30	160.89	0.005174	9.19	973.63	137.87	0.54
Reach-1	218	50-Year	7000.00	149.10	159.46		160.17	0.003693	6.80	1029.61	138.16	0.44
Reach-1	218	100-Year	7840.00	149.10	159.89		160.69	0.003942	7.20	1089.61	140.96	0.46
Reach-1	216	50-Year	7000.00	149.00	158.44		159.59	0.007109	9.30	831.98	127.38	0.61
Reach-1	216	100-Year	7840.00	149.00	158.74		160.06	0.007809	9.94	870.33	128.79	0.64
Reach-1	214	50-Year	7000.00	149.00	158.05		158.99	0.005019	7.86	917.72	137.43	0.51
Reach-1	214	100-Year	7840.00	149.00	158.29		159.39	0.005670	8.51	951.22	139.73	0.55
Reach-1	212	50-Year	7000.00	147.90	157.98		158.38	0.002691	6.21	1641.13	465.09	0.38
Reach-1	212	100-Year	7840.00	147.90	158.28		158.71	0.002782	6.46	1783.41	472.57	0.39
Reach-1	210	50-Year	7000.00	146.90	157.12	156.26	157.86	0.004762	7.75	1307.35	424.26	0.50
Reach-1	210	100-Year	7840.00	146.90	157.41	156.55	158.18	0.004854	8.02	1430.22	428.88	0.50

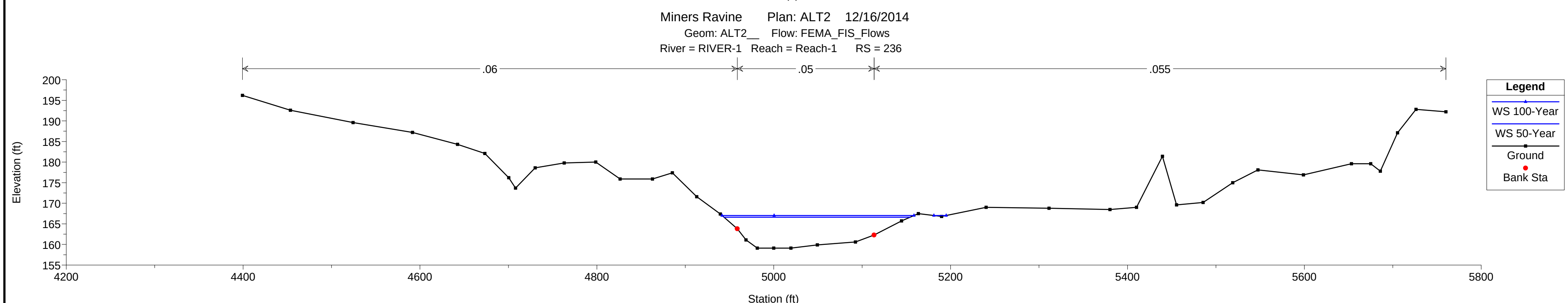
HEC-RAS Plan: ALT1   River: RIVER-1   Reach: Reach-1 (Continued)

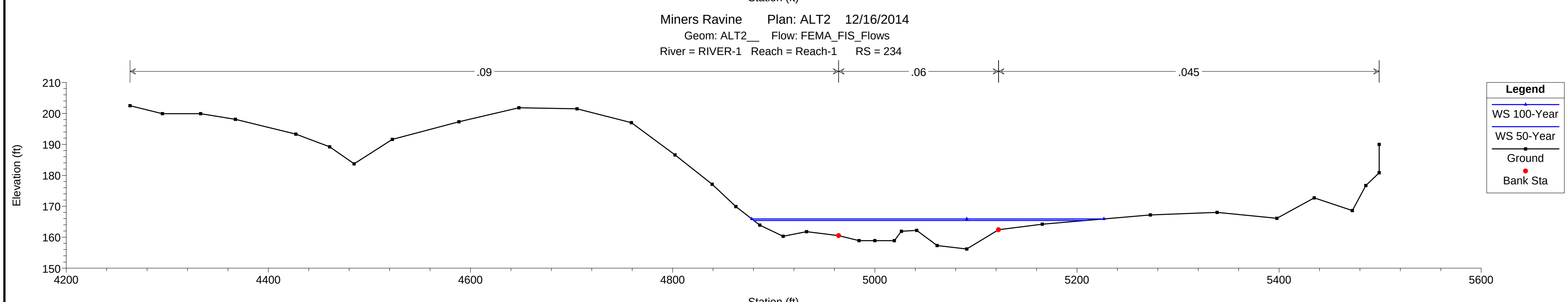
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	208	50-Year	7000.00	146.50	155.60	155.60	156.90	0.008934	10.14	1154.83	505.79	0.67
Reach-1	208	100-Year	7840.00	146.50	155.84	155.84	157.20	0.009242	10.54	1275.91	508.45	0.69
Reach-1	206	50-Year	7000.00	145.90	154.96		155.35	0.003266	6.35	1789.47	389.03	0.41
Reach-1	206	100-Year	7840.00	145.90	155.50		155.88	0.003009	6.32	2001.70	393.28	0.40
Reach-1	204	50-Year	7000.00	145.30	154.60		154.95	0.002832	6.05	1835.25	351.43	0.39
Reach-1	204	100-Year	7840.00	145.30	155.16		155.51	0.002611	6.09	2035.17	355.73	0.37
Reach-1	191	50-Year	7000.00	144.70	154.43		154.56	0.000738	3.34	2496.18	524.61	0.20
Reach-1	191	100-Year	7840.00	144.70	155.03		155.16	0.000645	3.26	2815.27	537.41	0.19
Reach-1	190	50-Year	7000.00	143.10	153.74	150.46	154.48	0.003892	6.87	1018.71	137.12	0.44
Reach-1	190	100-Year	7840.00	143.10	154.27	150.81	155.07	0.003944	7.18	1091.18	138.43	0.45
Reach-1	189.5		Bridge									
Reach-1	189	50-Year	7000.00	143.10	152.87	150.46	153.81	0.005740	7.78	899.52	134.95	0.53
Reach-1	189	100-Year	7840.00	143.10	153.36	150.81	154.38	0.005761	8.12	966.04	136.17	0.54
Reach-1	188	50-Year	7000.00	143.10	152.77	150.42	153.74	0.006001	7.89	886.84	134.72	0.54
Reach-1	188	100-Year	7840.00	143.10	153.26	150.78	154.31	0.006009	8.23	953.08	135.93	0.55

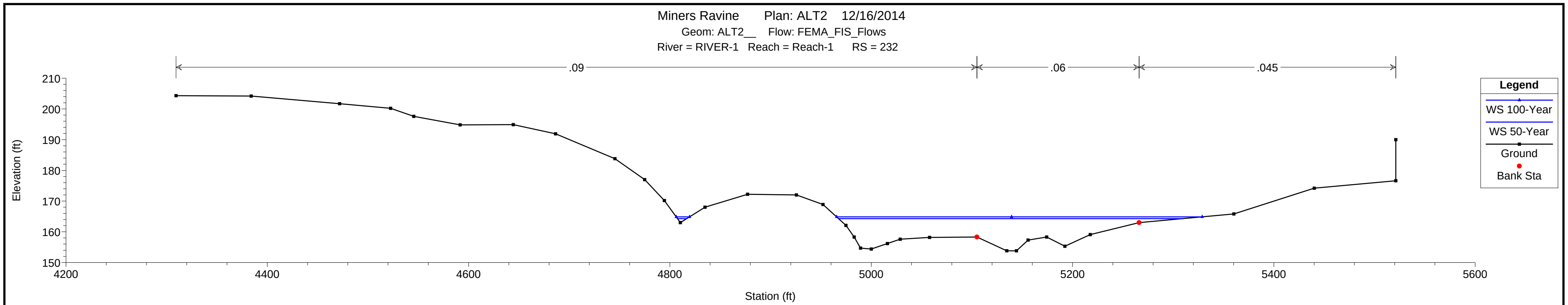

Reach-1
RIVER-1
189
190
191
204
206
208
210
212
214
216
218
219
221.133*
222.555*
224
225.*
226
228
230
232
234
236
238
240

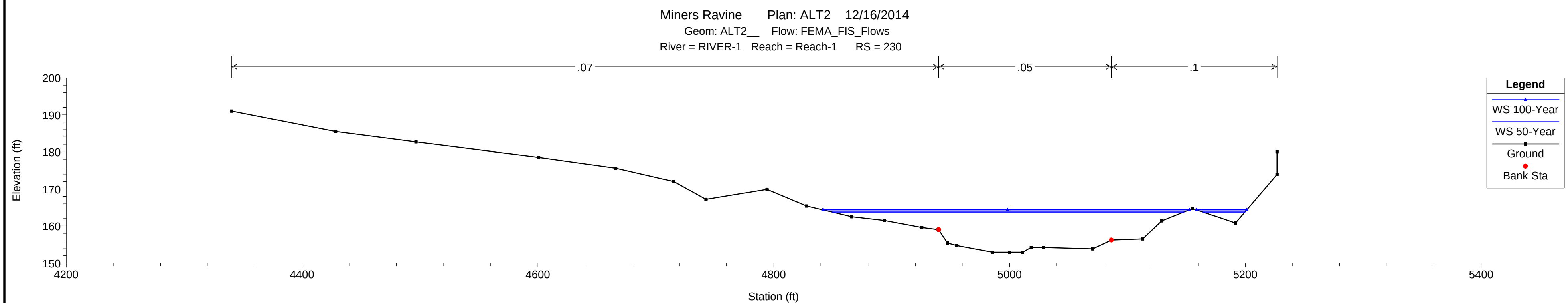

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 240 Confluence with Secret Ravine
.06
.05
.055
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

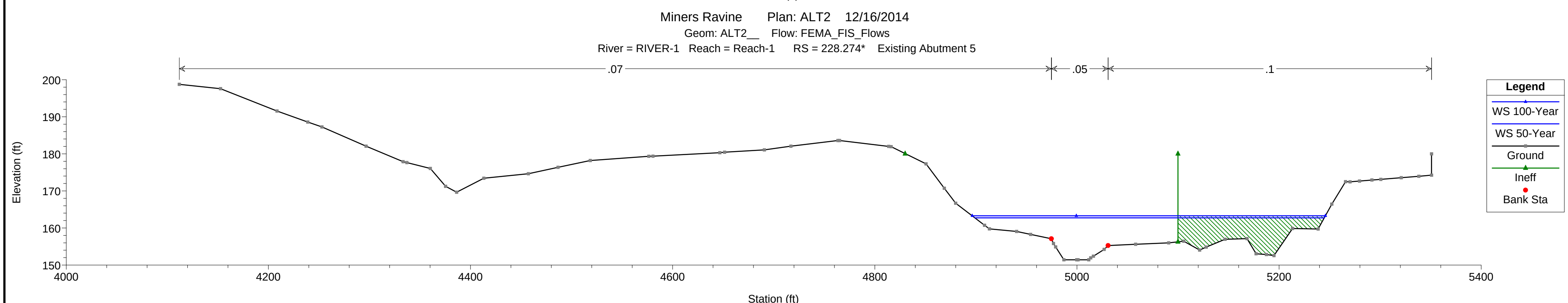

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 238
.06
.05
.055
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

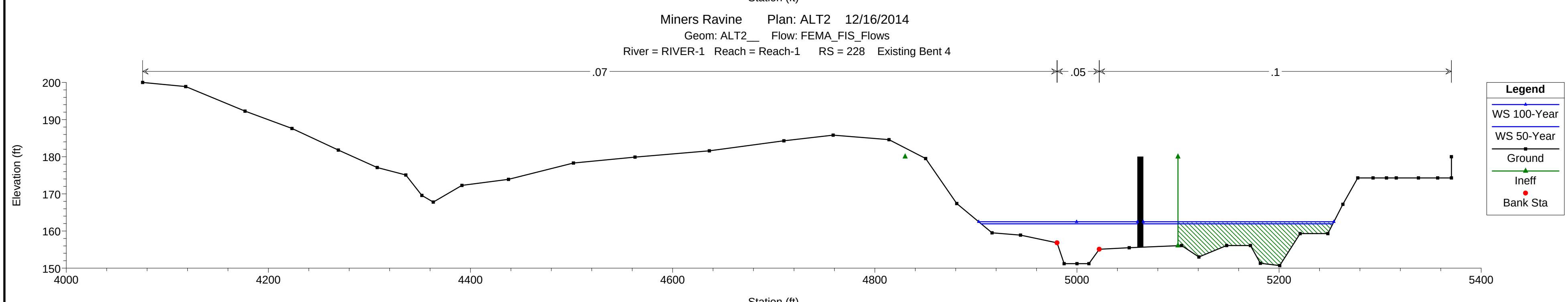

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 236
.06
.05
.055
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

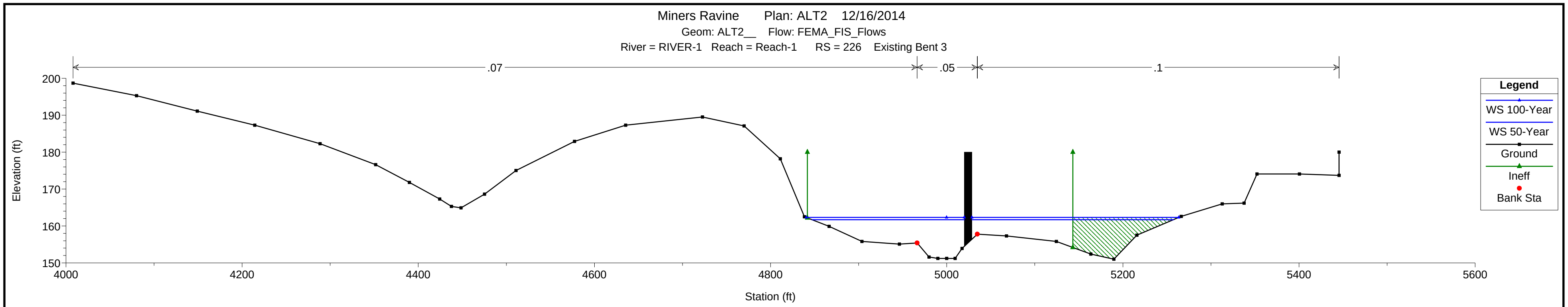

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 234
.09
.06
.045
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

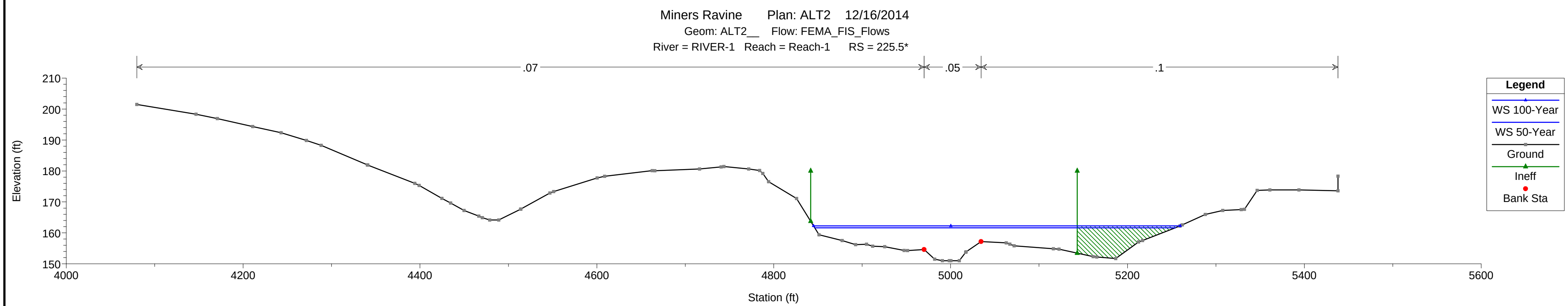

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 232
.09
.06
.045
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

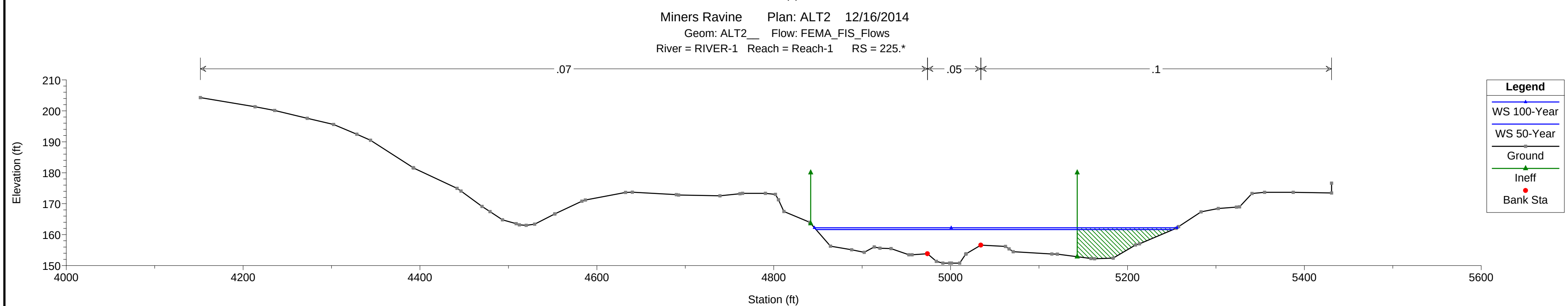

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 230
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

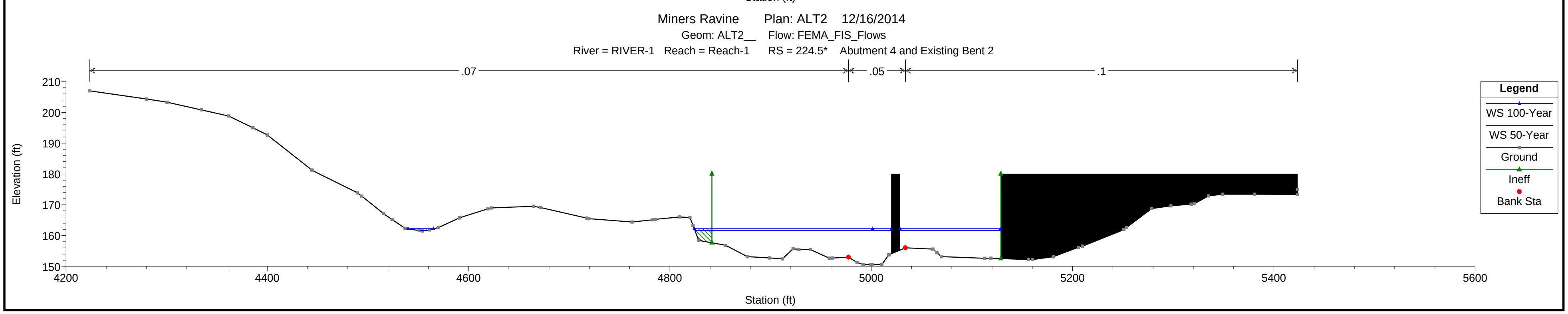

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 228.274* Existing Abutment 5
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

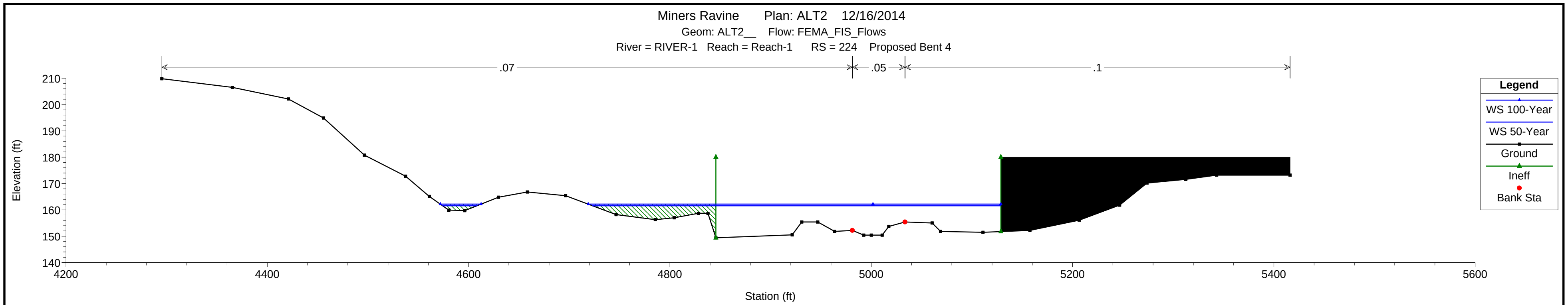

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 228 Existing Bent 4
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

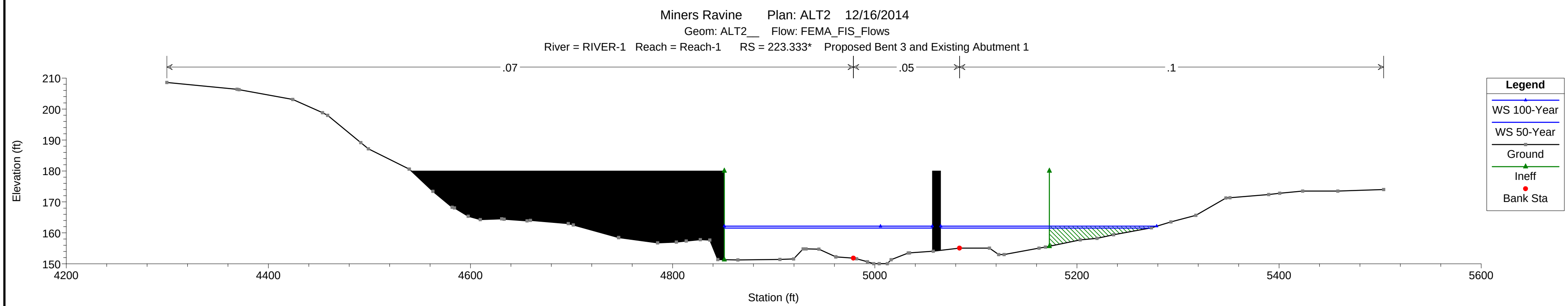

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 226 Existing Bent 3
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

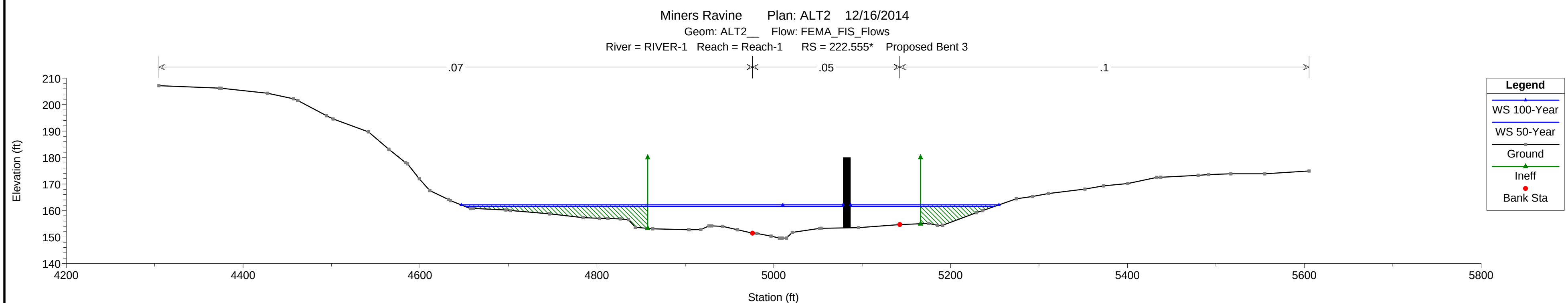

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 225.5*
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

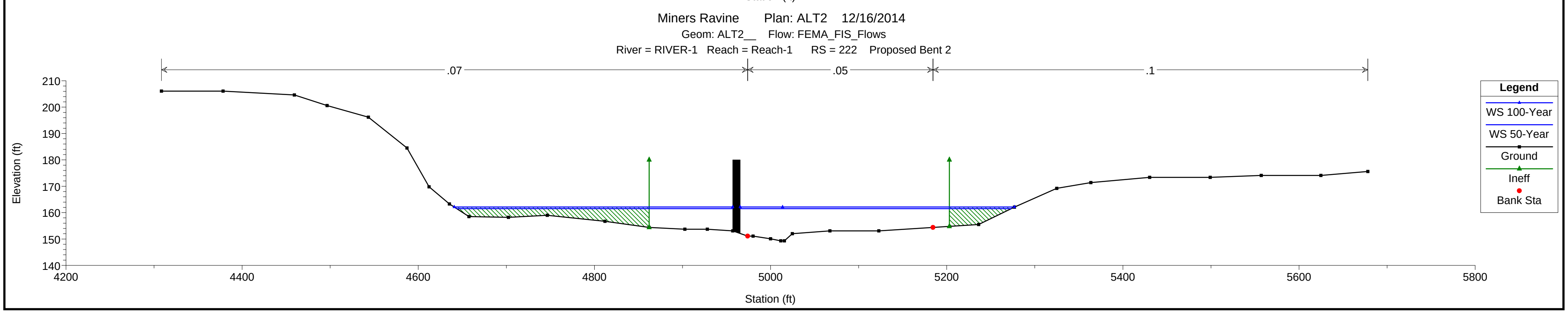

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 225.*
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

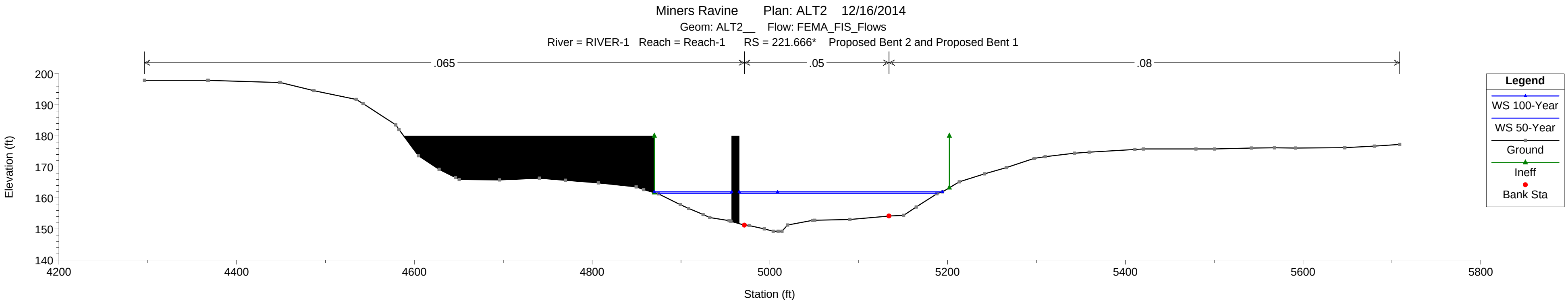

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 224.5* Abutment 4 and Existing Bent 2
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

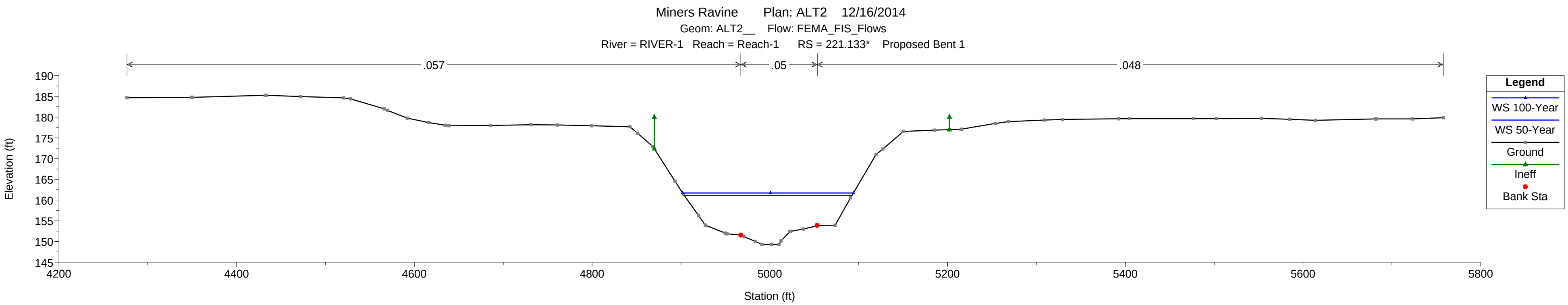

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 224 Proposed Bent 4
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

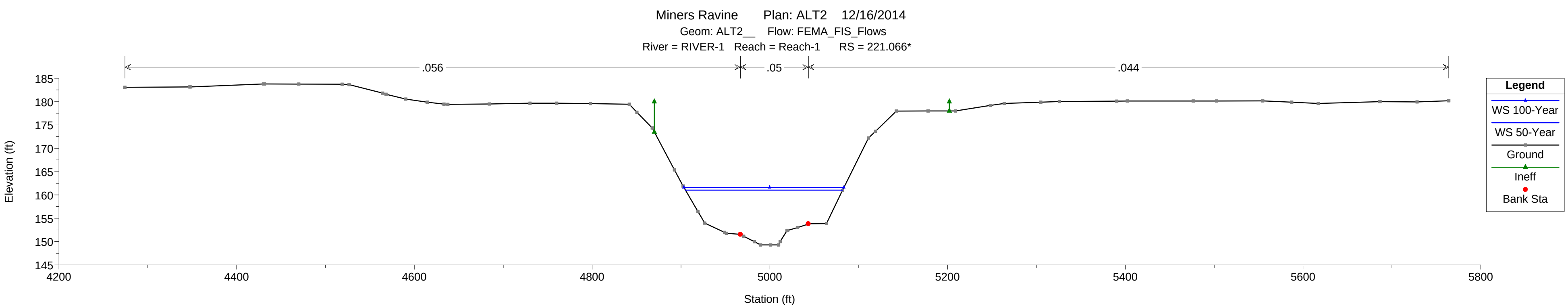

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 223.333* Proposed Bent 3 and Existing Abutment 1
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

