TECHNICAL MEMORANDUM ADDENDUM

To: Mike Dour

From: Tim Hayes, P.E.

Date: February 5, 2013

Subject: Dry Creek Greenway Multi-use Trail– Preliminary Hydraulics (Segments 1 and 5)

INTRODUCTION

This addendum for the Technical Memorandum dated September 05, 2012 will address the changes to the bridge design, hydraulic modeling and the resulting changes to the increases in water surface elevation that occurred since the date of that memorandum. The memorandum dated 9/05/12 was a revision to a memorandum originally submitted Civil Solutions. In general, the comments from Civil Solutions and subsequent comments from the City reflected discrepancies between models with regards to ineffective flow areas and bridge modeling. Those discrepancies were corrected and the results modified as part of the 9/05/2012 memorandum.

The original hydraulic model had numerous geometry files reflecting potential bridge designs for various amounts of freeboard during various storm events. The proposed design changes and changes to the hydraulic model were only made to the 200-year storm event bridge designs.

CHANGES TO DESIGN/HYDRAULIC ANALYSIS

Bridge low chord elevations have been designed to be three feet above the water surface elevation during the 200-year storm event and result in no water surface elevation increases greater than 0.10 feet during the 100-year storm event. In the previous memorandum, Bridges 2 and 14 showed increases greater than the allowable threshold. The proposed design has been modified such that the increases are now below the allowable limit.

Bridge 2 was modified by realigning the path to the north after crossing the incised portion of Dry Creek. This design change reduced the total blocked flow area caused by the fill slopes, allowing a larger conveyance area in the overbank.

Bridge 14 was modified by using retaining walls instead of fill slopes along the western side of Dry Creek. This reduced the total ineffective area along the downstream side of the bridge.

Additionally, ineffective flow was applied to the upstream cross section to account for the revised fill slope.

RESULTS

The changes to the design resulted in a lowering of the increases in water surface elevation to less than 0.10 feet, which is the maximum allowable change. Table 1 summarizes the changes in water surface elevations from the revised analysis.

SUMMARY AND CONCLUSIONS

Bridge design changes were necessary at Bridges 2 and 14 in order to reduce the impacts caused by the bridges. The designs have been modified such that the resulting increases are now less than 0.10 feet. Both bridges had alignment changes, and Bridge 14 replaced fill slopes on the downstream side of the bridge with retaining wall. The changes allowed for an increase in conveyance area when compared to the previous design. Figures are attached showing the revised bridge alignments.

TABLE 1: REVISED WSE IMPACT SUMMARY

BRIDGE CRITERIA	SECTION	EFFECT ON 100 YR WSE EXISTING	EFFECT ON 100 YR WSE W/ PROJECT	EFFECT ON 100 YR WSE DELTA	EFFECT ON 200 YR WSE EXISTING	EFFECT ON 200 YR WSE W/ PROJECT	EFFECT ON 200 YR WSE DELTA
BRIDGE #2							
SOFFIT AT 200 YR WSE (SPAN =80FT)	73167.6	134.76	134.72	-0.04	135.13	135.08	-0.05
	73222.4	134.78	134.76	-0.02	135.13	135.12	-0.01
	73277.2	134.83	134.88	0.05	135.19	135.24	0.05
	73345.3	134.85	134.92	0.07	135.21	135.29	0.08
	73481.3	134.79	134.87	0.08	135.15	135.24	0.09
	73565.3	134.99	135.06	0.07	135.32	135.4	0.08
BRIDGE #3							
SOFFIT AT 200 YR WSE (SPAN =160FT)	72982	134.66	134.67	0.01	135.03	135.04	0.01
	0	134.83	134.83	0	135.18	135.19	0.01
	100	134.83	134.84	0.01	135.19	135.2	0.01
	200	134.84	134.85	0.01	135.2	135.21	0.01
	73112.9	134.74	134.75	0.01	135.11	135.12	0.01
	73167.6	134.76	134.77	0.01	135.13	135.14	0.01
BRIDGE #4							
SOFFIT AT 200 YR WSE (SPAN =123FT)	0	134.83	134.82	-0.01	135.18	135.18	0
	100	134.83	134.83	0	135.19	135.19	0
	200	134.84	134.84	0	135.2	135.2	0
	350	134.86	134.86	0	135.22	135.22	0
	550	134.88	134.88	0	135.25	135.24	-0.01
	650	134.89	134.88	-0.01	135.26	135.25	-0.01
BRIDGE #14							
SOFFIT AT 200 YR WSE (SPAN =100FT)	565.1	141.26	141.31	0.05	141.54	141.62	0.08
	983.899	141.99	142.03	0.04	142.34	142.4	0.06
	1235.899	142.87	142.78	-0.09	143.5	143.44	-0.06
	1483.899	143.96	144.02	0.06	144.58	144.74	0.16
	1743.899	145.03	145.06	0.03	145.72	145.83	0.11
	2045.1	146.45	146.48	0.03	147.22	147.29	0.07

TECHNICAL MEMORANDUM

To: Mike Dour

From: Tim Hayes, P.E.

Date: September 05, 2012 (Revised February 6, 2013)

Subject: Dry Creek Greenway Multi-use Trail– Preliminary Hydraulics (Segments 1 and 5)

INTRODUCTION

The Dry Creek Greenway Multi-use Trail has a couple of proposed path alignments due to various constraints such as right-of-way restrictions, circulation and access needs and location within regulatory floodways. This memorandum looks at proposed bridge crossings 2, 3, 4, 13 and 14 to determine the impact that the proposed bridges have on the water surface elevations.

The current bridge design standard imposed by the Central Valley Flood Protection Board (CVFPB) sets the soffit of the bridge three feet above the 200-year water surface elevation. The City of Roseville Design Standard 10-18-A sets the soffit of the bridge at the water surface elevation that results from a discharge 50% greater than the 100-year design storm discharge.

The City has an existing HEC-RAS model that incorporates multiple hydrologic models for the 2-, 10-, 100- and 200-year design storms under existing and ultimate conditions. The ultimate conditions model serves as the base for this preliminary hydraulic analysis and ultimately will be updated to reflect the design.

This memorandum summarizes the results of the preliminary hydraulic analysis as well as assumptions made for the analysis. Figures follow the text and results are contained within the attached appendices. An additional appendix, Appendix J, has been attached which describes changes made from the original date of the memorandum to the design and the resulting impacts.

HYDRAULIC ANALYSIS

The existing HEC-RAS model is an unsteady state hydraulic model encompassing a significantly larger system of channels than the proposed project encompasses. Due to the complexity of the current hydraulic model, it was decided that a steady state model encompassing just the portions of the reaches being impacted would be adequate for assessing the floodplain water surface

elevations and impacts from the proposed bridge alternatives. Ultimately, the proposed improvements decided upon will be incorporated into the City HEC-RAS model.
A summary of the steps taken to create the steady state hydraulic models are provided below:

1) Locate existing cross section locations
2) Recut cross sections using LiDAR Data
3) Compare new and existing cross sections
4) Adjust existing cross sections to NAVD88 datum
5) Modify existing bridge/culvert crossings and channel inverts
6) Determine discharges and boundary conditions to be used
7) Compare existing HEC-RAS steady state to existing unsteady state model
8) Compare existing model with revised cross sections to existing steady state model
9) Prepare proposed conditions models
10) Summarize changes in water surface elevations at bridge locations

A description of each step is as follows:

1) A steady state HEC-RAS model was created utilizing a combination of the existing HEC-RAS model and topographic data (LiDAR) provided by the City. The existing model was not geo-referenced, so the first step in creating the new steady state model was to determine where the existing cross sections were cut. The locations of the existing cross sections were estimated by starting at known bridge locations and using the reach lengths from the model to approximate the locations. Using cross sections at the same locations as the existing cross sections will ease the process of updating the existing unsteady model, as well as allow for comparison of the existing steady state results to the unsteady state model.

2) The LiDAR data provided by the City was used to cut new cross sections geometries at the existing cross section locations.

3) The LiDAR cross sections were then compared to the existing model cross sections. Additionally, a comparison of the existing model water surface elevations and FEMA floodplain elevations were made, which showed that the existing model was on NGVD 29. Cross sections comparisons are attached in Appendix A.

4) The NOAA Vertcon website (http://www.ngs.noaa.gov/cgi-bin/VERTCON/vert_con.prl) was used to determine the elevation difference between NGVD29 and NAVD88 for the City of Roseville. The change was an increase in elevation of 2.32 feet, which was then globally applied to the existing HEC-RAS steady state model to convert it to the NAVD88 datum. The printout from the website in included in attached Appendix B. A comparison of the existing HEC-RAS cross sections after conversion to the NAVD88 datum and the LiDAR cross sections are also provided in Appendix B,

5) During review of the existing unsteady state model, it was noticed that the high chord elevation of the bridge at Riverside Avenue did not reflect the LiDAR data and was modified accordingly. The soffit of the bridge at Riverside Avenue was left unchanged. At Sunrise Avenue, the model has three large diameter pipe culverts as opposed to the bridge that exists today. This was also modified for the existing conditions model. Additionally, it was noticed that the channel inverts in the existing HEC-RAS model and the LiDAR model varied. The channel inverts were modified in the LiDAR model where the existing HEC-RAS model showed a lower channel invert. Cross section comparisons can be seen in Attached Appendix C and profile comparisons can be found in attached Appendix D.

6) The final step in creating the steady state existing conditions HEC-RAS model was to input the boundary conditions. This included downstream starting water surface elevations and peak discharges. To do this, the existing unsteady model was reviewed for each plan and the peak discharge associated with the maximum water surface elevations with those discharges were extracted for use. It was noticed while extracting this information that the peak discharges within one reach did not always reflect the same conditions that caused the peak water surface elevations. This information was also extracted. Summary tables showing peak discharge/water surface elevation and the peak water surface elevation/discharge are attached.

   At the confluence of Dry Creek above Cirby and Cirby Creek below Linda, it was noted the governing plan resulting in the peak water surface elevation within each reach was the same. Thus, the reaches were connected within the steady state model and a sole boundary condition at the downstream end of Dry Creek below Cirby was used. Within the steady state model, the plan resulting in the largest water surface elevation within a reach and the discharges within that reach during that plan were used within the model. The downstream boundary was set at the maximum water surface elevation extracted from the unsteady state model at that cross section.

7) The result of the above process yielded two existing conditions hydraulic models. The first steady state model created contained the unsteady state geometry with revised bridges and datum adjustment. The unsteady model results with the vertical datum adjustment was compared with the steady state model, which which had the unsteady state geometry and showed that the water surface elevations were generally within the range of +/- 0.5 feet during the 100-year storm event. A summary table is attached for the various storm events. Upstream of Sunrise Avenue, the water surface elevations were 2+ feet lower due to the bridge being modeled as opposed to the culverts. Results are summarized in attached Appendix E.

8) A comparison was then made between the existing conditions model utilizing LiDAR geometry to the existing model utilizing the unsteady model geometry, which showed the water surface elevations to generally be 0.5 feet lower during the 100-year design storm event. Results are summarized in attached Appendix F.

9) With the existing conditions models established, the proposed models were created. Bridges 2, 3, 4, 13 and 14 were modeled based on preliminary bridge designs that either had the soffit set just above the water surface elevation during a flow equal to 150% of the 100-year peak discharge, or the bridge soffits set at 3 feet above the 200-year design storm water surface elevation, or with bridges set just above the 10-year water surface elevations. The 10-year scenario has only one bridge that would be designed as such, which is Bridge 13, since it is not feasible to span the floodway at this location.

   There are two trail alignment alternatives at the confluence near Riverside Avenue, which result in multiple bridge models. Alternative 1 would include Bridges 2 and 4 and Alternative 2 would construct just Bridge 3 constructed. Along Linda Creek, there are also two alternatives; Alternative 1 would construct Bridge 13 with a soffit just above the 10-year water surface elevation and Alternative 2 would include Bridge 14 with a soffit set to either the City or CVFPB standard. Bridge soffit elevations were set based on water surface elevations and were preliminarily modeled using Civil 3D to estimate fill limits in order to determine the magnitude of blocked flow within the cross sections. The trusses are modeled as completely blocked from conveying flow. The truss heights were determined based on the following table:

Bridge Span	Truss Height
(ft)	(ft)
50	5
60	6
80	7
100	8
140	12

The following table summarizes the bridge spans modeled as part of the preliminary hydraulic analysis:

Bridge	Span
(ft)	(ft)
2	80
3	160
4	123
13	80
14	80

The FEMA Floodway was overlaid onto the project topography in order to determine the length of bridge needed to span the entire floodway. At the confluence near Riverside Avenue, the floodway in undefined. The floodway within this area was estimated by connecting the floodway upstream and downstream. This allowed Bridge 2, 3 and 4 to be modeled at the lengths necessary to span the floodway. Bridge 13 is located within the floodway at a confluence of two rivers, where it is not feasible to span the length of the floodway. Bridge 14 has been preliminarily design at a length greater than the floodway. The existing FEMA floodplain and floodway are shown on the attached figures. At Bridge 14, the bridge is shown not spanning the entire length of the floodway, however the FEMA lines do not correlate well with the topography. The bridge itself is designed with a length greater than the floodway width.

RESULTS

Each model was run for the 2-, 10-, 100-, 200- storm events as well as the discharge equal to 150% of the 100-year design discharge. The 150% of the 100-year discharge results in a peak discharge greater than the 200-year peak discharge. Since this "event" was not a part of the existing HEC-RAS model, the water surface elevation used for the downstream boundary conditions was set equal to the 200-year water surface elevation. Additionally, the water surface elevations during this event are likely to be higher than if run within the unsteady state model, where storage and lateral weirs are accounted for. The results shown would then be conservative in terms of the water surface elevation. Summary tables of the results are attached in Appendices G, H and I. Changes in water surface elevation are highlighted in red where the changes are greater than 0.10 feet.

As seen in the attached summary table for the alignment alternative with Bridges 2 and 4, there are significant increases in water surface elevation upstream of Bridge 2, located in Dry Creek above Cirby. This is a result of the large area of flow that will be blocked by the bridge fill, which will result in increased overflow across Riverside Avenue.

The alternative with Bridge 3 alleviates the significant increases associated with Bridge 2

Constructing Bridge 13 with a soffit elevation just above the 10-year storm event does not cause a significant increase in water surface elevation during any of the storm events modeled. This is largely due to the fact the floodplain is extremely wide at this location and the overbank flow will just flow around the bridge.

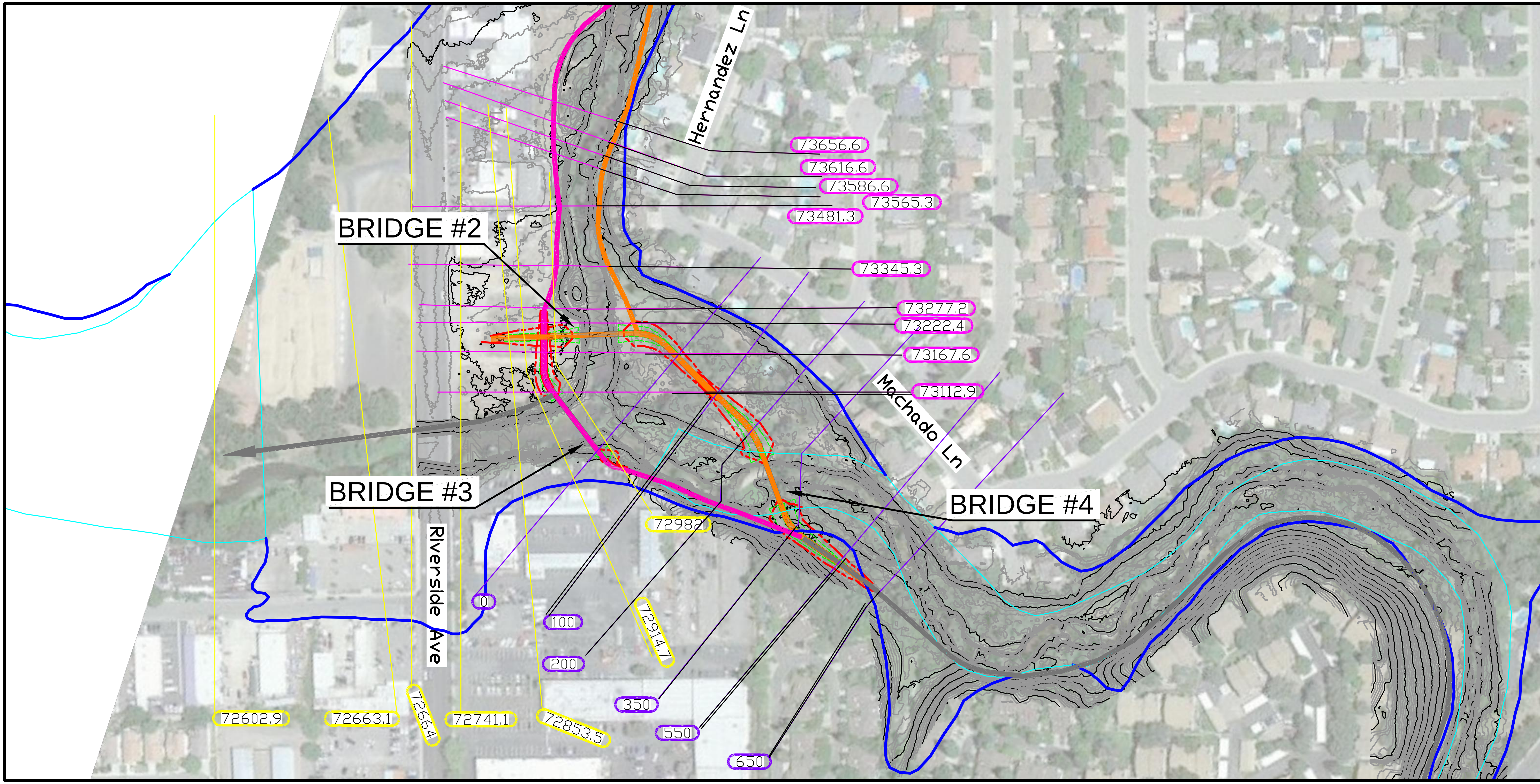
Bridge 14 has a single cross section with an increase greater than 0.10 with based upon the preliminary design of the soffit at 3 feet above the 200-year water surface elevation. This differs from the lower bridge elevation due to its increase in fill limits.

SUMMARY AND CONCLUSIONS

A localized steady state version of the existing citywide HEC-RAS model was developed for ease of use and to save time during interim modeling. Ultimately, the City model will be updated. The existing cross sections were modified with updated topographic data provided by the City, adjusted from NGVD29 to NAVD88 and the bridges updated to reflect current conditions. After revising the geometry of the cross sections, cross sections were surveyed at existing and new bridge locations. The surveyed cross sections were compared to the LiDAR and found to be similar, with the exception of the channel inverts below the flowing water surface. The channel inverts are 1-4 feet lower than shown by the LiDAR, however the model was not changed as detailed channel invert information is not available and the conveyance area is insignificant when compared to the entire channel cross section. This revised model was then further modified to include proposed bridges for various path alignments and bridge soffit elevations based on both City and State design standards and various design storm events.

The results of the analyses show that construction of Bridge 2 will result in a significant increase in water surface elevation upstream due to the bridge fill blocking overbank flow. This will result in an increase of flow over Riverside Avenue, which will eventually enter back into Dry Creek. All other bridge options show less than 0.10 feet increase with the exception of one cross section during the 200-year bridge soffit alternative for Bridge 14. If the alternative with Bridge 3 is chosen, there will be an increased cost due to limited right of way, which will result in the need to build retaining wall structures to accommodate the trail. Summary tables can be found in attached Appendices G though I.

The proposed design for Bridges 2 and 14 have since been modified such that the resulting increases in water surface elevations at each are now less than 0.10 feet. The changes and results are discussed in the Appendix J.



LEGEND

- 100-YEAR FILL LIMITS
- 200-YEAR FILL LIMITS
- 100-YEAR FEMA FLOODPLAIN
- 100-YEAR FEMA FLOODWAY
- 73656.6 DRY CREEK ABOVE CIRBY XS
- 650 CIRBY CREEK BELOW LINDA XS
- 72602.9 DRY CREEK BELOW CIRBY XS
- PATH ALIGNMENT
- ALTERNATIVE 1 ALIGNMENT
- ALTERNATIVE 2 ALIGNMENT

N

0 200' 400'

PSOMAS
1075 E. Creekside Ridge Drive #200
Roseville, CA 95678
(916) 788-8122
www.psomas.com

HEC-RAS WORKMAP
FOR
DRY CREEK GREENWAY BIKE TRAIL
RIVERSIDE CONFLUENCE

DATE: AUGUST 2012 PROJ NO: 6ROS012500

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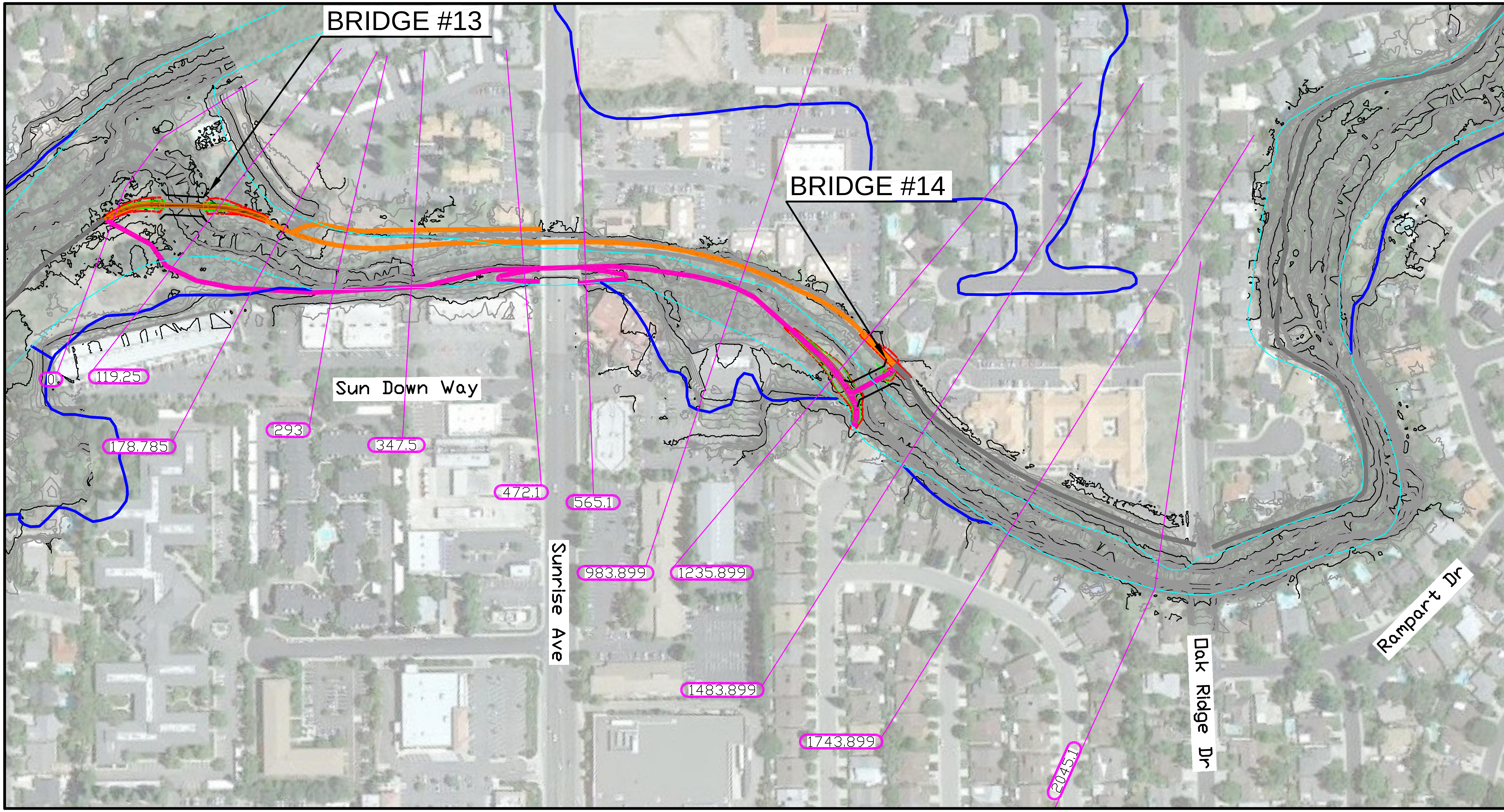

0 200' 400'

LEGEND

100-YEAR FILL LIMITS
200-YEAR FILL LIMITS
100-YEAR FEMA FLOODPLAIN
100-YEAR FEMA FLOODWAY
73656.6 LINDA CREEK BELOW STRAP XS
PATH ALIGNMENT
ALTERNATIVE 1 ALIGNMENT
ALTERNATIVE 2 ALIGNMENT

PSOMAS
1075 E. Creekside Ridge Drive #200
Roseville, CA 95678
(916) 788-8122
www.psomas.com

HEC-RAS WORKMAP
FOR
DRY CREEK GREENWAY BIKE TRAIL
LINDA CREEK

DATE: AUGUST 2012 PROJ NO: 6ROS012500 2 OF 2

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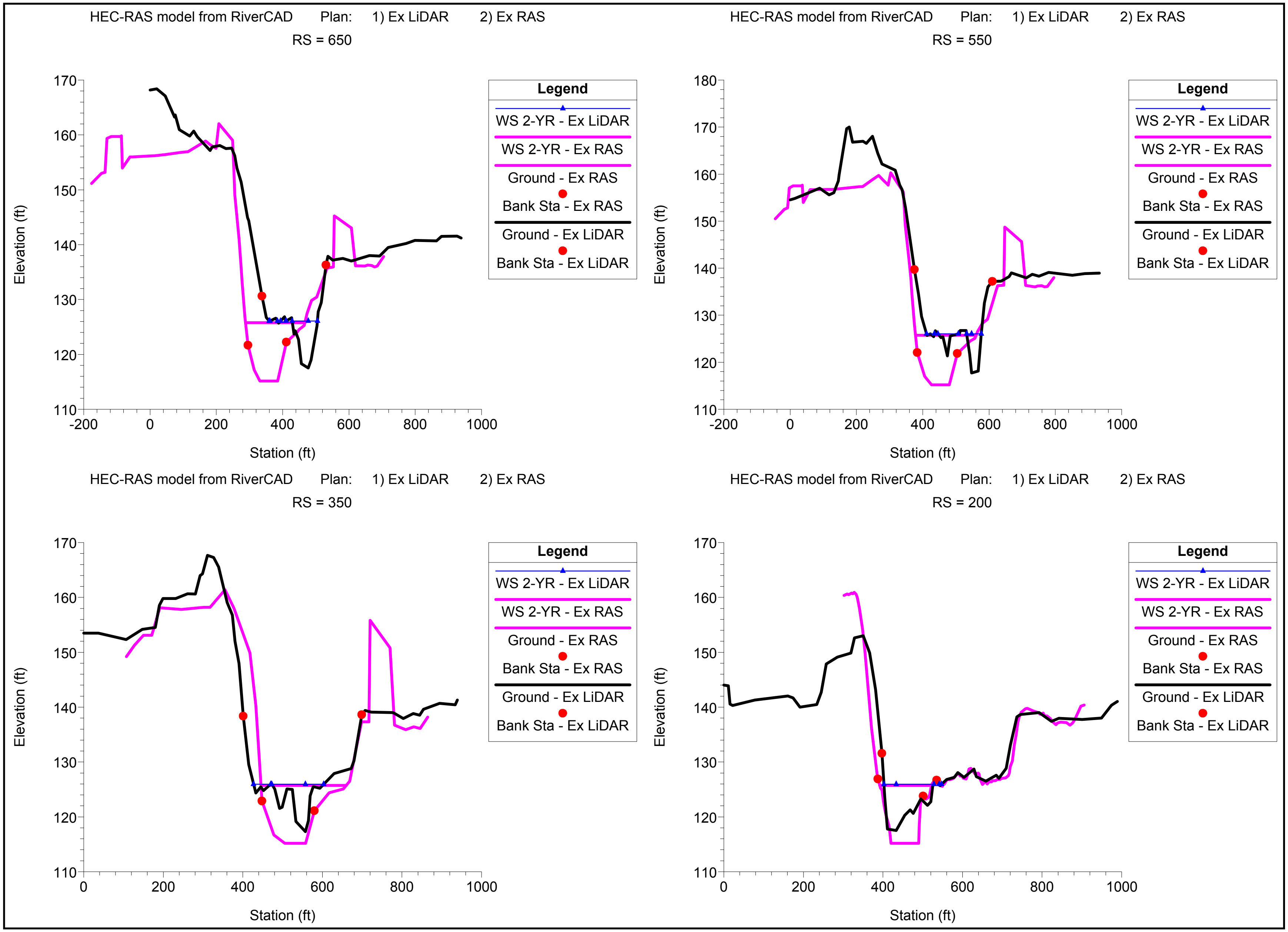
APPENDIX A

