

HYDRAULIC AND SCOUR REPORT FOR THE REPLACEMENT OF THE EDGEWOOD ROAD BRIDGE OVER THE JOHN HALL BROOK

AI Engineers has completed the Hydraulic and Scour evaluation for the Edgewood Road Bridge Replacement (Bridge No. 007002) over the John Hall Brook. Below is a summary of the results of the Hydraulics and Scour Evaluation. The summary includes a brief discussion regarding Hydrology; the Conditions of the Channel; Hydraulic Evaluation of Existing Conditions, Proposed Conditions, and the Temporary Conditions; Scour Evaluation, and the extent of the Riprap Requirements.

1.0 HYDROLOGY

Bridge No. 007002 is over John Hall Brook at the middle of three locations that the brook crosses the roadway. The total watershed area at Bridge No. 007002 is approximately 0.88 square miles.

FREQUENCY (YRS)	DISCHARGES (CFS)		
SOURCE	PUBLISHED FEMA DISCHARGE AT MOUTH OF JOHN HALL BROOK	FEMA DISCHARGE TRANSFERRED TO THE BRIDGE	DESIGN DISCHARGES (REGIONAL REGRESSION FORMULAS) AT BRIDGE
2	NOT CALCULATED	NOT CALCULATED	58
10	NOT CALCULATED	NOT CALCULATED	140
25	NOT CALCULATED	NOT CALCULATED	194
50	NOT CALCULATED	NOT CALCULATED	241
100	800	376	292
500	NOT CALCULATED	NOT CALCULATED	435

2.0 CHANNEL CONDITION

The existing channel has a natural streambed bottom comprised of sand and gravel and some cobbles. The banks are in poor condition with moderate under-bank scouring upstream and downstream of the bridge exposing tree roots and causing bank sloughing. A scour hole was observed immediately downstream of the existing bridge along the toe of the right bank. The hole was estimated to be 15-feet long x 6-feet wide x 2.5 feet deep.

3.0 HYDRAULIC EVALUATION

3.1 Introduction

AIE performed a Hydraulic Analysis for Edgewood Road Bridge Replacement (Bridge No. 007002) over the John Hall Brook evaluating the Existing, Proposed and Natural Conditions using the Army Corps of Engineers (ACOE) Hydraulic Engineering Center (HEC) River Analysis System (RAS) Version 5.0.7 computer model, which is a one-dimensional hydraulic program that uses river cross-sections and boundary conditions to estimate the WSELs and evaluate the hydraulic capacity of the bridge.

3.1.1 Existing Conditions

The existing structure consist of reinforced concrete slab on masonry/concrete abutments. The abutments are constructed of a combination of reinforced concrete (upstream portion) and mortared stone masonry (downstream portion). The structure's span length is 5.3-feet (downstream) and 6.7-feet (upstream) with a deck width of 22-feet. The existing structure's low chord elevation is at elevation 277.85-feet (NAVD88) and the top of roadway has an elevation of 270.00-feet (NAVD88).

3.1.2 Proposed Conditions

The proposed structure will be a precast three-sided reinforced concrete on precast concrete spread footing with a span length of 17-feet. The proposed structure will be 30-feet wide, have a low chord elevation of 277.82-feet (NAVD88), and have a roadway elevation will be 279.00-feet (NAVD88). During the construction of the proposed structure the existing abutments will be maintained, but a portion of the existing abutments will be removed down to elevation of 276.00-feet (NAVD88). A riparian shelf will be constructed between the existing abutments and the proposed abutments.

3.2 Hydraulic Evaluation

The drainage area at the Edgewood Road Bridge is approximately 0.88 square miles, which, according to the Chapter 9 of the ConnDOT Drainage Manual, classifies the bridge as a "small structure". As per the ConnDOT Drainage Manual, a "small structure" shall typically be designed to pass a discharge equal to the 50-year flood with a minimum freeboard of 1 foot (freeboard is defined as the vertical distance between the design water surface and the upstream control such as the low point of the roadway edge, sill of a building or other controlling element) and an increase in water surface elevation (at the upstream highway property line) of not more than one 1 foot above that which would have been obtained in the natural channel. Therefore, the existing and proposed structures were evaluated using the 50-year design storm and checked for 100-year storm. Summarized in the table below are the results of the hydraulic evaluation.

Structure	Water Surface Elevation (ft-NAVD88)	Low Chord Elevation (ft-NAVD88)	Roadway Elevation (ft-NAVD88)	Freeboard
50-year Design Storm				
Existing	279.20	277.85	279.00	-0.20
Proposed	278.49	277.82	279.00	0.51
100-year Check Storm				
Existing	279.29	277.85	279.00	-0.29
Proposed	278.73	277.82	279.00	0.07

4.0 Scour Evaluation

AIE also performed a Scour Analysis for proposed structure to estimate the potential magnitude of scour. HEC-18 was utilized to analyze the potential magnitude scouring at Bridge for 10, 25, 50 and 100-year storm frequencies were analyzed to determine the maximum scour through the bridge section. As expected, the 100-year frequency generated the greater scour depth of 3.97-feet.

5.0 Riprap

Equations in the USCOE publication EM 1110-2-1601 was used to estimate the required riprap bank protection. Intermediate riprap is recommended for protecting the upstream and downstream banks and will be used with boulder to prevent further scouring of the existing scour hole. The lateral and vertical extent of the required Riprap is shown on the Construction Drawings.

6.0 Temporary Conditions

A temporary hydraulics analysis has been performed on temporary facilities in accordance with Chapter 6.F-1 of the ConnDOT Drainage Manual for the construction of the proposed conditions. The recommended temporary facilities for the installation of the proposed abutments would consist of a combination of cofferdams and the use of the existing abutments. The location and elevation of the temporary facilities are shown on the Construction Drawings.



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