The Dow Chemical Company
Midland, MI 48674

July 16, 2010

Ms. Mary Logan
Remediation Project Manager
U.S. Environmental Protection Agency, Region 5
77 West Jackson
Chicago, IL 60604

Re: Task 2.1 Technical Memorandum-Revision 2-Settlement Agreement No. V-W-10-C-942 for The Tittabawassee River/Saginaw River & Bay Site
Dow Submittal Number 2010-037

Ms. Logan:

Attached please find the revised Task 2.1 Technical Memorandum-Revision 2 as required by AOC CERCLA Docket No. V-W-10-C-942 and Appendix A, Statement of Work Schedule. The attached document addresses EPA's June 2, 2010 comments on the April 12 draft Task 2.1 Technical Memorandum, and is also consistent with clarifications provided by EPA during our June 22 meeting. Additionally, after internal review following the July 2 submittal, it was discovered that a bank area was inadvertently removed during the completion of revisions. The attached revision incorporates this bank area back into the memorandum and reflects a total of 6 bank areas, which include and consolidate the 8 bank areas identified in the original April 12 submittal. Please feel free to contact me with any questions or concerns.

Sincerely,
The Dow Chemical Company

Todd Konechne
Project Coordinator

cc: Al Taylor, MDNRE
Diane Russell, U.S. EPA
Joseph Haas, U.S. Fish and Wildlife
Steve Lucas, Dow
Peter Wright, Dow
Greg Cochran, Dow

Task 2.1 Technical Memorandum

The Tittabawassee River/Saginaw River & Bay Site

Prepared by:
The Dow Chemical Company

Date:
July 16, 2010
Dow Submittal Number 2010.037
Revision 2

Contents

1 Introduction

This technical memorandum was prepared in accordance with the requirements contained in Section IX ("Work to be Performed") of the Administrative Settlement Agreement and Order on Consent (AOC) for The Tittabawassee River/Saginaw River & Bay Site ("Site") (Settlement Agreement No. V-W-10-C-942), and Task 2 of the Statement of Work (SOW; Attachment A of AOC), effective January 21, 2010 ("Settlement Agreement"). The purpose of Task 2, as described in the Settlement Agreement, is as follows:

> "to characterize and assess potential acute or near-term contaminant transport risks and, as necessary, [The Dow Chemical Company (Dow)] shall develop mitigation measures to address acute or near-term contaminant transport risks in advance of the respective Segment-Specific Response Proposal required under Task 8."

The expedited evaluation performed under Task 2 is not intended to represent a comprehensive response to address contaminant transport risks at the Site nor will the evaluations and resulting response actions conducted under Task 2 set precedent for the Task 8 Segment-Specific Response work. For example, consistent with the requirements of the SOW (e.g., Task 7.3), Dow is currently evaluating sediment stability and transport data collected throughout Operable Unit (OU) 1 and may develop additional tools to continue to allow previously completed and potential future response actions in OU 1 to be evaluated holistically. Consistent with the SOW, if approved by the U.S. Environmental Protection Agency (EPA) in consultation with the Michigan Department of Natural Resources and Environment (DNRE), Dow may utilize site-specific hydrodynamic, fate and transport, geomorphic and/or other environmental modeling tools in a weight-of-evidence evaluation for Task 2 and other SOW tasks. While these more detailed evaluation tools are not presently available for use in this memorandum, they could be available for use in follow-on Task 2 evaluations and Task 8 Segment-Specific Response work.

Consistent with the Settlement Agreement requirements, the Task 2.1 scoping meeting was held between EPA and the DNRE (collectively, the "Agencies") and Dow on February 25, 2010. Task 2.1 of the Settlement Agreement also requires Dow to develop a technical memorandum that identifies and sequences areas of potential acute or near-term contaminant transport risks, with submittal of the technical memorandum to the Agencies no later than 45 days after the Task 2.1 scoping meeting. The draft Task 2.1 Technical Memorandum was submitted to the Agencies on April 12, 2010, fulfilling this Task 2.1 requirement. Dow received comments and partial approval of the Task 2.1 Technical Memorandum in a June 2, 2010 letter from EPA. A follow-on meeting between the Agencies and Dow was held on June 22, 2010 to clarify the Agencies' comments. This final Task 2.1 Technical Memorandum addresses the Agencies' comments on the earlier draft.

2 Completed Early Actions

Dow and the Agencies have performed early response actions since 2007, focusing on areas with the highest potential for contaminant transport risk. Early actions were conducted under several regulatory authorities:

- Interim Response Activities (IRAs) conducted under Part 111 Hazardous Waste Management authorities of the Natural Resources and Environmental Protection Act, 1994 PA 451 as amended, as required by Dow's Hazardous Waste Management Facility Operating License.
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) authorities to mitigate potential acute or near-term contaminant transport risks.
- Voluntary cleanup actions performed by Dow consistent with permitting requirements.

The early actions included the following completed projects:

- **Reach B**: 2008 removal of approximately 19,000 cubic yards (cy) of bank soils containing elevated concentrations of contaminants of interest (COIs), followed by 2009 capping of approximately 700 linear feet (roughly 1.0 acre) of in-channel sediments and adjacent side slopes; maintenance and monitoring is ongoing to confirm the continued viability and protectiveness of the cap as a final remedial measure.
- **Reach D**: 2007 removal of approximately 19,000 cy of in-channel sediment with elevated concentrations of COIs, followed by 2009 capping of approximately 1,500 linear feet (roughly 1.4 acres) of in-channel sediments; maintenance and monitoring is ongoing to confirm the continued viability and protectiveness of the cap as a final remedial measure.
- **Reach J/K**: 2007 removal of approximately 32,000 cy of bank soils with elevated furan and dioxin toxicity equivalent (TEQ) levels, followed by stabilization and restoration of approximately 1,800 linear feet of shoreline.
- **Reach M**: 2008/2009 pilot stabilization and restoration projects addressing approximately 1,600 linear feet of bank soils with elevated TEQ levels using deep rooting native vegetation; long-term monitoring of the pilot projects is being performed to evaluate the effectiveness of these actions.
- **Reach O**: 2007 removal of approximately 22,000 cy of in-channel sediment with elevated TEQ levels, followed by stabilization and restoration of the 1,900-foot-long access road behind the industrial levee adjacent to the river and the three bank locations used to access the in-channel removal areas.
- **Reach TT – West Michigan Park**: 2009 removal of floodplain soils containing elevated TEQ levels, followed by stabilization and restoration of approximately 700 linear feet of shoreline.
- **Saginaw River - Wickes Park**: 2007 removal of approximately 700 cy of in-channel sediment with elevated TEQ levels.

As discussed above, further weight-of-evidence evaluations of these previously completed response actions and concurrent development of tools to assess potential future Task 2 or Segment-Specific Response actions in OU 1 is ongoing.

3 Areas of Potential Acute or Near-Term Contaminant Transport Risk

In accordance with the Settlement Agreement SOW, the objective of Task 2.1 is to use available data to identify and sequence areas of potential acute or near-term contaminant transport risks within the Site that may be addressed ahead of the Segment-Specific Response Proposals. The SOW also requires Dow to propose whether an identified area will be sequenced to start in either Task 2.2, 2.3, or 2.4, described below. A flow chart depicting the overall Task 2 characterization and sequencing process is provided in Figure 1.

- Task 2.2 is intended for areas where additional data (including sediment stability and/or chemical characterization data) are needed to determine if there is a potential acute or near-term contaminant transport risk.
- Task 2.3 provides a vehicle for further characterization and assessment of areas with the potential for acute or near-term contaminant transport risks, to determine if these areas warrant consideration of early responses ahead of the Segment-Specific Response Proposals.
- Task 2.4 provides for development of mitigation measures, as appropriate, for areas that clearly pose an acute or near-term contaminant transport risk based on existing information, and that warrant an early response in advance of the respective Segment-Specific Response Proposal required under Task 8.

A process approved in 2008 by the Michigan Department of Environmental Quality (MDEQ), now known as the Michigan Department of Natural Resources and Environment (DNRE), established a procedure for sampling, analysis, data evaluation, and determination of early response actions pursuant to the TEQ thresholds identified in the June 2008 *Tittabawassee River IRA Implementation Decision Tree for Furans and Dioxins*. The step-wise IRA decision tree process included the following:

- **Step 1**: Delineate potential IRA areas (e.g., based on step-out sampling, etc.)
- **Step 2**: Determine the need for an IRA based on the following factors:
    - Size and mass of deposit
    - Depth of elevated TEQ concentrations
    - Human exposure potential
    - Likelihood of remobilization using multiple lines of evidence
- **Step 3**: (If needed) Determine IRA timing based on area accessibility (e.g., river conditions, weather conditions, site access, permitting and ecological factors)
- **Step 4**: Implement the IRA as appropriate

Site characterization data collected under the IRA process and evaluated in this Task 2.1 technical memorandum were submitted to the Agencies as part of the April 2009 *Tittabawassee River and Floodplain Soils IRA Implementation Decision Tree Step 2 and 3 Report* and the June 2009 *Tittabawassee River and Floodplain Soils GeoMorph Site Characterization Report*, along with supplemental addenda to these reports. During the 2006, 2007 and 2008 investigations, nearly 2,000 in-channel and bank sediment cores were collected in OU 1, and more than 12,000 samples sectioned from these cores were analyzed for TEQ levels. Core locations are shown in Figure 2. Concurrent sediment and bank stability assessments including bank erosion hazard

index (BEHI) surveys throughout OU 1 were performed as a component of the overall GeoMorph site characterization. In-channel and bank deposits are discussed separately in the sections below.

In-Channel Deposits

As summarized in the April 2009 *Tittabawassee River and Floodplain Soils IRA Implementation Decision Tree Step 2 and 3 Report,* the IRA process identified 83 trigger locations where detailed step-out sampling was performed (79 in-channel plus 4 island trigger locations in a total of 38 deposits [i.e., some deposits had multiple sampling locations]). Based on these data, all but 8 in-channel areas in OU 1 were characterized as *de minimis* deposits. *De minimis* deposits were defined in the April 2009 report as those where only one sample of the riverbed had a uniquely high TEQ level relative to the step-out samples collected in the vicinity. Step-out sampling performed in these areas suggested that these *de minimis* deposits were isolated, with a limited footprint and relatively low TEQ mass. These *de minimis* deposits were not carried forward for further IRA assessments.

The step-out sampling initially identified 6 historical deposits characterized by a vertical sequence of buried sediment layers with elevated TEQ levels deposited during the early operations of Dow's Midland facility. These historical deposits appear to have remained undisturbed for decades and are currently overlain with relatively clean sand. Multiple lines of evidence suggest that these areas have a low likelihood of remobilization. For example, these historical in-channel deposits generally occur in accreting pointbars located along inside meander bends of the river. Geomorphologically, these accreting pointbars are stable formations that appear to be in equilibrium with current sediment transport conditions, and are anticipated to remain in place indefinitely. Additionally, the contaminant signatures in these deposits, and the lateral and vertical position of the deposits within the accreting pointbars, further indicate that the deposits are historical. Current conditions associated with the 6 historical deposits are summarized below.

- **Reach B** – Stations 24+00 to 25+50 (IRA Trigger Area TA015): Dow remediated this deposit in 2009 as part of the Reach B capping project summarized above.
- **Reach J/K** – Stations 189+50 to 198+00 (IRA Trigger Area TA016): Elevated TEQ levels in this deposit are buried 1 to 5 feet below the bed surface, though a single surface sediment sample collected from this pointbar deposit marginally exceeded the IRA threshold. Monitoring is ongoing to verify the continued stability of this deposit.
- **Upper Reach L** – Stations 236+25 to 239+50 (IRA Trigger Area TA017): Elevated TEQ levels are present in this deposit from 1 to 4 feet below the bed surface. Monitoring is ongoing to verify the continued stability of this deposit.
- **Lower Reach L** – Stations 256+00 to 258+50 (IRA Trigger Area TA018): Elevated TEQ levels in this deposit are buried 1 to 3 feet below the bed surface. Monitoring is ongoing to verify the continued stability of this deposit.
- **Upper Reach II** – Stations 782+00 to 785+00 (IRA Trigger Area TA019): Sediment TEQ levels marginally exceeded the IRA threshold from the sediment surface to 6 feet below the bed surface. Monitoring is ongoing to verify the continued stability of this deposit.
- **Lower Reach II** – Station 801+00 (IRA Trigger Area TA020): Sediment TEQ levels marginally exceeding the IRA threshold are present in this relatively small deposit from the sediment surface to 4 feet below the bed surface. Monitoring is ongoing to verify the continued stability of this deposit.

As summarized above, the Reach B deposit was remediated in 2009 and need not be considered further as part of the Task 2 evaluation.

The morphologic characteristics and stability of the historical in-channel deposit in Reach J/K have been actively monitored since 2006. Differential analysis of 2007 to 2009 bathymetric surveys indicates a net depositional setting across the Reach J/K pointbar. Bed pin monitoring from August 2008 to June 2010 confirms this net depositional setting, and also indicates an active bed thickness in a portion of this area of up to approximately 1.4 feet. Because of its net depositional characteristics, the Reach J/K pointbar deposit has been identified as a promising location for an accretion cap pilot study, using a geoweb product (e.g., materials used as part of the 2008/2009 Reach M pilot study outlined above) to accelerate sediment deposition and stability/isolation of underlying contaminated sediments. The accretion cap pilot study will be implemented in summer 2010 under the provisions of Task 5 of the SOW. The results of the Reach J/K accretion cap pilot study will be used to inform Segment 2 and future Segment Specific Response Proposals.

The remaining 4 historical deposits identified in the April 2009 report (i.e., in Upper Reach L, Lower Reach L, Upper Reach II and Lower Reach II) will be evaluated further in Task 2 to determine if early response actions may potentially be appropriate in these areas (Table 1; the locations of these deposits are depicted in Appendix A). Similar to the Reach J/K pointbar deposit summarized above, the morphologic characteristics and stability of these 4 deposits have been actively monitored since 2006, and the data indicate a net depositional setting and an active bed thickness of up to approximately 1.4 feet. Monitoring to evaluate the continued stability of these historical deposits is ongoing and will continue as part of Task 2.2 data collection.

Ongoing stability monitoring is also being performed at other in-channel *de minimis* deposits to further characterize sediment stability specifically, in Reach Q, Reach S, Reach MM, Reach QQ, Reach RR, Reach XX, and Reach YY., These activities are will be incorporated into the Task 2.2 data collection. The ongoing stability monitoring data, along with other relevant characterization information, will be incorporated into the Task 2.3 evaluation to determine if these deposits warrant consideration of early responses ahead of the Segment-Specific Response Proposals.

The other 2 of the 8 identified in-channel areas that are potentially vulnerable to near-term contaminant transport are in-channel center islands in Reaches MM and WW (April 2009 *Tittabawassee River and Floodplain Soils* IRA *Implementation Decision Tree Step 2 and 3 Report*; the locations of these island deposits are depicted in Appendix A). Similar to the deposits summarized above, these 2 in-channel islands are characterized by a vertical sequence of buried sediment layers with elevated TEQ levels, overlain with less impacted sediments/soils. Elevated TEQ levels currently extend from below the low water line upwards to approximately 8 to 12 feet above the low water level surface. Aerial photograph analyses indicate that the footprints of these islands have decreased over the past 70 years, indicating that the potential for remobilization of the existing buried TEQ mass exists. Thus, these islands received a relatively high overall IRA assessment in the April 2009 report. Further Task 2.2 monitoring will be performed in 2010 to more fully characterize the near-term contaminant remobilization potential of these 2 in-channel center islands (see Section 5).

Additionally, due to the aerial photograph analysis identifying a significant change in the footprint of the island at Reach MM over the past 70 years, in addition to Task 2.2 monitoring, this island will sequence directly into the Task 2.4 development of potential mitigation measures (see Section 4).

Banks

Investigations of bank erosion stability and potential TEQ transport in OU 1 were conducted and reported as part of the June 2009 *GeoMorph Site Characterization Report*. Particularly within Reaches M and N, a relatively large number of horizontal and vertical borings were advanced in close proximity to one another to characterize the relationship and continuity of TEQ concentrations in bank deposits (*GeoMorph Site Characterization* March 2008 Update, Attachment U-2). In nearshore borings advanced 10 to 20 feet from the river's edge within industrial age levees, maximum soil/sediment TEQ levels were typically observed at depths approximately 2 to 6 feet below ground surface, with lower levels above and below these subsurface deposits. This vertical profile is consistent with the increase in the manufacturing production capacity of the Dow Plant in the early part of the 20th century, followed by implementation of increasingly effective wastewater treatment processes and source control measures beginning in the 1920s.

