

# **Appendix A City of Neenah Harvesting Pilot Plan**

---



## Comprehensive Planning – Phase 1

# **DRAFT** - Harvesting Pilot Plan – City of Neenah

Little Lake Butte des Morts, Winnebago County, Wisconsin

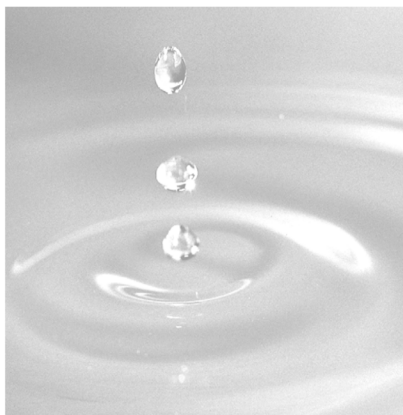
### Submitted to:

City of Neenah  
211 Walnut Street  
Neenah, WI 54956

### Submitted by:

GEI Consultants, Inc.  
3159 Voyager Drive  
Green Bay, WI 54311  
920.455.8200

February 5, 2025  
Project No. 2403578



---

Korin M Doering, CLM  
Project Manager – Water Resources

---

Brian Majka  
Senior Restoration Ecologist

# Table of Contents

---

<b>Record of Approvals and Revisions</b>	<b>iii</b>
<b>Acronyms and Abbreviations</b>	<b>iv</b>
<b>1. Introduction</b>	<b>1</b>
<b>2. Lake Access, Parks, and Trails</b>	<b>3</b>
<b>3. Stakeholder Input</b>	<b>5</b>
3.1. Stakeholder Reported Lake Use & Aquatic Plant Impairments	5
3.1. Stakeholder Habitat Protection Preferences	6
<b>4. Aquatic Plant Baseline - Pilot Area</b>	<b>10</b>
<b>5. Water Level Fluctuations</b>	<b>13</b>
<b>6. Permit Applications &amp; Reporting</b>	<b>1</b>
<b>7. Contractor Selection</b>	<b>4</b>
<b>8. Pilot Project Implementation Plan</b>	<b>5</b>
8.1. Harvesting Lanes and Disposal	5
8.2. Aquatic Invasive Species Prevention	9
8.3. Adaptive Decision Making Based on Depth and Stage	9
8.4. Education and Information Strategy	10
<b>9. Recommended Evaluation and Plan Updates</b>	<b>12</b>
9.1. Evaluating Harvesting Effectiveness	13
9.2. Assessing Non-Target Impacts	14
9.2.1. Aquatic Plant Community	14
9.2.2. Fish Community	15
9.2.3. Water Quality Impacts	15
9.2.4. Adaptive Approach and Plan Updates	16
<b>10. References</b>	<b>17</b>

## List of Tables

Table 4-1. Aquatic Plant Survey Summary Statistics for the Pilot Project Area.	10
Table 4-2. Pilot Project Area - Species Found on the Sampling Rake.	11
Table 4-3. Pilot Project Area Frequency Statistics by Species Found on the Sampling Rake.	11
Table 4-4. Dominant Sediment Type within Pilot Project Area.	12
Table 5-1. Monthly and Annual Average Stage at the Fritse Park Gage <sup>1</sup> - Little Lake Butte des Morts	1
Table 5-2. Monthly and Annual Average Water Depths at the Fritse Park Gage - Little Lake Butte des Morts.	1
Table 6-1. WI NR 107 & 109 permit application checklist.	1
Table 6-2. NR 109 Required Annual Harvesting Permit Documentation and Reporting.	2
Table 8-1. Harvesting Lane Segments Length and Area.	7
Table 8-2. Estimated Accessibility of Harvesting Lane Segments Based Off Fritse Park Gage Readings	10
Table 9-1. Recommended Monitoring Strategy by Resource Type.	13
Table 9-2. Acceptable Maximum Biovolume (BV) by Watercraft Type.	14

## List of Figures

Figure 1-1. Pilot Project Area Map.....	2
Figure 3-1. Recreational routes reported by stakeholders during July 2024 public meeting. ....	7
Figure 3-2. Recreational impairments reported by stakeholders during July 2024 public meeting. ....	8
Figure 3-3. Habitat preservation areas reported by stakeholders during July 2024 public meeting. ....	9
Figure 5-1. Example of Stage versus Water Depth.....	13
Figure 5-2. Depths measured during the 2024 Aquatic Plant Survey within the pilot area. ....	15
Figure 8-1. Harvesting lanes and segments within Pilot Project Area.....	6
Figure 8-2. Aquatic plant staging and disposal locations.....	8
Figure 9-1. Example of sonar algorithm output showing BV. ....	13

## Appendices

- Appendix A – Harvesting Lanes Map
- Appendix B – Aerial Imagery Review

## Record of Approvals and Revisions

---

Approval letter(s) from the Wisconsin Department of Natural Resources are provided as Appendix A.

<b>Name</b>	<b>Title</b>	<b>Agency</b>	<b>Date</b>	<b>Approval or Revision</b>	<b>Attachment (if applicable)</b>



# 1. Introduction

---

The City of Neenah hired GEI Consultants Inc. to design a pilot project for aquatic plant management (APM) in Little Lake Butte des Morts (LLBDM)<sup>1</sup>. Focusing on a small portion of LLBDM along the southern end of the lake near Arrowhead Park and Herb and Dolly Smith Park (Figure 1-1), this project aims to satisfy Goal 2 as outlined in the 2025 LLBDM Aquatic Plant Management (APM) Strategy.

LLBDM has nuisance-level aquatic plant growth that has negatively impacted, and in some cases prevented, recreational access and use of large portions of the lake. **The goal of APM within the pilot project area is to improve public recreational access and use by maintaining navigation channels for motorized and non-motorized watercraft as well as improving swimming, fishing, and aesthetics while protecting important habitat.**

The 2025 LLBDM APM Strategy describes lake characteristics, provides aquatic plant and water quality baselines, describes goals, and lists recommended actions. This plan is a supplement to the 2025 APM Strategy and provides the additional details needed to implement the pilot project as well as meet the Wisconsin Department of Natural Resources (WDNR) permit requirements for mechanical control under Wisconsin Administrative Code NR 109<sup>2</sup>. Because this pilot is designed to be adaptable to varying conditions, this document also provides information for permits that may be required under NR107<sup>3</sup> for herbicide applications.

LLBDM is a eutrophic, shallow lowland lake<sup>4</sup> with mixed stratification. The lake has a surface area of approximately 1,234 acres<sup>5</sup> with 12.83 miles of shoreline. The pilot project area was selected based on stakeholder feedback, proximity to kayak launch points and the Neenah Slough, and client preference. The proposed pilot area covers approximately 153 acres (12.4% of the lake) and seeks to enhance public recreational access for lake users and residents (Figure 1-1). The proposed harvesting lanes total approximately 13.92 acres which is 10% of the pilot area and 1.3% of the lake. According to the WDNR, there are currently no areas of special natural resources interest or other priority navigable waterways located within the pilot project area or the larger lake<sup>6</sup> [1].

The City of Neenah will implement the pilot project in June of 2025, pending WDNR approval of this aquatic plant management plan and necessary permits. The pilot will end in June of 2030 at which time an APM plan update will be needed. As part of the project, the City of Neenah will share successes and lessons learned with the community.

---

<sup>1</sup> WBIC 129800

<sup>2</sup> [https://docs.legis.wisconsin.gov/code/admin\\_code/nr/100/109](https://docs.legis.wisconsin.gov/code/admin_code/nr/100/109)

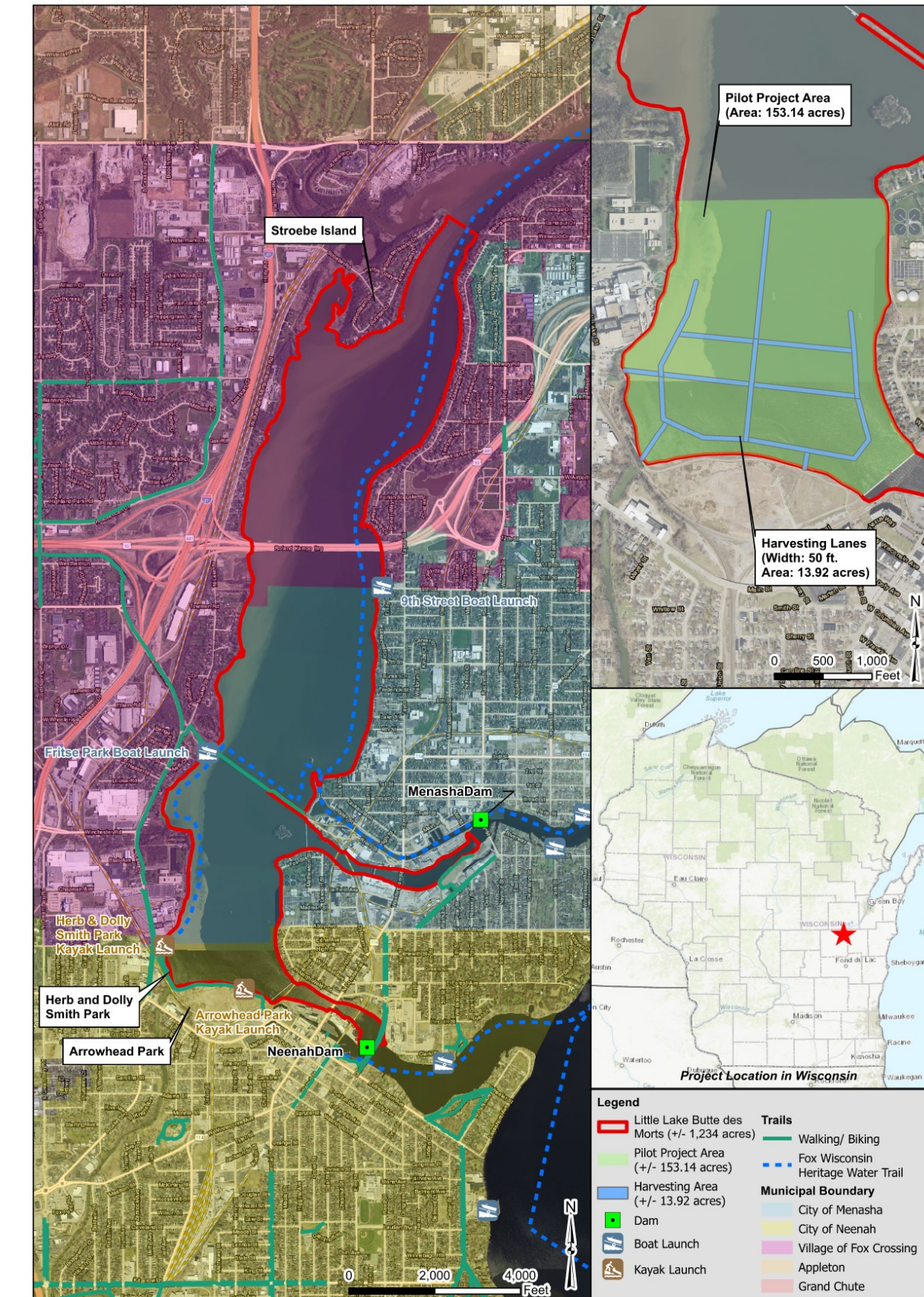
<sup>3</sup> [https://docs.legis.wisconsin.gov/code/admin\\_code/nr/100/107](https://docs.legis.wisconsin.gov/code/admin_code/nr/100/107)

<sup>4</sup> According to the State of Wisconsin's Natural Community Determination

<sup>5</sup> Lake Area of Interest (AOI) as defined in Appendix D of the 2025 LLBDM APM Strategy.

<sup>6</sup> Lake Winnebago, located to the Southeast and connected to LLBDM, is considered a priority navigable waterway Musky Area

Figure 1-1. Pilot Project Area Map



## **2. Lake Access, Parks, and Trails**

---

There are two public boat landings located on LLBDM and three kayak launches [1]. Details about these public access point as well as parks, natural areas, trails, and stakeholder reported use of the lake and recreational amenities are detailed in the 2025 LLBDM APM Strategy. Recreational features relevant to the pilot project are described below.

### **Loop the Little Lake**

According to the City of Neenah website, Loop the Little Lake, often referred to as the “Loop” is a 3.5-mile route that consists of off-road and pedestrian trails and links the communities of the Village of Fox Crossing, City of Menasha, and City of Neenah [2]. The Loop provides access to LLBDM with four unique trestle crossings: Fox Cities Trestle, Slough Trestle, Neenah Trestle, and Menasha Trestle. The Loop also connects to other trails that extend beyond LLBDM to other communities and waterbodies, including Lake Winnebago. Portions of the Loop border the pilot project area.

### **Fox-Wisconsin Heritage Water Trail**

The Fox-Wisconsin Heritage Water Trail is a paddle friendly water trail designated as a National Recreational Trail designed for non-motorized watercraft that connects the Upper Fox River, Winnebago Lakes, LLBDM, Lower Fox River, and Lower Green Bay. A segment of the water trail passes into the pilot project area.

### **Fritse Park**

Fritse Park is located along the southwest shoreline of LLBDM near the Friendship Trail bridge. This boat launch is owned and managed by the Village of Fox Crossing. The boarding dock and kayak launch are ADA accessible and kayak rentals are available onsite. This park is not located within the pilot project area but is the proposed location for launching the harvester.

### **Herb and Dolly Smith Park**

Herb and Dolly Smith Park is located on the southwest corner of LLBDM within the City of Neenah. The kayak and canoe launch provide non-motorized access to LLBDM within the pilot project area. There is also a fishing deck that provide shoreline fishing opportunities, and the park is connected to the Loop. This is the proposed dumpster staging area for offloading the collected plant material from the harvester.

### **Arrowhead Park**

Arrowhead Park is located along the southern extent of LLBDM within the City of Neenah. This was the former location of the Arrowhead Park Landfill. Ongoing efforts to restore and enhance connections to the site are being conducted by the Neenah Parks and Recreation Commission. Arrowhead has a new kayak launch that is located within the pilot project area.

### **Neenah Slough (Neenah Creek)**

The Neenah Slough, also called Neenah Creek, is a unique system because it can be characterized as a stream, lake, and marsh<sup>7</sup>. According to the WDNR, the slough is one of the major northern pike spawning areas connected to LLBDM. Migrating waterfowl utilize the wetlands located along the slough as resting and feeding areas. The slough ends where it enters LLBDM and is a popular route for kayaking and other paddle sports. Access to the slough for these activities is a valuable recreational asset to the community.

---

<sup>7</sup> <https://apps.dnr.wi.gov/water/waterDetail.aspx?WBIC=130800>

## 3. Stakeholder Input

---

Stakeholders were an integral part of development of the 2025 LLBDM APM Strategy and this pilot harvesting plan. Details about engagement efforts and results are described in the 2025 LLBDM APM Strategy. Input from stakeholders specifically relevant to the harvesting pilot are summarized below.

