Marshall Dam – Evaluation of Recent Analytic Data

March 4, 2019 Council Work Session

Agenda

1. Introduction
2. Evaluation of Findings
3. Additional Considerations
4. Conclusions
5. Discussion

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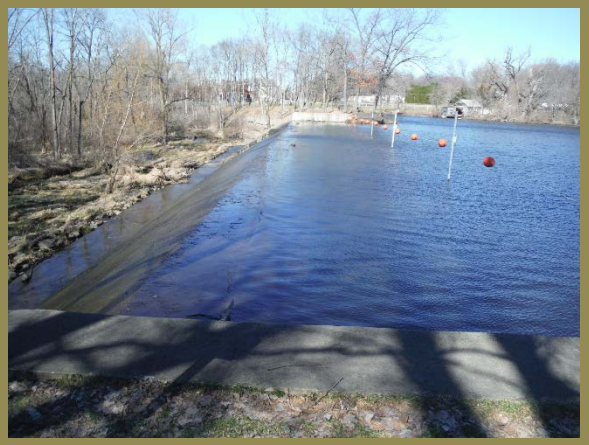
1 Introduction

- Project Background
- Report Purpose and Approach
- Methodology of 2018 Sampling
- Agency meeting



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- Project Background

Why another sediment study?

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• Project Background

ISSUES WITH ISLAND EMBANKMENT

October 2012 - Federal Energy Regulatory Commission (FERC) inspection identified several potential failure modes and items in need of remediation related to the Island Embankment.

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Ann Arbor, MI 48108
www.stantec.com

Consultants

Legend

Notes
SURVEY DATUM: NAVD88

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

Permit-Seal

Client/Project
CITY OF MARSHALL

MARSHALL HYDROELECTRIC DISPOSITION STUDY

Marshall, Michigan

Title
TOPOGRAPHIC SURVEY

0 50' 100'

Project No. 2075138800

Scale

Drawing No.

Sheet

Revision

Figure A.1

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Project Background

Structural

- Internal Erosion and Piping in Island Embankment
- Stability safety factor is too low

Hydraulic

- Inadequate discharge capacity at maximum flood

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Project Background

OPTIONS UNDER CONSIDERATION

- Repair Dam – using a temporary cofferdam
- Repair Dam – using temporary impoundment drawdown
- Remove Dam

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- # Project Background

2017 Cost Opinions	
Alternative	Cost Opinion
REPAIR	
Cofferdam	$2.1 Million
Temp. Drawdown	$22 Million
REMOVAL	
LOW	$44 Million
HIGH	$98 Million

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Project Background

SEDIMENT QUESTIONS

- Sediment quantity and quality are relevant to draw-down alternatives.
- Available sediment data was limited.

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- # Project Background

2017 *Marshall Hydroelectric Project Disposition Study*

"…additional analytical work may demonstrate that concern regarding the effect of sediment export on downstream aquatic ecosystems is unsubstantiated."

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- # Project Background

Desire to know what is currently in impoundment sediment and surface water.

Is there danger of exposure from sediments in place?

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Report Purpose and Approach

- Update findings and recommendation of 2017 *Marshall Hydroelectric Project Disposition Study*
- Focuses on sediment impacts related to permanent drawdown.

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Report Purpose and Approach (continued)

- Characterize sediment quality and disposal options for dredged materials.
- Characterize sediments in floodplain that would be exposed following drawdown.
- Provide information needed for permits.
- Potential for released sediments to result in water quality violations.

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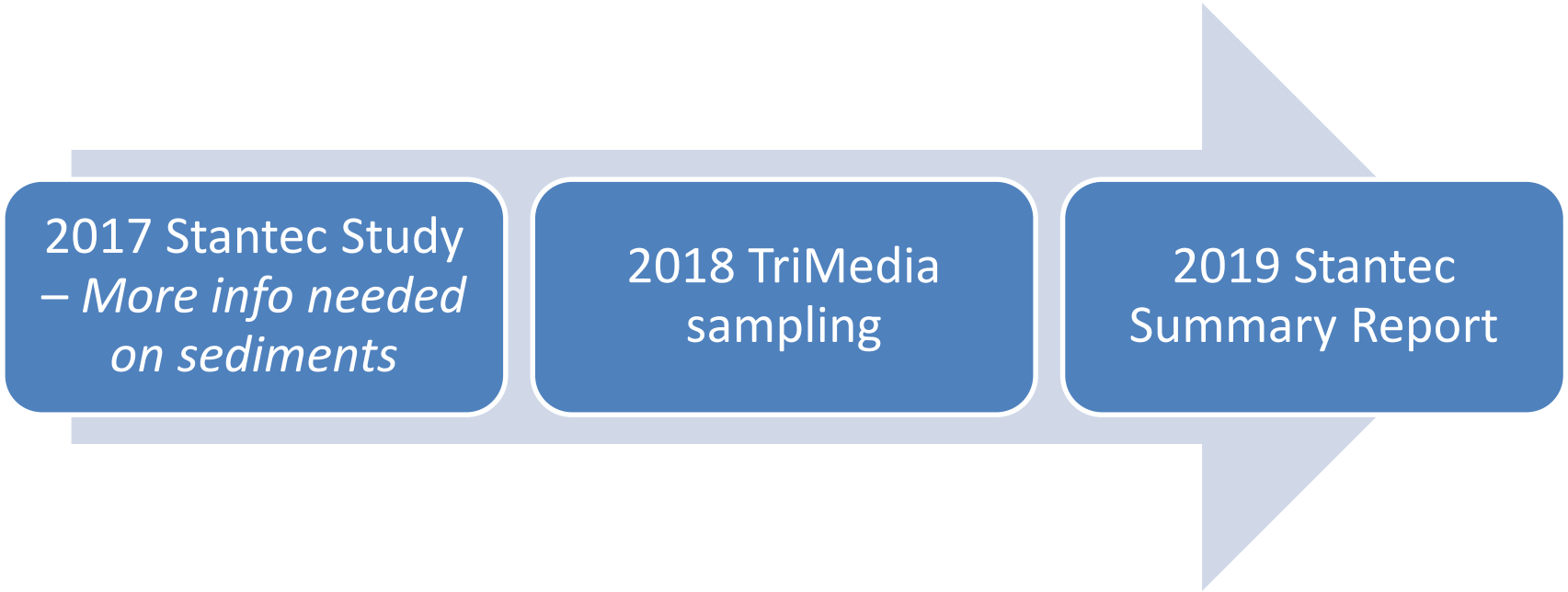
2017 Stantec Study – *More info needed on sediments*
2018 TriMedia sampling
2019 Stantec Summary Report

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2018 Study Methodology

Data were needed to help determine whether dam removal could cause unacceptable negative impacts on human health or aquatic resources.