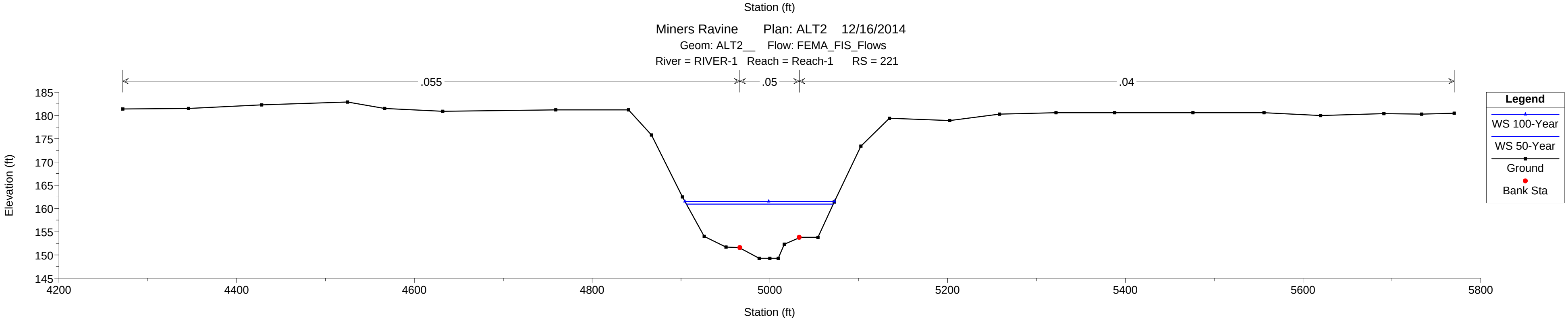

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 222.555* Proposed Bent 3
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

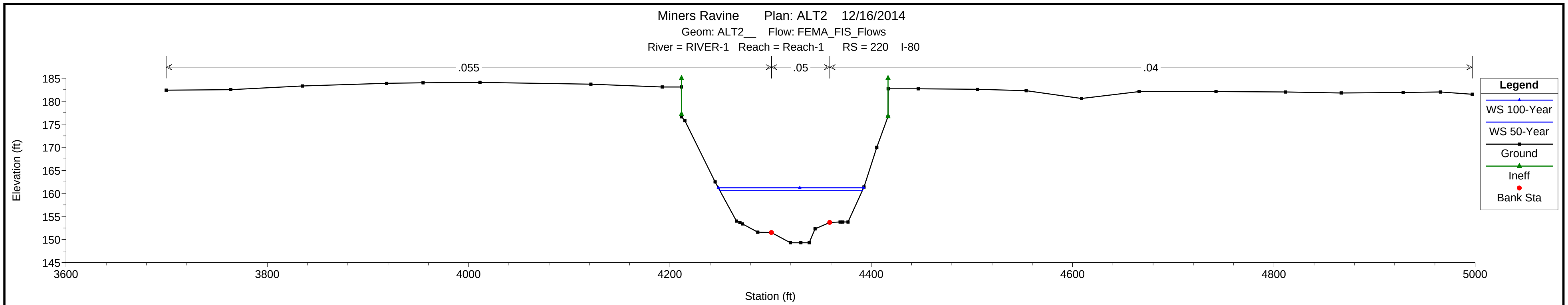

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 222 Proposed Bent 2
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

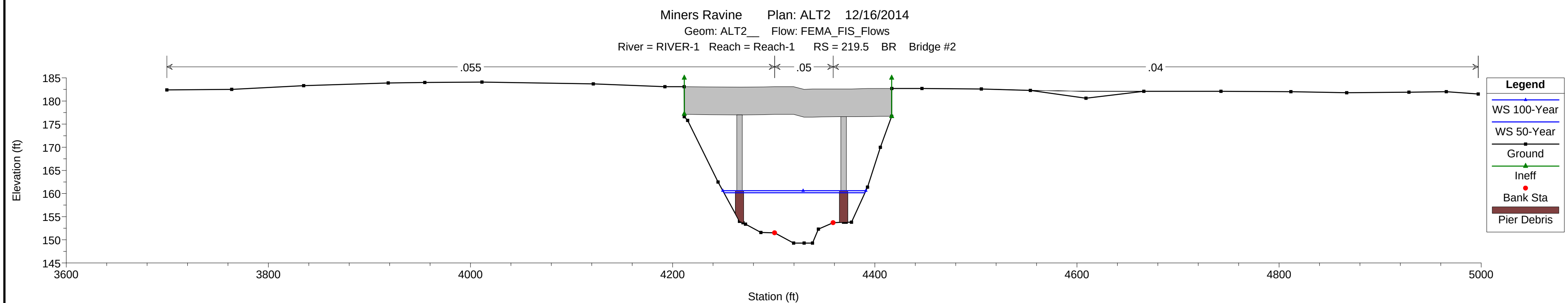

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 221.666* Proposed Bent 2 and Proposed Bent 1
.065
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

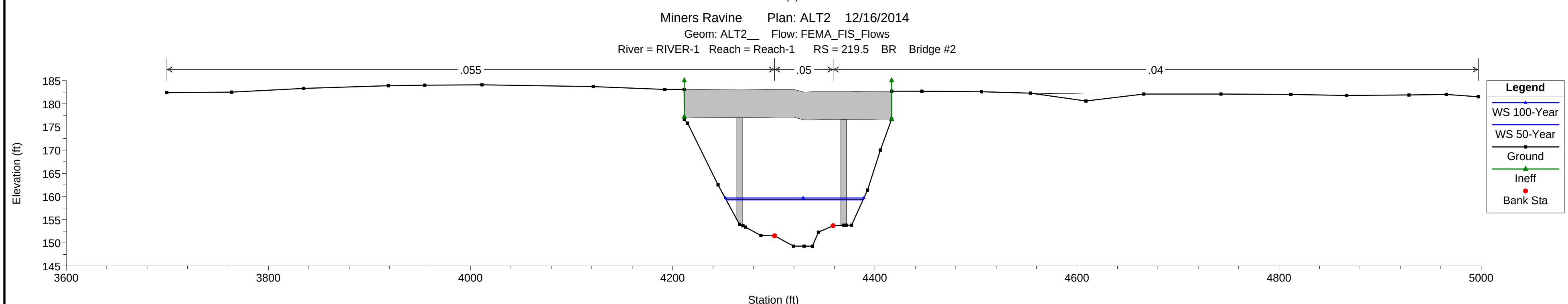

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 221.133* Proposed Bent 1
.057
.05
.048
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

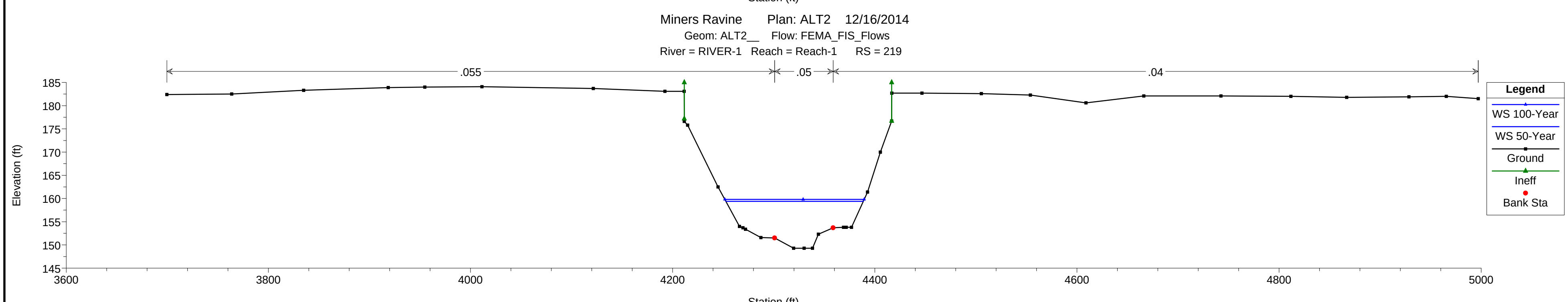

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 221.066*
.056
.05
.044
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

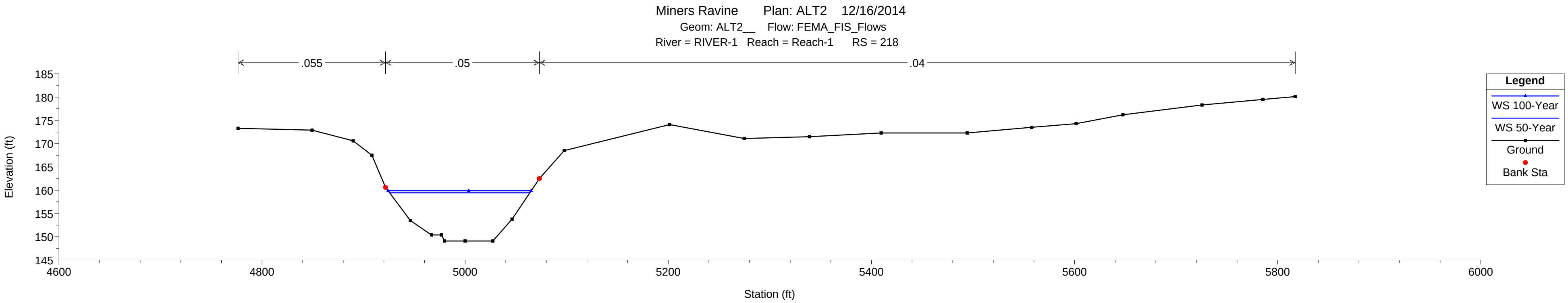

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 221
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

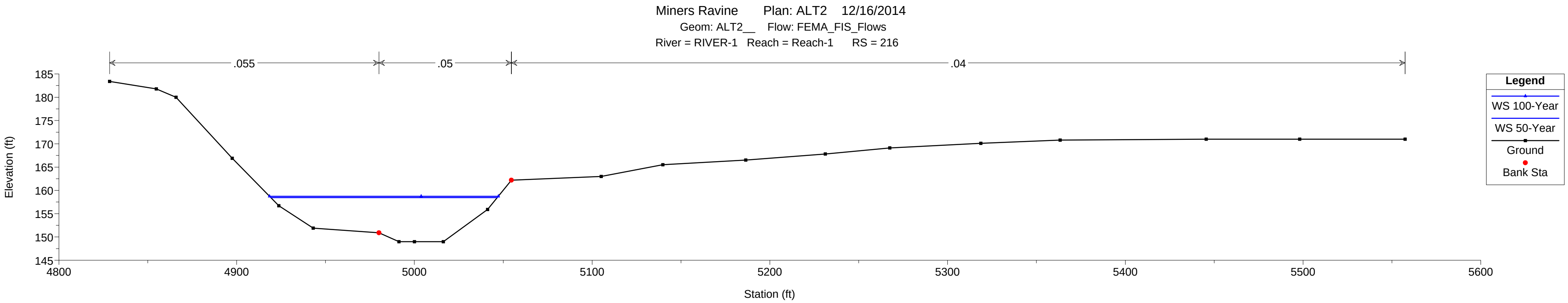

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 220 I-80
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

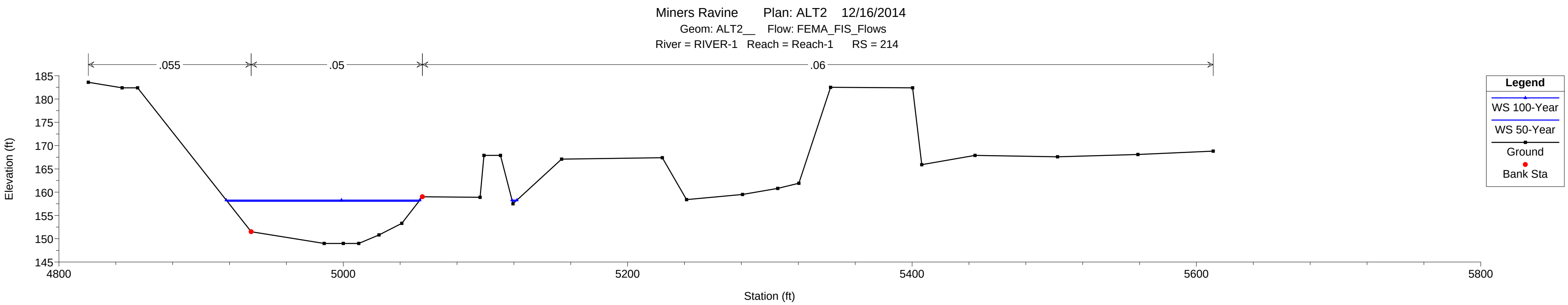

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 219.5 BR Bridge #2
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Pier Debris

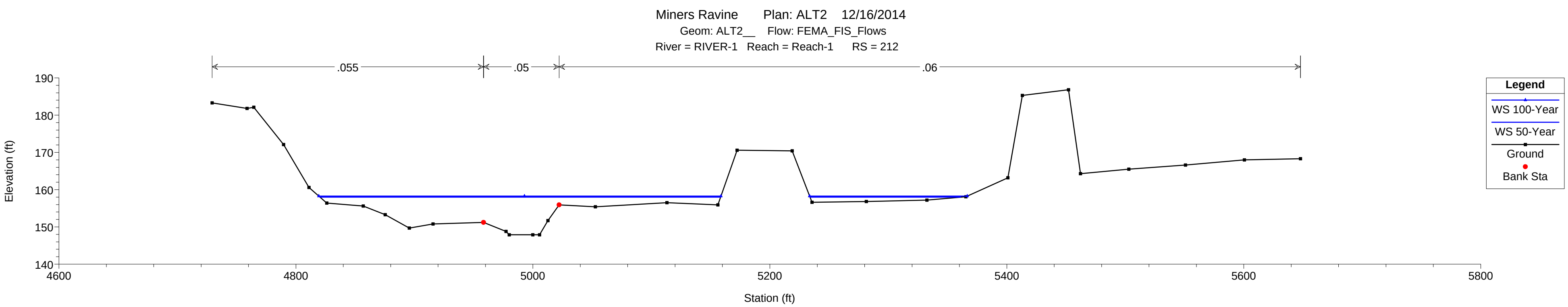

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 219.5 BR Bridge #2
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

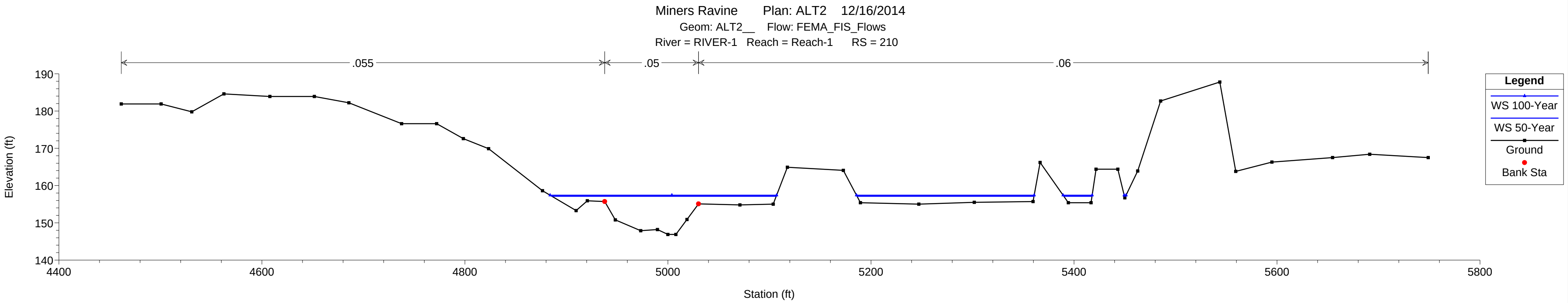

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 219
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

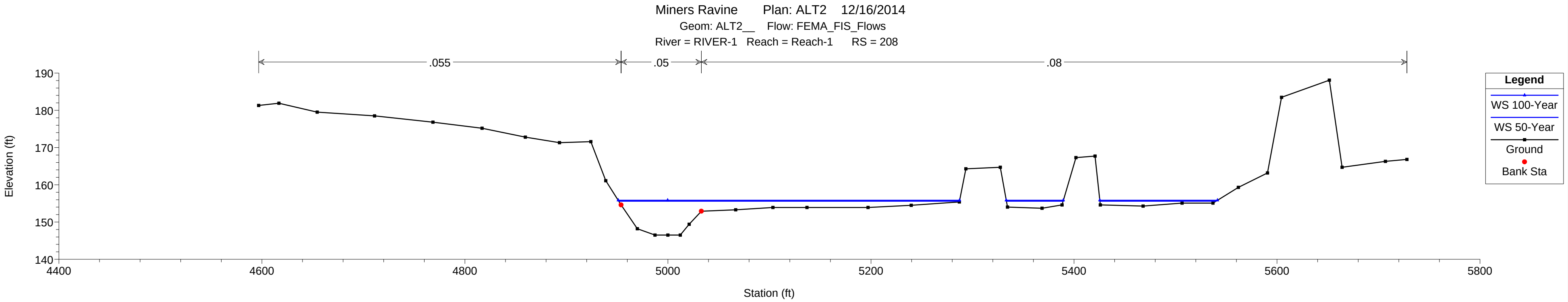

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 218
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

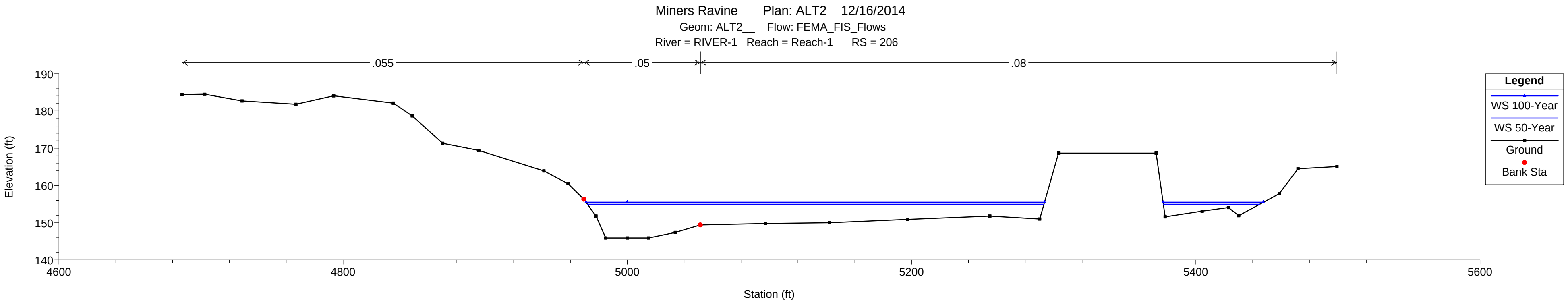

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 216
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

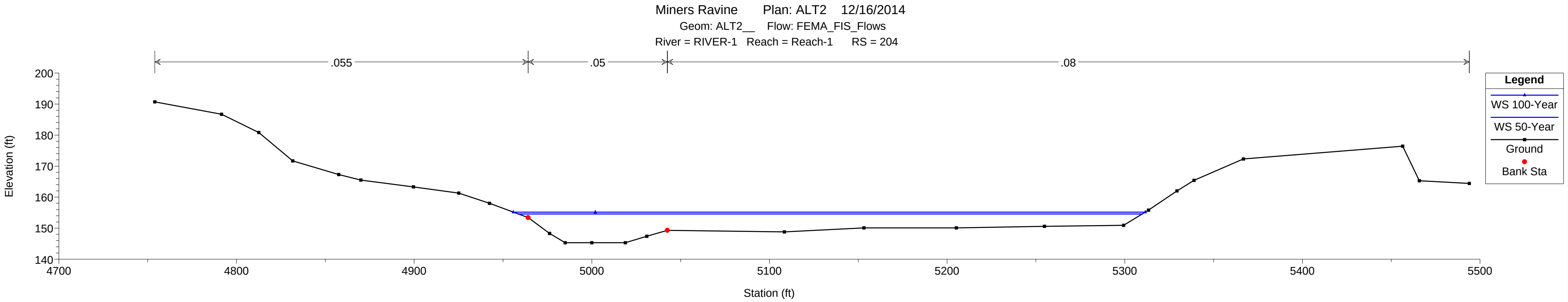

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 214
.055
.05
.06
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

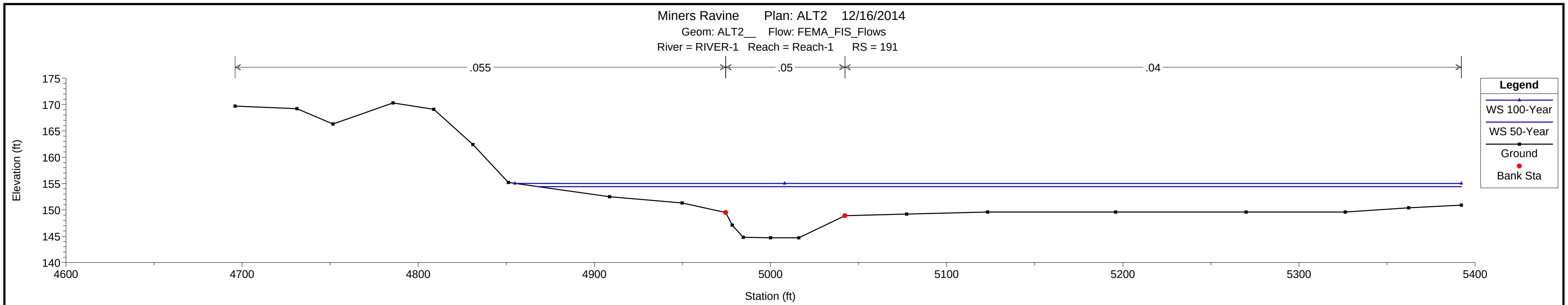

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 212
.055
.05
.06
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

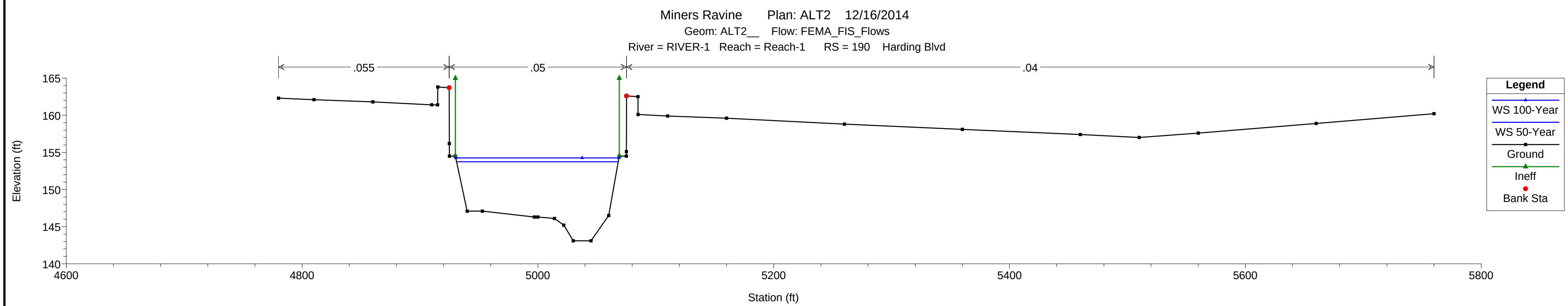

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 210
.055
.05
.06
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

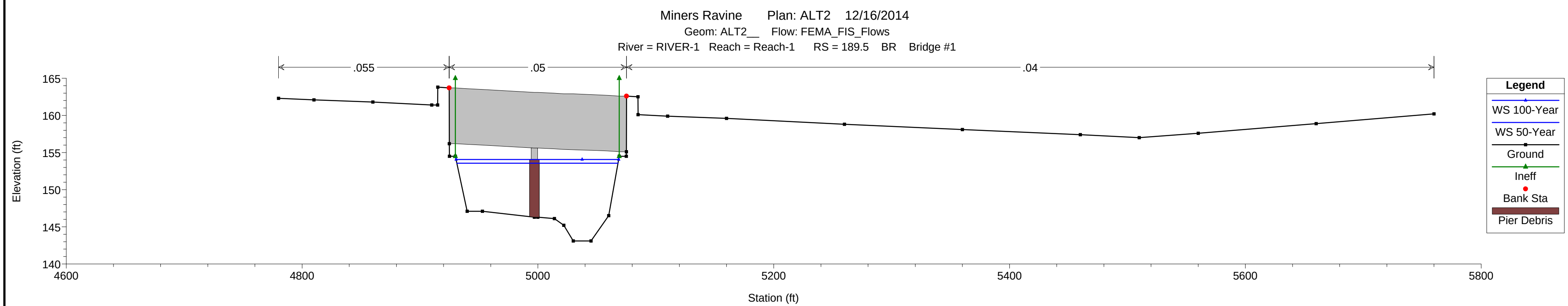

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 208
.055
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

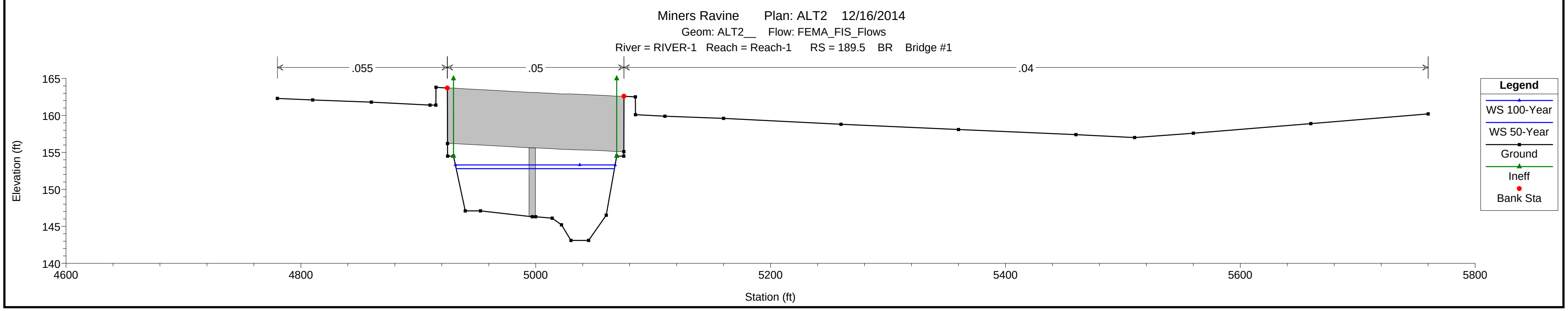

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 206
.055
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

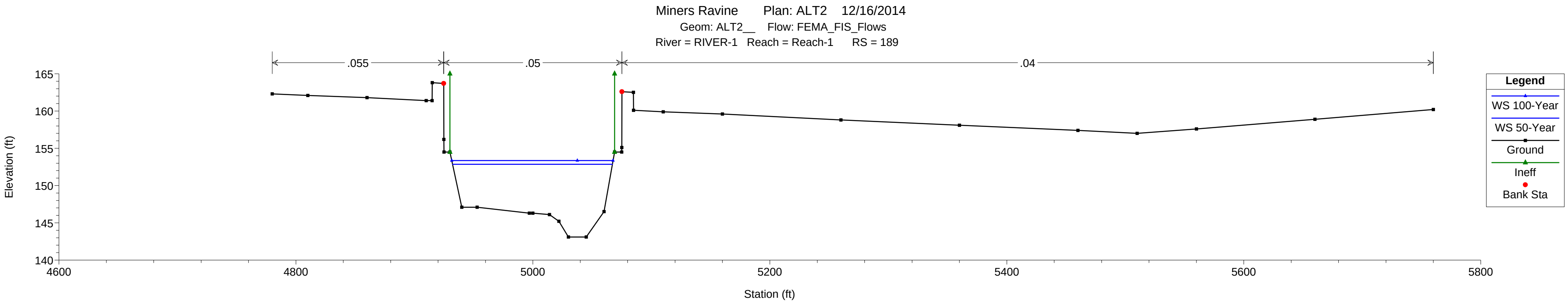

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 204
.055
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 191
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