### 3.1. Stakeholder Reported Lake Use & Aquatic Plant Impairments

During a public meeting held on July 18, 2024, attendees were asked to take part in a mapping exercise to gather information on how meeting participants use the lake and issues they encounter or observe. Participants were provided a paper map, colored pencils, and a list of questions. They were then asked to answer the questions by drawing on the map and writing in comments using specific colors. Prompts included categories such as recreation use areas and areas where recreation is impacted by aquatic plant growth. Data from the worksheets were merged and digitized into polygons representing each of the categories.

Areas that were mapped across greater than approximately 50% of responses were considered very common results. Areas that were mapped across approximately 10-50% of responses were considered common results. Areas that were mapped by a few responses were considered uncommon results. Although uncommon, this feedback was still taken into consideration when digitizing the data. For the purposes of this exercise, the 'nearshore area' encapsulates areas within 0-350 feet into the lake, and the 'offshore area' includes areas within 350-800 feet into the lake.

Results indicate that the most common boat navigation route reported by the mapping activity participants is a loop around the north central portion of LLBDM, ranging from approximately 400-900 feet offshore (Figure 3). The Ninth Street Boat Launch was the most noted access point to the lake. A loop along the northcentral shoreline of LLBDM was noted as a common kayaking route, with a few responses also noting the southwest shoreline as a kayaking route (Figure 3). An area within the northern portion of LLBDM was noted as an uncommon swimming route, with only a few responses noting this area (Figure 3). Three ice fishing areas were commonly noted on the maps and are located near the northwest, southwest, and east-central shoreline of LLBDM (Figure 3). Neither of the kayak launches near the southern portion of the lake were reported to be used.

Results also indicate that the northwest, eastern, and southern nearshore areas of LLBDM have aquatic vegetation growth that prevents boat navigation (Figure 4). In addition, the remainder of the nearshore and offshore areas of LLBDM were reported to have aquatic vegetation growth that inhibits boat navigation (Figure 4). In this context, inhibits is interpreted as limits. The northwestern/ northcentral portions of LLBDM, an area near the Menasha Lock, and the southwest portion of LLBDM were noted to have aquatic vegetation growth that inhibits other types of recreation (such as kayaking or swimming [Figure 4]).

These results were further analyzed and utilized to inform the need for and boundaries of the Pilot Project. As stakeholders generally reported recreational use impairments and inhibited access to the lake

in the southern portion of LLBDM, this area was identified as the Pilot Project Area to improve recreational access and opportunities through aquatic plant management. Additional information on the public meeting, stakeholder mapping exercise, and results can be found in the *2025 LLBDM APM Strategy*.

The Pilot Project Area intersects portions of LLBDM that stakeholders reported have aquatic vegetation that prevents and inhibits boating and kayaking (Figure 4). It also intersects the southern extents of a common kayak route and uncommon boating route (Figure 3). An ice fishing location is present within the Pilot Project Area as well (Figure 3). These findings indicate there is existing public interest in being able to take part in various recreational activities within this portion of the lake; however, it is currently impaired by aquatic vegetation growth. Conducting aquatic plant management within this area would enhance existing kayak and boating routes, while creating access and connectivity to the kayak launches along the southern shoreline of LLBDM.

### **3.1. Stakeholder Habitat Protection Preferences**

During the stakeholder mapping exercise described in Section 3.1, participants were also asked to illustrate areas where they'd like to see habitat preserved. Data and notes from the worksheets were merged and digitized into polygons. Results indicated that areas to the west of Stroebe Island, along the west shore under US-10, along the trestle trail, and the southern portion of LLBDM were noted to be areas that stakeholders want to see preserved for fish and wildlife habitat (Figure 5). Additional information on the public meeting, stakeholder mapping exercise, and results can be found in the *2025 LLBDM APM Strategy*.

The Pilot Project Area intersects portions of LLBDM that stakeholders want to see that habitat preserved (Figure 5). Comments left by stakeholders indicate that they want to see the habitat preserved for the purpose of preserving fish habitat. These findings indicate there is existing public interest in protecting habitat for fish species, which is likely motivated by improving recreational interests such as fishing. Conducting aquatic plant management within this area would enhance access to conduct recreational activities, such as fishing, within the southern portion of LLBDM.

Figure 3-1. Recreational routes reported by stakeholders during July 2024 public meeting.

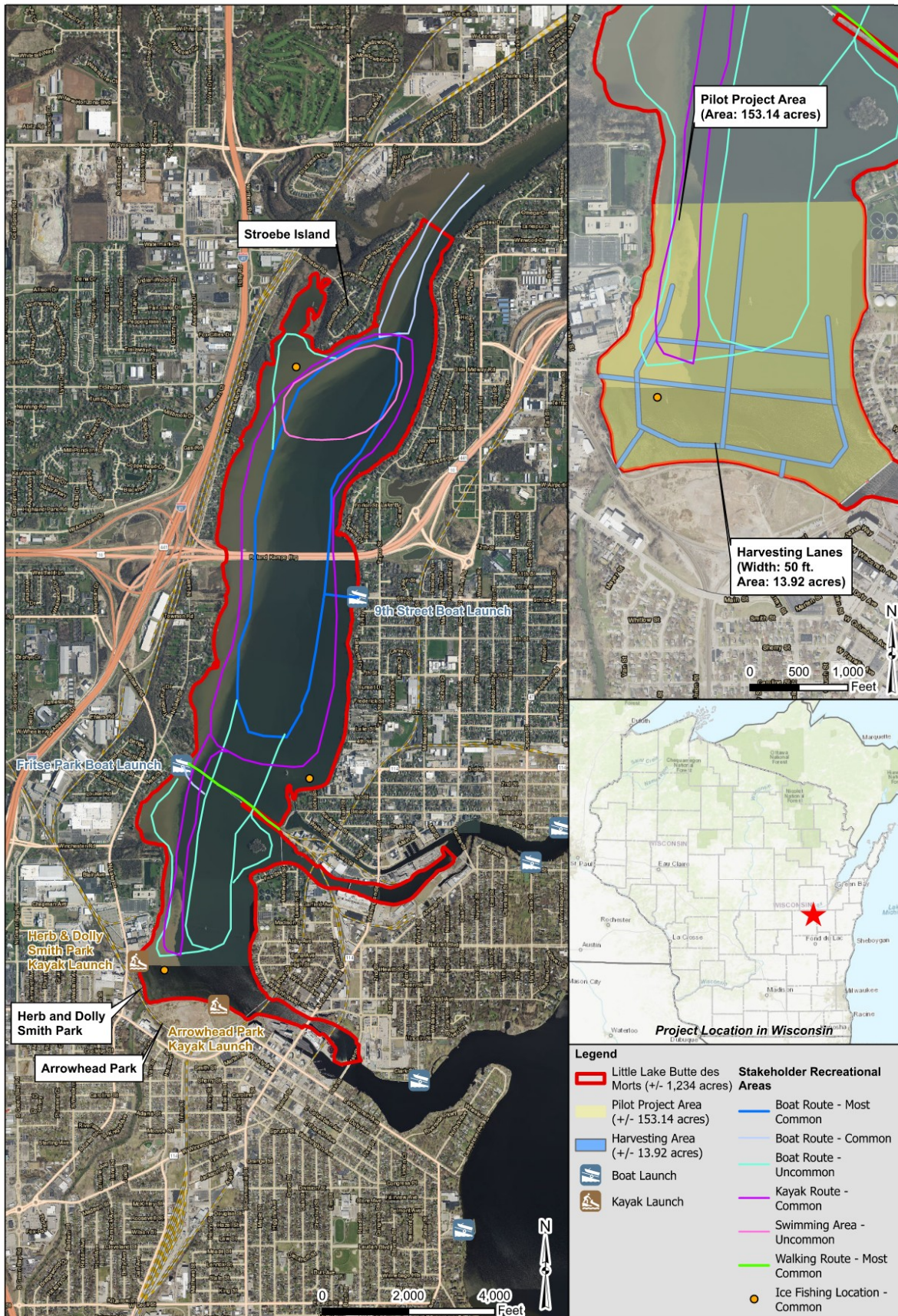


Figure 3-2. Recreational impairments reported by stakeholders during July 2024 public meeting.

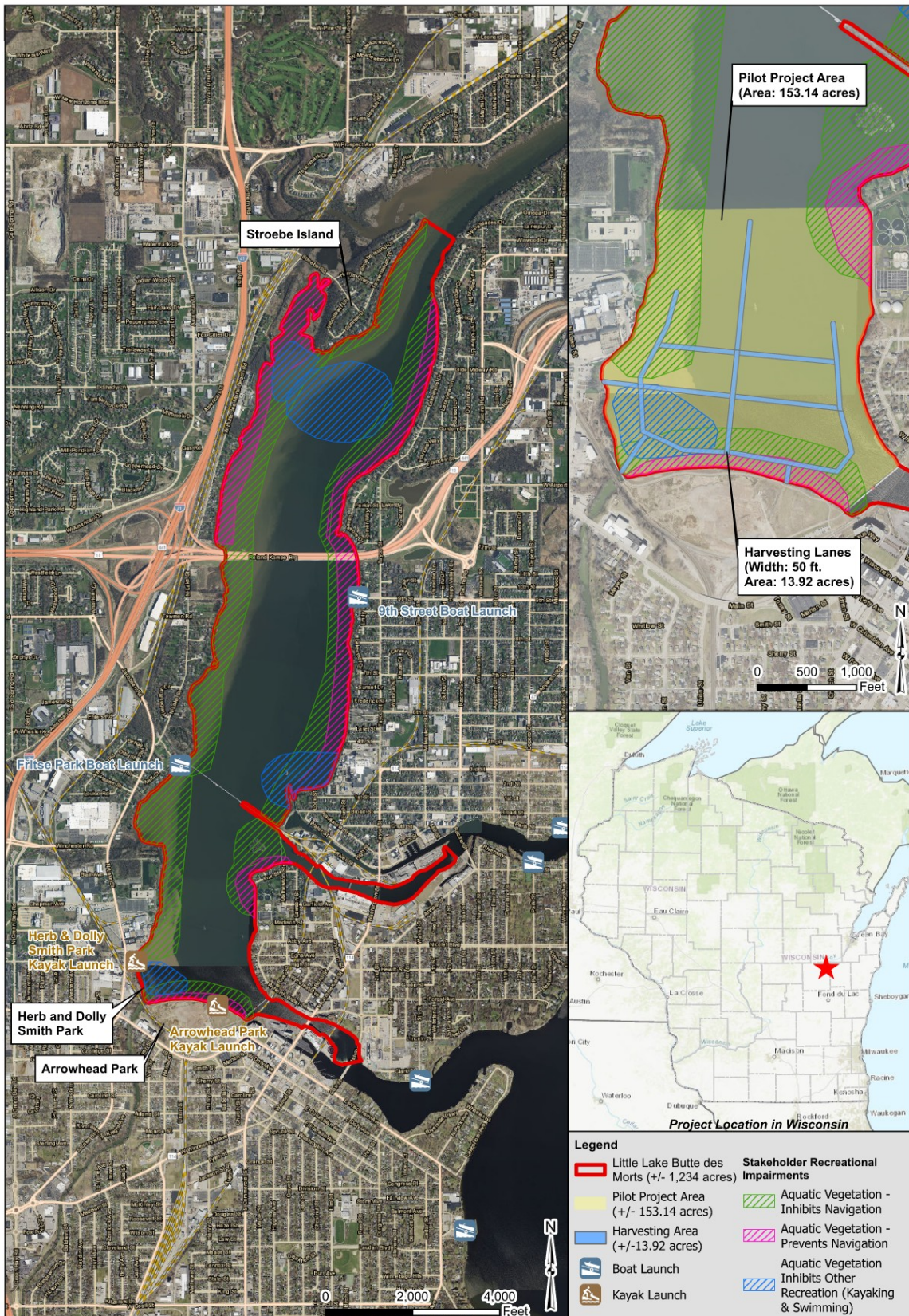
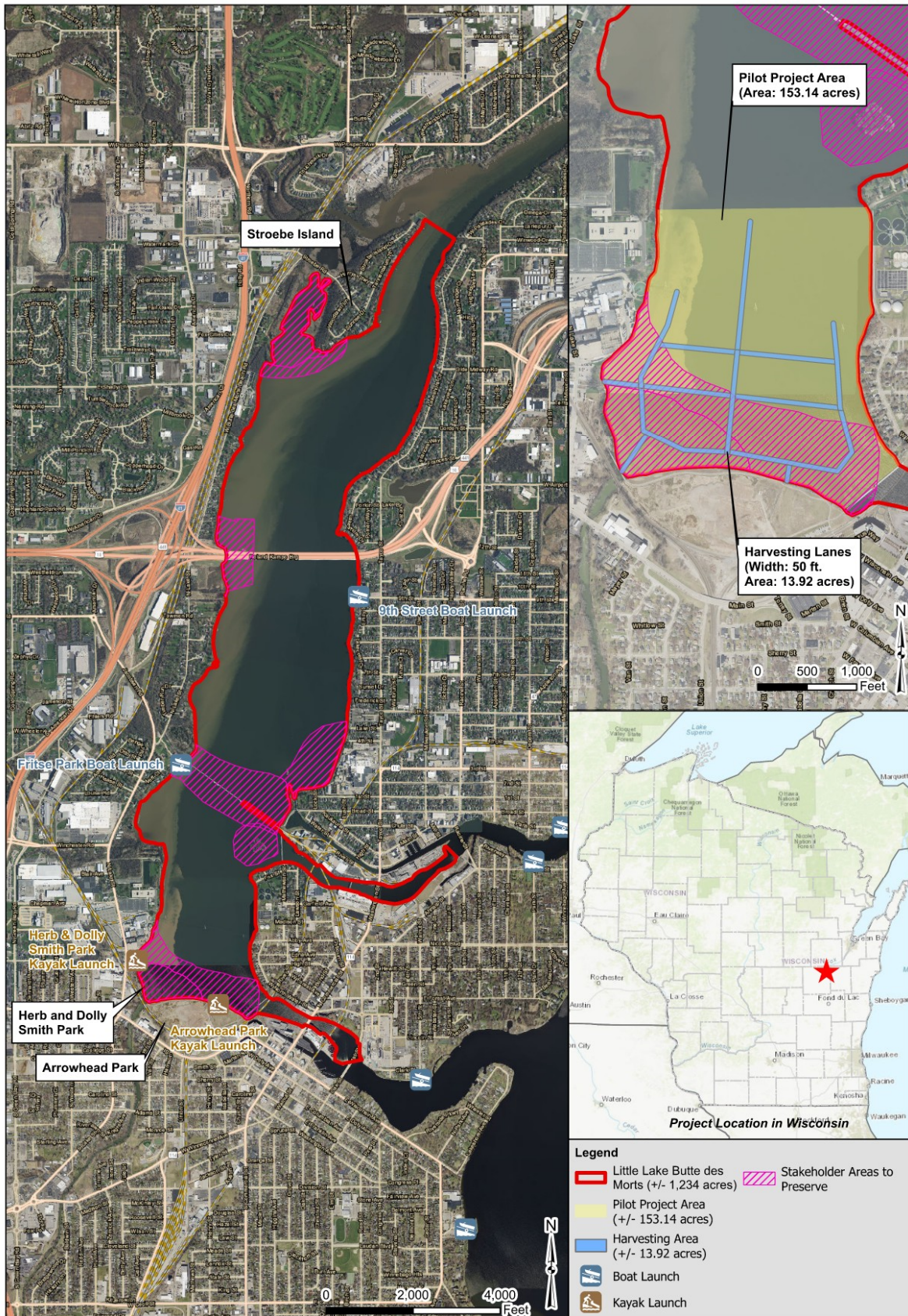


Figure 3-3. Habitat preservation areas reported by stakeholders during July 2024 public meeting.



