

Hydraulic Report (Final)

Haggerty Road over
Willow Creek
CS 82292 – JN 115177

July 31, 2013

Owner:



Prepared For:



Prepared By:



Prepared by:


Therese Pasichnyk, E.I.T., HH Engineering Ltd.

Reviewed By:


David Strockis, P.E., HH Engineering Ltd.

Approved By:


Alan L. Halbeisen, P.E., HH Engineering Ltd.

SUMMARY

This hydraulic analysis was conducted to examine the backwater effect of the structure which carries Haggerty Road over Willow Creek in Wayne County. Although Haggerty Road over Willow Creek is not within the proposed limits of construction of the Preferred Alternative and the crossing is not anticipated to be lengthened or replaced the following analysis was performed in the event the road construction limits extend to include the crossing as the project moves into design. This analysis found an improvement with the proposed conditions as compared with existing conditions for the 1% chance (100 year) flood event.

PROJECT DATA

STRUCTURE NUMBER:	B05
CONTROL SECTION:	82292
JOB NUMBER:	115177
STREAM:	Willow Creek
TOWNSHIP:	Canton Township
COUNTY:	Wayne
SECTION:	12
TOWN AND RANGE:	Town 2 South, Range 8 East
DRAINAGE AREA:	4.7 square miles
DISCHARGE:	10-year (10% chance flow) 480 cfs
	50-year (2% chance flow) 600 cfs
	100-year (1% chance flow) 650 cfs
	500-year (0.2% chance flow) 800 cfs

METHOD OF ANALYSIS

The U.S. Army Corps of Engineers HEC-RAS computer program, version 4.1.0, was used to determine the water surface profile elevations.

SCOPE OF STUDY

Willow Creek flows from west to east under Haggerty Road via two corrugated metal pipe culverts. The crossing is approximately 1/4 mile north of M-153 (Ford Road). Haggerty Road over Willow Creek consists of a five lane road with curb and gutter on each side. The existing crossing consists of two 11-foot span (22 foot hydraulic width) by 8-foot rise culverts with a total length (hydraulic length) of 100 feet. The upstream and downstream ends of the culverts have vertical concrete headwalls normal to the metal pipes and 45-degree flared wingwalls.

The existing culvert pipes show areas deflections, with particular areas being significant, and corrosion at various locations along their length. Certain areas are located under the roadway.

The proposed structure would consist of a single span prestressed concrete box beam superstructure (12 inch deep side-by-side beams with concrete deck) with total length of 28 feet (min) on pile supported cast-in-place concrete abutments. The hydraulic length of the structure would be approximately 120 feet. The low chord of the proposed structure would be set at the same elevation (EL 671.4) as the crown of the existing culvert. The overall available flow area is increased due to the longer span length. If replacement of this crossing is necessary, the Haggerty Road profile will need to be raised approximately 1 foot over Willow Creek for the proposed low chord elevation to match the crown elevation of the existing culvert pipe.



The existing channel for the creek is in general 10 to 13 feet in width at the bottom, 14 to 36 feet wide at the top (bank to bank) and an average depth of 1.2 feet at normal flow. The channel meanders through the crossing area limits. It enters the culverts from the upstream end at approximately 50-degrees to the headwall and exits the downstream end of the culverts normal to the headwall. Beyond the limits of the study, the channel is relatively straight upstream and downstream. Throughout the study reach, the channel has well defined banks upstream and downstream of the crossing.

The reach studied begins approximately 190 feet downstream of the existing structure and ends approximately 520 feet upstream. No other crossing are present within the limits of this analysis.

GEOMETRY OF THE MODEL

River cross sections were obtained by field survey by SSI at locations as recommended by MDOT and HH Engineering after an initial field visit. Survey data was recorded using a data collector. A baseline was established on the channel bank and referenced to the road centerline. One additional cross section upstream and downstream was added to the model beyond the surveyed cross sections. These additional sections were provided by the U.S. Army Corps of Engineers (USACE) HEC-RAS model/analysis performed on Willow Creek in 2005. All cross sections were tied to the baseline. Elevations are given in North American Vertical Datum of 1988 (NAVD 88).

MANNING'S ROUGHNESS COEFFICIENTS

Alan Halbeisen, P.E. and David Strockis, P.E. of HH Engineering (HHE) performed inspection of the site on December 12, 2012 to gather information on site conditions prior to running HEC-RAS. Manning's roughness coefficients ("n" values) are based on values given in Table 4-1 of the MDOT Drainage Manual. The overbanks within the study reach have medium brush and trees along the banks. The recommended "n" values for the channel are 0.04 downstream of the existing structure and 0.04 upstream. The recommended "n" value for the overbanks is 0.12 above the top of bank upstream and downstream of the existing crossing.

The proposed condition was modeled using the same values as the existing condition.

EXPANSION AND CONTRACTION COEFFICIENTS

Based on the stream geometry, expansion and contraction coefficients of 0.3 and 0.1 respectively were used. At the crossing, the expansion and contraction coefficients of 0.5 and 0.3 were used.

STARTING WATER SURFACE ELEVATION

The starting water surface elevation for the 1 percent chance (100 year) storm event was taken from the downstream channel cross section that was copied from the USACE HEC-RAS model. The flow data from the USACE model matches the flow data provided by MDEQ for the 1 percent chance storm event.

FINDINGS

The analysis performed indicates an improved condition with the proposed condition for the 1 percent (100 year) storm condition. The attached summary describes this improvement.



APPENDICES

SUMMARY TABLE
LOCATION MAP AND MAP OF CROSS SECTIONS
SECTION LOCATIONS
STREAM PROFILE & CROSS SECTIONS
MDEQ DISCHARGE INFORMATION
PHOTOGRAPHS
COMPUTER INPUT AND OUTPUT



SUMMARY TABLE



WILLOW CREEK

100-YEAR FLOOD FREQUENCY: EXISTING VS. PROPOSED CONDITIONS

ELEVATIONS ARE IN NAVD88.

SEC NO	VELOCITY IN CHANNEL (FPS)		TOP WIDTH (FT)		ENERGY GRADE (FT)		CHANGE IN ENERGY (FT)	COMPUTED WSEL (FT)		CHANGE IN WSEL (FT)
	EX	PROP	EX	PROP	EX	PROP		EX	PROP	
55	2.89	3.04	118.06	116.47	673.04	672.85	-0.19	672.93	672.72	-0.21
50	4.05	4.93	181.01	40.98	672.71	672.39	-0.32	672.50	672.04	-0.46
40	3.58	3.87	186.60	98.36	672.66	672.29	-0.37	672.49	672.09	-0.40
30	6.21	2.99	94.77	94.24	672.57	672.25	-0.32	672.13	672.11	-0.02
BRIDGE										
20	3.87	2.94	98.08	103.56	672.16	672.12	-0.04	671.92	671.99	0.07
10	3.93	3.93	148.94	148.94	672.08	672.08	0.00	671.89	671.89	0.00
5	4.48	4.48	152.75	152.75	671.95	671.95	0.00	671.73	671.73	0.00



LOCATION MAP AND MAP OF CROSS SECTIONS





Figure 1 - Vicinity Map



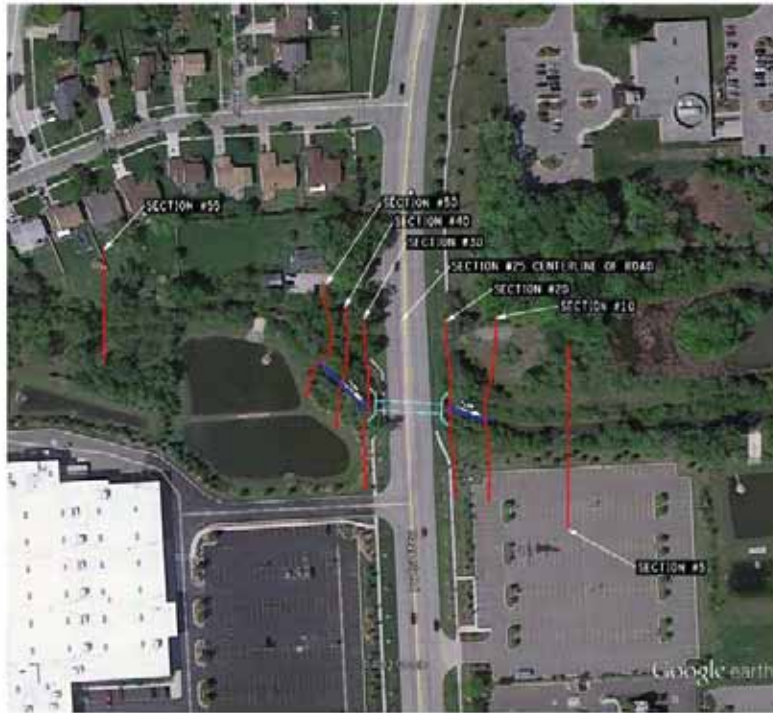
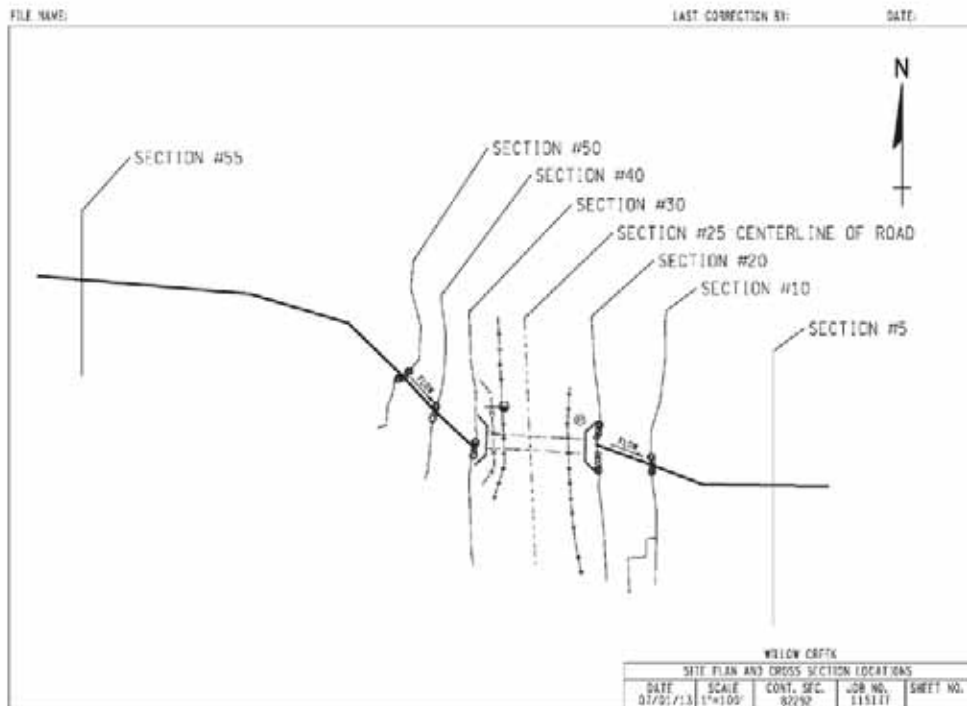
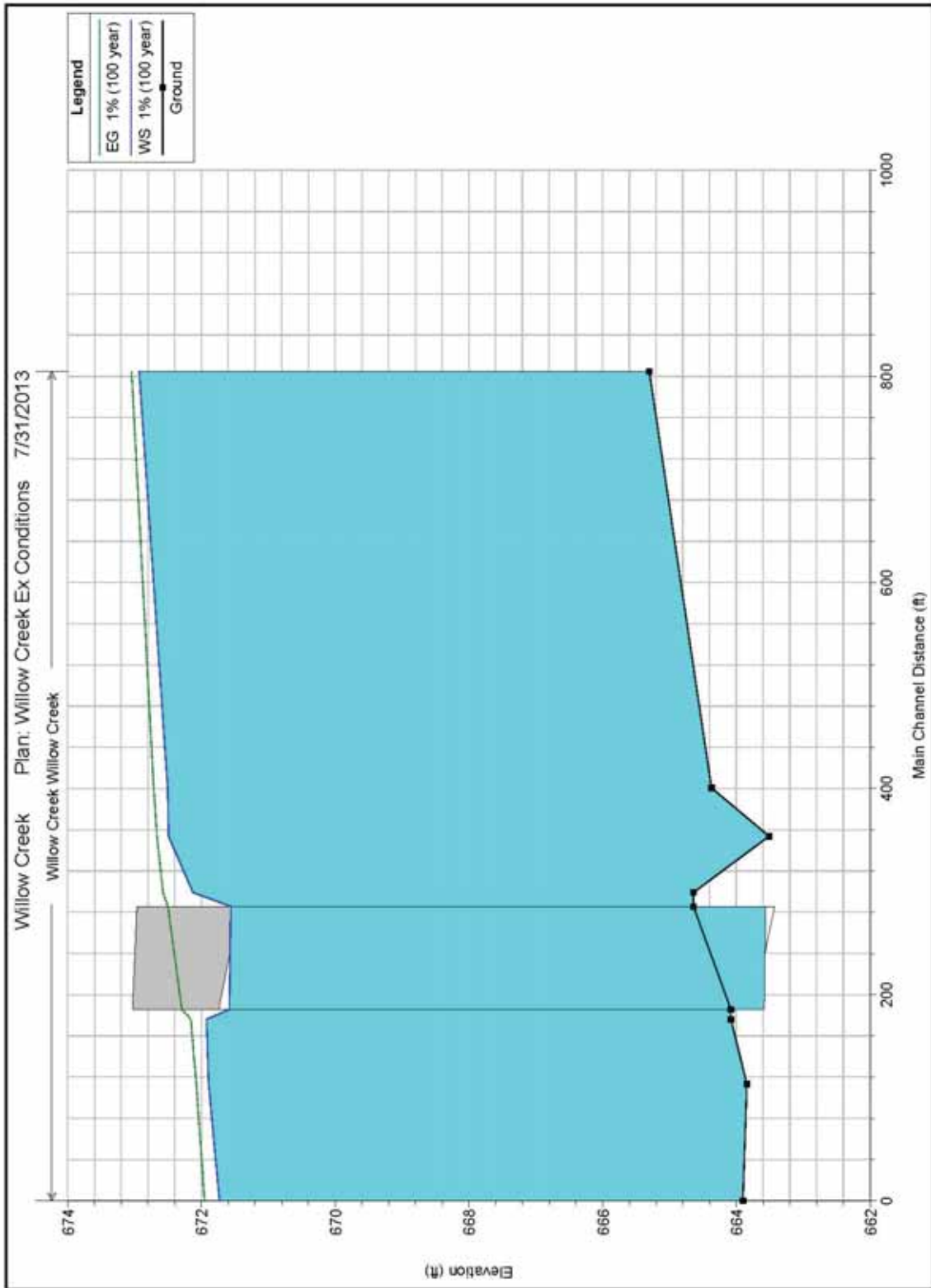


