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City of Franklin: Hydrology and Hydraulics Report

WAR-SR123-28.55 – SR123 at Beal Road-Shotwell Drive Intersection Improvement

PID No. 106224

Revised September 2020

180554

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Project Description

This project involves the realignment of Beal Road in Franklin County, Ohio and the subsequent replacement of the bridge that spans the stream known as Greens Run. This bridge is a 29-foot slab span supported on concrete substructure units.

Prior Studies

The effective flood hazard information for Greens Run at this location was prepared by the Federal Emergency Management Agency within, FLOOD INSURANCE STUDY NUMBER 39079CV000A, dated December 18, 2009. Stantec Consulting Services, Inc. performed the hydrologic and hydraulic analyses for this study for FEMA under Contract No. HSFE05-05-D-0026. The upstream boundary for this study is approximately 50 ft downstream from the project reach. Therefore, the flows were taken from the closest available cross section of the FIS. The existing condtions model for this hydraulic model was developed from survey data and the state DEM data.

Drainage Area

Greens Run drains approximately 1.2 square miles as it crosses underneath Beal Road, as determined by the USGS Streamstats website: (https://streamstats.usgs.gov/ss/). See **Appendix A** for a copy of the Streamstats report.

Peak Discharge

The peak flows presented in the FIS document will be used for this analysis per Section 1003.1.2 of the Location and Design Manual (L&D) and Section 203 of the Bridge Design Manual (BDM). The 100-year storm is used to calculate base flood elevations. The design storm for this facility is 25-years, because the average daily traffic (ADT) is greater than 2000 vehicles per day per L&D 1004.2 and BDM 203.

Peak discharges at this location were calculated using the FIS. A discrepancy between the cross section labels, profile and plan view was found within the FEMA data. The FIRM shows cross section “H” as the most upstream, however, this section has been determined to be “K” from the profile and river station.

Peak discharges for Greens Run are reported in the FIS as follows:

- Q10 = 600 cfs
- Q50 = 850 cfs
- Q100 = 960 cfs
- Q500 = 1220 cfs

The bridge design discharge (25-year) was derived logarithmically from plotted published discharges.

- Q25 = 743 cfs

Within the project reach, three confluences result in a flow change. Using ***Streamstats***, differences in drainage area were identified at each confluence and the stream discharges were adjusted proportionately. These adjustments can be found in **Table 1**.

Table 1 – Flow Change Location

Flood Frequency (year)	**RM 10020.79 Drainage Area:1.2 mi² Discharge:** (cfs)	**RM 10153.25 Drainage Area:0.98 mi² (686ft upstream) Discharge:** (cfs)	**RM 10333.38 Drainage Area:0.86 mi² (769 ft upstream) Discharge:** (cfs)
10	600	492	432
25	743	610	535
50	850	697	612
100	960	787	691
500	1220	1001	879

Hydraulic Calculations

Hydraulic calculations for the computation of backwater at the existing and proposed structures were performed using HEC-RAS 5.0.7. The hydraulic model is based upon current topographic field survey and the state DEM data. Tail water boundary conditions were set using the known water surface elevation (WSE) at cross section “K” in the **FIS**. A copy of the Floodway table is shown in Appendix H.

The Manning’s ‘n’ values for the cross-sections in the hydraulic model range from 0.040 to 0.100 for the left and right overbank and 0.035 for the channel.

See Appendix B for work map showing approximate locations of the river cross sections in the vicinity of the subject bridge.

The following hydraulic models were utilized to calculate the impacts of the proposed bridge replacement on existing BFEs.

- Existing Conditions
- Alternative 1 – Flat Top Culvert
- Alternative 2 – 28’ Arch Culvert
- Alternative 3 – 32’ Arch Culvert
- Alternative 4 – “O” Series 32’ Culvert

Existing Conditions Model

HEC-RAS plan name: Existing Conditions

The existing conditions hydraulic model for Greens Run was created from survey data and the state DEM. Flows were taken from the upstream most data (cross section “K”) in the **FIS**. Current cross sectional data was developed for the **HEC-2** model near the Beal Road Bridge.

See **Appendix C** for cross section plots and a profile representing the stream conditions in the Existing Conditions model and HEC-RAS outputs.

Proposed Alternatives

Four different alternatives have been evaluated for the purpose of hydraulic study and are summarized in **Table 1**:

Table 1 – Proposed Alternative Structures

Alternative	**Bridge Type**	**Number of Spans**	**Span Length** (ft)	**Depth of Superstructure** (ft)
1	Concrete pre-fabricated structure (28’ Flat top Culvert)	1	28	2.19
2	Concrete pre-fabricated structure (28’ Arch Culvert)	1	28	2.19
3	Concrete pre-fabricated structure (32’ Arch Culvert)	1	32	2.19
4	Concrete pre-fabricated structure (32’ O-Series Culvert)	1	32	2.19

Alternative 1 – Concrete pre-fabricated structure (28' Flat Top)

HEC-RAS plan name: Alternative 1

Table 3 summarizes the results of the hydraulic flow modeling for the proposed Concrete pre-fabricated structure (28' Flat Top Culvert).

Table 3 – Alternative 1 Summary of Results

Design Frequency (year)	**Discharge** (cfs)	**Existing Elevation Upstream Face** (ft)	**Proposed Elevation Upstream Face (ft)**	**Proposed Low Chord (ft)**	**Proposed Exit Velocity** (fps)
25	743	740.52	740.06	744	4.61
100	960	741.30	740.69	744	5.42

The proposed **Alternative 1** replacement structure meets the Bridge Headwater Controls per L&D 1006.3. The proposed 25-year (design year) and 100-year check headwater is lower than existing for the replacement structure. The design year flood does not contact the low chord of the bridge, which clears the headwater by 3.31 ft. The proposed structure also meets the controls specific to the FIS as shown below.

Table 4 is a comparison of Base Flood Elevations (BFE) for the 100-year frequency discharge for the existing condition with the proposed condition:

Table 4 – Alternative 1 Comparison of Calculated Base Flood Elevations

River Station	**Description**	**Published BFE** (ft)	**EXISTING Conditions BFE** (ft)	**ALT 1 Proposed Conditions BFE** (ft)	**Difference Between Existing and Proposed** (ft)
10333.38		N/A	747.26	747.26	0
10250.48		N/A	747.26	747.26	0
10200	SR123 Culvert				
10169.80		N/A	742.72	742.69	-0.03
10153.25		N/A	742.78	742.75	-0.03
10040.79		N/A	742.68	742.63	-0.05
10020.79		N/A	741.66	740.69	-0.97
10000	Beal Road Bridge				
9972.407		N/A	741.11	741.11	0
9884.092		N/A	740.88	740.88	0
9766.492		N/A	741.04	741.04	0
9564.450		N/A	741.00	741.00	0

The proposed **Alternative 1** does not increase the BFE based upon the calculations. The Concrete pre-fabricated structure (28' Flat Top Culvert) is hydraulically feasible within the proposed project limits.

See **Appendix D** for HEC-RAS outputs.

Alternative 2 – Concrete pre-fabricated structure (28' Arch Culvert)

HEC-RAS plan name: Alternative 2

Table 5 summarizes the results of the hydraulic flow modeling for the proposed Concrete pre-fabricated structure (28' Arch Culvert)

Table 5 – Alternative 2 Summary of Results

Design Frequency (year)	**Discharge** (cfs)	**Existing Elevation Upstream Face** (ft)	**Proposed Elevation Upstream Face (ft)**	**Proposed Low Chord (ft)**	**Exit Velocity** (fps)
25	610	740.52	740.06	744	4.68
100	787	741.30	740.69	744	5.57

The proposed **Alternative 2** replacement structure meets the Bridge Headwater Controls per L&D 1006.3. The proposed 25-year (design year) and 100-year check headwater is lower than existing for the replacement structure. The design year flood does not contact the low chord of the bridge, which clears the headwater by 3.79 ft. The proposed structure also meets the controls specific to the FIS as shown below.

Table 6 is a comparison of Base Flood Elevations (BFE) for the 100-year frequency discharge for the existing condition with the proposed condition:

Table 6 – Alternative 2 Comparison of Calculated Base Flood Elevations

River Station	Description	Published BFE (ft)	EXISTING Conditions BFE (ft)	ALT 2 Proposed Conditions BFE (ft)	Difference Between Existing and Proposed (ft)
10333.38		N/A	747.26	747.26	0
10250.48		N/A	747.26	747.26	0
10200	SR123 Culvert				
10169.80		N/A	742.72	742.69	-0.03
10153.25		N/A	742.78	742.75	-0.03
10040.79		N/A	742.68	742.63	-0.05
10020.79		N/A	741.66	740.69	-0.97
10000	Beal Road Bridge				
9972.407		N/A	741.11	741.11	0
9884.092		N/A	740.88	740.88	0
9766.492		N/A	741.04	741.04	0
9564.450		N/A	741.00	741.00	0

The proposed **Alternative 2** does not increase the BFE based upon the calculations. The Concrete pre-fabricated structure (28' Flat Top Culvert) is hydraulically feasible within the proposed project limits.

See **Appendix E** for HEC-RAS outputs

Alternative 3 – Concrete pre-fabricated structure (32' Arch Culvert)

HEC-RAS plan name: Alternative 3

Table 7 summarizes the results of the hydraulic flow modeling for the proposed Concrete pre-fabricated structure (28' Flat top Culvert).

Table 7 – Alternative 3 Summary of Results

Design Frequency (year)	Discharge (cfs)	Existing Elevation Upstream Face (ft)	Proposed Elevation Upstream Face (ft)	Proposed Low Chord (ft)	Exit Velocity (fps)
25	610	740.52	740.06	744	4.10
100	787	741.30	740.69	744	4.88

The proposed **Alternative 3** replacement structure meets the Bridge Headwater Controls per L&D 1006.3. The proposed 25-year (design year) and 100-year check headwater is lower than existing for the replacement structure. The design year flood does not contact the low chord of the bridge, which clears the headwater by 3.79 ft. The proposed structure also meets the controls specific to the **FIS** as shown below.

Table 8 is a comparison of Base Flood Elevations (BFE) for the 100-year frequency discharge for the existing condition with the proposed condition:

Table 8 – Alternative 3 Comparison of Calculated Base Flood Elevations

River Station	Description	Published BFE (ft)	EXISTING Conditions BFE (ft)	ALT 3 Proposed Conditions BFE (ft)	Difference Between Existing and Proposed (ft)
10333.38		N/A	747.26	747.19	-0.07
10250.48		N/A	747.26	747.19	-0.07
10200	SR123 Culvert				
10169.80		N/A	742.72	742.69	-0.03
10153.25		N/A	742.78	742.75	-0.03
10040.79		N/A	742.68	742.63	-0.05
10020.79		N/A	741.66	740.69	-0.97
10000	Beal Road Bridge				
9972.407		N/A	741.11	741.11	0
9884.092		N/A	740.88	740.88	0
9766.492		N/A	741.04	741.04	0
9564.450		N/A	741.00	741.00	0

The proposed **Alternative 3** does not increase the BFE based upon the calculations. The Concrete pre-fabricated structure (28' Flat Top Culvert) is hydraulically feasible within the proposed project limits.

See **Appendix F** for HEC-RAS outputs.

Alternative 4 – Concrete pre-fabricated structure (32' O-Series Culvert)

HEC-RAS plan name: Alternative 4

Table 9 summarizes the results of the hydraulic flow modeling for the proposed Concrete pre-fabricated structure (32' O-Series Culvert)

Table 9 – Alternative 4 Summary of Results

Design Frequency (year)	Discharge (cfs)	Existing Elevation Upstream Face (ft)	Proposed Elevation Upstream Face (ft)	Proposed Low Chord (ft)	Exit Velocity (fps)
25	610	740.52	740.06	744	4.10
100	787	741.30	740.69	744	4.88

The proposed **Alternative 4** replacement structure meets the Bridge Headwater Controls per L&D 1006.3. The proposed 25-year (design year) and 100-year check

headwater is lower than existing for the replacement structure. The design year flood does not contact the low chord of the bridge, which clears the headwater by 3.79 ft. The proposed structure also meets the controls specific to the FIS as shown below.

Table 10 is a comparison of Base Flood Elevations (BFE) for the 100-year frequency discharge for the existing condition with the proposed condition:

Table 10 – Alternative 4 Comparison of Calculated Base Flood Elevations

River Station	Description	Published BFE (ft)	EXISTING Conditions BFE (ft)	ALT 4 Proposed Conditions BFE (ft)	Difference Between Existing and Proposed (ft)
10333.38		N/A	747.26	747.26	0
10250.48		N/A	747.26	747.26	0
10200	SR123 Culvert				
10169.80		N/A	742.72	742.69	-0.03
10153.25		N/A	742.78	742.75	-0.03
10040.79		N/A	742.68	742.63	-0.05
10020.79		N/A	741.66	740.69	-0.97
10000	Beal Road Bridge				
9972.407		N/A	741.11	741.11	0
9884.092		N/A	740.88	740.88	0
9766.492		N/A	741.04	741.04	0
9564.450		N/A	741.00	741.00	0

The proposed **Alternative 4** does not increase the BFE based upon the calculations. The Concrete pre-fabricated structure (32' "O" Series Culvert) is hydraulically feasible within the proposed project limits.

See **Appendix G** for HEC-RAS outputs.

Flood Hazard Evaluation

The Concrete pre-fabricated structure, 28' Flat Top Culvert, **(Alternative 1)** is the preferred alternative structure for this location. There is no rise in the BFE because of this alternative.

The plan view drawing in **Appendix B** shows the approximate limits of 100-year flooding throughout the limits of the study area.

Special Flood Hazard Areas

The project site is located upstream of a **Zone AE** Special Flood Hazard Area with a floodway as shown on Flood Insurance Rate Map (**FIRM**), Warren County, Ohio and Incorporated Areas, Map Number **3907570016F**, and **2906560016F**, effective December 20, 2019. **Zone AE** areas with a floodway are locations where flood hazards

are known to exist and Base Flood Elevations (BFE) have been determined. Since the project is not within a **FIS** floodway as stated above, the design flood is not permitted to contact the low chord for new structures on new alignment per **L&D 1006.3.**

See **Appendix H** for a copy of the FIRM.

See **Appendix I** for photographs of the site.

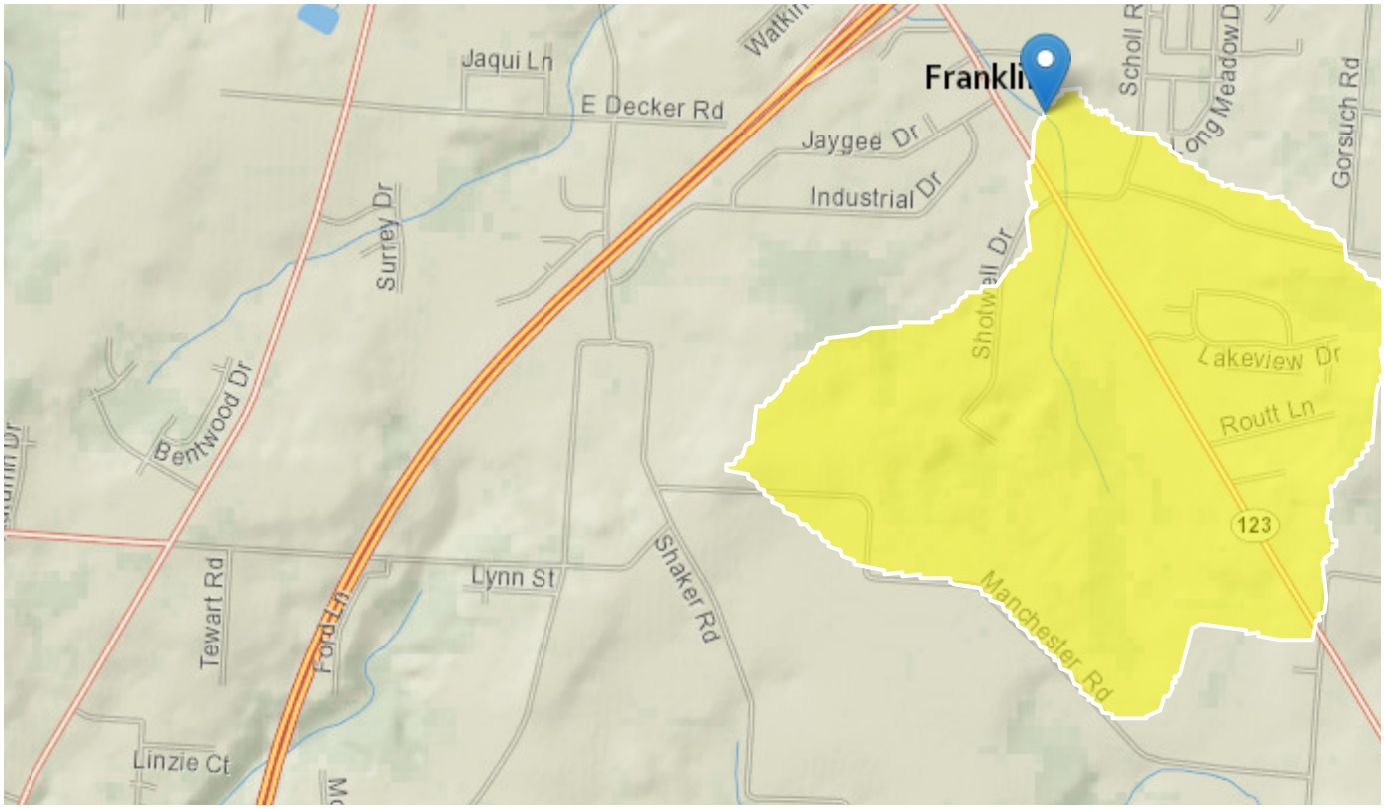
See **Appendix J** for the electronic files.

APPENDIX A

STREAMSTATS REPORT
BEAL ROAD

StreamStats Report

Region ID: OH
Workspace ID: OH20191217154250479000
Clicked Point (Latitude, Longitude): 39.53855, -84.28756
Time: 2019-12-17 10:43:06 -0500



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	1.2	square miles
OHREGC	Ohio Region C Indicator	1	dimensionless
OHREGA	Ohio Region A Indicator	0	dimensionless
CSL1085LFP	Change in elevation divided by length between points 10 and 85 percent of distance along the longest flow path to the basin divide, LFP from 2D grid	70.2	feet per mi
LC92STOR	Percentage of water bodies and wetlands determined from the NLCD	0.2	percent

Peak-Flow Statistics Parameters[Peak Flow Full Model Reg C SIR2019 5018]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.2	square miles	0.26	2514
OHREGC	Ohio Region C Indicator 1 if in C else 0	1	dimensionless	0	1
OHREGA	Ohio Region A Indicator 1 if in A else 0	0	dimensionless	0	1
CSL1085LFP	Stream Slope 10 and 85 Longest Flow Path	70.2	feet per mi	3.24	131
LC92STOR	Percent Storage from NLCD1992	0.2	percent	0	1.23

Peak-Flow Statistics Flow Report[Peak Flow Full Model Reg C SIR2019 5018]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PIl	PIu	SEp
2 Year Peak Flood	221	ft^3/s	114	429	40.1
5 Year Peak Flood	385	ft^3/s	208	713	37.2
10 Year Peak Flood	515	ft^3/s	277	960	37.6
25 Year Peak Flood	702	ft^3/s	374	1320	38.1
50 Year Peak Flood	857	ft^3/s	452	1630	37.8
100 Year Peak Flood	1020	ft^3/s	533	1960	39.6
500 Year Peak Flood	1460	ft^3/s	752	2830	40.3

Peak-Flow Statistics Citations

Koltun, G.F.,2019, Flood-frequency estimates for Ohio streamgages based on data through water year 2015 and techniques for estimating flood-frequency characteristics of rural, unregulated Ohio streams: U.S. Geological Survey Scientific Investigations Report 2019–5018, xx p. (https://dx.doi.org/10.3133/sir20195018)

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Application Version: 4.3.11

StreamStats Report

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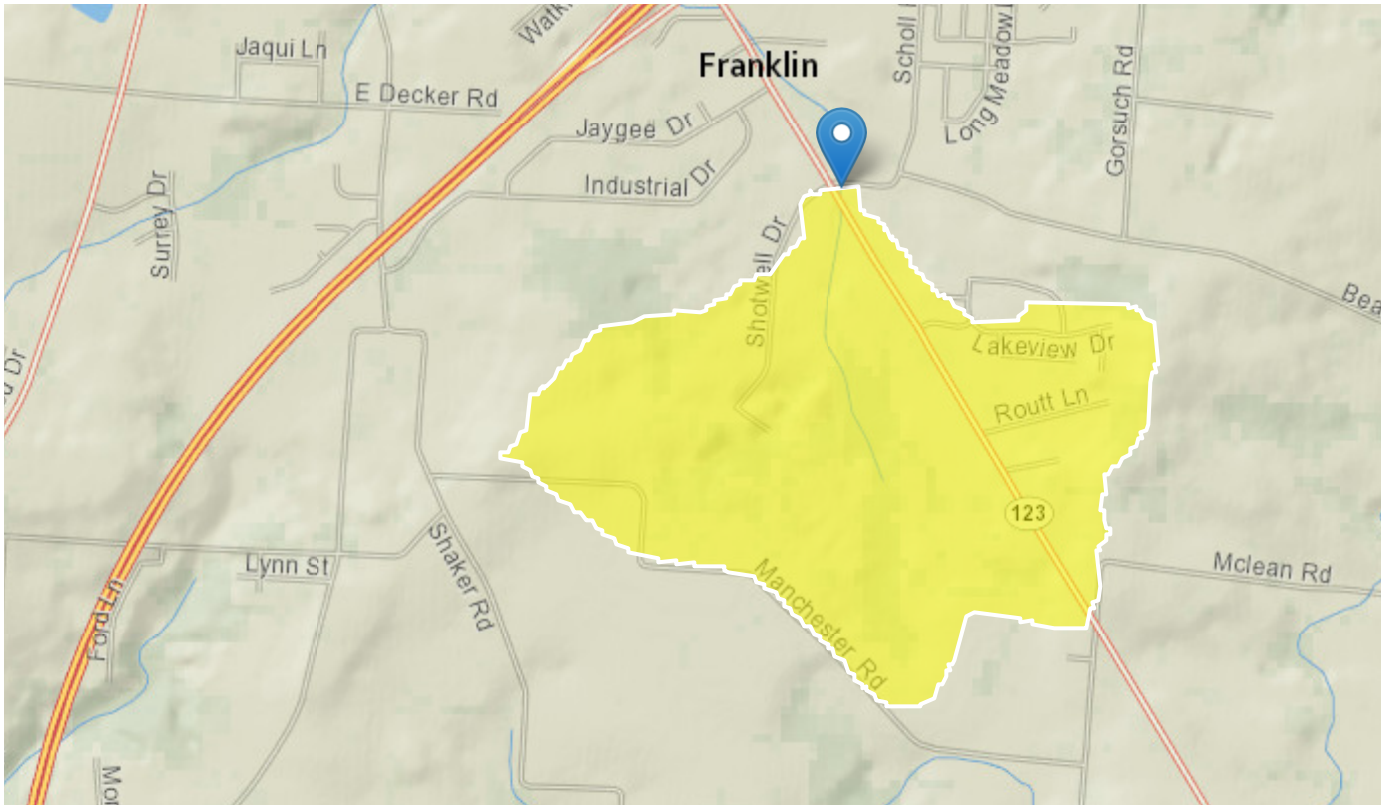

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	0.98	square miles
OHREGC	Ohio Region C Indicator	1	dimensionless
OHREGA	Ohio Region A Indicator	0	dimensionless
CSL1085LFP	Change in elevation divided by length between points 10 and 85 percent of distance along the longest flow path to the basin divide, LFP from 2D grid	67.8	feet per mi
LC92STOR	Percentage of water bodies and wetlands determined from the NLCD	0.25	percent

Peak-Flow Statistics Parameters[Peak Flow Full Model Reg C SIR2019 5018]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.98	square miles	0.26	2514
OHREGC	Ohio Region C Indicator 1 if in C else 0	1	dimensionless	0	1
OHREGA	Ohio Region A Indicator 1 if in A else 0	0	dimensionless	0	1
CSL1085LFP	Stream Slope 10 and 85 Longest Flow Path	67.8	feet per mi	3.24	131
LC92STOR	Percent Storage from NLCD1992	0.25	percent	0	1.23

Peak-Flow Statistics Flow Report[Peak Flow Full Model Reg C SIR2019 5018]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PIl	PIu	SEp
2 Year Peak Flood	187	ft^3/s	96.6	362	40.1
5 Year Peak Flood	325	ft^3/s	176	601	37.2
10 Year Peak Flood	435	ft^3/s	234	810	37.6
25 Year Peak Flood	593	ft^3/s	316	1110	38.1
50 Year Peak Flood	723	ft^3/s	381	1370	37.8
100 Year Peak Flood	863	ft^3/s	450	1660	39.6
500 Year Peak Flood	1230	ft^3/s	635	2390	40.3

Peak-Flow Statistics Citations

Koltun, G.F.,2019, Flood-frequency estimates for Ohio streamgages based on data through water year 2015 and techniques for estimating flood-frequency characteristics of rural, unregulated Ohio streams: U.S. Geological Survey Scientific Investigations Report 2019–5018, xx p. (https://dx.doi.org/10.3133/sir20195018)

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Application Version: 4.3.11

StreamStats Report

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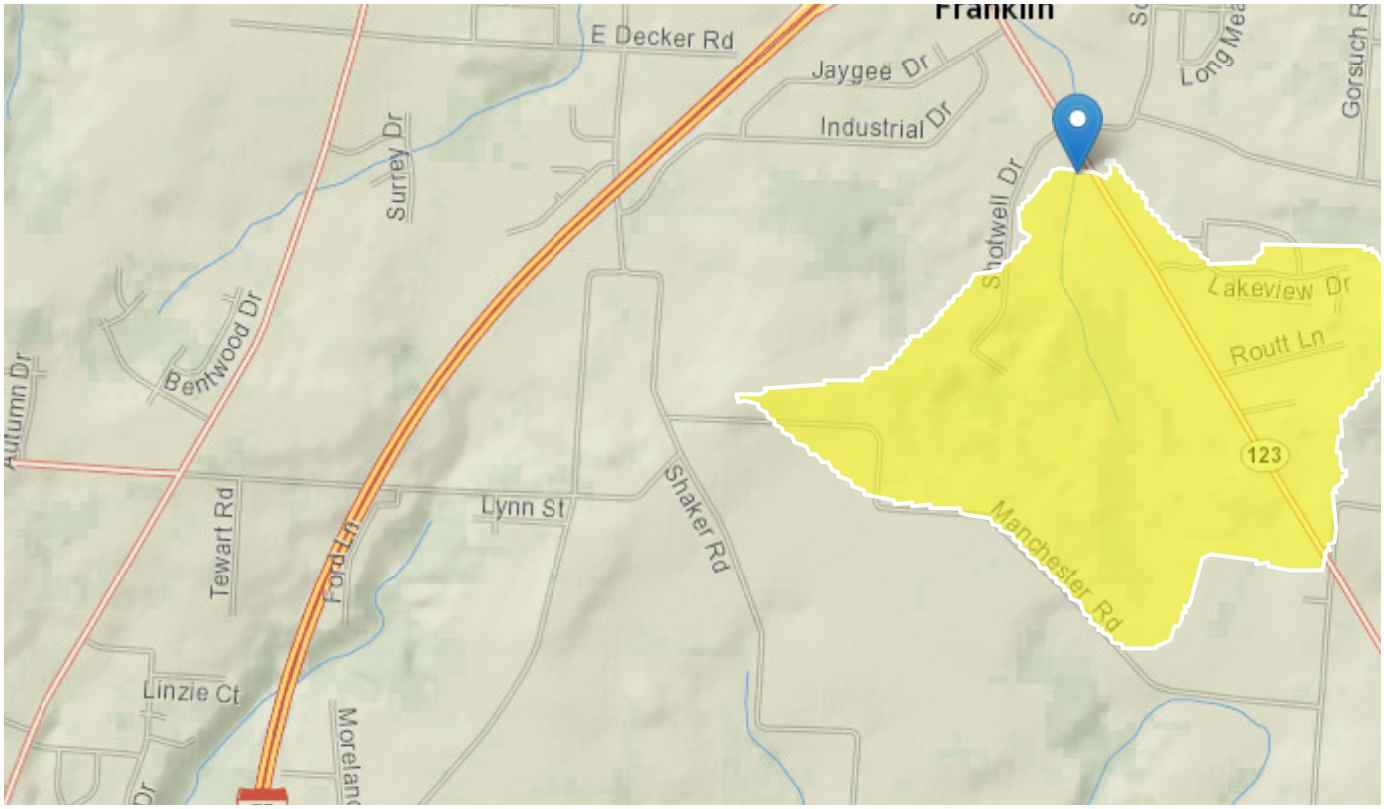

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	0.86	square miles
OHREGC	Ohio Region C Indicator	1	dimensionless
OHREGA	Ohio Region A Indicator	0	dimensionless
CSL1085LFP	Change in elevation divided by length between points 10 and 85 percent of distance along the longest flow path to the basin divide, LFP from 2D grid	72.6	feet per mi
LC92STOR	Percentage of water bodies and wetlands determined from the NLCD	0.28	percent

Peak-Flow Statistics Parameters[Peak Flow Full Model Reg C SIR2019 5018]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.86	square miles	0.26	2514
OHREGC	Ohio Region C Indicator 1 if in C else 0	1	dimensionless	0	1
OHREGA	Ohio Region A Indicator 1 if in A else 0	0	dimensionless	0	1
CSL1085LFP	Stream Slope 10 and 85 Longest Flow Path	72.6	feet per mi	3.24	131
LC92STOR	Percent Storage from NLCD1992	0.28	percent	0	1.23

Peak-Flow Statistics Flow Report[Peak Flow Full Model Reg C SIR2019 5018]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	PIl	PIu	SEp
2 Year Peak Flood	170	ft^3/s	87.9	330	40.1
5 Year Peak Flood	297	ft^3/s	161	550	37.2
10 Year Peak Flood	398	ft^3/s	214	741	37.6
25 Year Peak Flood	543	ft^3/s	290	1020	38.1
50 Year Peak Flood	663	ft^3/s	349	1260	37.8
100 Year Peak Flood	793	ft^3/s	413	1520	39.6
500 Year Peak Flood	1130	ft^3/s	584	2200	40.3

Peak-Flow Statistics Citations

Koltun, G.F.,2019, Flood-frequency estimates for Ohio streamgages based on data through water year 2015 and techniques for estimating flood-frequency characteristics of rural, unregulated Ohio streams: U.S. Geological Survey Scientific Investigations Report 2019–5018, xx p. (https://dx.doi.org/10.3133/sir20195018)

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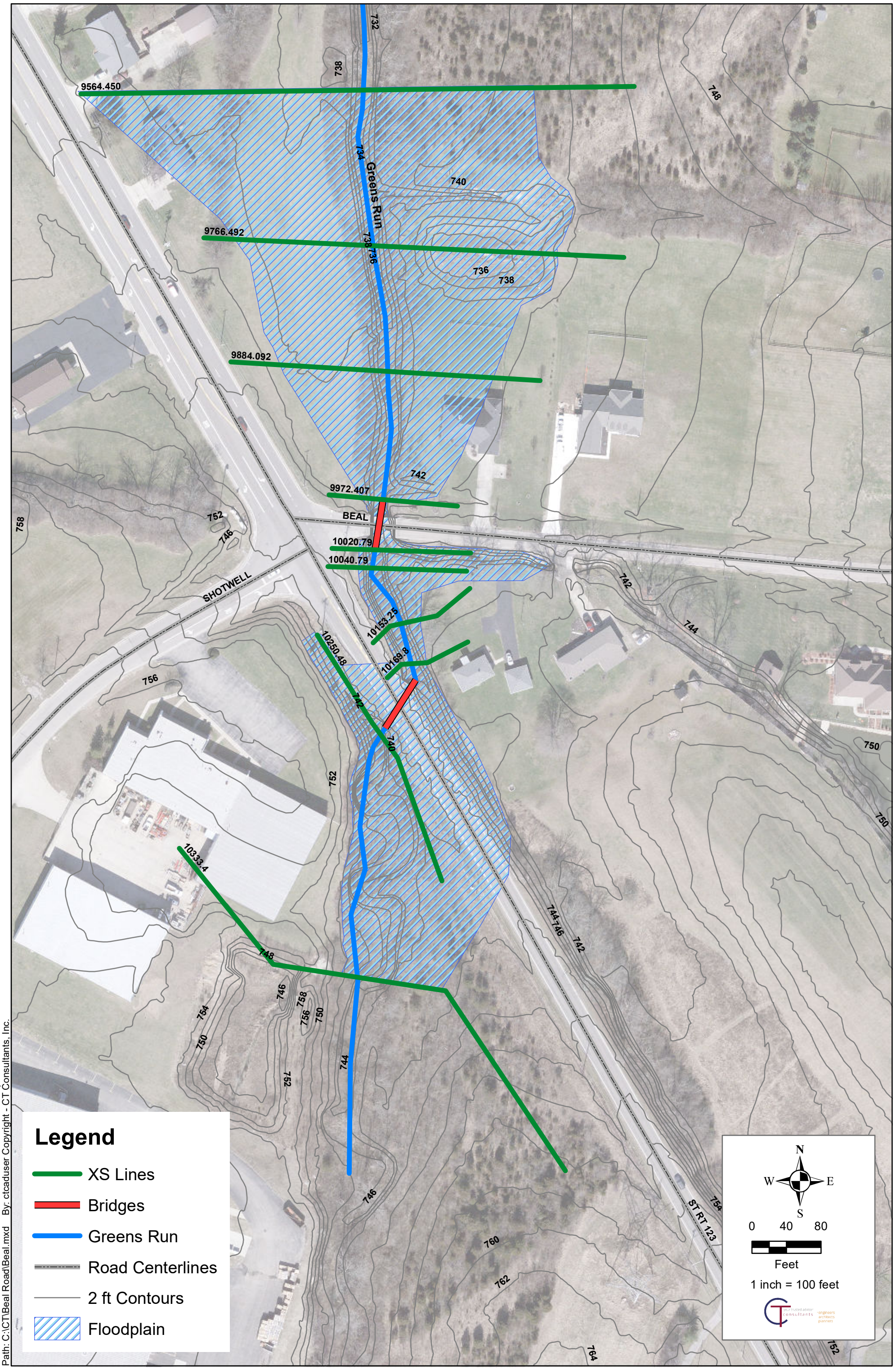
Application Version: 4.3.11

APPENDIX B
PLAN VIEW DRAWING

Beal Road - Floodplain Delineation



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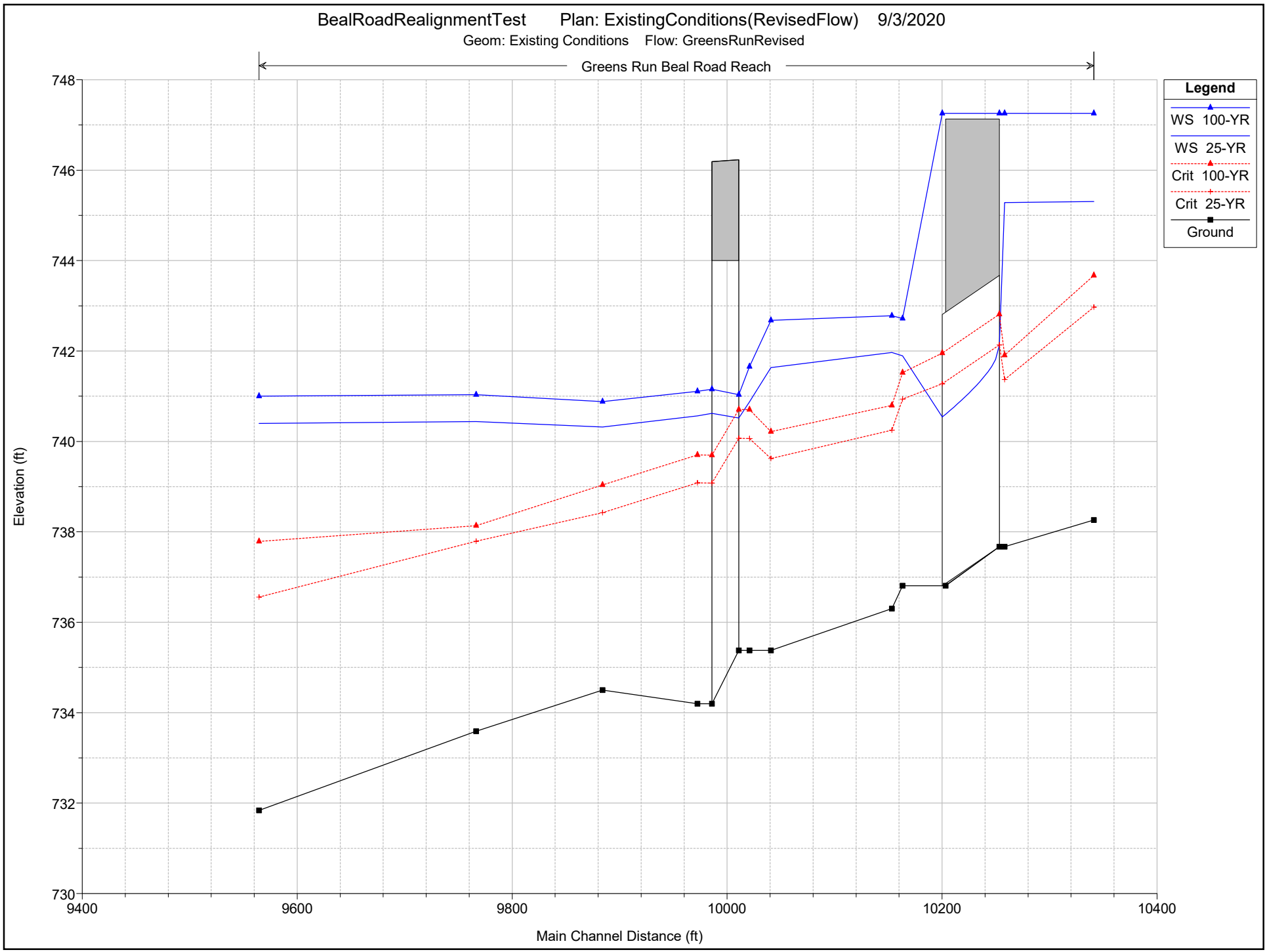
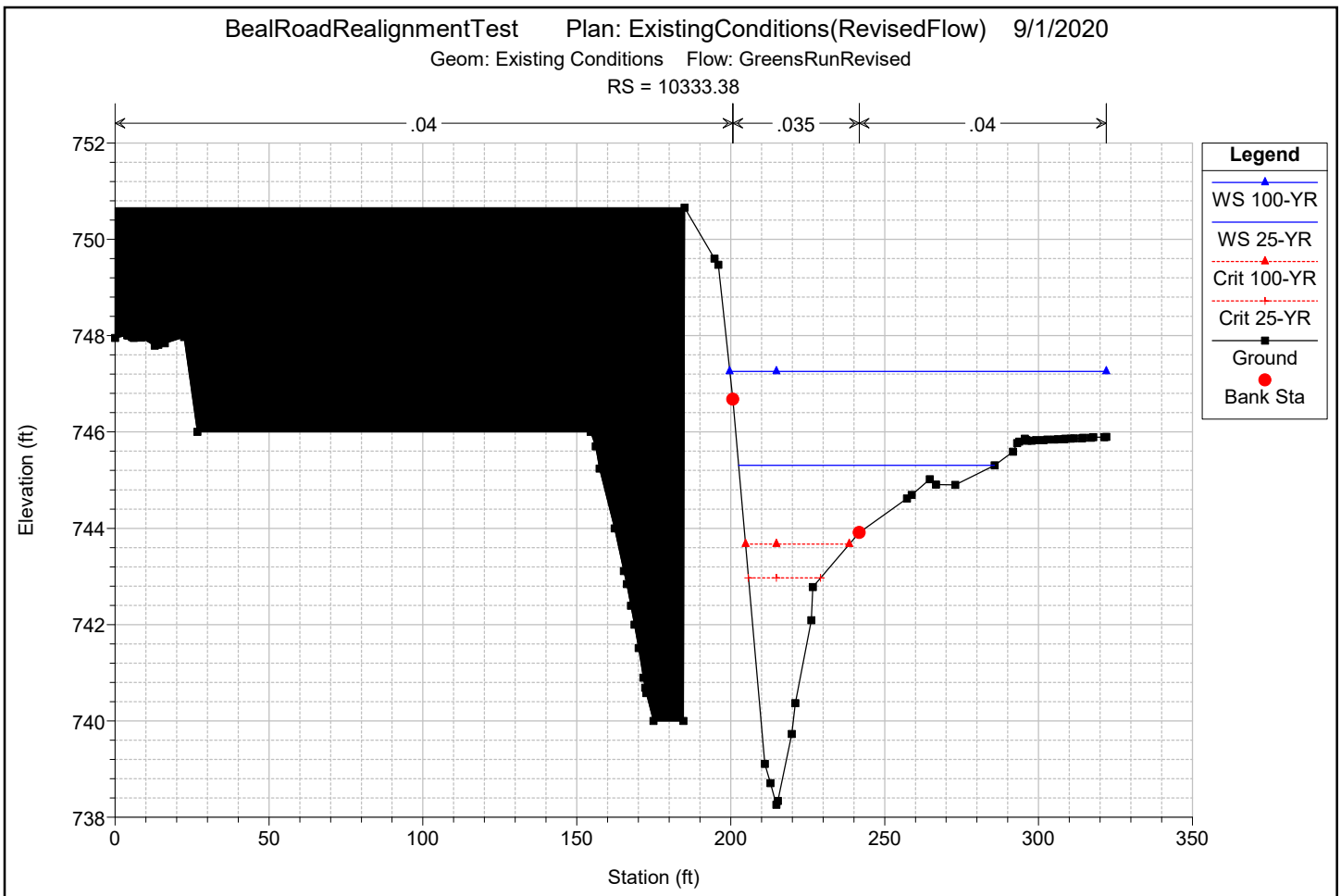
APPENDIX C