The layer-weighted average concentration (LWAc) is the calculated average concentration from the ground surface to the maximum depth of contamination. In the June 2009 report, each sampled layer was assigned a weighting factor to account for differences in the thicknesses of the sampled layers. The weighting factors normalize the influence of contaminant concentrations in each layer based on layer thickness..

The formula used to calculate LWAc was adapted from the EPA guidance document "*Soil Screening Guidance: User's Guide*, Publication 9355.4-23, July 1996, using layer thickness in place of depth interval. The calculation can be expressed mathematically as the following equation:

$$LWAc = \frac{\sum_{i=1}^{n} li \, ci}{\sum_{i=1}^{n} li}$$

Where:

li is the sampled layer

ci is the concentration measured in an individual core sample

the nth layer is the last layer sampled, defined as the deeper of two consecutive layers with less than 10 parts-per-trillion (ppt) TEQ

Bank areas with the highest LWAc TEQ levels extending from the ground surface to the bottom of the industrial age levee that are located in potential bank erosion areas have been identified for further consideration of possible early action as part of Task 2. Maps depicting LWAc bank soil TEQ levels throughout OU 1 are provided in Appendix A.

The investigation of the lower Tittabawassee River built upon the understanding of river morphology and contaminant distributions developed through detailed characterization of the upper and middle reaches of the river. The rationale for selection of 2008 in-channel, over-bank and floodplain sampling locations in the lower Tittabawassee River was identical to that employed in 2006 and 2007 for more upstream reaches. The selection of samples for chemical analysis was prioritized to identify the 1,000 ppt TEQ near-river floodplain boundary. However, all geomorphic features were sampled and analyzed with sufficient data density to meet the other study objectives as well.

Even though bank sampling data were less extensive in the lower Tittabawassee River than in the upper and middle reaches, these data are nevertheless adequate to complete the Task 2.1

sequencing activity for this area. Proxy values to conservatively estimate the TEQ levels were used in the June 2009 report only where analytical data were not available. The process of selecting proxy values utilizes multi lines of similarities in geomorphic features to project conservative TEQ concentrations. Parameters used to establish similarity included: river region, river reach, proximity to river, geomorphic feature description, relationship to meander bends, channel gradient, channel width, and soil/sediment profile descriptions. The Task 2.3 evaluation will also include a further comparison of LWAc values to surface or face values of samples from banks, incorporating the results of the Task 2.2 sampling of bank faces in target areas (see Section 5).The BEHI score provides a measure of a bank's potential susceptibility to erosion, integrating multiple variables and processes that contribute to erosion risk, including:

- Study bank height / bankfull height
- Root depth / study bank height
- Weighted root density (vegetation)
- Bank angle
- Surface protection
- Bank material adjustments (based on soil type and stratification)

The resultant BEHI scores range from 1 to 6, with a score of 1 indicating the lowest erosion risk and a score of 6 the highest. Maps depicting BEHI scores throughout OU 1 are provided in Appendix A, which combine all available survey data. BEHI evaluations to date have been completed at a resolution suitable to screen banks for Task 2 prioritization based on erosion potential; further evaluations of the appropriate spatial scales of BEHI evaluations will be included as part of follow-on Task 2 efforts.

Bank areas with the highest LWA TEQ levels and high corresponding BEHI scores (5 or greater) providing the greatest concern for erosion were retained for further consideration of possible early action in this Task 2.1 memorandum. In addition, banks located further downstream in OU 1 are a higher priority for early action than those further upstream, as the upstream segments will be addressed sooner under the Segment-Specific Response evaluations. The preliminary relationship between these three parameters (i.e., LWAc, BEHI, and segment location) identified 6 individual bank locations, which include and consolidate the original 8 bank areas identified in the April 12, 2010 submittal. This relationship is shown in Figures 3 to 5 and represents a cumulatively length of approximately 2,000 linear feet of banks to be evaluated further in Task 2. These bank areas are listed in Table 1 (the locations of these bank areas are depicted in Appendix A). While specific bank segments are identified in Table 1, the follow-on Task 2.2 data collection and Task 2.3 evaluation will also consider nearby adjacent banks as appropriate.

4 Task 2.4 - Development of Mitigation Measures

Task 2.4 is intended for areas where potential acute or near-term contaminant transport risks may clearly occur in OU 1 based on currently available TEQ data, erosional risk, and other information. Currently, only the Reach MM in-channel center island has been identified as a near-term contaminant transport risk warranting an early response in advance of the Segment-

Specific Response Proposal for this area. Thus, consistent with SOW requirements, the focused draft Response Proposal of mitigation measures for the Reach MM deposit will be submitted to the Agencies within 90 days after EPA approval of this Task 2.1 technical memorandum.

No other in-channel deposits and no banks have been identified at this time for an early response in advance of the respective Segment-Specific Response Proposal required under Task 8. However, further evaluation of historical in-channel deposits, in-channel center islands, and banks identified in Table 1 or discussed in the Sections above will be performed as part of the Task 2.2 data collection and/or Task 2.3 evaluation. These further evaluations may identify possible additional Task 2.4 projects that would be addressed in an early response, consistent with the SOW requirements.

5 Task 2.2 - Data Gaps

As depicted in Figure 1, if any of the identified in-channel deposits and banks carried forward in this Task 2.1 memorandum have significant data gaps that need to be filled to support the Task 2.3 assessment, such areas have been appropriately sequenced into Task 2.2. Identified data gaps include the following:

- Continued sediment stability monitoring in 2010 is needed to complete the Task 2 evaluation. Specifically, in-channel bed pins have been installed and are actively being monitored in 2010 at the following areas and transects:
    - Reach L (RL-236+50, RL-237+50, RL-239+00, RL-256+00, RL-257+00, RL-257+50, RL-258+50, RL-259+50, RL-260+50, RL-261+00)
    - Reach Q (RQ-359+00)
    - Reach S (RS-416+00, RS-417+50, RS-418+50)
    - Reach II (RII-772+00, RII-783+00, RII-785+00, RII-801+00)
    - Reach MM (RMM-900+50, RMM-903+50, RMM-905+00, RMM-913+50)
    - Reach QQ (RQQ-1023+50)
    - Reach RR (RRR-1041+50)
    - Reach XX (RXX-1242+00
    - Reach YY (RYY-1257+50, RYY-1276+00).
- Additional bathymetric surveys of the Sixth Street Turning Basin are needed in 2010 and 2011 to confirm observations of sediment deposition in this area reported during the 2007/2008 pilot study.
- Surface soil/sediment sampling is needed along the bank faces of the Reach WW in-channel center island to characterize these island deposits for the Task 2 evaluation (note that concurrent sampling of the bank faces of the Reach MM in-channel center island will be performed to support the Task 2.4 evaluation discussed in Section 4).
- Similarly, surface soil/sediment sampling of the bank areas listed in Table 1 are needed to characterize these banks for the Task 2 evaluation.

A draft Work Plan to fill surface soil/sediment sampling data gaps identified at the Reach WW in-channel center island and the 6 banks listed in Table 1, including a schedule to perform the specified work, will be submitted to the Agencies by July 19, 2010 (45 days after EPA partial approval of the earlier draft Task 2.1 technical memorandum addressing these areas). A Work Plan addendum addressing other Task 2.2 data gaps (e.g., stability monitoring of in-channel deposits) will be submitted to the Agencies within 45 days after EPA approval this Task 2.1 technical memorandum. Additional data gap work may also be proposed to the Agencies as needed following the Task 2.3 evaluations.

6 Task 2.3 - Determine Need for Early Response Action

The Task 2.2 areas sequenced into Task 2.2 (Table 1) will be sequenced to Task 2.3 following completion of the Task 2.2 data gap report. Consistent with SOW requirements, the draft Task 2.3 evaluation report identifying specific in-channel and/or bank areas warranting consideration of early responses ahead of the Segment-Specific Response Proposals will be submitted to the Agencies within 120 days after EPA approval of this Task 2.1 technical memorandum or as otherwise approved by EPA in the Task 2.2 work plans (for areas proceeding directly to Task 2.2). The Task 2.3 evaluation report will also assess whether banks located adjacent to target in-channel areas should also be included under Task 2, as it could potentially be more efficient to consider banks and in-channel areas concurrently.

As part of the Task 2.3 evaluation, further analysis of the Sixth Street Turning Basin will be included in the Task 2.3 report to assess the potential of the Turning Basin to control contaminant transport from OU 1 to OU 2 prior to completion of Segment-Specific Response actions. Evaluations will be conducted to predict depositional behavior in the Turning Basin area under a range of hydrodynamic flow conditions. The longevity of the sediment trap and routine maintenance requirements required to maintain optimal trapping conditions will also be evaluated. The Task 2.3 evaluation report will recommend how to best proceed with utilizing the Sixth Street Turning Basin sediment trap. Although alternative sediment trap locations may be considered as part of a larger OU 1/OU 2 remedy, the comprehensive evaluation of sediment and contaminant transport throughout OU 1 needs to be completed before an evaluation of additional sediment trap(s) in the lower Tittabawassee River/upper Saginaw Rivers, upstream of the Sixth Street Turning Basin can be performed

7 Task 2.6 - Identification of New Areas of Potential Acute or Near-Team Contaminant Transport Risk

Assessments are underway that will provide new information that may identify other areas to be addressed under Task 2. These assessments may include hydrodynamic and transport modeling, bathymetry analysis and thalweg mapping, and a comparison of the LWAc to surface TEQ values. These activities will be conducted as part of the Task 2.3 Assessment activities following the completion of the Task 2.2 data collection. A more specific schedule of the timing to complete these activities will be provided in the Task 2.2 work plan.

List of Figures

Figure 1:

Task 2 Characterization and Sequencing

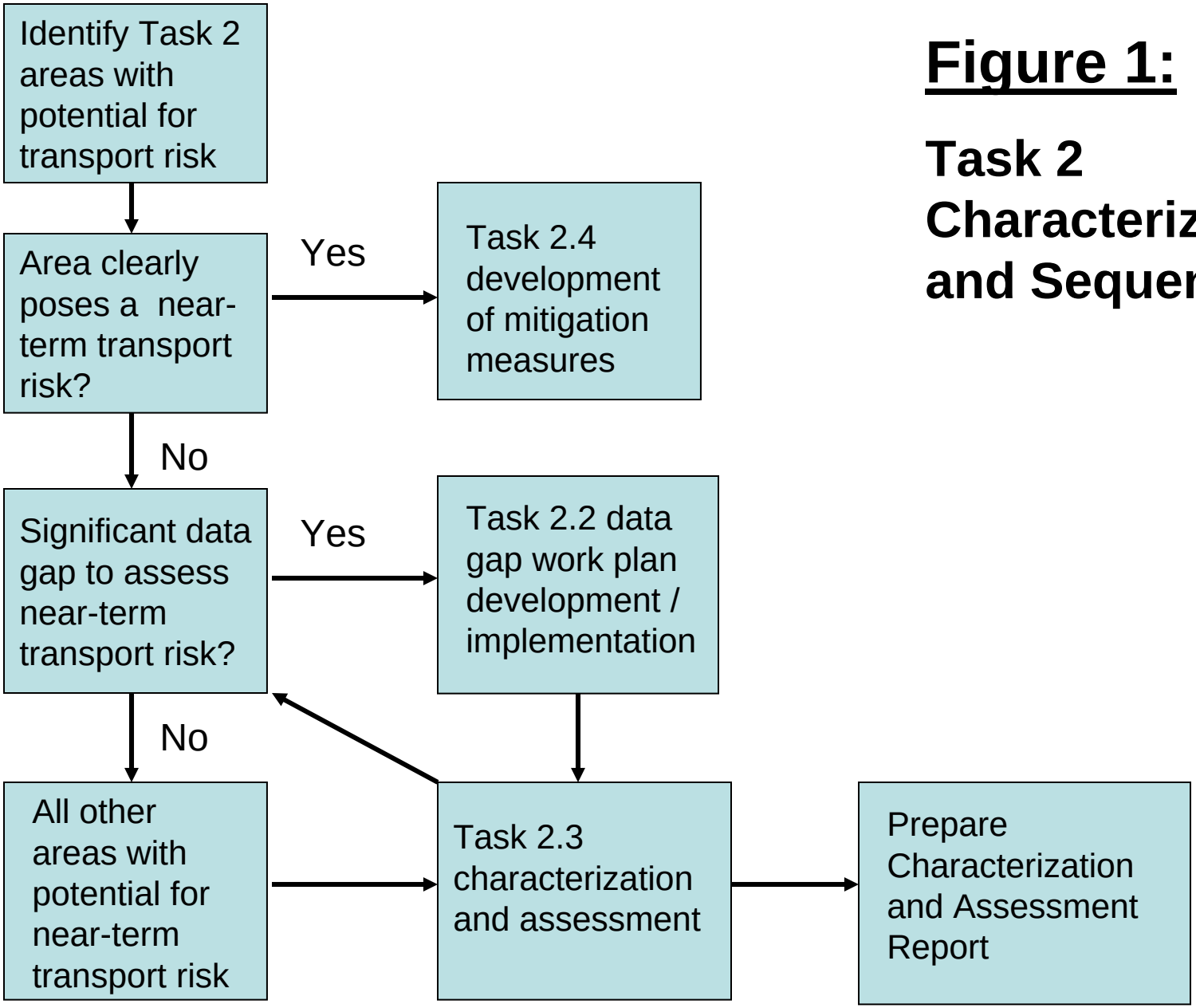

Figure 2:
OU 1 In-Channel and Bank Sample Locations

Sample Location

Reach

Figure 3. LWA Bank TEQ Concentrations by River Segment - BEHI 6

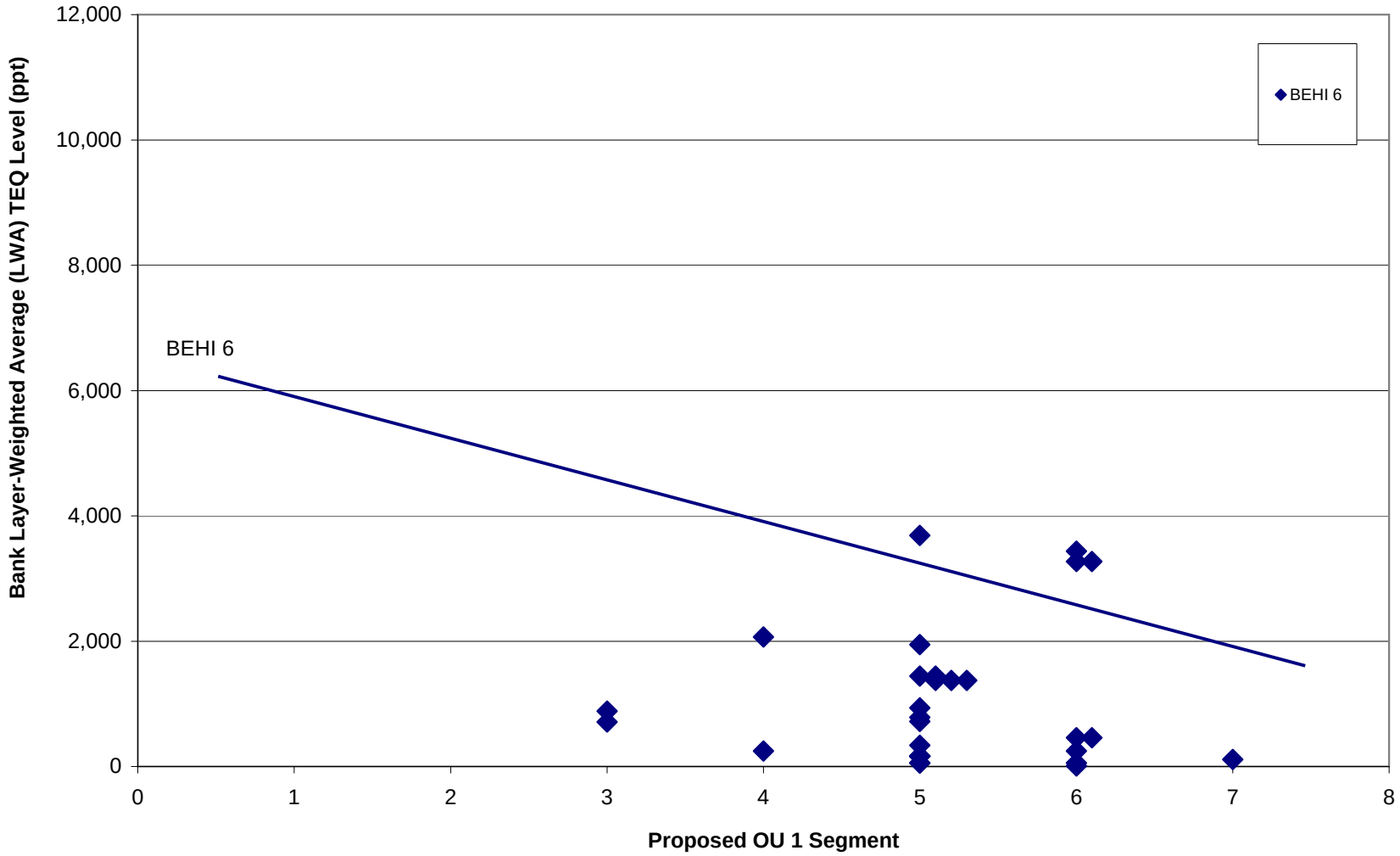

Figure 4. LWA Bank TEQ Concentrations by River Segment - BEHI 5

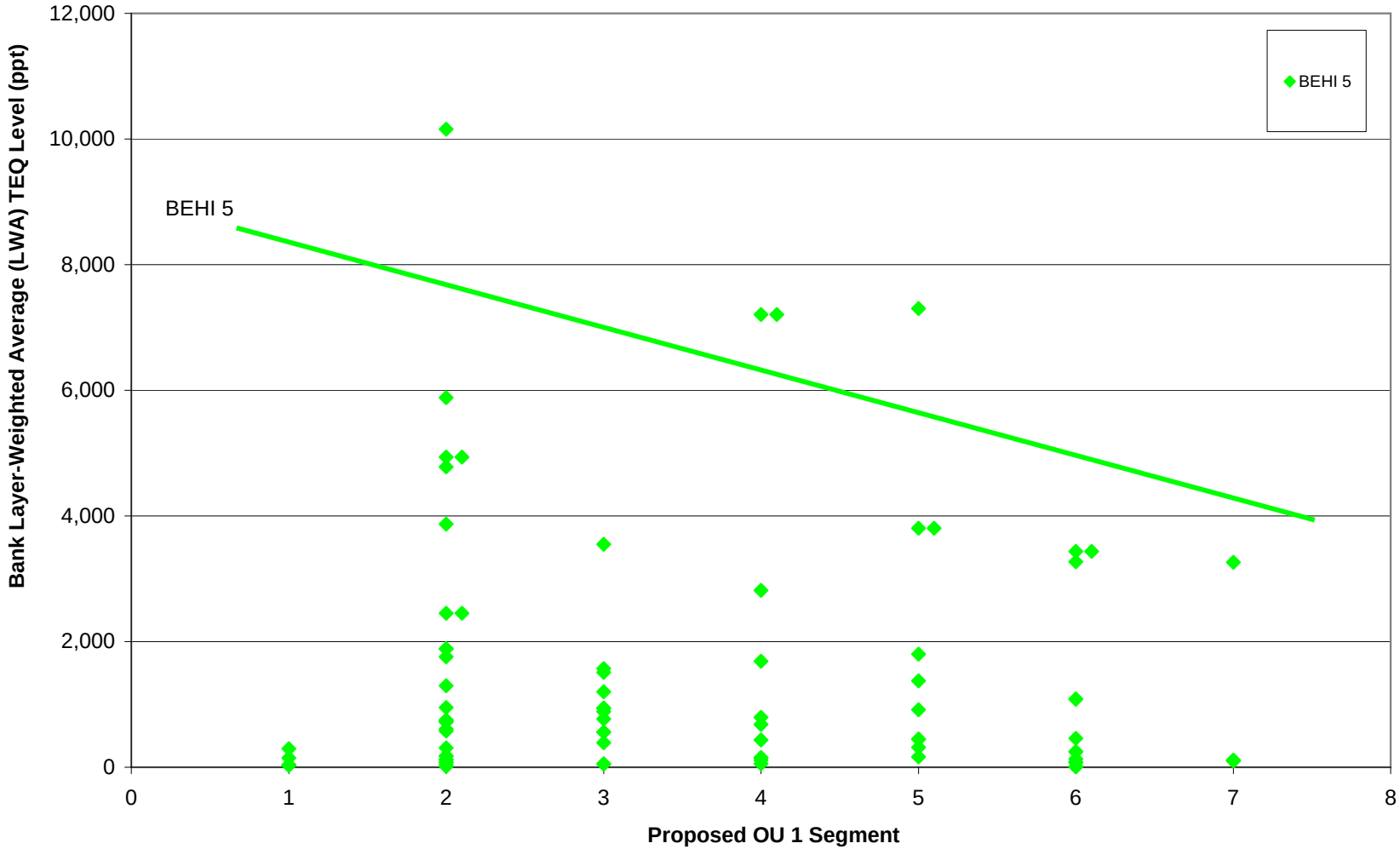

Figure 5. LWA Bank TEQ Concentrations and BEHI Scores by River Segment

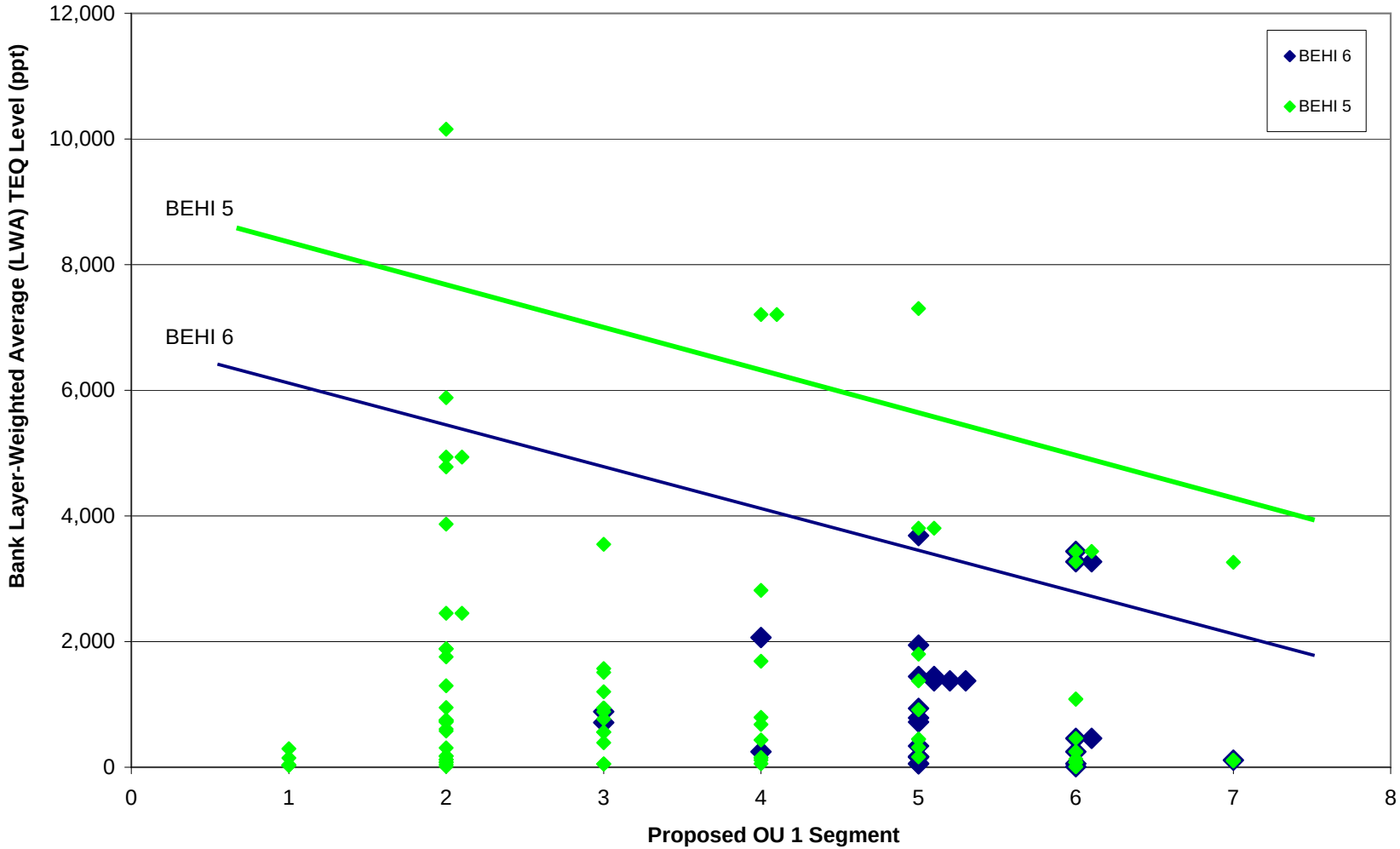

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Table 1. OU 1 Areas Retained for Further Task 2 Evaluation

Reach	Proposed Segment	IRA Trigger Area	River Station	Approximate Length (linear feet)	LWAc TEQ (ppt)	Deposit Average TEQ (ppt)	Adjacent to EU	BEHI Score	Task 2 Sequencing
In-Channel Historic Deposits									
J/K [a]	2	TA016	193+75	850	--	48,714	--	--	2010 pilot project [a]
L	2	TA017	238+00	325	--	34,000	--	--	Task 2.2 stability monitoring
L	2	TA018	257+25	250	--	38,333	--	--	Task 2.2 stability monitoring
Q	2	TA025	358+50	150	--	32,000	--	--	Task 2.2 stability monitoring
S	3	TA029	417+75	200	--	37,250	--	--	Task 2.2 stability monitoring
II	5	TA019	783+50	450	--	12,667	--	--	Task 2.2 stability monitoring
II	5	TA020	801+00	100	--	16,500	--	--	Task 2.2 stability monitoring
MM	5	TA043	913+50	100	--	15,000	--	--	Task 2.2 stability monitoring
QQ	6	TA044	1023+25	100	--	12,500	--	--	Task 2.2 stability monitoring
RR	6	TA045	1041+50	100	--	13,000	--	--	Task 2.2 stability monitoring
XX	7	TA048	1242+00	100	--	36,000	--	--	Task 2.2 stability monitoring
YY	7	TA049	1257+50	100	--	12,000	--	--	Task 2.2 stability monitoring
In-Channel Center Islands									
MM	5	TA052	903+75	100	--		--	--	Task 2.4 evaluation
WW	7	TA053	1187+50	400	--		--	--	Task 2.2 bank face sampling
Banks									
O [c]	2	--	326+00	236	10,155	--	--	5	2010 early action [c]
Z	4	--	556+00	524	7,207	--	008	5	Task 2.2 bank face sampling
AA	4	--	569+50	93	7,207	--	008	5	Task 2.2 bank face sampling
LL	5	--	872+50	509	7,302	--	--	5	Task 2.2 bank face sampling
LL	5	--	876+00	54	3,687	--	--	6	Task 2.2 bank face sampling
OO - PP	6		977+75	629	3,276 [b]	--	020	6	Task 2.2 bank face sampling
Other									
Sixth Street Turning Basin	8	--	--	--	--	--		--	Task 2.2 bathymetry

NOTES

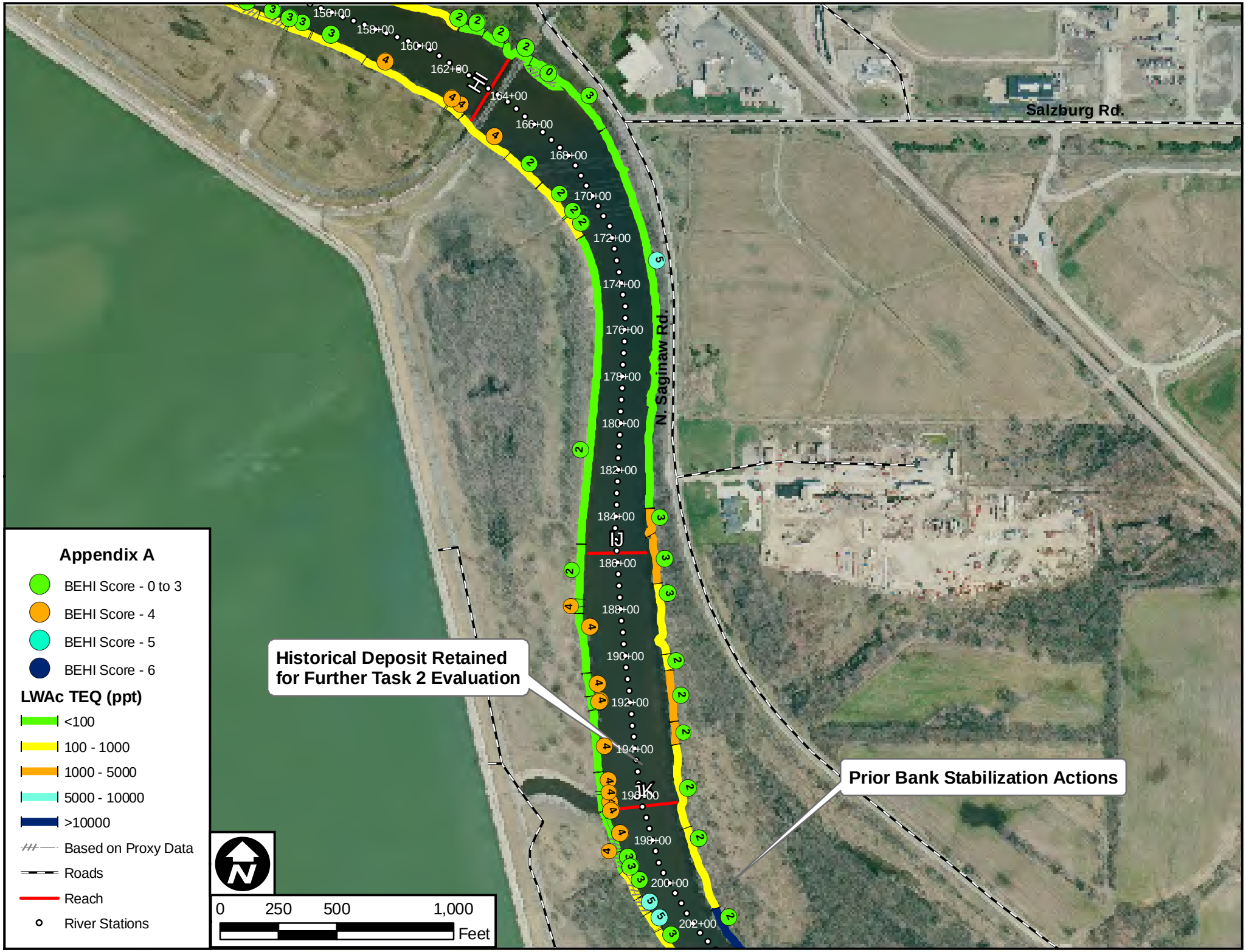
a. A cap accretion pilot project will be implemented in Reach J/K in lieu of Task 2 actions (see text)

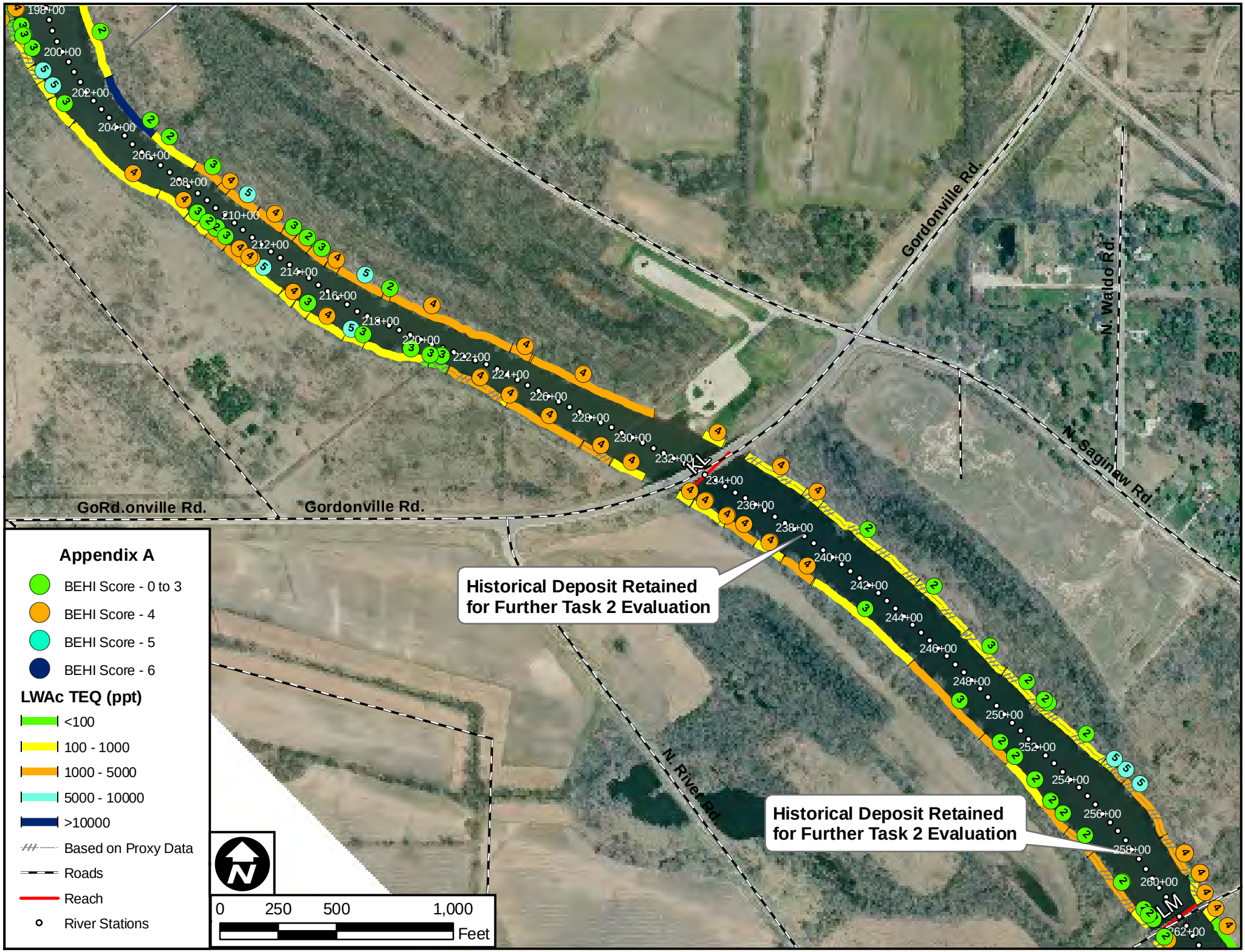
b. TEQ level estimated based on GeoMorph proxy value (see text)

