

STATE HIGHWAY 141 BRIDGE J-01-D OVER JOHN BROWN CREEK, COLORADO

Bridge J-0-D is located in Mesa County on State Highway 141 ML where the highway crosses John Brown Creek. Figure 1 shows Bridge J-01-D over John Brown Creek.

Hydrau-Tech, Inc. began the POA study of Bridge J-01-D by collecting information on the site and structure in question, including hydrologic characteristics of the site, GIS information and original bridge construction plans. Using these parameters, regional regression equations result in a 500-year flood discharge of 2,080 cfs (cubic feet per second). After completing a survey of the reach upstream and downstream of the structure and sediment size analysis, a HEC-RAS hydraulic model was developed. This model was used to estimate the hydraulic conditions during the 500-year flow including: discharge distributions, velocity distributions, and water surface profiles. Figure 2 shows the water surface profile produced by the HEC-RAS hydraulic model. Figure 3 shows the reach geometry plot produced by HEC-RAS.

Using the results from hydraulic modeling, theoretical scour estimates were calculated with FHWA's HEC-18 scour equations. Updated AutoCAD drawings were produced with adjusted datum elevations and theoretical scour lines in order to determine the stability of the structure under the scour conditions created by flooding. Figure 4 shows a completed theoretical scour plot using AutoCAD showing foundation elevations and potential scour.



Figure 1. Bridge J-01-D over John Brown Creek

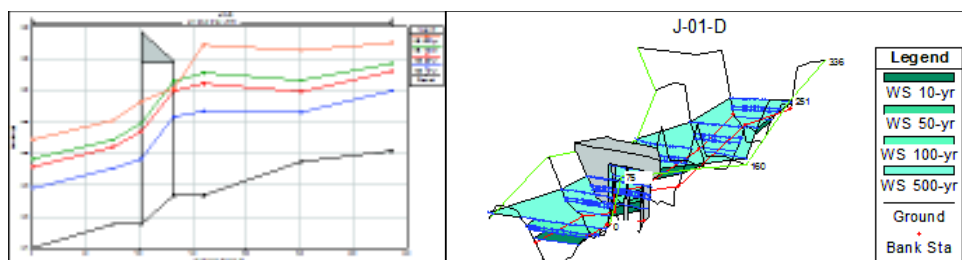


Figure 2 (Left). Water surface profile showing the 10, 50, 100 and 500-year flows
Figure 3 (Right). 3D Plot of the reach around structure J-01-D

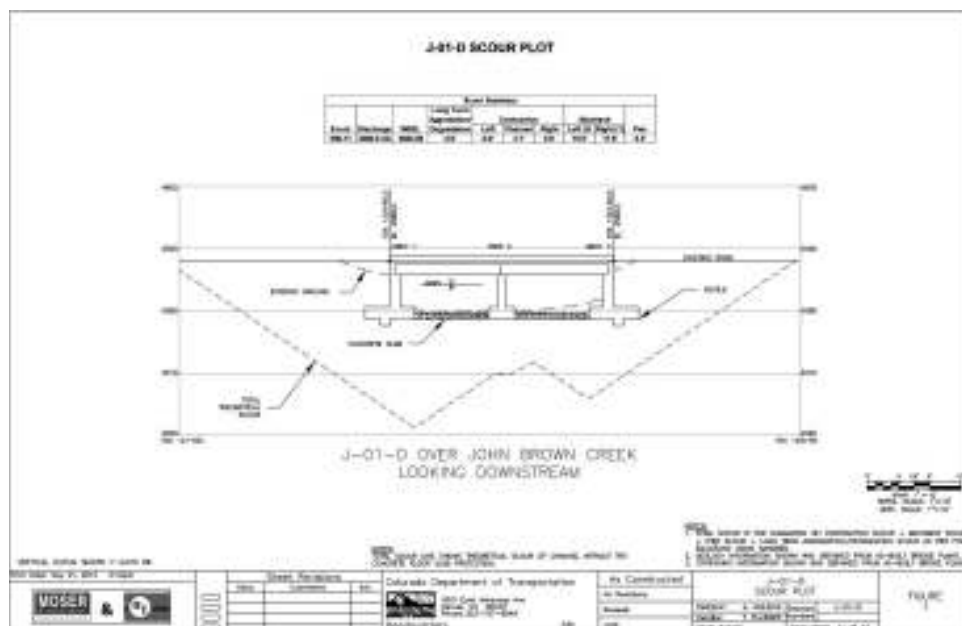


Figure 4. Scour plot generated in AutoCAD showing bridge geometry, foundation elevations, sediment boring hole results and theoretical scour

Based on the theoretical scour and the current site conditions such as foundation depths and existing structure protection, countermeasures were designed by Hydraul-Tech, Inc. A Vertical downstream drop structure was chosen as the preferred hydraulic scour countermeasure. Pier riprap sizing for the drop structure was selected by using FHWA's equations. Based on the theoretical velocities, riprap with a median grain size diameter of 1.0 feet was used to design drop structure protection. Using the guidelines in HEC-23 for drop

structure design, Hydraul-Tech, Inc. developed a preliminary drop structure design downstream of the bridge. Figure 5 shows an aerial image of structure J-01-D with the recommended scour countermeasure. Figure 6 shows a cross-sectional view of the structure with the recommended scour countermeasures and appropriate geometry. As a part of analysis, various cost estimates for alternative countermeasures were complete for comparison.

