

MEMORANDUM

TO: Charles Hay, AIA, President (Tappé Architects, Inc.)
FROM: Raju Vasamsetti, PE, CFM (Weston & Sampson)
DATE: August 21, 2023
SUBJECT: Lynch School – Proposed Footbridge Scour Analysis

1.0 Introduction

Purpose

The purpose of this memorandum is to present the results of scour analysis conducted at the subject bridge site to evaluate the scour performance of the proposed pedestrian footbridge over Horn Pond Brook. This investigation was conducted in a manner consistent with American Association of State Highway Officials (AASHTO), Federal Highway Administration (FHWA), and Massachusetts Department of Transportation (MassDOT) guidelines for preparation of scour analysis at bridge sites.

Scope

The scope of work for this investigation consisted of our review of pertinent hydrologic and hydraulic data for Horn Pond Brook at the project site that was developed by Weston & Sampson, and completion of a detailed scour analysis. The appendices will be made available for review on request. A narrative discussion of the problem statement, engineering methods, as well as results and conclusions of the scour study follow.

Executive Summary

A pedestrian foot bridge is proposed to be installed over Horn Pond Brook as part of the Lynch School improvements. The crossing will be a single span bridge over the brook on top of the stream banks. The new bridge will be supported on abutments along with an access ramp that parallels the brook.

The proposed bridge crossing is located within the National Flood Insurance Program (NFIP) base (100-year) flood Special Flood Hazard Area (SFHA). Base flood elevations were available for the stretch of the brook within the project limits.

2.0 Project Description

Proposed Bridge

The principal design objective is to propose a scour resistant bridge. The proposed structure will be a single span wooden truss frame structure that will be placed over proposed abutments; structure (approximately 34'-10" wide

x 7' – 6" length). The clear span will be 32.0' feet with the concrete abutments extended beyond the top of the stream banks.

The proposed pedestrian bridge will be located to the north of an existing vehicular bridge connecting the school property with Royal Street.

3.0 Engineering Methods

Hydrologic Analyses

Peak 10-, 50- 100-, and 500-year flood discharges for Horn Pond Brook were obtained from the latest effective FEMA Flood Insurance Study for the brook. Weston & Sampson evaluated the flooding extent of the proposed improvements at Lynch School and summarized the data in a memo dated January 2022. For this study, extreme rainfall events and future discharges were not considered. Regulatory FEMA flows were used to be consistent with FHWA guidelines.

10-, 50-, 100-, and 500-year peak flow discharges for the brook at the crossing are presented in Table 1.

Table 1. Summary of Discharges

Horn Pond Brook	10 - Year (Ft ³ /S)	25 - Year (Ft ³ /S)	50 - Year (Ft ³ /S)	100 - Year (Ft ³ /S)
@ Lynch School	180	400	570	1080

The hydraulic analysis performed as part of the flooding extent study has been retained. The proposed bridge is included in the hydraulic model.

4.0 Scour Analysis

Visual review of the existing Royal Street vehicular bridge abutments and the channel bottom slab at the bridge indicates that this structure was designed to be scour resistant with additional measures implemented to protect the banks of the brook. A detailed scour analysis was performed to determine if the proposed pedestrian bridge structure as designed will also be scour resistant.

Scour depths have been estimated following the procedures outlined in the latest April 2012 edition of HEC-18-Evaluating Scour at Bridges and the MassDOT Bridge Manual. Soil samples were collected at the bridge to estimate the D50 particle size of the material at the bottom of the brook. The proposed structure was evaluated for the following scour conditions:

- Long-term channel degradation and aggradation
- Lateral contraction scour (HEC-18, Sections 6.1-6.4)
- Pressure flow scour also known as vertical contraction scour
- Amended Froehlich's local abutment scour