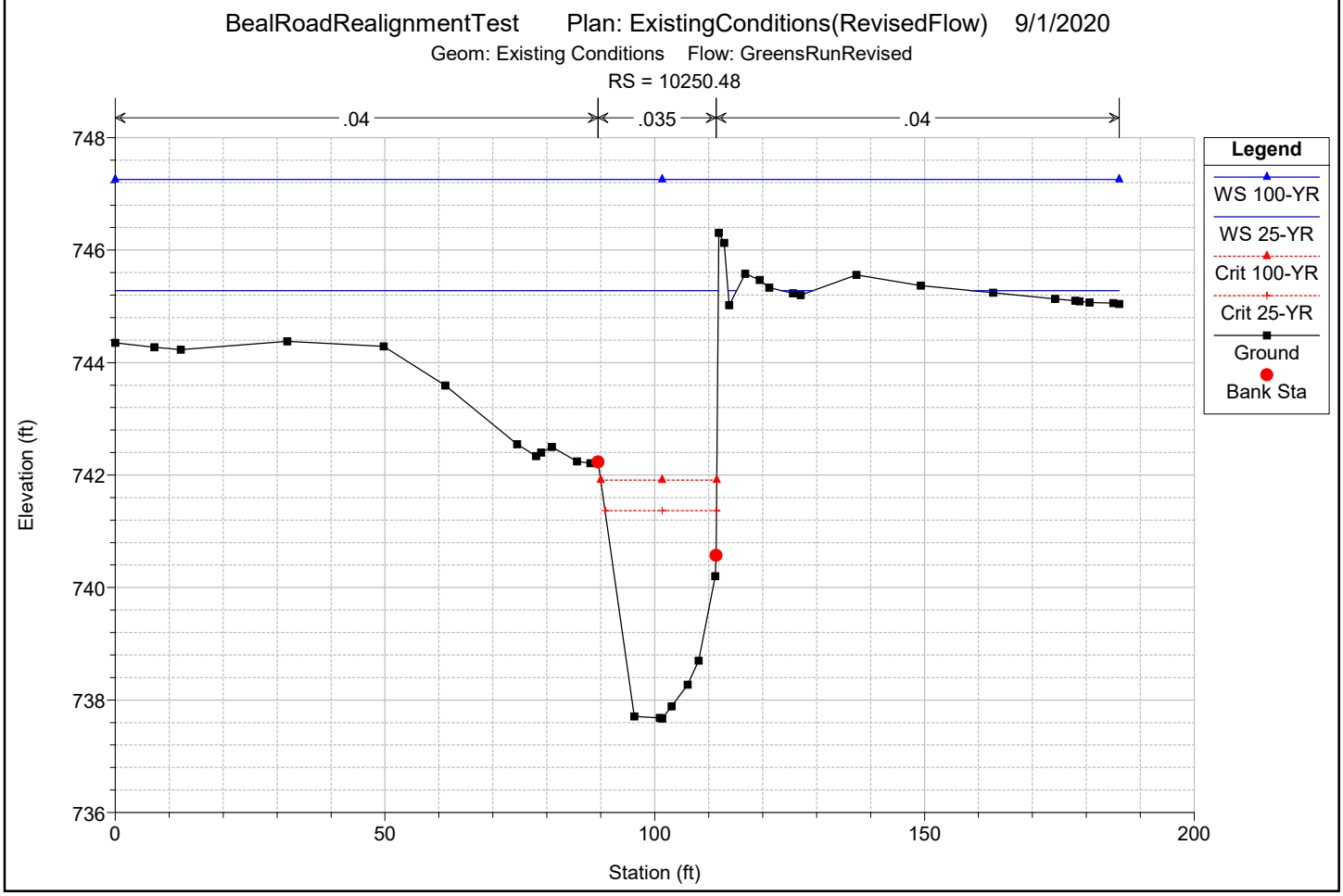
EXISTING CONDITIONS PROFILES, CROSS SECTIONS, AND RESULTS

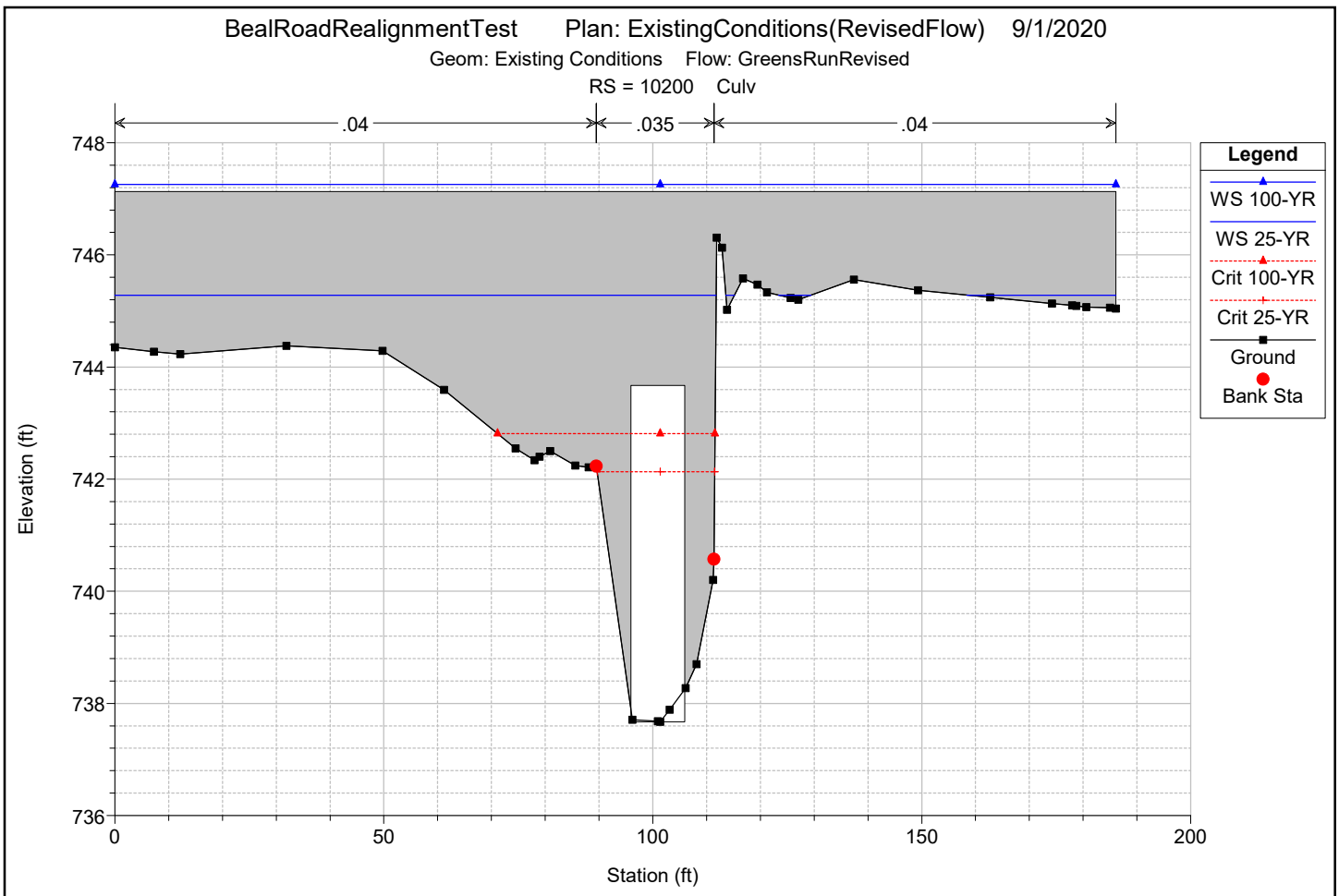

BealRoadRealignmentTest Plan: ExistingConditions(RevisedFlow) 9/3/2020
Geom: Existing Conditions Flow: GreensRunRevised
Greens Run Beal Road Reach
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Elevation (ft)
748
746
744
742
740
738
736
734
732
730
9400
9600
9800
10000
10200
10400
Main Channel Distance (ft)

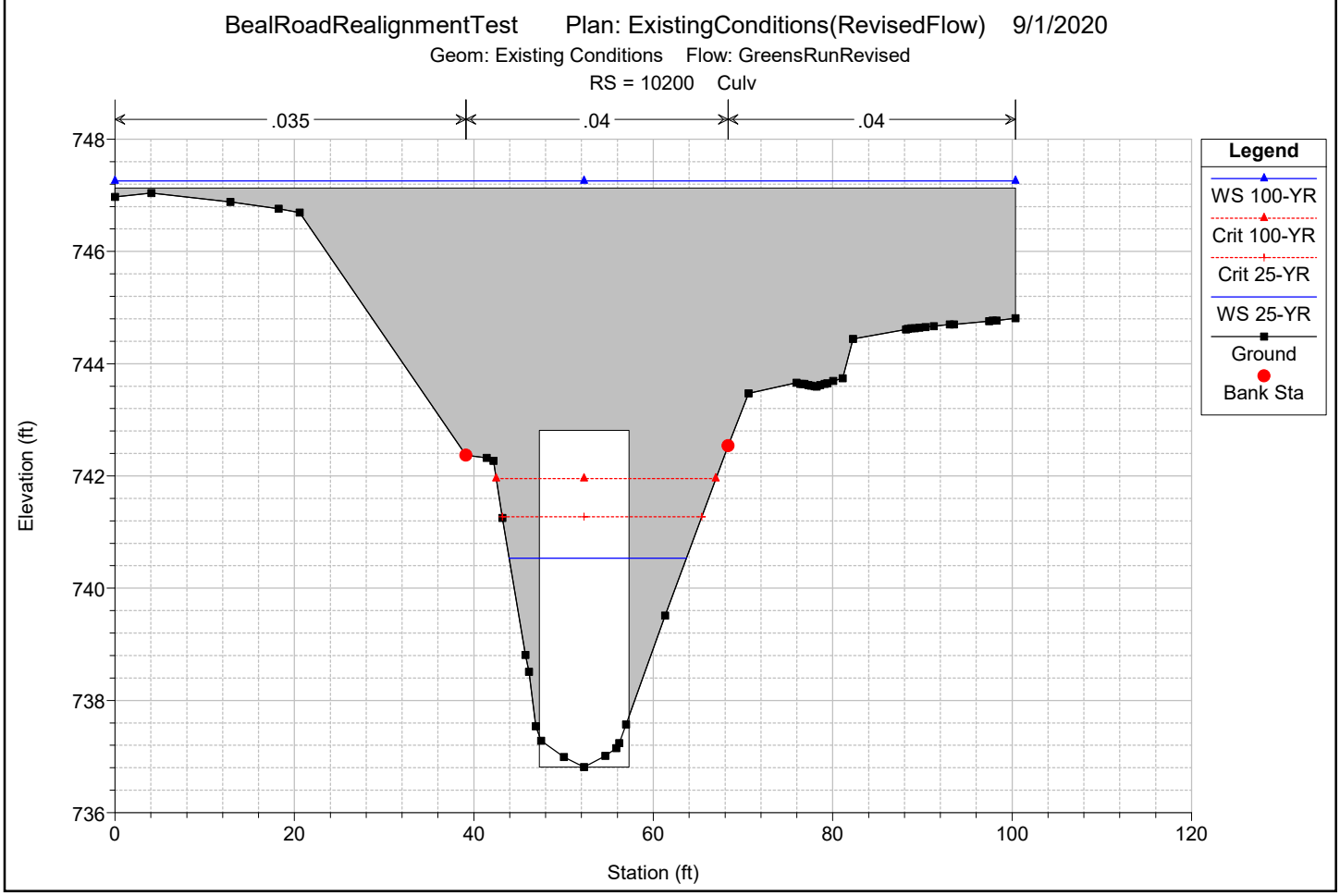
HEC-RAS Plan: ECRF River: Greens Run Reach: Beal Road Reach

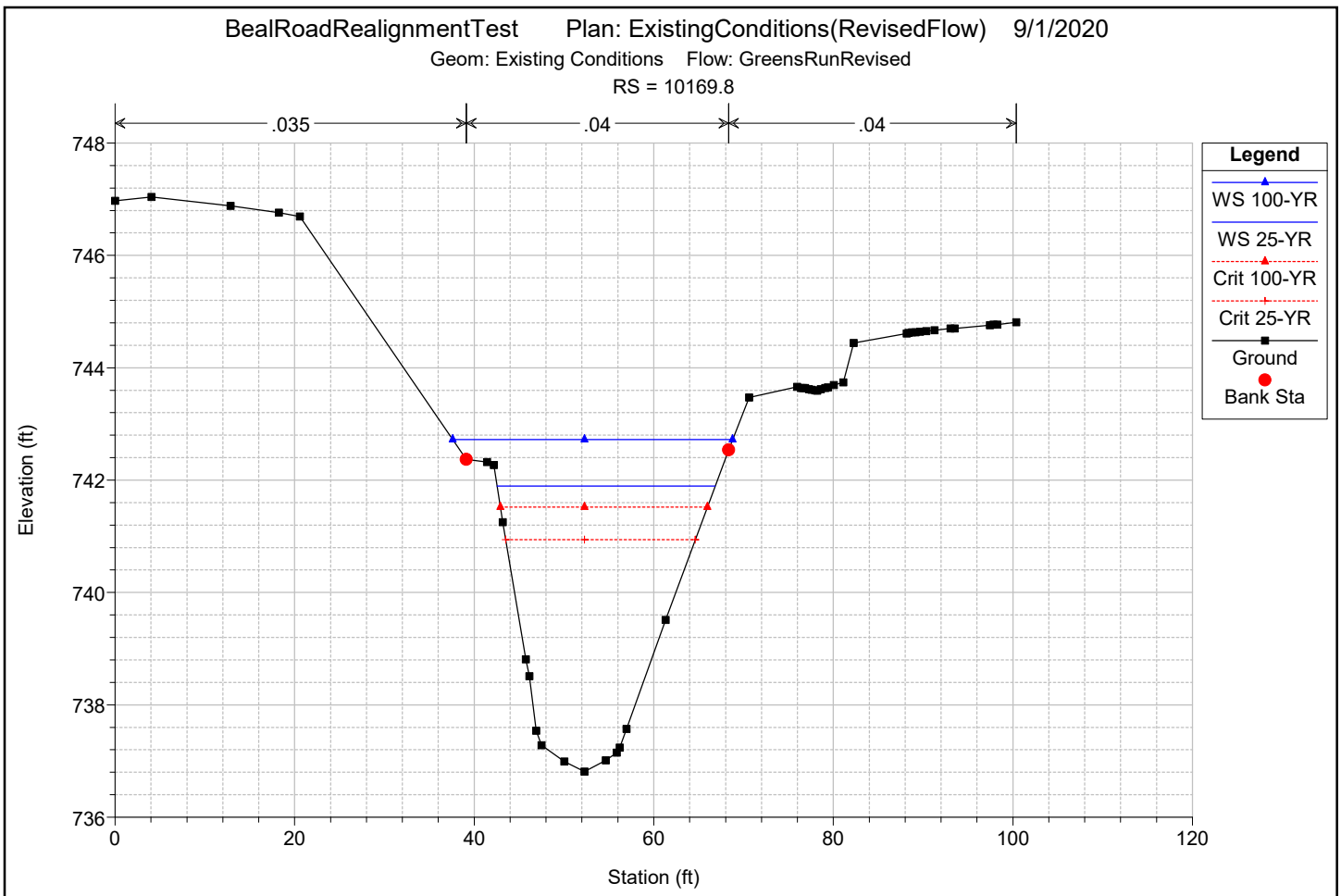
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Beal Road Reach	10333.38	25-YR	535.00	738.26	745.31	742.97	745.49	0.001424	3.57	166.87	83.12	0.33
Beal Road Reach	10333.38	100-YR	691.00	738.26	747.26	743.67	747.32	0.000341	2.27	385.70	122.36	0.17
Beal Road Reach	10250.48	25-YR	535.00	737.67	745.28	741.37	745.37	0.000381	2.72	283.86	147.15	0.19
Beal Road Reach	10250.48	100-YR	691.00	737.67	747.26	741.91	747.29	0.000108	1.73	645.61	186.08	0.10
Beal Road Reach	10200		Culvert									
Beal Road Reach	10169.8	25-YR	535.00	736.81	741.90	740.94	742.61	0.008013	6.77	79.00	24.28	0.66
Beal Road Reach	10169.8	100-YR	691.00	736.81	742.72	741.52	743.44	0.007387	6.82	101.54	31.16	0.65
Beal Road Reach	10153.25	25-YR	610.00	736.30	741.97	740.25	742.42	0.003211	5.39	113.08	30.61	0.49
Beal Road Reach	10153.25	100-YR	787.00	736.30	742.78	740.80	743.28	0.003043	5.66	139.11	33.50	0.49
Beal Road Reach	10040.79	25-YR	610.00	735.38	741.63	739.62	742.04	0.003344	5.11	119.30	36.66	0.50
Beal Road Reach	10040.79	100-YR	787.00	735.38	742.68	740.22	742.93	0.001836	4.28	225.55	110.62	0.38
Beal Road Reach	10020.79	25-YR	743.00	735.38	740.88	740.07	741.79	0.007057	7.68	96.80	27.97	0.73
Beal Road Reach	10020.79	100-YR	960.00	735.38	741.66	740.71	742.65	0.008374	7.98	120.28	37.80	0.79
Beal Road Reach	10000		Bridge									
Beal Road Reach	9972.407	25-YR	743.00	734.20	740.57	739.08	741.16	0.004154	6.17	120.51	32.67	0.57
Beal Road Reach	9972.407	100-YR	960.00	734.20	741.11	739.70	741.85	0.004753	6.92	138.76	34.98	0.61
Beal Road Reach	9884.092	25-YR	743.00	734.50	740.32	738.42	740.79	0.002773	5.53	137.09	61.09	0.48
Beal Road Reach	9884.092	100-YR	960.00	734.50	740.88	739.04	741.41	0.002824	5.98	192.10	116.11	0.49
Beal Road Reach	9766.492	25-YR	743.00	733.59	740.44	737.79	740.48	0.000342	2.05	500.62	224.00	0.16
Beal Road Reach	9766.492	100-YR	960.00	733.59	741.04	738.13	741.08	0.000306	2.09	635.98	229.30	0.16
Beal Road Reach	9564.450	25-YR	743.00	731.84	740.40	736.56	740.43	0.000149	1.75	680.91	238.69	0.12
Beal Road Reach	9564.450	100-YR	960.00	731.84	741.00	737.79	741.03	0.000146	1.83	828.70	253.98	0.12

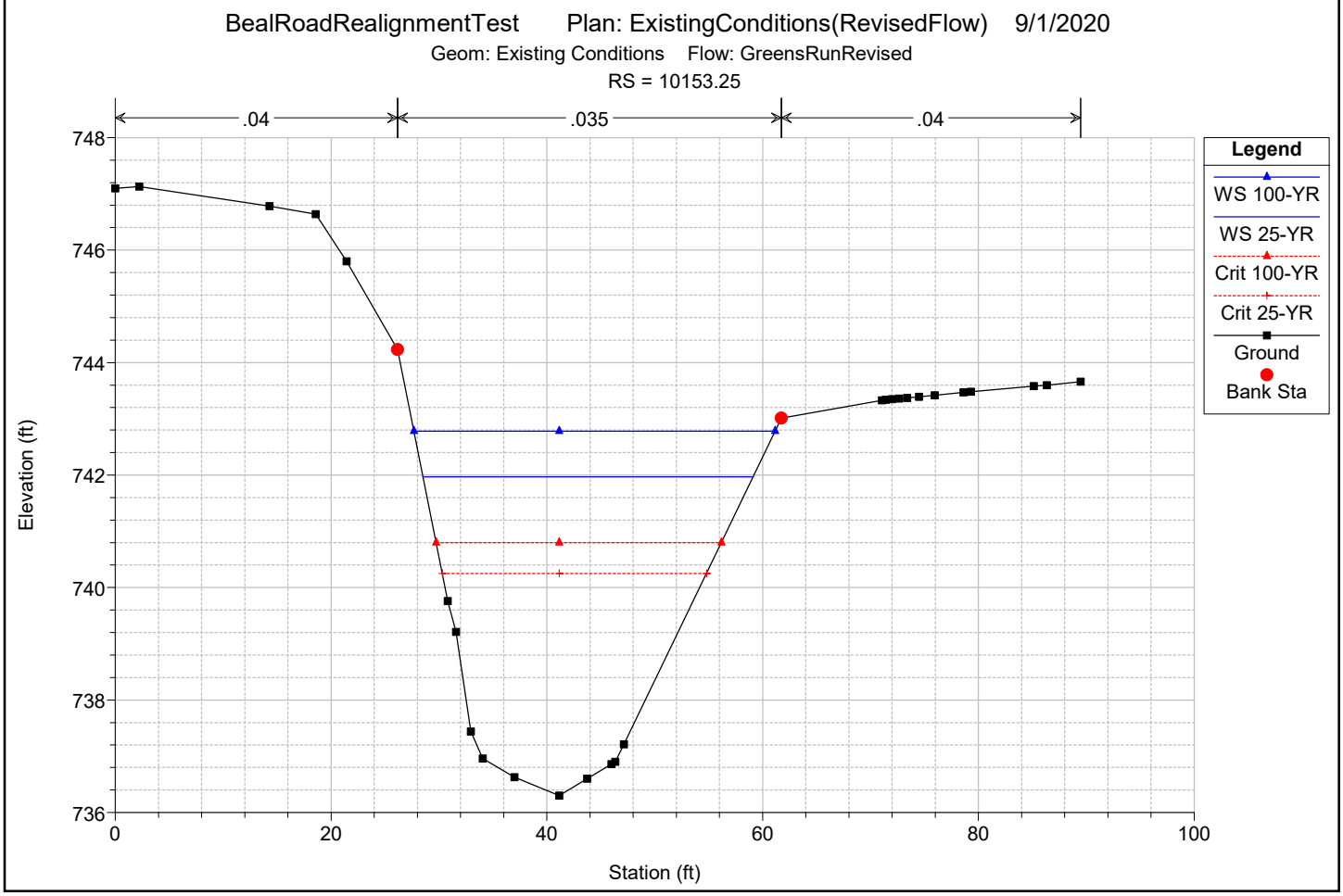

BealRoadRealignmentTest Plan: ExistingConditions(RevisedFlow) 9/1/2020
Geom: Existing Conditions Flow: GreensRunRevised
RS = 10333.38
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
752
750
748
746
744
742
740
738
0
50
100
150
200
250
300
350


BealRoadRealignmentTest Plan: ExistingConditions(RevisedFlow) 9/1/2020
Geom: Existing Conditions Flow: GreensRunRevised
RS = 10250.48
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
748
746
744
742
740
738
736
0
50
100
150
200


BealRoadRealignmentTest Plan: ExistingConditions(RevisedFlow) 9/1/2020
Geom: Existing Conditions Flow: GreensRunRevised
RS = 10200 Culv
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
748
746
744
742
740
738
736
0
50
100
150
200


BealRoadRealignmentTest Plan: ExistingConditions(RevisedFlow) 9/1/2020
Geom: Existing Conditions Flow: GreensRunRevised
RS = 10200 Culv
.035
.04
.04
Legend
WS 100-YR
Crit 100-YR
Crit 25-YR
WS 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
748
746
744
742
740
738
736
0
20
40
60
80
100
120

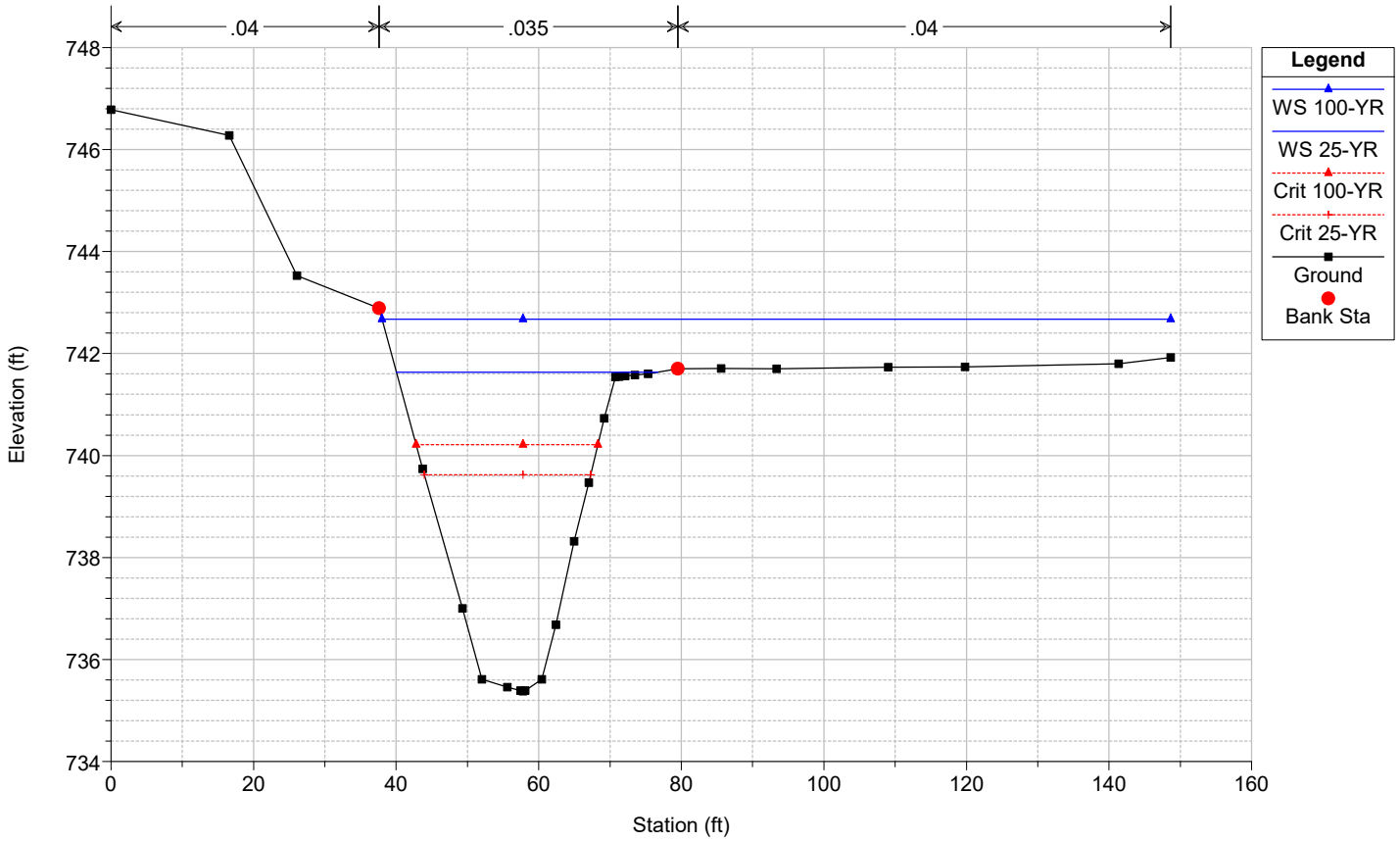

BealRoadRealignmentTest Plan: ExistingConditions(RevisedFlow) 9/1/2020
Geom: Existing Conditions Flow: GreensRunRevised
RS = 10169.8
.035
.04
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
748
746
744
742
740
738
736
0
20
40
60
80
100
120


BealRoadRealignmentTest Plan: ExistingConditions(RevisedFlow) 9/1/2020
Geom: Existing Conditions Flow: GreensRunRevised
RS = 10153.25
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
748
746
744
742
740
738
736
0
20
40
60
80
100

BealRoadRealignmentTest Plan: ExistingConditions(RevisedFlow) 9/1/2020

Geom: Existing Conditions Flow: GreensRunRevised

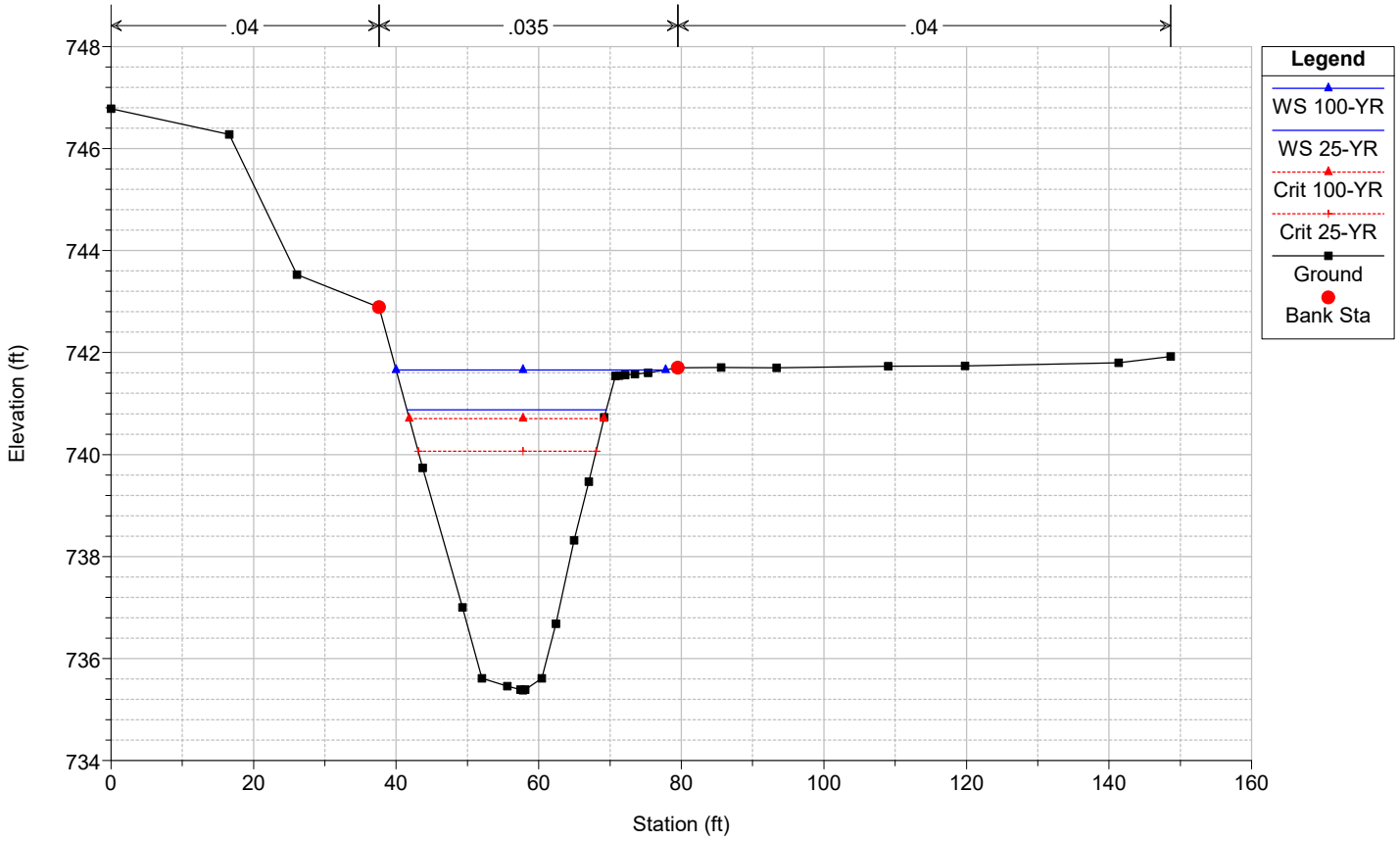
RS = 10040.79

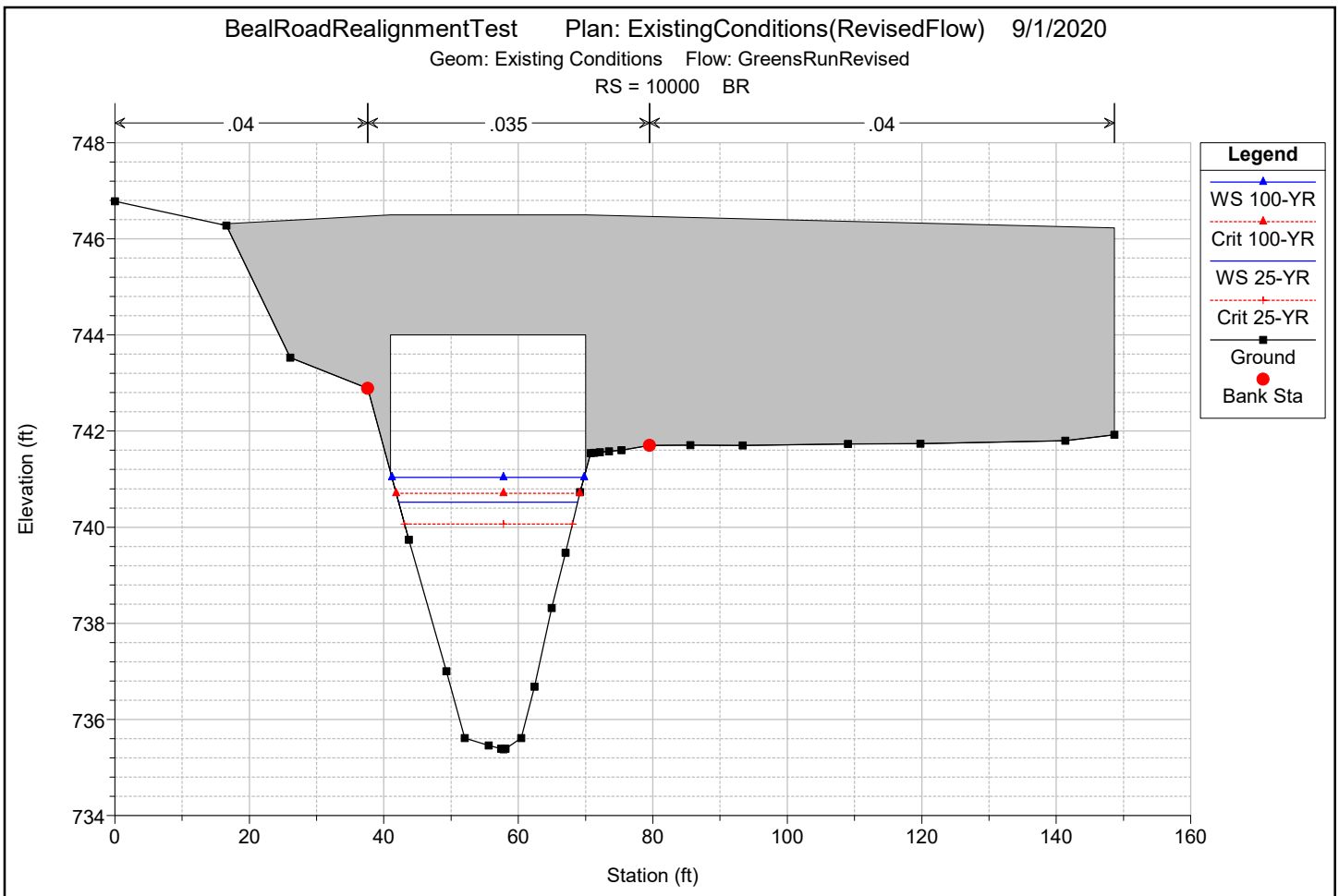


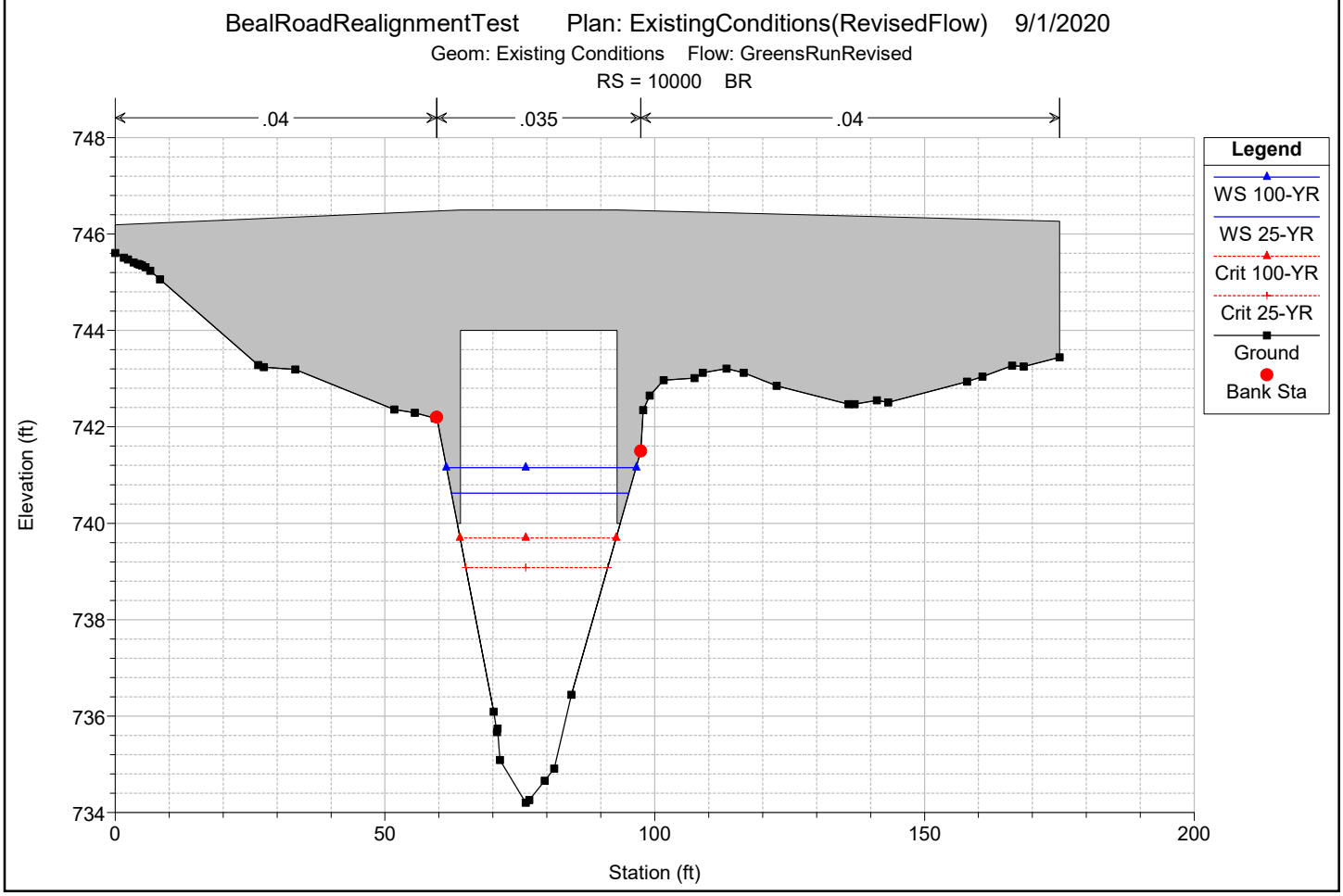
BealRoadRealignmentTest Plan: ExistingConditions(RevisedFlow) 9/1/2020

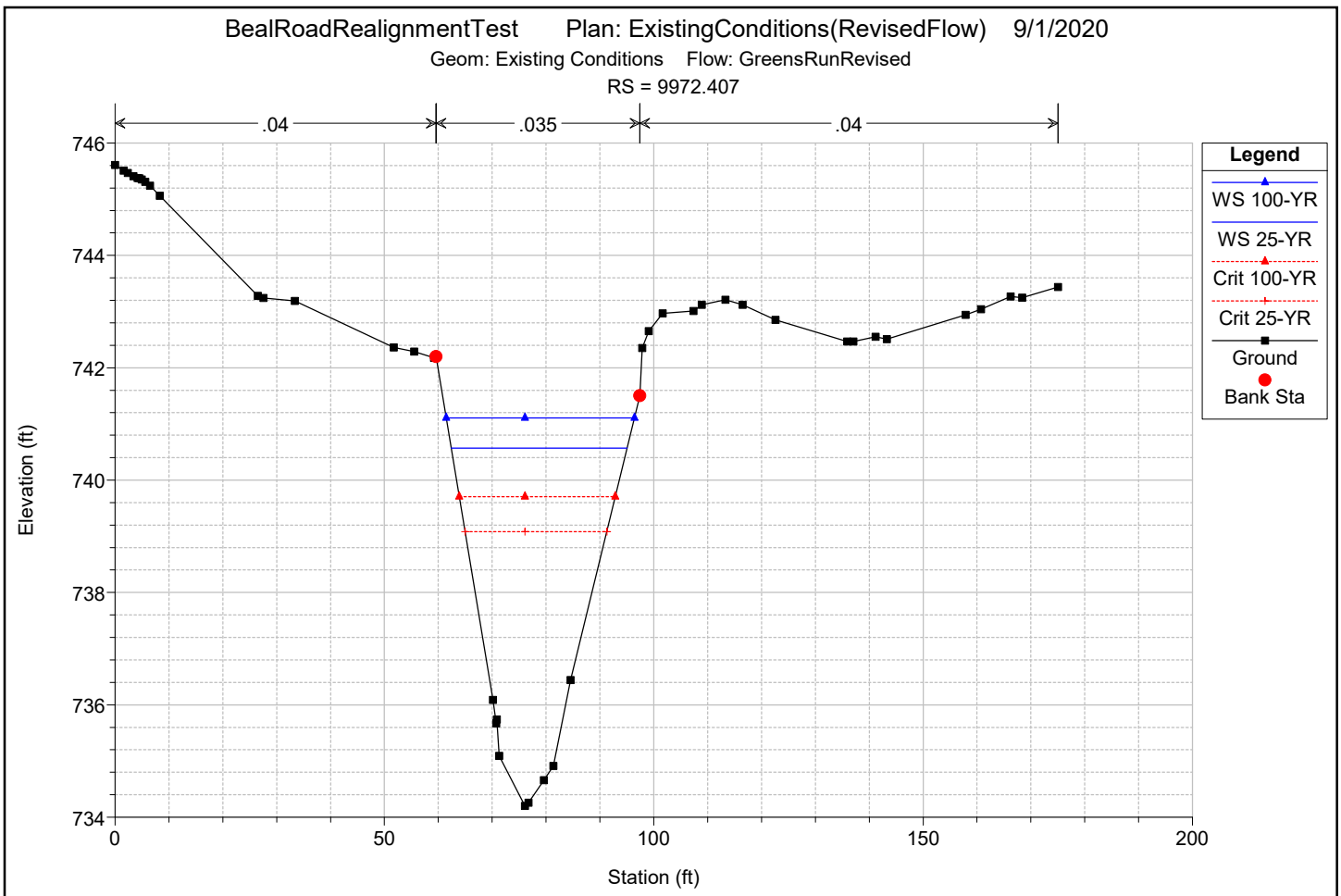
Geom: Existing Conditions Flow: GreensRunRevised

