OLSSON ASSOCIATES

MEMO

TO: Marvinetta Hartwig
CC: David Krickbaum, File
FROM: Deb Ohlinger
RE: US6 Bridge Configuration
Olsson Project No. 011-2359
DATE: November 17, 2011

This memorandum documents the preliminary analysis of the US 6 bridge opening needed to convey the 100-year South Platte River flow and meet Colorado Department of Transportation's (CDOT) freeboard requirements.

The CDOT *Drainage Design Manual* [Rev. 09-02-09] states that the minimum freeboard, in feet, for a low to moderate debris stream is calculated with the following equation:

$$\text{Freeboard} = 0.1\ Q^{0.3} + 0.008\ V$$

where Q = design discharge, cfs
V = mean velocity of the design flow through the bridge, feet per second (fps)

The freeboard is measured at a water surface elevation 50 to 100 feet upstream of the bridge. The 100-year discharge at the location of the bridge is 16,500 cfs. The average velocity through the existing bridge was 9.1 fps. The initial estimated freeboard was 2.49 feet. The water surface elevation used for the freeboard is at cross section 11372 in the HEC-RAS model obtained from the Conditional Letter of Map Revision (CLOMR) for the South Platte River Zuni to Sun Valley reach.

It was desired that the bridge opening length should be at least as wide as the floodway downstream of the bridge, which is approximately 156 feet. To achieve 2 horizontal to 1 vertical side slopes (2:1) to the bridge abutments, the lower portion of the South Platte River channel was left intact. Above the lower flow portion of the channel bottom, the 2:1 slope started and continued to the locations where the abutments might intersect the slopes. The abutments were set so that some vertical distance was available between the low chord and the bank. The vertical distances were 1.5 feet and 2.8 feet. These locations defined the overall length of the bridge opening. If the minimum vertical distance must be greater, the abutments can be moved in, reducing the bridge opening length. Two piers of 4-foot diameter were set to indicate a 3-span bridge. The piers are 67-68 feet apart. A schematic of the bridge geometry is included as Figure 1.

The resulting overall opening was 202.89 feet. The average velocity through the bridge was 7.21 fps, less than for existing conditions. The required freeboard for this velocity is 2.26 feet. The water surface elevation at cross section 11372 was 5207.05. The resulting required bridge low chord would be 5209.31. For this level of analysis, the low chord was set at 5209.5. The bridge opening can be reduced if warranted by additional input on the bridge design

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parameters. If it does decrease, the low chord elevation might need to increase. The piers do not appear to have a significant effect on the water surface elevation at cross section 11372. If a 1- or 2-span bridge is used, the low chord can be reduced by a couple of tenths of a foot.

An existing 44-inch diameter brick sanitary line is located west of the bridge. The center line of the sanitary line is approximately 31.7 feet away from the proposed west bridge abutment.

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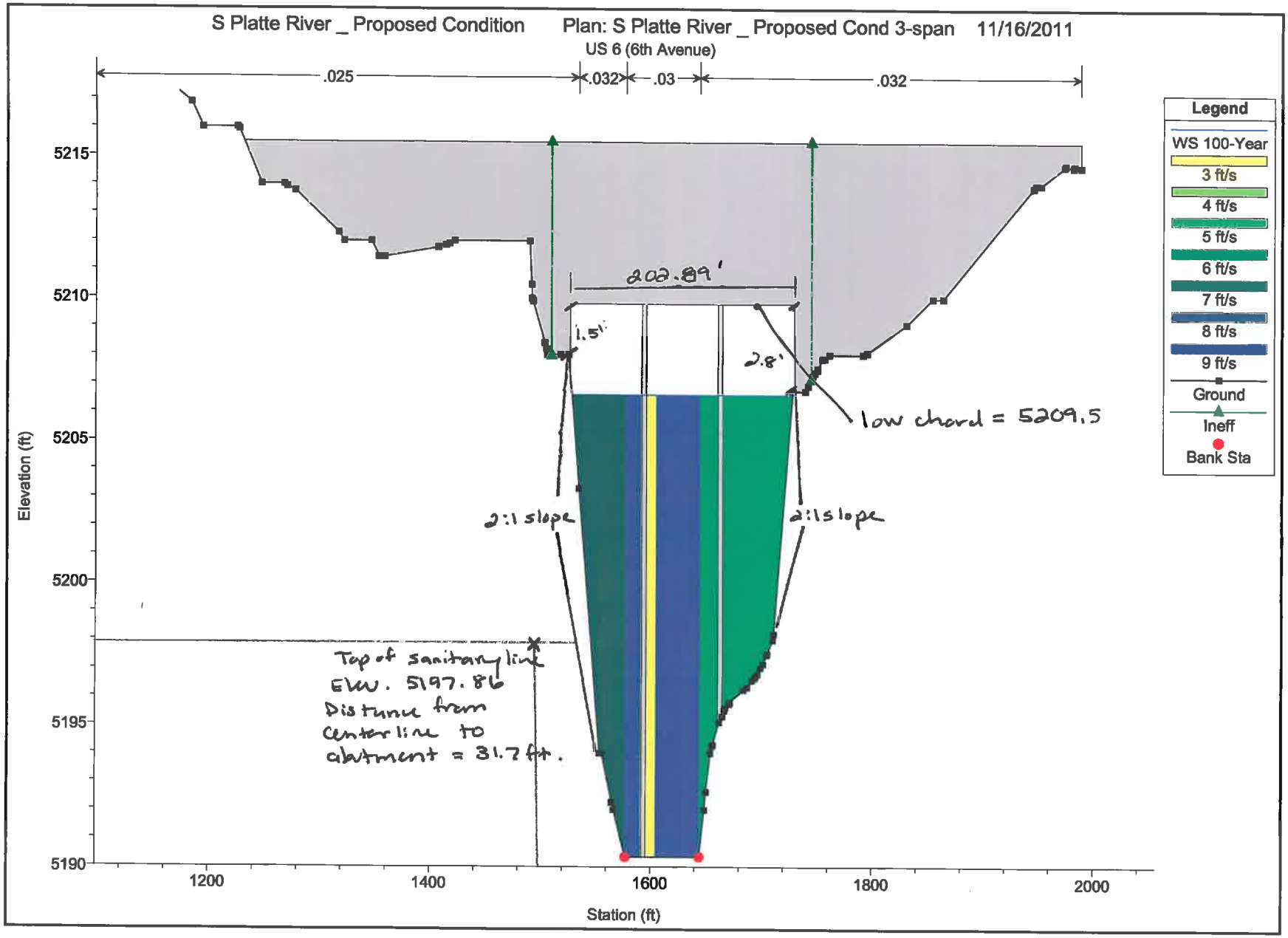

FIGURE 1. Bridge Schematic