## 4. Aquatic Plant Baseline - Pilot Area

An aquatic plant point intercept (PI) survey was conducted on LLBDM in July of 2024 by GEI Consultants with assistance from Fox-Wolf Watershed Alliance. The primary goal of the survey was to establish a baseline of aquatic plant presence, abundance, and diversity to inform lake and APM planning. Methods, definitions, and lake wide results are detailed in the 2025 LLBDM APM Strategy<sup>8</sup>. Results specific to the pilot project area are described below.

A total of 80 sites were surveyed within the pilot project area and 72 of those sites (90%) were vegetated (vegetation was pulled up on the sample rake). Average total rake fullness was 2.32 (range of 0-3). The maximum depth of plants was 7.0 feet. The average number of species found at vegetated sites was 3.3 species. Summary statistics are provided in Table 4-1.

There were 12 aquatic plant species observed on rake samples (Table 4-2). Filamentous algae were also found on the rake but not included in the species richness total. Coefficient of conservatism (C-value) values ranged from 0 (highly tolerant of disturbance, little fidelity to any natural community) to 10 (highly intolerant of disturbance, restricted to pre-settlement remnants) [3]. A C-value of 0 is also assigned to all non-native species. Survey results indicate that the average C-value of the pilot project area was 5.3.

The species with the highest frequency of occurrence (FOO) across vegetated sample sites was coontail, which has a C-value of 3. Two non-native, invasive species were observed (Curly-leaf pondweed (CLP) and Eurasian water milfoil (EWM)), which have a C-value of 0. Coontail (*Ceratophyllum demersum* [87.5%]) and common waterweed (*Elodea canadensis* [81.9%]) were the most frequently observed species across vegetated sample sites (Table 4-3).

**Table 4-1. Aquatic Plant Survey Summary Statistics for the Pilot Project Area.**

Summary Statistic	Result
Total number of sites visited	80
Total number of sites with vegetation	72
Maximum depth of plants (ft)	7.0
Total number of sites shallower than maximum depth of plants	80
Frequency of occurrence at sites shallower than maximum depth of plants	90%
Simpson Diversity Index	0.81
Average number of all species per site (shallower than max depth)	2.96
Average number of all species per site (veg. sites only)	3.29
Average number of native species per site (shallower than max depth)	2.46
Average number of native species per site (veg. sites only)	2.74
Species Richness	12
Species Richness (including visuals)	12
Average Rake Fullness	2.32

Table Notes:

<sup>8</sup> Additional water level data, summary statistics, and figures are included within the LLBDM Aquatic Plant Survey Tech Memo (Appendix B).

1. All sites within the pilot project area were sampled using a pole rake.

**Table 4-2. Pilot Project Area - Species Found on the Sampling Rake.**

Common Name	Scientific Name	C-value <sup>1</sup>	Number of sites where species found	Average Species Rake Fullness
Coontail	<i>Ceratophyllum demersum</i>	3	63	2.3
Common waterweed	<i>Elodea canadensis</i>	3	59	1.6
Eurasian water milfoil	<i>Myriophyllum spicatum</i>	0	37	1.6
Water star-grass	<i>Zosterella dubia</i> <sup>2</sup>	6	37	1.2
Wild celery	<i>Vallisneria americana</i>	6	24	1.5
Slender naiad	<i>Najas flexilis</i>	6	6	1
Curly-leaf pondweed	<i>Potamogeton crispus</i>	0	3	1
Small duckweed	<i>Lemna minor</i>	4	2	1
Leafy pondweed	<i>Potamogeton foliosus</i>	6	2	1
Fries' pondweed	<i>Potamogeton friesii</i>	8	2	1
White water lily	<i>Nymphaea odorata</i>	6	1	1
Large duckweed	<i>Spirodela polyrhiza</i>	5	1	1
Filamentous algae		N/A	27	2.1

Table Notes:

1. C-value = coefficient of conservatism
2. Formerly known as *Heteranthera dubia* (Jacq.) MacM.

**Table 4-3. Pilot Project Area Frequency Statistics by Species Found on the Sampling Rake.**

Common Name	Scientific Name	Frequency of Occurrence		Relative Frequency
		Within Vegetated Areas	At sites less than the max DOP <sup>1</sup>	
Coontail	<i>Ceratophyllum demersum</i>	87.50%	78.80%	26.60%
Common waterweed	<i>Elodea canadensis</i>	81.90%	73.80%	24.90%
Eurasian water milfoil	<i>Myriophyllum spicatum</i>	51.40%	46.30%	15.60%
Water star-grass	<i>Zosterella dubia</i> <sup>2</sup>	51.40%	46.30%	15.60%
Wild celery	<i>Vallisneria americana</i>	33.30%	30.00%	10.10%
Slender naiad	<i>Najas flexilis</i>	8.30%	7.50%	2.50%
Curly-leaf pondweed	<i>Potamogeton crispus</i>	4.20%	3.80%	1.30%
Small duckweed	<i>Lemna minor</i>	2.80%	2.50%	0.80%
Leafy pondweed	<i>Potamogeton foliosus</i>	2.80%	2.50%	0.80%
Fries' pondweed	<i>Potamogeton friesii</i>	2.80%	2.50%	0.80%
White water lily	<i>Nymphaea odorata</i>	1.40%	1.30%	0.40%
Large duckweed	<i>Spirodela polyrhiza</i>	1.40%	1.30%	0.40%
Filamentous algae		37.5%	33.8%	N/A

Table Notes:

1. Max DOP = Maximum depth of plants
2. Formerly known as *Heteranthera dubia* (Jacq.) MacM.

During the 2024 aquatic plant survey, the pole rake was used to approximate the dominant sediment type at each sample point. Results indicated that four sediment types were observed across the lake as

included in Table 4-4. Muck was the most prevalent sediment type observed across sample points (60%). Muck and rock mix was the least prevalent sediment type observed across sample points (2.5%).

**Table 4-4. Dominant Sediment Type within Pilot Project Area.**

<b>Dominant Sediment Type</b>	<b>Number of Sample Points</b>	<b>Percentage of Sample Points</b>
Muck	48	60.0%
Rock	17	21.3%
Sand	13	16.3%
Muck/ Rock Mix	2	2.5%

Sediment type is one contributing factor influencing where aquatic plant growth may occur within a lake ecosystem. Nutrient availability and root anchoring are ways that sediment influences the growth of aquatic plants. Organic, nutrient rich sediments, such as muck, create ideal conditions for aquatic plant growth. However, in lake ecosystems where nutrient loading occurs, high nutrient levels within the sediment may lead to excessive aquatic vegetation growth. Coarse, sandy sediments have lower nutrient availability, which creates less than ideal conditions for aquatic plant growth. Clay sediments have the capability to retain and provide nutrients to aquatic plants; however, highly compact clay sediments can limit the ability of the plant’s roots to grow. It is important to consider the sediment composition when determining the aquatic plant management recommendations.

The complete lake wide aquatic plant survey report is provided as Appendix B in the 2025 LLBDM APM Strategy.

## 5. Water Level Fluctuations

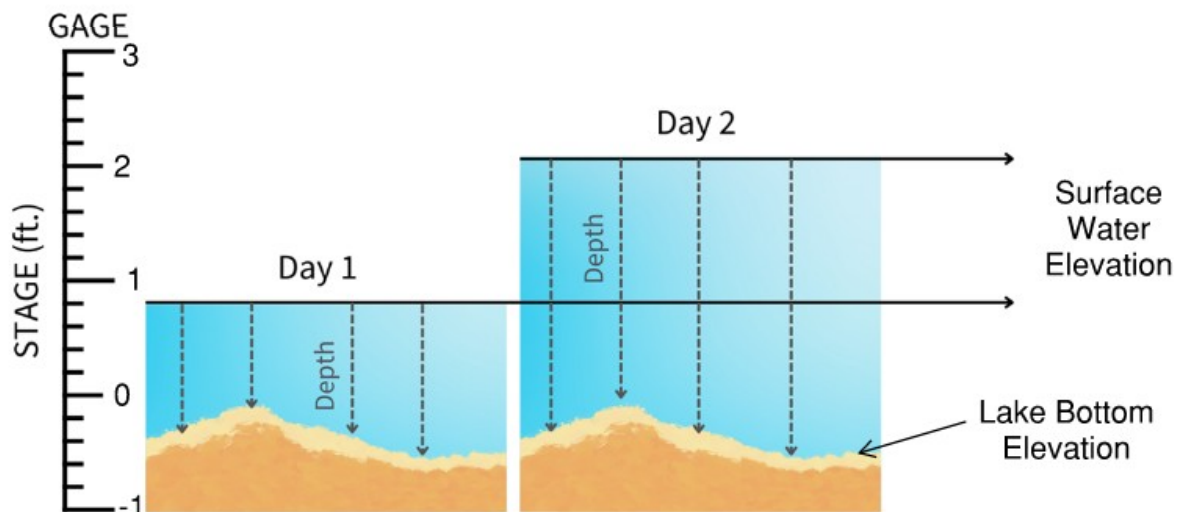
Depth is an important consideration for APM, especially when defining lanes for mechanical harvesting. A minimum of 3.0 feet of water depth is needed to operate without disturbing the lakebed. Depending on the size and specifications of the harvesting equipment used, the actual depth required to operate effectively may be deeper than 3.0 feet.

According to the WDNR website, LLBDM has a maximum depth of 18 feet [4]. However, water depths fluctuate daily, seasonally, and annually due to weather and outflows of the Neenah and Menasha Dams<sup>9</sup>. During the 2024 aquatic plant survey, LLBDM had a maximum measured depth of 23.0 feet and an average water depth of 7.23 feet<sup>10</sup>. The maximum depth measured during that survey was deeper than the WDNR's listing of 18 feet. This is an example of how much water depths can fluctuate in LLBDM.

Currently, no publicly available bathymetric contour map or dataset exist for LLBDM. To understand annual water level fluctuations and inform development of this harvesting plan, aerial imagery, and stage data from the Fritse Park gage were reviewed.

**Water level or stage** refers to the vertical distance (height) from an established point of reference (elevation plane). Terms often used interchangeably include stage, gage height and water level. For the gage at Fritse park, the established point of reference is equal to the elevation of the 0-foot stage level (736.21 ft NAVD88 USACE). Stage readings from a water level gage can be tied to surface water elevations using the known elevation of the established point of reference. When the Fritse Park gage

**Figure 5-1. Example of Stage versus Water Depth.**



Note: 0-foot stage is not equivalent to the bottom of the lake, therefore, a stage of 2.0 feet does not mean that the lake is 2.0 feet deep.

<sup>9</sup> USACE regulates the outflows of the Menasha Dam and influences decisions for outflows of the Neenah Dam.

<sup>10</sup> These water depths were measured at an average surface water elevation across survey dates of 738.45 feet above mean sea level (NAVD88).

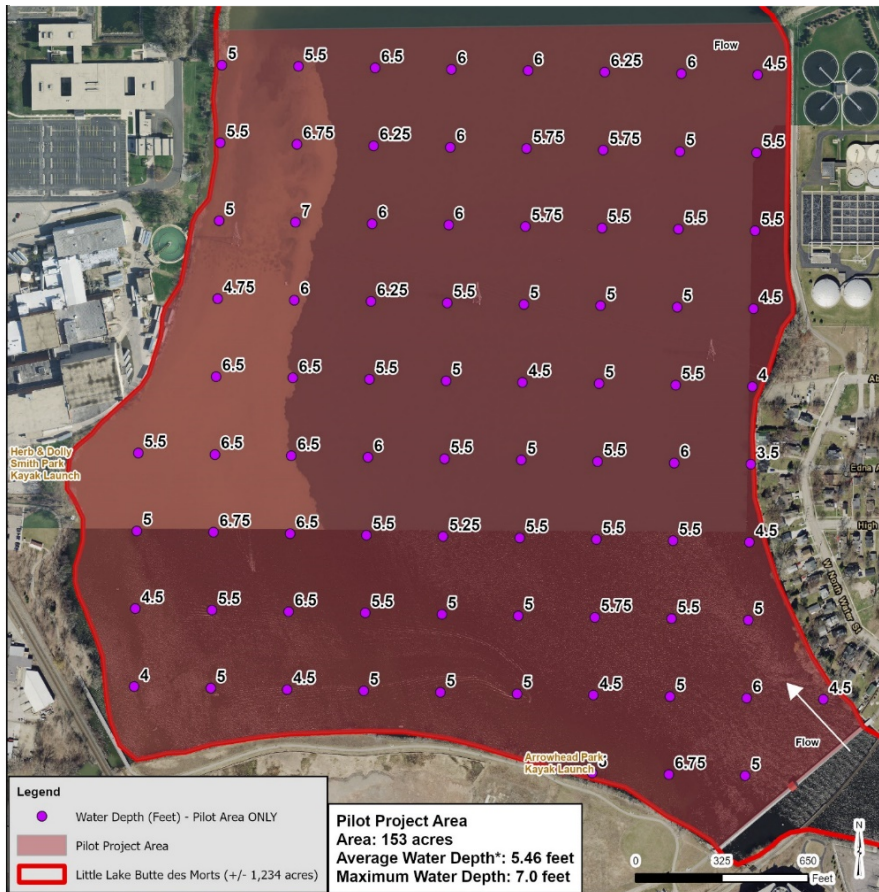
reads 0-feet, the surface water elevation is 736.21 ft (NAVD88). If the gage reads 1-foot, the surface water elevation is 737.21 ft (NAVD88).

**Water depth** is the difference between the elevation of the water’s surface and the elevation of the lake bottom. Water depth is not the same as stage or water level (Figure 5-1). Depth varies throughout a lake depending on the contours and variability of the lake bottom. The relationships among stage, surface water elevation, and water depth of a lake can be used to approximate lake depths using stage readings. Water depths measured throughout the lake in the field can be tied to stage readings collected at the gage during the same time period.