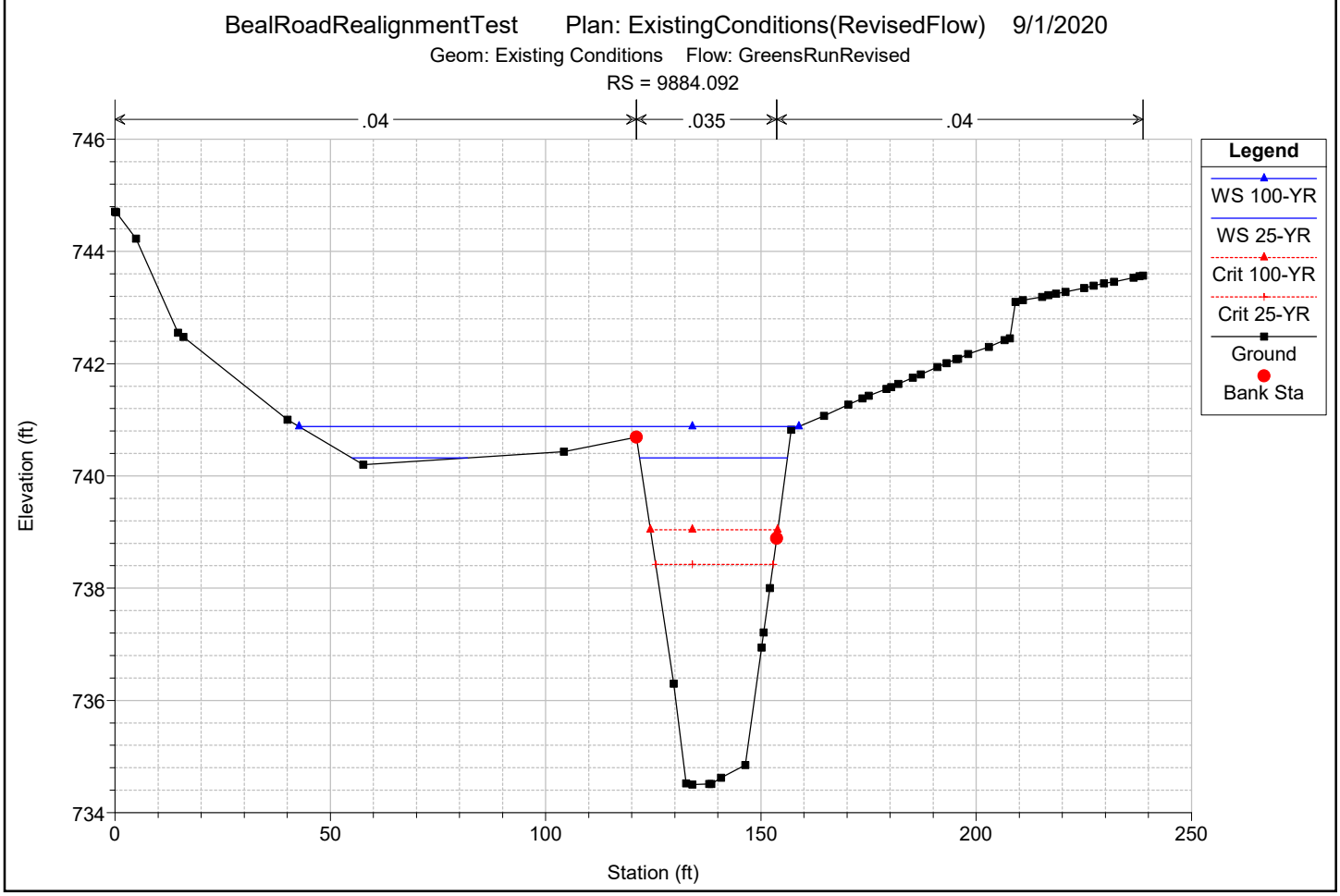
RS = 10020.79

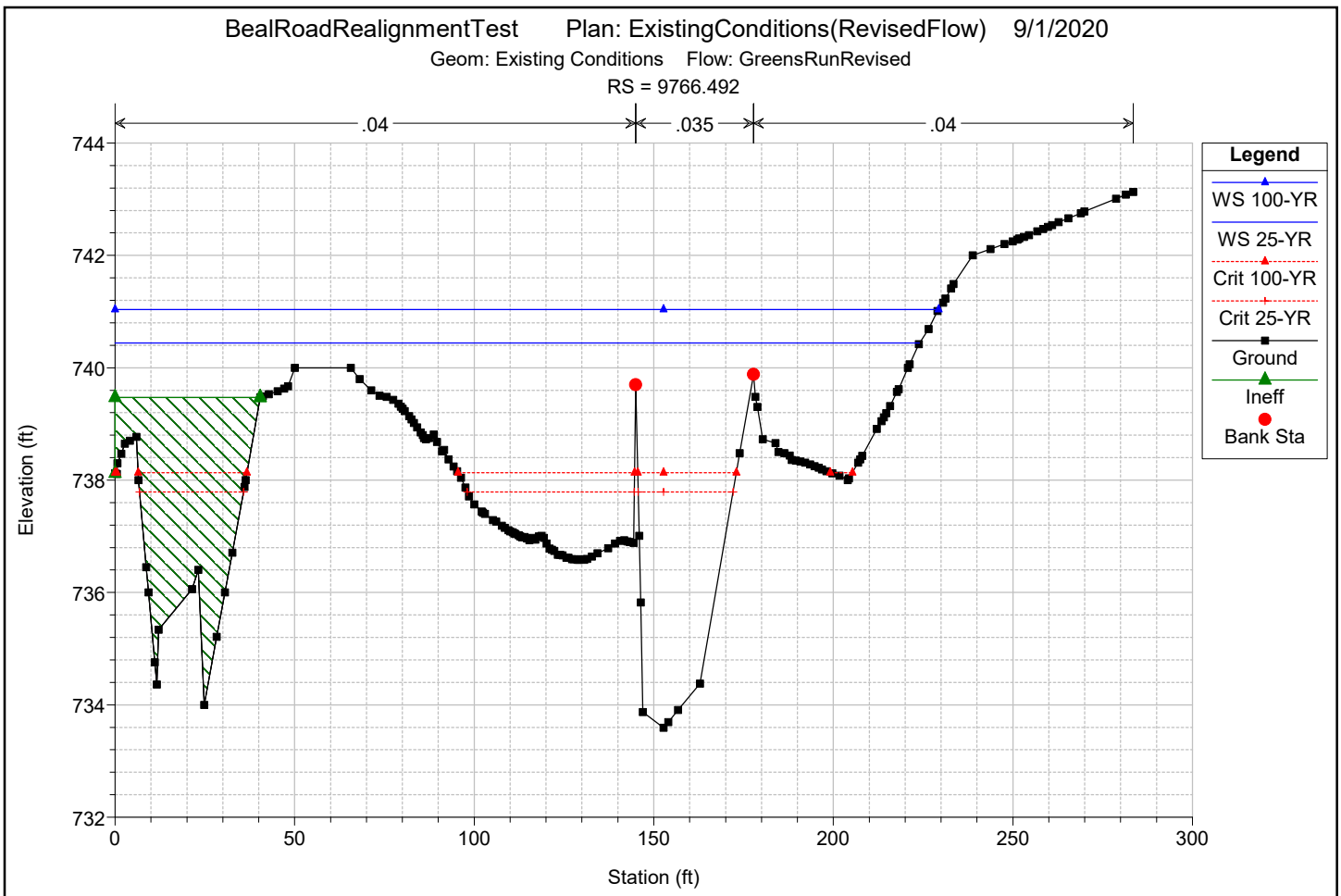


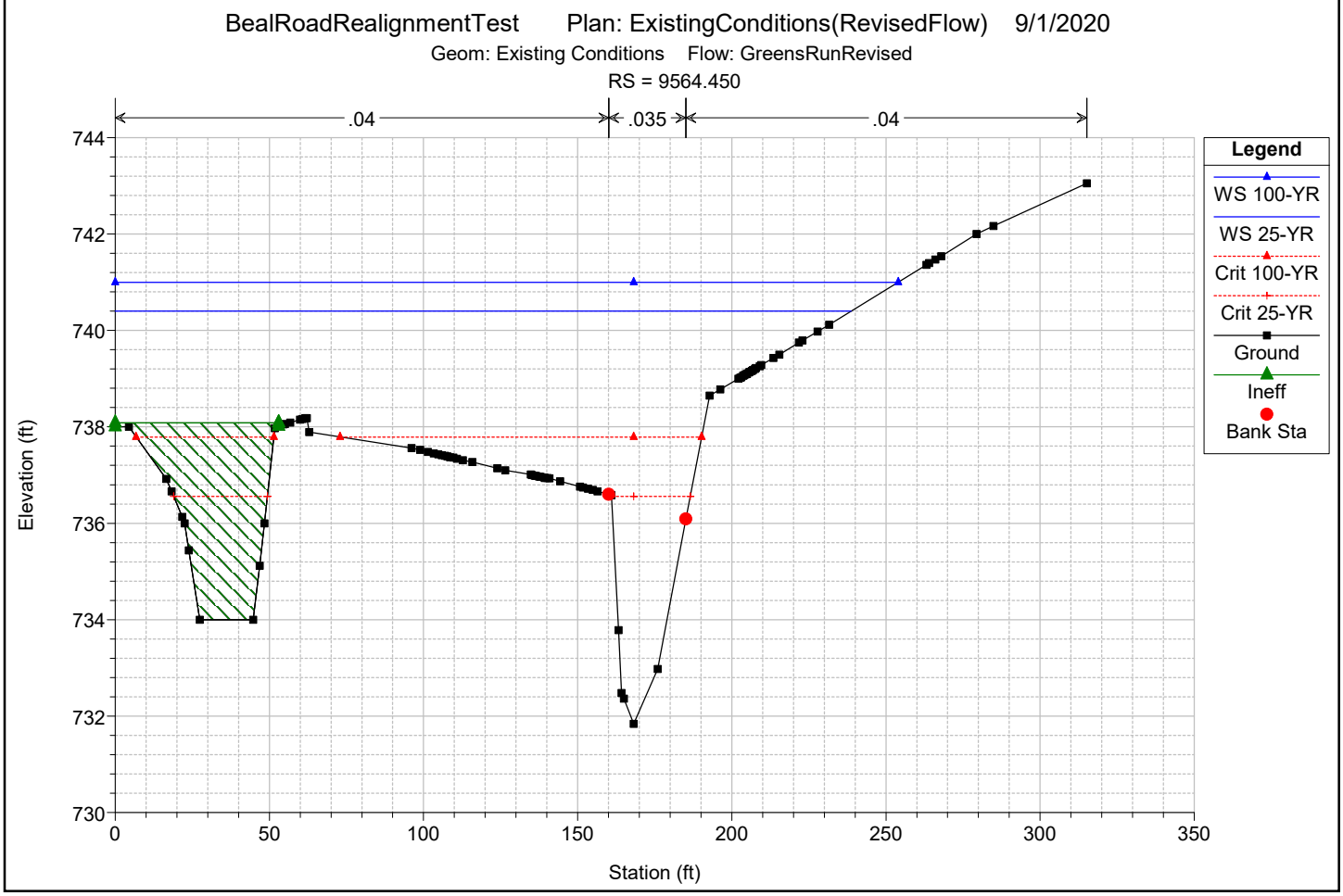

BealRoadRealignmentTest Plan: ExistingConditions(RevisedFlow) 9/1/2020
Geom: Existing Conditions Flow: GreensRunRevised
RS = 10000 BR
.04
.035
.04
Legend
WS 100-YR
Crit 100-YR
WS 25-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
748
746
744
742
740
738
736
734
0
20
40
60
80
100
120
140
160


BealRoadRealignmentTest Plan: ExistingConditions(RevisedFlow) 9/1/2020
Geom: Existing Conditions Flow: GreensRunRevised
RS = 10000 BR
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
748
746
744
742
740
738
736
734
0
50
100
150
200


BealRoadRealignmentTest Plan: ExistingConditions(RevisedFlow) 9/1/2020
Geom: Existing Conditions Flow: GreensRunRevised
RS = 9972.407
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
746
744
742
740
738
736
734
0
50
100
150
200

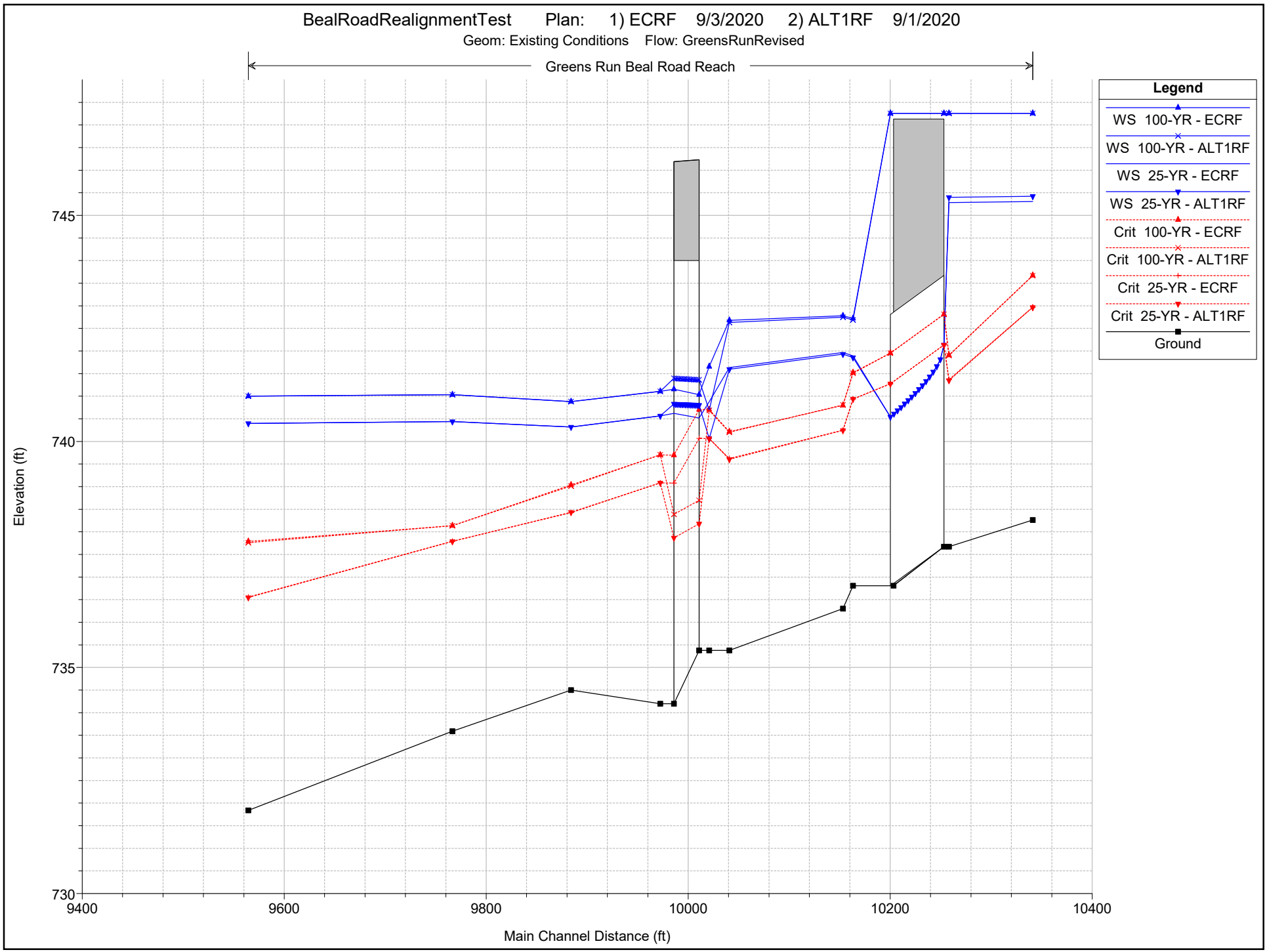

BealRoadRealignmentTest Plan: ExistingConditions(RevisedFlow) 9/1/2020
Geom: Existing Conditions Flow: GreensRunRevised
RS = 9884.092
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
746
744
742
740
738
736
734
0
50
100
150
200
250


BealRoadRealignmentTest Plan: ExistingConditions(RevisedFlow) 9/1/2020
Geom: Existing Conditions Flow: GreensRunRevised
RS = 9766.492
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
744
742
740
738
736
734
732
0
50
100
150
200
250
300


BealRoadRealignmentTest Plan: ExistingConditions(RevisedFlow) 9/1/2020
Geom: Existing Conditions Flow: GreensRunRevised
RS = 9564.450
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
744
742
740
738
736
734
732
730
0
50
100
150
200
250
300
350

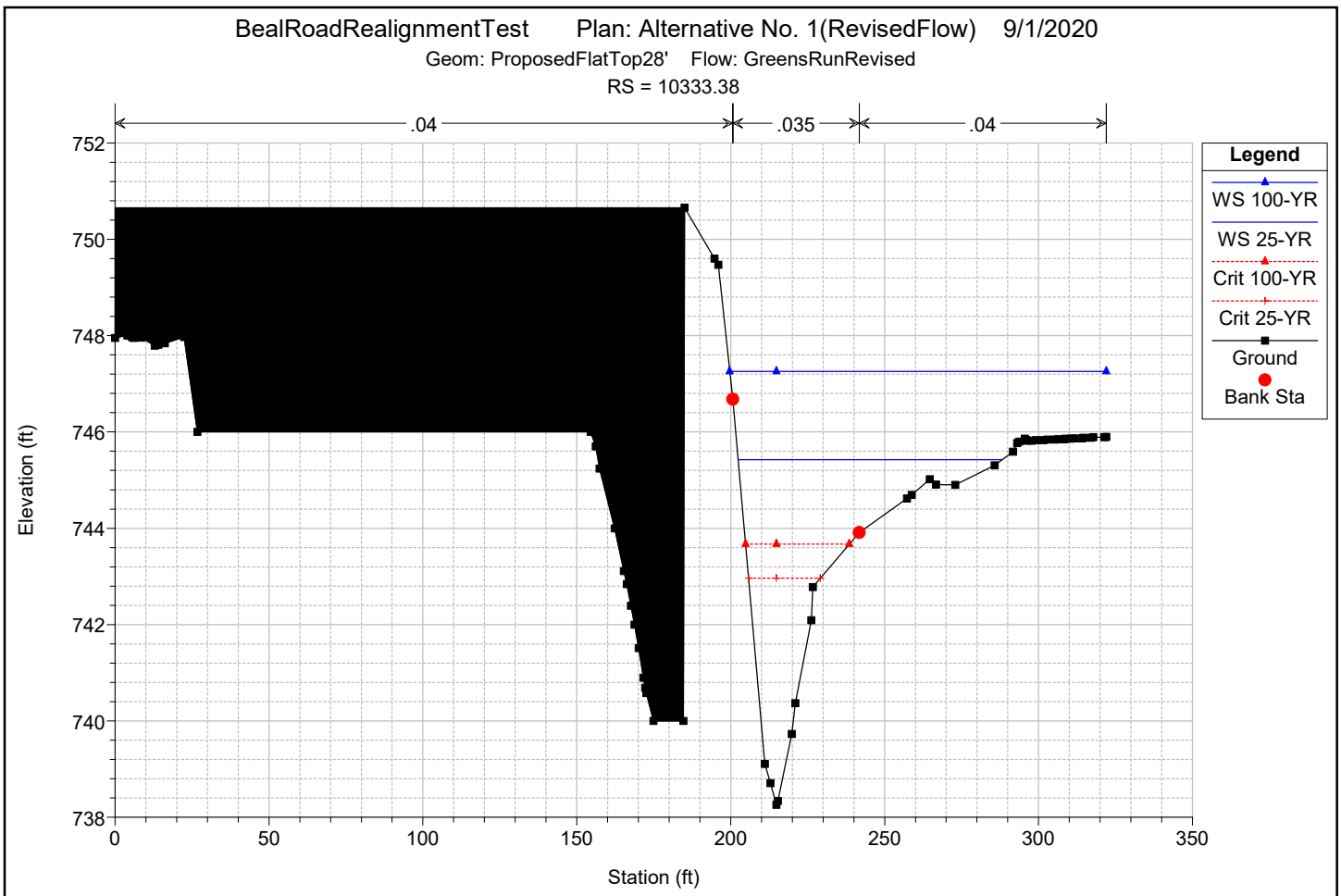
APPENDIX D

ALTERNATIVE 1 PROFILES, CROSS SECTIONS, AND RESULTS


BealRoadRealignmentTest Plan: 1) ECRF 9/3/2020 2) ALT1RF 9/1/2020
Geom: Existing Conditions Flow: GreensRunRevised
Greens Run Beal Road Reach
Legend
WS 100-YR - ECRF
WS 100-YR - ALT1RF
WS 25-YR - ECRF
WS 25-YR - ALT1RF
Crit 100-YR - ECRF
Crit 100-YR - ALT1RF
Crit 25-YR - ECRF
Crit 25-YR - ALT1RF
Ground
Elevation (ft)
745
740
735
730
9400
9600
9800
10000
10200
10400
Main Channel Distance (ft)

HEC-RAS River: Greens Run Reach: Beal Road Reach

Reach	River Sta	Profile	Plan	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)	
Beal Road Reach	10333.38	25-YR	ALT1RF	535.00	738.26	745.42	742.97	745.59	0.001258	3.42	176.63	85.74	0.31
Beal Road Reach	10333.38	25-YR	ECRF	535.00	738.26	745.31	742.97	745.49	0.001424	3.57	166.87	83.12	0.33
Beal Road Reach	10333.38	100-YR	ALT1RF	691.00	738.26	747.26	743.67	747.32	0.000341	2.27	385.70	122.36	0.17
Beal Road Reach	10333.38	100-YR	ECRF	691.00	738.26	747.26	743.67	747.32	0.000341	2.27	385.70	122.36	0.17
Beal Road Reach	10250.48	25-YR	ALT1RF	535.00	737.67	745.40	741.35	745.48	0.000341	2.60	302.66	165.41	0.18
Beal Road Reach	10250.48	25-YR	ECRF	535.00	737.67	745.28	741.37	745.37	0.000381	2.72	283.86	147.15	0.19
Beal Road Reach	10250.48	100-YR	ALT1RF	691.00	737.67	747.26	741.90	747.29	0.000108	1.73	645.61	186.08	0.10
Beal Road Reach	10250.48	100-YR	ECRF	691.00	737.67	747.26	741.91	747.29	0.000108	1.73	645.61	186.08	0.10
Beal Road Reach	10200			Culvert									
Beal Road Reach	10169.8	25-YR	ALT1RF	535.00	736.81	741.85	740.94	742.59	0.008292	6.86	78.01	24.14	0.67
Beal Road Reach	10169.8	25-YR	ECRF	535.00	736.81	741.90	740.94	742.61	0.008013	6.77	79.00	24.28	0.66
Beal Road Reach	10169.8	100-YR	ALT1RF	691.00	736.81	742.69	741.51	743.42	0.007650	6.89	100.42	30.92	0.66
Beal Road Reach	10169.8	100-YR	ECRF	691.00	736.81	742.72	741.52	743.44	0.007387	6.82	101.54	31.16	0.65
Beal Road Reach	10153.25	25-YR	ALT1RF	610.00	736.30	741.93	740.25	742.39	0.003304	5.45	111.90	30.47	0.50
Beal Road Reach	10153.25	25-YR	ECRF	610.00	736.30	741.97	740.25	742.42	0.003211	5.39	113.08	30.61	0.49
Beal Road Reach	10153.25	100-YR	ALT1RF	787.00	736.30	742.75	740.80	743.25	0.003111	5.70	137.97	33.38	0.49
Beal Road Reach	10153.25	100-YR	ECRF	787.00	736.30	742.78	740.80	743.28	0.003043	5.66	139.11	33.50	0.49
Beal Road Reach	10040.79	25-YR	ALT1RF	610.00	735.38	741.59	739.61	742.01	0.003244	5.17	117.93	34.67	0.49
Beal Road Reach	10040.79	25-YR	ECRF	610.00	735.38	741.63	739.62	742.04	0.003344	5.11	119.30	36.66	0.50
Beal Road Reach	10040.79	100-YR	ALT1RF	787.00	735.38	742.63	740.20	742.90	0.001934	4.36	220.47	110.54	0.39
Beal Road Reach	10040.79	100-YR	ECRF	787.00	735.38	742.68	740.22	742.93	0.001836	4.28	225.55	110.62	0.38
Beal Road Reach	10020.79	25-YR	ALT1RF	743.00	735.38	740.06	740.06	741.58	0.013944	9.87	75.26	24.96	1.00
Beal Road Reach	10020.79	25-YR	ECRF	743.00	735.38	740.88	740.07	741.79	0.007057	7.68	96.80	27.97	0.73
Beal Road Reach	10020.79	100-YR	ALT1RF	960.00	735.38	740.69	740.69	742.40	0.013673	10.48	91.57	27.24	1.01
Beal Road Reach	10020.79	100-YR	ECRF	960.00	735.38	741.66	740.71	742.65	0.008374	7.98	120.28	37.80	0.79
Beal Road Reach	10000			Culvert									
Beal Road Reach	9972.407	25-YR	ALT1RF	743.00	734.20	740.57	739.08	741.16	0.004154	6.17	120.51	32.67	0.57
Beal Road Reach	9972.407	25-YR	ECRF	743.00	734.20	740.57	739.08	741.16	0.004154	6.17	120.51	32.67	0.57
Beal Road Reach	9972.407	100-YR	ALT1RF	960.00	734.20	741.11	739.71	741.85	0.004753	6.92	138.76	34.98	0.61
Beal Road Reach	9972.407	100-YR	ECRF	960.00	734.20	741.11	739.70	741.85	0.004753	6.92	138.76	34.98	0.61
Beal Road Reach	9884.092	25-YR	ALT1RF	743.00	734.50	740.32	738.43	740.79	0.002773	5.53	137.09	61.09	0.48
Beal Road Reach	9884.092	25-YR	ECRF	743.00	734.50	740.32	738.42	740.79	0.002773	5.53	137.09	61.09	0.48
Beal Road Reach	9884.092	100-YR	ALT1RF	960.00	734.50	740.88	739.01	741.41	0.002824	5.98	192.10	116.11	0.49
Beal Road Reach	9884.092	100-YR	ECRF	960.00	734.50	740.88	739.04	741.41	0.002824	5.98	192.10	116.11	0.49
Beal Road Reach	9766.492	25-YR	ALT1RF	743.00	733.59	740.44	737.79	740.48	0.000342	2.05	500.62	224.00	0.16
Beal Road Reach	9766.492	25-YR	ECRF	743.00	733.59	740.44	737.79	740.48	0.000342	2.05	500.62	224.00	0.16
Beal Road Reach	9766.492	100-YR	ALT1RF	960.00	733.59	741.04	738.14	741.08	0.000306	2.09	635.98	229.30	0.16
Beal Road Reach	9766.492	100-YR	ECRF	960.00	733.59	741.04	738.13	741.08	0.000306	2.09	635.98	229.30	0.16
Beal Road Reach	9564.450	25-YR	ALT1RF	743.00	731.84	740.40	736.55	740.43	0.000149	1.75	680.91	238.69	0.12
Beal Road Reach	9564.450	25-YR	ECRF	743.00	731.84	740.40	736.56	740.43	0.000149	1.75	680.91	238.69	0.12
Beal Road Reach	9564.450	100-YR	ALT1RF	960.00	731.84	741.00	737.76	741.03	0.000146	1.83	828.70	253.98	0.12
Beal Road Reach	9564.450	100-YR	ECRF	960.00	731.84	741.00	737.79	741.03	0.000146	1.83	828.70	253.98	0.12