- Direct contact
- Mobilization of contaminants
- Exposing wildlife to previously buried contaminants

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2018 Study Methodology

Establish sampling transects above and below the dam

- 15 homogenized core samples
  Represents sediment that would be removed
- 15 discrete core samples
  Represents sediment that would be left in place and open to exposure at various levels
- 30 surface grab samples upstream
  Represents sediment that would be left in place and open to exposure on new uplands

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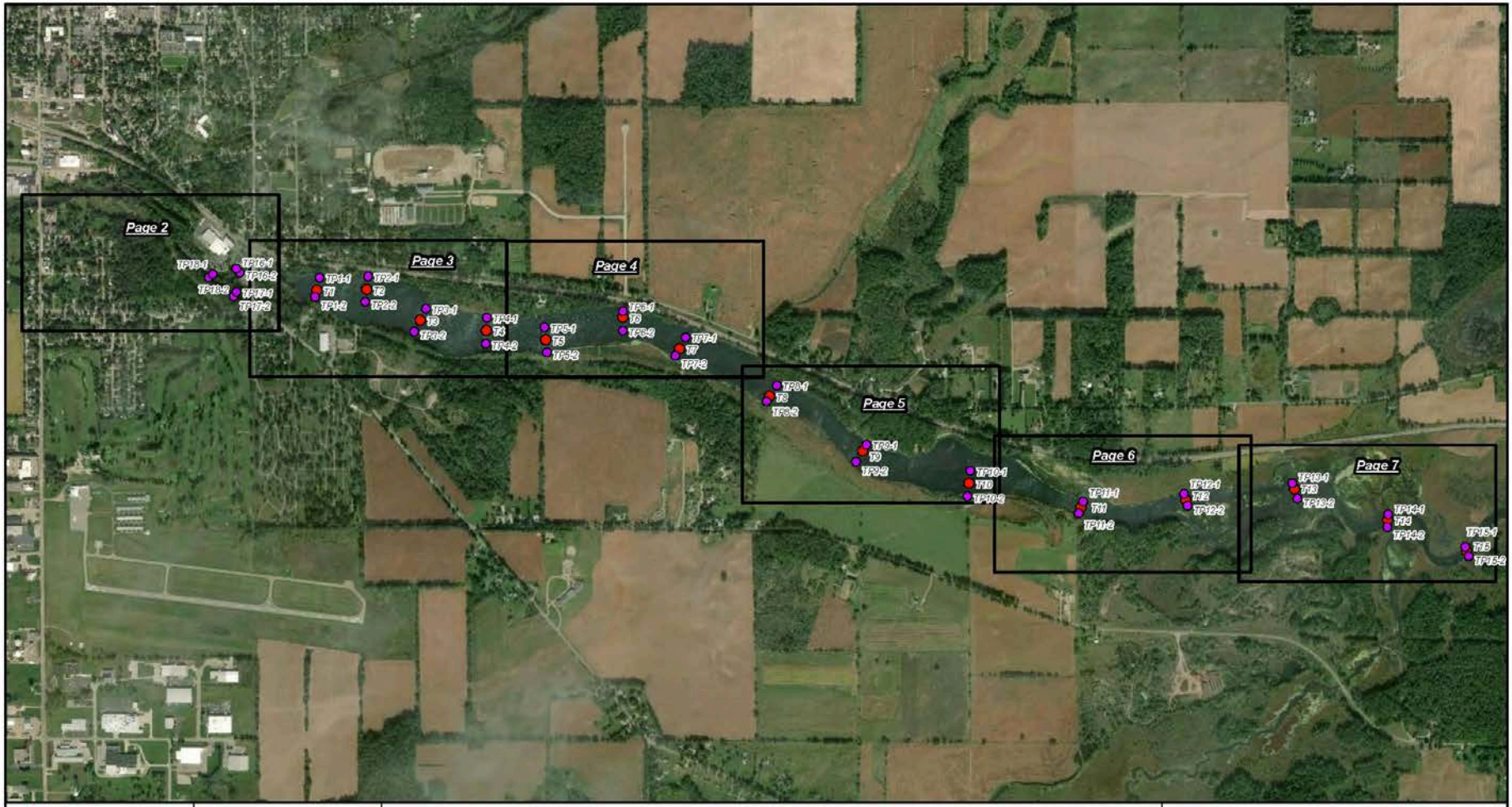

TRIMEDIA
ENVIRONMENTAL & ENGINEERING

Drawn:	KGK	8/21/2018
Approved:	ETS	8/21/2018
Project #:	2018-084	

Map Location

Legend
- Ponar Sample Locations
- Vibracore/Surface Water Sample Locations

N

0 550 1,100 2,200 Feet

FIGURE 1
APPROXIMATE SAMPLE LOCATIONS

PAGE 1 OF 7

CITY OF MARSHALL
SEDIMENT SAMPLING

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2018 Study Methodology

- 6 sediment grab samples downstream
  To make a background comparison
- 15 water column samples
  Gives idea if sediments are contaminating water
- 15 Carlson's trophic status indices (TSI)
  Assesses nutrient status of impoundment to determine whether release could adversely impact river downstream

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2018 Study Methodology

Homogenized sediment core samples -
Used to characterize dredged material for proper disposal and supports sediment transport modeling

- Sieve grain analysis
- Synthetic Precipitation Leaching Procedure (SPLP)
- Michigan 10 metals
- Polycyclic Aromatic Hydrocarbons (PAHs)
- Polychlorinated Biphenyls (PCBs)
- Total Organic Carbon (TOC).

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2018 Study Methodology

Discrete sediment core samples (tested by layer) - Develop a profile of sediments as they were laid down over time, look for hot spots

- Sieve grain analysis
- Michigan 10 metals
- Bioaccumulative Chemicals of Concern (BCCs)
- PAHs
- PCBs

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2018 Study Methodology

Grab samples (surface) –
Characterize floodplain sediments that would be uncovered following drawdown of the impoundment

- Michigan 10 metals
- Pesticides and BCCs
- PAHs
- PCBs

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2018 Study Methodology

Surface water samples –
Assesses chemical and nutrient status of impoundment to determine whether release could adversely impact river downstream

- Michigan 10 Metals
- PAHs
- Pesticides and BCCs
- PCBs
- Total phosphorus and Chlorophyll a

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2018 Study Methodology

Findings discussed with MDEQ and other agencies

Get regulatory feedback

Discuss path forward

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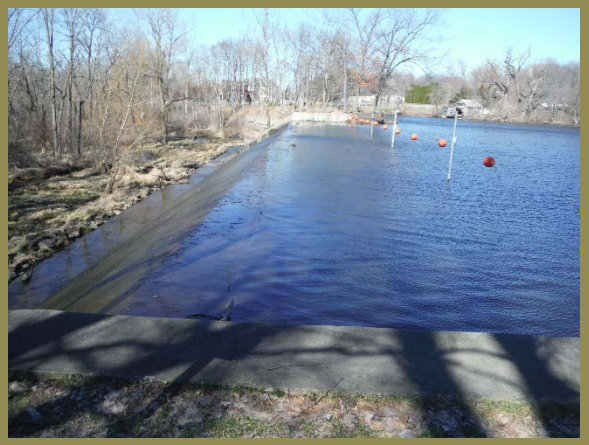
2 Evaluation of Findings

- Dredge Project Requirements
- Natural Resources and Environmental Protection
- Sediment Volume



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Dredge Project Requirements

Pilot channel for drawdown

- Removes sediment for deposit elsewhere

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Dredge Project Requirements

What is proper disposal method?

- Upland disposal
- Municipal solid waste
- Toxic waste landfill

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Dredge Project Requirements

Tests on homogenized core samples:

- Sieve testing
- Synthetic Precipitation Leaching Procedure (SPLP)

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- Dredge Project Requirements

Upland disposal

Municipal Solid Waste

- # Natural Resources and Environmental Protection

Part 201 of NREPA looks at future land use

- City is not liable for sediments in place since City did not cause

- But, due care is required to prevent excess risk or making the situation worse

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- Natural Resources and Environmental Protection
  - Human Health
  - Ecological Health
  - Surface Water

Human Health

Criteria Based on:

- Direct contact
- Ambient and particulate air inhalation
- Protection of groundwater/surface water interface
- Protection of groundwater/drinking water exposure pathways

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- Human Health

Criteria:

Generic Cleanup Criteria for Soil

Statewide Default Background Values

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- # Human Health

Generic Cleanup Criteria for Soil

Applies to sediment that would remain in place and would become soil after drawdown(exposed to air).