The elevation of the lake bottom can be calculated by subtracting measured water depth from the surface water elevation obtained from stage readings. Combining the above information, the stage reading on a specific day can be used to estimate what the water depth would be at certain locations within LLBDM. The relationships among these variables were used to support the development of the harvesting lanes and evaluate their accessibility under fluctuating water levels.

The United States Army Corps of Engineers (USACE) collects water stage data hourly at their Fritse Park gage station<sup>11</sup>. Monthly (June to September) and annual (2012 – 2024) average stage calculated from Fritse Park gage readings are included in Table 5-1 and Table 5-2. Table 5-1 includes average stage readings, as recorded by the Fritse Park Gage. Table 5-2 includes estimated average water depths of the lake at the gage.

**Figure 5-2. Depths measured during the 2024 Aquatic Plant Survey within the pilot area.**



Water depths were estimated using the relationships that were established between Fritse Park Stage readings and water depths measured in the field. Water depths were measured at sampling locations during the 2024 aquatic plant survey (Figure 5-2). Stage data were provided by the USACE and then averaged across all aquatic plant survey dates<sup>12</sup>. The average stage reading was converted into an average surface water elevation of 738.454 feet above mean sea level (MSL) – NAVD88. The surface water elevation was used to estimate the elevation of the lake bottom for each aquatic plant survey point.

The elevations were then used to estimate the water depth at each aquatic plant survey point under various hypothetical stage readings and/or surface water elevations, as described in Section 8.3.

<sup>11</sup> USACE Fritse Park Gage metadata: [https://hads.ncep.noaa.gov/cgi-bin/hads/interactiveDisplays/displayMetaData.pl?table=dc&nesdis\\_id=CE26C6EC](https://hads.ncep.noaa.gov/cgi-bin/hads/interactiveDisplays/displayMetaData.pl?table=dc&nesdis_id=CE26C6EC)

<sup>12</sup> Stage readings were averaged across dates because the aquatic plant surveys were conducted on multiple days.

Estimated water depths were calculated using the stage level data and the known surface water elevation of the 0-foot stage level. As an example, at the Fritse Park Gage, average water depths in 2012 and 2013 were 3.05 feet and 3.54 feet, respectively. This is in comparison to the highest average water depth of 4.64 feet (2024) and 4.52 feet (2019) (Table 5-2).

Fluctuations in water levels across years are somewhat noticeable in aerial imagery spanning from 2000 to 2023. In 2000, 2003, 2005, 2013 and 2015, water levels appear to be lower than other years as indicated by large areas of exposed sediment near the Trestle Trail and adjacent islands. These findings are consistent with the annual average stage and water depths displayed in Table 5-1 and Table 5-2, respectively. Aerial imagery reviewed is included as Appendix B.

**Table 5-1. Monthly and Annual Average Stage at the Fritse Park Gage<sup>1</sup>- Little Lake Butte des Morts**

		Water Stage (ft) by Year												MONTHLY AVERAGES	
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023		2024
Month <sup>2</sup>	Jun.	0.81	1.88	2.34	2.14	1.71	2.32	1.95	2.46	2.99	1.04	1.75	1.08	2.64	1.93
	Jul.	0.52	1.11	1.05	0.91	1.15	1.83	1.22	2.05	1.96	2.63	1.15	0.85	3.29	1.52
	Aug.	0.61	0.70	0.98	0.79	0.97	1.06	1.15	1.33	1.19	1.93	1.32	0.96	1.68	1.13
	Sep.	0.48	0.68	1.42	1.44	1.67	1.27	3.21	2.45	1.23	1.67	1.43	0.79	1.14	1.45
ANNUAL AVERAGES		0.60	1.09	1.44	1.31	1.37	1.61	1.87	2.07	1.84	1.84	1.41	0.92	2.19	

Table Notes:

1. Stage level readings measured in feet at the Fritse Park Gage. Stage levels do not equal lake water depth.
2. For the purposes of the harvesting plan, water levels were analyzed seasonally (June - September). Analyzed months are when harvesting may occur within LLBDM. WDNR guidance does not allow harvesting within Wisconsin Lakes until June 1.

**Table 5-2. Monthly and Annual Average Water Depths at the Fritse Park Gage - Little Lake Butte des Morts.**

		Water Depth (ft) by Year												MONTHLY AVERAGES	
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023		2024
Month <sup>1</sup>	Jun.	3.26	4.33	4.79	4.59	4.16	4.77	4.40	4.91	5.44	3.49	4.20	3.53	5.09	4.38
	Jul.	2.97	3.56	3.50	3.36	3.60	4.28	3.67	4.50	4.41	5.08	3.60	3.30	5.74	3.97
	Aug.	3.06	3.15	3.43	3.24	3.42	3.51	3.60	3.78	3.64	4.38	3.77	3.41	4.13	3.58
	Sep.	2.93	3.13	3.87	3.89	4.12	3.72	5.66	4.90	3.68	4.12	3.88	3.24	3.59	3.90
ANNUAL AVERAGES		3.05	3.54	3.90	3.77	3.82	4.07	4.33	4.52	4.29	4.27	3.87	3.37	4.64	

Table Notes:

1. For the purposes of the harvesting plan, water levels were analyzed seasonally (June - September). Analyzed months are when harvesting may occur within LLBDM.

## 6. Permit Applications & Reporting

In Wisconsin, permits are needed for aquatic plant control when<sup>13</sup>:

- Chemicals are used ([NR 107, Wis. Adm. Code](#), [WPDES](#)).
- Biological controls are used ([NR 107, Wis. Adm. Code](#)).
- Plants are removed mechanically ([NR 109, Wis. Adm. Code](#)).
- Physical techniques such as drawdown are used ([Ch. 30/31](#)).
- Plants are removed manually from an area greater than 30 feet in width along the shore.

Before engaging in any aquatic plant management or nuisance control activities, contacting the local WDNR aquatic plant management coordinator is highly recommended. With an approved aquatic plant management plan, WDNR may issue a mechanical harvesting permit under NR 109 for a 3-to-5-year term. Information required for a mechanical harvesting permit is listed in Table 6-1.

Chemical application permits for herbicides under NR 107 are typically only valid for one year. If herbicides will be used, the selected contractor should provide the necessary details for a permit application, documentation, and reporting.

Documentation and reporting of harvesting efforts is a requirement of APM permits in Wisconsin. The WDNR’s Mechanical/Manual Reporting Form<sup>14</sup> should be filled out as accurately and completely as possible and submitted to the WDNR through their ePermitting system. Descriptions of the types of information that will be needed for mechanical harvesting documentation and reporting are outlined in Table 6-2. This is also described in the WDNR’s APM ePermitting Guidebook<sup>15</sup>. Additional requirements may be prescribed in the permit approval conditions provided by the WDNR.

**Table 6-1. WI NR 107 & 109 permit application checklist.**

Applicant Section:	
<input type="checkbox"/>	Name, address, & phone/email for the current parcel landowner/sponsor. <i>Note: do not list the contractor business information as the applicant.</i>
Waterbody Address section:	
<input type="checkbox"/>	Name, address, & phone/email for the waterbody contact (may be the same as the Applicant section). <i>Note: do not list the contractor business information in this section.</i> <i>Waterbody: Little Lake Butte des Morts (WBIC 129800)</i>
Applicator section:	
<input type="checkbox"/>	Has current & correct applicator certification numbers for all employees who will conduct control.
<input type="checkbox"/>	Has current contractor business license number for the business doing the control work (the number begins with 93-XXXX-XXXX). <i>Note: enter “NA” for business license number if not applicable (this is rare).</i>
Riparian Owners section (select <u>one</u> ):	

<sup>13</sup> <https://dnr.wisconsin.gov/topic/lakes/plants>

<sup>14</sup> WDNR Mechanical/Manual Reporting Form (3200-011)

<sup>15</sup> [https://dnr.wisconsin.gov/sites/default/files/topic/Lakes/APM\\_ePermitting\\_Guidebook.pdf](https://dnr.wisconsin.gov/sites/default/files/topic/Lakes/APM_ePermitting_Guidebook.pdf)

<input type="checkbox"/>	Has a list of names and addresses for all parcel owners who share ownership of the waterbody or are located adjacent to the control area within 150 ft. <i>Note: The list may be typed in the digital permit form or included as an attachment.</i>
<input type="checkbox"/>	Riparian owners list is not needed because the waterbody is contained on a single parcel and/or no other parcel owners are located adjacent to the control area.
<b>Site Information – Waterbody section:</b>	
<input type="checkbox"/>	Has correct county in which the waterbody is located. <i>Little Lake Butte des Morts, Winnebago County</i>
<input type="checkbox"/>	Has correct latitude & longitude in decimal degree format that accurately plots to the control area. <i>44.192323° -88.469224°</i>
<b>Site Information – Proposed Control Area section:</b>	
<input type="checkbox"/>	Has the correct acreage and corresponds with the site map. <i>Length, width and depth of each control area or lane is provided in Table 6.</i>
<b>Application Tab – Target Plant section:</b>	
<input type="checkbox"/>	Has an accurate list of specific plants & aquatic organisms intended for control. <i>See Table 3.</i>
<input type="checkbox"/>	Does not have generic statements such as “all invasives.”
<b>Application Tab- Chemical Control section (if applicable):</b>	
<input type="checkbox"/>	Has accurate & targeted list of proposed chemicals that correspond with target species.
<input type="checkbox"/>	Has specific trade names if using the “other” box.
<input type="checkbox"/>	Does not have lengthy list of products, as this shows a lack of a clear control plan.
<b>Attachments – Site Map:</b>	
<input type="checkbox"/>	Has labeled map(s) that clearly show the control area(s) using recent aerial imagery & matches with site information section. <i>See Figure 1 and Figure 6.</i>
<input type="checkbox"/>	If permitting areas within a larger waterbody, map has polygons outlining each control area.
<b>Attachments – Public Notice:</b>	
<input type="checkbox"/>	Has acceptable evidence that public notice requirement was completed prior to submitting application. <i>Note: this is required when the control area exceeds 10 acres or 10% of the waterbody’s area is 10ft or less in depth.</i>

**Table 6-2. NR 109 Required Annual Harvesting Permit Documentation and Reporting.**

Information Needed	2025 Quick Reference or instructions
<b>Control Information</b>	Start Date: the start date of harvesting operations.
	End Date: the end date of harvesting operations.
	Estimated days of conducting control: Obtain from contractor.
	Control method/equipment used: mechanical harvesting.
	Comments: relevant comments such as the number of harvesters used, or types of harvesting equipment.
<b>Controller / Operation Information</b>	Individual or business name, address, and phone number of contractor or operator.
	Name of the person filling out the form.
	Names of individual equipment operators
<b>Disposal Site Information</b>	Disposal Site Name: City of Neenah Landfill
	Disposal Site Address: 1495 Tullar Rd, Neenah, WI 54956
<b>Site Summary and Species Details</b>	Site number:
	Property name: Little Lake Butte Des Morts
	Address/Fire Number: Herb and Dolly Smith Park and Arrowhead Park

Information Needed	2025 Quick Reference or instructions
	Controlled acreage: This is the maximum amount of harvested area within one growing season.
	Permitted acreage: This is the permitted amount of area that can be theoretically harvested under the WDNR permit.
	Sensitive area: As of this harvesting plan, the City of Neenah’s harvesting zone is not within a sensitive area.
	Latitude and longitude: 44.192323° -88.469224°)
	Hours spent: Total harvesting hours spent. This is time that the harvester is operating.
	Total amount of plants or organisms removed/controlled: total amount of plants to be removed can be quantified by taking the number of loads and multiplying by a standard weight (lbs) per load. Units in pounds (lbs)
	Comments: Any notable comments about harvest efficiency, non-target impacts etc.
	Species Detail: For this section, please enter approximately the different dominant species found in the harvesting zone. This can be done on a percentage scale based on the results provided in Section 4.

## 7. Contractor Selection

---

Selecting a qualified contractor is an important step for successful implementation of an APM project. Polk County Association of Lakes (PCALR) developed a guide to help people choose an appropriate and qualified contractor for lake planning grants [5]. The following checklist was adapted from the PCALR to more specifically assist with evaluating, selecting, and working with an APM contractor:

Develop a specific list of tasks for contractor bids (detailed work plan).

Consider having several contractors offer proposals for the project.

Request training, background, certifications, memberships, affiliations, and committees from those you plan to interview for the project. *Look for aquatic plant identification training, herbicide applicator certificate (if applicable), etc.*

Interview at least three contractors.

Check with the Wisconsin Circuit Court<sup>16</sup>, Better Business Bureau<sup>17</sup>, and Department of Agriculture, Trade & Consumer Protection<sup>18</sup> for complaints or violations.

Contact the contractor's references and get a credit report before signing any contract.

Request proof of insurance.

Sign a contract with the contractor you have selected. Make sure the contract includes a detailed list of project deliverables as well as their AIS decontamination procedures for equipment.

Communicate regularly with the contractor and WDNR during the project.

Choose separate consultants for planning/monitoring and implementation. This helps to avoid bias of pre- and post-treatment monitoring.

---

<sup>16</sup> <http://wcca.wicourts.gov>

<sup>17</sup> [www.bbb.org](http://www.bbb.org)

<sup>18</sup> [www.datcp.state.wi.us](http://www.datcp.state.wi.us)

## 8. Pilot Project Implementation Plan

---

LLBDM has nuisance-level aquatic plant growth that has negatively impacted, and in some cases prevented, recreational access and use of the lake. The goal of APM within the pilot project area is to improve public recreational access and use by maintaining navigation channels for motorized and non-motorized watercraft as well as improving swimming, fishing, and aesthetics while protecting important habitat. Implementation of the pilot project will include mechanical harvesting with potential for herbicide applications, education and information efforts, and monitoring. These activities are described below.

### 8.1. Harvesting Lanes and Disposal

Integrated Pest Management (IPM) is a wholistic approach to natural resource management. IPM is a decision-making strategy which utilizes information about how pest species interact with the broader ecosystem. As part of IPM several different management methods are considered and alternatives are analyzed to determine which methods are most feasible. Many lake management techniques may work in one waterbody but may not in another and the IPM process helps to determine which methods are most appropriate. Integrated Pest Management is recognized as the most effective approach to managing aquatic plant problems because it makes use of all available tools. IPM also includes continuous monitoring and evaluation, comparing goals to outcomes of aquatic plant control to inform the next round of management.

Several alternatives to mechanical harvesting were considered including hand pulling, suction harvesting, Diver Assisted Suction Harvesting (DASH), hydraulic dredging, herbicides, biological controls, nutrient reduction, education, and AIS prevention. To evaluate potential management methods, each method was assessed for applicability, reliability, duration of benefits, frequency of application, regulatory requirements, costs, and likelihood of stakeholder support. Full comparison and analysis of aquatic plant control methods is described in the 2025 LLBDM APM Strategy.