BealRoadRealignmentTest Plan: Alternative No. 1(RevisedFlow) 9/1/2020
Geom: ProposedFlatTop28' Flow: GreensRunRevised
RS = 10333.38
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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750
748
746
744
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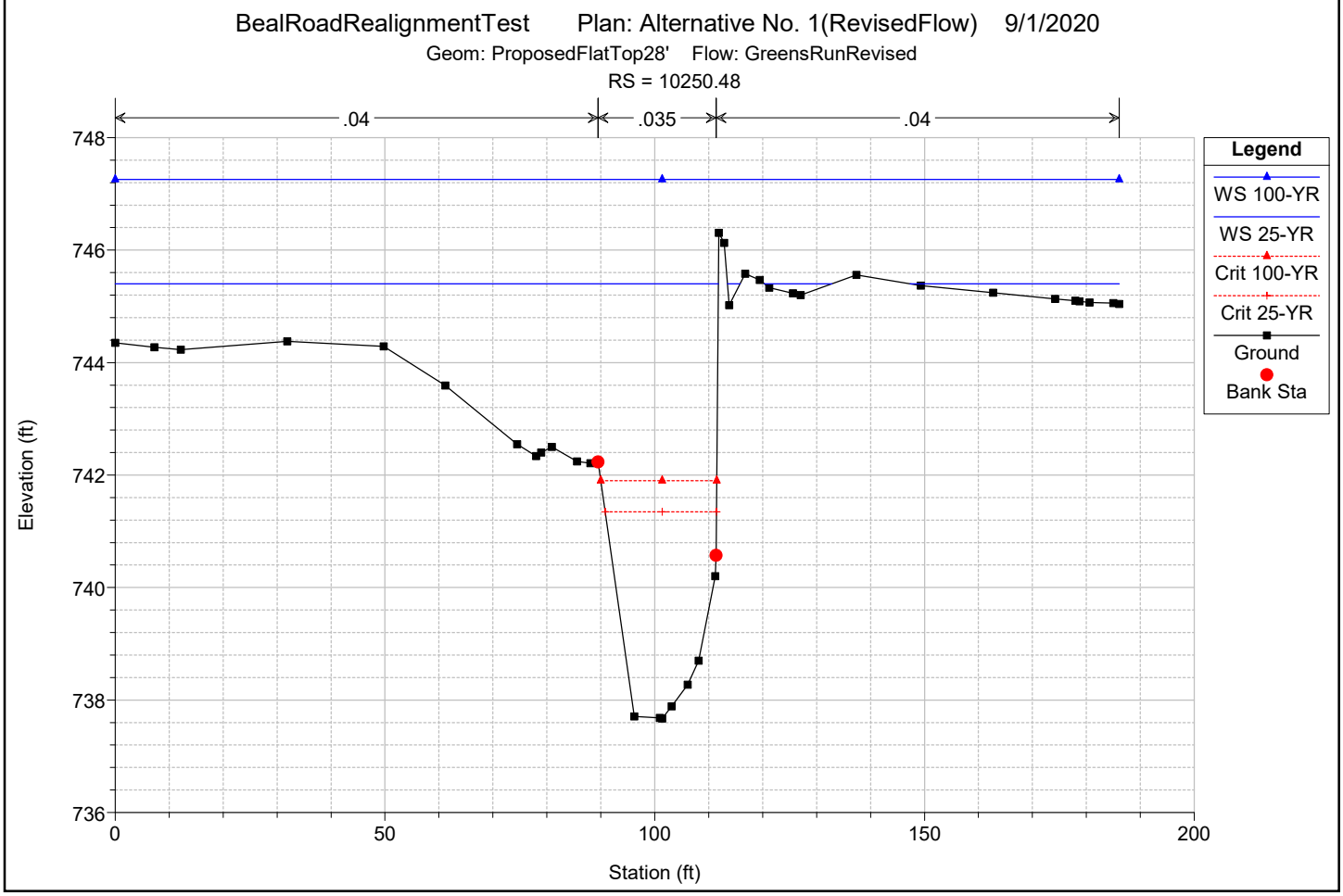
BealRoadRealignmentTest Plan: Alternative No. 1(RevisedFlow) 9/1/2020
Geom: ProposedFlatTop28' Flow: GreensRunRevised
RS = 10250.48
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.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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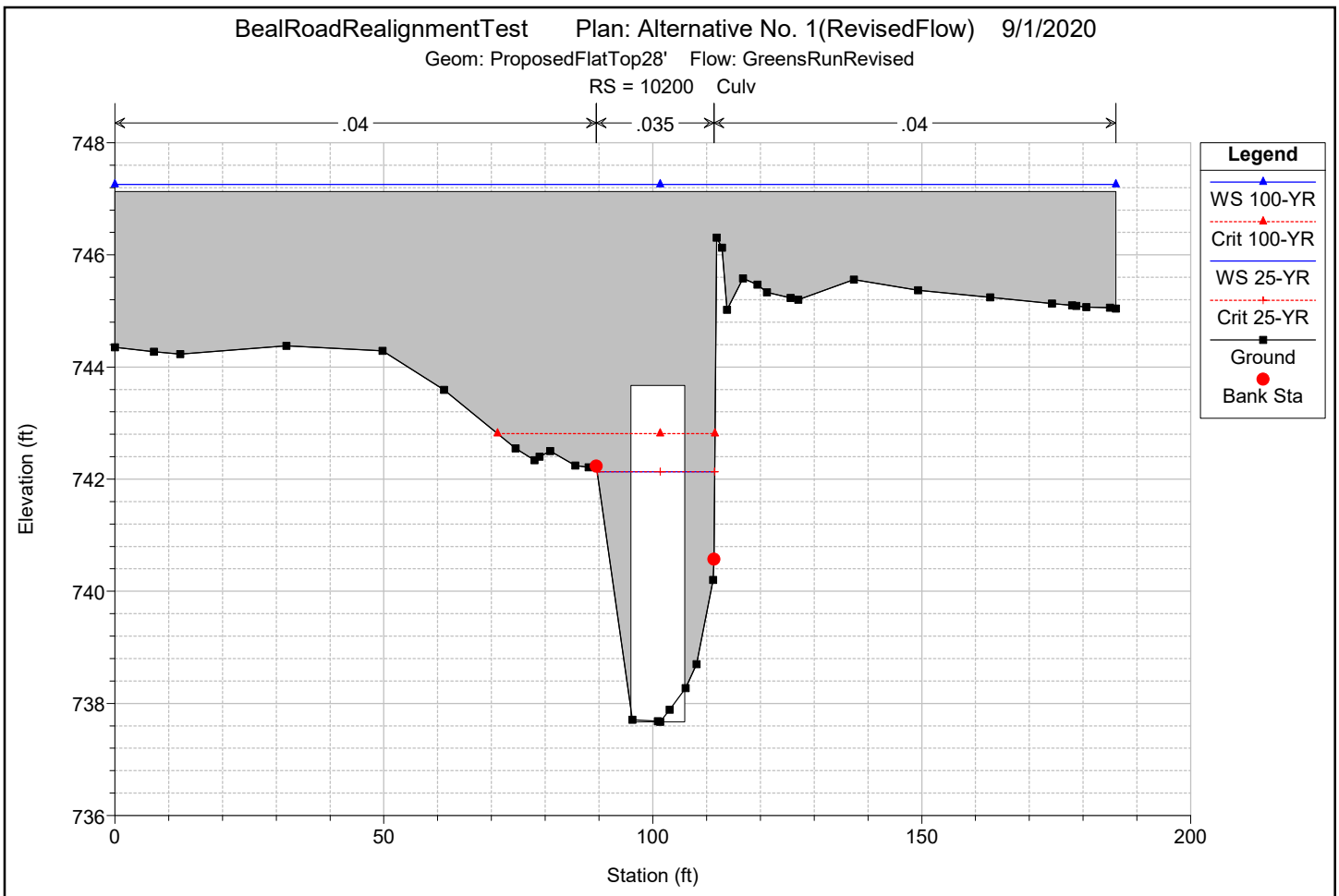
BealRoadRealignmentTest Plan: Alternative No. 1(RevisedFlow) 9/1/2020
Geom: ProposedFlatTop28' Flow: GreensRunRevised
RS = 10200 Culv
.04
.035
.04
Legend
WS 100-YR
Crit 100-YR
WS 25-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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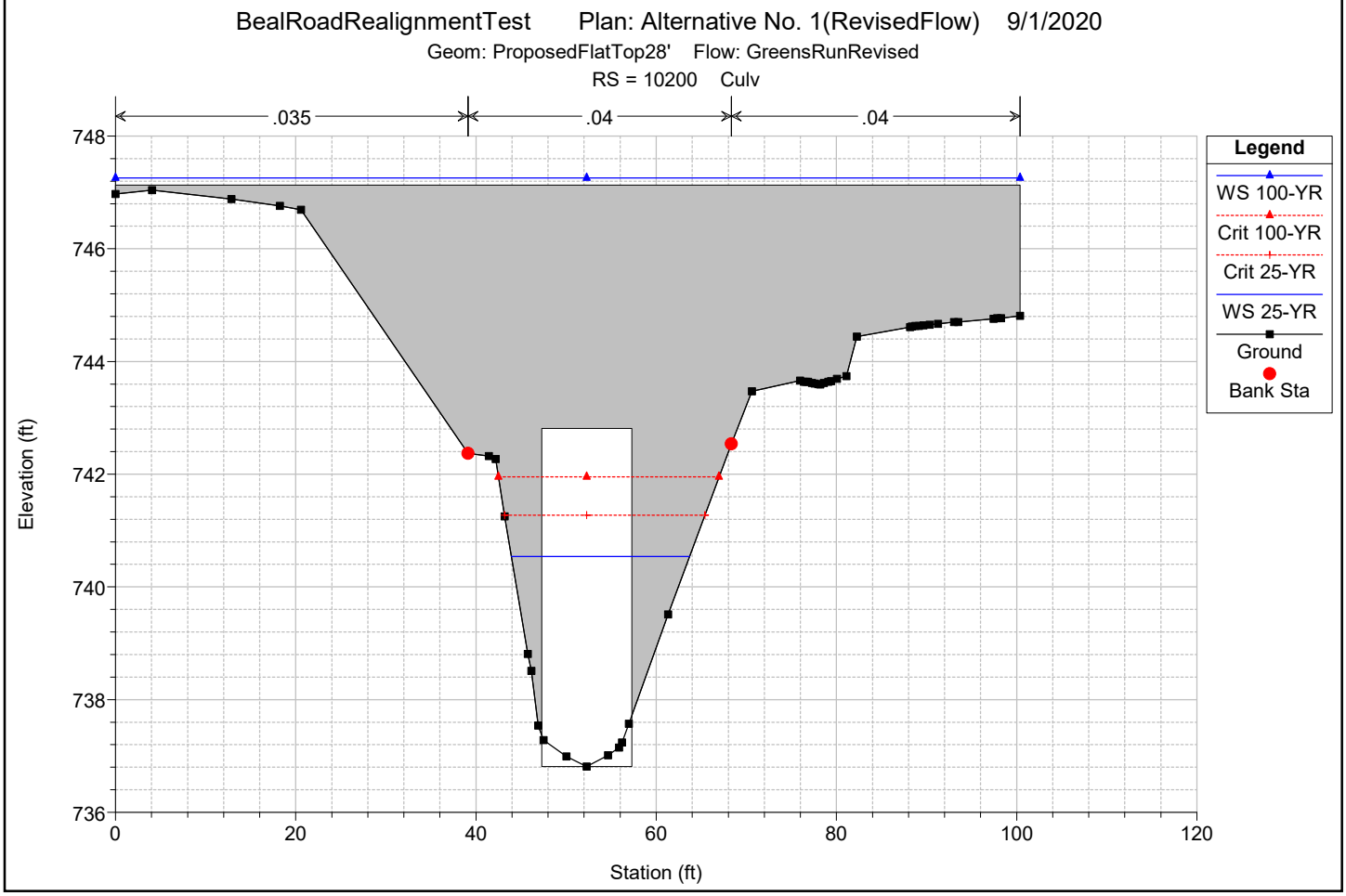
BealRoadRealignmentTest Plan: Alternative No. 1(RevisedFlow) 9/1/2020
Geom: ProposedFlatTop28' Flow: GreensRunRevised
RS = 10200 Culv
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.04
Legend
WS 100-YR
Crit 100-YR
Crit 25-YR
WS 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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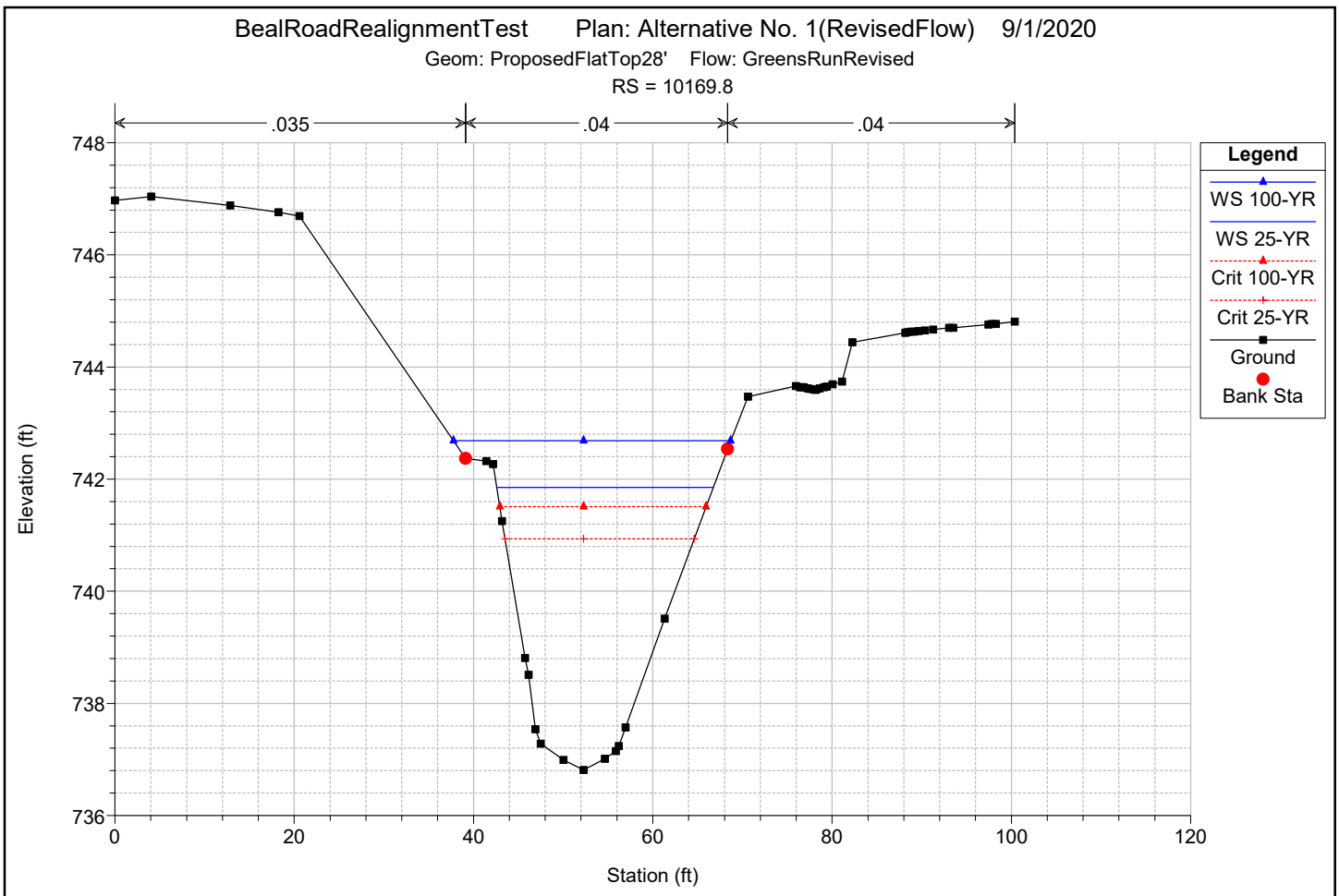
BealRoadRealignmentTest Plan: Alternative No. 1(RevisedFlow) 9/1/2020
Geom: ProposedFlatTop28' Flow: GreensRunRevised
RS = 10169.8
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Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
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Station (ft)
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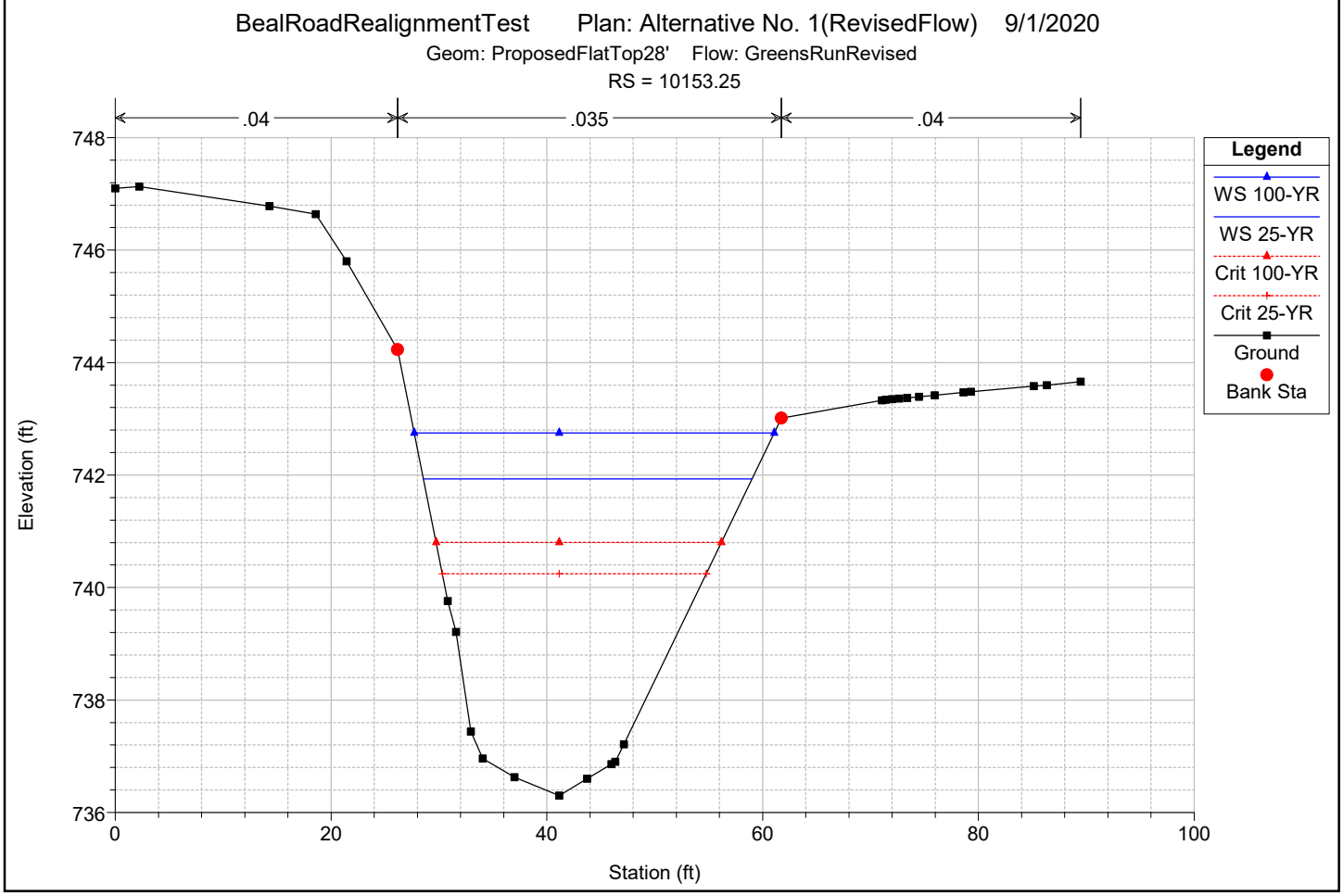
BealRoadRealignmentTest Plan: Alternative No. 1(RevisedFlow) 9/1/2020
Geom: ProposedFlatTop28' Flow: GreensRunRevised
RS = 10153.25
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.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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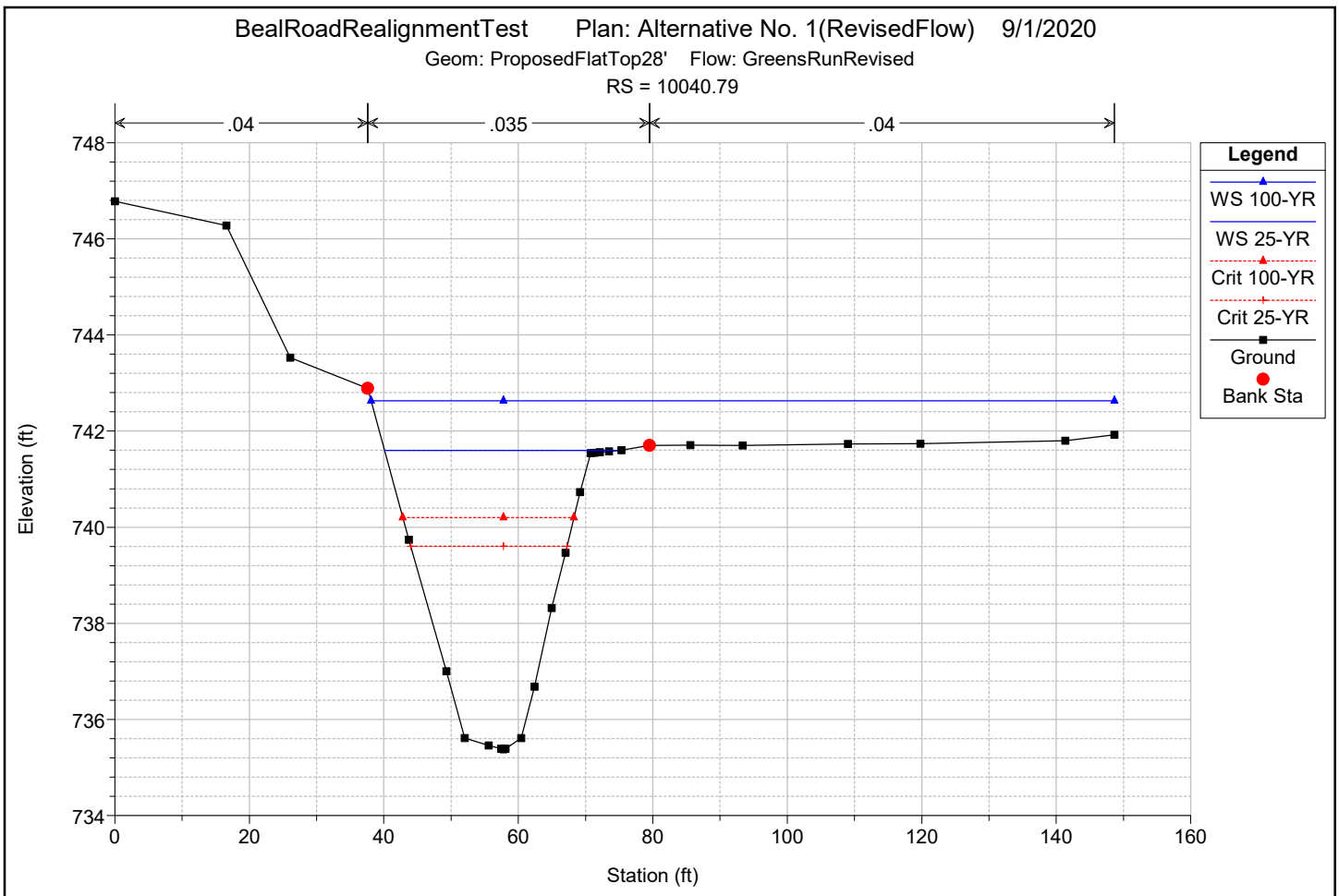
BealRoadRealignmentTest Plan: Alternative No. 1(RevisedFlow) 9/1/2020
Geom: ProposedFlatTop28' Flow: GreensRunRevised
RS = 10040.79
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Legend
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WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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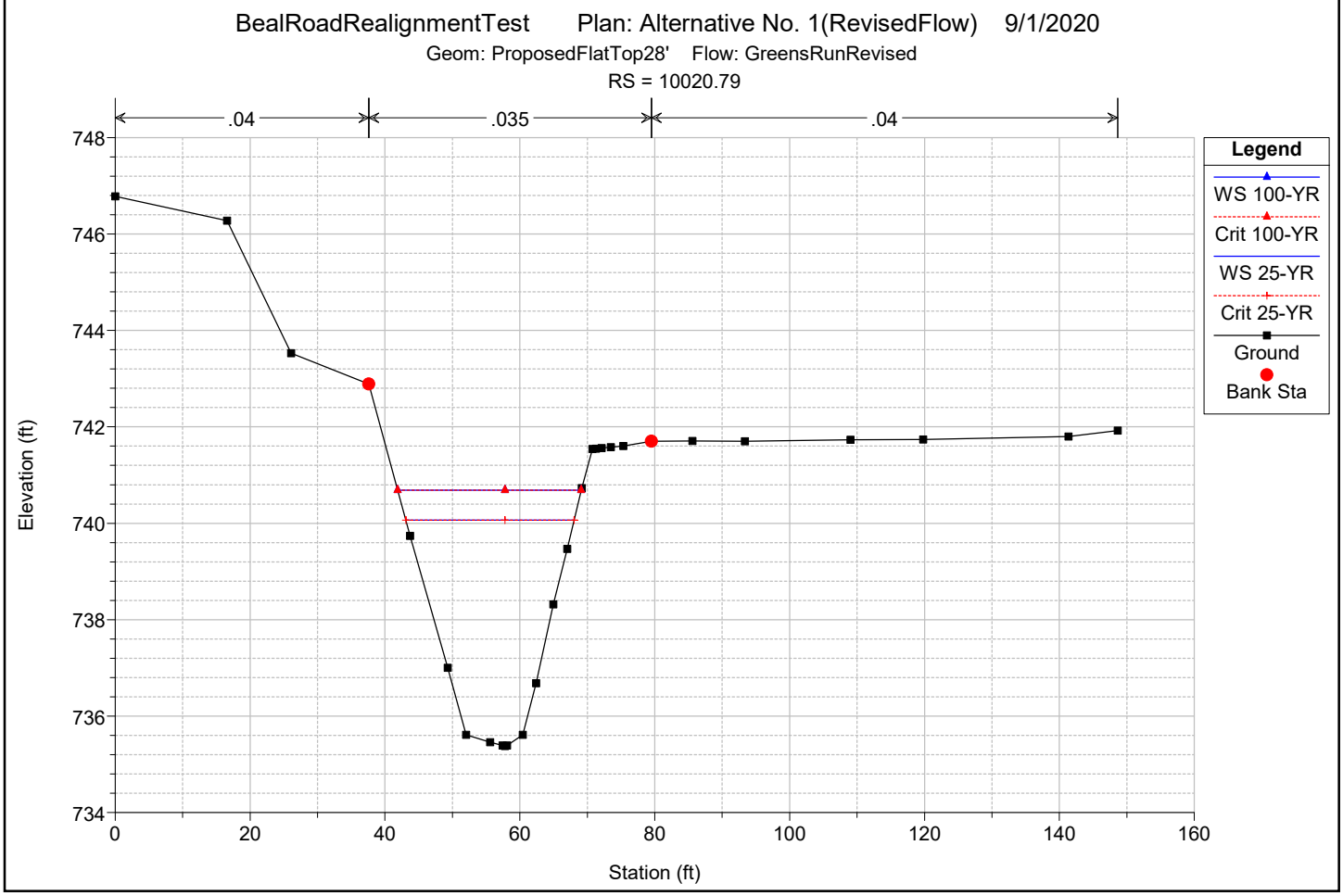
BealRoadRealignmentTest Plan: Alternative No. 1(RevisedFlow) 9/1/2020
Geom: ProposedFlatTop28' Flow: GreensRunRevised
RS = 10020.79
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.035
.04
Legend
WS 100-YR
Crit 100-YR
WS 25-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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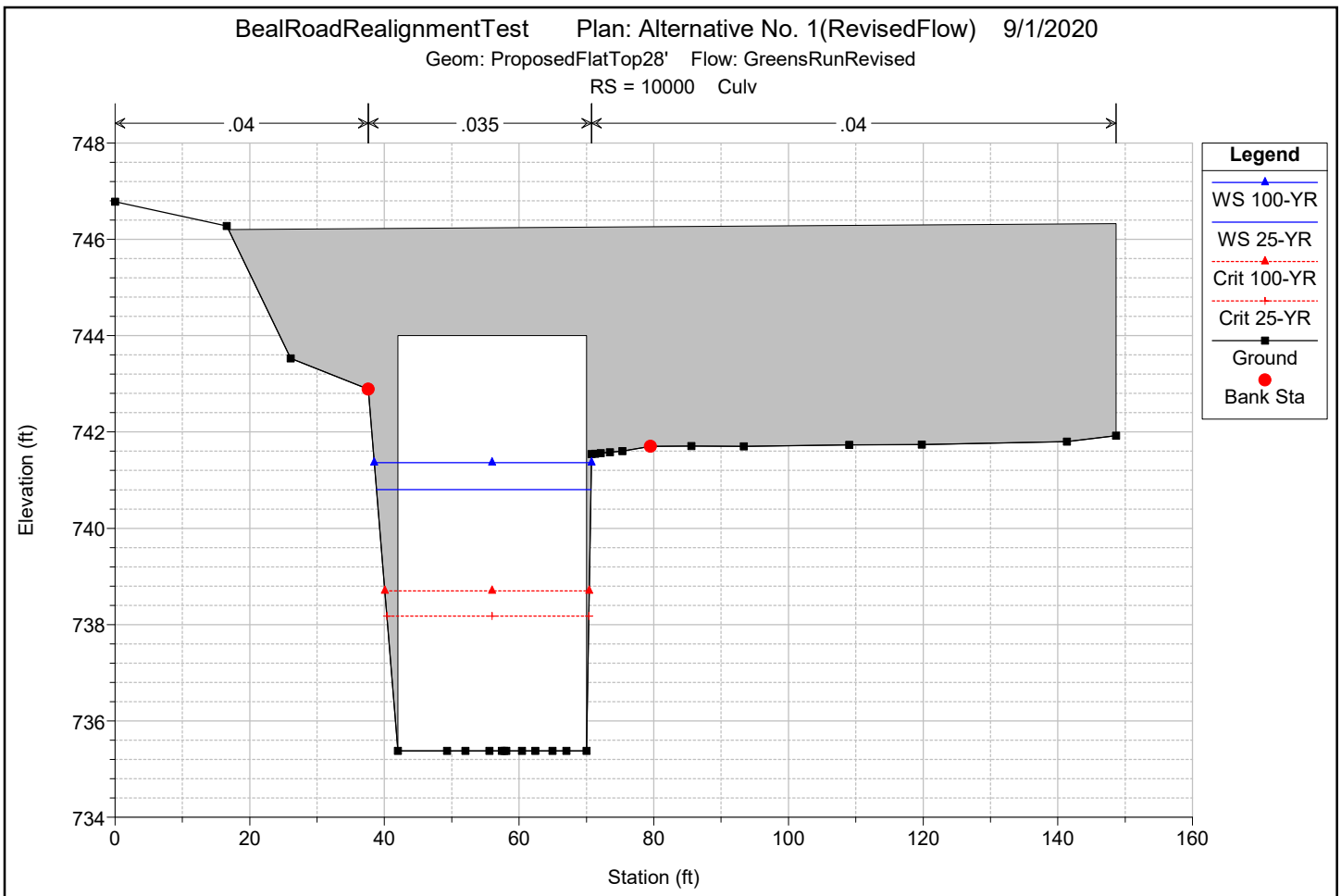
BealRoadRealignmentTest Plan: Alternative No. 1(RevisedFlow) 9/1/2020
Geom: ProposedFlatTop28' Flow: GreensRunRevised
RS = 10000 Culv
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.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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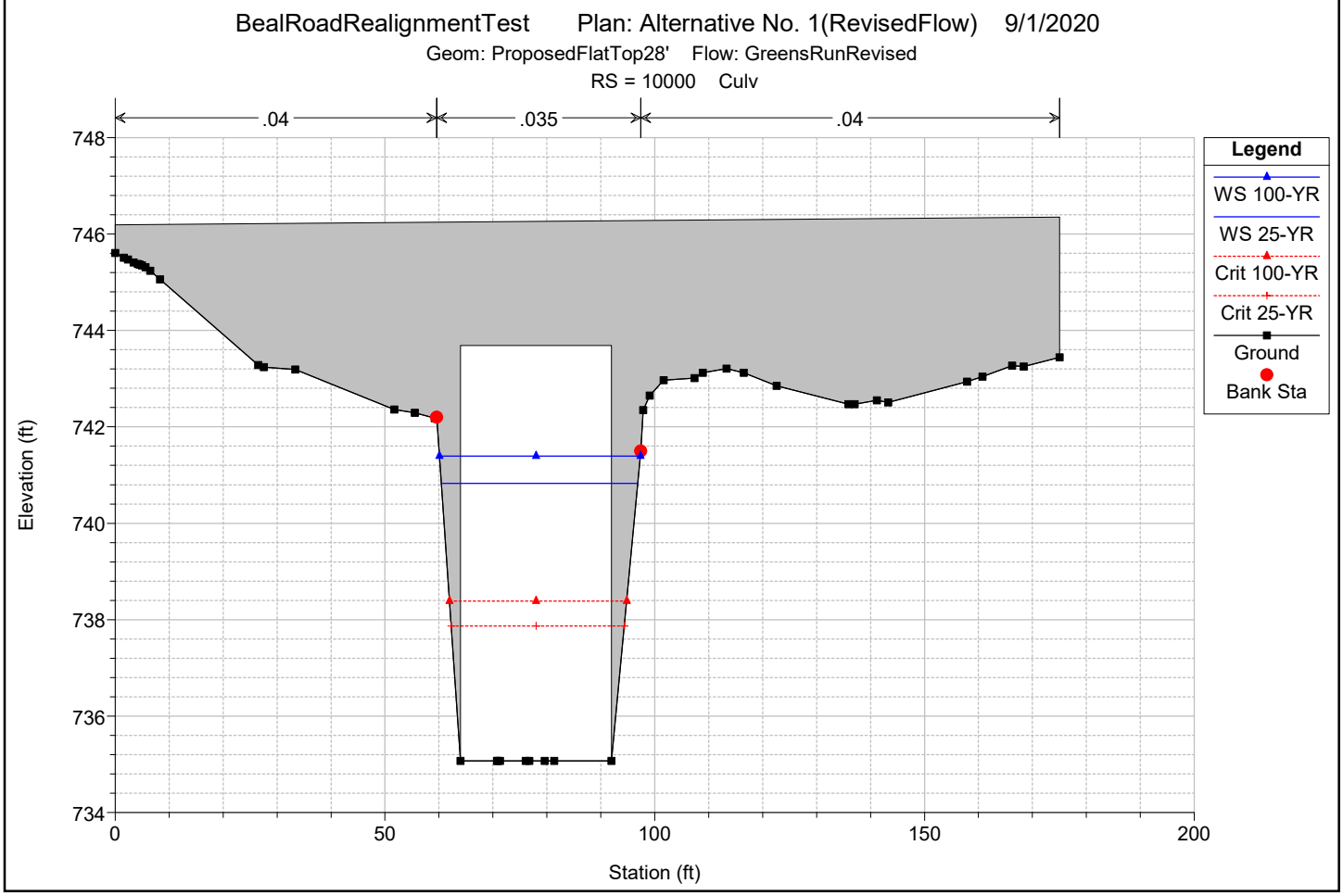
BealRoadRealignmentTest Plan: Alternative No. 1(RevisedFlow) 9/1/2020
Geom: ProposedFlatTop28' Flow: GreensRunRevised
RS = 10000 Culv
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.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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744
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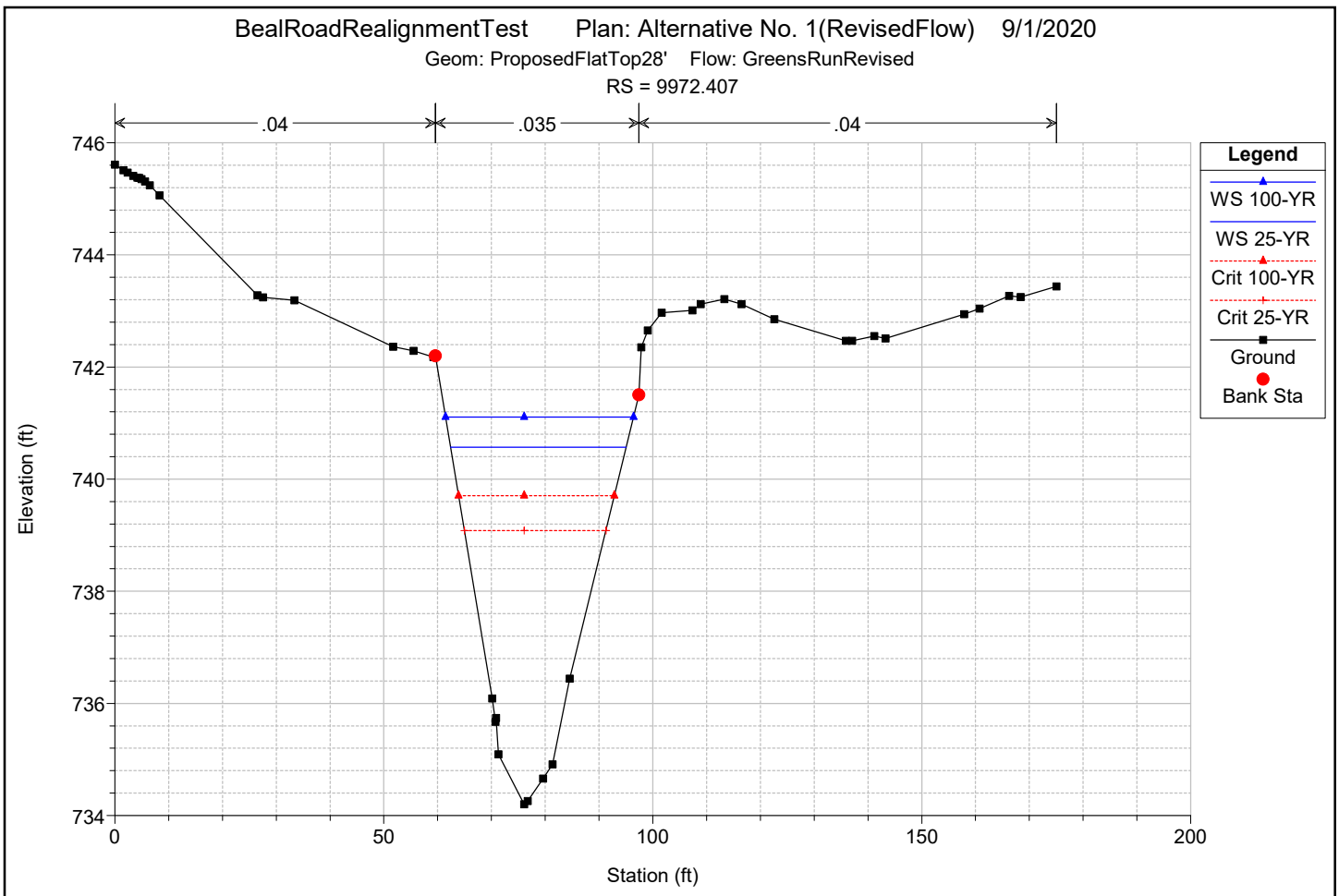
BealRoadRealignmentTest Plan: Alternative No. 1(RevisedFlow) 9/1/2020
Geom: ProposedFlatTop28' Flow: GreensRunRevised
RS = 9972.407
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.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
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Station (ft)
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744
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740
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150
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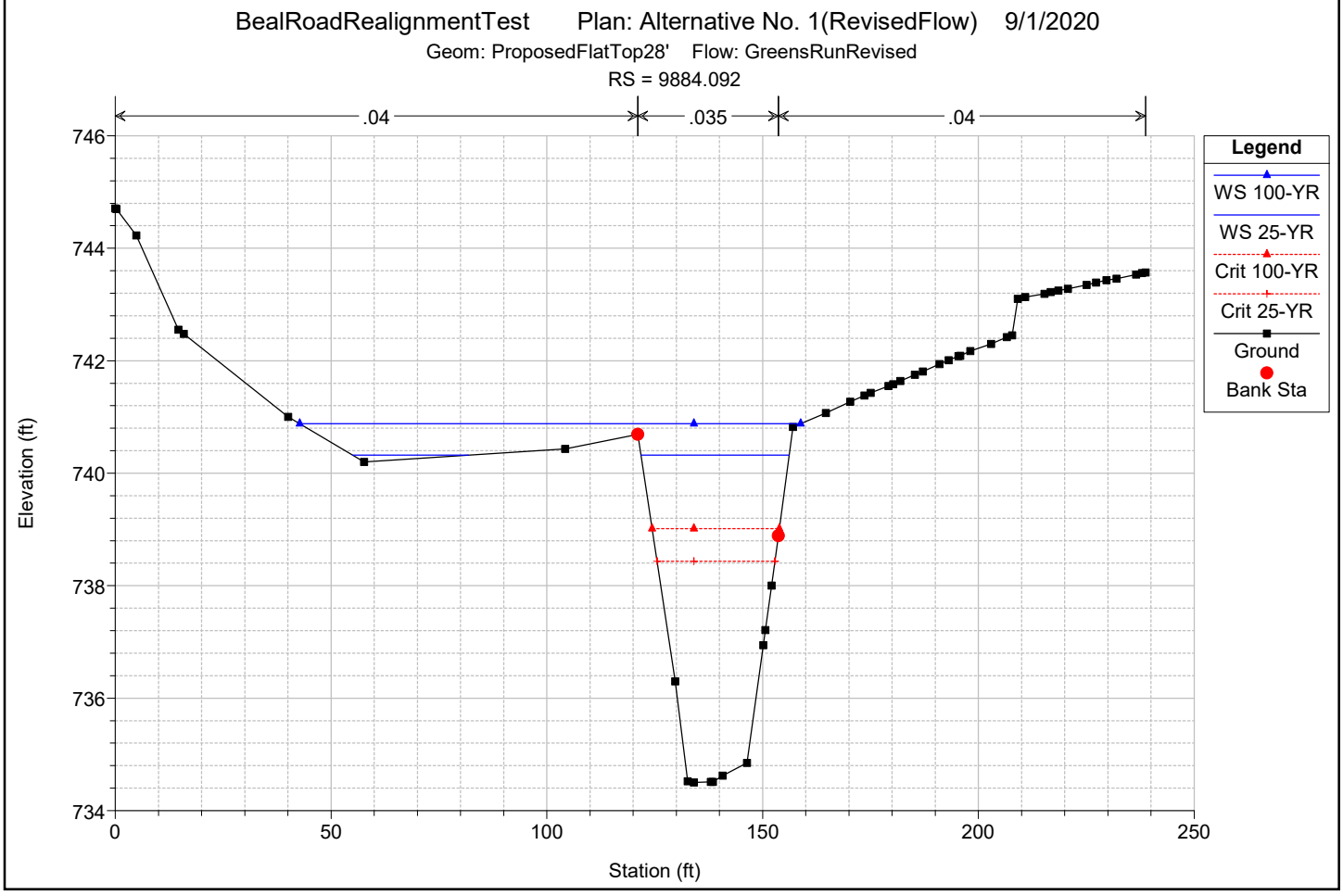
BealRoadRealignmentTest Plan: Alternative No. 1(RevisedFlow) 9/1/2020
Geom: ProposedFlatTop28' Flow: GreensRunRevised
RS = 9884.092
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
746
744
742
740
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100
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200
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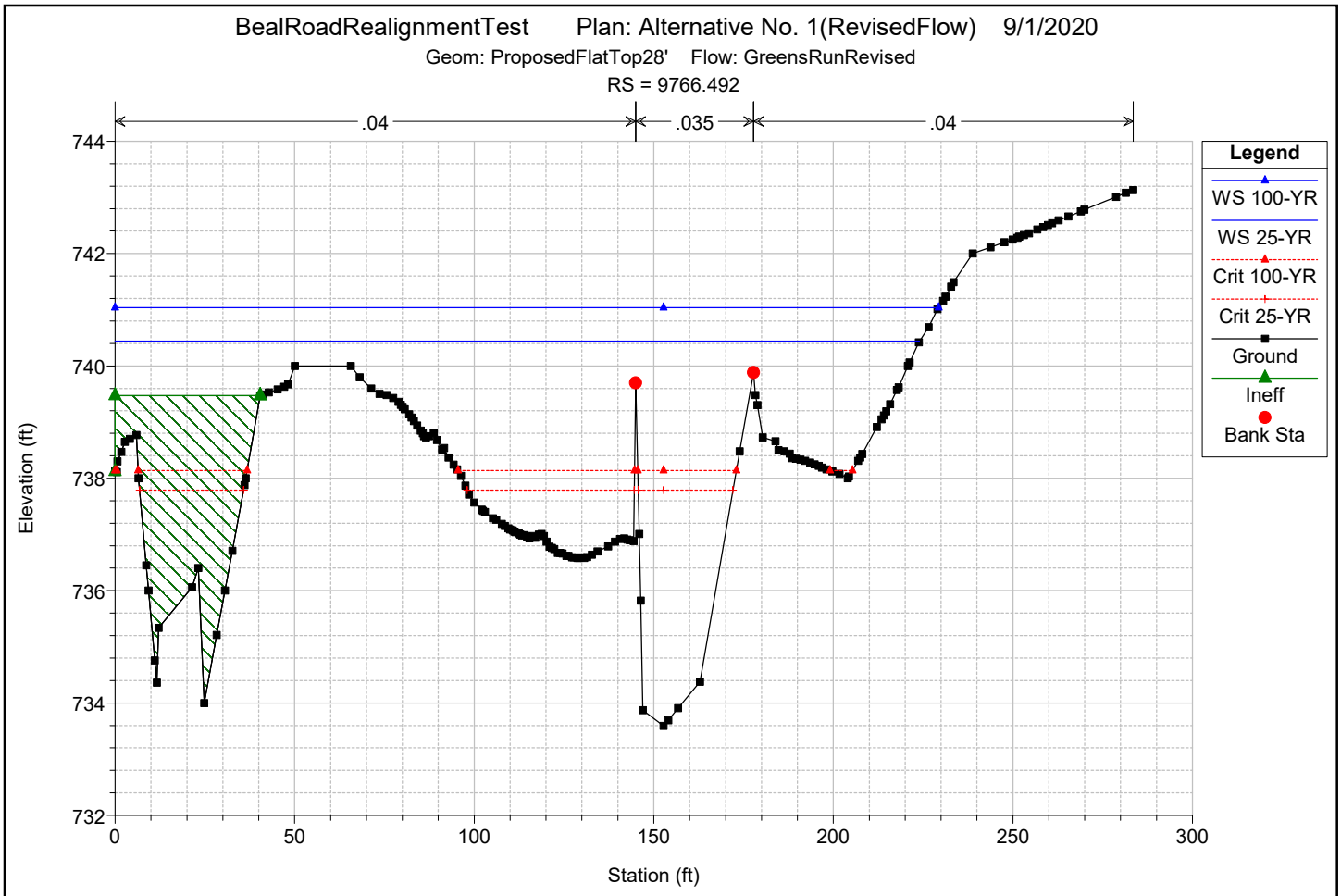
BealRoadRealignmentTest Plan: Alternative No. 1(RevisedFlow) 9/1/2020
Geom: ProposedFlatTop28' Flow: GreensRunRevised
RS = 9766.492
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
744
742
740
738
736
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732
0
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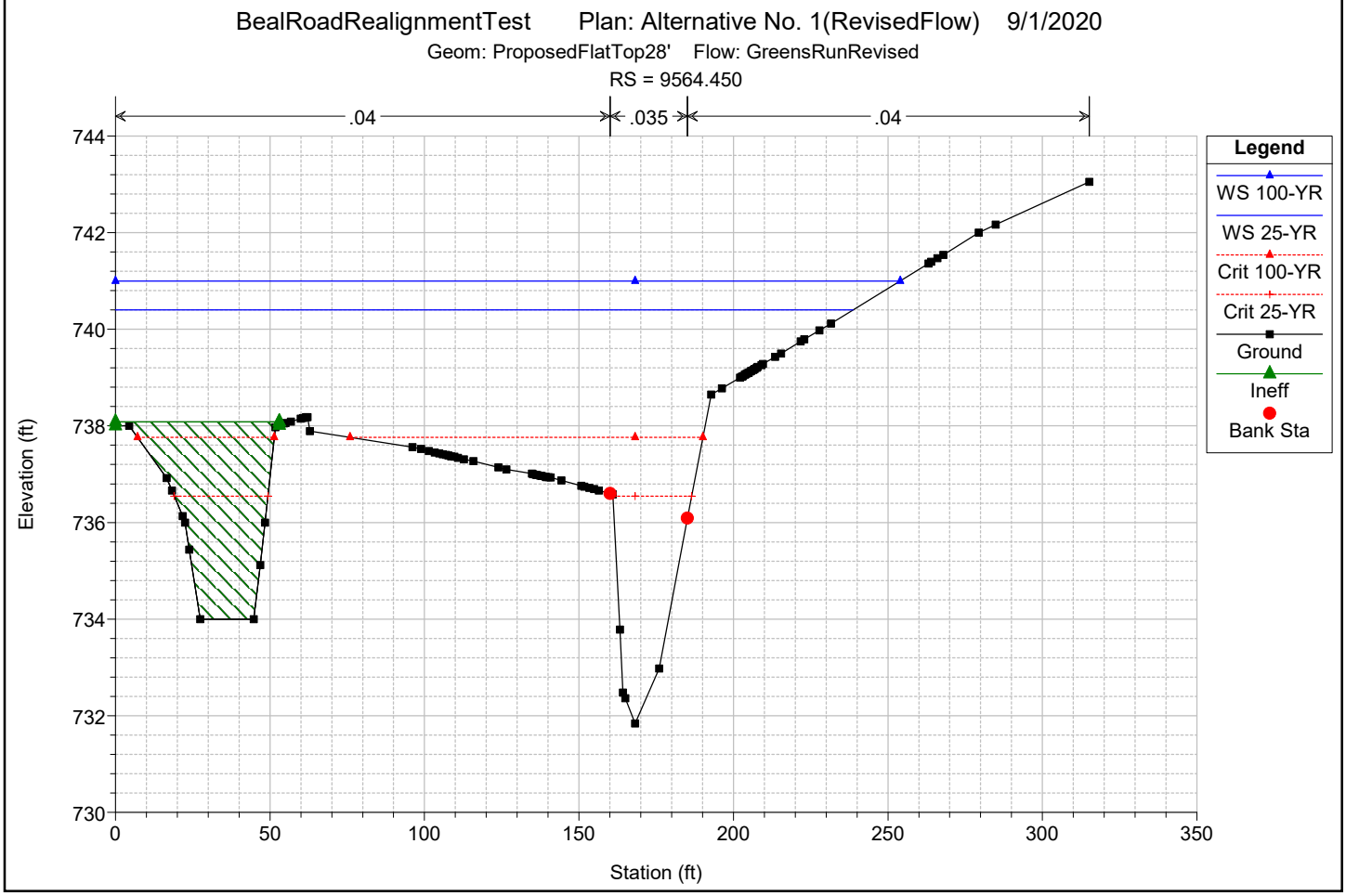
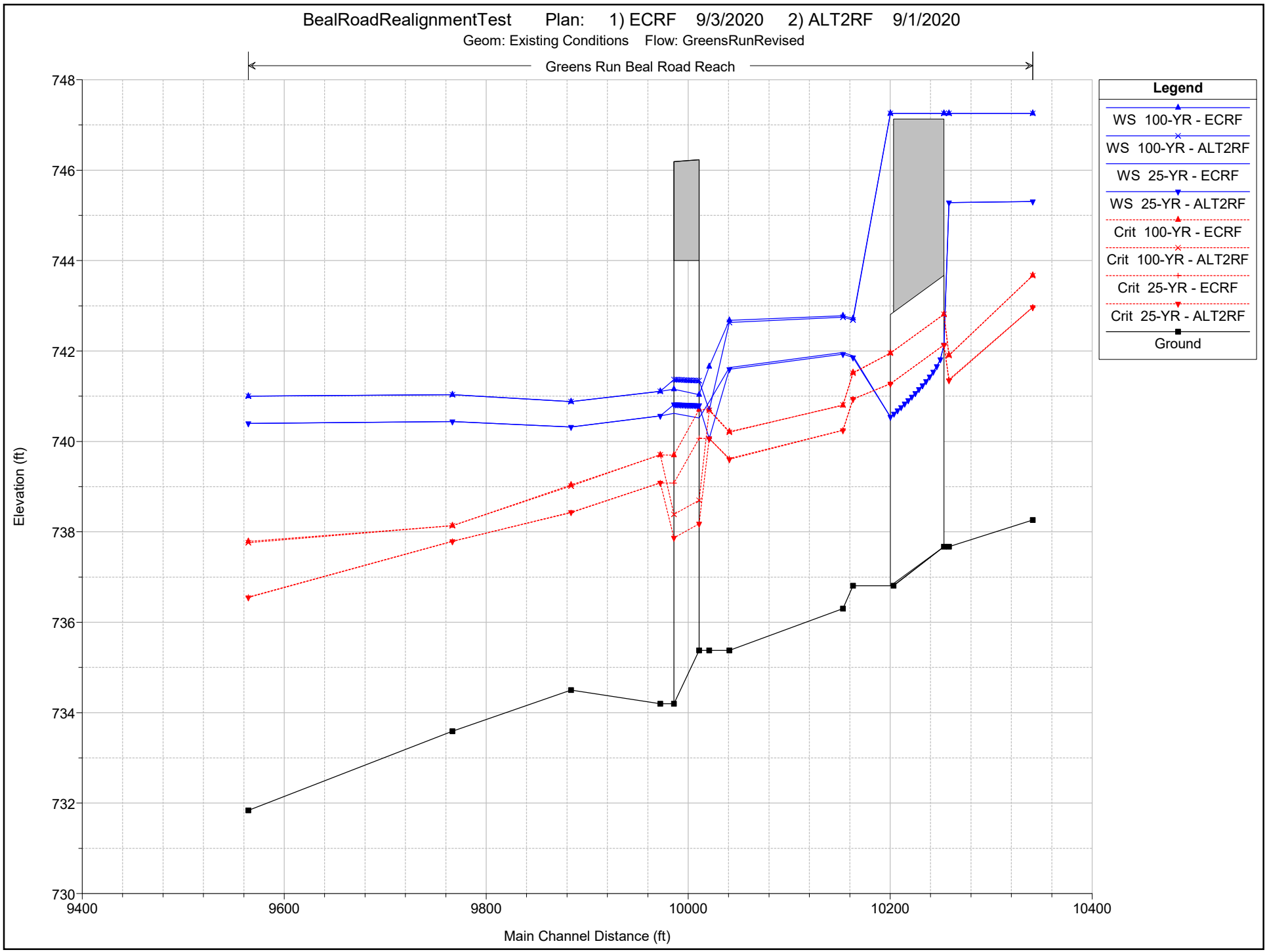
100
150
200
250
300


BealRoadRealignmentTest Plan: Alternative No. 1(RevisedFlow) 9/1/2020
Geom: ProposedFlatTop28' Flow: GreensRunRevised
RS = 9564.450
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
744
742
740
738
736
734
732
730
0
50
100
150
200
250
300
350

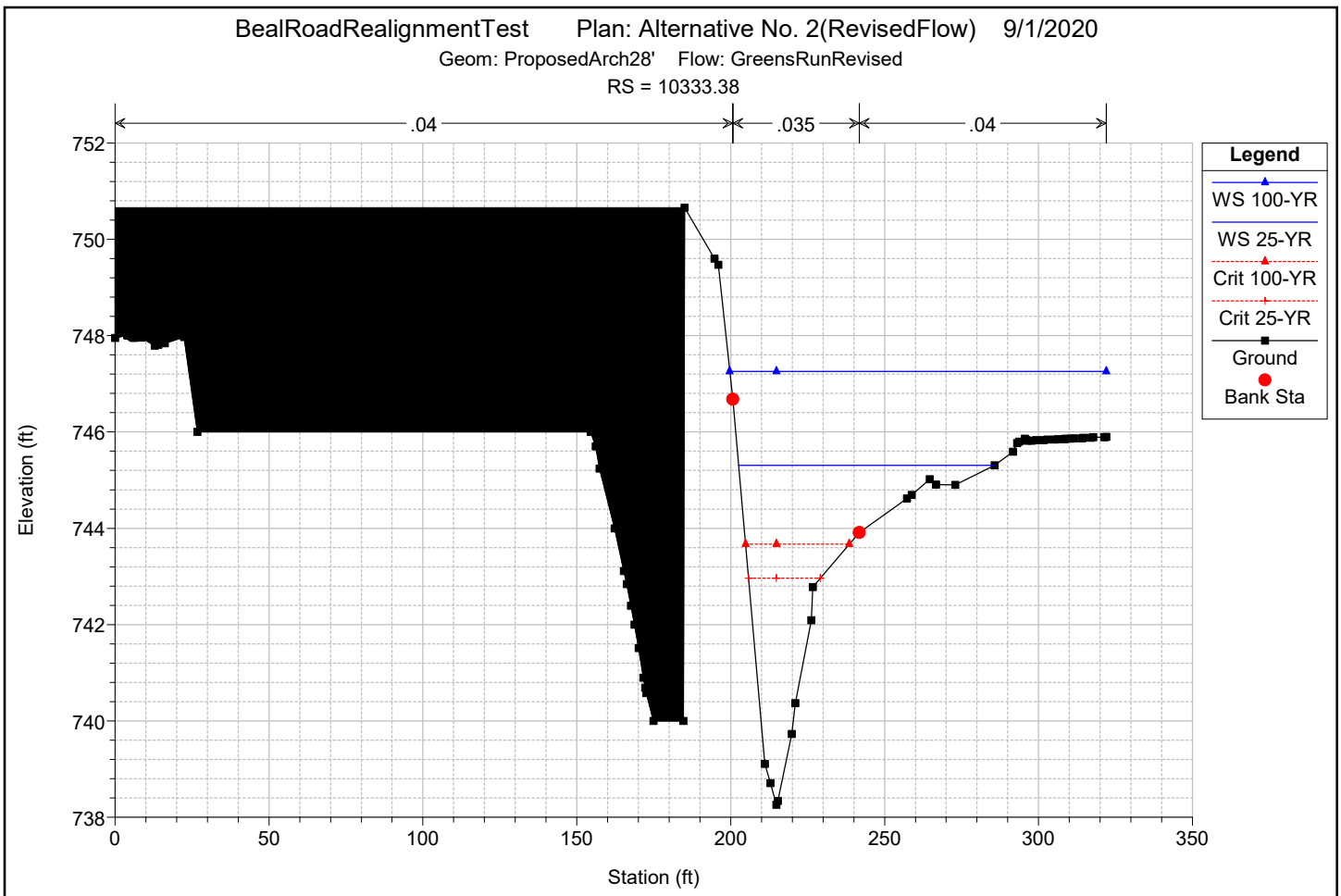
APPENDIX E

ALTERNATIVE 2 PROFILES, CROSS SECTIONS, AND RESULTS


BealRoadRealignmentTest Plan: 1) ECRF 9/3/2020 2) ALT2RF 9/1/2020
Geom: Existing Conditions Flow: GreensRunRevised
Greens Run Beal Road Reach
Legend
WS 100-YR - ECRF
WS 100-YR - ALT2RF
WS 25-YR - ECRF
WS 25-YR - ALT2RF
Crit 100-YR - ECRF
Crit 100-YR - ALT2RF
Crit 25-YR - ECRF
Crit 25-YR - ALT2RF
Ground
Elevation (ft)
748
746
744
742
740
738
736
734
732
730
9400
9600
9800
10000
10200
10400
Main Channel Distance (ft)

HEC-RAS Plan: ALT2RF River: Greens Run Reach: Beal Road Reach

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)	
Beal Road Reach	10333.38	25-YR	535.00	738.26	745.31	742.97	745.49	0.001424	3.57	166.87	83.12	0.33
Beal Road Reach	10333.38	100-YR	691.00	738.26	747.26	743.67	747.32	0.000341	2.27	385.70	122.36	0.17
Beal Road Reach	10250.48	25-YR	535.00	737.67	745.28	741.35	745.37	0.000381	2.72	283.85	147.13	0.19
Beal Road Reach	10250.48	100-YR	691.00	737.67	747.26	741.90	747.29	0.000108	1.73	645.61	186.08	0.10
Beal Road Reach	10200		Culvert									
Beal Road Reach	10169.8	25-YR	535.00	736.81	741.85	740.94	742.59	0.008292	6.86	78.01	24.14	0.67
Beal Road Reach	10169.8	100-YR	691.00	736.81	742.69	741.51	743.42	0.007650	6.89	100.42	30.92	0.66
Beal Road Reach	10153.25	25-YR	610.00	736.30	741.93	740.25	742.39	0.003304	5.45	111.90	30.47	0.50
Beal Road Reach	10153.25	100-YR	787.00	736.30	742.75	740.80	743.25	0.003111	5.70	137.97	33.38	0.49
Beal Road Reach	10040.79	25-YR	610.00	735.38	741.59	739.61	742.01	0.003244	5.17	117.93	34.67	0.49
Beal Road Reach	10040.79	100-YR	787.00	735.38	742.63	740.20	742.90	0.001934	4.36	220.47	110.54	0.39
Beal Road Reach	10020.79	25-YR	743.00	735.38	740.06	740.06	741.58	0.013944	9.87	75.26	24.96	1.00
Beal Road Reach	10020.79	100-YR	960.00	735.38	740.69	740.69	742.40	0.013673	10.48	91.57	27.24	1.01
Beal Road Reach	10000		Culvert									
Beal Road Reach	9972.407	25-YR	743.00	734.20	740.57	739.08	741.16	0.004154	6.17	120.51	32.67	0.57
Beal Road Reach	9972.407	100-YR	960.00	734.20	741.11	739.71	741.85	0.004753	6.92	138.76	34.98	0.61
Beal Road Reach	9884.092	25-YR	743.00	734.50	740.32	738.43	740.79	0.002773	5.53	137.09	61.09	0.48
Beal Road Reach	9884.092	100-YR	960.00	734.50	740.88	739.01	741.41	0.002824	5.98	192.10	116.11	0.49
Beal Road Reach	9766.492	25-YR	743.00	733.59	740.44	737.79	740.48	0.000342	2.05	500.62	224.00	0.16
Beal Road Reach	9766.492	100-YR	960.00	733.59	741.04	738.14	741.08	0.000306	2.09	635.98	229.30	0.16
Beal Road Reach	9564.450	25-YR	743.00	731.84	740.40	736.55	740.43	0.000149	1.75	680.91	238.69	0.12
Beal Road Reach	9564.450	100-YR	960.00	731.84	741.00	737.76	741.03	0.000146	1.83	828.70	253.98	0.12


