Appendix I
Drainage Report for Mission Creek Habitat Restoration Project

DRAINAGE REPORT
for
MISSION CREEK HABITAT RESTORATION PROJECT
SOUTHERN CALIFORNIA EDISON

County of Santa Barbara
APN: 153-270-009

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I. INTRODUCTION

The Mission Creek Stream Habitat Restoration Project (Project), as described in the Mission Creek Habitat Restoration Plan (Creek HRP, HELIX, 2021), is being implemented to remediate streambed and surrounding riparian and upland areas impacted as a result of Southern California Edison (SCE) road grading and vegetation management activities in the Mission Canyon area of Santa Barbara County, California that occurred in December 2019 (See Figure 1 for project location). During the December 2019 road work, sidecast material consisting of rock, woody debris, and sediment were disposed downgradient of Spyglass Ridge Road, including areas within Mission Creek. The Project goal is to restore stream flows, stabilize soils of the creek bank, repair habitat features such as pools within the stream bed, remediate and mitigate impacts to trees, and restore impacted woodland/forest and chaparral habitats (Creek HRP, HELIX, 2021).

Wilson Mikami Corporation has prepared this Hydrology/Hydraulic Report in conformance with Jurisdictional Agency standards to the implementation of sidecast removal and the potential restoration and repair of stream features within impacted areas of Mission Creek as outlined in the Creek HRP. This Hydrology/Hydraulic report compared the flow impacts between the existing condition (with sidecast) to the proposed condition (with sidecast removal) within Mission Creek.

This Hydrology Study is prepared to analyze run-off from off-site tributary drainage areas to the proposed Mission Creek Habitat Restoration Project site. USGS topography will be utilized to determine the hydrologic boundary. Hydrology calculations will be prepared utilizing Santa Barbara County's methodology.

Hydraulic Studies are prepared to compare the impact of proposed sidecast removal within Mission Creek. HEC-RAS was utilized to analyze the channel upstream and downstream of the existing and proposed stream restoration areas. The HEC-RAS analysis is based upon USGS topographic information and supplemented with field topography adjacent to the existing and proposed stream restoration areas.

II. HYDROLOGY

A. OFFSITE RUN-ON

Mission Creek consists of an existing unlined stream system that conveys storm runoff from Mission Canyon located as part of the Los Padres National Forest on the north, Mission Canyon confluence with

Rattlesnake Canyon just upstream of City of Santa Barbara. After the confluence, Mission Creek continues to travel south and adjacent to Highway 101, and finally outlets into Pacific Ocean. Mission Creek is part of the County's South Coast Watershed system. The proposed stream restoration areas are located at approximately 12,500 feet south of the Angostura Pass, which composed the upper part of the Mission Creek watershed (See Figure 2 for vicinity map). The tributary area to the proposed stream restoration areas is approximately 1,260 acres.

The Project area is located within the Mission Creek-Frontal Santa Barbara Channel watershed (Hydrologic Unit Code 180600130203), defined by Mission Creek and its tributaries. Mission Creek flows south along Tunnel Trail, parallel to Spyglass Ridge Road, and eventually flows to the Ocean at Stearns Wharf.

B. PRE-DEVELOPED CONDITION

Several post-impact field surveys occurred in 2020 and early 2021 to evaluate pre-restoration conditions of the Project area. A post-impact LiDAR survey along with a topographic survey of creek impact sites were performed in early 2020 to produce a topographic map of the canyon and determine two--dimensional sidecast surface areas and estimate the volumes of sidecast material. A field visit by the Project environmental contractor was performed in November 2020 to estimate depths, refine the volume estimates, and evaluate sidecast composition using a combination of engineering and surveying techniques. A follow-up survey was performed in March 2021 to determine if slide areas had changed since the 2020 survey and to field delineate the limits of the sidecast areas. Additionally, a fluvial morphology team consisting of stream restoration ecologists, a fluvial morphologist, and a stream hydrologist, conducted several site visits in October 2021 to further characterize the deposits within the impacted sites (Creek HRP, HELIX, 2021).

Mission Creek within the Project area is an ephemeral waterway and generally consists of a riffle-pool habitat sequence. Riffle-pool sequences are commonly found in mountain streams and provide particularly valuable habitat for fish and other wildlife (CWA 404(b)(1) Guidelines (40 CFR 230.45)). The rapid movement of water over a coarse substrate in riffles results in a rough flow, a turbulent surface, and high dissolved oxygen levels in the water. The rocky creek bed in riffles provides protection from predators, sources of food deposition, and shelter. Riffles also provide bank (lateral) and/or bed (vertical) stability. The stability of bed and banks provided by riffle habitat is important to reduce the potential for channel degradation following material removal. Impacted portions of the creek bed lacking cobbles and boulders can become vulnerable to erosional forces during creek flows (Creek HRP, HELIX, 2021).

The slopes of the Mission Canyon in the upper mountainous part of the drainage are steep, and the width of the creek bed is relatively narrow. Vegetation occurs where terrain allows and is composed of a shrub/herbaceous understory and an upper canopy dominated by California bay and sycamore. Much of the canyon along the Project area has a high angle of repose and is composed of exposed rock face escarpments. Where soil has deposited along steep slopes, it is loosely compacted and contains fractured rock material. The exposed rock face of the canyon is highly weathered, fractured, and unstable due to natural erosive processes that provide the creek with its boulder, cobble, and gravel structure. The steepness of the drainage, the unstable condition of slope material, along with the continual erosional and hydrological forces, creates an environment of steep, unstable mountainous terrain. Slides of sidecast material from the December 2019 road work may have caused further destabilization along impacted areas of the canyon slopes (Creek HRP, HELIX, 2021).

C. POST-DEVELOPED

One of the objectives of this creek restoration project is to remove all sidecast material deposited as a result of the December 2019 road work.

SCE will implement the least invasive methodology described in Creek HRP to remove all rocks, coarse woody debris, and fine sediment sidecast into Mission Creek. The total estimated volume of sidecast material within RWQCB and CDFW jurisdictional areas is approximately 1,040 cubic yards, contained within the model study area, Creek Sites 1 through 4. SCE anticipates that 100 percent of this material will be removed. Sidecast deposits in these areas are believed to be fully removable through the implementation of the methodologies described in the Creek HRP.

D. METHODOLOGY

The Hydrology Study for Mission Creek is based on Santa Barbara County Flood Control and Water Conservation District design guidelines. WinTR-55 program created by United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), Conservation Engineering Division is used for the hydrology analysis.

WinTR-55 is a single-event rainfall-runoff, small watershed hydrologic model. The model generates hydrographs from both urban and agricultural areas and at selected points along the stream system. Hydrographs are routed downstream through channels and/ or reservoirs. Multiple sub-areas can be modeled within the watershed. The following is the program's capabilities and limitations:

Minimum Area:	1 acre
Maximum Area:	25 square miles
Number of Sub-watersheds:	1 to 10
Number of Reaches:	0 to 10
Reach Routing:	Muskingum-Cunge
Structure Routing:	Storage-Indication
Rainfall Depth:	User-defined, for this project South Coast area rainfall data is used

2-year	3.20
5-year	4.61
10-year	5.55
25-year	6.71
50-year	7.56
100-year	8.38

Rainfall Distributions:	NRCS Type I, IA, II, III, for this project Type I is used
Rainfall Duration:	24-hour
Dimensionless Unit Hydrograph:	Standard peak factor 484
Antecedent Runoff Condition:	AMC2

Hydrologic Soil Group:Used http://websoilsurvey.nrcs,usda.gov/app/ to obtain hydrologic soils group for the project. Most of the soils group indicated hydrologic soil group D, see Appendix A.

Runoff Curve Number: Used Tables 2-2A through 2-2D of "TR-55, Urban Hydrology for Small Watershed," Published by USDA NRCS. For the project, the Runoff Curve Number for Herbaceous cover in Fair Condition and Hydrologic Soil Group D is 89, see Appendix A.

Time of Concentration: Lag for a watershed can be defined as the elapsed time (in hours) from the beginning of unit effective rainfall to the instant that the summation hydrograph for the point of concentration reaches 50 percent of ultimate discharge. By comparing lag values (obtained from the analysis of rainfall-runoff data) to catchment time of concentration Tc values, a relationship is readily determined, lag= 0.8Tc.

For large scale natural condition catchment studies, the following empirical formula is used:

$$\text{Lag (hour)} = Ct\ ((L * Lca) / S^{0.5})^{m}$$

Where

Ct = a constant (24 n), for n value, 0.040 is used

L = length of longest watercourse (miles)

Lca = length along longest watercourse, measured upstream to a point opposite center of area (miles)

S = overall slope of drainage area between the headwaters and the collection point (feet per mile)

m = a constant determined (0.38)

For time concentration and lag calculations, See Appendix A.

III. HYDRAULIC ANALYSIS

Mission Creek is located in the unincorporated areas of Santa Barbara County, California. The hydraulic study was performed for approximately 500 feet of the stream. The extent of the stream is from 100 feet upstream of Spyglass Road Bridge crossing to 400 feet downstream. The overbank area of Mission Creek for entire study reach area is natural open space (Los Padres National Forest). The Spyglass Road Bridge is a metal I-beam bridge with stone abutments and steel plate top surface (See Figures 7 & 8).

A. HYDRAULIC MODEL ASSUMPTIONS

The U.S. Army Corps of Engineers (USACE) HEC-RAS, River Analysis System (USACE, 2016), was used to analyze the impact of the proposed sidecast removal within Mission Creek. The HEC- RAS 5.0.7 version was utilized for developing the channel geometric model.

The HEC-RAS model is a comprehensive program that is intended for calculating water surface profile hydraulics for steady/unsteady and gradually varied flow in natural and manmade channels. It is the primary tool used in the industry to evaluate the hydraulics of floodplain and floodplain mapping studies. The steady flow component is the process used for the current study and is capable of modeling subcritical, supercritical, and mixed flowrate surface profile regimes. The basic computational procedure is based on the solution of the one-dimensional energy equation. Energy losses are evaluated by friction and contraction/expansion. The momentum equation is utilized in situations where the water surface profile is rapidly varied. The effects of various obstructions such as bridges and structures within the floodplain may be considered in the computation.

The following several assumptions and guidelines were utilized in the development of the floodplain hydraulic model for the Mission Creek Stream Restoration project:

Cross-Section Data
A post-impact LiDAR survey along with a topographic survey of creek impact sites were performed in early 2020 to produce a topographic map of the canyon. LIDAR data was in the form of mass points (each point was attributed with latitude, longitude and elevation). Projected mass points were used to create a Triangulated Irregular Network (TIN) for the areas surrounding the stream. 1-foot and 5-foot contours were generated from the TIN.

1-foot and 5-foot contours were used to cut a total of 28 cross-sections for the study area. Each cross-section was oriented such that it is normal to the contours. The structure information for Spyglass Road Bridge is obtained from measurements in the field.

Channel Roughness

Proper selection of the Manning's roughness coefficient, n value, is one of the more critical and subjective elements describing the hydraulics. The selection of the appropriate Manning's roughness coefficient was performed based on: (1) field observation and inspection of the existing floodplain conditions, (2) color aerial photographs, (3) field ground photographs of representative locations along the natural creek corridor, and (4) comparison to published guidelines for roughness selection based on similar ground photographs corresponding to representative cross sections.

Manning’s coefficient values were determined using photographs taken during field reconnaissance in conjunction with the aerial images to estimate Manning’s coefficients of the cross sections. For channel areas, a Manning’s n value of 0.04 is selected. For overbank areas, a Manning’s n value of 0.05 is selected.

Interval Spacing

The cross-section spacing was generally between 5 feet to 20 feet in separation. Cross-section spacing was also determined based upon ensuring that the average channel characteristics were correctly modeled, including all changes in the average geometry or roughness.

Boundary Conditions

Boundary conditions within the flow data menu are necessary to initiate calculations. Starting water surface elevation for upstream was based upon normal depth using a slope of 0.037 due to the flat bottom reach of the creek, for downstream critical depth is used due to the steep bottom reach of the creek.

Discharge

Hydraulic modeling was performed using the 100 year storm discharge of 1,673 cfs at the upstream end of the Mission Creek study.

B. PRE-DEVELOPED HYDRAULIC MODEL

A Pre-Developed hydraulic model was developed based on post-impact LiDAR survey along with a topographic survey of creek impact sites. A total of 28 cross sections and a bridge crossing were used for the model. For Pre-Developed condition hydraulic calculations, see Appendix B.

C. POST-DEVELOPED HYDRAULIC MODEL

A Post-Developed hydraulic model was developed which reflects the four (4) proposed sidecast removal areas within the Mission Creek. The sidecast removal areas and limits are based on the coordination with the fluvial morphology and stream hydrologist team's recommendations. Recommendations for the removals are based on a memorandum letter from Helix Environmental Planning (as Appendix G). Removal depths and widths are outlined in a table as part of the memorandum letter. The tabular data represents field data collected and compiled by Ecokai Environmental, Inc. for the purpose use in the regulatory permitting process and development of the HRP. The data was collected for the purpose of creek characterization and restoration design and adjustments may be require during the actual sidecast removal process.

Cross Sections with removal limits are prepared and included in Appendix F. For Post-Developed condition hydraulic calculations, see Appendix C.

IV. RESULTS

A. HYDROLOGY ANALYSIS

The Hydrology Analysis for Mission Creek consists of 1 subarea total of 1,260.2 acres which generate a Q2 of 488 cfs, Q5 of 810 cfs, Q10 of 1,027 cfs, Q25 of 1,294 cfs, Q50 of 1,487 cfs, and Q100 of 1,673 cfs at the outlet point. This drainage area ultimately flows along Mission Creek, then drains into Pacific Ocean. The WinTr-55 calculations are included in Appendix A, and Hydrology Map located in Appendix D.

B. PRE-DEVELOPED HYDRAULIC ANALYSIS

In the Pre-Developed Hydraulic Analysis, HEC-RAS was utilized to analyze the hydraulic components of the existing stream which reflects the existing streambed geometry and cross sections.

A summary of calculated water surface elevations for the 100-year hydraulic analysis performed with HEC-RAS, which reflects pre-developed condition for Mission Creek is indicated in Table No. 1 – Pre-Developed Condition Hydraulic Summary. A Hydraulic Exhibit – Pre-Developed Condition is located in Appendix E.

The pre-developed model indicated a few small pools at the bottom of the creek (River Stations 1928, 1976 and 2068) and many channel bottom areas with sidecast deposits (River Stations 1700, 1733, 1750, 1777, 1793, 1913, 1951, 1965, 2041 and 2051).

The results shown on Table No. 1 indicated the channel velocities slow down significantly within Creek Site 1 area (River Stations 2035 to 2068). This is due to the runoff entering an exiting pool at River Station 2068. Flow depths within Creek Site 1 area (River Stations 2035 to 2068) increased due to the energy loss entering the pool and the bridge crossing at River Station 2009.5. The bridge opening created an obstruction and caused a backwater effect upstream of the bridge, in this case Creek Site 1 area.

A creek profile is included in Figure 9 to depict the channel bottom and flow depths. The water surface profile showed a non-laminar flow pattern due to the irregular channel geometry, small ponds and sidecast deposits.

C. POST-DEVELOPED HYDRAULIC ANALYSIS

In the Post-Developed Hydraulic Analysis, HEC-RAS was utilized to analyze the hydraulic components of the existing stream which reflects the four (4) proposed sidecast removal areas, bridge crossing, existing streambed geometry and cross sections.

A summary of calculated water surface elevations for the 100-year hydraulic analysis performed with HEC-RAS, which reflects post-developed condition for the Mission Creek is indicated in Table No. 2 – Post-Developed Condition Hydraulic Summary. A Hydraulic Exhibit – Post-Developed Condition is located in Appendix E. Cross Sections for the sidecast removals are included in Appendix F.

Table 3 is prepared to compare changes between the pre- and post-developed conditions, for the water surface elevations and channel velocities. The difference in water surface elevations range from -5.2' to +0.9'. The difference in channel velocities range from -5.7 ft/s to +15.6 ft/s. These changes are caused by the proposed sidecast removals at or/and near the bottom of the stream bed – it is proposed to remove 1' to 4' of side cast material in the channel bottom and side slopes. These changes in channel geometry create small ponding pools and small drops in the channel bottom throughout the sidecast removal areas.

A few of the sections upstream of the bridge (Sections 2051 and 2068) have the most significant changes in flow depths and velocities. Due to the removal of the sidecast material at the bottom of the creek which created a steeper channel gradient and the bridge crossing still act as obstruction, a backwater condition is created upstream of the bridge. Most sections upstream of the bridge (Sections 2018 to 2068) experienced an increase in velocities (range from 3.7 ft/s to 15.6 ft/s) and decrease in flow depths (range from 1.8’ to 4.9’).

A creek profile is included in Figure 10 to depict the channel bottom and flow depths. The water surface profile showed a non-laminar flow pattern due to the irregular channel geometry, small ponds and sidecast deposits.

Overall, the post-developed condition (with sidecast removals) will create a restored stream condition similar to that which existed prior to side cast deposition.

V. REFERENCES

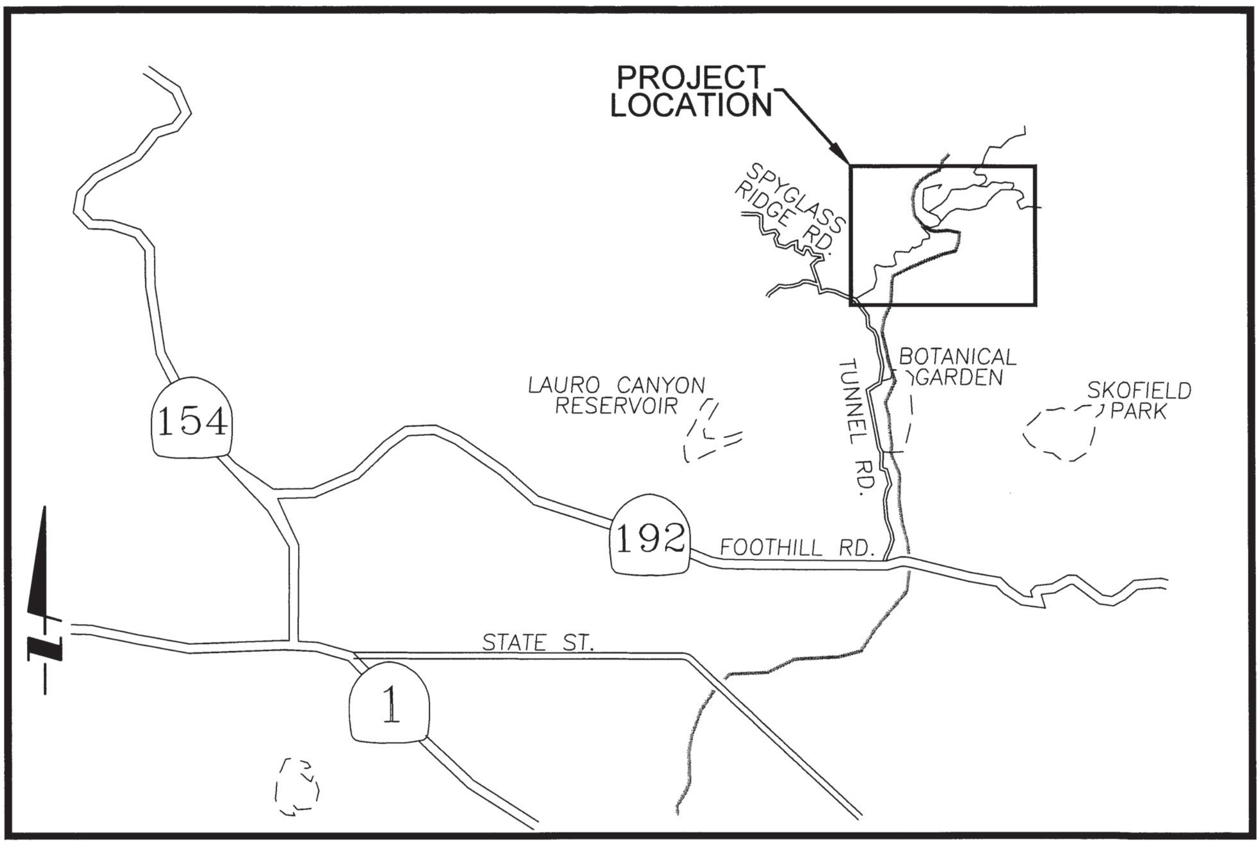
HELIX Environmental Planning, 2021. Mission Creek Habitat Restoration Plan. Prepared for Southern California Edison.

HELIX Environmental Planning, 2021. Technical Implementation Plan Restoration of Creek Sites 1-4, Mission Creek Habitat Restoration Project, Santa Barbara County, California. Prepared for Southern California Edison.

USACE, 2016. River Analysis System User's Manual for Version 5.0, Hydrologic Engineering Center, Davis, CA.

USDA, 2009, Small Watershed Hydrology Win TR-55 User Guide, NRCS Conservation Engineering Division.

VI. FIGURES



VICINITY MAP
NO SCALE

FIGURE 1

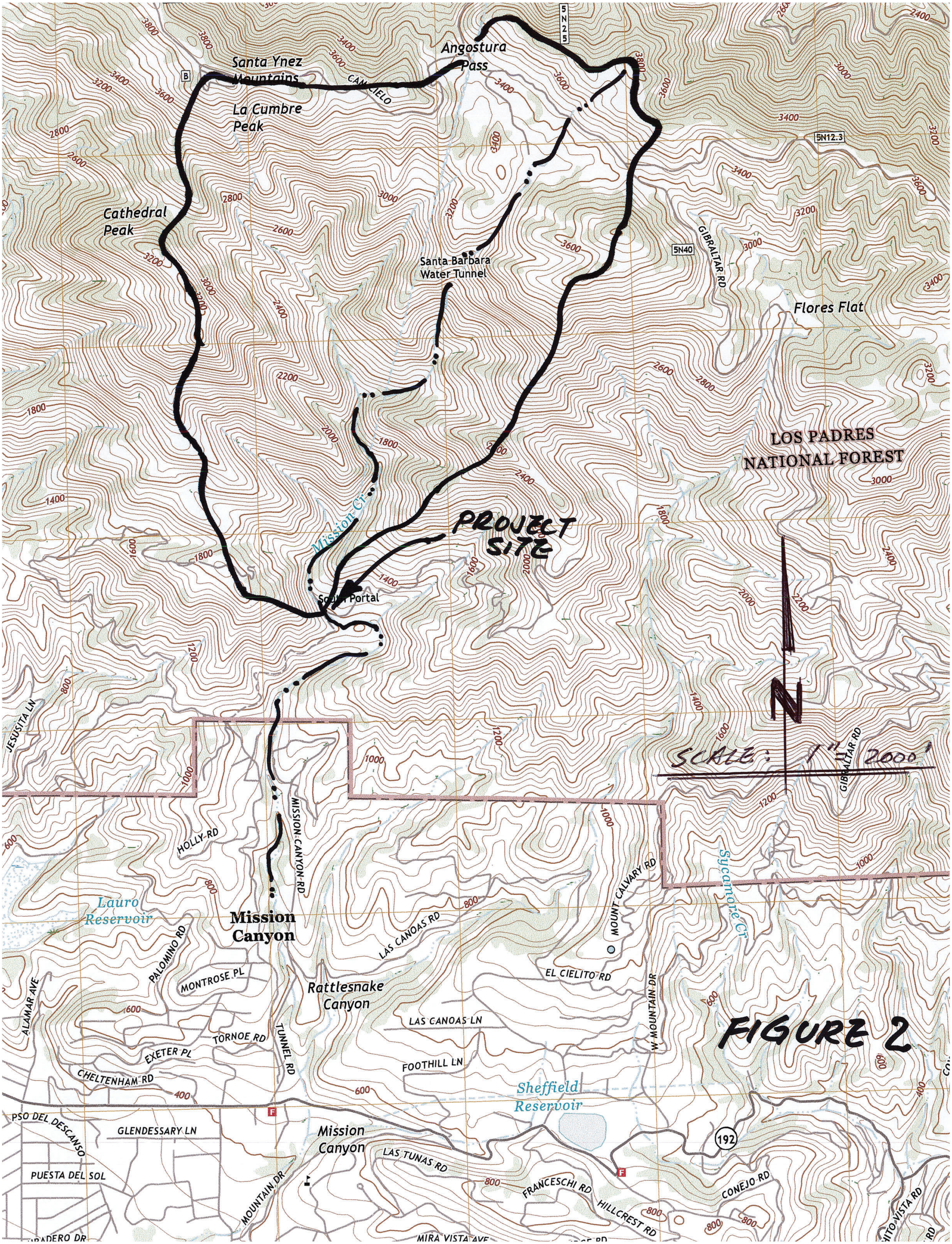

Angostura Pass
Santa Ynez Mountains
La Cumbre Peak
Cathedral Peak
Santa Barbara Water Tunnel
Flores Flat
LOS PADRES NATIONAL FOREST
Mission Cr
PROJECT SITE
South Portal
N
SCALE: 1" = 2000'
Mission Canyon
Lauro Reservoir
Rattlesnake Canyon
Sycamore Cr
FIGURE 2
Sheffield Reservoir
Mission Canyon
GIBRALTAR RD
MISSION CANYON RD
HOLLY RD
JESUSITA LN
LAS CANOAS RD
MOUNT CALVARY RD
EL CIELITO RD
LAS CANOAS LN
FOOTHILL LN
W. MOUNTAIN DR
PALOMINO RD
MONTROSE PL
TORNOE RD
TUNNEL RD
EXETER PL
CHELTENHAM RD
ALAMAR AVE
PSO DEL DESCANSO
GLENDESSARY LN
PUESTA DEL SOL
MOUNTAIN DR
LAS TUNAS RD
FRANCESCHI RD
HILLCREST RD
CONEJO RD
MIRA VISTA AVE
192
5N25
5N12.3
5N40

Figure 3: Looking down on Creek Site 1 where sidecast material under netting from top of right bank just upstream of Spyglass Road Bridge.

Source: HELIX, 2021.

Figure 4: Looking upstream at Creek Site 1 from under the bridge. Sidecast can be seen under netting on both sides of the creek and within the creek bed mixed in with existing rock.

Source: HELIX, 2021.

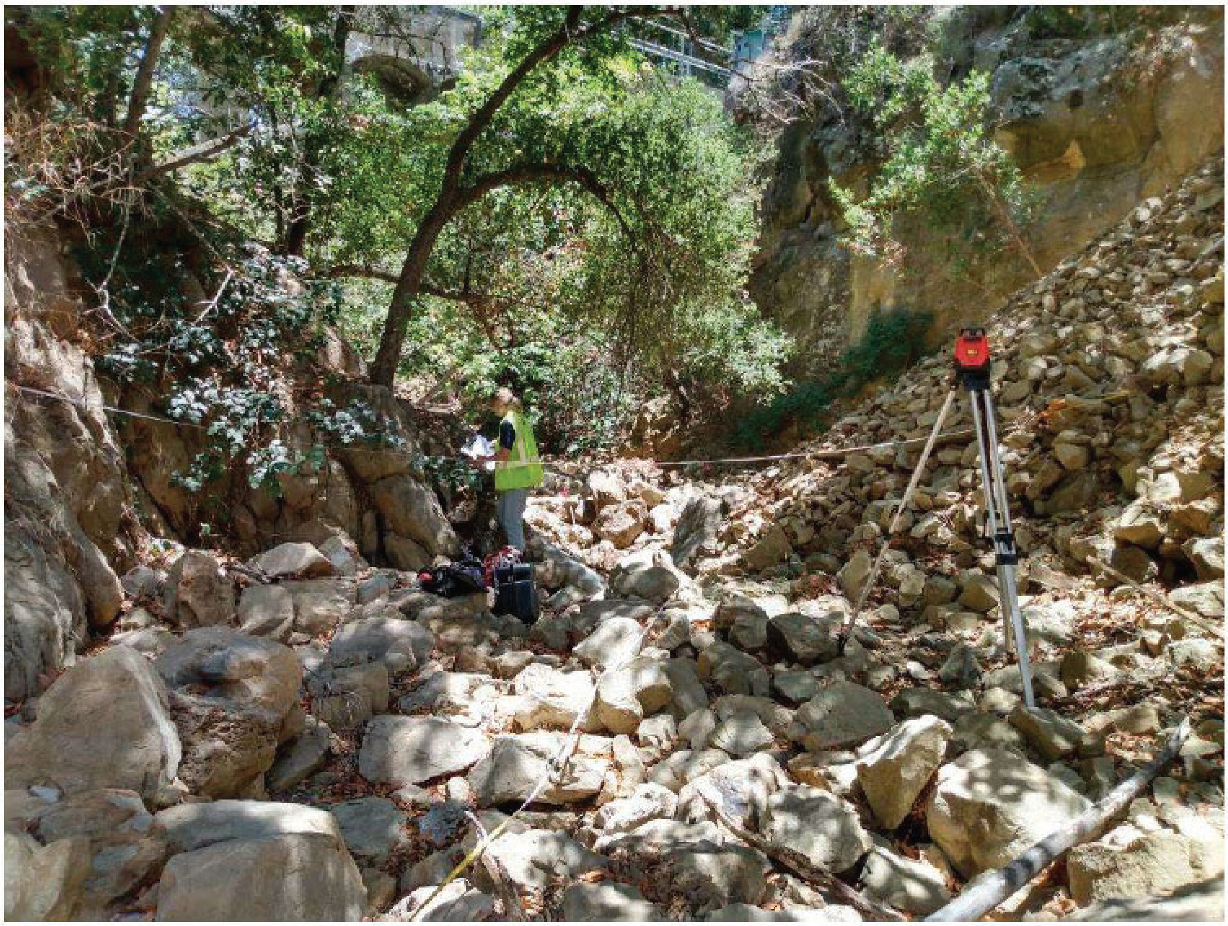


Figure 5: Looking downstream at Creek Site 2 showing sidecast material intermixed with pre-existing creek boulders and cobbles on the downstream side of the bridge.

Source: HELIX, 2021.

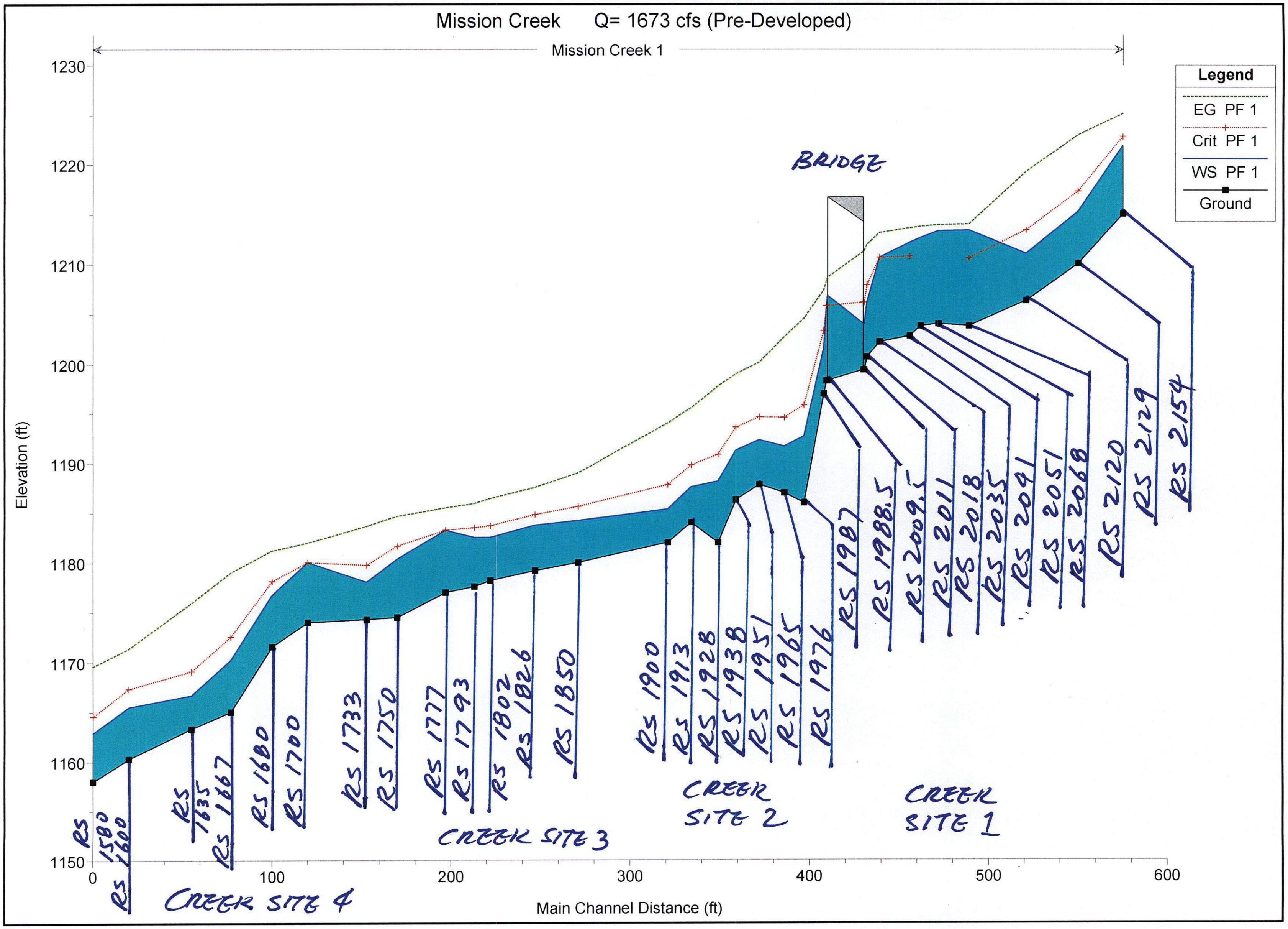
Source: HELIX, 2021.

Figure 6: Looking Upstream at Creek Site 4 with majority of sidecast is along the right bank with large sidecast boulders and cobbles within the creek bed.

Source: HELIX, 2021.

Figure 7: Upstream of Spyglass Road Bridge, Looking downstream.

Figure 8: Downstream End of Spyglass Road Bridge.



Mission Creek Q= 1673 cfs (Pre-Developed)
Mission Creek 1
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
BRIDGE
Elevation (ft)
1230
1220
1210
1200
1190
1180
1170
1160
1150
Main Channel Distance (ft)
0
100
200
300
400
500
600
RS 1580
RS 1600
RS 1635
RS 1667
RS 1680
RS 1700
RS 1733
RS 1750
RS 1777
RS 1793
RS 1802
RS 1826
RS 1850
RS 1900
RS 1913
RS 1928
RS 1938
RS 1951
RS 1965
RS 1976
RS 1987
RS 1988.5
RS 2009.5
RS 2011
RS 2018
RS 2035
RS 2041
RS 2051
RS 2068
RS 2120
RS 2129
RS 2154
CREEK SITE 4
CREEK SITE 3
CREEK SITE 2
CREEK SITE 1

FIGURE 9

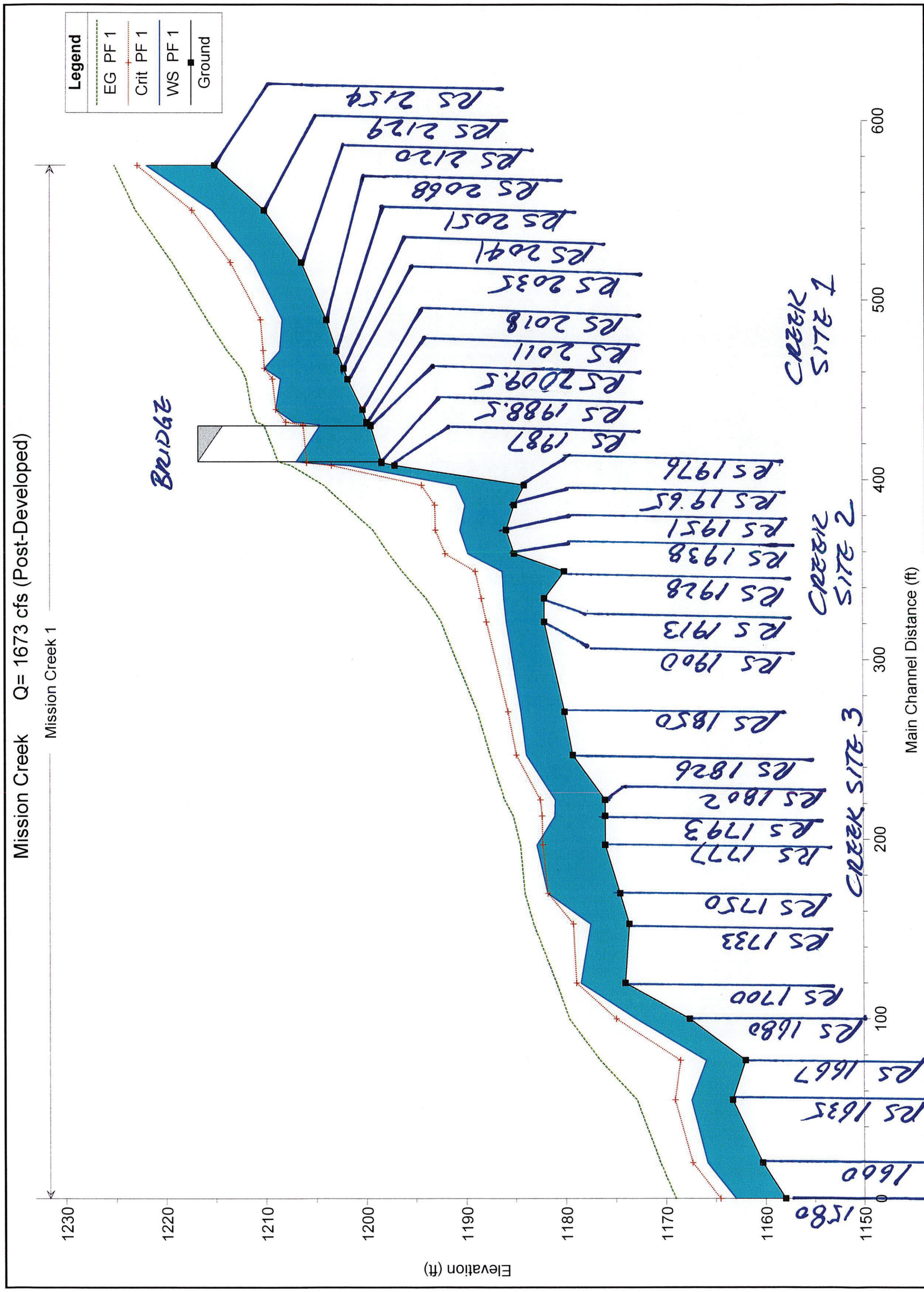

Mission Creek Q= 1673 cfs (Post-Developed)
Mission Creek 1
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Elevation (ft)
Main Channel Distance (ft)
1150
1160
1170
1180
1190
1200
1210
1220
1230
0
100
200
300
400
500
600
BRIDGE
CREEK SITE 1
CREEK SITE 2
CREEK SITE 3
CREEK SITE 4
RS 1580
RS 1600
RS 1635
RS 1667
RS 1680
RS 1700
RS 1733
RS 1750
RS 1777
RS 1793
RS 1802
RS 1826
RS 1850
RS 1900
RS 1913
RS 1928
RS 1938
RS 1951
RS 19.65
RS 1976
RS 1987
RS 1988.5
RS 2009.5
RS 2011
RS 2018
RS 2035
RS 2041
RS 2051
RS 2068
RS 2120
RS 2129
RS 2154

FIGURE 10

VII. TABLES

TABLE 1: HYDRAULIC SUMMARY - PRE DEVELOPED CONDITION

RIVER STA	Q (cfs)	CHANNEL ELEV. (ft)	W.S. ELEV. (ft)	FLOW DEPTH (ft)	CHANNEL VEL. (fps)
2154	1673	1215.00	1221.88	6.88	14.57
2129	1673	1210.00	1215.20	5.20	22.34
2100	1673	1206.30	1210.98	4.68	23.10
2068	1673	1203.80	1213.33	9.53	6.45
2051	1673	1204.00	1213.26	9.26	6.50
2041	1673	1203.80	1212.57	8.77	8.62
2035	1673	1202.80	1212.11	9.31	9.73
2018	1673	1202.20	1210.60	8.40	12.62
2011	1673	1200.70	1206.14	5.44	19.25
2009.5	1673	1199.40	1203.97	4.57	21.74
2000	Bridge				
1988.5	1673	1198.30	1205.77	7.47	12.89
1987	1673	1197.00	1201.51	4.51	19.36
1976	1673	1186.00	1192.66	6.66	27.64
1965	1673	1187.00	1191.63	4.63	26.67
1951	1673	1187.80	1192.25	4.45	22.51
1938	1673	1186.30	1191.20	4.90	22.32
1928	1673	1182.00	1188.10	6.10	24.93
1913	1673	1184.00	1187.53	3.53	22.70
1900	1673	1182.00	1185.32	3.32	23.63
1850	1673	1180.00	1184.17	4.17	17.62
1826	1673	1179.20	1183.70	4.50	15.72
1802	1673	1178.20	1182.52	4.32	15.92
1793	1673	1177.60	1182.51	4.91	14.88
1777	1673	1177.00	1183.25	6.25	12.14
1750	1673	1174.50	1180.36	5.86	16.65
1733	1673	1174.30	1178.02	3.72	19.05
1700	1673	1174.00	1180.03	6.03	11.28
1680	1673	1171.60	1176.73	5.13	17.00
1657	1673	1165.00	1170.20	5.20	23.82
1635	1673	1163.30	1166.67	3.37	24.41
1600	1673	1160.30	1165.49	5.19	19.51
1580	1673	1158.00	1162.85	4.85	20.81

See Appendix B for support information

TABLE 2: HYDRAULIC SUMMARY - POST DEVELOPED CONDITION

RIVER STA	Q (cfs)	CHANNEL ELEV. (ft)	W.S. ELEV. (ft)	FLOW DEPTH (ft)	CHANNEL VEL. (fps)
2154	1673	1215.00	1221.88	6.88	14.57
2129	1673	1210.00	1215.20	5.20	22.34
2100	1673	1206.30	1210.98	4.68	23.10
2068	1673	1203.80	1208.16	4.36	22.07
2051	1673	1202.80	1208.40	5.60	18.51
2041	1673	1202.10	1209.97	7.87	12.29
2035	1673	1201.70	1208.33	6.63	15.03
2018	1673	1200.20	1208.81	8.61	12.63
2011	1673	1199.80	1207.00	7.20	15.54
2009.5	1673	1199.40	1204.41	5.01	19.14
2000	Bridge				
1988.5	1673	1198.30	1205.77	7.47	12.89
1987	1673	1197.00	1201.51	4.51	19.36
1976	1673	1184.00	1190.76	6.76	29.25
1965	1673	1185.00	1189.89	4.89	27.81
1951	1673	1185.80	1190.38	4.58	23.77
1938	1673	1185.00	1189.62	4.62	22.66
1928	1673	1180.00	1186.14	6.14	25.50
1913	1673	1182.00	1186.00	4.00	22.48
1900	1673	1182.00	1185.77	3.77	20.58
1850	1673	1180.00	1184.32	4.32	16.83
1826	1673	1179.20	1183.77	4.57	15.40
1802	1673	1176.00	1180.92	4.92	18.08
1793	1673	1176.00	1180.97	4.97	16.44
1777	1673	1176.00	1182.78	6.78	10.39
1750	1673	1174.50	1181.67	7.17	12.24
1733	1673	1173.60	1177.42	3.82	19.18
1700	1673	1174.00	1178.42	4.42	12.58
1680	1673	1167.60	1172.89	5.29	20.80
1657	1673	1162.00	1165.92	3.92	26.15
1635	1673	1163.30	1167.40	4.10	18.76
1600	1673	1160.30	1165.81	5.51	17.45
1580	1673	1158.00	1162.98	4.98	19.72

See Appendix B for support information

TABLE 3: HYDRAULIC COMPARISON

RIVER STA.	Q (cfs)	PRE-DEV. W.S. ELEV. (ft)	POST-DEV. W.S. ELEV. (ft)	DIFFERENCE IN W.S. ELEV. (ft)	PRE-DEV. VELOCITY (fps)	POST-DEV. VELOCITY (fps)	DIFFERENCE IN VELOCITY (fps)
2154	1673	1221.88	1221.88	0.0	14.57	14.57	0.0
2129	1673	1215.20	1215.20	0.0	22.34	22.34	0.0
2100	1673	1210.98	1210.98	0.0	23.10	23.10	0.0
2068	1673	1213.33	1208.16	-5.2	6.45	22.07	15.6
2051	1673	1213.26	1208.40	-4.9	6.50	18.51	12.0
2041	1673	1212.57	1209.97	-2.6	8.62	12.29	3.7
2035	1673	1212.11	1208.33	-3.8	9.73	15.03	5.3
2018	1673	1210.60	1208.81	-1.8	12.62	12.63	0.0
2011	1673	1206.14	1207.00	0.9	19.25	15.54	-3.7
2009.5	1673	1203.97	1204.41	0.4	21.74	19.14	-2.6
2000	Bridge						
1988.5	1673	1205.77	1205.77	0.0	12.89	12.89	0.0
1987	1673	1201.51	1201.51	0.0	19.36	19.36	0.0
1976	1673	1192.66	1190.76	-1.9	27.64	29.25	1.6
1965	1673	1191.63	1189.89	-1.7	26.67	27.81	1.1
1951	1673	1192.25	1190.38	-1.9	22.51	23.77	1.3
1938	1673	1191.20	1189.62	-1.6	22.32	22.66	0.3
1928	1673	1188.10	1186.14	-2.0	24.93	25.50	0.6
1913	1673	1187.53	1186.00	-1.5	22.70	22.48	-0.2
1900	1673	1185.32	1185.77	0.5	23.63	20.58	-3.1
1850	1673	1184.17	1184.32	0.1	17.62	16.83	-0.8
1826	1673	1183.70	1183.77	0.1	15.72	15.40	-0.3
1802	1673	1182.52	1180.92	-1.6	15.92	18.08	2.2
1793	1673	1182.51	1180.97	-1.5	14.88	16.44	1.6
1777	1673	1183.25	1182.78	-0.5	12.14	10.39	-1.8
1750	1673	1180.36	1181.67	1.3	16.65	12.24	-4.4
1733	1673	1178.02	1177.42	-0.6	19.05	19.18	0.1
1700	1673	1180.03	1178.42	-1.6	11.28	12.58	1.3
1680	1673	1176.73	1172.89	-3.8	17.00	20.80	3.8
1657	1673	1170.20	1165.92	-4.3	23.82	26.15	2.3
1635	1673	1166.67	1167.40	0.7	24.41	18.76	-5.7
1600	1673	1165.49	1165.81	0.3	19.51	17.45	-2.1
1580	1673	1162.85	1162.98	0.1	20.81	19.72	-1.1

See Appendix B for support information

VIII. APPENDICES

APPENDIX A

Win TR-55
Inputs

WinTR-55 Current Data Description

--- Identification Data ---

User: MN
Project: Mission Creek
SubTitle: Stream Restoration
State: California
County: Santa Barbara
Filename: C:\Users\Mng.WILSONMIKAMI\AppData\Roaming\WinTR-55\Mission creek.w55

Date: 9/20/2021
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
Area A	Existing Land Use	Outlet	1260.2	89	2.420

Total area: 1260.20 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.2	4.61	5.55	6.71	7.56	8.38	3.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type I
Dimensionless Unit Hydrograph: <standard>

MN

Mission Creek
Stream Restoration
Santa Barbara County, California

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.2	4.61	5.55	6.71	7.56	8.38	3.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type I
Dimensionless Unit Hydrograph: <standard>

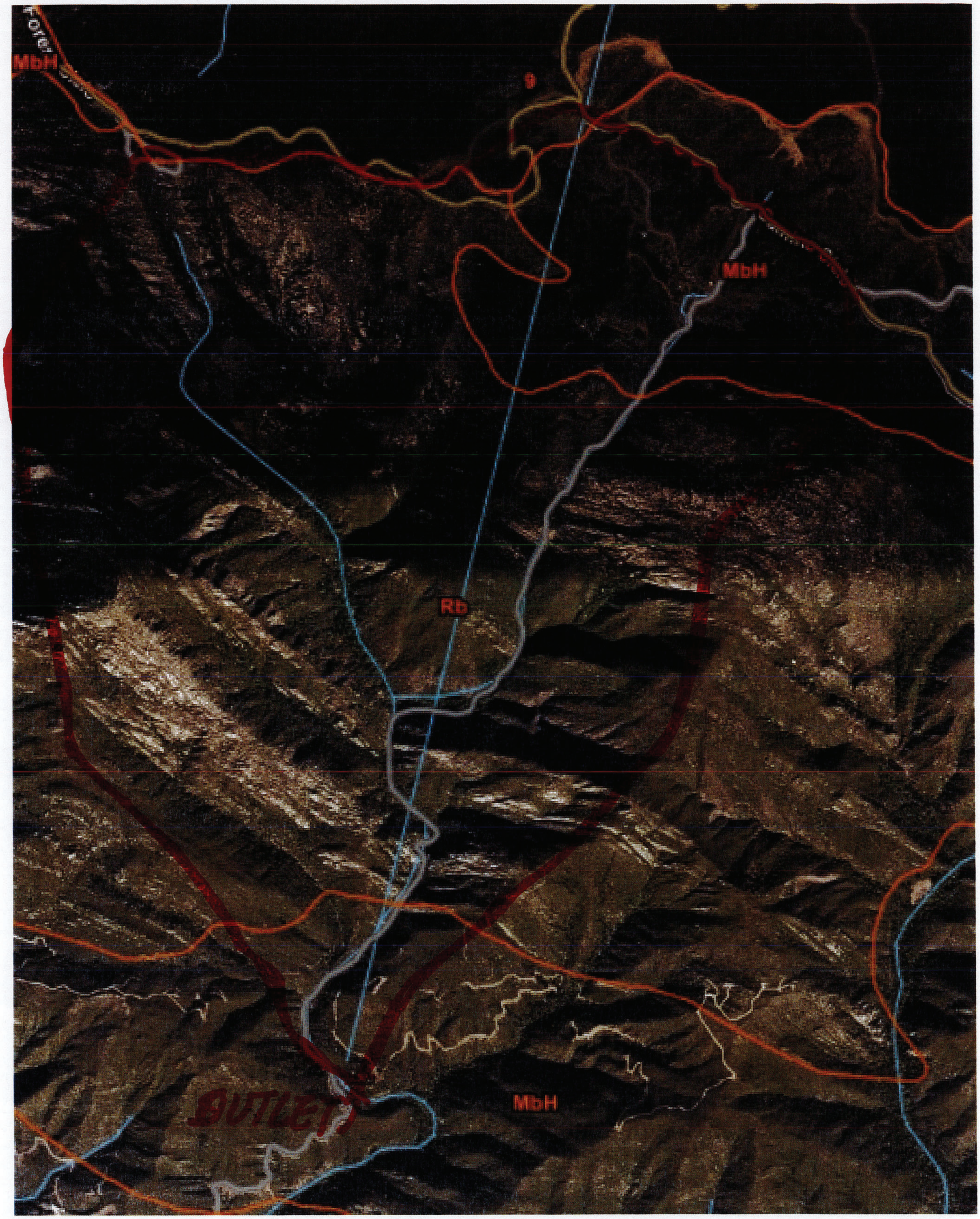
WinTR-55 Outputs

MN

Mission Creek
Stream Restoration
Santa Barbara County, California

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS						
Area A	488.05	809.72	1026.37	1293.36	1487.02	1673.05
REACHES						
OUTLET	488.05	809.72	1026.37	1293.36	1487.02	1673.05



HYDROLOGIC SOIL GROUP MAP

SOURCE : USDA / NRCS / WEB SOIL SURVEY

Santa Barbara County, California, South Coastal Part

MbH—Maymen-Rock outcrop complex , 50 to 75 percent slopes

Map Unit Setting

National map unit symbol: hc73
Elevation: 390 to 3,710 feet
Mean annual precipitation: 23 to 33 inches
Mean annual air temperature: 59 to 64 degrees F
Frost-free period: 290 to 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Maymen and similar soils: 50 percent
Rock outcrop: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Maymen

Setting

Landform: Mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Residuum weathered from shale, conglomerate and/or sandstone

Typical profile

H1 - 0 to 4 inches: stony fine sandy loam
H2 - 4 to 14 inches: loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 50 to 75 percent
Depth to restrictive feature: 10 to 18 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.8 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D

Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Sedimentary rock

Typical profile

H1 - 0 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 50 to 99 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high

Interpretive groups

Land capability classification (irrigated): 8
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Minor Components

Gaviota

Percent of map unit: 8 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Lodo

Percent of map unit: 8 percent
Landform: Low hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Hydric soil rating: No

Unnamed

Percent of map unit: 4 percent

Hydric soil rating: No

Data Source Information

Soil Survey Area: Los Padres National Forest Area, California
Survey Area Data: Version 12, May 29, 2020

Soil Survey Area: Santa Barbara County, California, South Coastal Part
Survey Area Data: Version 13, May 29, 2020

Santa Barbara County, California, South Coastal Part

Rb—Rock outcrop-Maymen complex, 75 to 100 percent slopes

Map Unit Setting

National map unit symbol: hc6f
Elevation: 490 to 4,030 feet
Mean annual precipitation: 24 to 34 inches
Mean annual air temperature: 57 to 63 degrees F
Frost-free period: 265 to 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Rock outcrop: 70 percent
Maymen and similar soils: 25 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rock Outcrop

Setting

Landform: Mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Sedimentary rock

Typical profile

H1 - 0 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 75 to 99 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high

Interpretive groups

Land capability classification (irrigated): 8
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Description of Maymen

Setting

Landform: Mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Residuum weathered from shale, conglomerate and/or sandstone

Typical profile

H1 - 0 to 4 inches: stony fine sandy loam
H2 - 4 to 14 inches: loam
H3 - 14 to 18 inches: unweathered bedrock

Properties and qualities

Slope: 75 to 99 percent
Depth to restrictive feature: 0 to 15 inches to lithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.8 inches)

Interpretive groups

Land capability classification (irrigated): 8e
Land capability classification (nonirrigated): 8e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Gaviota

Percent of map unit: 3 percent
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Lodo

Percent of map unit: 2 percent
Landform: Low hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Data Source Information

Soil Survey Area: Los Padres National Forest Area, California
Survey Area Data: Version 12, May 29, 2020

Soil Survey Area: Santa Barbara County, California, South Coastal Part
Survey Area Data: Version 13, May 29, 2020

Table 2-2a Runoff curve numbers for urban areas [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

1 Average runoff condition, and $I_a = 0.2S$.

2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

4 Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Table 2-2b Runoff curve numbers for cultivated agricultural lands [1]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2]	Hydrologic condition [3]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

1 Average runoff condition, and I_a=0.2S
2 Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.
3 Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

Table 2-2c Runoff curve numbers for other agricultural lands [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4]	48	65	73
Woods—grass combination (orchard or tree farm). [5]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

1 Average runoff condition, and $I_a = 0.2S$.
2 ***Poor:*** <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.
3 ***Poor***: <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.
4 Actual curve number is less than 30; use CN = 30 for runoff computations.
5 CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.
6 ***Poor:*** Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Table 2-2d Runoff curve numbers for arid and semiarid rangelands [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition [2]	A [3]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

1 Average runoff condition, and I_a, = 0.2S. For range in humid regions, use table 2-2c.
2 Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.
3 Curve numbers for group A have been developed only for desert shrub.