CROSS SECTION COMPARISON

EX. HEC-RAS(29 DATUM)/
EXISTING LIDAR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WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
110
120
130
140
150
160
170
-200
0
200
400
600
800
1000
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WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
110
120
130
140
150
160
170
180
-200
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200
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HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
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Legend
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WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
110
120
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150
160
170
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HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 200
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
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120
130
140
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160
170
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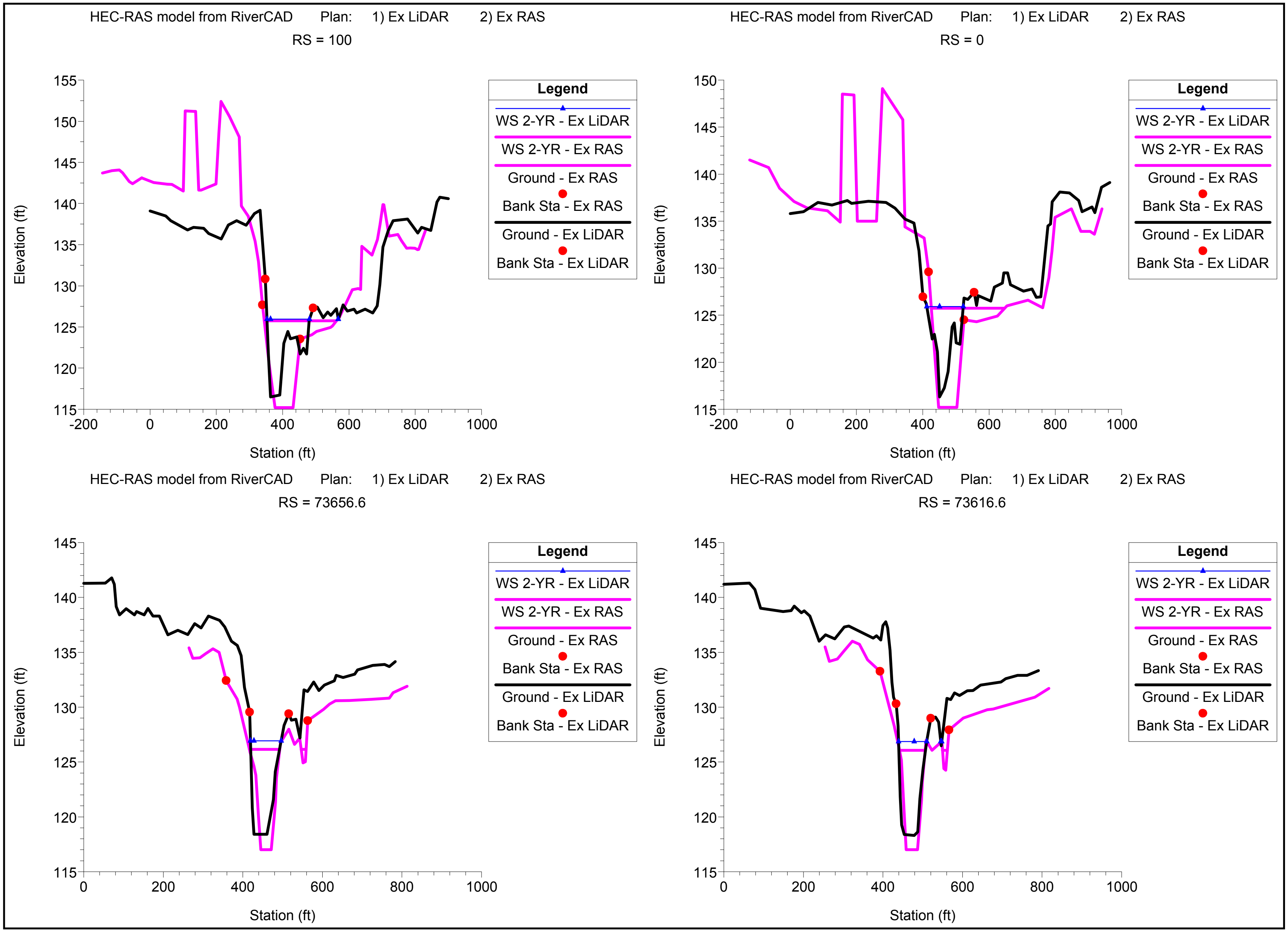
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WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
155
150
145
140
135
130
125
120
115
-200
0
200
400
600
800
1000
Station (ft)
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
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Legend
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WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
150
145
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1000
Station (ft)
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 73656.6
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
145
140
135
130
125
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115
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Station (ft)
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 73616.6
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
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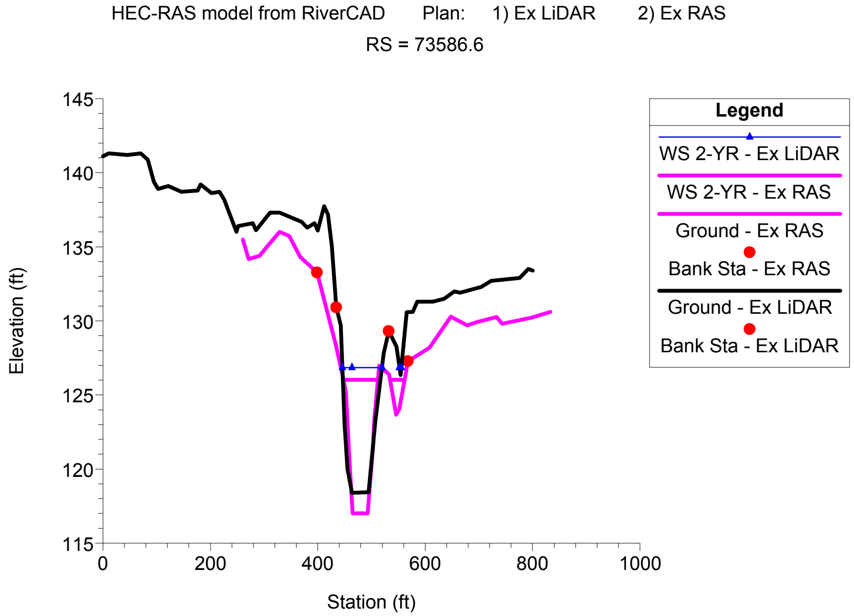
Station (ft)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Station (ft)
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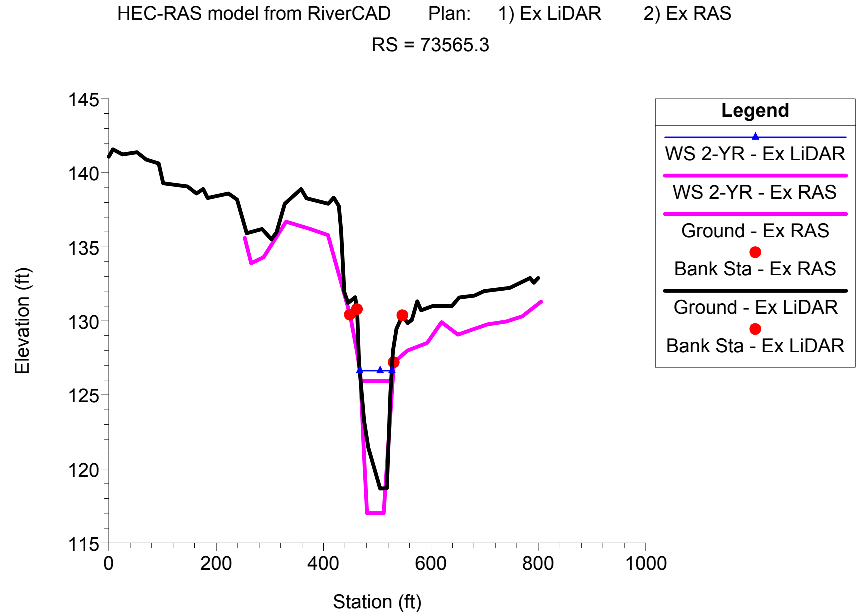
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR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Elevation (ft)
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140
135
130
125
120
115
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200
400
600
800
1000
Station (ft)
Legend
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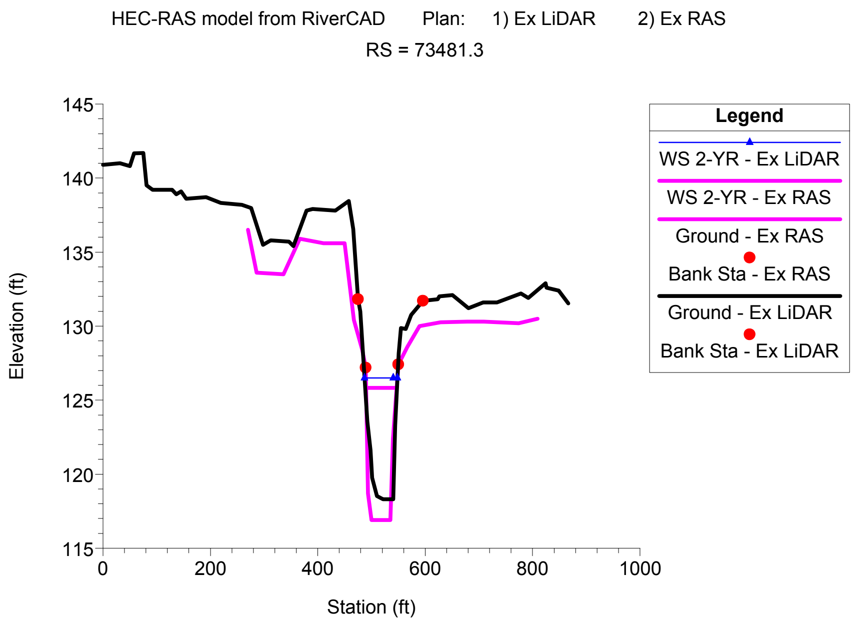
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR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Elevation (ft)
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140
135
130
125
120
115
0
200
400
600
800
1000
Station (ft)
Legend
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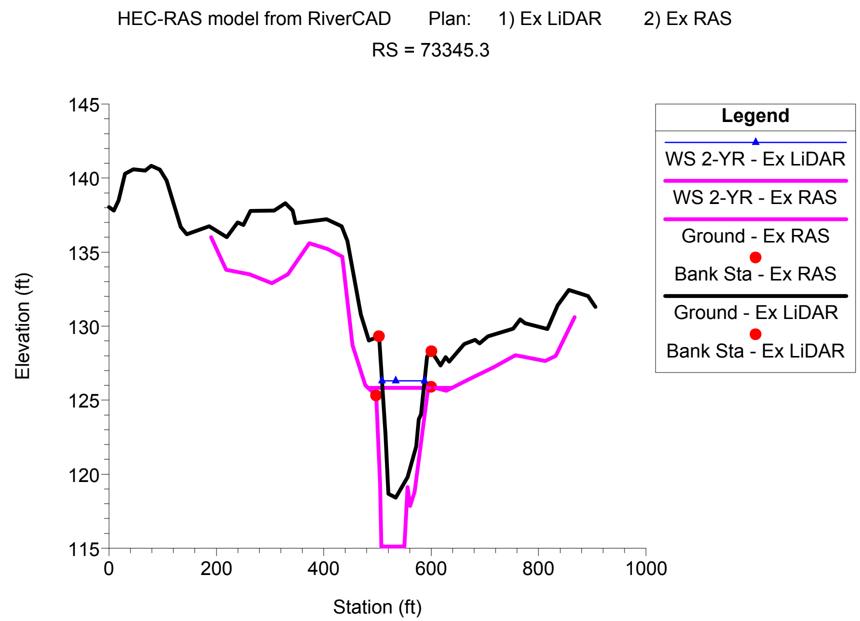
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR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Elevation (ft)
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140
135
130
125
120
115
0
200
400
600
800
1000
Station (ft)
Legend
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WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
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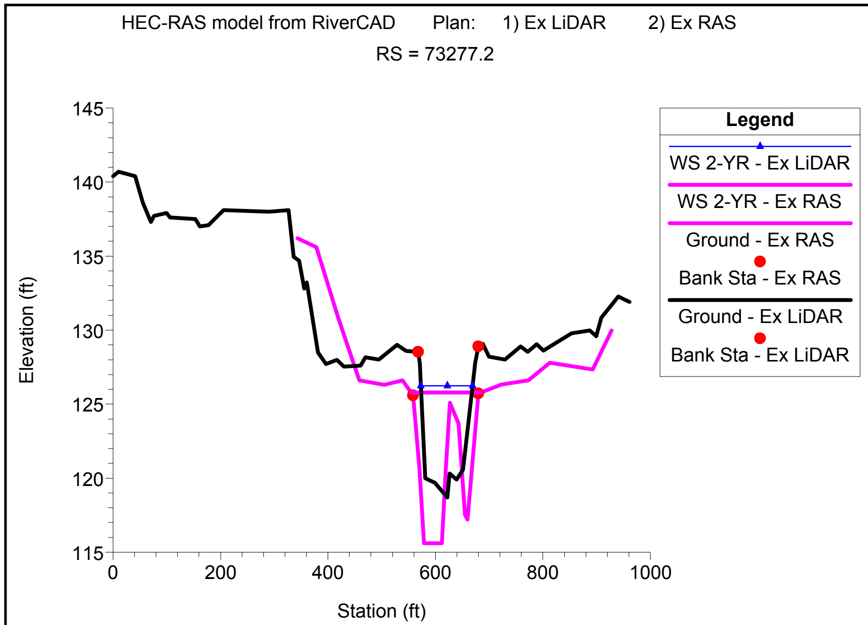
Bank Sta - Ex LiDAR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Legend
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WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
145
140
135
130
125
120
115
0
200
400
600
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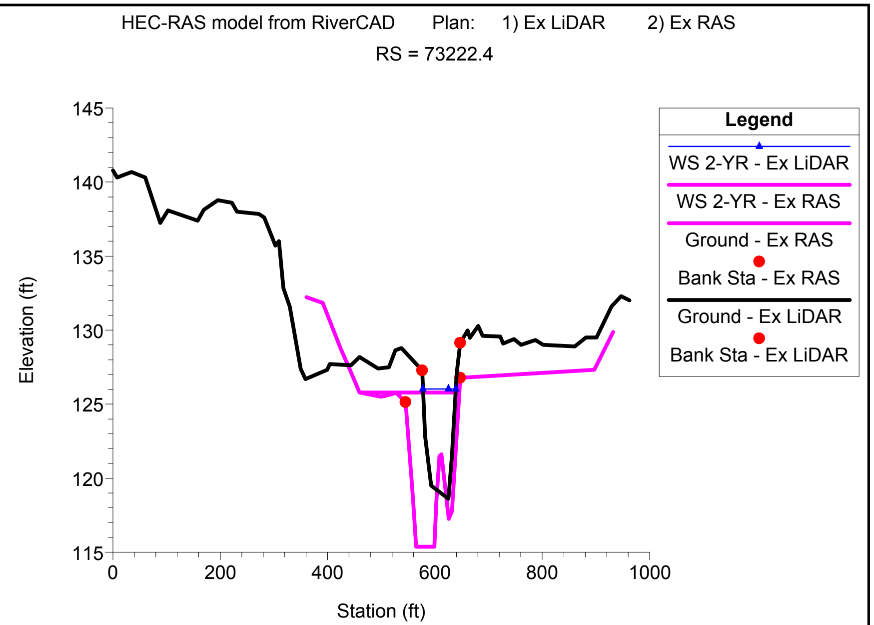
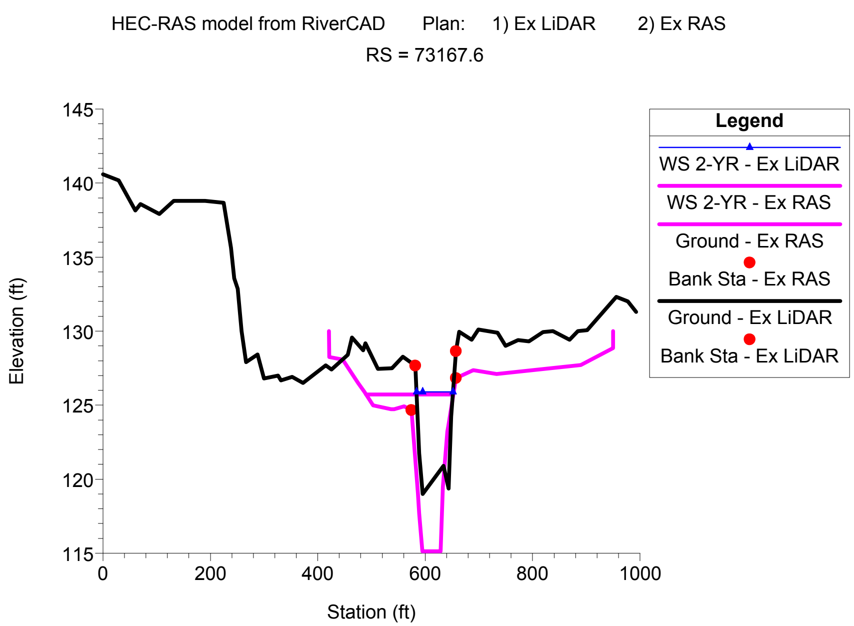
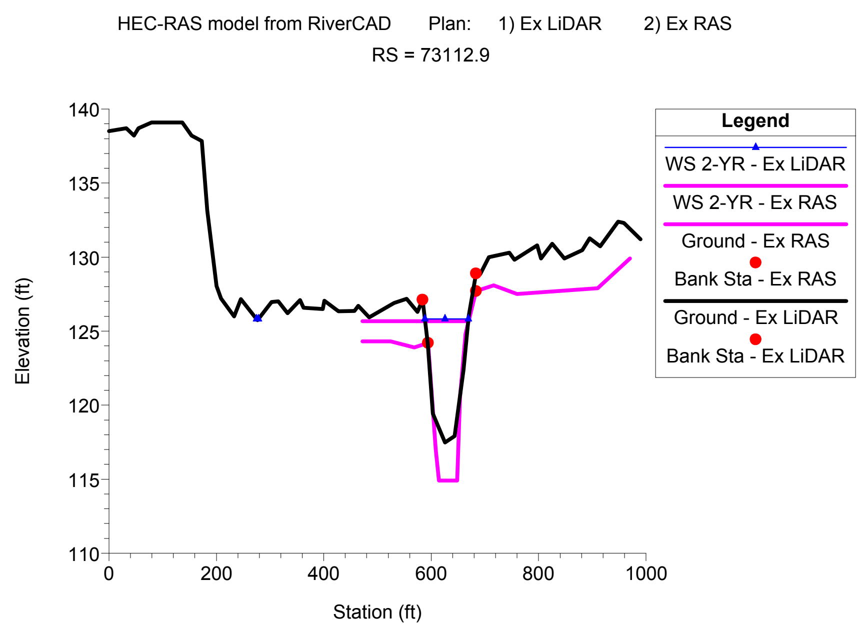
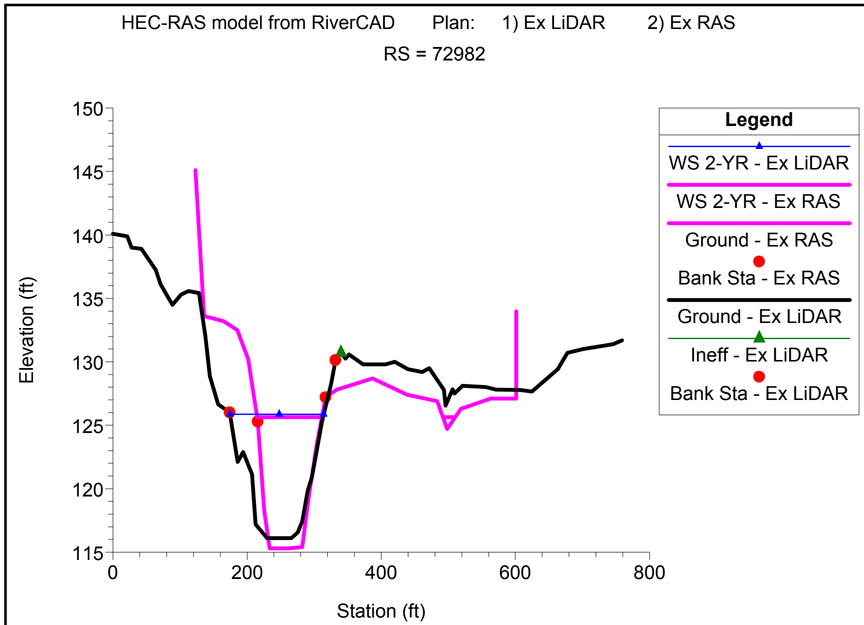
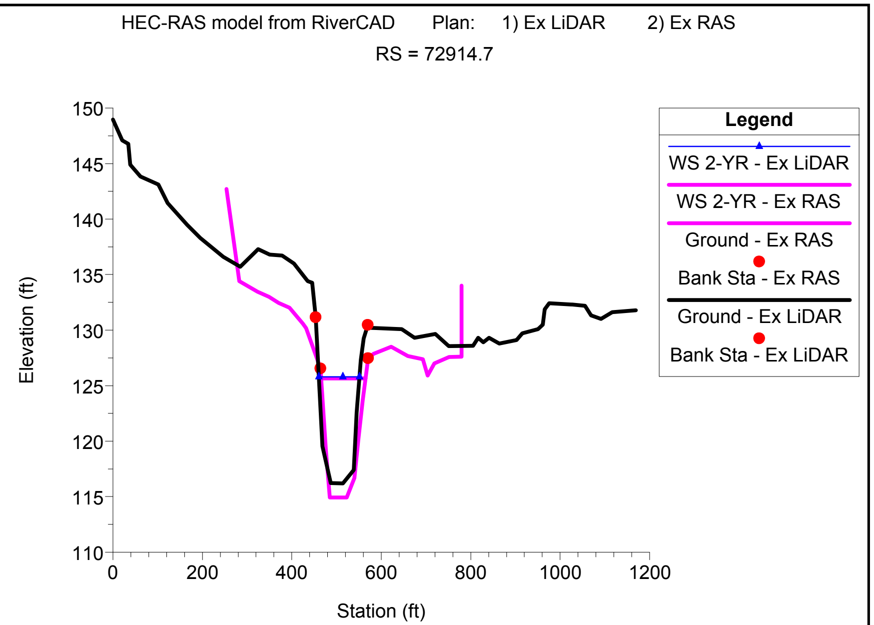
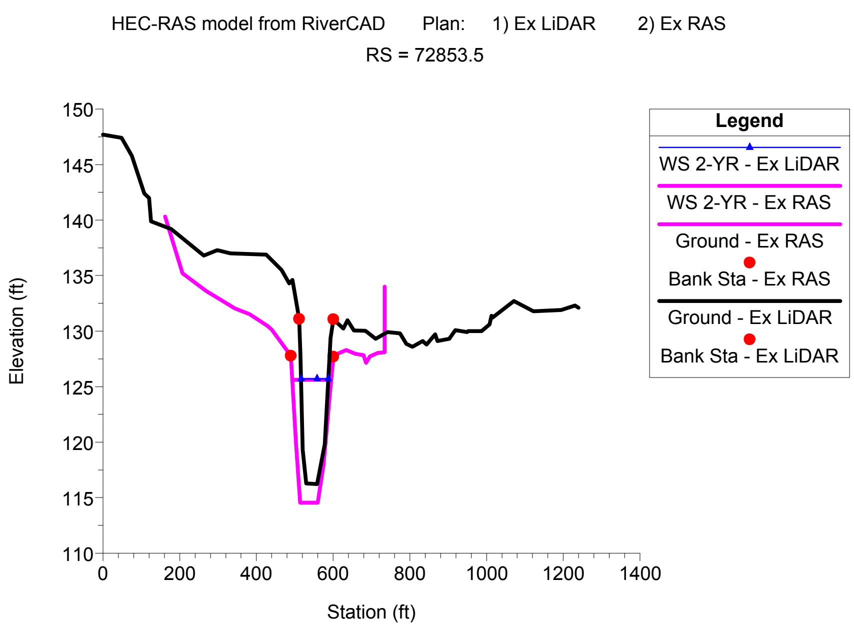

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 73222.4
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
145
140
135
130
125
120
115
0
200
400
600
800
1000

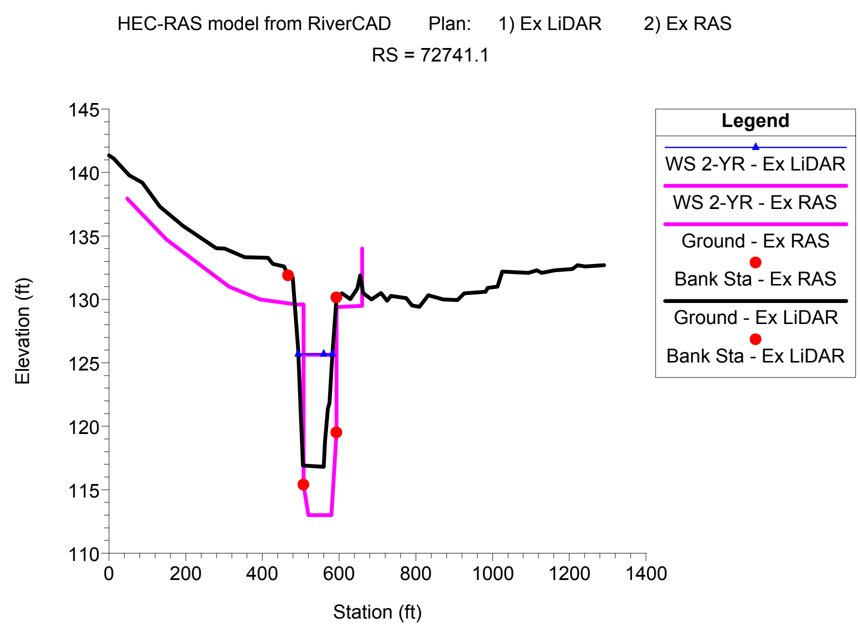

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 73167.6
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
145
140
135
130
125
120
115
0
200
400
600
800
1000

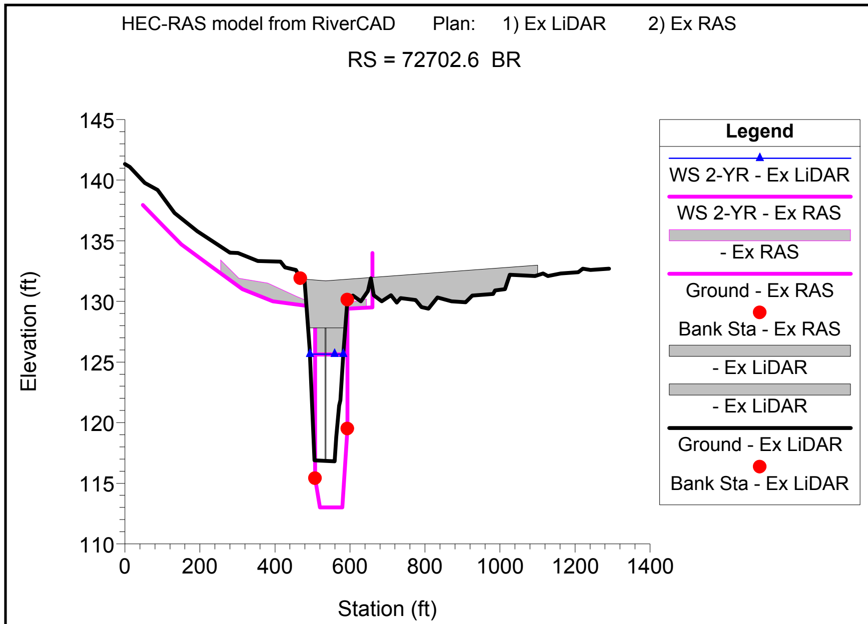

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 73112.9
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
140
135
130
125
120
115
110
0
200
400
600
800
1000

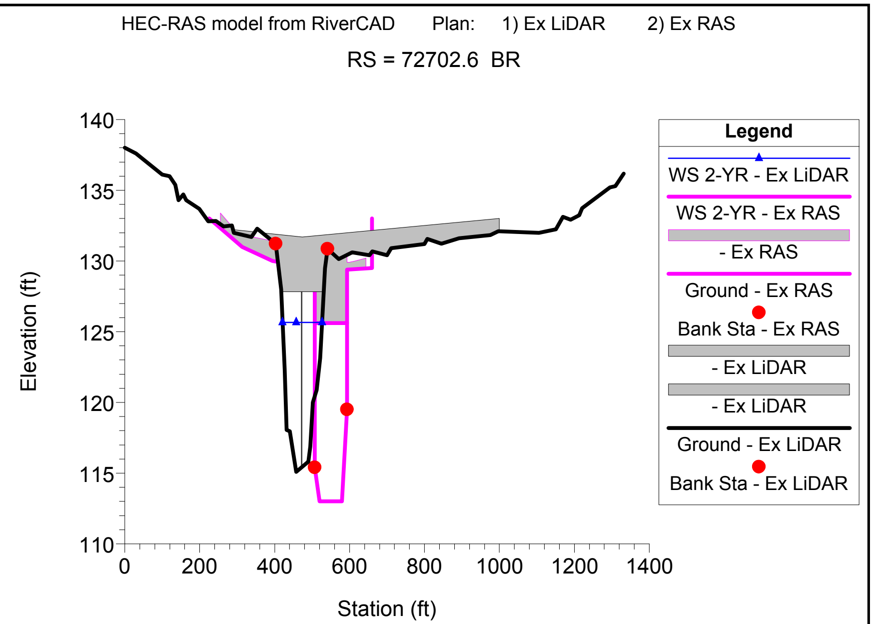

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 72982
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Ineff - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)

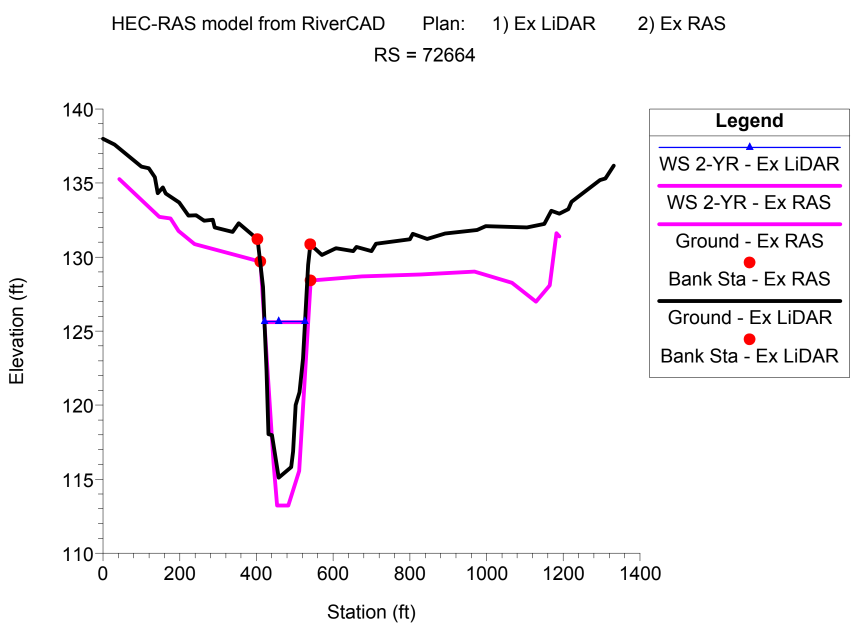

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 72914.7
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)

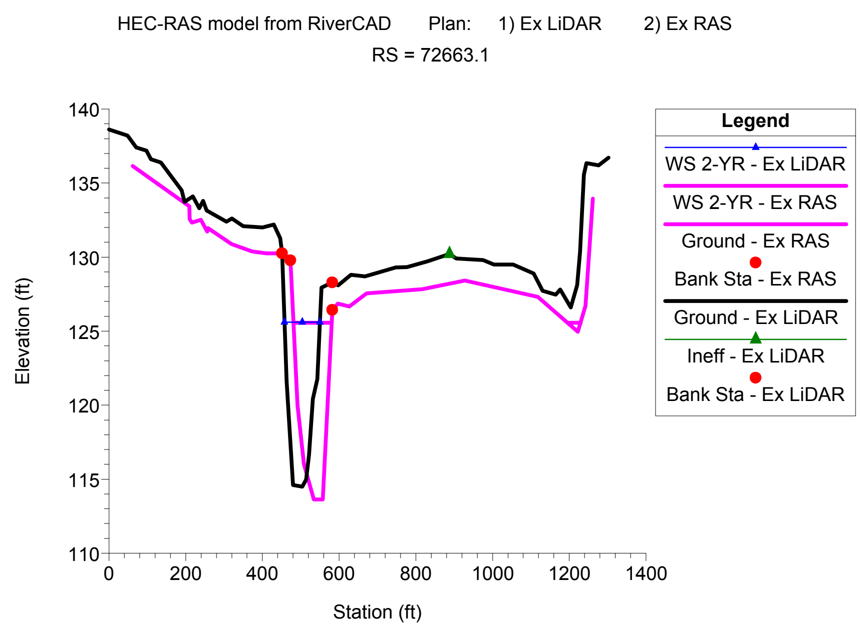

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 72853.5
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)

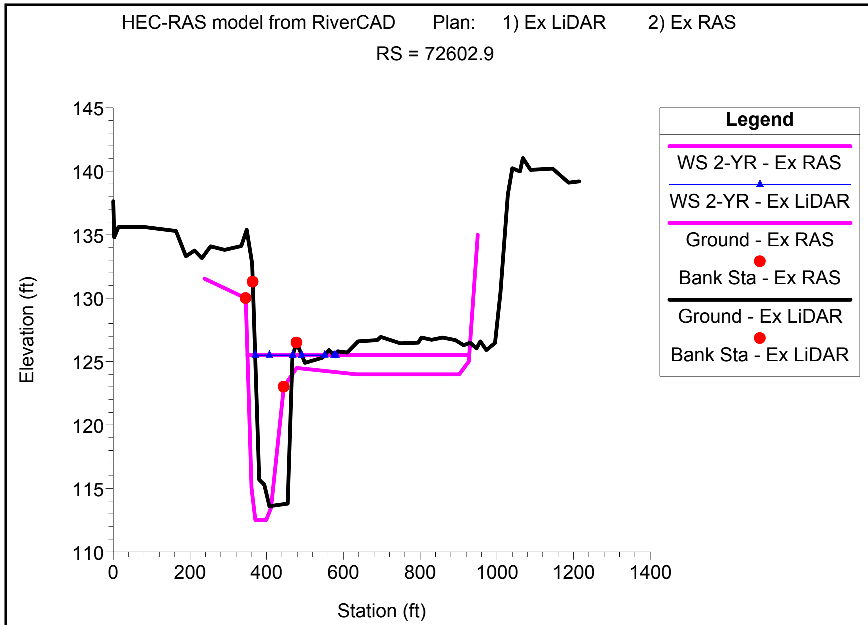

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 72741.1
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)

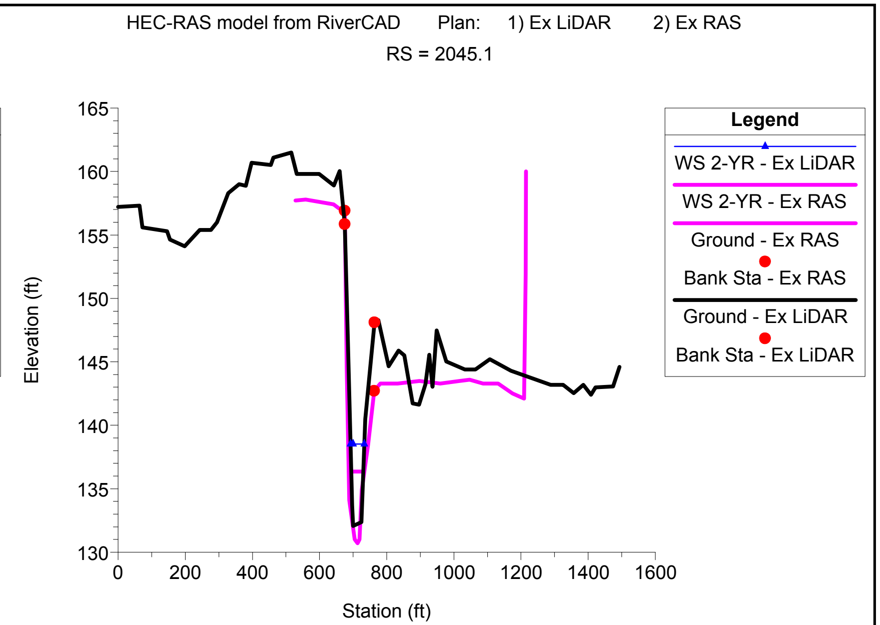

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 72702.6 BR
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
- Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
- Ex LiDAR
- Ex LiDAR
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
145
140
135
130
125
120
115
110
0
200
400
600
800
1000
1200
1400