Based on the results of the APM alternatives evaluation, mechanical harvesting was identified as the method most appropriate for the pilot area. As such, harvesting is being recommended as the primary method for managing nuisance-level submerged aquatic plant growth with herbicide applications as a secondary option during low water periods. Prevention and education were also identified as important components of an IPM approach. This is based on preferences of the City of Neenah and stakeholders as well as results from the alternatives analysis as outlined in the 2025 LLBDM APM Strategy.

Within the pilot area, harvesting lanes were designed and located to improve recreational access and navigability and in consideration of harvesting efficacy based on water depths, launch and unloading locations, and abundance of aquatic plants. Harvesting lanes are shown in Figure 8-1 and listed in **Table 8-1**. Each lane is 50 feet wide. The estimated total acreage to be harvested is +/- 13.92 acres, as depicted in Figure 6.

Figure 8-1. Harvesting lanes and segments within Pilot Project Area.



**Table 8-1. Harvesting Lane Segments Length and Area.**

Segment ID	Area (Acres)	Length (Feet)
A	0.42	372.5
B	0.54	473.8
C	1.23	1,076.2
D	1.50	1,303.2
E	0.87	755.4
F	1.01	884.2
G	1.52	1,324.8
H	1.23	1,068.5
I	1.11	964.2
J	1.20	1,043.7
K	1.04	907.7
L	2.06	1,792.4
M	0.21	183.0
<b>TOTAL</b>	<b>13.92</b>	<b>12,149.4</b>

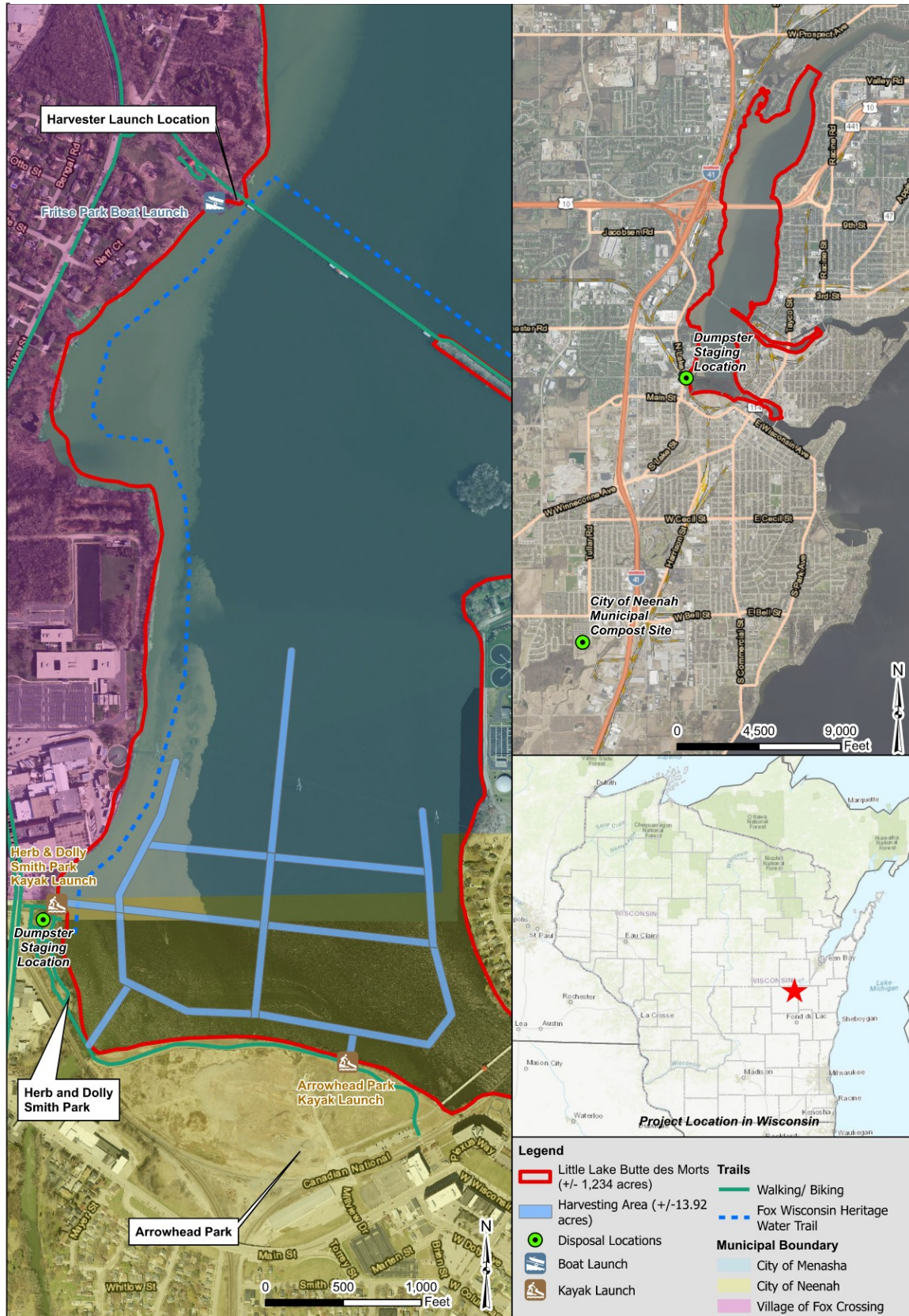
The harvester will be trailered to and launched from Fritse Park which is the only boat landing that provides adequate access to the pilot project area. Fritse Park is located in the Village of Fox Crossing which is approximately 3,700 feet (0.70 miles) from the northern entry point of mapped harvesting lanes. Harvesters typically travel at three to four miles per hour. Actual speed will vary depending on the equipment specifications, flow of the river channel, wind, and weight of the plant material as it is collected and stored onboard. Travel time will be an important consideration when estimating the amount of time it will take to complete each harvesting event.

Herb and Dolly Smith Park, located along the west shore of the pilot project area, was selected as the dumpster staging area where the harvester will offload harvested plant material as needed during operations (Figure 8-2)<sup>19</sup>. This park also has a kayak launch which is one of the access points of interest for this pilot. During operations, the selected contractor should follow the prescribed harvesting lanes in a way that maximizes efficiency for travel, harvesting, and unloading.

The City of Neenah will provide dumpsters at the staging area and haul filled dumpsters to the disposal location to incorporate plant material into the City's compost, as needed. The proposed disposal location is the City of Neenah compost site at 1495 Tullar Rd, Neenah, WI 54956 (Figure 8-2). Alternative disposal sites may be considered, such as the University of Wisconsin-Oshkosh biodigester.

<sup>19</sup> Per communications with the City of Neenah (Personal comm. M. Kading, Nov. 2024)

Figure 8-2. Aquatic plant staging and disposal locations.



## 8.2. Aquatic Invasive Species Prevention

Harvesting equipment that is used in more than one water body should be cleaned and decontaminated before entering and after leaving LLBDM to prevent the spread of aquatic invasive species. Certain measures are required by WI NR 40<sup>20</sup> such as removal of plant material, debris, and sediment from all equipment by hand with hand tools or with pressurized water. Equipment must also be decontaminated using hot water, steam, or applying a bleach solution. Key steps include:

1. **Remove** all visible plants and debris including plant fragments from the harvester and equipment such as the cutting blades, conveyor belts, and any other parts that come into contact with water and plants.
2. **Drain** all water by emptying compartments and the motor.
3. **Scrub** all exterior surfaces with a long-handled, stiff-bristled brush to remove sediments. An alternative to a stiff-bristled brush is to spray equipment with pressurized water to remove any remaining sediment or small particles.
4. **Steam-clean, use hot water ( $\geq 140^{\circ}$  F), or spray with a bleach solution** to disinfect equipment. The outside and inside of the harvester, trailer, conveyer belts, bilges and pumps should be steam cleaned or sprayed with hot water. If using a bleach solution, spray everything and let it sit for a minimum of 10 minutes. Then rinse with clean water.
5. **Dry the equipment:** Allow the harvester to dry completely for a minimum of five days before transporting it to a different lake. Drying is an effective way to kill any remaining aquatic invasive species.

Steam cleaning is the preferred method for decontamination when possible<sup>21</sup>.

## 8.3. Adaptive Decision Making Based on Depth and Stage

LLBDM experiences daily, seasonal, and cyclical fluctuations in water levels and flows that are influenced by the weather and operations of dams located upstream and downstream from the lake. The pilot project area is shallow, and accessibility of a harvester may be limited in some areas when water levels are low. The minimum depth for harvesting is 3.0 feet to avoid disturbing lake sediment. Greater depths may be necessary depending on equipment specifications. To determine the actual effective harvesting depth for LLBDM, trial and error may be needed.

As described in Section 5, the Fritse Park Gage stage level reading on a specific day can be used to estimate the water depth at aquatic plant survey points within LLBDM. This information was used to develop guidance for assessing suitability of conditions for harvesting based on Fritse Park Gage stage readings for each lane segment (Table 8-2).

---

<sup>20</sup> <https://dnr.wisconsin.gov/topic/Invasives/prevention>

<sup>21</sup> <https://apps.dnr.wi.gov/swims/Documents/DownloadDocument?id=113967385>

Suitable gage readings are estimates based on field collected data and Fritse Park Gage readings; a level of error is expected. These values are for informed decision making and not for navigational purposes. To account for expected error, ranges of gage readings, and the estimated water depths of each segment, were evaluated. The accessibility of each segment was ranked as accessible, caution, or inaccessible for each gage reading range. If a segment is ranked as accessible, it is estimated that water depths will be significantly greater than the 3.0-foot threshold. When the Fritse Park Gage reads  $\geq 2.2$  feet, it is estimated that all segments will be accessible. If a segment is ranked as caution, it is estimated that water depths will be close to (within 0.5 feet) of the 3.0-foot threshold. Extra caution should be taken when entering and operating in segments ranked as caution. If a segment is ranked as inaccessible, it is estimated that water depths will be less than the 3.0-foot threshold. Harvesting is not recommended to be conducted in segments ranked as inaccessible. When the Fritse Park Gage reads  $\leq 0.5$  feet, it is estimated that all segments will be inaccessible.

**Table 8-2. Estimated Accessibility of Harvesting Lane Segments Based Off Fritse Park Gage Readings**

Fritse Park Gage Reading (feet)	Accessible Segments	Caution Segments	Inaccessible Segments
$\geq 2.2$	All	-	-
1.75 - 2.2	C, D, E, F, G, H, I, J, K, L, M	A, B	-
1.5 <sup>i</sup> - 1.75	C, D, E, F, G, H, I, J, K, L, M	-	A, B
1.0 - 1.5	C, E, F, G, H, I, J, K	D, L, M	A, B
0.5 - 1.0	-	C, E, F, G, H, I, J, K	A, B, D, L, M
$\leq 0.5$	-	-	All

<sup>i</sup>The average Fritse Park Gage reading from 2012-2021 was 1.5 feet.

As mentioned in Section 5, water levels fluctuate daily, seasonally, and annually within LLBDM. The minimum monthly stage level between 2012- 2024 was 0.48 feet (September 2012). The maximum monthly stage level between 2012 – 2024 was 3.29 feet (July 2024). The average monthly stage level between 2012 – 2024 was 1.51 feet. This indicates that in average to high water levels years in LLBDM, the majority of harvesting segments will be accessible to harvest. During years when harvesting is not feasible due to lake conditions, herbicide applications may be a suitable alternative. The City of Neenah is recommended to work with the WDNR and a licensed herbicide applicator to determine applicability, application timing, rates, and permit requirements.

## 8.4. Education and Information Strategy

The main goal of the pilot project is to improve recreational value for the public. To support this effort, education and dissemination of information will be important for success. Recommendations include:

1. Hold one public meeting each year before APM begins to discuss the activities planned for the upcoming season, share results from the previous year’s activities, and collect stakeholder feedback.
2. Post signage at Herb and Dolly Smith Park, Arrowhead Park, and Fritse Park about the pilot project to education lake users and the public about the effort. Consider also adding signage to

the trails. Harvesters are large pieces of machinery that will catch the attention of bystanders. Signage can help raise awareness about the effort and explain operations to alleviate concerns or address questions the public may have about the operation. Signage should be durable, weather resistant, and include contact information. A QR code could be included on signage to direct people to dedicated webpage.

3. Post signage about AIS prevention at Herb and Dolly Smith Park, Arrowhead Park, and Fritse Park. Consider also adding signage to the trails. Signage should be consistent with WDNR messaging and include contact information. A QR code could be included on signage to direct people to dedicated webpage.
4. Post information about the pilot project on the City of Neenah’s webpage and social media pages.
5. Implement a Clean Boats, Clean Waters campaign at Fritse Park. See goals and recommendations in the 2025 LLBDM APM Strategy.

## 9. Recommended Evaluation and Plan Updates

---

An aquatic plant management plan is a dynamic document intended to be adaptable to changing conditions and needs. This means APM plans can and should be updated as management actions are implemented, needs are met, or new concerns arise. At a minimum, plans should be updated every five years. This section describes the recommended monitoring, evaluation, and update frequency for the pilot project.

Monitoring is a recommended IPM component of aquatic plant management projects. Results can be used to evaluate effectiveness of APM activities in meeting project goals, detect potential issues, and quantify non-target impacts. The specific parameters that are monitored depends on the goals of an APM plan, implemented actions, and permit requirements (if any).

Monitoring for effectiveness would typically be conducted soon after harvesting or two weeks after application of herbicides. Examples of questions to ask to help evaluate conditions after a treatment:

1. Did the implemented actions meet the goals of the aquatic plant management plan?
2. Were non-target plants or other species harmed?
3. Was there significant oxygen depletion?
4. Was there an algal response to nutrients released from decaying vegetation?
5. Was there a noticeable change in the abundances or diversity of invasive or native species?
6. How soon did targeted plants grow back to nuisance levels following treatment?
7. Was there a change in water clarity after treatment?
8. How did the ecosystem respond? (fish, wildlife, etc)

To prevent the appearance of bias or conflict of interest, it is recommended that monitoring and evaluations be conducted by someone other than the contractor who applied a treatment or conducted harvesting. That way, the contractor is not responsible for evaluating the effectiveness of their own work. This may be done by hiring a different contractor or by using trained volunteers.

In addition to evaluating the effectiveness of management actions, monitoring can also be used to assess changes in the lake ecosystem. This may include new introductions of invasive species as well as detect changes in water quality, fisheries, or the native plant community.

A list of recommended monitoring strategies by resource type is provided in Table 9-1. Each of the strategies is described in further detail in the proceeding sections. Volunteers can be trained to do some of the monitoring through the statewide Citizen Lake Monitoring Network (CLMN). However, some methods are not tailored for volunteers, such as aquatic plant surveys, because it requires a high degree of experience and training.