TIME OF CONCENTRATION AND LAG CALCULATIONS

For large scale natural condition catchment studies, the following empirical formula is used:

$$\text{lag (hours)} = Ct\ ((L \bullet Lca)/S^{0.5})^{m}$$

where

Ct = a constant (24 n), for n value, 0.040 is used

L = length of longest watercourse (miles)

Lca = length along longest watercourse, measured upstream to a point opposite center of area (miles)

S = overall slope of drainage area between the headwaters and the collection point (feet per mile)

m = a constant determined (0.38)

Ct = 24 (0.04)

L = 2.37 miles

Lca = 1.42 miles

S = 0.208

m = 0.38

$$\text{lag} = 24\ (0.04)\ (2.37 * 1.42 / (0.208)^{0.5})^{0.38}$$

$$= 1.94 \text{ hours}$$

$$\text{Lag} = 0.8\ Tc$$

$$= 0.8 / 1.94$$

$$= 2.42 \text{ hours}$$

$\bar{n}$ = **0.015**

1. Drainage area has fairly uniform, gentle slopes
2. Most watercourses either improved or along paved streets
3. Groundcover consists of some grasses - large % of area impervious
4. Main water course improved channel or conduit

$\bar{n}$ = **0.020**

1. Drainage area has some graded and non-uniform, gentle slopes
2. Over half of the area watercourses are improved or paved streets
3. Groundcover consists of equal amount of grasses and impervious area
4. Main watercourse is partly improved channel or conduit and partly greenbelt (see n = 0.025)

$\bar{n}$ = **0.025**

1. Drainage area is generally rolling with gentle side slopes
2. Some drainage improvements in the area - streets and canals
3. Groundcover consists mostly of scattered brush and grass and small % impervious
4. Main watercourse is straight channels which are turfed or with stony beds and weeds on earth bank (greenbelt type)

$\bar{n}$ = **0.030**

1. Drainage area is generally rolling with rounded ridges and moderate side slopes
2. No drainage improvements exist in the area
3. Groundcover includes scattered brush and grasses
4. Watercourses meander in fairly straight, unimproved channels with some boulders and lodged debris

$\bar{n}$ = **0.040**

1. Drainage area is composed of steep upper canyons with moderate slopes in lower canyons
2. No drainage improvements exist in the area
3. Groundcover is mixed brush and trees with grasses in lower canyons
4. Watercourses have moderate bends and are moderately impeded by boulders and debris with meandering courses

$\bar{n}$ = **0.050**

1. Drainage area is quite rugged with sharp ridges and steep canyons
2. No drainage improvements exist in the area
3. Groundcover, excluding small areas of rock outcrops, includes many trees and considerable underbrush
4. Watercourses meander around sharp bends, over large boulders and considerable debris obstruction

$\bar{n}$ = **0.200**

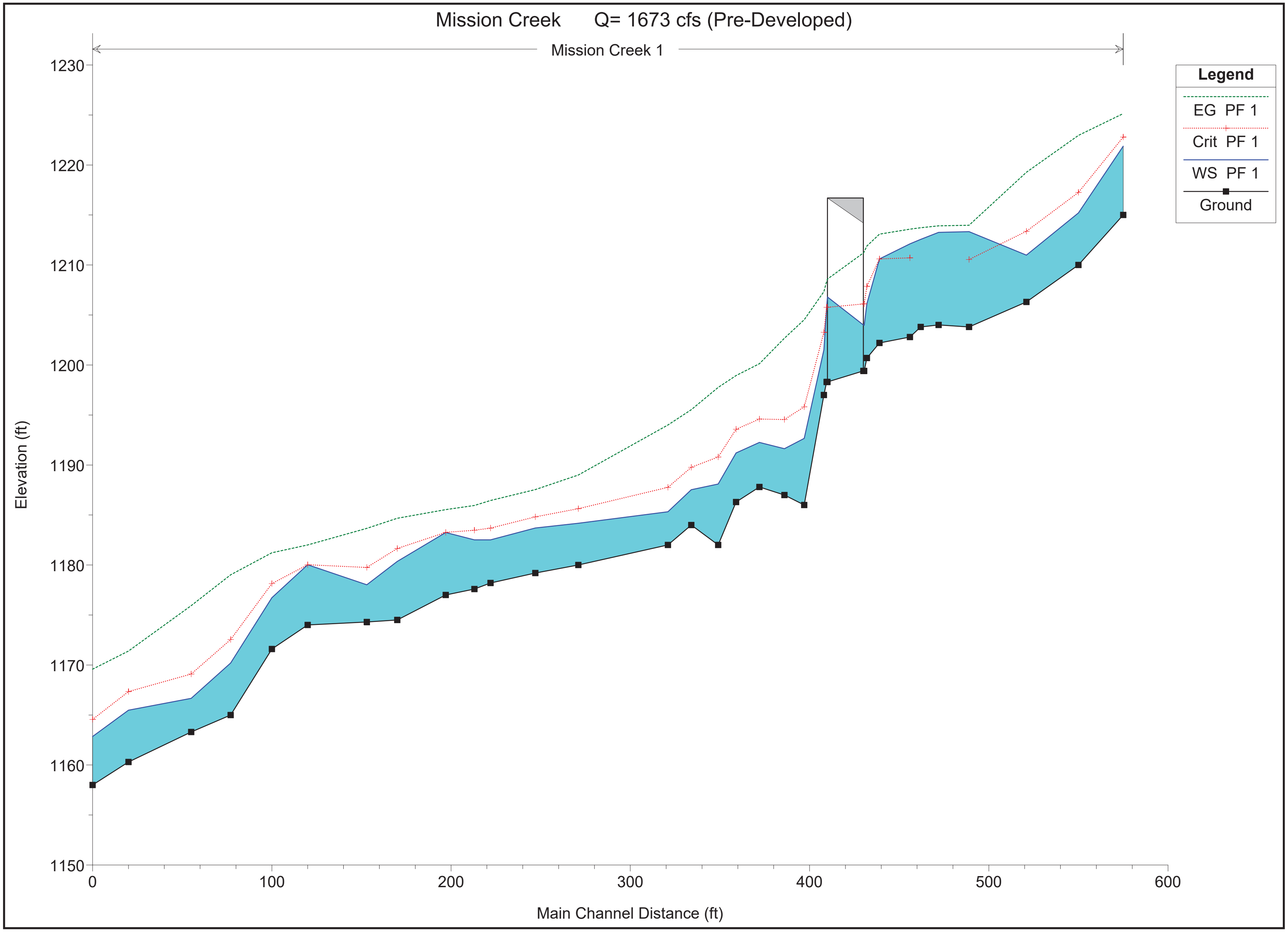
1. Drainage area has comparatively uniform slopes
2. No drainage improvements exist in the area
3. Groundcover consists of cultivated crops or substantial growths of grass and fairly dense small shrubs, cacti, or similar vegetation
4. Surface characteristics are such that channelization does not occur

APPENDIX B

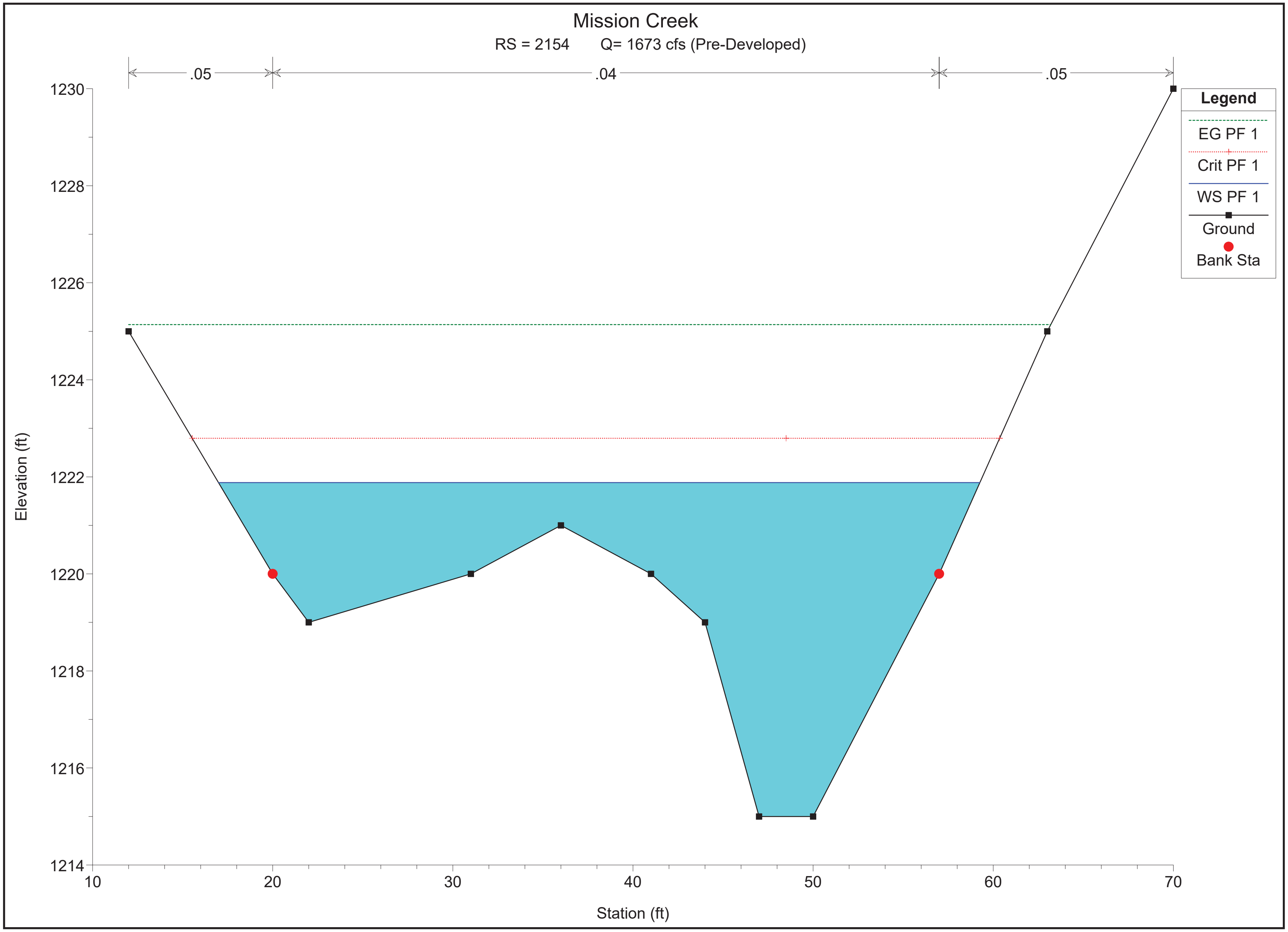
HEC-RAS Plan: Plan 12 River: Mission Creek Reach: 1 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	2154	PF 1	1673.00	1215.00	1221.88	1222.79	1225.14	0.040059	14.57	118.11	42.27	1.47
1	2129	PF 1	1673.00	1210.00	1215.20	1217.26	1222.96	0.147340	22.34	74.90	34.64	2.68
1	2100	PF 1	1673.00	1206.30	1210.98	1213.37	1219.27	0.107595	23.10	72.43	24.74	2.38
1	2068	PF 1	1673.00	1203.80	1213.33	1210.54	1213.98	0.003275	6.45	259.43	44.32	0.47
1	2051	PF 1	1673.00	1204.00	1213.26		1213.92	0.003275	6.50	257.44	43.48	0.47
1	2041	PF 1	1673.00	1203.80	1212.57		1213.72	0.006413	8.62	194.11	33.90	0.64
1	2035	PF 1	1673.00	1202.80	1212.11	1210.72	1213.58	0.008613	9.73	171.98	30.06	0.72
1	2018	PF 1	1673.00	1202.20	1210.60	1210.60	1213.08	0.017128	12.62	132.55	27.67	1.00
1	2011	PF 1	1673.00	1200.70	1206.14	1207.87	1211.90	0.053977	19.25	86.91	21.77	1.70
1	2009.5	PF 1	1673.00	1199.40	1203.97	1206.11	1211.32	0.084775	21.74	76.96	23.65	2.12
1	2000		Bridge									
1	1988.5	PF 1	1673.00	1198.30	1205.77	1205.77	1208.35	0.016341	12.89	129.79	27.29	1.00
1	1987	PF 1	1673.00	1197.00	1201.51	1203.28	1207.34	0.061567	19.36	86.41	24.86	1.83
1	1976	PF 1	1673.00	1186.00	1192.66	1195.82	1204.53	0.144565	27.64	60.53	17.64	2.63
1	1965	PF 1	1673.00	1187.00	1191.63	1194.54	1202.68	0.145156	26.67	62.74	20.93	2.72
1	1951	PF 1	1673.00	1187.80	1192.25	1194.60	1200.13	0.092210	22.51	74.32	22.83	2.20
1	1938	PF 1	1673.00	1186.30	1191.20	1193.58	1198.94	0.084098	22.32	74.97	21.41	2.10
1	1928	PF 1	1673.00	1182.00	1188.10	1190.80	1197.76	0.118710	24.93	67.11	21.20	2.47
1	1913	PF 1	1673.00	1184.00	1187.53	1189.77	1195.53	0.111208	22.70	73.71	28.08	2.47
1	1900	PF 1	1673.00	1182.00	1185.32	1187.77	1194.01	0.112068	23.63	70.79	23.45	2.40
1	1850	PF 1	1673.00	1180.00	1184.17	1185.63	1189.00	0.056277	17.62	94.94	30.75	1.77
1	1826	PF 1	1673.00	1179.20	1183.70	1184.81	1187.54	0.041840	15.72	106.45	31.98	1.52
1	1802	PF 1	1673.00	1178.20	1182.52	1183.69	1186.45	0.044520	15.92	105.12	34.04	1.60
1	1793	PF 1	1673.00	1177.60	1182.51	1183.47	1185.95	0.034845	14.88	112.45	33.03	1.42
1	1777	PF 1	1673.00	1177.00	1183.25	1183.27	1185.54	0.017111	12.14	137.79	30.47	1.01
1	1750	PF 1	1673.00	1174.50	1180.36	1181.66	1184.67	0.039215	16.65	100.47	25.56	1.48
1	1733	PF 1	1673.00	1174.30	1178.02	1179.75	1183.66	0.071563	19.05	87.81	31.06	2.00
1	1700	PF 1	1673.00	1174.00	1180.03	1180.03	1182.01	0.016508	11.28	148.36	38.07	1.01
1	1680	PF 1	1673.00	1171.60	1176.73	1178.14	1181.22	0.049414	17.00	98.39	30.87	1.68
1	1657	PF 1	1673.00	1165.00	1170.20	1172.54	1179.02	0.135645	23.82	70.23	28.57	2.68
1	1635	PF 1	1673.00	1163.30	1166.67	1169.09	1175.93	0.141355	24.41	68.54	27.68	2.73
1	1600	PF 1	1673.00	1160.30	1165.49	1167.34	1171.40	0.075490	19.51	85.75	30.13	2.04
1	1580	PF 1	1673.00	1158.00	1162.85	1164.56	1169.58	0.101762	20.81	80.40	32.91	2.35

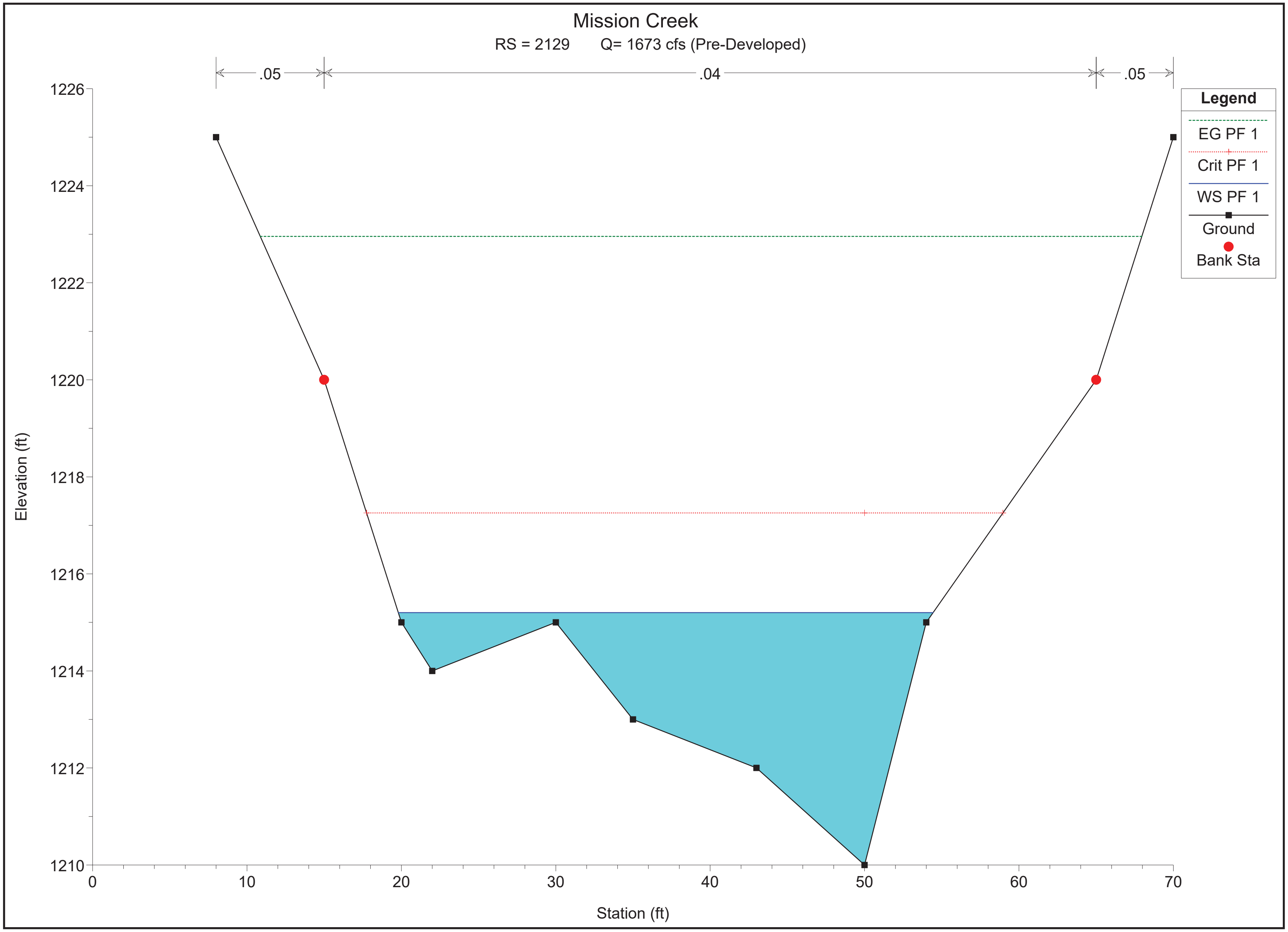
PRE-DEVELOPED



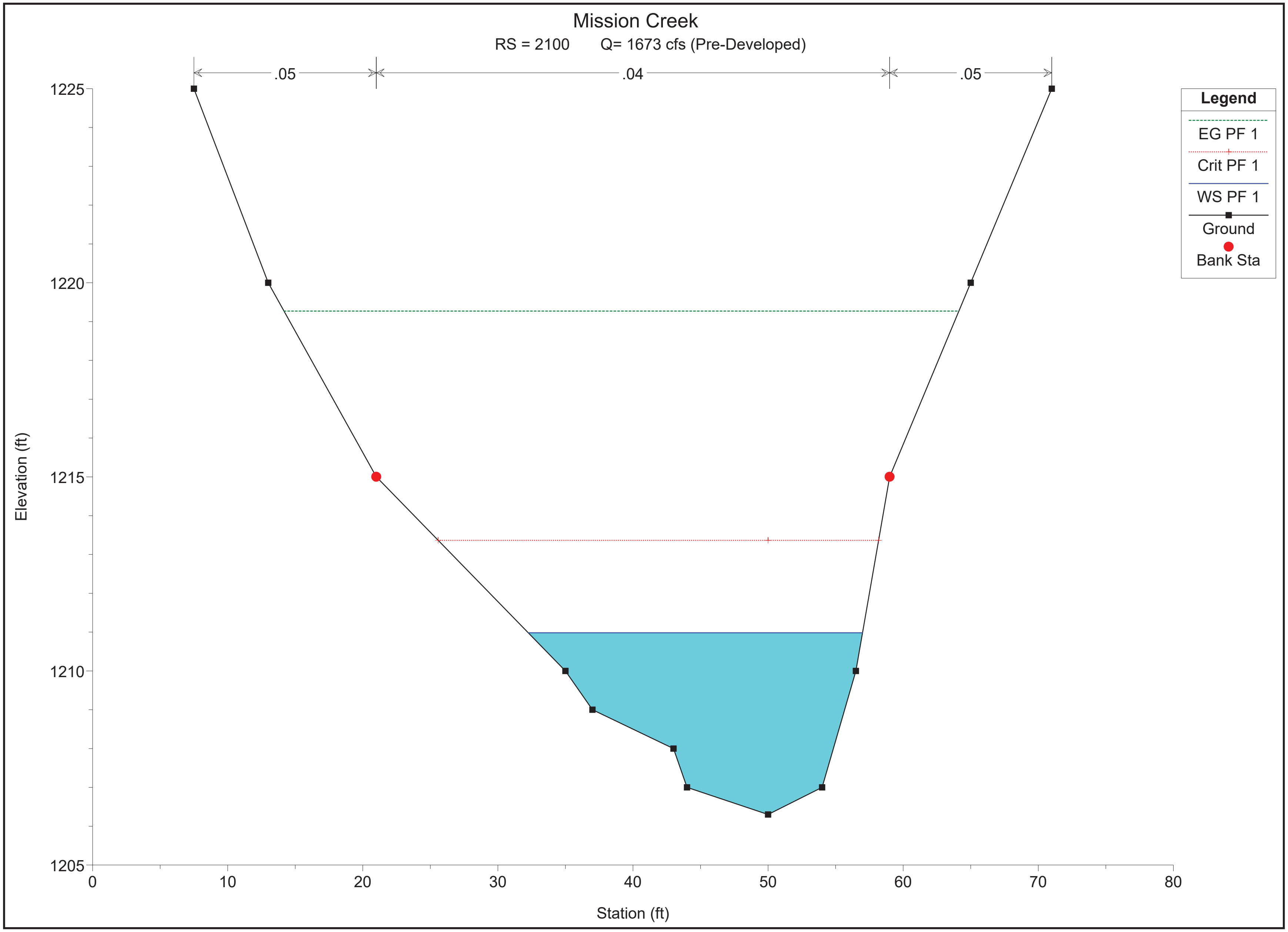
Mission Creek Q= 1673 cfs (Pre-Developed)
Mission Creek 1
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Elevation (ft)
1230
1220
1210
1200
1190
1180
1170
1160
1150
0
100
200
300
400
500
600
Main Channel Distance (ft)

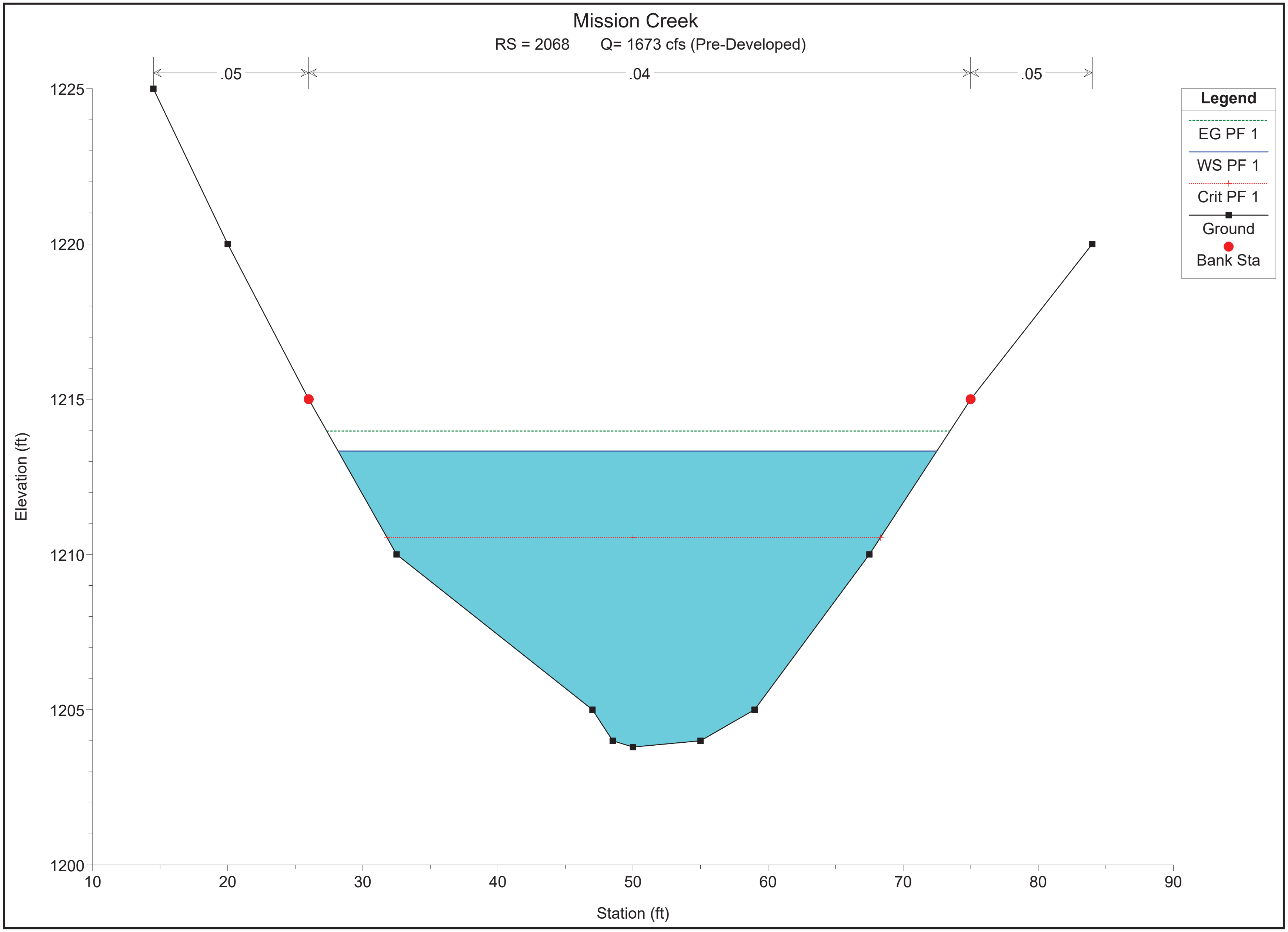


Mission Creek
RS = 2154 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1214
1216
1218
1220
1222
1224
1226
1228
1230
Station (ft)
10
20
30
40
50
60
70

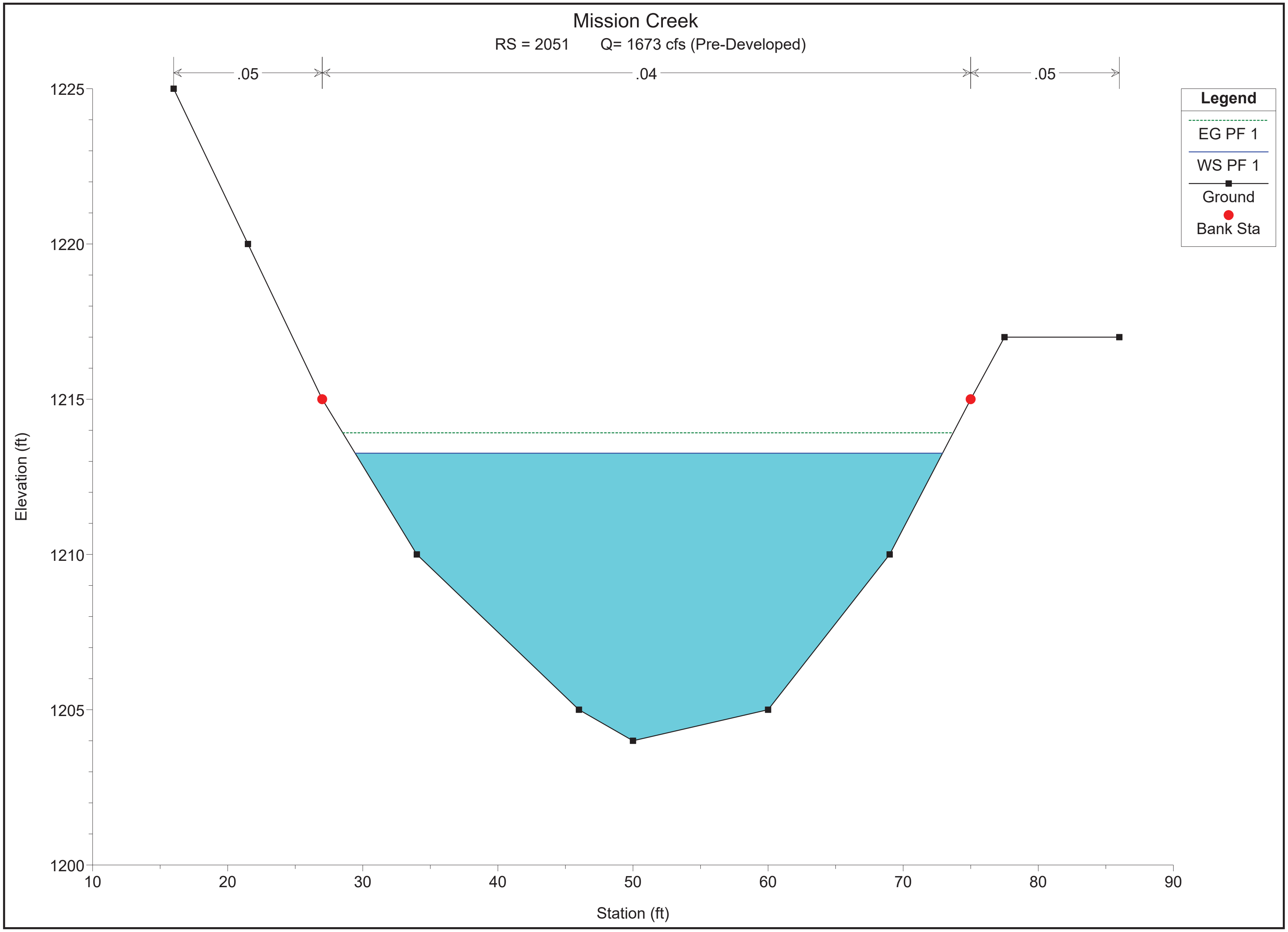


Mission Creek
RS = 2129 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1226
1224
1222
1220
1218
1216
1214
1212
1210
0
10
20
30
40
50
60
70
Station (ft)

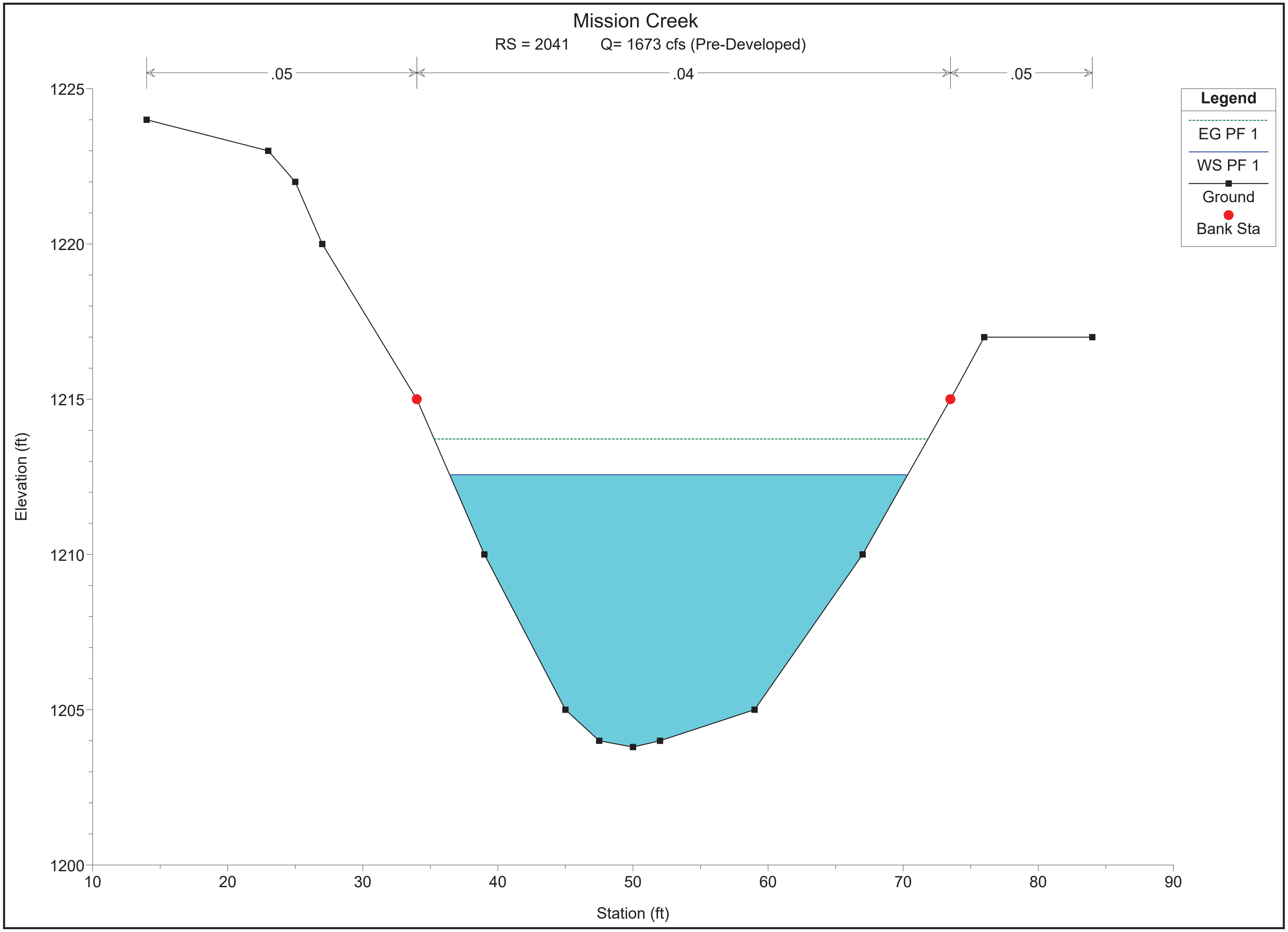

Mission Creek
RS = 2100 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1225
1220
1215
1210
1205
Station (ft)
0
10
20
30
40
50
60
70
80



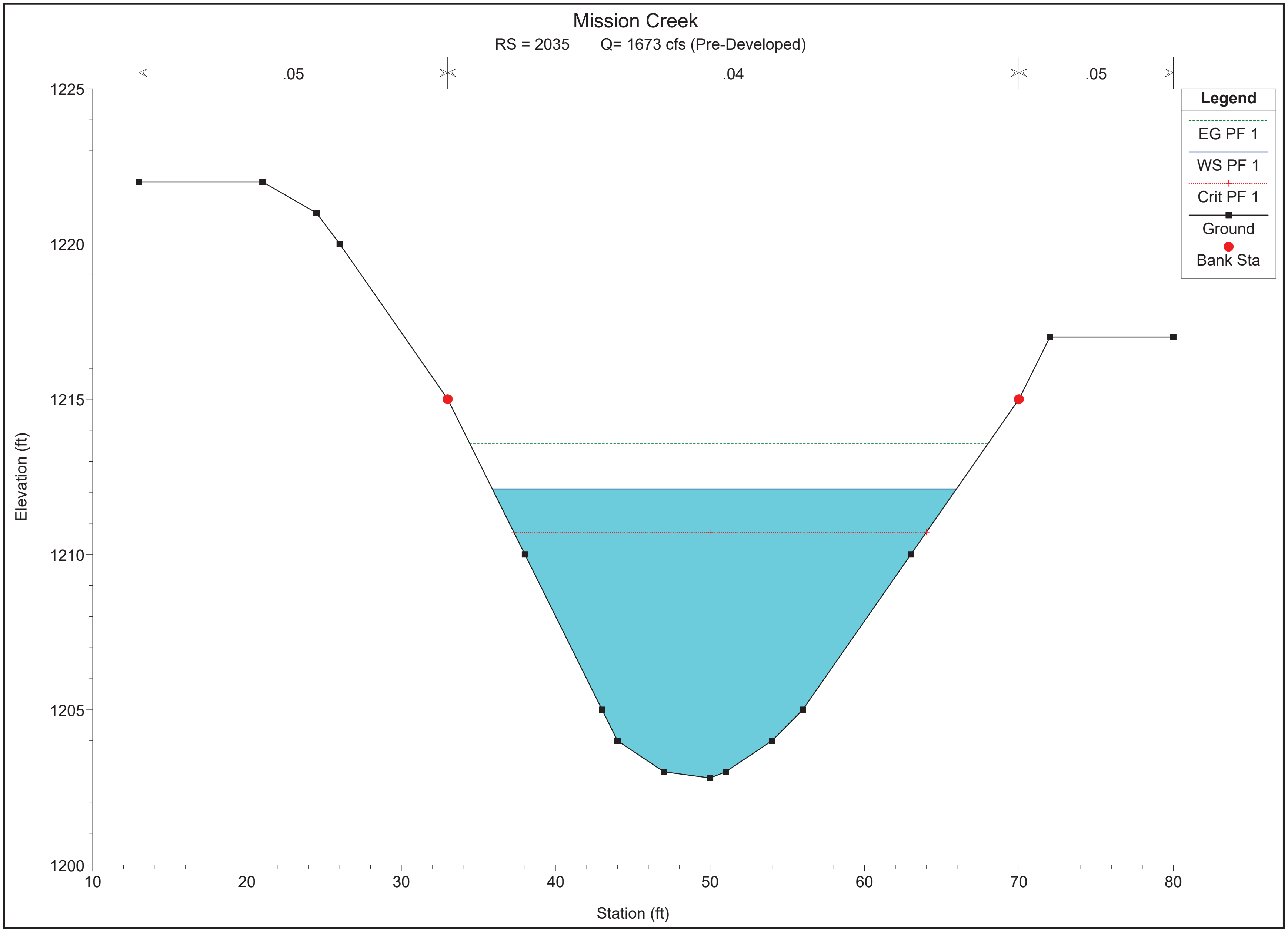
Mission Creek
RS = 2068 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
1225
1220
1215
1210
1205
1200
10
20
30
40
50
60
70
80
90
Elevation (ft)
Station (ft)



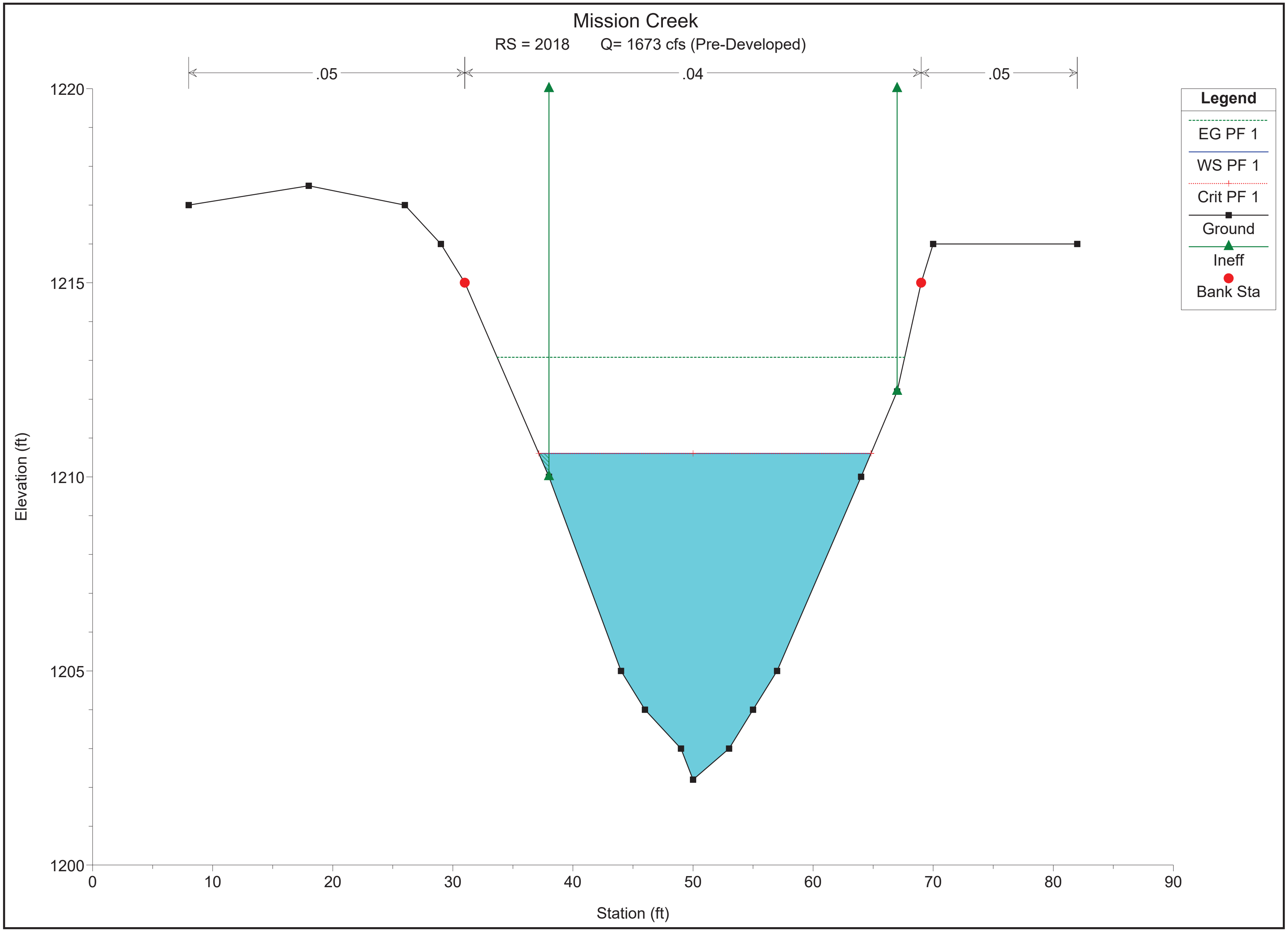
Mission Creek
RS = 2051 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
1225
1220
1215
1210
1205
1200
Elevation (ft)
10
20
30
40
50
60
70
80
90
Station (ft)



