MEMO

TO: Town of Lyons, Colorado
FROM: Werner Water Engineering
DATE: 3-10-2025
SUBJECT: Lyons Ute Highway Stream Stabilization Project

Construction of the Lyons Ute Highway Streambank Stabilization Project was completed in two phases. The first phase was completed in March and April of 2024 and the second phase was completed in the fall of 2024. The project was broken into two phases due to run off in St. Vrain Creek and scheduling conflicts.

The scope work for debris removal in the project was significantly larger than was expected. There were substantial quantities of sub-surface concrete that were removed. The only demolition and debris removal that was a variation from the permitted plan was the removal of the concrete piece connected to the building circled in Figure 1.

Figure 1 Section of building that was removed.

During the Spring of 2024, debris removal and site grading on the downstream end of the project was completed.

During construction additional site planning was performed beyond the scope of the stream restoration project. Part of that site planning included looking at modifying the grading of the floodplain benching. During those discussions the changes were modeled in the permit model to check floodplain impacts. The changes did not cause the proposed

condition to result in a rise compared to the existing, therefore the bench in front of the building was extended as a part of the stream project.

The proposed design included four locations with boulder access stairs. Only one of the four sets of access stairs were installed. The two areas of access stairs in the upstream terraced boulder revetment were modified to be boulder revetment. The access stairs nearest the building were excluded and the slope of the bank was graded at a 3:1 slope to match the rest of the slope. The downstream set of access stairs were installed.

The upstream terraced boulder revetment was modified in two ways. The downstream extend of the terracing was tied into the existing concrete tank wall closer to the north than the proposed plan. The existing surface the proposed plan was developed from had an incorrect breakline so this modification was to line the terracing up with the existing conditions more appropriately. This area is highlighted in yellow in Figure 2.