Figure 2 - Aerial Photo Showing Approximate Cross-Section Locations



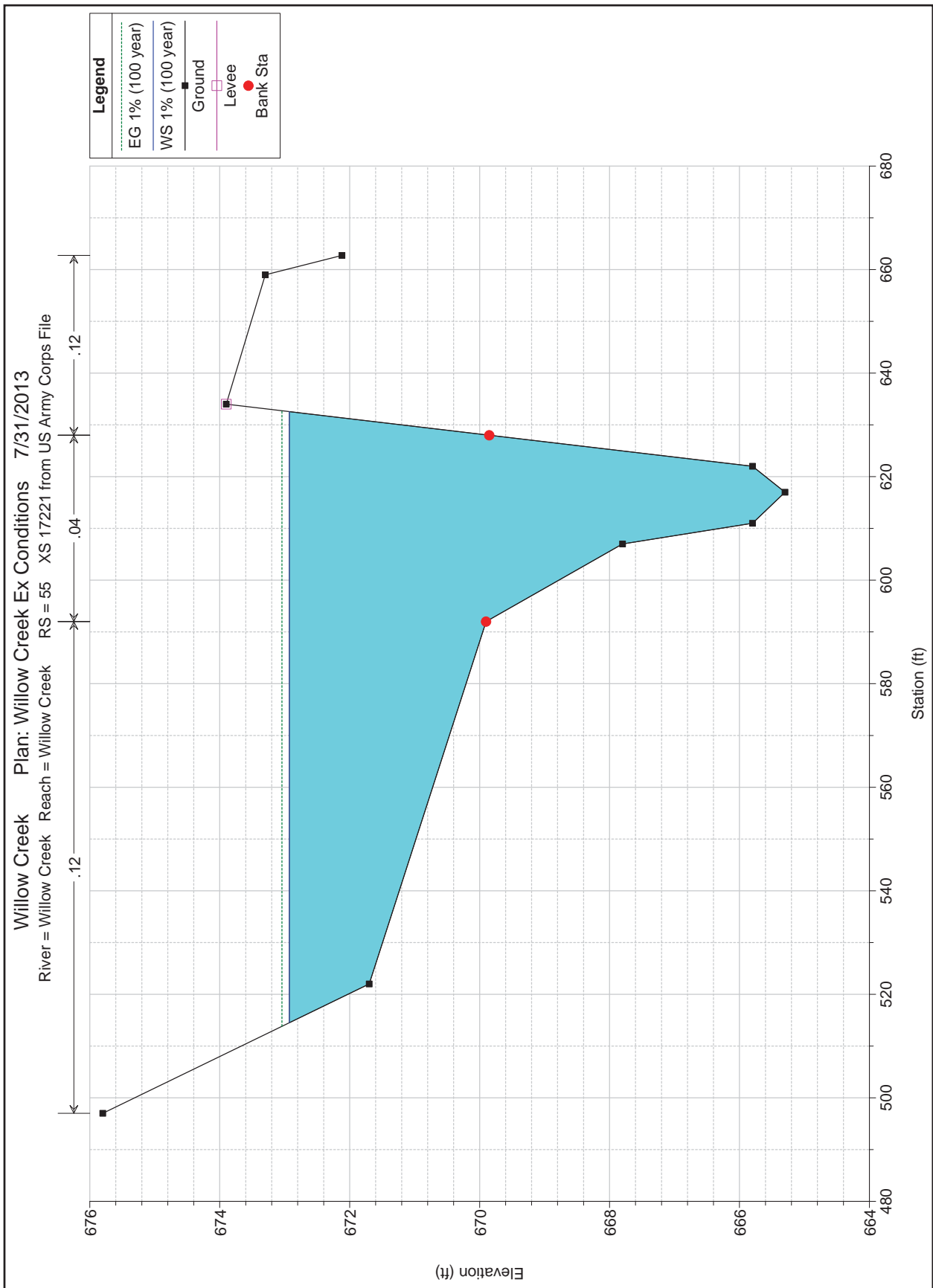
STREAM PROFILE & CROSS SECTIONS

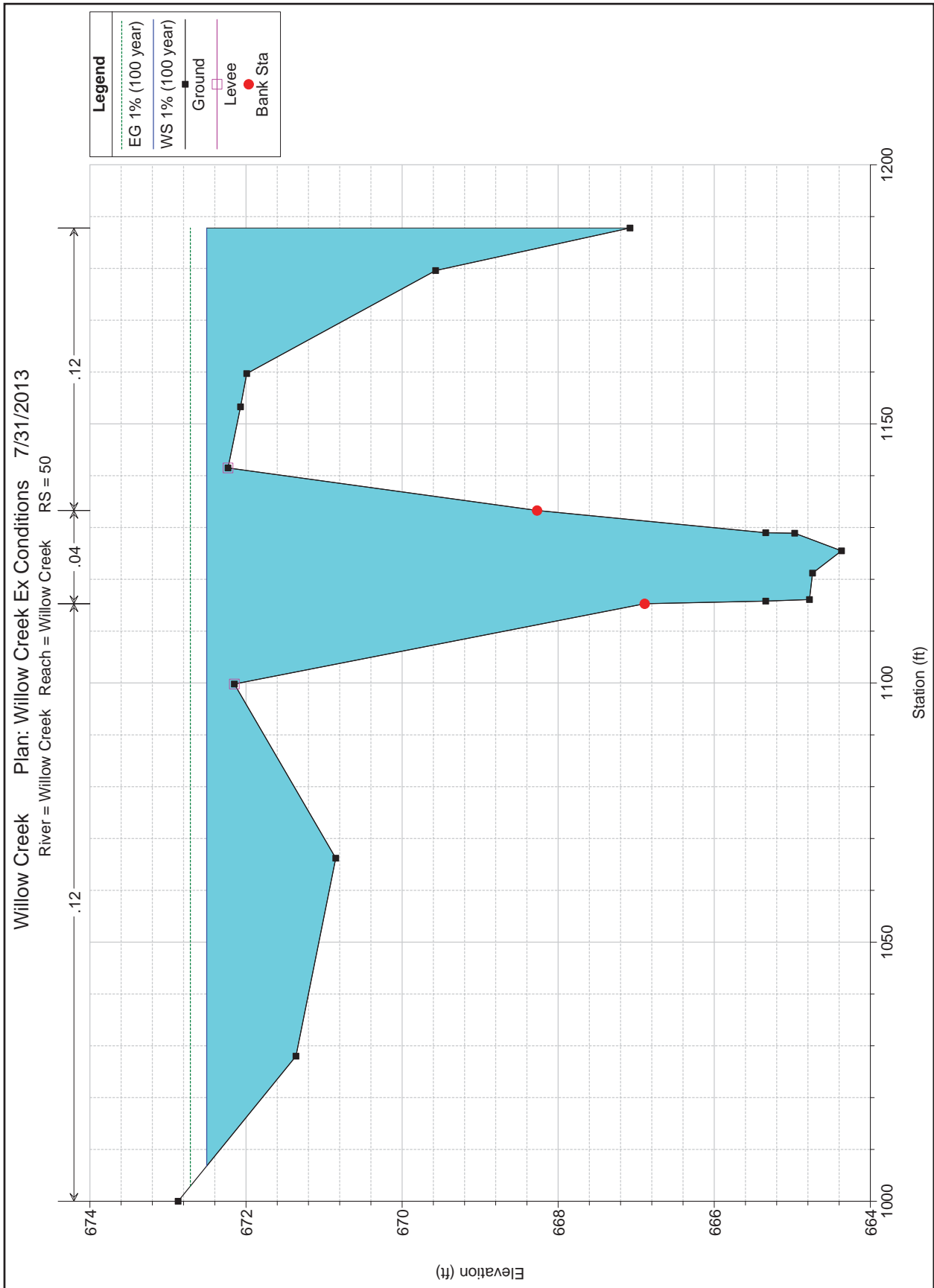




Haggerty Road over
 Willow Creek
 CS 82292 - JN 115177