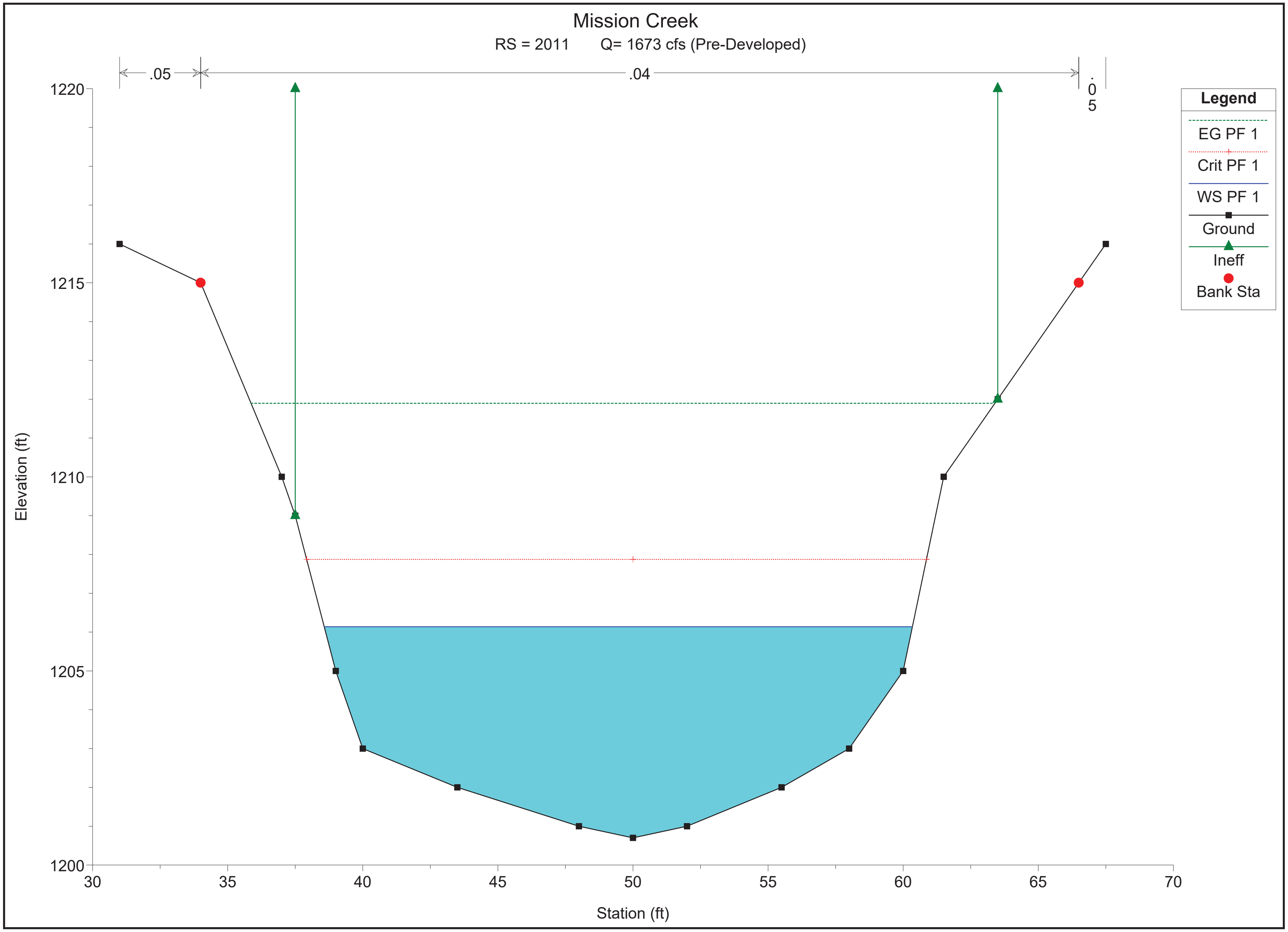
Mission Creek
RS = 2041 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1200
1205
1210
1215
1220
1225
Station (ft)
10
20
30
40
50
60
70
80
90



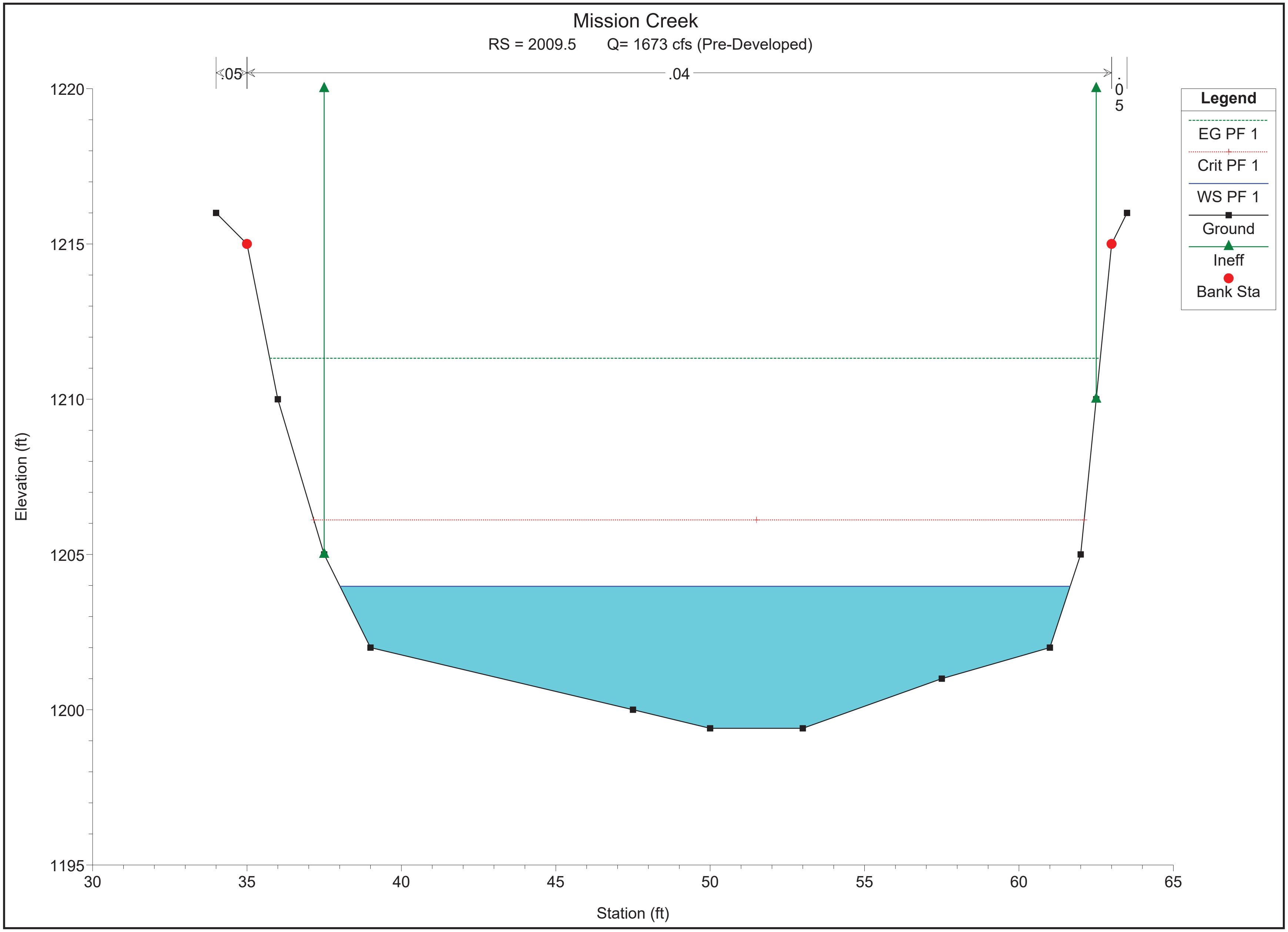
Mission Creek
RS = 2035 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
1225
1220
1215
1210
1205
1200
Elevation (ft)
10
20
30
40
50
60
70
80
Station (ft)



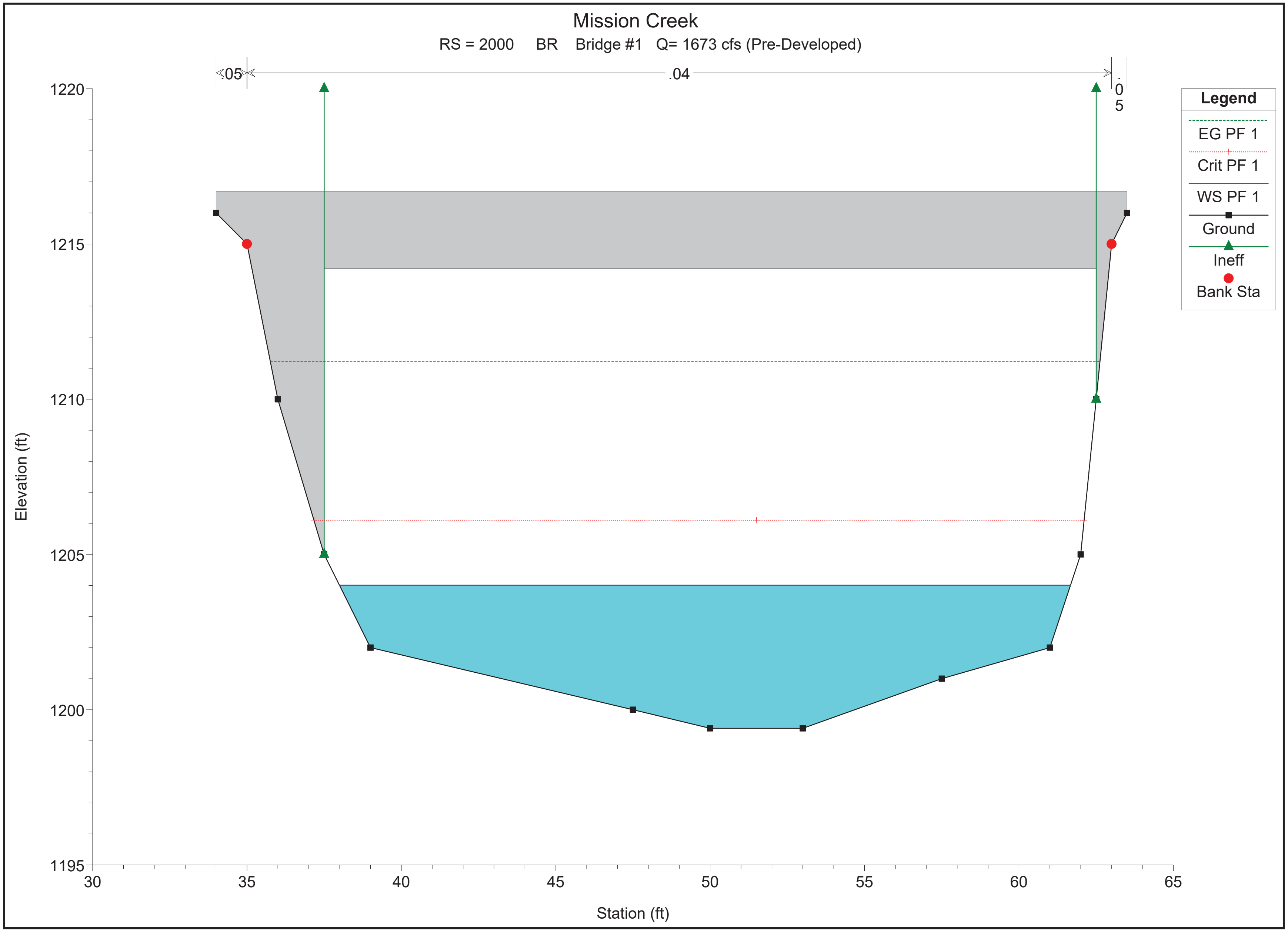
Mission Creek
RS = 2018 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
1220
1215
1210
1205
1200
0
10
20
30
40
50
60
70
80
90
Station (ft)



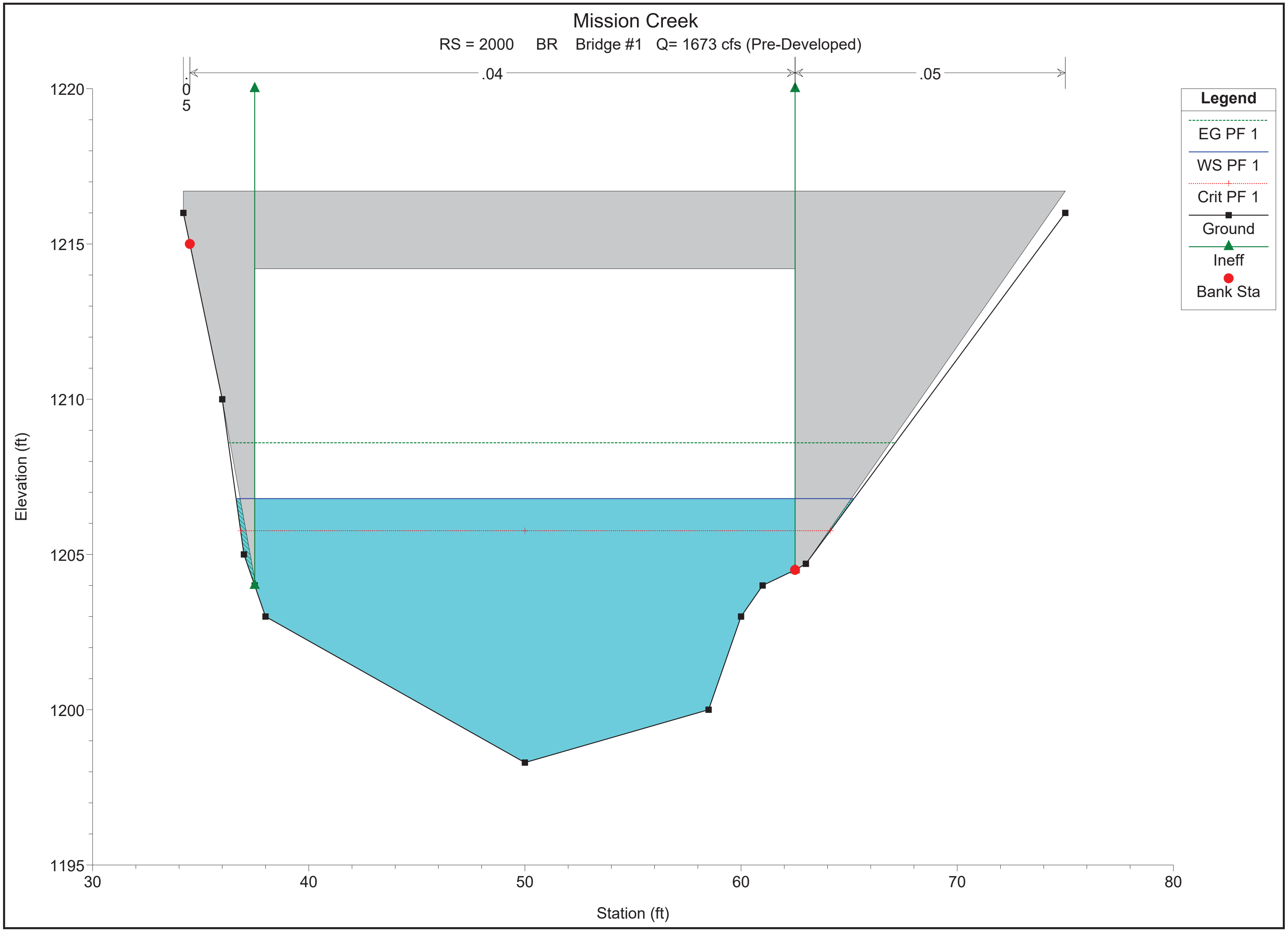
Mission Creek
RS = 2011 Q= 1673 cfs (Pre-Developed)
.05
.04
.
0
5
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
1220
1215
1210
1205
1200
30
35
40
45
50
55
60
65
70
Station (ft)



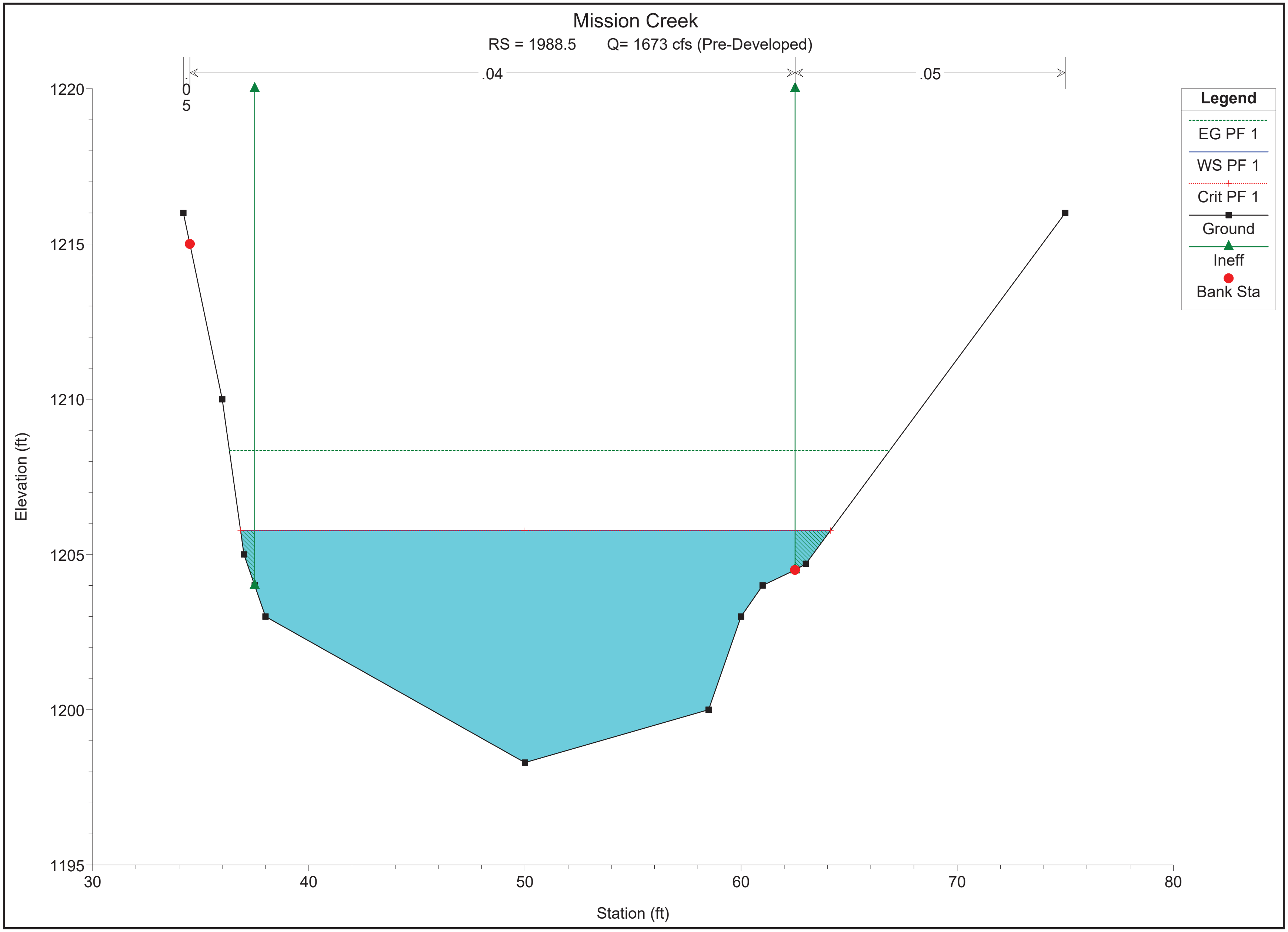
Mission Creek
RS = 2009.5 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
1220
1215
1210
1205
1200
1195
30
35
40
45
50
55
60
65



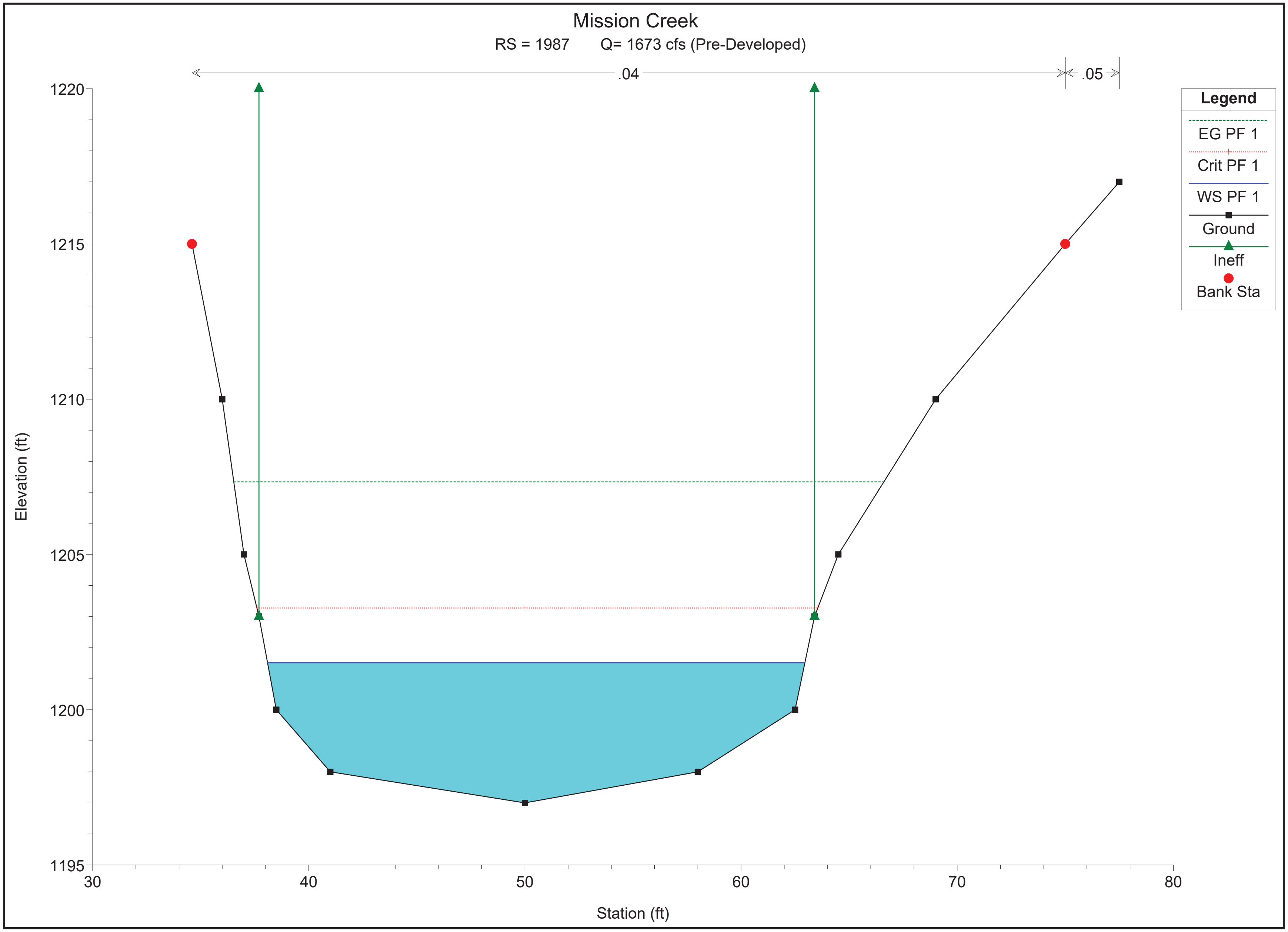
Mission Creek
RS = 2000 BR Bridge #1 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Ineff
Bank Sta
1220
1215
1210
1205
1200
1195
Elevation (ft)
30
35
40
45
50
55
60
65
Station (ft)



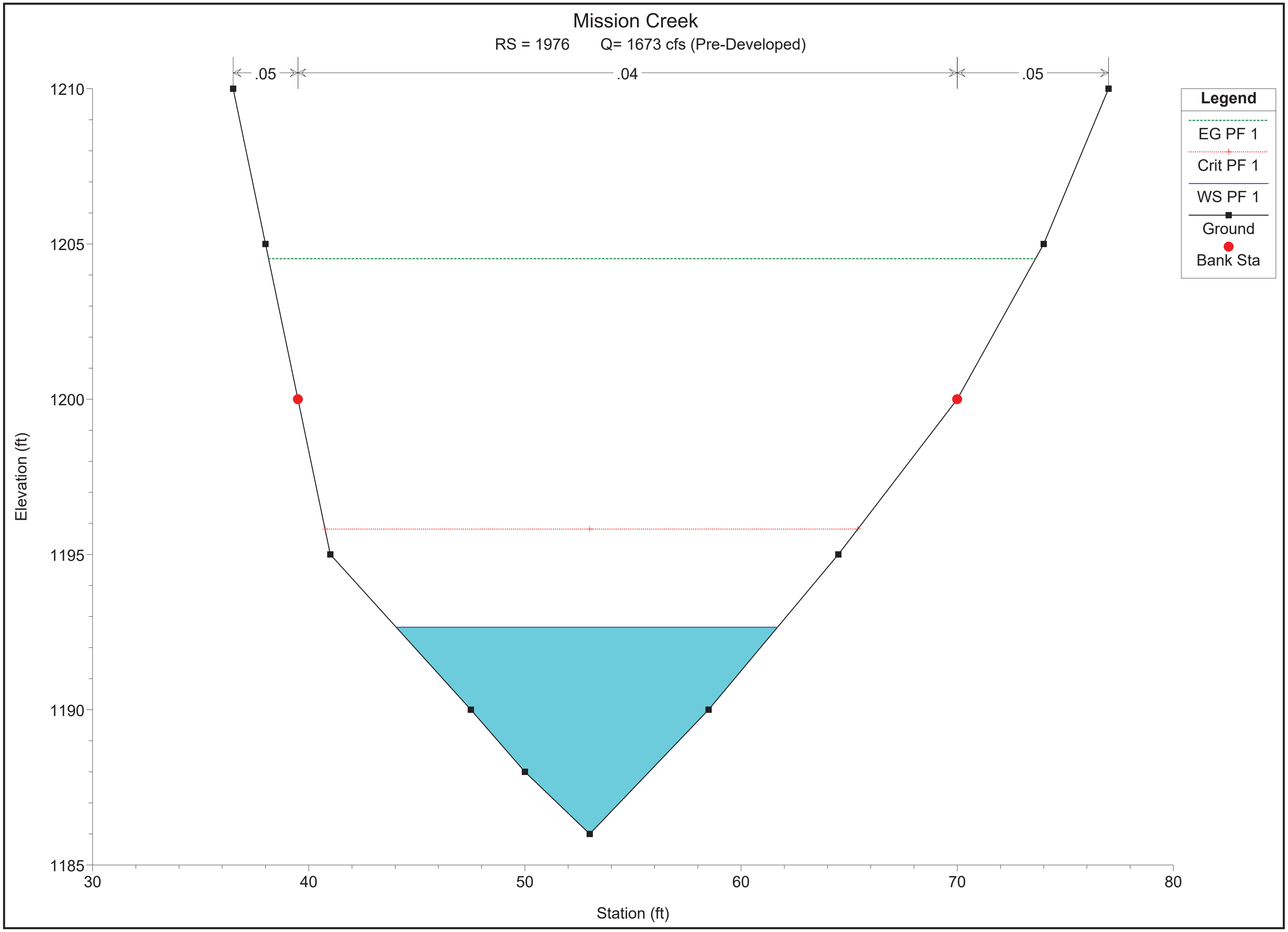
Mission Creek
RS = 2000 BR Bridge #1 Q= 1673 cfs (Pre-Developed)
.04
.05
.0
5
1220
1215
1210
1205
1200
1195
Elevation (ft)
30
40
50
60
70
80
Station (ft)
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Ineff
Bank Sta



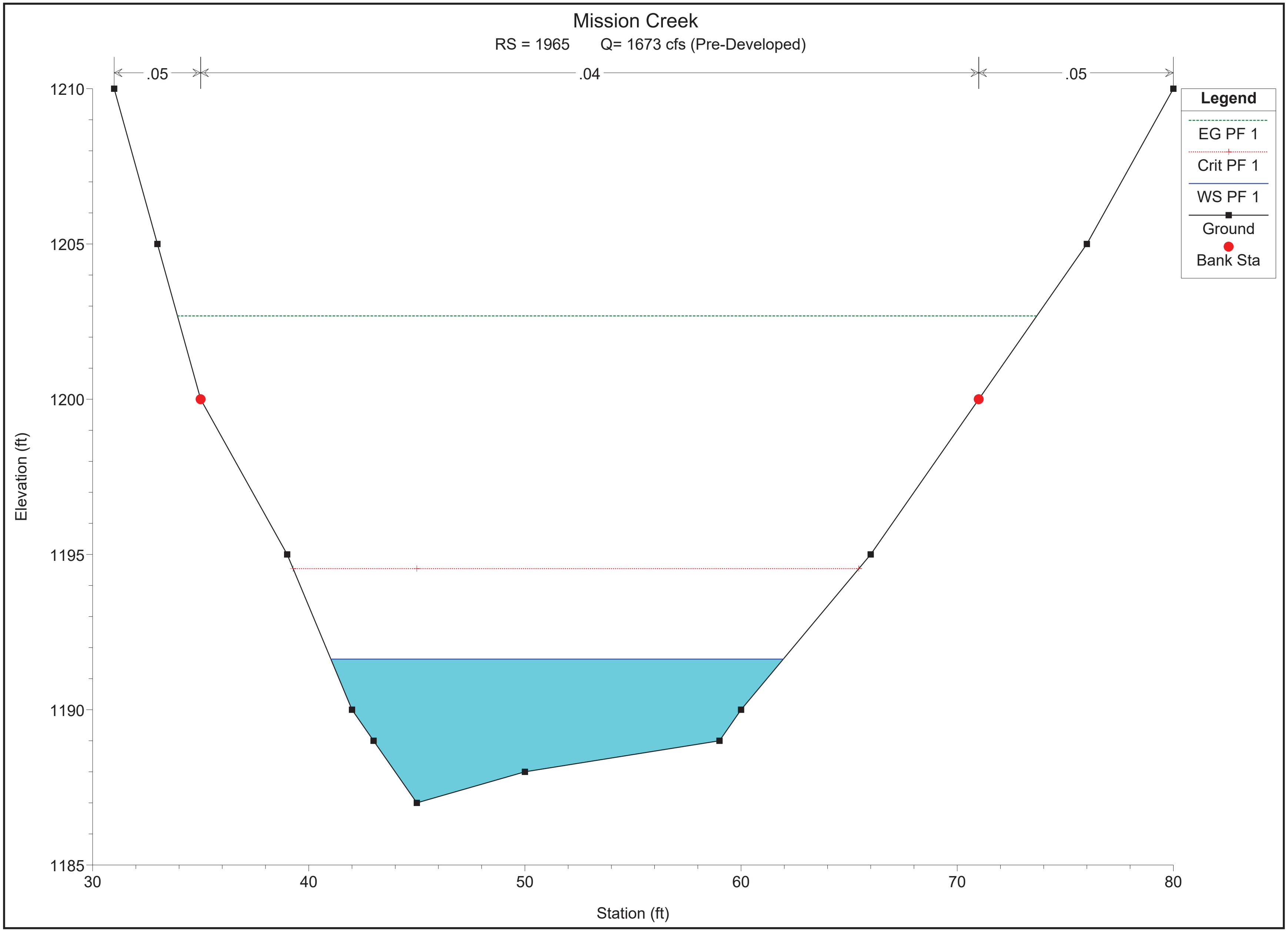
Mission Creek
RS = 1988.5 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
1195
1200
1205
1210
1215
1220
Station (ft)
30
40
50
60
70
80

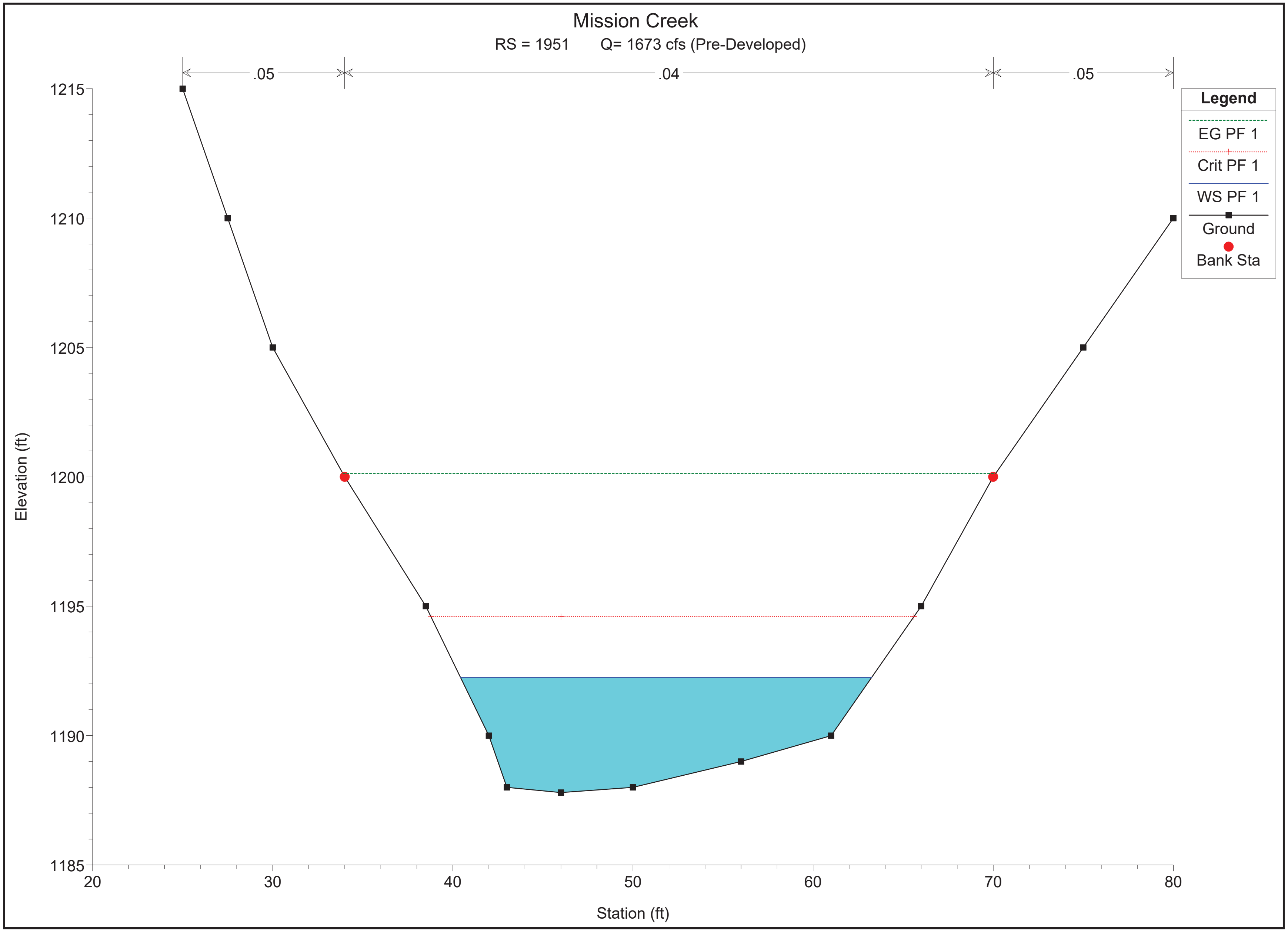


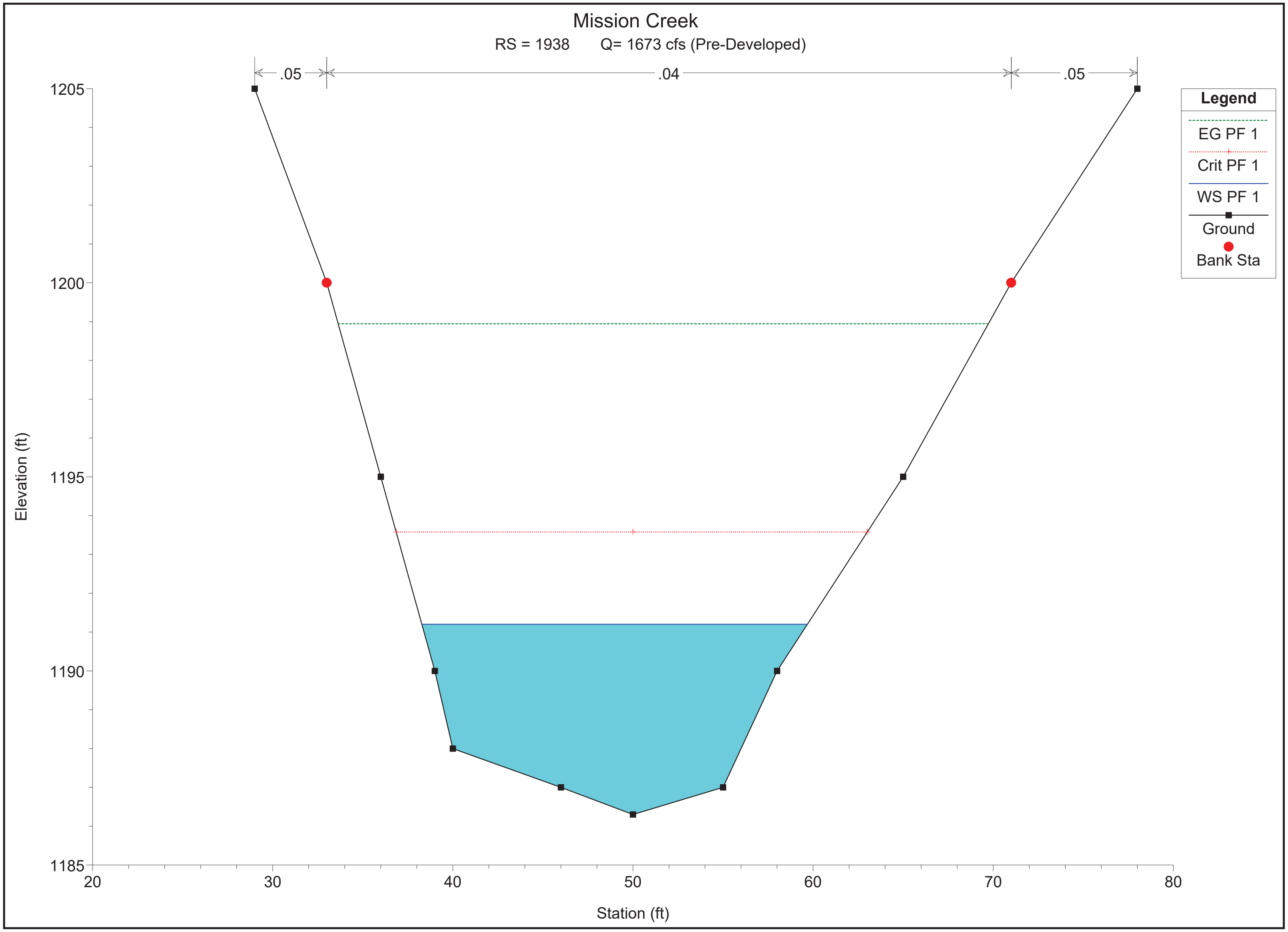
Mission Creek
RS = 1987 Q= 1673 cfs (Pre-Developed)
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Ineff
Bank Sta
1220
1215
1210
1205
1200
1195
Elevation (ft)
30
40
50
60
70
80
Station (ft)

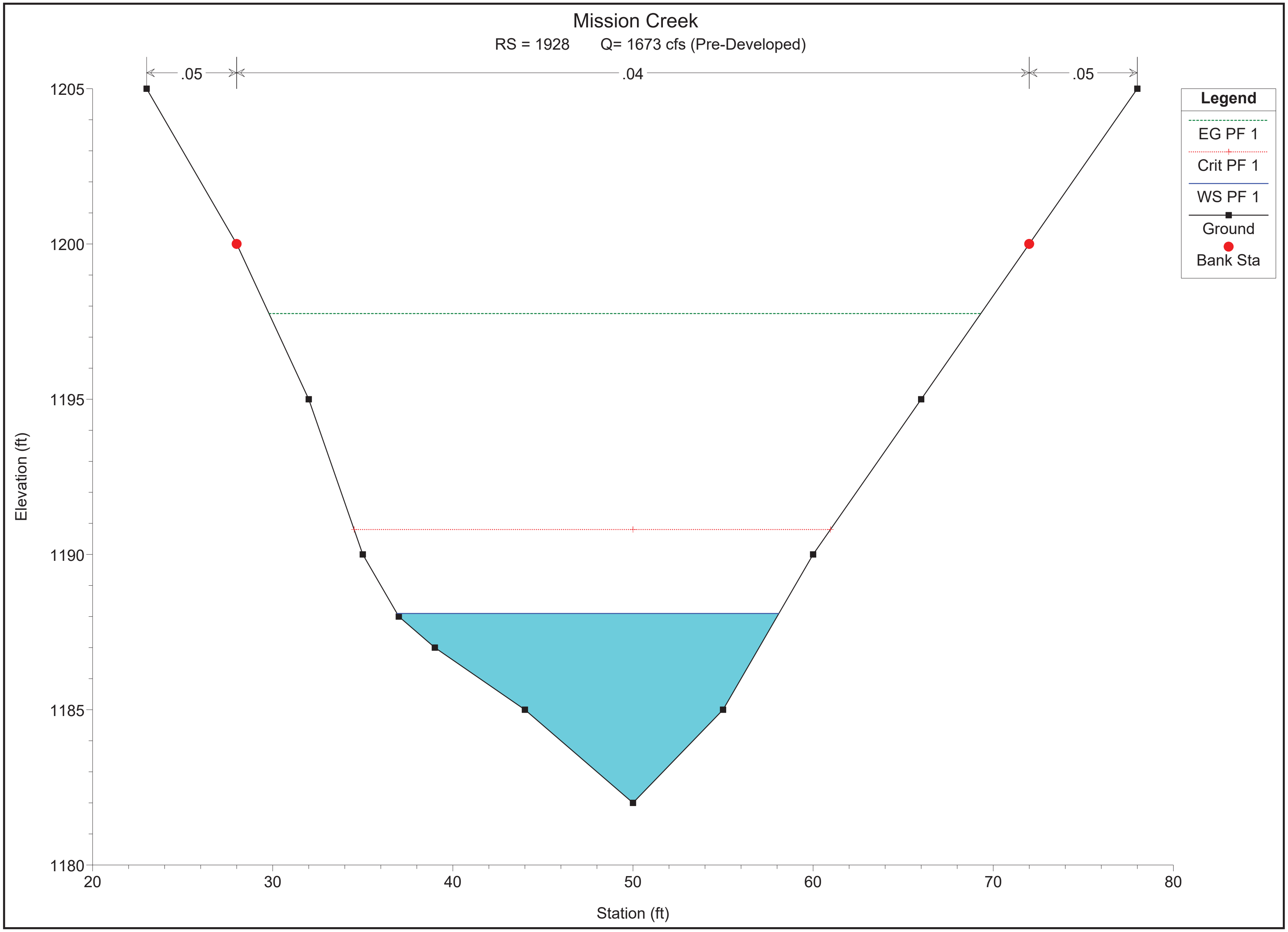


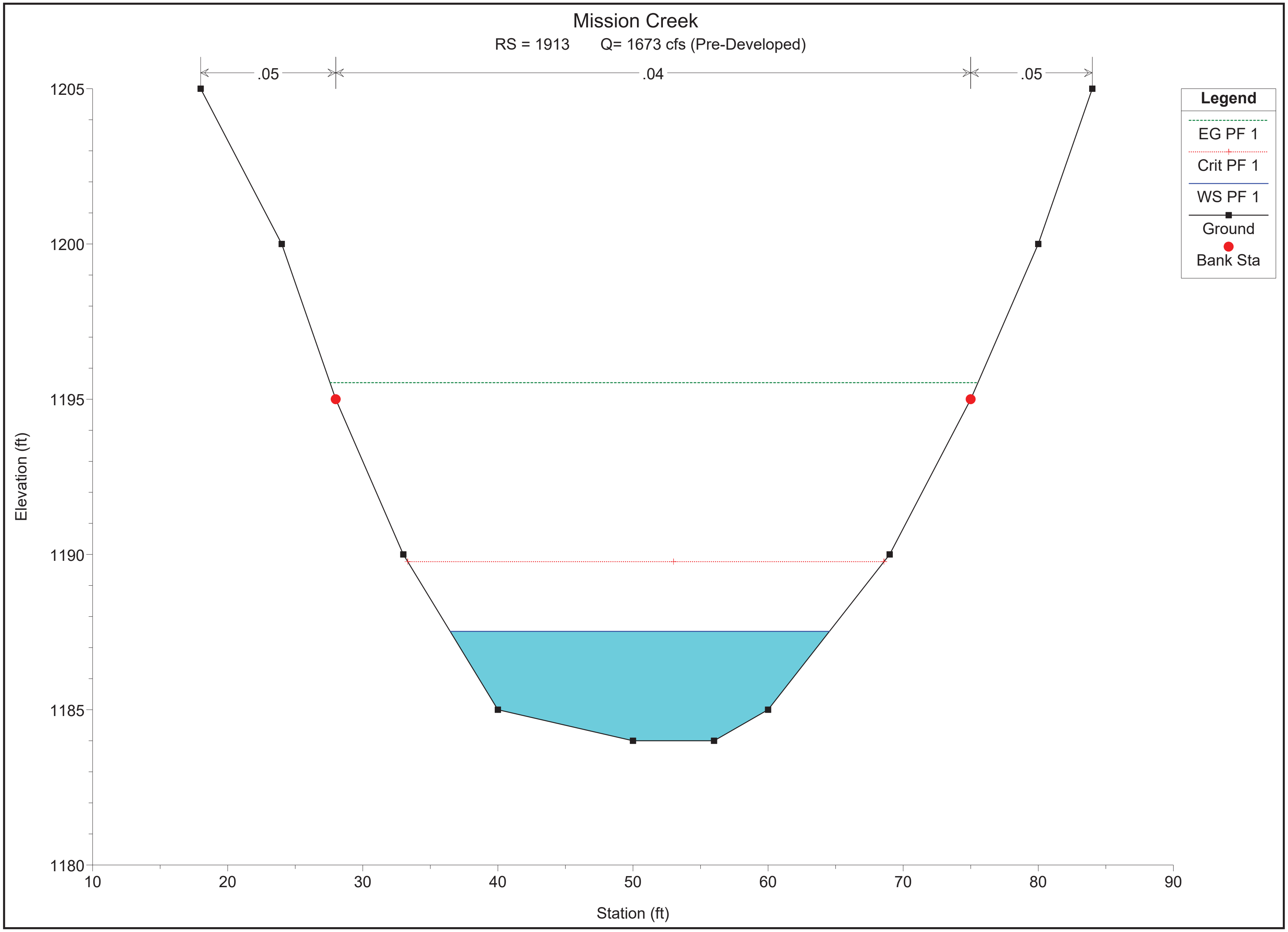
Mission Creek
RS = 1976 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1210
1205
1200
1195
1190
1185
30
40
50
60
70
80
Station (ft)


Mission Creek
RS = 1965 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1210
1205
1200
1195
1190
1185
30
40
50
60
70
80
Station (ft)

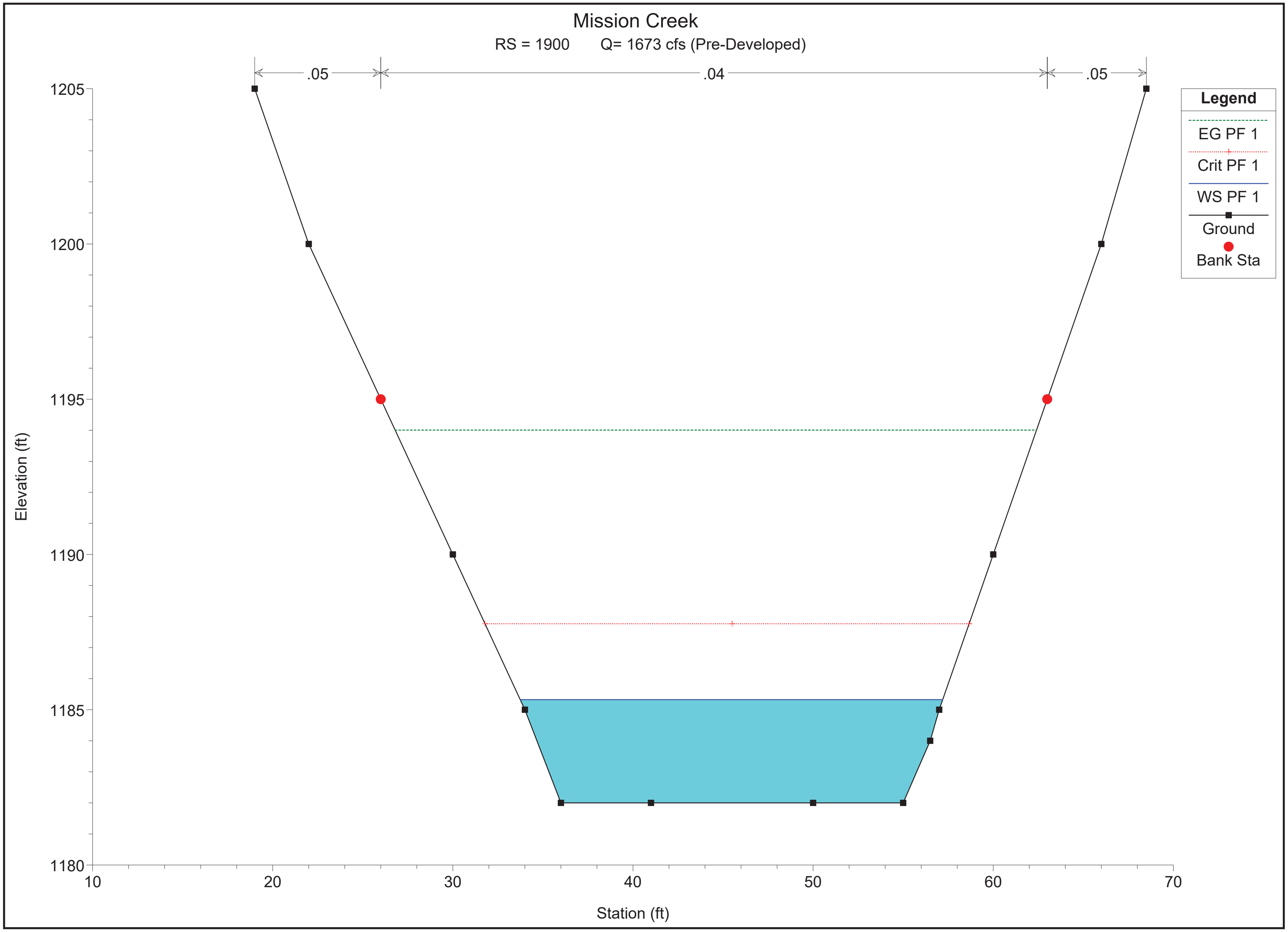

Mission Creek
RS = 1951 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
1215
1210
1205
1200
1195
1190
1185
Elevation (ft)
20
30
40
50
60
70
80
Station (ft)