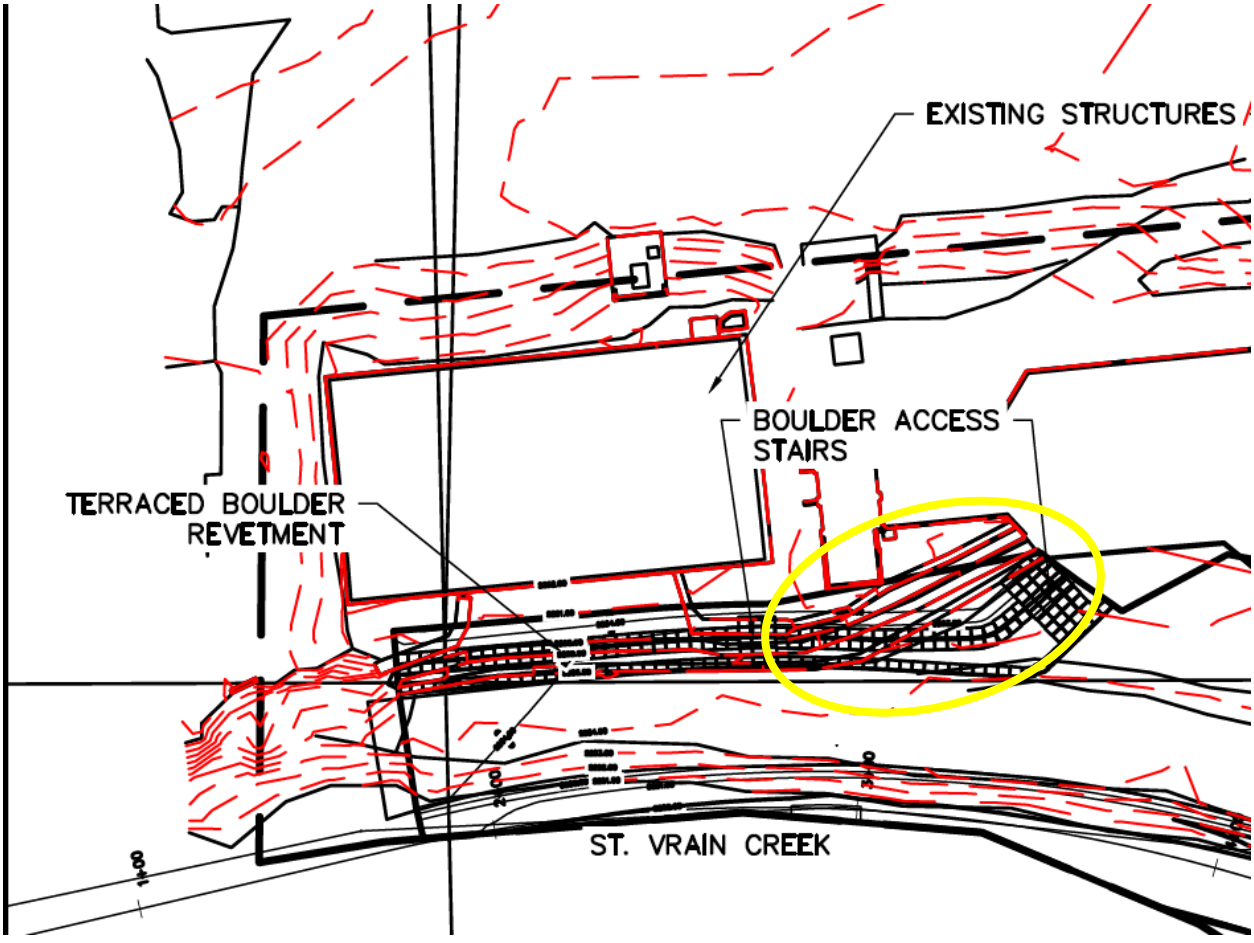

Figure 2 Terraced boulder revetment as-built

The other deviation from the proposed plan in the terraced boulder revetment was the upper row of boulders was wrapped back to tie into the wall of the existing structure. The final elevation in this recessed area was set to be above 5261 so it would be above the modeled BFE. The final constructed terraced boulder revetment is shown in Figure 3.

Figure 3 Final terraced boulder revetment with recessed upper row.

Typically, projects do not have major deviations from the permitted plans, and usually remodeling at the conclusion of a project is not performed unless a LOMR is required. Due to the scope of the deviations in the project, the changes were modeled during construction and the as-built conditions.

The hydraulic model in this reach is very sensitive to changes. This was true in the as-built conditions, as well as the permitted design. Cross section 175692.7 was the most sensitive and the as-built survey resulted in a difference in the right overbank area that was beyond the grading limits of the project. A new existing conditions plan was created to account for this difference in pre-disturbance conditions. The survey used for the design was collected in 2017 and natural changes occurred in the right over bank, primarily being the deposition

of material on the floodplain bench. The differences in the as-built surveyed cross section compared to the existing conditions cross section used in the design are shown in Figure 4. The more recent survey is the black line.