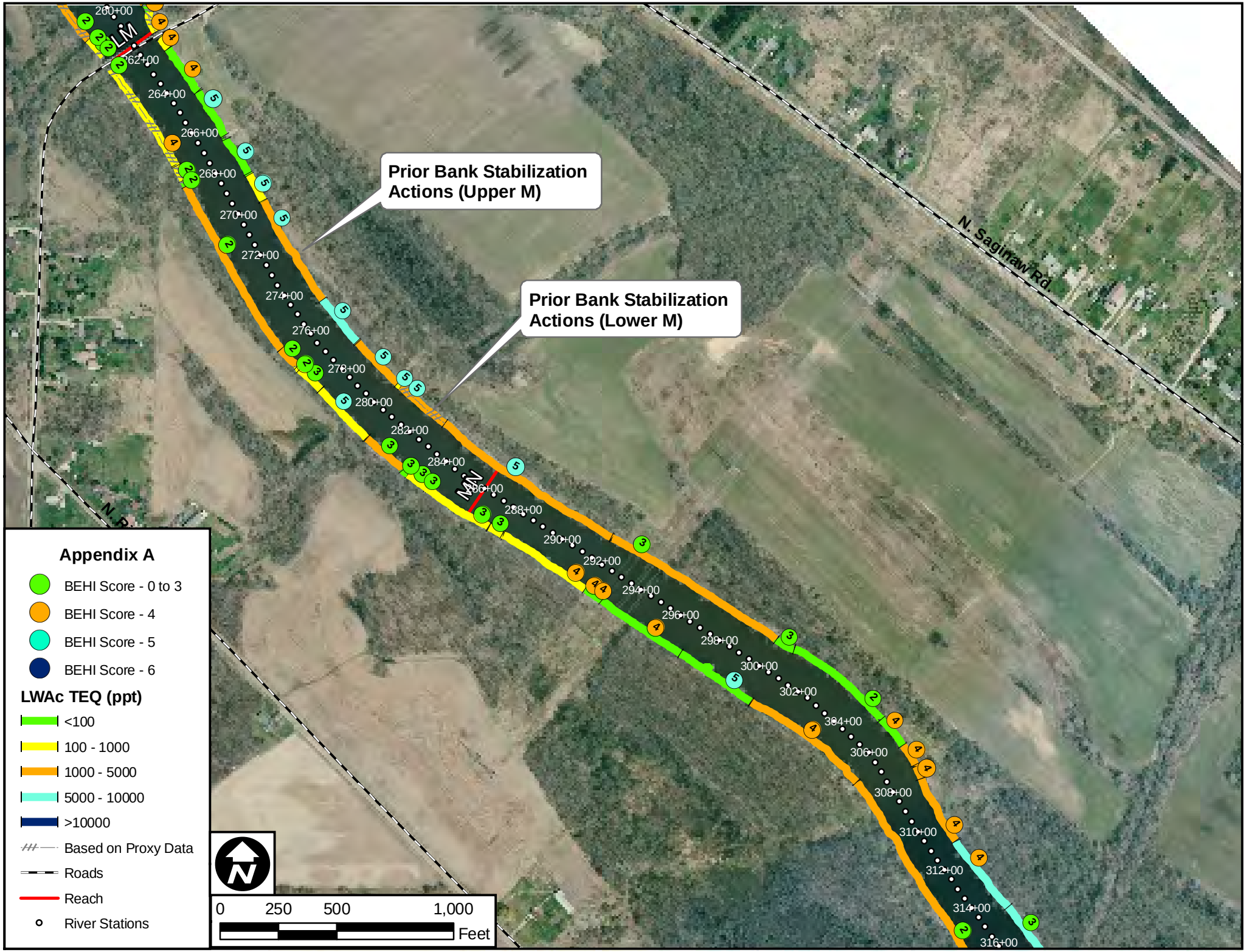
c. Reach O bank will be addressed as an Early Action enforcable by the provisions of the AOC.

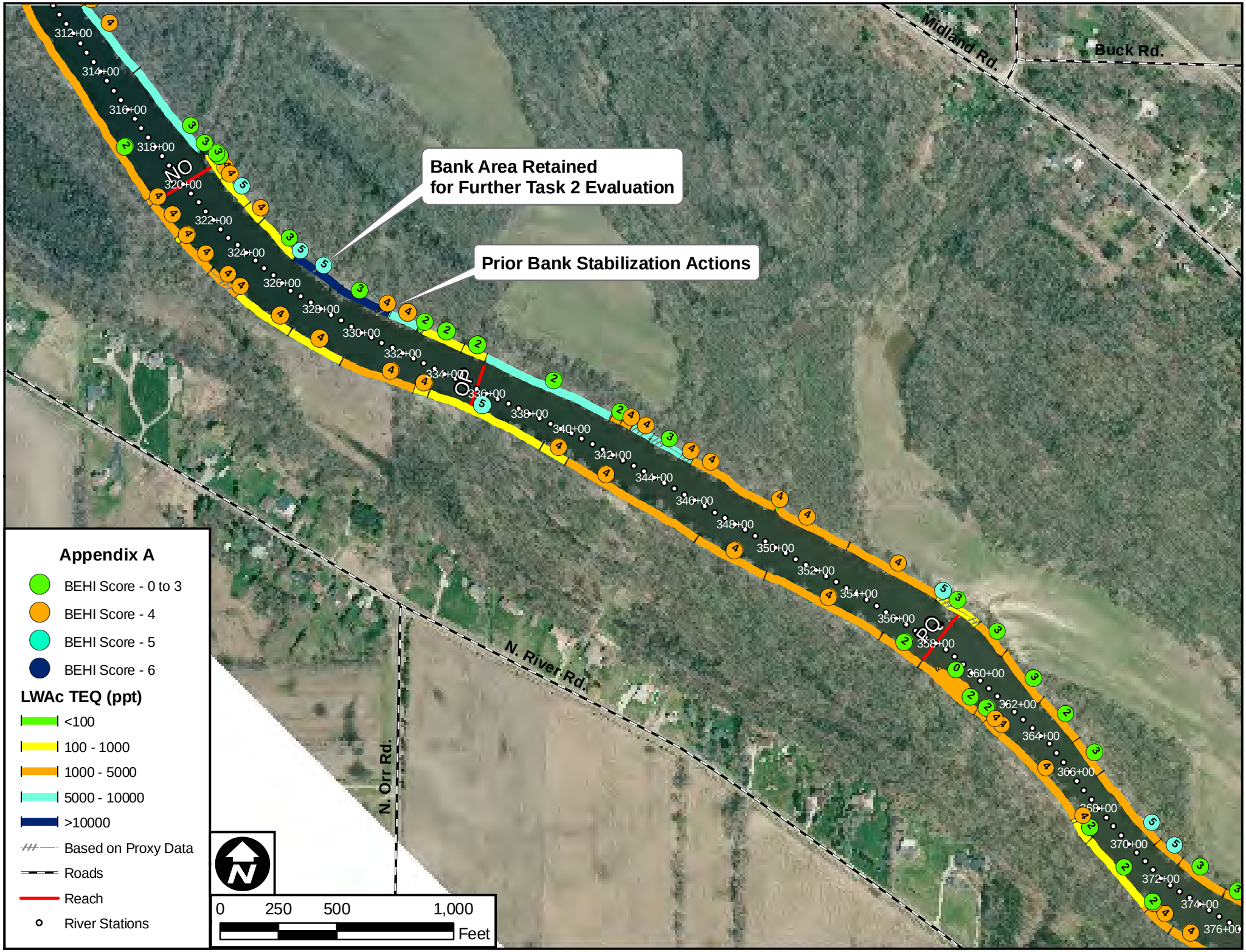
Appendices

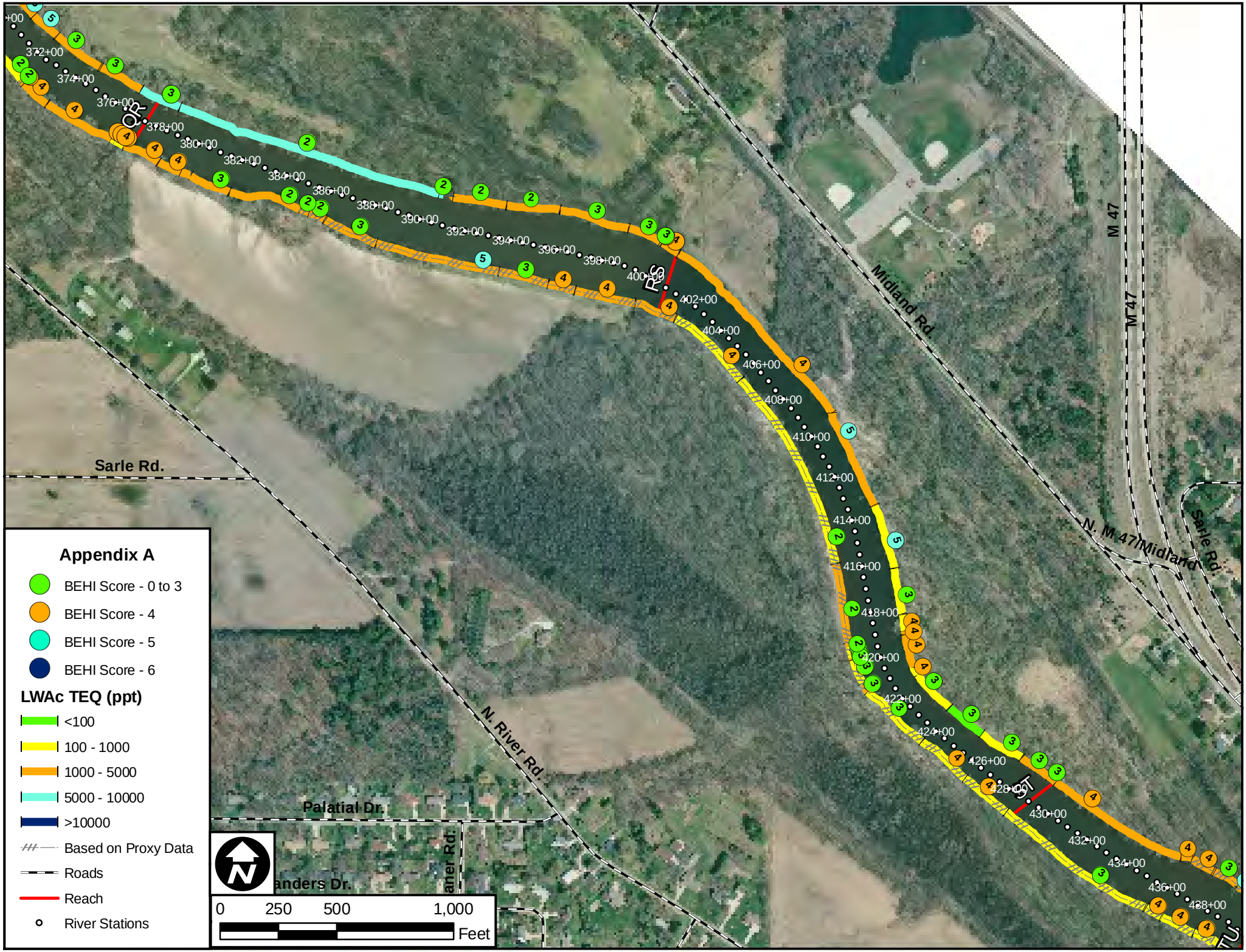
Appendix A: Maps of LWAc Bank TEQ Levels and BEHI Scores

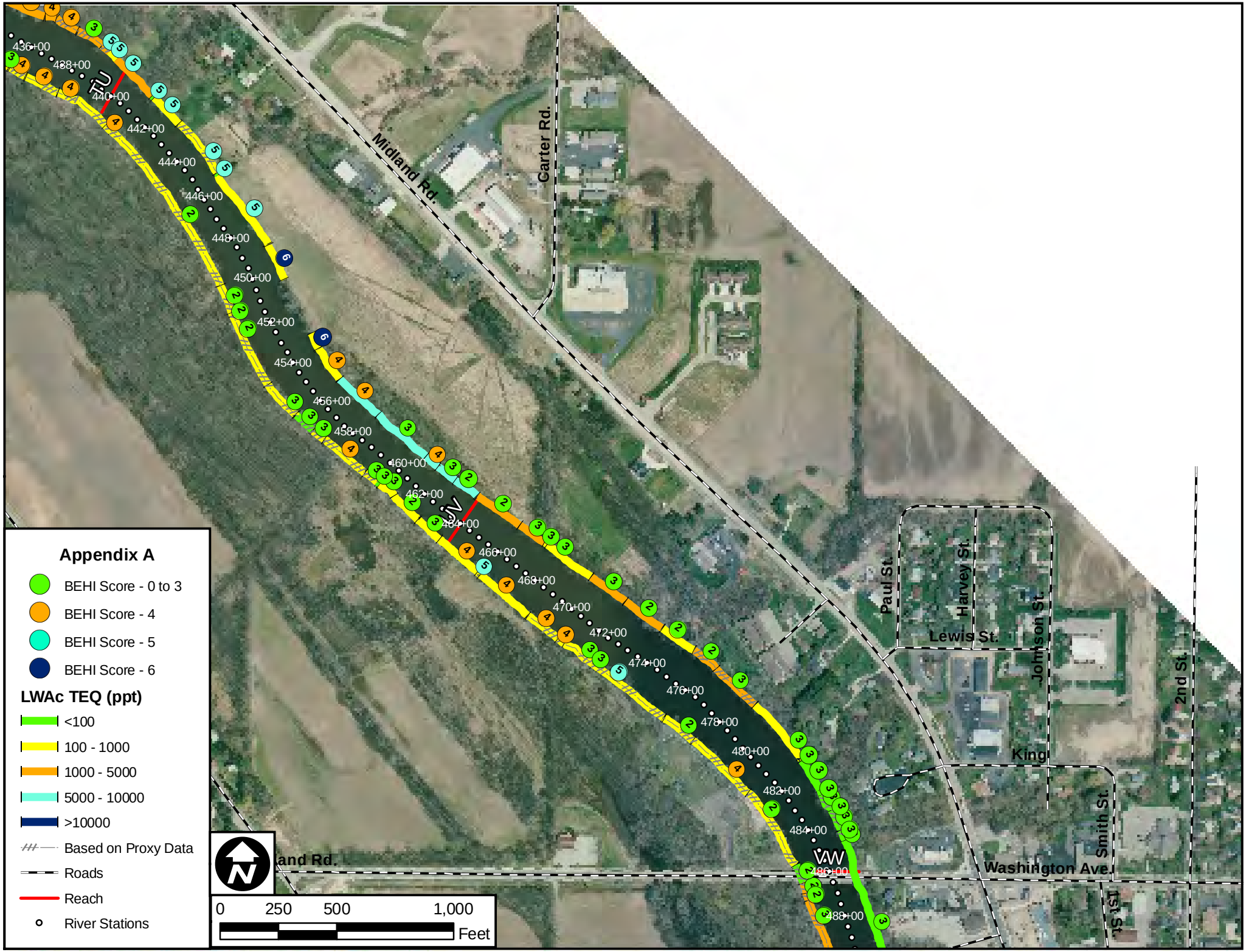

Salzburg Rd.
N. Saginaw Rd.
156+00
158+00
160+00
162+00
164+00
166+00
168+00
170+00
172+00
174+00
176+00
178+00
180+00
182+00
184+00
186+00
188+00
190+00
192+00
194+00
196+00
198+00
200+00
202+00
HI
IJ
IK
Historical Deposit Retained for Further Task 2 Evaluation
Prior Bank Stabilization Actions
Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
0 250 500 1,000
Feet