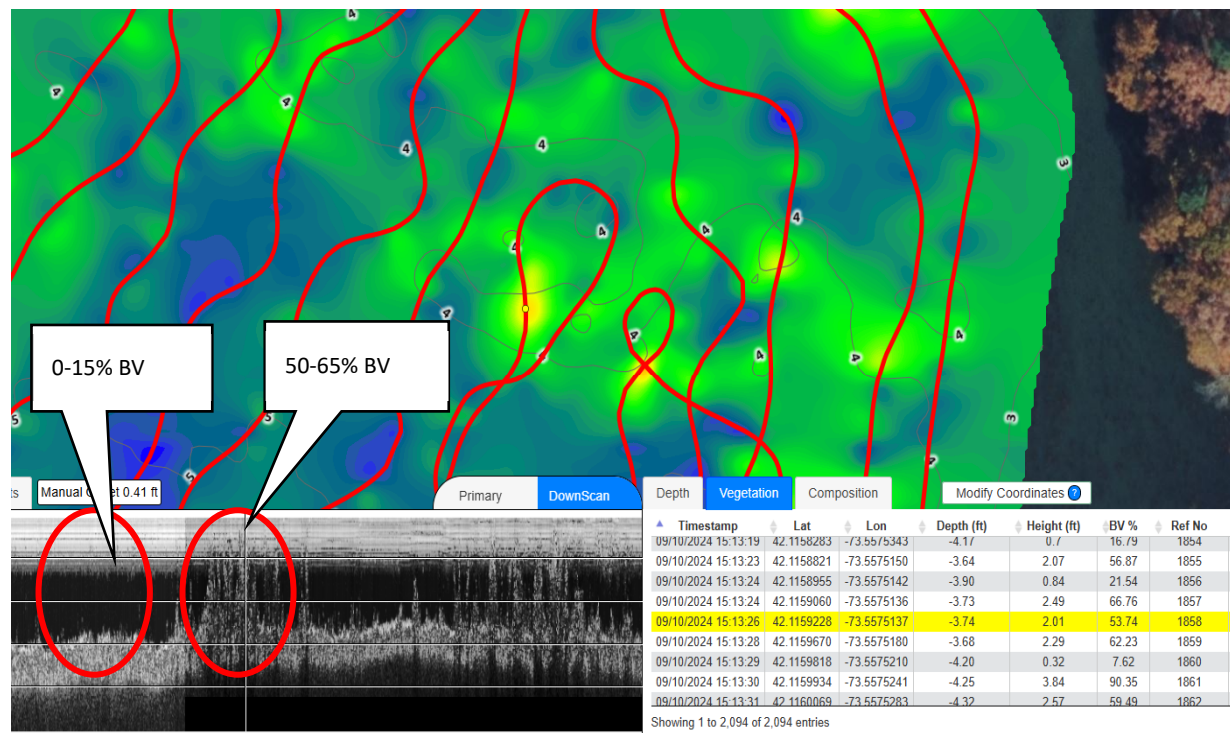
**Table 9-1. Recommended Monitoring Strategy by Resource Type.**

Resource	Purpose	Recommended Strategy	Frequency
Aquatic Plants	Effectiveness	SONAR downscan imaging to determine Biovolume	Pre-harvesting each year and post-harvesting once per year
Aquatic Plants	Non-target Impacts	Point Intercept Sampling	Pilot area: every three years Whole lake: every five years
Fisheries	Non-target Impacts	Utilize WDNR fisheries data	Whole lake multi gear sampling survey every 5 years.
Water Quality	Non-target Impacts	Visual inspection and water quality sample sites.	Monthly during growing season at established long-term deep site and added long-term site in harvest zone.

## 9.1. Evaluating Harvesting Effectiveness

Annually documenting the success of harvesting efforts can be done using an area-wide coverage sampling approach such as sonar recordings. Sonar mapping involves navigating the entire project area using a fish finder or equivalent device equipped with a transducer. Data collected by the sonar can then be analyzed for patterns. Third party companies offer algorithms to calculate biovolume (BV), which is the relative height of plants in the water column and interpolate between BV points to create a raster heat map surface. Harvesting lanes should have a lower average BV than the surrounding area that was not harvested due to cutting of vegetation. An example of the sonar output by one third party company is shown in Figure 9-1.

**Figure 9-1. Example of sonar algorithm output showing BV.**



Acceptable harvesting lane BV values should be evaluated based on the depth of the site, associated plant height, and types of watercraft using the lanes. As the water depth increases, the corresponding maximum BV for plants that will allow kayaks or motorboats to pass gets larger (Table 9-2).

**Table 9-2. Acceptable Maximum Biovolume (BV) by Watercraft Type.**

Water Depth	Acceptable Maximum BV by Watercraft Type			
	Kayaks		Motorboats	
	BV %	Plant Height	BV %	Plant Height
1 ft	0%	0 ft <sup>1</sup>	0%	0 ft <sup>1</sup>
2 ft	50%	1 ft	0%	0 ft <sup>1</sup>
3 ft	65%	2 ft	33%	1 ft
4 ft	75%	3 ft	50%	2 ft
5 ft	80%	4 ft	60%	3 ft
6 ft	83%	5 ft	75%	4 ft
7 ft	86%	6 ft	71%	5 ft
8 ft	88%	7 ft	75%	6 ft

Table Notes:

1. It would be difficult to navigate at this water depth regardless of plant height.

## 9.2. Assessing Non-Target Impacts

Maintaining recreational navigation lanes can lead to non-target impacts on the native plant community, fish and wildlife, and water quality. The potential effects of mechanical harvest upon the LLBDM ecosystem will be monitored through assessment of water quality, plant, and fish communities.

### 9.2.1. Aquatic Plant Community

Maintaining lanes for navigation involves control of plants within the pre-determined lane areas. Harvesting these lanes will remove a portion of the plant biomass, leaving the roots and the bottom part of each plant in place (similar to mowing a lawn).

To monitor for potential impacts to the aquatic plant community, aquatic plant point intercept (PI) surveys are recommended every few years within the pilot project area and at least every five years lake wide. The inventory results can then be compared to the baseline inventory completed at the beginning of the aquatic plant management planning process. This type of survey provides the data needed to check for changes in species richness, diversity, and distribution.

Most aquatic plant species that are present in LLBDM are likely to recover from harvesting within weeks of cutting, preserving the integrity of the plant community over the long term. If the results of aquatic plant PI surveys (compared to baseline) show a decline in species richness or diversity, it could be an indication that aquatic plant control efforts are negatively impacting the native plant community and alternative management methods should be considered.

### **9.2.2. Fish Community**

Cutting and maintaining lanes in heavily vegetated habitats will reduce the overall coverage of aquatic vegetation. Since the harvesting area for the City of Neenah is a small portion of the total LLBDM area, removal of vegetation is not anticipated to significantly reduce available habitat or have measurable impacts on the population dynamics of recreationally important fish species. The creation of harvesting lanes in areas with dense aquatic plant growth can enhance habitat for some fish by creating an edge effect. This increase habitat diversity for different species [6]. For example, young of the year fish may hide in dense patches of vegetation while predators utilize open channels to roam and hunt.

WDNR fisheries data for LLBDM is collected on a 5-year basis and can be used to assess impacts of lane maintenance on the fish populations in the City of Neenah’s harvest area. The survey effort includes a combination of fyke netting and shoreline electrofishing. The surveys assess species composition, size structure, relative abundance, and some species have age samples collected. The surveys track population metrics over time allowing for the accumulation of trend data. This allows fisheries management staff to observe change in the fisheries of LLBDM and make/change regulations as needed.

WDNR fisheries completed surveys on LLBDM in 2015, 2020, and 2021, including electrofishing and fyke net surveys. The next survey will likely take place in 2026. Survey results from prior years can be used to assess changes in fishery composition and as an indicator for potential non-target impacts of aquatic plant management activities.

### **9.2.3. Water Quality Impacts**

The WDNR conducted water quality monitoring for LLBDM once per month in July, August, and September 2024. Monitoring took place at the long-term trend, deep hole sampling site near the HWY 10 bridge (Station 713305). Parameters measured included TP, chl-a, water temperature, DO, and Secchi depth. Additional Secchi depth data were collected by volunteers in 2000 and 2013-2015. Water quality monitoring effort should be maintained in LLBDM. To assess potential non-target impacts of the pilot program, an additional long-term site could be added within or just outside of the harvesting area. The same water quality parameters should be collected at both sites to provide insight into lake health and inform management decisions.

Removal of aquatic vegetation can disturb sediments in very shallow (<3 feet) areas, it may be helpful to measure turbidity or clarity before and after management. If herbicides were used, water sample collection and herbicide concentration analysis should be added to the monitoring list and may be required under the permit [7]. Degradation of plant material after herbicide application can release soluble nutrients into the overlying water column [8,9], which in some cases can feed algae growth. For the scope of the city’s harvesting plan there will likely be no significant impacts to water quality, largely due to the scale of the plant removal. The proposed harvesting lanes are approximately 13.92 acres which is 10% of the 153-acre pilot area, and 1.3% of the 1,234-acre lake. GEI staff that monitor other aquatic plant management programs have not seen impacts to water quality unless >50% of the vegetation is removed from a waterbody at once.

Monitoring of impacts to water quality should involve visual inspection of the harvesting lanes to determine if there is excessive turbidity or algal growth present. Unless there is evidence of negative impacts to water quality, it is recommended monitoring consists of continued monitoring at the long-term deep hole site complemented by the addition a new long-term sampling site within the harvesting area.

#### **9.2.4. *Adaptive Approach and Plan Updates***

Results from monitoring can inform decisions about whether the APM plan should be modified. If issues are detected or management actions are not as effective as intended, it may be necessary to adjust the management approach or implement a new one. If the results indicate that the management actions are effective without issues, the decision may be to maintain the current course.

In general, aquatic plant management plans should be updated every five years. Plans should be updated sooner if there is a large change to the overall strategy such as shifts in harvest lane areas or if new techniques are employed. Plan updates should include the relative success and lessons learned from past efforts, evaluation of potential non-target impacts, and a discussion of proposed changes. Ideally, consultation with the WDNR would occur prior to making plan updates or permit modifications.

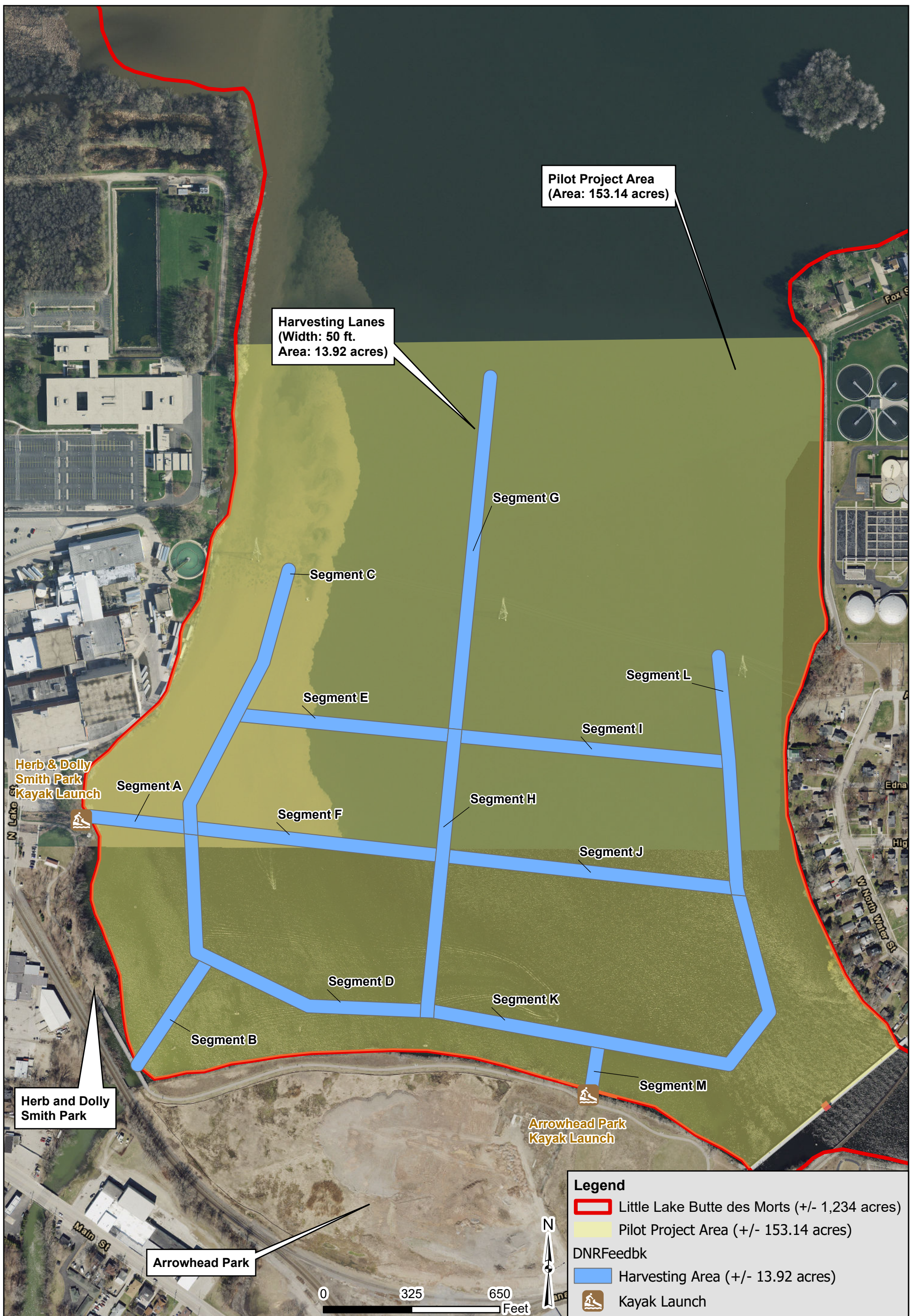
## 10. References

---

1. Wisconsin Department of Natural Resources. Wisconsin Lakes - Lake Winnebago [Internet]. [cited 2024 Jun 6]. Available from: <https://apps.dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=131100&page=invasive>
2. City of Neenah. Loop the Little Lake [Internet]. City of Neenah. Available from: <https://www.ci.neenah.wi.us/departments/parks-recreation/loop-the-little-lake/>
3. Bernthal TW. Development of A Floristic Quality Assessment Methodology for Wisconsin [Internet]. 2003 Jun. Available from: [https://dnr.wisconsin.gov/sites/default/files/topic/Wetlands/Floristic\\_Quality\\_Assessment\\_Methodology\\_2023.pdf](https://dnr.wisconsin.gov/sites/default/files/topic/Wetlands/Floristic_Quality_Assessment_Methodology_2023.pdf)
4. Wisconsin Department of Natural Resources. Wisconsin Lakes - Little Lake Butte Des Morts [Internet]. [cited 2024 May 8]. Available from: <https://apps.dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=129800&page=facts>
5. PCALR. Selecting a Contractor for Lake Planning Grant Projects [Internet]. Polk County Association of Lakes and Rivers; 2006. Available from: chrome-extension://efaidnbnmnnibpcajpcglclefindmkaj/https://pcalr.lakekit.net/wp-content/uploads/sites/25/2011/12/ChoseContractorGuides.pdf
6. Lawrence P. Rozas, William E. Odum. Occupation of submerged aquatic vegetation by fishes: testing the roles of food and refuge. *Oecologia*. 1988 Oct;77:101–6.
7. Chris Kolasinski. Little Lake Butte des Morts Treatment Record. Wisconsin Department of Natural Resources Data Curator; 2024.
8. Strange, R. J. Nutrient Release and Community Metabolism Following Application of Herbicide to Macrophytes in Microcosms. *Journal of Applied Ecology*. 13(3):889–97.
9. Woodward, K.B., Rendle, D., David, S. and Hofstra, D. Nutrient release dynamics in relation to stages of *Lagarosiphon* major decay following treatment with diquat herbicide. *Hydrobiologia*. 2024;851(9):2205–14.