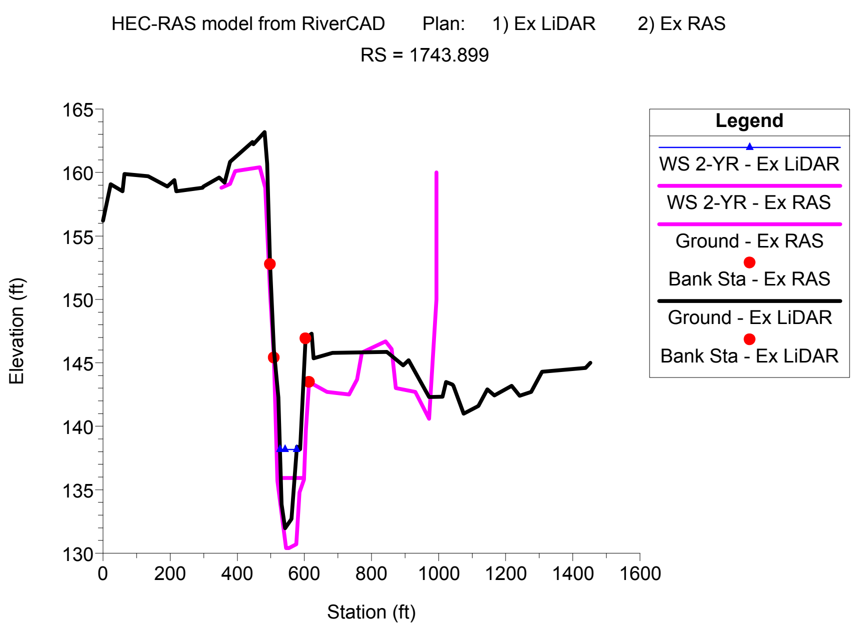

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 72702.6 BR
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
- Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
- Ex LiDAR
- Ex LiDAR
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
140
135
130
125
120
115
110
0
200
400
600
800
1000
1200
1400

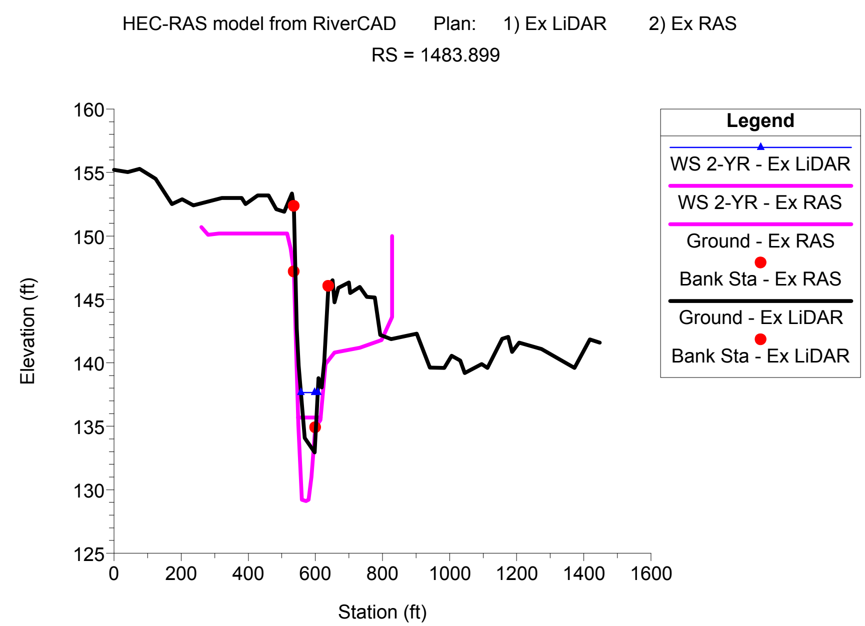

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 72664
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
140
135
130
125
120
115
110
0
200
400
600
800
1000
1200
1400

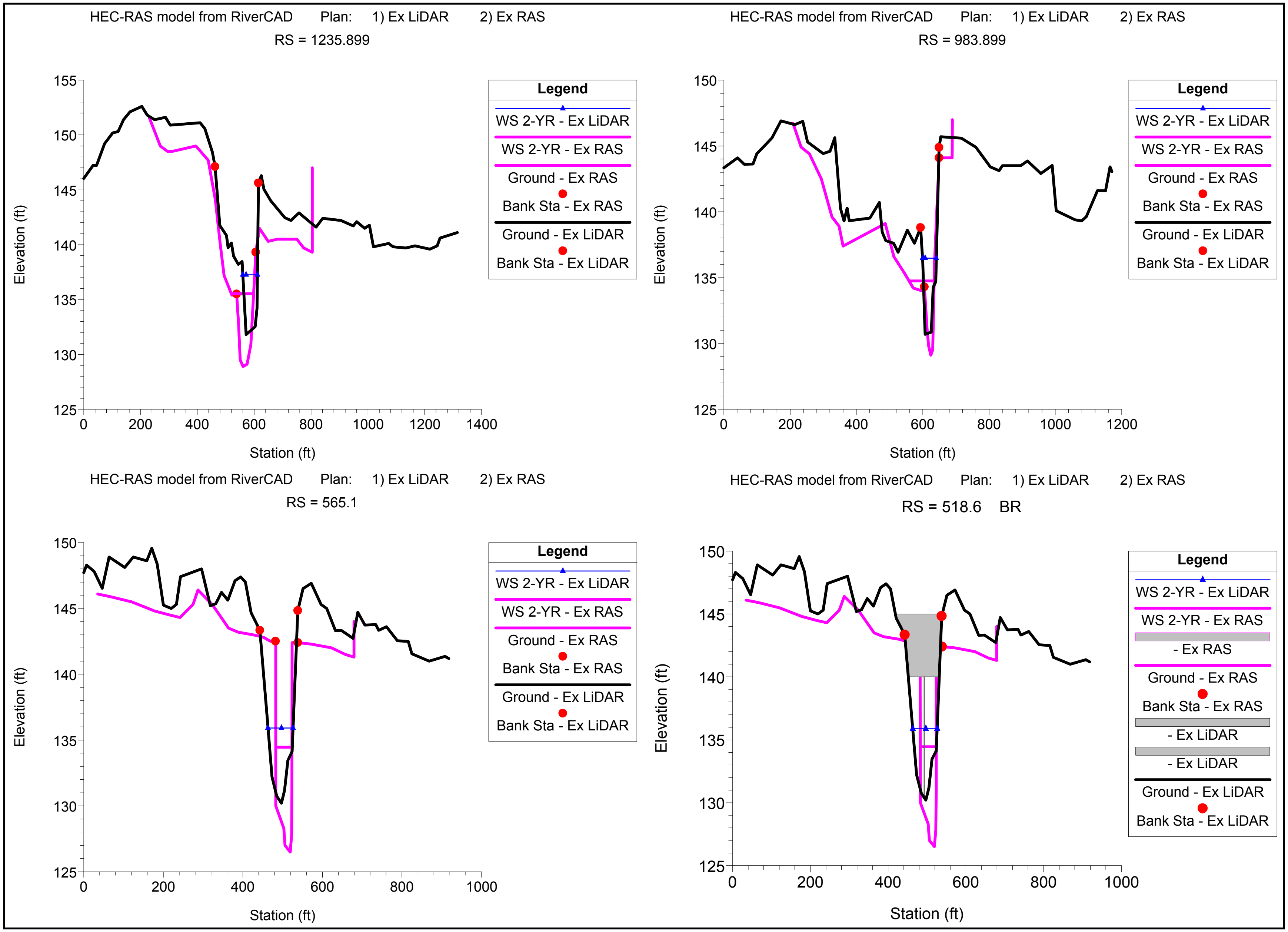

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 72663.1
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Ineff - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
140
135
130
125
120
115
110
0
200
400
600
800
1000
1200
1400

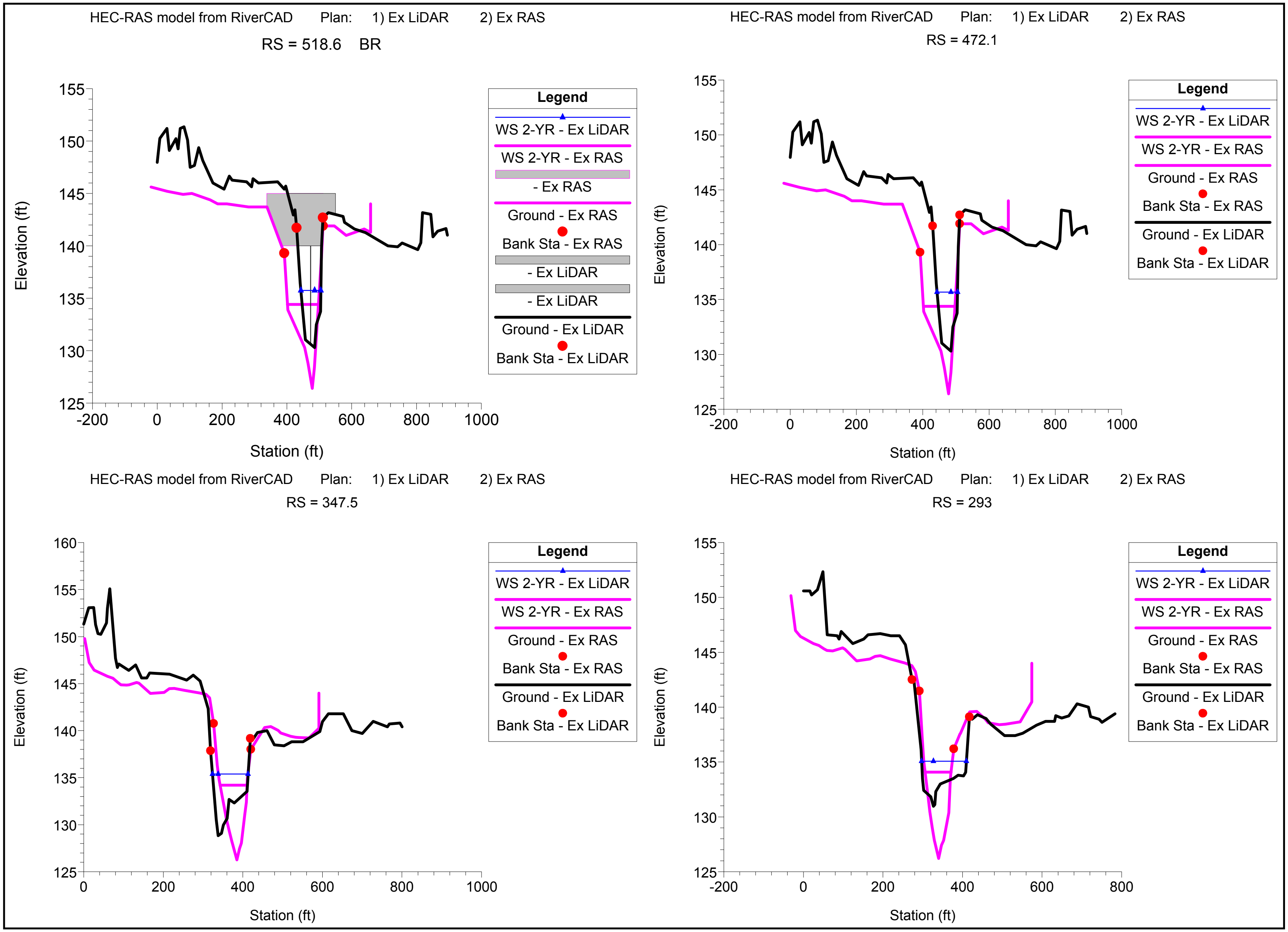

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 72602.9
Legend
WS 2-YR - Ex RAS
WS 2-YR - Ex LiDAR
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
145
140
135
130
125
120
115
110
0
200
400
600
800
1000
1200
1400

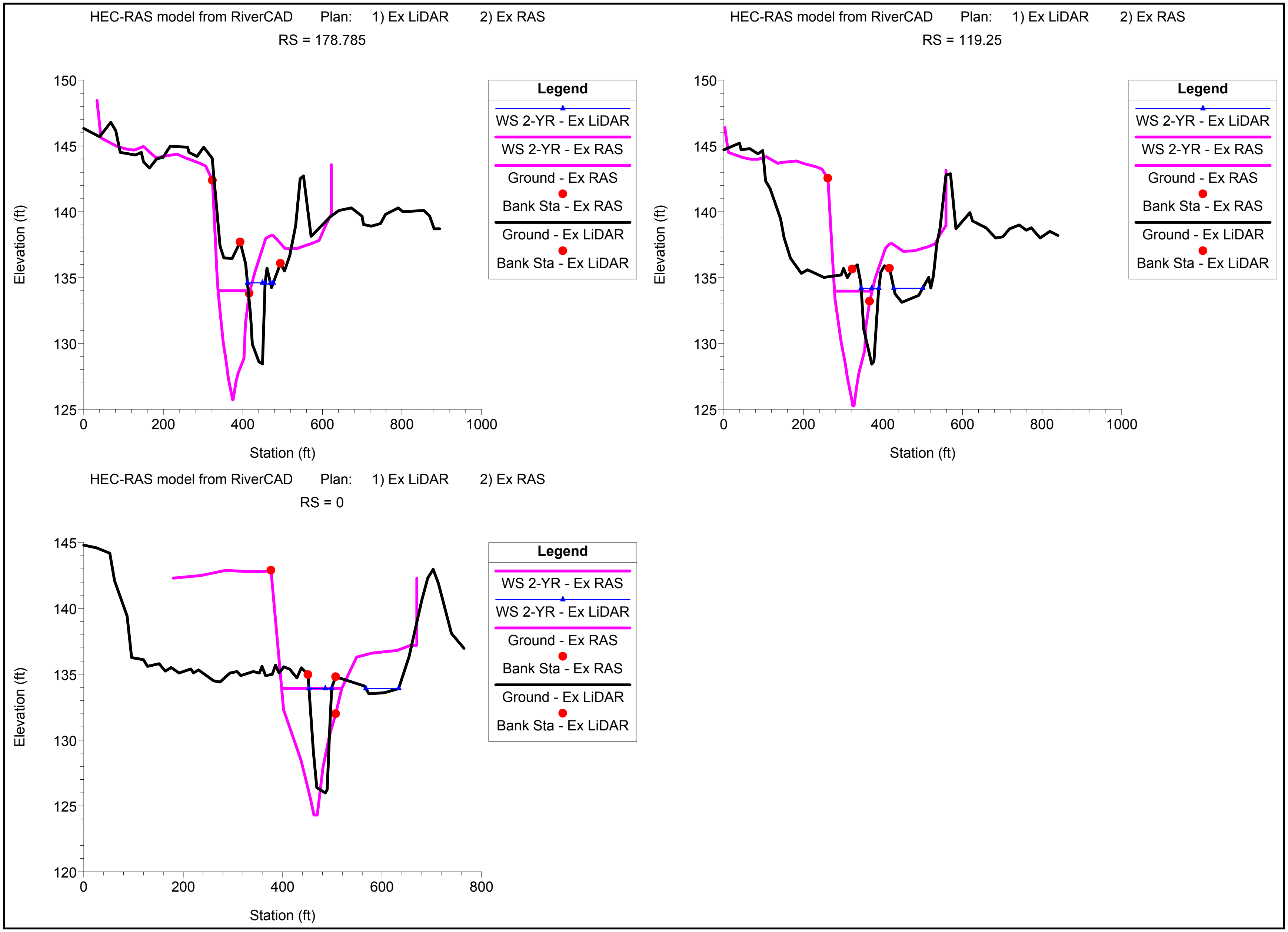

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 2045.1
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
165
160
155
150
145
140
135
130
0
200
400
600
800
1000
1200
1400
1600


HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 1743.899
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
165
160
155
150
145
140
135
130
0
200
400
600
800
1000
1200
1400
1600


HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 1483.899
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
160
155
150
145
140
135
130
125
0
200
400
600
800
1000
1200
1400
1600


HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 1235.899
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
155
150
145
140
135
130
125
0
200
400
600
800
1000
1200
1400
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 983.899
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
150
145
140
135
130
125
0
200
400
600
800
1000
1200
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 565.1
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
150
145
140
135
130
125
0
200
400
600
800
1000
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 518.6 BR
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
- Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
- Ex LiDAR
- Ex LiDAR
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
150
145
140
135
130
125
0
200
400
600
800
1000


HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 518.6 BR
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
- Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
- Ex LiDAR
- Ex LiDAR
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
155
150
145
140
135
130
125
-200
0
200
400
600
800
1000
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 472.1
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 347.5
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
160
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 293
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)



HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 178.785
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 119.25
Legend
WS 2-YR - Ex LiDAR
WS 2-YR - Ex RAS
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS
RS = 0
Legend
WS 2-YR - Ex RAS
WS 2-YR - Ex LiDAR
Ground - Ex RAS
Bank Sta - Ex RAS
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)

APPENDIX B

CROSS SECTION COMPARISON

EX. HEC-RAS(88 DATUM)/ EXISTING LIDAR

Questions concerning the VERTCON process may be mailed to NGS

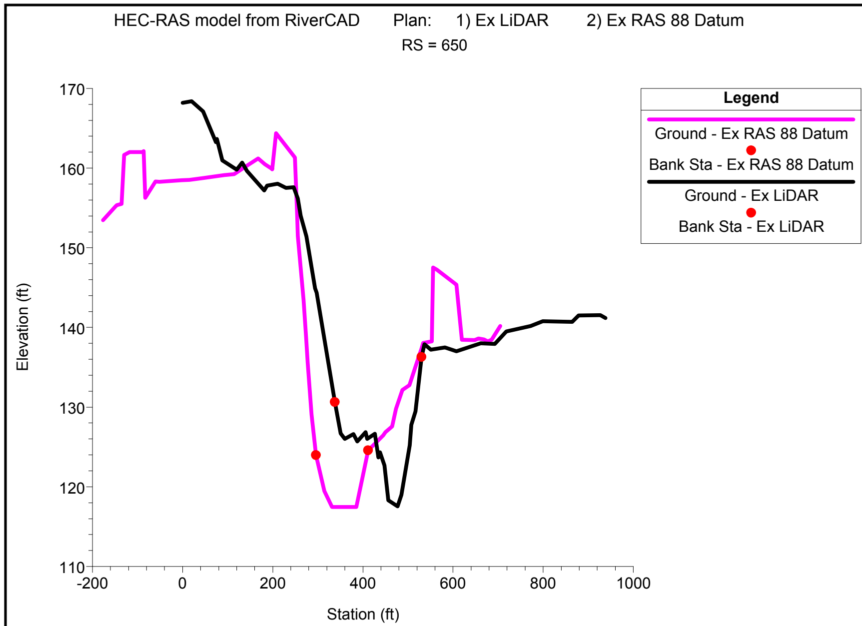
Latitude: 38.8833

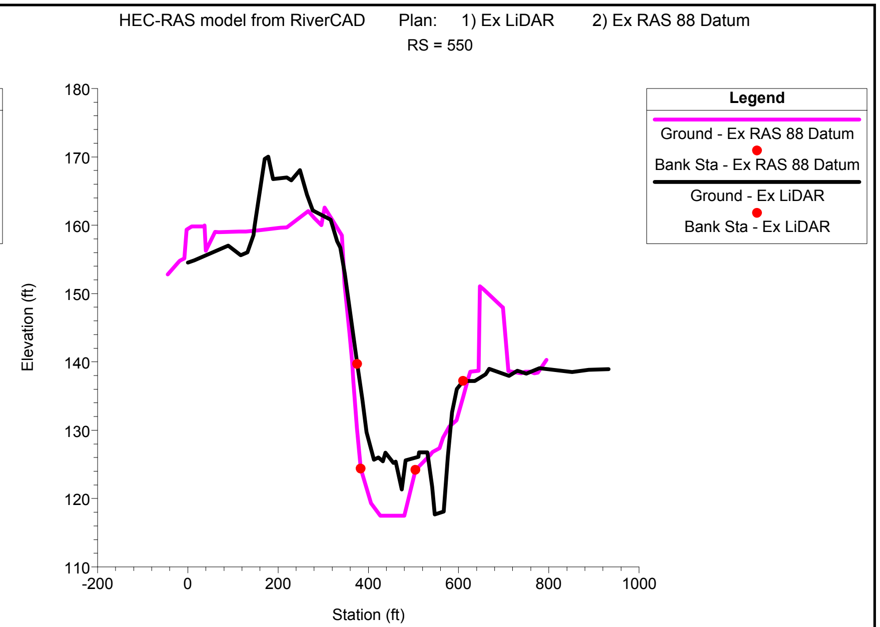
Longitude: 121.4833

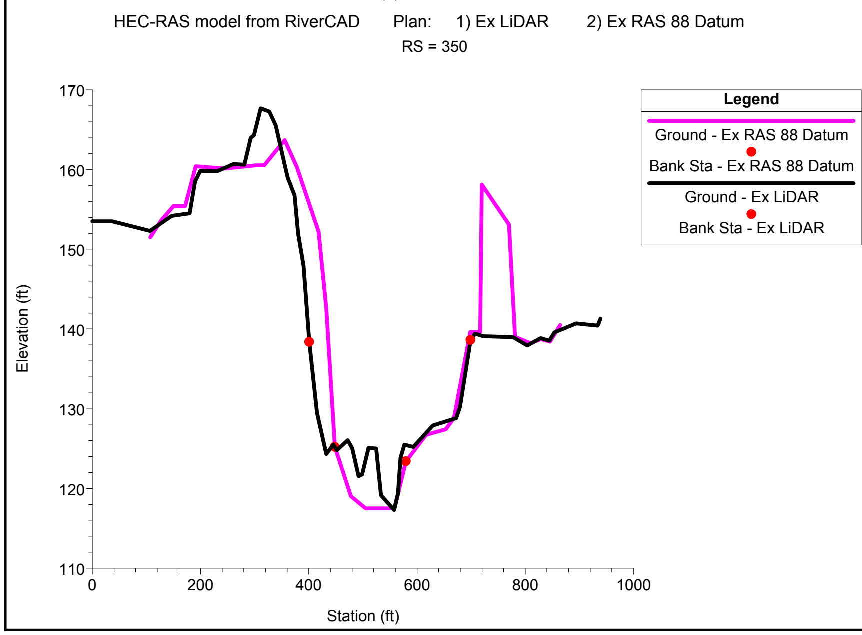
NGVD 29 height: 1 ft

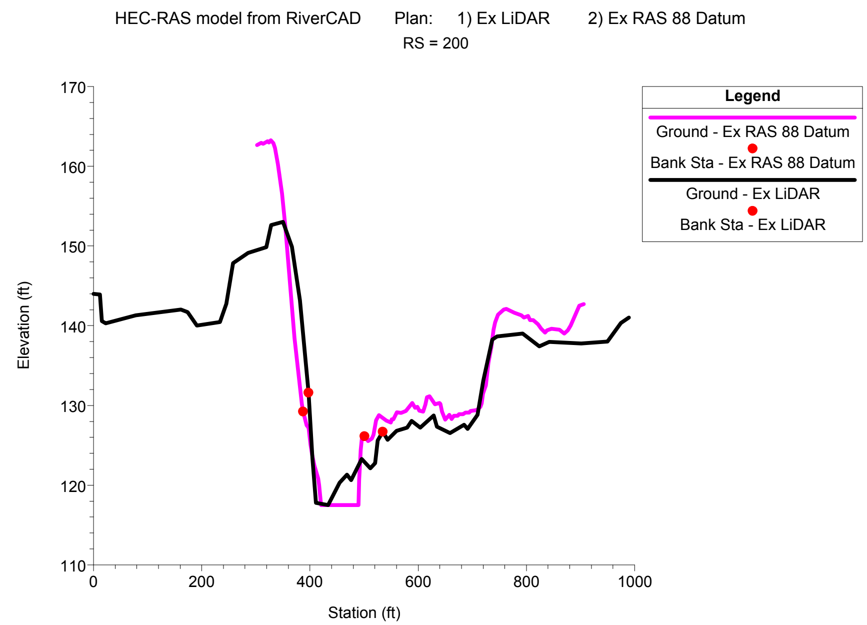
Datum shift(NAVD 88 minus NGVD 29): 2.316 feet

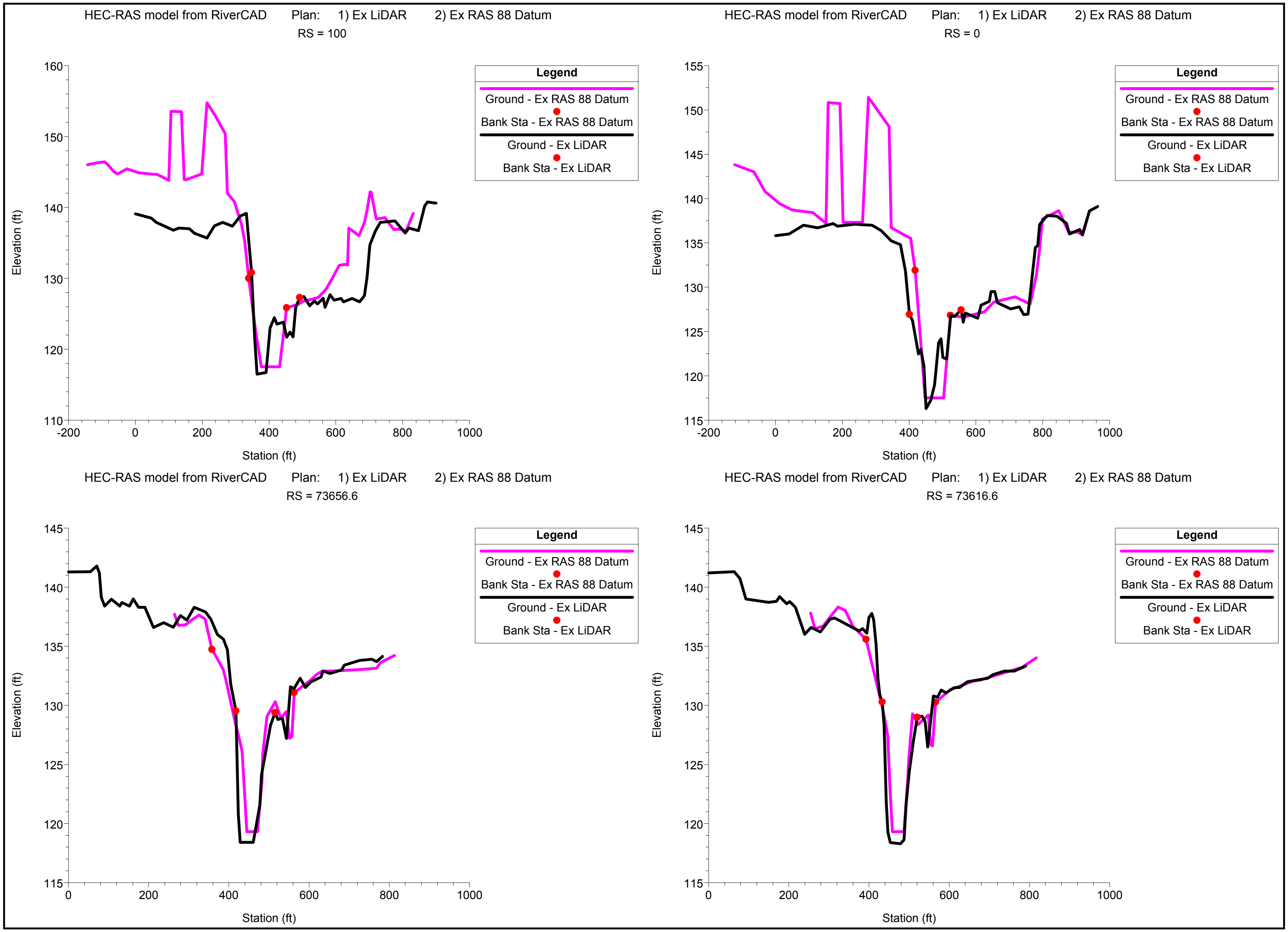
Converted to NAVD 88 height: 3.316 feet


HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 650
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
170
160
150
140
130
120
110
-200
0
200
400
600
800
1000

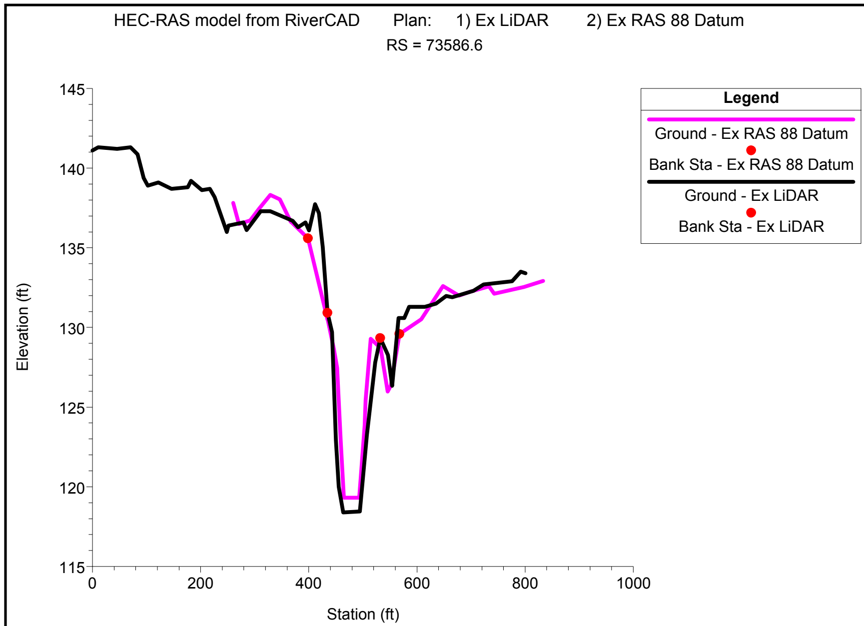

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 550
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
180
170
160
150
140
130
120
110
-200
0
200
400
600
800
1000

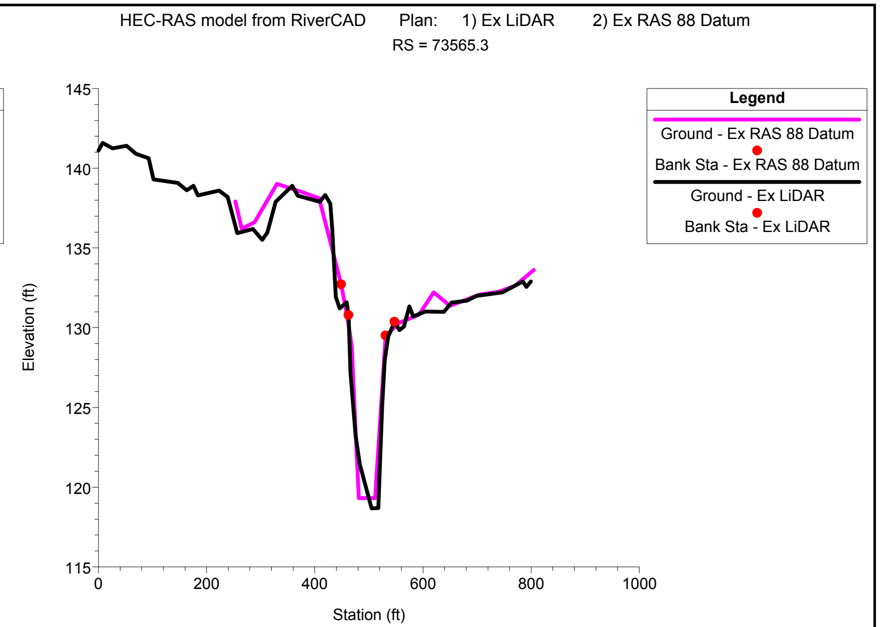

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 350
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
170
160
150
140
130
120
110
0
200
400
600
800
1000

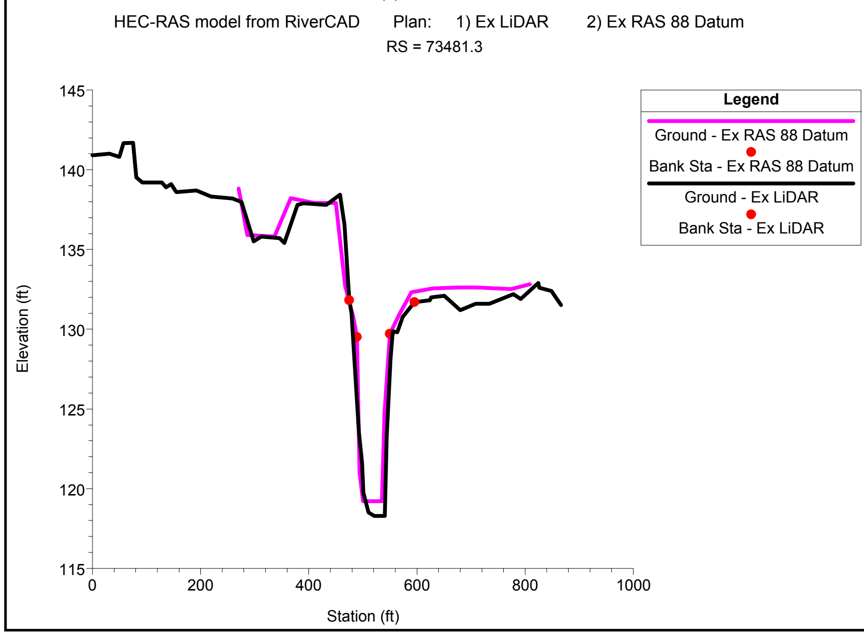

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 200
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
170
160
150
140
130
120
110
0
200
400
600
800
1000