Based on assumed land use (**non-residential**).

Exposed pathways must be present and applicable (ground cover or other due care can block a pathway).

Background values considered normal for the area.

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- # Human Health

Compare results from upstream sediment *grab* samples (from upland areas)

Non-residential generic cleanup criteria **not** exceeded by UCL95 for any analyte

Statewide default background levels exceeded by UCL95 for several metals (Ar, Ba, Cd, Cr, Pb, Hg and Se)

Background values are not risk based.

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deposits are heavily vegetated and/or isolated for from riverine erosional processes and will likely remain in place following a temporary or permanent drawdown of the impoundment. Based on limited preliminary data of sediment depth and location, the impoundment is estimated to be holding approximately 1.5 million cubic yards of sediment (Riser 2016, Stantec unpublished). Figures 1 presents a longitudinal profile of fine sediment storage in the impoundment with the dam on the left side of the graphic and the upstream extent of the impoundment on the right. This profile was derived from soundings collected by Riser (2016) and Stantec (unpublished). Figure 2 illustrates sediment depths as determined by the difference between the top (Sed.Top) and bottom (Sed.Bot) of sediment at individual sounding points along cross sections. The station label for each section corresponds to position on the longitudinal profile (Figure1).

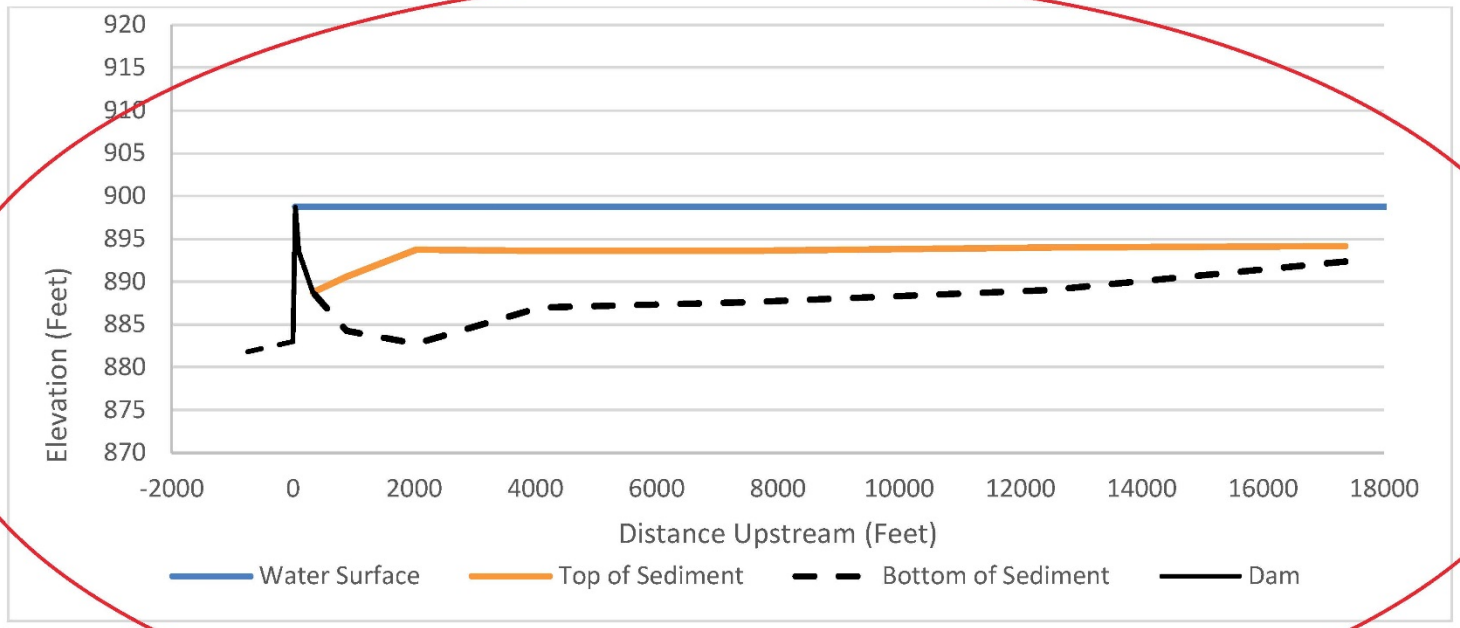
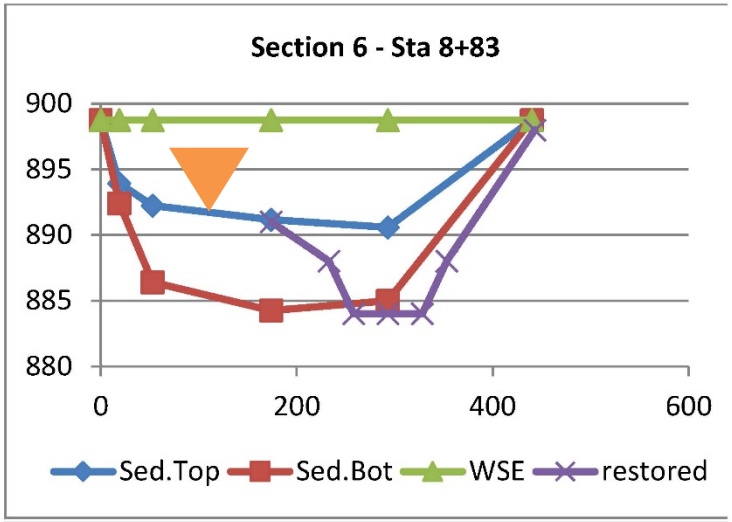
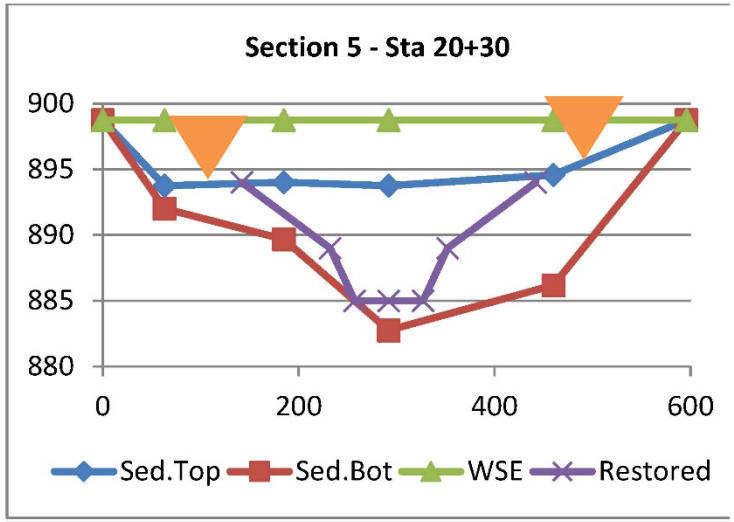


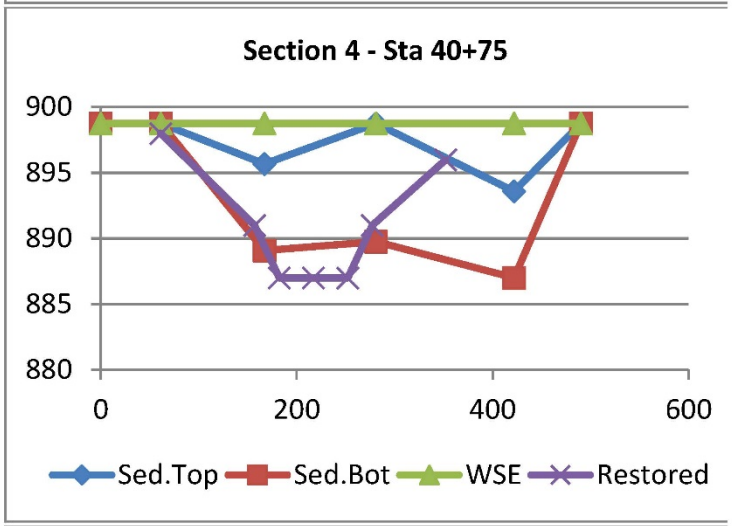
Figure 1. Sediment depth as a function of longitudinal distance upstream of the dam.