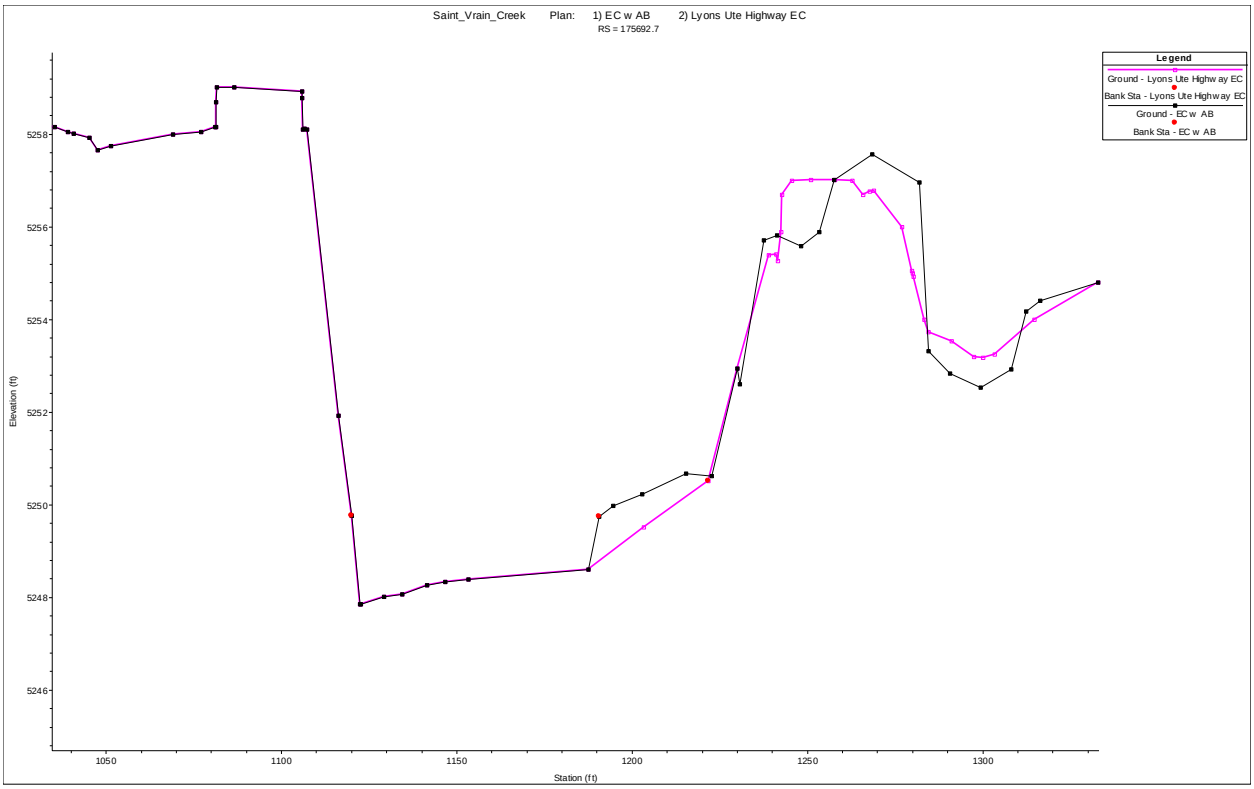

Figure 4 Comparison of Existing Condition model to survey data in right overbank.

Updating the existing conditions with the actual geometry in the undisturbed area was needed for the modeling to be an accurate comparison and to show that there is no-rise between existing and constructed. The updated existing conditions geometry caused considerable rises in two cross sections and minor changes in multiple other cross sections as shown in Table 1.

Table 1 Design existing versus as-built existing.

		Existing	Updated existing	Difference
Reach	River Sta	W.S. Elev	W.S. Elev	EC AB - EC
		(ft)	(ft)	
SVC_RM1	177461.6	5271.65	5271.65	0
SVC_RM1	177355.2	5271.58	5271.6	0.02
SVC_RM1	177244	5271.54	5271.56	0.02
SVC_RM1	177141.3	5271.52	5271.54	0.02
SVC_RM1	176962.2	5271.44	5271.45	0.01
SVC_RM1	176888 SVC_97, US HW 36			0
SVC_RM1	176782.2	5265.22	5265.24	0.02
SVC_RM1	176708.6			0
SVC_RM1	176324.2	5263.26	5263.21	-0.05
SVC_RM1	176308.6			0
SVC_RM1	176137.1	5261.24	5261.23	-0.01
SVC_RM1	175848.2	5258.67	5259.4	0.73
SVC_RM1	175838.7			0
SVC_RM1	175692.7	5256.74	5257.2	0.46
SVC_RM1	175486.2	5253.74	5253.74	0

The geometry from the as-built survey was incorporated into the as-built plan in the model. Comparisons of the as-built compared to the proposed permitting plans are shown in Figures Figure 5Figure 7. Comparisons of the as-built to proposed plans are also shown in the cross section sheets of the attached as-built plans.