Mission Creek
RS = 1938 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1205
1200
1195
1190
1185
20
30
40
50
60
70
80
Station (ft)

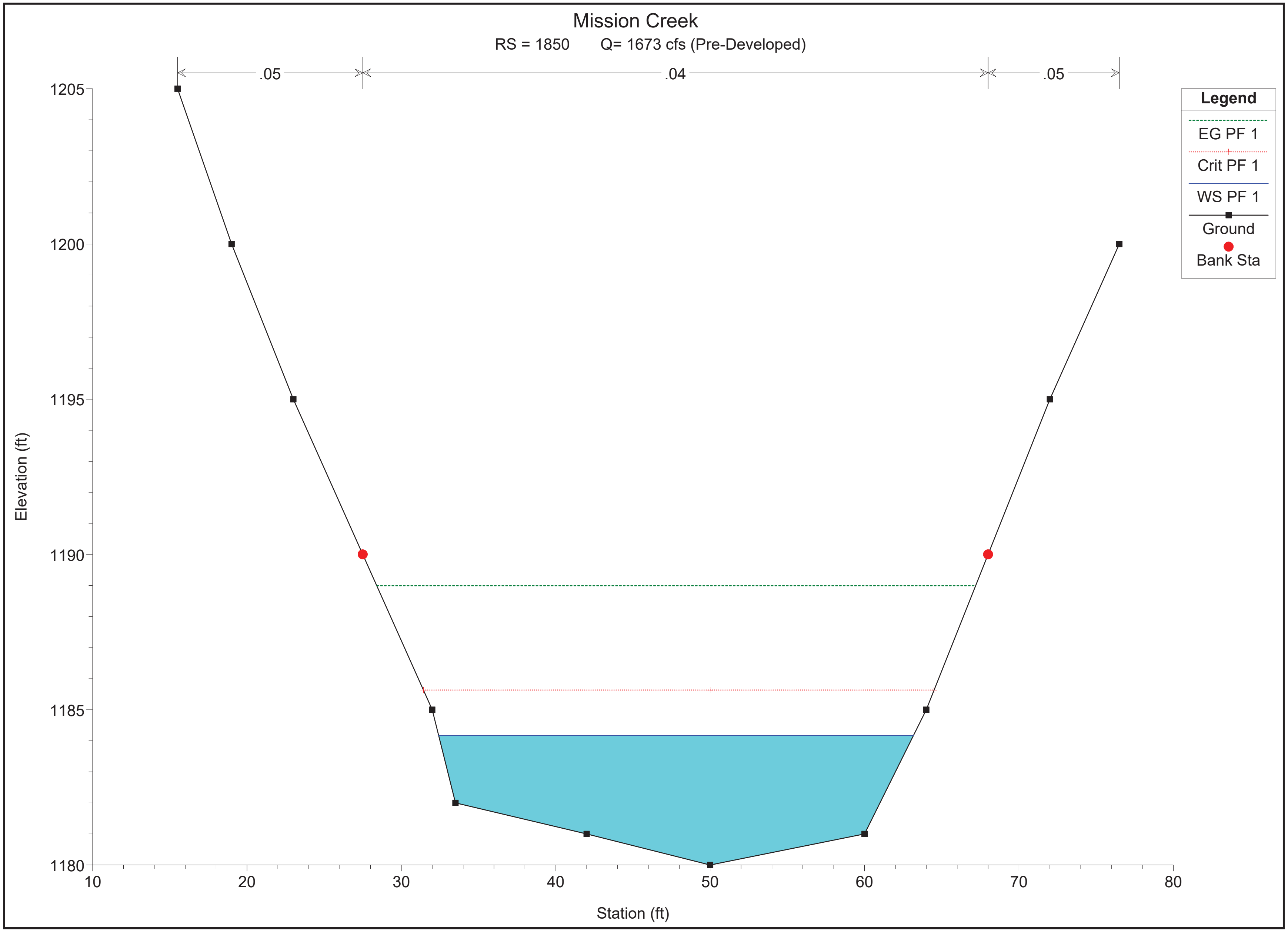

Mission Creek
RS = 1928 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1205
1200
1195
1190
1185
1180
20
30
40
50
60
70
80
Station (ft)



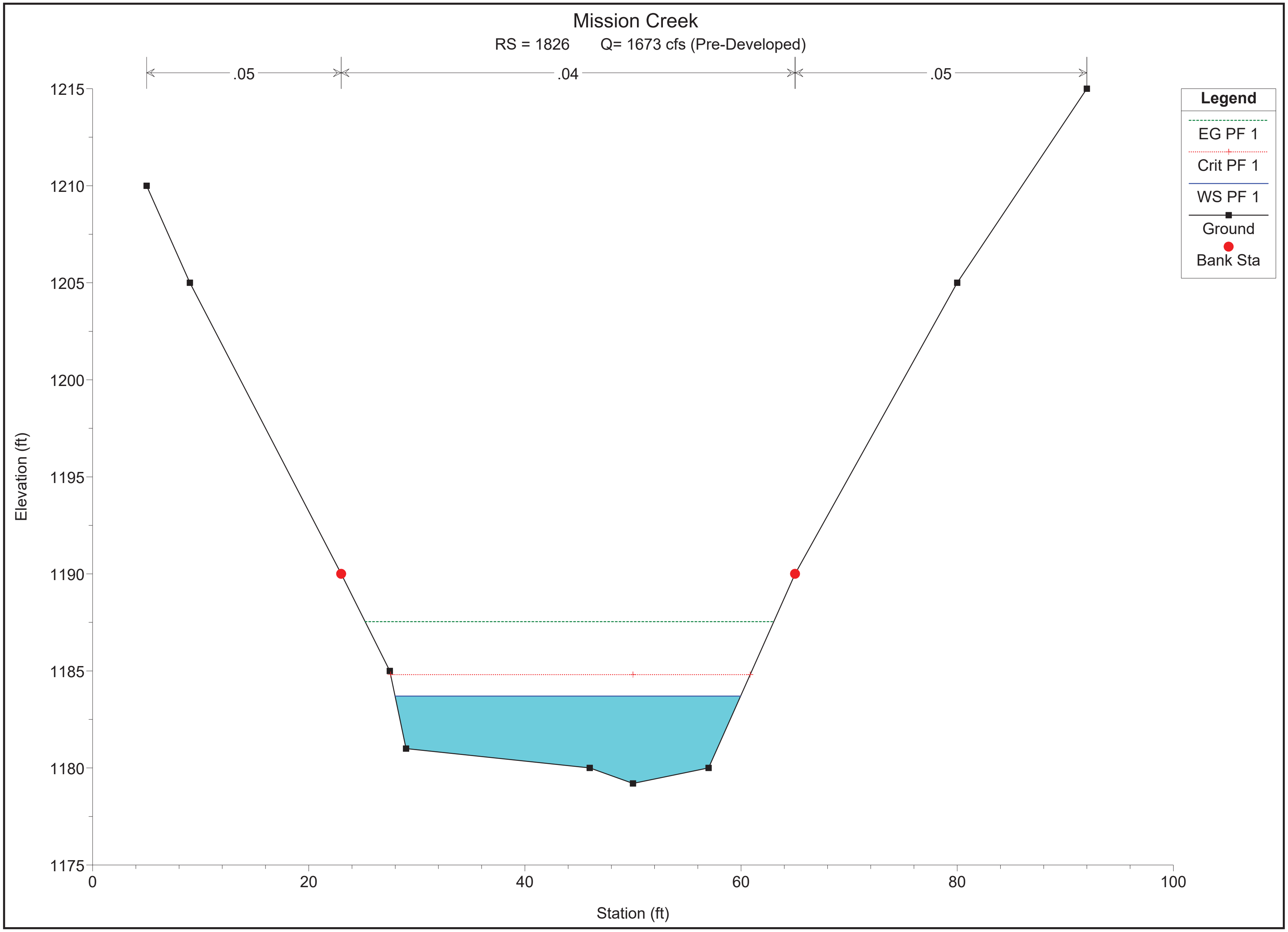
Mission Creek
RS = 1913 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1205
1200
1195
1190
1185
1180
10
20
30
40
50
60
70
80
90
Station (ft)



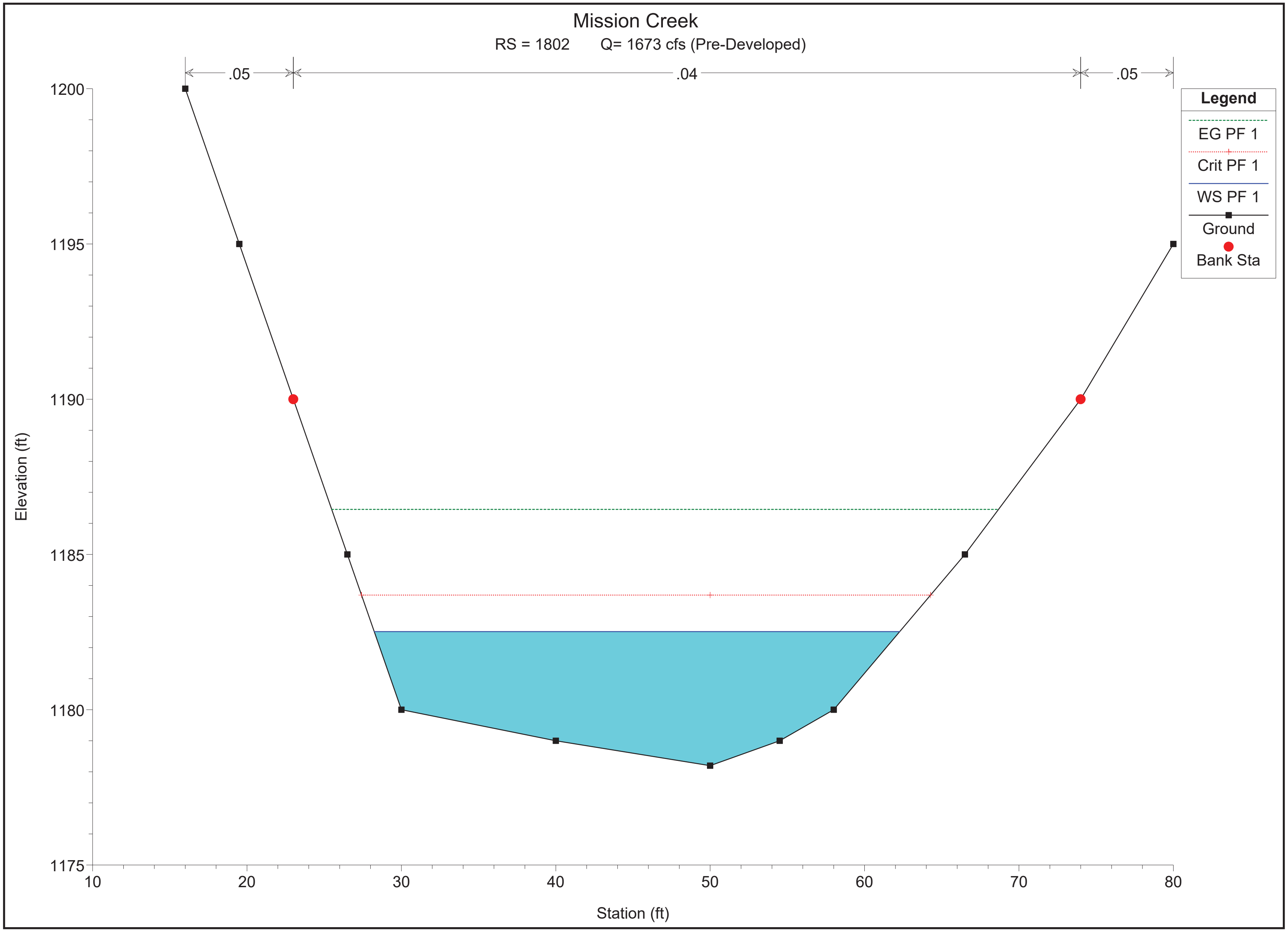
Mission Creek
RS = 1900 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
1180
1185
1190
1195
1200
1205
10
20
30
40
50
60
70

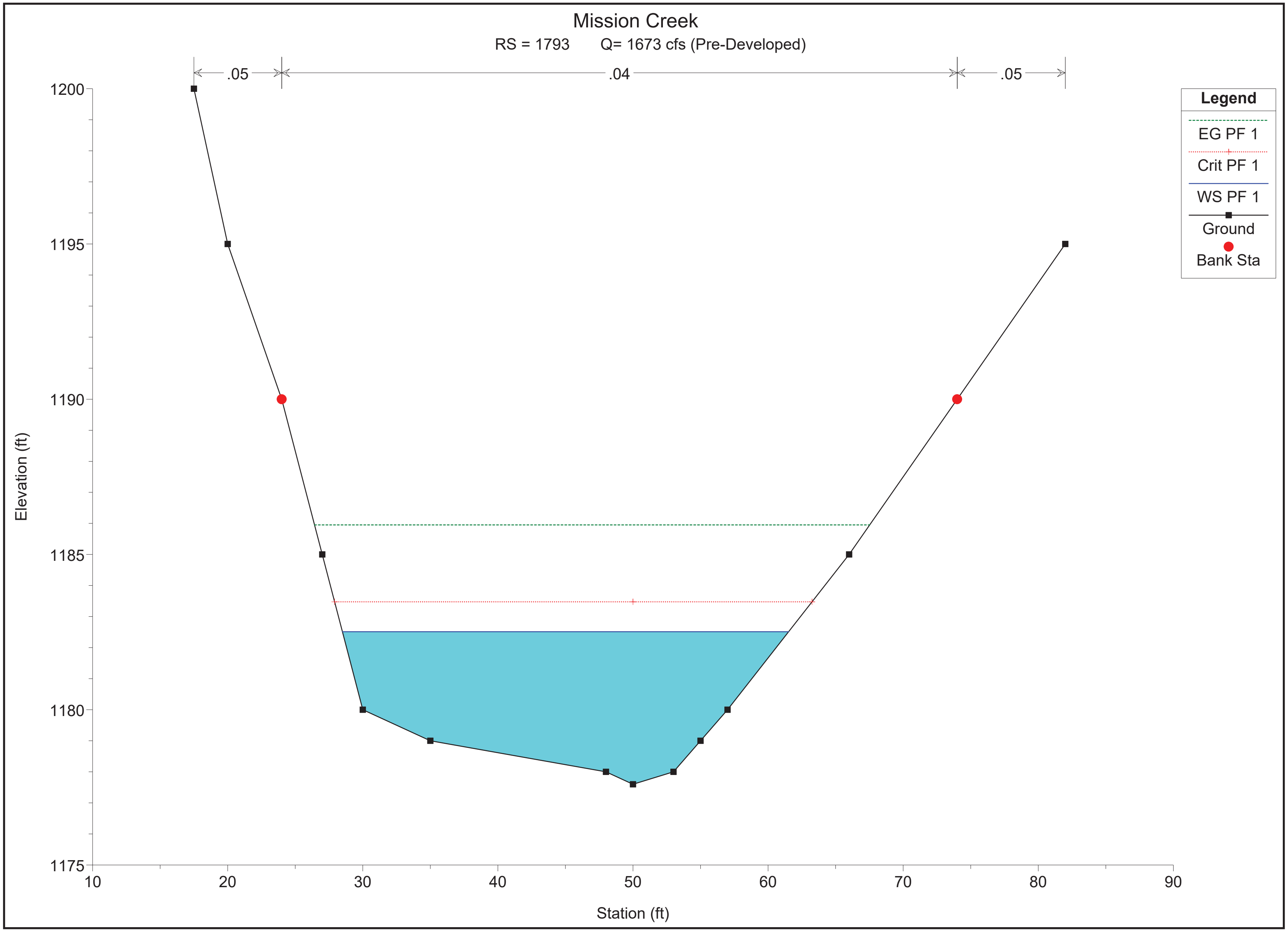


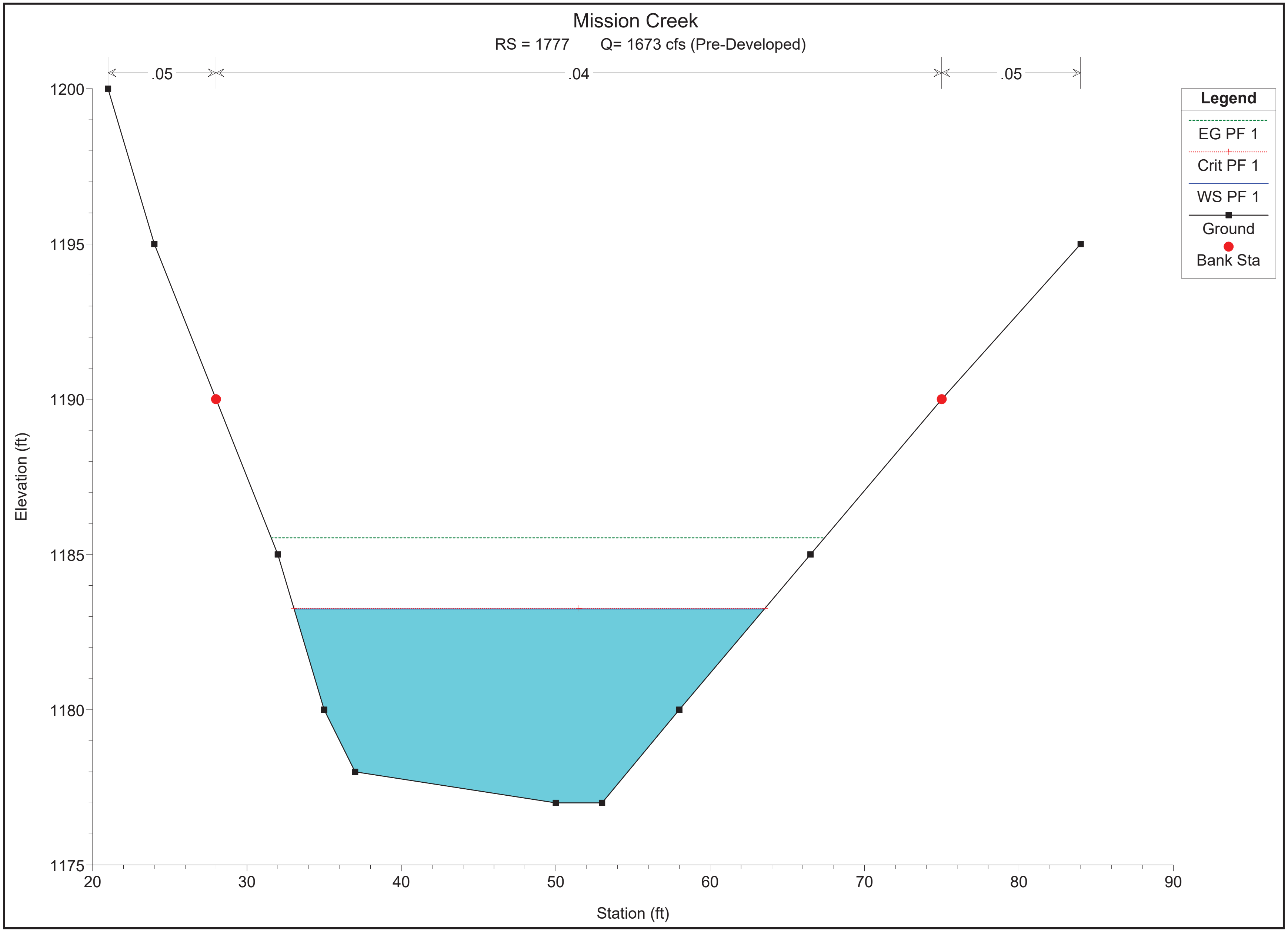
Mission Creek
RS = 1850 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
1205
1200
1195
1190
1185
1180
Elevation (ft)
10
20
30
40
50
60
70
80
Station (ft)



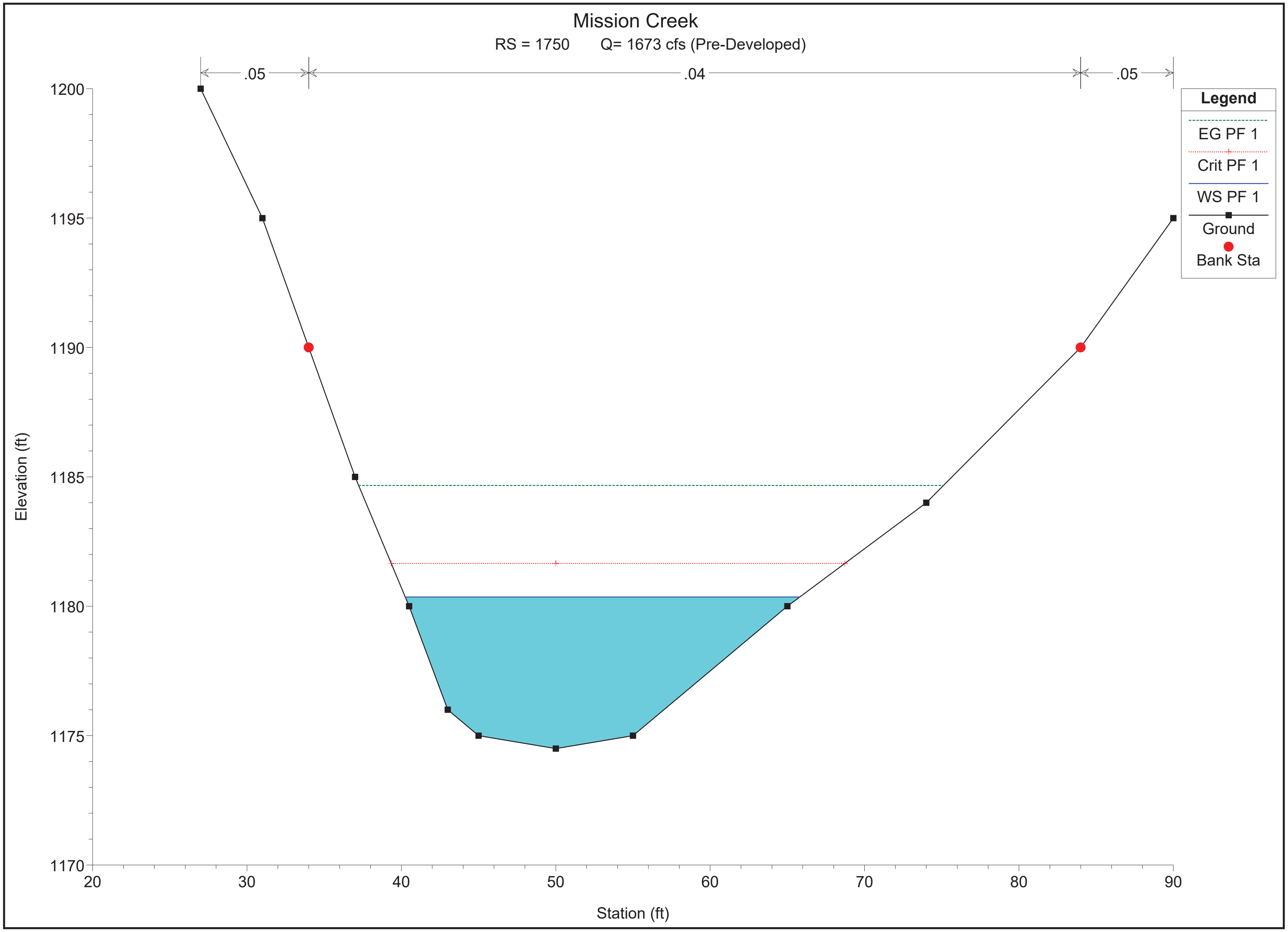
Mission Creek
RS = 1826 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1215
1210
1205
1200
1195
1190
1185
1180
1175
0
20
40
60
80
100
Station (ft)

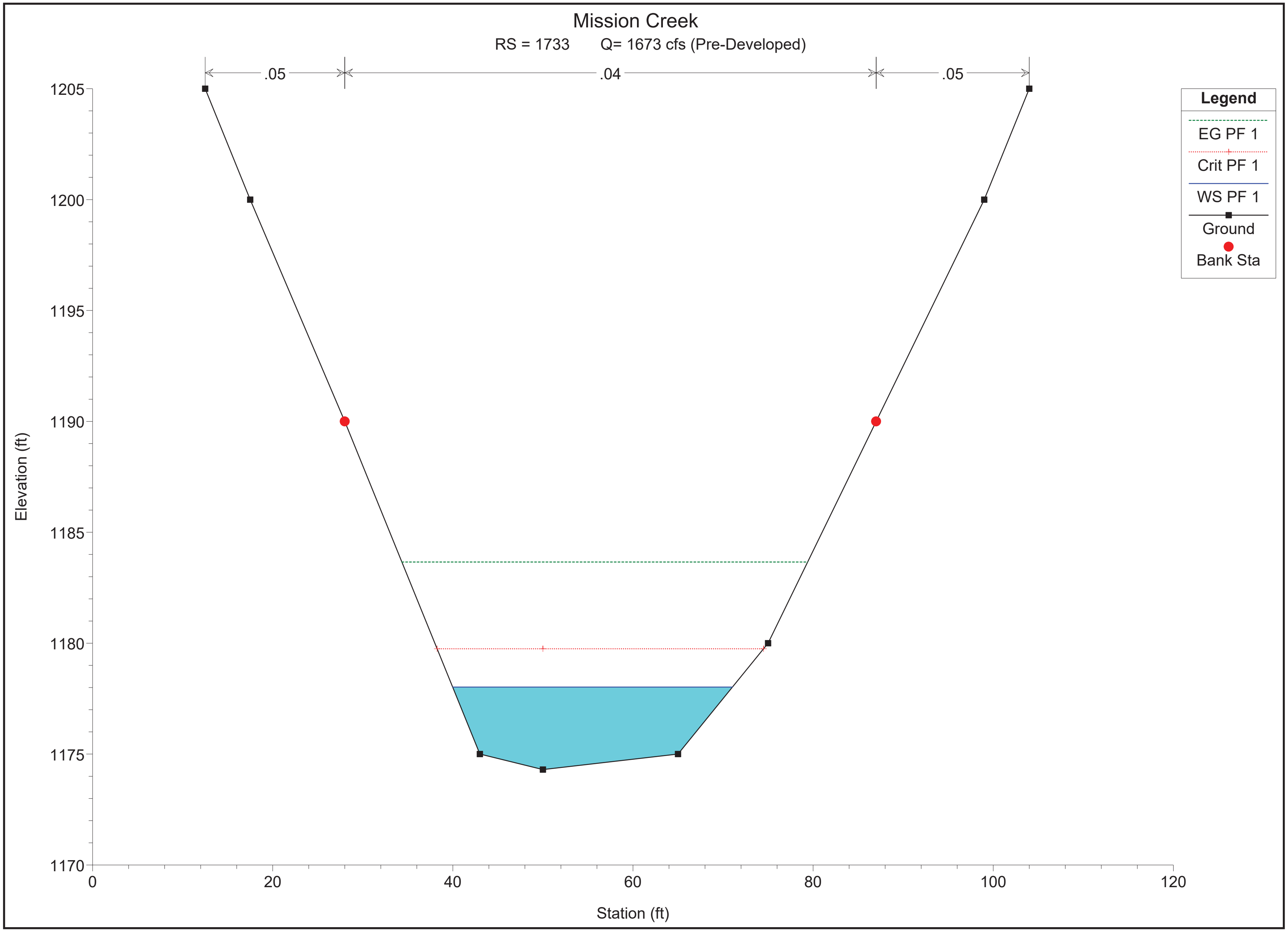

Mission Creek
RS = 1802 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1200
1195
1190
1185
1180
1175
10
20
30
40
50
60
70
80
Station (ft)


Mission Creek
RS = 1793 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1200
1195
1190
1185
1180
1175
Station (ft)
10
20
30
40
50
60
70
80
90

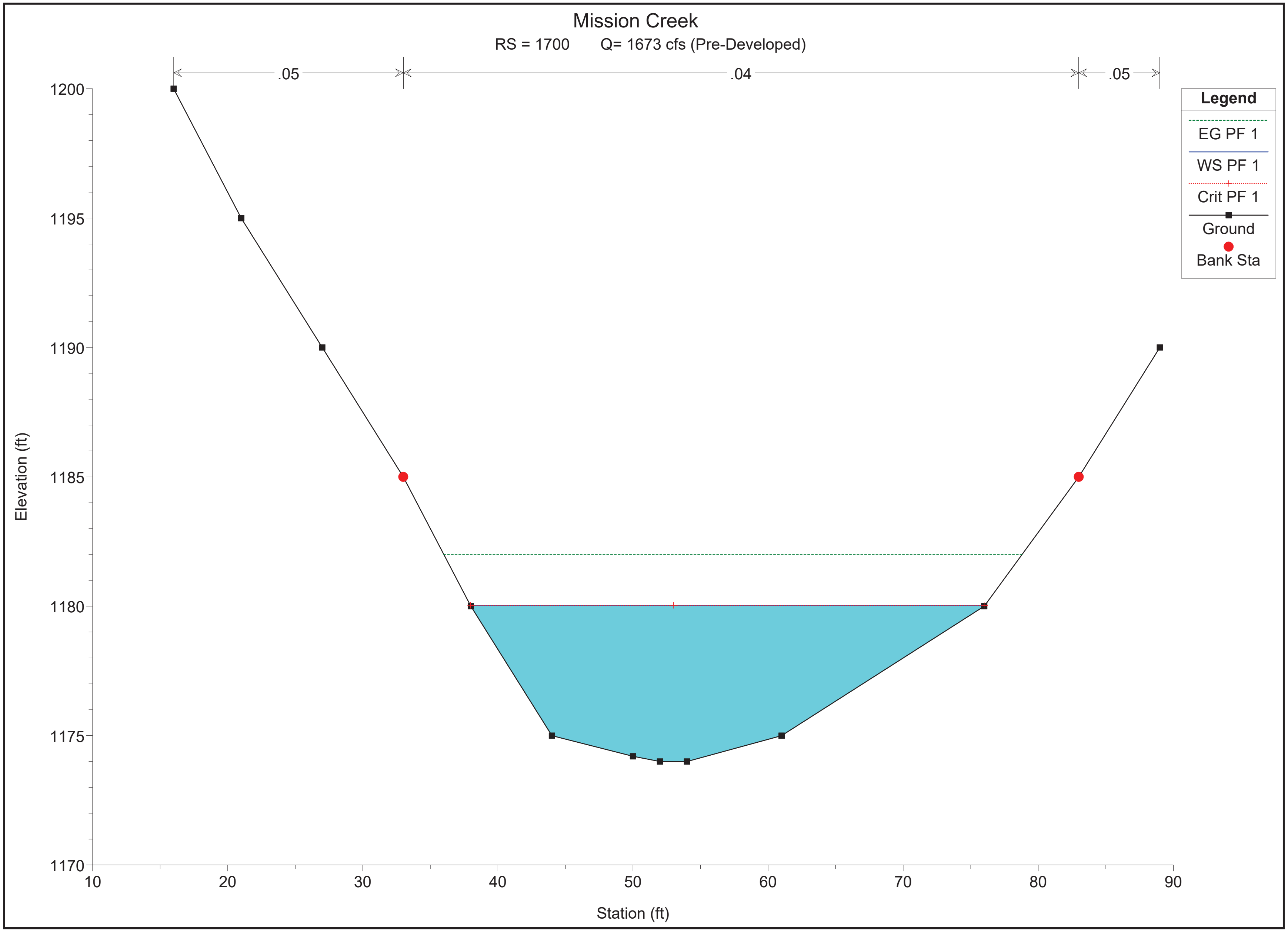


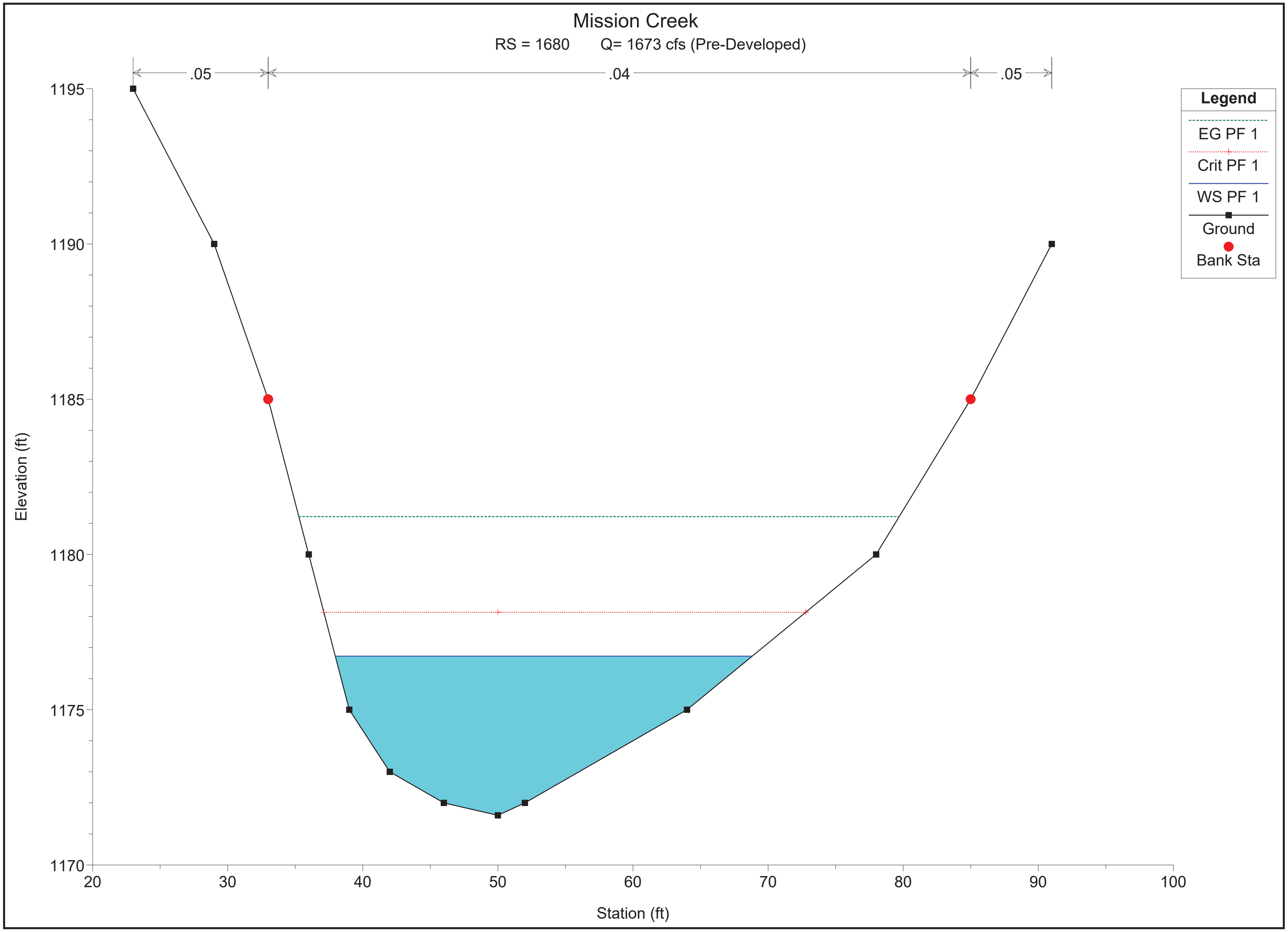
Mission Creek
RS = 1777 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1200
1195
1190
1185
1180
1175
Station (ft)
20
30
40
50
60
70
80
90


Mission Creek
RS = 1750 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1200
1195
1190
1185
1180
1175
1170
20
30
40
50
60
70
80
90
Station (ft)

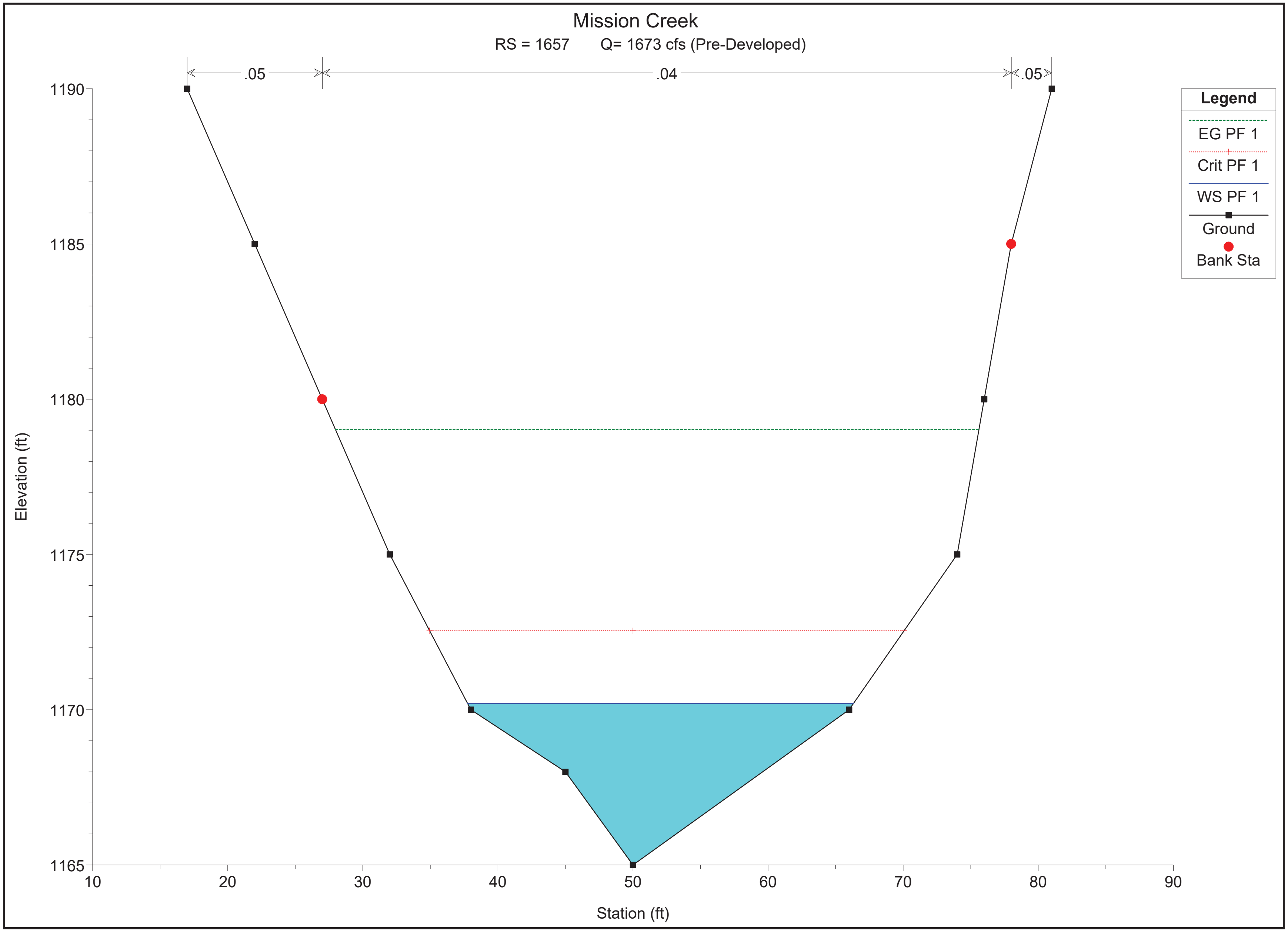


Mission Creek
RS = 1733 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1205
1200
1195
1190
1185
1180
1175
1170
0
20
40
60
80
100
120
Station (ft)

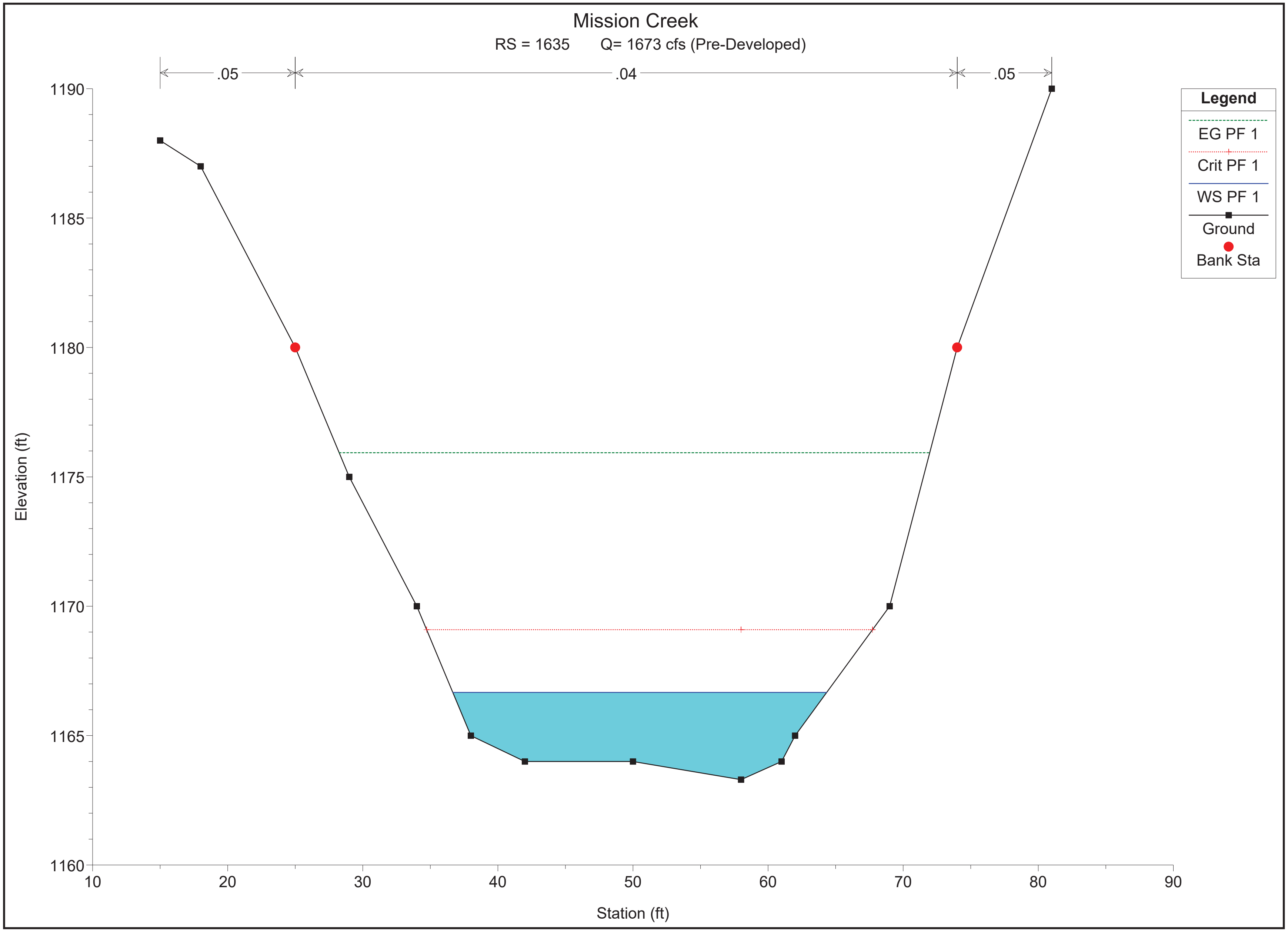

Mission Creek
RS = 1700 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
1200
1195
1190
1185
1180
1175
1170
10
20
30
40
50
60
70
80
90
Station (ft)



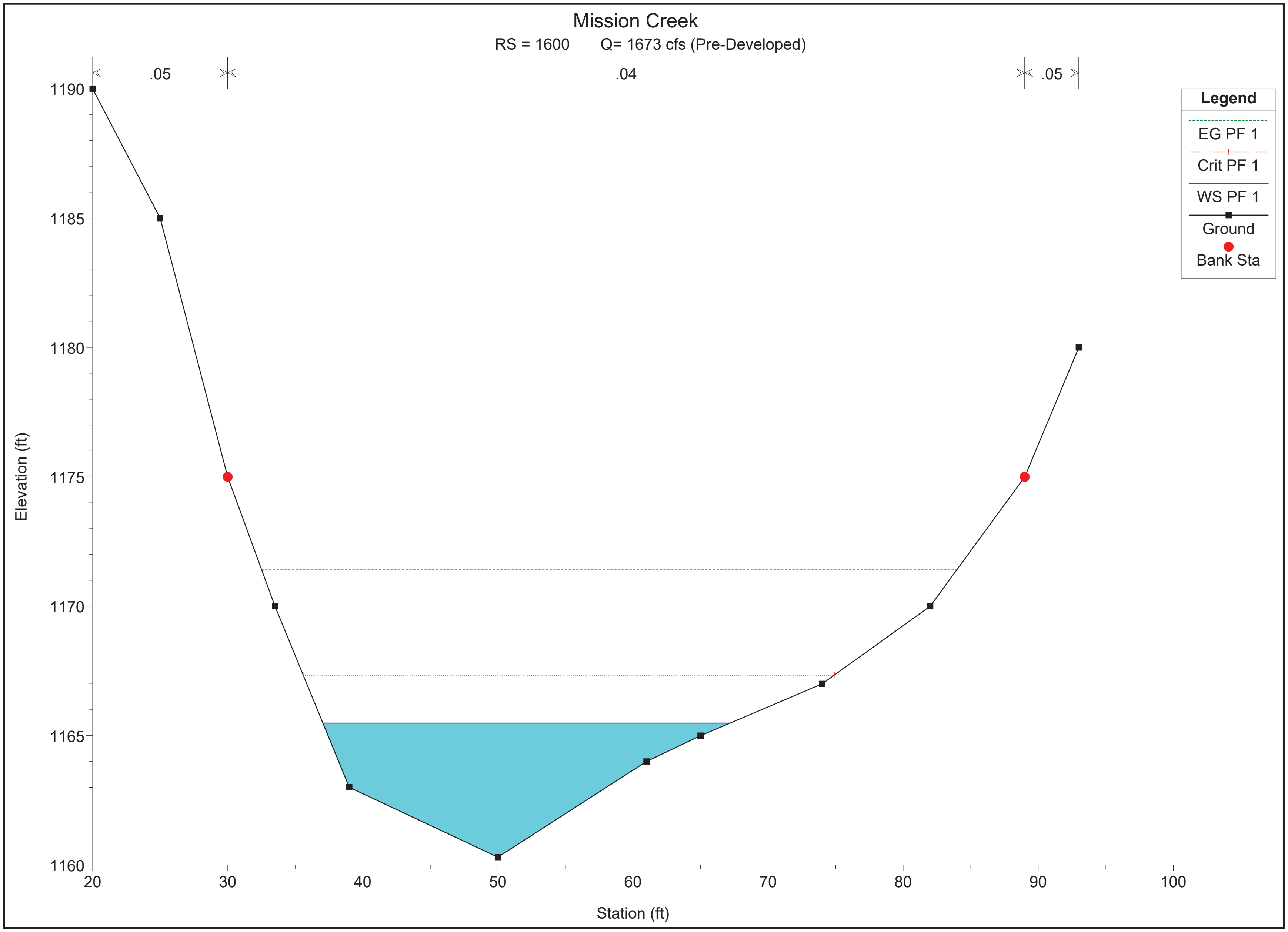
Mission Creek
RS = 1680 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1195
1190
1185
1180
1175
1170
20
30
40
50
60
70
80
90
100
Station (ft)