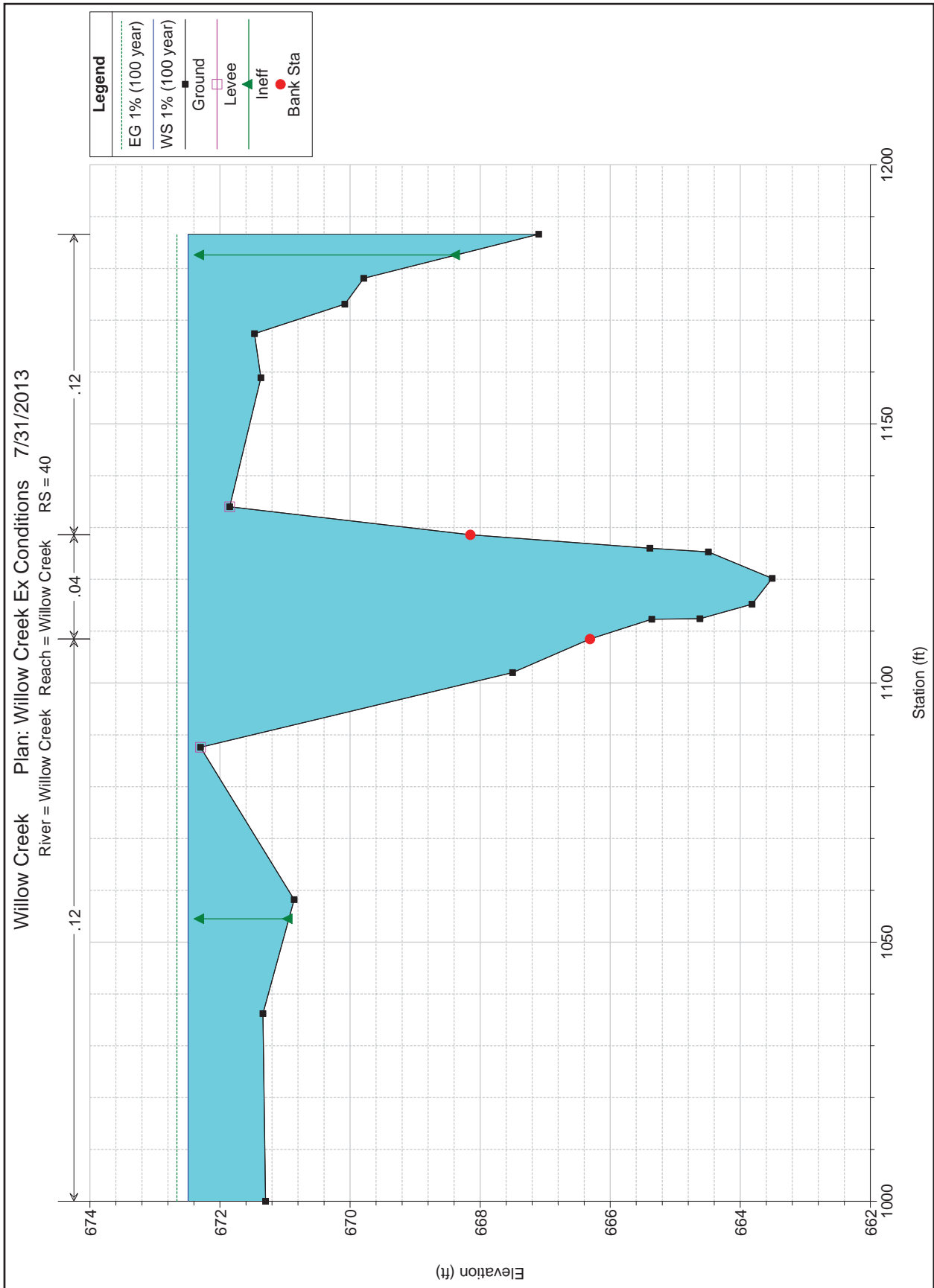






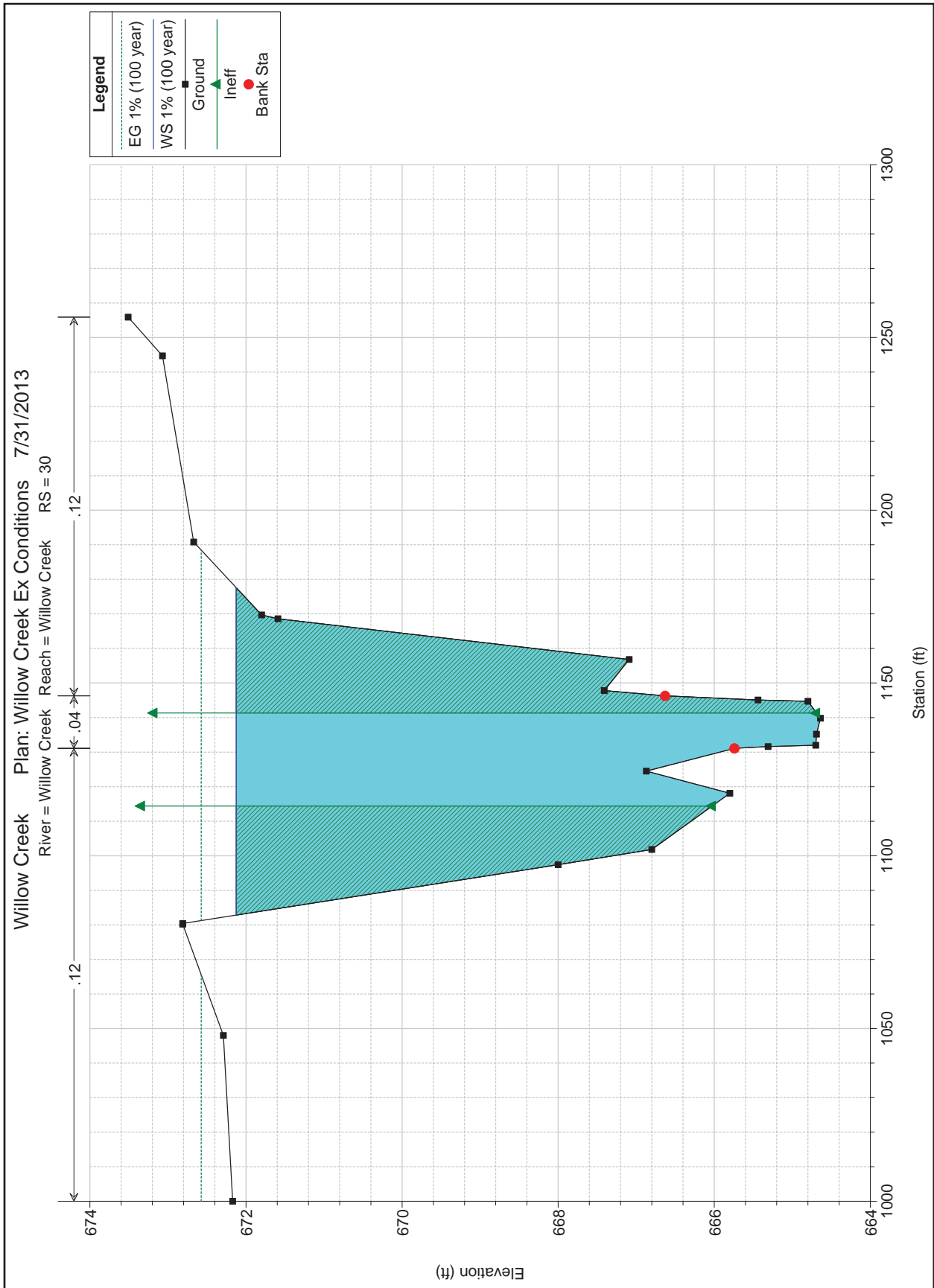
Haggerty Road over
 Willow Creek
 CS 82292 - JN 115177





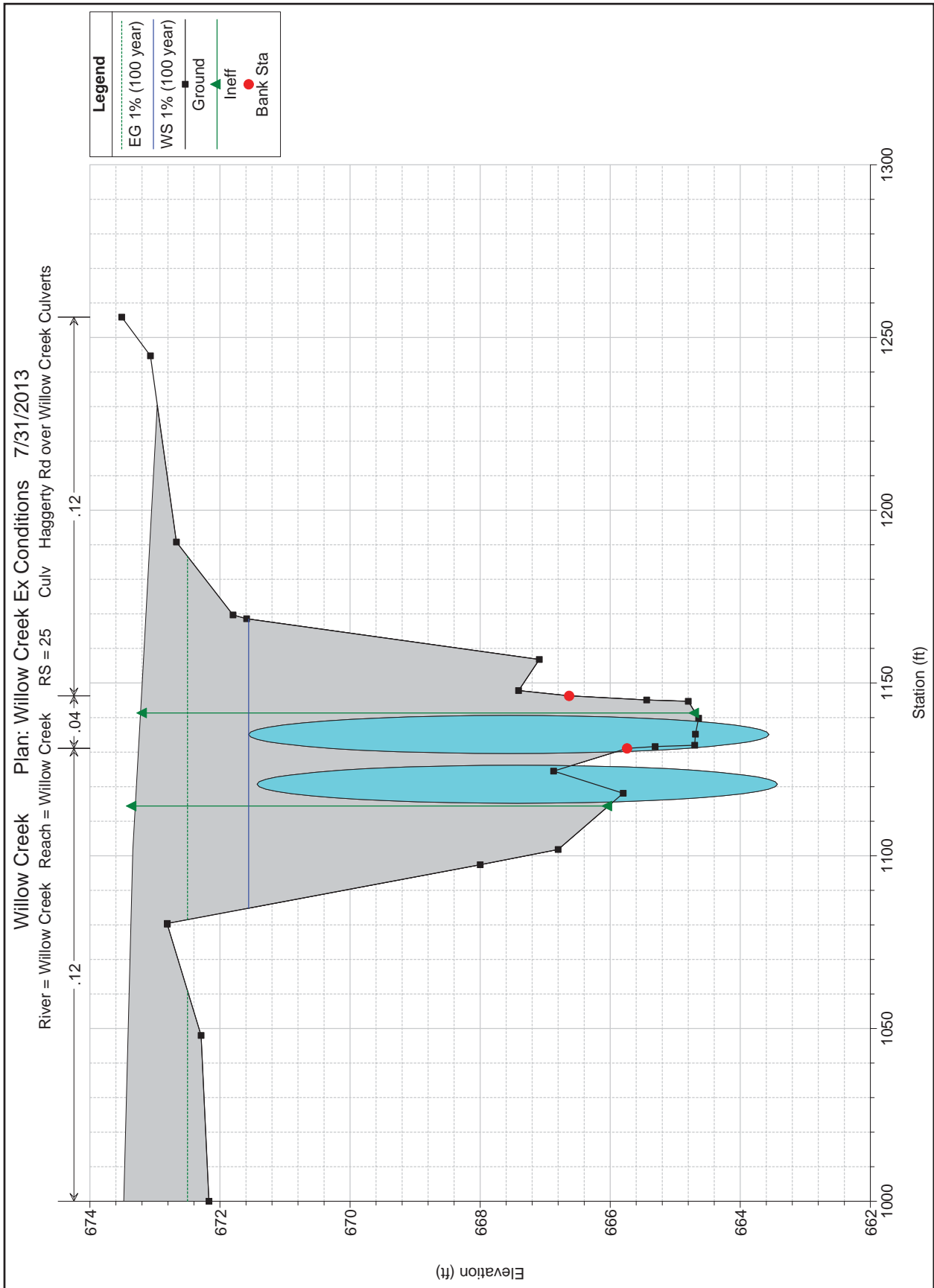
Haggerty Road over
 Willow Creek
 CS 82292 - JN 115177