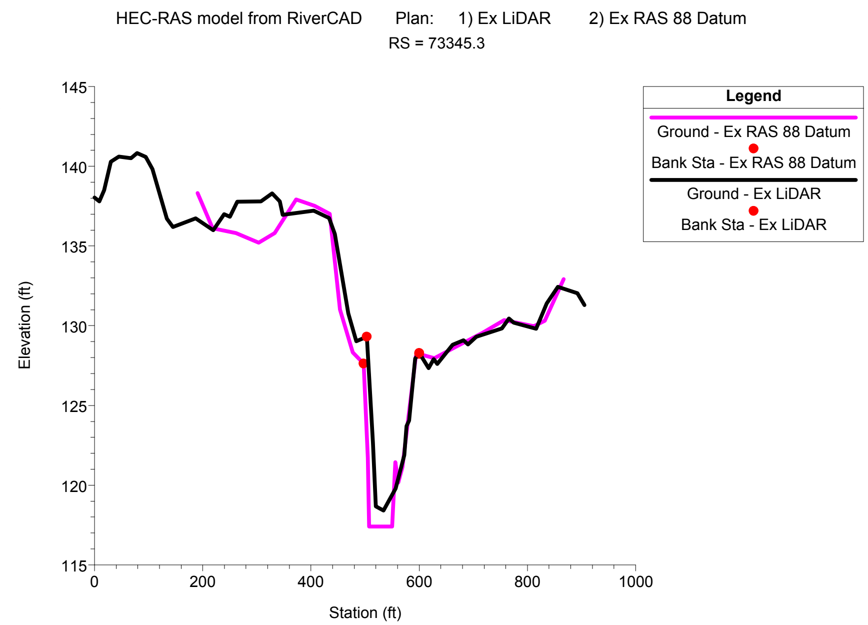


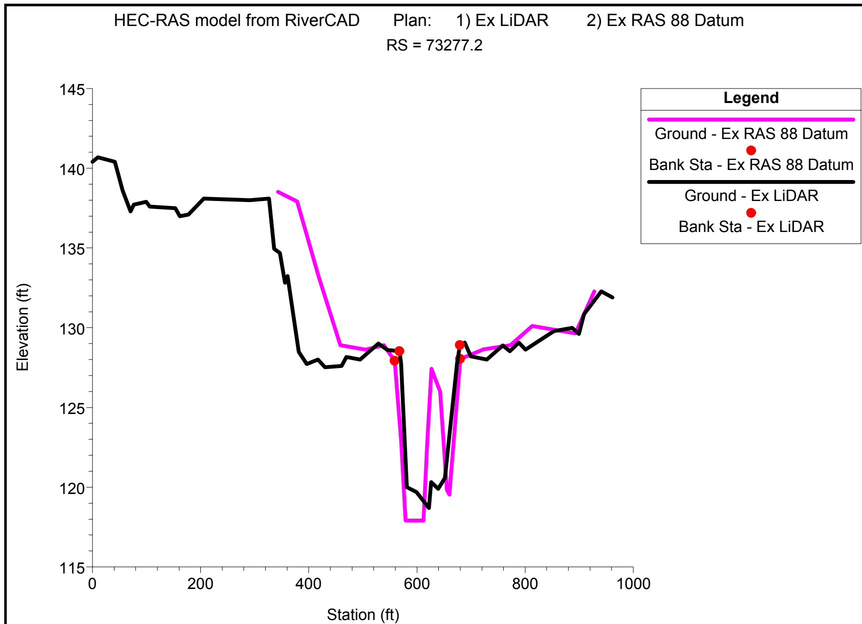
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 100
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
160
150
140
130
120
110
-200
0
200
400
600
800
1000
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 0
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
155
150
145
140
135
130
125
120
115
-200
0
200
400
600
800
1000
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 73656.6
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
145
140
135
130
125
120
115
0
200
400
600
800
1000
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 73616.6
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
145
140
135
130
125
120
115
0
200
400
600
800
1000

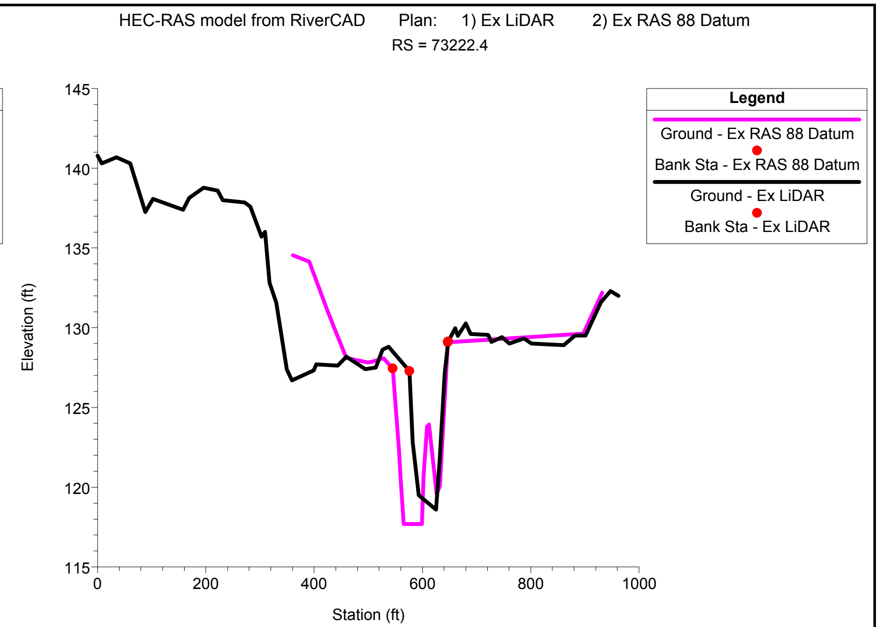

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 73586.6
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
145
140
135
130
125
120
115
0
200
400
600
800
1000

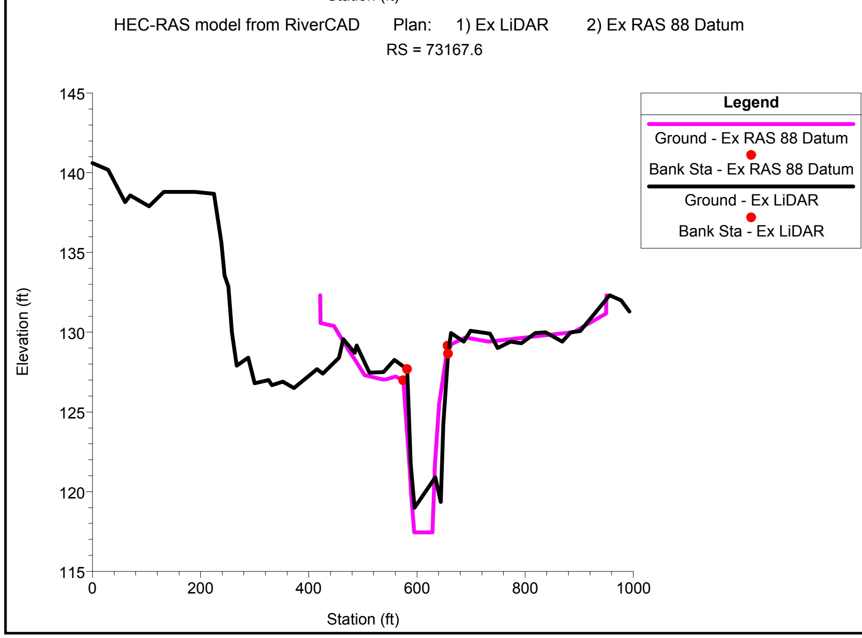

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 73565.3
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
145
140
135
130
125
120
115
0
200
400
600
800
1000

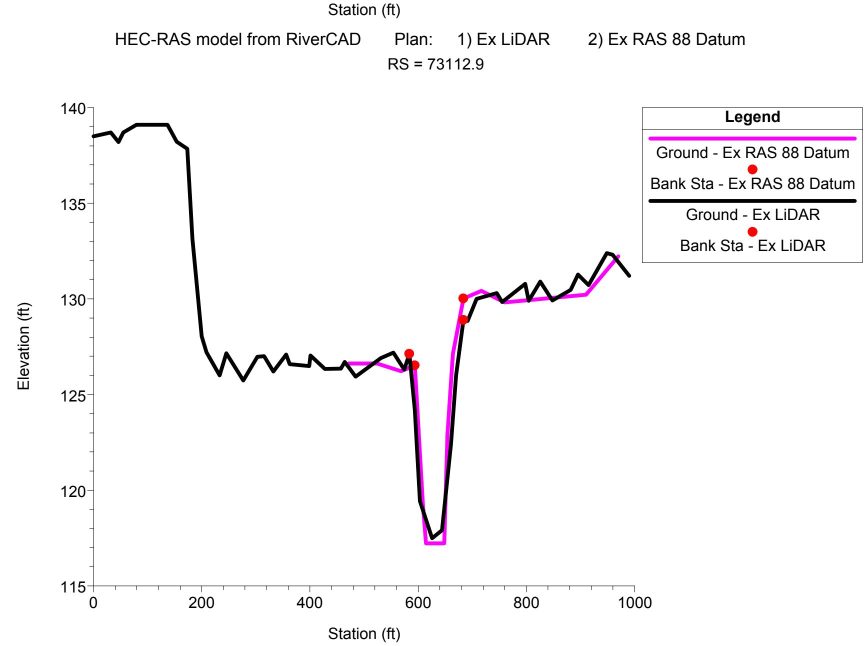

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 73481.3
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
145
140
135
130
125
120
115
0
200
400
600
800
1000

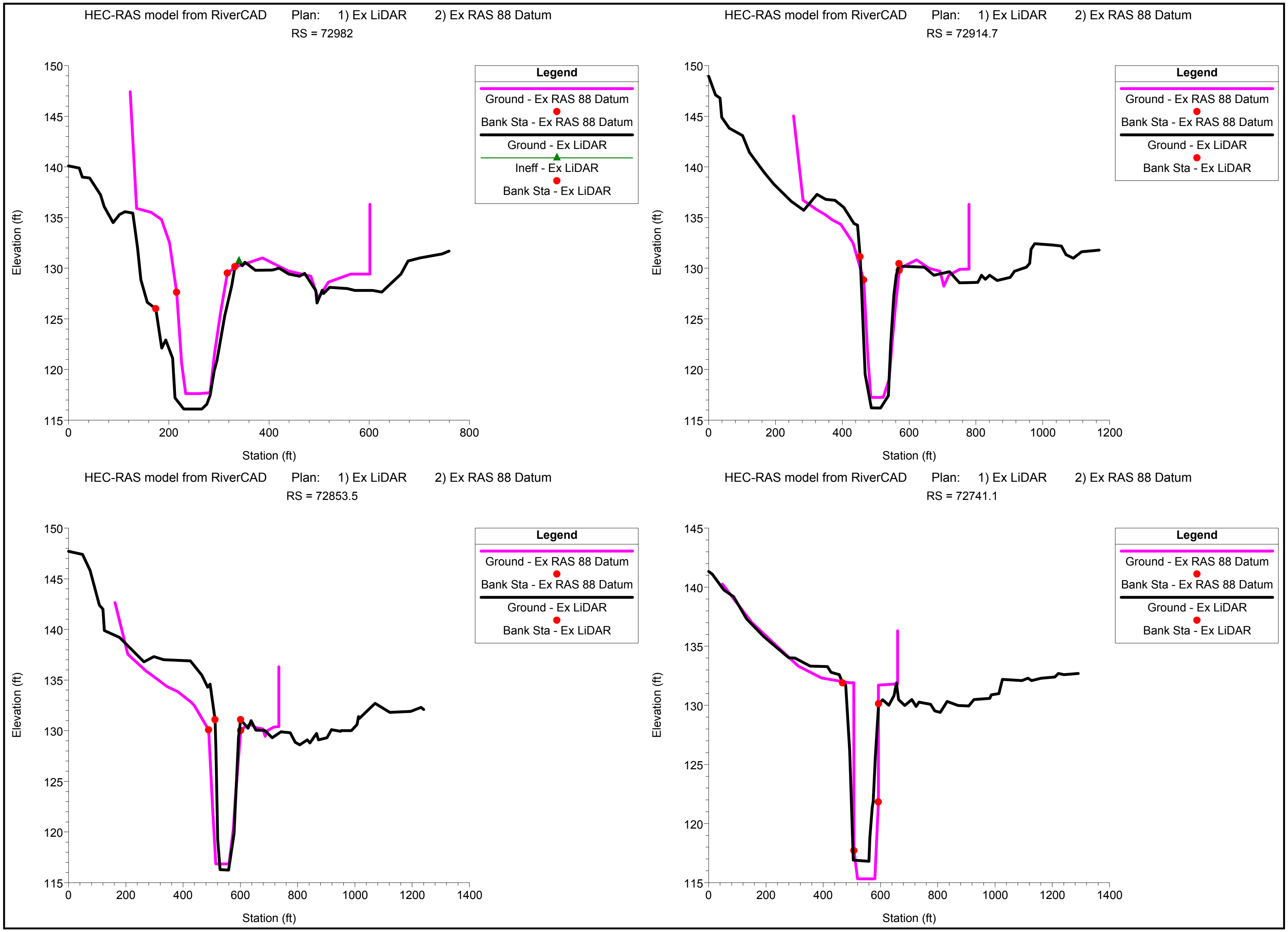

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 73345.3
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
145
140
135
130
125
120
115
0
200
400
600
800
1000

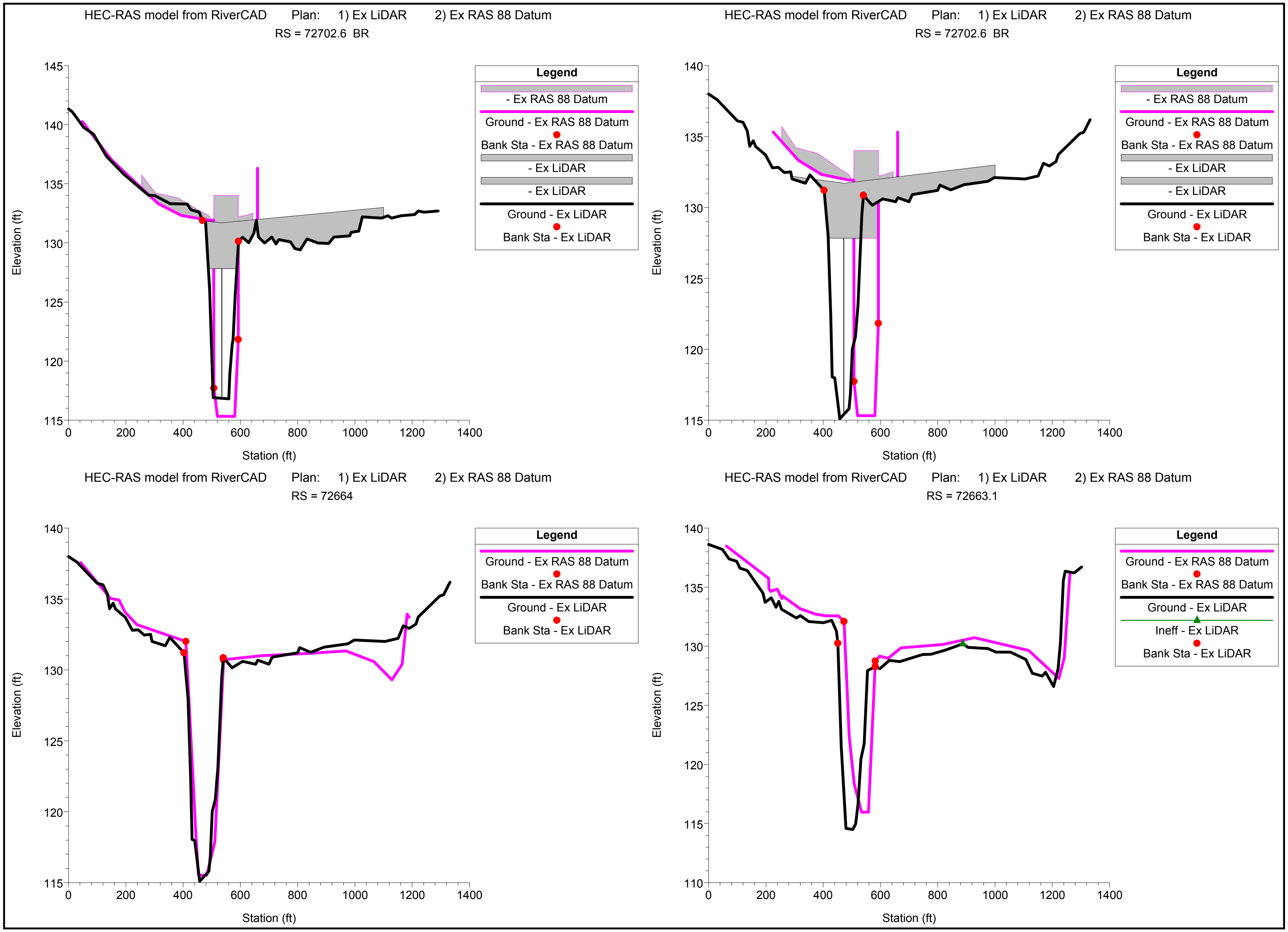

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 73277.2
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
145
140
135
130
125
120
115
0
200
400
600
800
1000

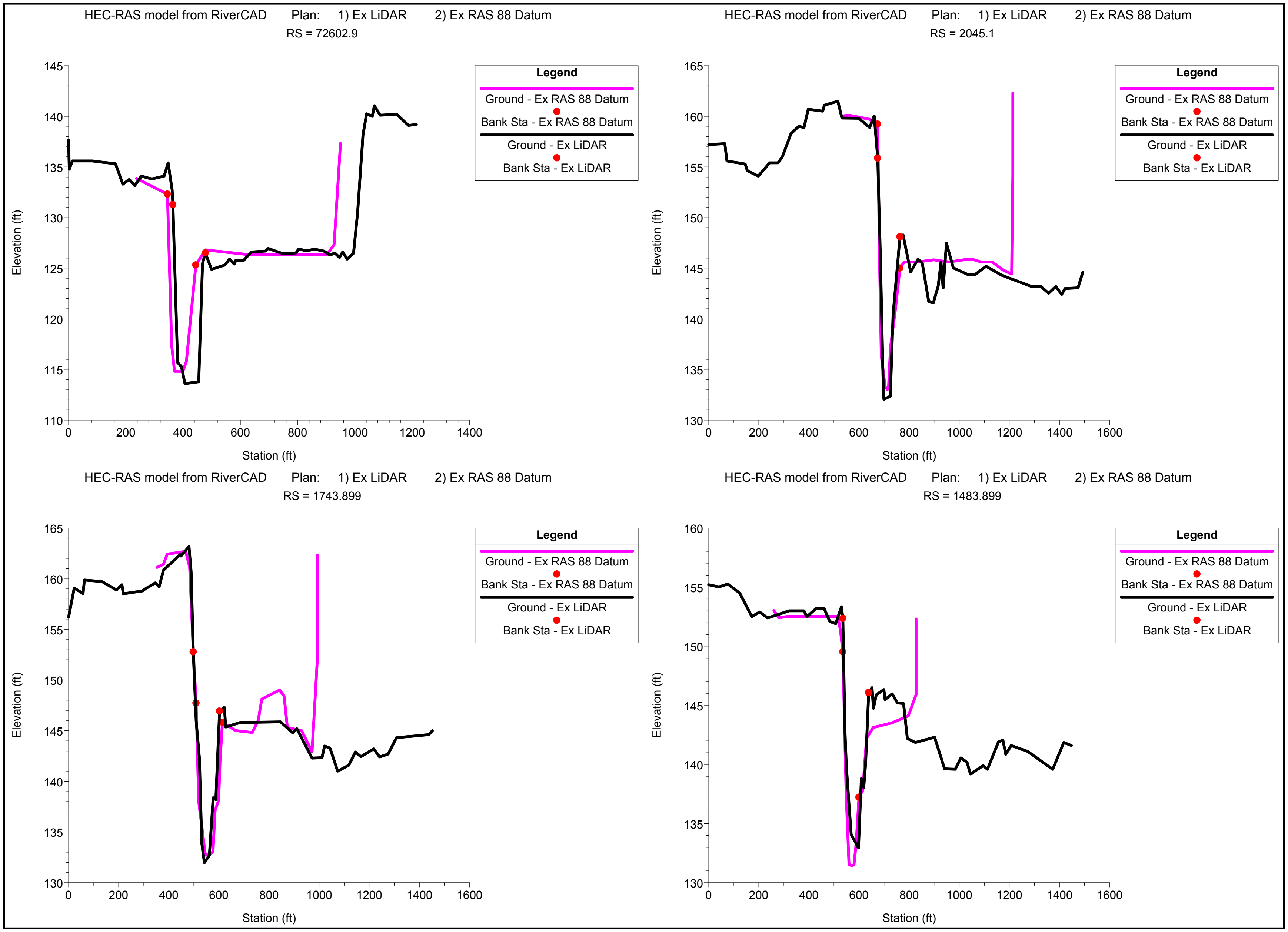

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 73222.4
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
145
140
135
130
125
120
115
0
200
400
600
800
1000

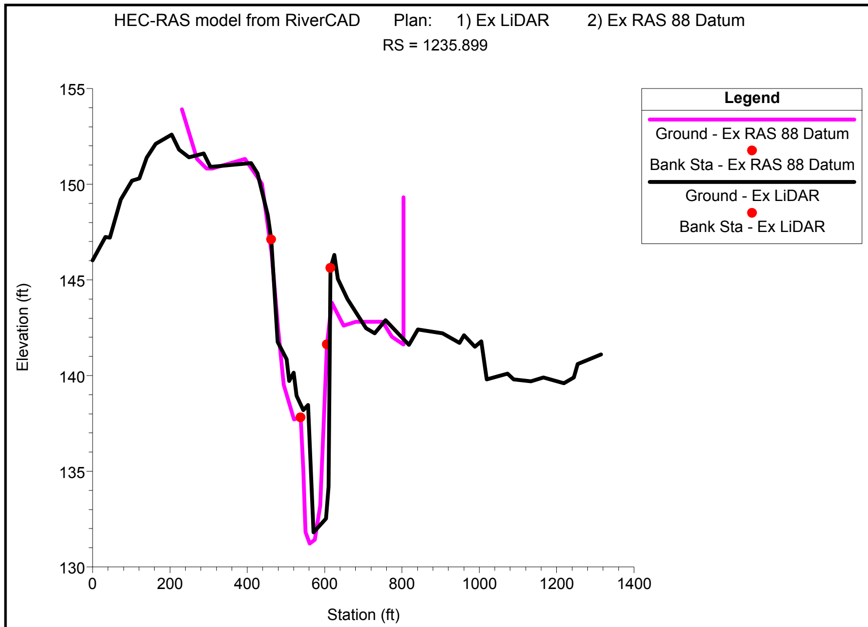

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 73167.6
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
145
140
135
130
125
120
115
0
200
400
600
800
1000

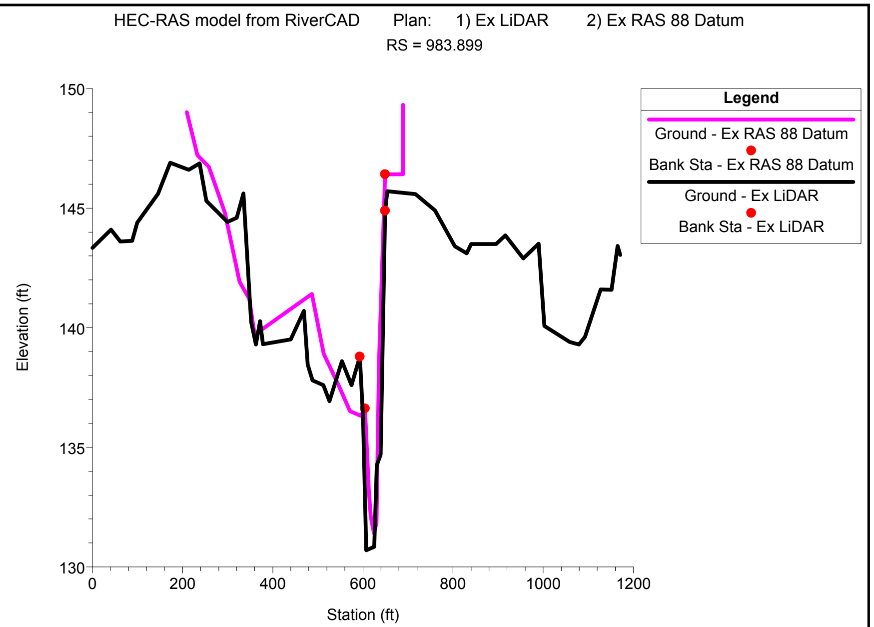

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 73112.9
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
140
135
130
125
120
115
0
200
400
600
800
1000

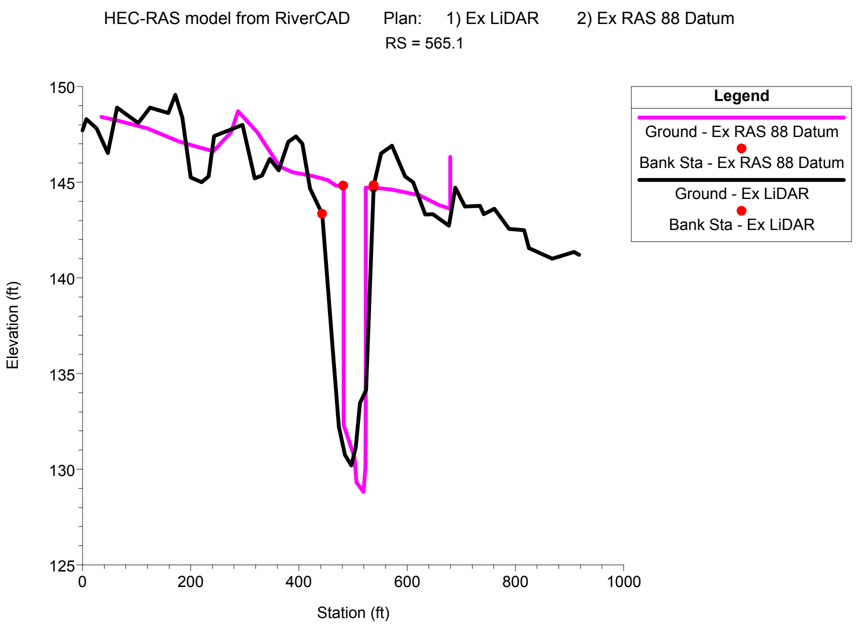

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 72982
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Ineff - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
150
145
140
135
130
125
120
115
0
200
400
600
800
Station (ft)
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 72914.7
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
150
145
140
135
130
125
120
115
0
200
400
600
800
1000
1200
Station (ft)
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 72853.5
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
150
145
140
135
130
125
120
115
0
200
400
600
800
1000
1200
1400
Station (ft)
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 72741.1
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
145
140
135
130
125
120
115
0
200
400
600
800
1000
1200
1400
Station (ft)

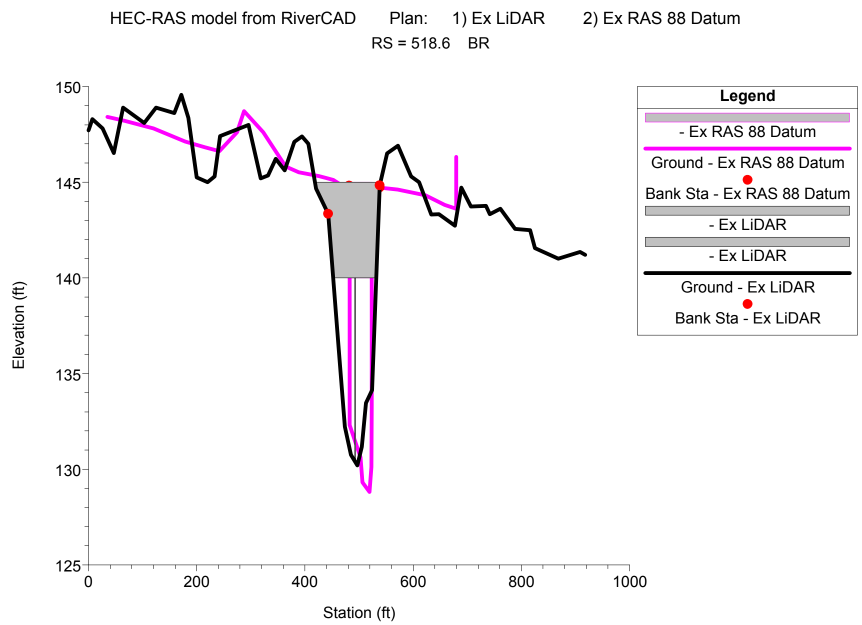

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 72702.6 BR
Legend
- Ex RAS 88 Datum
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
- Ex LiDAR
- Ex LiDAR
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 72702.6 BR
Legend
- Ex RAS 88 Datum
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
- Ex LiDAR
- Ex LiDAR
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 72664
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 72663.1
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Ineff - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)


HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 72602.9
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 2045.1
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 1743.899
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 1483.899
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)

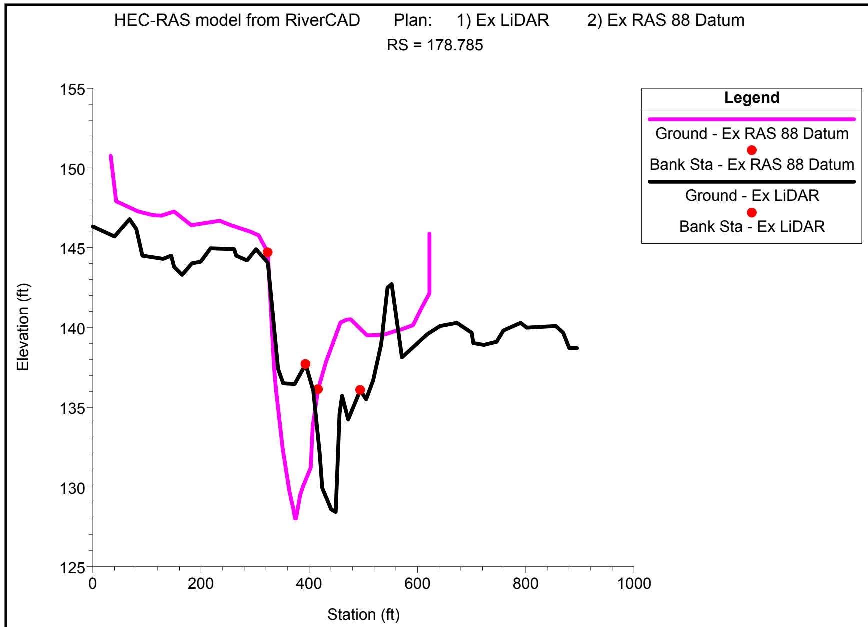

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 1235.899
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
155
150
145
140
135
130
0
200
400
600
800
1000
1200
1400

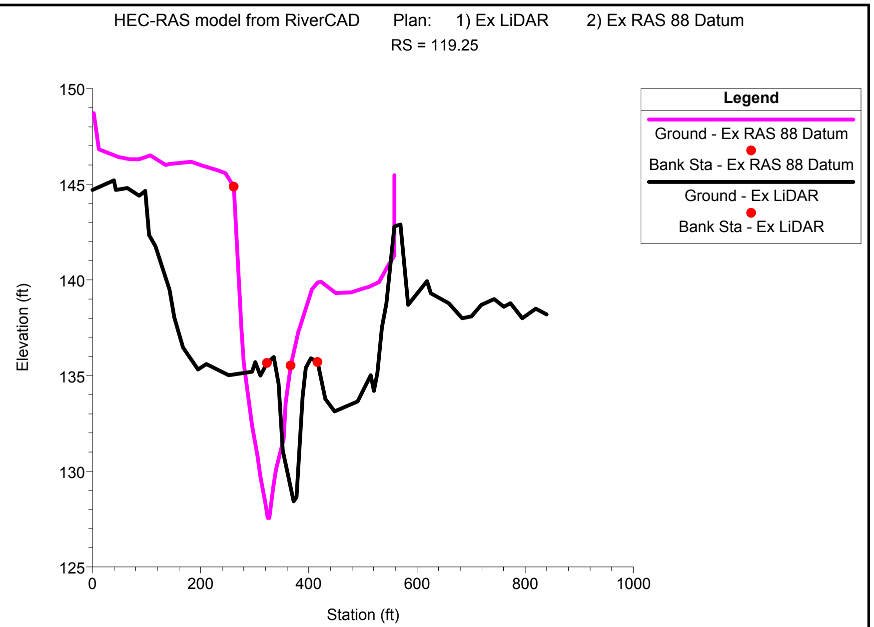

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 983.899
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
150
145
140
135
130
0
200
400
600
800
1000
1200