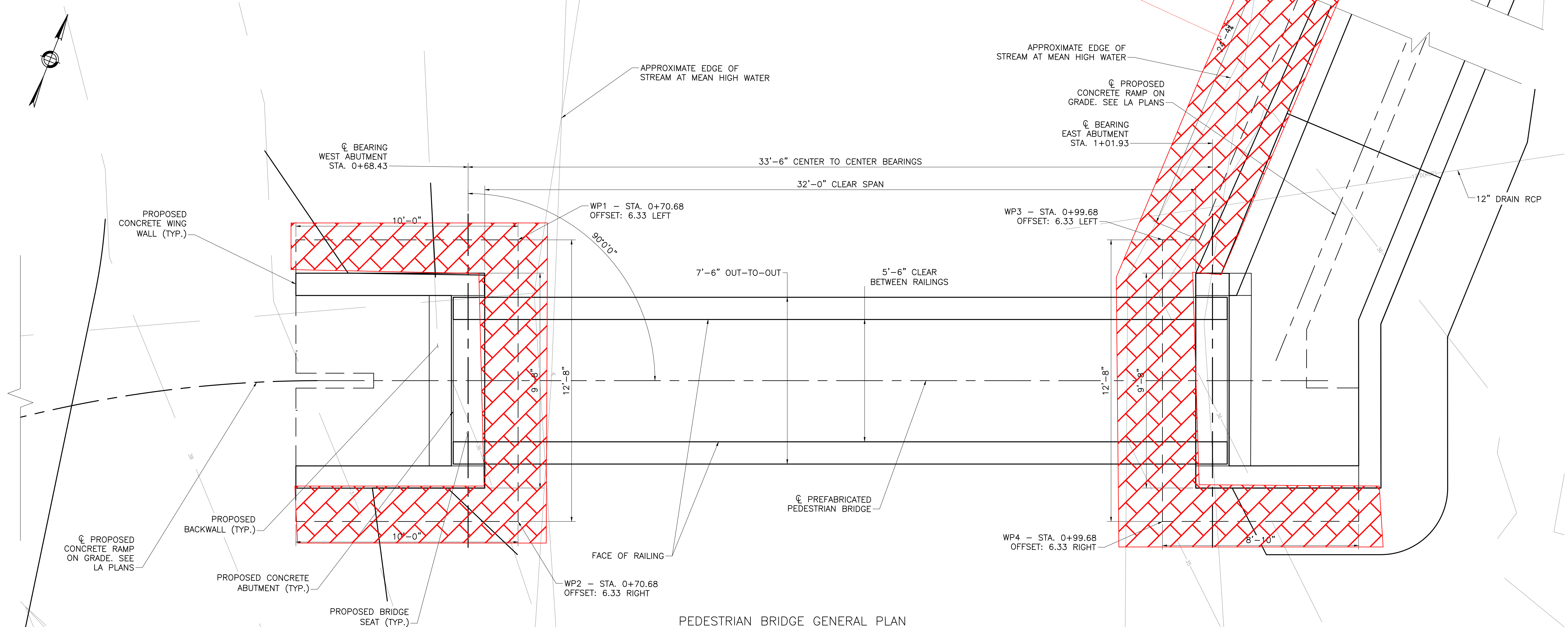
Scour was estimated for a 25-year design storm event and checked for a 50-year storm event. The potential total maximum scour was estimated to be approximately 1.5 feet below the bottom of the stream channel. The stream channel bottom is indicated to be approximately at elevation 32.5 feet. The expected scour depth is approximately 31.0 feet which is above the bottom of the footing. It is ideal to have the top of the footing to be below the scour depth elevation however, in this case with the footings set back approximately 10 to 15 feet beyond the stream channel bottom, the proposed footings are expected to be scour resistant.

Due to the expected higher velocities during flood events and the stream channel banks that are expected to be disturbed during construction, the banks of the brook shall be reinforced with riprap similar in size and extent to those at the adjacent Royal Street bridge. The approximate extents of the riprap are shown in the plan and cross-section views of the attached plans.

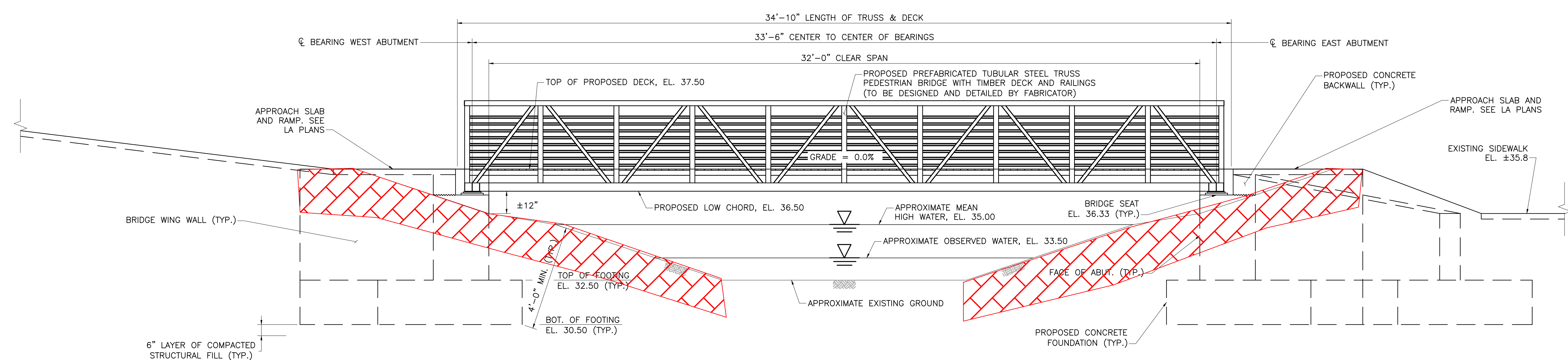
5.0 Recommendations

The proposed scour is expected to be below the top of the footing but not deep enough to undermine the footing. In addition, the proposed abutments are set back far enough to avoid having any appreciable scour impact on the footings. Riprap shall be installed as indicated to reinforce the disturbed banks of the brook at the bridge crossing and along the access ramp retaining wall. Riprap similar to that provided around the Royal Street Bridge shall be installed.

INDICATES
APPROXIMATE LIMITS
OF RECOMMENDED
RIPRAP PLACEMENT



PEDESTRIAN BRIDGE GENERAL PLAN
SCALE: 1/2" = 1'-0"



PEDESTRIAN BRIDGE SOUTH ELEVATION
SCALE: 1/2" = 1'-0"

Drawing Issue Record:	
07/26/2023	90% CD COST ESTIMATE SUBMISSION

Project: 14767.2
Date: 07/26/2023
Scale: AS NOTED
Drawn By: JTJ
Checked By: MMS

PEDESTRIAN
BRIDGE PLAN
AND ELEVATION