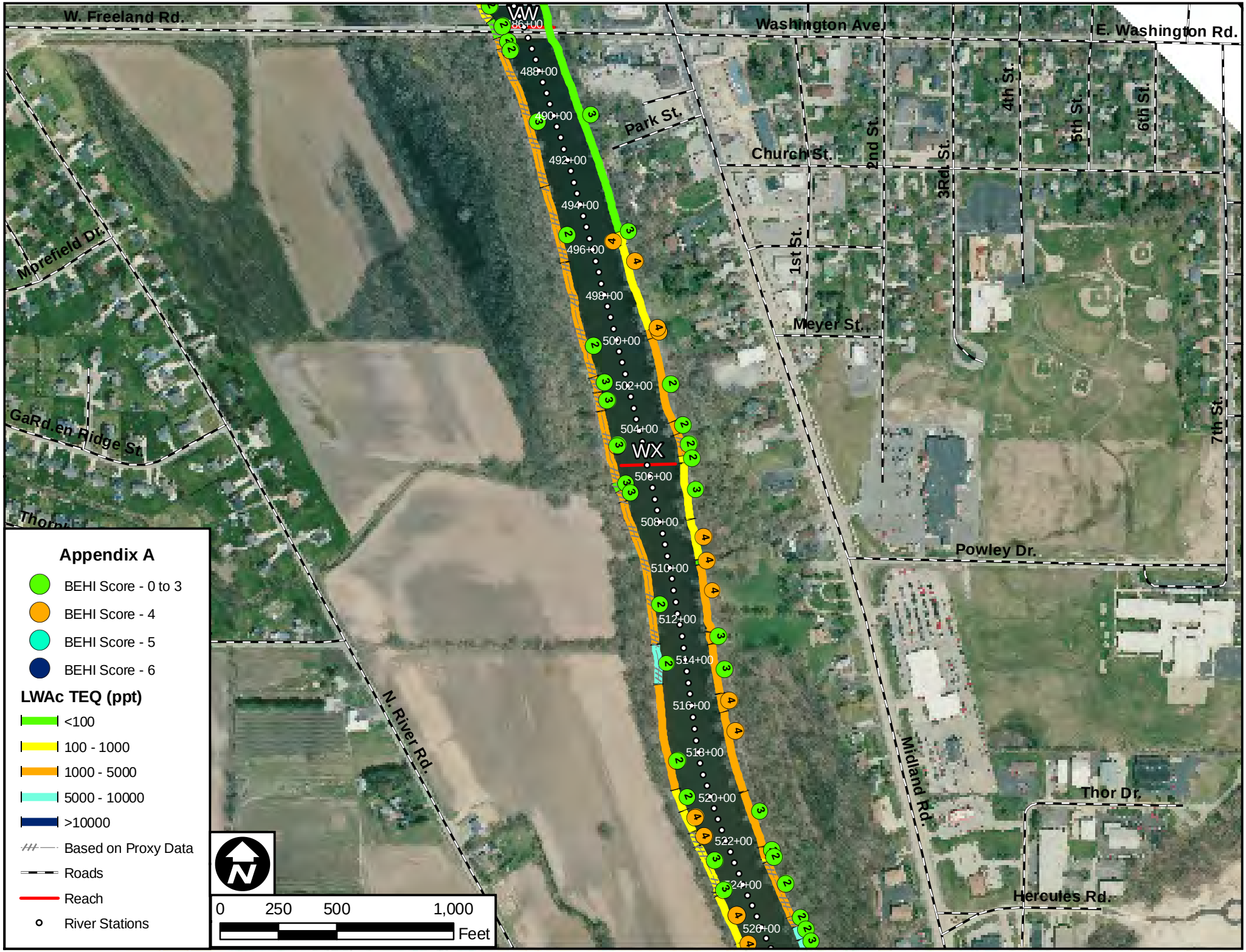

Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
0 250 500 1,000
Feet
Historical Deposit Retained for Further Task 2 Evaluation
Historical Deposit Retained for Further Task 2 Evaluation
GoRd.onville Rd.
Gordonville Rd.
Gordonville Rd.
N. Waldo Rd.
N. Saginaw Rd.
N. River Rd
198+00
200+00
202+00
204+00
206+00
208+00
210+00
212+00
214+00
216+00
218+00
220+00
222+00
224+00
226+00
228+00
230+00
232+00
234+00
236+00
238+00
240+00
242+00
244+00
246+00
248+00
250+00
252+00
254+00
256+00
258+00
260+00
262+00
LM

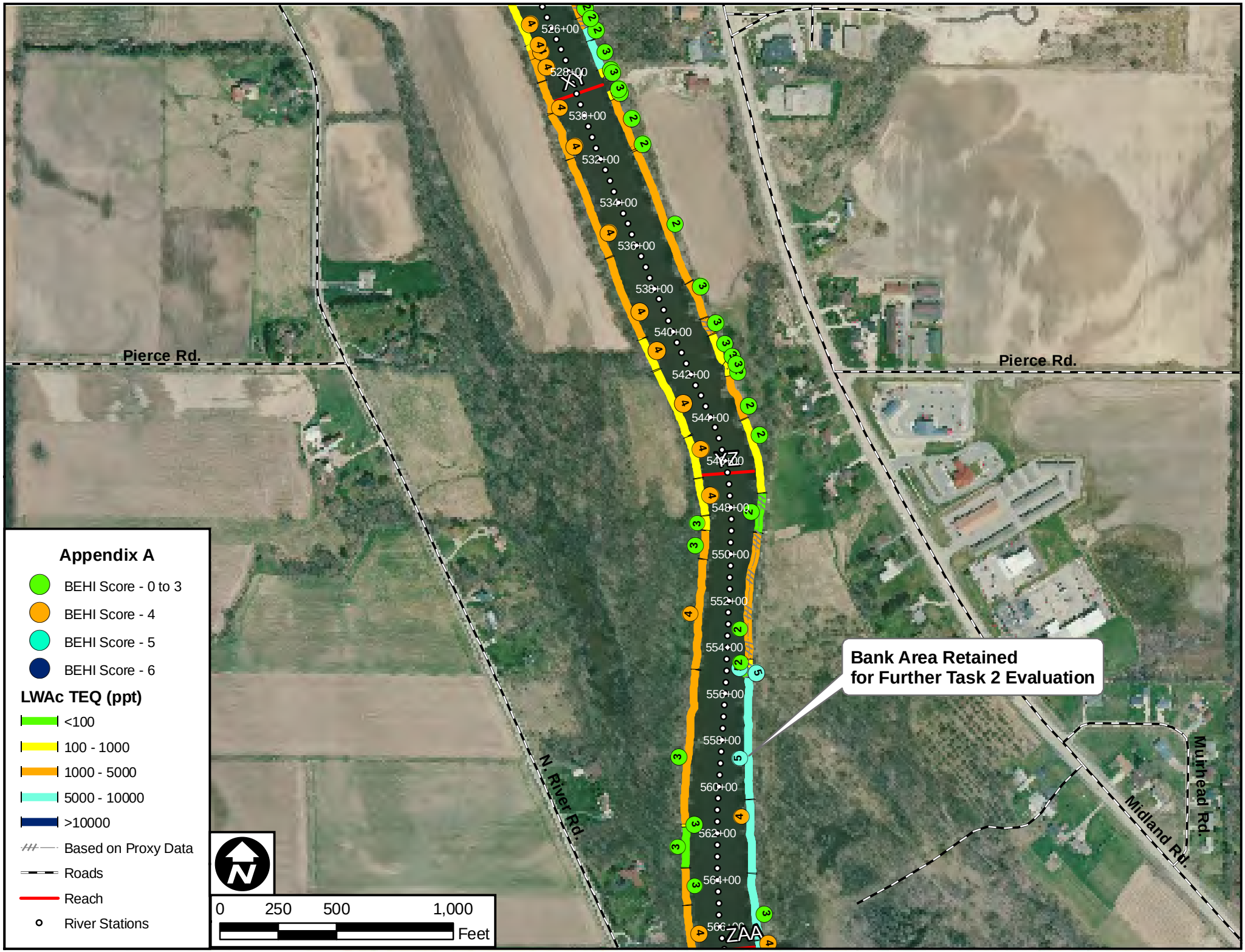

Prior Bank Stabilization Actions (Upper M)
Prior Bank Stabilization Actions (Lower M)
N. Saginaw Rd.
LM
MN
260+00
262+00
264+00
266+00
268+00
270+00
272+00
274+00
276+00
278+00
280+00
282+00
284+00
286+00
288+00
290+00
292+00
294+00
296+00
298+00
300+00
302+00
304+00
306+00
308+00
310+00
312+00
314+00
316+00
Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
0 250 500 1,000
Feet

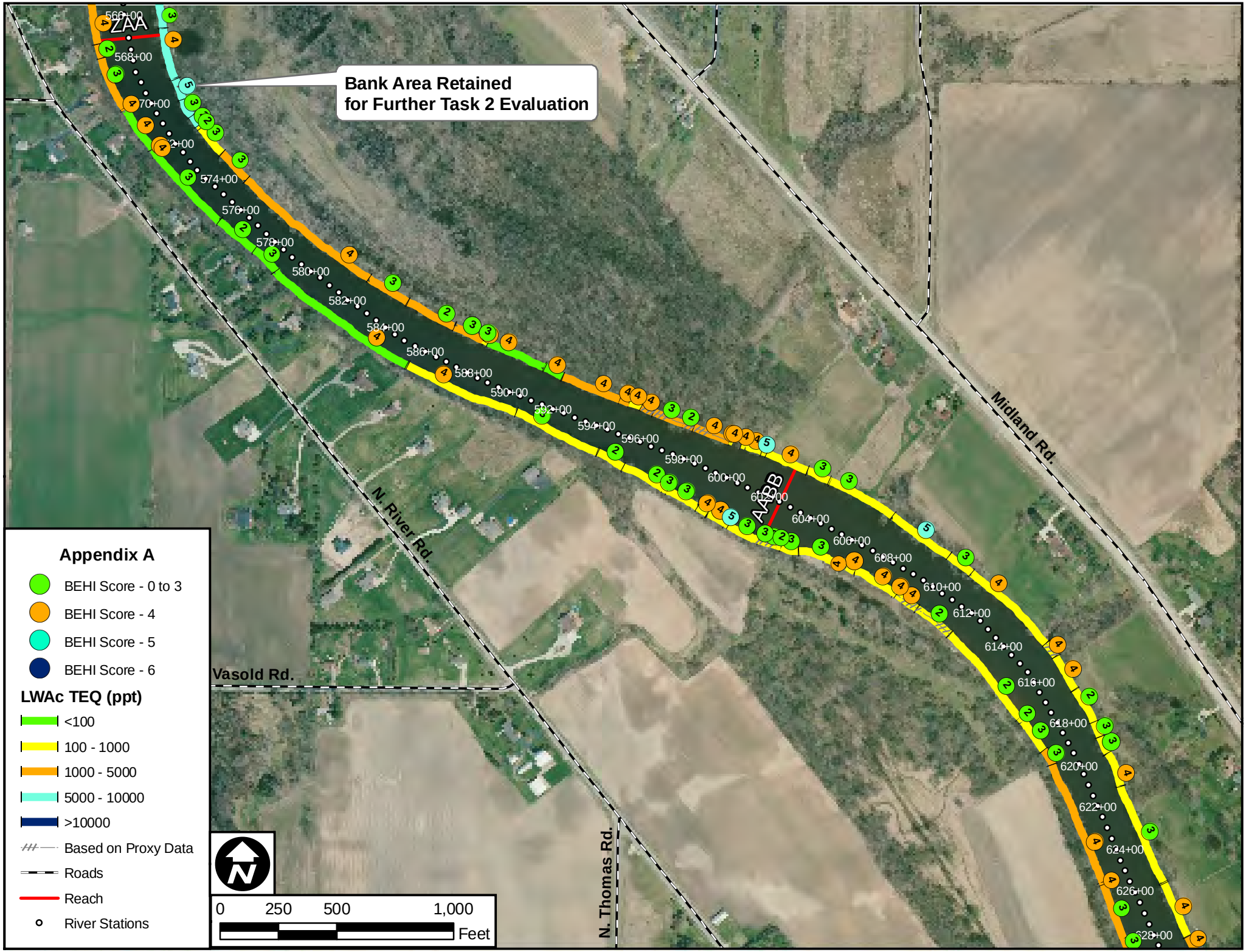

Midland Rd.
Buck Rd.
N. River Rd.
N. Orr Rd.
Bank Area Retained
for Further Task 2 Evaluation
Prior Bank Stabilization Actions
NO
RO
RO
312+00
314+00
316+00
318+00
320+00
322+00
324+00
326+00
328+00
330+00
332+00
334+00
336+00
338+00
340+00
342+00
344+00
346+00
348+00
350+00
352+00
354+00
356+00
358+00
360+00
362+00
364+00
366+00
368+00
370+00
372+00
374+00
376+00
Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
N
0
250
500
1,000
Feet

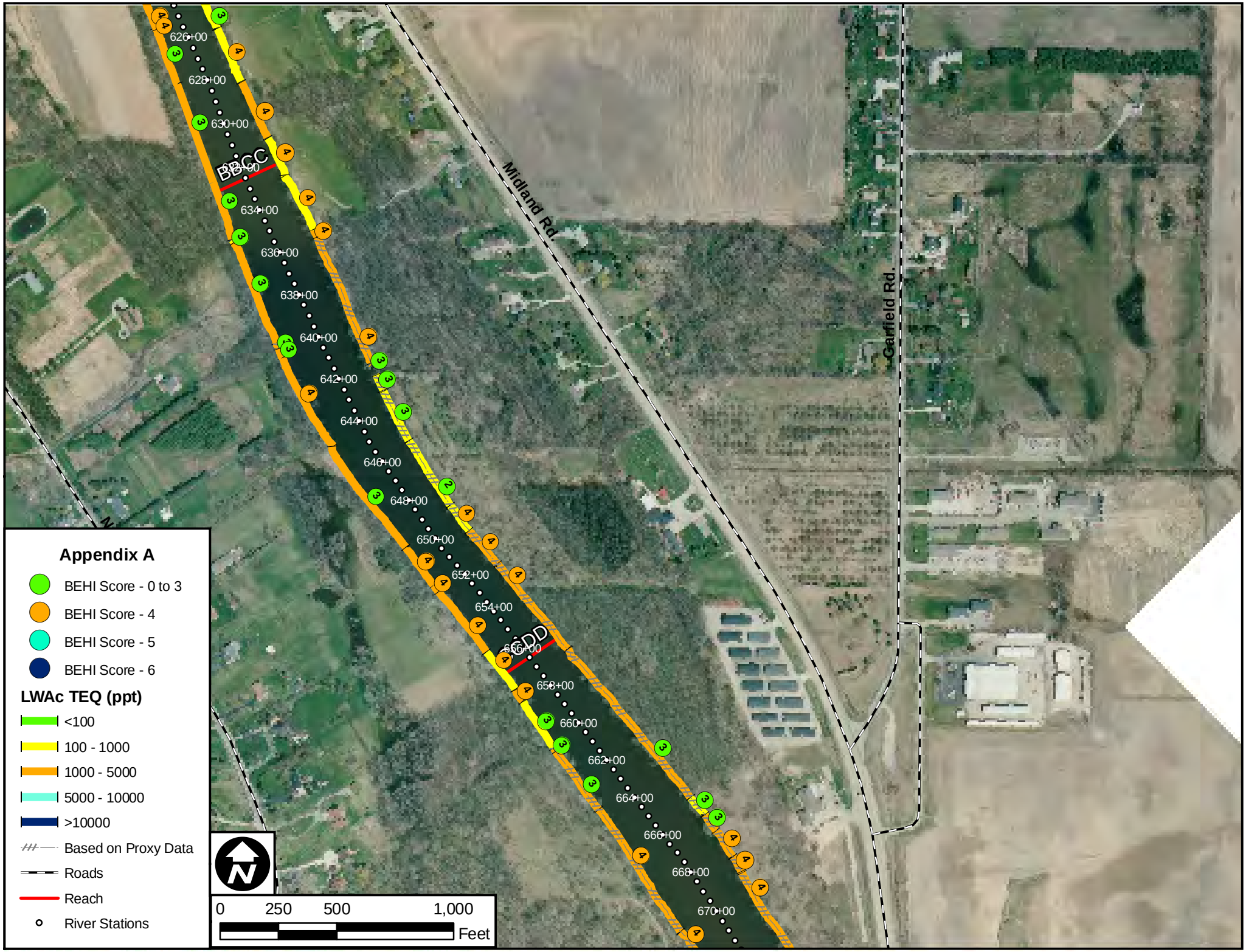

Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
0 250 500 1,000
Feet
Midland Rd.
M 47
N. M 47/Midland
Sarle Rd.
N. River Rd.
Palatial Dr.
anders Dr.
aner Rd.
QR
RS
RT
372+00
374+00
376+00
378+00
380+00
382+00
384+00
386+00
388+00
390+00
392+00
394+00
396+00
398+00
400+00
402+00
404+00
406+00
408+00
410+00
412+00
414+00
416+00
418+00
420+00
422+00
424+00
426+00
428+00
430+00
432+00
434+00
436+00
438+00