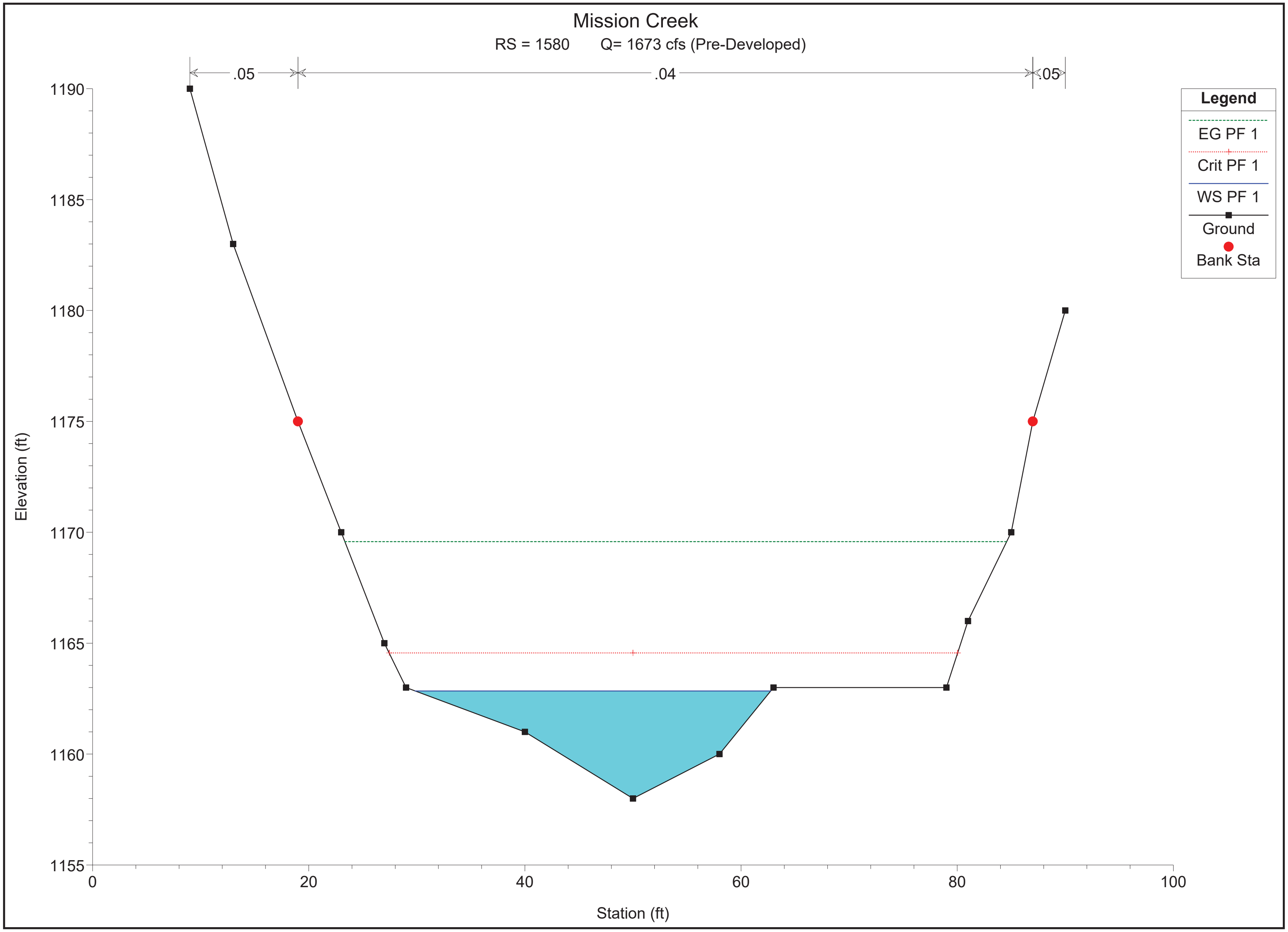
Mission Creek
RS = 1657 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1190
1185
1180
1175
1170
1165
10
20
30
40
50
60
70
80
90
Station (ft)



Mission Creek
RS = 1635 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1160
1165
1170
1175
1180
1185
1190
Station (ft)
10
20
30
40
50
60
70
80
90



Mission Creek
RS = 1600 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1190
1185
1180
1175
1170
1165
1160
20
30
40
50
60
70
80
90
100
Station (ft)

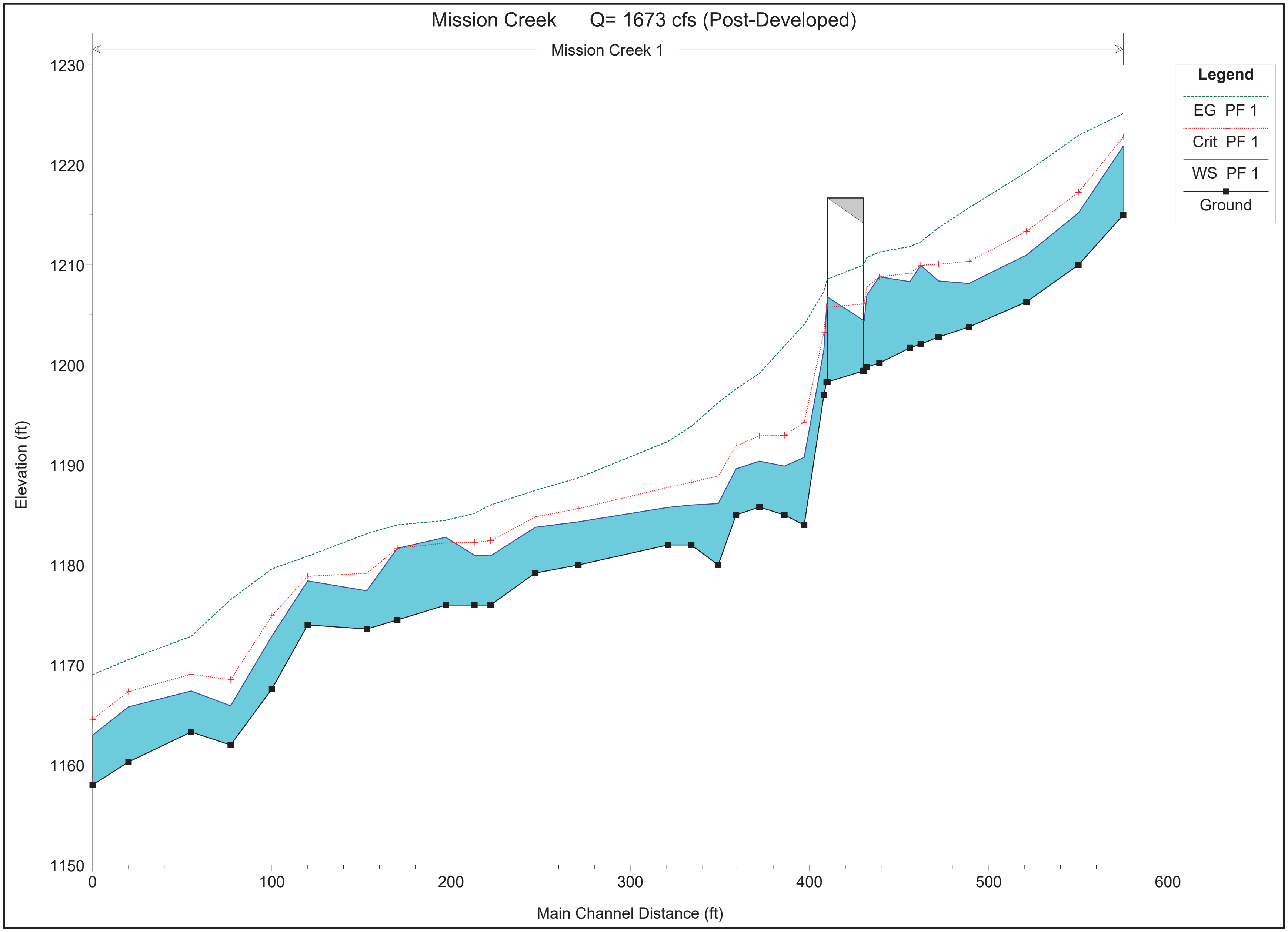

Mission Creek
RS = 1580 Q= 1673 cfs (Pre-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1190
1185
1180
1175
1170
1165
1160
1155
0
20
40
60
80
100
Station (ft)

APPENDIX C

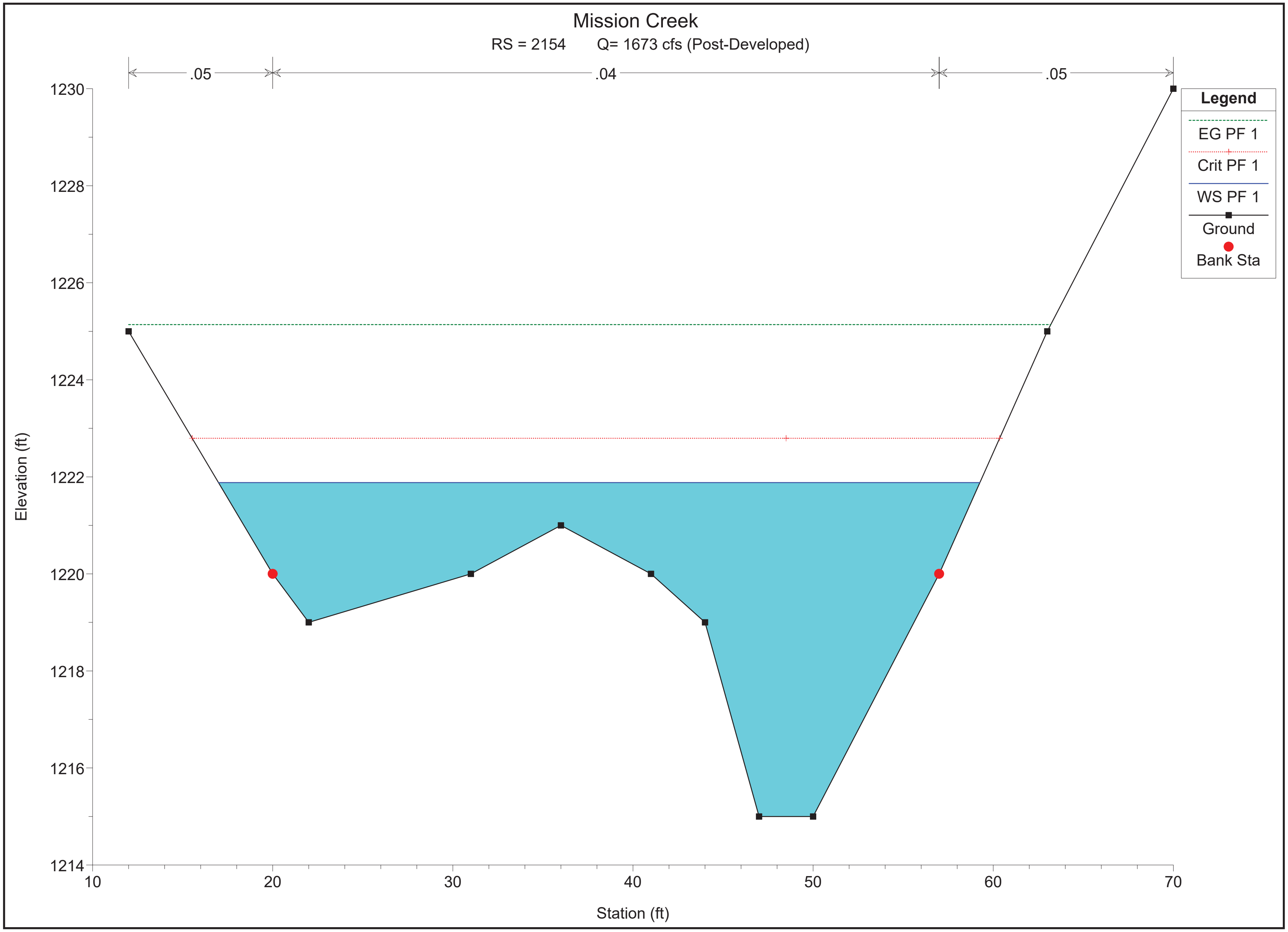
HEC-RAS Plan: Plan 12 River: Mission Creek Reach: 1 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	2154	PF 1	1673.00	1215.00	1221.88	1222.79	1225.14	0.040059	14.57	118.11	42.27	1.47
1	2129	PF 1	1673.00	1210.00	1215.20	1217.26	1222.96	0.147340	22.34	74.90	34.64	2.68
1	2100	PF 1	1673.00	1206.30	1210.98	1213.37	1219.27	0.107595	23.10	72.43	24.74	2.38
1	2068	PF 1	1673.00	1203.80	1208.16	1210.36	1215.73	0.101080	22.07	75.81	27.73	2.35
1	2051	PF 1	1673.00	1202.80	1208.40	1210.07	1213.72	0.062502	18.51	90.40	29.90	1.88
1	2041	PF 1	1673.00	1202.10	1209.97	1209.97	1212.32	0.017106	12.29	136.10	29.23	1.00
1	2035	PF 1	1673.00	1201.70	1208.33	1209.17	1211.84	0.028393	15.03	111.31	25.75	1.27
1	2018	PF 1	1673.00	1200.20	1208.81	1208.81	1211.29	0.017528	12.63	132.42	26.58	1.00
1	2011	PF 1	1673.00	1199.80	1207.00	1207.81	1210.75	0.029752	15.53	107.70	22.35	1.25
1	2009.5	PF 1	1673.00	1199.40	1204.41	1206.11	1210.10	0.058036	19.14	87.43	24.01	1.77
1	2000		Bridge									
1	1988.5	PF 1	1673.00	1198.30	1205.77	1205.77	1208.35	0.016341	12.89	129.79	27.29	1.00
1	1987	PF 1	1673.00	1197.00	1201.51	1203.28	1207.34	0.061567	19.36	86.41	24.86	1.83
1	1976	PF 1	1673.00	1184.00	1190.76	1194.28	1204.06	0.161310	29.25	57.19	15.72	2.70
1	1965	PF 1	1673.00	1185.00	1189.89	1192.96	1201.91	0.160010	27.81	60.16	20.16	2.84
1	1951	PF 1	1673.00	1185.80	1190.38	1192.91	1199.16	0.102881	23.77	70.39	21.65	2.32
1	1938	PF 1	1673.00	1185.00	1189.62	1191.92	1197.60	0.102243	22.66	73.82	25.33	2.34
1	1928	PF 1	1673.00	1180.00	1186.14	1188.89	1196.25	0.128168	25.50	65.60	20.98	2.54
1	1913	PF 1	1673.00	1182.00	1186.00	1188.27	1193.86	0.101974	22.48	74.41	26.81	2.38
1	1900	PF 1	1673.00	1182.00	1185.77	1187.77	1192.35	0.074427	20.58	81.30	24.07	1.97
1	1850	PF 1	1673.00	1180.00	1184.32	1185.63	1188.71	0.048949	16.83	99.43	30.97	1.66
1	1826	PF 1	1673.00	1179.20	1183.77	1184.81	1187.46	0.039360	15.40	108.61	32.06	1.48
1	1802	PF 1	1673.00	1176.00	1180.92	1182.43	1186.00	0.075213	18.08	92.56	37.01	2.01
1	1793	PF 1	1673.00	1176.00	1180.97	1182.25	1185.17	0.053945	16.44	101.77	36.53	1.74
1	1777	PF 1	1673.00	1176.00	1182.78	1182.21	1184.45	0.011849	10.39	161.05	34.48	0.85
1	1750	PF 1	1673.00	1174.50	1181.67	1181.67	1184.00	0.017234	12.24	136.64	29.44	1.00
1	1733	PF 1	1673.00	1173.60	1177.42	1179.18	1183.13	0.073320	19.18	87.25	31.26	2.02
1	1700	PF 1	1673.00	1174.00	1178.42	1178.87	1180.88	0.024065	12.58	133.01	38.92	1.20
1	1680	PF 1	1673.00	1167.60	1172.89	1174.93	1179.61	0.088470	20.80	80.42	28.27	2.17
1	1657	PF 1	1673.00	1162.00	1165.92	1168.53	1176.54	0.160977	26.15	63.99	26.06	2.94
1	1635	PF 1	1673.00	1163.30	1167.40	1169.08	1172.86	0.064566	18.76	89.19	29.27	1.89
1	1600	PF 1	1673.00	1160.30	1165.81	1167.34	1170.54	0.056174	17.45	95.89	31.86	1.77
1	1580	PF 1	1673.00	1158.00	1162.98	1164.56	1169.02	0.088323	19.72	84.85	33.86	2.20

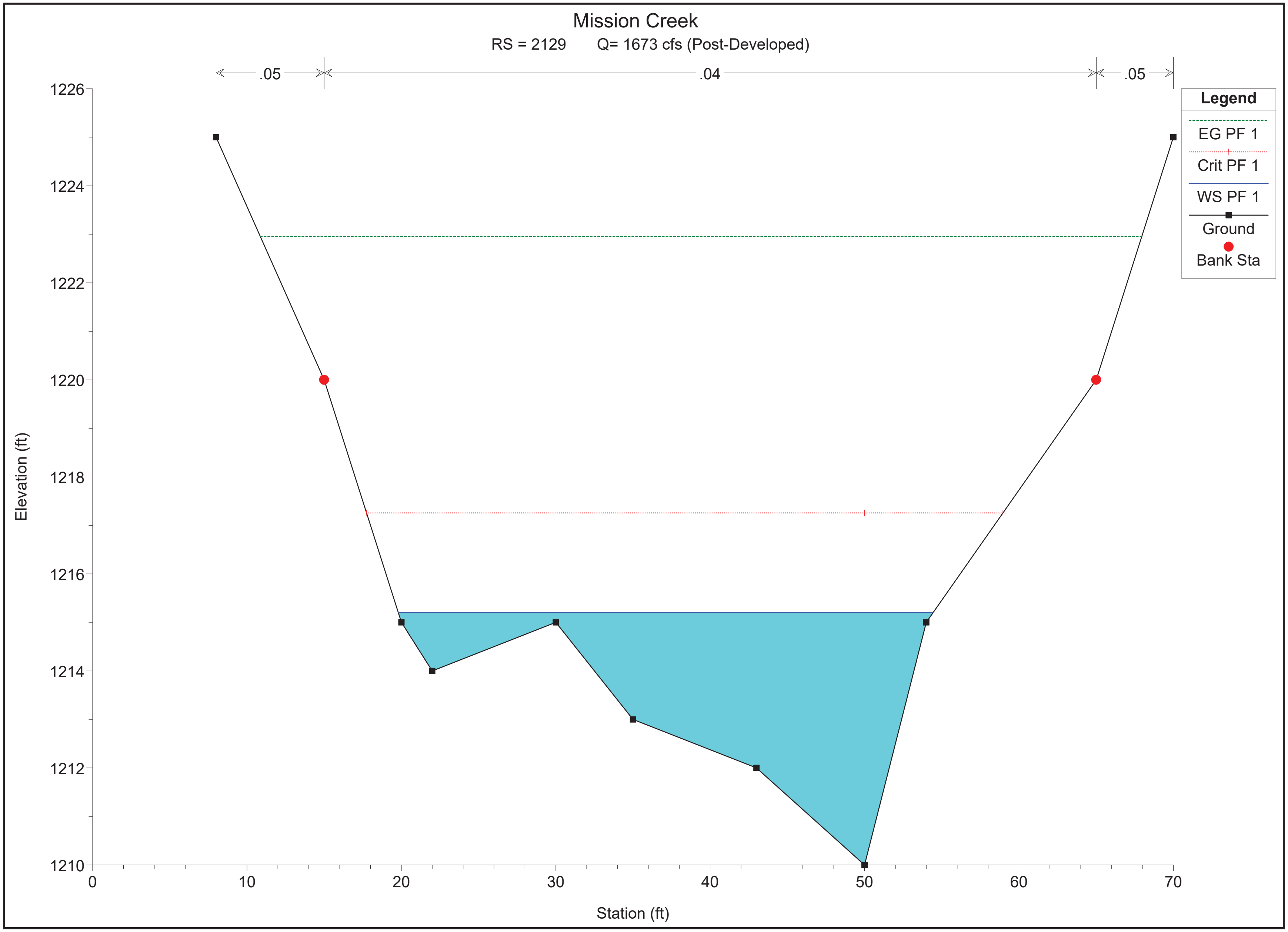
POST-DEVELOPED

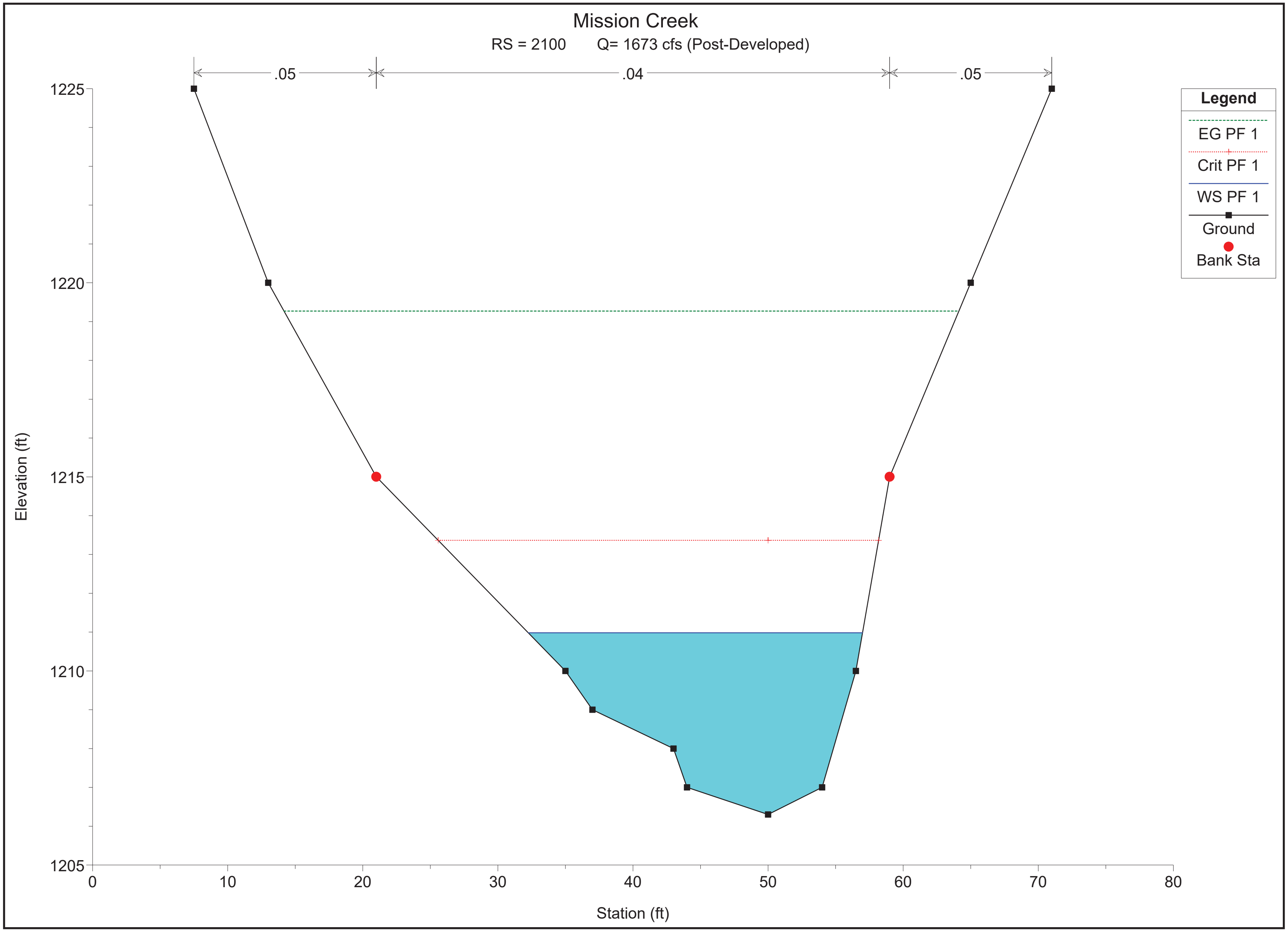


Mission Creek Q= 1673 cfs (Post-Developed)
Mission Creek 1
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Elevation (ft)
1150
1160
1170
1180
1190
1200
1210
1220
1230
Main Channel Distance (ft)
0
100
200
300
400
500
600

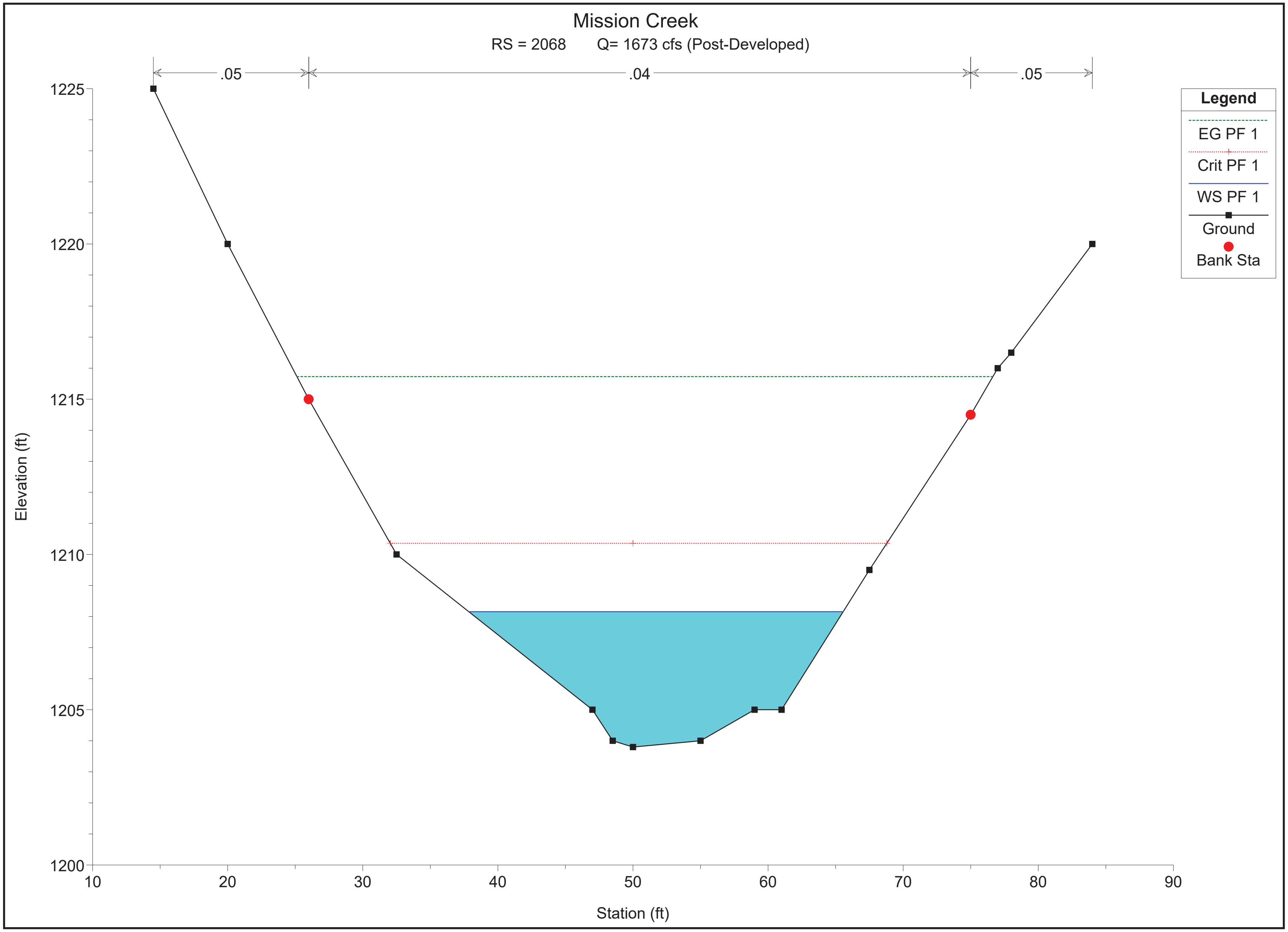


Mission Creek
RS = 2154 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1230
1228
1226
1224
1222
1220
1218
1216
1214
10
20
30
40
50
60
70
Station (ft)

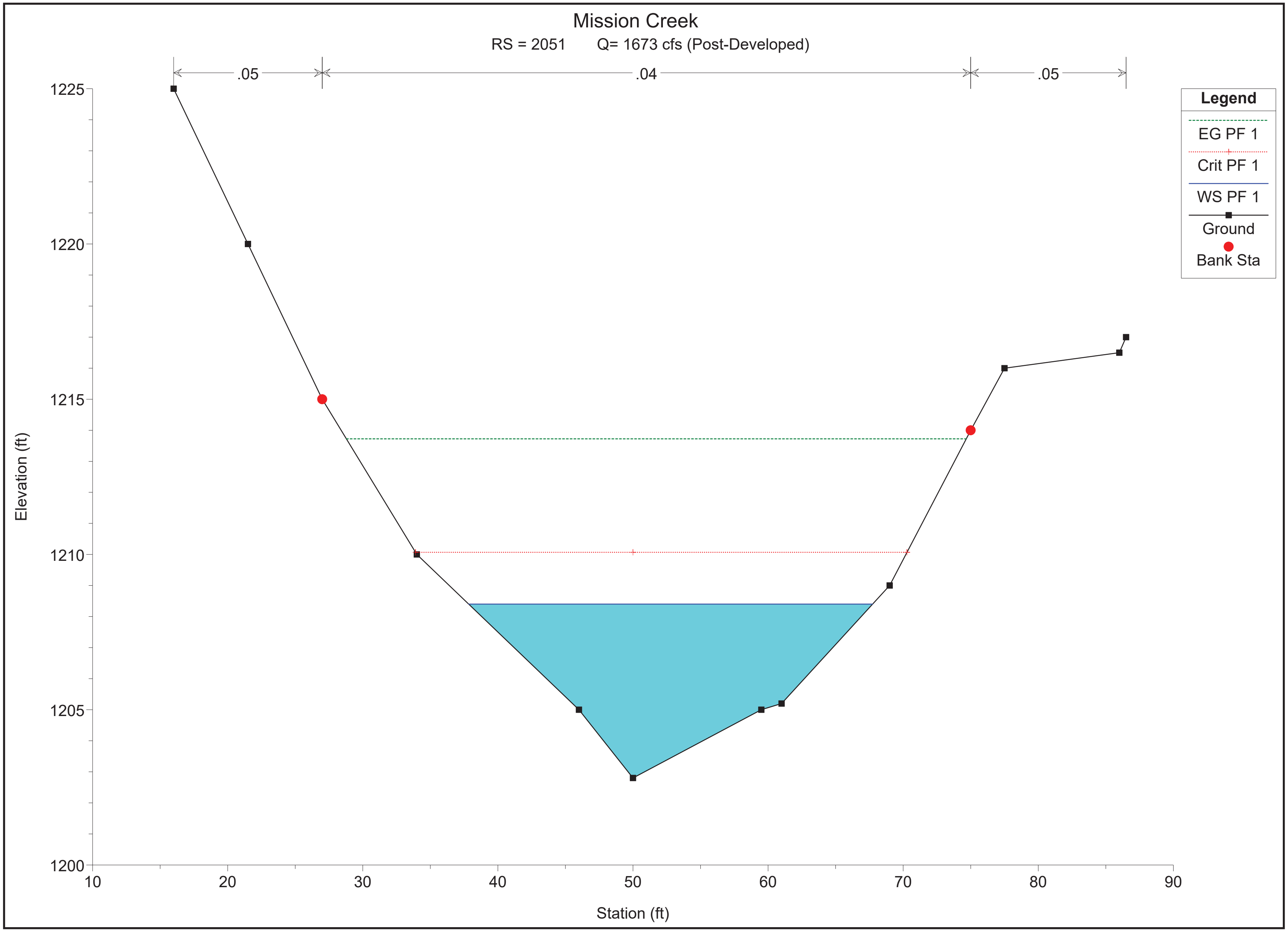

Mission Creek
RS = 2129 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1226
1224
1222
1220
1218
1216
1214
1212
1210
0
10
20
30
40
50
60
70
Station (ft)

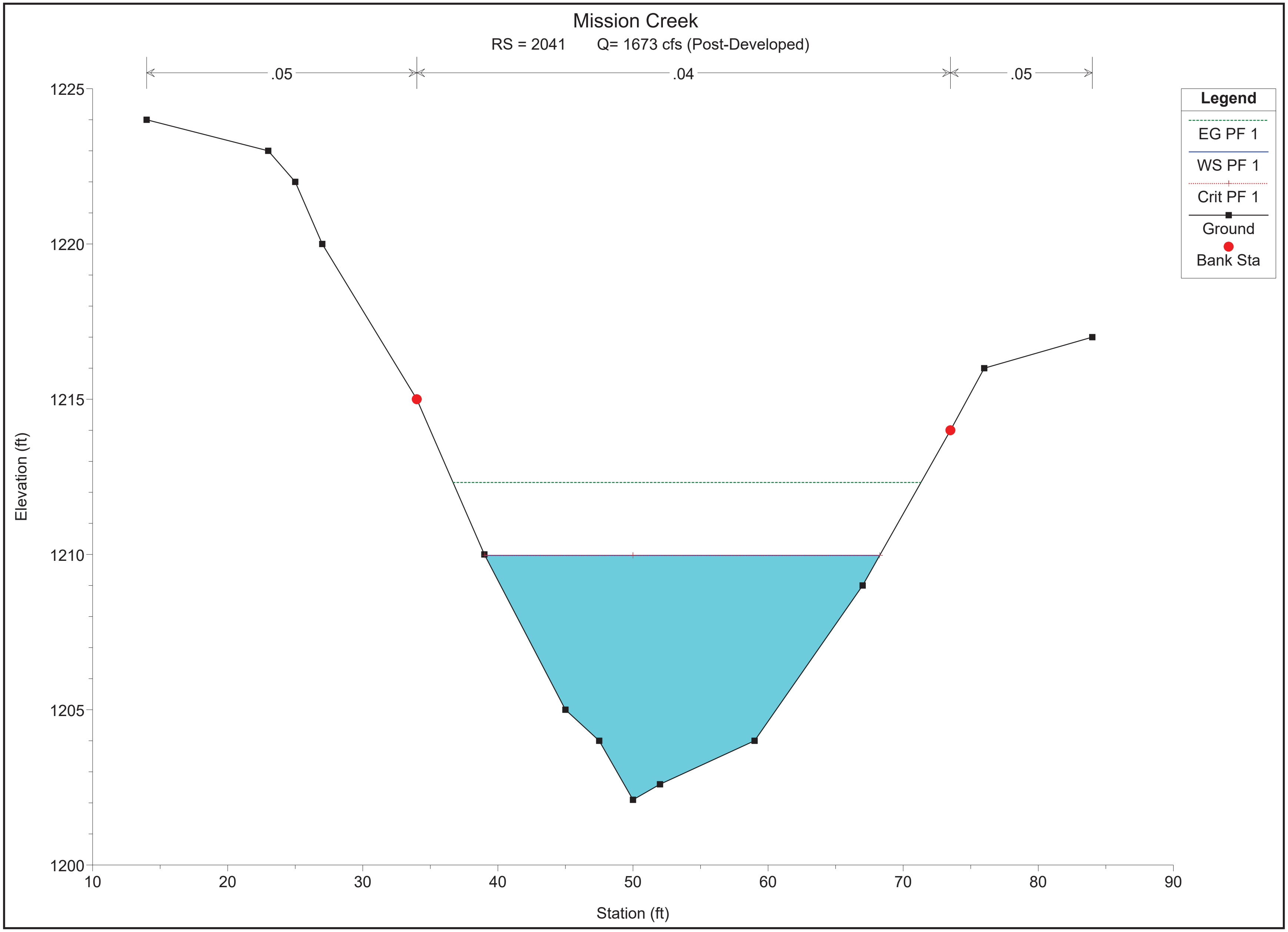


Mission Creek
RS = 2100 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
1225
1220
1215
1210
1205
Elevation (ft)
0
10
20
30
40
50
60
70
80
Station (ft)

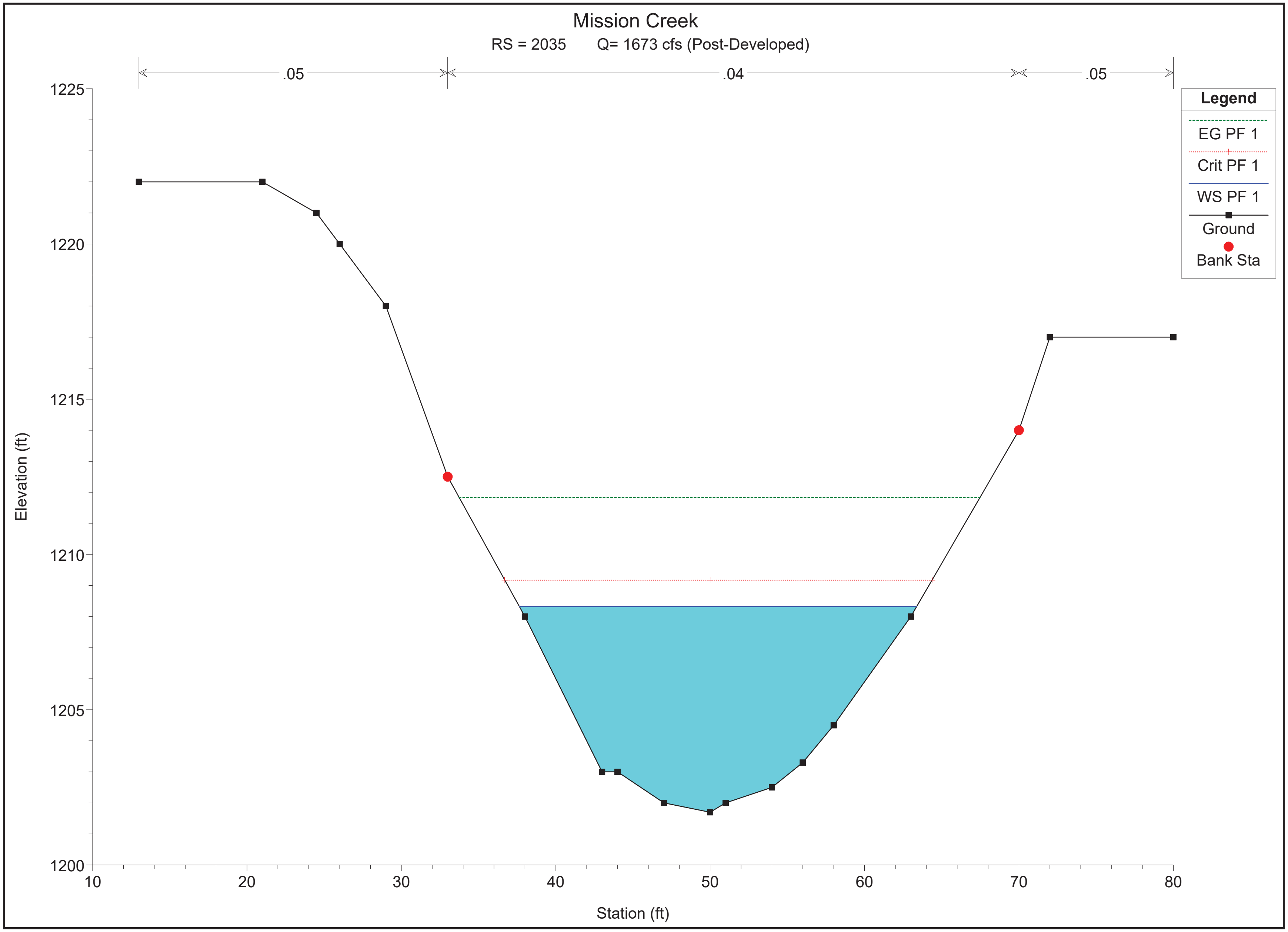


Mission Creek
RS = 2068 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1225
1220
1215
1210
1205
1200
10
20
30
40
50
60
70
80
90
Station (ft)

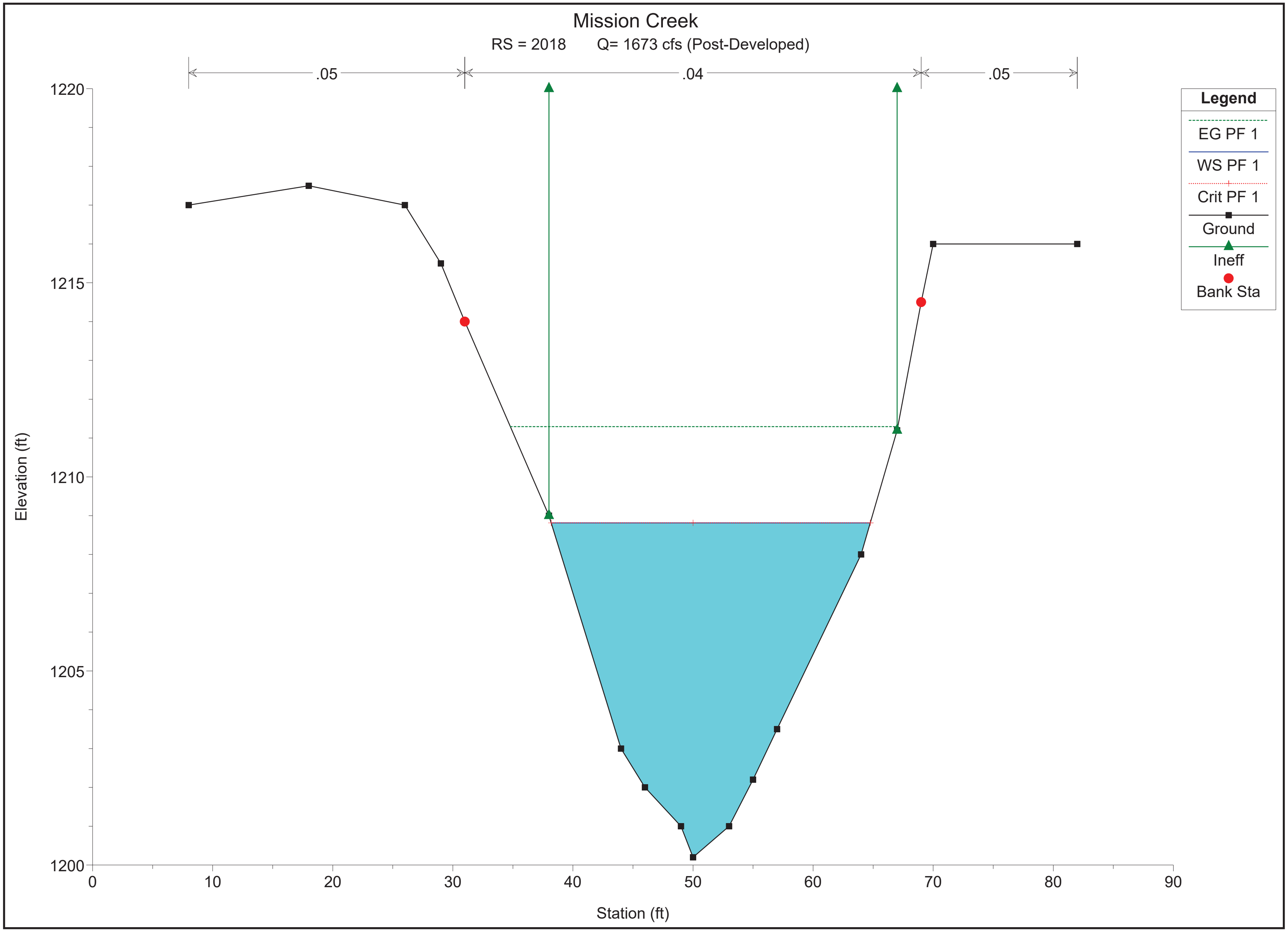

Mission Creek
RS = 2051 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1225
1220
1215
1210
1205
1200
10
20
30
40
50
60
70
80
90
Station (ft)

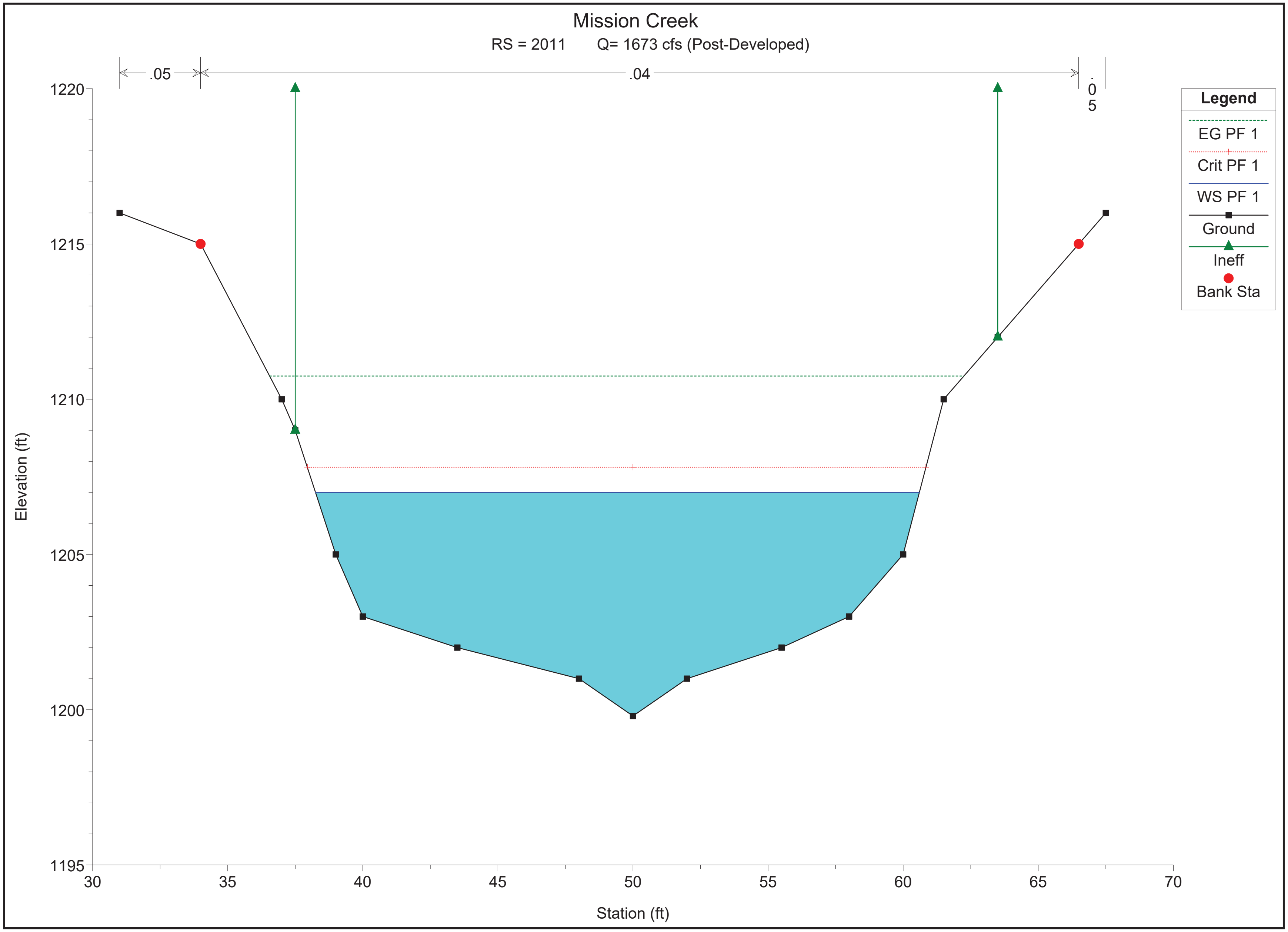


Mission Creek
RS = 2041 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
1225
1220
1215
1210
1205
1200
Station (ft)
10
20
30
40
50
60
70
80
90

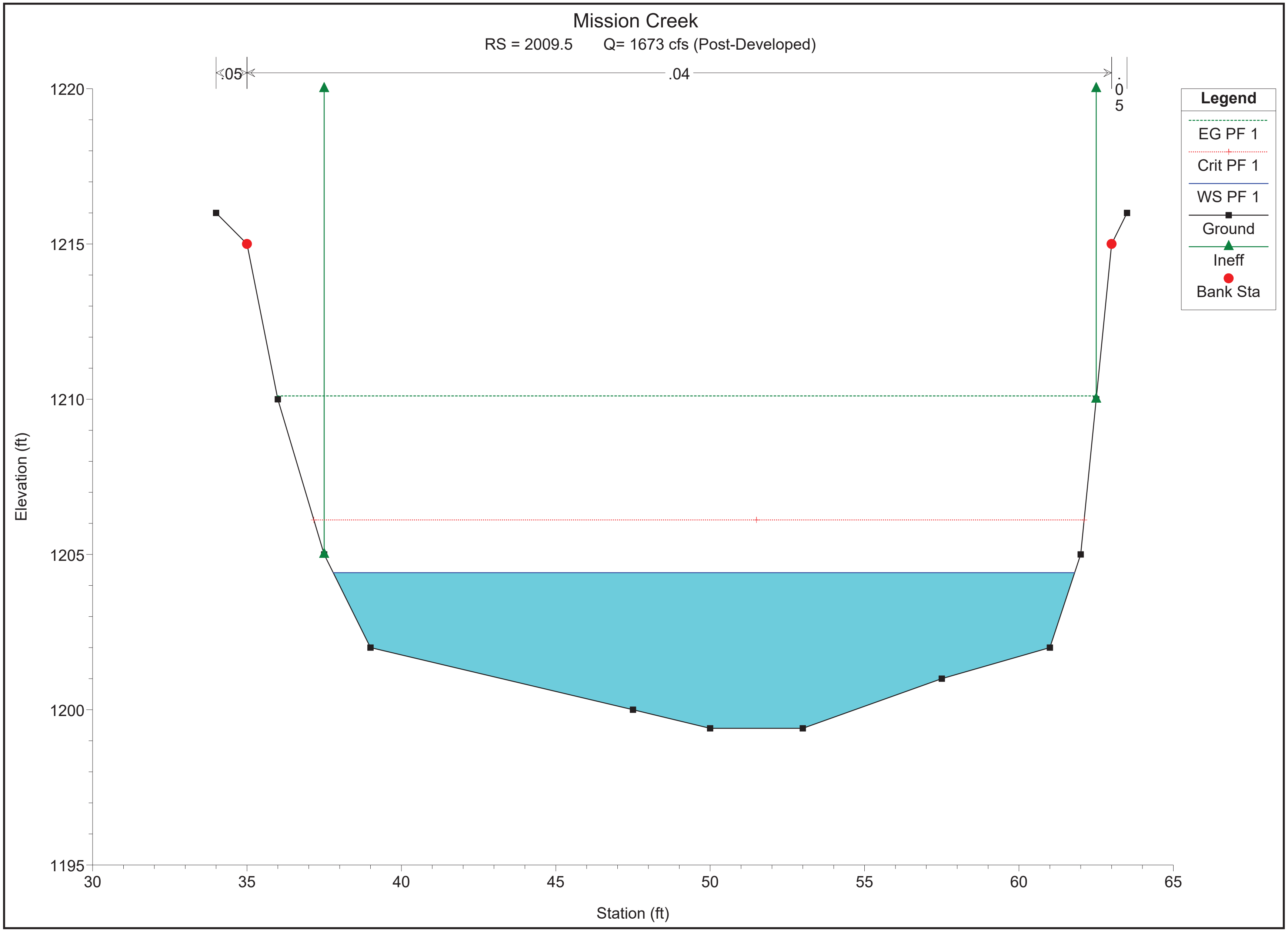


Mission Creek
RS = 2035 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1225
1220
1215
1210
1205
1200
10
20
30
40
50
60
70
80
Station (ft)