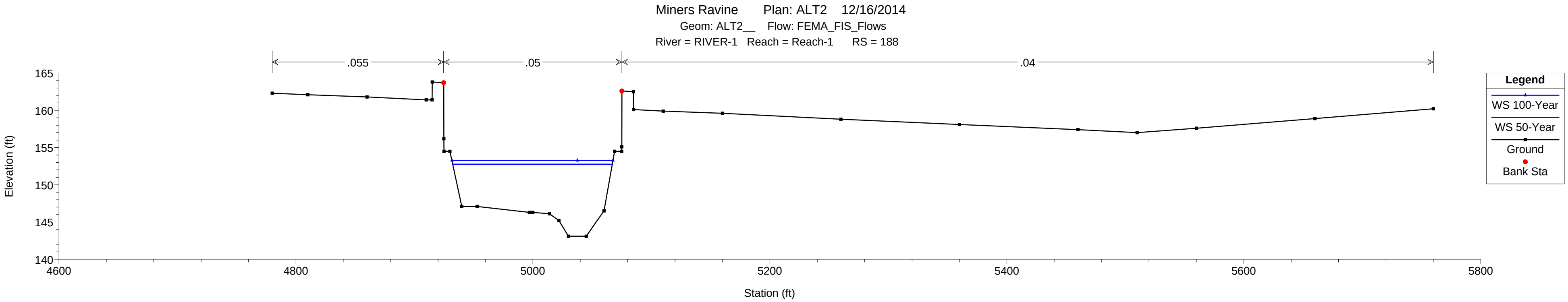

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 190 Harding Blvd
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta


Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 189.5 BR Bridge #1
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Pier Debris

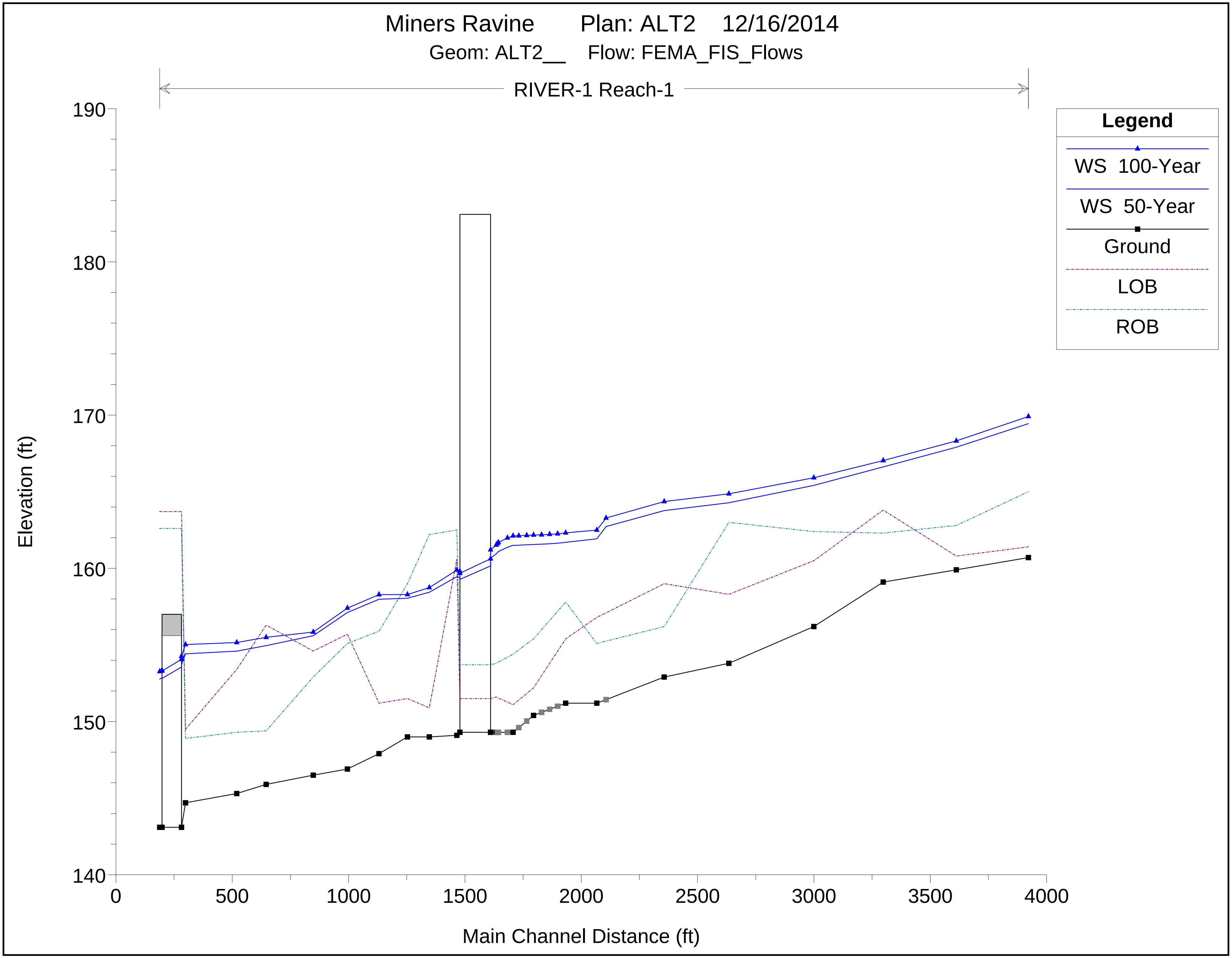

Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 189.5 BR Bridge #1
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta



Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 189
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta



Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 188
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta



Miners Ravine Plan: ALT2 12/16/2014
Geom: ALT2__ Flow: FEMA_FIS_Flows
RIVER-1 Reach-1
Legend
WS 100-Year
WS 50-Year
Ground
LOB
ROB
Elevation (ft)
Main Channel Distance (ft)
190
180
170
160
150
140
0
500
1000
1500
2000
2500
3000
3500
4000

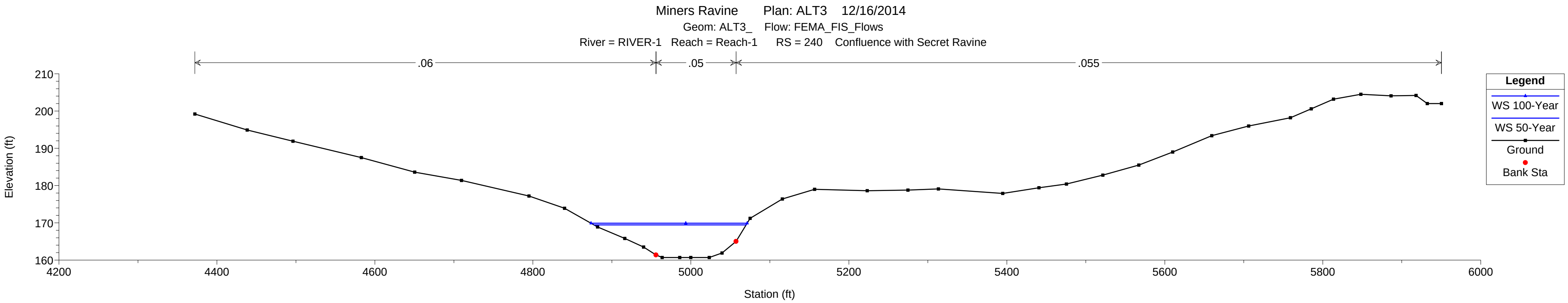
HEC-RAS Plan: ALT02 River: RIVER-1 Reach: Reach-1

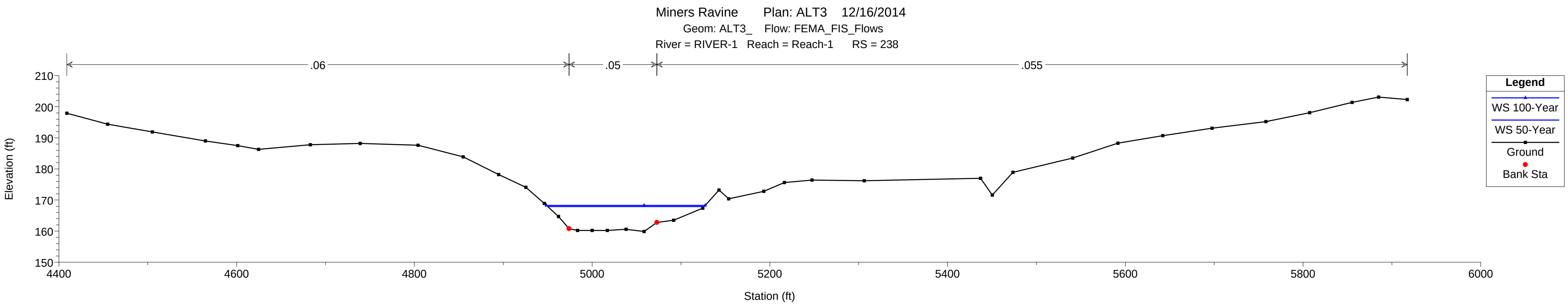
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	240	50-Year	7000.00	160.70	169.44		170.13	0.003515	7.11	1150.92	192.64	0.44
Reach-1	240	100-Year	7840.00	160.70	169.91		170.65	0.003574	7.44	1240.88	197.81	0.45
Reach-1	238	50-Year	7000.00	159.90	167.90		168.81	0.005141	8.11	987.66	176.09	0.52
Reach-1	238	100-Year	7840.00	159.90	168.32		169.30	0.005237	8.49	1061.47	178.98	0.53
Reach-1	236	50-Year	7000.00	159.10	166.62		167.29	0.004168	6.67	1113.46	210.51	0.46
Reach-1	236	100-Year	7840.00	159.10	167.03		167.76	0.004202	6.98	1203.02	231.03	0.47
Reach-1	234	50-Year	7000.00	156.20	165.42		165.87	0.004891	5.83	1426.11	328.90	0.41
Reach-1	234	100-Year	7840.00	156.20	165.91		166.37	0.004526	5.90	1593.32	348.45	0.40
Reach-1	232	50-Year	7000.00	153.80	164.28		164.50	0.002489	4.24	1969.76	350.60	0.29
Reach-1	232	100-Year	7840.00	153.80	164.86		165.09	0.002321	4.34	2182.21	376.35	0.29
Reach-1	230	50-Year	7000.00	152.90	163.77		164.04	0.001081	4.41	1994.82	334.16	0.25
Reach-1	230	100-Year	7840.00	152.90	164.36		164.65	0.001082	4.59	2196.05	353.54	0.25
Reach-1	228.274*	50-Year	7000.00	151.43	162.73	159.93	163.46	0.003587	8.15	1322.16	345.59	0.45
Reach-1	228.274*	100-Year	7840.00	151.43	163.28	160.32	164.06	0.003582	8.44	1434.76	349.40	0.46
Reach-1	228	50-Year	7000.00	151.20	161.93	160.43	163.13	0.006772	10.73	1104.25	342.48	0.60
Reach-1	228	100-Year	7840.00	151.20	162.50	160.81	163.73	0.006593	11.00	1212.87	346.07	0.60
Reach-1	226	50-Year	7000.00	151.20	161.69	158.97	162.12	0.003529	6.66	1649.64	401.68	0.39
Reach-1	226	100-Year	7840.00	151.20	162.31	159.26	162.74	0.003333	6.69	1828.60	414.40	0.38
Reach-1	225.5*	50-Year	7000.00	151.00	161.64	158.35	161.97	0.002273	5.99	1889.21	407.95	0.35
Reach-1	225.5*	100-Year	7840.00	151.00	162.25	158.63	162.60	0.002148	6.09	2072.23	414.69	0.35
Reach-1	225.*	50-Year	7000.00	150.80	161.61	157.63	161.86	0.001754	5.35	2093.27	403.54	0.31
Reach-1	225.*	100-Year	7840.00	150.80	162.22	157.86	162.49	0.001695	5.49	2275.78	409.98	0.31
Reach-1	224.5*	50-Year	7000.00	150.60	161.57	156.86	161.76	0.001647	4.58	2199.68	299.95	0.26
Reach-1	224.5*	100-Year	7840.00	150.60	162.19	157.07	162.39	0.001630	4.69	2371.59	321.39	0.26
Reach-1	224	50-Year	7000.00	150.40	161.56	154.57	161.69	0.000799	3.71	2690.48	439.98	0.21
Reach-1	224	100-Year	7840.00	150.40	162.17	154.84	162.32	0.000816	3.91	2864.89	450.61	0.22
Reach-1	223.333*	50-Year	7000.00	150.03	161.53	155.58	161.66	0.000842	3.40	2683.50	412.46	0.20
Reach-1	223.333*	100-Year	7840.00	150.03	162.15	155.83	162.29	0.000850	3.54	2876.87	419.44	0.20
Reach-1	222.555*	50-Year	7000.00	149.61	161.51	155.63	161.63	0.000696	3.16	2569.85	590.00	0.19
Reach-1	222.555*	100-Year	7840.00	149.61	162.12	155.85	162.26	0.000699	3.29	2754.94	599.85	0.19
Reach-1	222	50-Year	7000.00	149.30	161.50	155.48	161.61	0.000504	2.88	2836.72	621.04	0.17
Reach-1	222	100-Year	7840.00	149.30	162.12	155.69	162.24	0.000504	3.01	3041.85	627.72	0.17
Reach-1	221.666*	50-Year	7000.00	149.30	161.37	155.77	161.57	0.000855	3.82	2238.35	305.22	0.22
Reach-1	221.666*	100-Year	7840.00	149.30	161.98	156.05	162.19	0.000854	3.98	2428.26	315.93	0.22
Reach-1	221.133*	50-Year	7000.00	149.30	161.10	156.23	161.47	0.001586	5.43	1494.36	188.62	0.30
Reach-1	221.133*	100-Year	7840.00	149.30	161.68	156.56	162.09	0.001605	5.68	1606.22	192.06	0.31
Reach-1	221.066*	50-Year	7000.00	149.30	161.03	156.35	161.45	0.001759	5.76	1400.62	176.77	0.32
Reach-1	221.066*	100-Year	7840.00	149.30	161.61	156.69	162.07	0.001783	6.03	1504.41	180.08	0.33
Reach-1	221	50-Year	7000.00	149.30	160.94		161.42	0.001959	6.13	1306.26	165.21	0.34
Reach-1	221	100-Year	7840.00	149.30	161.52		162.04	0.001989	6.41	1402.02	168.26	0.34
Reach-1	220	50-Year	7000.00	149.30	160.66	156.92	161.34	0.002913	7.33	1093.23	141.79	0.41
Reach-1	220	100-Year	7840.00	149.30	161.21	157.30	161.96	0.002967	7.67	1172.13	144.31	0.42
Reach-1	219.5		Bridge									
Reach-1	219	50-Year	7000.00	149.30	159.38	156.92	160.36	0.004961	8.72	915.73	135.93	0.52
Reach-1	219	100-Year	7840.00	149.30	159.81	157.30	160.89	0.005174	9.19	973.63	137.87	0.54
Reach-1	218	50-Year	7000.00	149.10	159.46		160.17	0.003693	6.80	1029.61	138.16	0.44
Reach-1	218	100-Year	7840.00	149.10	159.89		160.69	0.003942	7.20	1089.61	140.96	0.46
Reach-1	216	50-Year	7000.00	149.00	158.44		159.59	0.007109	9.30	831.99	127.38	0.61
Reach-1	216	100-Year	7840.00	149.00	158.74		160.06	0.007809	9.94	870.33	128.79	0.64

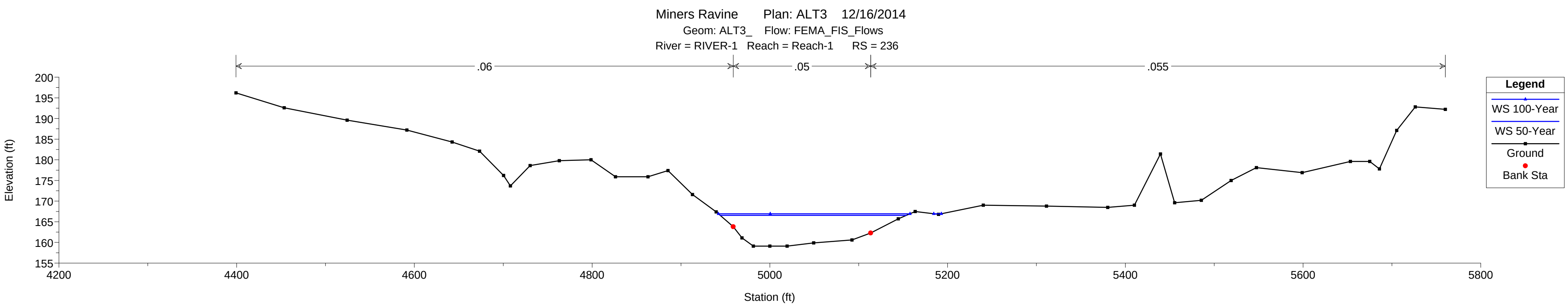
HEC-RAS Plan: ALT02   River: RIVER-1   Reach: Reach-1 (Continued)

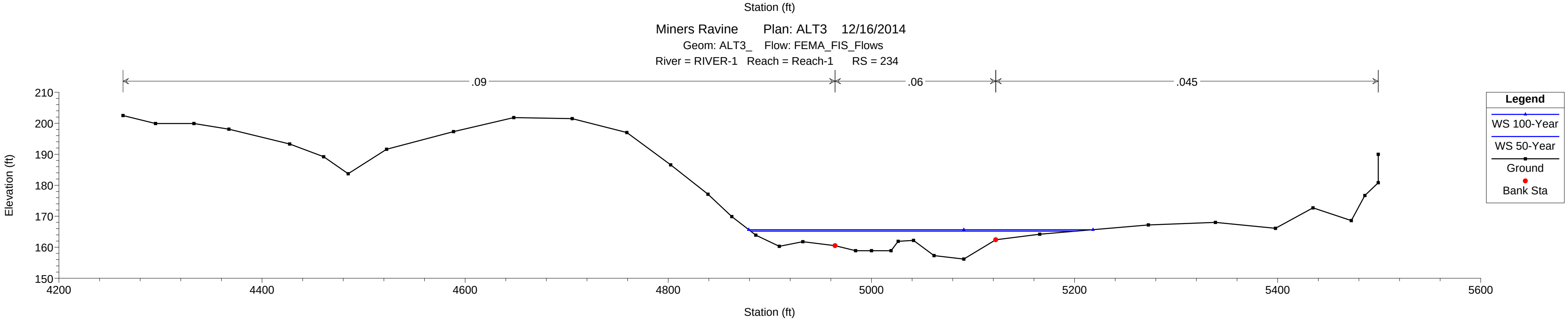
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	214	50-Year	7000.00	149.00	158.05		158.99	0.005019	7.86	917.72	137.43	0.51
Reach-1	214	100-Year	7840.00	149.00	158.29		159.39	0.005670	8.51	951.22	139.73	0.55
Reach-1	212	50-Year	7000.00	147.90	157.98		158.38	0.002691	6.21	1641.14	465.09	0.38
Reach-1	212	100-Year	7840.00	147.90	158.28		158.71	0.002782	6.46	1783.41	472.57	0.39
Reach-1	210	50-Year	7000.00	146.90	157.12	156.26	157.86	0.004762	7.75	1307.36	424.26	0.50
Reach-1	210	100-Year	7840.00	146.90	157.41	156.55	158.18	0.004854	8.02	1430.22	428.88	0.50
Reach-1	208	50-Year	7000.00	146.50	155.60	155.60	156.90	0.008934	10.14	1154.83	505.79	0.67
Reach-1	208	100-Year	7840.00	146.50	155.84	155.84	157.20	0.009242	10.54	1275.91	508.45	0.69
Reach-1	206	50-Year	7000.00	145.90	154.96		155.35	0.003271	6.35	1788.52	389.02	0.41
Reach-1	206	100-Year	7840.00	145.90	155.50		155.88	0.003014	6.33	2000.61	393.26	0.40
Reach-1	204	50-Year	7000.00	145.30	154.59		154.95	0.002837	6.06	1834.18	351.41	0.39
Reach-1	204	100-Year	7840.00	145.30	155.16		155.51	0.002616	6.10	2033.99	355.70	0.37
Reach-1	191	50-Year	7000.00	144.70	154.42		154.56	0.000739	3.34	2494.31	524.54	0.20
Reach-1	191	100-Year	7840.00	144.70	155.02		155.16	0.000646	3.27	2813.28	537.33	0.19
Reach-1	190	50-Year	7000.00	143.10	153.74	150.46	154.47	0.003899	6.88	1018.11	137.11	0.44
Reach-1	190	100-Year	7840.00	143.10	154.26	150.81	155.07	0.003951	7.19	1090.55	138.42	0.45
Reach-1	189.5		Bridge									
Reach-1	189	50-Year	7000.00	143.10	152.86	150.46	153.80	0.005761	7.79	898.47	134.94	0.53
Reach-1	189	100-Year	7840.00	143.10	153.35	150.81	154.37	0.005781	8.12	964.94	136.15	0.54
Reach-1	188	50-Year	7000.00	143.10	152.77	150.42	153.74	0.006001	7.89	886.84	134.72	0.54
Reach-1	188	100-Year	7840.00	143.10	153.26	150.78	154.31	0.006009	8.23	953.08	135.93	0.55

Reach-1
RIVER-1
189
190
191
204
206
208
210
212
218
219
221
222
223.333*
224.5*
226
228
229.103*
230
232
234
236
238
240

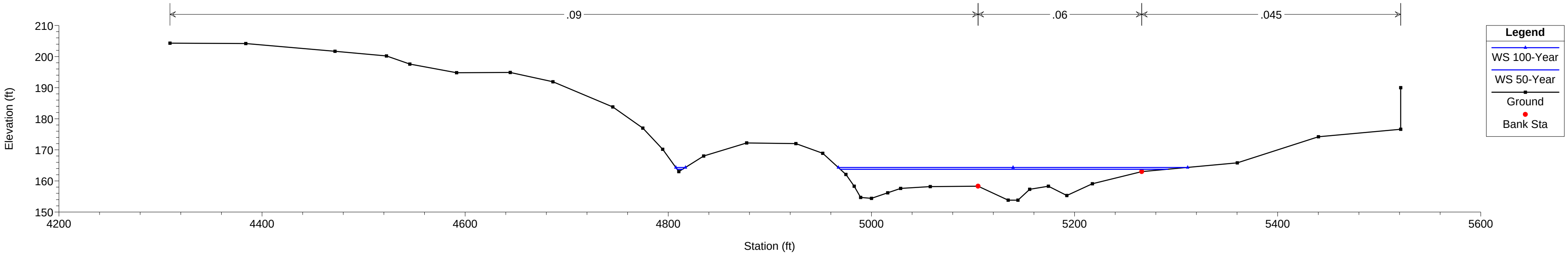

Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 240 Confluence with Secret Ravine
.06
.05
.055
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 238
.06
.05
.055
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

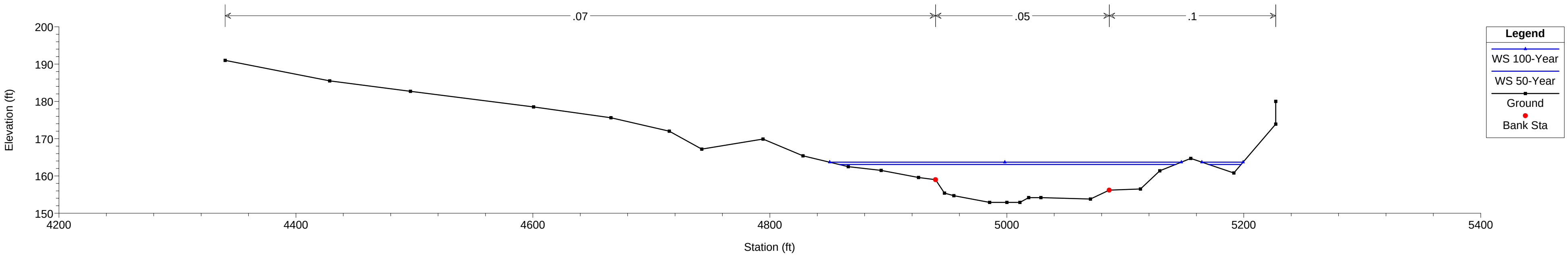

Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 236
.06
.05
.055
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 234
.09
.06
.045
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

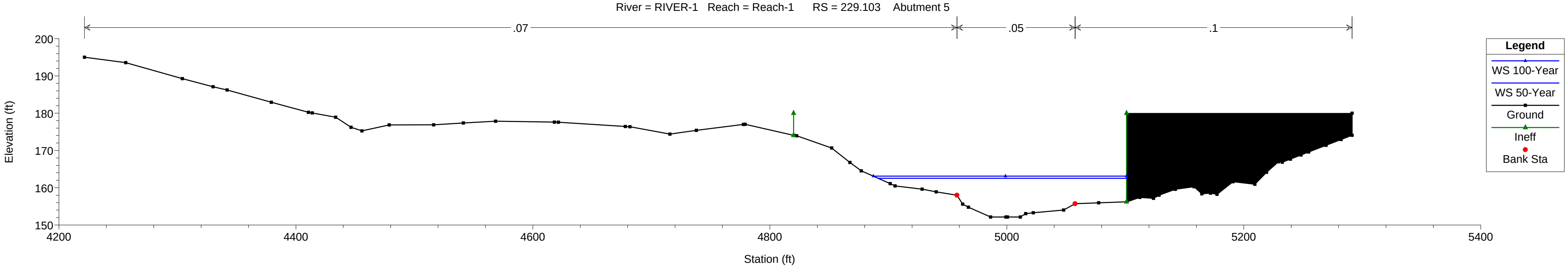
Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 232



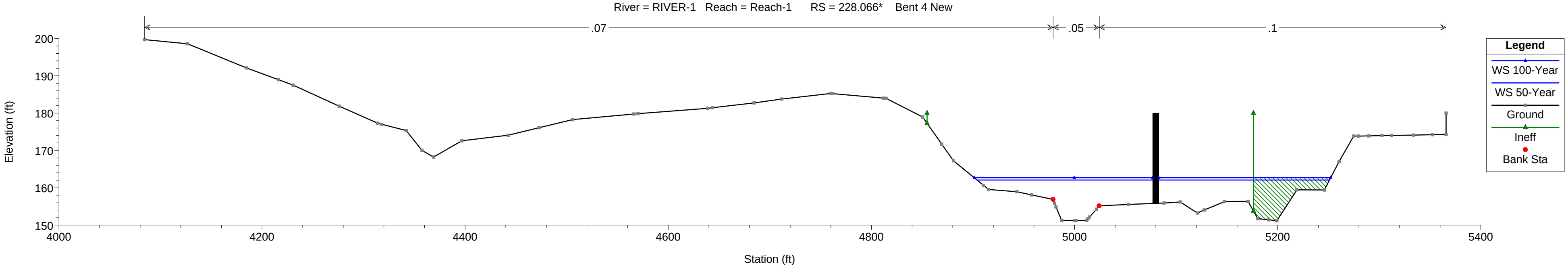
Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 230

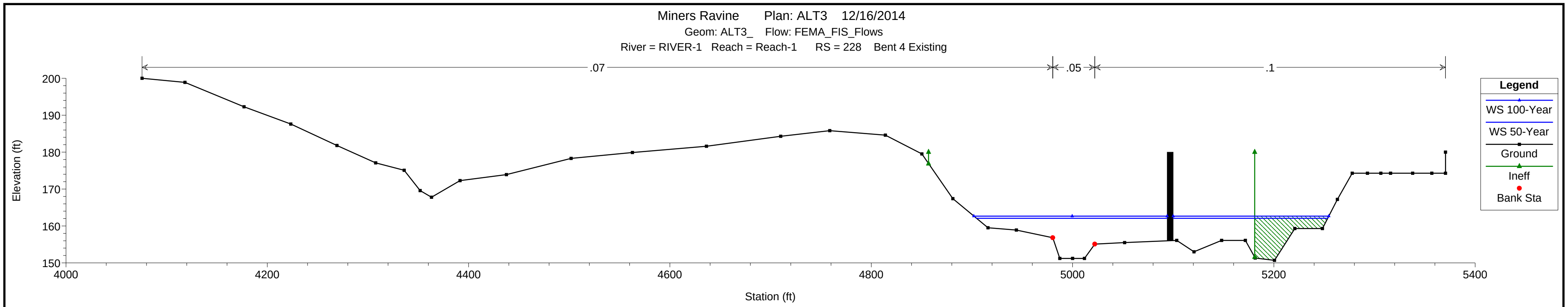


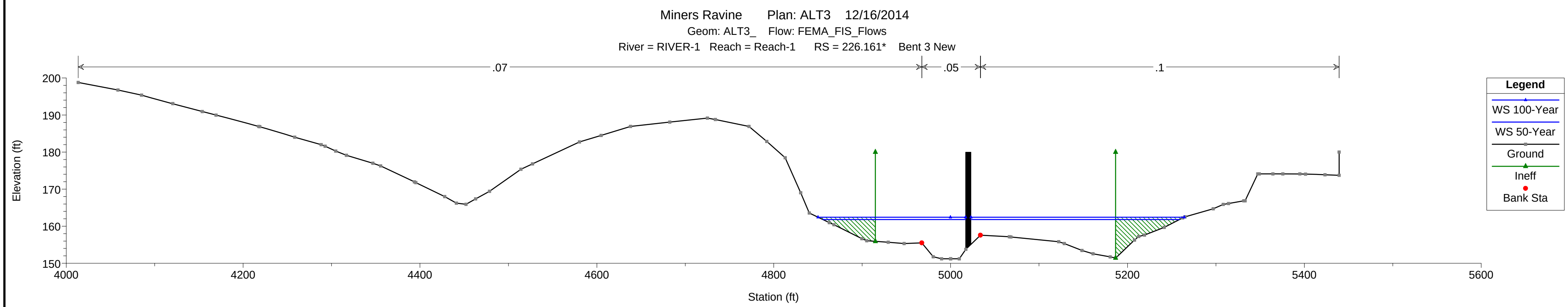
Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 229.103 Abutment 5