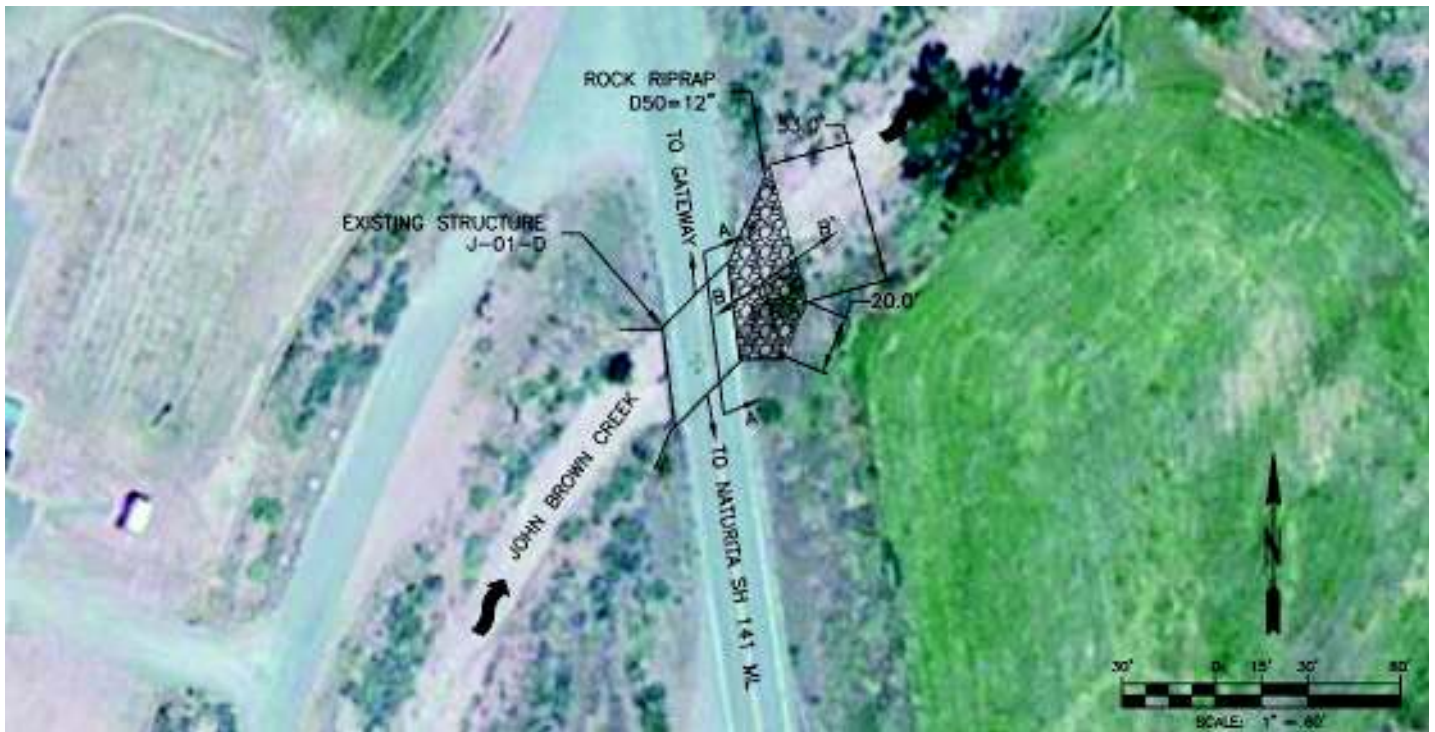


Figure 5. Plan view of Bridge J-01-D with recommended hydraulic scour countermeasure location

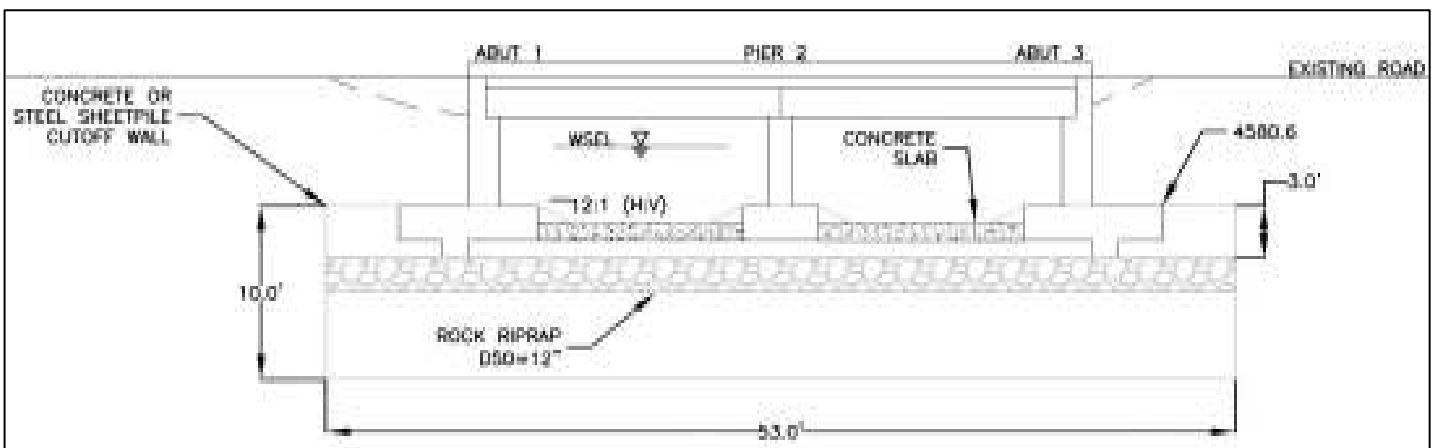


Figure 6. Cross-sectional view of Bridge J-01-D with recommended hydraulic scour countermeasure