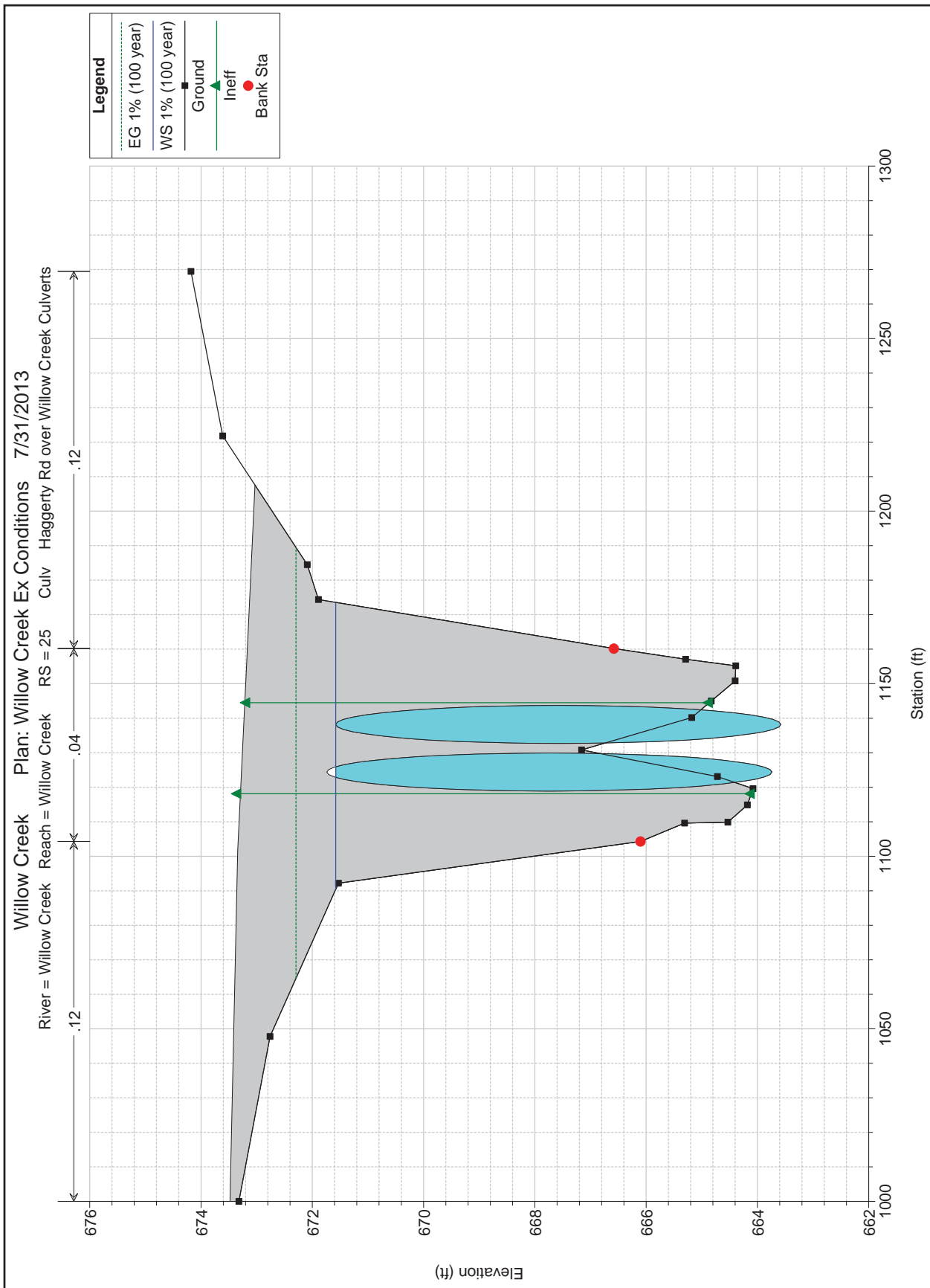
Haggerty Road over
 Willow Creek
 CS 82292 - JN 115177



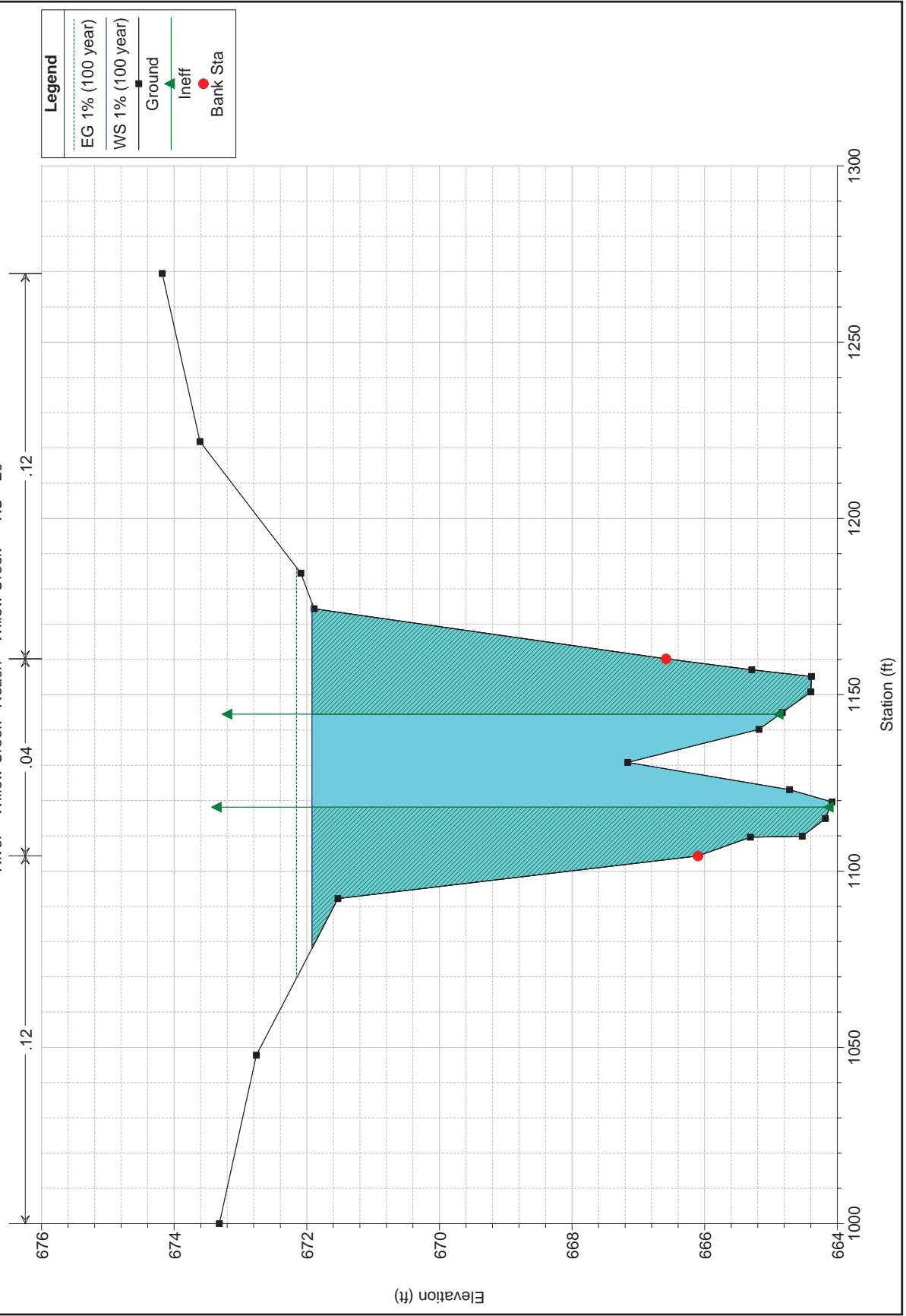


Haggerty Road over
 Willow Creek
 CS 82292 - JN 115177





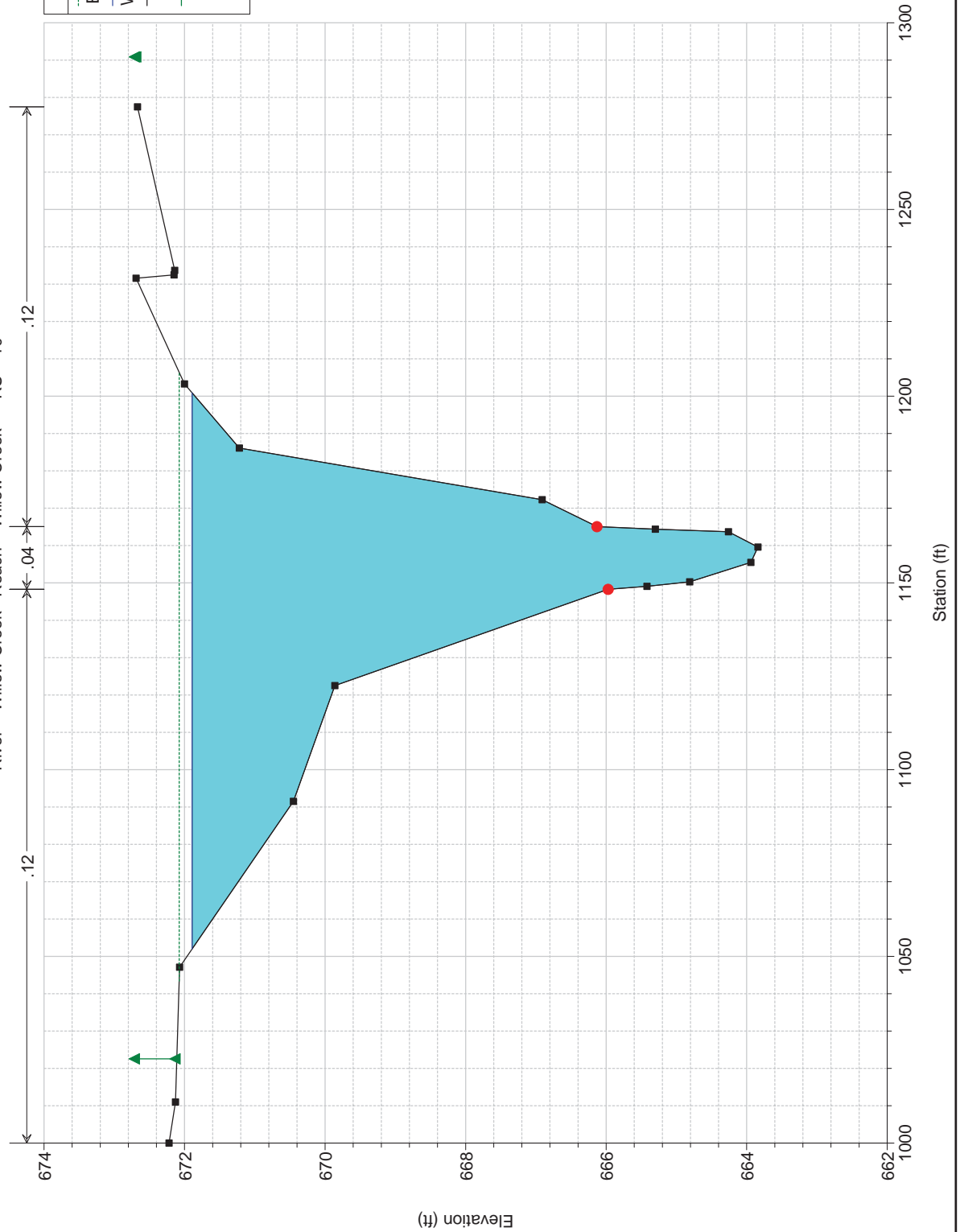
Willow Creek Plan: Willow Creek Ex Conditions 7/31/2013
 River = Willow Creek Reach = Willow Creek RS = 20