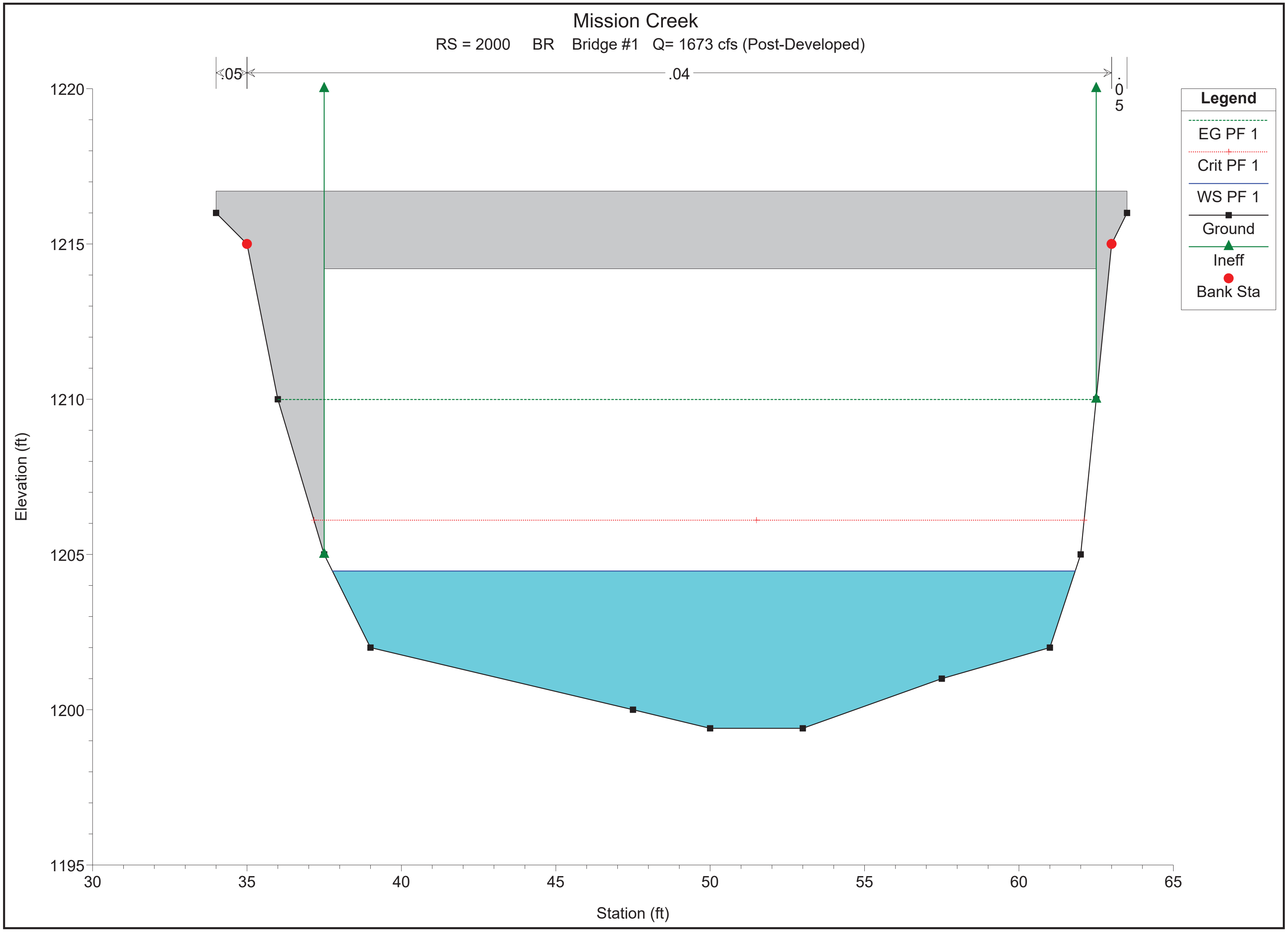

Mission Creek
RS = 2018 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
1220
1215
1210
1205
1200
Station (ft)
0
10
20
30
40
50
60
70
80
90



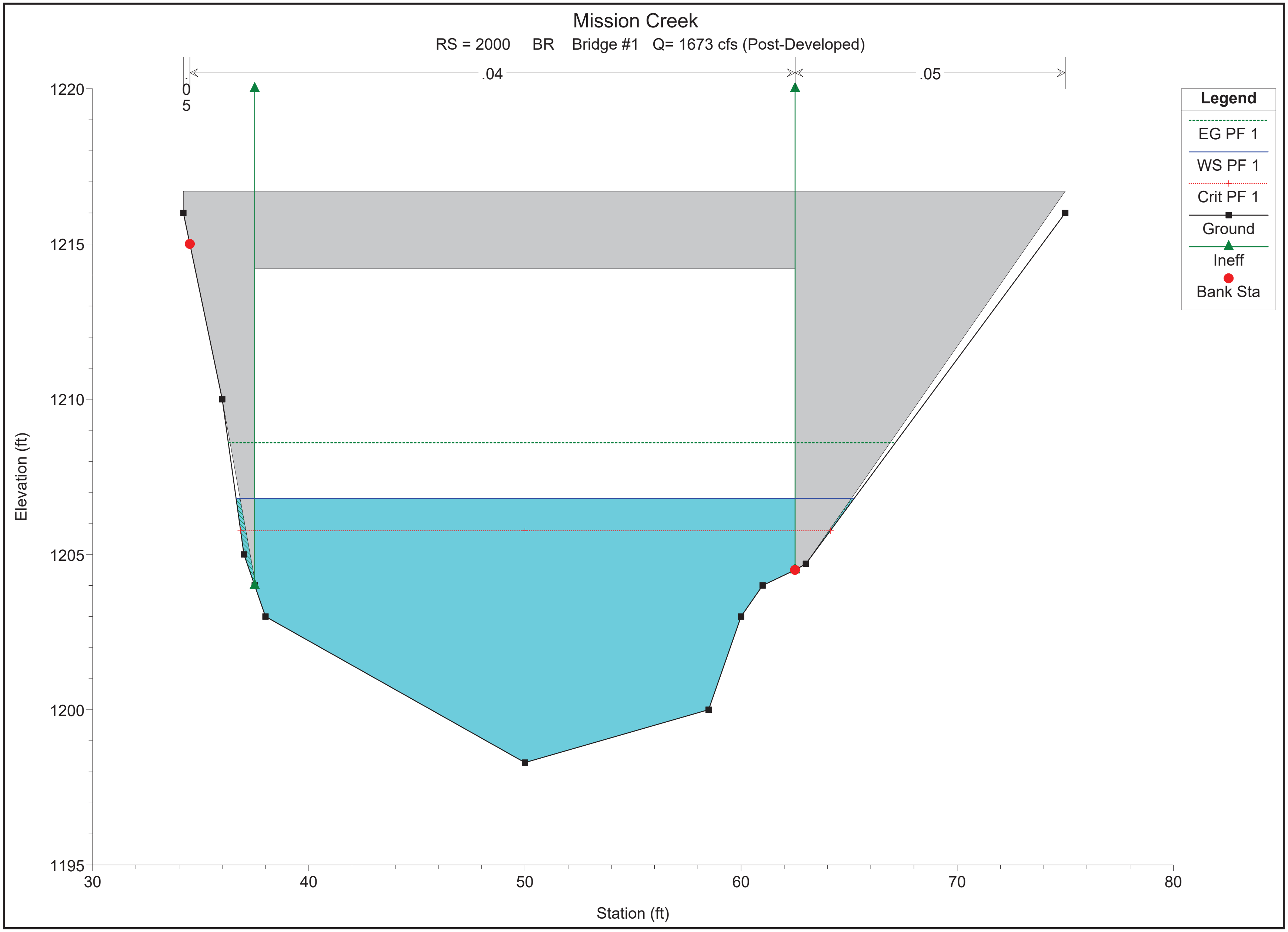
Mission Creek
RS = 2011 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
1220
1215
1210
1205
1200
1195
30
35
40
45
50
55
60
65
70
Station (ft)



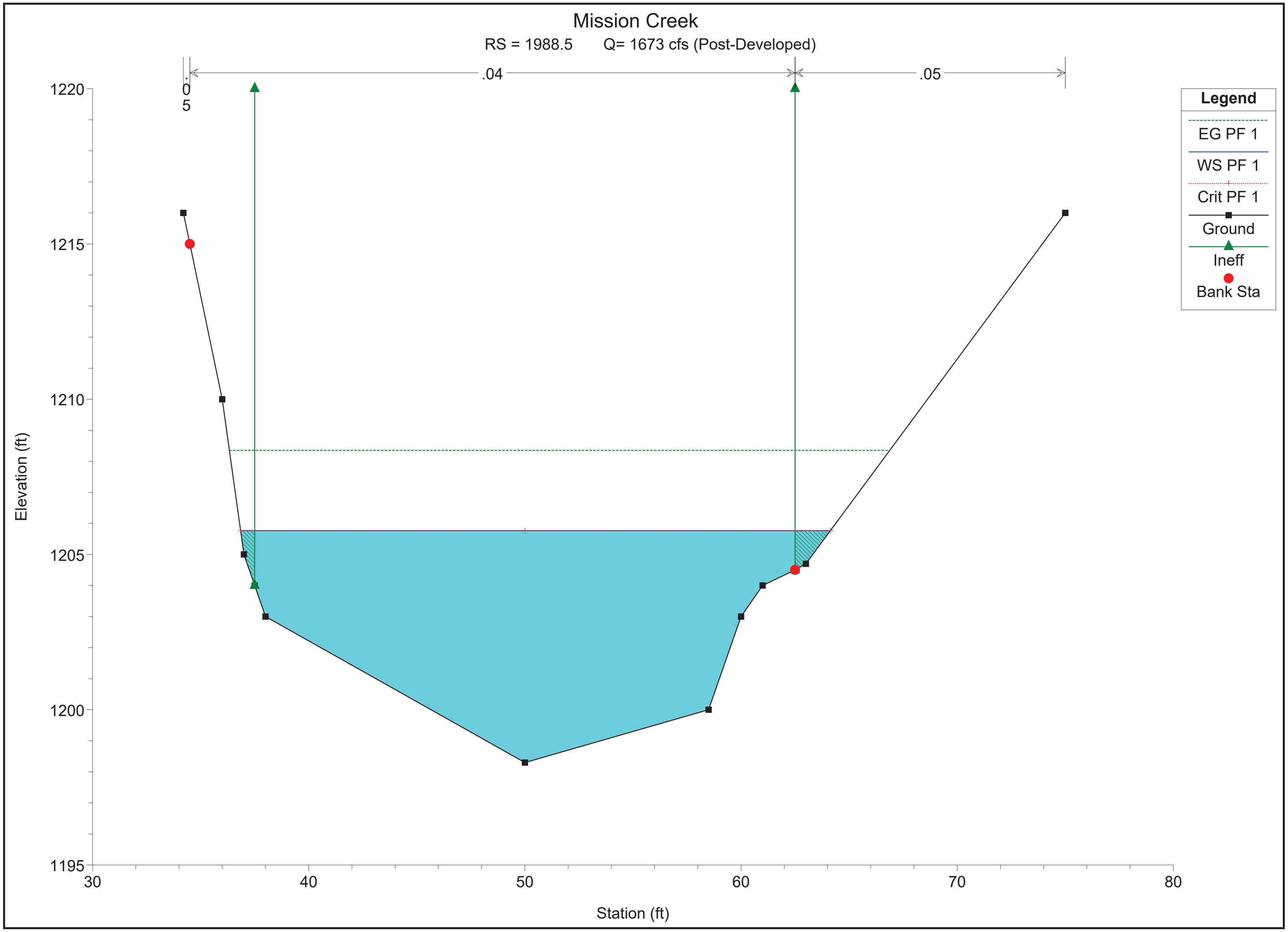
Mission Creek
RS = 2009.5 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
1220
1215
1210
1205
1200
1195
Station (ft)
30
35
40
45
50
55
60
65



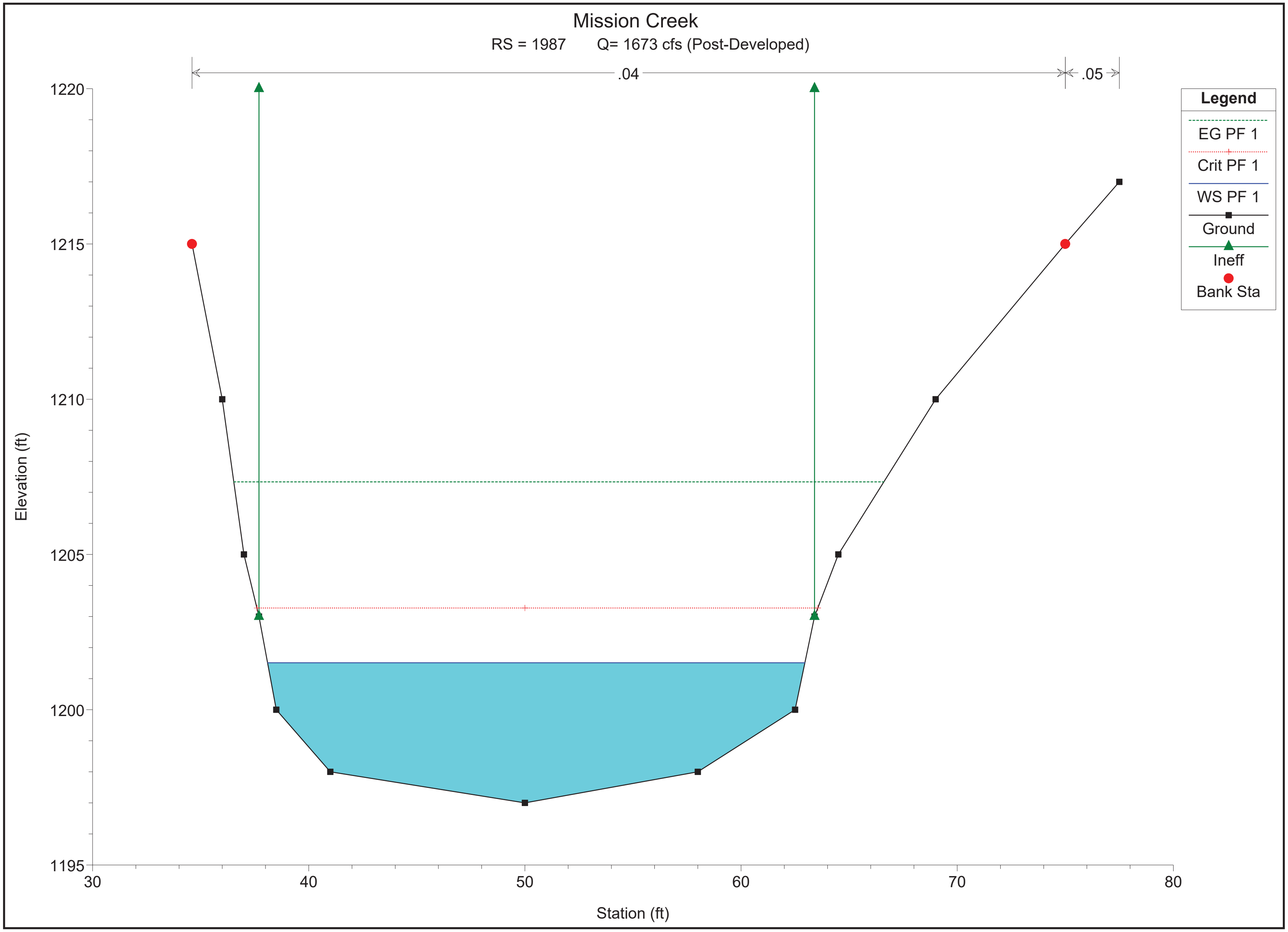
Mission Creek
RS = 2000 BR Bridge #1 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
1220
1215
1210
1205
1200
1195
30
35
40
45
50
55
60
65



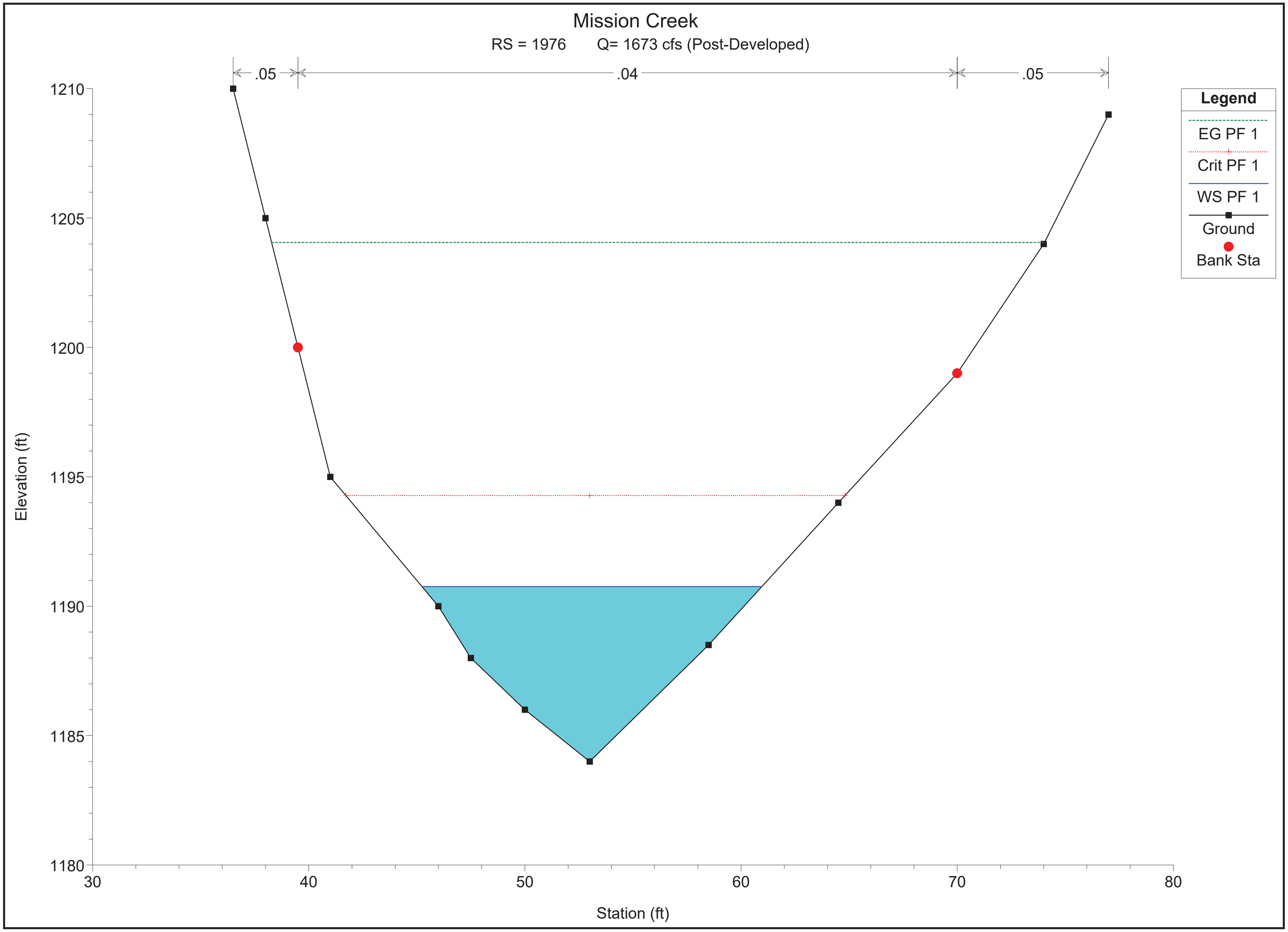
Mission Creek
RS = 2000 BR Bridge #1 Q= 1673 cfs (Post-Developed)
.04
.05
0
5
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Ineff
Bank Sta
1220
1215
1210
1205
1200
1195
Elevation (ft)
30
40
50
60
70
80
Station (ft)

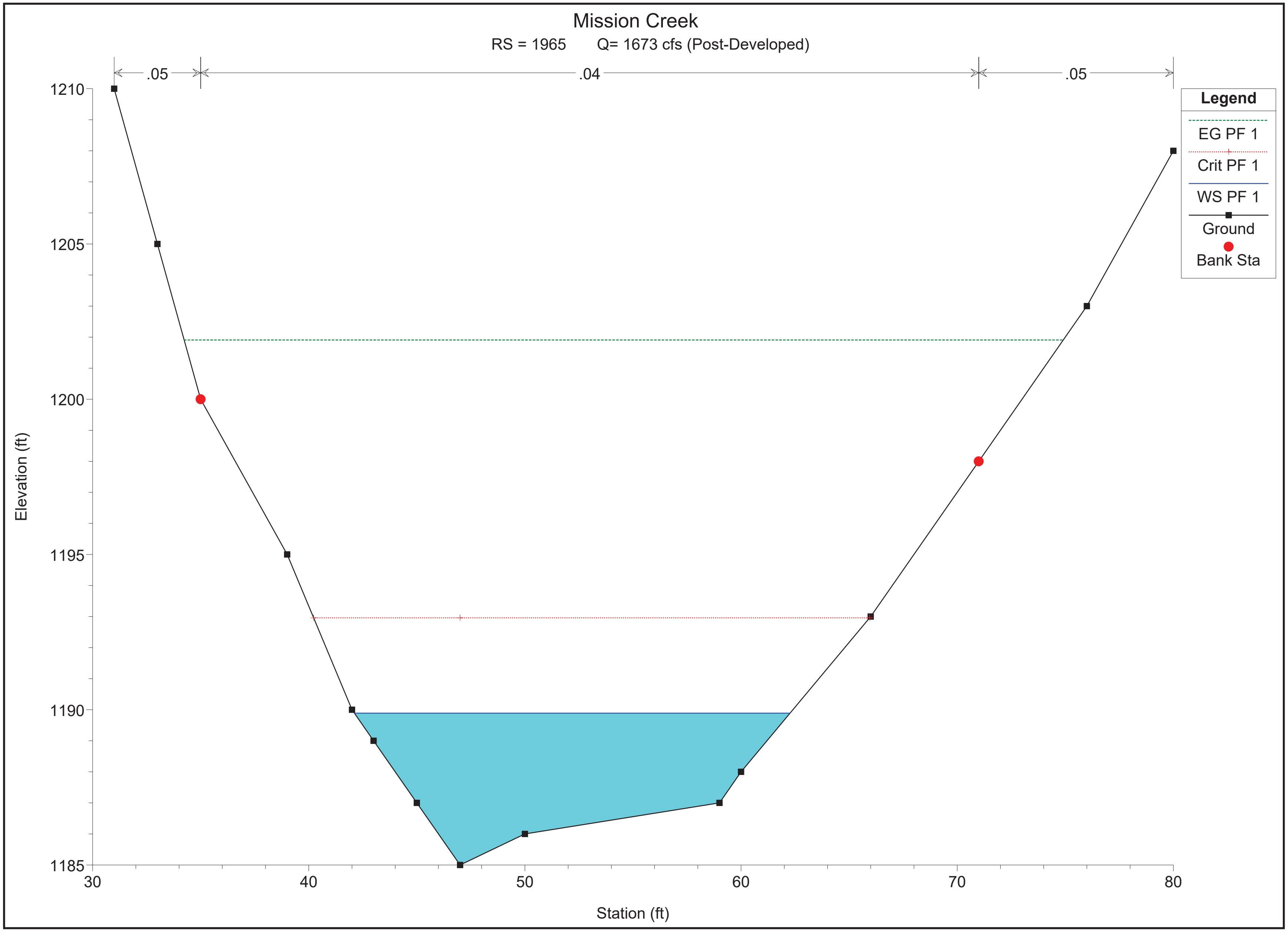


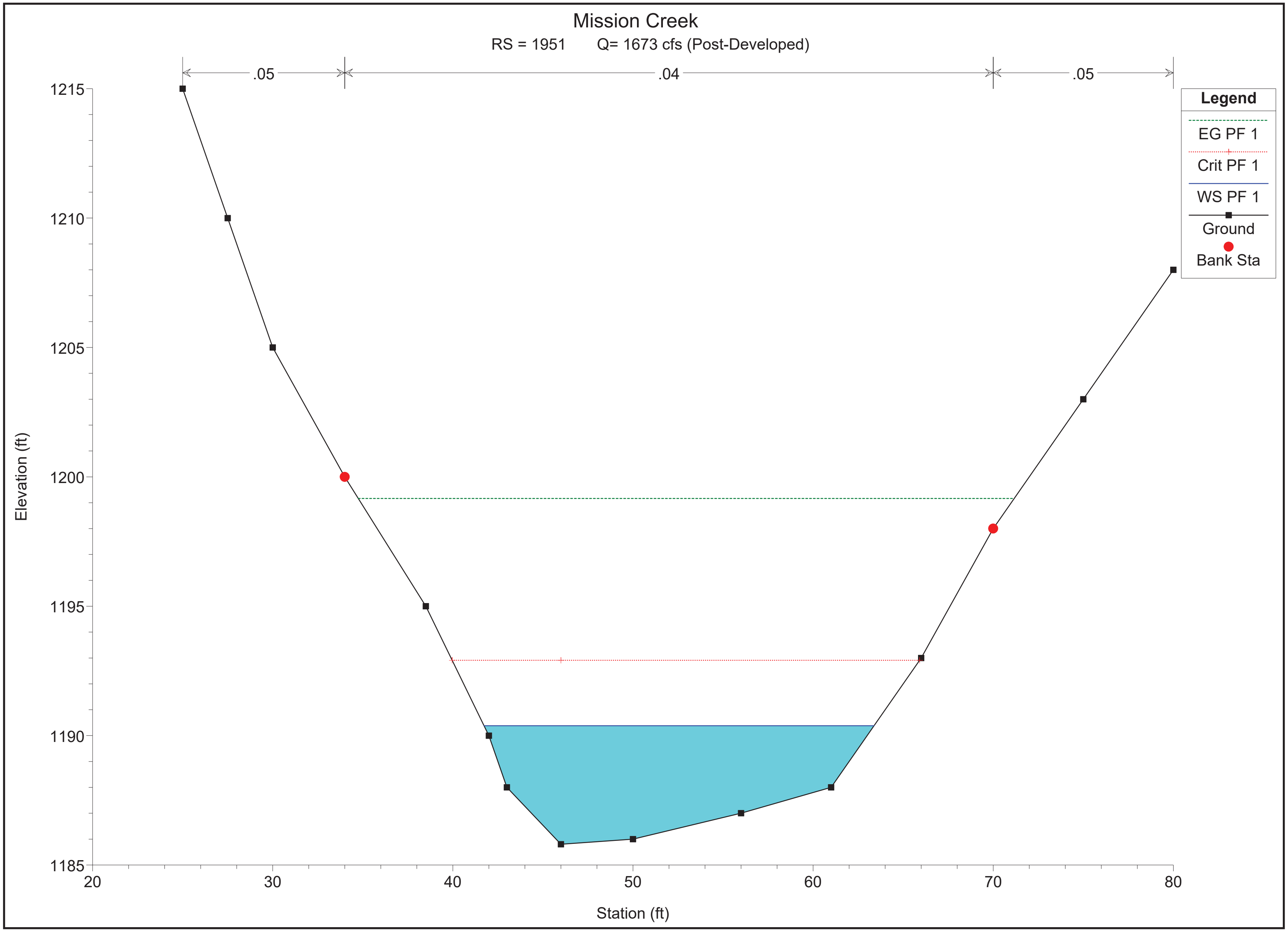
Mission Creek
RS = 1988.5 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
1220
1215
1210
1205
1200
1195
30
40
50
60
70
80
Station (ft)



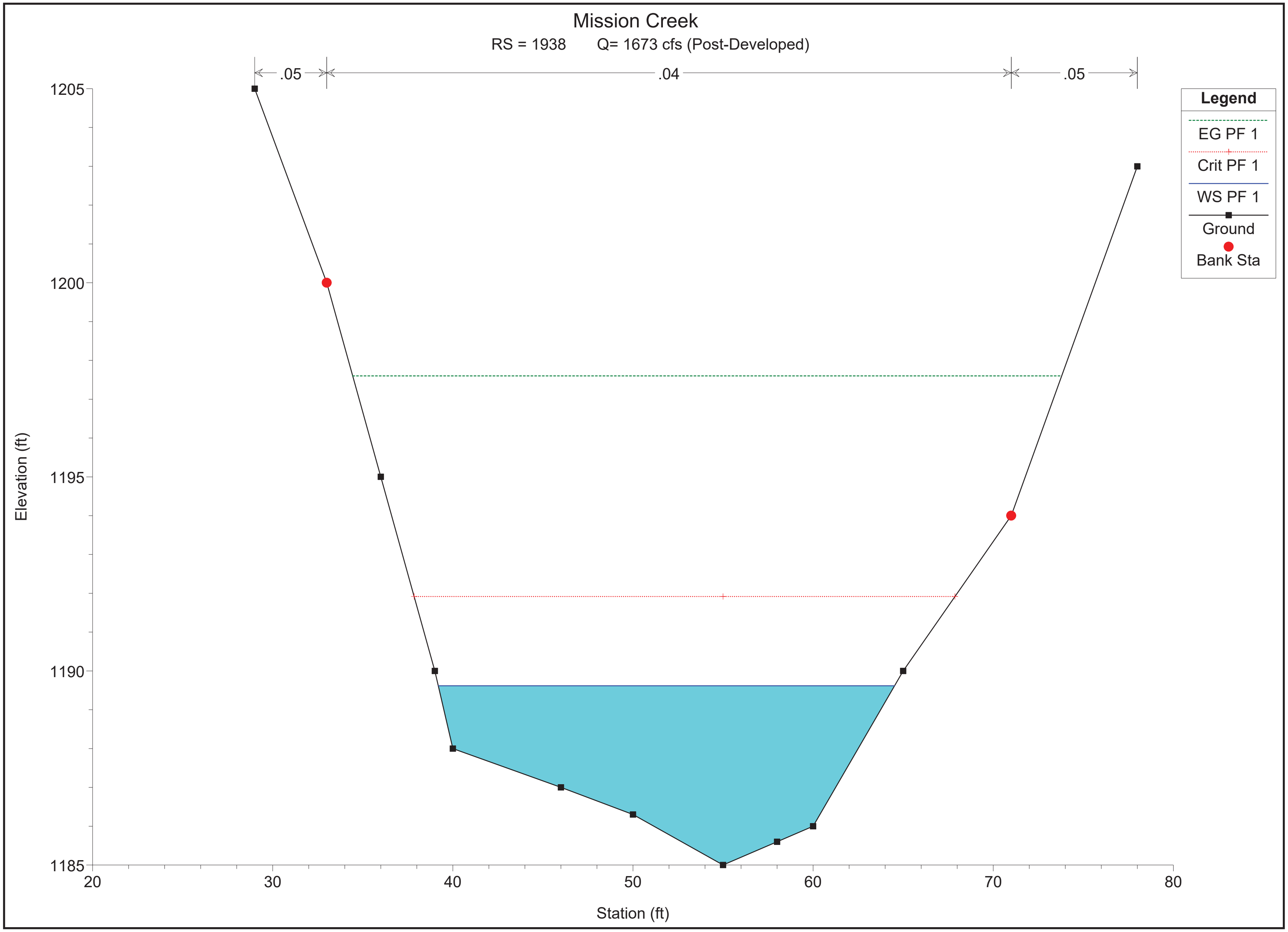
Mission Creek
RS = 1987 Q= 1673 cfs (Post-Developed)
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Ineff
Bank Sta
Elevation (ft)
1220
1215
1210
1205
1200
1195
30
40
50
60
70
80
Station (ft)

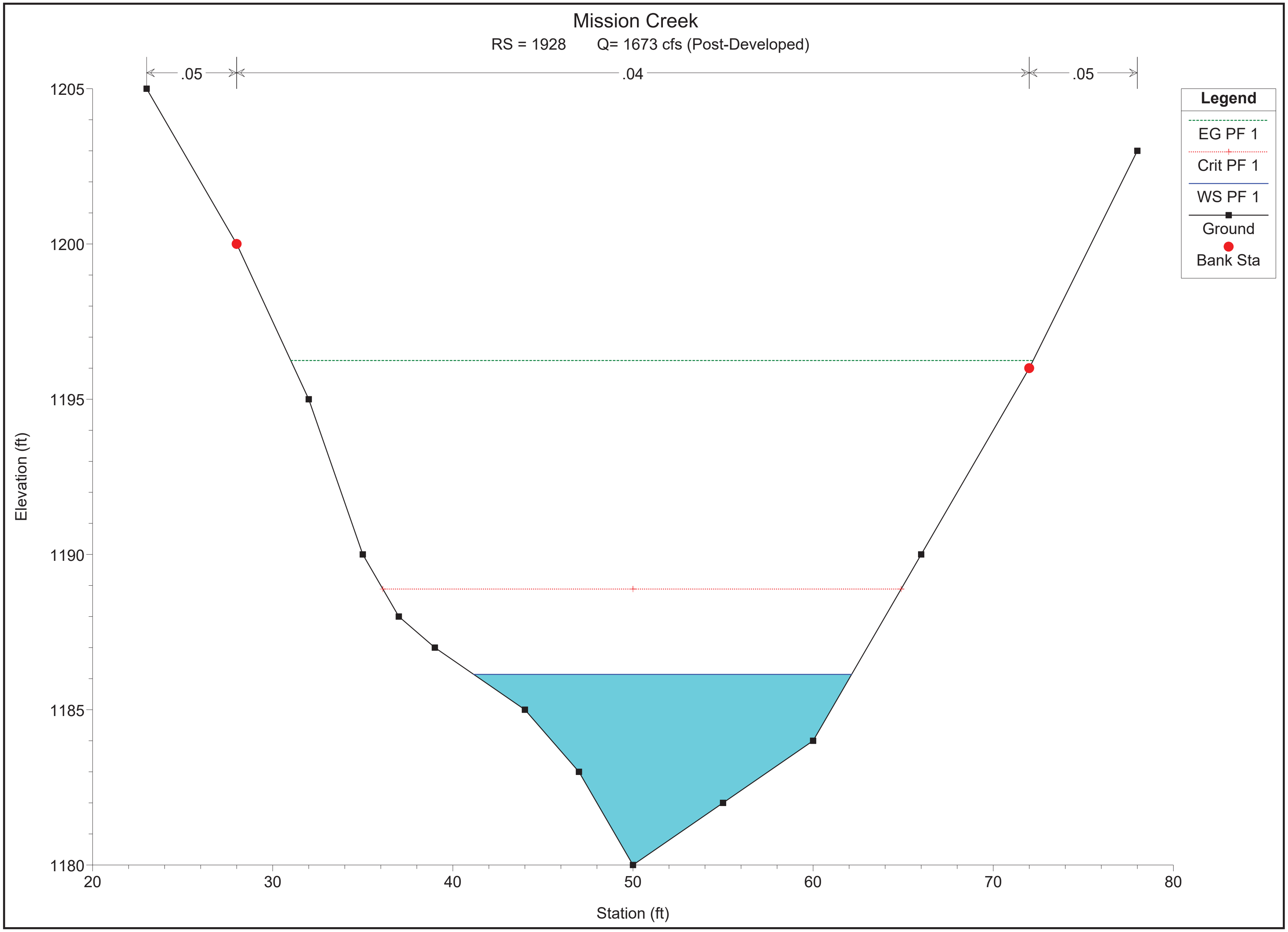

Mission Creek
RS = 1976 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1210
1205
1200
1195
1190
1185
1180
30
40
50
60
70
80
Station (ft)

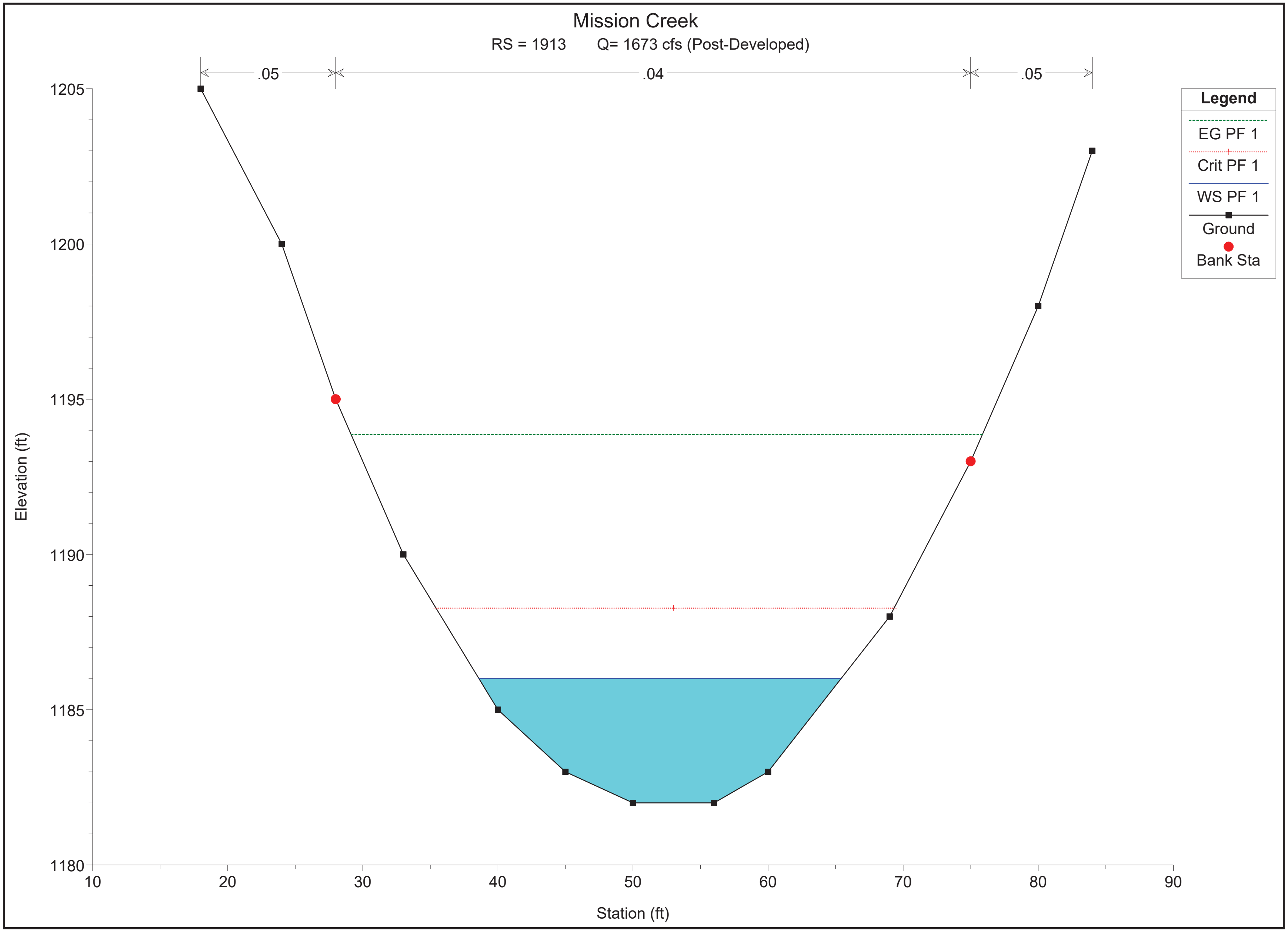

Mission Creek
RS = 1965 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1210
1205
1200
1195
1190
1185
30
40
50
60
70
80
Station (ft)



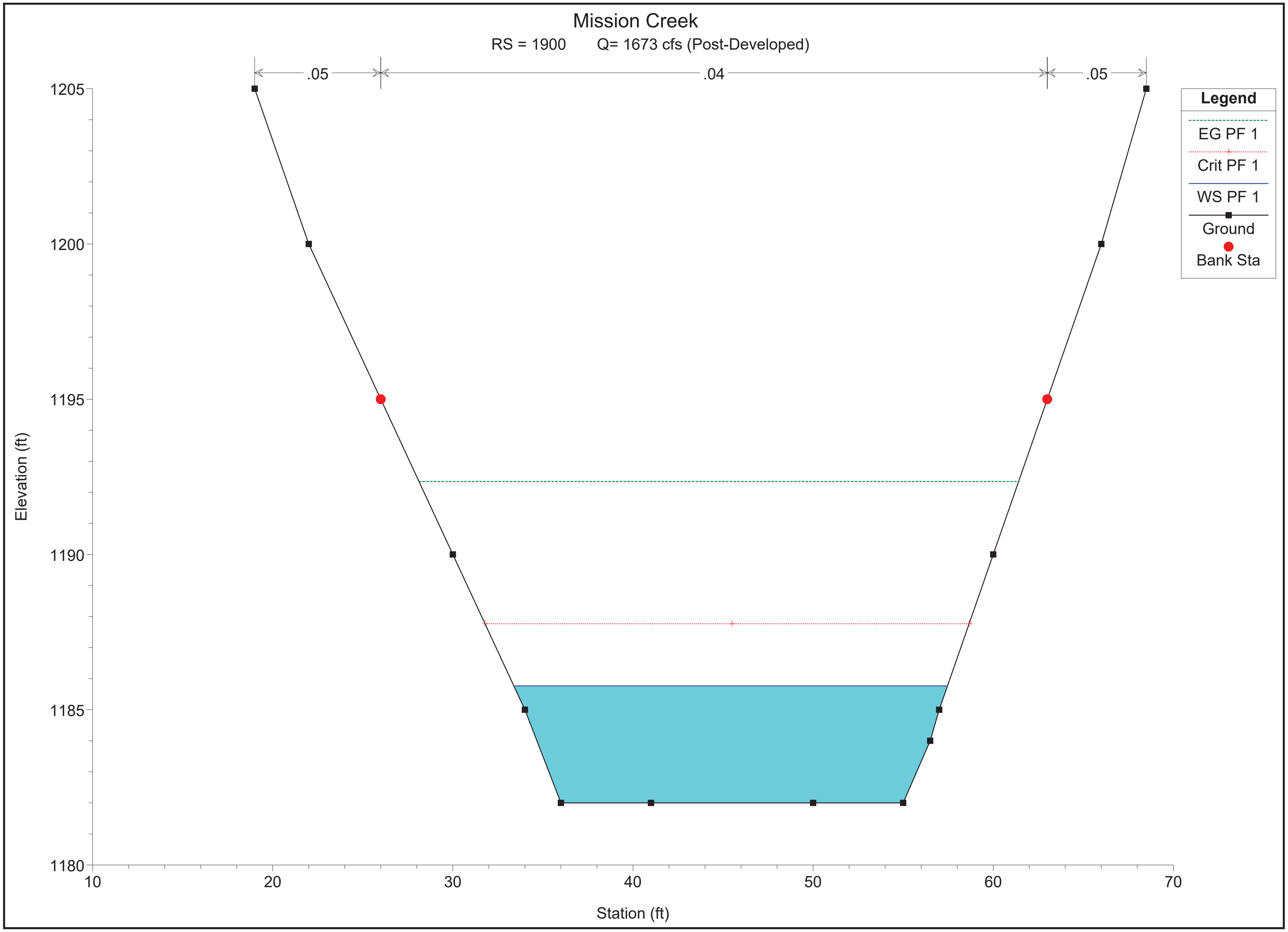
Mission Creek
RS = 1951 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1215
1210
1205
1200
1195
1190
1185
20
30
40
50
60
70
80
Station (ft)

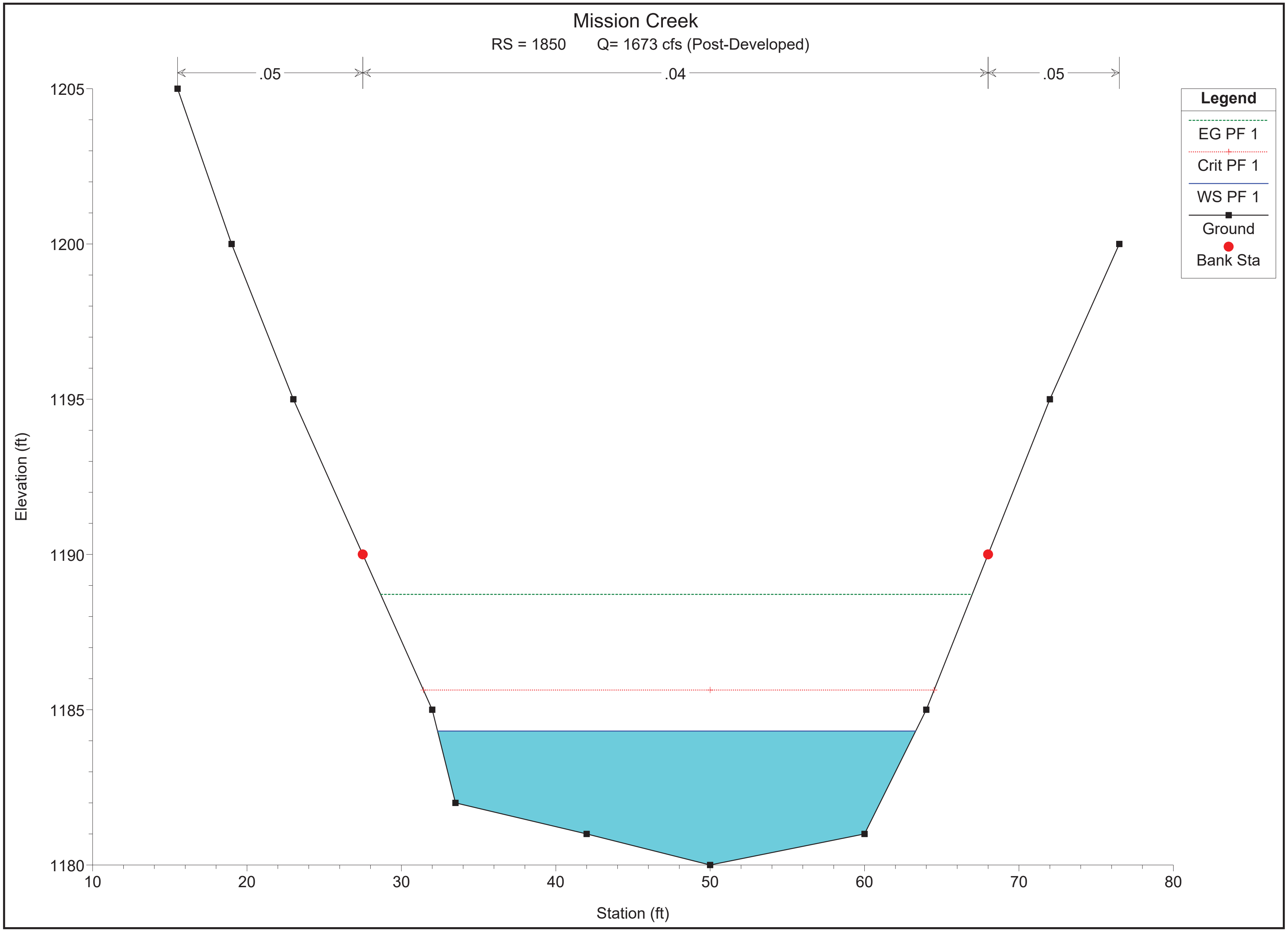

Mission Creek
RS = 1938 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1205
1200
1195
1190
1185
Station (ft)
20
30
40
50
60
70
80


Mission Creek
RS = 1928 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1205
1200
1195
1190
1185
1180
20
30
40
50
60
70
80
Station (ft)