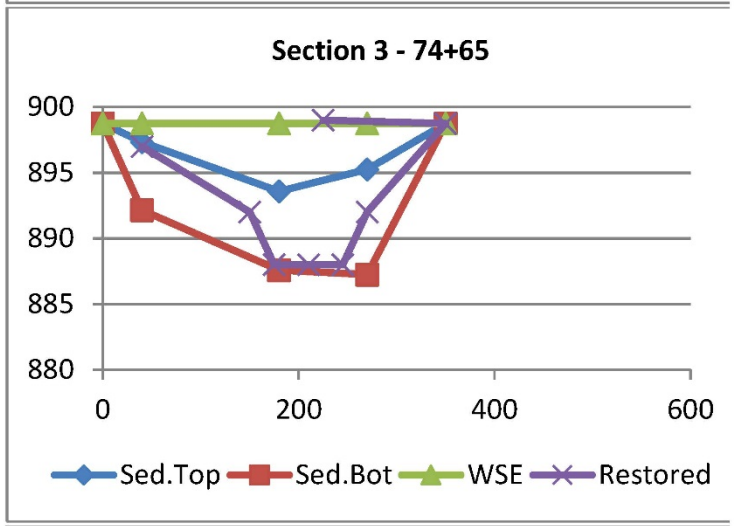
GRAB SAMPLE TARGET AREAS

June 9, 2017









• Human Health

Downstream sediment *grab* samples

Statewide default background levels exceeded by UCL95 for:

- Arsenic
- Zinc

Background values are not risk based.

Few PAHs and No Pesticides detected.

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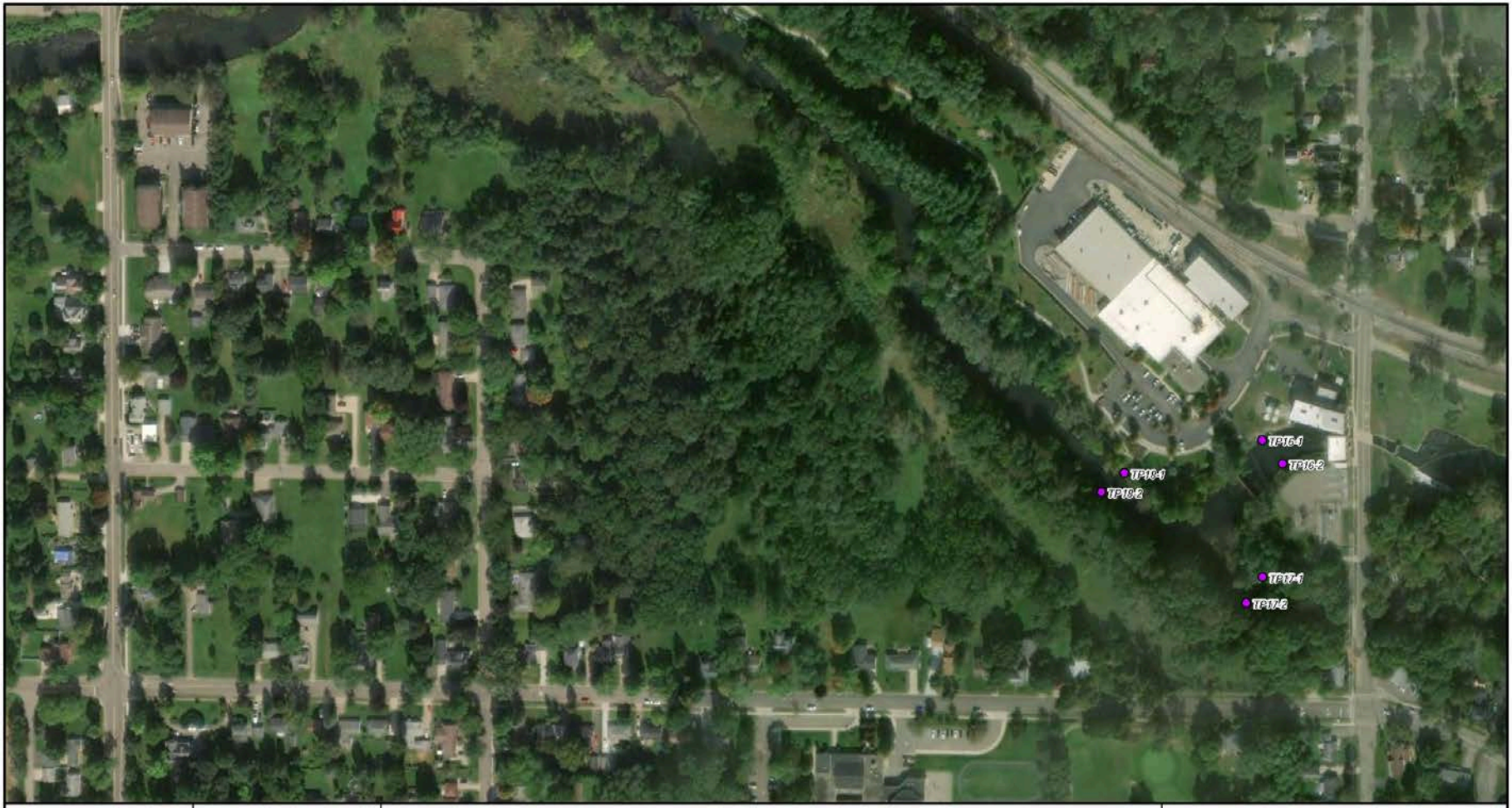

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Drawn:	KGK	8/21/2018
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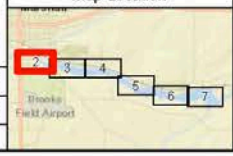
Map Location



Legend
- Ponar Sample Locations
- Vibracore/Surface Water Sample Locations

N

0 100 200 400 Feet

FIGURE 1
APPROXIMATE SAMPLE LOCATIONS

CITY OF MARSHALL
SEDIMENT SAMPLING

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- # Human Health

Discrete sediment core samples (from within proposed channel)

Non-residential drinking water protection criteria was exceeded by UCL95 result for

- Cadmium
- Assumes that Cd in sediment leaches to a potable water source

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- # Human Health

Discrete sediment core samples (from within proposed channel)

Statewide default background levels were exceeded by UCL95 for analyzed metals (Ar, Ba, Cd, Cr, Cu, Pb, Hg, Se, Ag, Zn)

Background values are not risk based.

