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Technical Memorandum

To: Mr. Gary Rayburn, Chair, Healthy Pine River
From: Steve Crider and Christene Jones
Subject: Sediment Survey, Pine River Mill Pond, Alma, MI
Date: September 28, 2016
Project: 22291008.00
c: David Hibbs

1.0 Introduction

On August 9, 2016, Barr Engineering Company (Barr) completed a sediment survey in the Pine River Mill Pond (pond). The pond, located in Alma, Michigan, is formed by the backwater of the Pine River created as a result of the Alma Dam near the State Street Bridge. This work was previously detailed in "Proposal and Agreement to Conduct Sediment Survey, Pine River Mill Pond, Alma, MI," dated December 17, 2015 and approved by Gary Rayburn of Healthy Pine River. The objective of the sediment survey was to estimate the location and volume of sediments that have deposited in the pond. This investigation represents the initial stage of a feasibility study to assess removal of sediments from behind the dam.

2.0 Field methods

To estimate sediment thickness and distribution, Barr performed a series of soundings at 11 transects extending from the dam to just upstream of Honeyoey Creek (see Figure 1 for locations of transects). At each sounding, Barr completed two measurements: 1) the depth from the water surface to the sediment-water interface; and 2) the depth from the water surface to the bottom of accumulated sediments. These measurements were collected from a boat or via wading using a 15-foot long rod of half-inch diameter rebar. However, access to the river's edge was not possible along some transects due to extensive areas of vegetation and lack of clearance for the boat to navigate to shore. The sediment-water interface was measured where the rebar initially came to rest on top of sediment, while the bottom of accumulated sediments was identified by pushing the rebar down from the point of initial resistance until hitting refusal. It should be noted that the refusal may indicate the natural (or hard packed) ground beneath the sediment or debris such as logs buried in the sediment.

The location and respective depths at each sounding were transcribed manually and recorded using a Global Positioning System (GPS) device. The GPS was a Trimble GeoHX Geoexplorer 2008 Series with an accuracy of plus or minus eight inches. Data was then imported into a Geographic Information System (GIS) and used to generate a bathymetric survey. Figure 2 shows the sediment thickness throughout the pond. The data from this field work was used in subsequent calculations to estimate an approximate volume of sediment that had been deposited over the natural (or hard-packed) ground.

3.0 GIS methods

Barr created a geodatabase file containing a digitized river bank and river centerline dataset (approximated from data provided by the state of Michigan and a 2014 aerial photograph provided by the Farm Service Agency). The GPS measurements collected by Barr along each transect were post-processed and added to the geodatabase; each measurement included depth to water-sediment interface, depth to refusal, and a computed thickness of sediment. During the survey, access to the river's edge was not possible along some transects due to extensive areas of vegetation and lack of clearance for the boat to navigate to shore; at those locations an approximated river's edge was established using the data provided by the state of Michigan. Utilizing these datasets, a series of cross sections were digitized as 'lines of best fit' between the measured locations from the river's edge (when available), perpendicular to the centerline. This procedure allowed the interpolated areas between transects to bend to follow the river center line and shoreline

The digitized cross sections and sample locations were then entered to a scripted ArcGIS tool which uses the measured depths to interpolate a new series of cross sections, at shorter intervals, along the entire length of the digitized river centerline. The outputted cross sections are 3D polylines, meaning elevation is assigned at points along the line, which are then used to generate an interpolated depth surface called a triangulated irregular network (TIN). The TIN is then converted to a raster representation of the interpolated depths.

After the above process was completed for two surfaces: 1) the depth to water-sediment interface and 2) the depth to river bottom, the volume of sediment accumulated in the study area was then calculated as the difference between the two surfaces.

4.0 Findings

Volumetric calculations show that there are roughly 420,000 cubic yards of sediment deposited in the pond. Barr estimated the location of the pre-dam channel by reviewing the depth of channel, the thickness of sediments, and the sinuosity of the river upstream and downstream of the project area. Figure 1 shows the water depth of the pond and the locations of the soundings; the water is notably shallow (less than 2 feet deep) at the outlet of Honeyoey Creek. Figure 2 shows the sediment thickness throughout the pond. Figure 3 depicts Barr's estimate of the pre-dam river channel alignment. If dredging the sediments are part of Healthy Pine River's future project plans, then the sediments will need to be characterized.

5.0 References

State of Michigan Data source: http://www.mcgi.state.mi.us/mgdl/framework/metadata/Gratiot.html

2014 Farm Service Agency Aerial source: https://www.fsa.usda.gov/programs-and-services/aerial-photography/imagery-programs/naip-imagery/

6.0 Attachments

Figure 1 Depth to Sediment-Water Interface

Figure 2 Sediment Thickness

Figure 3 Estimated Pre-dam River Channel Alignment