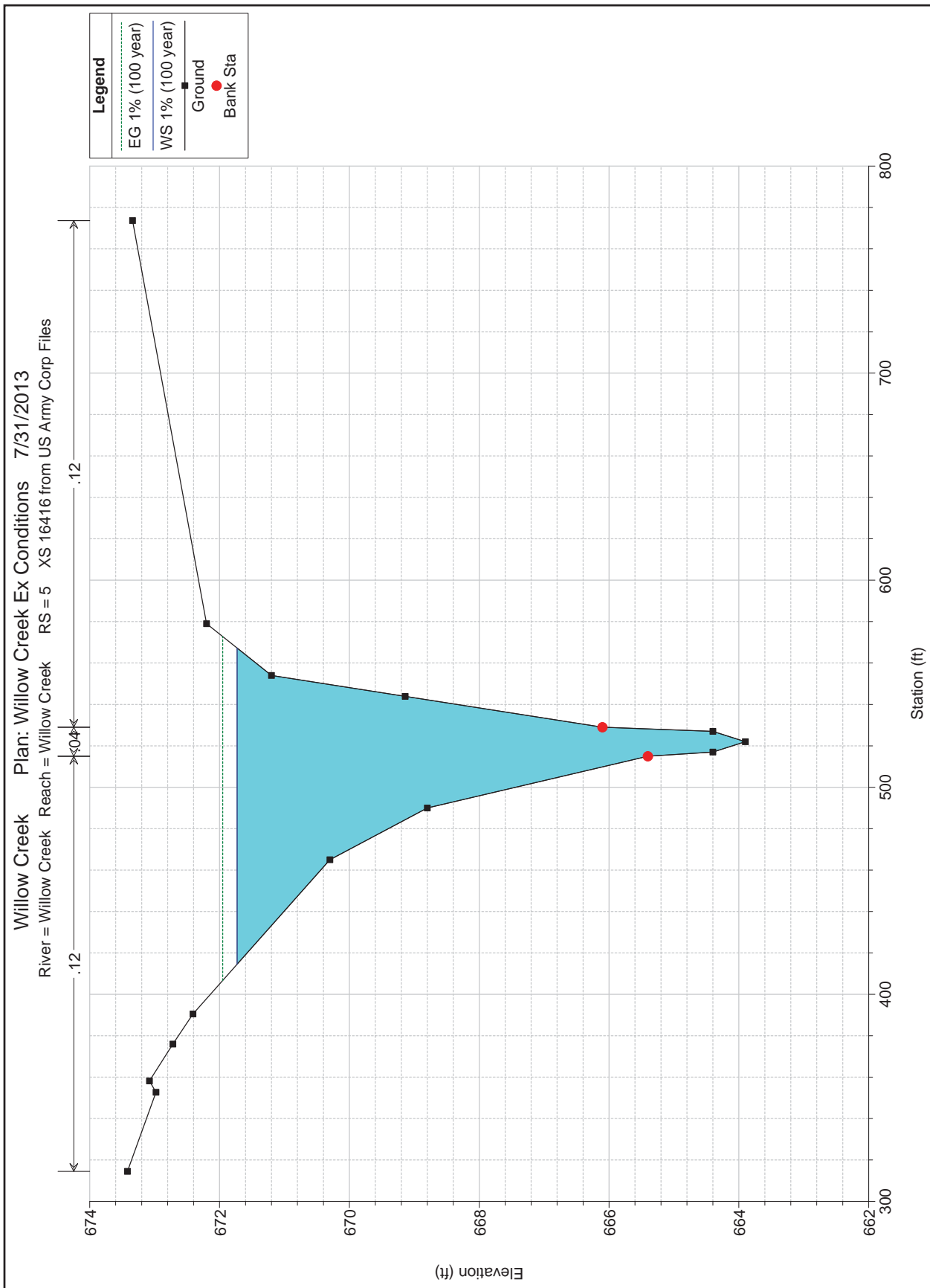


Willow Creek Plan: Willow Creek Ex Conditions 7/31/2013

River = Willow Creek Reach = Willow Creek RS = 10

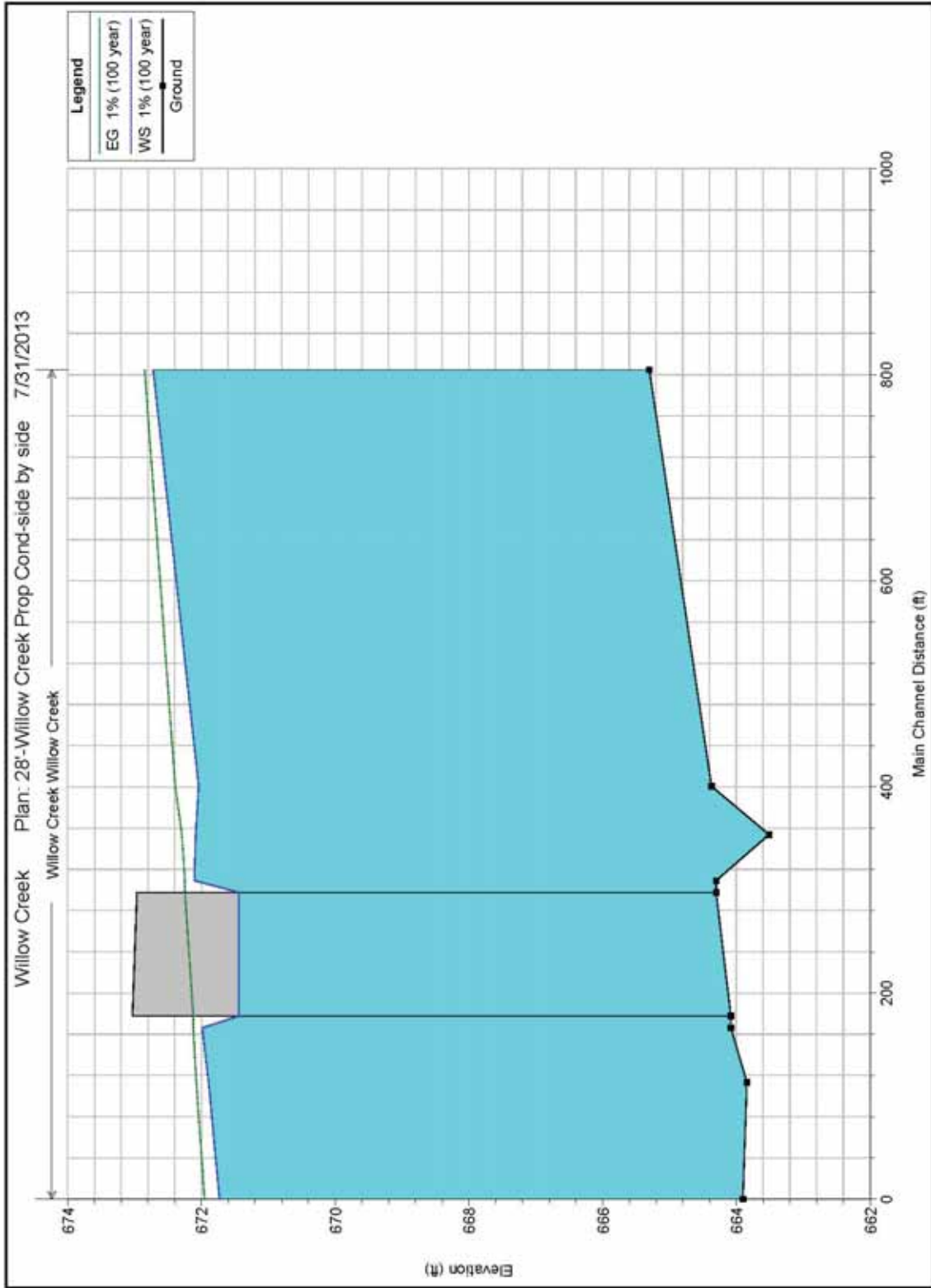
Legend	
—	EG 1% (100 year)
—	WS 1% (100 year)
■	Ground
▲	Ineff
●	Bank Sta





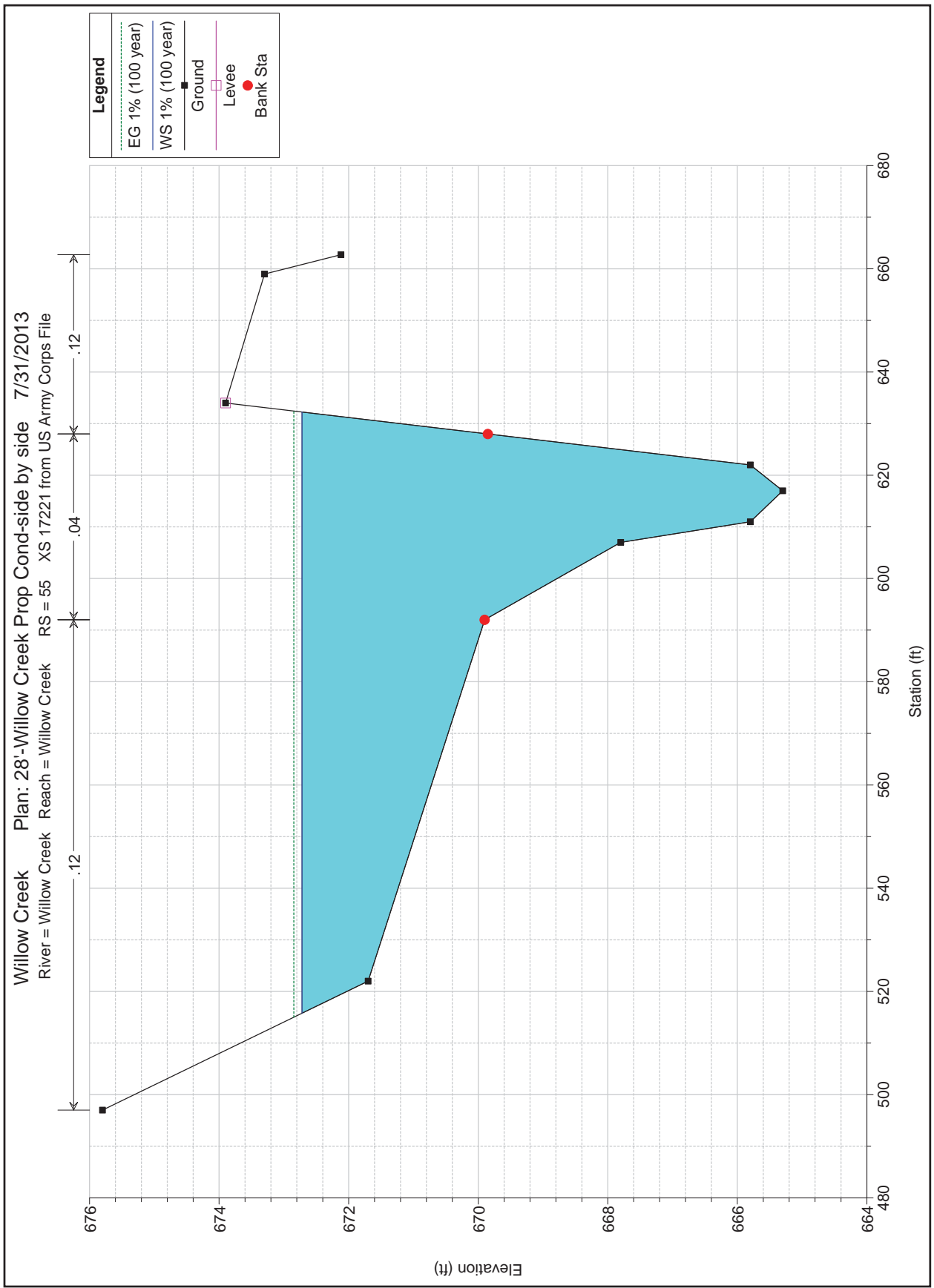
Haggerty Road over
 Willow Creek
 CS 82292 - JN 115177