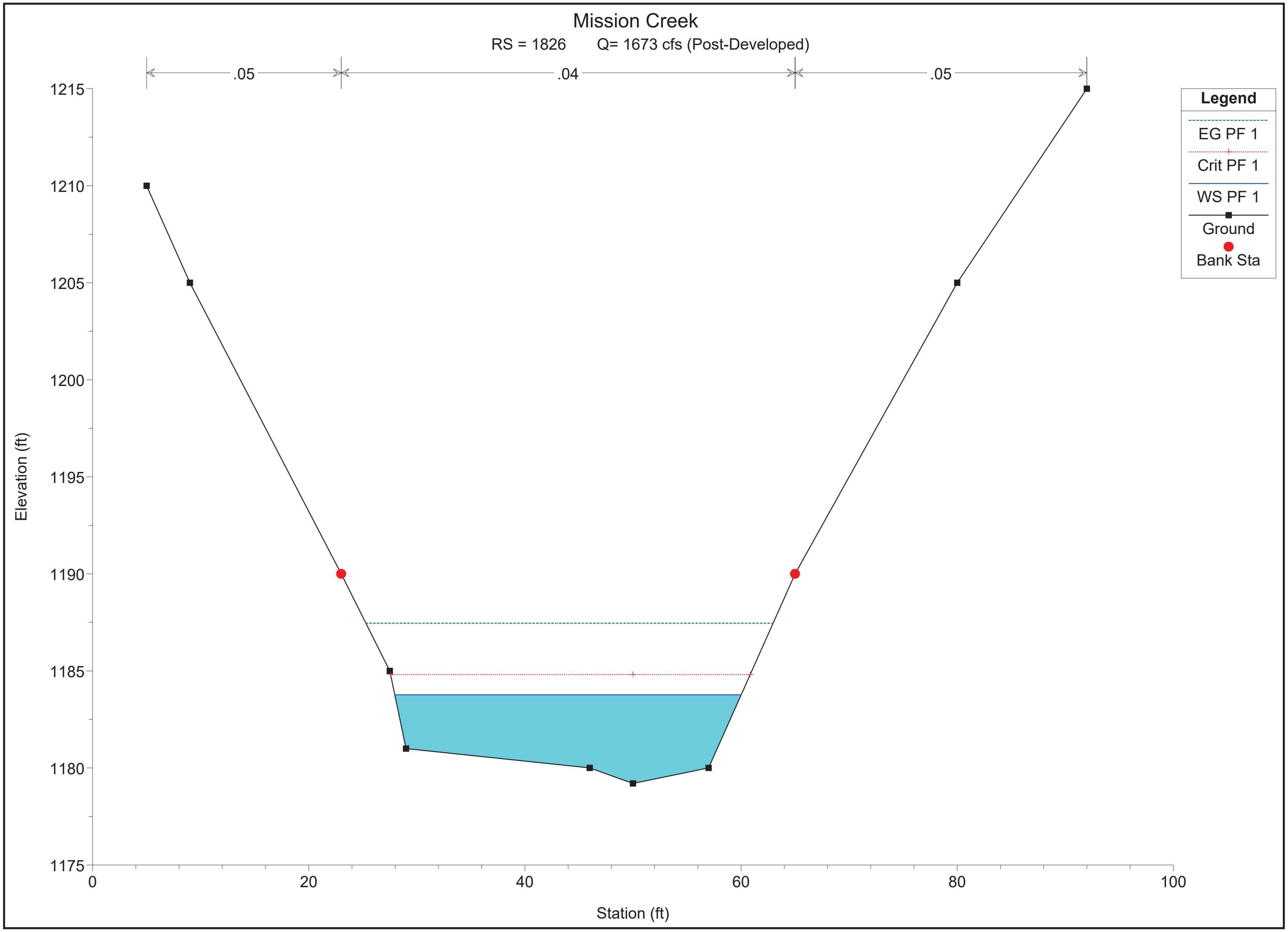


Mission Creek
RS = 1913 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1205
1200
1195
1190
1185
1180
10
20
30
40
50
60
70
80
90
Station (ft)

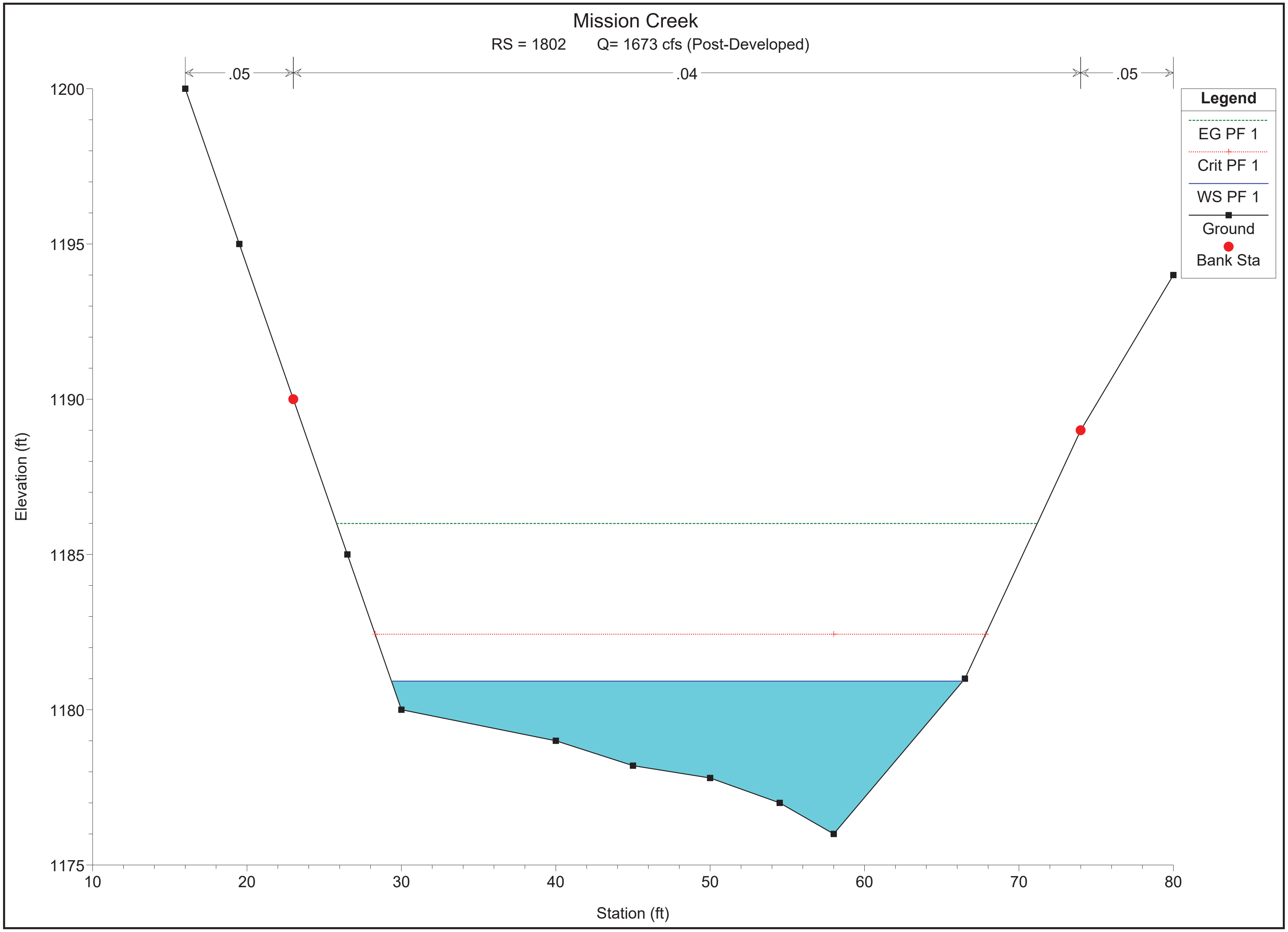

Mission Creek
RS = 1900 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1205
1200
1195
1190
1185
1180
10
20
30
40
50
60
70
Station (ft)

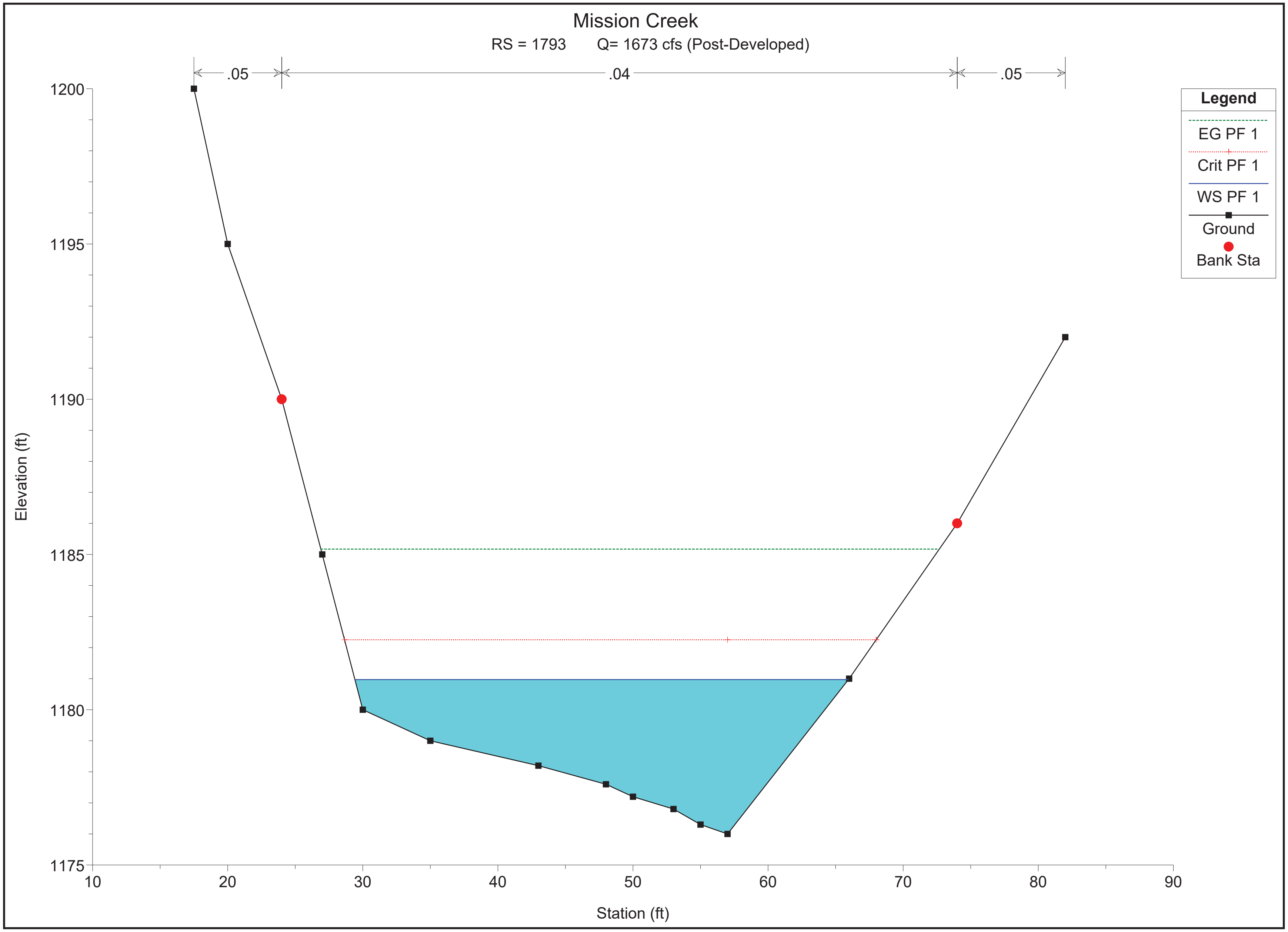


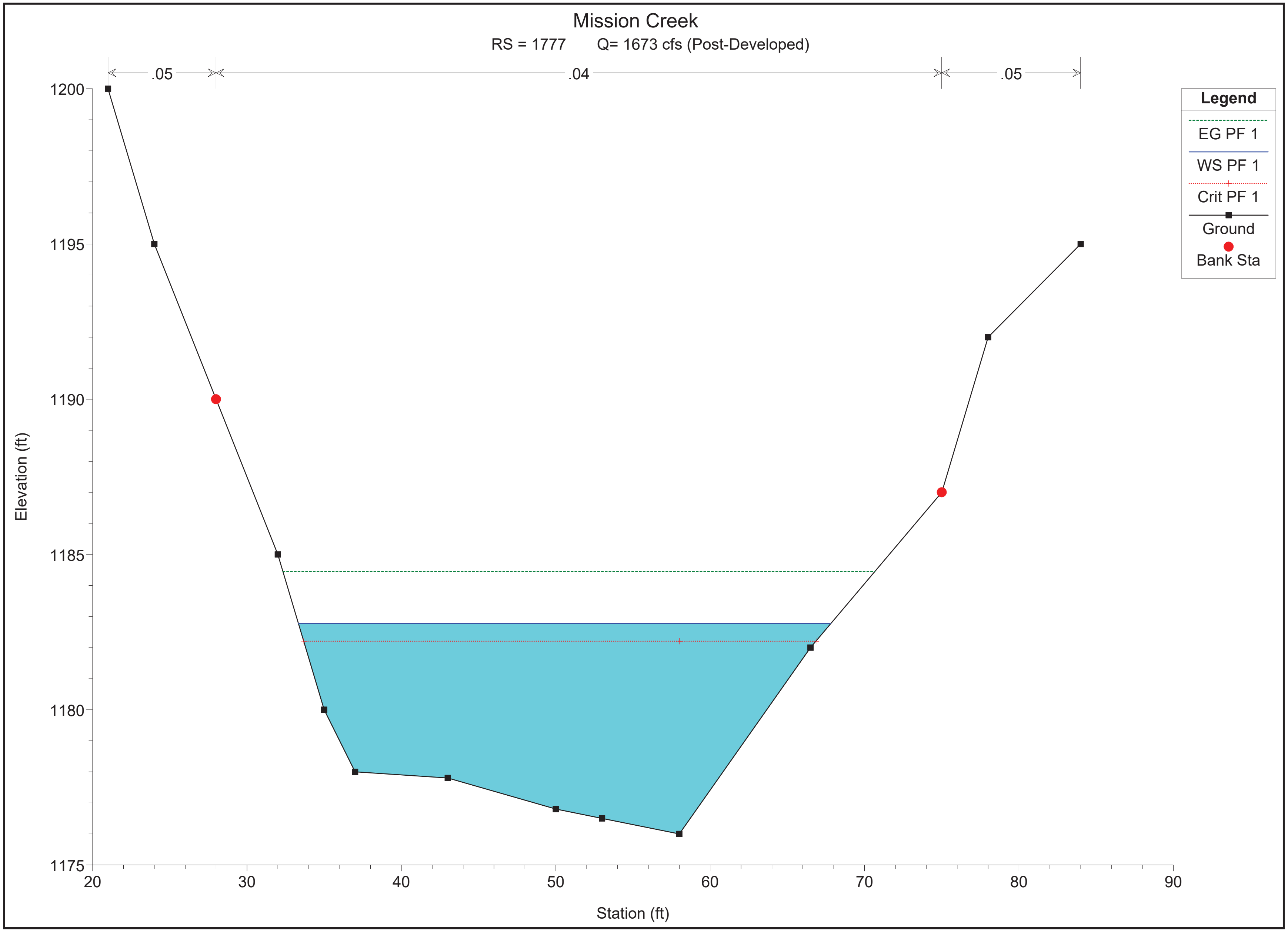
Mission Creek
RS = 1850 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
1205
1200
1195
1190
1185
1180
Elevation (ft)
10
20
30
40
50
60
70
80
Station (ft)



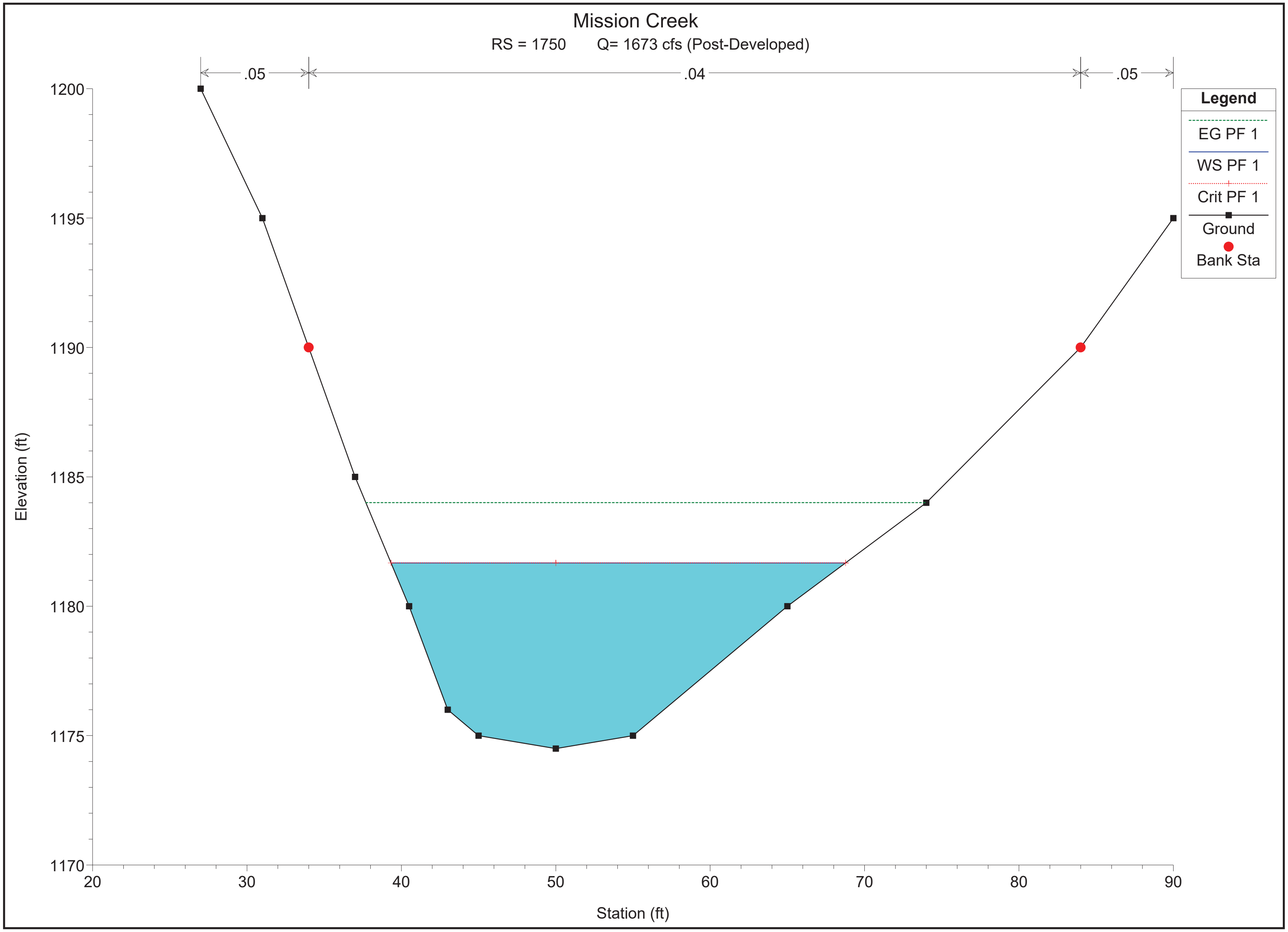
Mission Creek
RS = 1826 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1215
1210
1205
1200
1195
1190
1185
1180
1175
0
20
40
60
80
100
Station (ft)

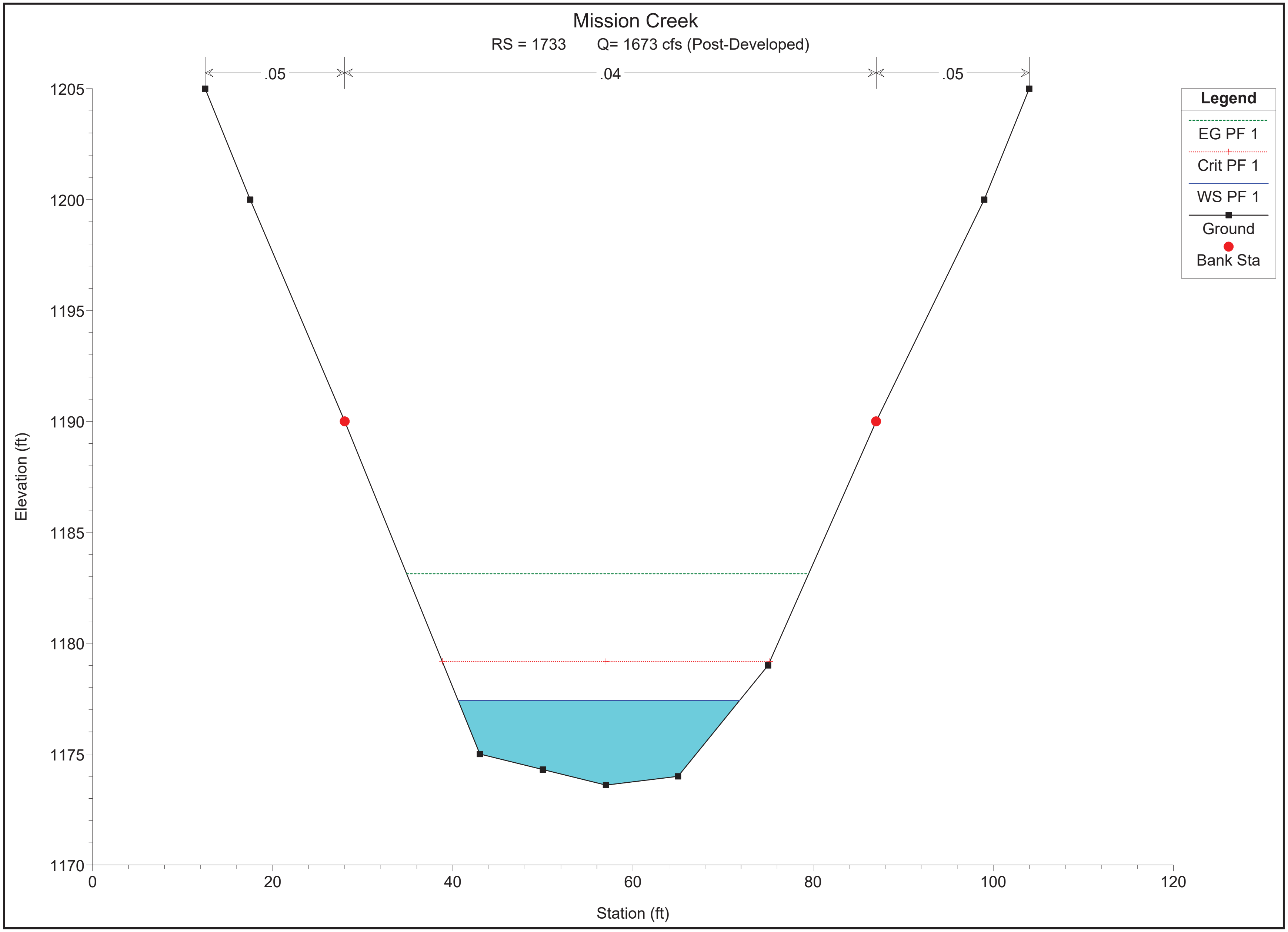

Mission Creek
RS = 1802 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1200
1195
1190
1185
1180
1175
Station (ft)
10
20
30
40
50
60
70
80


Mission Creek
RS = 1793 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1200
1195
1190
1185
1180
1175
10
20
30
40
50
60
70
80
90
Station (ft)

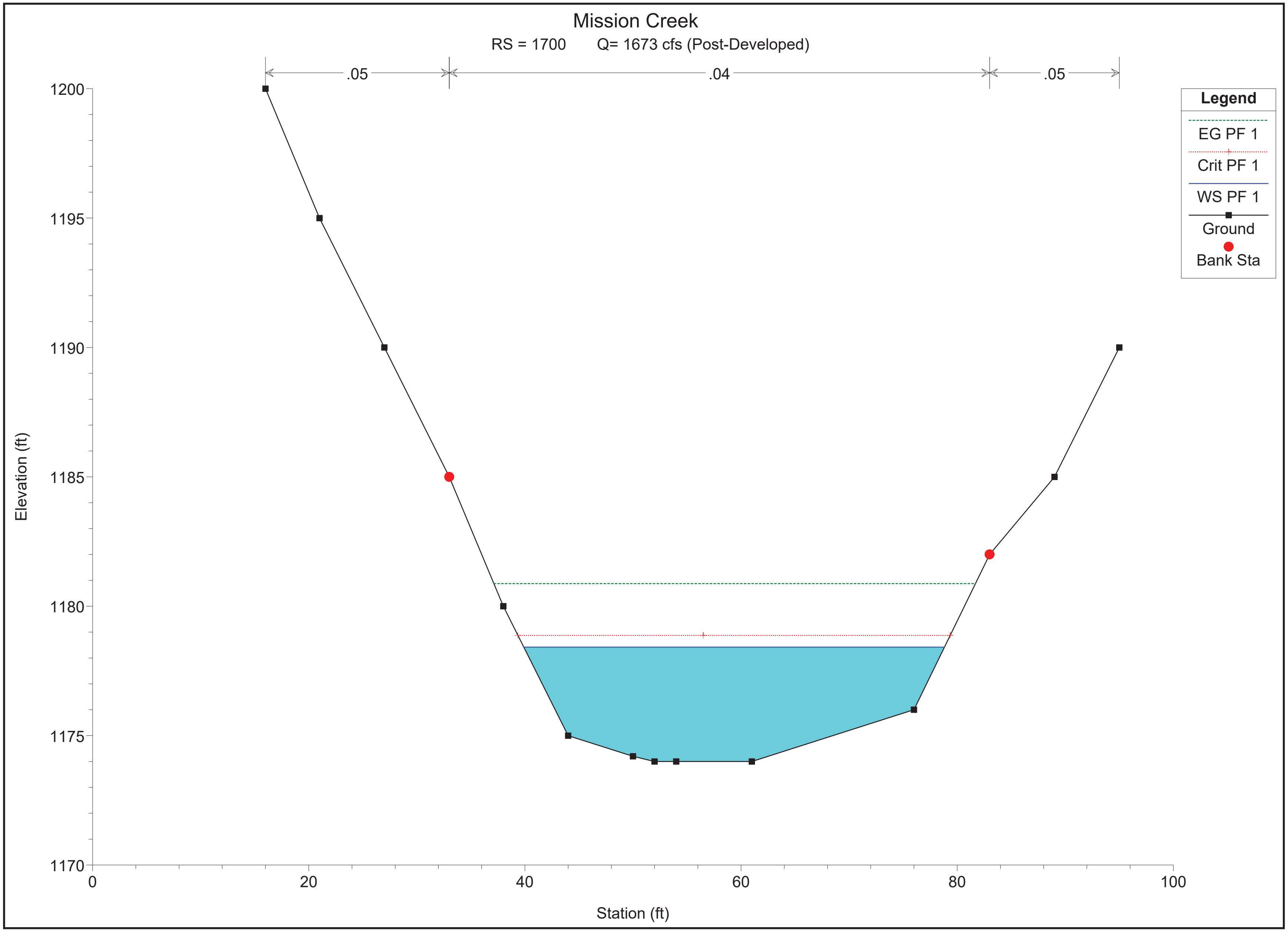


Mission Creek
RS = 1777 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
Elevation (ft)
Station (ft)
1200
1195
1190
1185
1180
1175
20
30
40
50
60
70
80
90

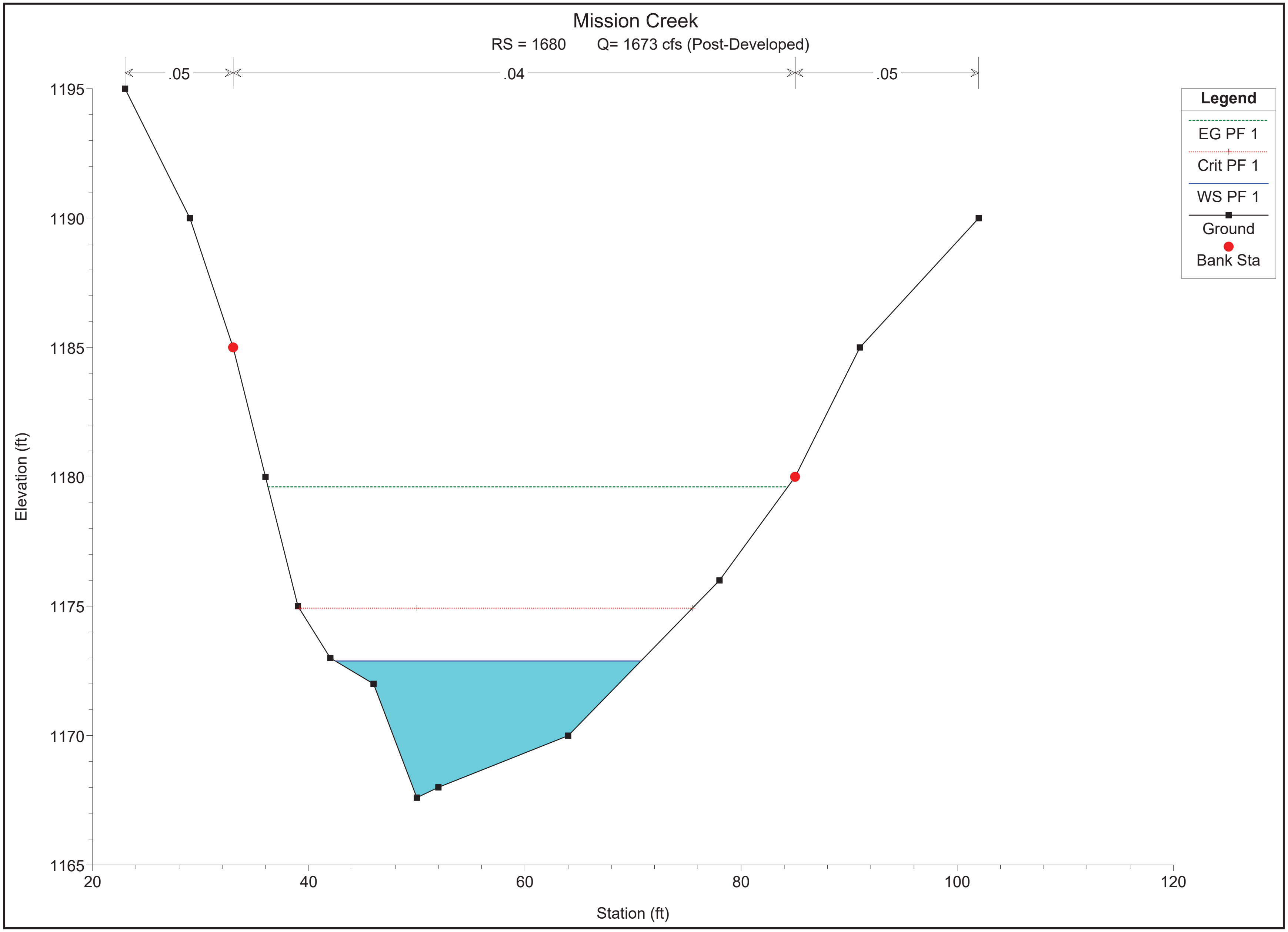

Mission Creek
RS = 1750 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Bank Sta
1200
1195
1190
1185
1180
1175
1170
Elevation (ft)
20
30
40
50
60
70
80
90
Station (ft)

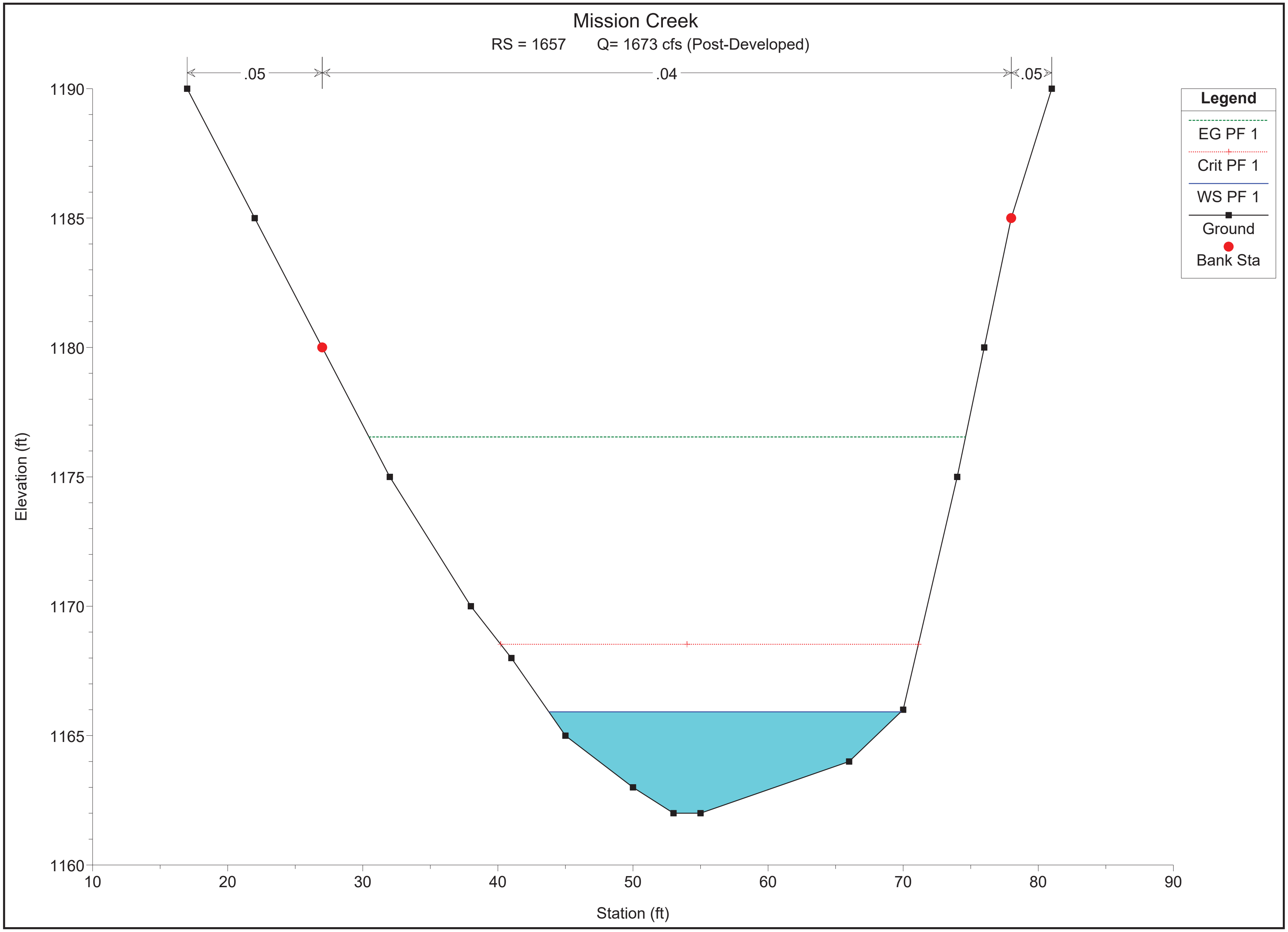


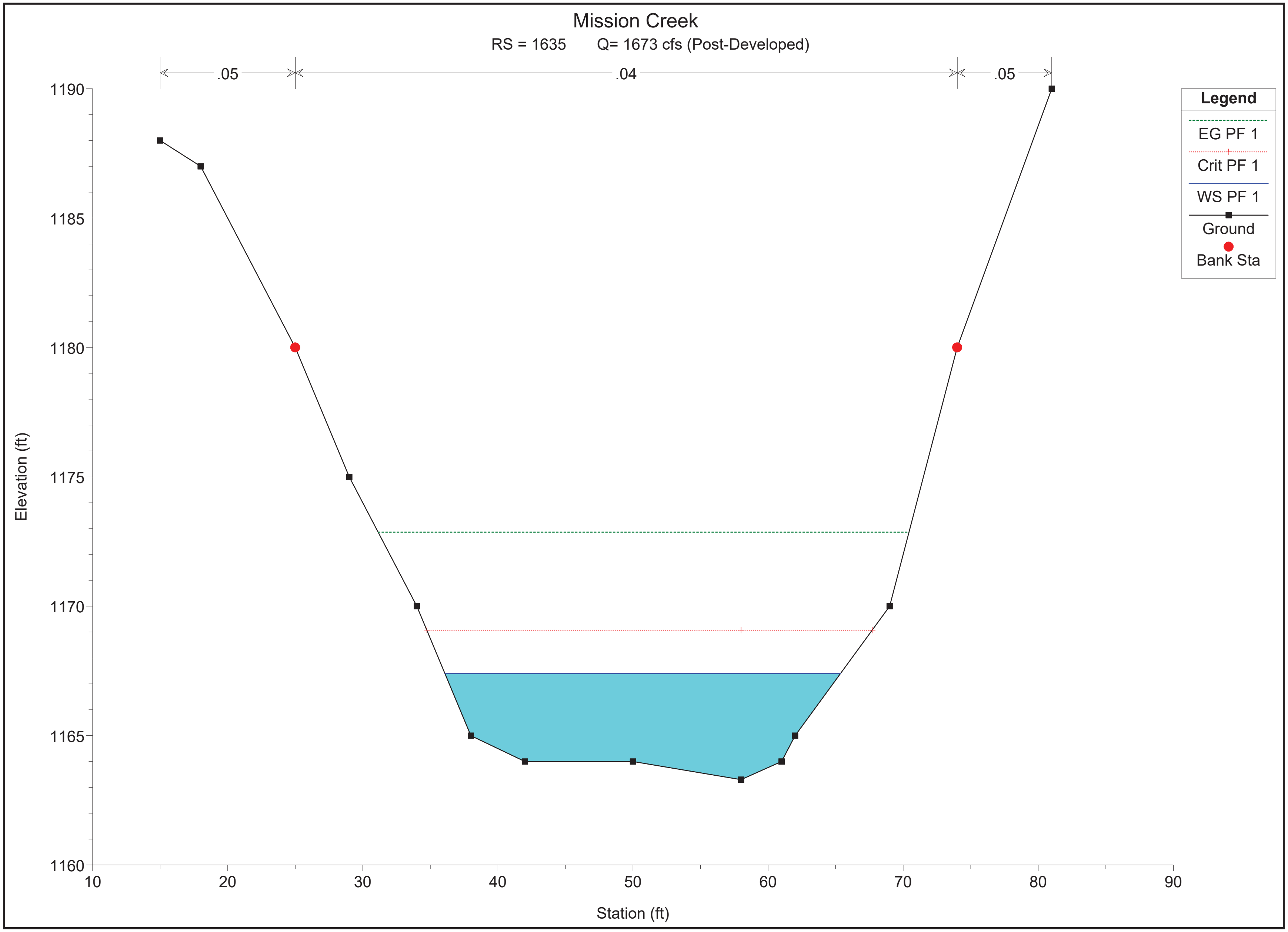
Mission Creek
RS = 1733 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1205
1200
1195
1190
1185
1180
1175
1170
0
20
40
60
80
100
120
Station (ft)



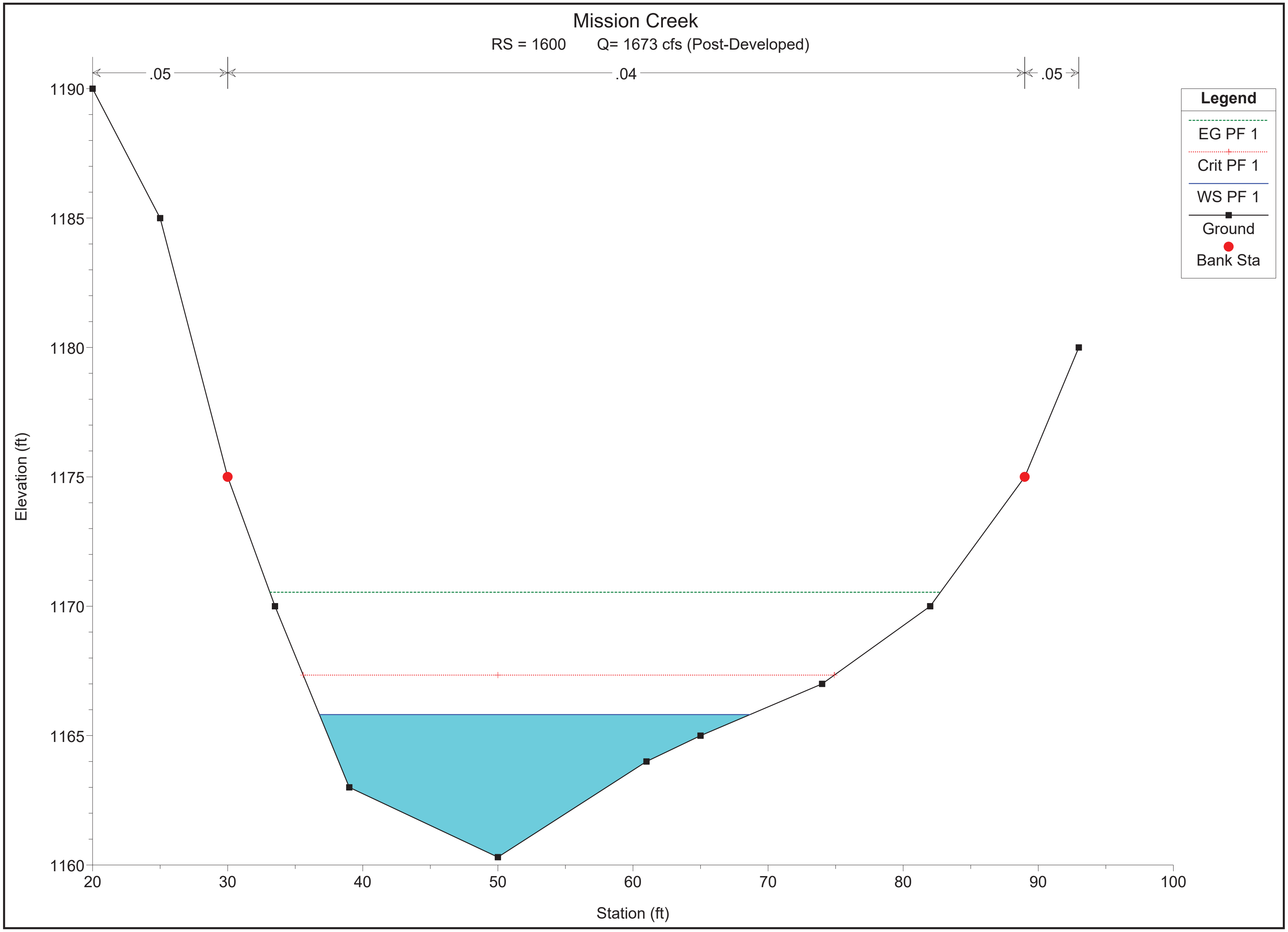
Mission Creek
RS = 1700 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1200
1195
1190
1185
1180
1175
1170
0
20
40
60
80
100
Station (ft)


Mission Creek
RS = 1680 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1195
1190
1185
1180
1175
1170
1165
Station (ft)
20
40
60
80
100
120

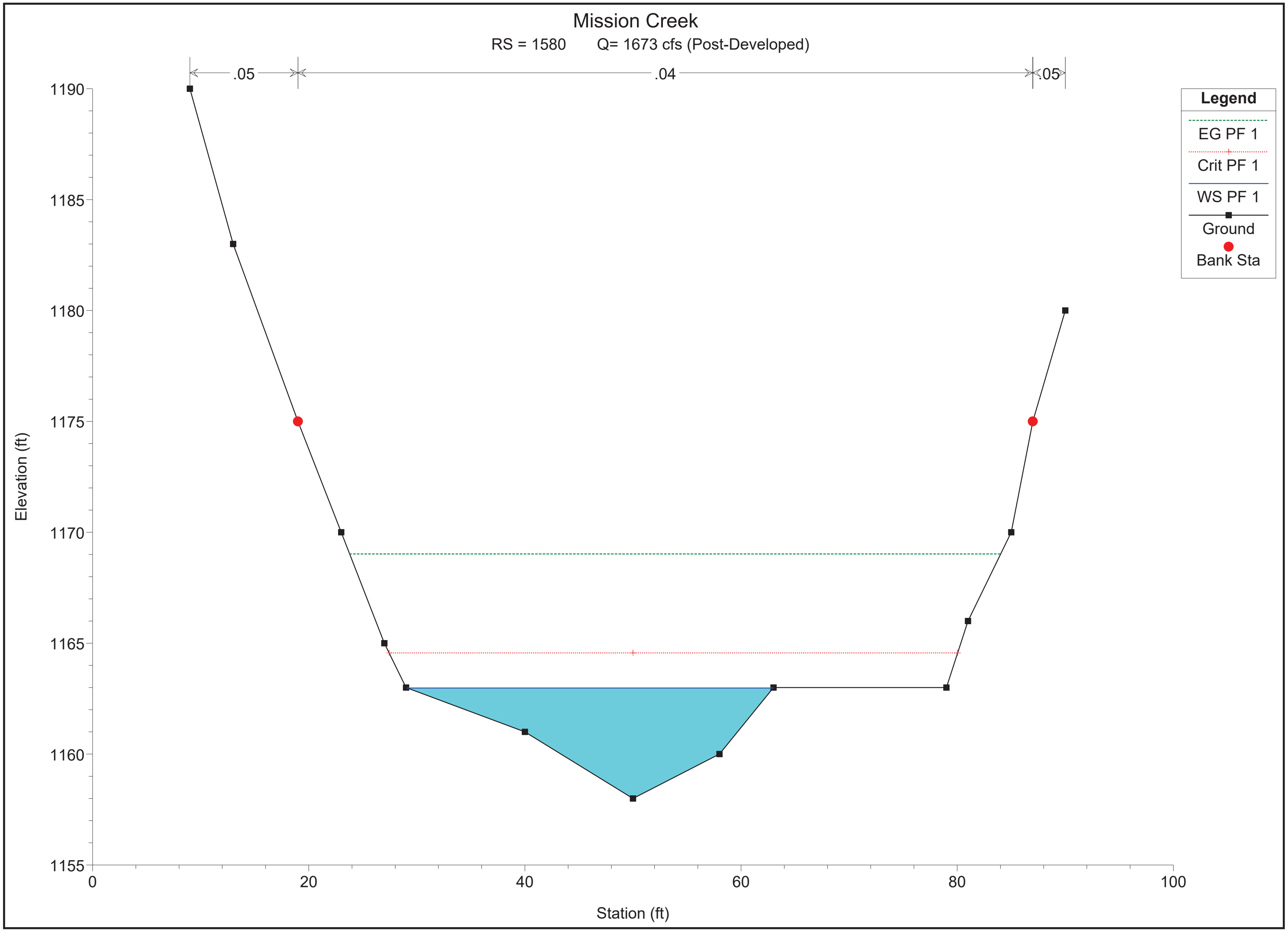

Mission Creek
RS = 1657 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1160
1165
1170
1175
1180
1185
1190
Station (ft)
10
20
30
40
50
60
70
80
90



Mission Creek
RS = 1635 Q= 1673 cfs (Post-Developed)
.05
.04
.05
1190
1185
1180
1175
1170
1165
1160
Elevation (ft)
10
20
30
40
50
60
70
80
90
Station (ft)
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta

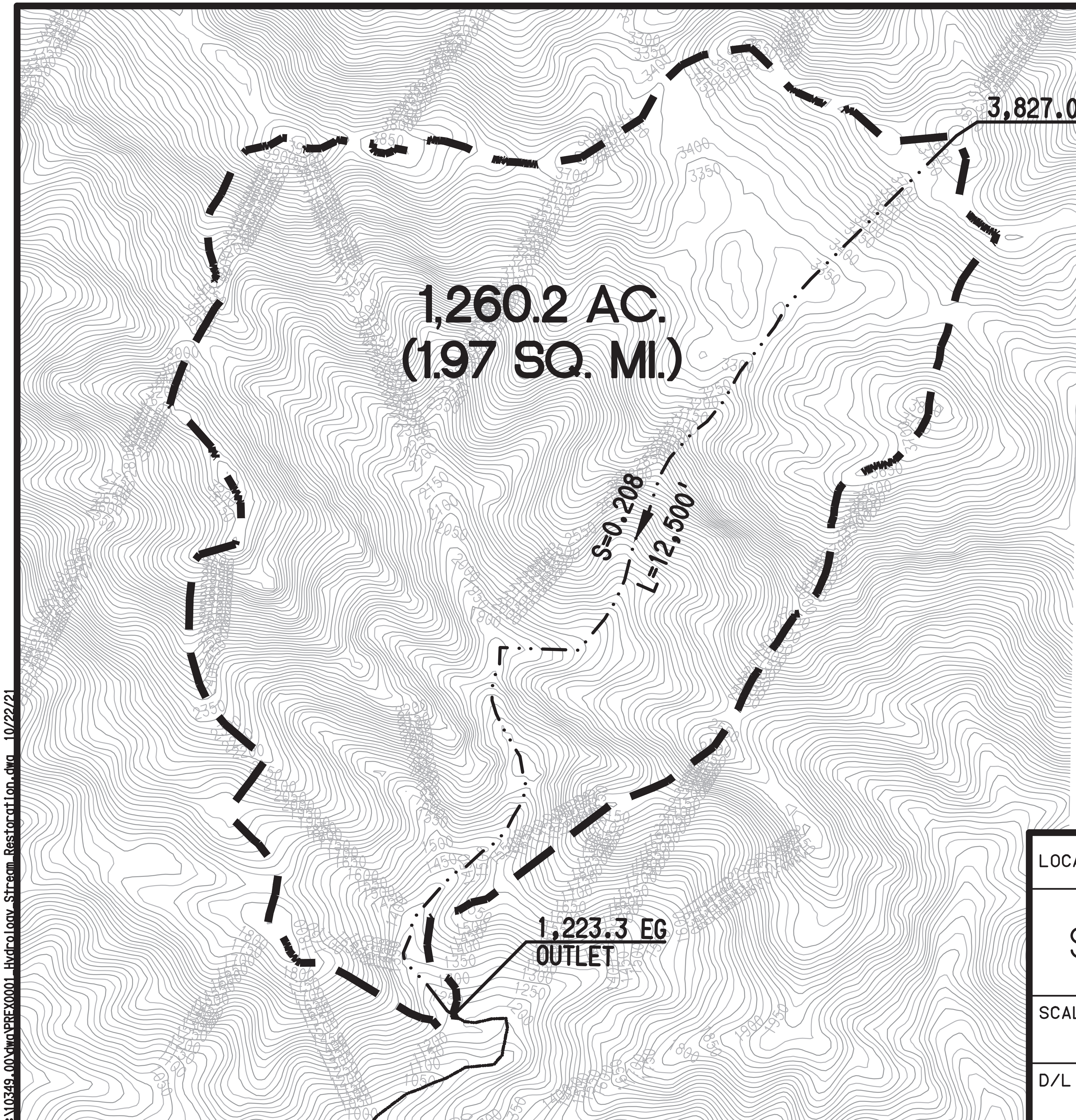


Mission Creek
RS = 1600 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1190
1185
1180
1175
1170
1165
1160
20
30
40
50
60
70
80
90
100
Station (ft)