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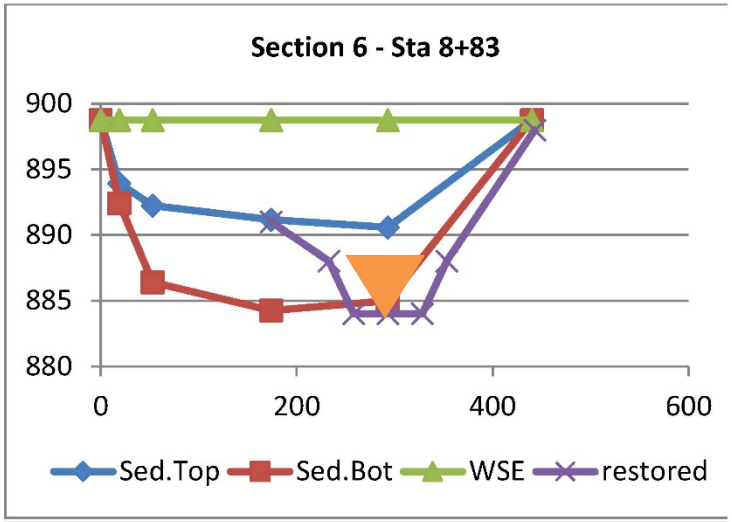
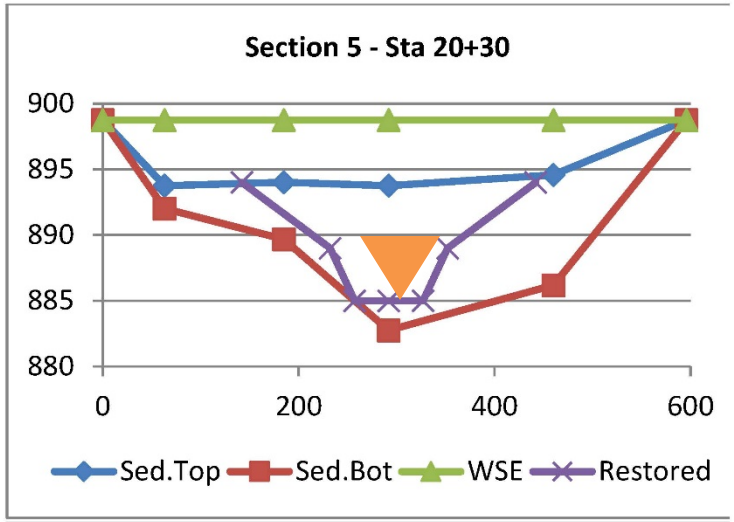
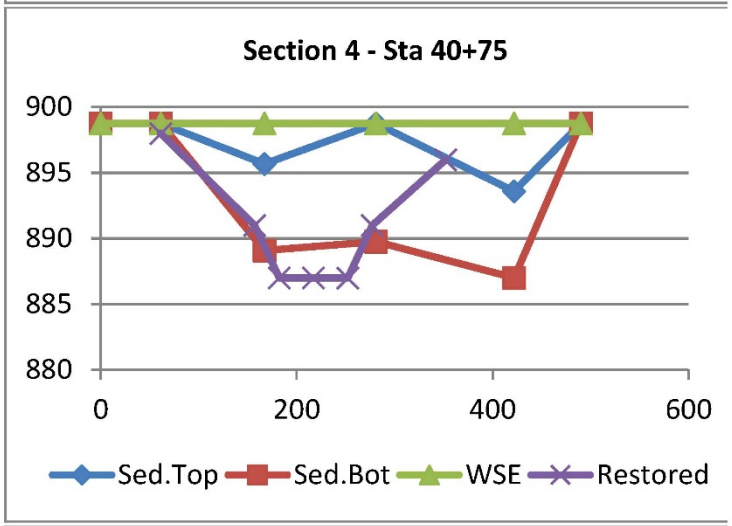
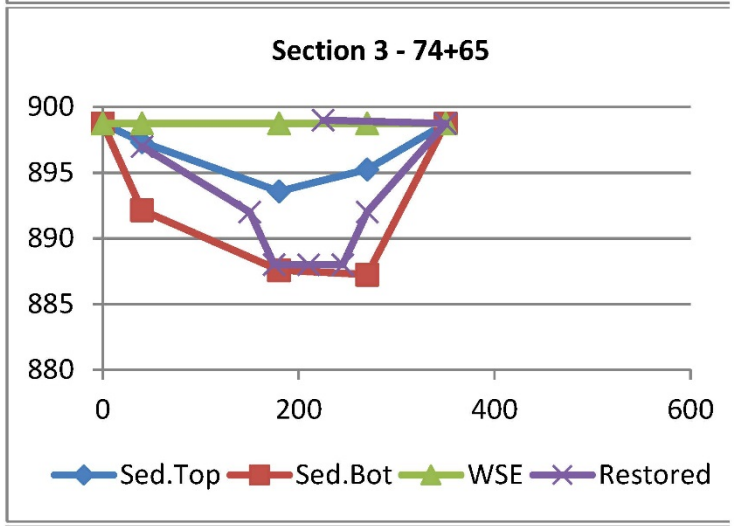
DISCRETE SAMPLE TARGET AREAS

June 9, 2017









Ecological Health

Screening Criteria Based on:

MDEQ Consensus-Based Sediment Quality, Guidelines for Freshwater Ecosystems

- Threshold Effect Concentrations – TECs

Region 4 Sediment Screening Values for Hazardous Waste Sites

- Ecological Screening Values – ESVs
- Refinement Screening Values – RSVs

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Ecological Health

Sediment *grab* samples:

- UCL95 for all metals exceeded Region 4 ESVs.
- UCL95 exceeded RSV value for:
  - Barium
  - Cadmium
  - Chromium

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Ecological Health

Sediment *grab* samples:

- UCL95 for 10 PAHs exceeded Region 4 ESVs for sediment quality guidelines.
- No RSVs were available for PAHs.
- No pesticides detected in grab samples.