The floodplain bench that was modified is obvious in Figure 6. The toe of the slope on the left bank in Figure 7 was moved slightly north to tie the grading into the existing streambank upstream of the property as well and the peak in the center of the channel was existing material that had deposited and was not placed by the project. That deposit of material is on the adjacent property and could not be impacted by the project as there was no agreement with the landowner for any work to occur on their property.

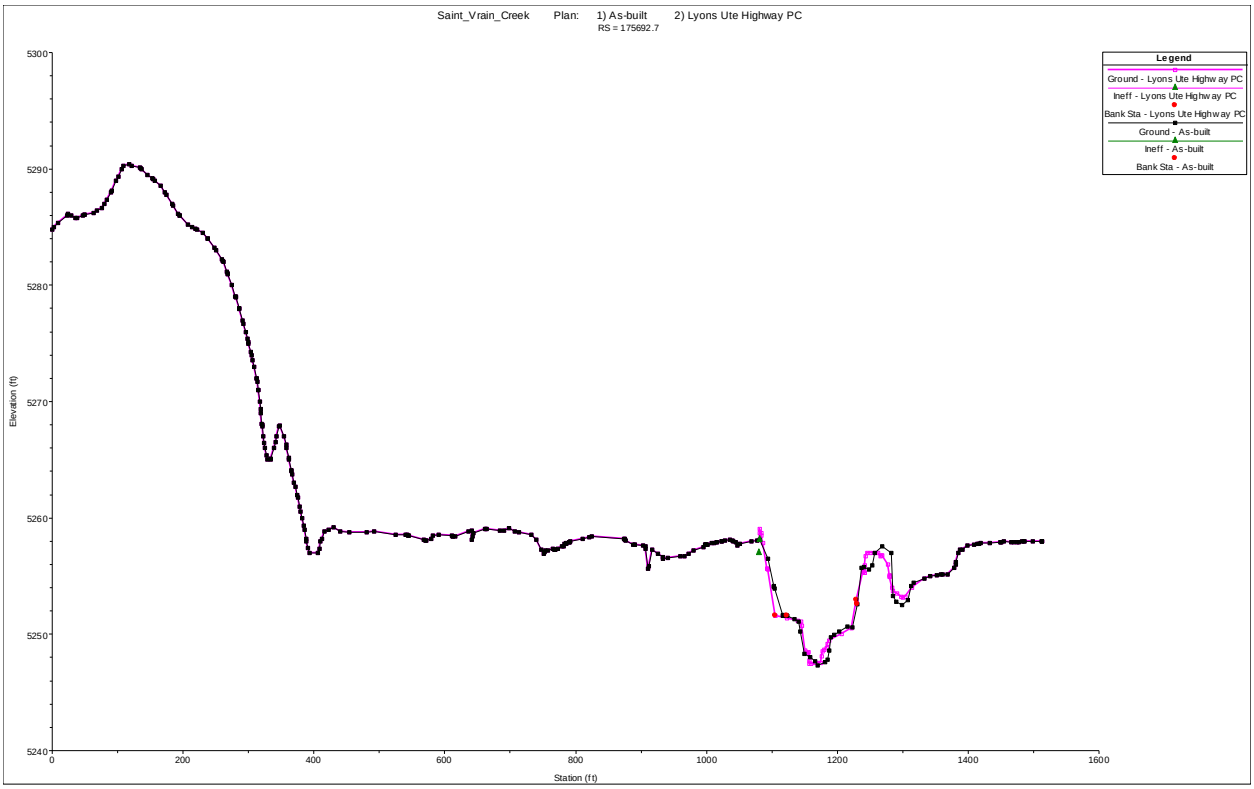

Figure 5 Cross Section 175692.7 as-built compared to proposed.