Mission Creek
RS = 1580 Q= 1673 cfs (Post-Developed)
.05
.04
.05
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Bank Sta
Elevation (ft)
1190
1185
1180
1175
1170
1165
1160
1155
Station (ft)
0
20
40
60
80
100

APPENDIX D



LEGEND

▬ ▬	WATERSHED BOUNDARY
—·· —	FLOWLINE

N

GRAPHIC SCALE

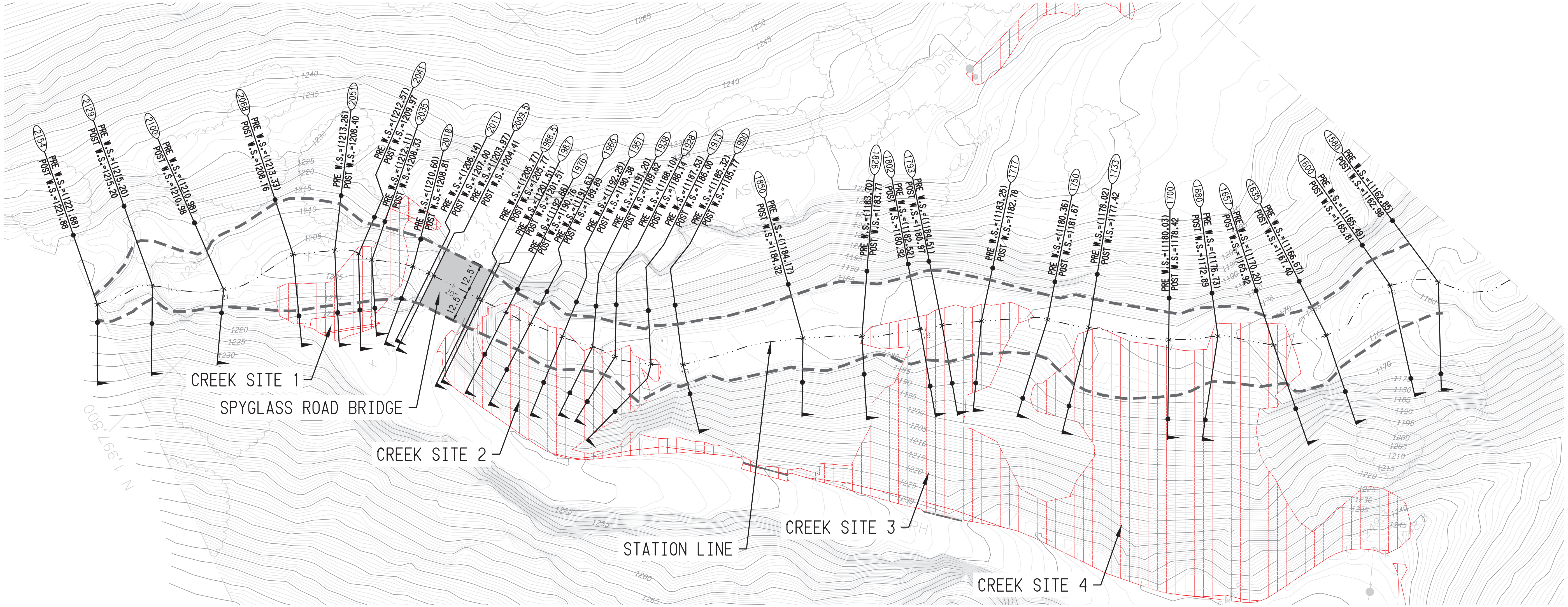
1200 0 600 1200 2400 3600

SCALE: 1" = 1,200'

LOCATION: MISSION CREEK		
STREAM RESTORATION HYDROLOGY MAP		
SCALE: 1"=1,200'	SOUTHERN CALIFORNIA EDISON An EDISON INTERNATIONAL Company	
D/L	APPENDIX D	1 OF 1

S:\10349.00\dwg\PREX0001 Hydrology Stream Restoration.dwg 10/22/21

APPENDIX E



LEGEND

(line symbol)	FLOWLINE
(dashed line symbol)	100 YEAR STORM FLOOD LIMIT
PRE W.S.=(1215.0)	PRE DEVELOPED 100 YEAR STORM WATER SURFACE ELEVATION
POST W.S.=1215.0	POST DEVELOPED 100 YEAR STORM WATER SURFACE ELEVATION
x	CHANNEL STATION
•	BANK STATION
1600	SECTION NUMBER AND DIRECTION
(hatched area symbol)	PROPOSED SIDECAST REMOVAL AREA

GRAPHIC SCALE

20 0 10 20 40 60

SCALE: 1" = 20'

LOCATION:	GOLETA-SANTA BARBARA 66kV T/L GOLETA-CARPINTERIA-DESAL-SANTA BARBARA 66kV T/L SANTA BARBARA-SAN MARCOS 66kV T/L

HYDRAULICS EXHIBIT
(PRE AND POST DEVELOPED CONDITIONS)

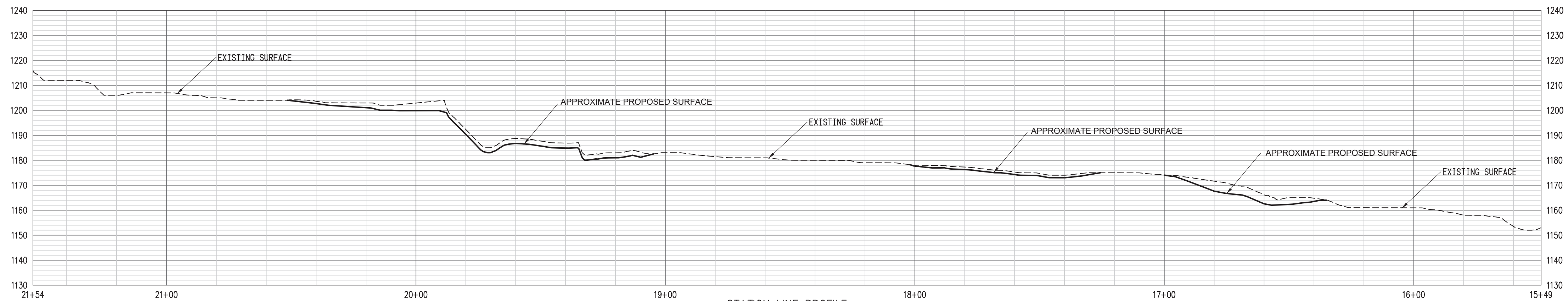
SCALE: 1"=20'

SOUTHERN CALIFORNIA EDISON An EDISON INTERNATIONAL Company

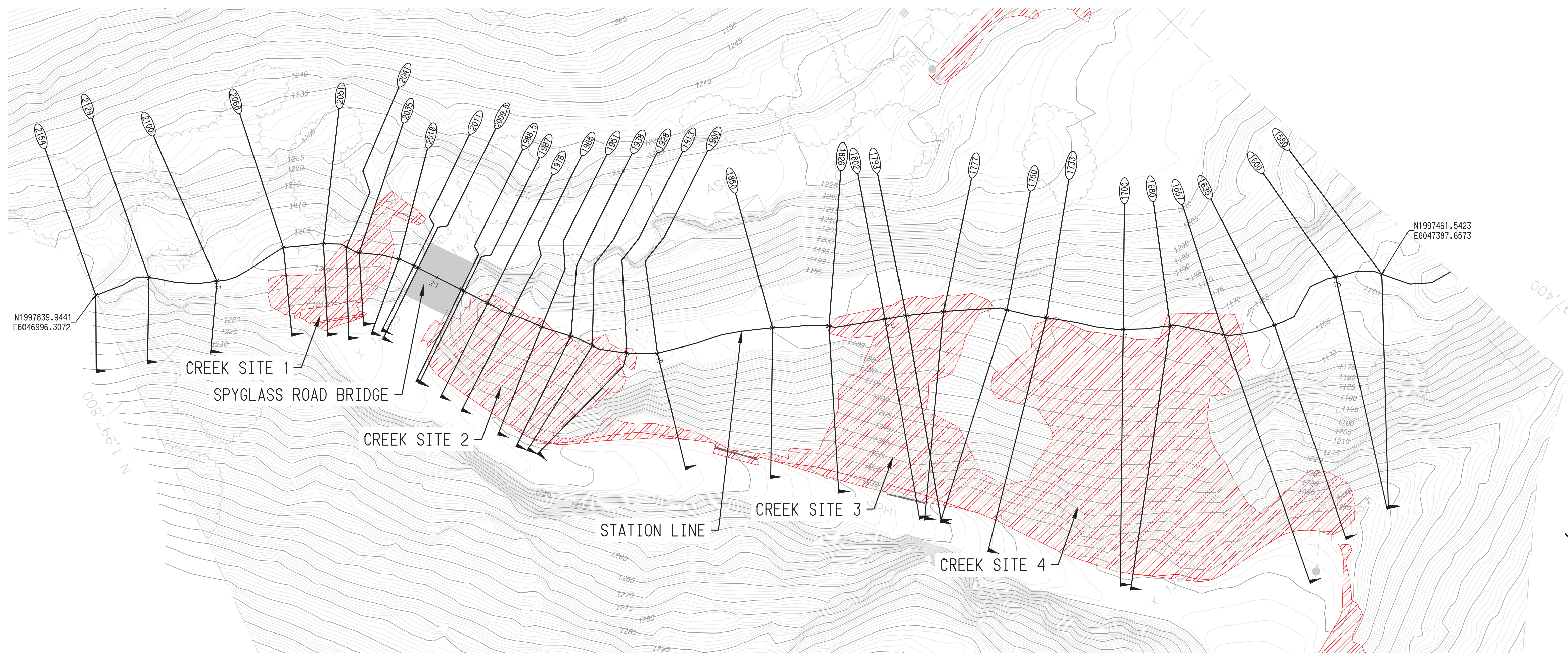
D/L

APPENDIX E

APPENDIX F



STATION LINE PROFILE
SCALE: HORIZ. 1"=20'
VERT. 1"=20'



GRAPHIC SCALE
SCALE: 1" = 20'

REFERENCE DRAWINGS	REFERENCE DRAWINGS	NO.	REVISIONS	DATE	SAP WO	SUPV	APPROVED	ENGR	CK'D	MADE	P.E.	NO.	REVISIONS	DATE	SAP WO	SUPV	APPROVED	ENGR	CK'D	MADE	P.E.

LOCATION: GOLETA–SANTA BARBARA 66kV T/L
GOLETA–CARPINTERIA–DESAL–SANTA BARBARA 66kV T/L
SANTA BARBARA–SAN MARCOS 66kV T/L

MISSION CREEK STREAM HABITAT RESTORATION PROJECT

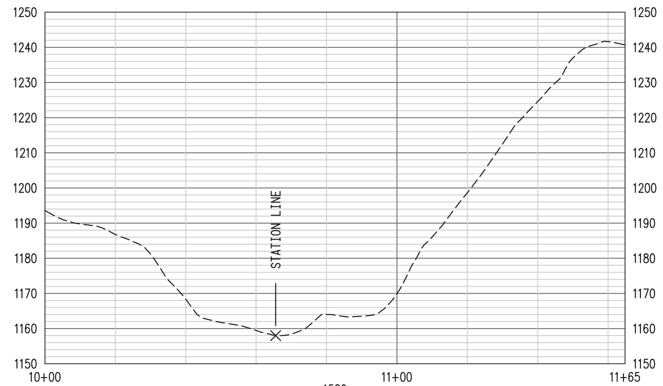
PLAN AND PROFILE

SOUTHERN CALIFORNIA EDISON An EDISON INTERNATIONAL Company

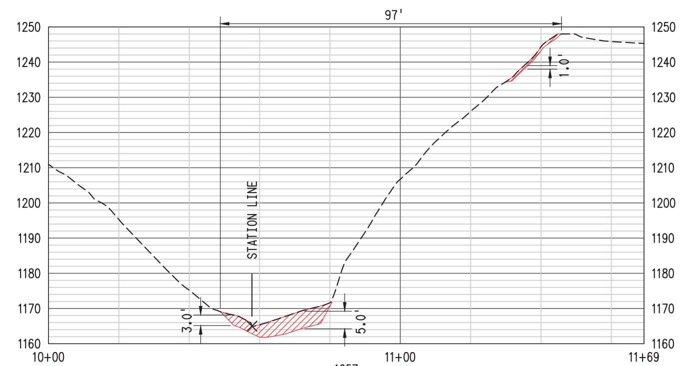
SHEET NO. 1
SCALE: 1"=20'
1 OF 3 SHTS.

* REVISE ON AUTOCAD SYSTEM ONLY *

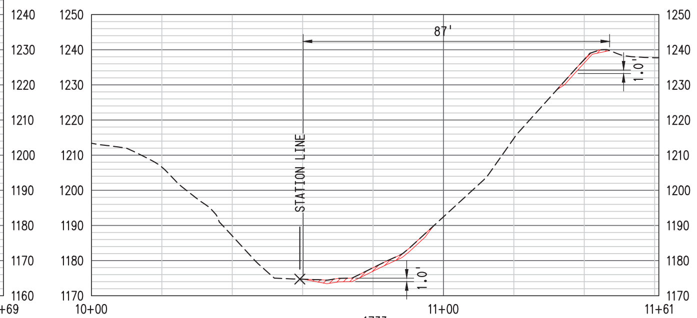
SOUTHERN CALIFORNIA EDISON
2016 - 5 SIZE



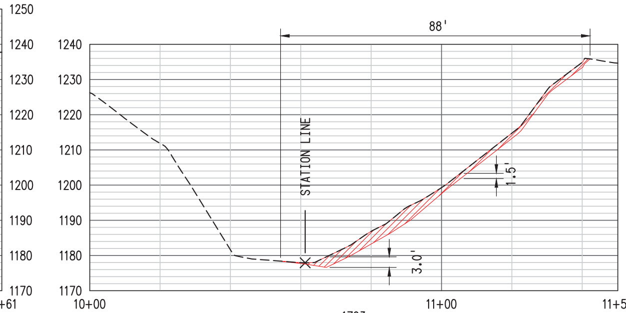
1580
SCALE: HORIZ. 1"=20'
VERT. 1"=20'
(LOOKING DOWNSTREAM)



1657
SCALE: HORIZ. 1"=20'
VERT. 1"=20'
(LOOKING DOWNSTREAM)



1733
SCALE: HORIZ. 1"=20'
VERT. 1"=20'
(LOOKING DOWNSTREAM)



1793
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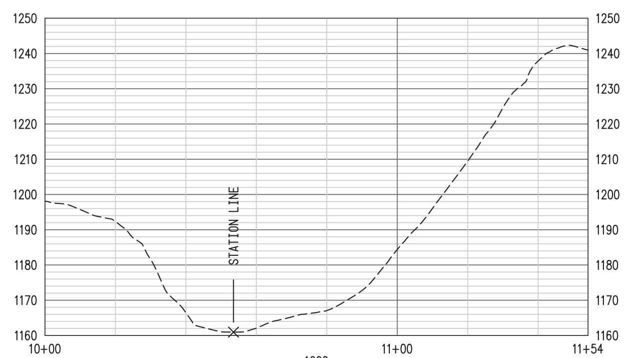
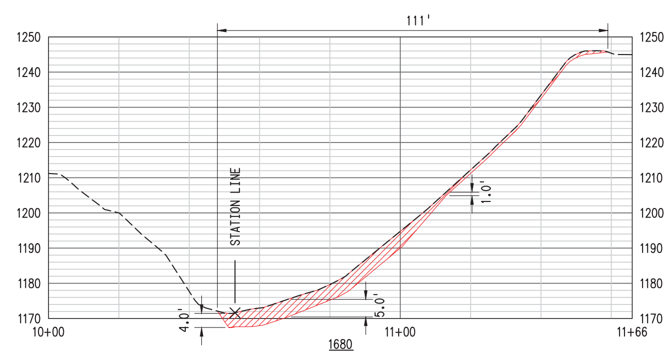
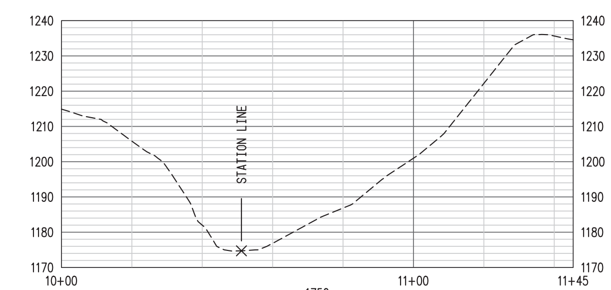
VERT. 1"=20'
(LOOKING DOWNSTREAM)



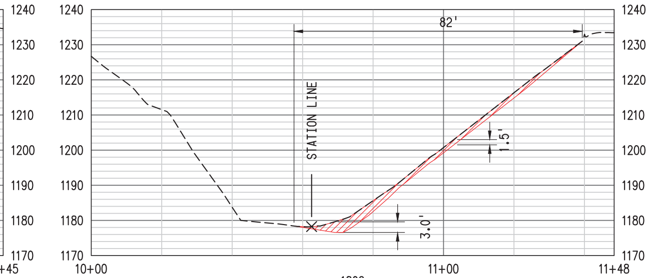
1600
SCALE: HORIZ. 1"=20'
VERT. 1"=20'
(LOOKING DOWNSTREAM)



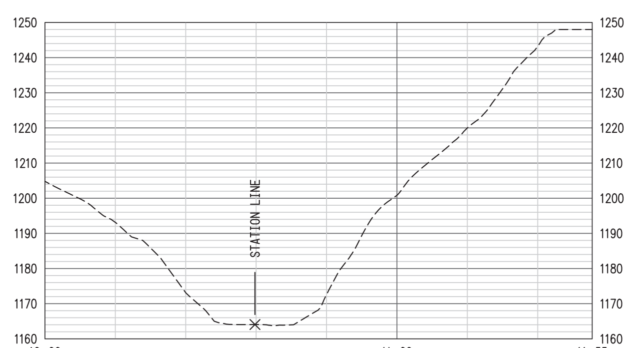
1680
SCALE: HORIZ. 1"=20'
VERT. 1"=20'
(LOOKING DOWNSTREAM)



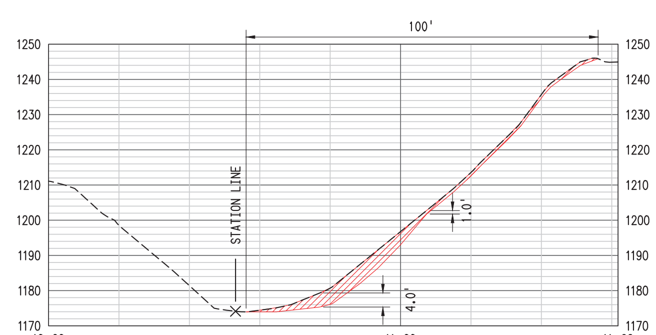
1750
SCALE: HORIZ. 1"=20'
VERT. 1"=20'
(LOOKING DOWNSTREAM)



1802
SCALE: HORIZ. 1"=20'
VERT. 1"=20'
(LOOKING DOWNSTREAM)



1635
SCALE: HORIZ. 1"=20'
VERT. 1"=20'
(LOOKING DOWNSTREAM)



1700
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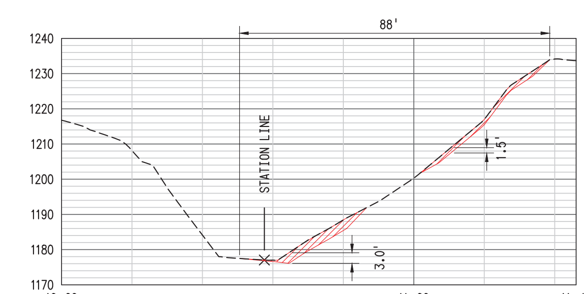
VERT. 1"=20'
(LOOKING DOWNSTREAM)



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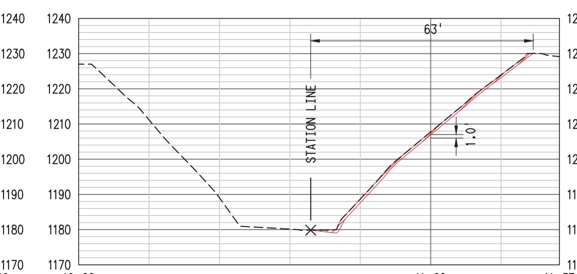
VERT. 1"=20'
(LOOKING DOWNSTREAM)



1826
SCALE: HORIZ. 1"=20'
VERT. 1"=20'
(LOOKING DOWNSTREAM)

* REVISE ON AUTOCAD SYSTEM ONLY *

DIGALERT
DIAL TOLL FREE 811
AT LEAST TWO DAYS BEFORE YOU DIG

REFERENCE DRAWINGS	REFERENCE DRAWINGS	NO.	REVISIONS	DATE	SAP WO	SUPV	APPROVED	ENGR	CK'D	MADE	P.E.	NO.	REVISIONS	DATE	SAP WO	SUPV	APPROVED	ENGR	CK'D	MADE	P.E.

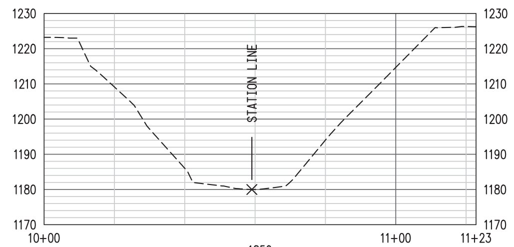
LOCATION: GOLETA-SANTA BARBARA 66kV T/L
GOLETA-CARPINTERIA-DESAL-SANTA BARBARA 66kV T/L
SANTA BARBARA-SAN MARCOS 66kV T/L
MISSION CREEK STREAM HABITAT RESTORATION PROJECT

SECTIONS

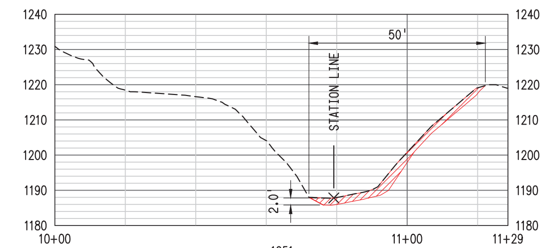
SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL Company

SHEET NO. 2
SCALE: 1"=20'
2 OF 3 SHTS.

SOUTHERN CALIFORNIA EDISON
2016 - S SIZE



1850
SCALE: HORIZ. 1"=20'
VERT. 1"=20'
(LOOKING DOWNSTREAM)



1951
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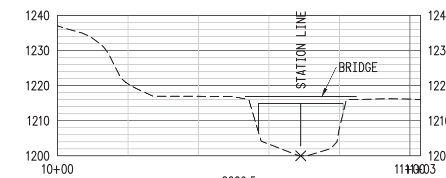
VERT. 1"=20'
(LOOKING DOWNSTREAM)



2009.5
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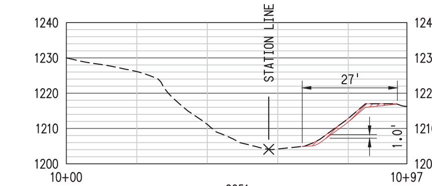
(LOOKING DOWNSTREAM)



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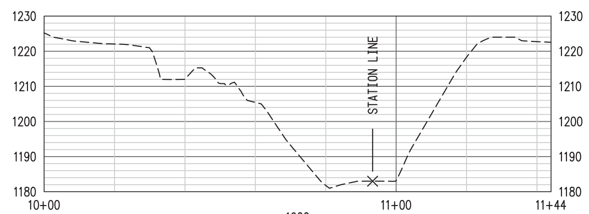
(LOOKING DOWNSTREAM)



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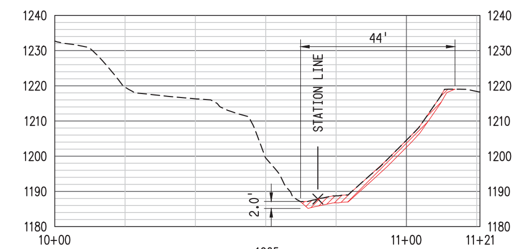

1965
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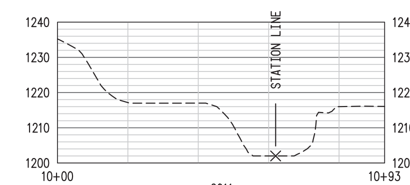
(LOOKING DOWNSTREAM)



2011
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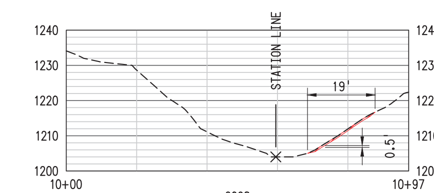
(LOOKING DOWNSTREAM)



2068
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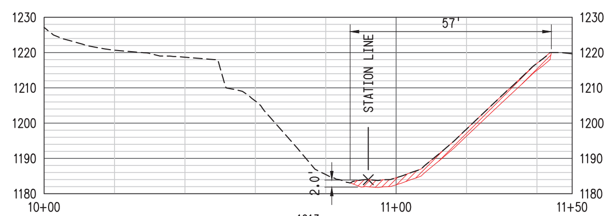

1913
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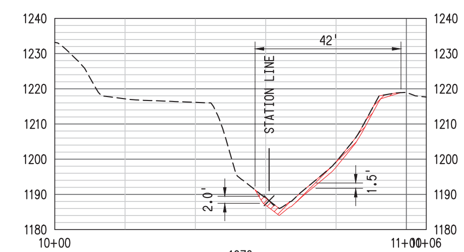

1976
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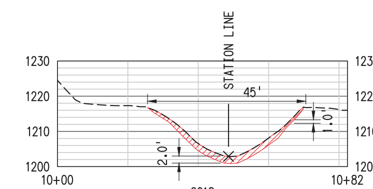

2018
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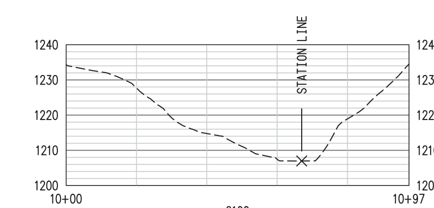
(LOOKING DOWNSTREAM)



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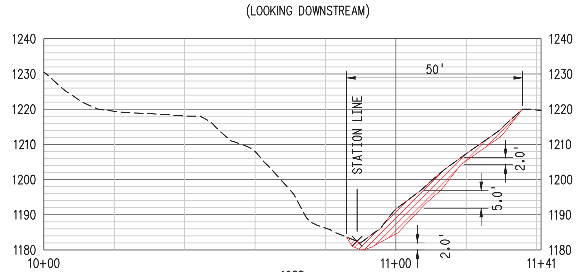
(LOOKING DOWNSTREAM)



1928
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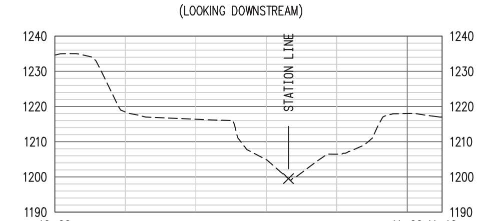
VERT. 1"=20'
(LOOKING DOWNSTREAM)



1987
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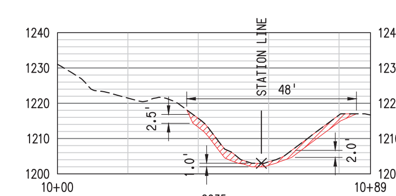
(LOOKING DOWNSTREAM)



2035
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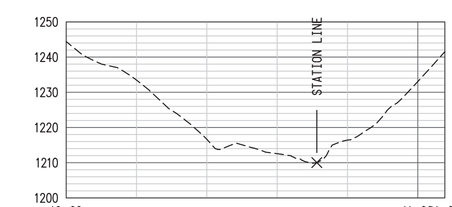
(LOOKING DOWNSTREAM)



2129
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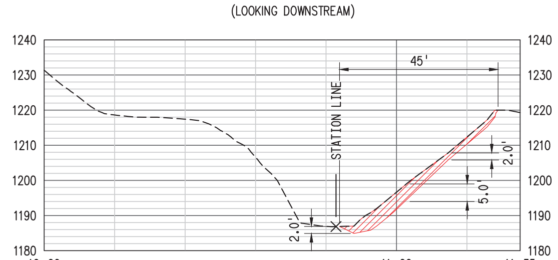

1938
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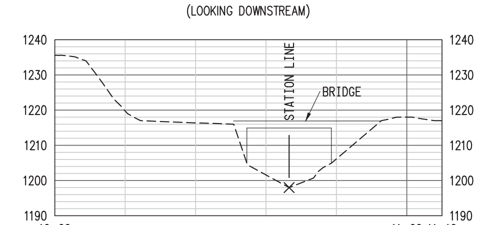

1988.5
SCALE: HORIZ. 1"=20'
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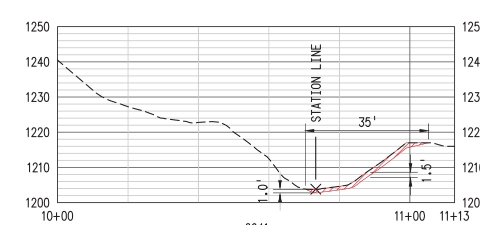
(LOOKING DOWNSTREAM)



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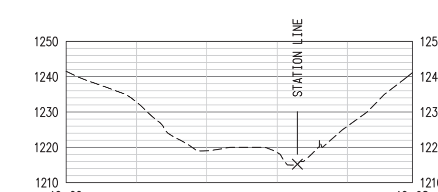

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(LOOKING DOWNSTREAM)

DIGALERT
DIAL TOLL FREE 811
AT LEAST TWO DAYS BEFORE YOU DIG

* REVISE ON AUTOCAD SYSTEM ONLY *

REFERENCE DRAWINGS	REFERENCE DRAWINGS	NO.	REVISIONS	DATE	SAP WO	SUPV	APPROVED	ENGR	CK'D	MADE	P.E.	NO.	REVISIONS	DATE	SAP WO	SUPV	APPROVED	ENGR	CK'D	MADE	P.E.

LOCATION: GOLETA-SANTA BARBARA 66kV T/L
GOLETA-CARPINTERIA-DESAL-SANTA BARBARA 66kV T/L
SANTA BARBARA-SAN MARCOS 66kV T/L
MISSION CREEK STREAM HABITAT RESTORATION PROJECT

SECTIONS

SOUTHERN CALIFORNIA EDISON
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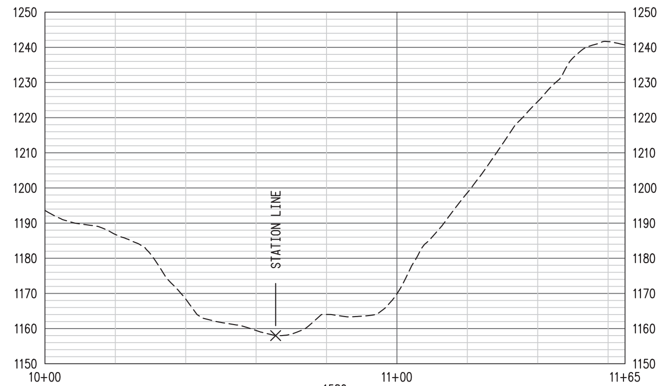
SHEET NO. 3
SCALE: 1"=20'
3 OF 3 SHTS.

SOUTHERN CALIFORNIA EDISON
2016 - S SIZE

1 2 3 4 5 6 7 8 9 10 11 12



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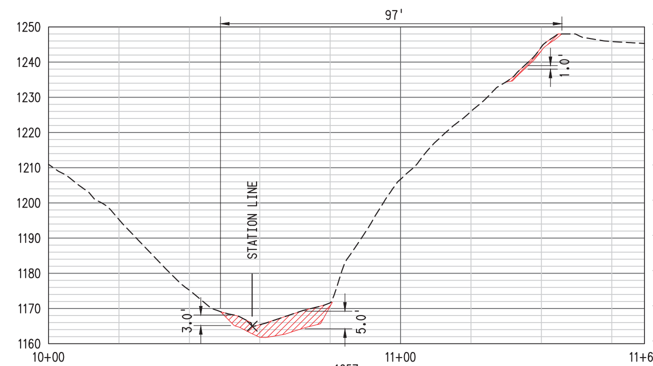

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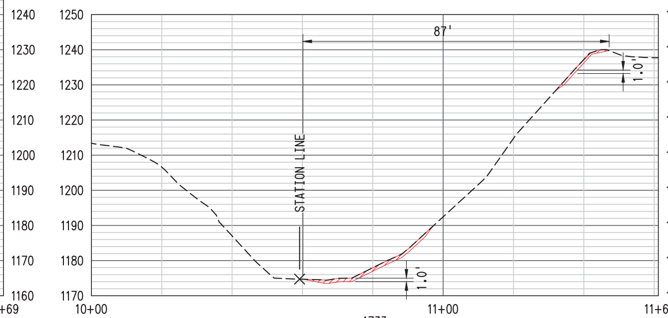

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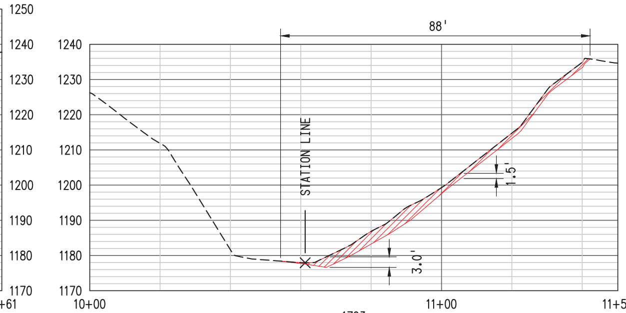

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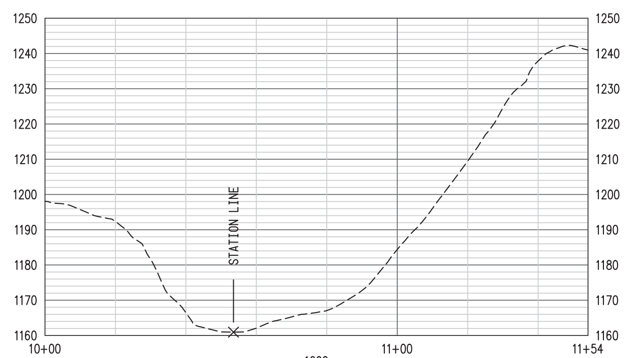

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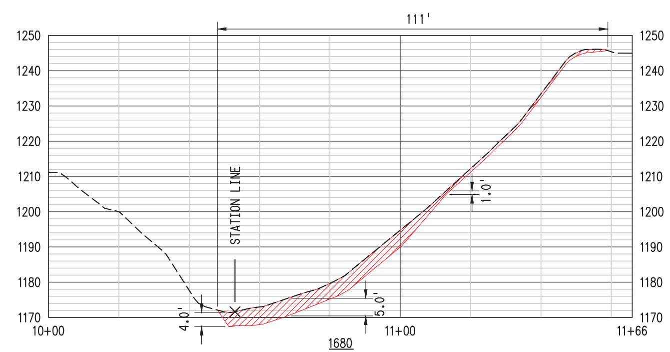

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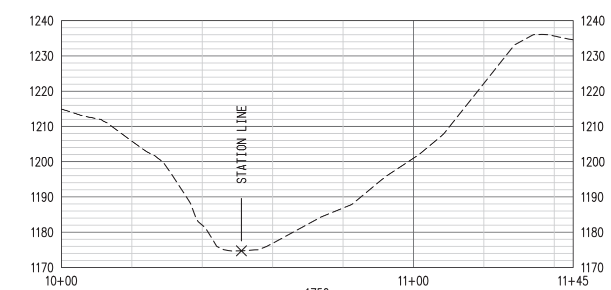

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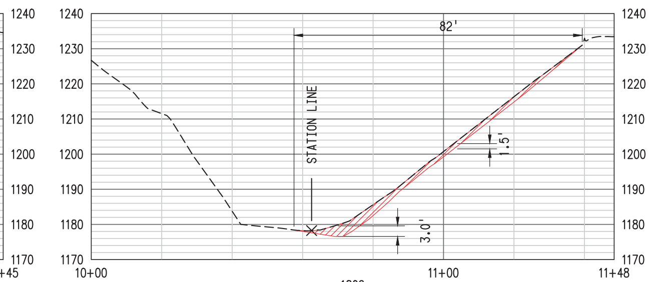

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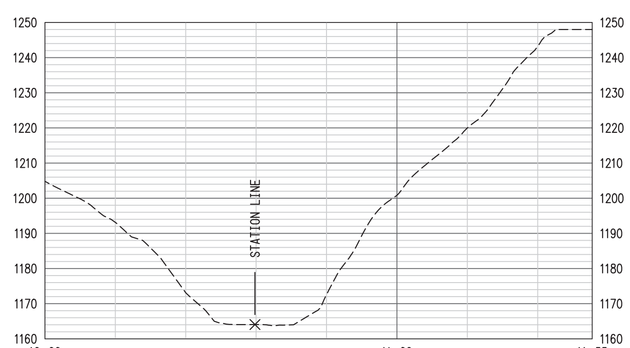

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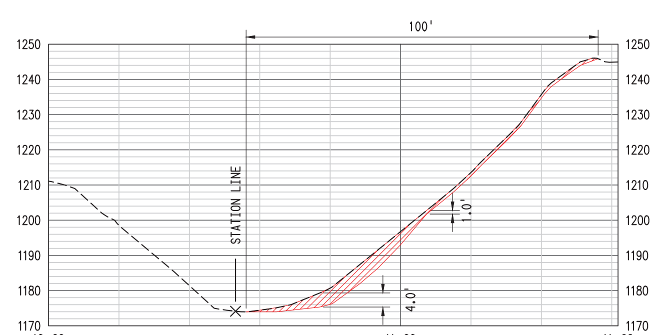

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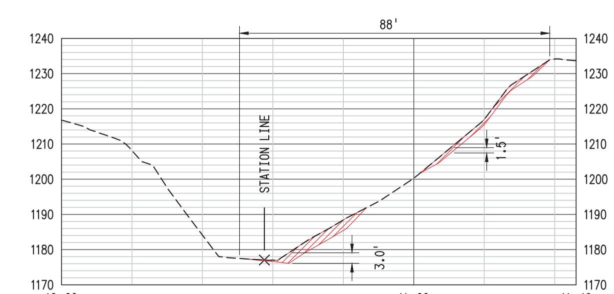

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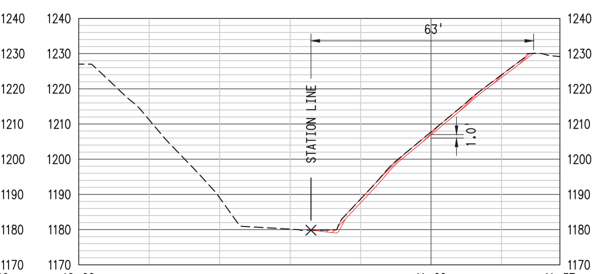

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(LOOKING DOWNSTREAM)

DIGALERT
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AT LEAST TWO DAYS BEFORE YOU DIG
UNDERGROUND SERVICE ALERT OF SOUTHERN CALIFORNIA

* REVISE ON AUTOCAD SYSTEM ONLY *

REFERENCE DRAWINGS	REFERENCE DRAWINGS	NO.	REVISIONS	DATE	SAP WO	SUPV	APPROVED	ENGR	CK'D	MADE	P.E.	NO.	REVISIONS	DATE	SAP WO	SUPV	APPROVED	ENGR	CK'D	MADE	P.E.

LOCATION: GOLETA-SANTA BARBARA 66kV T/L
GOLETA-CARPINTERIA-DESAL-SANTA BARBARA 66kV T/L
SANTA BARBARA-SAN MARCOS 66kV T/L
MISSION CREEK STREAM HABITAT RESTORATION PROJECT

SECTIONS

SOUTHERN CALIFORNIA EDISON
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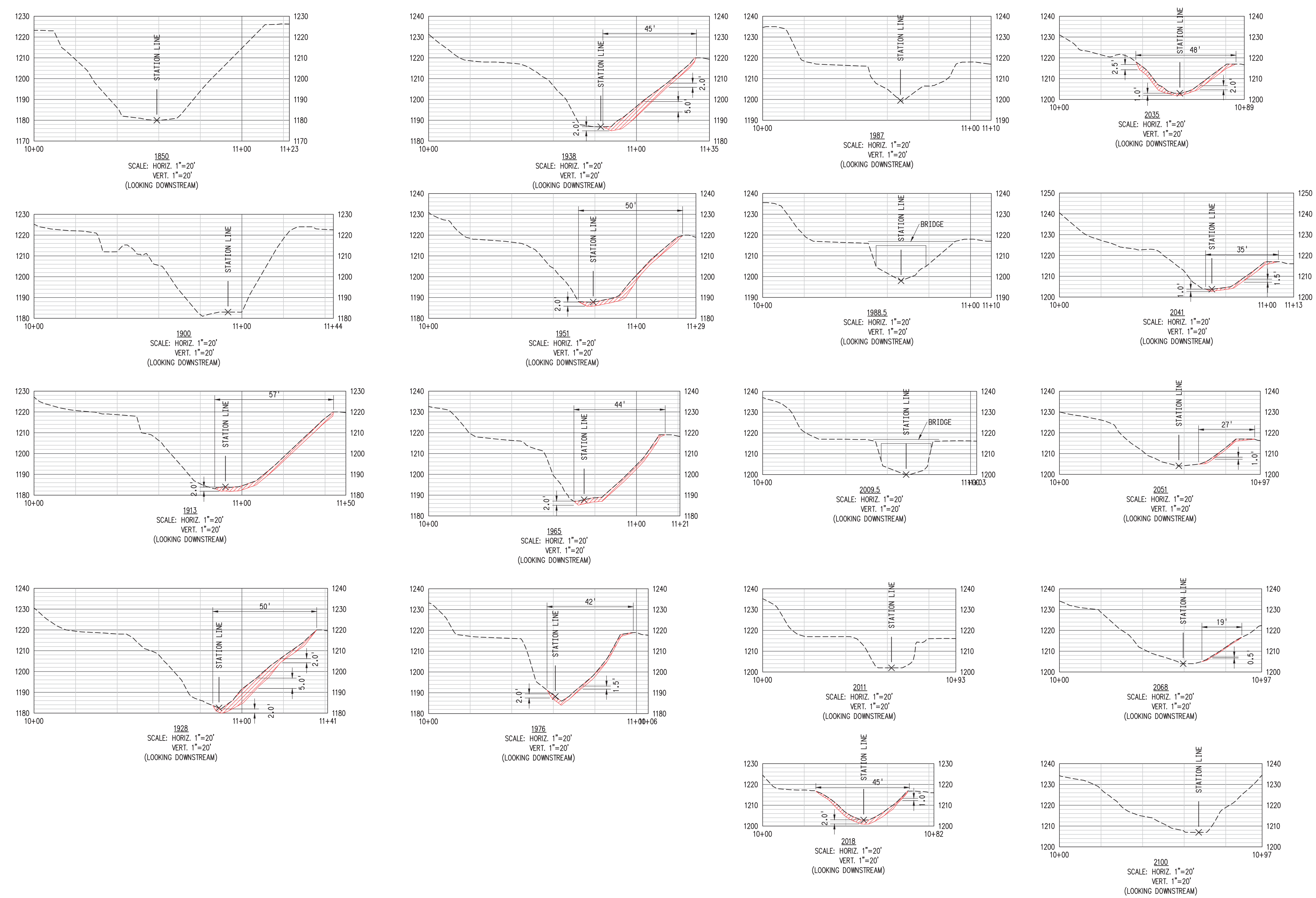
SHEET NO.
2
SCALE: 1"=20'
2 OF 3 SHTS.

SOUTHERN CALIFORNIA EDISON
2016 - 5 SIZE

APPENDIX F



REFERENCE DRAWINGS	REFERENCE DRAWINGS	NO.	REVISIONS	DATE	SAP WO	SUPV	APPROVED	ENGR	CK'D	MADE	P.E.	NO.	REVISIONS	DATE	SAP WO	SUPV	APPROVED	ENGR	CK'D	MADE	P.E.

LOCATION: GOLETA–SANTA BARBARA 66kV T/L
GOLETA–CARPINTERIA–DESAL–SANTA BARBARA 66kV T/L
SANTA BARBARA–SAN MARCOS 66kV T/L

MISSION CREEK STREAM HABITAT RESTORATION PROJECT

SECTIONS

SOUTHERN CALIFORNIA EDISON An EDISON INTERNATIONAL Company

SHEET NO. 3

SCALE: 1"=20'

3 OF 3 SHTS.

* REVISE ON AUTOCAD SYSTEM ONLY *

SOUTHERN CALIFORNIA EDISON
2016 - S SIZE

APPENDIX F

APPENDIX G

Memorandum

HELIX Environmental Planning, Inc.
7578 El Cajon Boulevard
La Mesa, CA 91942
619.462.1515 **tel**
619.462.0552 **fax**
www.**helixepi**.com

HELIX
Environmental Planning

Date: **November 19, 2021**

To: **Mark Mikami: WILSON MIKAMI CORPORATION**

cc: **Jim Burton: EcoKai**
Todd Bear: EcoKai
Peter Tomsovic: HELIX

From: **Justin Fischbeck**

Subject: **Sidecast data for Mission Creek; Creek areas 1-4**

HELIX Project:

Message:

This memorandum accompanies the data requested related to sidecast removal within Creek Sites 1 through 4 of the Mission Creek Restoration Project as it pertains to your hydrologic modeling effort. The attached table provides dimensions of sidecast material that lies within the top water surface width of the modeled stream flow (Q = 1673 cfs) and along specified cross-sections provided by Wilson Mikami. Dimensions provided include flow top width distance from creek centerline, main sidecast deposit distance from creek centerline (based on toe of slope of sidecast material), and average width and depth of sidecast material within the modeled stream flow, including the main sidecast deposits and areas of sidecast overflow into the creek bed.

The transmitted tabular data represents field data collected and compiled by EcoKai for the purpose of use in the regulatory permitting process and development of the HRP. The data was collected for the purposes of creek characterization and restoration design and should not be considered as having design survey-level accuracy. As such, the precision of this data has limitations. It is up to the end user to decide how best to incorporate the information and its applicability for their own objectives.

The following are assumptions used to compile and present these data for your consideration in your model output:

- Flow top widths are assumed to be equidistance on both left and right banks from the creek centerline. Top widths of stream flow data are found in the Pre-Developed Condition table in the Drainage Report for the Mission Creek Habitat Restoration Project (October 21, 2021).

- It is assumed that the placement of the creek centerline presented in the Drainage Report and the creek centerline used in EcoKai's field survey are comparable.

- The average sidecast depths within flow top widths along each HEC-RAS cross-section are estimated based on EcoKai's field observations and are not based on survey data or direct measurement of sidecast depth above the natural ground surface along each cross-section.

- All sidecast material located within Creek Sites 1 through 4 will be removed.

Creek Site	Right Bank (RB) / Left Bank (LB)	EK Station (ft)	HEC-RAS Station Sections	Flow Top Width Distance from Centerline (ft) *	Main SC Deposit Distance (toe of slope) from Centerline (ft) **	Ave Width of SC within Q (ft) ***	Ave Depth of SC within Q (ft) ****	Estimated Depth of SC Overflow within Creek Bed (ft)
1	RB	67.5	2068	22.0	9.0	13.0	0.5	0
	RB	84.5	2051	21.5	9.5	12.0	1.0	0
	RB	94.5	2041	17.0	7.5	9.5	1.5	1
	RB	100.5	2035	15.0	5.0	10.0	2.0	1
	RB	117.5	2018	14.0	5.0	9.0	2.0	1
	LB	100.5	2035	15.0	5.0	10.0	2.5	1
2	RB	159.5	1976	9.0	5.0	4.0	1.5	2
	RB	170.5	1965	10.5	5.5	5.0	2.0	2
	RB	184.5	1951	11.5	8.0	3.5	2.0	2
	RB	197.5	1938	10.5	4.0	6.5	5.0	2
	RB	207.5	1928	10.5	4.5	6.0	5.0	2
	RB	222.5	1913	14.0	5.5	8.5	2.0	2
3	RB	333.5	1802	17.0	6.5	10.5	3.0	0
	RB	342.5	1793	19.0	6.0	13.0	3.0	0
	RB	358.5	1777	15.0	6.0	9.0	3.0	0
4	RB	402.5	1733	17.0	16.0	1.0	1.0	0
	RB	435.5	1700	17.0	9.0	8.0	4.0	0
	RB	455.5	1680	15.0	0.0	15.0	5.0	4
	RB	478.5	1657	14.0	1.0	13.0	5.0	3

* From Pre-Developed Data Table in Drainage Report - Assumes Top Width is equidistance on L and R banks from creek centerline (e.g., Top Width = 44 ft, = 22 feet both sides of creek centerline)
** Field Measured by EcoKai along creek centerline as determined by EcoKai
*** Assumes HEC-RAS and EcoKai creek centerlines are the same and assumes stations along centerline are equivalent
**** Based on field estimates and photo reference
Q=1673 cfs