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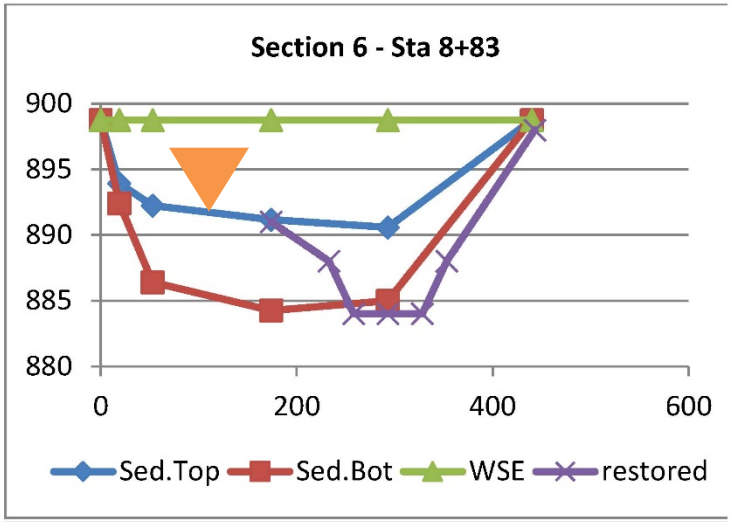
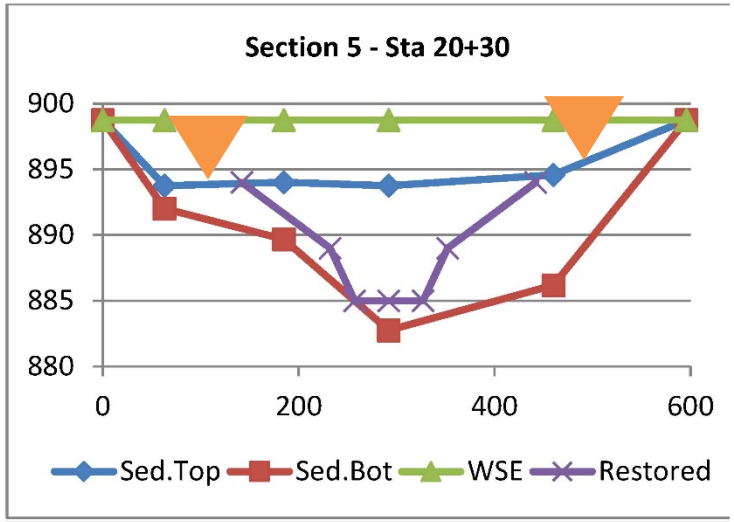
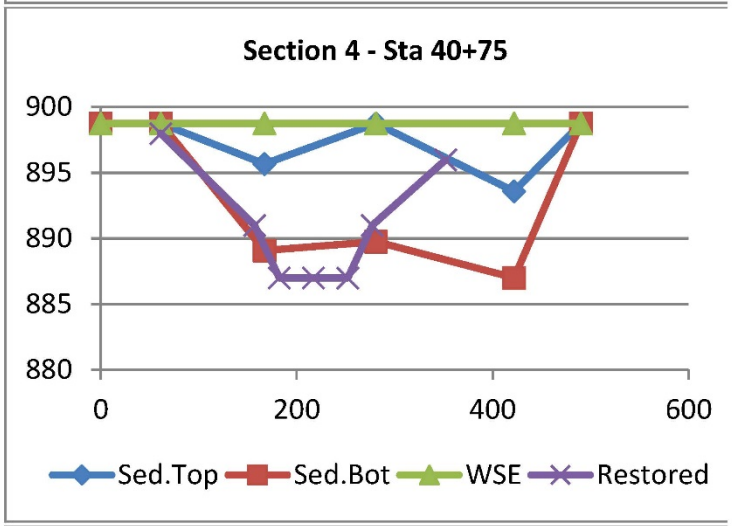
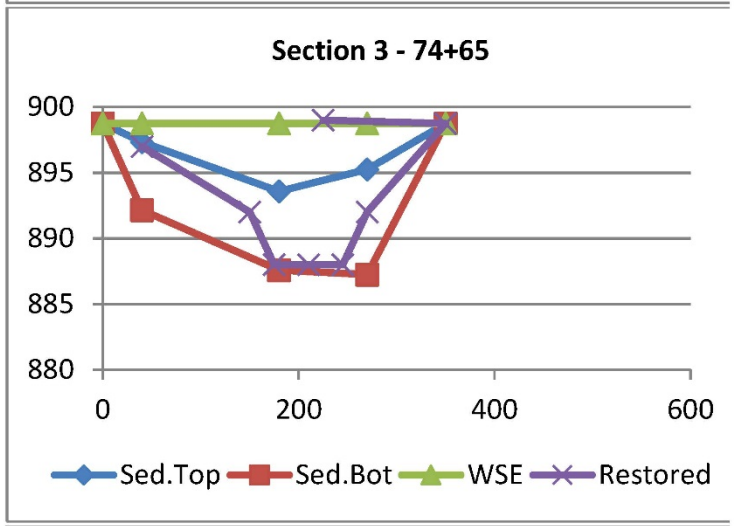
GRAB SAMPLE TARGET AREAS

June 9, 2017









- # Ecological Health

After permanently dewatering, sediment guidelines no longer apply – screening levels for terrestrial soil are generally higher.

Based on these findings, adverse impacts to **terrestrial** ecological receptors is not expected.

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Ecological Health

Discrete core samples:

- UCL95 for all metals exceeded Region 4 ESVs.
- UCL95 exceeded RSV value for:
  - Barium
  - Cadmium
  - Chromium
  - Zinc

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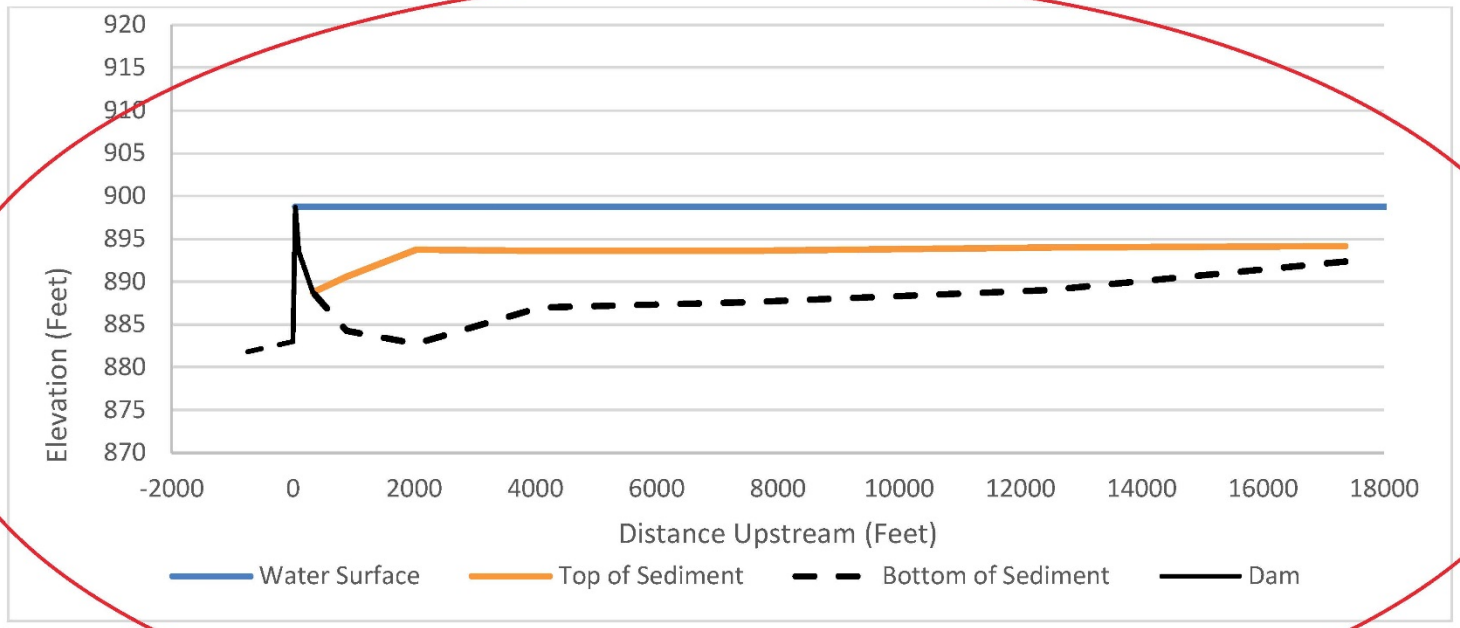
deposits are heavily vegetated and/or isolated for from riverine erosional processes and will likely remain in place following a temporary or permanent drawdown of the impoundment. Based on limited preliminary data of sediment depth and location, the impoundment is estimated to be holding approximately 1.5 million cubic yards of sediment (Riser 2016, Stantec unpublished). Figures 1 presents a longitudinal profile of fine sediment storage in the impoundment with the dam on the left side of the graphic and the upstream extent of the impoundment on the right. This profile was derived from soundings collected by Riser (2016) and Stantec (unpublished). Figure 2 illustrates sediment depths as determined by the difference between the top (Sed.Top) and bottom (Sed.Bot) of sediment at individual sounding points along cross sections. The station label for each section corresponds to position on the longitudinal profile (Figure1).