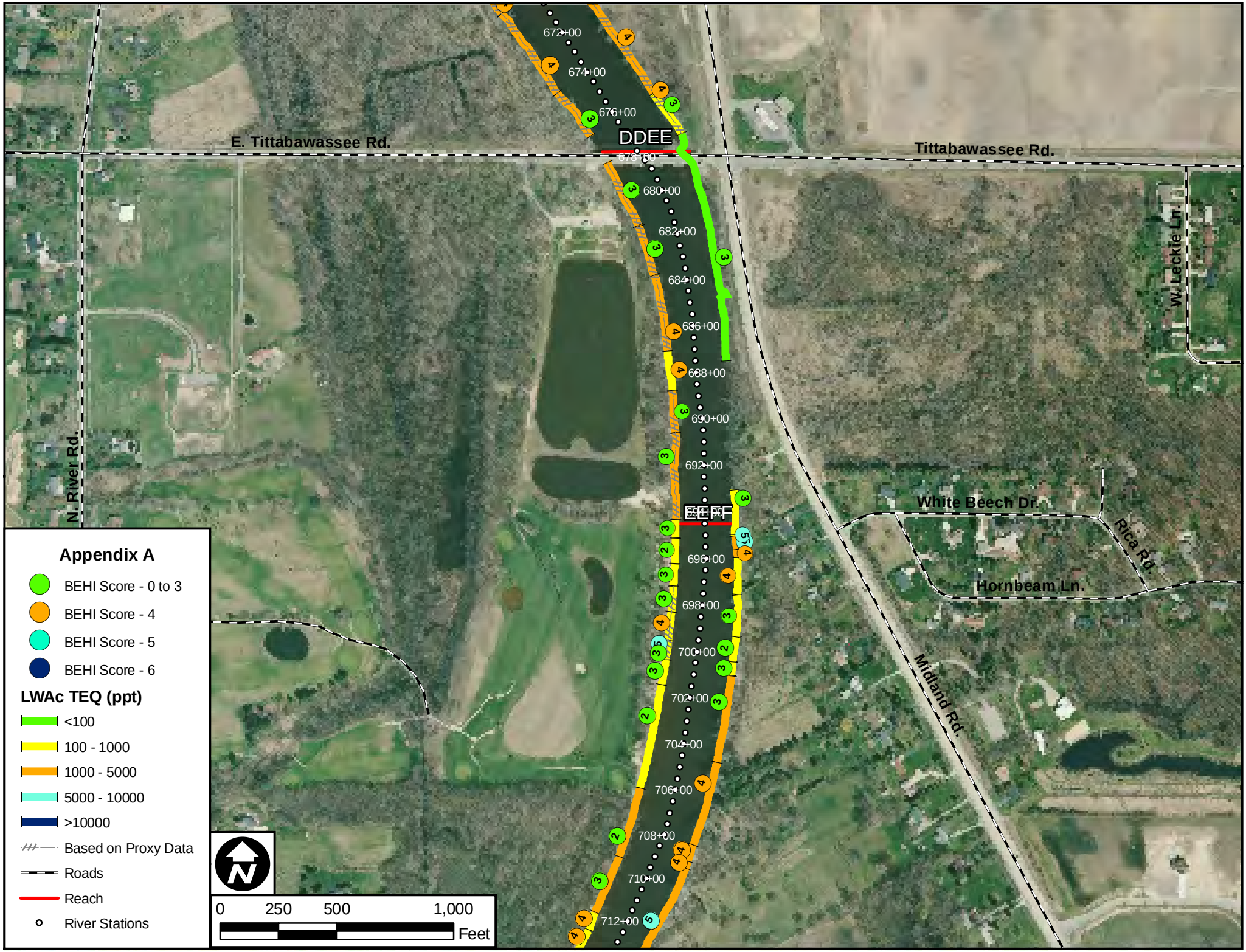

Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
0 250 500 1,000
Feet
TU
IV
VW
436+00
438+00
440+00
442+00
444+00
446+00
448+00
450+00
452+00
454+00
456+00
458+00
460+00
462+00
464+00
466+00
468+00
470+00
472+00
474+00
476+00
478+00
480+00
482+00
484+00
486+00
488+00
Midland Rd.
Carter Rd.
Paul St.
Harvey St.
Lewis St.
Johnson St.
2nd St.
King
Smith St.
Washington Ave.
1st St.

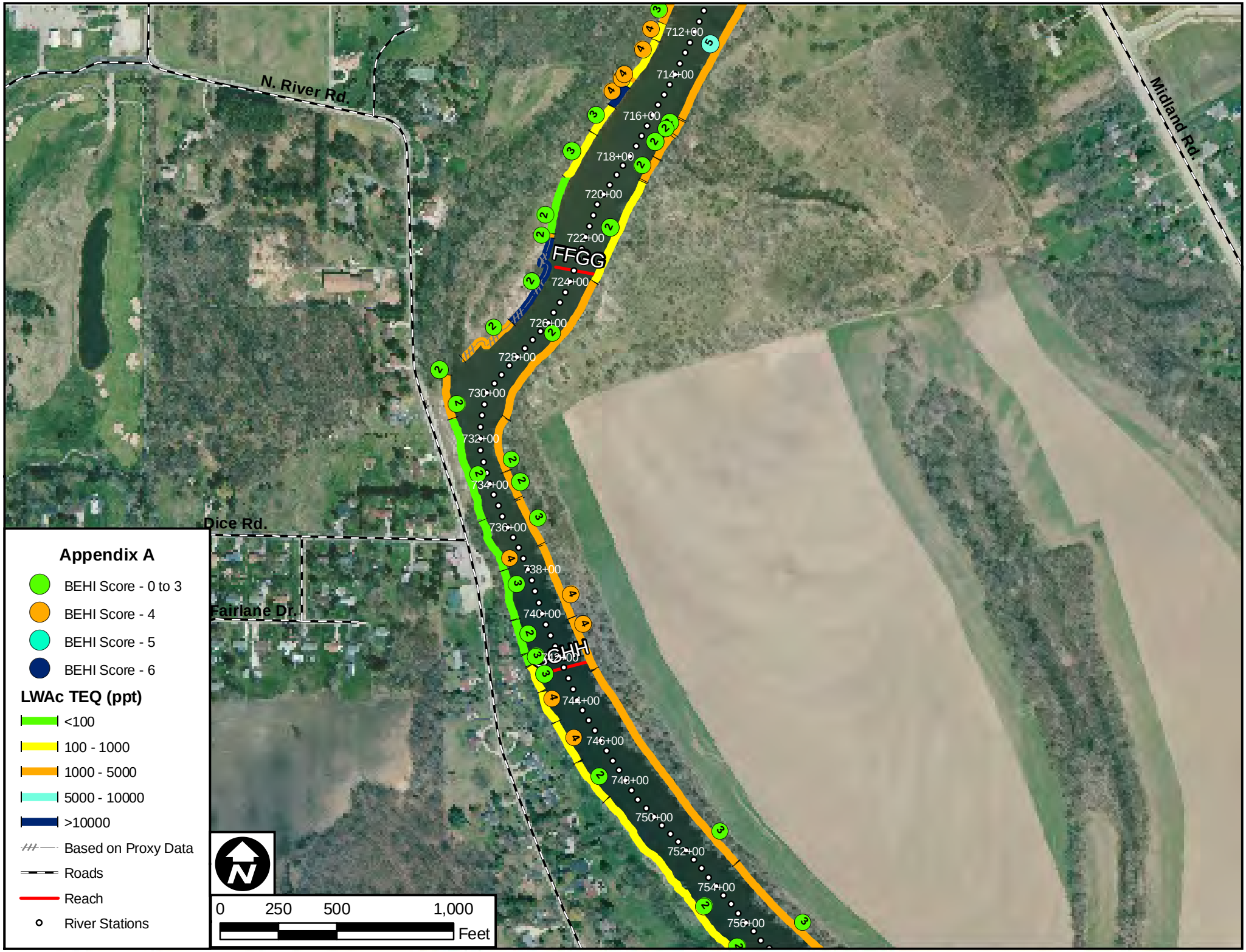

W. Freeland Rd.
Washington Ave.
E. Washington Rd.
Park St.
Church St.
Meyer St.
Powley Dr.
Thor Dr.
Hercules Rd.
Midland Rd.
N. River Rd.
Mprefield Dr.
GaRd.en Ridge St.
1st St.
2nd St.
3Rd St.
4th St.
5th St.
6th St.
7th St.
WW
WX
486+00
488+00
490+00
492+00
494+00
496+00
498+00
500+00
502+00
504+00
506+00
508+00
510+00
512+00
514+00
516+00
518+00
520+00
522+00
524+00
526+00
Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
0 250 500 1,000
Feet

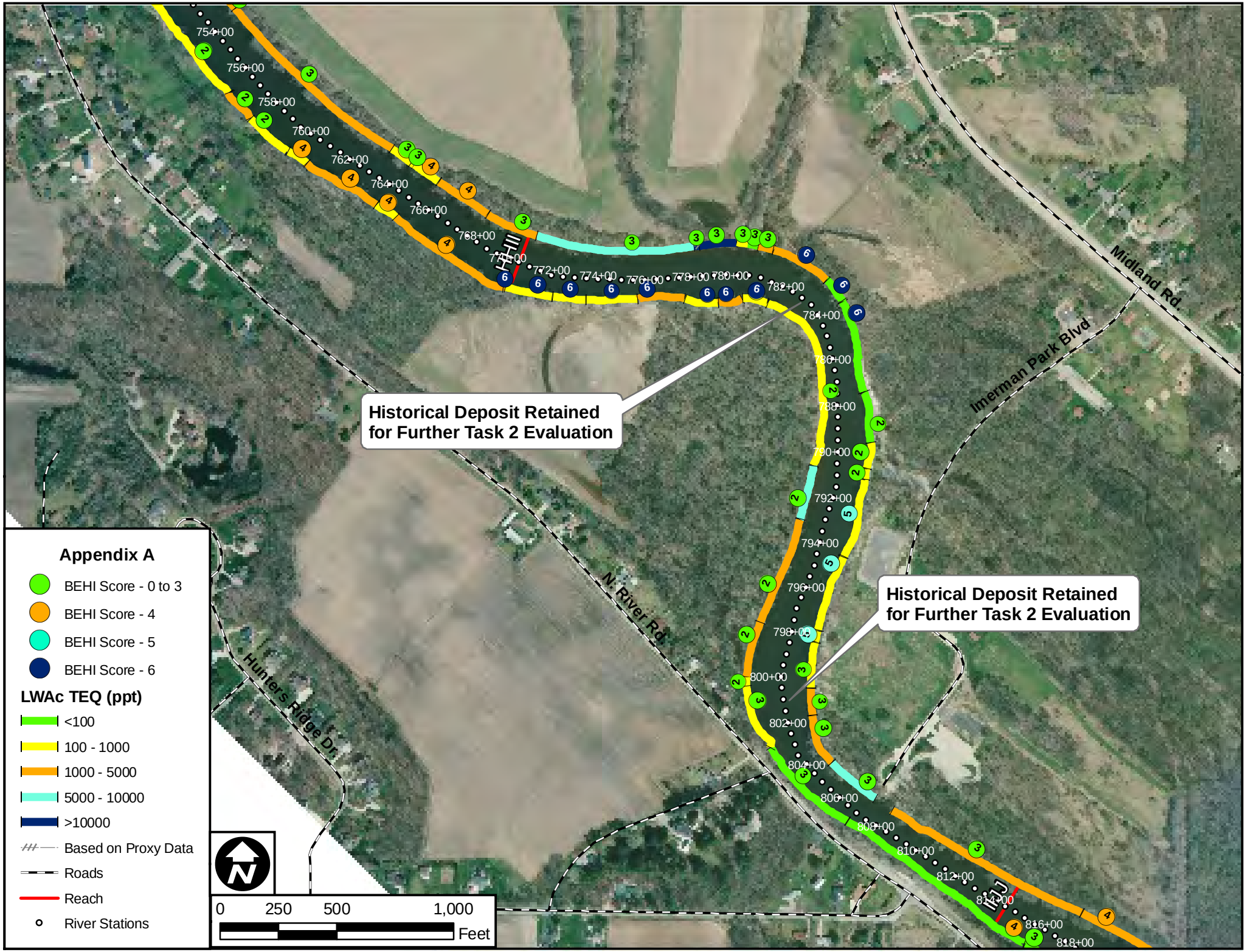

Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
0 250 500 1,000
Feet
Pierce Rd.
Pierce Rd.
N. River Rd.
Midland Rd.
Murhead Rd.
526+00
528+00
530+00
532+00
534+00
536+00
538+00
540+00
542+00
544+00
546+00
548+00
550+00
552+00
554+00
556+00
558+00
560+00
562+00
564+00
566+00
XY
XZ
ZAA
Bank Area Retained
for Further Task 2 Evaluation

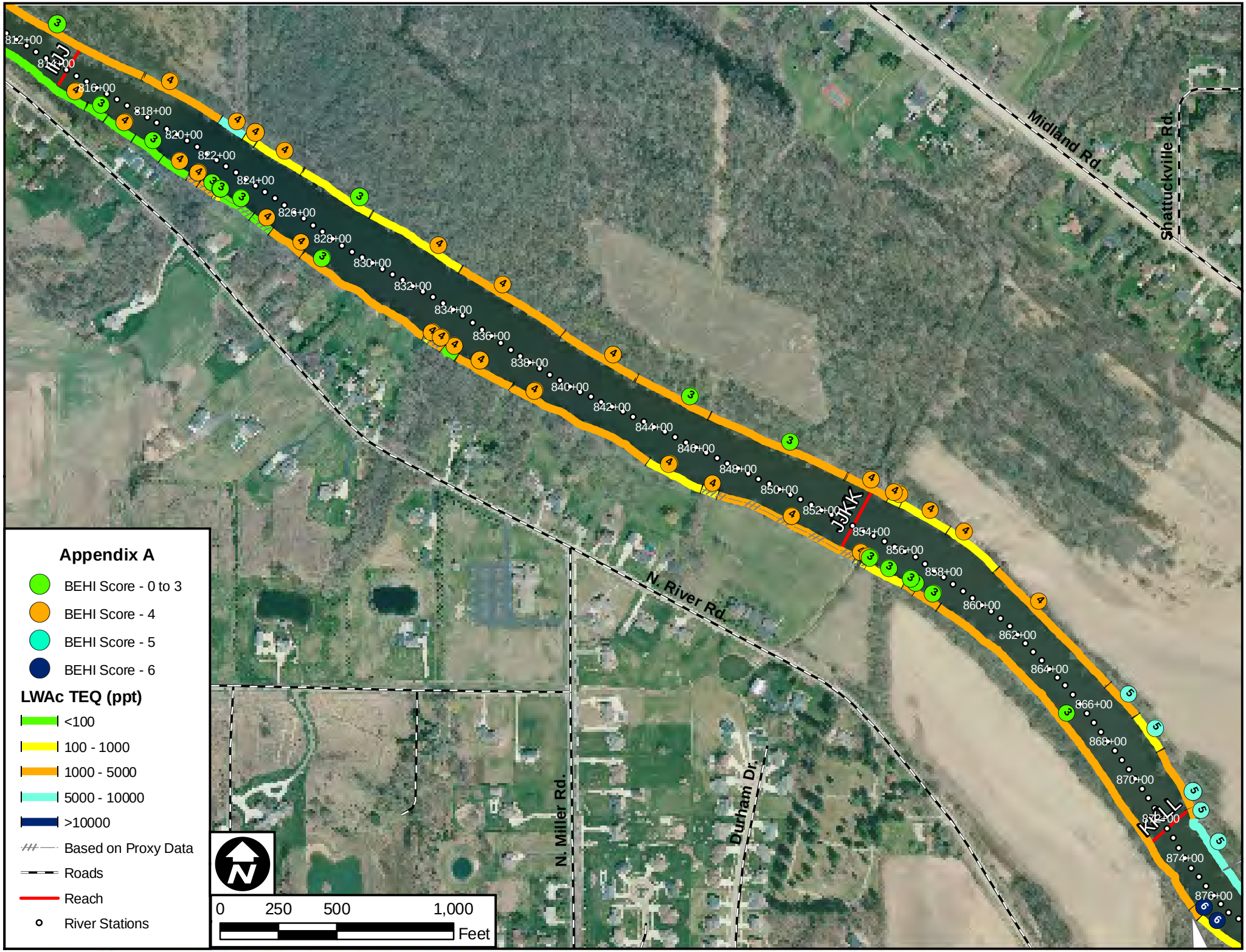

Bank Area Retained
for Further Task 2 Evaluation
ZAA
AABB
Midland Rd.
N. River Rd.
Vasold Rd.
N. Thomas Rd.
Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
0 250 500 1,000
Feet