BealRoadRealignmentTest Plan: Alternative No. 2(RevisedFlow) 9/1/2020
Geom: ProposedArch28' Flow: GreensRunRevised
RS = 10333.38
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
752
750
748
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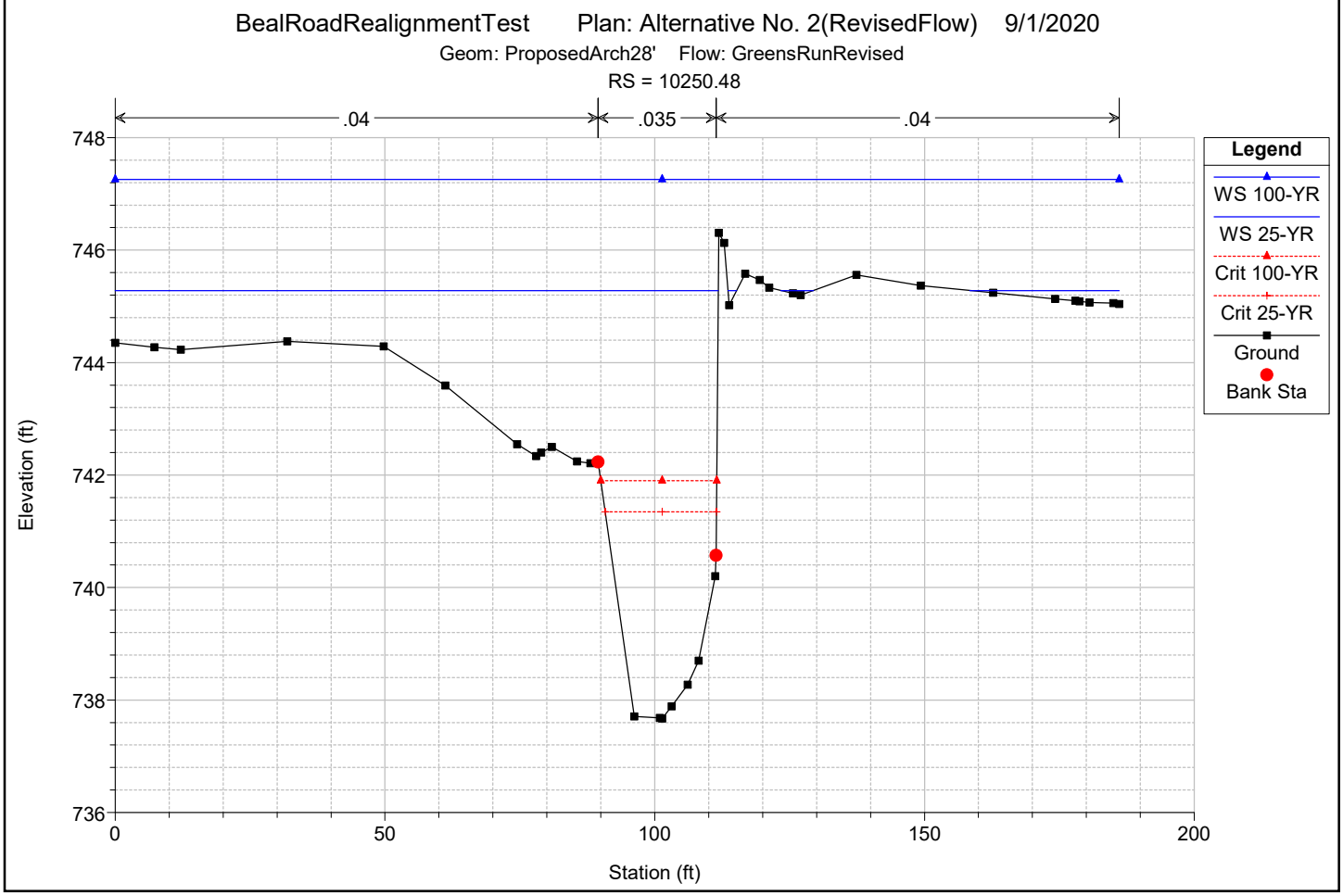
BealRoadRealignmentTest Plan: Alternative No. 2(RevisedFlow) 9/1/2020
Geom: ProposedArch28' Flow: GreensRunRevised
RS = 10250.48
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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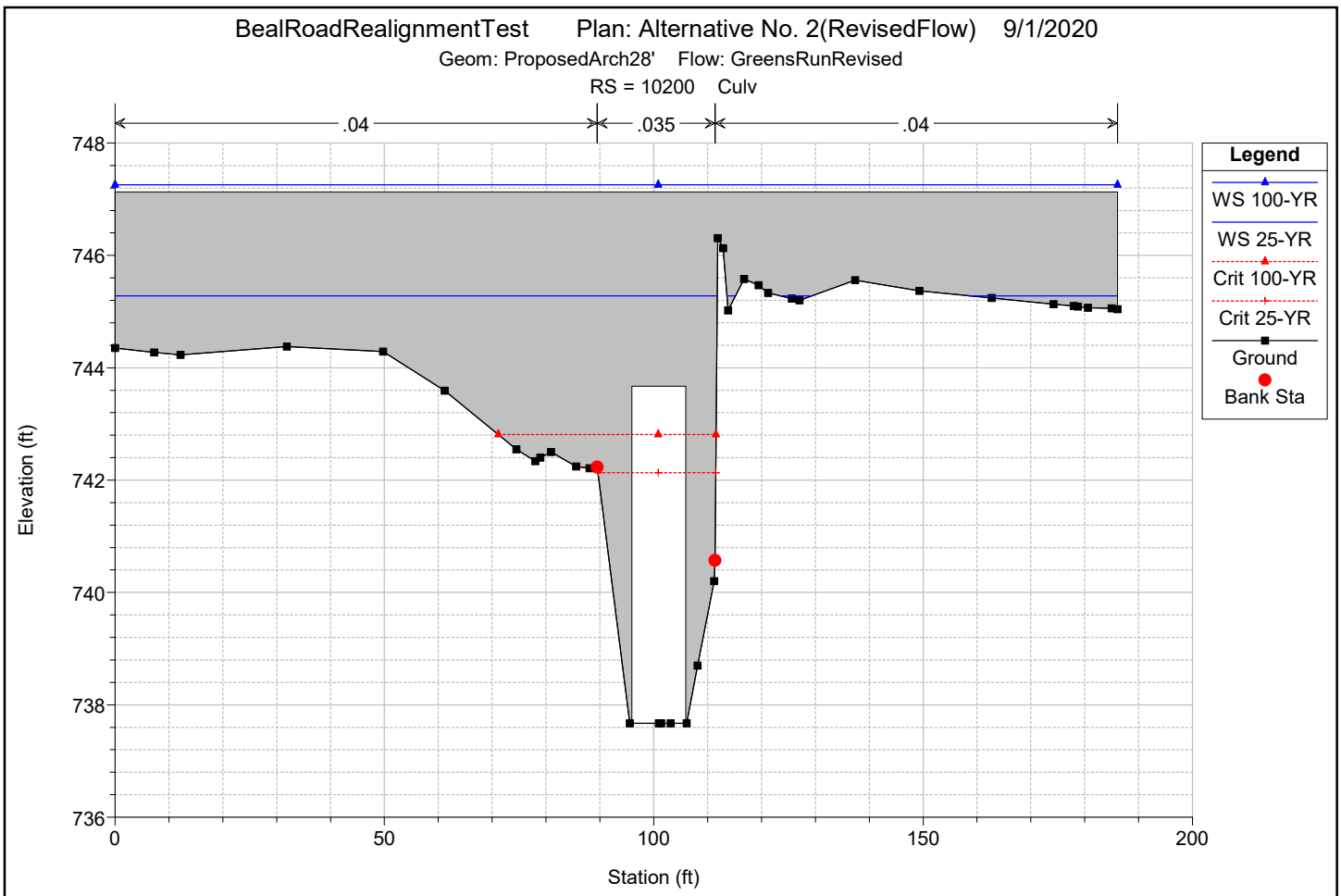
BealRoadRealignmentTest Plan: Alternative No. 2(RevisedFlow) 9/1/2020
Geom: ProposedArch28' Flow: GreensRunRevised
RS = 10200 Culv
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
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100
150
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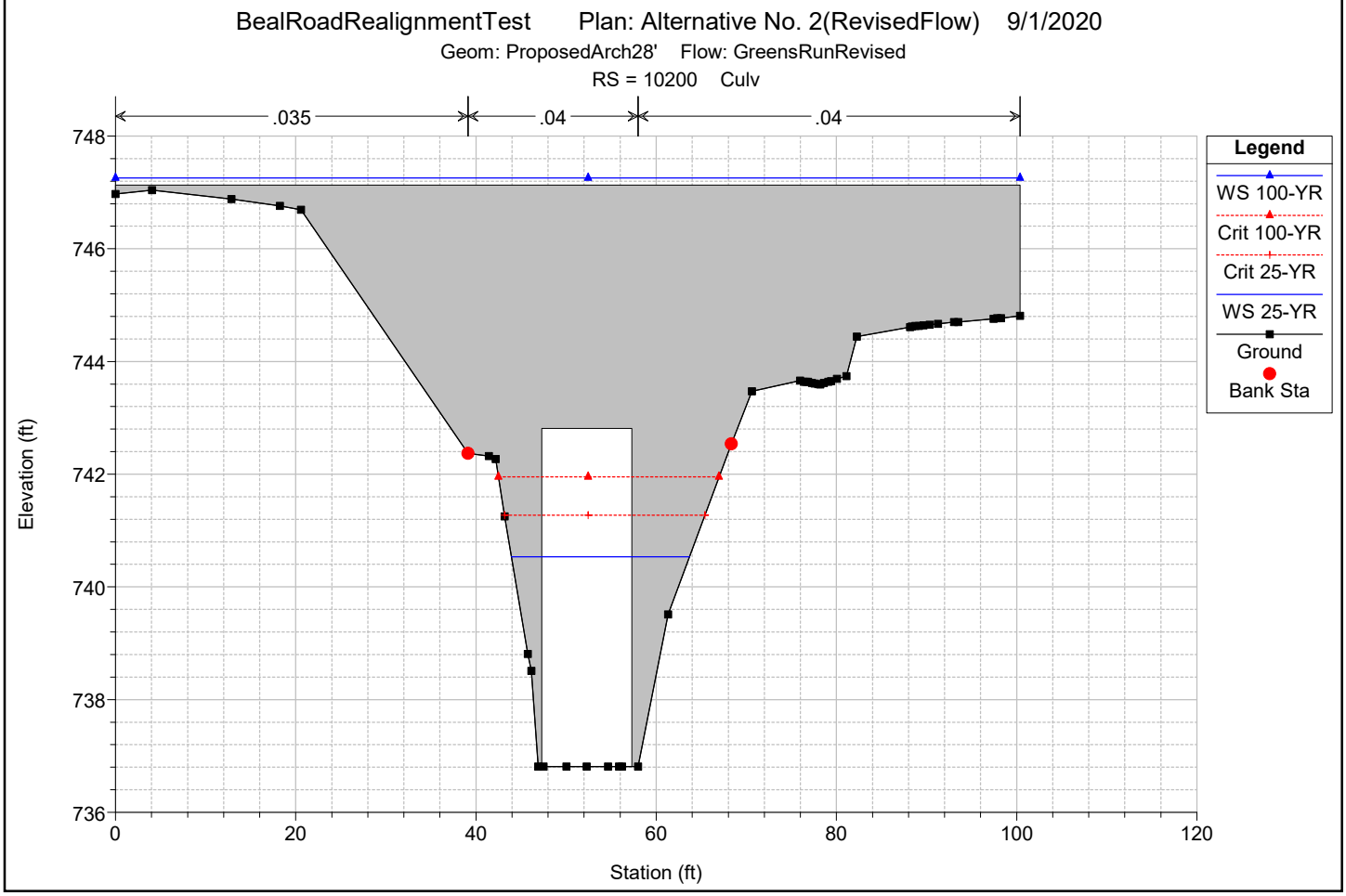
Station (ft)


BealRoadRealignmentTest Plan: Alternative No. 2(RevisedFlow) 9/1/2020
Geom: ProposedArch28' Flow: GreensRunRevised
RS = 10200 Culv
.035
.04
.04
Legend
WS 100-YR
Crit 100-YR
Crit 25-YR
WS 25-YR
Ground
Bank Sta
Elevation (ft)
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20
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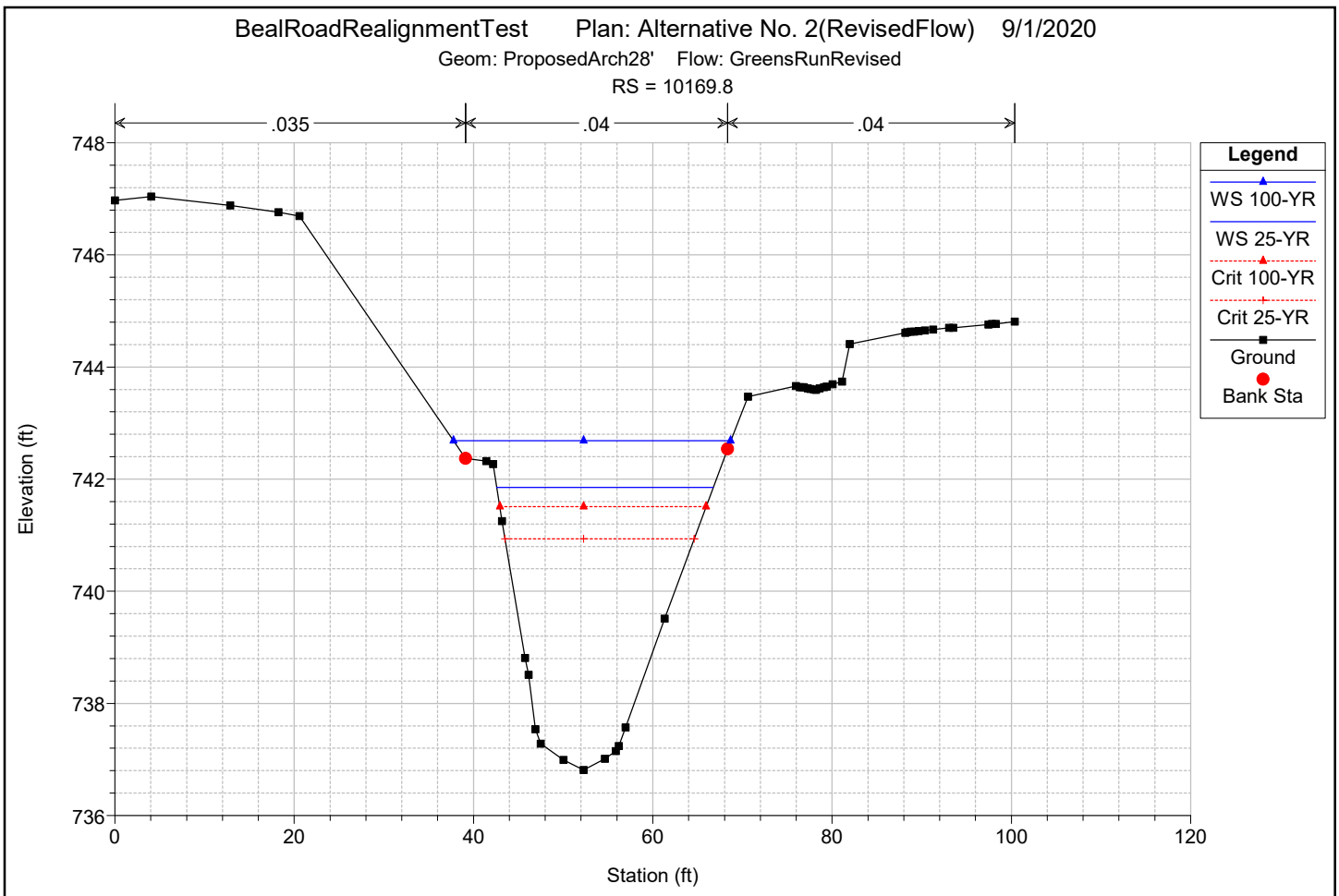
80
100
120
Station (ft)


BealRoadRealignmentTest Plan: Alternative No. 2(RevisedFlow) 9/1/2020
Geom: ProposedArch28' Flow: GreensRunRevised
RS = 10169.8
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.04
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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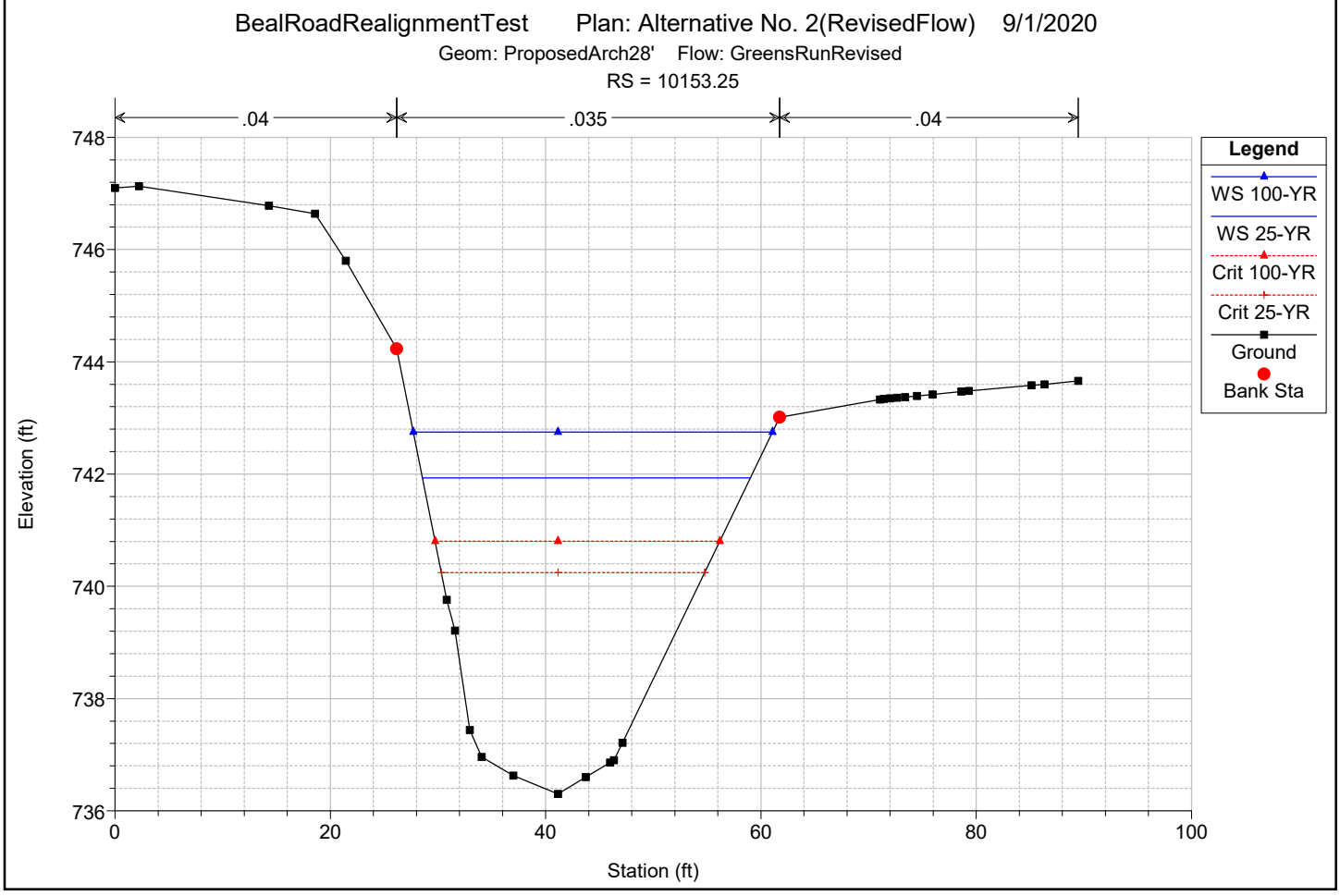
BealRoadRealignmentTest Plan: Alternative No. 2(RevisedFlow) 9/1/2020
Geom: ProposedArch28' Flow: GreensRunRevised
RS = 10153.25
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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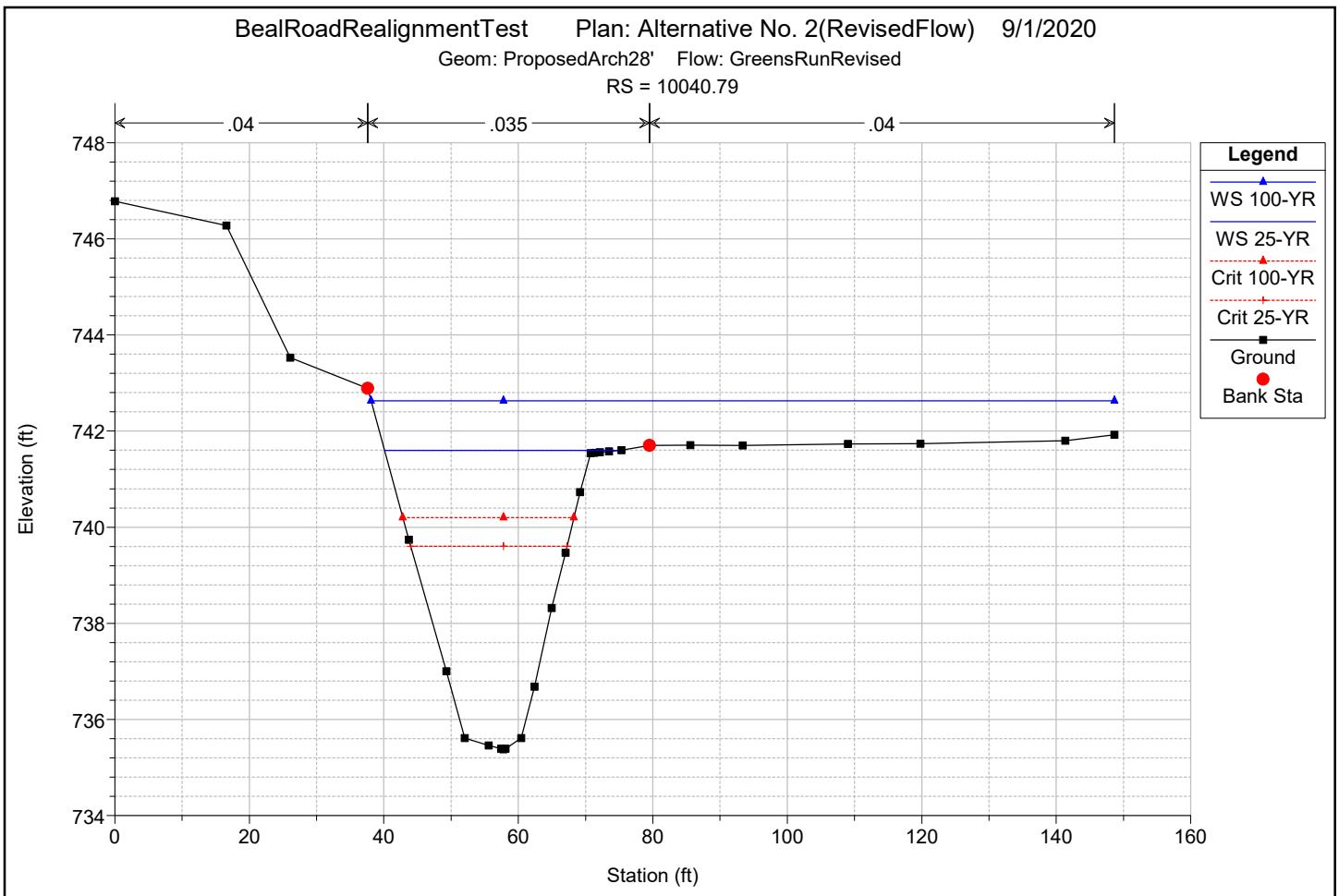
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Geom: ProposedArch28' Flow: GreensRunRevised
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Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
748
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100
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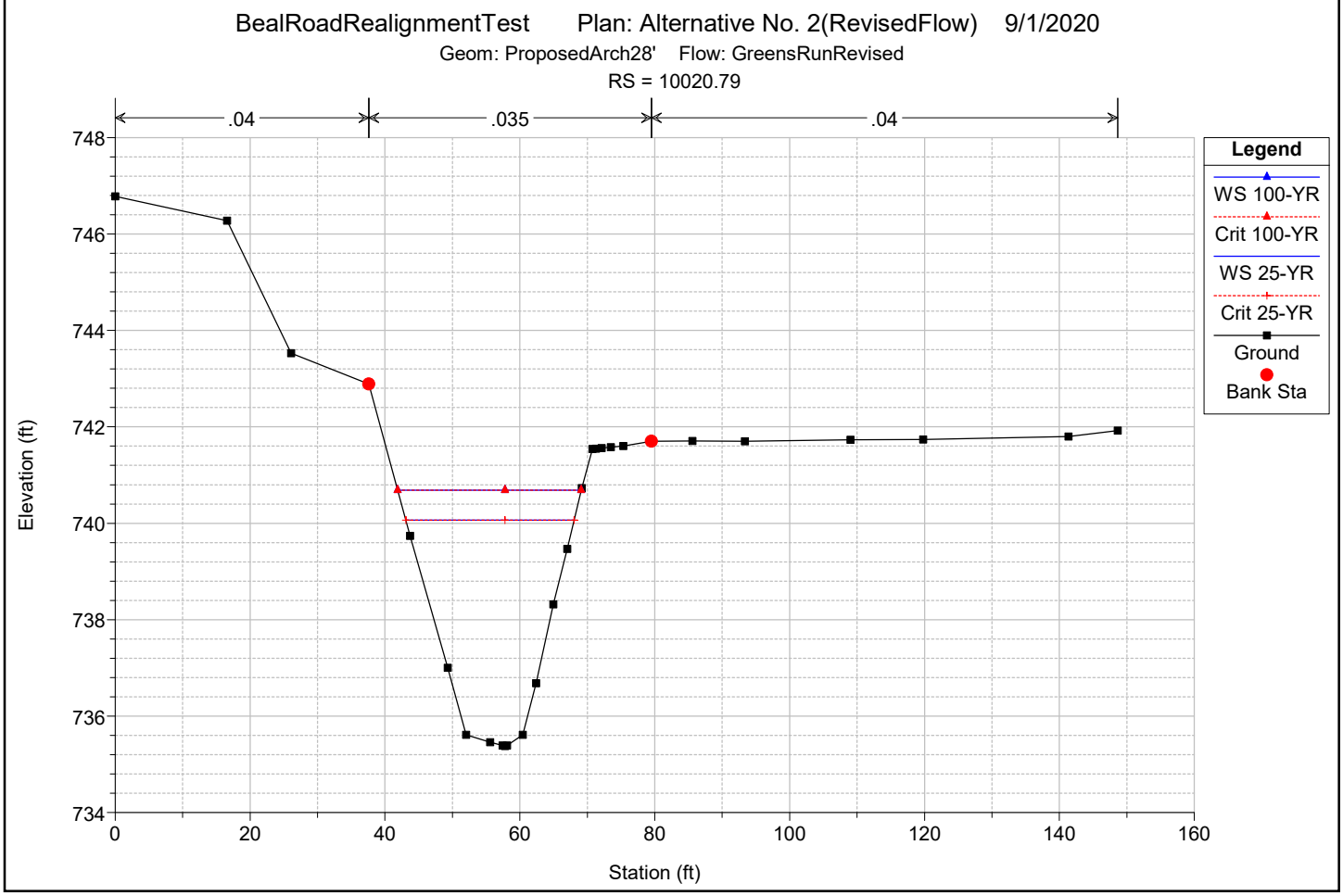
BealRoadRealignmentTest Plan: Alternative No. 2(RevisedFlow) 9/1/2020
Geom: ProposedArch28' Flow: GreensRunRevised
RS = 10020.79
.04
.035
.04
Legend
WS 100-YR
Crit 100-YR
WS 25-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
748
746
744
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740
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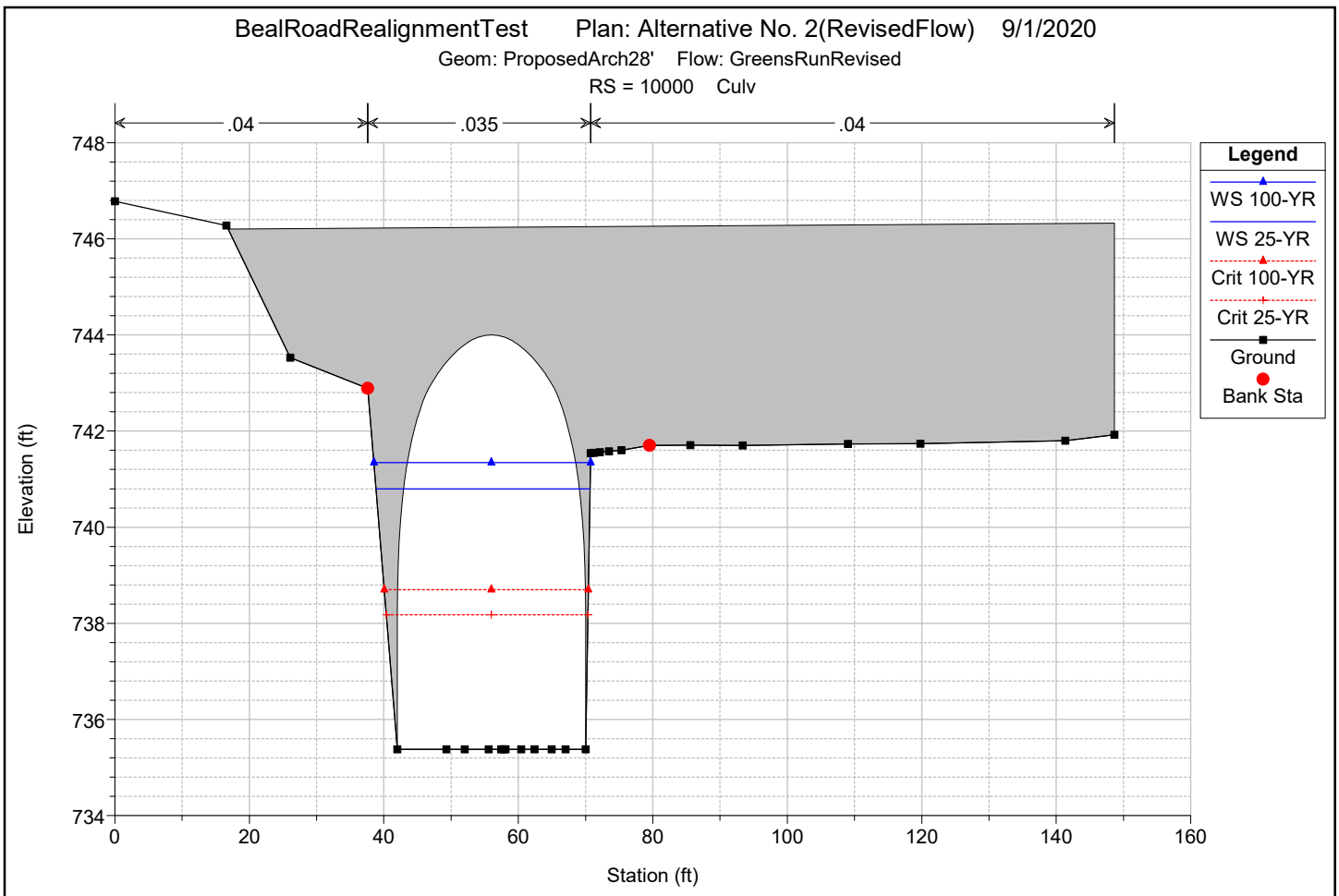
BealRoadRealignmentTest Plan: Alternative No. 2(RevisedFlow) 9/1/2020
Geom: ProposedArch28' Flow: GreensRunRevised
RS = 10000 Culv
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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746
744
742
740
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40
60
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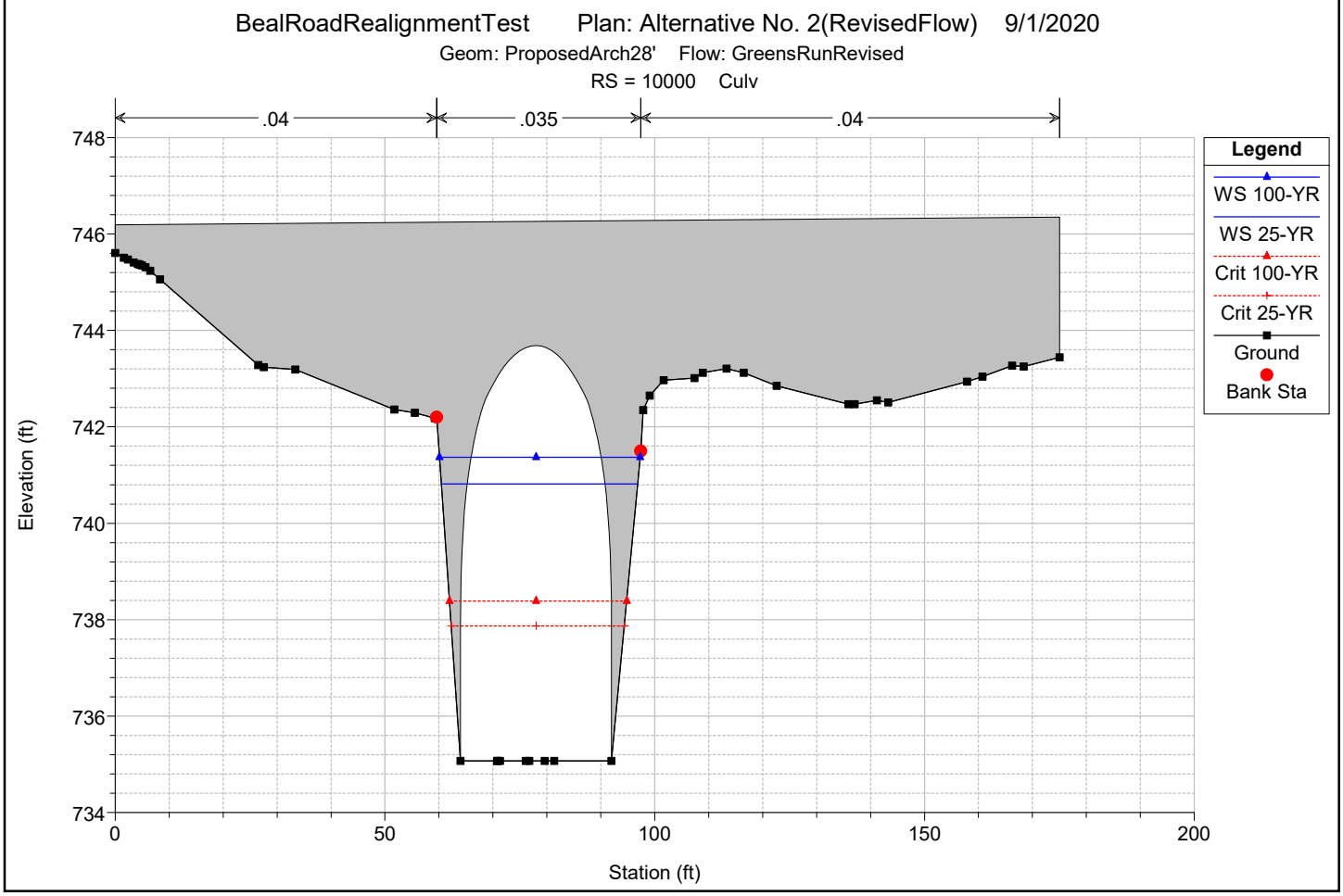
BealRoadRealignmentTest Plan: Alternative No. 2(RevisedFlow) 9/1/2020
Geom: ProposedArch28' Flow: GreensRunRevised
RS = 10000 Culv
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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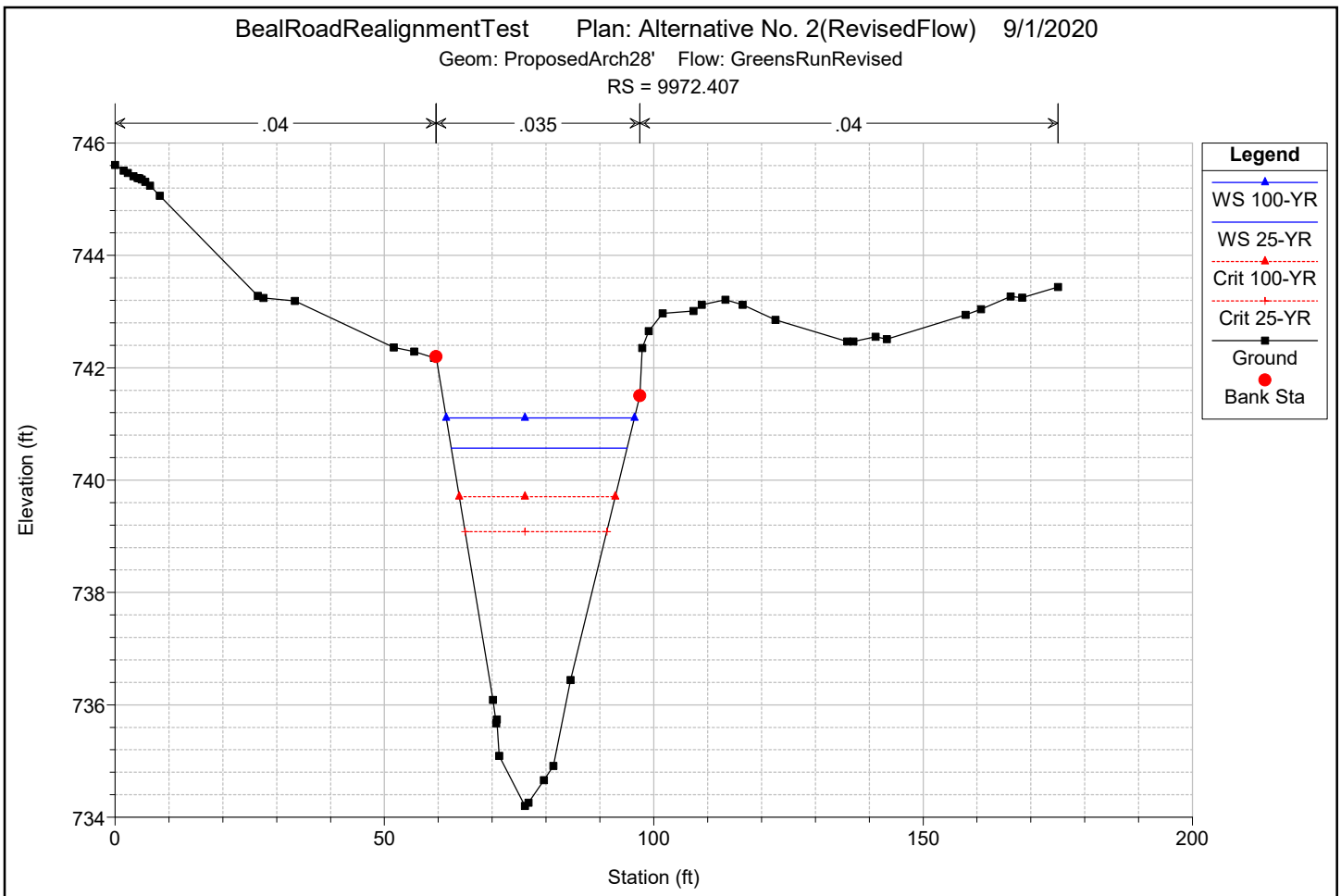
BealRoadRealignmentTest Plan: Alternative No. 2(RevisedFlow) 9/1/2020
Geom: ProposedArch28' Flow: GreensRunRevised
RS = 9972.407
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.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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744
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740
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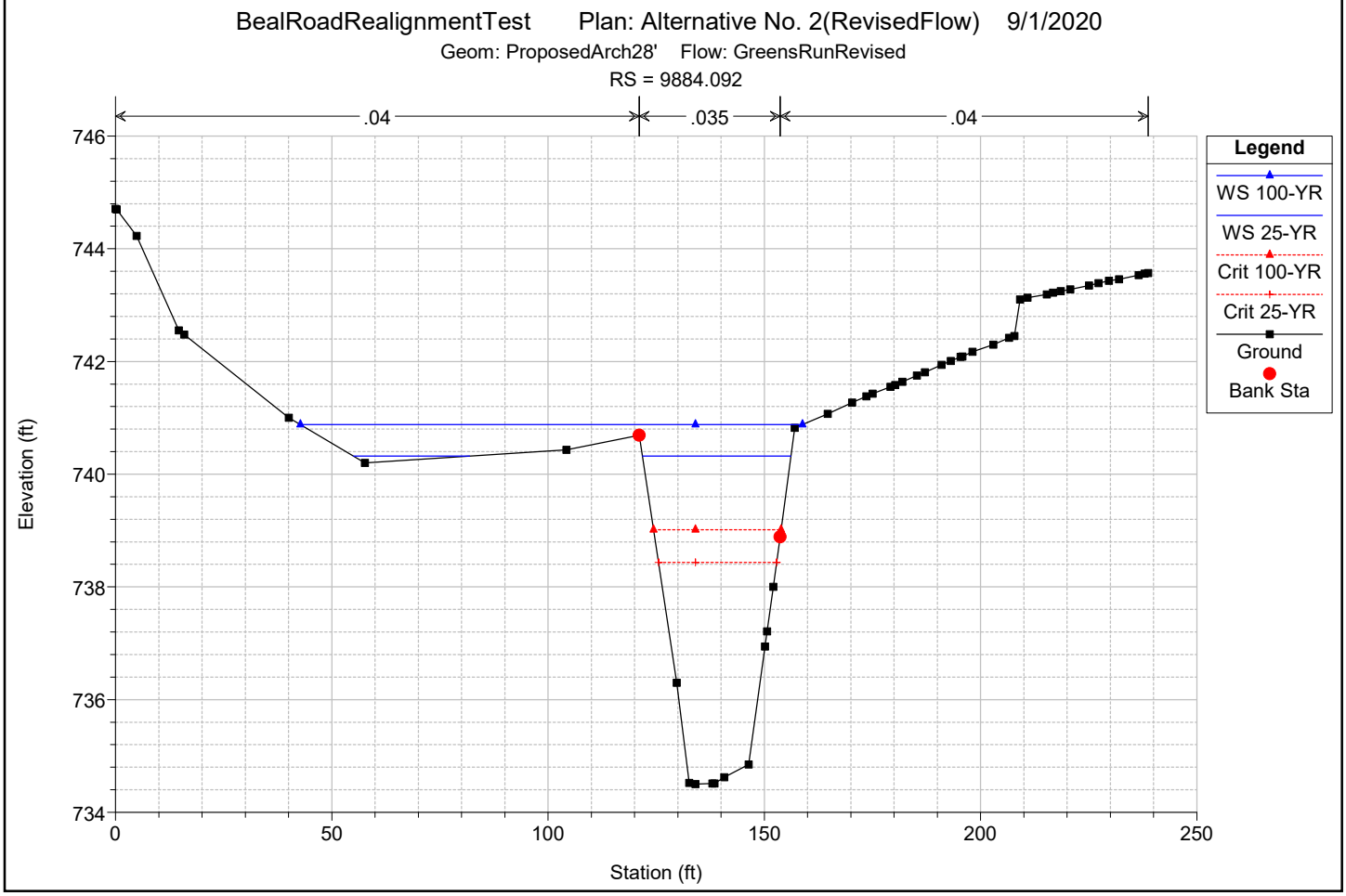
BealRoadRealignmentTest Plan: Alternative No. 2(RevisedFlow) 9/1/2020
Geom: ProposedArch28' Flow: GreensRunRevised
RS = 9884.092
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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744
742
740
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200
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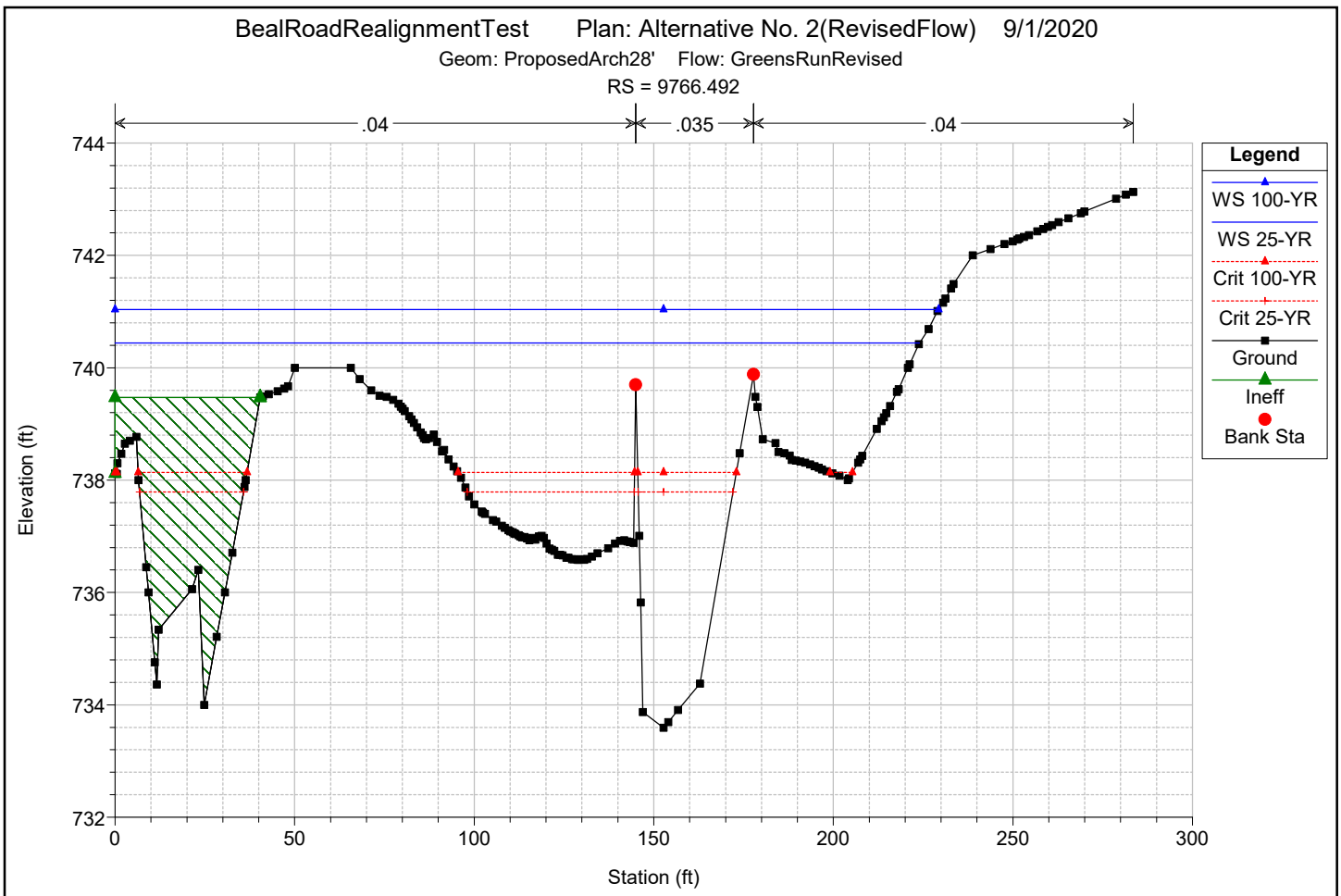
BealRoadRealignmentTest Plan: Alternative No. 2(RevisedFlow) 9/1/2020
Geom: ProposedArch28' Flow: GreensRunRevised
RS = 9766.492
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.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
744
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740
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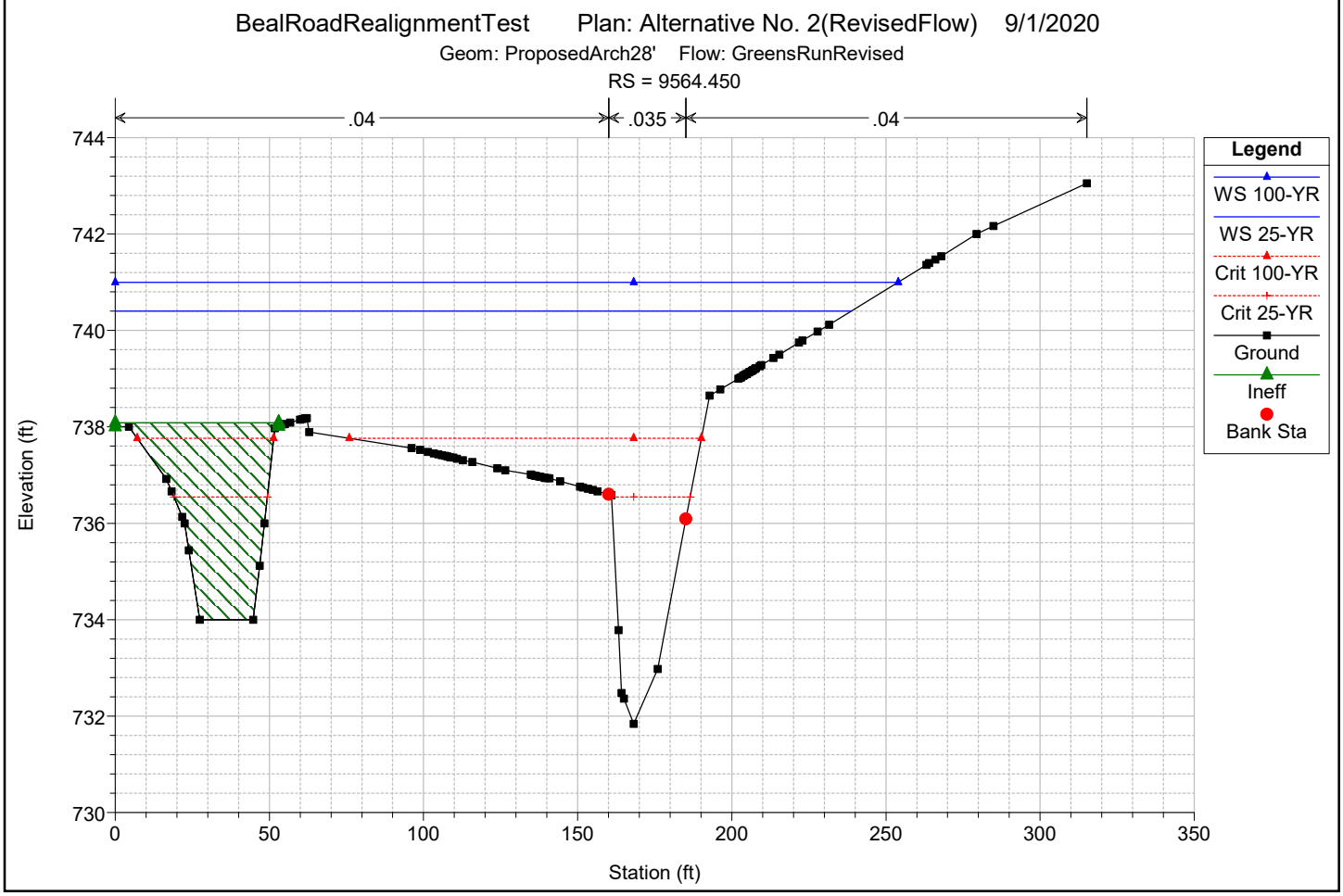
BealRoadRealignmentTest Plan: Alternative No. 2(RevisedFlow) 9/1/2020
Geom: ProposedArch28' Flow: GreensRunRevised
RS = 9564.450
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
744
742
740
738
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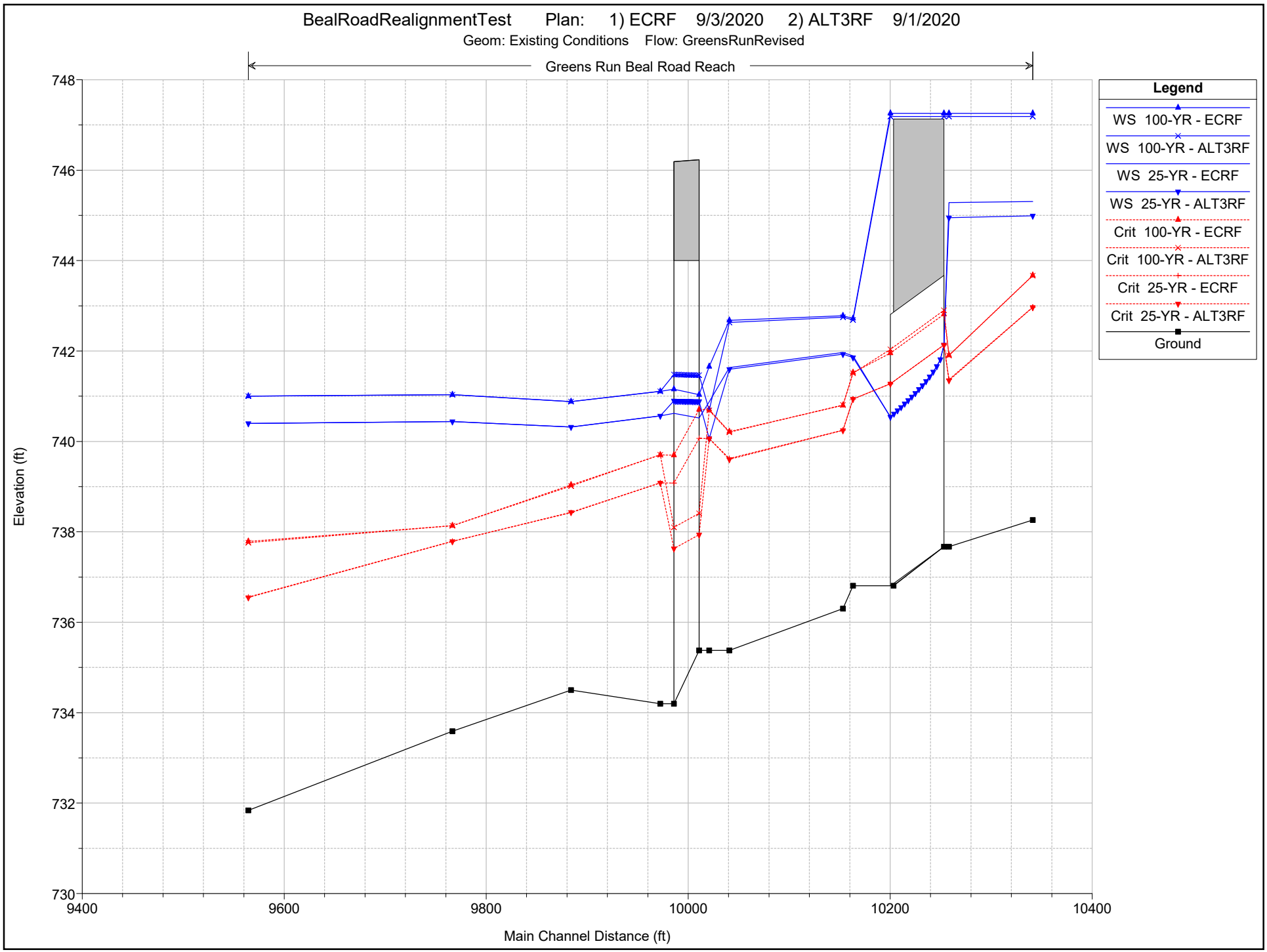
0
50
100
150
200
250
300
350