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DISCRETE SAMPLE TARGET AREAS

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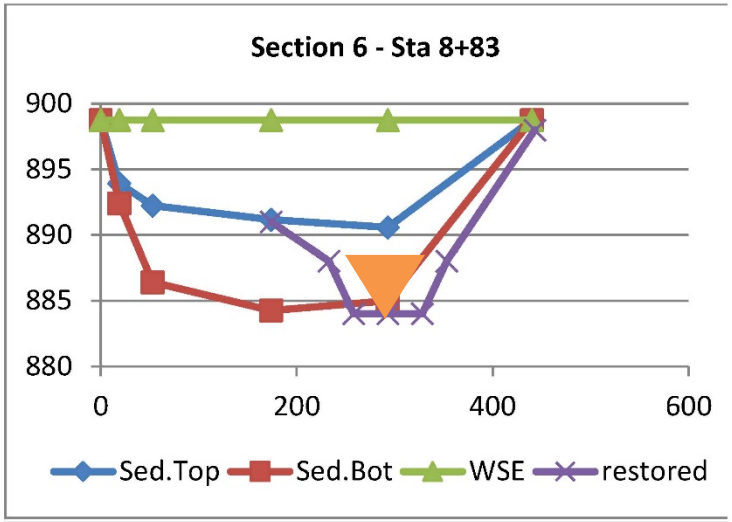

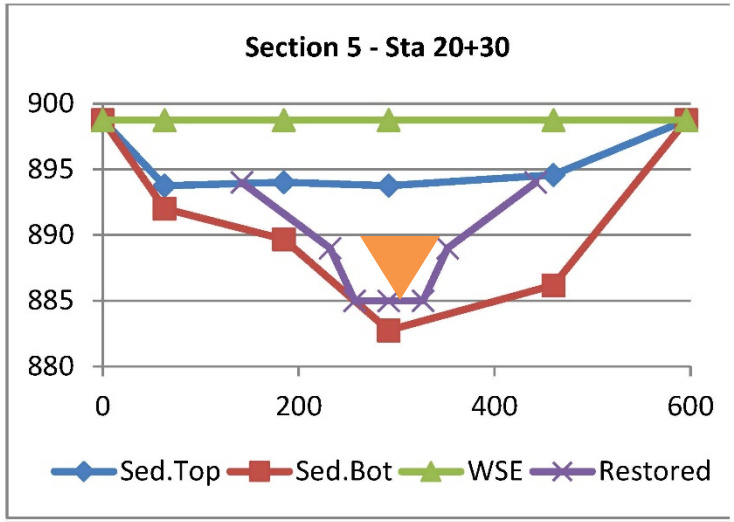

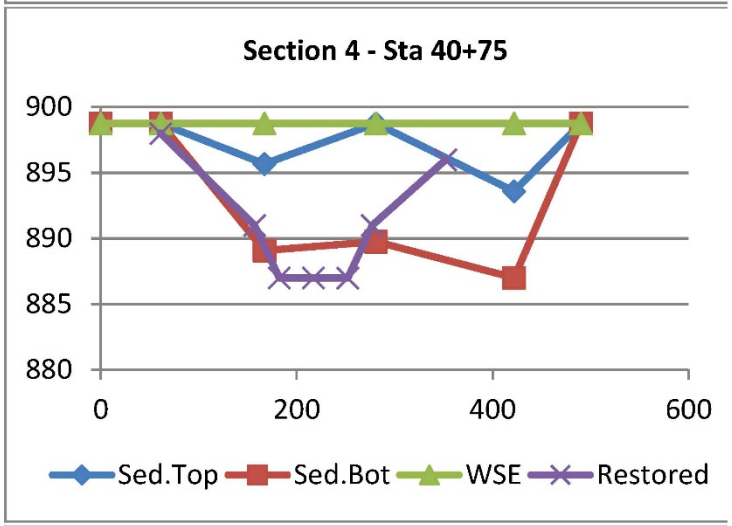

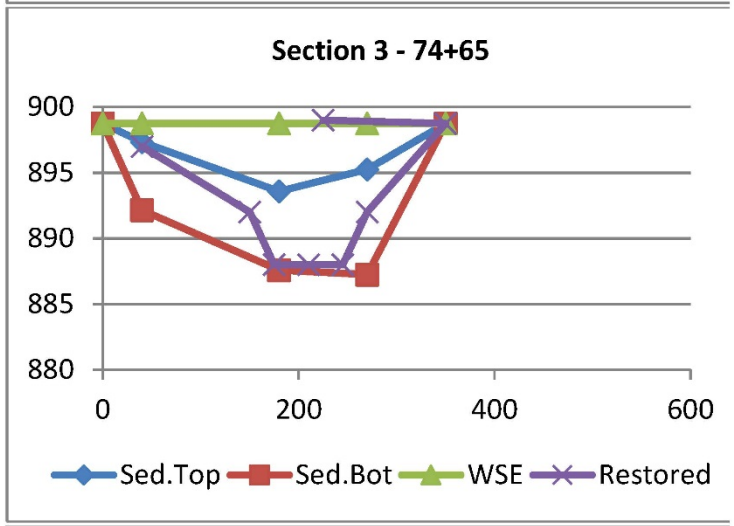

Ecological Health

Discrete core samples:

- UCL95 for 12 PAHs exceeded Region 4 ESVs for sediment quality guidelines.
- Total PCBs exceeded Region 4 ESVs.
- 2,3,7,8-TCDD (dioxin) was detected in 19 of 45 discrete samples, but did not exceed RSV in any location.
- No pesticides detected in discrete core samples.

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- Ecological Health

Due to sediment mobilization after a drawdown, more testing would have to be done at that time.

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- Ecologiacl Health

Downstream sediment *grab* samples

Region 4 ESVs exceeded by UCL95 for:

- Arsenic
- Barium

Few PAHs and No Pesticides detected.