# **Appendix A Harvesting Lanes Map**

---



**FIGURE 6  
HARVESTING LANES MAP**

CITY OF NEENAH  
LITTLE LAKE BUTTE DES MORTS MANAGEMENT PROJECT  
WINNEBAGO COUNTY, WISCONSIN

Drawn: SLC 1/17/2025

Approved: KD 1/17/2025

Scale: AS SHOWN

Project Number: 2403578

Page 1 of 1



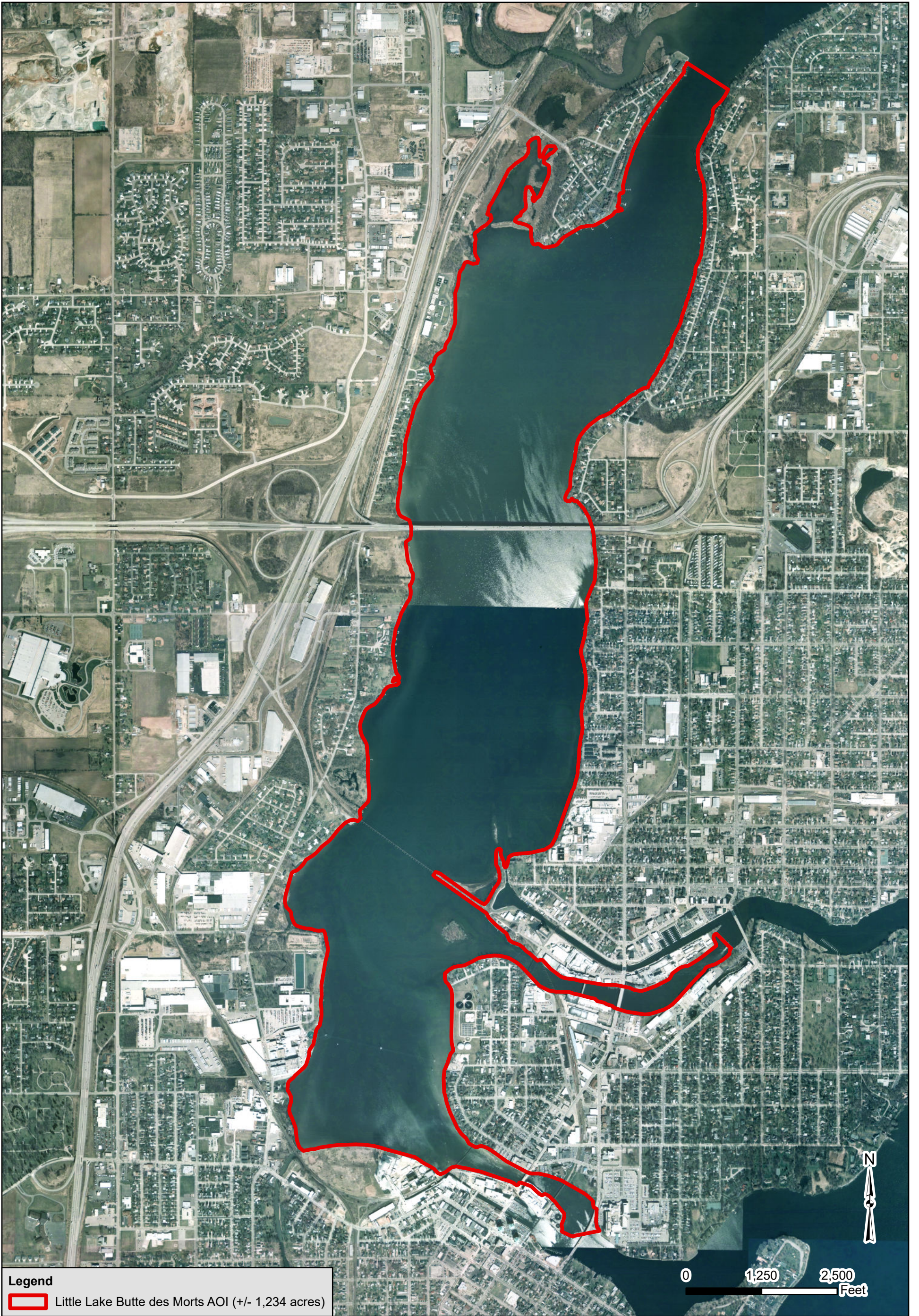
3159 Voyager Drive  
Green Bay, WI 54311  
www.geiconsultants.com


### Harvesting Lane Segments

Segment ID	Area (Acres)	Length (Feet)
A	0.42	372.5
B	0.54	473.8
C	1.23	1,076.2
D	1.50	1,303.2
E	0.87	755.4
F	1.01	884.2
G	1.52	1,324.8
H	1.23	1,068.5
I	1.11	964.2
J	1.20	1,043.7
K	1.04	907.7
L	2.06	1,792.4
M	0.21	183.0
<b>TOTAL</b>	<b>13.92</b>	<b>12,149.4</b>

# **Appendix B Aerial Imagery Review**

---



**Legend**  
 Little Lake Butte des Morts AOI (+/- 1,234 acres)


**GEI**   
 Consultants  
 3159 Voyager Drive  
 Green Bay, WI 54311  
 www.geiconsultants.com

**AERIAL IMAGERY REVIEW  
 WINNEBAGO COUNTY AERIAL IMAGERY  
 SPRING 2000**

CITY OF NEENAH  
 LITTLE LAKE BUTTE DES MORTS MANAGEMENT PROJECT  
 WINNEBAGO COUNTY, WISCONSIN

Drawn: SLC 1/13/2025
Approved: KD 1/13/2025
Scale: AS SHOWN
Project Number: 2403578
Page 1 of 11



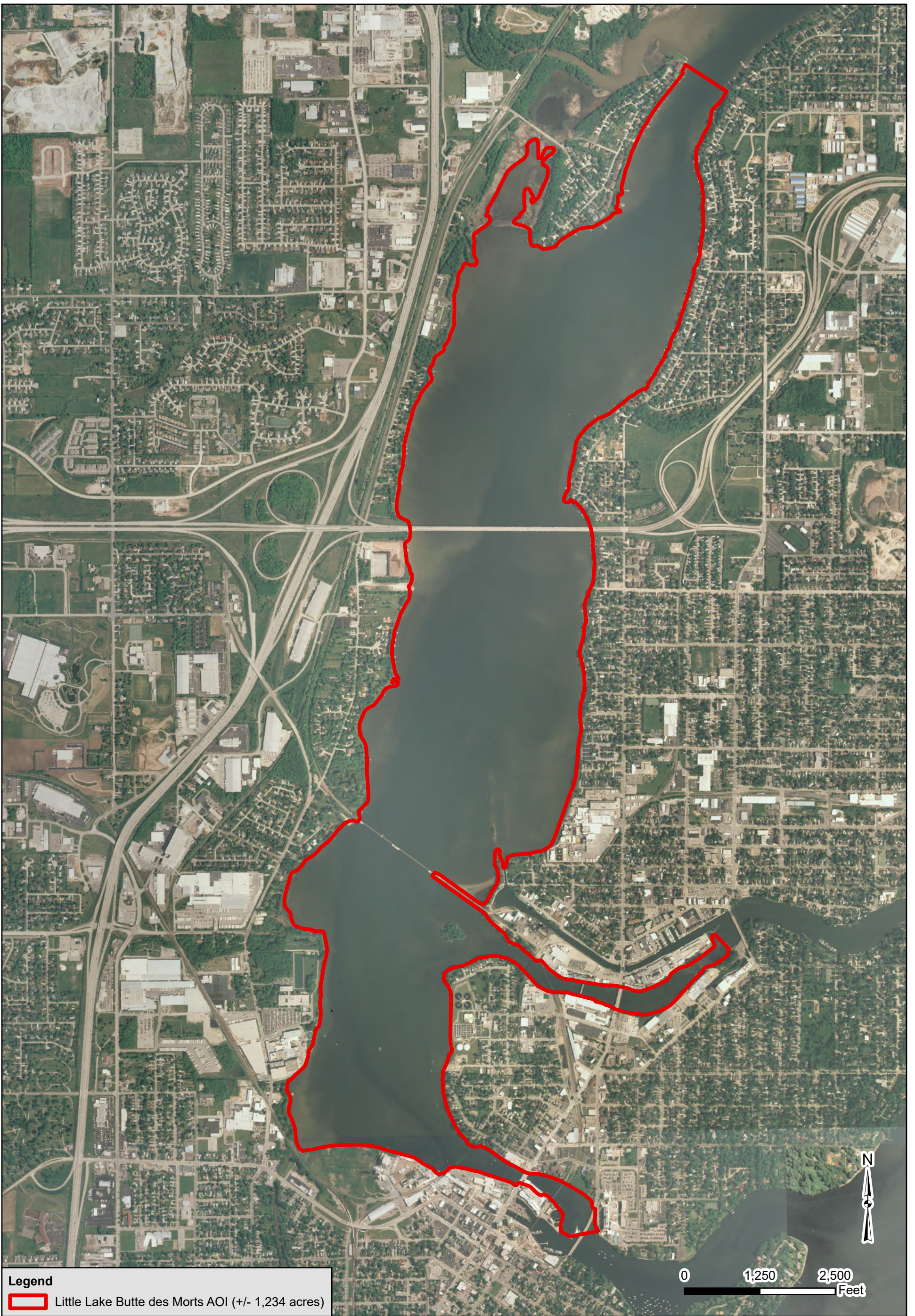
**Legend**  
 Little Lake Butte des Morts AOI (+/- 1,234 acres)


**GEI**   
 Consultants  
 3159 Voyager Drive  
 Green Bay, WI 54311  
 www.geiconsultants.com

**AERIAL IMAGERY REVIEW  
 WINNEBAGO COUNTY AERIAL IMAGERY  
 SPRING 2003**

CITY OF NEENAH  
 LITTLE LAKE BUTTE DES MORTS MANAGEMENT PROJECT  
 WINNEBAGO COUNTY, WISCONSIN

Drawn: SLC 1/13/2025
Approved: KD 1/13/2025
Scale: AS SHOWN
Project Number: 2403578
Page 2 of 11



**Legend**  
 Little Lake Butte des Morts AOI (+/- 1,234 acres)


**GEI**   
 Consultants  
 3159 Voyager Drive  
 Green Bay, WI 54311  
 www.geiconsultants.com

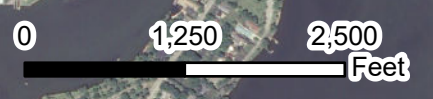
**AERIAL IMAGERY REVIEW  
 WDNR AERIAL IMAGERY  
 SUMMER 2005**

CITY OF NEENAH  
 LITTLE LAKE BUTTE DES MORTS MANAGEMENT PROJECT  
 WINNEBAGO COUNTY, WISCONSIN

Drawn: SLC 1/13/2025
Approved: KD 1/13/2025
Scale: AS SHOWN
Project Number: 2403578
Page 3 of 11



**Legend**  
 Little Lake Butte des Morts AOI (+/- 1,234 acres)

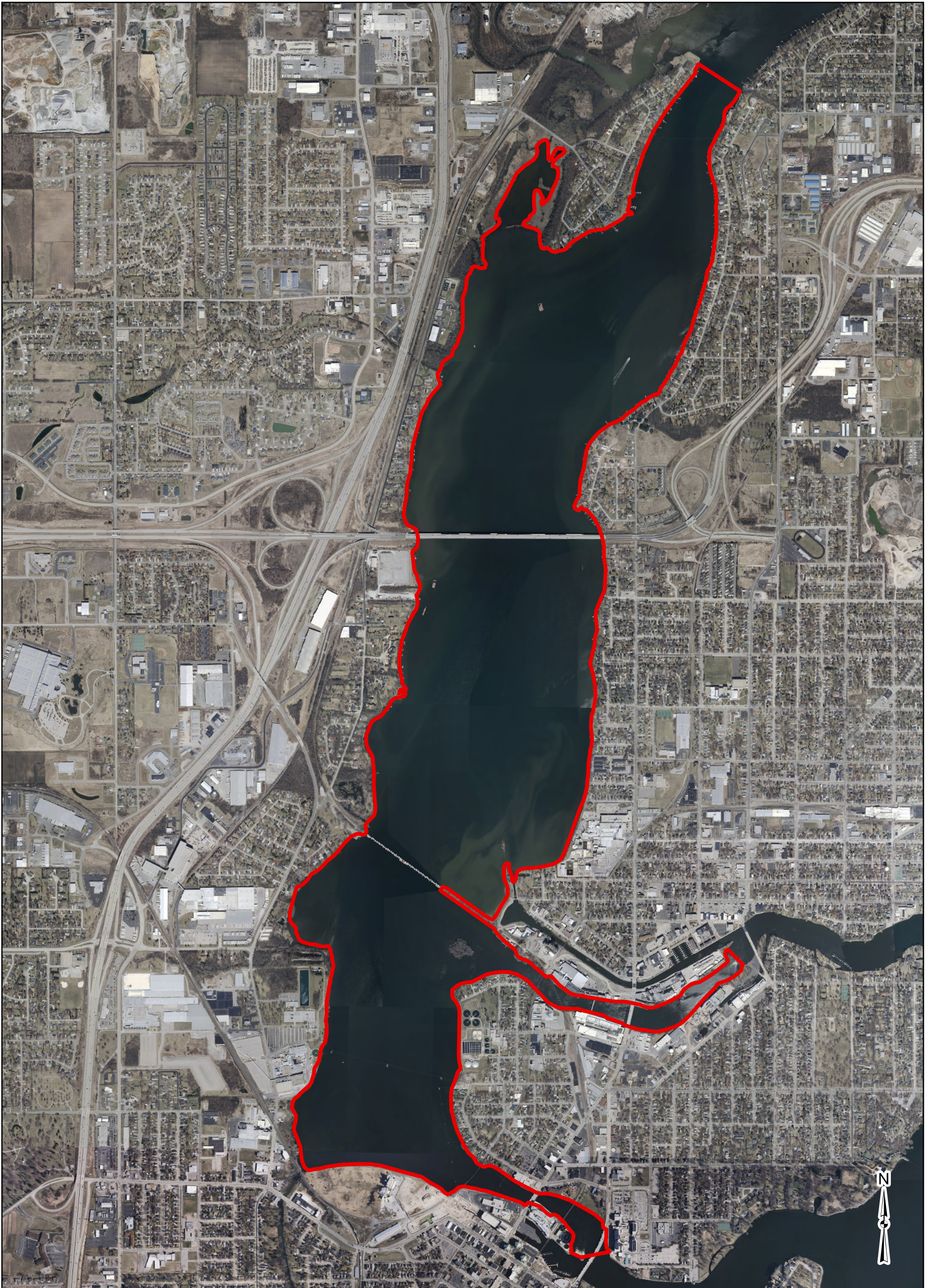



**GEI** Consultants  
 3159 Voyager Drive  
 Green Bay, WI 54311  
 www.geiconsultants.com

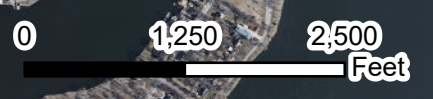
**AERIAL IMAGERY REVIEW  
 WDNR AERIAL IMAGERY  
 SUMMER 2008**