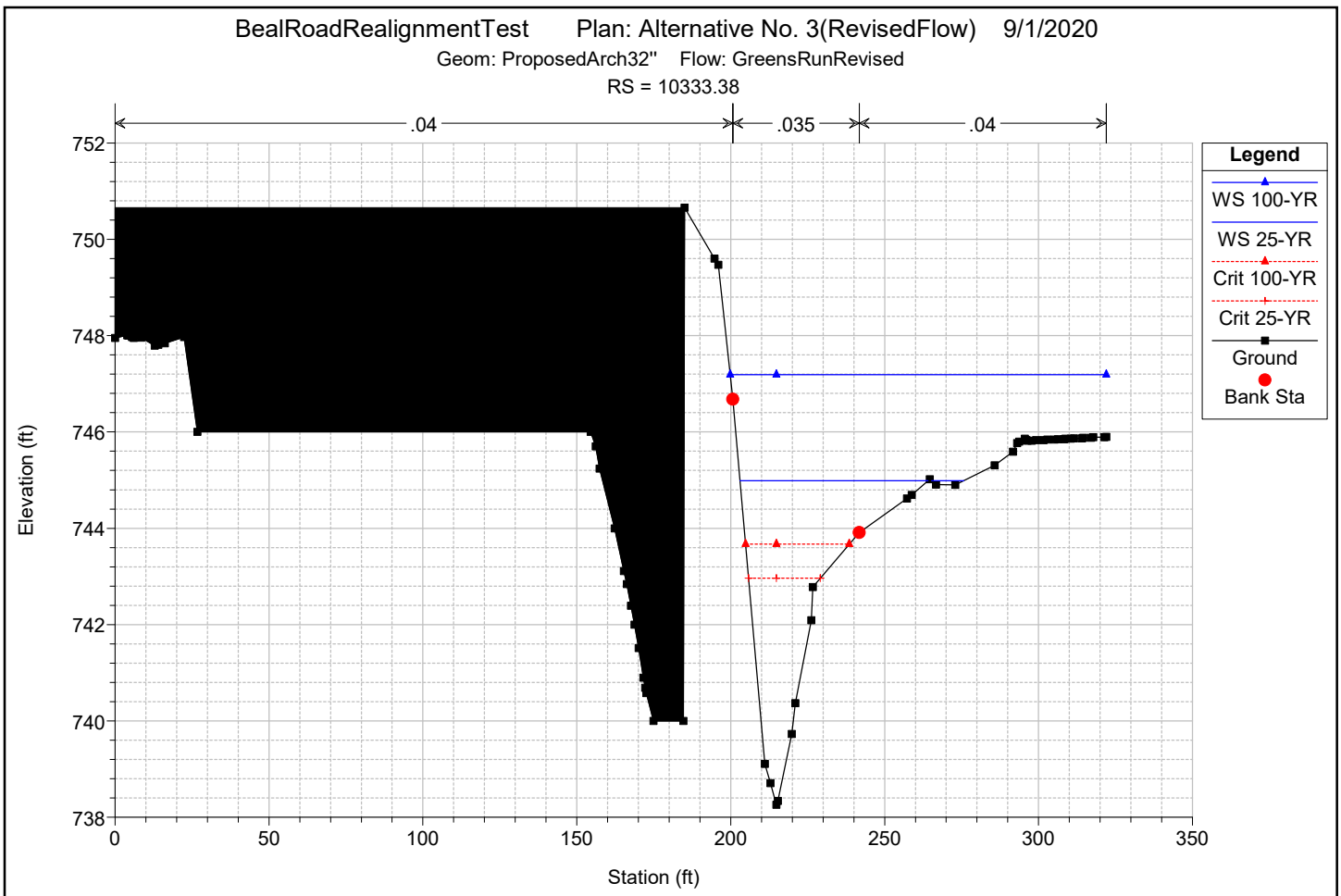
APPENDIX F

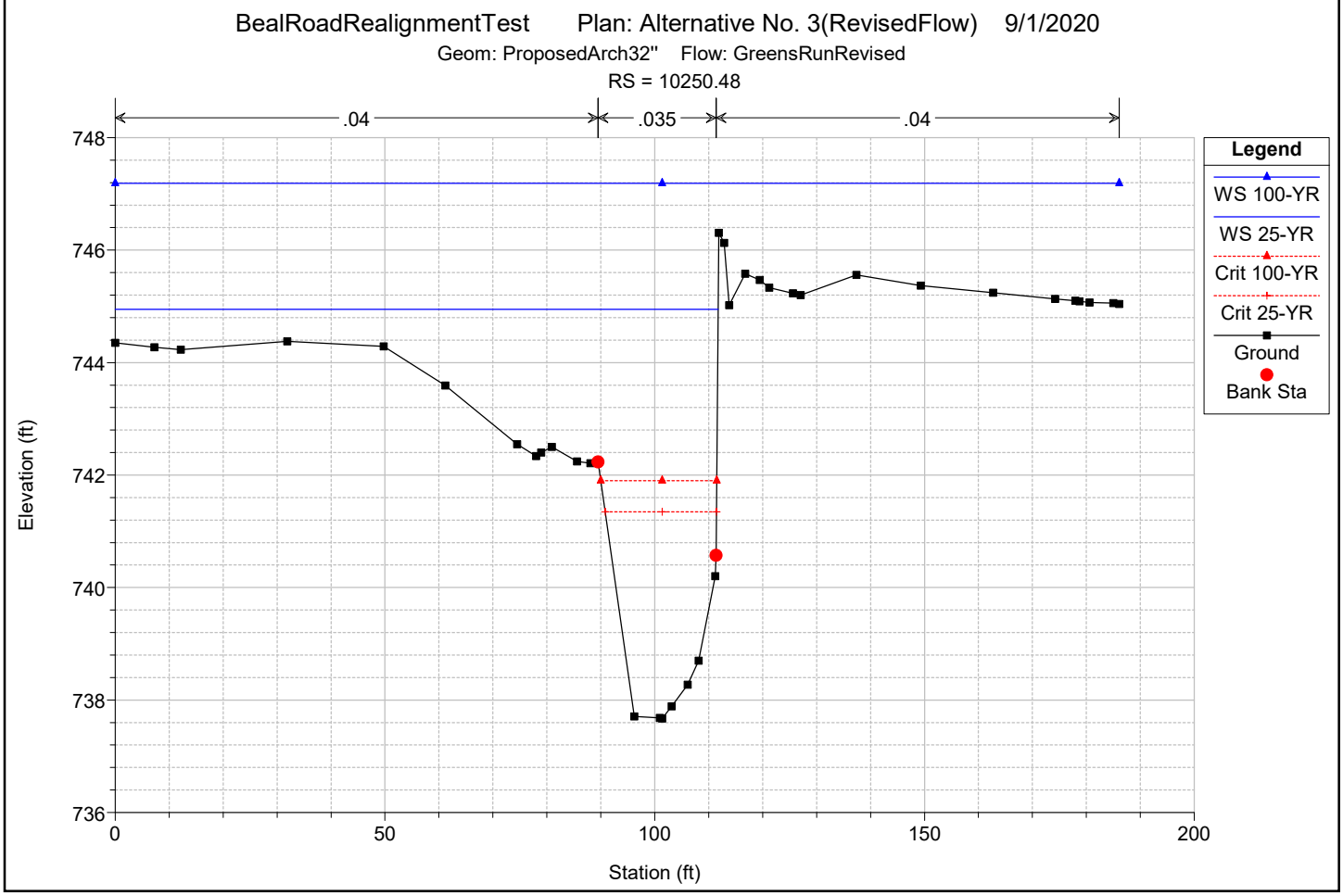
ALTERNATIVE 3 PROFILES, CROSS SECTIONS, AND RESULTS


BealRoadRealignmentTest Plan: 1) ECRF 9/3/2020 2) ALT3RF 9/1/2020
Geom: Existing Conditions Flow: GreensRunRevised
Greens Run Beal Road Reach
Legend
WS 100-YR - ECRF
WS 100-YR - ALT3RF
WS 25-YR - ECRF
WS 25-YR - ALT3RF
Crit 100-YR - ECRF
Crit 100-YR - ALT3RF
Crit 25-YR - ECRF
Crit 25-YR - ALT3RF
Ground
Elevation (ft)
748
746
744
742
740
738
736
734
732
730
9400
9600
9800
10000
10200
10400
Main Channel Distance (ft)

HEC-RAS Plan: ALT3RF River: Greens Run Reach: Beal Road Reach

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)	
Beal Road Reach	10333.38	25-YR	535.00	738.26	744.99	742.97	745.23	0.002006	4.03	142.18	71.63	0.39
Beal Road Reach	10333.38	100-YR	691.00	738.26	747.19	743.67	747.25	0.000363	2.32	376.94	122.24	0.18
Beal Road Reach	10250.48	25-YR	535.00	737.67	744.95	741.35	745.07	0.000517	3.05	242.62	111.75	0.22
Beal Road Reach	10250.48	100-YR	691.00	737.67	747.19	741.90	747.22	0.000115	1.77	632.23	186.08	0.11
Beal Road Reach	10200		Culvert									
Beal Road Reach	10169.8	25-YR	535.00	736.81	741.85	740.94	742.59	0.008292	6.86	78.01	24.14	0.67
Beal Road Reach	10169.8	100-YR	691.00	736.81	742.69	741.51	743.42	0.007650	6.89	100.42	30.92	0.66
Beal Road Reach	10153.25	25-YR	610.00	736.30	741.93	740.25	742.39	0.003304	5.45	111.90	30.47	0.50
Beal Road Reach	10153.25	100-YR	787.00	736.30	742.75	740.80	743.25	0.003111	5.70	137.97	33.38	0.49
Beal Road Reach	10040.79	25-YR	610.00	735.38	741.59	739.61	742.01	0.003244	5.17	117.93	34.67	0.49
Beal Road Reach	10040.79	100-YR	787.00	735.38	742.63	740.20	742.90	0.001934	4.36	220.47	110.54	0.39
Beal Road Reach	10020.79	25-YR	743.00	735.38	740.06	740.06	741.58	0.013944	9.87	75.26	24.96	1.00
Beal Road Reach	10020.79	100-YR	960.00	735.38	740.69	740.69	742.40	0.013673	10.48	91.57	27.24	1.01
Beal Road Reach	10000		Culvert									
Beal Road Reach	9972.407	25-YR	743.00	734.20	740.57	739.08	741.16	0.004154	6.17	120.51	32.67	0.57
Beal Road Reach	9972.407	100-YR	960.00	734.20	741.11	739.71	741.85	0.004753	6.92	138.76	34.98	0.61
Beal Road Reach	9884.092	25-YR	743.00	734.50	740.32	738.43	740.79	0.002773	5.53	137.09	61.09	0.48
Beal Road Reach	9884.092	100-YR	960.00	734.50	740.88	739.01	741.41	0.002824	5.98	192.10	116.11	0.49
Beal Road Reach	9766.492	25-YR	743.00	733.59	740.44	737.79	740.48	0.000342	2.05	500.62	224.00	0.16
Beal Road Reach	9766.492	100-YR	960.00	733.59	741.04	738.14	741.08	0.000306	2.09	635.98	229.30	0.16
Beal Road Reach	9564.450	25-YR	743.00	731.84	740.40	736.55	740.43	0.000149	1.75	680.91	238.69	0.12
Beal Road Reach	9564.450	100-YR	960.00	731.84	741.00	737.76	741.03	0.000146	1.83	828.70	253.98	0.12


BealRoadRealignmentTest Plan: Alternative No. 3(RevisedFlow) 9/1/2020
Geom: ProposedArch32" Flow: GreensRunRevised
RS = 10333.38
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
752
750
748
746
744
742
740
738
0
50
100
150
200
250
300
350


BealRoadRealignmentTest Plan: Alternative No. 3(RevisedFlow) 9/1/2020
Geom: ProposedArch32" Flow: GreensRunRevised
RS = 10250.48
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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744
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740
738
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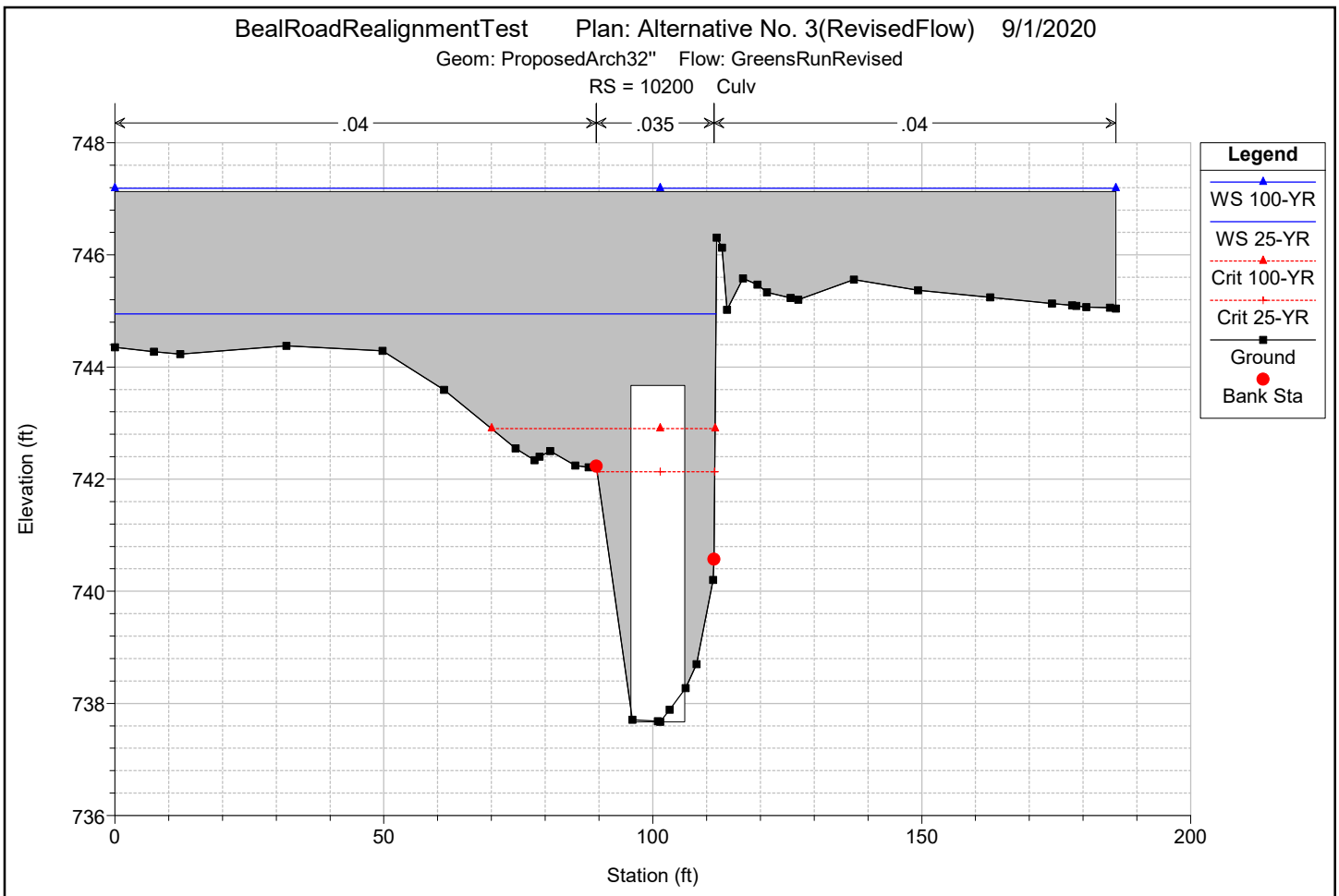
100
150
200


BealRoadRealignmentTest Plan: Alternative No. 3(RevisedFlow) 9/1/2020
Geom: ProposedArch32" Flow: GreensRunRevised
RS = 10200 Culv
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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746
744
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740
738
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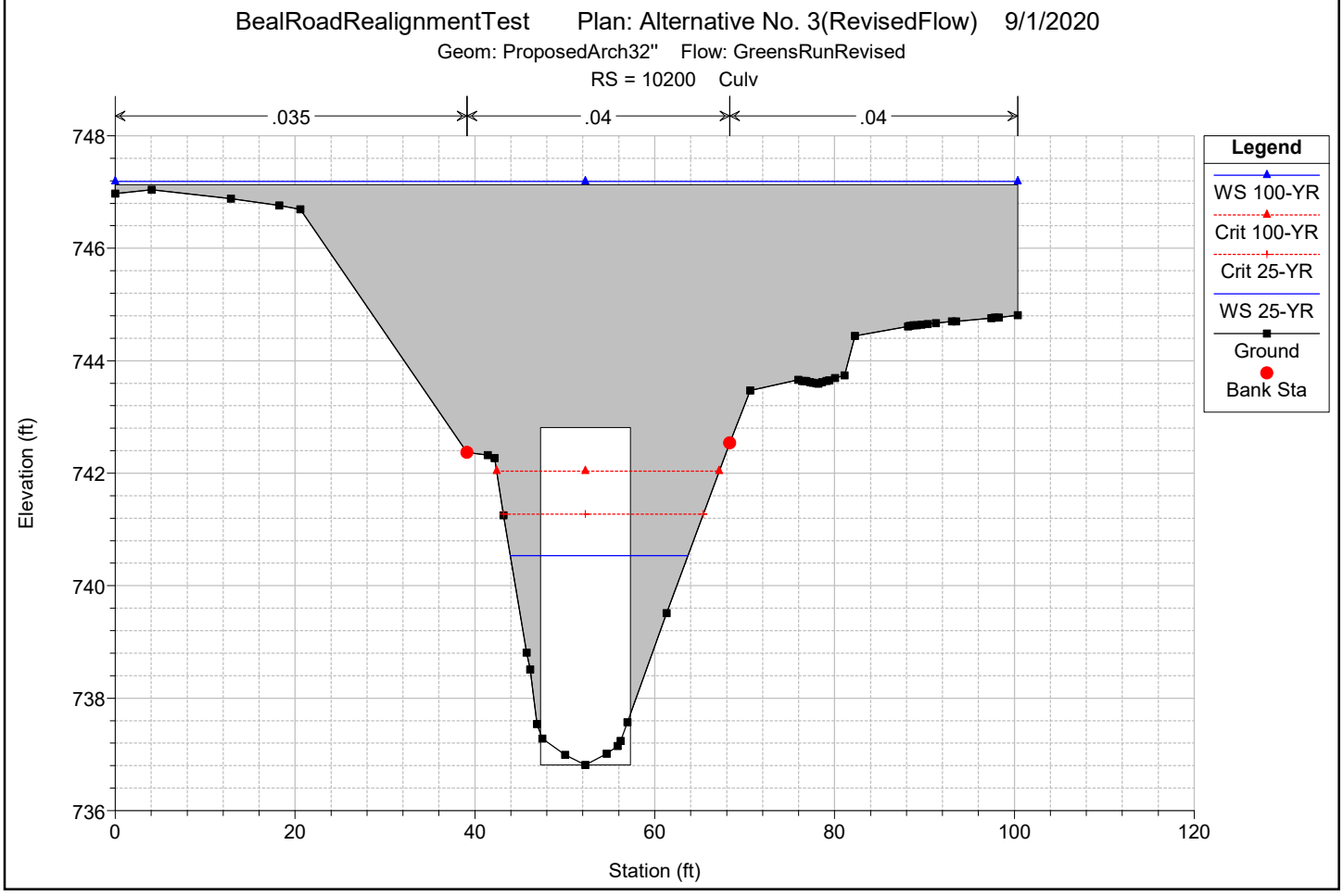
100
150
200


BealRoadRealignmentTest Plan: Alternative No. 3(RevisedFlow) 9/1/2020
Geom: ProposedArch32" Flow: GreensRunRevised
RS = 10200 Culv
.035
.04
.04
Legend
WS 100-YR
Crit 100-YR
Crit 25-YR
WS 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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746
744
742
740
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60
80
100
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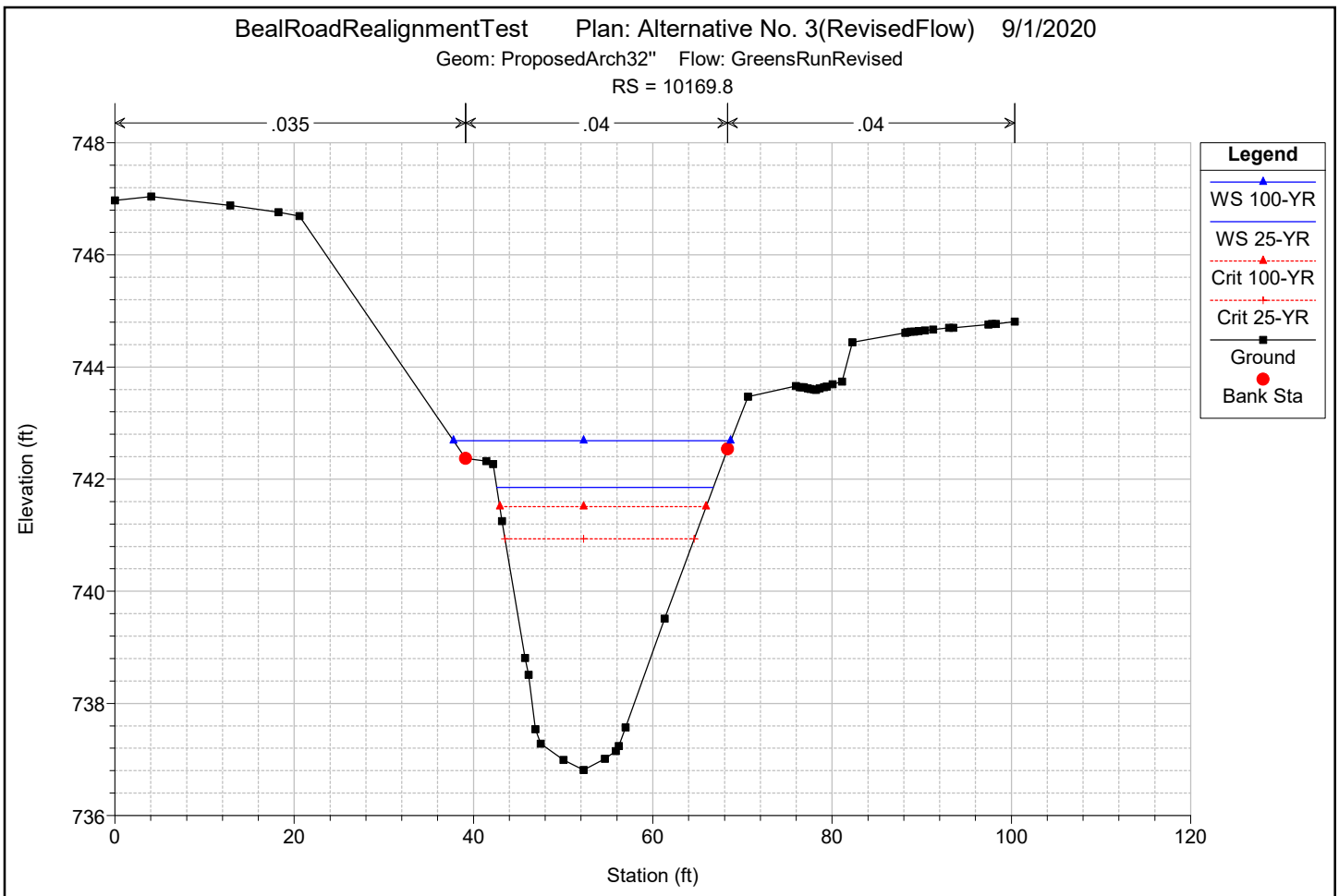
BealRoadRealignmentTest Plan: Alternative No. 3(RevisedFlow) 9/1/2020
Geom: ProposedArch32" Flow: GreensRunRevised
RS = 10169.8
.035
.04
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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100
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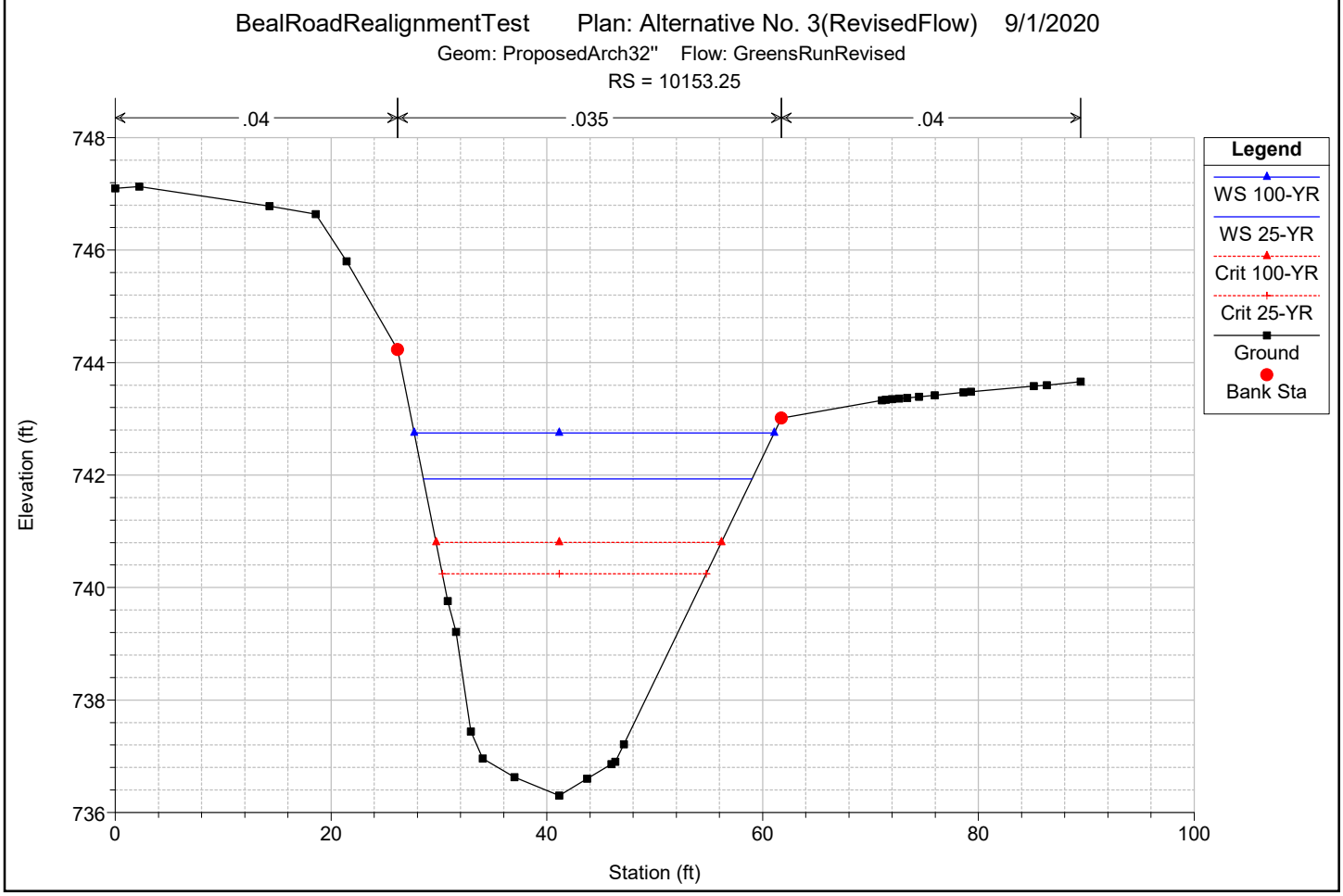
BealRoadRealignmentTest Plan: Alternative No. 3(RevisedFlow) 9/1/2020
Geom: ProposedArch32" Flow: GreensRunRevised
RS = 10153.25
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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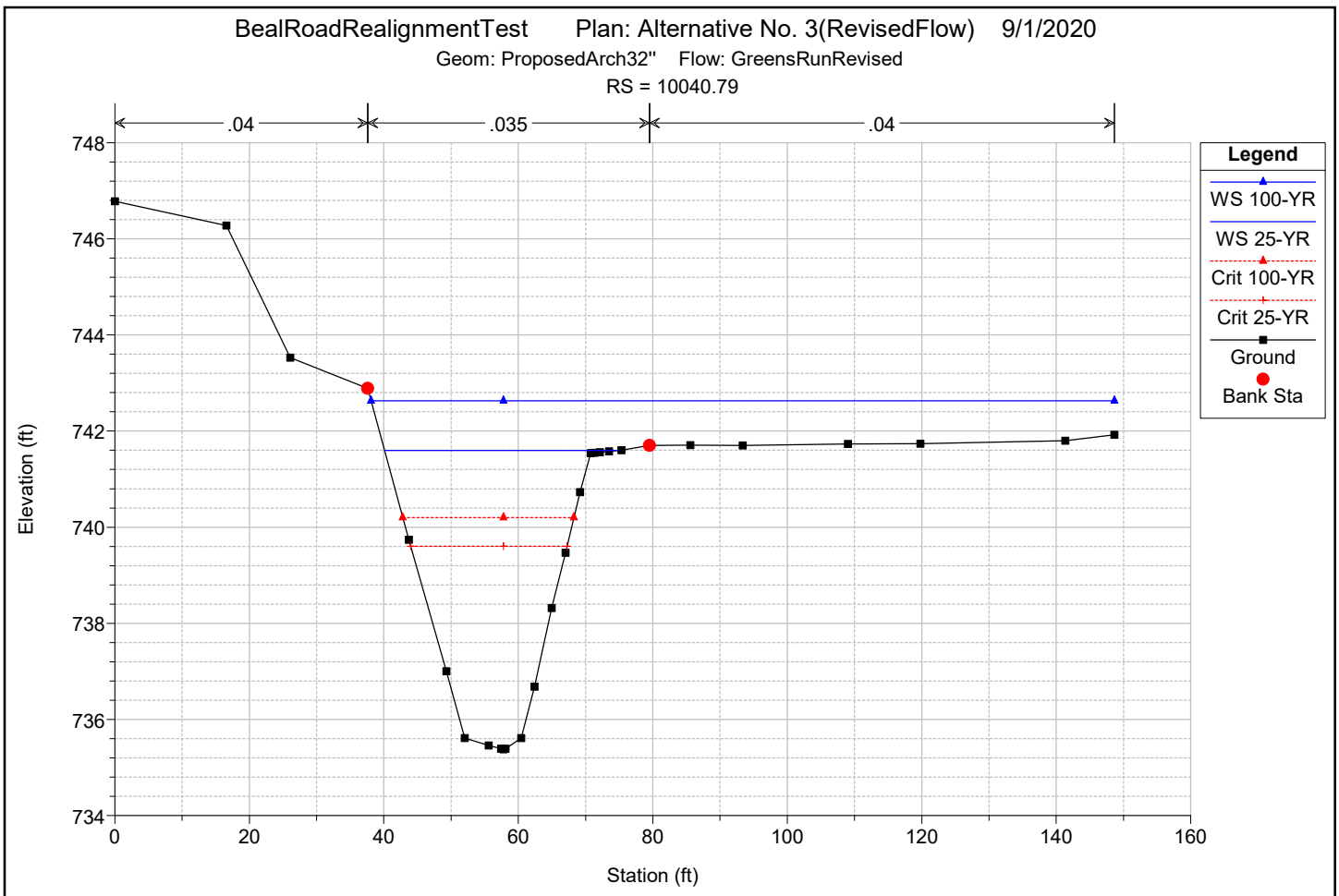
80
100