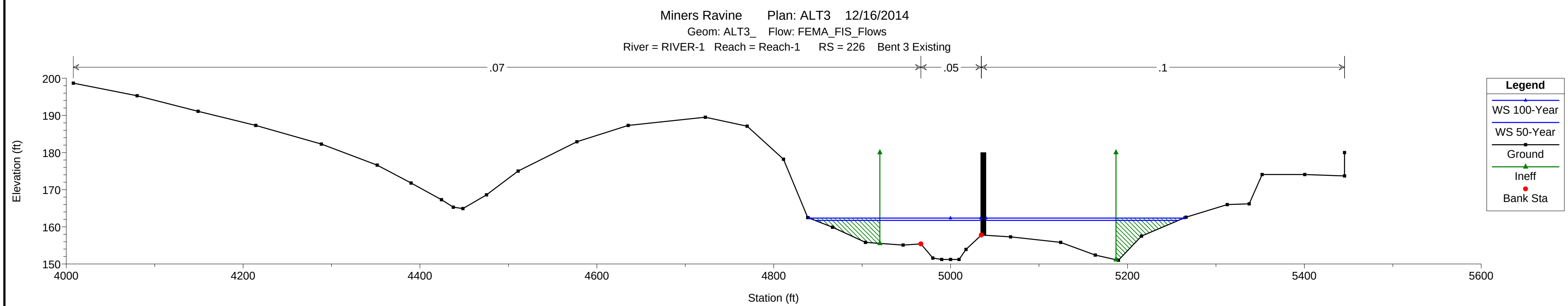


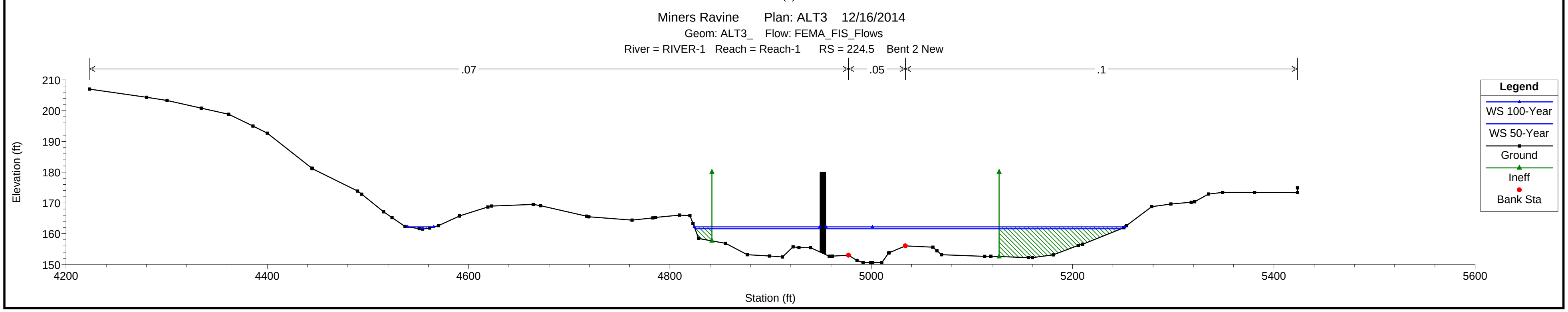
Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 228.066* Bent 4 New



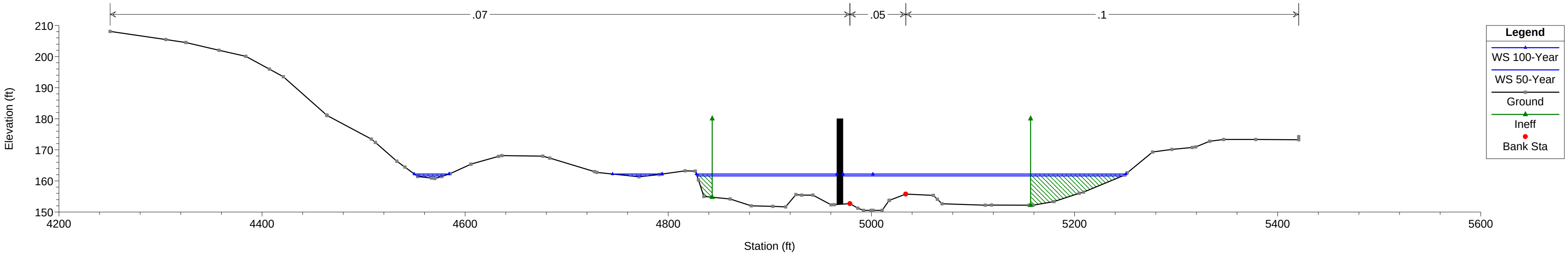

Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 228 Bent 4 Existing
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta


Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 226.161* Bent 3 New
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

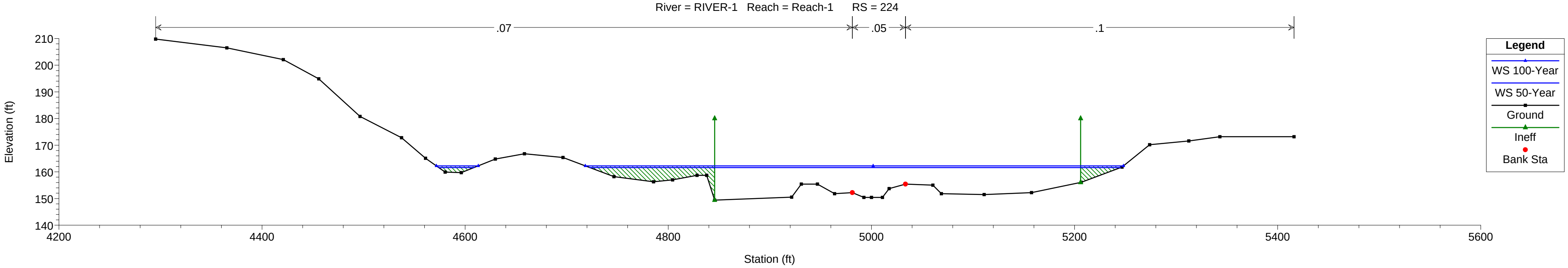

Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 226 Bent 3 Existing
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta


Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 224.5 Bent 2 New
.07
.05
.1
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

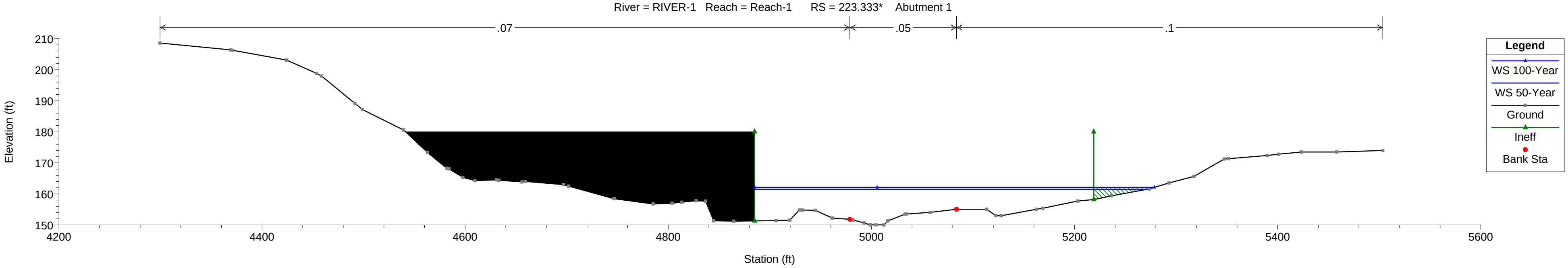
Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 224.311* Bent 2 Existing



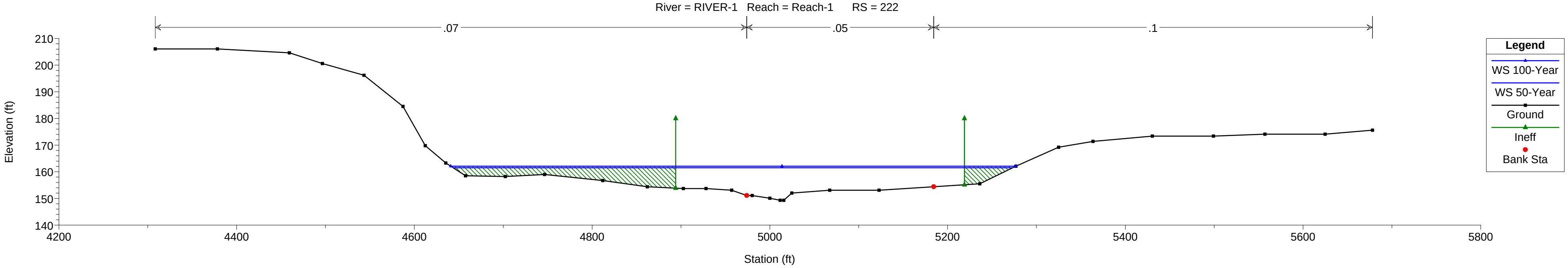
Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 224

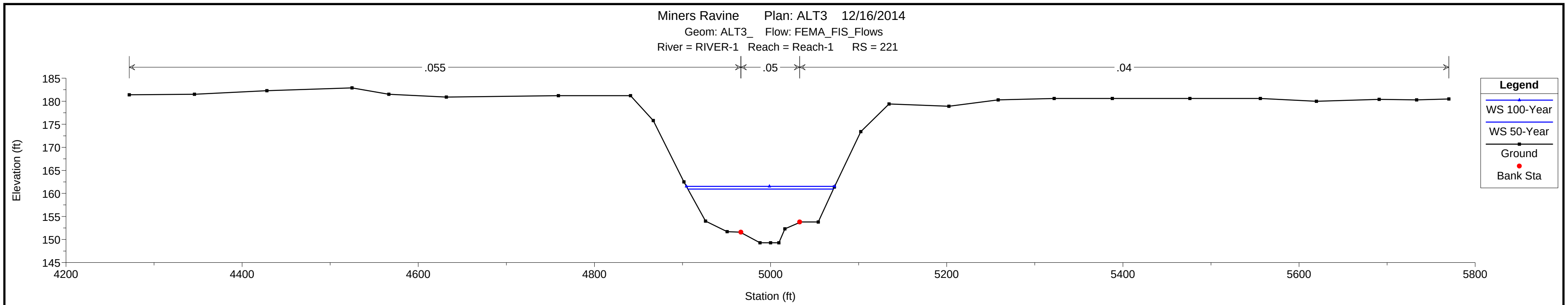


Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 223.333* Abutment 1

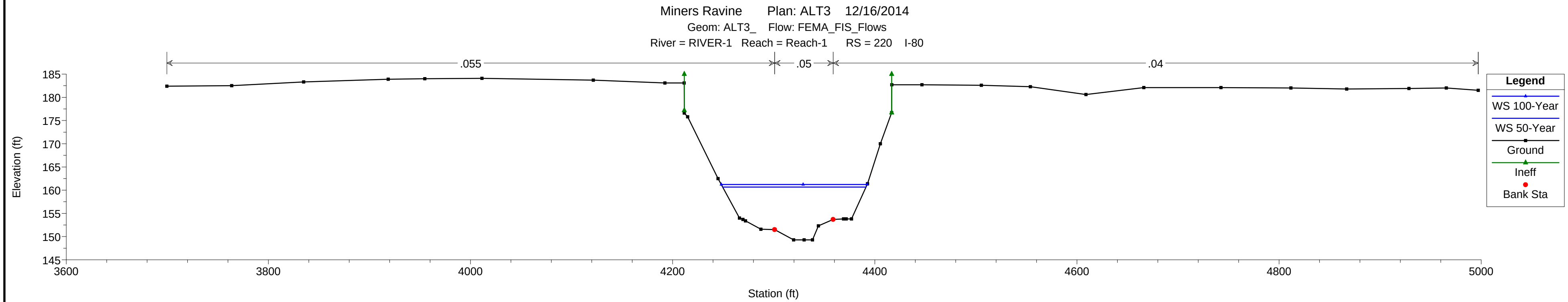


Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 222

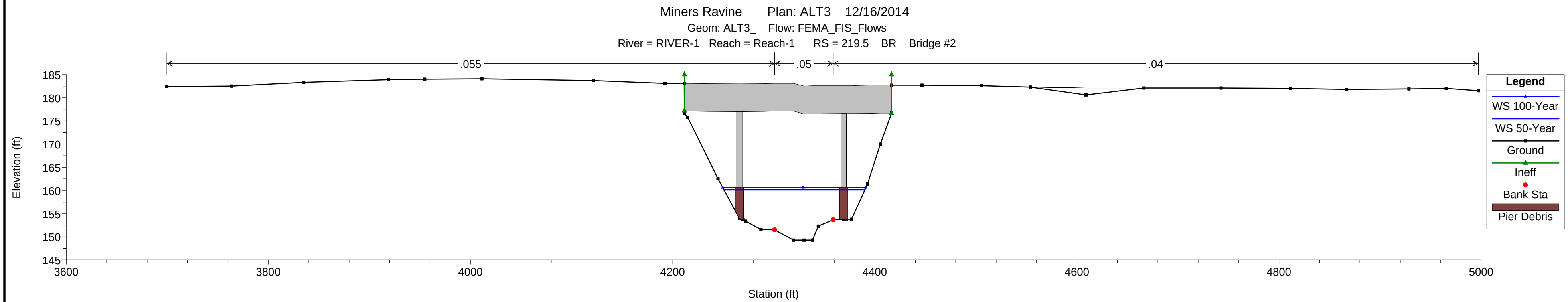




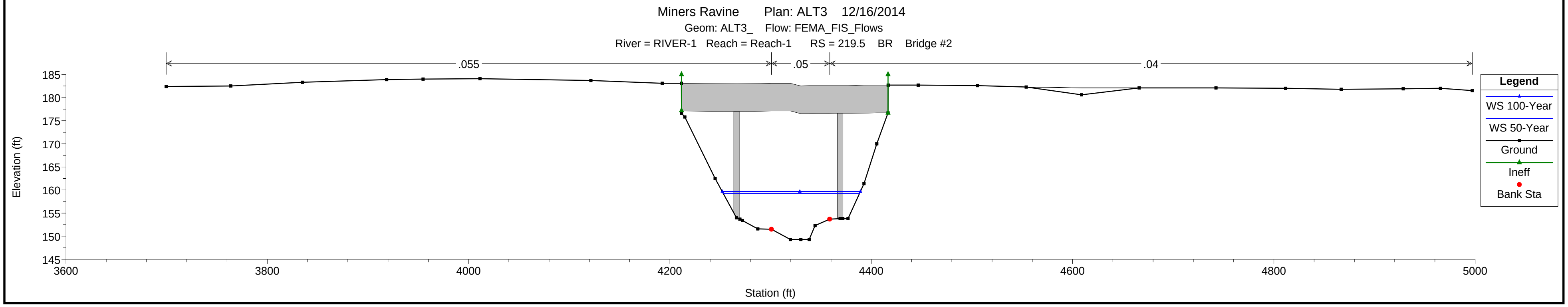
Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 221
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta



Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 220 I-80
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

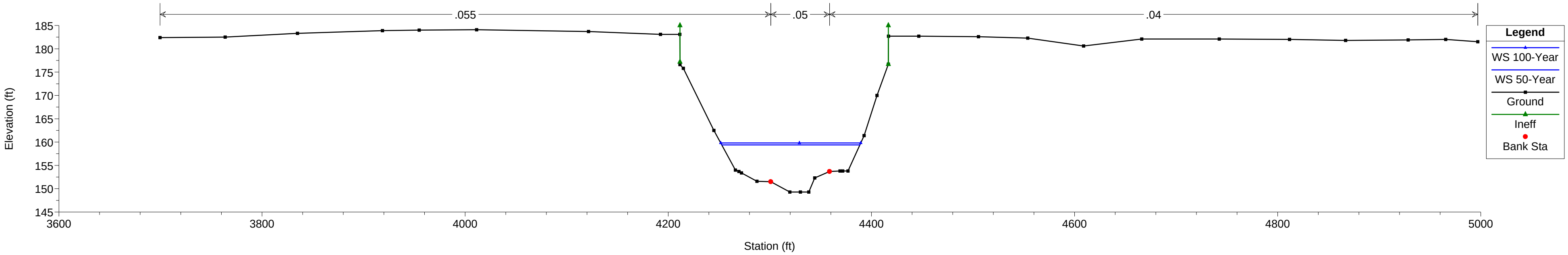


Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 219.5 BR Bridge #2
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Pier Debris

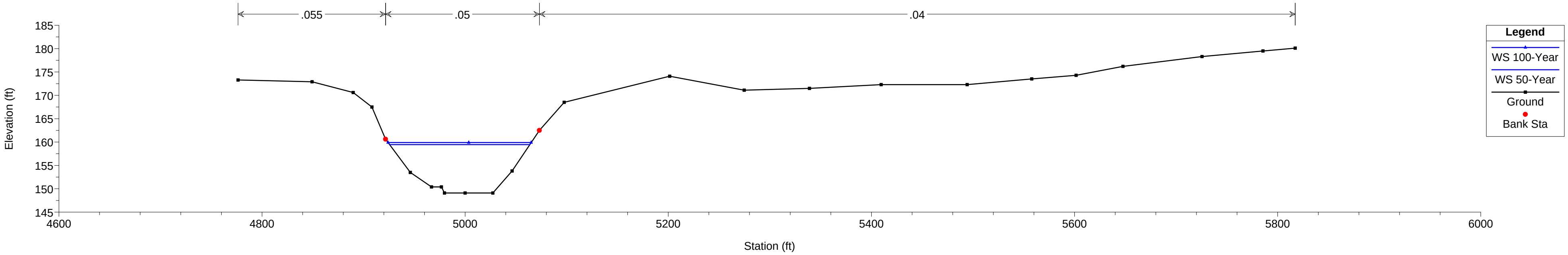


Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 219.5 BR Bridge #2
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

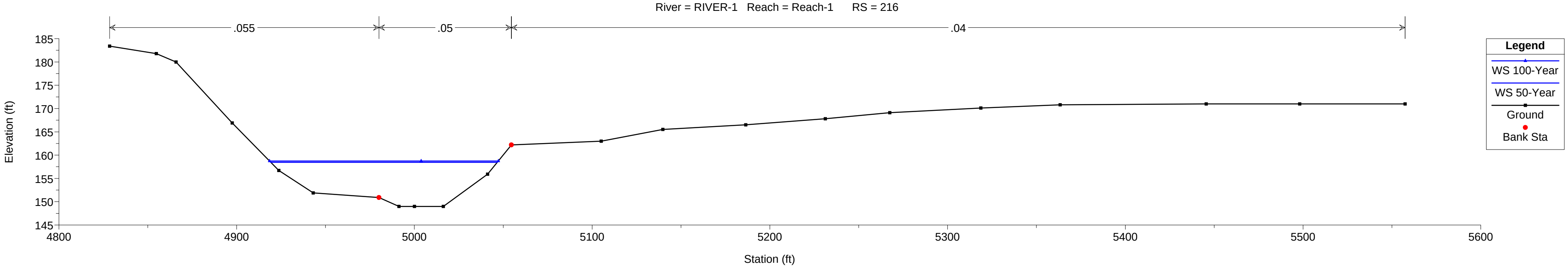
Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 219



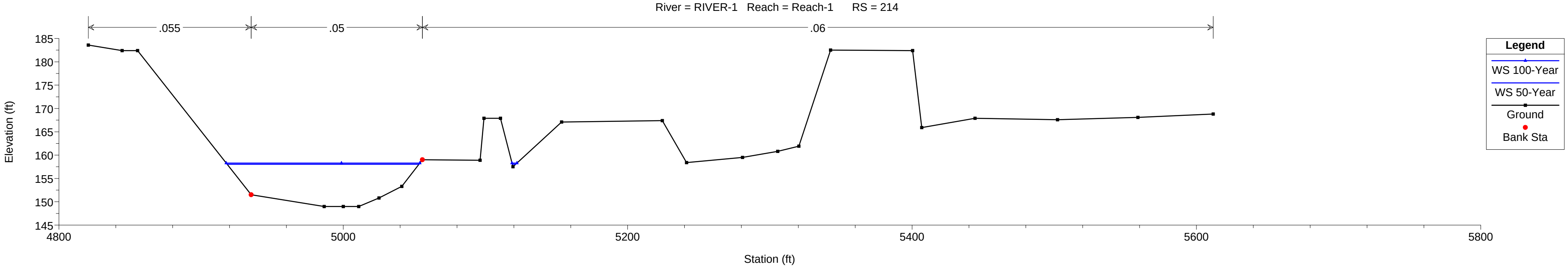
Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 218

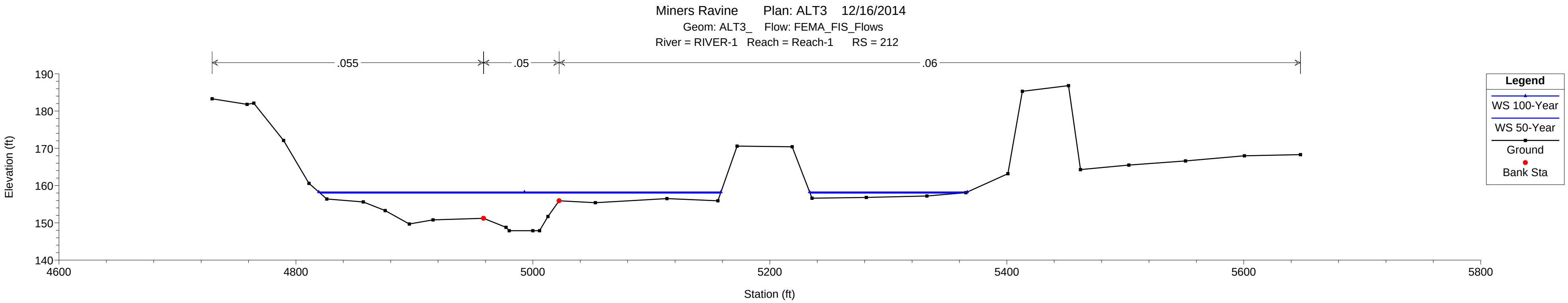


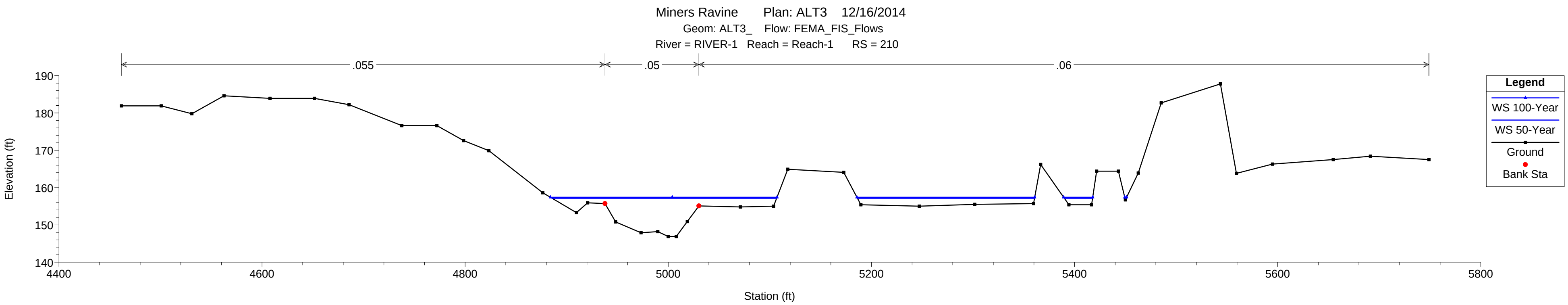
Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 216

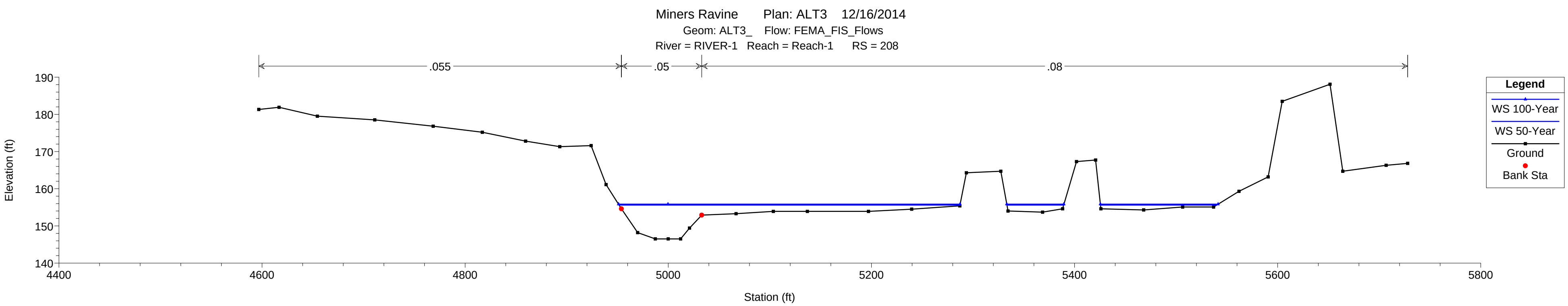


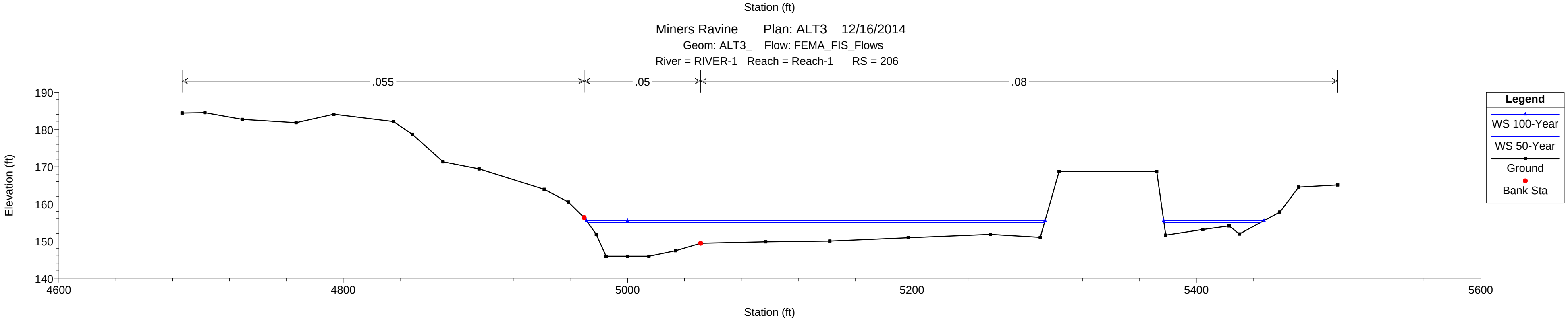
Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 214

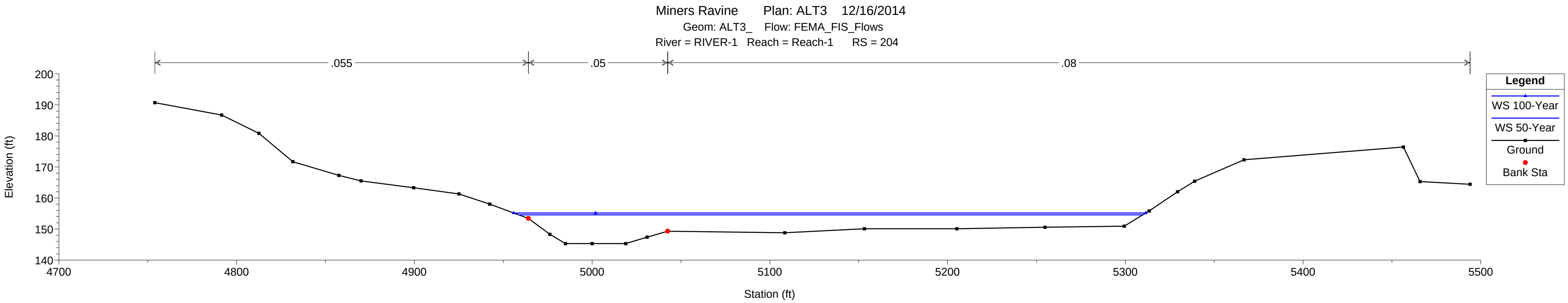



Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 212
.055
.05
.06
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

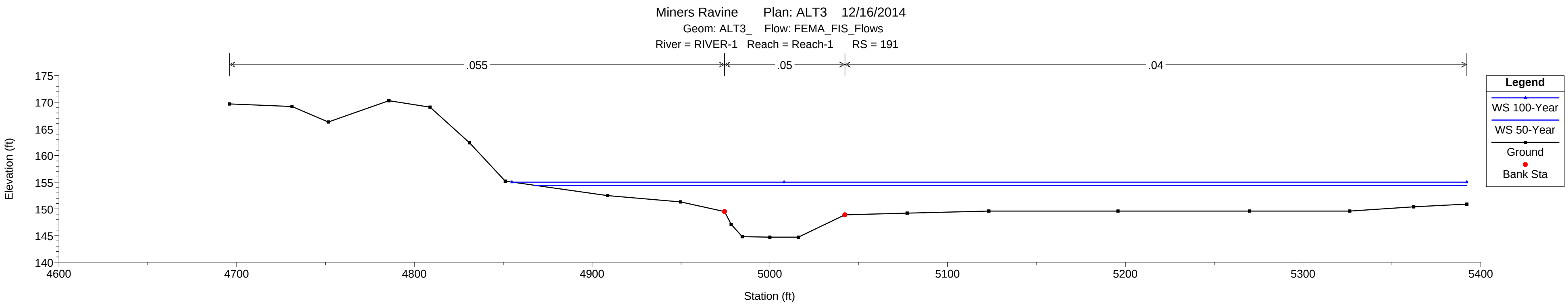

Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 210
.055
.05
.06
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta


Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 208
.055
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

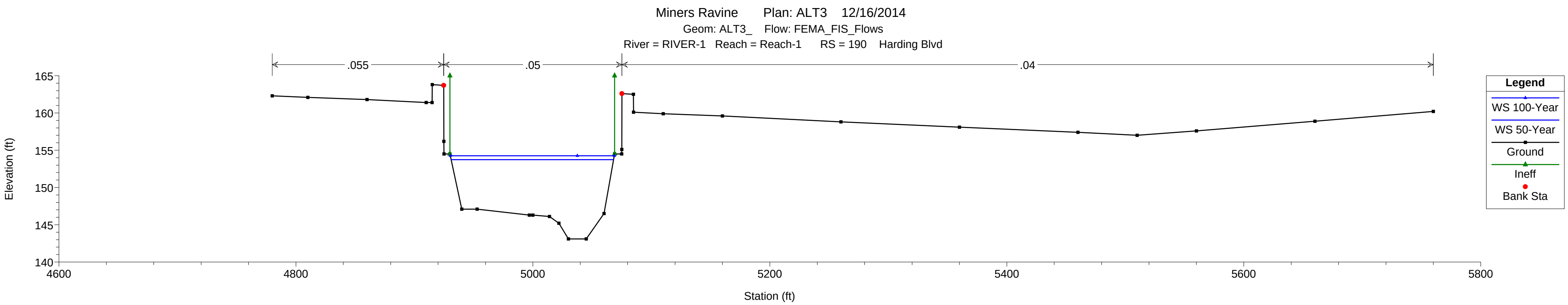

Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 206
.055
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta



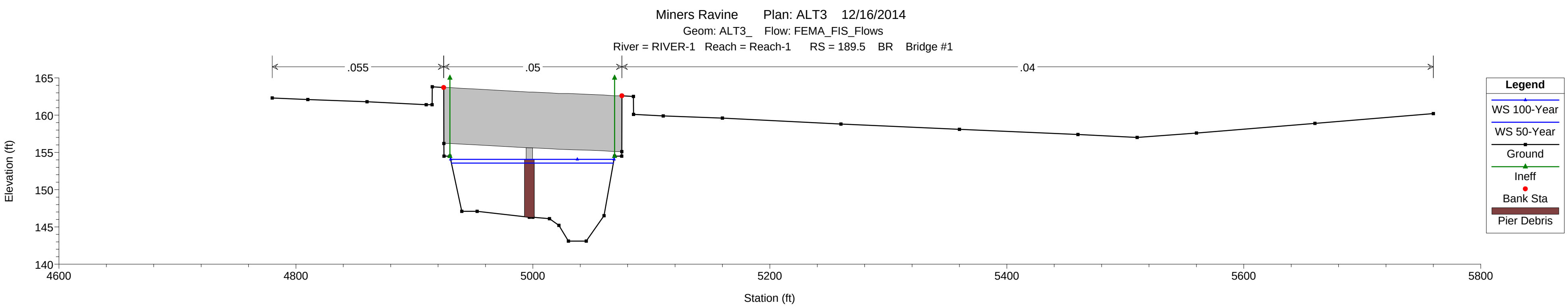
Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 204
.055
.05
.08
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta



Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 191
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Bank Sta

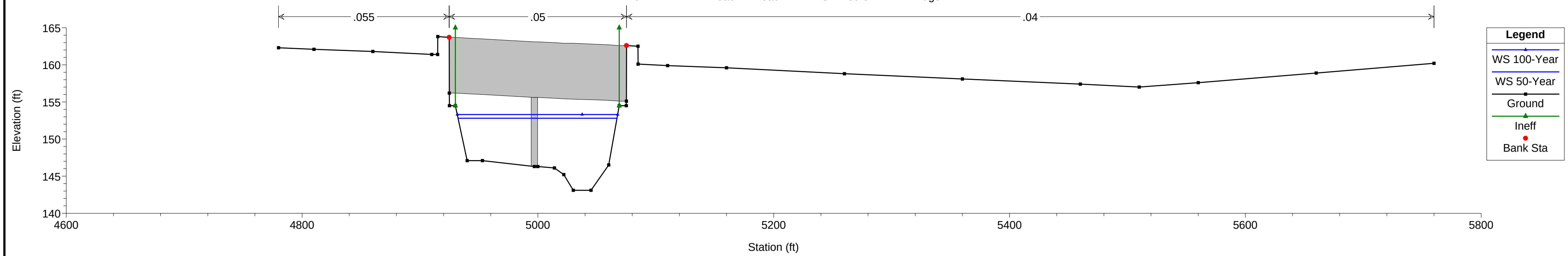


Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 190 Harding Blvd
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta

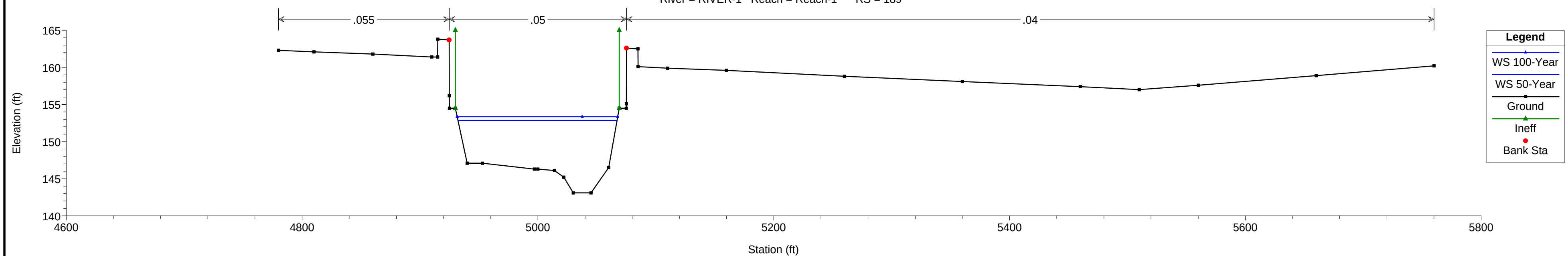


Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 189.5 BR Bridge #1
.055
.05
.04
Elevation (ft)
Station (ft)
Legend
WS 100-Year
WS 50-Year
Ground
Ineff
Bank Sta
Pier Debris

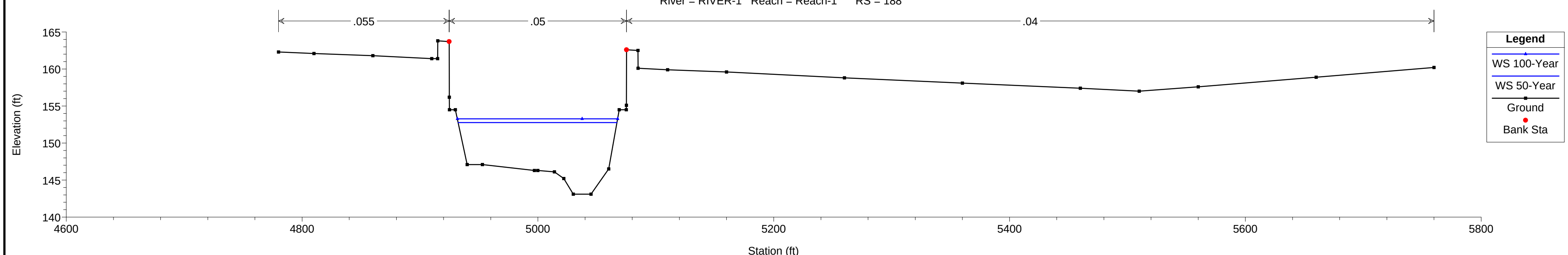
Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 189.5 BR Bridge #1

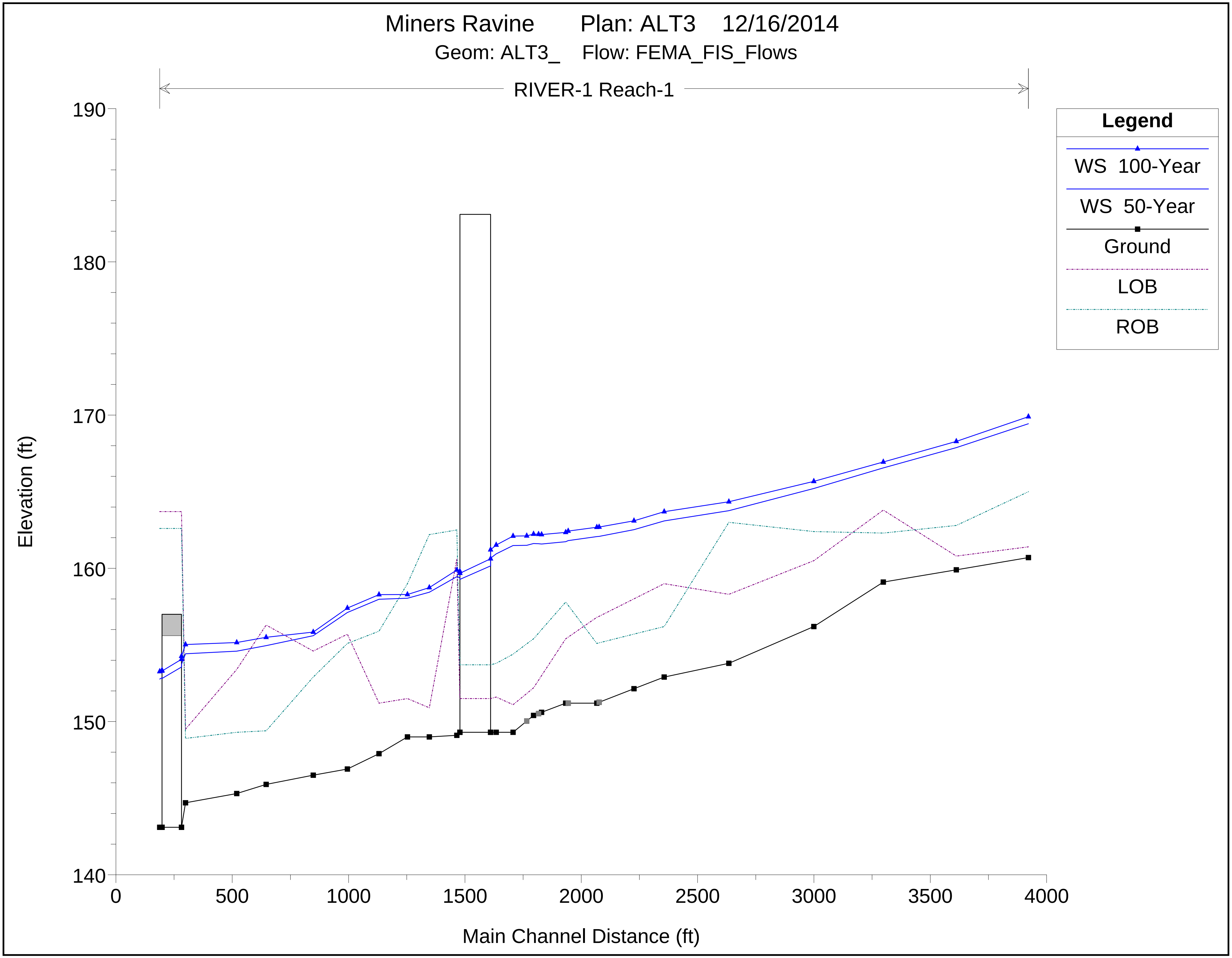


Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 189



Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
River = RIVER-1 Reach = Reach-1 RS = 188




Miners Ravine Plan: ALT3 12/16/2014
Geom: ALT3_ Flow: FEMA_FIS_Flows
RIVER-1 Reach-1
Legend
WS 100-Year
WS 50-Year
Ground
LOB
ROB
Elevation (ft)
190
180
170
160
150
140
0
500
1000
1500
2000
2500
3000
3500
4000
Main Channel Distance (ft)

HEC-RAS Plan: ALT3 River: RIVER-1 Reach: Reach-1

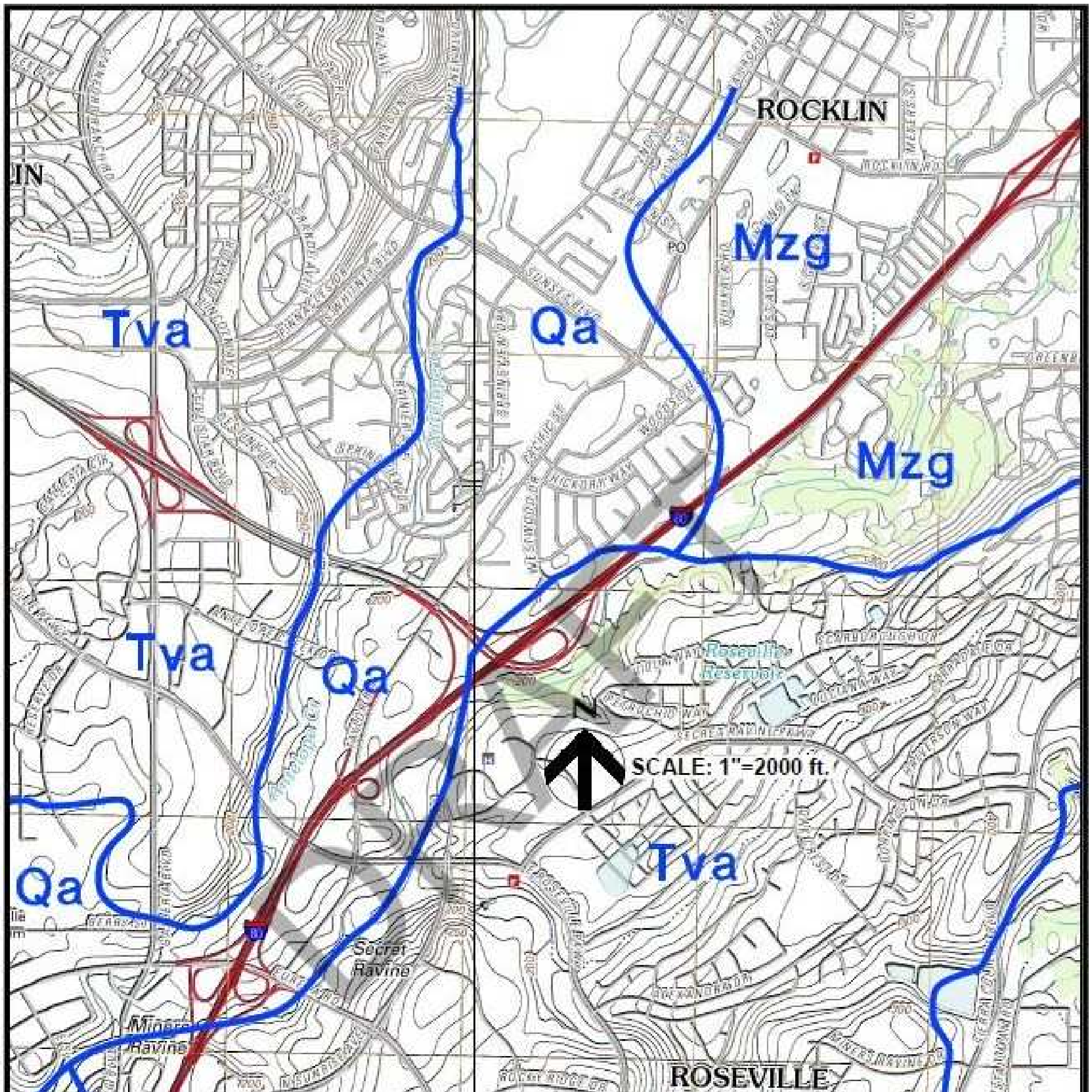
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	240	50-Year	7000.00	160.70	169.44		170.13	0.003527	7.12	1149.43	192.55	0.44
Reach-1	240	100-Year	7840.00	160.70	169.89		170.64	0.003591	7.45	1238.81	197.69	0.45
Reach-1	238	50-Year	7000.00	159.90	167.88		168.79	0.005207	8.15	983.28	175.92	0.53
Reach-1	238	100-Year	7840.00	159.90	168.28		169.28	0.005322	8.53	1055.56	178.75	0.54
Reach-1	236	50-Year	7000.00	159.10	166.55		167.24	0.004329	6.75	1098.99	209.41	0.47
Reach-1	236	100-Year	7840.00	159.10	166.94		167.69	0.004401	7.08	1182.78	224.25	0.48
Reach-1	234	50-Year	7000.00	156.20	165.21		165.71	0.005576	6.09	1359.81	320.82	0.44
Reach-1	234	100-Year	7840.00	156.20	165.67		166.18	0.005223	6.19	1512.21	339.11	0.43
Reach-1	232	50-Year	7000.00	153.80	163.76		164.02	0.003286	4.61	1794.41	327.82	0.33
Reach-1	232	100-Year	7840.00	153.80	164.35		164.62	0.003013	4.70	1993.82	353.61	0.33
Reach-1	230	50-Year	7000.00	152.90	163.09		163.43	0.001422	4.82	1775.99	311.72	0.28
Reach-1	230	100-Year	7840.00	152.90	163.69		164.04	0.001398	4.99	1968.93	331.58	0.28
Reach-1	229.103	50-Year	7000.00	152.14	162.52	158.75	163.11	0.002649	6.58	1364.20	209.49	0.39
Reach-1	229.103	100-Year	7840.00	152.14	163.10	159.14	163.72	0.002625	6.83	1486.68	213.61	0.39
Reach-1	228.066*	50-Year	7000.00	151.26	162.09	159.25	162.63	0.003557	7.85	1652.75	341.09	0.44
Reach-1	228.066*	100-Year	7840.00	151.26	162.69	159.71	163.24	0.003419	8.01	1814.12	344.96	0.44
Reach-1	228	50-Year	7000.00	151.20	162.07	159.10	162.57	0.003468	7.76	1705.31	342.90	0.43
Reach-1	228	100-Year	7840.00	151.20	162.68	159.57	163.19	0.003337	7.91	1869.60	346.71	0.43
Reach-1	226.161*	50-Year	7000.00	151.20	161.81	158.33	162.12	0.002722	5.72	1860.24	397.37	0.34
Reach-1	226.161*	100-Year	7840.00	151.20	162.43	158.58	162.75	0.002632	5.82	2024.26	408.06	0.33
Reach-1	226	50-Year	7000.00	151.20	161.73	158.24	162.08	0.002482	5.97	1834.49	404.99	0.36
Reach-1	226	100-Year	7840.00	151.20	162.35	158.50	162.71	0.002408	6.12	1994.28	417.63	0.35
Reach-1	224.5	50-Year	7000.00	150.60	161.59	156.83	161.80	0.001508	5.03	2198.98	422.58	0.29
Reach-1	224.5	100-Year	7840.00	150.60	162.20	157.04	162.44	0.001486	5.22	2371.11	447.60	0.29
Reach-1	224.311*	50-Year	7000.00	150.52	161.61	156.03	161.75	0.001040	4.21	2625.21	454.26	0.24
Reach-1	224.311*	100-Year	7840.00	150.52	162.22	156.23	162.38	0.001039	4.39	2815.26	500.19	0.24
Reach-1	224	50-Year	7000.00	150.40	161.62	154.46	161.70	0.000573	3.16	3347.33	557.62	0.18
Reach-1	224	100-Year	7840.00	150.40	162.24	154.71	162.33	0.000581	3.32	3570.67	571.01	0.18
Reach-1	223.333*	50-Year	7000.00	150.03	161.50	156.07	161.66	0.000928	3.87	2591.25	386.34	0.23
Reach-1	223.333*	100-Year	7840.00	150.03	162.12	156.30	162.29	0.000917	4.02	2796.96	393.51	0.23
Reach-1	222	50-Year	7000.00	149.30	161.48	155.46	161.60	0.000507	2.88	2776.91	629.38	0.17
Reach-1	222	100-Year	7840.00	149.30	162.10	155.67	162.22	0.000507	3.01	2977.41	636.04	0.17
Reach-1	221	50-Year	7000.00	149.30	160.94		161.42	0.001959	6.13	1306.26	165.21	0.34
Reach-1	221	100-Year	7840.00	149.30	161.52		162.04	0.001989	6.41	1402.02	168.26	0.34
Reach-1	220	50-Year	7000.00	149.30	160.66	156.92	161.34	0.002913	7.33	1093.23	141.79	0.41
Reach-1	220	100-Year	7840.00	149.30	161.21	157.30	161.96	0.002967	7.67	1172.13	144.31	0.42
Reach-1	219.5		Bridge									
Reach-1	219	50-Year	7000.00	149.30	159.38	156.92	160.36	0.004961	8.72	915.73	135.93	0.52
Reach-1	219	100-Year	7840.00	149.30	159.81	157.30	160.89	0.005174	9.19	973.63	137.87	0.54
Reach-1	218	50-Year	7000.00	149.10	159.46		160.17	0.003693	6.80	1029.61	138.16	0.44
Reach-1	218	100-Year	7840.00	149.10	159.89		160.69	0.003942	7.20	1089.61	140.96	0.46
Reach-1	216	50-Year	7000.00	149.00	158.44		159.59	0.007109	9.30	831.99	127.38	0.61
Reach-1	216	100-Year	7840.00	149.00	158.74		160.06	0.007809	9.94	870.33	128.79	0.64
Reach-1	214	50-Year	7000.00	149.00	158.05		158.99	0.005019	7.86	917.72	137.43	0.51
Reach-1	214	100-Year	7840.00	149.00	158.29		159.39	0.005670	8.51	951.22	139.73	0.55
Reach-1	212	50-Year	7000.00	147.90	157.98		158.38	0.002691	6.21	1641.14	465.09	0.38
Reach-1	212	100-Year	7840.00	147.90	158.28		158.71	0.002782	6.46	1783.41	472.57	0.39
Reach-1	210	50-Year	7000.00	146.90	157.12	156.26	157.86	0.004762	7.75	1307.36	424.26	0.50
Reach-1	210	100-Year	7840.00	146.90	157.41	156.55	158.18	0.004854	8.02	1430.22	428.88	0.50

HEC-RAS Plan: ALT3 River: RIVER-1 Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	208	50-Year	7000.00	146.50	155.60	155.60	156.90	0.008934	10.14	1154.83	505.79	0.67
Reach-1	208	100-Year	7840.00	146.50	155.84	155.84	157.20	0.009242	10.54	1275.91	508.45	0.69
Reach-1	206	50-Year	7000.00	145.90	154.96		155.35	0.003271	6.35	1788.52	389.02	0.41
Reach-1	206	100-Year	7840.00	145.90	155.50		155.88	0.003014	6.33	2000.61	393.26	0.40
Reach-1	204	50-Year	7000.00	145.30	154.59		154.95	0.002837	6.06	1834.18	351.41	0.39
Reach-1	204	100-Year	7840.00	145.30	155.16		155.51	0.002616	6.10	2033.99	355.70	0.37
Reach-1	191	50-Year	7000.00	144.70	154.42		154.56	0.000739	3.34	2494.31	524.54	0.20
Reach-1	191	100-Year	7840.00	144.70	155.02		155.16	0.000646	3.27	2813.28	537.33	0.19
Reach-1	190	50-Year	7000.00	143.10	153.74	150.46	154.47	0.003899	6.88	1018.11	137.11	0.44
Reach-1	190	100-Year	7840.00	143.10	154.26	150.81	155.07	0.003951	7.19	1090.55	138.42	0.45
Reach-1	189.5		Bridge									
Reach-1	189	50-Year	7000.00	143.10	152.86	150.46	153.80	0.005761	7.79	898.47	134.94	0.53
Reach-1	189	100-Year	7840.00	143.10	153.35	150.81	154.37	0.005781	8.12	964.94	136.15	0.54
Reach-1	188	50-Year	7000.00	143.10	152.77	150.42	153.74	0.006001	7.89	886.84	134.72	0.54
Reach-1	188	100-Year	7840.00	143.10	153.26	150.78	154.31	0.006009	8.23	953.08	135.93	0.55

Appendix C Geotechnical/Geologic Information

Appendix C.1 Geologic Map



LEGEND

Qa - Alluvium (Riverbank and Turlock Lake Formations)

Tva - Andesitic, volcanic mudflows, breccia, and sediments (Mehrten Formation)

Mzg - Granitic rock of the Rocklin Pluton

- Approximate geologic contact

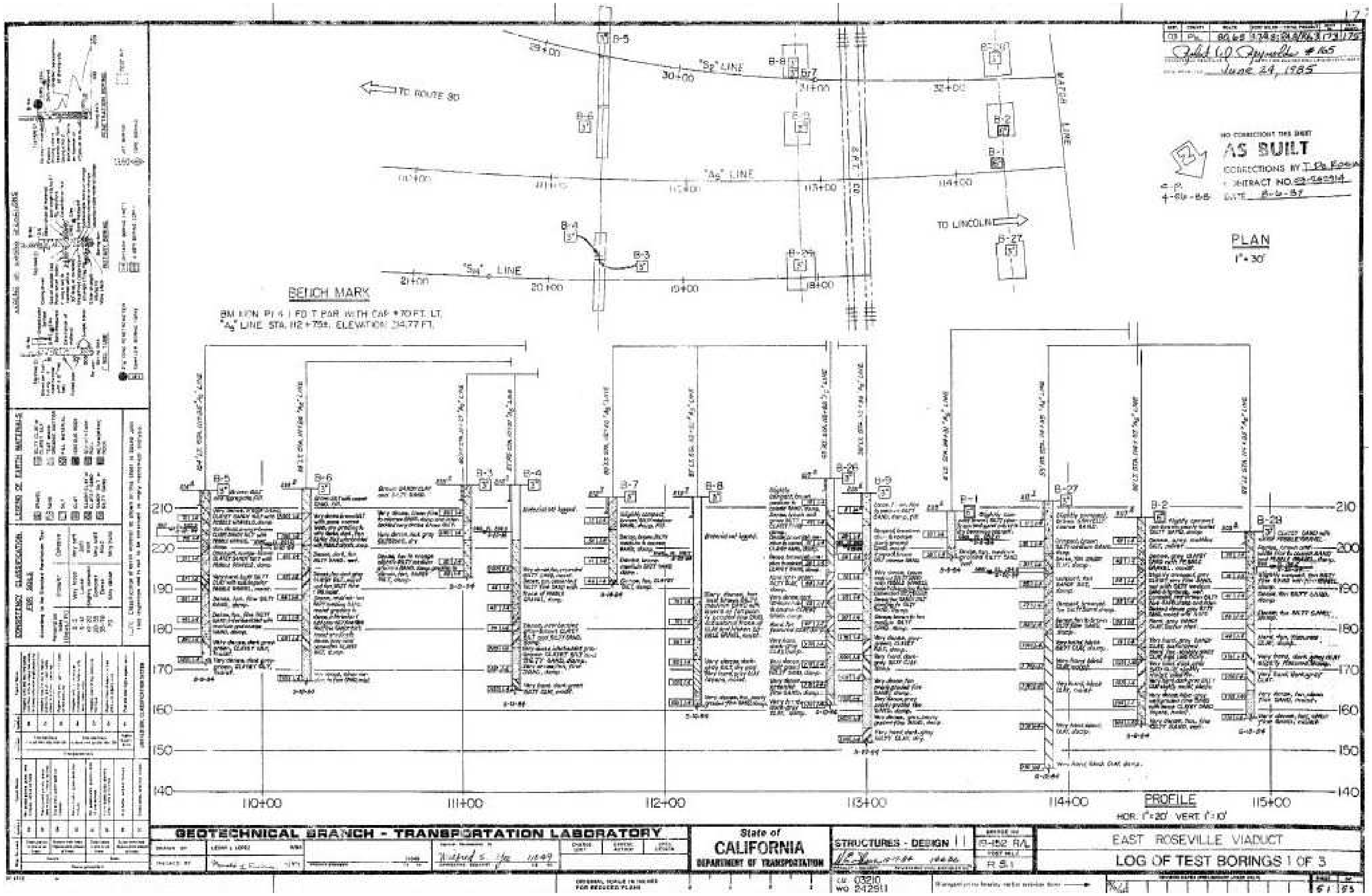
Base Source: USGS Roseville and Rocklin Quadrangles, 7.5 Minute Series topographic, 1:24000, dated 2012.
Geologic Source: Modified after Livingston, 1974, and Loyd, 1995.

blackburn consulting
11521 Blocker Drive, Suite 110
Auburn, CA 95603
Phone: (530) 887-1494
Fax: (530) 887-1495
www.blackburnconsulting.com