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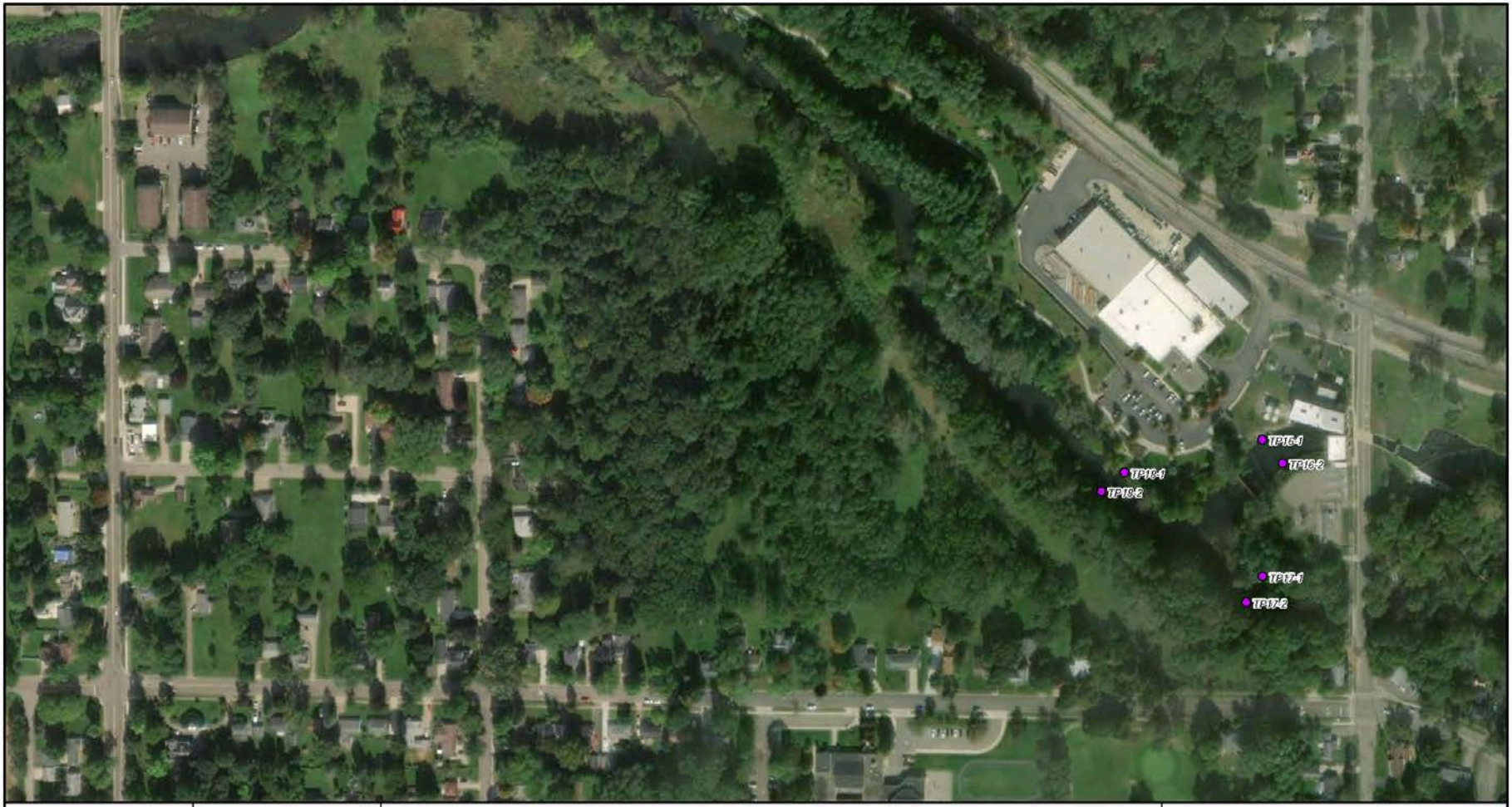

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Map Location

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FIGURE 1
APPROXIMATE SAMPLE LOCATIONS

PAGE 2 OF 7

CITY OF MARSHALL
SEDIMENT SAMPLING

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- # Surface Water

No aquatic macrophytes in main channel from T1 to T9.

Some emergent plants near river banks for T10 through T15.

The report indicates that the existing water quality generally is very healthy.

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- # Sediment Volume

2017 estimate: 1.5 million cubic yards.

Current bottom elevations approximately equal to prior elevations.

No change in volume anticipated

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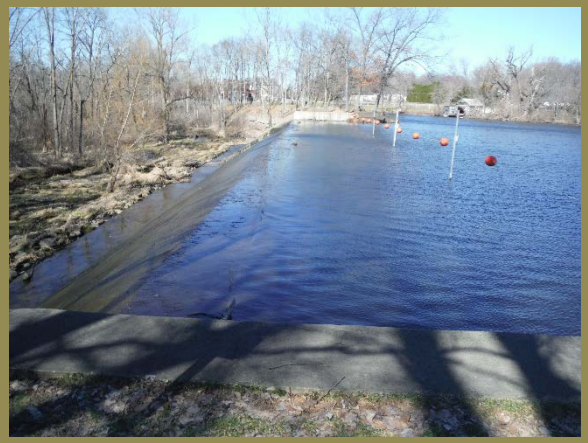
3 Additional Considerations

- Property ownership
- Gas pipelines
- Use of impounded water as resource
- Benefits of maintaining dam
- Benefits of dam removal



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- Property Ownership

Determine ownership of land now under water.

Detailed search of County's physical records.

Ownership impacts future land use assumptions.

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- Gas Pipelines

Two significant gas pipeline crossings identified.

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- # Use of Impounded Water as a Resource

  No plans at this time.

  Presence of dam generally makes adding an intake easier, though location with respect to sediment has to be considered.

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Benefits of Maintaining Dam

Potential for continuing to generate "green" power.

Recreational uses.

Aesthetic preferences of residents.

Short-term costs typically lower.

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- # Benefits of Dam Removal

No longer need to maintain, inspect or repair the dam.

Removes risk and liability of accidental release.

More fully oxygenated river with pools and riffles.

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- # Benefits of Dam Removal

Free fish passage (approximately 10 river miles would open)

Riparian vegetation reduces erosion and maintains cooler water temperatures.

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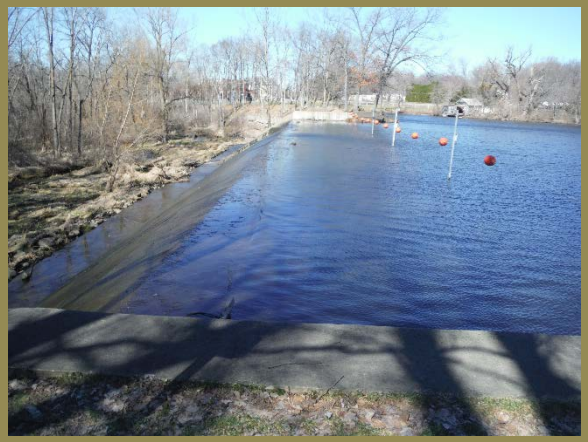
4 Conclusions

- Summary
- Notch and Release
- Cost opinions



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- Summary

Relatively uniform horizontal and vertical distribution of metals and other pollutants.

No “hot spots” found.

Sediment quality allows for upland disposal or disposal in municipal landfill.

Sediment quality may also allow for notch and release – need regulator buy-in

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- Summary

To form pilot channel:

- Roughly 60,000 to 160,000 CY of advanced dredging.
- 300,000 to 540,000 CY of earthwork after dredging.

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- Summary

Assuming non-residential use (for example recreational use), due care is likely to be:

- Revegetation
- Deed restriction

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- Summary

If residential use, due care may require:

- Clean cover
- Continuing Maintenance

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- # Notch and Release

  - Method where impoundment is gradually drawn down.
  - Removes need for significant dredging, excavation and disposal of sediments.

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- # Notch and Release

  - MDEQ Remediation and Redevelopment Division is currently developing Part 201 technical resource documents

  - Possible risk of Part 201 violation downstream due to mobilization of sediments.

  - Further investigation needed to determine if this is the case.

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- Notch and Release

If Notch and Release is permittable, there can be significant cost reduction in dam removal.

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- Cost Opinions

2019 Cost Opinions	
Alternative	Cost Opinion
REPAIR	
Cofferdam	$2.1 Million
Temp. Drawdown	$22 Million
REMOVAL	
Dredge - LOW	$43 Million
Dredge - HIGH	$88 Million
Notch and Release	$14 Million

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5 Discussion