BealRoadRealignmentTest Plan: Alternative No. 3(RevisedFlow) 9/1/2020
Geom: ProposedArch32" Flow: GreensRunRevised
RS = 10040.79
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.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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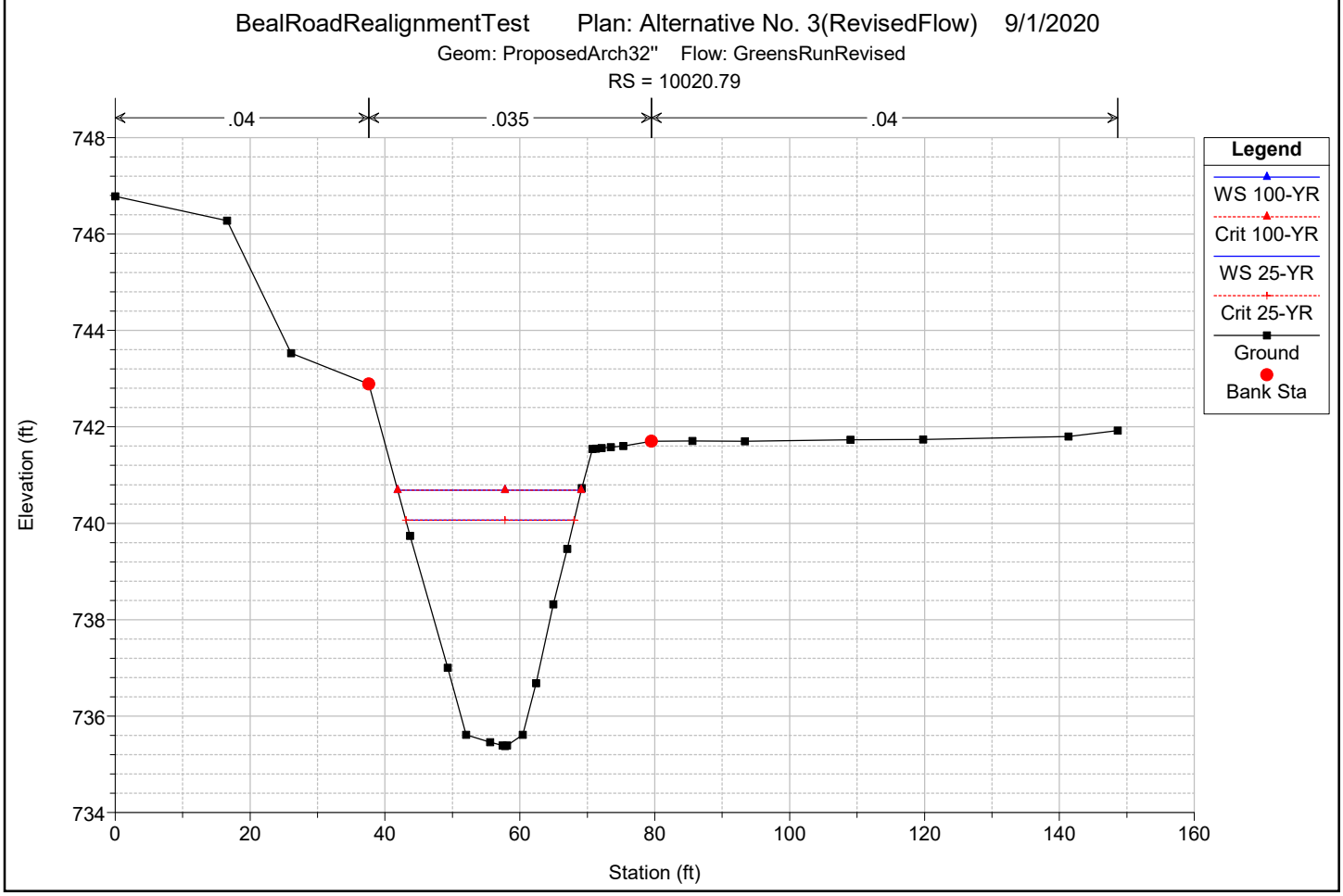
BealRoadRealignmentTest Plan: Alternative No. 3(RevisedFlow) 9/1/2020
Geom: ProposedArch32" Flow: GreensRunRevised
RS = 10020.79
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.04
Legend
WS 100-YR
Crit 100-YR
WS 25-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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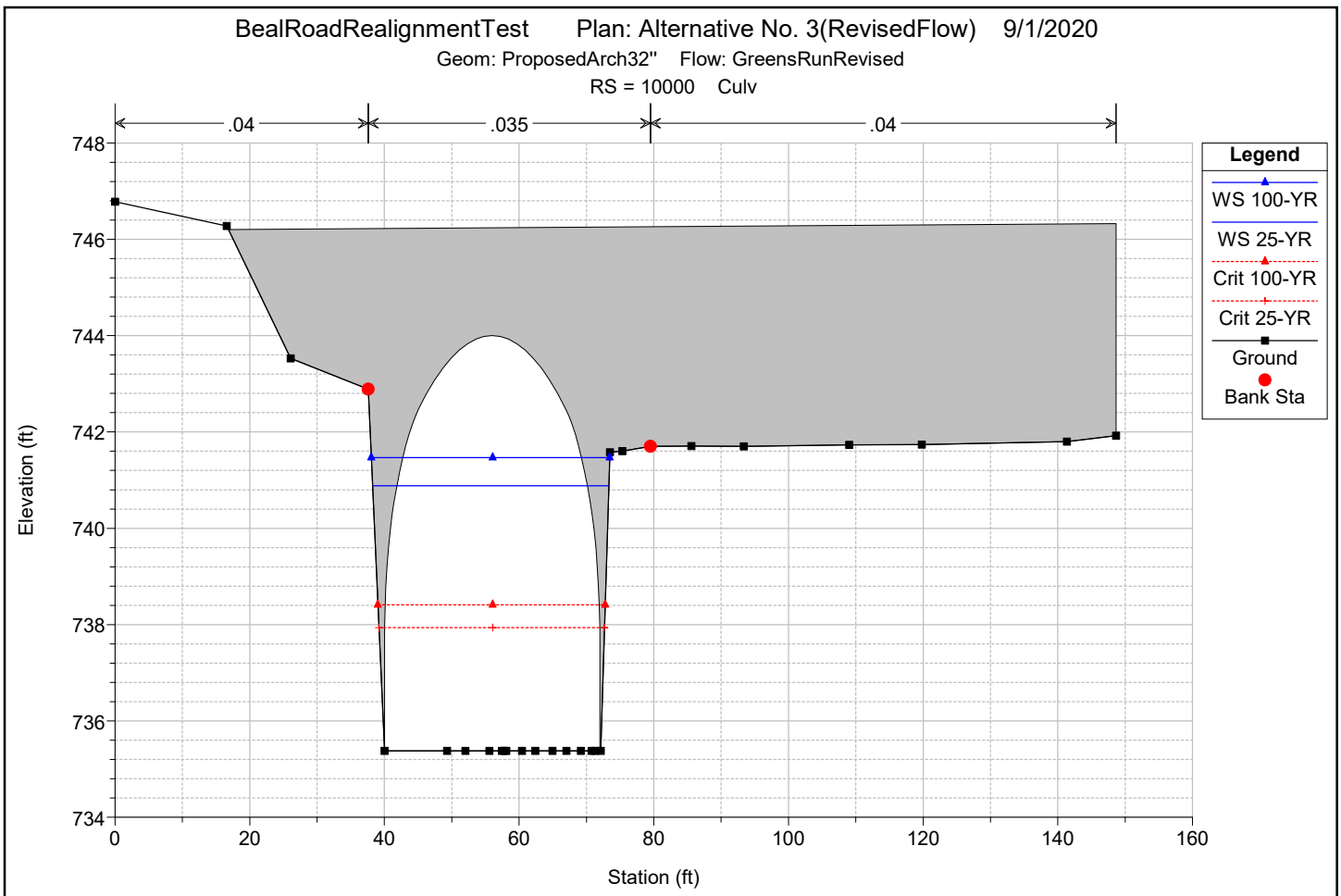
BealRoadRealignmentTest Plan: Alternative No. 3(RevisedFlow) 9/1/2020
Geom: ProposedArch32" Flow: GreensRunRevised
RS = 10000 Culv
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.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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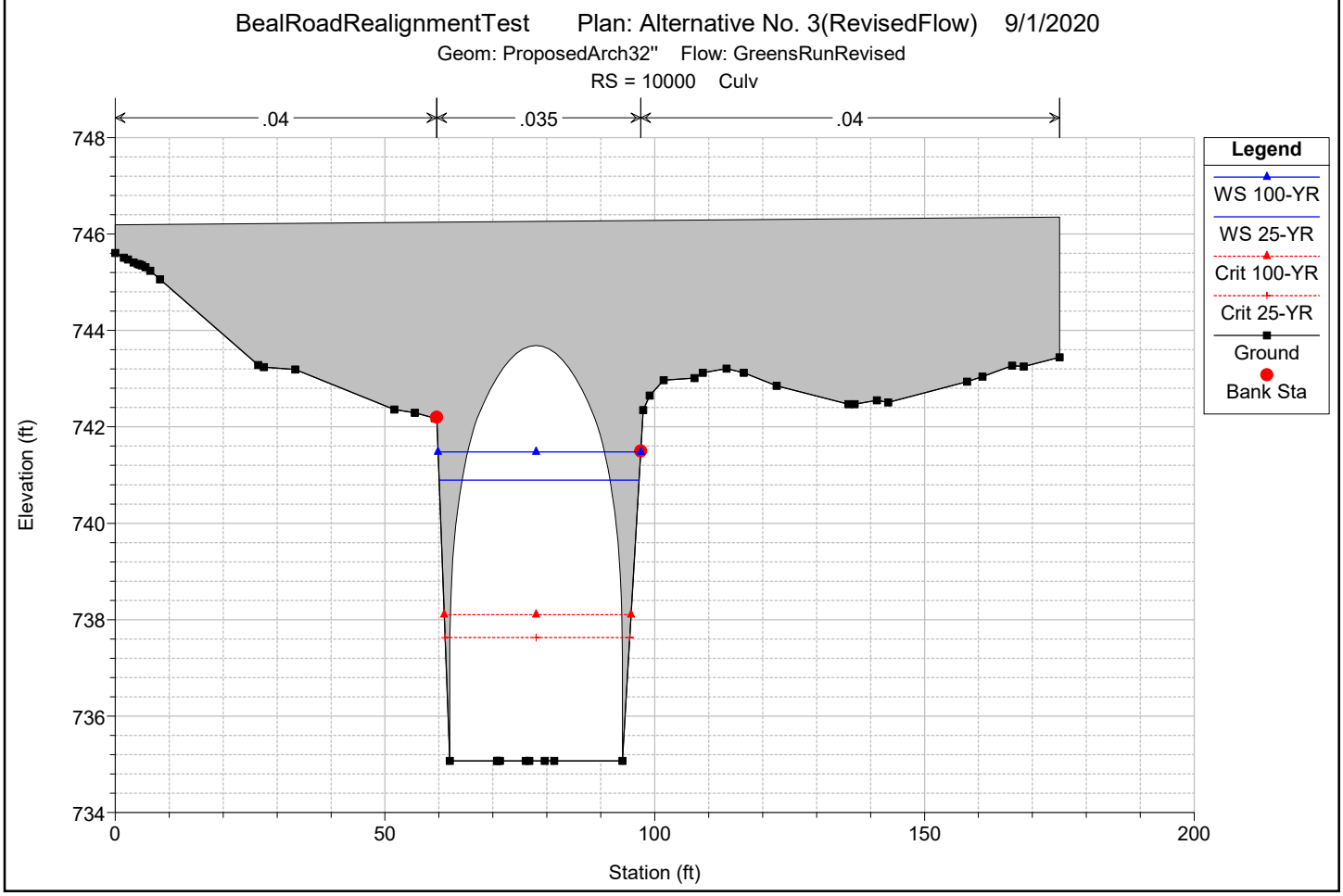
BealRoadRealignmentTest Plan: Alternative No. 3(RevisedFlow) 9/1/2020
Geom: ProposedArch32" Flow: GreensRunRevised
RS = 10000 Culv
.04
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.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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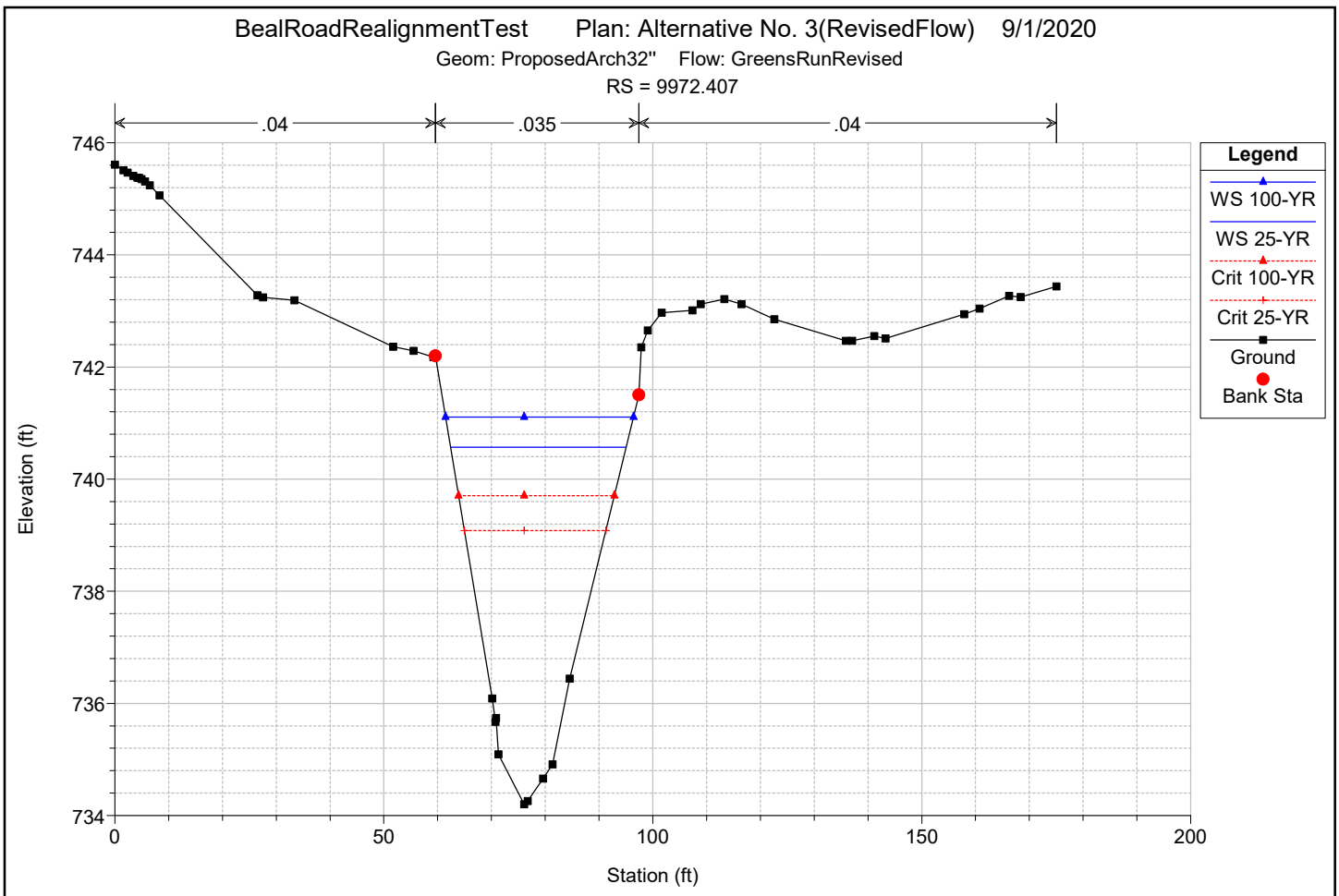
BealRoadRealignmentTest Plan: Alternative No. 3(RevisedFlow) 9/1/2020
Geom: ProposedArch32" Flow: GreensRunRevised
RS = 9972.407
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.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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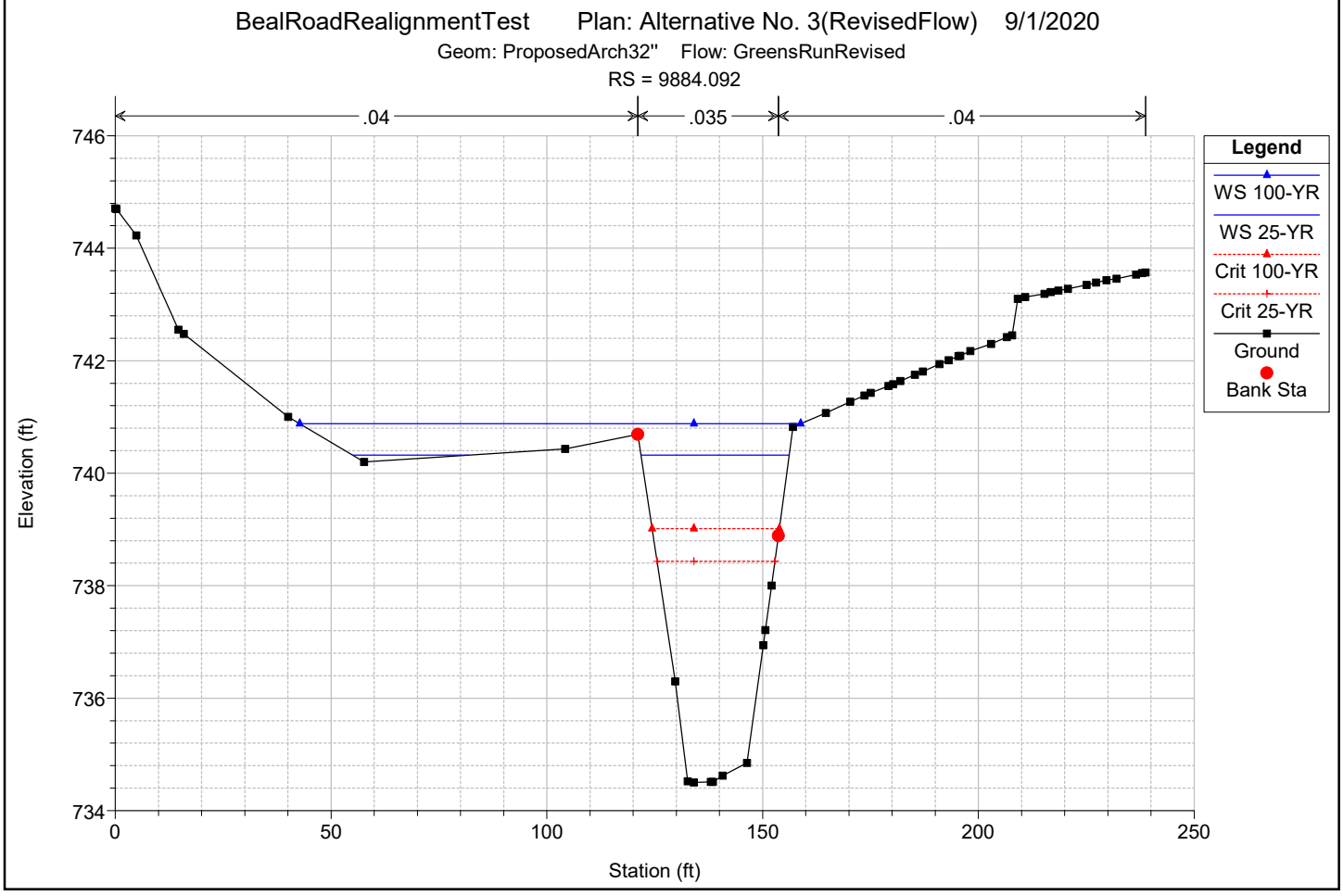
BealRoadRealignmentTest Plan: Alternative No. 3(RevisedFlow) 9/1/2020
Geom: ProposedArch32" Flow: GreensRunRevised
RS = 9884.092
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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742
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734
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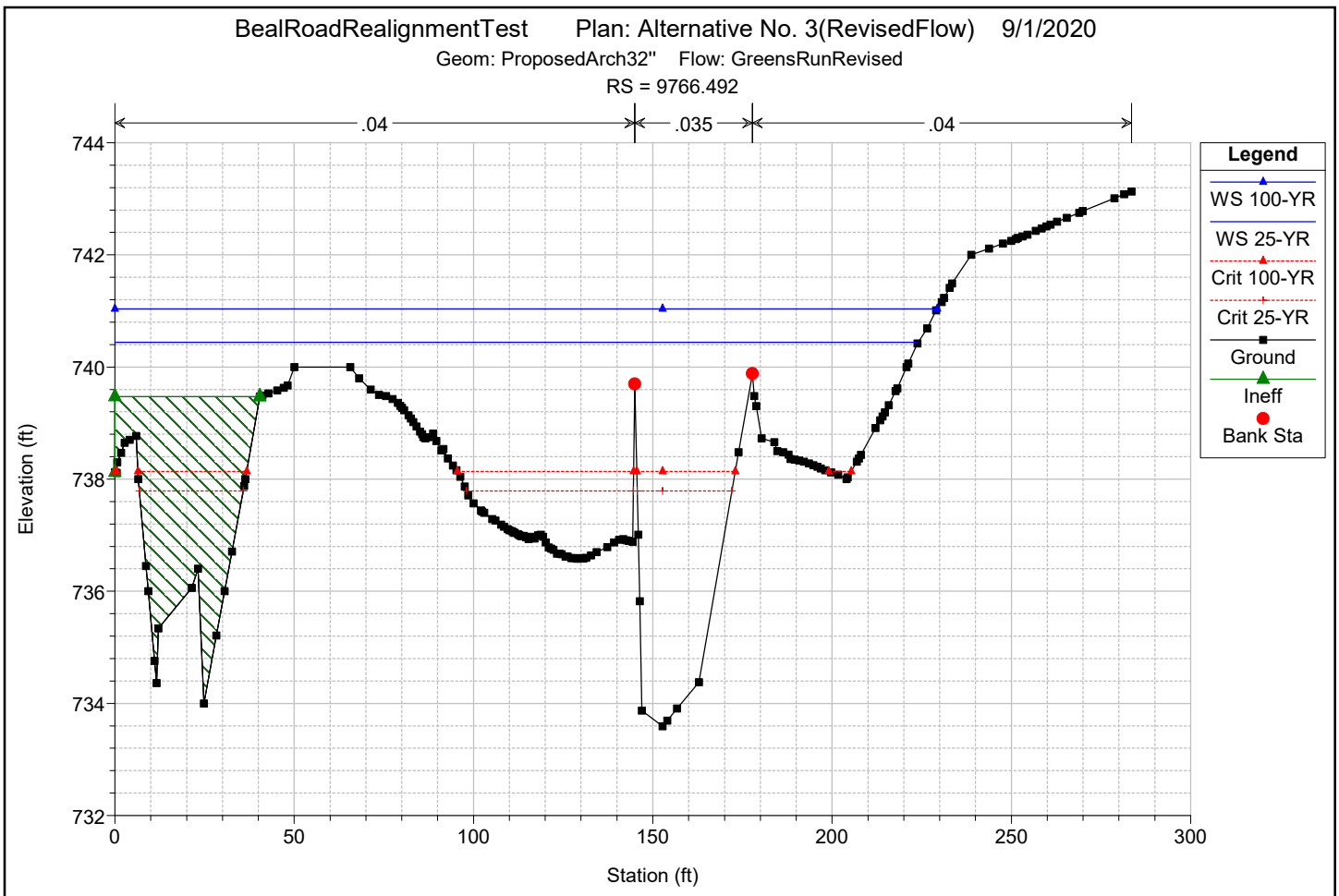
BealRoadRealignmentTest Plan: Alternative No. 3(RevisedFlow) 9/1/2020
Geom: ProposedArch32" Flow: GreensRunRevised
RS = 9766.492
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
744
742
740
738
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732
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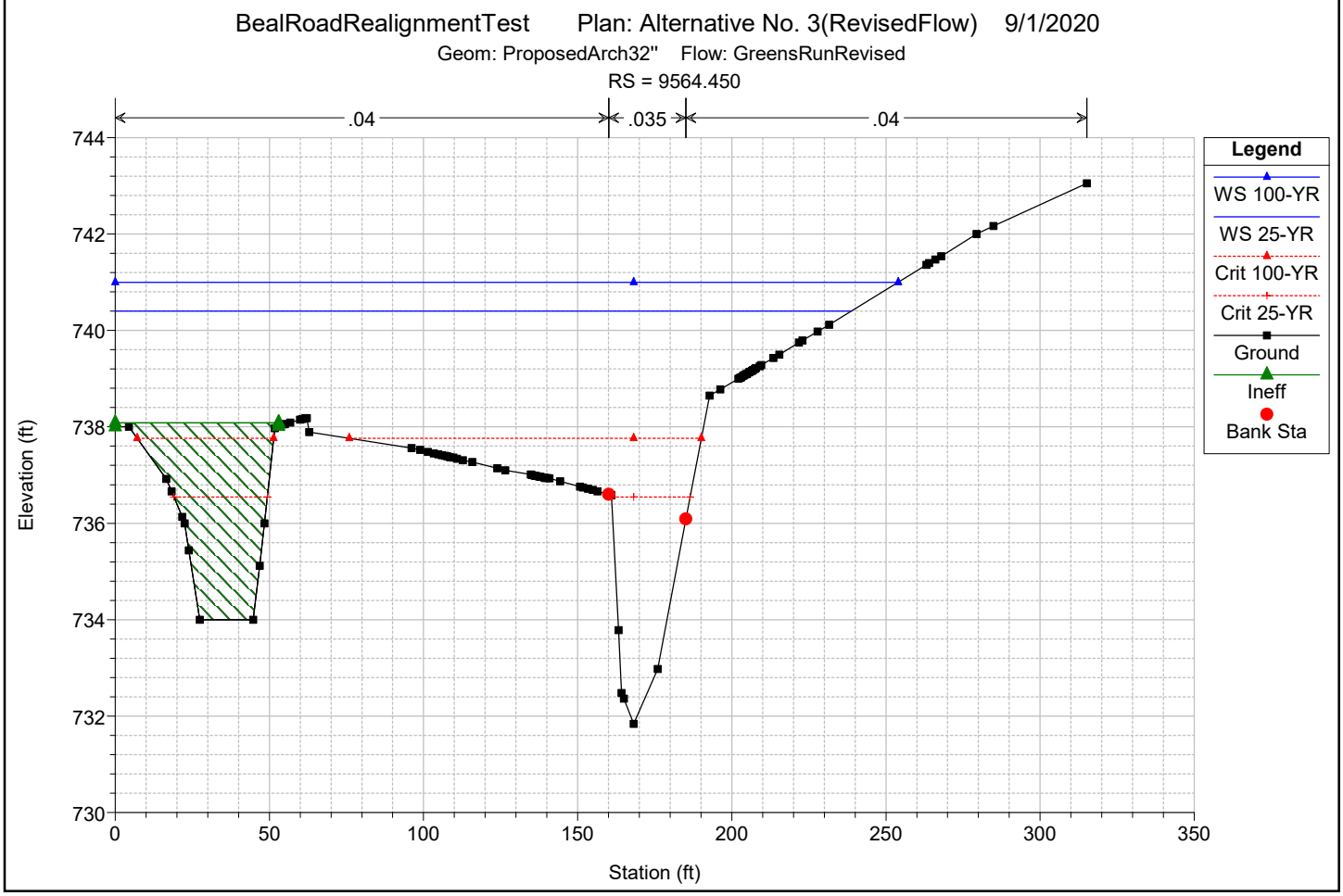
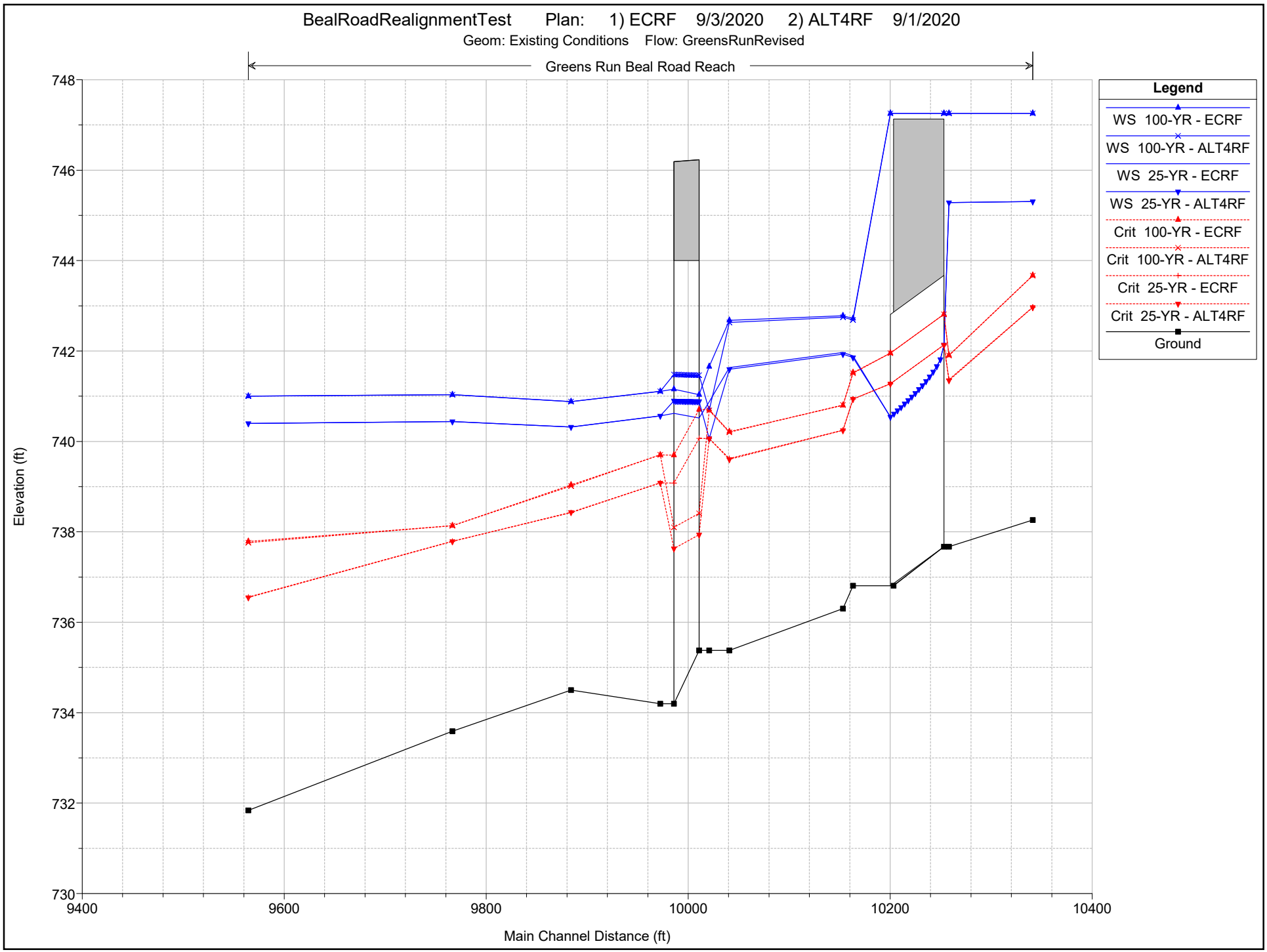
200
250
300


BealRoadRealignmentTest Plan: Alternative No. 3(RevisedFlow) 9/1/2020
Geom: ProposedArch32" Flow: GreensRunRevised
RS = 9564.450
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
744
742
740
738
736
734
732
730
0
50
100
150
200
250
300
350

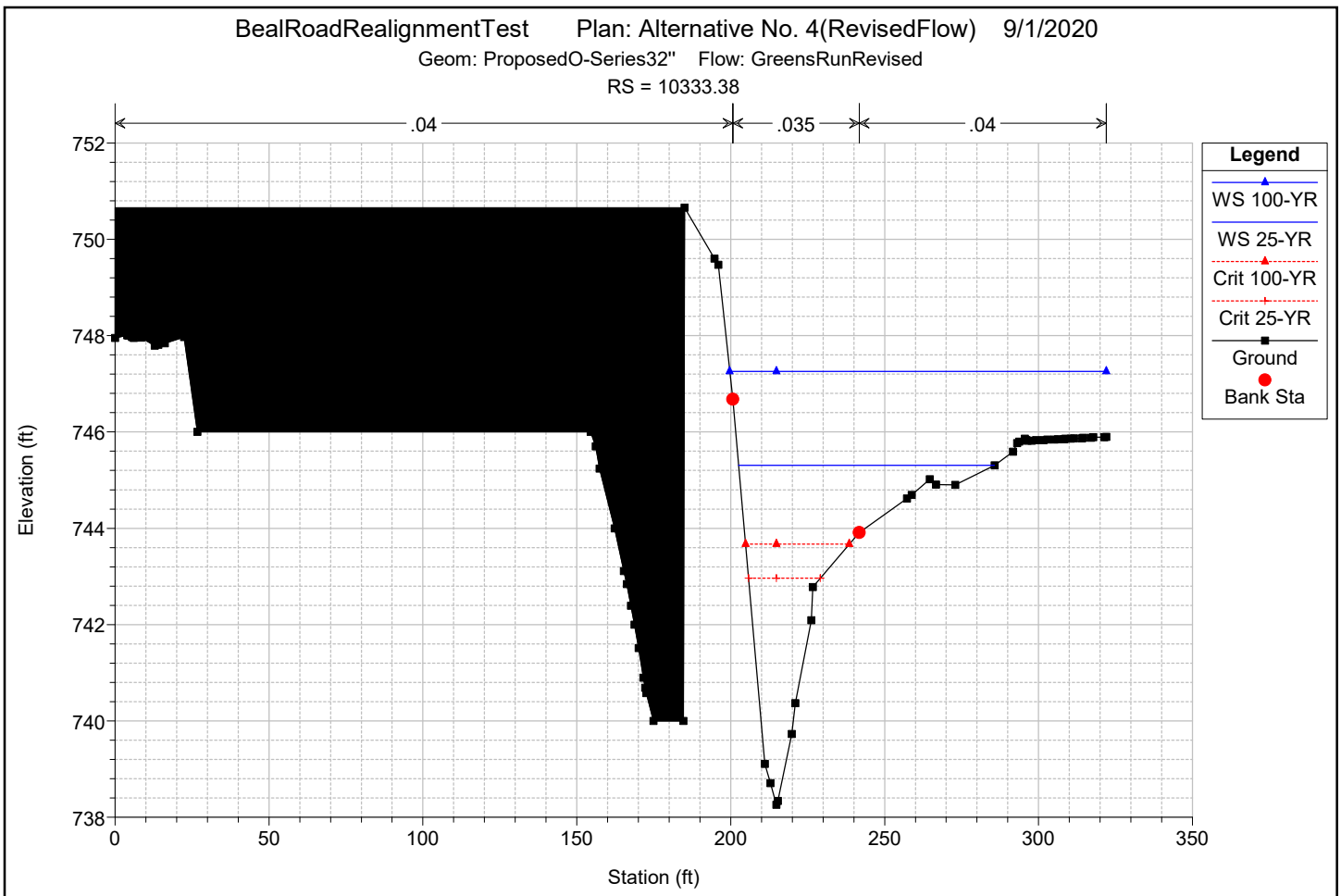
APPENDIX G

ALTERNATIVE 4 PROFILES, CROSS SECTIONS, AND RESULTS


BealRoadRealignmentTest Plan: 1) ECRF 9/3/2020 2) ALT4RF 9/1/2020
Geom: Existing Conditions Flow: GreensRunRevised
Greens Run Beal Road Reach
Legend
WS 100-YR - ECRF
WS 100-YR - ALT4RF
WS 25-YR - ECRF
WS 25-YR - ALT4RF
Crit 100-YR - ECRF
Crit 100-YR - ALT4RF
Crit 25-YR - ECRF
Crit 25-YR - ALT4RF
Ground
Elevation (ft)
748
746
744
742
740
738
736
734
732
730
9400
9600
9800
10000
10200
10400
Main Channel Distance (ft)