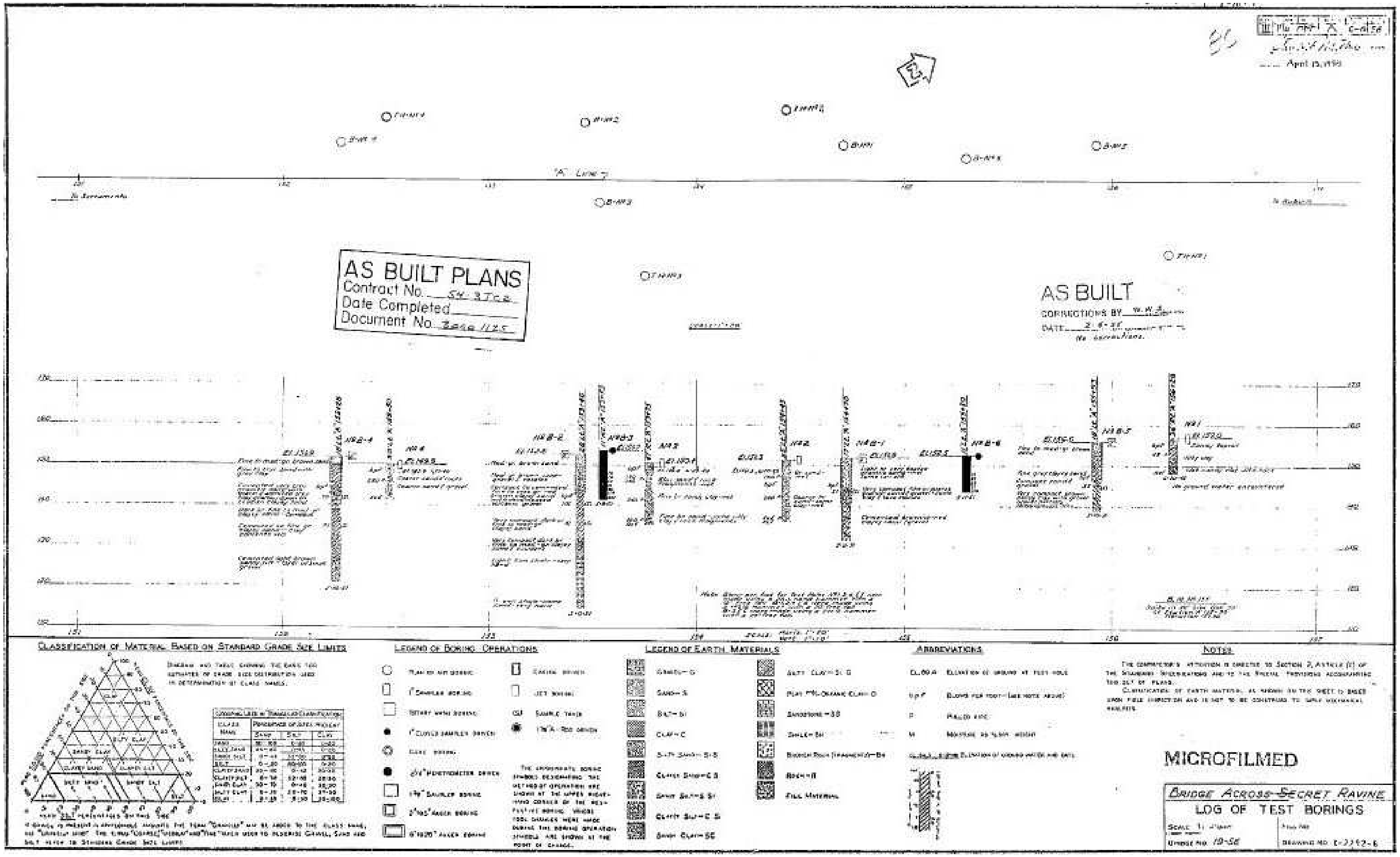
GEOLOGIC MAP
I-80 / SR65 Interchange Project
Placer County, California

File No. 1980.4.1
May 2013
Figure 3

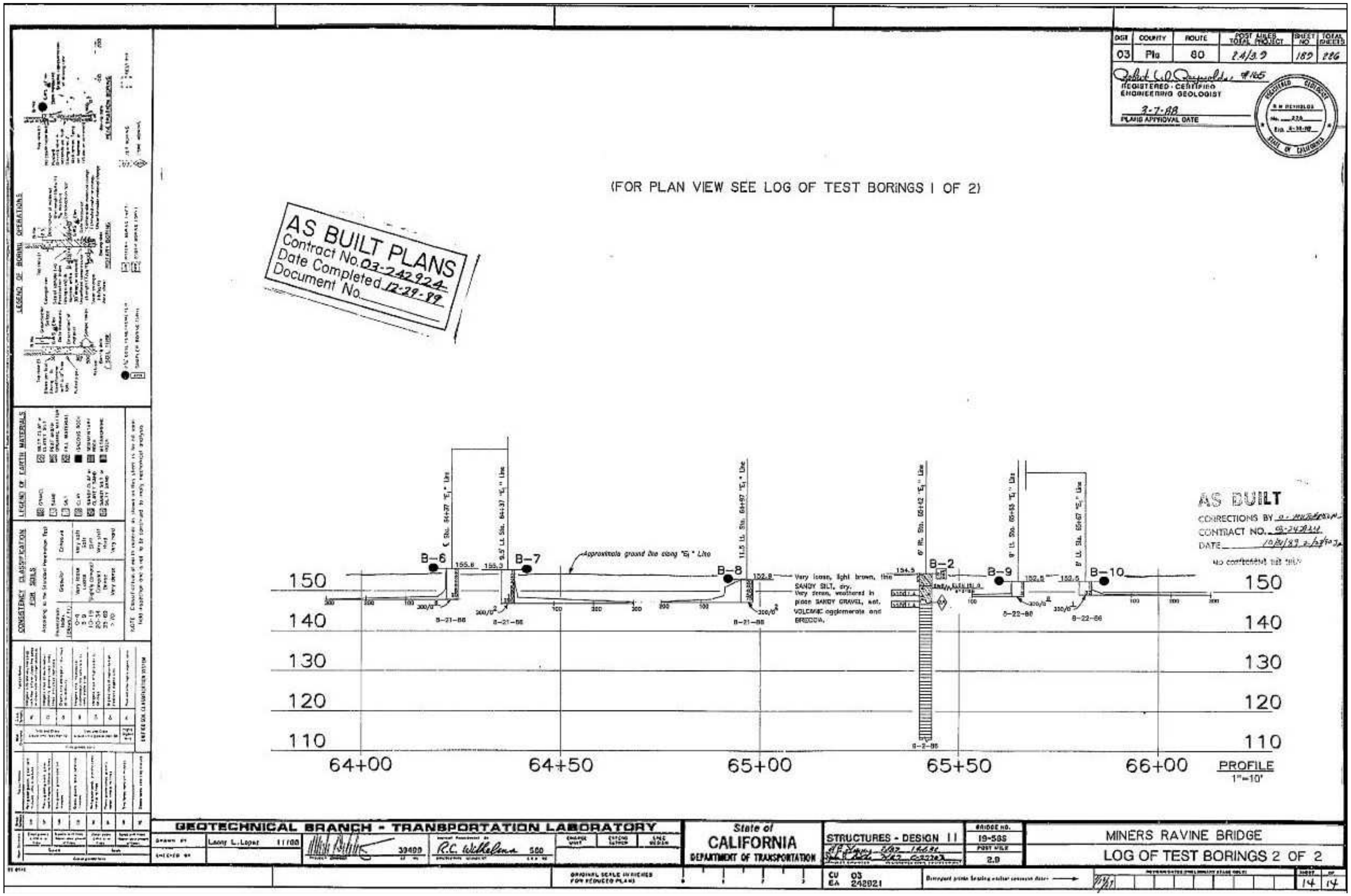
Appendix C.2 East Roseville Viaduct As-built Plan (1987) - Log Boring Test Results


AS BUILT
PLAN
BENCH MARK
TO ROUTE 80
TO LINCOLN
PROFILE
110+00
111+00
112+00
113+00
114+00
115+00
GEOTECHNICAL BRANCH - TRANSPORTATION LABORATORY
State of CALIFORNIA
DEPARTMENT OF TRANSPORTATION
STRUCTURES - DESIGN
EAST ROSEVILLE VIADUCT
LOG OF TEST BORINGS 1 OF 3

Appendix C.3 Miners Ravine Bridge at Miners Ravine As-built Plan (1989) - Log Boring Test Results


AS BUILT PLANS
Contract No.
Date Completed
Document No.
AS BUILT
CORRECTIONS BY
DATE
CLASSIFICATION OF MATERIAL BASED ON STANDARD GRADE SIZE LIMITS
LEGEND OF BORING OPERATIONS
LEGEND OF EARTH MATERIALS
ABBREVIATIONS
NOTES
MICROFILMED
BRIDGE ACROSS SECRET RAVINE
LOG OF TEST BORINGS

Appendix C.4 I-80 Off-Ramp to Eureka Road Bridge at Miners Ravine As-built Plan (1989) - Log Boring Test Results


(FOR PLAN VIEW SEE LOG OF TEST BORINGS 1 OF 2)
AS BUILT PLANS
Contract No. 03-242924
Date Completed 12-29-99
Document No.
REGISTERED CERTIFIED ENGINEERING GEOLOGIST
PLANS APPROVAL DATE
AS BUILT
B-6
B-7
B-8
B-2
B-9
B-10
Approximate ground line along "E1" Line
Very loose, light brown, fine SANDY SILT, dry.
Very dense, weathered in place SANDY GRAVEL, wet.
VOLCANIC agglomerate and BRECCIA.
150
140
130
120
110
64+00
64+50
65+00
65+50
66+00
PROFILE
1"=10'
GEOTECHNICAL BRANCH - TRANSPORTATION LABORATORY
State of CALIFORNIA
DEPARTMENT OF TRANSPORTATION
STRUCTURES - DESIGN 11
19-58S
MINERS RAVINE BRIDGE
LOG OF TEST BORINGS 2 OF 2
LEGEND OF BORING OPERATIONS
LEGEND OF EARTH MATERIALS
CONSISTENCY CLASSIFICATION FOR SOILS
ORIGINAL SCALE IN INCHES FOR REDUCED PLANS
CU 03
EA 242921

Appendix D Scour Calculations

Appendix D.1 E. Roseville Viaduct at Antelope Creek Scour Calculations

I-80/SR 65 Interchange Improvements

Placer County, California

Ultimate (Contraction) Scour

100-year Flow
Calculation guideline from HEC-18 5th Edition
Input from HEC-RAS for Proposed ALTERNATIVE 1, 2 and 3 at Antelope Creek

Page 6.15, Page 151 / 340 , Section 6.7 Contraction Scour in Cohesive Materials (6.7.1 Ultimate Scour)

$$y_{s-ult} = 0.94 y_1 \left(\frac{1.83 V_2}{\sqrt{g y_1}} - \frac{K_u \sqrt{\frac{\tau_c}{\rho}}}{g n y_1^{1/3}} \right)$$

	English Units		Metric Units						
y1	9.9	ft	3.0	m	Upstream depth				
V2	4.1	ft/s	1.2	m/s	Average velocity in contracted section				
tc					Critical shear stress				
n	0.055		0.055		Manning's n				
Ku	1.486		1		1.486 fot U.S. Customary, and 1.0 for S.I.				
r		slugs/ft3			Density	1000	kg/m3 =	1.94	slugs/ft3
g	32.2	ft/s^2	9.81	m/s^2					
D50			0.2	mm					

Density, rho
http://www.mo10.nrcs.usda.gov/references/guides/properties/moistbulkdensity.html

Material	Density			
	Metric Units		English Units	
Very Fine Sand	1900	kg/m3	3.69	slugs/ft3
Very Fine Sand	1900	kg/m3	3.69	slugs/ft3
Water, sea	1026	kg/m3	1.99	slugs/ft3
Water, pure	1000	kg/m3	1.94	slugs/ft3

Critical Shear Stress Tc	Tc (N/m2)	Tc (lb/ft2)
Tc=0.05(D50)^-0.4	0.1	
Tc=0.006(D50)^-2	0.2	

Scour Depths

Very Fine Sand ,Tc=0.05(D50)^-0.4					**Very Fine Sand ,Tc=0.05(D50)^-0.4**				
1.16	m	3.8	ft	ys	1.16	m	3.8	ft	ys
Very Fine Sand ,Tc=0.006(D50)^-2					**Very Fine Sand ,Tc=0.006(D50)^-2**				
1.16	m	3.8	ft	ys	1.16	m	3.8	ft	ys

I-80/SR 65 Interchange Improvements
Placer County, California
Local Scour at Piers - Cohesive

100-year Flow
Calculation guideline from HEC-18 5th Edition
Input from HEC-RAS for Proposed ALTERNATIVE 1, 2 and 3 at Antelope Creek

Page 7.38, Page 204 / 340 , Section 7.12 Pier Scour In Cohesive Materials

ys = 2.2 K1 K2 a^0.65 [(2.6V1 - Vc) / sqrt (g)] ^0.7

Bent 6

L	49.5	ft	Pier length
a	5.5	ft	Pier width
L/a	9		If L/a is larger than 12, then use 12 as a maximum
Θ	90	degrees	Angle of attack of flow
	Group of cylinders		Pier shape
K1	1		Correction factor for pier shape
K2	4.2		Correction factor for angle of attack
V1	0	ft/s	Approach velocity
Vc	0.2	m/s	From Figure 4.7:
Vc	0.7	ft/s	using an erosion rate of 0.1 mm/hr
g	32.2	ft/s^2	and based on silty sand (SM)
ys	**0.00**	**ft**	

Bent 10

L	49.5	ft	Pier length
a	5.5	ft	Pier width
L/a	9		If L/a is larger than 12, then use 12 as a maximum
Θ	90	degrees	Angle of attack of flow
	Group of cylinders		Pier shape
K1	1		Correction factor for pier shape
K2	4.2		Correction factor for angle of attack
V1	1.49	ft/s	Approach velocity
Vc	0.2	m/s	From Figure 4.7:
Vc	0.7	ft/s	using an erosion rate of 0.1 mm/hr
g	32.2	ft/s^2	and based on silty sand (SM)
ys	**18.68**	**ft**	

Bent 11

L	49.5	ft	Pier length
a	5.5	ft	Pier width
L/a	9		If L/a is larger than 12, then use 12 as a maximum
Θ	90	degrees	Angle of attack of flow
	Group of cylinders		Pier shape
K1	1		Correction factor for pier shape
K2	4.2		Correction factor for angle of attack
V1	2.8	ft/s	Approach velocity
Vc	0.2	m/s	From Figure 4.7:
Vc	0.7	ft/s	using an erosion rate of 0.1 mm/hr
g	32.2	ft/s^2	and based on silty sand (SM)
ys	**30.97**	**ft**	

Appendix D.2 EN and SE Connector at Secret Ravine Scour Calculations

I-80/SR 65 Interchange Improvements
Placer County, California
Ultimate (Contraction) Scour

100-year Flow
Calculation guideline from HEC-18 5th Edition
Input from HEC-RAS for Proposed ALTERNATIVE 1 of Secret Ravine

Page 6.15, Page 151 / 340 , Section 6.7 Contraction Scour in Cohesive Materials (6.7.1 Ultimate Scour)

$$y_{s-ult} = 0.94 y_1 \left(\frac{1.83 V_2}{\sqrt{g y_1}} - \frac{K_u \sqrt{\frac{\tau_c}{\rho}}}{g n y_1^{1/3}} \right)$$

	English Units		Metric Units					
y1	6.9	ft	2.1	m	Upstream depth			
V2	7.3	ft/s	2.2	m/s	Average velocity in contracted section			
tc					Critical shear stress			
n	0.1		0.1		Manning's n			
Ku	1.486		1		1.486 fot U.S. Customary, and 1.0 for S.I.			
r		slugs/ft3			Density	1000	kg/m3 =	1.94 slugs/ft3
g	32.2	ft/s^2	9.81	m/s^2				
D50			0.2	mm				

Density, rho
http://www.mo10.nrcs.usda.gov/references/guides/properties/moistbulkdensity.html

Material	Density			
	Metric Units		English Units	
Very Fine Sand	1900	kg/m3	3.69	slugs/ft3
Very Fine Sand	1900	kg/m3	3.69	slugs/ft3
Water, sea	1026	kg/m3	1.99	slugs/ft3
Water, pure	1000	kg/m3	1.94	slugs/ft3

Critical Shear Stress Tc	Tc (N/m2)	Tc (lb/ft2)
Tc=0.05(D50)^-0.4	0.1	
Tc=0.006(D50)^-2	0.2	

Scour Depths

Very Fine Sand ,Tc=0.05(D50)^-0.4			**Very Fine Sand ,Tc=0.05(D50)^-0.4**		
1.76 m	5.8 ft	ys	1.76 m	5.8 ft	ys
Very Fine Sand ,Tc=0.006(D50)^-2			**Very Fine Sand ,Tc=0.006(D50)^-2**		
1.75 m	5.8 ft	ys	1.75 m	5.8 ft	ys

I-80/SR 65 Interchange Improvements

Placer County, California

Local Scour at Piers - Cohesive

100-year Flow
Calculation guideline from HEC-18 5th Edition
Input from HEC-RAS for Proposed ALTERNATIVE 1 of Secret Ravine

Page 7.38, Page 204 / 340 , Section 7.12 Pier Scour In Cohesive Materials
ys = 2.2 K1 K2 a^0.65 [(2.6V1 - Vc) / sqrt (g)] ^0.7

Bent 5SE

L	8.25	ft	Pier length
a	5.5	ft	Pier width
L/a	1.5		If L/a is larger than 12, then use 12 as a maximum
Θ	90	degrees	Angle of attack of flow
	Square nose		Pier shape
K1	1		Correction factor for pier shape
K2	1.3		Correction factor for angle of attack
V1	5.65	ft/s	Approach velocity
Vc	0.2	m/s	From Figure 4.7:
Vc	0.7	ft/s	using an erosion rate of 0.1 mm/hr
g	32.2	ft/s^2	and based on silty sand (SM)
ys	**16.35**	**ft**	

Bent 5NW

L	8.25	ft	Pier length
a	5.5	ft	Pier width
L/a	1.5		If L/a is larger than 12, then use 12 as a maximum
Θ	90	degrees	Angle of attack of flow
	Square nose		Pier shape
K1	1		Correction factor for pier shape
K2	1.3		Correction factor for angle of attack
V1	5.02	ft/s	Approach velocity
Vc	0.2	m/s	From Figure 4.7:
Vc	0.7	ft/s	using an erosion rate of 0.1 mm/hr
g	32.2	ft/s^2	and based on silty sand (SM)
ys	**14.99**	**ft**	

Bent 6

L	8.25	ft	Pier length
a	5.5	ft	Pier width
L/a	1.5		If L/a is larger than 12, then use 12 as a maximum
Θ	90	degrees	Angle of attack of flow
	Square nose		Pier shape
K1	1		Correction factor for pier shape
K2	1.3		Correction factor for angle of attack
V1	4.18	ft/s	Approach velocity
Vc	0.2	m/s	From Figure 4.7:
Vc	0.7	ft/s	using an erosion rate of 0.1 mm/hr
g	32.2	ft/s^2	and based on silty sand (SM)
ys	**13.08**	**ft**	

Bent 7NW

L	8.25	ft	Pier length
a	5.5	ft	Pier width
L/a	1.5		If L/a is larger than 12, then use 12 as a maximum
Θ	90	degrees	Angle of attack of flow
	Square nose		Pier shape
K1	1		Correction factor for pier shape
K2	1.3		Correction factor for angle of attack
V1	5.22	ft/s	Approach velocity
Vc	0.2	m/s	From Figure 4.7:
Vc	0.7	ft/s	using an erosion rate of 0.1 mm/hr
g	32.2	ft/s^2	and based on silty sand (SM)
ys	**15.42**	**ft**	

Bent 7SE

L	8.25	ft	Pier length
a	5.5	ft	Pier width
L/a	1.5		If L/a is larger than 12, then use 12 as a maximum
Θ	90	degrees	Angle of attack of flow
	Square nose		Pier shape
K1	1		Correction factor for pier shape
K2	1.3		Correction factor for angle of attack
V1	5.72	ft/s	Approach velocity
Vc	0.2	m/s	From Figure 4.7:
Vc	0.7	ft/s	using an erosion rate of 0.1 mm/hr
g	32.2	ft/s^2	and based on silty sand (SM)
ys	**16.49**	**ft**	

Bent 10

L	8.25	ft	Pier length
a	5.5	ft	Pier width
L/a	1.5		If L/a is larger than 12, then use 12 as a maximum
Θ	90	degrees	Angle of attack of flow
	Square nose		Pier shape
K1	1		Correction factor for pier shape
K2	1.3		Correction factor for angle of attack
V1	2.26	ft/s	Approach velocity
Vc	0.2	m/s	From Figure 4.7:
Vc	0.7	ft/s	using an erosion rate of 0.1 mm/hr
g	32.2	ft/s^2	and based on silty sand (SM)
ys	**8.18**	**ft**	

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Placer County, California

Local Scour at Piers - Cohesive

100-year Flow
Calculation guideline from HEC-18 5th Edition
Input from HEC-RAS for Proposed ALTERNATIVE 1 of Secret Ravine

Bent 11

L	8.25	ft	Pier length
a	5.5	ft	Pier width
L/a	1.5		If L/a is larger than 12, then use 12 as a maximum
Θ	90	degrees	Angle of attack of flow
	Square nose		Pier shape
K1	1		Correction factor for pier shape
K2	1.3		Correction factor for angle of attack
V1	1.92	ft/s	Approach velocity
Vc	0.2	m/s	From Figure 4.7:
Vc	0.7	ft/s	using an erosion rate of 0.1 mm/hr
g	32.2	ft/s^2	and based on silty sand (SM)
ys	**7.18**	**ft**	

Bent 12

L	8.25	ft	Pier length
a	5.5	ft	Pier width
L/a	1.5		If L/a is larger than 12, then use 12 as a maximum
Θ	90	degrees	Angle of attack of flow
	Square nose		Pier shape
K1	1		Correction factor for pier shape
K2	1.3		Correction factor for angle of attack
V1	3.17	ft/s	Approach velocity
Vc	0.2	m/s	From Figure 4.7:
Vc	0.7	ft/s	using an erosion rate of 0.1 mm/hr
g	32.2	ft/s^2	and based on silty sand (SM)
ys	**10.63**	**ft**	

Bent 13

L	8.25	ft	Pier length
a	5.5	ft	Pier width
L/a	1.5		If L/a is larger than 12, then use 12 as a maximum
Θ	90	degrees	Angle of attack of flow
	Square nose		Pier shape
K1	1		Correction factor for pier shape
K2	1.3		Correction factor for angle of attack
V1	2.73	ft/s	Approach velocity
Vc	0.2	m/s	From Figure 4.7:
Vc	0.7	ft/s	using an erosion rate of 0.1 mm/hr
g	32.2	ft/s^2	and based on silty sand (SM)
ys	**9.48**	**ft**	

Bent 14

L	8.25	ft	Pier length
a	5.5	ft	Pier width
L/a	1.5		If L/a is larger than 12, then use 12 as a maximum
Θ	90	degrees	Angle of attack of flow
	Square nose		Pier shape
K1	1		Correction factor for pier shape
K2	1.3		Correction factor for angle of attack
V1	1.53	ft/s	Approach velocity
Vc	0.2	m/s	From Figure 4.7:
Vc	0.7	ft/s	using an erosion rate of 0.1 mm/hr
g	32.2	ft/s^2	and based on silty sand (SM)
ys	**5.96**	**ft**	

Bent 15

L	8.25	ft	Pier length
a	5.5	ft	Pier width
L/a	1.5		If L/a is larger than 12, then use 12 as a maximum
Θ	90	degrees	Angle of attack of flow
	Square nose		Pier shape
K1	1		Correction factor for pier shape
K2	1.3		Correction factor for angle of attack
V1	1.62	ft/s	Approach velocity
Vc	0.2	m/s	From Figure 4.7:
Vc	0.7	ft/s	using an erosion rate of 0.1 mm/hr
g	32.2	ft/s^2	and based on silty sand (SM)
ys	**6.25**	**ft**	

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Placer County, California

Ultimate (Contraction) Scour

100-year Flow
Calculation guideline from HEC-18 5th Edition
Input from HEC-RAS for Proposed ALTERNATIVE 1 of Secret Ravine (EN Connector)

Page 6.15, Page 151 / 340 , Section 6.7 Contraction Scour in Cohesive Materials (6.7.1 Ultimate Scour)

$$y_{s-ult} = 0.94 y_1 \left(\frac{1.83 V_2}{\sqrt{g y_1}} - \frac{K_u \sqrt{\frac{\tau_c}{\rho}}}{g n y_1^{1/3}} \right)$$

	English Units		Metric Units						
y1	6.9	ft	2.1	m	Upstream depth				
V2	7.3	ft/s	2.2	m/s	Average velocity in contracted section				
tc					Critical shear stress				
n	0.1		0.1		Manning's n				
Ku	1.486		1		1.486 fot U.S. Customary, and 1.0 for S.I.				
r		slugs/ft3			Density	1000	kg/m3 =	1.94	slugs/ft3
g	32.2	ft/s^2	9.81	m/s^2					
D50			0.2	mm					

Density, rho
http://www.mo10.nrcs.usda.gov/references/guides/properties/moistbulkdensity.html

Material	Density			
	Metric Units		English Units	
Very Fine Sand	1900	kg/m3	3.69	slugs/ft3
Very Fine Sand	1900	kg/m3	3.69	slugs/ft3
Water, sea	1026	kg/m3	1.99	slugs/ft3
Water, pure	1000	kg/m3	1.94	slugs/ft3

Critical Shear Stress Tc	Tc (N/m2)	Tc (lb/ft2)
Tc=0.05(D50)^-0.4	0.1	
Tc=0.006(D50)^-2	0.2	

Scour Depths

Very Fine Sand ,Tc=0.05(D50)^-0.4					**Very Fine Sand ,Tc=0.05(D50)^-0.4**				
1.76	m	5.8	ft	ys	1.76	m	5.8	ft	ys
Very Fine Sand ,Tc=0.006(D50)^-2					**Very Fine Sand ,Tc=0.006(D50)^-2**				
1.75	m	5.8	ft	ys	1.75	m	5.8	ft	ys

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Placer County, California

Ultimate (Contraction) Scour

100-year Flow
Calculation guideline from HEC-18 5th Edition
Input from HEC-RAS for Proposed ALTERNATIVES 2 and 3 of Secret Ravine (EN Connector)

Page 6.15, Page 151 / 340 , Section 6.7 Contraction Scour in Cohesive Materials (6.7.1 Ultimate Scour)

$$y_{s-ult} = 0.94 y_1 \left(\frac{1.83 V_2}{\sqrt{g y_1}} - \frac{K_u \sqrt{\frac{\tau_c}{\rho}}}{g n y_1^{1/3}} \right)$$

	English Units		Metric Units						
y1	7.1	ft	2.2	m	Upstream depth				
V2	5.7	ft/s	1.7	m/s	Average velocity in contracted section				
tc					Critical shear stress				
n	0.07		0.07		Manning's n				
Ku	1.486		1		1.486 fot U.S. Customary, and 1.0 for S.I.				
r		slugs/ft3			Density	1000	kg/m3 =	1.94	slugs/ft3
g	32.2	ft/s^2	9.81	m/s^2					
D50			0.2	mm					

Density, rho
http://www.mo10.nrcs.usda.gov/references/guides/properties/moistbulkdensity.html

Material	Density			
	Metric Units		English Units	
Very Fine Sand	1900	kg/m3	3.69	slugs/ft3
Very Fine Sand	1900	kg/m3	3.69	slugs/ft3
Water, sea	1026	kg/m3	1.99	slugs/ft3
Water, pure	1000	kg/m3	1.94	slugs/ft3

Critical Shear Stress Tc	Tc (N/m2)	Tc (lb/ft2)
Tc=0.05(D50)^-0.4	0.1	
Tc=0.006(D50)^-2	0.2	

Scour Depths

Very Fine Sand ,Tc=0.05(D50)^-0.4						**Very Fine Sand ,Tc=0.05(D50)^-0.4**					
1.39	m	4.6	ft	ys		1.39	m	4.6	ft	ys	
Very Fine Sand ,Tc=0.006(D50)^-2						**Very Fine Sand ,Tc=0.006(D50)^-2**					
1.38	m	4.5	ft	ys		1.38	m	4.5	ft	ys	

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Placer County, California

Ultimate (Contraction) Scour

100-year Flow
Calculation guideline from HEC-18 5th Edition
Input from HEC-RAS for Proposed ALTERNATIVES 2 and 3 of Secret Ravine (EB On-Ramp Connector)

Page 6.15, Page 151 / 340 , Section 6.7 Contraction Scour in Cohesive Materials (6.7.1 Ultimate Scour)

$$y_{s-ult} = 0.94y_1\left(\frac{1.83V_2}{\sqrt{gy_1}} - \frac{K_u\sqrt{\frac{\tau_c}{\rho}}}{gny_1^{1/3}}\right)$$