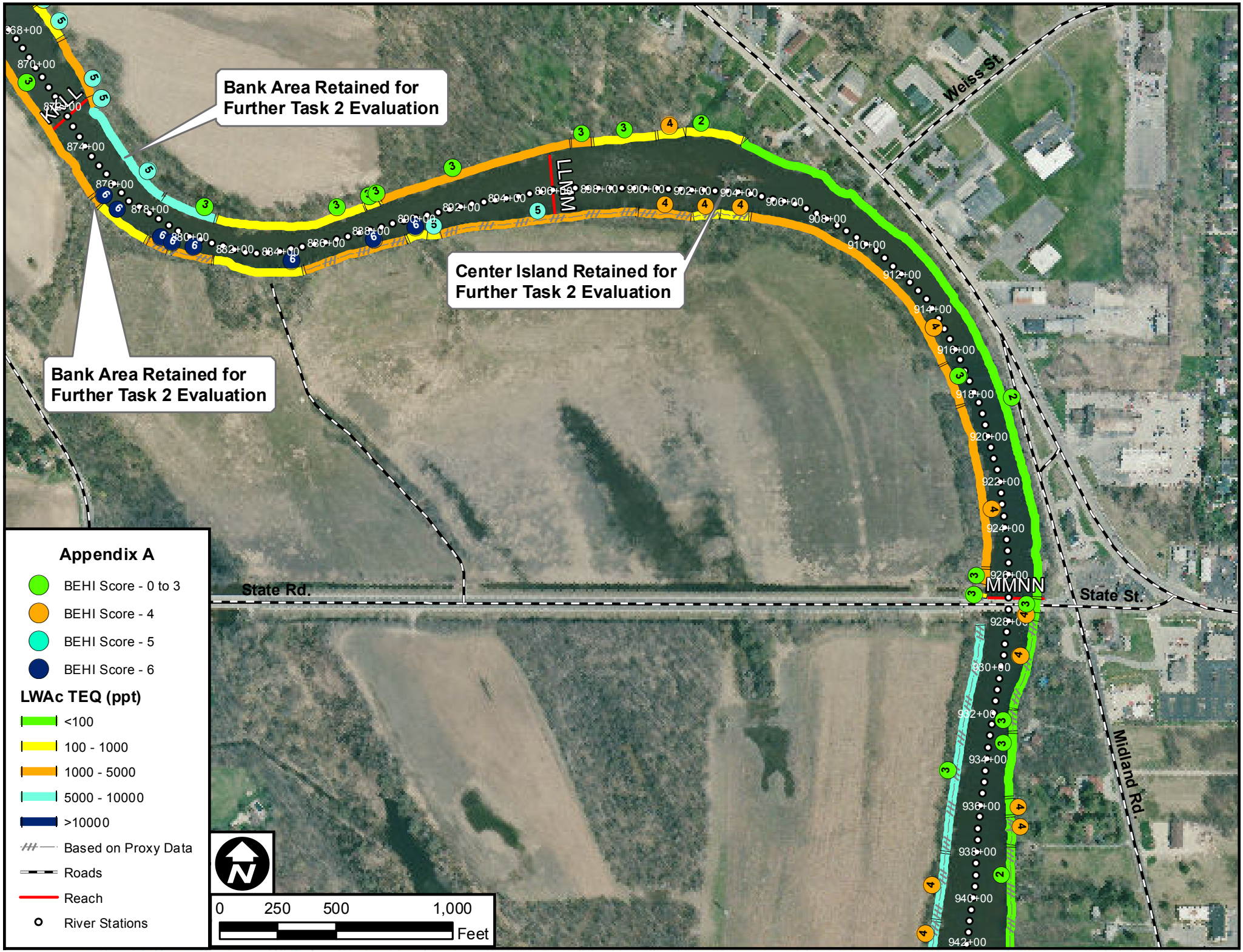

Midland Rd.
Garfield Rd.
BBCC
CCDD
626+00
628+00
630+00
632+00
634+00
636+00
638+00
640+00
642+00
644+00
646+00
648+00
650+00
652+00
654+00
656+00
658+00
660+00
662+00
664+00
666+00
668+00
670+00
Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
N
0
250
500
1,000
Feet

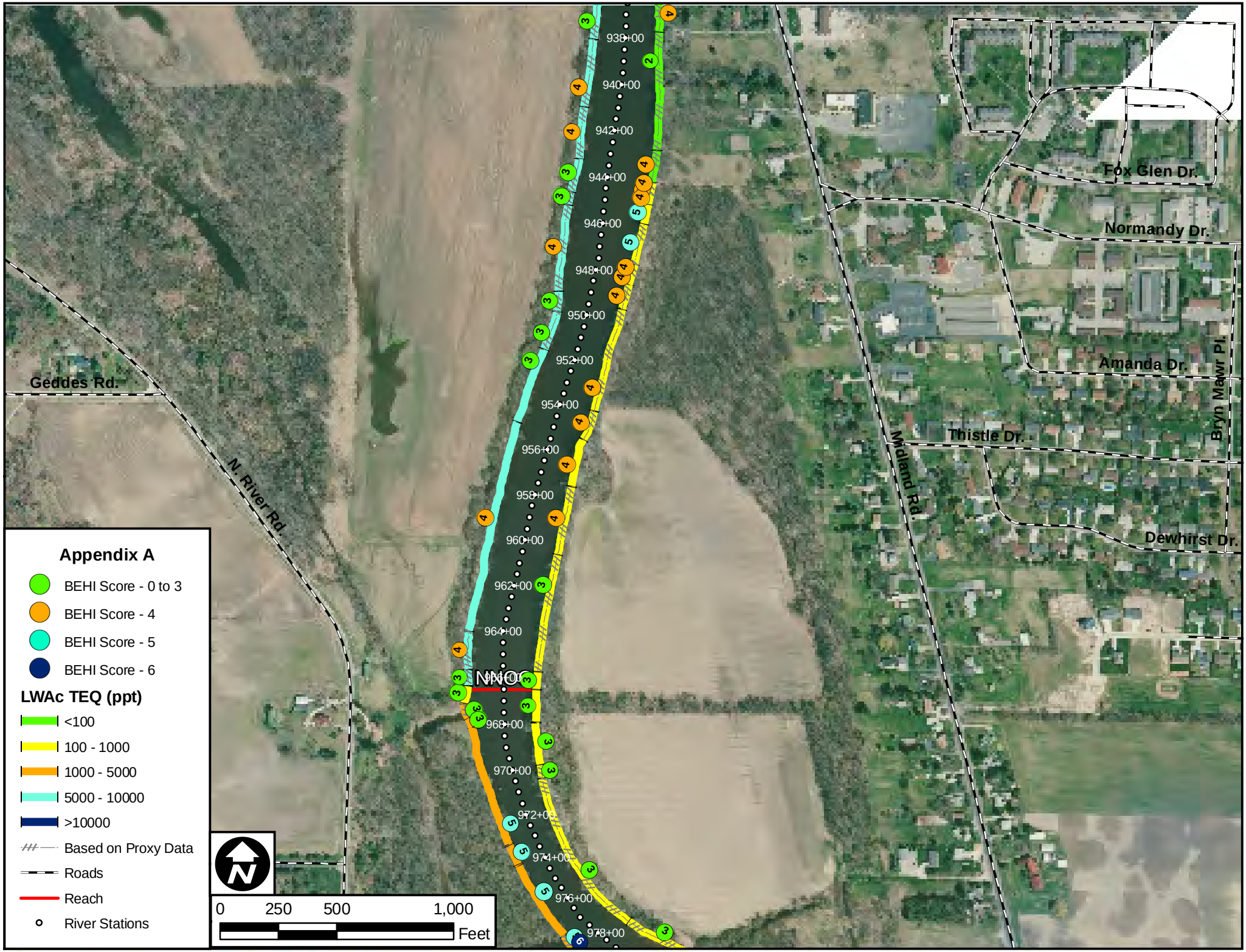

E. Tittabawassee Rd.
Tittabawassee Rd.
N. River Rd.
W. Leckie Ln.
White Beech Dr.
Rica Rd.
Hornbeam Ln.
Midland Rd.
DDEE
EEFF
672+00
674+00
676+00
680+00
682+00
684+00
686+00
688+00
690+00
692+00
696+00
698+00
700+00
702+00
704+00
706+00
708+00
710+00
712+00
Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
0 250 500 1,000
Feet


N. River Rd.
Midland Rd.
Dice Rd.
Fairlane Dr.
712+00
714+00
716+00
718+00
720+00
722+00
FFGG
724+00
726+00
728+00
730+00
732+00
734+00
736+00
738+00
740+00
742+00
GHH
744+00
746+00
748+00
750+00
752+00
754+00
756+00
Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
0 250 500 1,000
Feet

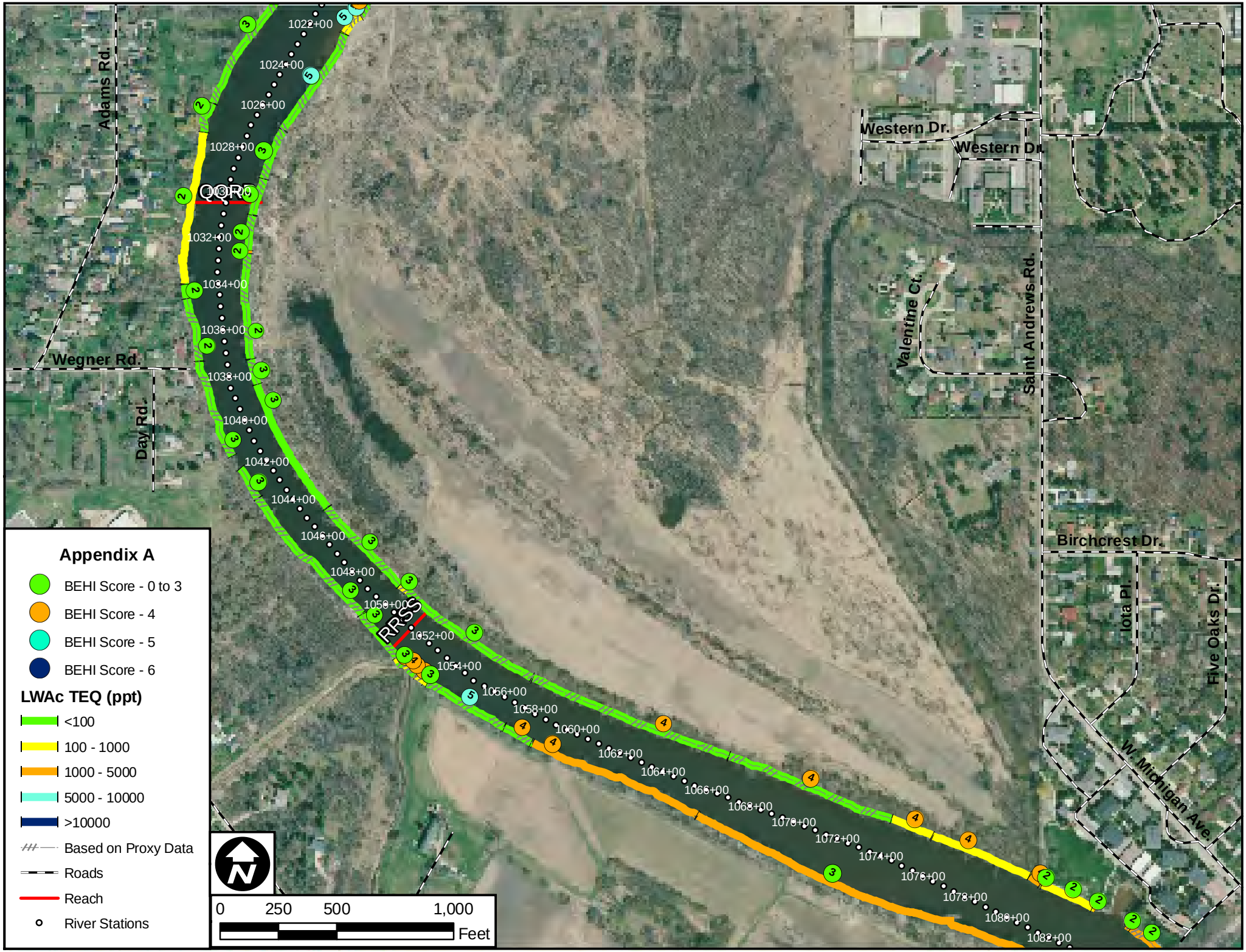

Historical Deposit Retained for Further Task 2 Evaluation
Historical Deposit Retained for Further Task 2 Evaluation
Midland Rd.
Imerman Park Blvd
N River Rd
Hunters Ridge Dr
HH
JJ
754+00
756+00
758+00
760+00
762+00
764+00
766+00
768+00
770+00
772+00
774+00
776+00
778+00
780+00
782+00
784+00
786+00
788+00
790+00
792+00
794+00
796+00
798+00
800+00
802+00
804+00
806+00
808+00
810+00
812+00
814+00
816+00
818+00
Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
0 250 500 1,000
Feet

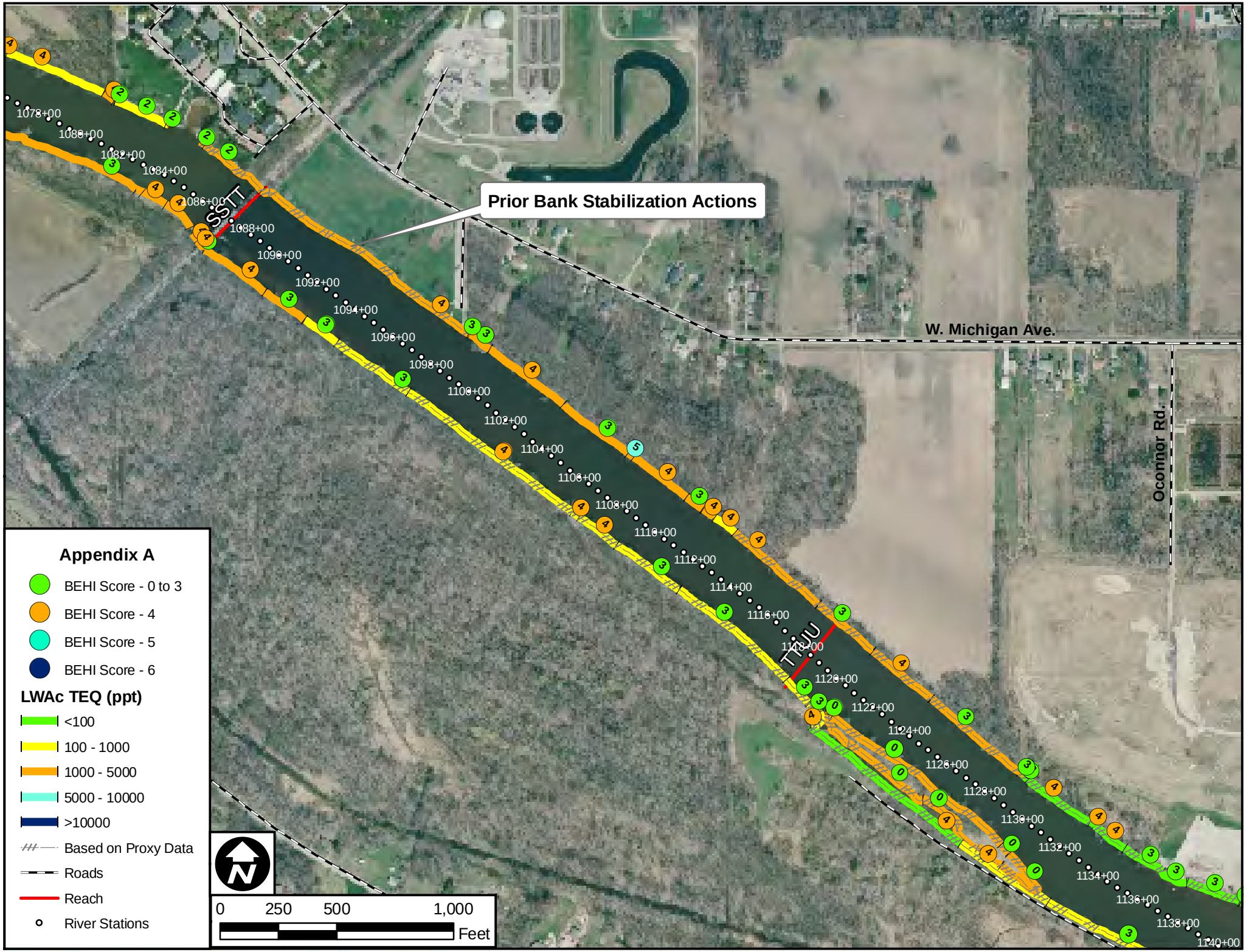

Midland Rd.
Shattuckville Rd.
N. River Rd.
N. Miller Rd.
Durham Dr.
IIJJ
JJKK
KKLL
812+00
814+00
816+00
818+00
820+00
822+00
824+00
826+00
828+00
830+00
832+00
834+00
836+00
838+00
840+00
842+00
844+00
846+00
848+00
850+00
852+00
854+00
856+00
858+00
860+00
862+00
864+00
866+00
868+00
870+00
872+00
874+00
876+00
Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
0 250 500 1,000
Feet