Haggerty Road over
 Willow Creek
 CS 82292 - JN 115177

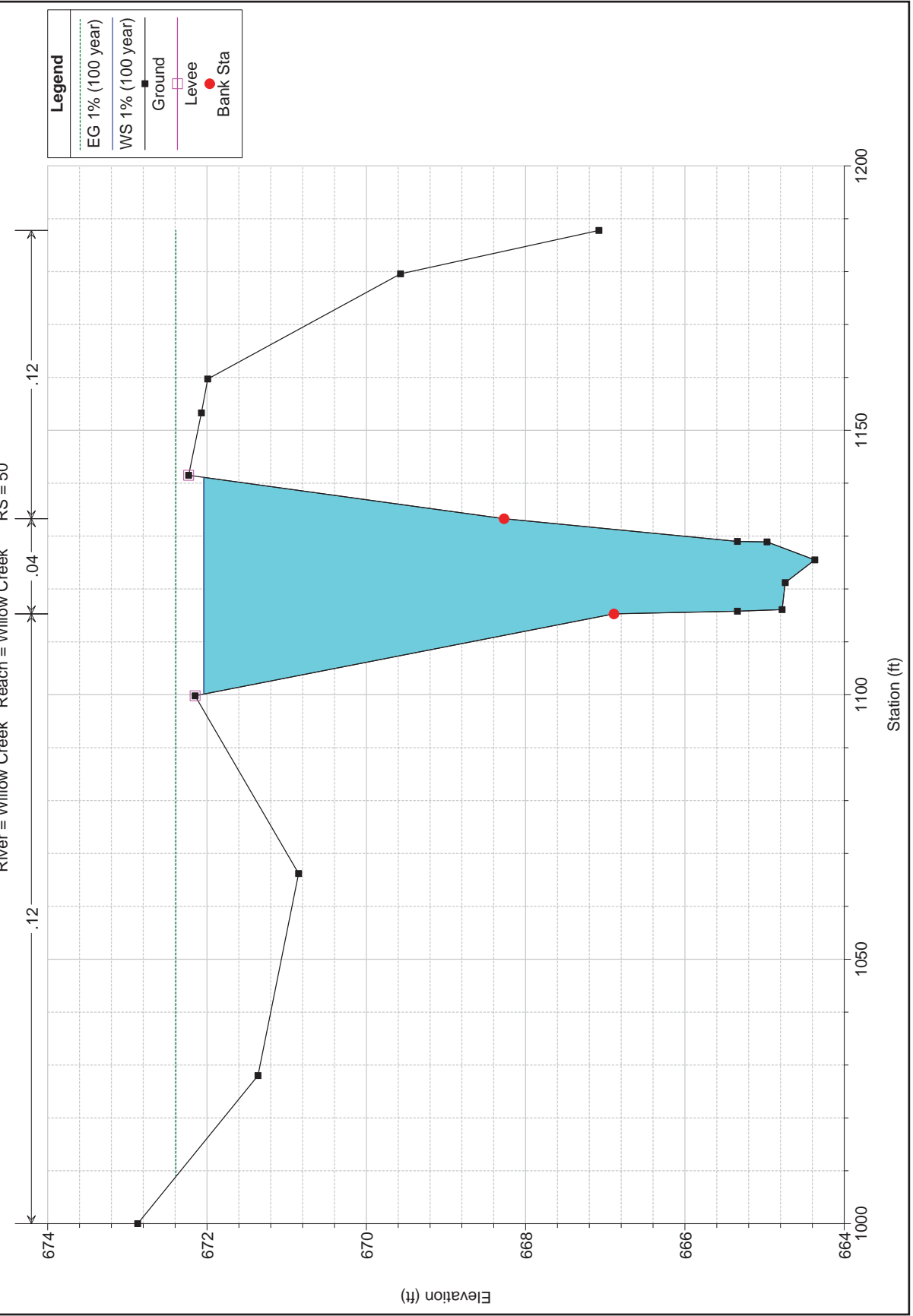


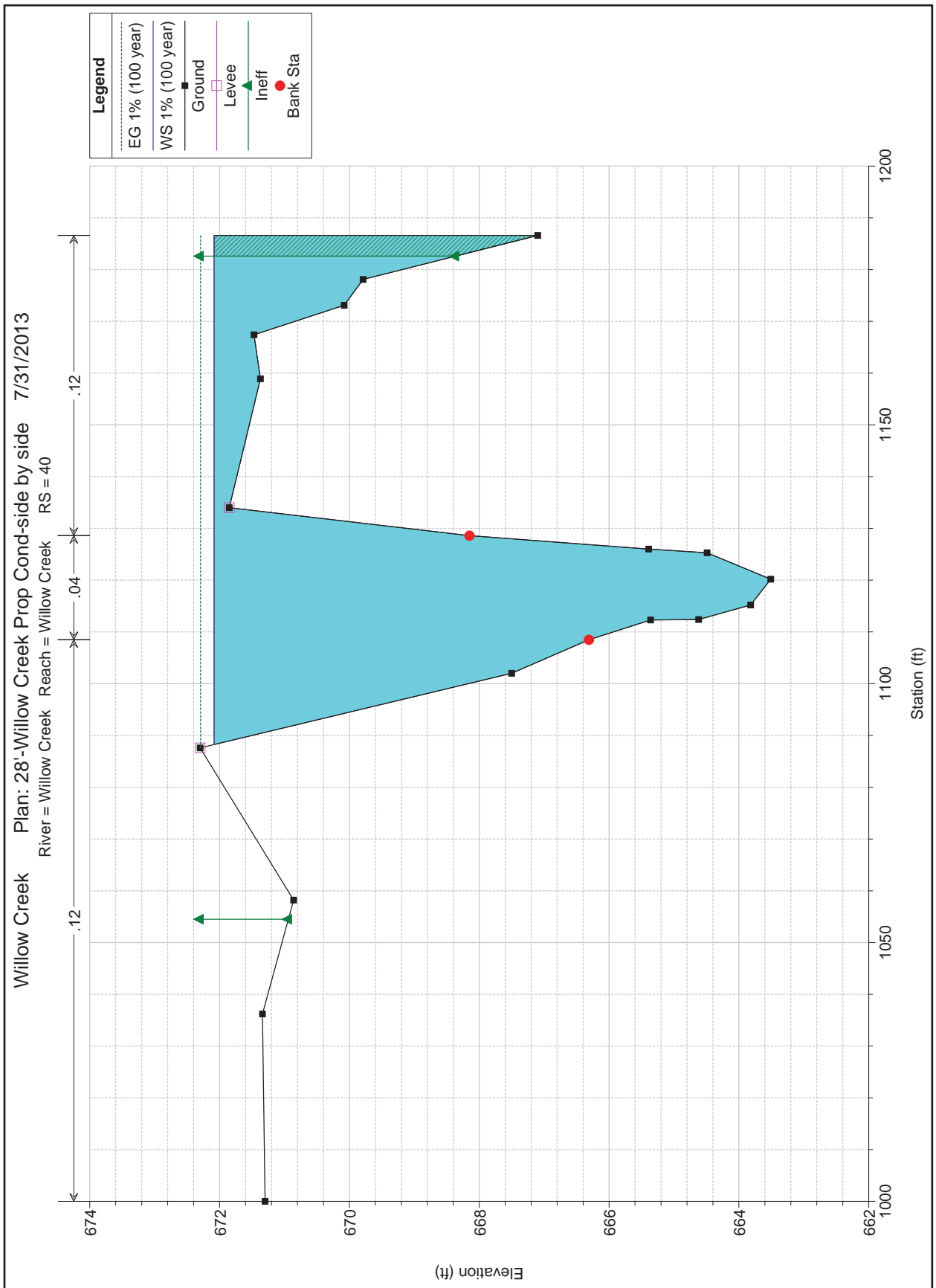


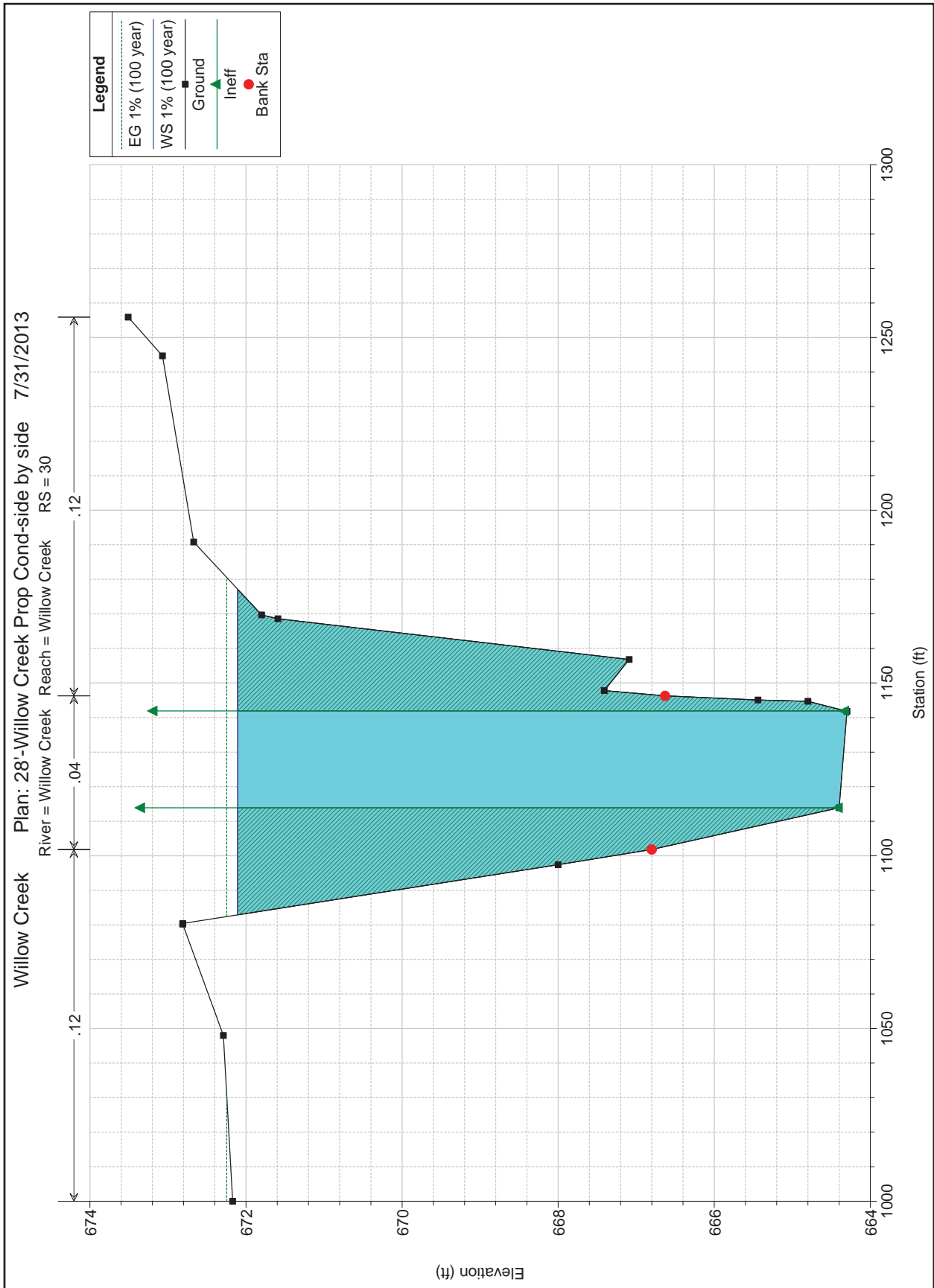
Haggerty Road over
 Willow Creek
 CS 82292 - JN 115177