	English Units		Metric Units						
y1	7.7	ft	2.3	m	Upstream depth				
V2	4.8	ft/s	1.5	m/s	Average velocity in contracted section				
tc					Critical shear stress				
n	0.07		0.07		Manning's n				
Ku	1.486		1		1.486 fot U.S. Customary, and 1.0 for S.I.				
r		slugs/ft3			Density	1000	kg/m3 =	1.94	slugs/ft3
g	32.2	ft/s^2	9.81	m/s^2					
D50			0.2	mm					

Density, rho
http://www.mo10.nrcs.usda.gov/references/guides/properties/moistbulkdensity.html

Material	Density			
	Metric Units		English Units	
Very Fine Sand	1900	kg/m3	3.69	slugs/ft3
Very Fine Sand	1900	kg/m3	3.69	slugs/ft3
Water, sea	1026	kg/m3	1.99	slugs/ft3
Water, pure	1000	kg/m3	1.94	slugs/ft3

Critical Shear Stress Tc	Tc (N/m2)	Tc (lb/ft2)
Tc=0.05(D50)^-0.4	0.1	
Tc=0.006(D50)^-2	0.2	

Scour Depths

Very Fine Sand ,Tc=0.05(D50)^-0.4						**Very Fine Sand ,Tc=0.05(D50)^-0.4**					
1.21	m	4.0	ft	ys		1.21	m	4.0	ft	ys	
Very Fine Sand ,Tc=0.006(D50)^-2						**Very Fine Sand ,Tc=0.006(D50)^-2**					
1.21	m	4.0	ft	ys		1.21	m	4.0	ft	ys	

Appendix D.3 Miners Ravine Bridge at Miners Ravine Scour Calculations

I-80/SR 65 Interchange Improvements

Placer County, California

Ultimate (Contraction) Scour

100-year Flow
Calculation guideline from HEC-18 5th Edition
Input from HEC-RAS for Proposed ALTERNATIVE 2 of Miners Ravine

Page 6.15, Page 151 / 340 , Section 6.7 Contraction Scour in Cohesive Materials (6.7.1 Ultimate Scour)

$$y_{s-ult} = 0.94 y_1 \left(\frac{1.83 V_2}{\sqrt{g y_1}} - \frac{K_u \sqrt{\frac{\tau_c}{\rho}}}{g n y_1^{1/3}} \right)$$

	English Units		Metric Units					
y1	10.8	ft	3.3	m	Upstream depth			
V2	3.3	ft/s	1.0	m/s	Average velocity in contracted section			
tc					Critical shear stress			
n	0.07		0.07		Manning's n			
Ku	1.486		1		1.486 fot U.S. Customary, and 1.0 for S.I.			
r		slugs/ft3			Density	1000	kg/m3 =	1.94 slugs/ft3
g	32.2	ft/s^2	9.81	m/s^2				
D50			0.2	mm				

Density, rho
http://www.mo10.nrcs.usda.gov/references/guides/properties/moistbulkdensity.html

Material	Density			
	Metric Units		English Units	
Very Fine Sand	1900	kg/m3	3.69	slugs/ft3
Very Fine Sand	1900	kg/m3	3.69	slugs/ft3
Water, sea	1026	kg/m3	1.99	slugs/ft3
Water, pure	1000	kg/m3	1.94	slugs/ft3

Critical Shear Stress Tc	Tc (N/m2)	Tc (lb/ft2)
Tc=0.05(D50)^-0.4	0.1	
Tc=0.006(D50)^-2	0.2	

Scour Depths

Very Fine Sand ,Tc=0.05(D50)^-0.4						**Very Fine Sand ,Tc=0.05(D50)^-0.4**					
0.97	m	3.2	ft	ys		0.97	m	3.2	ft	ys	
Very Fine Sand ,Tc=0.006(D50)^-2						**Very Fine Sand ,Tc=0.006(D50)^-2**					
0.96	m	3.2	ft	ys		0.96	m	3.2	ft	ys	

I-80/SR 65 Interchange Improvements

Placer County, California

Ultimate (Contraction) Scour

100-year Flow
Calculation guideline from HEC-18 5th Edition
Input from HEC-RAS for Proposed ALTERNATIVE 3 of Miners Ravine

Page 6.15, Page 151 / 340 , Section 6.7 Contraction Scour in Cohesive Materials (6.7.1 Ultimate Scour)

$$y_{s-ult} = 0.94y_1\left(\frac{1.83V_2}{\sqrt{gy_1}} - \frac{K_u\sqrt{\frac{\tau_c}{\rho}}}{gny_1^{1/3}}\right)$$

	English Units		Metric Units						
y1	10.4	ft	3.2	m	Upstream depth				
V2	7.9	ft/s	2.4	m/s	Average velocity in contracted section				
tc					Critical shear stress				
n	0.07		0.07		Manning's n				
Ku	1.486		1		1.486 fot U.S. Customary, and 1.0 for S.I.				
r		slugs/ft3			Density	1000	kg/m3 =	1.94	slugs/ft3
g	32.2	ft/s^2	9.81	m/s^2					
D50			0.2	mm					

Density, rho
http://www.mo10.nrcs.usda.gov/references/guides/properties/moistbulkdensity.html

Material	Density			
	Metric Units		English Units	
Very Fine Sand	1900	kg/m3	3.69	slugs/ft3
Very Fine Sand	1900	kg/m3	3.69	slugs/ft3
Water, sea	1026	kg/m3	1.99	slugs/ft3
Water, pure	1000	kg/m3	1.94	slugs/ft3

Critical Shear Stress Tc	Tc (N/m2)	Tc (lb/ft2)
Tc=0.05(D50)^-0.4	0.1	
Tc=0.006(D50)^-2	0.2	

Scour Depths

Very Fine Sand ,Tc=0.05(D50)^-0.4						**Very Fine Sand ,Tc=0.05(D50)^-0.4**					
2.33	m	7.7	ft	ys		2.33	m	7.7	ft	ys	
Very Fine Sand ,Tc=0.006(D50)^-2						**Very Fine Sand ,Tc=0.006(D50)^-2**					
2.33	m	7.6	ft	ys		2.33	m	7.6	ft	ys	

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Placer County, California
Local Scour at Piers - Cohesive
100-year Flow
Calculation guideline from HEC-18 5th Edition
Input from HEC-RAS for Proposed ALTERNATIVE 3 of Miners Ravine

Page 7.38, Page 204 / 340 , Section 7.12 Pier Scour In Cohesive Materials
ys = 2.2 K1 K2 a^0.65 [(2.6V1 - Vc) / sqrt (g)] ^0.7

Bent 2

L	8.25	ft	Pier length
a	5.5	ft	Pier width
L/a	1.5		If L/a is larger than 12, then use 12 as a maximum
Ө	90	degrees	Angle of attack of flow
	Square nose		Pier shape
K1	1		Correction factor for pier shape
K2	1.3		Correction factor for angle of attack
V1	3	ft/s	Approach velocity
Vc	0.2	m/s	From Figure 4.7:
Vc	0.7	ft/s	using an erosion rate of 0.1 mm/hr
g	32.2	ft/s^2	and based on silty sand (SM)
ys	**10.2**	**ft**	

Bent 3

L	8.25	ft	Pier length
a	5.5	ft	Pier width
L/a	1.5		If L/a is larger than 12, then use 12 as a maximum
Ө	90	degrees	Angle of attack of flow
	Square nose		Pier shape
K1	1		Correction factor for pier shape
K2	1.3		Correction factor for angle of attack
V1	4.0	ft/s	Approach velocity
Vc	0.2	m/s	From Figure 4.7:
Vc	0.7	ft/s	using an erosion rate of 0.1 mm/hr
g	32.2	ft/s^2	and based on silty sand (SM)
ys	**12.7**	**ft**	

Bent 4

L	8.25	ft	Pier length
a	5.5	ft	Pier width
L/a	1.5		If L/a is larger than 12, then use 12 as a maximum
Ө	90	degrees	Angle of attack of flow
	Square nose		Pier shape
K1	1		Correction factor for pier shape
K2	1.3		Correction factor for angle of attack
V1	3.3	ft/s	Approach velocity
Vc	0.2	m/s	From Figure 4.7:
Vc	0.7	ft/s	using an erosion rate of 0.1 mm/hr
g	32.2	ft/s^2	and based on silty sand (SM)
ys	**11.0**	**ft**	

1243 Alpine Road, Suite 108
Walnut Creek, CA 94596
Phone: 925.941.0017
Fax: 925.941.0018
www.wreco.com

I-80/SR 65 Interchange Improvements
Placer County, California
Local Scour at Abutments - Froehlich or HIRE

100-year Flow
Calculation guideline from HEC-18 5th Edition
Input from HEC-RAS for Proposed ALTERNATIVE 3 of Miners Ravine

Units = (SI or English)	English	
g = acceleration due to gravity =	32.2	ft/s^2

Left Overbank = Abutment #x (CARDINAL DIRECTION)

y1 = depth of flow at abutment on the overbank or in the main channel =	9.9	ft
L = length of embankment projected normal to flow =	16.9	ft
Ratio of projected embankment length to flow depth = L/y1 =	1.708E+00	
Abutment scour equation to be used =	Froehlich	

Froehlich's Live Bed Abutment Scour Equation

L' = length of active flow obstructed by the embankment =	17.2	ft
Ae = flow area of the approach cross section obstructed by the embankment =	215.4	ft^2
ya = average depth of flow on the flood plain = Ae/L	12.71	ft
Qe = flow obstructed by the abutment and approach embankment =	589	ft^3/s
Ve = flow velocity = Qe/Ae =	2.7	ft/s
Fr = Froude Number of approach flow upstream of the abutment =	0.14	
Θ = abutment skew =	90	degrees
K1 = coefficient for abutment shape =	1	
K2 = coefficient for angle of embankment shape = Θ/90)^0.13 =	1	
Ys = abutment scour = ya*(2.27*k1*k2*((L'/ya)^0.43)*(Fr^0.61)+1) =	**22.4**	**ft**

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I-80/SR 65 Interchange Improvements
Placer County, California
Local Scour at Abutments - Froehlich or HIRE

100-year Flow
Calculation guideline from HEC-18 5th Edition
Input from HEC-RAS for Proposed ALTERNATIVE 3 of Miners Ravine

Units = (SI or English)	English	
g = acceleration due to gravity =	32.2	ft/s^2
Right Overbank = Abutment #x (CARDINAL DIRECTION)		
y1 = depth of flow at abutment on the overbank or in the main channel =	5.8	ft
L = length of embankment projected normal to flow =	16.3	ft
Ratio of projected embankment length to flow depth =	2.789E+00	
Abutment scour equation to be used =	Froehlich	
Froehlich's Live Bed Abutment Scour Equation		
L' = length of active flow obstructed by the embankment =	14.0	ft
Ae = flow area of the approach cross section obstructed by the embankment =	103.8	ft^2
ya = average depth of flow on the flood plain = ae/l	6.38	ft
Qe = flow obstructed by the abutment and approach embankment =	227	ft^3/s
Ve = flow velocity = Qe/Ae =	2.19084778	ft/s
Fr = Froude Number of approach flow upstream of the abutment =	0.15	
Θ = abutment skew =	90	degrees
K1 = coefficient for abutment shape =	1	
K2 = coefficient for angle of embankment shape = Θ/90)^0.13 =	1	
Ys = abutment scour = ya*(2.27*k1*k2*((L'/ya)^0.43)*(Fr^0.61)+1) =	**12.8**	**ft**

I-80/SR 65 Interchange Improvements
Placer County, California
Local Scour at Piers - Cohesive

100-year Flow
Calculation guideline from HEC-18 5th Edition
Input from HEC-RAS for Proposed ALTERNATIVE 2 of Miners Ravine

Page 7.38, Page 204 / 340 , Section 7.12 Pier Scour In Cohesive Materials

ys = 2.2 K1 K2 a^0.65 [(2.6V1 - Vc) / sqrt (g)] ^0.7

Bent 2

L	8.25	ft	Pier length
a	5.5	ft	Pier width
L/a	1.5		If L/a is larger than 12, then use 12 as a maximum
ϴ	90	degrees	Angle of attack of flow
	Square nose		Pier shape
K1	1		Correction factor for pier shape
K2	1.3		Correction factor for angle of attack
V1	1.8	ft/s	Approach velocity
Vc	0.2	m/s	From Figure 4.7:
Vc	0.7	ft/s	using an erosion rate of 0.1 mm/hr
g	32.2	ft/s^2	and based on silty sand (SM)
ys	**6.66**	**ft**	

Bent 3

L	8.25	ft	Pier length
a	5.5	ft	Pier width
L/a	1.5		If L/a is larger than 12, then use 12 as a maximum
ϴ	90	degrees	Angle of attack of flow
	Square nose		Pier shape
K1	1		Correction factor for pier shape
K2	1.3		Correction factor for angle of attack
V1	2.9	ft/s	Approach velocity
Vc	0.2	m/s	From Figure 4.7:
Vc	0.7	ft/s	using an erosion rate of 0.1 mm/hr
g	32.2	ft/s^2	and based on silty sand (SM)
ys	**9.93**	**ft**	

Appendix E Rock Slope Protection (RSP) Calculations

Appendix E.1 Miners Ravine at Miners Ravine RSP Calculations

I-80/SR 65 Interchange
Placer County, California
Rock Slope Protection Calculations for Abutments and Banks
Input from HEC-RAS for Proposed Alternative 2 of Miners Ravine
100-year Flow

California Bank and Shore Rock Slope Protection Design

Location	**Upstream**	**Upstream Face**	**Downstream Face**	**Downstream**
Flow Condition	**Impinging**	**Impinging**	**Impinging**	**Impinging**
W (lb)	5	2	6	8
RSP Class	Backing No. 2	Backing No. 3	Backing No. 2	Backing No. 2

HEC-23 3rd Edition

D50	6	4	6	7	median stone diameter, inches
RSP Class	Facing	Backing No. 2	Facing	Facing	rock class

Selected RSP Size

Outer layer	Light	Light	Light	Light
Fabric Type	A	A	A	A

Thickness Per HEC-11

Thickness should not be less than the larger of 1.5 times D50 or D100.

D50 =	1.3	1.3	1.3	1.3	ft
1.5 * D50 =	2.0	2.0	2.0	2.0	ft
D100=	1.8	1.8	1.8	1.8	ft

Thickness Per CABS for outer layer

Thickness	**2.5**	**2.5**	**2.5**	**2.5**	ft
Placement	B	B	B	B	

I-80/SR 65 Interchange
Placer County, California
Rock Slope Protection Calculations for Banks
Calculation guideline from California Bank and Shore Rock Slope Protection Design

Input from HEC-RAS for Proposed Alternative 2 of Miners Ravine

100-year Flow

$$W = \frac{0.00002\,V^{6}\,SG}{(SG-1)^{3}\,SIN^{3}(r-a)}$$

Location	Upstream	Upstream Face	Downstream Face	Downstream
Storm Event	100-year	100-year	100-year	100-year
VM (ft/s)	5.0	4.2	5.2	5.5
Flow Condition	Impinging	Impinging	Impinging	Impinging
SG	2.7	2.7	2.7	2.7
r (degrees)	70	70	70	70
a (degrees)	34	34	34	34

Impinging Flow Condition

V (ft/s)	6.6	5.6	6.9	7.3
W (lb)	4.8	1.8	5.9	8.3
RSP Class	Backing No. 2	Backing No. 3	Backing No. 2	Backing No. 2

W = minimum rock mass, pounds

VM = average channel velocity, ft/s

V = velocity to which bank is exposed, ft/s
(for impinging flow, multiply VM by 1.33)

SG = specific gravity of rock

r = 70 degrees (for randomly placed rubble, a constant)

a = outside slope face angle with horizontal, degrees

Calculation guideline from HEC-23 3rd Edition

Input from HEC-RAS for Proposed Alternative 2 of Miners Ravine

100-year Flow

Location	Upstream	Upstream Face	Downstream Face	Downstream	
V	5.0	4.2	5.2	5.5	ft/s
g	32.2	32.2	32.2	32.2	ft/s^2
y	10.5	11.1	11.4	11.5	ft
Fr	0.27	0.22	0.27	0.28	
	Isbash	**Isbash**	**Isbash**	**Isbash**	**from HEC-23**

For Froude Numbers $(V/(gy)^{1/2}) <= 0.80$, Isbash relationship

y	10.5	11.1	11.4	11.5	depth of flow in the contracted bridge opening, ft
K	1.0	1.0	1.0	1.0	(1.02 for vertical wall abutment, 0.89 or for spill-through abutment)
S_s	2.7	2.7	2.7	2.7	specific gravity of rock
V	5.0	4.2	5.2	5.5	average velocity in contracted section, ft/s
g	32.2	32.2	32.2	32.2	gravitational acceleration, ft/s^2
D_{50}	0.5	0.3	0.5	0.6	median stone diameter, ft
D_{50}	5.7	4.1	6.1	6.9	median stone diameter, inches
	Facing	Backing No. 2	Facing	Facing	rock class

Appendix E.2 Miners Ravine Bridge (Widen) Off-Ramp at Miners Ravine RSP Calculations

I-80/SR 65 Interchange
Placer County, California
Rock Slope Protection Calculations for Abutments and Banks
Input from HEC-RAS for Proposed Alternative 3 of Miners Ravine
100-year Flow

California Bank and Shore Rock Slope Protection Design

Location	**Upstream**	**Upstream Face**	**Downstream Face**	**Downstream**
Flow Condition	**Impinging**	**Impinging**	**Impinging**	**Impinging**
W (lb)	32	83	1	0
RSP Class	Facing	Facing	Backing No. 3	Backing No. 3

HEC-23 3rd Edition

D50	11	15	4	2	median stone diameter, inches
RSP Class	Light	1/4 Ton	Backing No. 2	Backing No. 2	rock class

Selected RSP Size

Outer layer	Light	Light	Light	Light
Fabric Type	A	A	A	A

Thickness Per HEC-11
Thickness should not be less than the larger of 1.5 times D50 or D100.

D50 =	1.3	1.3	1.3	1.3	ft
1.5 * D50 =	2.0	2.0	2.0	2.0	ft
D100=	1.8	1.8	1.8	1.8	ft

Thickness Per CABS for outer layer

Thickness	**2.5**	**2.5**	**2.5**	**2.5**	ft
Placement	B	B	B	B	

I-80/SR 65 Interchange

Placer County, California

Rock Slope Protection Calculations for Banks

Calculation guideline from California Bank and Shore Rock Slope Protection Design

Input from HEC-RAS for Proposed Alternative 3 of Miners Ravine

100-year Flow

$$W = \frac{0.00002\,V^{6}\,SG}{(SG-1)^{3}\,SIN^{3}(r-a)}$$

Location	Upstream	Upstream Face	Downstream Face	Downstream
Storm Event	100-year	100-year	100-year	100-year
VM (ft/s)	6.8	8.0	4.0	3.0
Flow Condition	Impinging	Impinging	Impinging	Impinging
SG	2.7	2.7	2.7	2.7
r (degrees)	70	70	70	70
a (degrees)	34	34	34	34

Impinging Flow Condition

V (ft/s)	9.1	10.7	5.3	4.0
W (lb)	31.9	83.1	1.3	0.2
RSP Class	Facing	Facing	Backing No. 3	Backing No. 3

W = minimum rock mass, pounds
VM = average channel velocity, ft/s
V = velocity to which bank is exposed, ft/s
(for impinging flow, multiply VM by 1.33)
SG = specific gravity of rock
r = 70 degrees (for randomly placed rubble, a constant)
a = outside slope face angle with horizontal, degrees

Calculation guideline from HEC-23 3rd Edition

Input from HEC-RAS for Proposed Alternative 3 of Miners Ravine

100-year Flow

Location	Upstream	Upstream Face	Downstream Face	Downstream	
V	6.8	8.0	4.0	3.0	ft/s
g	32.2	32.2	32.2	32.2	ft/s^2
y	9.6	10.4	9.5	9.6	ft
Fr	0.39	0.44	0.23	0.17	
	Isbash	**Isbash**	**Isbash**	**Isbash**	**from HEC-23**

For Froude Numbers $(V/(gy)^{1/2})<=0.80$, Isbash relationship

y	9.6	10.4	9.5	9.6	depth of flow in the contracted bridge opening, ft
K	1.0	1.0	1.0	1.0	(1.02 for vertical wall abutment, 0.89 or for spill-through abutment)
S_s	2.7	2.7	2.7	2.7	specific gravity of rock
V	6.8	8.0	4.0	3.0	average velocity in contracted section, ft/s
g	32.2	32.2	32.2	32.2	gravitational acceleration, ft/s^2
D_{50}	0.9	1.2	0.3	0.2	median stone diameter, ft
D_{50}	10.7	14.8	3.7	2.1	median stone diameter, inches
	Light	Light	Backing No. 2	Backing No. 2	rock class

Appendix F Location Hydraulic Study (LHS) Forms

Appendix F.1 E. Roseville Viaduct at Antelope Creek LHS Form

LOCATION HYDRAULIC STUDY FORM

Dist. 3 Co. Placer County Rte. State Route 65 P.M.________
EA: 03-4E3200 Federal-Aid Project Number:________

Floodplain Description:
According to the FEMA FIRM 06061C0477G (November 21, 2001), E. Roseville Viaduct at Antelope Creek is in a designated Zone AE floodplain. Zone AE is a base flood zone with determined flood elevations. There is also a FEMA designated floodway at this location.

1. Description of Proposal *(include any physical barriers i.e. concrete barriers, soundwalls, etc. and design elements to minimize floodplain impacts)*
The proposed E. Roseville Viaduct bridge will be a 14-span, cast-in-place, concrete box girder bridge for all the build alternatives. The existing parallel structures would be widened on both sides and require additional piers to support the widened structures. The additional piers would be placed parallel to the existing piers along the entire length of the viaduct.

2. ADT: Current 106,055 Projected 151,500 (2040 No-build); 155,600 (2040 Build)

3. Hydraulic Data: Base Flood Q100=________CFS
WSE100= ________ *The flood of record, if greater than Q100:*
Q=________CFS WSE= ________
Overtopping flood Q= ______CFS WSE= ________

Are NFIP maps and studies available? NO________YES________

4. Is the highway location alternative within a regulatory floodway ?
NO ________YES X

5. Attach map with flood limits outlined showing all buildings or other improvements within the base floodplain.

Potential Q100 backwater damages:

		NO	YES
A.	Residences?	X	
B.	Other Bldgs?	X	
C.	Crops?	X	
D.	Natural and beneficial Floodplain values?		X

"Natural and beneficial flood-plain values" shall include but are not limited to fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture, aquaculture, forestry, natural moderation of floods, water quality maintenance, and groundwater recharge.

6. Type of Traffic:

	NO	YES
A. Emergency supply or evacuation route?		X
B. Emergency vehicle access?		X
C. Practicable detour available?		X
D. School bus or mail route?		X

7. Estimated duration of traffic interruption for 100-year event hours: N/A

8. Estimated value of Q100 flood damages (if any) – moderate risk level.

A.	Roadway	$ N/A
B	Property	$ N/A
	Total	$ N/A

9. Assessment of Level of Risk
Low X
Moderate______
High________

For High Risk projects, during design phase, additional Design Study Risk Analysis may be necessary to determine design alternative.

LOCATION HYDRAULIC STUDY FORM cont.

Dist. ____3____ Co. Placer County ____ Rte. State Route 65 ____ P.M. ____________
Federal-Aid Project Number: ________________________________
EA ____03-4E3200____ Bridge No. ____19-0152 R/L____

PREPARED BY:

Signature:
I certify that I have conducted a Location Hydraulic Study consistent with 23 CFR 650 and that the information summarized in items numbers 3, 4, 5, 8, and 9 of this form is accurate.

______________________________ *Date* ____________
District Hydraulic Engineer *(capital and 'on' system projects)*

[signature] *Date* 1/12/15
Local Agency/Consulting Hydraulic Engineer *(local assistance projects)*

Is there any longitudinal encroachment, significant encroachment, or any support of incompatible Floodplain development? NO ___X___ YES ________

If yes, provide evaluation and discussion of practicability of alternatives in accordance with 23 CFR 650.113

Information developed to comply with the Federal requirement for the Location Hydraulic Study shall be retained in the project files.

I certify that item numbers 1, 2, 6 and 7 of this Location Hydraulic Study Form are accurate and will ensure that Final PS&E reflects the information and recommendations of said report:

______________________________ *Date* ____________
District Project Engineer *(capital and 'on' system projects)*

______________________________ *Date* ____________
Local Agency Project Engineer *(local assistance projects)*

CONCURRED BY:
I have reviewed the quality and adequacy of the floodplain submittal consistent with the attached checklist, and concur that the submittal is adequate to meet the mandates of 23 CFR 650.

______________________________ *Date* ____________
District Project Manager *(capital and'on' system projects)*

______________________________ *Date* ____________
Local Agency Project Manager *(Local Assistance projects)*

______________________________ *Date* ____________
District Local Assistance Engineer *(or District Hydraulic Branch for very complex projects or when required expertise is unavailable. Note: District Hydraulic Branch review of local assistance projects shall be based on reasonableness and concurrence with the information provided).*

I concur that the natural and beneficial floodplain values are consistent with the results of other studies prepared pursuant to 23 CFR 771, and that the NEPA document or determination includes environmental mitigation consistent with the Floodplain analysis.

______________________________ *Date* ____________
District Senior Environmental Planner *(or Designee)*

Note: If a significant floodplain encroachment is identified as a result of floodplains studies, FHWA will need to approve the encroachment and concur in the Only Practicable Alternative Finding.

Appendix F.2 EN and SE Connectors at Secret Ravine LHS Form

LOCATION HYDRAULIC STUDY FORM

Dist. 3 Co. Placer County Rte. State Route 65 P.M.______
EA: 03-4E3200 Federal-Aid Project Number:______

Floodplain Description:
According to the FEMA FIRM 06061C0477G (November 21, 2001), EN and SE connectors at Secret Ravine are in a designated Zone AE floodplain. Zone AE is a base flood zone with determined flood elevations. There is a FEMA designated floodway at this location.

1. Description of Proposal *(include any physical barriers i.e. concrete barriers, soundwalls, etc. and design elements to minimize floodplain impacts)*
The EN and SE cast-in-place, concrete, box-girder bridge connectors are proposed to be added by all the build alternatives. For Alternative 1, the EN connector is an approximately 60.8 ft wide by 2,140 ft long bridge. For Alternatives 2 and 3 the width of the E80/N65 connector is also approximately 60.8 ft with a length of 1,458 ft. The SE bridge connector has an approximate width of 48.8 ft and length of 2,440 ft for all the build alternatives.

2. ADT: Current 150,000 Projected 194,200 (2040 No-build); 213,000 (2040 Build)

3. Hydraulic Data: Base Flood Q100= 4,700 CFS
WSE100= see table below

Structure	Bent	Alternative 1		Alternative 2(3)	
		100-year WSE (ft NGVD 29)		100-yr WSE (ft NGVD-29)	
		Existing	Proposed	Existing	Proposed
EN Connector	5SE	184.24	184.25	184.15	184.22
	5NW	184.4	184.43	184.61	184.67
	6	185.1	185.15	185.33	185.39
	7NW	185.79	185.73	186.34	186.38
	7SE	185.95	186.07	186.53	186.6
SE Connector	10	189.22	189.25	190.8	190.81
	11	190	190.01	191.33	191.35
	12	190.73	190.75	191.8	191.85
	13	191.29	191.32	192.05	192.12
	14	191.78	191.83	--	--
	15	192.06	192.11	--	--

The flood of record, if greater than Q100:
Q=______CFS WSE= ______
Overtopping flood Q= ______CFS WSE= ______

Are NFIP maps and studies available? NO______YES______

4. Is the highway location alternative within a regulatory floodway ?
NO ______YES X

5. Attach map with flood limits outlined showing all buildings or other improvements within the base floodplain.

Potential Q100 backwater damages:

A. Residences? NO X YES______
B. Other Bldgs? NO X YES______
C. Crops? NO X YES______
D. Natural and beneficial Floodplain values? NO______YES X

"Natural and beneficial flood-plain values" shall include but are not limited to fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture, aquaculture, forestry, natural moderation of floods, water quality maintenance, and groundwater recharge.

LOCATION HYDRAULIC STUDY FORM cont.

Dist. ___3___ Co. Placer County ___ Rte. State Route 65 ___ P.M.________
Federal-Aid Project Number:________
EA ___03-4E3200___ Bridge No.________

6. Type of Traffic:

A. Emergency supply or evacuation route?	NO________	YES __X__
B. Emergency vehicle access?	NO________	YES __X__
C. Practicable detour available?	NO________	YES __X__
D. School bus or mail route?	NO________	YES __X__

7. Estimated duration of traffic interruption for 100-year event hours:___N/A___

8. Estimated value of Q100 flood damages (if any) – moderate risk level.

A.	Roadway	$___N/A___
B	Property	$___N/A___
	Total	$___N/A___

9. Assessment of Level of Risk

Low___X___
Moderate_____
High________

For High Risk projects, during design phase, additional Design Study Risk Analysis may be necessary to determine design alternative.

LOCATION HYDRAULIC STUDY FORM cont.

Dist. 3 Co. Placer County Rte. State Route 65 P.M.______
Federal-Aid Project Number:______
EA 03-4E3200 Bridge No.______

PREPARED BY:

Signature:
I certify that I have conducted a Location Hydraulic Study consistent with 23 CFR 650 and that the information summarized in items numbers 3, 4, 5, 8, and 9 of this form is accurate.