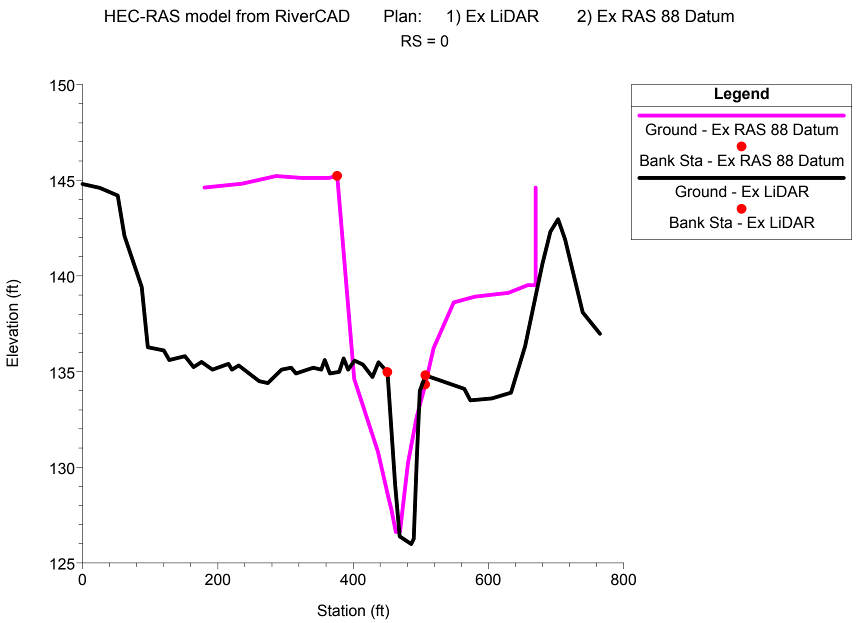

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 565.1
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
150
145
140
135
130
125
0
200
400
600
800
1000


HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 518.6 BR
Legend
- Ex RAS 88 Datum
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
- Ex LiDAR
- Ex LiDAR
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
150
145
140
135
130
125
0
200
400
600
800
1000

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 518.6 BR
Legend
- Ex RAS 88 Datum
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
- Ex LiDAR
- Ex LiDAR
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
155
150
145
140
135
130
125
-200
0
200
400
600
800
1000
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 472.1
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
155
150
145
140
135
130
125
-200
0
200
400
600
800
1000
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 347.5
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
160
155
150
145
140
135
130
125
0
200
400
600
800
1000
HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 293
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
155
150
145
140
135
130
125
-200
0
200
400
600
800


HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 178.785
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
155
150
145
140
135
130
125
0
200
400
600
800
1000

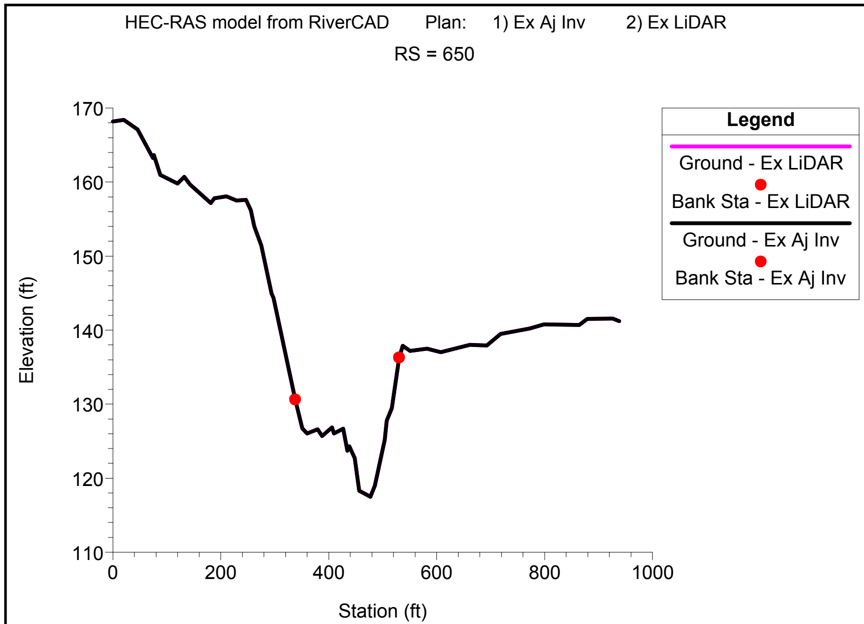

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 119.25
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
150
145
140
135
130
125
0
200
400
600
800
1000

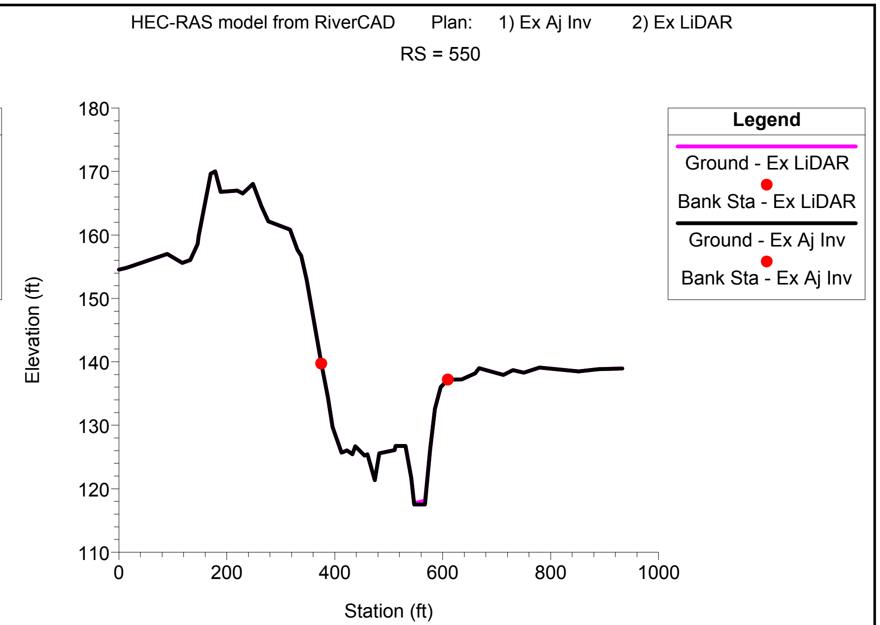

HEC-RAS model from RiverCAD Plan: 1) Ex LiDAR 2) Ex RAS 88 Datum
RS = 0
Legend
Ground - Ex RAS 88 Datum
Bank Sta - Ex RAS 88 Datum
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Elevation (ft)
Station (ft)
150
145
140
135
130
125
0
200
400
600
800

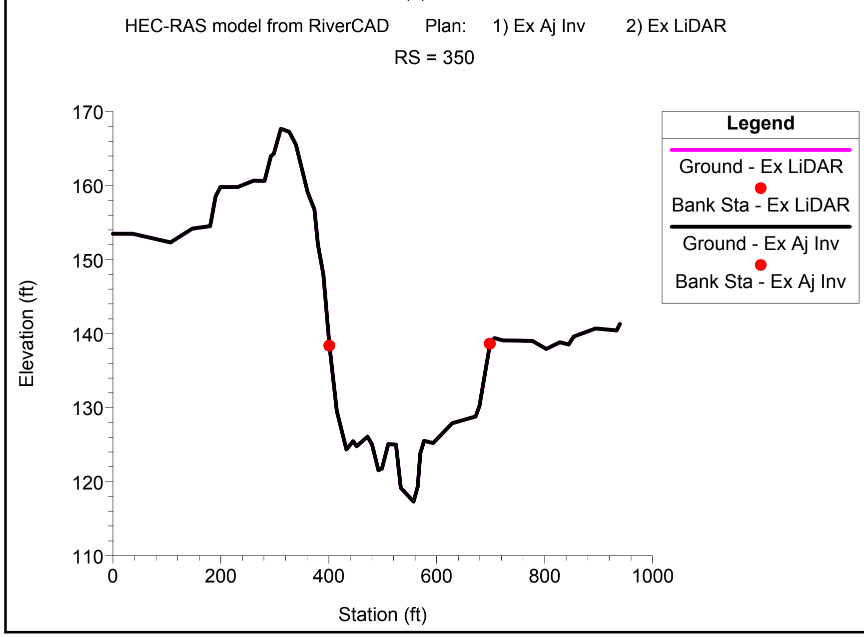
APPENDIX C

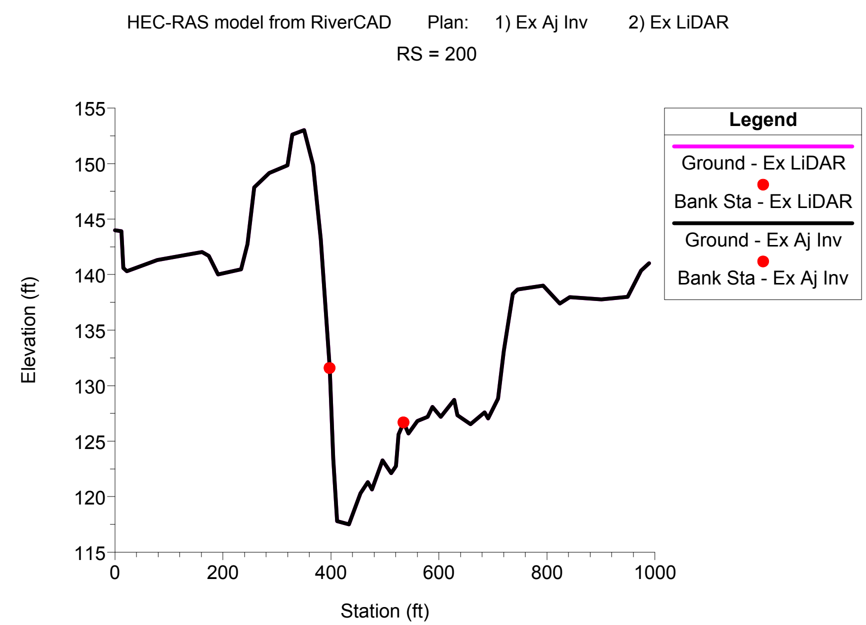
CROSS SECTION COMPARISON

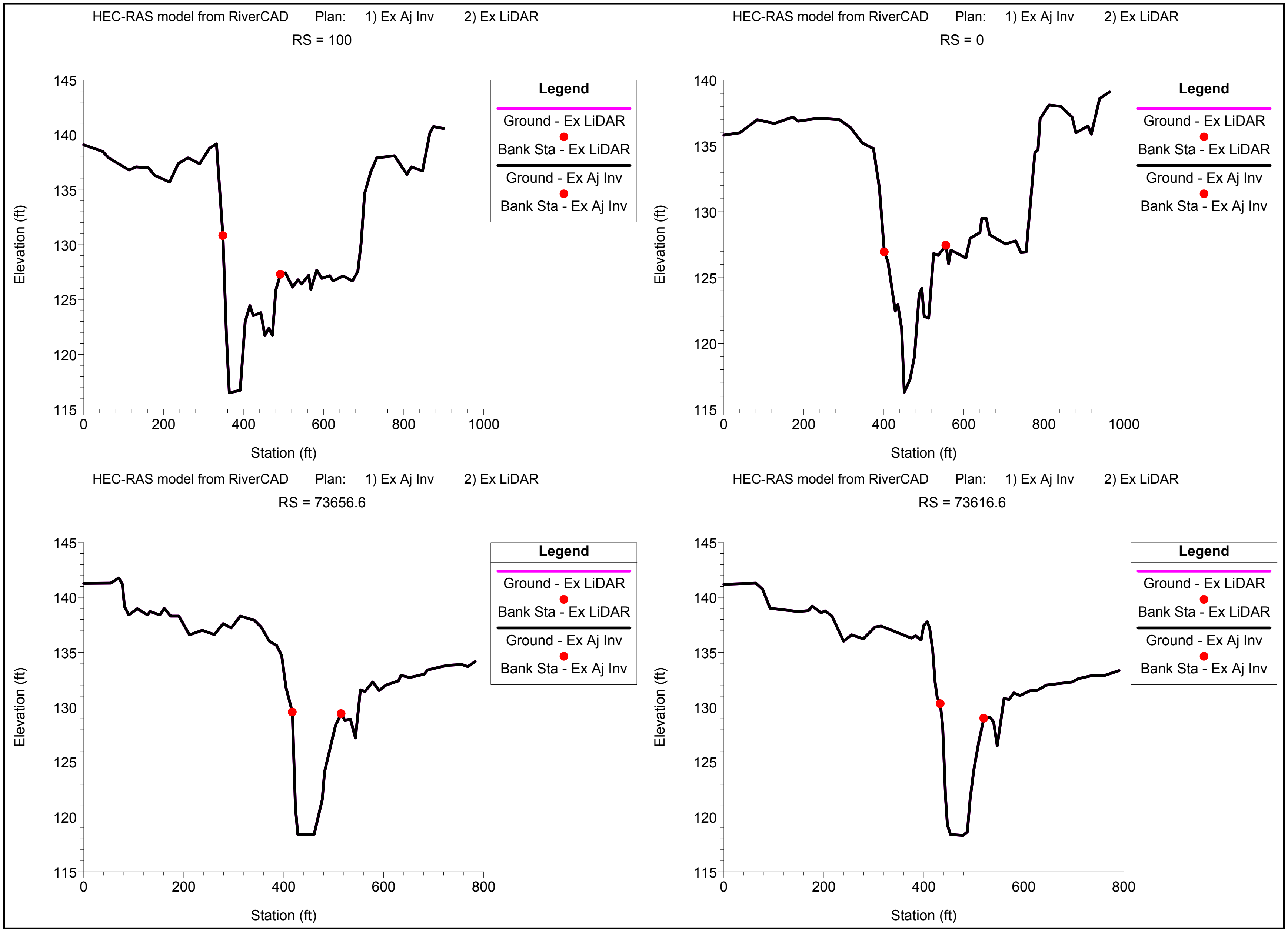
EXISTING LIDAR/
EXISTING LIDAR ADJUST INVERTS

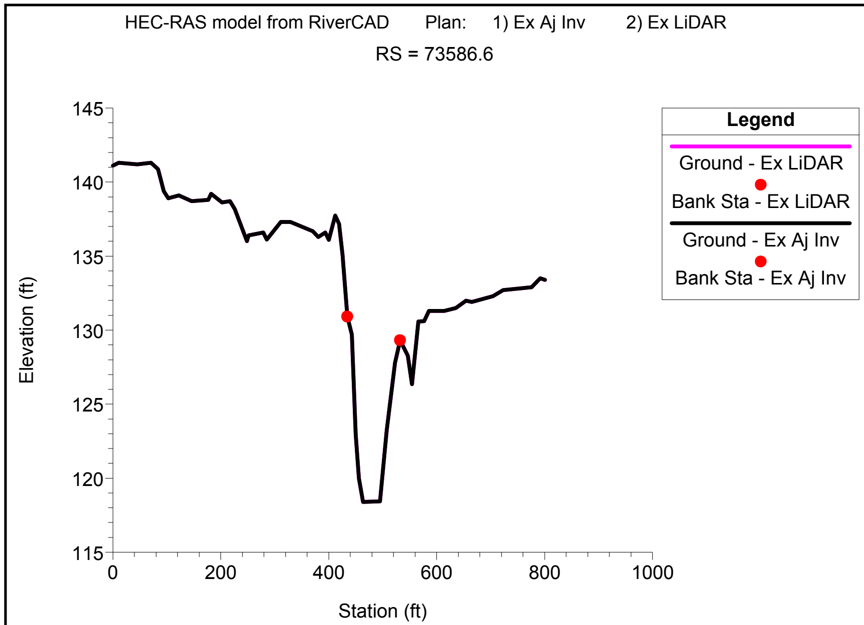

HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 650
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
Station (ft)
170
160
150
140
130
120
110
0
200
400
600
800
1000

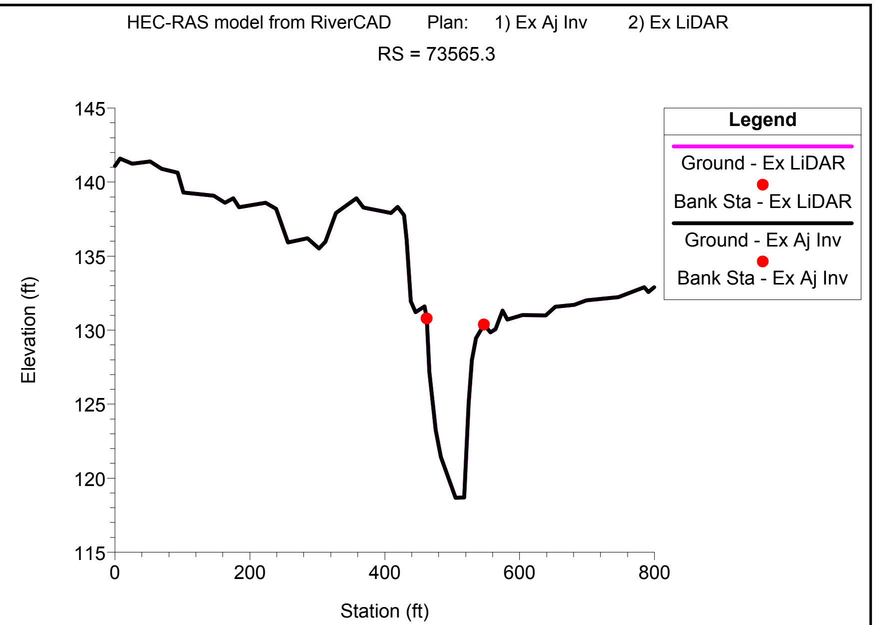

HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 550
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
Station (ft)
180
170
160
150
140
130
120
110
0
200
400
600
800
1000

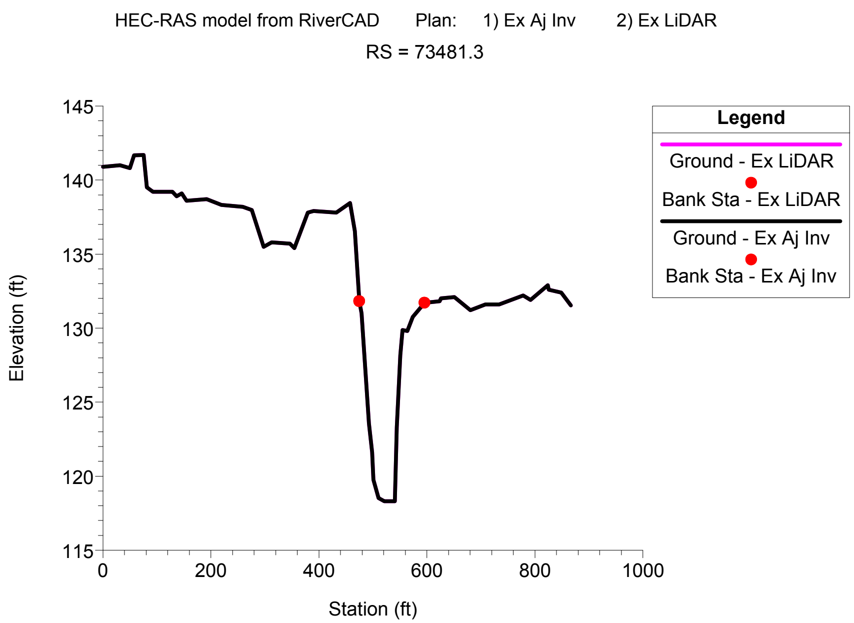

HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 350
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
Station (ft)
170
160
150
140
130
120
110
0
200
400
600
800
1000

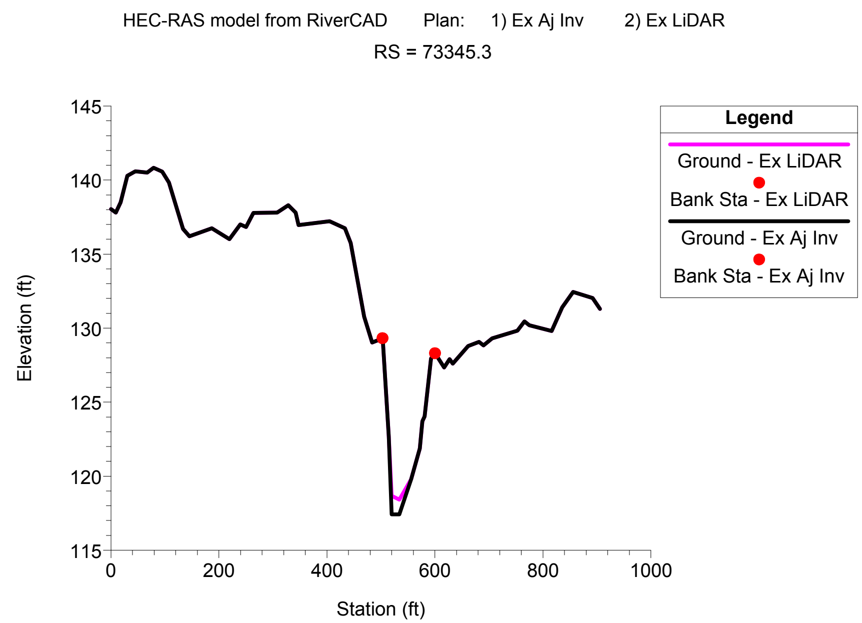

HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 200
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
Station (ft)
155
150
145
140
135
130
125
120
115
0
200
400
600
800
1000

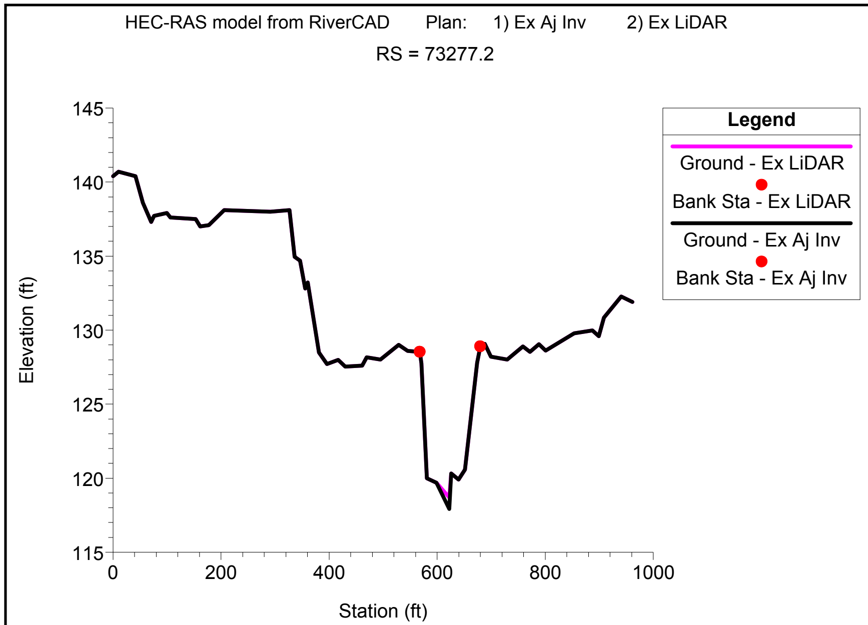

HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 100
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
145
140
135
130
125
120
115
0
200
400
600
800
1000
Station (ft)
HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 0
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
140
135
130
125
120
115
0
200
400
600
800
1000
Station (ft)
HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 73656.6
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
145
140
135
130
125
120
115
0
200
400
600
800
Station (ft)
HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 73616.6
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
145
140
135
130
125
120
115
0
200
400
600
800
Station (ft)

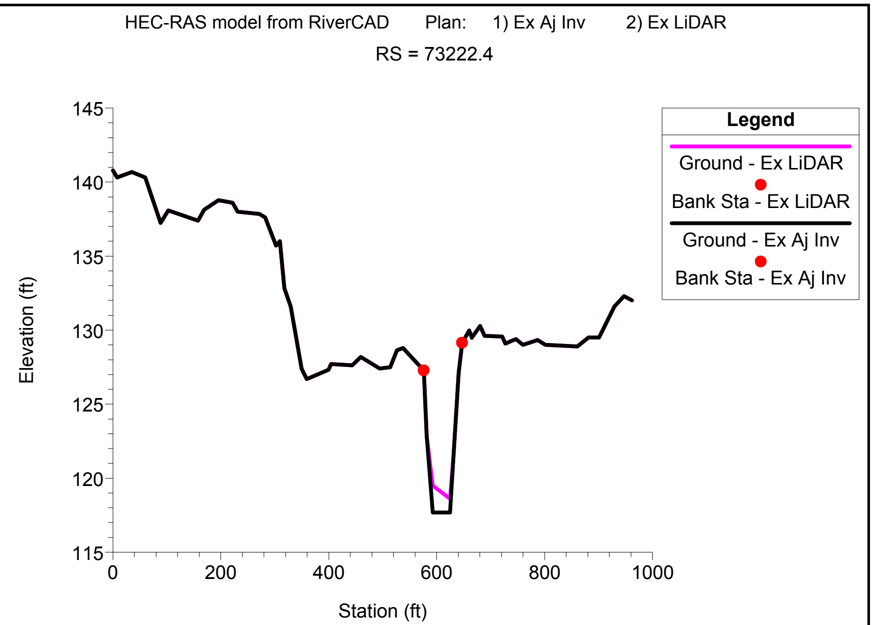

HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 73586.6
Elevation (ft)
145
140
135
130
125
120
115
0
200
400
600
800
1000
Station (ft)
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv

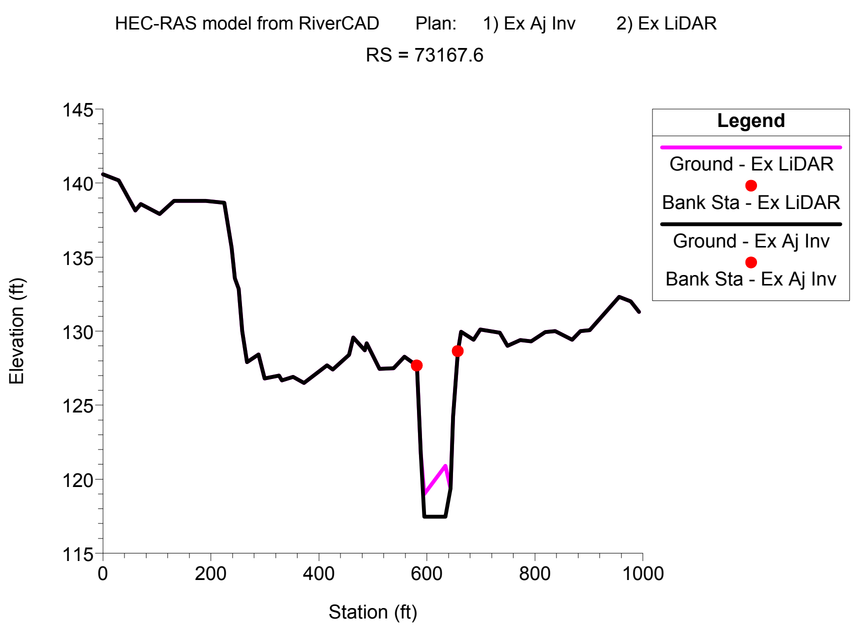

HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 73565.3
Elevation (ft)
145
140
135
130
125
120
115
0
200
400
600
800
Station (ft)
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv

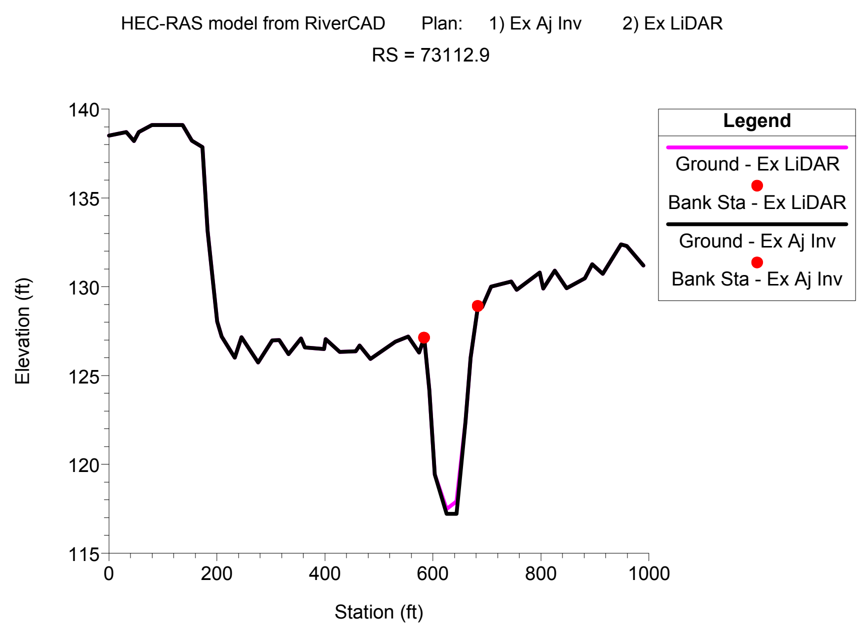

HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 73481.3
Elevation (ft)
145
140
135
130
125
120
115
0
200
400
600
800
1000
Station (ft)
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv


HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 73345.3
Elevation (ft)
145
140
135
130
125
120
115
0
200
400
600
800
1000
Station (ft)
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv

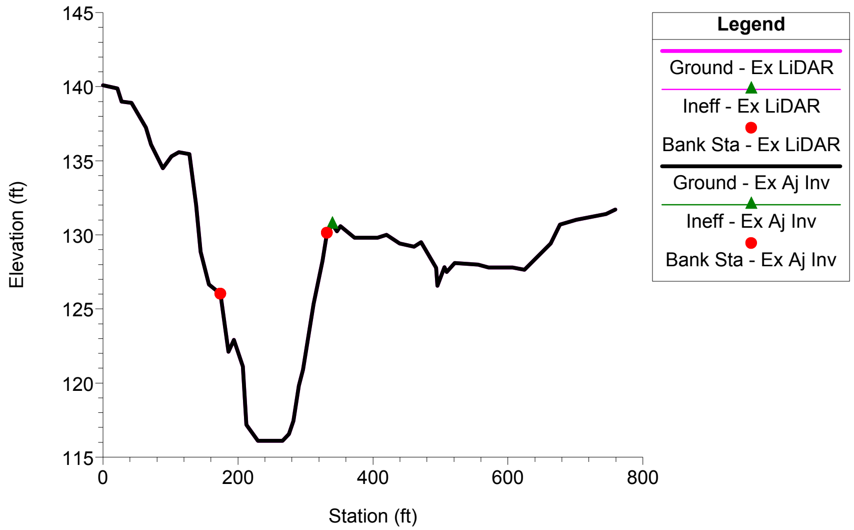

HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 73277.2
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
Station (ft)
145
140
135
130
125
120
115
0
200
400
600
800
1000


HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 73222.4
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
Station (ft)
145
140
135
130
125
120
115
0
200
400
600
800
1000

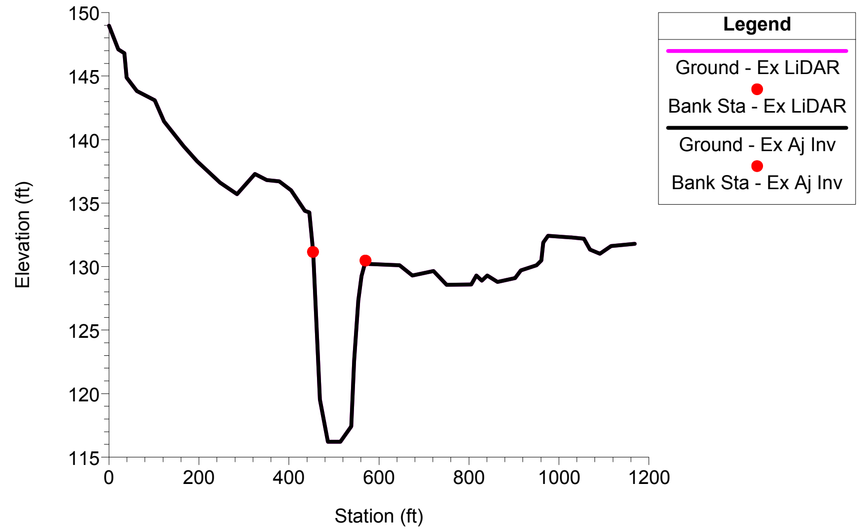

HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 73167.6
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
Station (ft)
145
140
135
130
125
120
115
0
200
400
600
800
1000


HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 73112.9
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
Station (ft)
140
135
130
125
120
115
0
200
400
600
800
1000