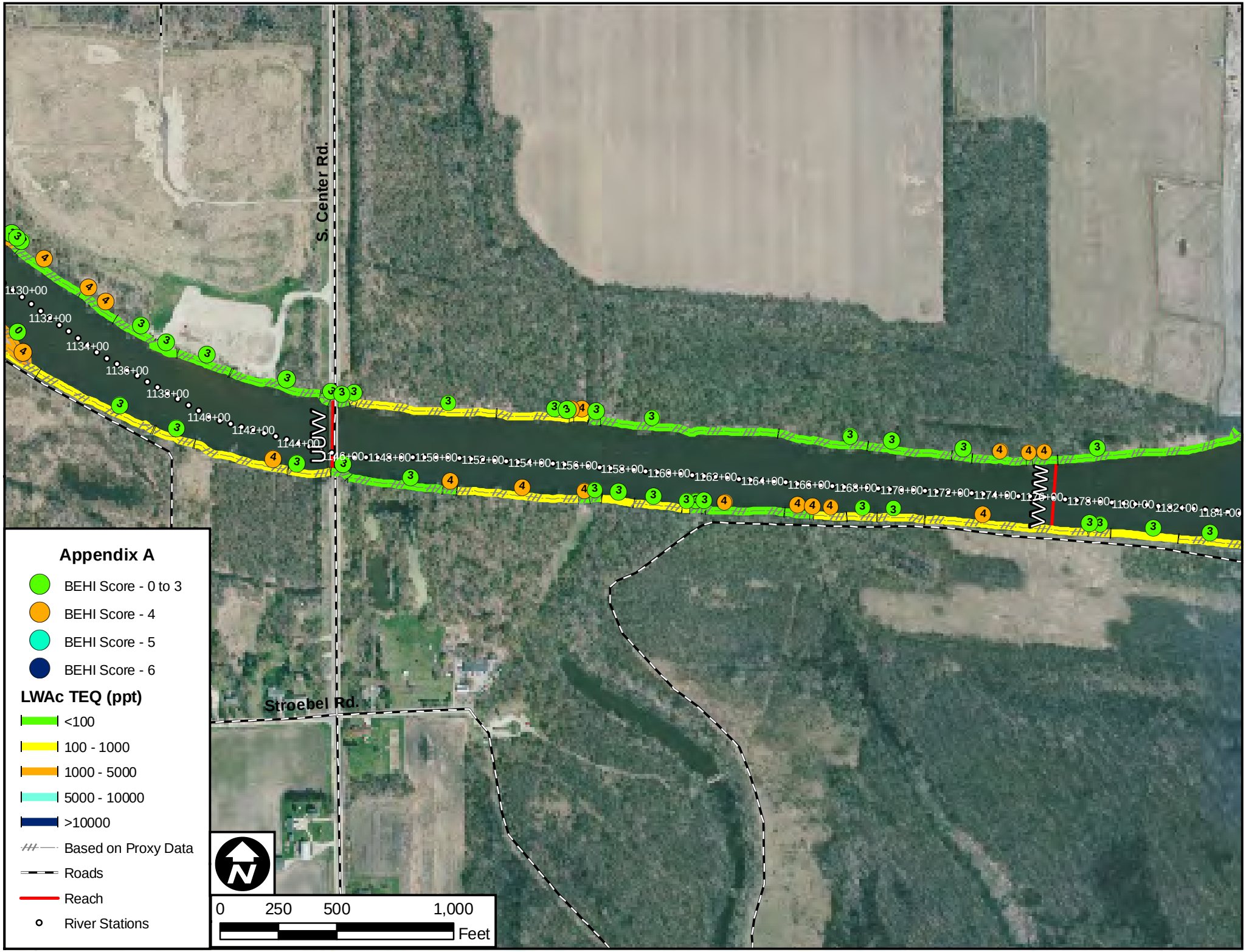

Bank Area Retained for Further Task 2 Evaluation
Center Island Retained for Further Task 2 Evaluation
Bank Area Retained for Further Task 2 Evaluation
KKLL
LLMM
MMNN
Weiss St.
State Rd.
State St.
Midland Rd.
Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
0 250 500 1,000
Feet

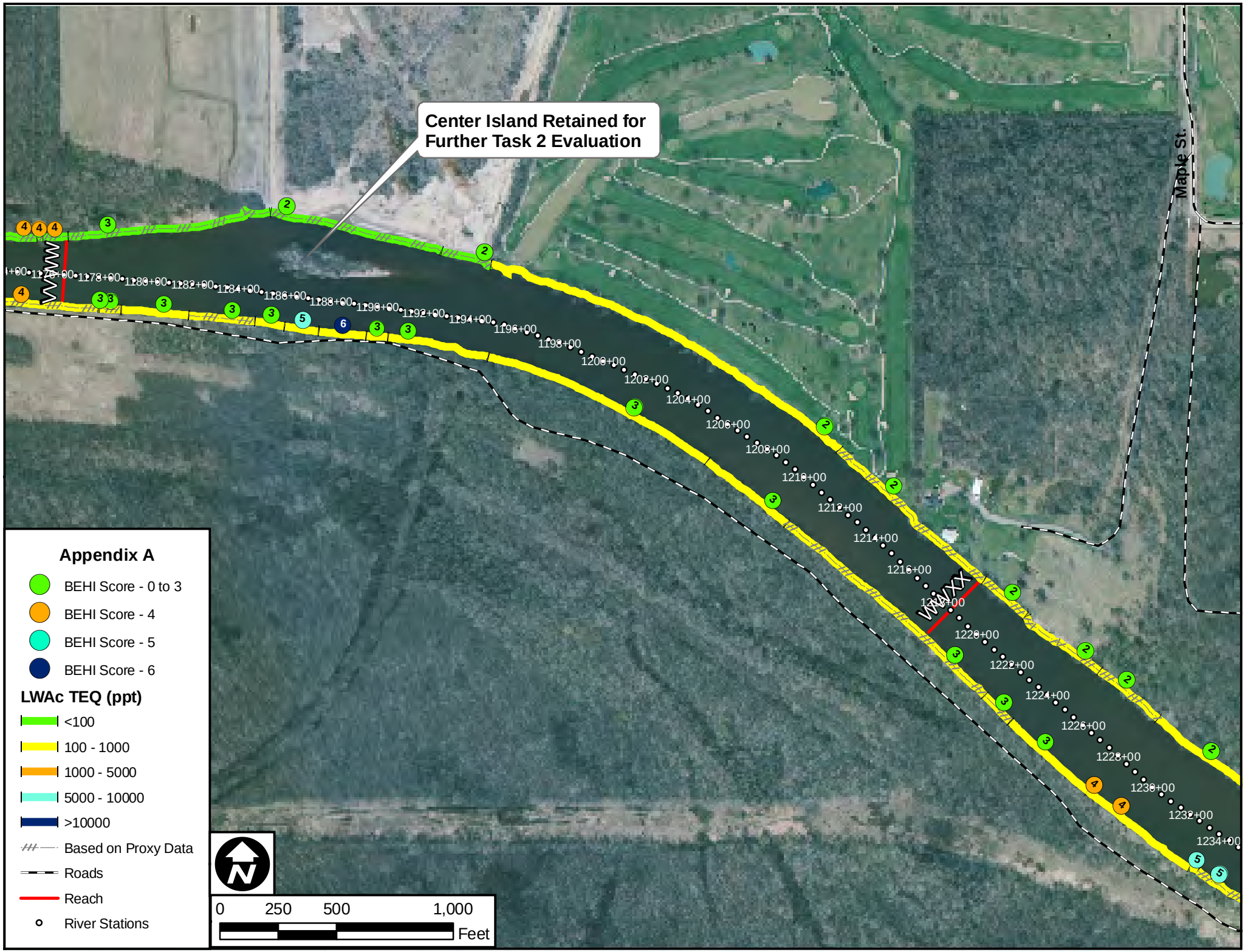

Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
0 250 500 1,000
Feet
938+00
940+00
942+00
944+00
946+00
948+00
950+00
952+00
954+00
956+00
958+00
960+00
962+00
964+00
966+00
968+00
970+00
972+00
974+00
976+00
978+00
Geddes Rd.
N. River Rd.
Midland Rd.
Fox Glen Dr.
Normandy Dr.
Amanda Dr.
Bryn Mawr Pl.
Thistle Dr.
Dewhirst Dr.

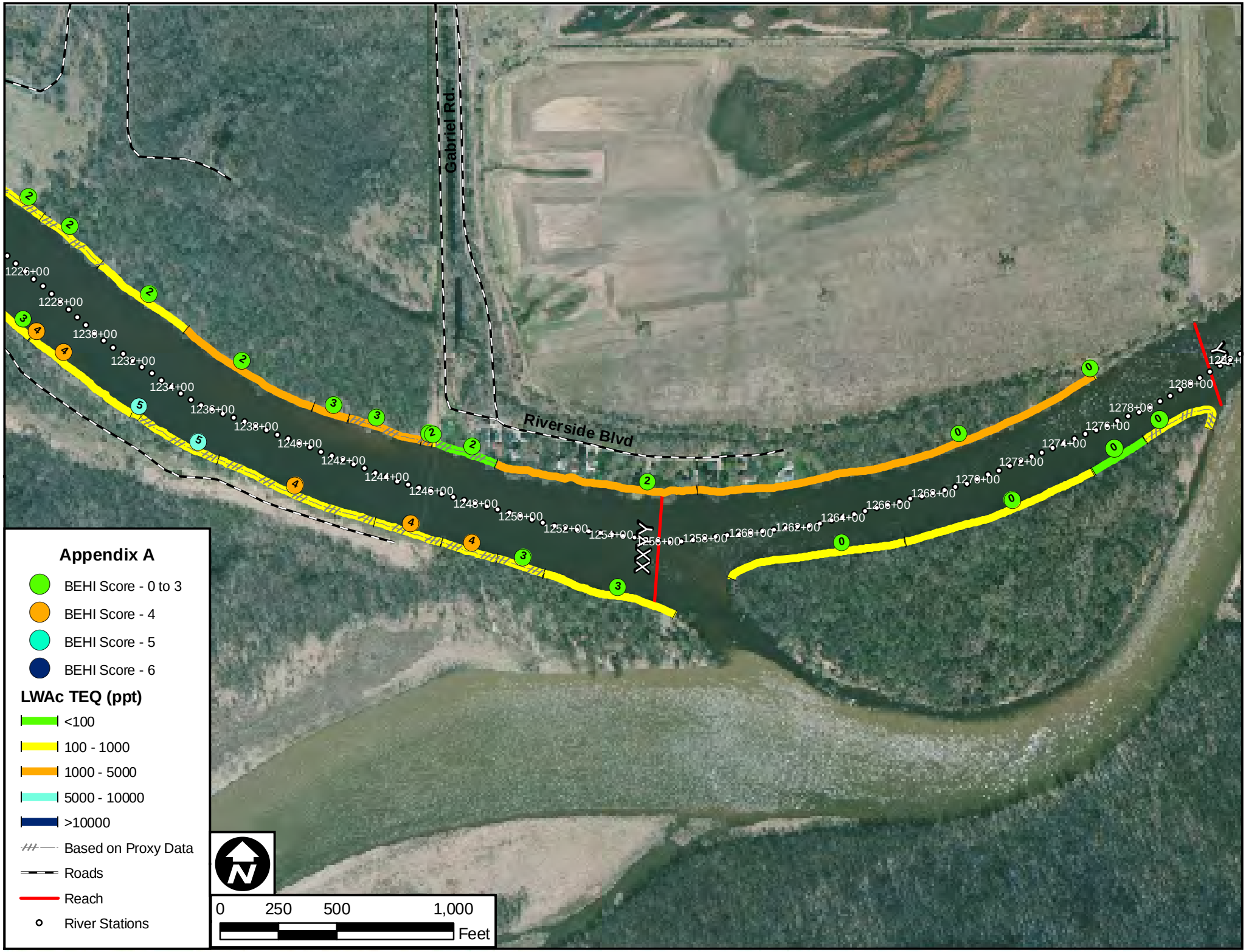

Bank Area Retained for Further Task 2 Evaluation
COPR
PROC
978+00
980+00
982+00
984+00
986+00
988+00
990+00
992+00
994+00
996+00
998+00
1000+00
1002+00
1004+00
1006+00
1008+00
1010+00
1012+00
1014+00
1016+00
1018+00
1020+00
1022+00
1024+00
McCliggott Rd.
N. River Rd.
Wallace Dr.
Shields Ct.
Gratiot Rd.
Adams Rd.
Midland Rd.
Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
0 250 500 1,000
Feet


Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
0 250 500 1,000
Feet
N
1022+00
1024+00
1026+00
1028+00
1030+00
1032+00
1034+00
1036+00
1038+00
1040+00
1042+00
1044+00
1046+00
1048+00
1050+00
1052+00
1054+00
1056+00
1058+00
1060+00
1062+00
1064+00
1066+00
1068+00
1070+00
1072+00
1074+00
1076+00
1078+00
1080+00
1082+00
Adams Rd.
Wegner Rd.
Day Rd.
Western Dr.
Valentine Ct.
Saint Andrews Rd.
Birchcrest Dr.
Iota Pl.
Five Oaks Dr.
W. Michigan Ave.


Prior Bank Stabilization Actions
W. Michigan Ave.
Oconnor Rd.
SSTT
TTUU
1078+00
1080+00
1082+00
1084+00
1086+00
1088+00
1090+00
1092+00
1094+00
1096+00
1098+00
1100+00
1102+00
1104+00
1106+00
1108+00
1110+00
1112+00
1114+00
1116+00
1118+00
1120+00
1122+00
1124+00
1126+00
1128+00
1130+00
1132+00
1134+00
1136+00
1138+00
1140+00
Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
0 250 500 1,000
Feet


S. Center Rd.
UNT
WWTP
Stroebel Rd.
1130+00
1132+00
1134+00
1136+00
1138+00
1140+00
1142+00
1144+00
1146+00
1148+00
1150+00
1152+00
1154+00
1156+00
1158+00
1160+00
1162+00
1164+00
1166+00
1168+00
1170+00
1172+00
1174+00
1176+00
1178+00
1180+00
1182+00
1184+00
Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
0
250
500
1,000
Feet


Center Island Retained for Further Task 2 Evaluation
Maple St.
WWW
WWXX
1178+00
1180+00
1182+00
1184+00
1186+00
1188+00
1190+00
1192+00
1194+00
1196+00
1198+00
1200+00
1202+00
1204+00
1206+00
1208+00
1210+00
1212+00
1214+00
1216+00
1218+00
1220+00
1222+00
1224+00
1226+00
1228+00
1230+00
1232+00
1234+00
Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
N
0
250
500
1,000
Feet


Gabriel Rd.
Riverside Blvd
XXX
Y
1226+00
1228+00
1230+00
1232+00
1234+00
1236+00
1238+00
1240+00
1242+00
1244+00
1246+00
1248+00
1250+00
1252+00
1254+00
1256+00
1258+00
1260+00
1262+00
1264+00
1266+00
1268+00
1270+00
1272+00
1274+00
1276+00
1278+00
1280+00
Appendix A
BEHI Score - 0 to 3
BEHI Score - 4
BEHI Score - 5
BEHI Score - 6
LWAc TEQ (ppt)
<100
100 - 1000
1000 - 5000
5000 - 10000
>10000
Based on Proxy Data
Roads
Reach
River Stations
0 250 500 1,000
Feet