______ *Date* ______
District Hydraulic Engineer *(capital and 'on' system projects)*

Andeth Oe *Date* 1/12/15
Local Agency/Consulting Hydraulic Engineer *(local assistance projects)*

Is there any longitudinal encroachment, significant encroachment, or any support of incompatible Floodplain development? NO______ YES X

If yes, provide evaluation and discussion of practicability of alternatives in accordance with 23 CFR 650.113

Information developed to comply with the Federal requirement for the Location Hydraulic Study shall be retained in the project files.

I certify that item numbers 1, 2, 6 and 7 of this Location Hydraulic Study Form are accurate and will ensure that Final PS&E reflects the information and recommendations of said report:

______ *Date* ______
District Project Engineer *(capital and 'on' system projects)*

______ *Date* ______
Local Agency Project Engineer *(local assistance projects)*

CONCURRED BY:
I have reviewed the quality and adequacy of the floodplain submittal consistent with the attached checklist, and concur that the submittal is adequate to meet the mandates of 23 CFR 650.

______ *Date* ______
District Project Manager *(capital and'on' system projects)*

______ *Date* ______
Local Agency Project Manager *(Local Assistance projects)*

______ *Date* ______
District Local Assistance Engineer *(or District Hydraulic Branch for very complex projects or when required expertise is unavailable. Note: District Hydraulic Branch review of local assistance projects shall be based on reasonableness and concurrence with the information provided).*

I concur that the natural and beneficial floodplain values are consistent with the results of other studies prepared pursuant to 23 CFR 771, and that the NEPA document or determination includes environmental mitigation consistent with the Floodplain analysis.

______ *Date* ______
District Senior Environmental Planner *(or Designee)*

Note: If a significant floodplain encroachment is identified as a result of floodplains studies, FHWA will need to approve the encroachment and concur in the Only Practicable Alternative Finding.

Appendix F.3 Miners Ravine Bridge at Miners Ravine LHS Form

LOCATION HYDRAULIC STUDY FORM

Dist. ___3___ Co.__Placer County___ Rte.___Interstate 80___ P.M.________
EA:___03-4E3200___ Federal-Aid Project Number:________

Floodplain Description:
According to the FEMA FIRM 06061C0479G (November 21, 2001), the I-80 bridge over Miners Ravine is in a designated Zone AE floodplain. Zone AE is a base flood zone with determined flood elevations. There is a FEMA designated floodway at this location.

1. Description of Proposal *(include any physical barriers i.e. concrete barriers, soundwalls, etc. and design elements to minimize floodplain impacts)*
The proposed I-80 bridge at Miners Ravine will be a 3-span, cast-in-place, reinforced concrete "T" Beam bridge for all the build alternatives. The proposed bridge will have a length of 232.8 ft, same as the existing bridge. The existing bridge will be widened by 6 ft on the downstream side after removing a segment of the existing bridge. Additional square shaped piers of the same dimensions as the existing bridge – 3 ft by 3 ft will be placed parallel to the existing piers.

2. ADT: Current___155,000 (2009)___ Projected__197,400 (2040 No-build); 204,200 (2040 Build)___

3. Hydraulic Data: Base Flood Q100=___7,840___CFS
WSE100= ___161.5 (ft, NGVD 29) – Existing;
161.5 (ft, NGVD 29) – Proposed (all alternatives)___ *The flood of record, if greater than Q100:*
Q=__________CFS WSE= ______________
Overtopping flood Q= ______CFS WSE= ______________

Are NFIP maps and studies available? NO__________YES_________

4. Is the highway location alternative within a regulatory floodway ?
NO __________YES___X_____

5. Attach map with flood limits outlined showing all buildings or other improvements within the base floodplain.

Potential Q100 backwater damages:

A.	Residences?	NO___X_____YES_________
B.	Other Bldgs?	NO___X_____YES_________
C.	Crops?	NO___X_____YES_________
D.	Natural and beneficial Floodplain values?	NO__________YES___X_____

"Natural and beneficial flood-plain values" shall include but are not limited to fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture, aquaculture, forestry, natural moderation of floods, water quality maintenance, and groundwater recharge.

6. Type of Traffic:

A. Emergency supply or evacuation route?	NO__________YES___X_____
B. Emergency vehicle access?	NO__________YES___X_____
C. Practicable detour available?	NO__________YES___X_____
D. School bus or mail route?	NO__________YES___X_____

7. Estimated duration of traffic interruption for 100-year event hours:____N/A___

8. Estimated value of Q100 flood damages (if any) – moderate risk level.

A.	Roadway	$___N/A______
B	Property	$___N/A______
	Total	$___N/A______

9. Assessment of Level of Risk Low___X_____
Moderate______
High_________

For High Risk projects, during design phase, additional Design Study Risk Analysis may be necessary to determine design alternative.

LOCATION HYDRAULIC STUDY FORM cont.

Dist. 3 Co. Placer County Rte. Interstate 80 P.M.________
Federal-Aid Project Number:________
EA 03-4E3200 Bridge No. 19-0056

PREPARED BY:

Signature:
I certify that I have conducted a Location Hydraulic Study consistent with 23 CFR 650 and that the information summarized in items numbers 3, 4, 5, 8, and 9 of this form is accurate.

________________ *Date* ________
District Hydraulic Engineer *(capital and 'on' system projects)*

Andelth Och *Date* 1/12/15
Local Agency/Consulting Hydraulic Engineer *(local assistance projects)*

Is there any longitudinal encroachment, significant encroachment, or any support of incompatible Floodplain development? NO X YES_____

If yes, provide evaluation and discussion of practicability of alternatives in accordance with 23 CFR 650.113

Information developed to comply with the Federal requirement for the Location Hydraulic Study shall be retained in the project files.

I certify that item numbers 1, 2, 6 and 7 of this Location Hydraulic Study Form are accurate and will ensure that Final PS&E reflects the information and recommendations of said report:

________________ *Date* ________
District Project Engineer *(capital and 'on' system projects)*

________________ *Date* ________
Local Agency Project Engineer *(local assistance projects)*

CONCURRED BY:
I have reviewed the quality and adequacy of the floodplain submittal consistent with the attached checklist, and concur that the submittal is adequate to meet the mandates of 23 CFR 650.

________________ *Date* ________
District Project Manager *(capital and'on' system projects)*

________________ *Date* ________
Local Agency Project Manager *(Local Assistance projects)*

________________ *Date* ________
District Local Assistance Engineer *(or District Hydraulic Branch for very complex projects or when required expertise is unavailable. Note: District Hydraulic Branch review of local assistance projects shall be based on reasonableness and concurrence with the information provided).*

I concur that the natural and beneficial floodplain values are consistent with the results of other studies prepared pursuant to 23 CFR 771, and that the NEPA document or determination includes environmental mitigation consistent with the Floodplain analysis.

________________ *Date* ________
District Senior Environmental Planner *(or Designee)*

Note: If a significant floodplain encroachment is identified as a result of floodplains studies, FHWA will need to approve the encroachment and concur in the Only Practicable Alternative Finding.

Appendix F.4 Miners Ravine Bridge (Widen) Off-Ramp to Eureka Road Bridge at Miners Ravine LHS Form

LOCATION HYDRAULIC STUDY FORM

Dist. 3 Co. Placer County Rte. Interstate 80 Off-ramp to Eureka Road P.M.________
EA: 03-4E3200 Federal-Aid Project Number:________

Floodplain Description:
According to the FEMA FIRM 06061C0479G (November 21, 2001), the I-80 Off-Ramp to Eureka Road over Miners Ravine is in a designated Zone AE floodplain. Zone AE is a base flood zone bridge with determined flood elevations. There is a FEMA designated floodway at this location.

1. Description of Proposal *(include any physical barriers i.e. concrete barriers, soundwalls, etc. and design elements to minimize floodplain impacts)*
Only Alternative 3 proposes to modify the I-80 Off-Ramp to Eureka Road bridge at Miners Ravine. The proposed bridge will be a 4-span, cast-in-place, concrete box-girder bridge with a width of 39.2 ft and a length of 470.5 ft approximately. Additional column piers of the same dimensions as the existing bridge – 5.5 ft will be placed parallel to the existing piers.

2. ADT: Current 155,000 (2009) Projected 197,400 (2040 No-build); 204,200 (2040 Build)

3. Hydraulic Data: Base Flood Q100= 7,840 CFS
WSE100= 163.6 (ft, NGVD 29) – Existing;
163.6 (ft, NGVD 29) – Proposed (Alternative 3) *The flood of record, if greater than Q100:*
Q=______CFS WSE= ______
Overtopping flood Q= ______CFS WSE= ______

Are NFIP maps and studies available? NO______ YES______

4. Is the highway location alternative within a regulatory floodway ?
NO ______ YES X

5. Attach map with flood limits outlined showing all buildings or other improvements within the base floodplain.

Potential Q100 backwater damages:

A.	Residences?	NO X	YES
B.	Other Bldgs?	NO X	YES
C.	Crops?	NO X	YES
D.	Natural and beneficial Floodplain values?	NO	YES X

"Natural and beneficial flood-plain values" shall include but are not limited to fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture, aquaculture, forestry, natural moderation of floods, water quality maintenance, and groundwater recharge.

6. Type of Traffic:

A. Emergency supply or evacuation route?	NO	YES X
B. Emergency vehicle access?	NO	YES X
C. Practicable detour available?	NO	YES X
D. School bus or mail route?	NO	YES X

7. Estimated duration of traffic interruption for 100-year event hours: N/A

8. Estimated value of Q100 flood damages (if any) – moderate risk level.

A.	Roadway	$ N/A
B	Property	$ N/A
	Total	$ N/A

9. Assessment of Level of Risk Low X
Moderate______
High______

For High Risk projects, during design phase, additional Design Study Risk Analysis may be necessary to determine design alternative.

LOCATION HYDRAULIC STUDY FORM cont.

Dist. ___3___ Co. Placer County Rte. Interstate 80 Off-ramp to Eureka Road P.M.________
Federal-Aid Project Number:________
EA ___03-4E3200___ Bridge No. ___19-0056 S___

PREPARED BY:

Signature:
I certify that I have conducted a Location Hydraulic Study consistent with 23 CFR 650 and that the information summarized in items numbers 3, 4, 5, 8, and 9 of this form is accurate.

________________________ *Date* ________
District Hydraulic Engineer *(capital and 'on' system projects)*

Anadeleth Cohen *Date* 1/12/15
Local Agency/Consulting Hydraulic Engineer *(local assistance projects)*

Is there any longitudinal encroachment, significant encroachment, or any support of incompatible Floodplain development? NO___X___YES________

If yes, provide evaluation and discussion of practicability of alternatives in accordance with 23 CFR 650.113

Information developed to comply with the Federal requirement for the Location Hydraulic Study shall be retained in the project files.

I certify that item numbers 1, 2, 6 and 7 of this Location Hydraulic Study Form are accurate and will ensure that Final PS&E reflects the information and recommendations of said report:

________________________ *Date* ________
District Project Engineer *(capital and 'on' system projects)*

________________________ *Date* ________
Local Agency Project Engineer *(local assistance projects)*

CONCURRED BY:
I have reviewed the quality and adequacy of the floodplain submittal consistent with the attached checklist, and concur that the submittal is adequate to meet the mandates of 23 CFR 650.

________________________ *Date* ________
District Project Manager *(capital and'on' system projects)*

________________________ *Date* ________
Local Agency Project Manager *(Local Assistance projects)*

________________________ *Date* ________
District Local Assistance Engineer *(or District Hydraulic Branch for very complex projects or when required expertise is unavailable. Note: District Hydraulic Branch review of local assistance projects shall be based on reasonableness and concurrence with the information provided).*

I concur that the natural and beneficial floodplain values are consistent with the results of other studies prepared pursuant to 23 CFR 771, and that the NEPA document or determination includes environmental mitigation consistent with the Floodplain analysis.

________________________ *Date* ________
District Senior Environmental Planner *(or Designee)*

Note: If a significant floodplain encroachment is identified as a result of floodplains studies, FHWA will need to approve the encroachment and concur in the Only Practicable Alternative Finding.

Appendix F.5 I-80 Loop On-Ramp from Eureka Road at Miners Ravine LHS Form

LOCATION HYDRAULIC STUDY FORM

Dist.____3____Co.____Placer County__Rte.___Interstate 80 Loop On-ramp from Eureka Road__P.M.________________
EA:___03-4E3200___________ Federal-Aid Project Number:________________

Floodplain Description:
According to the FEMA FIRM 06061C0479G (November 21, 2001), the I-80 Loop On-Ramp to Eureka Road over Miners Ravine is in a designated Zone AE floodplain. Zone AE is a base flood zone bridge with determined flood elevations. There is a FEMA designated floodway at this location.

1. Description of Proposal *(include any physical barriers i.e. concrete barriers, soundwalls, etc. and design elements to minimize floodplain impacts)*
The proposed Loop On-Ramp to Eureka Road will be a roadway structure on fill. The proposed roadway will be re-aligned approximately 80 ft farther in to the Miners Ravine floodplain in a southwesterly direction for all build alternatives.

2. ADT: Current____155,000 (2009)____ Projected_197,400 (2040 No-build); 204,200 (2040 Build)____

3. Hydraulic Data: Base Flood Q100=____7,840__CFS
WSE100= ____162.6 (ft, NGVD 29) – Existing;
_162.6 (ft, NGVD 29) – Proposed (Alternative 3)____ *The flood of record, if greater than Q100:*
Q=__________CFS WSE= _____________
Overtopping flood Q= _______CFS WSE= _____________

Are NFIP maps and studies available? NO__________YES_________

4. Is the highway location alternative within a regulatory floodway ?
NO __________YES___X_____

5. Attach map with flood limits outlined showing all buildings or other improvements within the base floodplain.

Potential Q100 backwater damages:

A.	Residences?	NO___X_____YES_________
B.	Other Bldgs?	NO___X_____YES_________
C.	Crops?	NO___X_____YES_________
D.	Natural and beneficial Floodplain values?	NO__________YES___X_____

"Natural and beneficial flood-plain values" shall include but are not limited to fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture, aquaculture, forestry, natural moderation of floods, water quality maintenance, and groundwater recharge.

6. Type of Traffic:

A. Emergency supply or evacuation route?	NO__________YES___X_____
B. Emergency vehicle access?	NO__________YES___X_____
C. Practicable detour available?	NO__________YES___X_____
D. School bus or mail route?	NO__________YES___X_____

7. Estimated duration of traffic interruption for 100-year event hours:____N/A___

8. Estimated value of Q100 flood damages (if any) – moderate risk level.

A.	Roadway	$___N/A______
B	Property	$___N/A______
	Total	$___N/A______

9. Assessment of Level of Risk Low___X_____
Moderate_____
High_________

For High Risk projects, during design phase, additional Design Study Risk Analysis may be necessary to determine design alternative.

LOCATION HYDRAULIC STUDY FORM cont.

Dist.__3__Co.__Placer County__Rte.__Interstate 80 Loop On-ramp from Eureka Road__P.M.________
Federal-Aid Project Number:________
EA __03-4E3200__ Bridge No.________

PREPARED BY:

Signature:
I certify that I have conducted a Location Hydraulic Study consistent with 23 CFR 650 and that the information summarized in items numbers 3, 4, 5, 8, and 9 of this form is accurate.

________________ *Date* ________
District Hydraulic Engineer *(capital and 'on' system projects)*

Andrea Ack ________ *Date* 1/12/15
Local Agency/Consulting Hydraulic Engineer *(local assistance projects)*

Is there any longitudinal encroachment, significant encroachment, or any support of incompatible Floodplain development? NO________YES__X__

If yes, provide evaluation and discussion of practicability of alternatives in accordance with 23 CFR 650.113

Information developed to comply with the Federal requirement for the Location Hydraulic Study shall be retained in the project files.

I certify that item numbers 1, 2, 6 and 7 of this Location Hydraulic Study Form are accurate and will ensure that Final PS&E reflects the information and recommendations of said report:

________________ *Date* ________
District Project Engineer *(capital and 'on' system projects)*

________________ *Date* ________
Local Agency Project Engineer *(local assistance projects)*

CONCURRED BY:
I have reviewed the quality and adequacy of the floodplain submittal consistent with the attached checklist, and concur that the submittal is adequate to meet the mandates of 23 CFR 650.

________________ *Date* ________
District Project Manager *(capital and'on' system projects)*

________________ *Date* ________
Local Agency Project Manager *(Local Assistance projects)*

________________ *Date* ________
District Local Assistance Engineer *(or District Hydraulic Branch for very complex projects or when required expertise is unavailable. Note: District Hydraulic Branch review of local assistance projects shall be based on reasonableness and concurrence with the information provided).*

I concur that the natural and beneficial floodplain values are consistent with the results of other studies prepared pursuant to 23 CFR 771, and that the NEPA document or determination includes environmental mitigation consistent with the Floodplain analysis.

________________ *Date* ________
District Senior Environmental Planner *(or Designee)*

Note: If a significant floodplain encroachment is identified as a result of floodplains studies, FHWA will need to approve the encroachment and concur in the Only Practicable Alternative Finding.

Appendix G Summary Encroachment Forms

Appendix G.1 E. Roseville Viaduct at Antelope Creek Summary Encroachment Form

SUMMARY FLOODPLAIN ENCROACHMENT REPORT

Dist. 3 Co. Placer County Rte. State Route 65 P.M. ______
Federal-Aid Project Number *(Local Assistance)* ______
Project No.: 03-4E3200 Bridge No. 19-0152 R/L
Limits: The existing E. Roseville Viaduct bridge parallel structures would be widened on both sides and connected by a median. The southbound section will be widened by a maximum of 6.5 ft, and the northbound section will be widened by a maximum of 25 feet. The median connector is 56.5 ft wide. Additional piers will be placed to support the widened structures.
Floodplain Description: According to the FEMA FIRM 06061C0477G (November 21, 2001), E. Roseville Viaduct at Antelope Creek in a designated Zone AE floodplain. Zone AE is a base flood zone with determined flood elevations. There is a FEMA designated floodplain at this location.

		No	Yes
1.	Is the proposed action a longitudinal encroachment of the base floodplain?	X	
2.	Are the risks associated with the implementation of the proposed action significant?	X	
3.	Will the proposed action support probable incompatible floodplain development?	X	
4.	Are there any significant impacts on natural and beneficial floodplain values?	X	
5.	Routine construction procedures are required to minimize impacts on the floodplain. Are there any special mitigation measures necessary to minimize impacts or restore and preserve natural and beneficial floodplain values? If yes, explain.	X	
6.	Does the proposed action constitute a significant floodplain encroachment as defined in 23 CFR, Section 650.105(q).	X	
7.	Are Location Hydraulic Studies that document the above answers on file? If not explain.		X

PREPARED BY:

______ *Date* ______
District Project Engineer *(capital and 'on' system projects)*

Andelle Q *Date* 1/12/15
Local Agency/Consulting Hydraulic Engineer *(local assistance projects)*

CONCURRED BY:

______ *Date* ______
District Project Manager *(capital and 'on' system projects)*

______ *Date* ______
District Local Assistance Engineer *(Local Assistance projects)*

I concur that impacts to natural and beneficial floodplain values are consistent with the results of other studies prepared pursuant to 23 CFR 771, and that the NEPA document or determination includes environmental mitigation consistent with the Floodplain analysis.

______ *Date* ______
District Senior Environmental Planner *(or Designee)*

Note: If a significant floodplain encroachment is identified as a result of floodplains studies, FHWA will need to approve the encroachment and concur in the Only Practicable Alternative Finding.

Appendix G.2 EN and SE Connectors at Secret Ravine Summary Encroachment Form

SUMMARY FLOODPLAIN ENCROACHMENT REPORT

Dist. 3 Co. Placer County Rte. Interstate 80/State Route 65 P.M. ______
Federal-Aid Project Number *(Local Assistance)* ______
Project No.: 03-4E3200 Bridge No. ______
Limits: The proposed E80/N65 and S65/E80 connector bridges over Secret Ravine will not follow the alignment of the existing connectors for all the build alternatives. Both connectors will be located to the east of the existing connectors (see sections 1.3 and 3.4 for further details).
Floodplain Description: According to the FEMA FIRM 06061C0477G (November 21, 2001), EN and SE connectors at Secret Ravine is in a designated Zone AE floodplain. Zone AE is a base flood zone with determined flood elevations. There is also a FEMA designated floodplain at this location.

		No	Yes
1.	Is the proposed action a longitudinal encroachment of the base floodplain?		X
2.	Are the risks associated with the implementation of the proposed action significant?	X	
3.	Will the proposed action support probable incompatible floodplain development?	X	
4.	Are there any significant impacts on natural and beneficial floodplain values?	X	
5.	Routine construction procedures are required to minimize impacts on the floodplain. Are there any special mitigation measures necessary to minimize impacts or restore and preserve natural and beneficial floodplain values? If yes, explain.	X	
6.	Does the proposed action constitute a significant floodplain encroachment as defined in 23 CFR, Section 650.105(q).	X	
7.	Are Location Hydraulic Studies that document the above answers on file? If not explain.		X

PREPARED BY:

______ *Date* ______
District Project Engineer *(capital and 'on' system projects)*

[signature] *Date* 1/12/15
Local Agency/Consulting Hydraulic Engineer *(local assistance projects)*

CONCURRED BY:

______ *Date* ______
District Project Manager *(capital and 'on' system projects)*

______ *Date* ______
District Local Assistance Engineer *(Local Assistance projects)*

I concur that impacts to natural and beneficial floodplain values are consistent with the results of other studies prepared pursuant to 23 CFR 771, and that the NEPA document or determination includes environmental mitigation consistent with the Floodplain analysis.

______ *Date* ______
District Senior Environmental Planner *(or Designee)*

Note: If a significant floodplain encroachment is identified as a result of floodplains studies, FHWA will need to approve the encroachment and concur in the Only Practicable Alternative Finding.

Appendix G.3 Miners Ravine bridge at Miners Ravine Summary Encroachment Form

SUMMARY FLOODPLAIN ENCROACHMENT REPORT

Dist. 3 Co. Placer County Rte. Interstate 80 P.M. ______
Federal-Aid Project Number *(Local Assistance)* ______
Project No.: 03-4E3200 Bridge No. 19-0056
Limits: The proposed I-80 bridge at Miners Ravine will be a 3-span, cast-in-place, reinforced concrete, "T" beam bridge for all Build alternatives. A section of the existing bridge will be removed and the bridge will be widened by approximately 6.8 ft on the downstream side to have a total width of 88.3 ft.
Floodplain Description: According to the FEMA FIRM 06061C0479G (November 21, 2001), the I-80 bridge over Miners Ravine is in a designated Zone AE floodplain. Zone AE is a base flood zone with determined flood elevations. There is a FEMA designated floodway at this location.

		No	Yes
1.	Is the proposed action a longitudinal encroachment of the base floodplain?	X	
2.	Are the risks associated with the implementation of the proposed action significant?	X	
3.	Will the proposed action support probable incompatible floodplain development?	X	
4.	Are there any significant impacts on natural and beneficial floodplain values?	X	
5.	Routine construction procedures are required to minimize impacts on the floodplain. Are there any special mitigation measures necessary to minimize impacts or restore and preserve natural and beneficial floodplain values? If yes, explain.	X	
6.	Does the proposed action constitute a significant floodplain encroachment as defined in 23 CFR, Section 650.105(q).	X	
7.	Are Location Hydraulic Studies that document the above answers on file? If not explain.		X

PREPARED BY:

______________________ *Date* ______
District Project Engineer *(capital and 'on' system projects)*

Anolette Ocr ______________________ *Date* 1/12/15
Local Agency/Consulting Hydraulic Engineer *(local assistance projects)*

CONCURRED BY:

______________________ *Date* ______
District Project Manager *(capital and 'on' system projects)*

______________________ *Date* ______
District Local Assistance Engineer *(Local Assistance projects)*

I concur that impacts to natural and beneficial floodplain values are consistent with the results of other studies prepared pursuant to 23 CFR 771, and that the NEPA document or determination includes environmental mitigation consistent with the Floodplain analysis.

______________________ *Date* ______
District Senior Environmental Planner *(or Designee)*

Note: If a significant floodplain encroachment is identified as a result of floodplains studies, FHWA will need to approve the encroachment and concur in the Only Practicable Alternative Finding.

Appendix G.4 Miners Ravine Bridge (Widen) Off-Ramp to Eureka Road at Miners Ravine Summary Encroachment Form

SUMMARY FLOODPLAIN ENCROACHMENT REPORT

Dist. 3 Co. Placer County Rte. Interstate 80 Off-ramp to Eureka Road P.M. ______________
Federal-Aid Project Number *(Local Assistance)* ______________
Project No.: 03-4E3200 Bridge No. 19-0056 S
Limits: The proposed I-80 Off-Ramp to Eureka Road bridge at Miners Ravine will be a 4-span, cast-in-place, concrete box-girder bridge with a width of 39.2 ft and a length of 470.5 ft approximately. A section of the existing bridge will be removed and the bridge will be widened by approximately 14.2 ft on the upstream side.
Floodplain Description: According to the FEMA FIRM 06061C0479G (November 21, 2001), the I-80 Off-Ramp to Eureka Road bridge over Miners Ravine is in a designated Zone AE floodplain. Zone AE is a base flood zone with determined flood elevations. There is a FEMA designated floodway at this location.

		No	Yes
1.	Is the proposed action a longitudinal encroachment of the base floodplain?	X	
2.	Are the risks associated with the implementation of the proposed action significant?	X	
3.	Will the proposed action support probable incompatible floodplain development?	X	
4.	Are there any significant impacts on natural and beneficial floodplain values?	X	
5.	Routine construction procedures are required to minimize impacts on the floodplain. Are there any special mitigation measures necessary to minimize impacts or restore and preserve natural and beneficial floodplain values? If yes, explain.	X	
6.	Does the proposed action constitute a significant floodplain encroachment as defined in 23 CFR, Section 650.105(q).	X	
7.	Are Location Hydraulic Studies that document the above answers on file? If not explain.		X

PREPARED BY:

______________________________ *Date* ______________
District Project Engineer *(capital and 'on' system projects)*

______________________________ *Date* 1/12/15
Local Agency/Consulting Hydraulic Engineer *(local assistance projects)*

CONCURRED BY:

______________________________ *Date* ______________
District Project Manager *(capital and 'on' system projects)*

______________________________ *Date* ______________
District Local Assistance Engineer *(Local Assistance projects)*

I concur that impacts to natural and beneficial floodplain values are consistent with the results of other studies prepared pursuant to 23 CFR 771, and that the NEPA document or determination includes environmental mitigation consistent with the Floodplain analysis.

______________________________ *Date* ______________
District Senior Environmental Planner *(or Designee)*

Note: If a significant floodplain encroachment is identified as a result of floodplains studies, FHWA will need to approve the encroachment and concur in the Only Practicable Alternative Finding.

Appendix G.5 I-80 Loop On-Ramp from Eureka Road at Miners Ravine Summary Encroachment Form

SUMMARY FLOODPLAIN ENCROACHMENT REPORT

Dist. 3 Co. Placer County Rte. Interstate 80 On-ramp from Eureka Road P.M. ____
Federal-Aid Project Number *(Local Assistance)* ____
Project No.: 03-4E3200 Bridge No. ____
Limits: The proposed Loop On-Ramp to Eureka Road will be a roadway structure on fill. The proposed roadway will be re-aligned approximately 80 ft farther in to the Miners Ravine floodplain in a southwesterly direction for all build alternatives.
Floodplain Description: According to the FEMA FIRM 06061C0479G (November 21, 2001), the I-80 Loop On-Ramp to Eureka Road over Miners Ravine is in a designated Zone AE floodplain. Zone AE is a base flood zone bridge with determined flood elevations. There is a FEMA designated floodway at this location.

		No	Yes
1.	Is the proposed action a longitudinal encroachment of the base floodplain?		X
2.	Are the risks associated with the implementation of the proposed action significant?	X	
3.	Will the proposed action support probable incompatible floodplain development?	X	
4.	Are there any significant impacts on natural and beneficial floodplain values?	X	
5.	Routine construction procedures are required to minimize impacts on the floodplain. Are there any special mitigation measures necessary to minimize impacts or restore and preserve natural and beneficial floodplain values? If yes, explain.	X	
6.	Does the proposed action constitute a significant floodplain encroachment as defined in 23 CFR, Section 650.105(q).	X	
7.	Are Location Hydraulic Studies that document the above answers on file? If not explain.		X

PREPARED BY:

____ *Date* ____
District Project Engineer *(capital and 'on' system projects)*

Andlt Ou *Date* 1/12/15
Local Agency/Consulting Hydraulic Engineer *(local assistance projects)*

CONCURRED BY:

____ *Date* ____
District Project Manager *(capital and 'on' system projects)*

____ *Date* ____
District Local Assistance Engineer *(Local Assistance projects)*

I concur that impacts to natural and beneficial floodplain values are consistent with the results of other studies prepared pursuant to 23 CFR 771, and that the NEPA document or determination includes environmental mitigation consistent with the Floodplain analysis.

____ *Date* ____
District Senior Environmental Planner *(or Designee)*

Note: If a significant floodplain encroachment is identified as a result of floodplains studies, FHWA will need to approve the encroachment and concur in the Only Practicable Alternative Finding.