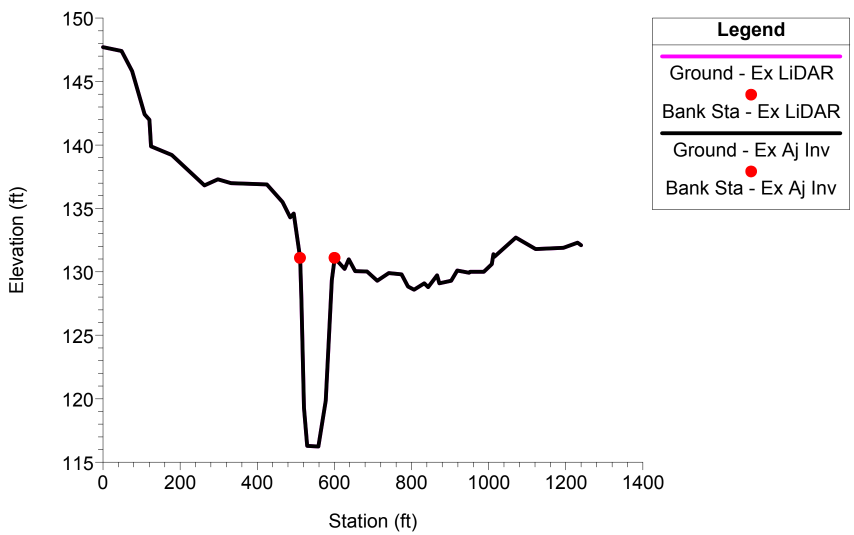
HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 72982



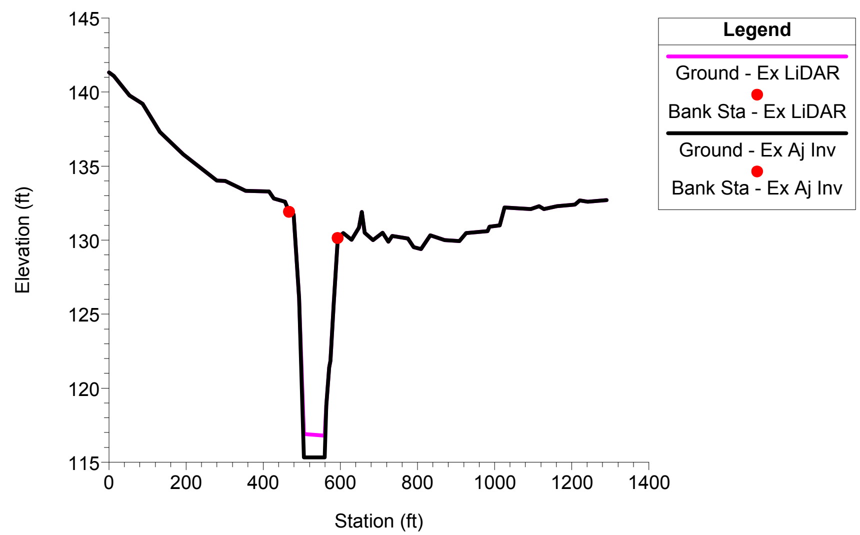
HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 72914.7

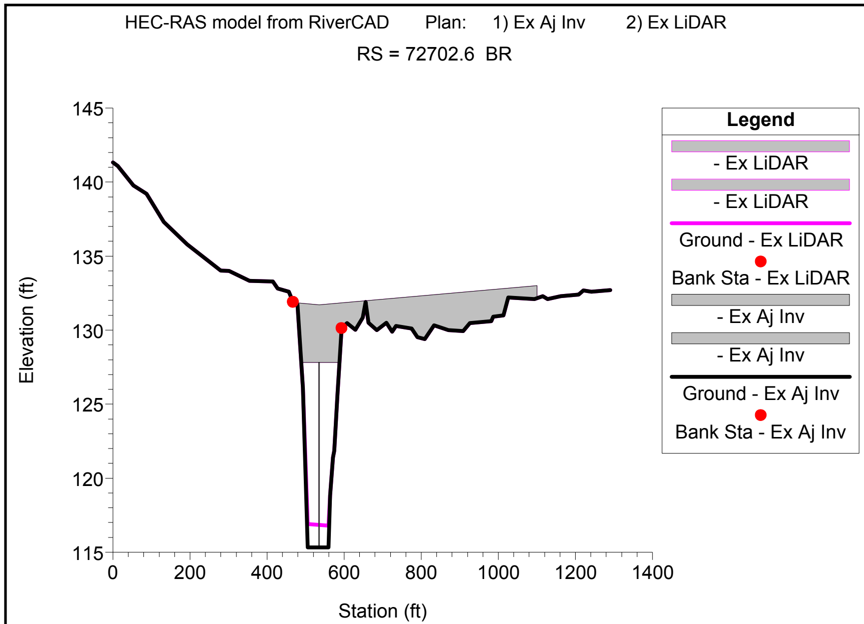


HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 72853.5

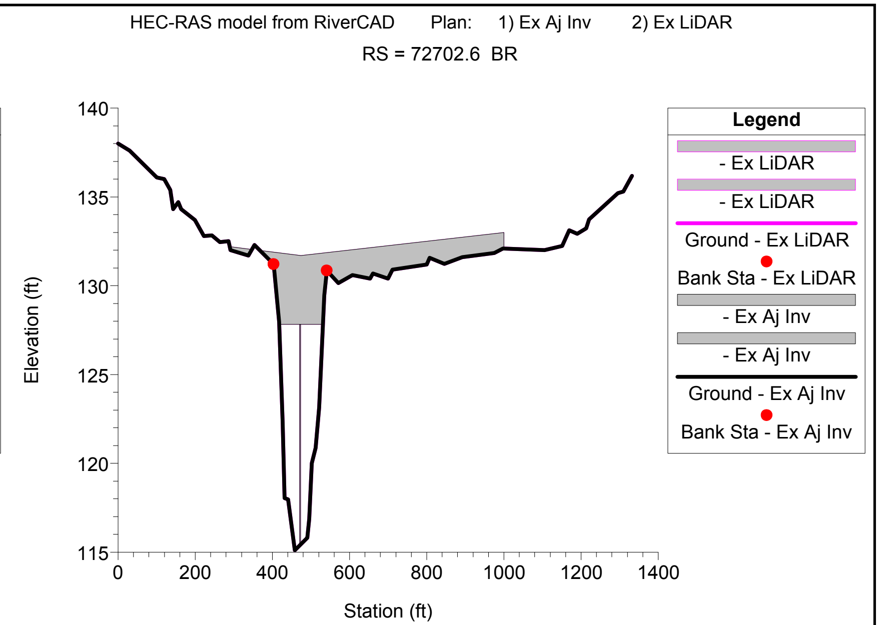


HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 72741.1

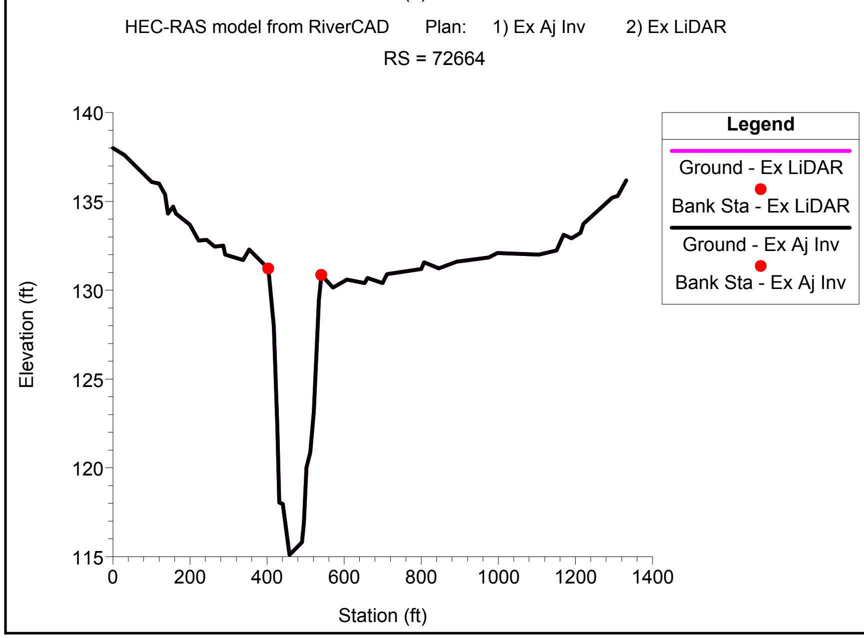




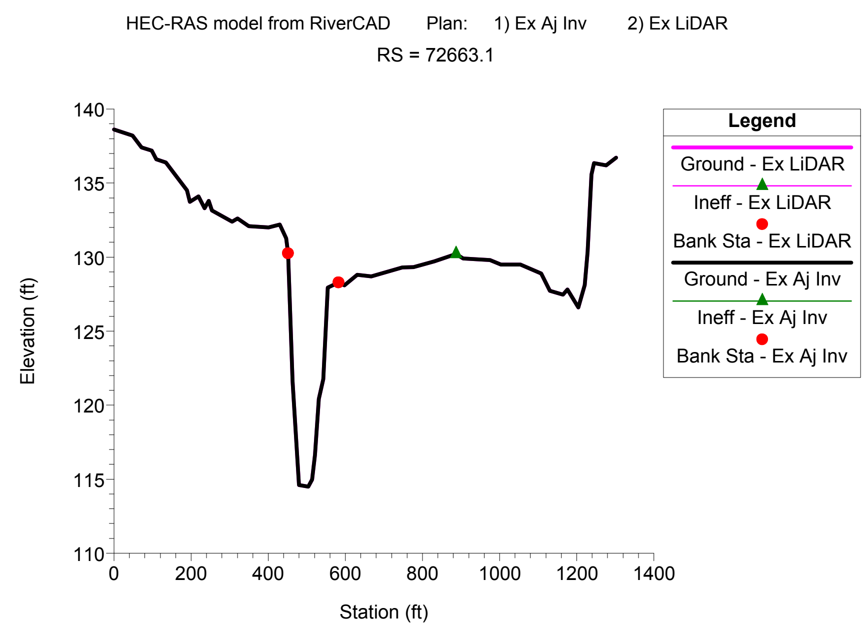
HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 72702.6 BR
Elevation (ft)
Station (ft)
Legend
- Ex LiDAR
- Ex LiDAR
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
- Ex Aj Inv
- Ex Aj Inv
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv



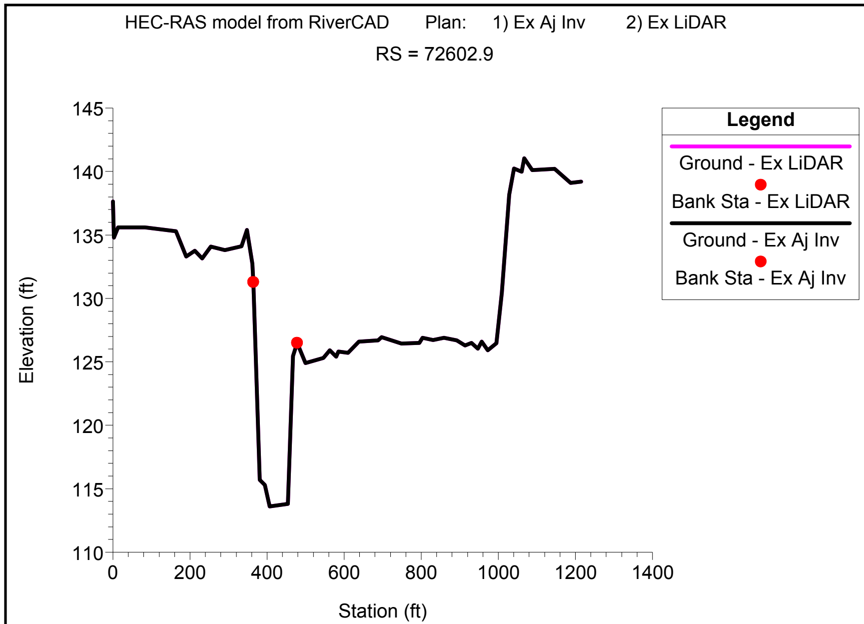
HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 72702.6 BR
Elevation (ft)
Station (ft)
Legend
- Ex LiDAR
- Ex LiDAR
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
- Ex Aj Inv
- Ex Aj Inv
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv

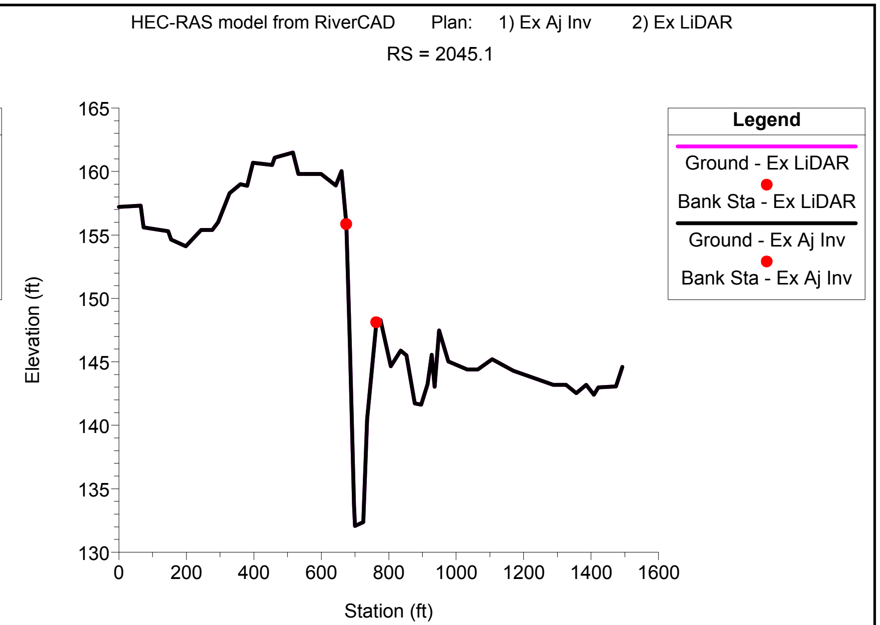


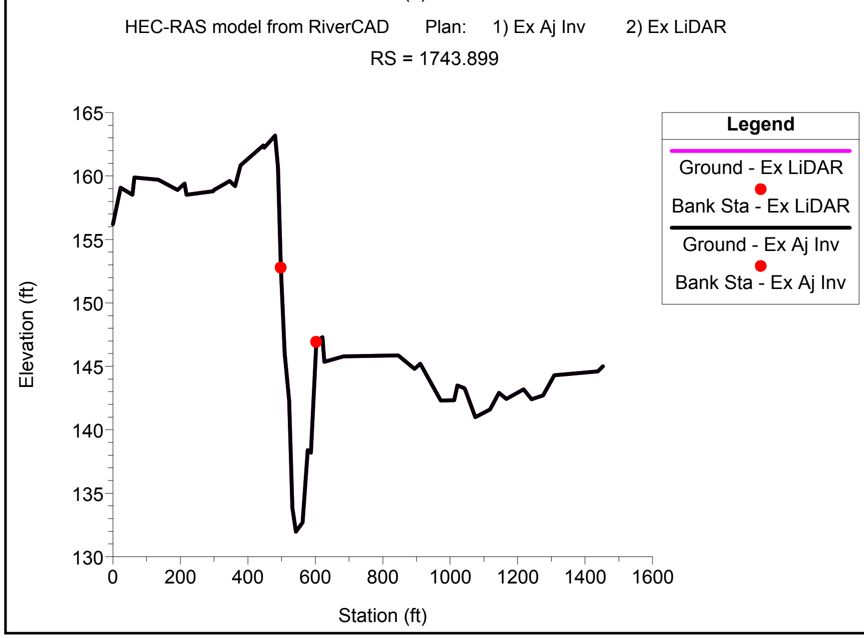
HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 72664
Elevation (ft)
Station (ft)
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv

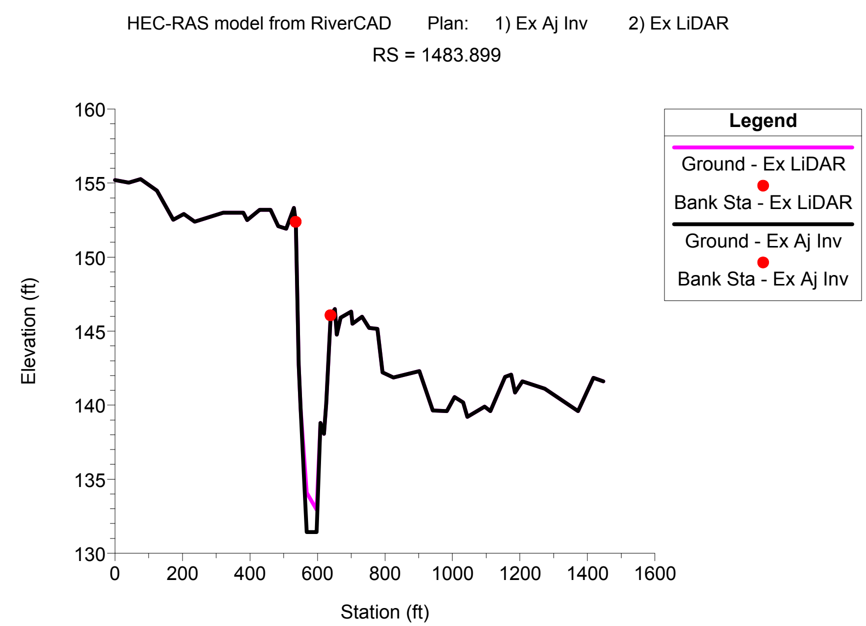


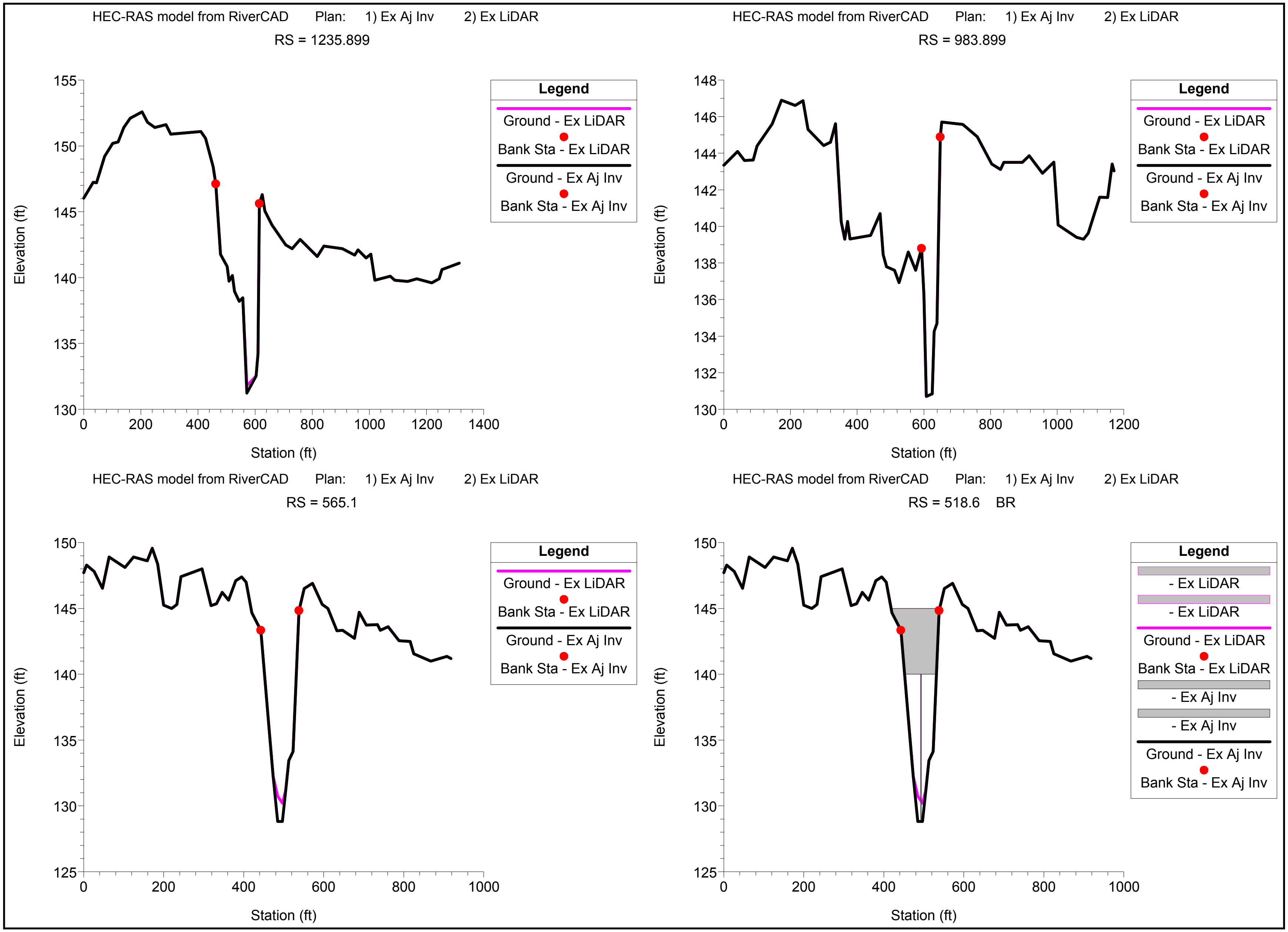
HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 72663.1
Elevation (ft)
Station (ft)
Legend
Ground - Ex LiDAR
Ineff - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Ineff - Ex Aj Inv
Bank Sta - Ex Aj Inv

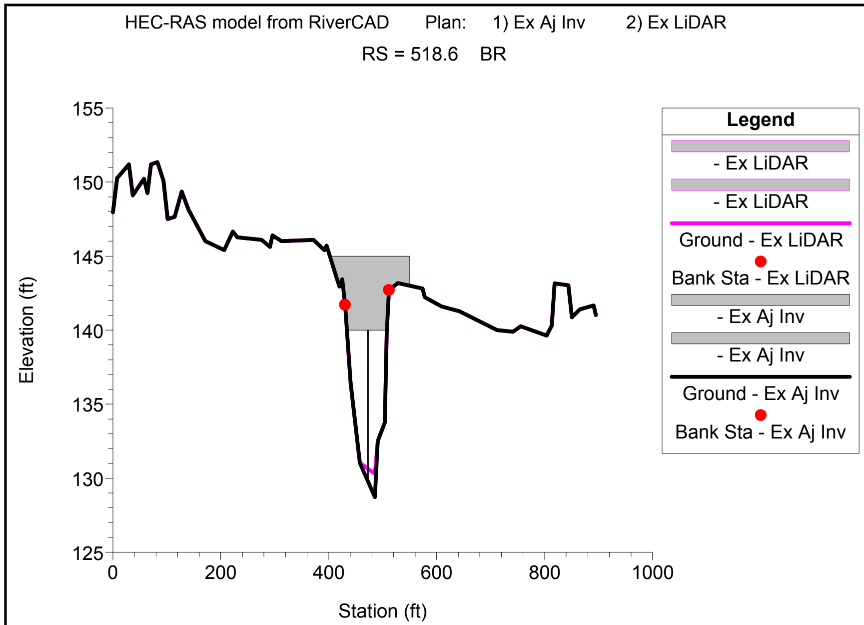

HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 72602.9
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
145
140
135
130
125
120
115
110
0 200 400 600 800 1000 1200 1400
Station (ft)

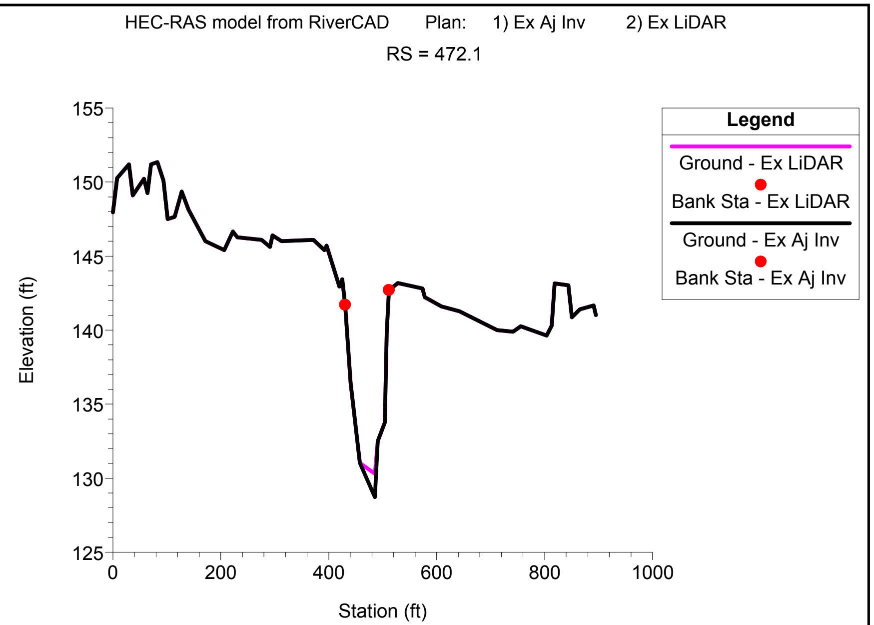

HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 2045.1
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
165
160
155
150
145
140
135
130
0 200 400 600 800 1000 1200 1400 1600
Station (ft)

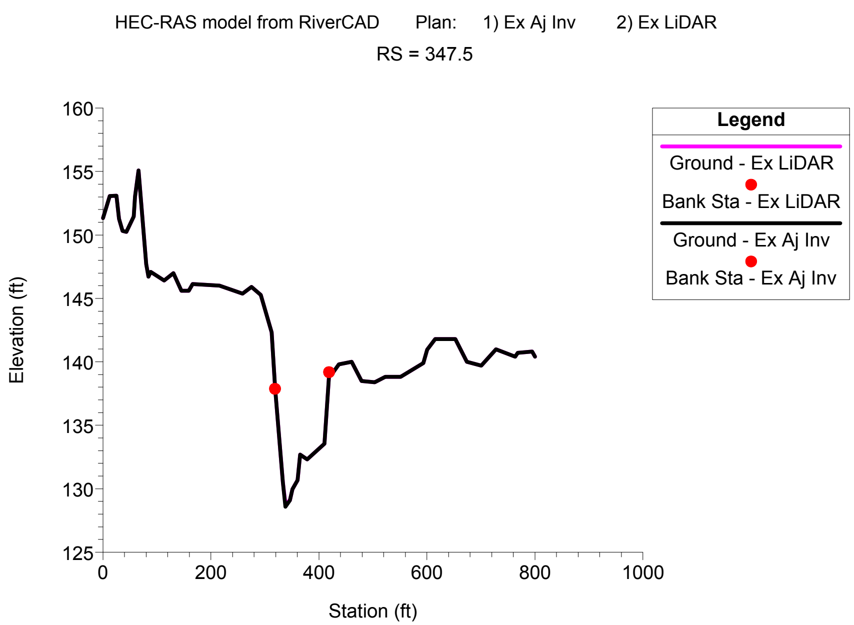

HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 1743.899
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
165
160
155
150
145
140
135
130
0 200 400 600 800 1000 1200 1400 1600
Station (ft)

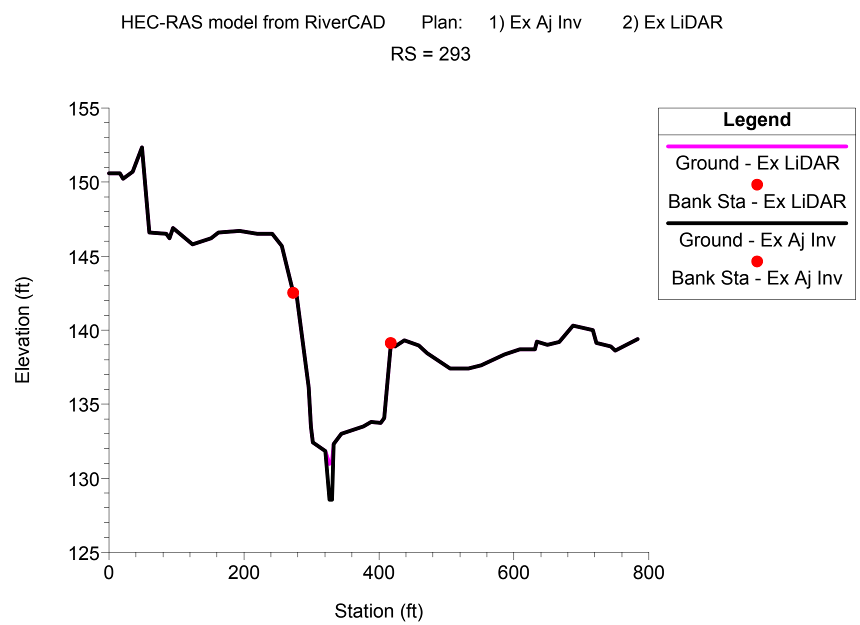

HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 1483.899
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
160
155
150
145
140
135
130
0 200 400 600 800 1000 1200 1400 1600
Station (ft)

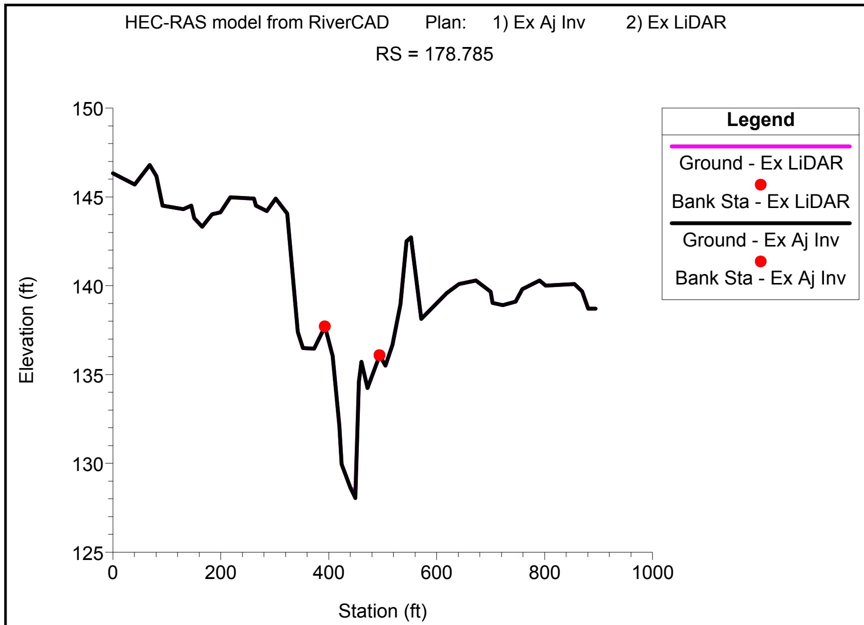

HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 1235.899
Elevation (ft)
Station (ft)
155
150
145
140
135
130
0
200
400
600
800
1000
1200
1400
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 983.899
Elevation (ft)
Station (ft)
148
146
144
142
140
138
136
134
132
130
0
200
400
600
800
1000
1200
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 565.1
Elevation (ft)
Station (ft)
150
145
140
135
130
125
0
200
400
600
800
1000
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 518.6 BR
Elevation (ft)
Station (ft)
150
145
140
135
130
125
0
200
400
600
800
1000
Legend
- Ex LiDAR
- Ex LiDAR
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
- Ex Aj Inv
- Ex Aj Inv
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv


HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 518.6 BR
Legend
- Ex LiDAR
- Ex LiDAR
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
- Ex Aj Inv
- Ex Aj Inv
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
Station (ft)
155
150
145
140
135
130
125
0
200
400
600
800
1000

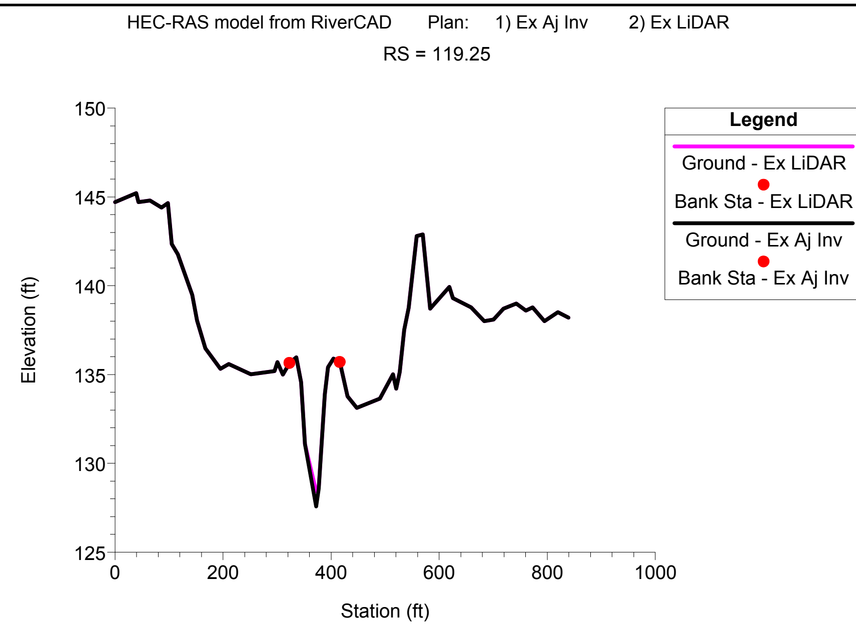

HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 472.1
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
Station (ft)
155
150
145
140
135
130
125
0
200
400
600
800
1000


HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 347.5
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
Station (ft)
160
155
150
145
140
135
130
125
0
200
400
600
800
1000

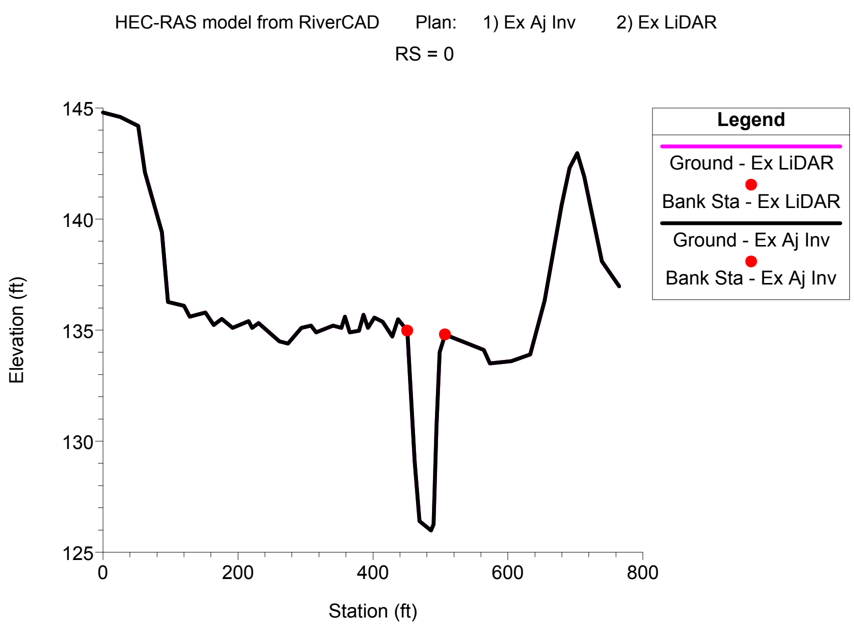

HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 293
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
Station (ft)
155
150
145
140
135
130
125
0
200
400
600
800



HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 178.785
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
150
145
140
135
130
125
0
200
400
600
800
1000
Station (ft)



HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 119.25
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
150
145
140
135
130
125
0
200
400
600
800
1000
Station (ft)

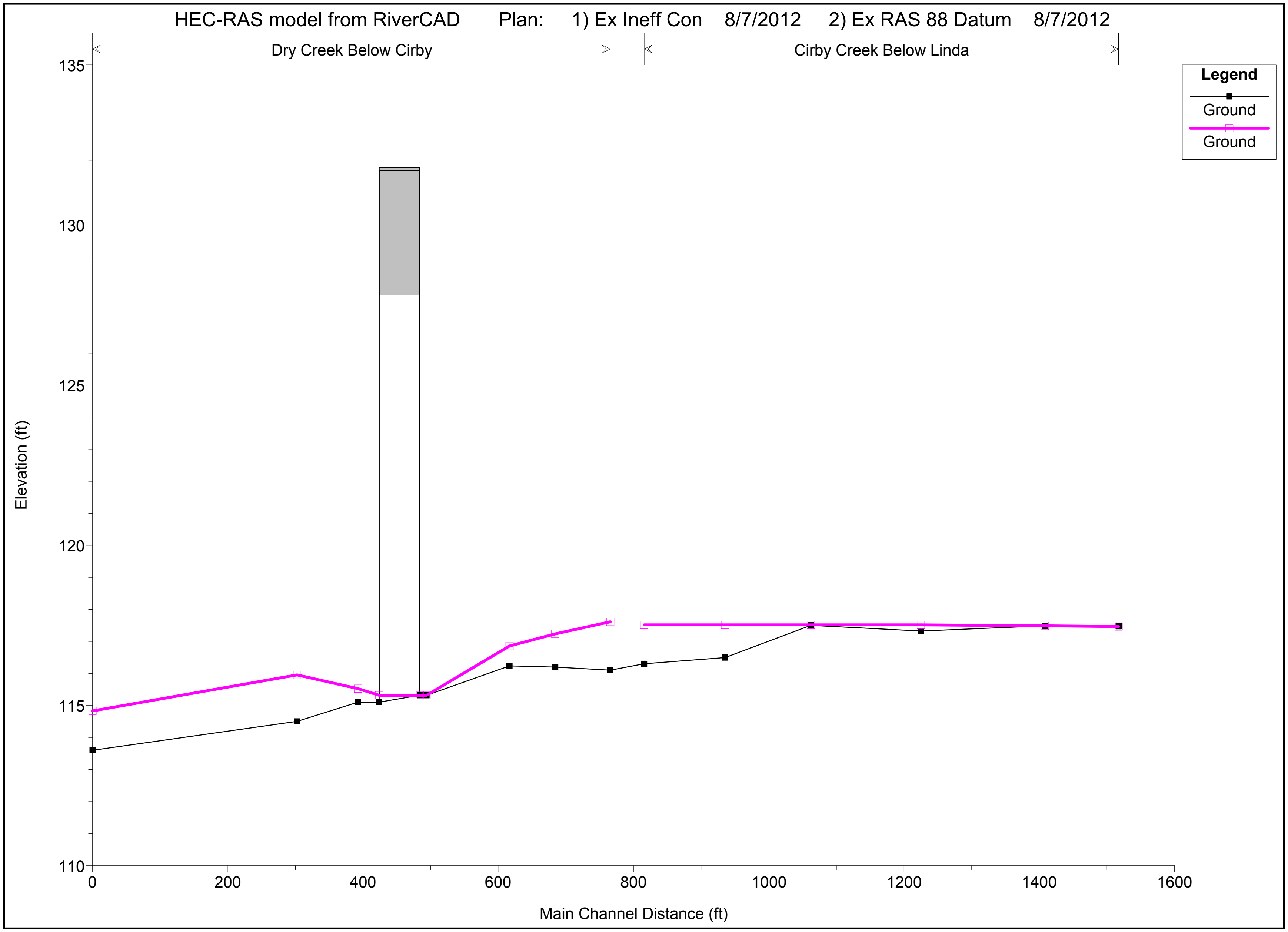


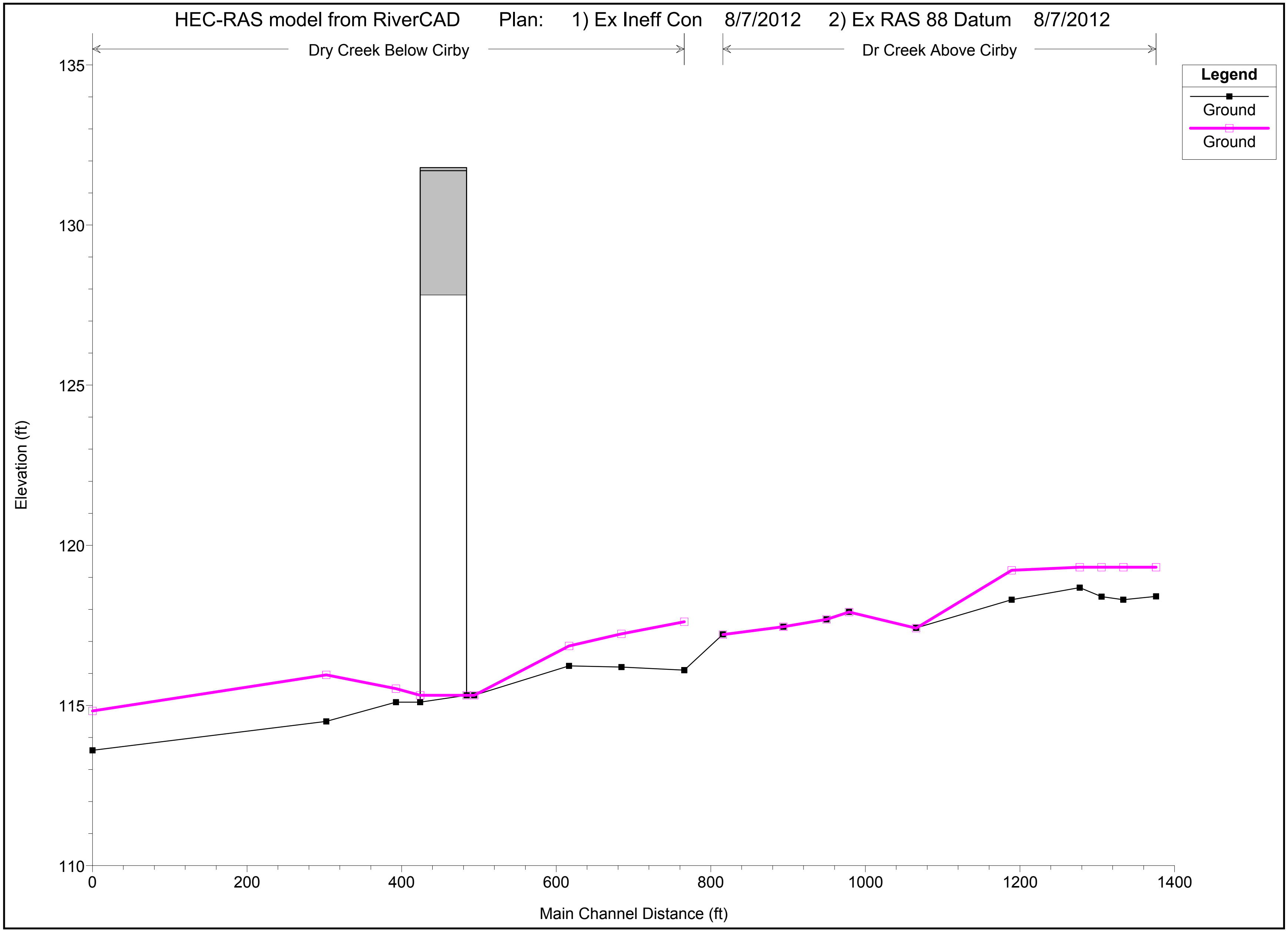
HEC-RAS model from RiverCAD Plan: 1) Ex Aj Inv 2) Ex LiDAR
RS = 0
Legend
Ground - Ex LiDAR
Bank Sta - Ex LiDAR
Ground - Ex Aj Inv
Bank Sta - Ex Aj Inv
Elevation (ft)
145
140
135
130
125
0
200
400
600
800
Station (ft)

APPENDIX D

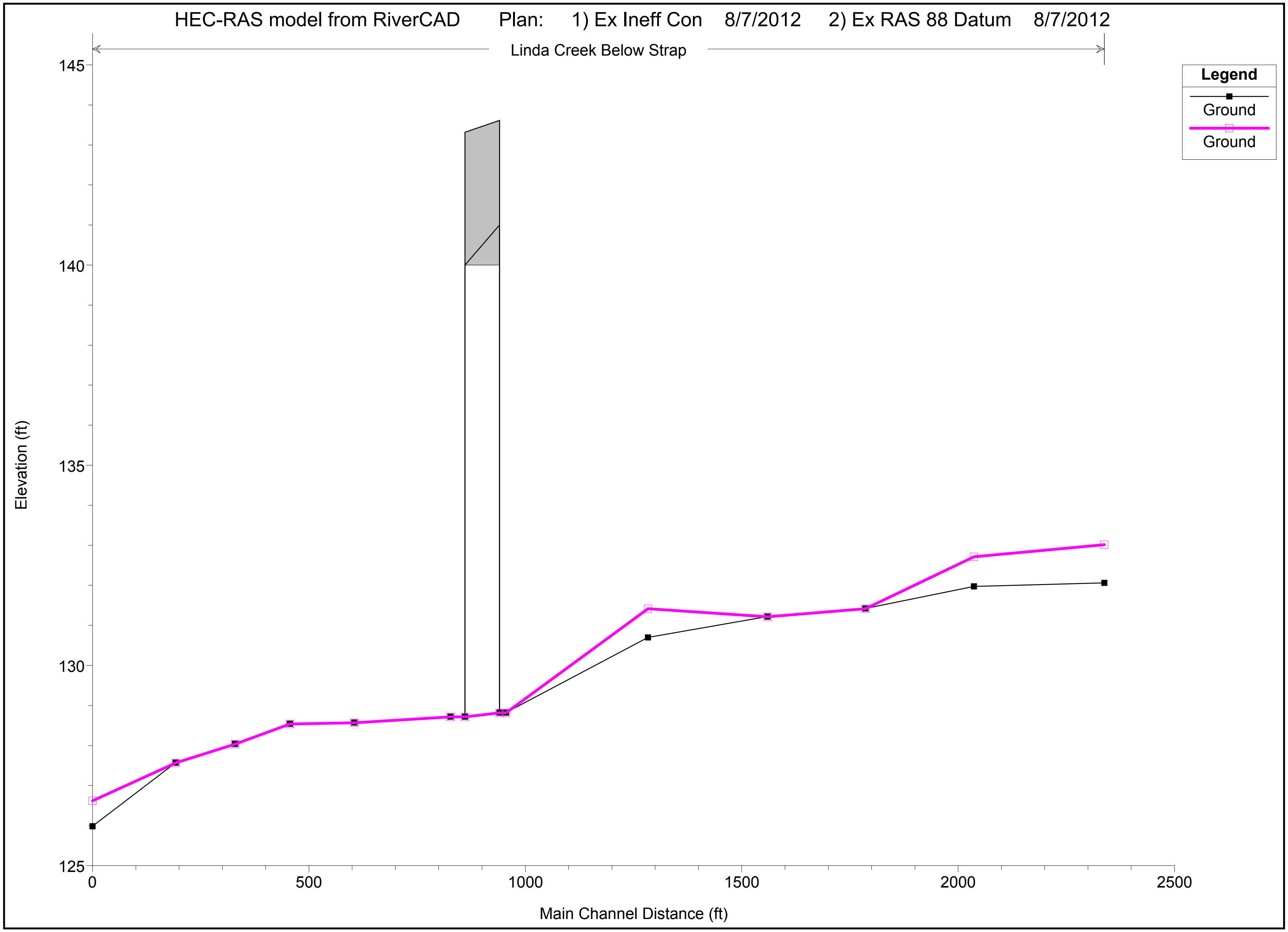
PROFILE COMPARISON

EXISTING HEC RAS/
EXISTING LIDAR ADJUST INVERTS


HEC-RAS model from RiverCAD Plan: 1) Ex Ineff Con 8/7/2012 2) Ex RAS 88 Datum 8/7/2012
Dry Creek Below Cirby
Cirby Creek Below Linda
Legend
Ground
Ground
Elevation (ft)
135
130
125
120
115
110
0
200
400
600
800
1000
1200
1400
1600
Main Channel Distance (ft)



HEC-RAS model from RiverCAD Plan: 1) Ex Ineff Con 8/7/2012 2) Ex RAS 88 Datum 8/7/2012
Dry Creek Below Cirby
Dr Creek Above Cirby
Legend
Ground
Ground
Elevation (ft)
135
130
125
120
115
110
0
200
400
600
800
1000
1200
1400
Main Channel Distance (ft)



HEC-RAS model from RiverCAD Plan: 1) Ex Ineff Con 8/7/2012 2) Ex RAS 88 Datum 8/7/2012
Linda Creek Below Strap
Legend
Ground
Ground
Elevation (ft)
145
140
135
130
125
0
500
1000
1500
2000
2500
Main Channel Distance (ft)

APPENDIX E

EXISTING UNSTEADY HEC-RAS RESULTS USED FOR STEADY STATE MODEL

River	Reach	River Sta	Max Q Plan	10-YR Max Q	10-YR Max Q WSE (88 datum)	10-YR Max Q WSE	Max WSE Plan	10-year Max WSE (88 datum)	10-year Max WSE	10 YR Max WSE Q	Max Q Plan	2-YR Max Q	2-yr Ex WSE 88	2-YR Max Q WSE (88 datum)	2-YR Max Q WSE	Max WSE Plan	2-yr Ex WSE 88	2-year Max WSE (88 datum)	2-year Max WSE	2 YR Max WSE Q
Cirby Creek	Below Linda	0	LC40L	1549.29	129.986	127.67	SE40M	130.696	128.38	1037.51	LC40L	537.96		126.216	123	AC5L		126.266	123.05	392.45
Cirby Creek	Below Linda	100	LC40L	1550.05	129.996	127.68	SE40M	130.696	128.38	1038.62	LC40L	538.63		126.226	123.01	AC5L		126.276	123.06	392.45
Cirby Creek	Below Linda	200	LC40L	1550.78	130.016	127.7	SE40M	130.706	128.39	1038.69	LC40L	538.85		126.236	123.02	AC5L		126.276	123.06	392.54
Cirby Creek	Below Linda	300	LC40L	1550.79	130.026	127.71	SE40M	130.706	128.39	1039.5	CC5G	553.48		126.016	122.8	AC5L		126.286	123.07	392.55
Cirby Creek	Below Linda	350	LC40L	1550.79	130.026	127.71	SE40M	130.706	128.39	1038.71	CC5G	553.42		126.026	122.81	AC5L		126.286	123.07	392.65
Cirby Creek	Below Linda	550	LC40L	1551.61	125.036	122.72	SE40M	130.716	128.4	1038.72	CC5G	553.63		126.036	122.82	AC5L		126.296	123.08	392.67
Cirby Creek	Below Linda	650	LC40L	1552.43	125.046	122.73	SE40M	130.716	128.4	1038.74	LC40L	553.64		126.046	122.83	AC5L		126.296	123.08	392.79
Dr Creek	Above Cirby	73112.9	SE40M	4552.63	130.456	128.14	Same				AC5L	1414.05		126.126	122.91	Same				
Dr Creek	Above Cirby	73167.6	SE40M	4551.16	130.476	128.16	Same				AC5L	1414.03		126.176	122.96	Same				
Dr Creek	Above Cirby	73200									N/A			3.216						
Dr Creek	Above Cirby	73222.4	SE40M	4561.8	130.646	128.33	Same				AC5L	1414.07		126.336	123.12	Same				
Dr Creek	Above Cirby	73277.2	SE40M	4561.83	130.716	128.4	Same				AC5L	1414.06		126.406	123.19	Same				
Dr Creek	Above Cirby	73345.3	SE40M	4563.21	130.776	128.46	Same				AC5L	1414.06		126.646	123.43	Same				
Dr Creek	Above Cirby	73481.3	SE40M	4550.12	130.436	128.12	Same				AC5L	1414.06		126.586	123.37	Same				
Dr Creek	Above Cirby	73565.3	SE40M	4585.88	131.076	128.76	Same				AC5L	1414.06		126.896	123.68	Same				
Dr Creek	Above Cirby	73586.6	SE40M	4596.99	131.606	129.29	Same				AC5L	1414.07		126.986	123.77	Same				
Dr Creek	Above Cirby	73616.6	SE40M	4597.93	131.696	129.38	Same				AC5L	1414.07		127.126	123.91	Same				
Dr Creek	Above Cirby	73656.6	SE40M	4595.97	131.906	129.59	Same				AC5L	1412.06		127.306	124.09	Same				
Dry Creek	Below Cirby	72602.9	SE40M	5579.14	128.996	126.68	SAME				AC5L	1805.9		125.476	122.26	SAME				
Dry Creek	Below Cirby	72663.1	SE40M	5581.02	129.136	126.82	SAME				AC5L	1805.97		125.656	122.44	SAME				
Dry Creek	Below Cirby	72664	SE40M	5593.11	129.706	127.39	SAME				AC5L	1806.28		125.986	122.77	SAME				
Dry Creek	Below Cirby	72702.6	SE40M		2.316		SAME				AC5L	1806.28		126.006	122.79	SAME				
Dry Creek	Below Cirby	72741.1	SE40M	5599.63	130.116	127.8	SAME				AC5L	1806.28		126.036	122.82	SAME				
Dry Creek	Below Cirby	72853.5	SE40M	5599.66	130.076	127.76	SAME				AC5L	1806.35		125.996	122.78	SAME				
Dry Creek	Below Cirby	72914.7	SE40M	5599.67	130.096	127.78	SAME				AC5L	1806.27		125.996	122.78	SAME				
Dry Creek	Below Cirby	72950	SE40M		2.316		SAME				AC5L					SAME				
Dry Creek	Below Cirby	72982	SE40M	5598.35	130.136	127.82	SAME				AC5L	1806.41		126.056	122.84	SAME				
Linda Creek	Below Strap	0	LC40L	1600.95	136.226	133.91	SAME				LC40L	502.45		133.916	130.7	SAME				
Linda Creek	Below Strap	62	LC40L	1601.46	136.406	134.09	SAME				LC40L	502.47		134.126	130.91	SAME				
Linda Creek	Below Strap	119.25	LC40L	1602	136.636	134.32	SAME				LC40L	502.48		134.356	131.14	SAME				
Linda Creek	Below Strap	178.785	LC40L	1602.26	136.906	134.59	SAME				LC40L	502.48		134.606	131.39	SAME				
Linda Creek	Below Strap	293	LC40L	1602.69	137.596	135.28	SAME				LC40L	502.49		135.156	131.94	SAME				
Linda Creek	Below Strap	347.5	LC40L	1602.73	137.966	135.65	SAME				LC40L	502.5		135.456	132.24	SAME				
Linda Creek	Below Strap	472.1	LC40L	1602.33	138.376	136.06	SAME				LC40L	502.21		135.996	132.78	SAME				
Linda Creek	Below Strap	518.6	CULVERT								CULVERT									
Linda Creek	Below Strap	565.1	LC40L	1602.39	139.876	137.56	SAME				LC40L	502.23		136.566	133.35	SAME				
Linda Creek	Below Strap	983.899	LC40L	1597.6	142.006	139.69	SAME				LC40L	499.06		138.916	135.7	SAME				
Linda Creek	Below Strap	1235.899	LC40L	1429.12	142.416	140.1	SAME				LC40L	372.29		139.496	136.28	SAME				
Linda Creek	Below Strap	1300	LC40L	1429.12	142.456	140.14	SAME				LC40L	372.29		139.526	136.31	SAME				
Linda Creek	Below Strap	1483.899	LC40L	1429.34	142.656	140.34	SAME				LC40L	372.3		139.566	136.35	SAME				
Linda Creek	Below Strap	1743.899	LC40L	1429.72	142.926	140.61	SAME				LC40L	372.3		139.756	136.54	SAME				
Linda Creek	Below Strap	2045.1	LC40L	1430.27	143.356	141.04	SAME				LC40L	372.4		140.076	136.86	SAME				

River	Reach	River Sta	Max Q Plan	200-YR Max Q	200-YR Max Q WSE (88 datum)	200-YR Max Q WSE	Max WSE Plan	200-year Max WSE (88 datum)	200-year Max WSE	200 YR Max WSE Q	Max Q Plan	100-YR Max Q	100-YR Max Q WSE (88 datum)	100-YR Max Q WSE	Max WSE Plan	100-year Max WSE (88 datum)	100-year Max WSE	100 YR Max WSE Q
Cirby Creek	Below Linda	0	CC5G	3613	135.016	132.7	SE40N	135.876	133.56	3107.34	LC40L	3142.82	134.436	132.12	SE40N	135.216	132.9	2626.07
Cirby Creek	Below Linda	100	CC5G	3613.22	135.016	132.7	SE40N	135.876	133.56	3107.12	LC40L	3141.43	134.446	132.13	SE40N	135.216	132.9	2626.92
Cirby Creek	Below Linda	200	CC5G	3612.1	135.026	132.71	SE40N	135.876	133.56	3106.88	LC40L	3144.36	134.456	132.14	SE40N	135.226	132.91	2626.97
Cirby Creek	Below Linda	300	CC5G	3612.14	135.046	132.73	SE40N	135.886	133.57	3107.14	LC40L	3148.78	134.466	132.15	SE40N	135.236	132.92	2627.01
Cirby Creek	Below Linda	350	CC5G	3612.19	135.046	132.73	SE40N	135.886	133.57	3107.15	LC40L	3147.3	134.466	132.15	SE40N	135.236	132.92	2627.63
Cirby Creek	Below Linda	550	CC5G	3658.42	135.056	132.74	SE40N	135.896	133.58	3107.19	LC40L	3148.84	134.476	132.16	SE40N	135.236	132.92	2627.66
Cirby Creek	Below Linda	650	CC5G	3658.44	135.066	132.75	SE40N	135.906	133.59	3107.21	LC40L	3151.9	134.486	132.17	SE40N	135.246	132.93	2627.67
Dr Creek	Above Cirby	73112.9	SE40M	7442.21	135.796	133.48	SE40N	135.806	133.49	7320.87	SE40M	7154.73	135.096	132.78	SE40N	135.146	132.83	7024.9
Dr Creek	Above Cirby	73167.6	SE40M	8225.02	135.786	133.47	SE40N	135.806	133.49	8019.6	SE40M	7724.61	135.096	132.78	SE40N	135.136	132.82	7608.81
Dr Creek	Above Cirby	73222.4	SE40M	9034.86	135.786	133.47	SE40N	135.806	133.49	8835.3	SE40M	7478.49	135.106	132.79	SE40N	135.146	132.83	8213.54
Dr Creek	Above Cirby	73277.2	SE40M	9034.12	135.806	133.49	SE40N	135.816	133.5	8835.35	SE40M	8316.62	135.126	132.81	SE40N	135.166	132.85	8213.56
Dr Creek	Above Cirby	73345.3	SE40M	9915.93	135.746	133.43	SE40N	135.756	133.44	9271.05	SE40M	8933.39	135.076	132.76	SE40N	135.126	132.81	8846.4
Dr Creek	Above Cirby	73481.3	SE40M	10655.17	135.646	133.33	SE40N	135.666	133.35	10467.92	SE40M	9880.54	134.426	132.11	SE40N	134.486	132.17	9834.16
Dr Creek	Above Cirby	73565.3	SE40M	11328.95	135.046	132.73	SE40N	135.096	132.78	11133.61	SE40M	10400.13	135.336	133.02	SE40N	135.356	133.04	10362.61
Dr Creek	Above Cirby	73586.6	SE40M	12122.39	136.146	133.83	SE40N	136.136	133.82	11962.6	SE40M	10401.38	135.566	133.25	SE40N	135.586	133.27	10364
Dr Creek	Above Cirby	73616.6	SE40M	12367.07	136.166	133.85	SE40N	136.146	133.83	12205.12	SE40M	10558.3	135.586	133.27	SE40N	135.606	133.29	10523.52
Dr Creek	Above Cirby	73656.6	SE40M	12593.04	136.266	133.95	SE40N	136.246	133.93	12430.74	SE40M	10698.73	135.696	133.38	SE40N	135.706	133.39	10664.97
Dry Creek	Below Cirby	72602.9	SE40N	15853.55	134.616	132.3	SAME				SE40N	13452.68	133.746	131.43	SAME			
Dry Creek	Below Cirby	72663.1	SE40N	15856.99	134.756	132.44	SAME				SE40N	13454.82	133.876	131.56	SAME			
Dry Creek	Below Cirby	72664	SE40N	9176.98	135.136	132.82	SAME				SE40N	8803.75	134.246	131.93	SAME			
Dry Creek	Below Cirby	72702.6	SE40N	9174.76	134.956	132.64	SAME				SE40N	8802.85	134.066	131.75	SAME			
Dry Creek	Below Cirby	72741.1	SE40N	9181.7	135.366	133.05	SAME				SE40N	8807.89	134.666	132.35	SAME			
Dry Creek	Below Cirby	72853.5	SE40N	9181.74	135.356	133.04	SAME				SE40N	8806.78	134.646	132.33	SAME			
Dry Creek	Below Cirby	72914.7	SE40N	9183.79	135.446	133.13	SAME				SE40N	8807.97	134.746	132.43	SAME			
Dry Creek	Below Cirby	72950	SE40N	9182.94	135.516	133.2	SAME				SE40N	8807.56	134.826	132.51	SAME			
Dry Creek	Below Cirby	72982	SE40N	9181.05	135.396	133.08	SAME				SE40N	8807.65	134.716	132.4	SAME			
Linda Creek	Below Strap	0	LC40L	2830.4	138.946	136.63	SAME				LC40L	2738.43	138.176	135.86	SAME			
Linda Creek	Below Strap	62	LC40L	2830.55	139.086	136.77	SAME				LC40L	2738.72	138.356	136.04	SAME			
Linda Creek	Below Strap	119.25	LC40L	2830.57	139.246	136.93	SAME				LC40L	2744.28	138.576	136.26	SAME			
Linda Creek	Below Strap	178.785	LC40L	2830.79	139.446	137.13	SAME				LC40L	2745.22	138.836	136.52	SAME			
Linda Creek	Below Strap	293	LC40L	2831.97	140.036	137.72	SAME				LC40L	2750.32	139.566	137.25	SAME			
Linda Creek	Below Strap	347.5	LC40L	2832.68	140.406	138.09	SAME				LC40L	2752.51	140.006	137.69	SAME			
Linda Creek	Below Strap	472.1	LC40L	2833.9	140.756	138.44	SAME				LC40L	2752.3	140.266	137.95	SAME			
Linda Creek	Below Strap	518.6	CULVERT								CULVERT							
Linda Creek	Below Strap	565.1	LC40L	2846.88	v	142.38	SAME				LC40L	2758.89	144.376	142.06	SAME			
Linda Creek	Below Strap	983.899	LC40L	3985.57	143.49	143.49	SAME				LC40L	3641.78	145.496	143.18	SAME			
Linda Creek	Below Strap	1235.899	LC40L	3796.15	143.84	143.84	SAME				LC40L	3463.34	145.556	143.24	SAME			
Linda Creek	Below Strap	1300	LC40L	3796.23	143.98	143.98	SAME				LC40L	3283.36	145.936	143.62	SAME			
Linda Creek	Below Strap	1483.899	LC40L	3796.26	144.15	144.15	SAME				LC40L	3284.03	146.086	143.77	SAME			
Linda Creek	Below Strap	1743.899	LC40L	3796.65	144.35	144.35	SAME				LC40L	3287.96	146.276	143.96	SAME			
Linda Creek	Below Strap	2045.1	LC40L	3975.02	144.87	144.87	SAME				LC40L	3365.79	146.776	144.46	SAME			