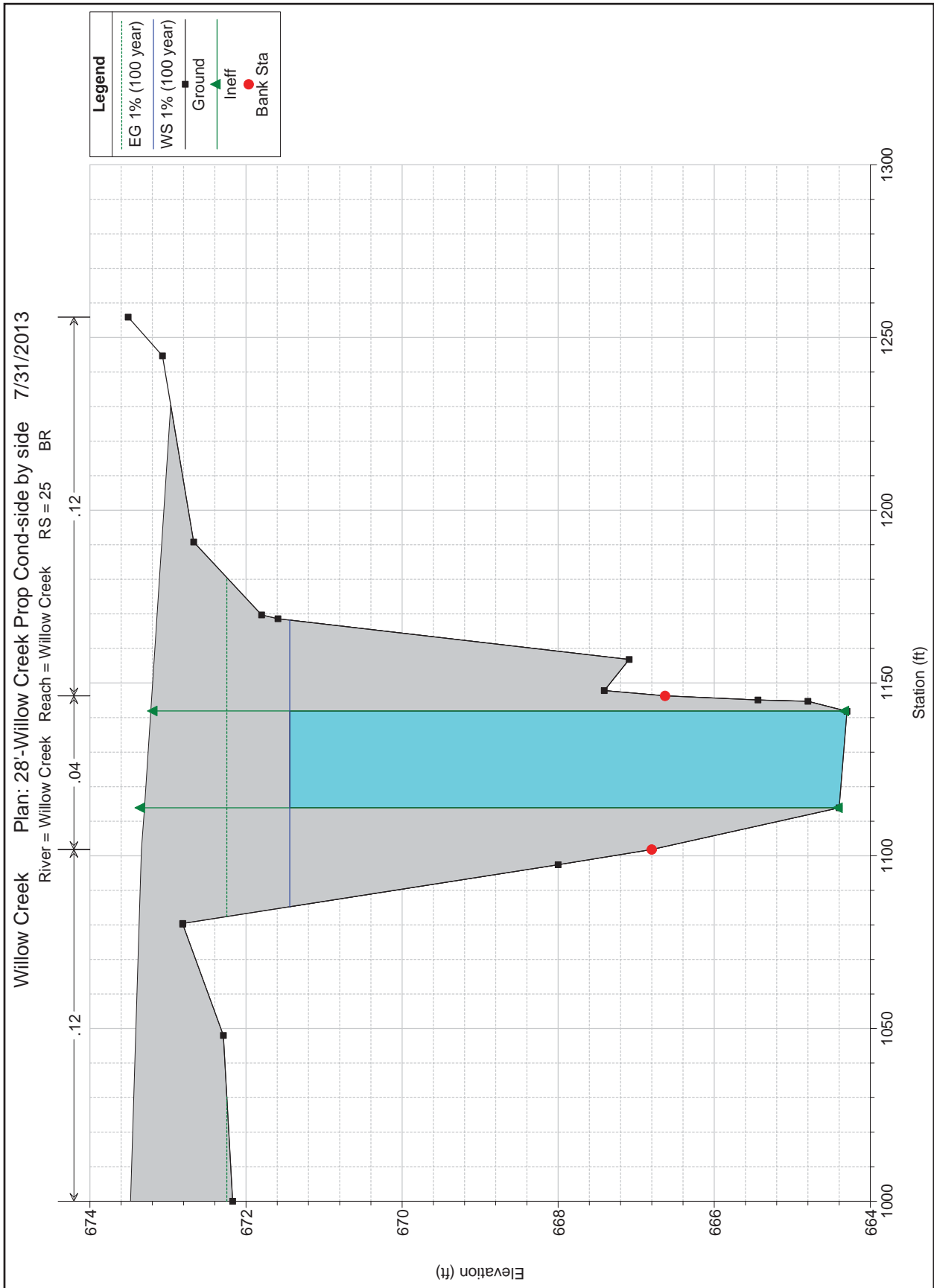


Willow Creek Plan: 28'-Willow Creek Prop Cond-side by side 7/31/2013
 River = Willow Creek Reach = Willow Creek RS = 50





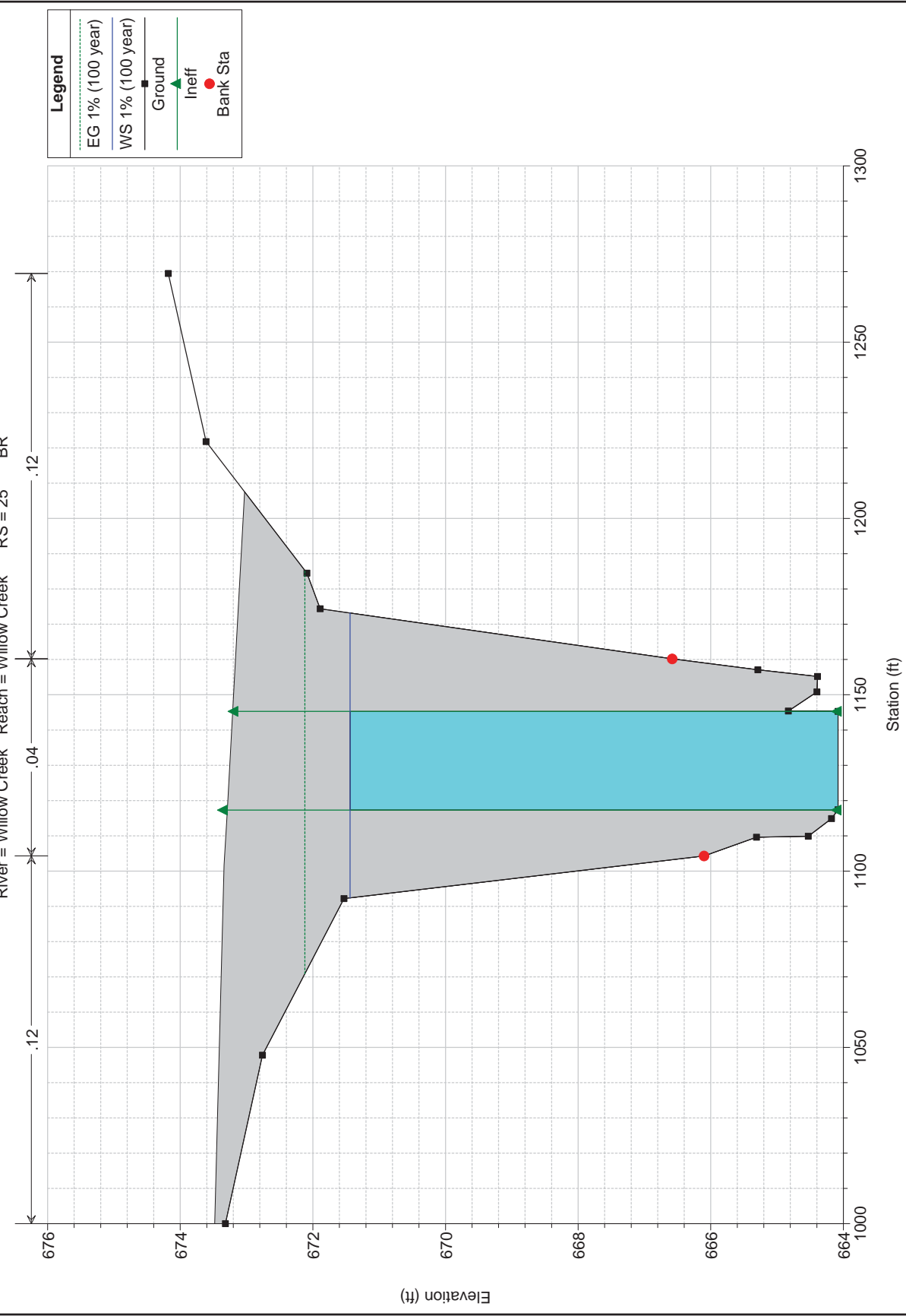




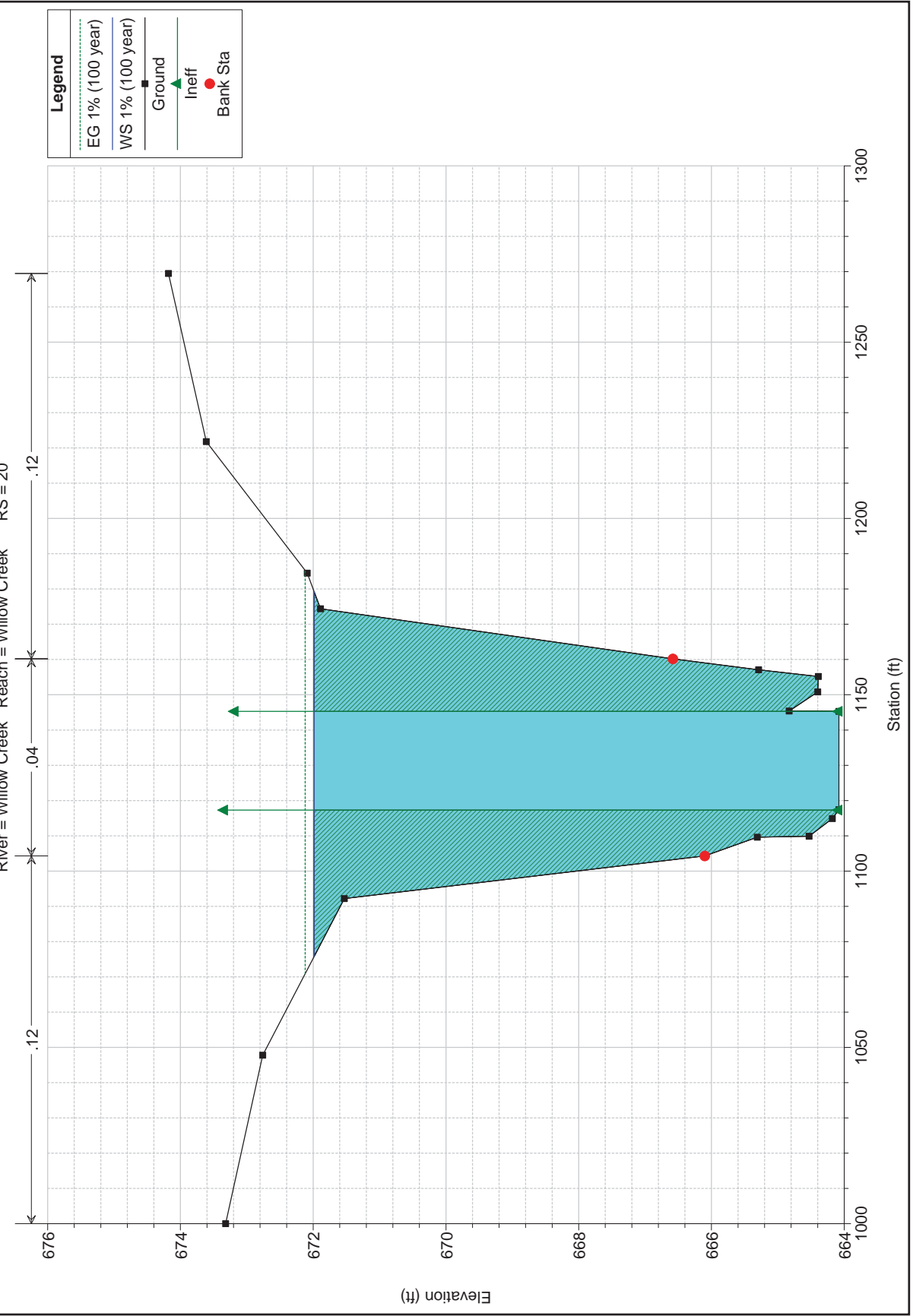
Haggerty Road over
 Willow Creek
 CS 82292 - JN 115177