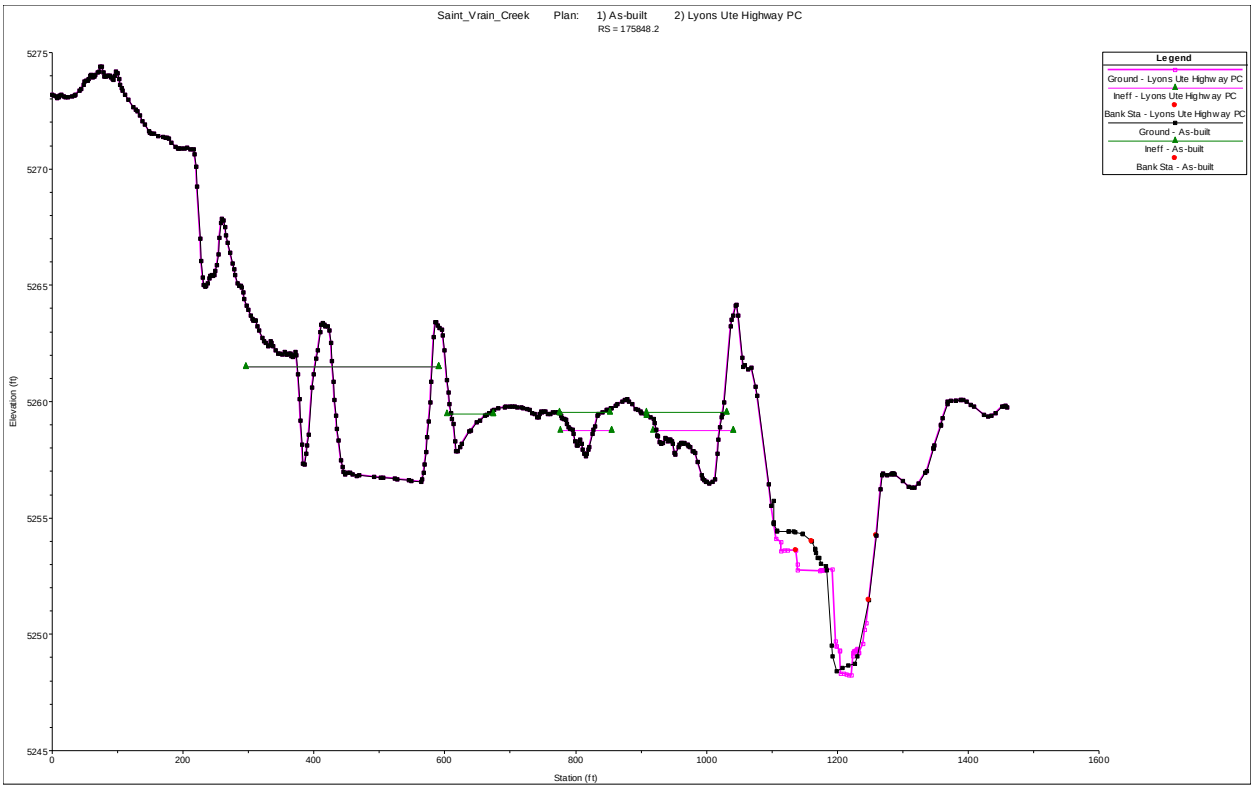

Figure 6 Cross Section 175848.2 as-built compared to proposed.