HEC-RAS Plan: ALT4RF River: Greens Run Reach: Beal Road Reach

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)	
Beal Road Reach	10333.38	25-YR	535.00	738.26	745.31	742.97	745.49	0.001424	3.57	166.87	83.12	0.33
Beal Road Reach	10333.38	100-YR	691.00	738.26	747.26	743.67	747.32	0.000341	2.27	385.70	122.36	0.17
Beal Road Reach	10250.48	25-YR	535.00	737.67	745.28	741.35	745.37	0.000381	2.72	283.85	147.13	0.19
Beal Road Reach	10250.48	100-YR	691.00	737.67	747.26	741.90	747.29	0.000108	1.73	645.61	186.08	0.10
Beal Road Reach	10200		Culvert									
Beal Road Reach	10169.8	25-YR	535.00	736.81	741.85	740.94	742.59	0.008292	6.86	78.01	24.14	0.67
Beal Road Reach	10169.8	100-YR	691.00	736.81	742.69	741.51	743.42	0.007650	6.89	100.42	30.92	0.66
Beal Road Reach	10153.25	25-YR	610.00	736.30	741.93	740.25	742.39	0.003304	5.45	111.90	30.47	0.50
Beal Road Reach	10153.25	100-YR	787.00	736.30	742.75	740.80	743.25	0.003111	5.70	137.97	33.38	0.49
Beal Road Reach	10040.79	25-YR	610.00	735.38	741.59	739.61	742.01	0.003244	5.17	117.93	34.67	0.49
Beal Road Reach	10040.79	100-YR	787.00	735.38	742.63	740.20	742.90	0.001934	4.36	220.47	110.54	0.39
Beal Road Reach	10020.79	25-YR	743.00	735.38	740.06	740.06	741.58	0.013944	9.87	75.26	24.96	1.00
Beal Road Reach	10020.79	100-YR	960.00	735.38	740.69	740.69	742.40	0.013673	10.48	91.57	27.24	1.01
Beal Road Reach	10000		Culvert									
Beal Road Reach	9972.407	25-YR	743.00	734.20	740.57	739.08	741.16	0.004154	6.17	120.51	32.67	0.57
Beal Road Reach	9972.407	100-YR	960.00	734.20	741.11	739.71	741.85	0.004753	6.92	138.76	34.98	0.61
Beal Road Reach	9884.092	25-YR	743.00	734.50	740.32	738.43	740.79	0.002773	5.53	137.09	61.09	0.48
Beal Road Reach	9884.092	100-YR	960.00	734.50	740.88	739.01	741.41	0.002824	5.98	192.10	116.11	0.49
Beal Road Reach	9766.492	25-YR	743.00	733.59	740.44	737.79	740.48	0.000342	2.05	500.62	224.00	0.16
Beal Road Reach	9766.492	100-YR	960.00	733.59	741.04	738.14	741.08	0.000306	2.09	635.98	229.30	0.16
Beal Road Reach	9564.450	25-YR	743.00	731.84	740.40	736.55	740.43	0.000149	1.75	680.91	238.69	0.12
Beal Road Reach	9564.450	100-YR	960.00	731.84	741.00	737.76	741.03	0.000146	1.83	828.70	253.98	0.12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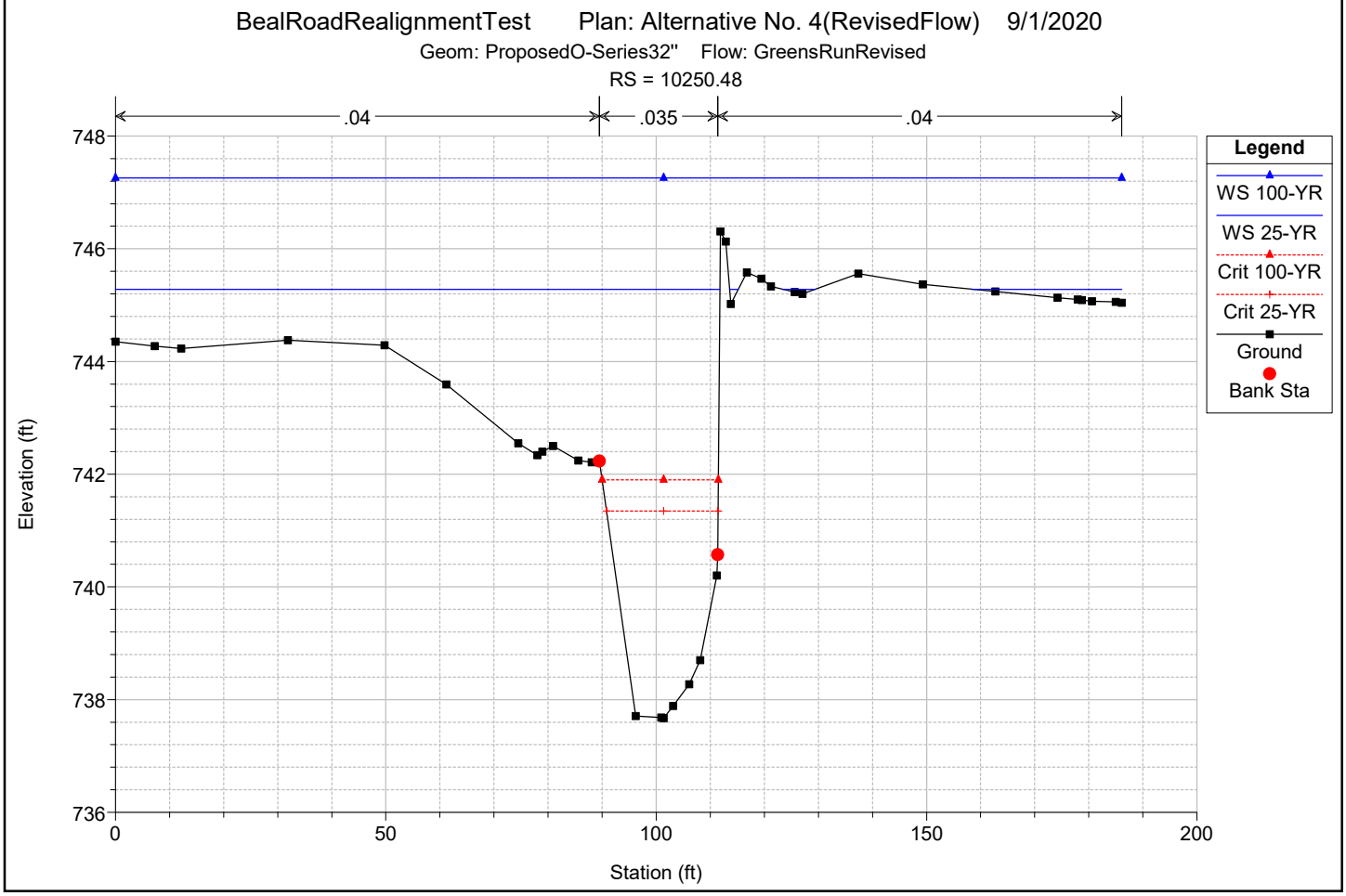
Geom: ProposedO-Series32" Flow: GreensRunRevised
RS = 10333.38
.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
752
750
748
746
744
742
740
738
0
50
100
150
200
250
300
350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.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
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Station (ft)
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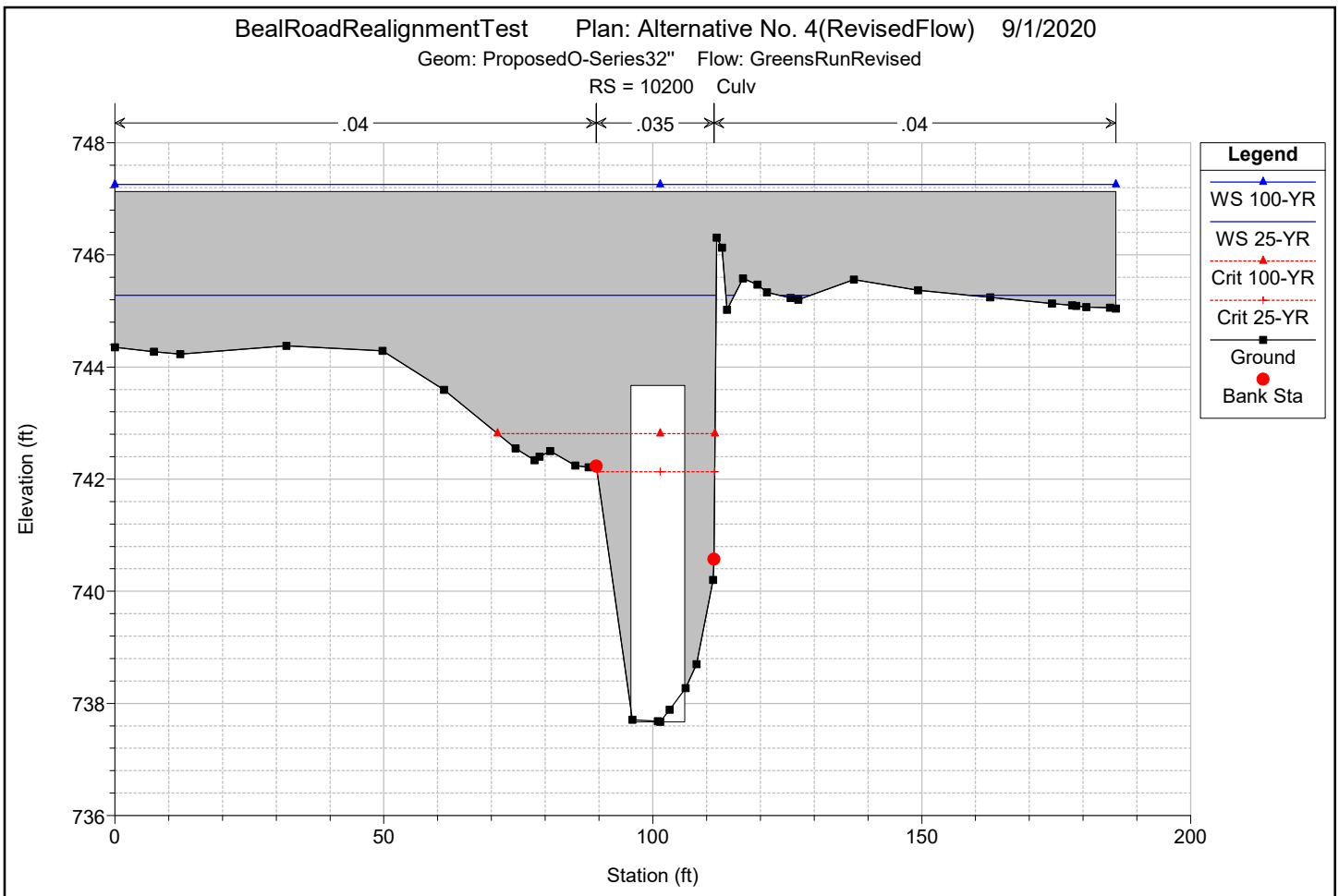
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.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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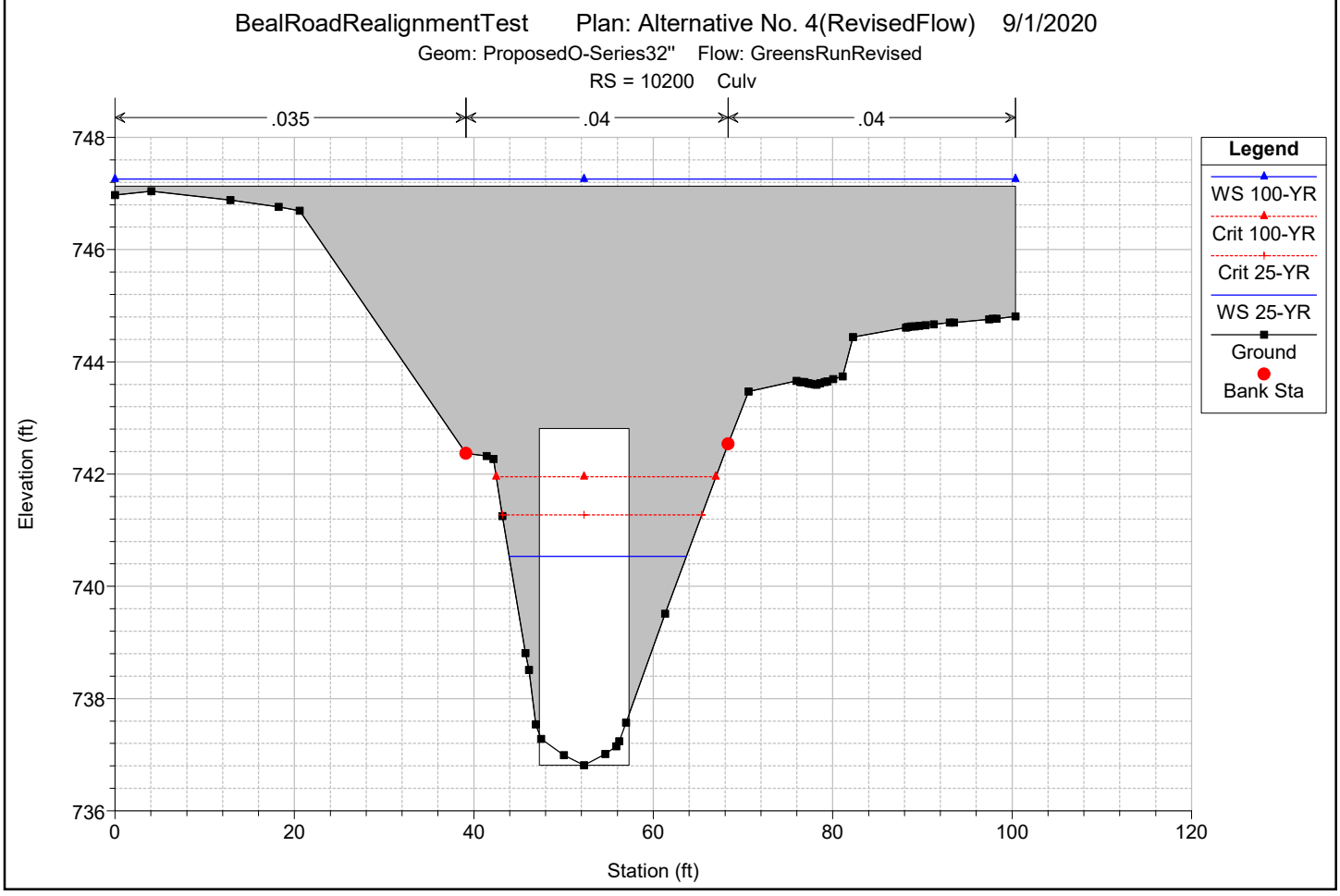
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.035
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Legend
WS 100-YR
Crit 100-YR
Crit 25-YR
WS 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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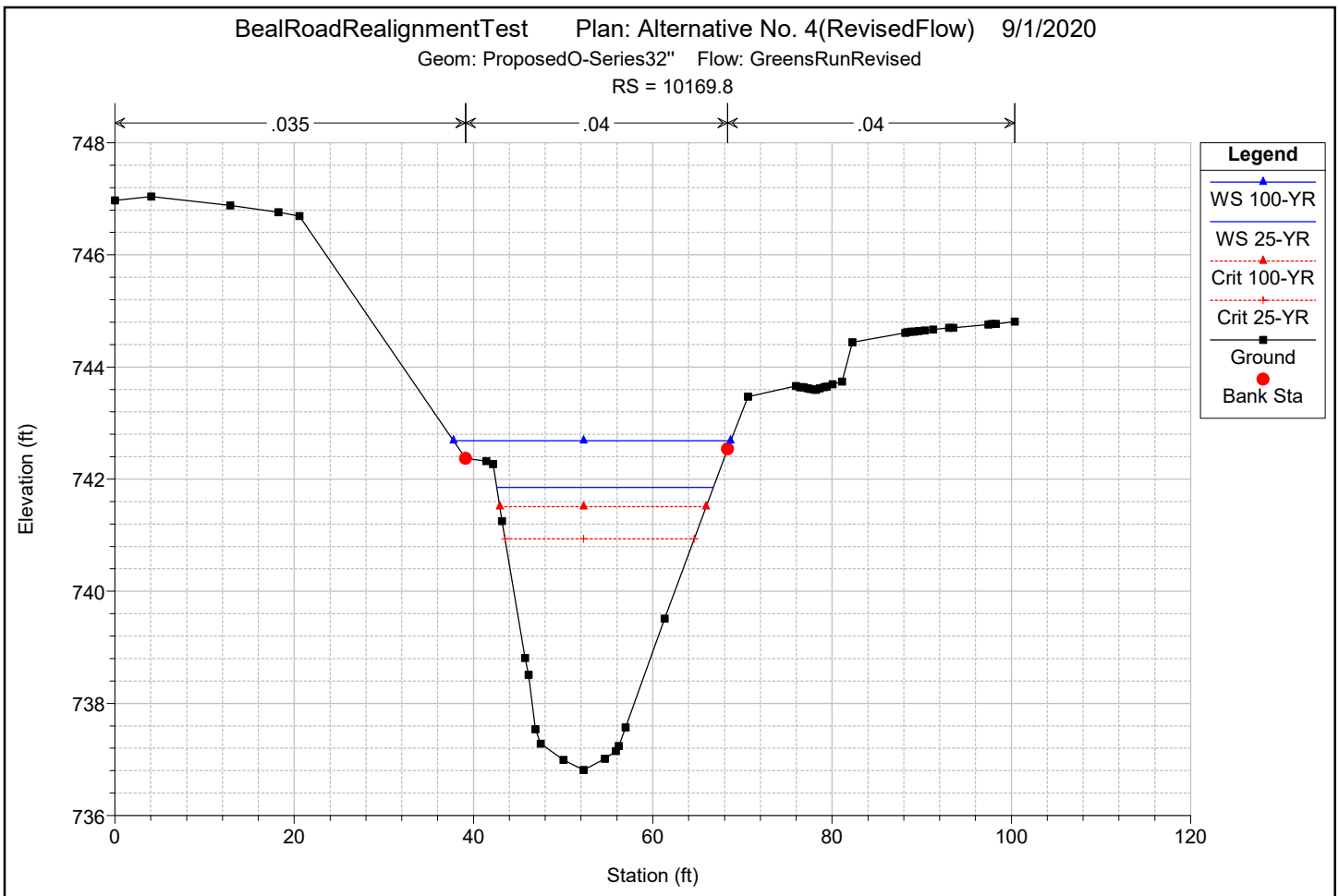
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.04
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
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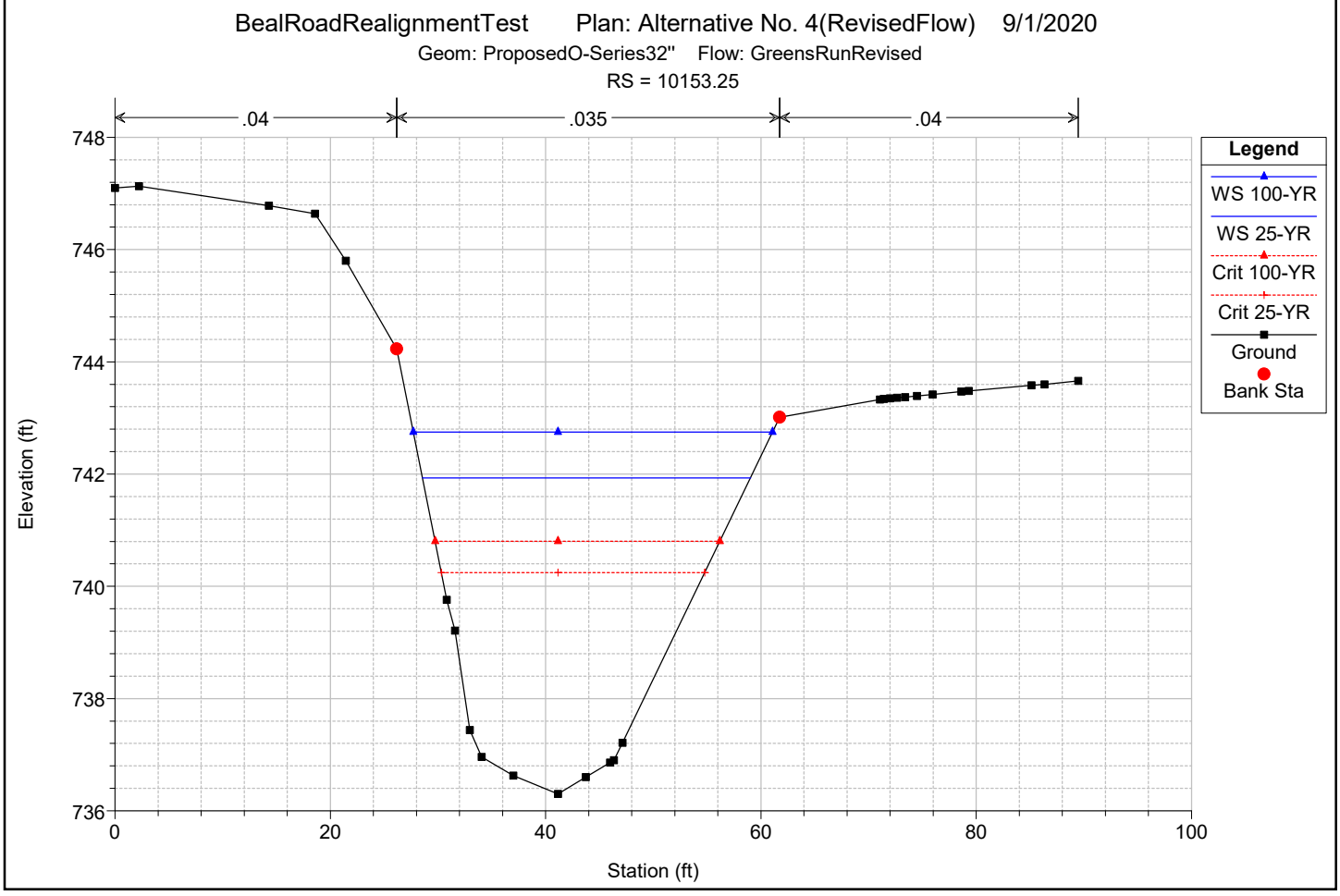
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.035
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Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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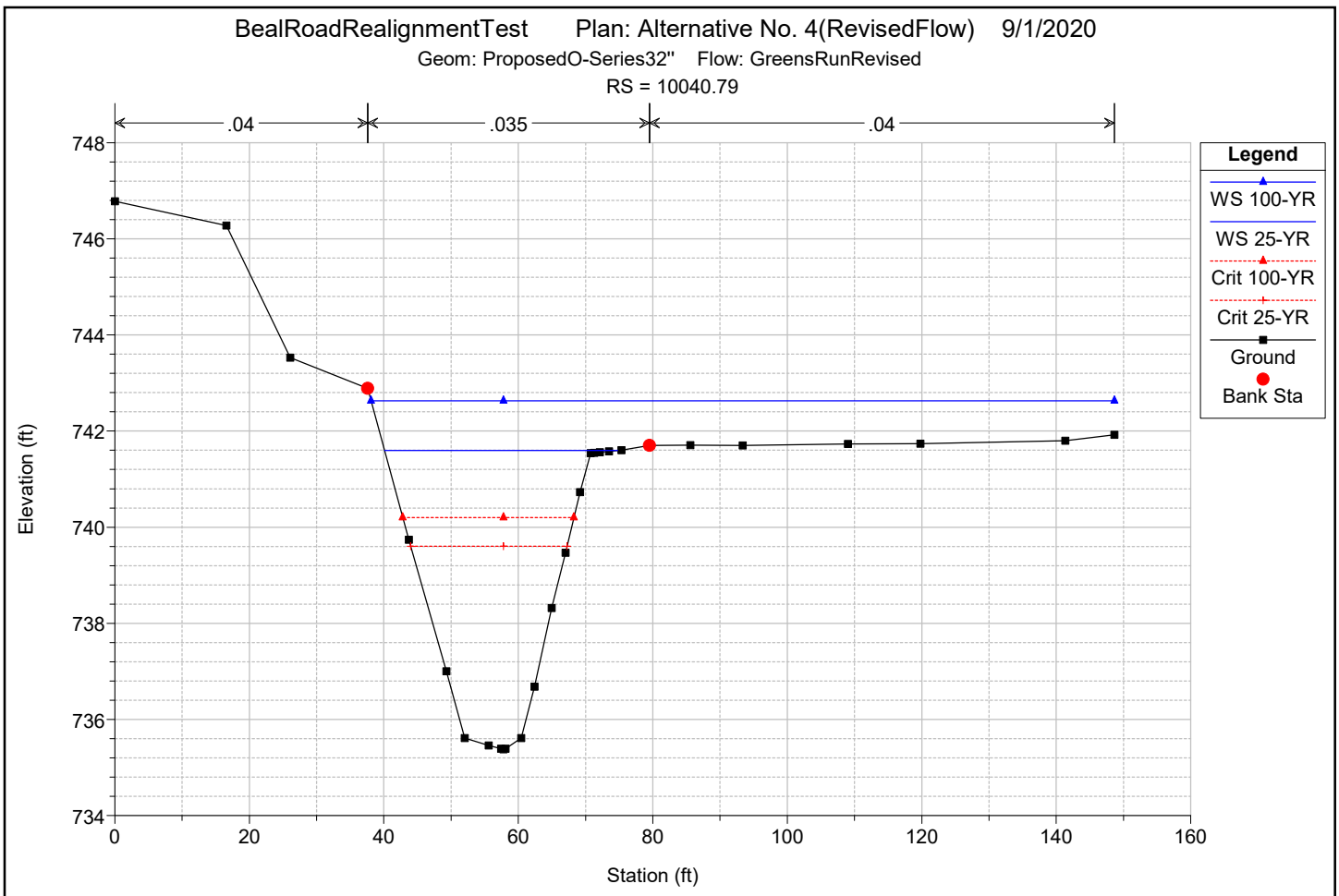
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.035
.04
Legend
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WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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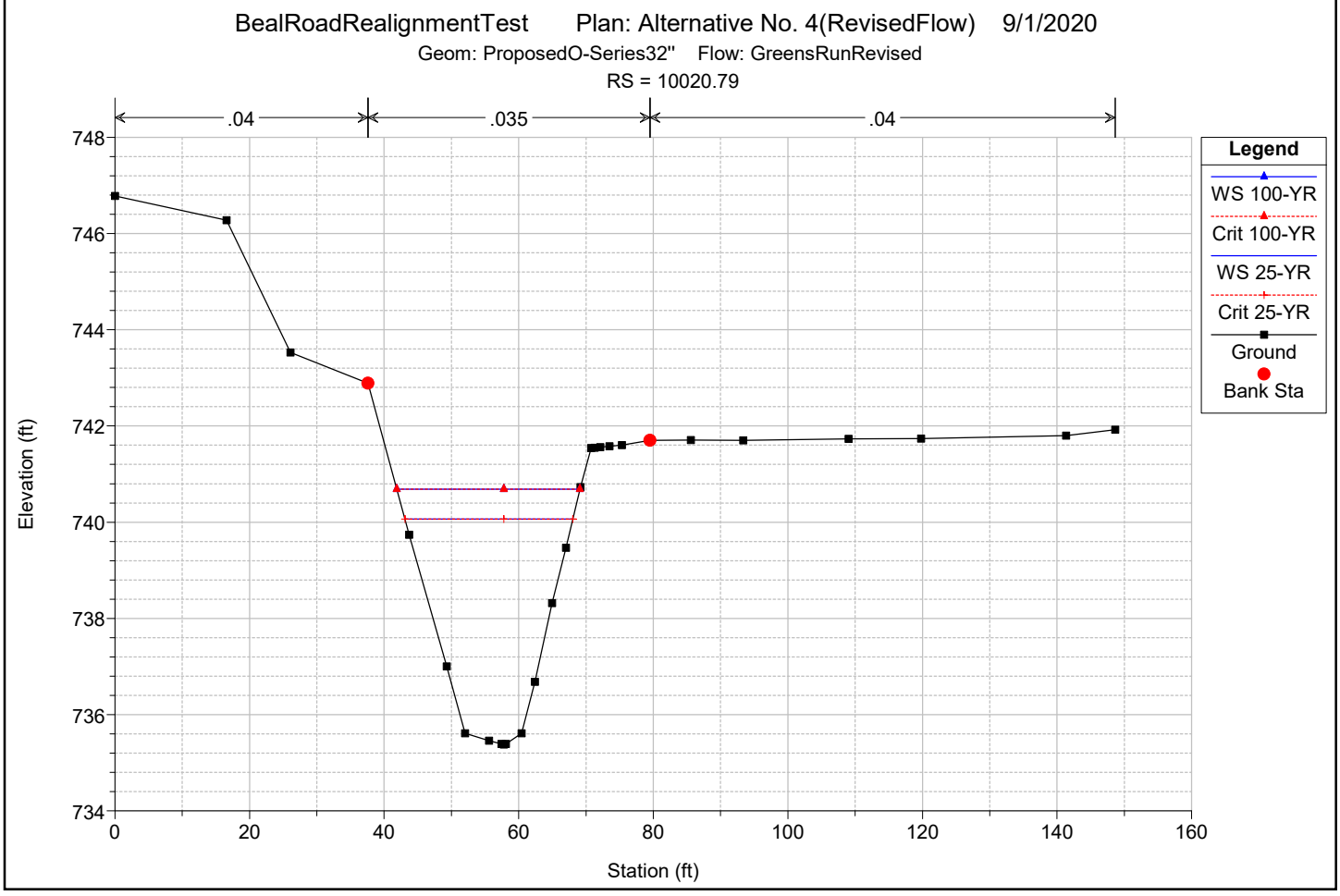
140
160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Geom: ProposedO-Series32" Flow: GreensRunRevised
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.035
.04
Legend
WS 100-YR
Crit 100-YR
WS 25-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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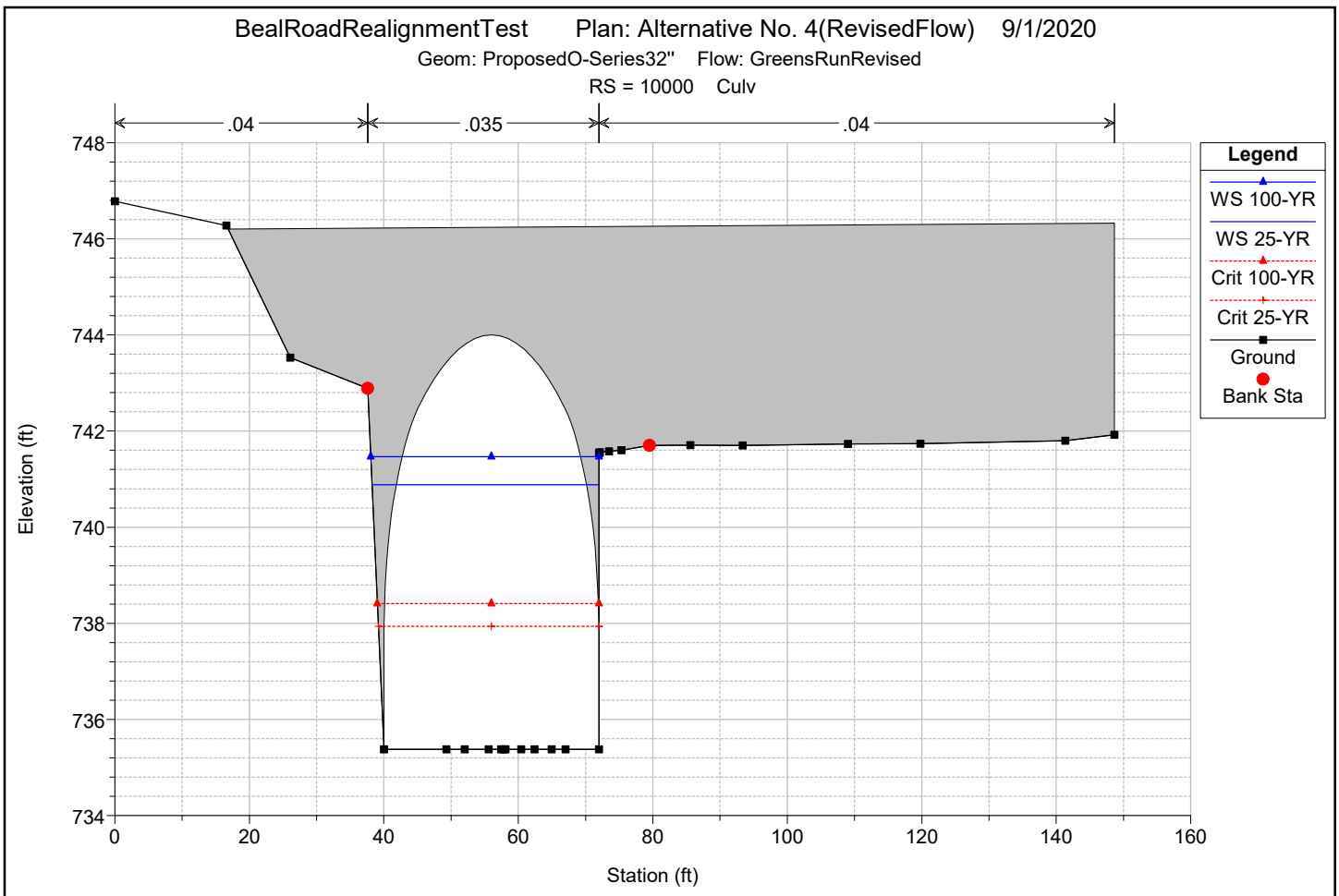
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Geom: ProposedO-Series32" Flow: GreensRunRevised
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.04
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Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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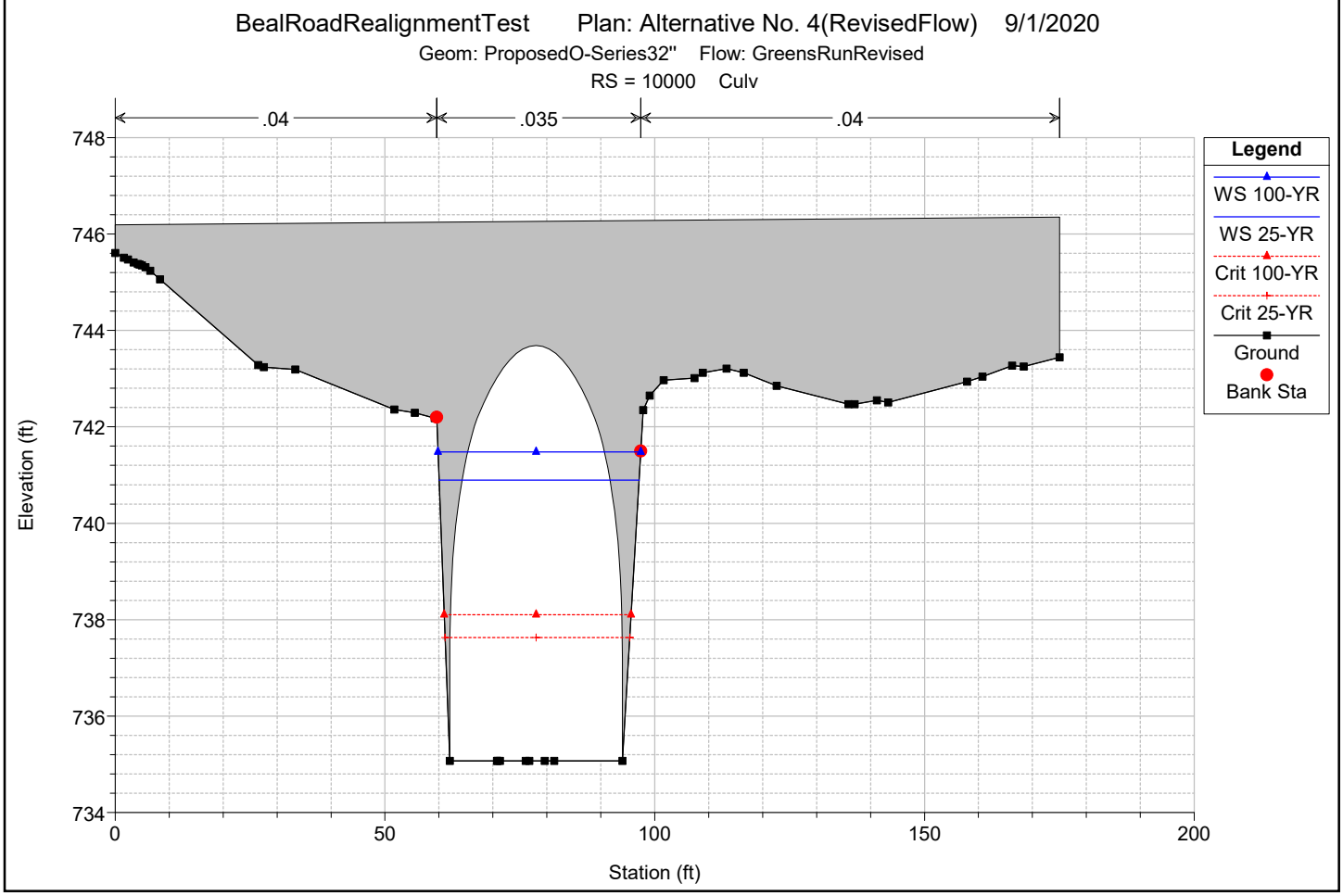
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Geom: ProposedO-Series32" Flow: GreensRunRevised
RS = 10000 Culv
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Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
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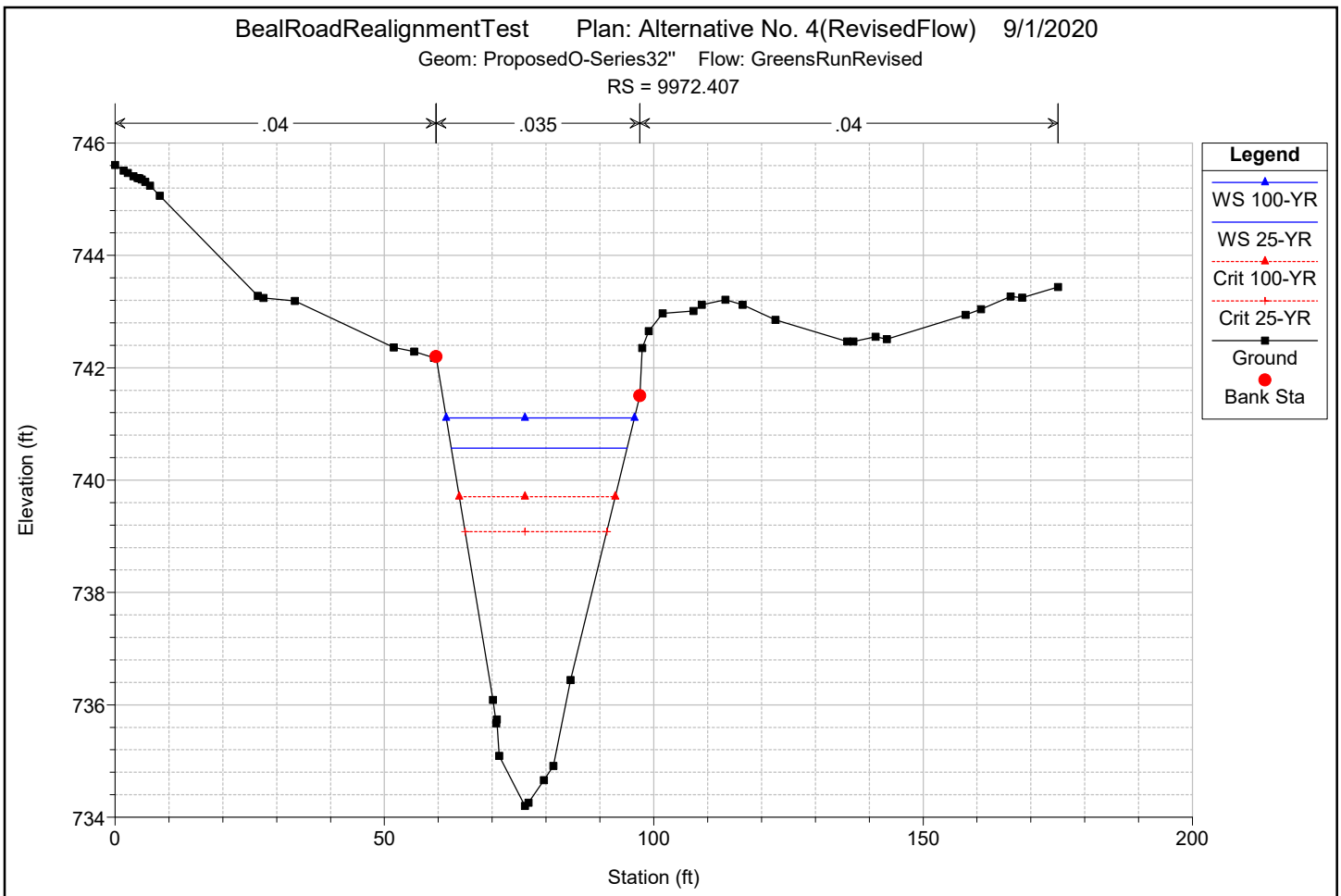
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.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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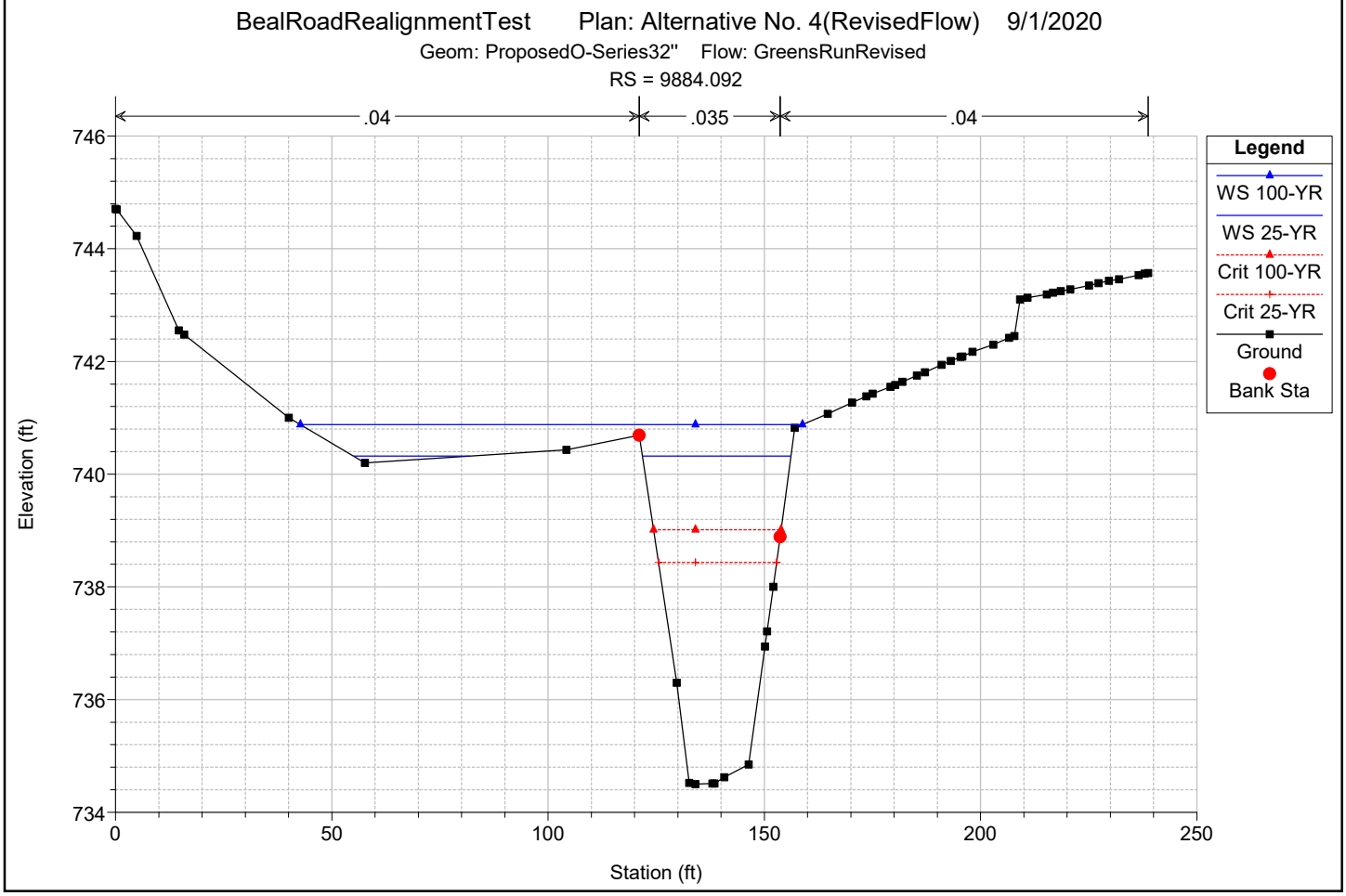
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Geom: ProposedO-Series32" Flow: GreensRunRevised
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.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Bank Sta
Elevation (ft)
Station (ft)
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744
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740
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0
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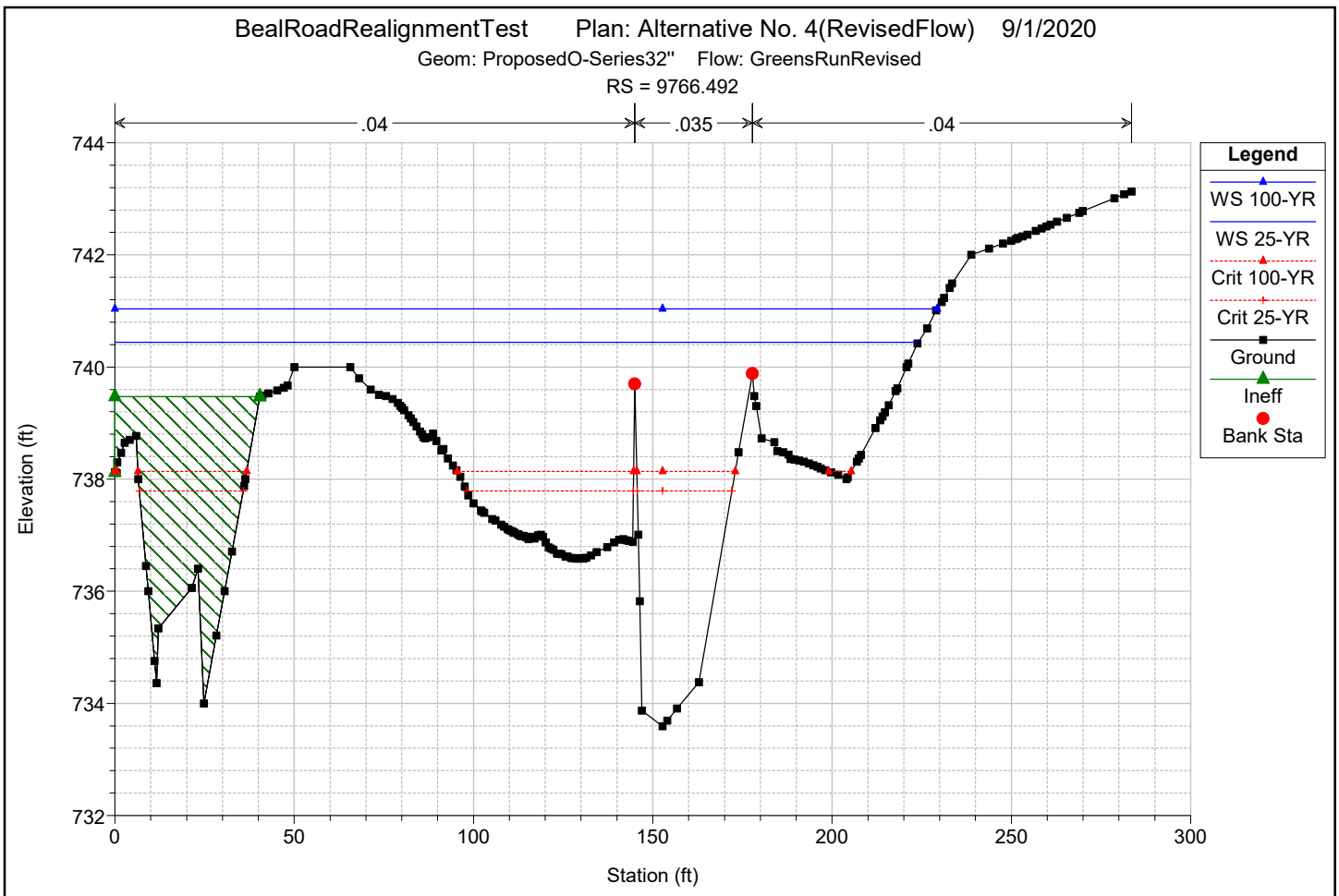
200
250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.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Ineff
Bank Sta
Elevation (ft)
744
742
740
738
736
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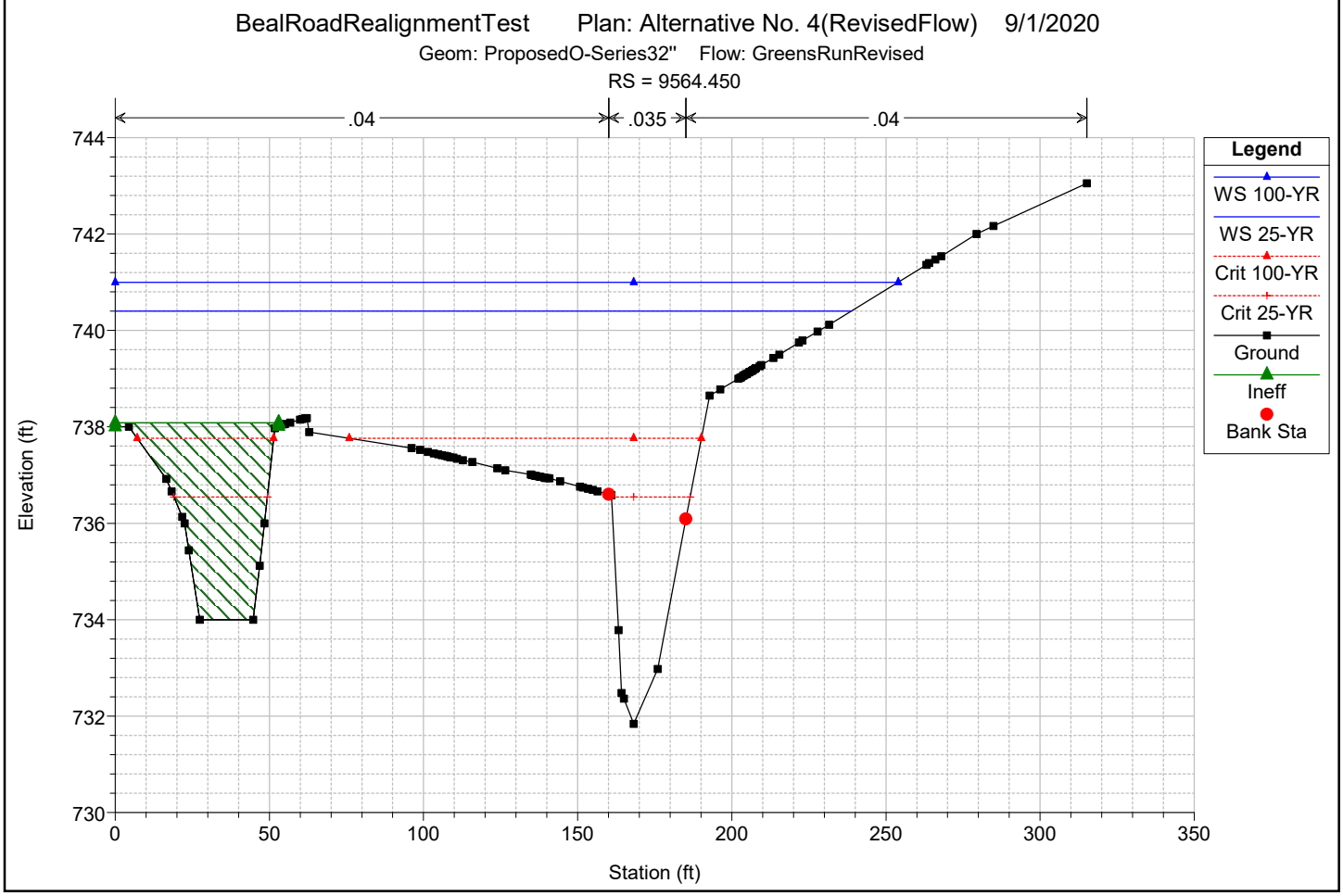
732
0
50
100
150
200
250
300
Station (ft)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.04
.035
.04
Legend
WS 100-YR
WS 25-YR
Crit 100-YR
Crit 25-YR
Ground
Ineff
Bank Sta
Elevation (ft)
744
742
740
738
736
734
732
730
0
50
100
150
200
250
300
350
Station (ft)

APPENDIX H

FEMA DOCUMENTS

Note: This area is shown as being protected from the 1-percent-annual-chance or greater flood hazard by a levee system. Overtopping or failure of any levee system is possible. For additional information see the "Accredited Levee Note" in Notes to Users.

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR ZONE DESCRIPTIONS AND INDEX MAP

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTPS://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE) *Zone A,V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD

- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes. *Zone X*

OTHER AREAS

- NO SCREEN Areas Determined to be Outside the 0.2% Annual Chance Floodplain *Zone X*
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES

- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES

- E 18.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
- 8 Coastal Transect
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in the community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was provided in digital format from multiple resources by the Ohio Geographically Referenced Information Program (OGRIP), National Atlas, Warren County GIS Department, Montgomery County Auditor's Office, United States Geological Survey (USGS), and Ohio Department of Natural Resources (ODNR). This information was also derived from digital orthophotography at a 4-foot resolution from photography dated 2012. Imagery shown on FIRM from 2018.

ACCREDITED LEVEE NOTES TO USERS: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/national-flood-insurance-program.

SCALE

N

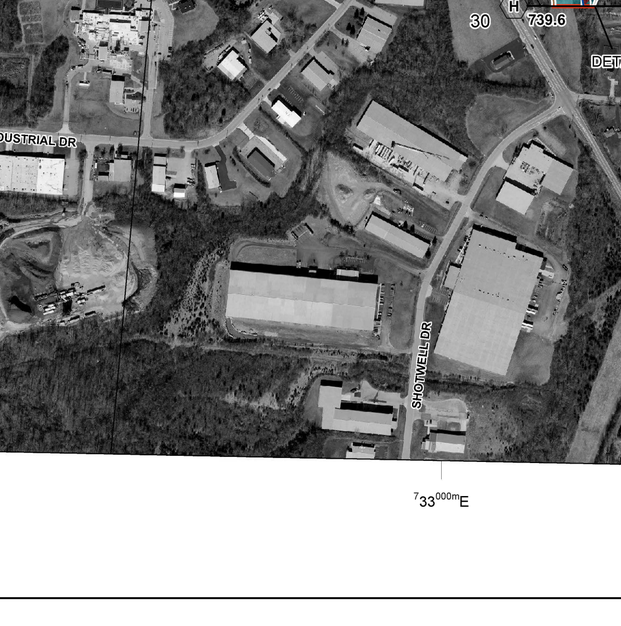
Map Projection:
NAD 1983 StatePlane Ohio South FIPS 3402 Feet;
Western Hemisphere; Vertical Datum: NAVD 88

1 inch = 500 feet 1:6,000

0 500 1,000 2,000 Feet

0 125 250 500 Meters

PANEL LOCATOR



* PANEL NOT PRINTED

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

WARREN COUNTY, OHIO
AND INCORPORATED AREAS

PANEL 16 OF 280

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
FRANKLIN, CITY OF	390556	0016	F
WARREN COUNTY	390757	0016	F

VERSION NUMBER
2.3.2.0

MAP NUMBER
39165C0016F

MAP REVISED
DECEMBER 20, 2019

FLOODING SOURCE		FLOODWAY				1-PERCENT-ANNUAL-CHANCE WATER SURFACE ELEVATION (FEET NAVD)			
CROSS SECTION	DISTANCE	WIDTH (FEET)	WIDTH REDUCED FROM PRIOR STUDY[5] (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Greens Run									
J	5,174 [1]	138		428	3.5	735.4	735.4	735.9	0.5
K	6,072 [1]	33		135	7.1	741.6	741.6	741.6	0.0
Lake Chetac Creek									
A	14,731 [2]	11		63	10.2	831.4	831.4	831.9	0.5
B	14,837 [2]	43		161	4.0	834.6	834.6	834.6	0.0
C	15,840 [2]	25		68	9.5	841.0	841.0	841.1	0.1
D	16,262 [2]	30		74	8.7	854.1	854.1	854.1	0.0
E	17,424 [2]	43	28	264	2.4	856.9	856.9	857.4	0.5
F	17,899 [2]	251		327	2.0	873.0	873.0	873.0	0.0
G	19,219 [2]	30		57	6.7	873.3	873.3	873.3	0.0
H	20,592 [2]	18		56	6.8	886.2	886.2	886.5	0.3
Little Miami River									
A	129,888 [3]	408/297[4]		9,200	8.6	592.1	592.1	593.0	0.9
B	135,432 [3]	487		10,545	7.5	596.4	596.4	597.3	0.9
C	142,296 [3]	302		8,165	9.7	601.3	601.3	602.1	0.8
D	149,952 [3]	505		9,495	8.2	607.6	607.6	608.4	0.8
E	154,704 [3]	579		12,540	6.2	611.2	611.2	612.2	1.0
F	159,984 [3]	530		10,706	7.2	614.3	614.3	615.2	0.9

[1]Feet above confluence with Tommy's Run [2]Feet above confluence with Little Miami River [3]Feet above confluence with Ohio River [4]Total Width/Width Within Warren County

[5]See Explanation in Section 4.2 Floodways

Table 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

WARREN COUNTY, OH

AND INCORPORATED AREAS

FLOODWAY DATA

Greens Run - Lake Chetac Creek - Little Miami River

APPENDIX I
SITE PHOTOGRAPHS

Upstream Face STA–Spangler Street

Downstream Face STA–Spangler Street

Downstream Channel STA–Spangler Street

APPENDIX J
ELECTRONIC FILES