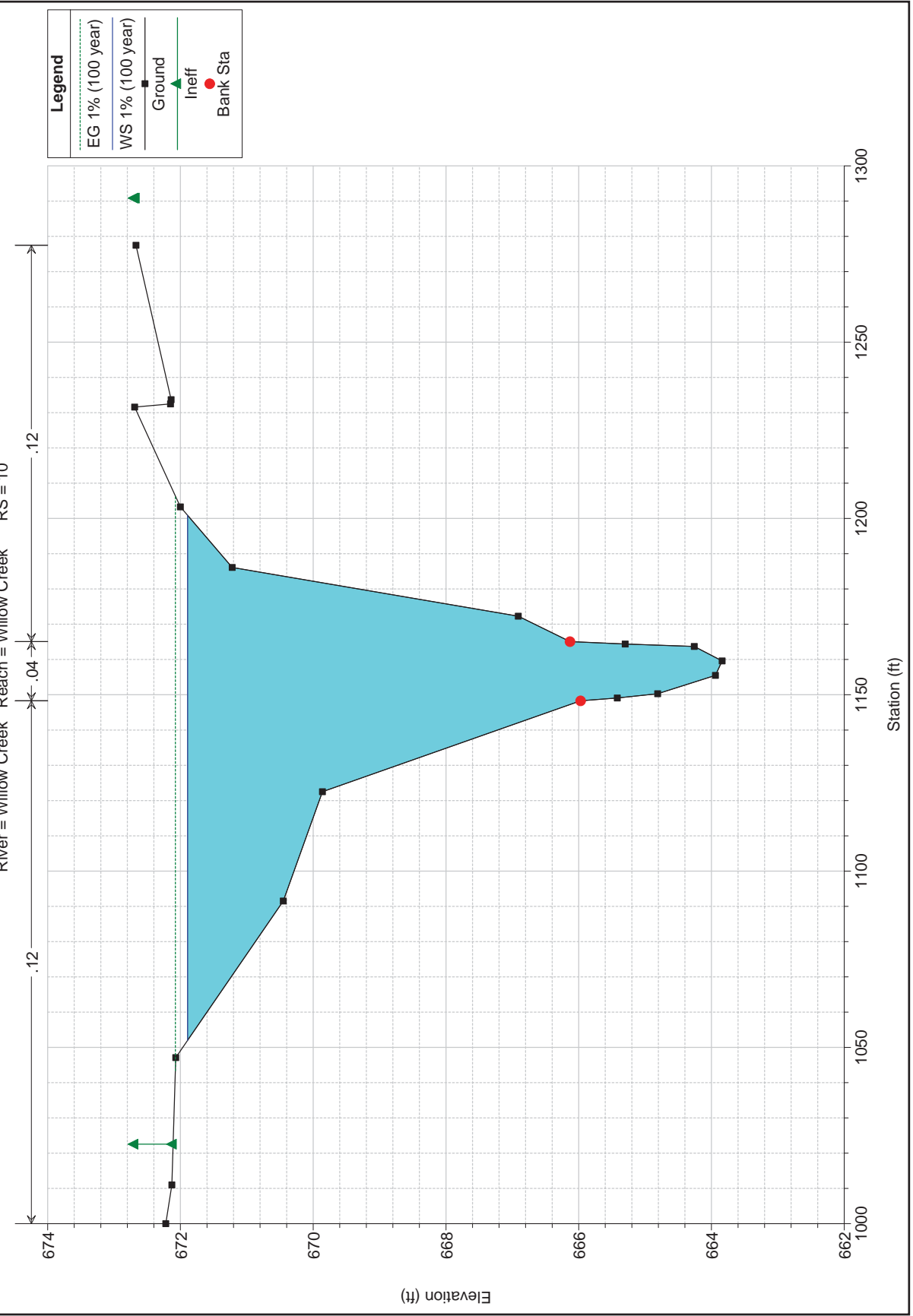
Willow Creek Plan: 28'-Willow Creek Prop Cond-side by side 7/31/2013
 River = Willow Creek Reach = Willow Creek RS = 25 BR







Willow Creek Plan: 28'-Willow Creek Prop Cond-side by side 7/31/2013
 River = Willow Creek Reach = Willow Creek RS = 20

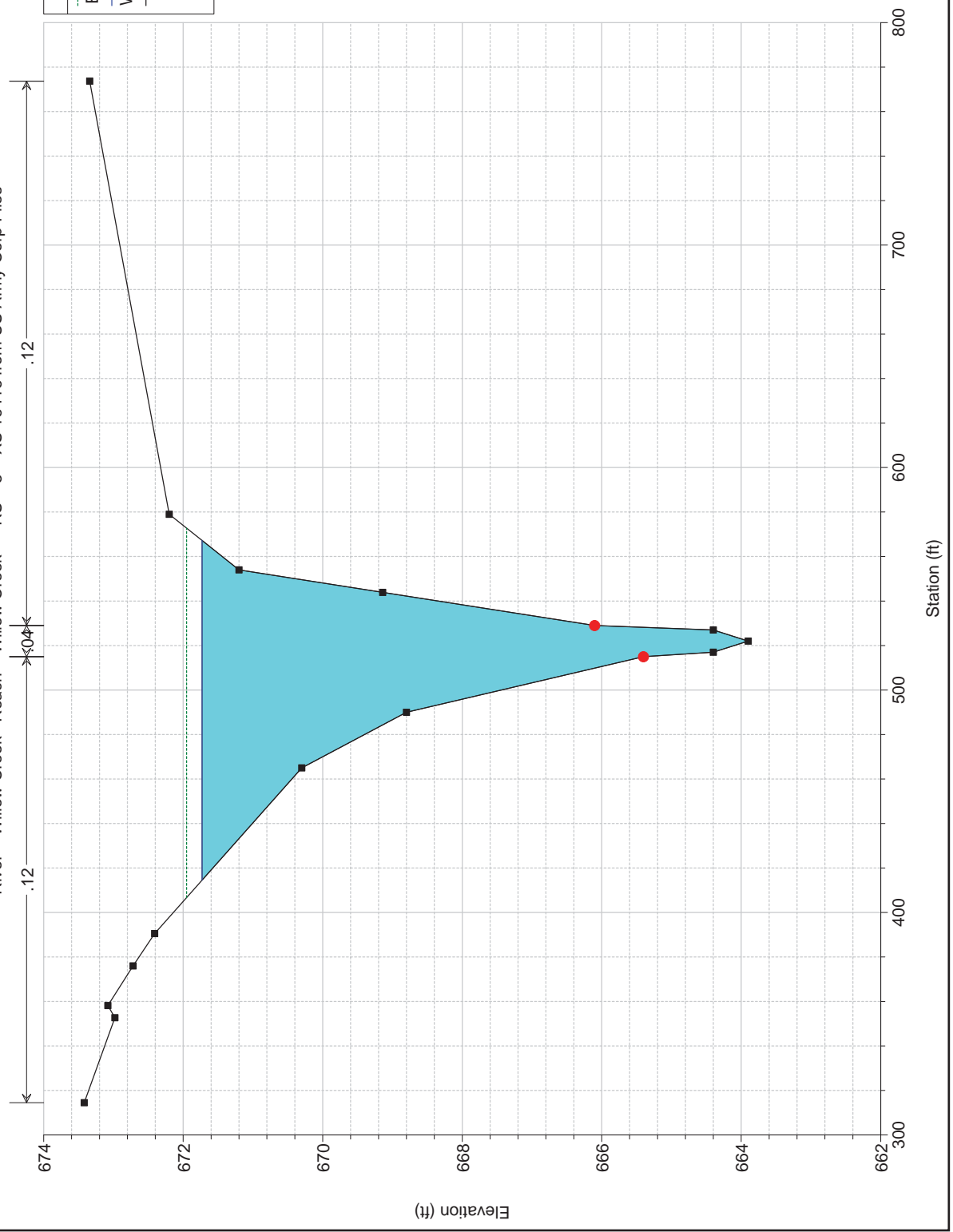


Willow Creek Plan: 28'-Willow Creek Prop Cond-side by side 7/31/2013
 River = Willow Creek Reach = Willow Creek RS = 10



Willow Creek Plan: 28'-Willow Creek Prop Cond-side by side 7/31/2013
 River = Willow Creek Reach = Willow Creek RS = 5 XS 16416 from US Army Corp Files

Legend	
	EG 1% (100 year)
	WS 1% (100 year)
	Ground
	Bank Sta



Haggerty Road over
 Willow Creek
 CS 82292 - JN 115177



MDEQ DISCHARGE INFORMATION

Haggerty Road over
Willow Creek
CS 82292 - JN 115177



David Strockis

From: deq-wrd-qreq <deq-wrd-qreq@michigan.gov>
Sent: Wednesday, August 15, 2012 3:10 PM
To: 'David Strockis'
Subject: RE: flood or low flow discharge request (ContentID - 168812)

This reply is being sent via email only.

We have estimated the flood frequency discharges requested in your email of August 2, 2012 (Process No. 20120273), as follows:

Willow Creek at I-275, Section 12, T2S, R8E, Canton Township, Wayne County, has a drainage area of 4.7 square miles. The 50%, 20%, 10%, 4%, 2%, 1%, and 0.5% chance peak flows are estimated to be 330 cubic feet per second (cfs), 420 cfs, 480 cfs, 550 cfs, 600 cfs, 650 cfs, and 700 cfs, respectively. (Watershed Basin No. 31 Rouge).

Tributary to Willow Creek at I-275, Section 13, T2S, R8E, Canton Township, Wayne County, has a drainage area of 0.59 square miles. (Watershed Basin No. 31 Rouge). Since the drainage area is less than two square miles, a permit is not required under the provisions of the Floodplain Regulatory Authority found in Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). A permit may be required under Part 301, Inland Lakes and Streams, of the NREPA.

Please include a copy of this letter with your application for permit and indicate whether or not the project is funded under Act 51. These estimates should be confirmed by our office if an application is not submitted within one year. If you have any questions concerning the discharge estimates, please contact Ms. Susan Greiner, Hydrologic Studies and Dam Safety Unit, at 517-241-1210 or by email to GreinerS@michigan.gov. Any questions concerning hydraulic and/or environmental permit issues should be directed to Mr. Jerry Fulcher, Water Resources Division, Transportation and Flood Hazard Management Unit, at 517-335-3172 or by email to FulcherG@michigan.gov.

-----Original Message-----

From: David Strockis [mailto:dstockis@hhengltd.com]
Sent: Thursday, August 02, 2012 7:39 AM
To: deq-wrd-qreq
Subject: flood or low flow discharge request (ContentID - 168812)

Requestor: David Strockis
Company: HH Engineering, Ltd
Address: 220 Bagley, Suite 500
City: Detroit, MI
Zip: 48226
Phone: 313-963-6560
Date: 08/02/2012
F50percent: Yes
F20percent: Yes
F10percent: Yes
F4percent: Yes
F2percent: Yes
F1percent: Yes
F0.5percent: Yes



ContactAgency: None Selected
ContactPerson:
Watercourse: Willow Creek
LocalName:
CountyLocation: Wayne
CityorTownship: Canton
Section: 12
Town: 02S
Range: 08E
Location: Willow Creek within the interchange of I-275 & M-153 (Ford Road), north of M-153 (Ford Rd).
FFR1: MDOT Road Project

Content-Length: 358808



PHOTOGRAPHS



**Haggerty Road over Willow Creek
Canton Township, Section 12, T 02 S, R 08 E, Wayne County**



3600 Looking North, West end of culverts



3601 Looking West (upstream)



**Haggerty Road over Willow Creek
Canton Township, Section 12, T 02 S, R 08 E, Wayne County**



3602 West end of pipes



3603 Looking East inside North pipe



Haggerty Road over Willow Creek
Canton Township, Section 12, T 02 S, R 08 E, Wayne County



3604 Looking East inside South pipe



3605 East end of pipes



Haggerty Road over Willow Creek
Canton Township, Section 12, T 02 S, R 08 E, Wayne County



3606 East end of pipes



3607 Large deflection, East end of South pipe



**Haggerty Road over Willow Creek
Canton Township, Section 12, T 02 S, R 08 E, Wayne County**



3608 East end of pipes



3609 Looking East (downstream)



**Haggerty Road over Willow Creek
Canton Township, Section 12, T 02 S, R 08 E, Wayne County**



3610 Looking east from Haggerty Road



3611 Looking North, East side of Haggerty Road



**Haggerty Road over Willow Creek
Canton Township, Section 12, T 02 S, R 08 E, Wayne County**



3612 Looking East from upstream bank