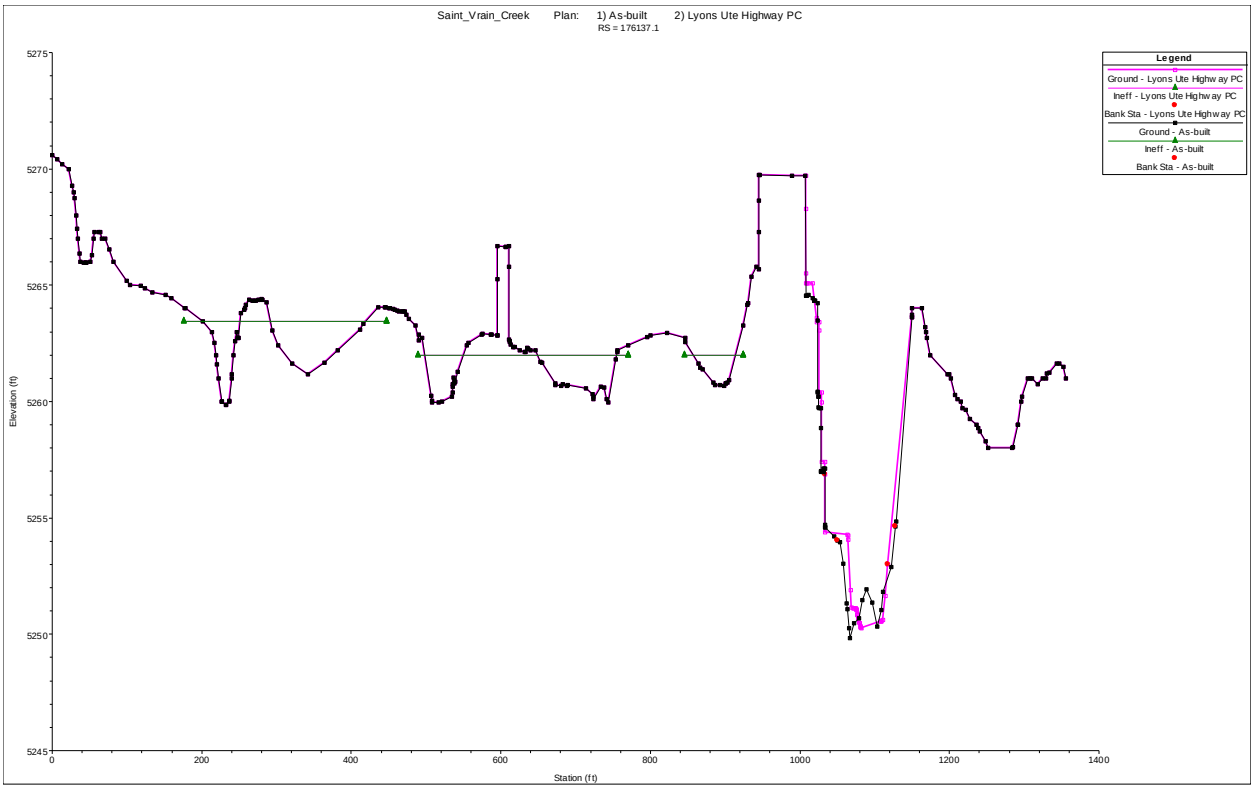

Figure 7 Cross Section 176137.1 as-built compared to proposed.

The results of the remodeling of the project reach shows differences in resulting water surface elevations of up to a decrease of 0.27 feet. The proposed design had a maximum decrease in water surface elevation of 0.26 feet at the same cross section. The as-built, existing and differences are shown in Table 2.

Table 2 As-built versus existing.

		Updated existing	As-built	Difference
Reach	River Sta	W.S. Elev	W.S. Elev	AB-EC
		(ft)	(ft)	(ft)
SVC_RM1	177461.6	5271.65	5271.65	0
SVC_RM1	177355.2	5271.6	5271.58	-0.02
SVC_RM1	177244	5271.56	5271.53	-0.03
SVC_RM1	177141.3	5271.54	5271.51	-0.03
SVC_RM1	176962.2	5271.45	5271.43	-0.02
SVC_RM1	176888 SVC_97, US HW 36			0
SVC_RM1	176782.2	5265.24	5265.24	0
SVC_RM1	176708.6			0
SVC_RM1	176324.2	5263.21	5263.21	0
SVC_RM1	176308.6			0
SVC_RM1	176137.1	5261.23	5260.96	-0.27
SVC_RM1	175848.2	5259.4	5259.3	-0.1
SVC_RM1	175838.7			0
SVC_RM1	175692.7	5257.2	5257.04	-0.16
SVC_RM1	175486.2	5253.74	5253.74	0

Construction always results in minor differences between as-built and proposed grades when working in natural stream environments. The differences between grades were within what would be reasonably expected. The resulting model still shows no rises comparing the existing to proposed conditions and there are no decreases of more than 0.3 feet, which is a criterion from the State of Colorado that would require a LOMR.