APPENDIX F

EXISTING MODELS COMPARISON

			Existing HEC-RAS Model (Unsteady)				Psomas Existing HEC RAS (Steady) 88 Datum					Difference = Unsteady-Steady				Psomas Existing Revised XS Geometry					Difference=Psomas Revised Geometry - Exist Ras 88				
River	Reach	River Sta	2-yr	10-yr	100-yr	200-yr	2-yr	10-yr	100-yr	200-yr	150%100yr	2-yr	10-yr	100-yr	200-yr	2-yr	10-yr	100-yr	200-yr	150%100yr	2-yr	10-yr	100-yr	200-yr	150%100yr
Cirby Creek	Below Linda	0	126.266	130.696	135.216	135.876	126.06	130.44	135.14	135.74	136.27	0.206	0.256	0.076	0.136	125.91	130.48	134.83	135.18	135.9	-0.15	0.04	-0.31	-0.56	-0.37
Cirby Creek	Below Linda	100	126.276	130.696	135.216	135.876	126.06	130.44	135.15	135.75	136.28	0.216	0.256	0.066	0.126	125.92	130.49	134.83	135.19	135.92	-0.14	0.05	-0.32	-0.56	-0.36
Cirby Creek	Below Linda	200	126.276	130.706	135.226	135.876	126.07	130.45	135.15	135.76	136.3	0.206	0.256	0.076	0.116	125.93	130.49	134.84	135.2	135.94	-0.14	0.04	-0.31	-0.56	-0.36
Cirby Creek	Below Linda	350	126.286	130.706	135.236	135.886	126.08	130.46	135.16	135.77	136.33	0.206	0.246	0.076	0.116	126.01	130.52	134.88	135.25	136.02	-0.07	0.06	-0.28	-0.52	-0.31
Cirby Creek	Below Linda	550	126.296	130.716	135.236	135.896	126.08	130.46	135.17	135.77	136.34	0.216	0.256	0.066	0.126	126.05	130.53	134.89	135.26	136.05	-0.03	0.07	-0.28	-0.51	-0.29
Cirby Creek	Below Linda	650	126.296	130.716	135.246	135.906	126.08	130.47	135.18	135.78	136.35	0.216	0.246	0.066	0.126	125.81	130.21	134.74	135.11	135.78	-0.27	-0.26	-0.44	-0.67	-0.57
Dr Creek	Above Cirby	73112.9	126.126	130.456	135.146	135.806	125.91	130.13	135.08	135.69	136.18	0.216	0.326	0.066	0.116	125.89	130.3	134.76	135.13	135.82	-0.02	0.17	-0.32	-0.56	-0.36
Dr Creek	Above Cirby	73167.6	126.176	130.476	135.136	135.806	126.02	130.27	135.1	135.71	136.22	0.156	0.206	0.036	0.096	125.92	130.38	134.78	135.13	135.86	-0.1	0.11	-0.32	-0.58	-0.36
Dr Creek	Above Cirby	73222.4	126.336	130.646	135.146	135.806	126.16	130.55	135.12	135.72	136.27	0.176	0.096	0.026	0.086	126.14	130.76	134.85	135.21	135.9	-0.02	0.21	-0.27	-0.51	-0.37
Dr Creek	Above Cirby	73277.2	126.406	130.716	135.166	135.816	126.19	130.6	135.13	135.73	136.26	0.216	0.116	0.036	0.086	126.29	130.8	134.79	135.15	135.83	0.1	0.2	-0.34	-0.58	-0.43
Dr Creek	Above Cirby	73345.3	126.646	130.776	135.126	135.756	126.3	130.69	135.14	135.74	136.27	0.346	0.086	-0.014	0.016	126.44	131.15	134.99	135.32	136.09	0.14	0.46	-0.15	-0.42	-0.18
Dr Creek	Above Cirby	73481.3	126.586	130.436	134.486	135.666	126.31	130.4	134.68	135.4	135.66	0.276	0.036	-0.194	0.266	126.67	131.66	135.22	135.46	136.41	0.36	1.26	0.54	0.06	0.75
Dr Creek	Above Cirby	73565.3	126.896	131.076	135.356	135.096	126.56	131.07	135.57	136.04	136.89	0.336	0.006	-0.214	-0.944	126.71	131.7	135.25	135.49	136.45	0.15	0.63	-0.32	-0.55	-0.44
Dr Creek	Above Cirby	73586.6	126.986	131.606	135.586	136.136	126.67	131.74	135.86	136.26	137.27	0.316	-0.134	-0.274	-0.124	126.78	131.84	135.28	135.53	136.51	0.11	0.1	-0.58	-0.73	-0.76
Dr Creek	Above Cirby	73616.6	127.126	131.696	135.606	136.146	126.77	131.82	135.88	136.28	137.29	0.356	-0.124	-0.274	-0.134	125.5	129	133.75	134.16	131.51	-1.27	-2.82	-2.13	-2.12	-5.78
Dr Creek	Above Cirby	73656.6	127.306	131.906	135.706	136.246	126.92	132.03	135.96	136.36	137.39	0.386	-0.124	-0.254	-0.114	125.6	129.16	133.91	134.37	132.3	-1.32	-2.87	-2.05	-1.99	-5.09
Dry Creek	Below Cirby	72602.9	125.476	128.996	133.746	134.616	125.5	129	133.75	134.16	132.51	-0.024	-0.004	-0.004	0.456	125.66	129.34	134.03	134.55	133.23	0.16	0.34	0.28	0.39	0.72
Dry Creek	Below Cirby	72663.1	125.656	129.136	133.876	134.756	125.73	129.29	133.98	134.45	133.34	-0.074	-0.154	-0.104	0.306	125.69	129.7	134.27	134.69	134.99	-0.04	0.41	0.29	0.24	1.65
Dry Creek	Below Cirby	72664	125.986	129.706	134.246	135.136	125.82	129.54	134.17	134.7	134.01	0.166	0.166	0.076	0.436	125.67	129.6	134.16	134.59	134.77	-0.15	0.06	-0.01	-0.11	0.76
Dry Creek	Below Cirby	72853.5	125.996	130.076	134.646	135.356	125.85	129.75	134.6	135.24	135.24	0.146	0.326	0.046	0.116	133.92	136.23	138.18	138.95	138.95	8.07	6.48	3.58	3.71	3.71
Dry Creek	Below Cirby	72914.7	125.996	130.096	134.746	135.446	125.84	129.76	134.71	135.35	135.49	0.156	0.336	0.036	0.096	134.17	136.54	138.32	139.03	139.12	8.33	6.78	3.61	3.68	3.63
Dry Creek	Below Cirby	72982	126.056	130.136	134.716	135.396	125.87	129.85	134.91	135.53	135.89	0.186	0.286	-0.194	-0.134	134.99	137.57	139.09	139.56	140.09	9.12	7.72	4.18	4.03	4.2
Linda Creek	Below Strap	0	133.916	136.226	138.176	138.946	133.92	136.23	138.18	138.95	138.95	-0.004	-0.004	-0.004	-0.004	135.29	137.91	139.5	139.81	140.42	1.37	1.68	1.32	0.86	1.47
Linda Creek	Below Strap	119.25	134.356	136.636	138.576	139.246	134.14	136.63	138.57	139.25	139.56	0.216	0.006	0.006	-0.004	135.75	138.76	141.26	141.54	143.74	1.61	2.13	2.69	2.29	4.18
Linda Creek	Below Strap	178.785	134.606	136.906	138.836	139.446	134.35	137.02	138.98	139.56	140.13	0.256	-0.114	-0.144	-0.114	136.18	139.47	141.99	142.34	144.45	1.83	2.45	3.01	2.78	4.32
Linda Creek	Below Strap	293	135.156	137.596	139.566	140.036	134.59	137.45	139.42	139.91	140.68	0.566	0.146	0.146	0.126	137.03	140.73	142.87	143.5	144.92	2.44	3.28	3.45	3.59	4.24
Linda Creek	Below Strap	347.5	135.456	137.966	140.006	140.406	134.95	138.07	140.14	140.54	141.62	0.506	-0.104	-0.134	-0.134	137.29	141.3	143.96	144.58	145.96	2.34	3.23	3.82	4.04	4.34
Linda Creek	Below Strap	472.1	135.996	138.376	140.266	140.756	135.52	138.76	140.94	141.26	142.61	0.476	-0.384	-0.674	-0.504	137.6	141.86	145.03	145.72	146.98	2.08	3.1	4.09	4.46	4.37
Linda Creek	Below Strap	518.6														138.1	142.65	146.45	147.22	147.26	138.1	142.65	146.45	147.22	147.26
Linda Creek	Below Strap	565.1	136.566	139.876	144.376		135.71	138.89	141.65	142.03	144.45	0.856	0.986	2.726	-142.03	135.75	138.76	141.26	141.54	143.74	0.04	-0.13	-0.39	-0.49	-0.71
Linda Creek	Below Strap	983.899	138.916	142.006	145.496	143.49	136.22	140.08	142.98	143.47	145.82	2.696	1.926	2.516	0.02	136.18	139.47	141.99	142.34	144.45	-0.04	-0.61	-0.99	-1.13	-1.37
Linda Creek	Below Strap	1235.899	139.496	142.416	145.556	143.84	137.47	140.99	143.55	144.19	146.1	2.026	1.426	2.006	-0.35	137.03	140.73	142.87	143.5	144.92	-0.44	-0.26	-0.68	-0.69	-1.18
Linda Creek	Below Strap	1483.899	139.566	142.656	146.086	144.15	137.66	141.36	144.17	144.78	146.51	1.906	1.296	1.916	-0.63	137.29	141.3	143.96	144.58	145.96	-0.37	-0.06	-0.21	-0.2	-0.55
Linda Creek	Below Strap	1743.899	139.756	142.926	146.276	144.35	137.96	141.84	145.15	145.74	147.25	1.796	1.086	1.126	-1.39	137.6	141.86	145.03	145.72	146.98	-0.36	0.02	-0.12	-0.02	-0.27
Linda Creek	Below Strap	2045.1	140.076	143.356	146.776	144.87	138.5	142.48	146.08	146.68	148.02	1.576	0.876	0.696	-1.81	138.1	142.65	146.45	147.22	147.26	-0.4	0.17	0.37	0.54	-0.76

APPENDIX G

100-YR BRIDGE SUMMARY

BRIDGE #2																
	SECTION	EFFECT ON 2 YR WSE			EFFECT ON 10 YR WSE			EFFECT ON 100 YR WSE			EFFECT ON 200 YR WSE			EFFECT ON 150% YR WSE		
DGE CRITERIA		EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA
SOFFIT AT 100 YR WSE (SPAN =80FT)	73167.6	125.89	125.89	0	130.3	130.25	-0.05	134.76	134.68	-0.08	135.13	135.05	-0.08	135.82	135.67	-0.15
	73222.4	125.92	125.92	0	130.38	130.35	-0.03	134.78	134.72	-0.06	135.13	135.08	-0.05	135.86	135.71	-0.15
	73277.2	126.06	126.06	0	130.7	130.79	0.09	134.83	134.98	0.15	135.19	135.35	0.16	135.88	136.03	0.15
	73345.3	126.14	126.14	0	130.76	130.85	0.09	134.85	135	0.15	135.21	135.37	0.16	135.9	136.06	0.16
	73481.3	126.29	126.29	0	130.8	130.88	0.08	134.79	134.94	0.15	135.15	135.32	0.17	135.83	135.99	0.16
	73565.3	126.44	126.44	0	131.15	131.23	0.08	134.99	135.12	0.13	135.32	135.48	0.16	136.09	136.23	0.14

BRIDGE #3																
	SECTION	EFFECT ON 2 YR WSE			EFFECT ON 10 YR WSE			EFFECT ON 100 YR WSE			EFFECT ON 200 YR WSE			EFFECT ON 150% YR WSE		
DGE CRITERIA		EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA
SOFFIT AT 100 YR WSE (SPAN =160FT)	72982	125.85	125.85	0	130.27	130.28	0.01	134.66	134.67	0.01	135.03	135.04	0.01	135.63	135.65	0.02
	0	125.91	125.91	0	130.48	130.48	0	134.83	134.83	0	135.18	135.19	0.01	135.9	135.91	0.01
	100	125.92	125.93	0.01	130.49	130.49	0	134.83	134.84	0.01	135.19	135.2	0.01	135.92	135.93	0.01
	200	125.93	125.94	0.01	130.49	130.5	0.01	134.84	134.85	0.01	135.2	135.21	0.01	135.94	135.95	0.01
	73112.9	125.81	125.81	0	130.21	130.22	0.01	134.74	134.75	0.01	135.11	135.12	0.01	135.78	135.8	0.02
	73167.6	125.89	125.9	0.01	130.3	130.3	0	134.76	134.77	0.01	135.13	135.14	0.01	135.82	135.83	0.01

BRIDGE #4																
	SECTION	EFFECT ON 2 YR WSE			EFFECT ON 10 YR WSE			EFFECT ON 100 YR WSE			EFFECT ON 200 YR WSE			EFFECT ON 150% YR WSE		
DGE CRITERIA		EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA
SOFFIT AT 100 YR WSE (SPAN =123FT)	0	125.91	125.91	0	130.48	130.48	0	134.83	134.82	-0.01	135.18	135.17	-0.01	135.9	135.88	-0.02
	100	125.92	125.92	0	130.49	130.49	0	134.83	134.83	0	135.19	135.19	0	135.92	135.9	-0.02
	200	125.93	125.93	0	130.49	130.49	0	134.84	134.85	0.01	135.2	135.21	0.01	135.94	135.94	0
	350	125.95	125.95	0	130.5	130.5	0	134.86	134.85	-0.01	135.22	135.22	0	135.98	135.96	-0.02
	550	126.01	126	-0.01	130.52	130.52	0	134.88	134.88	0	135.25	135.25	0	136.02	136.03	0.01
	650	126.05	126.04	-0.01	130.53	130.54	0.01	134.89	134.92	0.03	135.26	135.3	0.04	136.05	136.13	0.08

BRIDGE #14																
	SECTION	EFFECT ON 2 YR WSE			EFFECT ON 10 YR WSE			EFFECT ON 100 YR WSE			EFFECT ON 200 YR WSE			EFFECT ON 150% YR WSE		
DGE CRITERIA		EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA
SOFFIT AT 100 YR WSE (SPAN =80FT)	565.1	135.75	135.76	0.01	138.76	138.76	0	141.26	141.29	0.03	141.54	141.68	0.14	143.74	144.03	0.29
	983.899	136.18	136.18	0	139.47	139.48	0.01	141.99	142.01	0.02	142.34	142.44	0.1	144.45	144.68	0.23
	1235.899	137.03	137.04	0.01	140.73	140.62	-0.11	142.87	142.78	-0.09	143.5	143.46	-0.04	144.92	144.95	0.03
	1483.899	137.29	137.29	0	141.3	141.2	-0.1	143.96	144.05	0.09	144.58	144.78	0.2	145.96	146.38	0.42
	1743.899	137.6	137.6	0	141.86	141.78	-0.08	145.03	145.09	0.06	145.72	145.85	0.13	146.98	147.47	0.49
	2045.1	138.1	138.1	0	142.65	142.6	-0.05	146.45	146.49	0.04	147.22	147.31	0.09	147.26	148.96	1.7

APPENDIX H

200-YEAR BRIDGE SUMMARY

BRIDGE #2																
	SECTION	EFFECT ON 2 YR WSE			EFFECT ON 10 YR WSE			EFFECT ON 100 YR WSE			EFFECT ON 200 YR WSE			EFFECT ON 150% YR WSE		
DGE CRITERIA		EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA
SOFFIT AT 200 YR WSE (SPAN =80FT)	73167.6	125.89	125.89	0	130.3	130.24	-0.06	134.76	134.64	-0.12	135.13	135.01	-0.12	135.82	135.59	-0.23
	73222.4	125.92	125.92	0	130.38	130.33	-0.05	134.78	134.68	-0.1	135.13	135.04	-0.09	135.86	135.63	-0.23
	73277.2	126.06	126.06	0	130.7	130.82	0.12	134.83	135.06	0.23	135.19	135.43	0.24	135.88	136.13	0.25
	73345.3	126.14	126.14	0	130.76	130.88	0.12	134.85	135.07	0.22	135.21	135.45	0.24	135.9	136.16	0.26
	73481.3	126.29	126.29	0	130.8	130.91	0.11	134.79	135.02	0.23	135.15	135.4	0.25	135.83	136.09	0.26
	73565.3	126.44	126.44	0	131.15	131.25	0.1	134.99	135.19	0.2	135.32	135.55	0.23	136.09	136.32	0.23

BRIDGE #3																
	SECTION	EFFECT ON 2 YR WSE			EFFECT ON 10 YR WSE			EFFECT ON 100 YR WSE			EFFECT ON 200 YR WSE			EFFECT ON 150% YR WSE		
DGE CRITERIA		EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA
SOFFIT AT 200 YR WSE (SPAN =160FT)	72982	125.85	125.85	0	130.27	130.28	0.01	134.66	134.67	0.01	135.03	135.04	0.01	135.63	135.65	0.02
	0	125.91	125.91	0	130.48	130.48	0	134.83	134.83	0	135.18	135.19	0.01	135.9	135.92	0.02
	100	125.92	125.93	0.01	130.49	130.49	0	134.83	134.84	0.01	135.19	135.2	0.01	135.92	135.94	0.02
	200	125.93	125.94	0.01	130.49	130.5	0.01	134.84	134.85	0.01	135.2	135.21	0.01	135.94	135.96	0.02
	73112.9	125.81	125.81	0	130.21	130.22	0.01	134.74	134.75	0.01	135.11	135.12	0.01	135.78	135.8	0.02
	73167.6	125.89	125.9	0.01	130.3	130.3	0	134.76	134.77	0.01	135.13	135.14	0.01	135.82	135.84	0.02

BRIDGE #4																
	SECTION	EFFECT ON 2 YR WSE			EFFECT ON 10 YR WSE			EFFECT ON 100 YR WSE			EFFECT ON 200 YR WSE			EFFECT ON 150% YR WSE		
DGE CRITERIA		EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA
SOFFIT AT 200 YR WSE (SPAN =123FT)	0	125.91	125.91	0	130.48	130.48	0	134.83	134.82	-0.01	135.18	135.17	-0.01	135.9	135.88	-0.02
	100	125.92	125.92	0	130.49	130.49	0	134.83	134.83	0	135.19	135.19	0	135.92	135.9	-0.02
	200	125.93	125.93	0	130.49	130.49	0	134.84	134.85	0.01	135.2	135.21	0.01	135.94	135.94	0
	350	125.95	125.95	0	130.5	130.5	0	134.86	134.85	-0.01	135.22	135.22	0	135.98	135.96	-0.02
	550	126.01	126	-0.01	130.52	130.52	0	134.88	134.88	0	135.25	135.25	0	136.02	136.03	0.01
	650	126.05	126.04	-0.01	130.53	130.54	0.01	134.89	134.92	0.03	135.26	135.3	0.04	136.05	136.13	0.08

BRIDGE #14																
	SECTION	EFFECT ON 2 YR WSE			EFFECT ON 10 YR WSE			EFFECT ON 100 YR WSE			EFFECT ON 200 YR WSE			EFFECT ON 150% YR WSE		
DGE CRITERIA		EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA
SOFFIT AT 200 YR WSE (SPAN =80FT)	565.1	135.75	135.76	0.01	138.76	138.78	0.02	141.26	141.31	0.05	141.54	141.62	0.08	143.74	143.88	0.14
	983.899	136.18	136.19	0.01	139.47	139.49	0.02	141.99	142.03	0.04	142.34	142.4	0.06	144.45	144.56	0.11
	1235.899	137.03	137.04	0.01	140.73	140.62	-0.11	142.87	142.78	-0.09	143.5	143.44	-0.06	144.92	144.83	-0.09
	1483.899	137.29	137.29	0	141.3	141.2	-0.1	143.96	144.1	0.14	144.58	144.83	0.25	145.96	146.38	0.42
	1743.899	137.6	137.6	0	141.86	141.78	-0.08	145.03	145.12	0.09	145.72	145.88	0.16	146.98	147.48	0.5
	2045.1	138.1	138.1	0	142.65	142.6	-0.05	146.45	146.51	0.06	147.22	147.32	0.1	147.26	148.41	1.15

APPENDIX I

10-YEAR BRIDGE 13 SUMMARY

BRIDGE #13 (10-year soffit)																
	SECTION	EFFECT ON 2 YR WSE			EFFECT ON 10 YR WSE			EFFECT ON 100 YR WSE			EFFECT ON 200 YR WSE			EFFECT ON 150% YR WSE		
DGE CRITERIA		EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA
SOFFIT AT 10 YR WSE (SPAN =80FT)	0	133.92	133.92	0	136.23	136.23	0	138.18	138.18	0	138.95	138.95	0	138.95	138.95	0
	119.25	134.17	134.2	0.03	136.56	136.57	0.01	138.36	138.41	0.05	139.06	139.09	0.03	139.19	139.24	0.05
	178.785	134.54	134.57	0.03	136.92	136.94	0.02	138.47	138.54	0.07	139.11	139.17	0.06	139.28	139.39	0.11
	293	134.99	135	0.01	137.57	137.57	0	139.09	139.15	0.06	139.56	139.61	0.05	140.09	140.18	0.09
	347.5	135.29	135.3	0.01	137.91	137.91	0	139.5	139.55	0.05	139.81	139.94	0.13	140.42	140.7	0.28
	472.1	135.56	135.57	0.01	138.37	138.38	0.01	140.11	140.14	0.03	140.32	140.48	0.16	141.14	141.48	0.34

APPENDIX J

BRIDGE 2 AND 14 REVISIONS ADDENDUM

TECHNICAL MEMORANDUM ADDENDUM

To: Mike Dour

From: Tim Hayes, P.E.

Date: February 6, 2013

Subject: Dry Creek Greenway Multi-use Trail– Preliminary Hydraulics (Segments 1 and 5)

INTRODUCTION

This addendum to the Preliminary Hydraulics Technical Memorandum, dated September 5, 2012 will address the changes to the bridge design, hydraulic modeling and the resulting changes to the increases in water surface elevation that occurred since the date of that memorandum. The memorandum, September 5, 2012, was a revision to a memorandum originally submitted to Civil Solutions for review. In general, the comments from Civil Solutions and subsequent comments received from the City were related to discrepancies between models with regards to ineffective flow areas and bridge modeling. Those discrepancies were corrected and the results modified as part of this technical memorandum addendum, dated February 6, 2013, and revisions to the original technical memorandum, dated September 5, 2012.

The original hydraulic model had numerous geometry files reflecting potential bridge designs for various amounts of freeboard during various storm events. The proposed design changes and changes to the hydraulic model were made to meet the freeboard requirements for the 200-year storm event bridge designs.

CHANGES TO DESIGN/HYDRAULIC ANALYSIS

Bridge low chord (soffit) elevations have been designed to be three feet above the water surface elevation during the 200-year storm event and result in no water surface elevation increases greater than 0.10 feet during the 100-year storm event. In the previous memorandum, Bridges 2 and 14 showed increases greater than the allowable threshold. The proposed design has been modified such that the increases are now below the allowable limit.

Bridge 2 was modified by realigning the path to the north after crossing the incised portion of Dry Creek. This design change reduced the total blocked flow area caused by the fill slopes, allowing a larger conveyance area in the overbank.

Bridge 14 was modified by using retaining walls instead of fill slopes along the western side of Dry Creek. This reduced the total ineffective area along the downstream side of the bridge. Additionally, ineffective flow was applied to the upstream cross section to account for the revised fill slope.

RESULTS

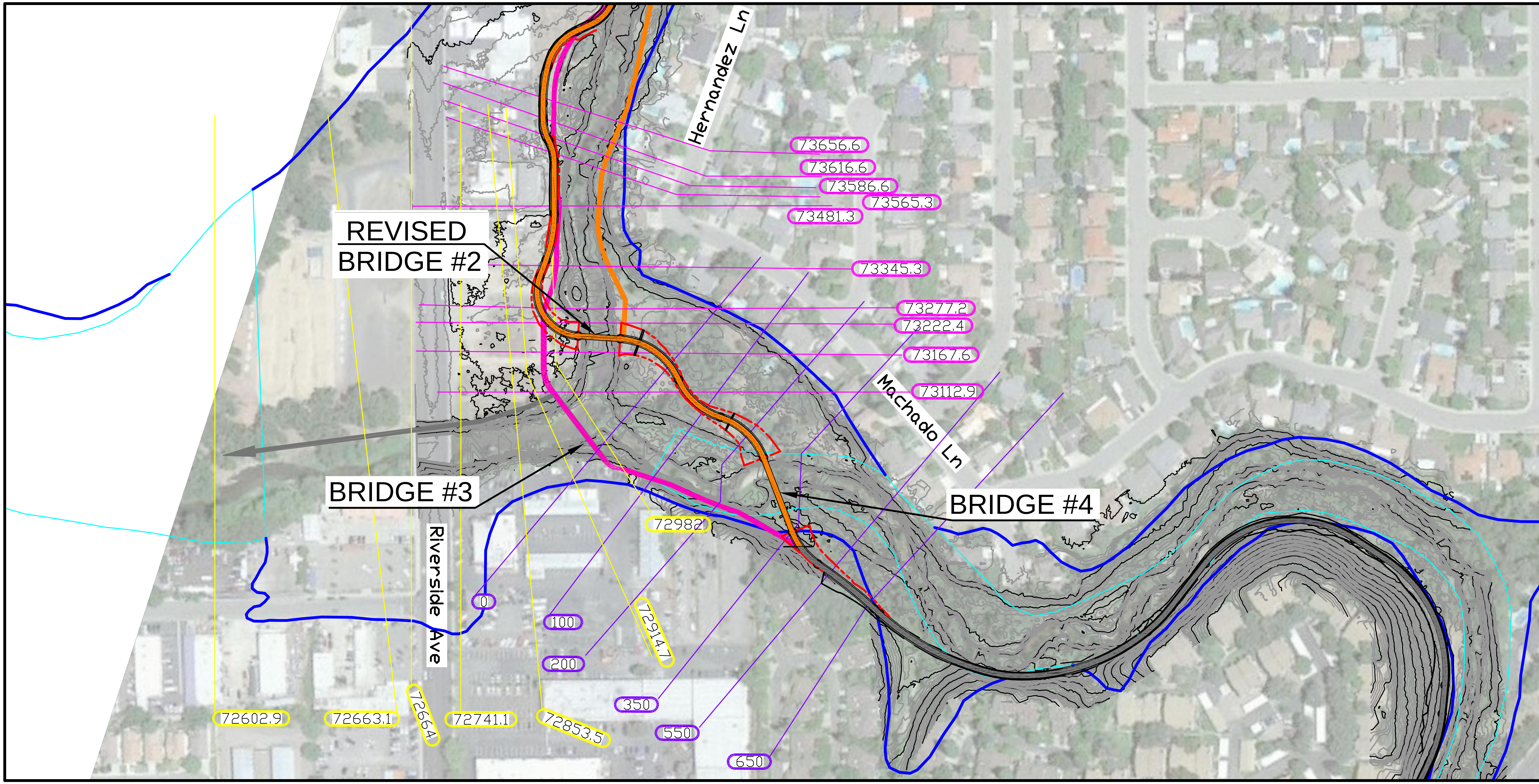
The changes to the design resulted in a lowering of the increases in water surface elevation to less than 0.10 feet, which is the maximum allowable change. Table 1 summarizes the changes in water surface elevations from the revised analysis.

SUMMARY AND CONCLUSIONS

Bridge design changes were necessary at Bridges 2 and 14 in order to reduce the impacts caused by the new bridge crossings. The designs have been modified such that the resulting increases are now less than 0.10 feet. Both bridges had alignment changes, and Bridge 14 replaced fill slopes on the downstream side of the bridge with retaining wall. The changes allowed for an increase in conveyance area when compared to the previous design. Figures are attached showing the revised bridge alignments.

TABLE 1: REVISED WSE IMPACT SUMMARY

BRIDGE #2							
	SECTION	EFFECT ON 100 YR WSE			EFFECT ON 200 YR WSE		
BRIDGE CRITERIA		EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA
SOFFIT AT 200 YR WSE (SPAN =80FT)	73167.6	134.76	134.72	-0.04	135.13	135.08	-0.05
	73222.4	134.78	134.76	-0.02	135.13	135.12	-0.01
	73277.2	134.83	134.88	0.05	135.19	135.24	0.05
	73345.3	134.85	134.92	0.07	135.21	135.29	0.08
	73481.3	134.79	134.87	0.08	135.15	135.24	0.09
	73565.3	134.99	135.06	0.07	135.32	135.4	0.08
BRIDGE #3							
	SECTION	EFFECT ON 100 YR WSE			EFFECT ON 200 YR WSE		
BRIDGE CRITERIA		EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA
SOFFIT AT 200 YR WSE (SPAN =160FT)	72982	134.66	134.67	0.01	135.03	135.04	0.01
	0	134.83	134.83	0	135.18	135.19	0.01
	100	134.83	134.84	0.01	135.19	135.2	0.01
	200	134.84	134.85	0.01	135.2	135.21	0.01
	73112.9	134.74	134.75	0.01	135.11	135.12	0.01
	73167.6	134.76	134.77	0.01	135.13	135.14	0.01
BRIDGE #4							
	SECTION	EFFECT ON 100 YR WSE			EFFECT ON 200 YR WSE		
BRIDGE CRITERIA		EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA
SOFFIT AT 200 YR WSE (SPAN =123FT)	0	134.83	134.82	-0.01	135.18	135.18	0
	100	134.83	134.83	0	135.19	135.19	0
	200	134.84	134.84	0	135.2	135.2	0
	350	134.86	134.86	0	135.22	135.22	0
	550	134.88	134.88	0	135.25	135.24	-0.01
	650	134.89	134.88	-0.01	135.26	135.25	-0.01
BRIDGE #14							
	SECTION	EFFECT ON 100 YR WSE			EFFECT ON 200 YR WSE		
BRIDGE CRITERIA		EXISTING	W/ PROJECT	DELTA	EXISTING	W/ PROJECT	DELTA
SOFFIT AT 200 YR WSE (SPAN =100FT)	565.1	141.26	141.31	0.05	141.54	141.62	0.08
	983.899	141.99	142.03	0.04	142.34	142.4	0.06
	1235.899	142.87	142.78	-0.09	143.5	143.44	-0.06
	1483.899	143.96	144.02	0.06	144.58	144.74	0.16
	1743.899	145.03	145.06	0.03	145.72	145.83	0.11
	2045.1	146.45	146.48	0.03	147.22	147.29	0.07



LEGEND

- 100-YEAR FILL LIMITS
- 200-YEAR FILL LIMITS
- 100-YEAR FEMA FLOODPLAIN
- 100-YEAR FEMA FLOODWAY
- 73656.6 DRY CREEK ABOVE CIRBY XS
- 650 CIRBY CREEK BELOW LINDA XS
- 72602.9 DRY CREEK BELOW CIRBY XS
- PATH ALIGNMENT
- ALTERNATIVE 1 ALIGNMENT
- ALTERNATIVE 2 ALIGNMENT

0 200' 400'

PSOMAS
1075 E. Creekside Ridge Drive #200
Roseville, CA 95678
(916) 788-8122
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HEC-RAS WORKMAP
FOR
DRY CREEK GREENWAY BIKE TRAIL
RIVERSIDE CONFLUENCE

DATE: AUGUST 2012 PROJ NO: 6ROS012500 1 OF 2

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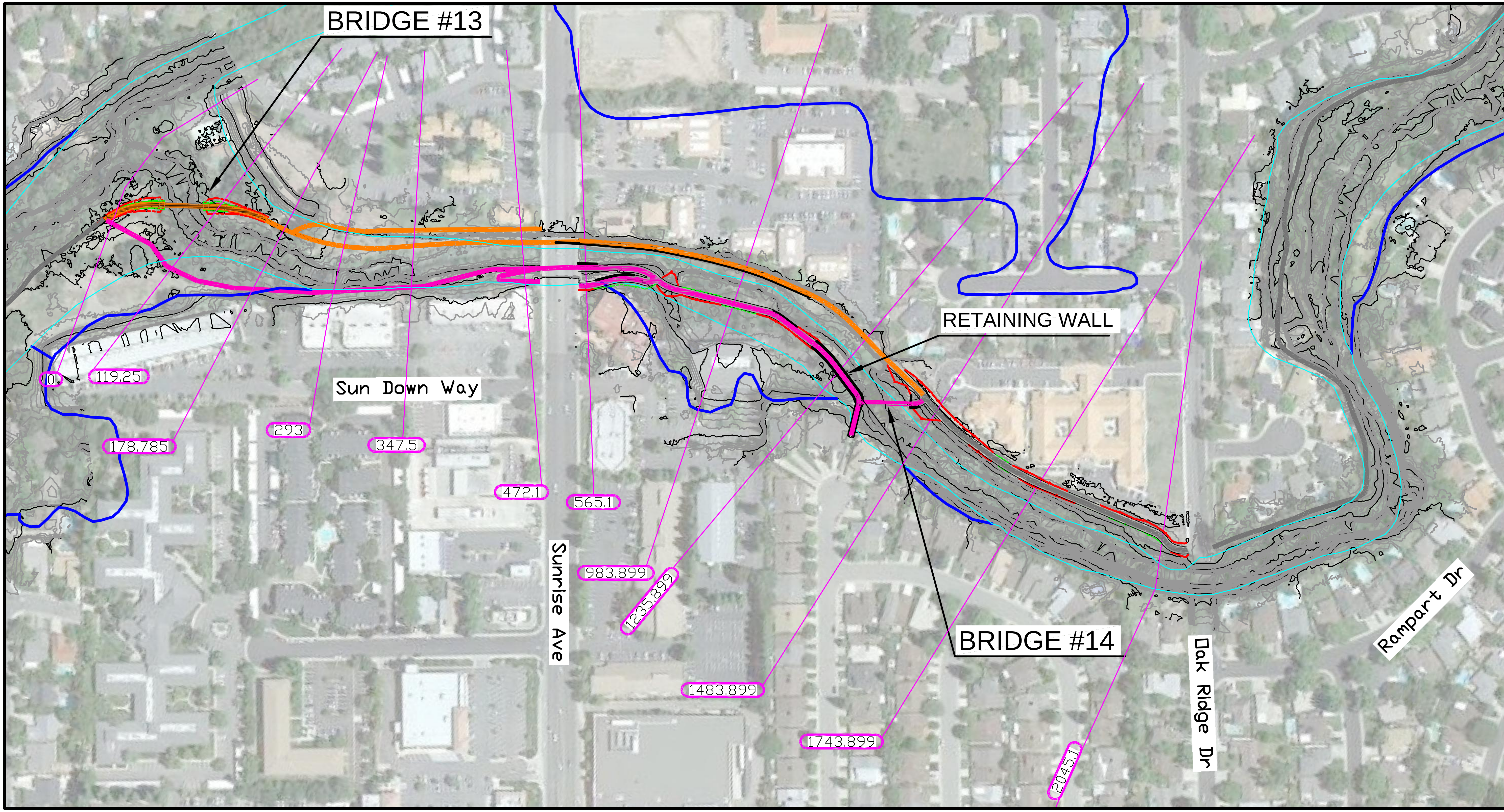

0 200' 400'

LEGEND

- 100-YEAR FILL LIMITS
- 200-YEAR FILL LIMITS
- 100-YEAR FEMA FLOODPLAIN
- 100-YEAR FEMA FLOODWAY
- 73656.6 LINDA CREEK BELOW STRAP XS
- PATH ALIGNMENT
- ALTERNATIVE 1 ALIGNMENT
- ALTERNATIVE 2 ALIGNMENT

PSOMAS
1075 E. Creekside Ridge Drive #200
Roseville, CA 95678
(916) 788-8122
www.psomas.com

HEC-RAS WORKMAP
FOR
DRY CREEK GREENWAY BIKE TRAIL
LINDA CREEK

DATE: AUGUST 2012 PROJ NO: 6ROS012500 2 OF 2

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