CITY OF NEENAH  
 LITTLE LAKE BUTTE DES MORTS MANAGEMENT PROJECT  
 WINNEBAGO COUNTY, WISCONSIN

Drawn: SLC 1/13/2025
Approved: KD 1/13/2025
Scale: AS SHOWN
Project Number: 2403578
Page 4 of 11



**Legend**  
 Little Lake Butte des Morts AOI (+/- 1,234 acres)

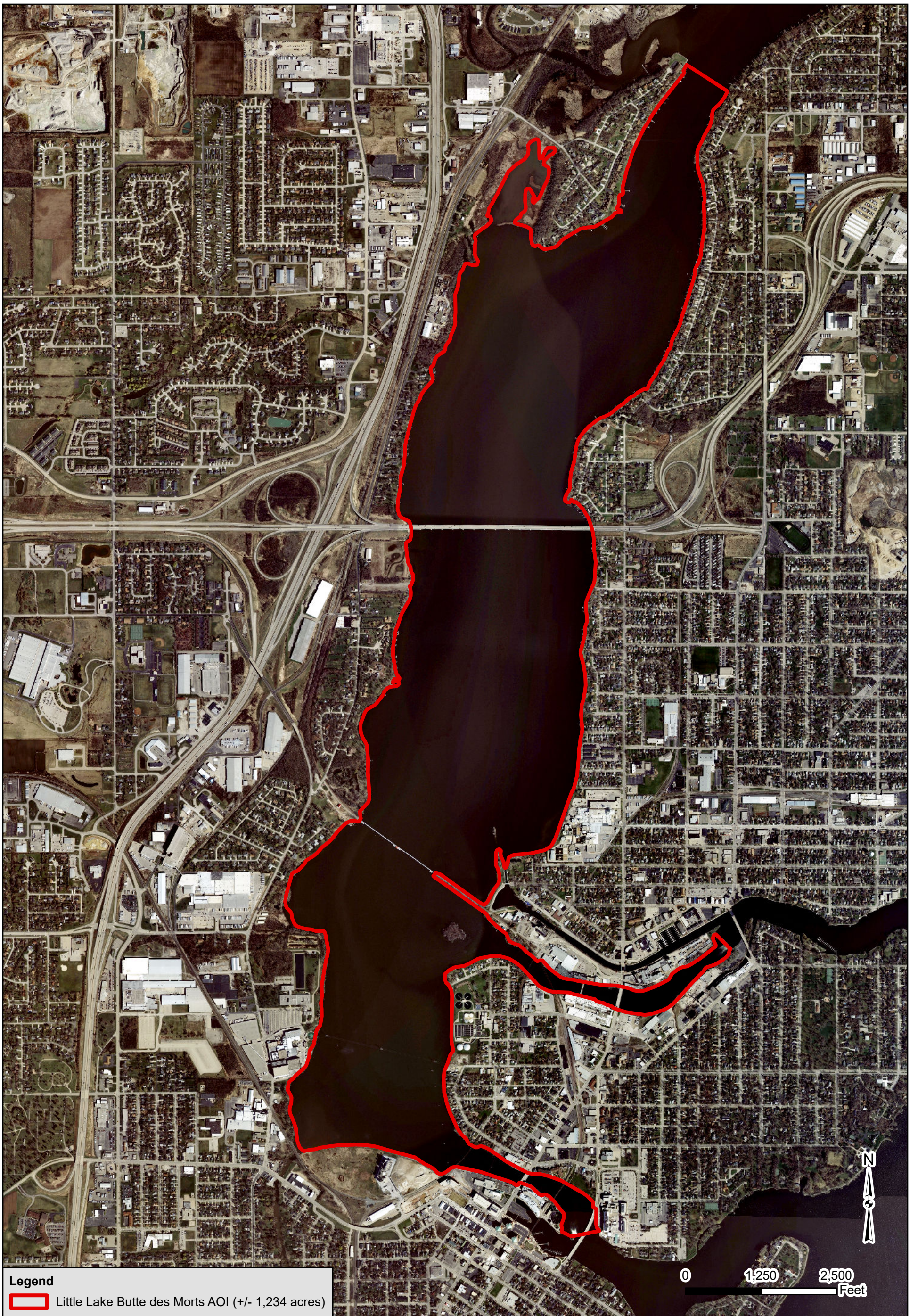



**GEI**   
 Consultants  
 3159 Voyager Drive  
 Green Bay, WI 54311  
 www.geiconsultants.com

**AERIAL IMAGERY REVIEW  
 WINNEBAGO COUNTY AERIAL IMAGERY  
 2009**

CITY OF NEENAH  
 LITTLE LAKE BUTTE DES MORTS MANAGEMENT PROJECT  
 WINNEBAGO COUNTY, WISCONSIN

Drawn: SLC 1/13/2025
Approved: KD 1/13/2025
Scale: AS SHOWN
Project Number: 2403578
Page 5 of 11



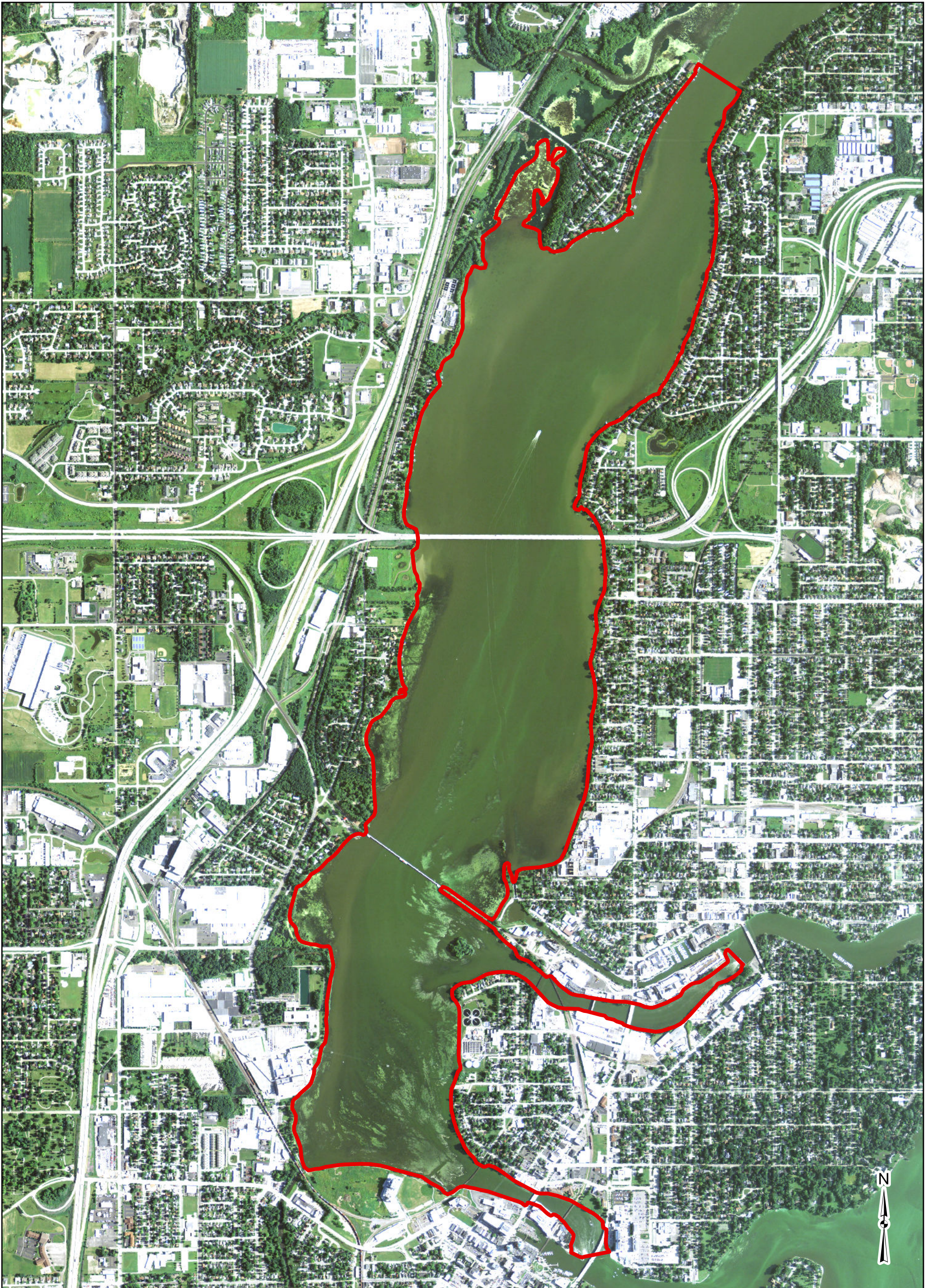
**Legend**  
 Little Lake Butte des Morts AOI (+/- 1,234 acres)


**GEI** Consultants  
 3159 Voyager Drive  
 Green Bay, WI 54311  
 www.geiconsultants.com

**AERIAL IMAGERY REVIEW  
 WDNR AERIAL IMAGERY  
 SPRING 2010**

CITY OF NEENAH  
 LITTLE LAKE BUTTE DES MORTS MANAGEMENT PROJECT  
 WINNEBAGO COUNTY, WISCONSIN

Drawn: SLC 1/13/2025
Approved: KD 1/13/2025
Scale: AS SHOWN
Project Number: 2403578
Page 6 of 11



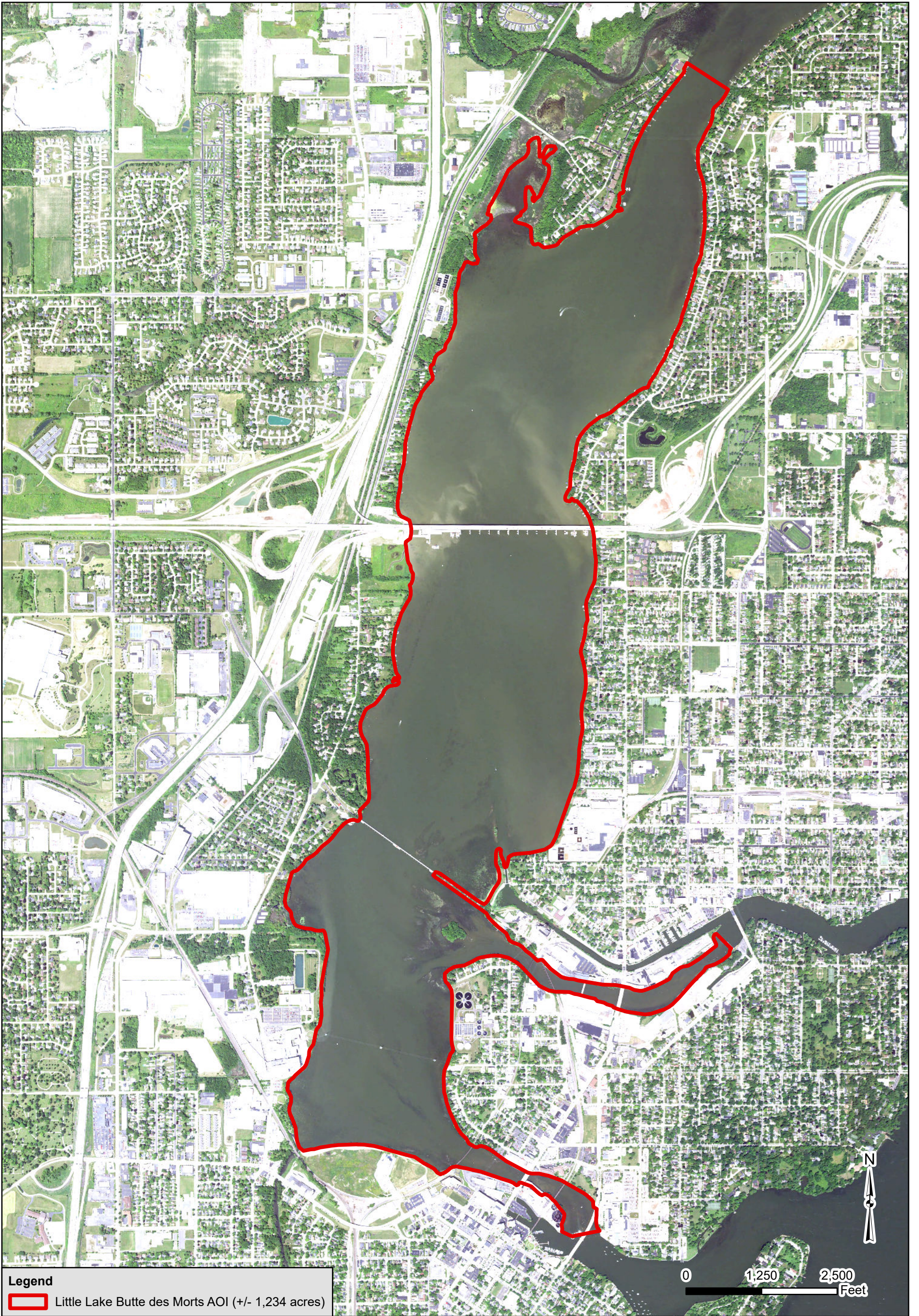
**Legend**  
 Little Lake Butte des Morts AOI (+/- 1,234 acres)


**GEI**   
 Consultants  
 3159 Voyager Drive  
 Green Bay, WI 54311  
 www.geiconsultants.com

**AERIAL IMAGERY REVIEW  
 WDNR AERIAL IMAGERY  
 SUMMER 2013**

CITY OF NEENAH  
 LITTLE LAKE BUTTE DES MORTS MANAGEMENT PROJECT  
 WINNEBAGO COUNTY, WISCONSIN

Drawn: SLC 1/13/2025
Approved: KD 1/13/2025
Scale: AS SHOWN
Project Number: 2403578
Page 7 of 11



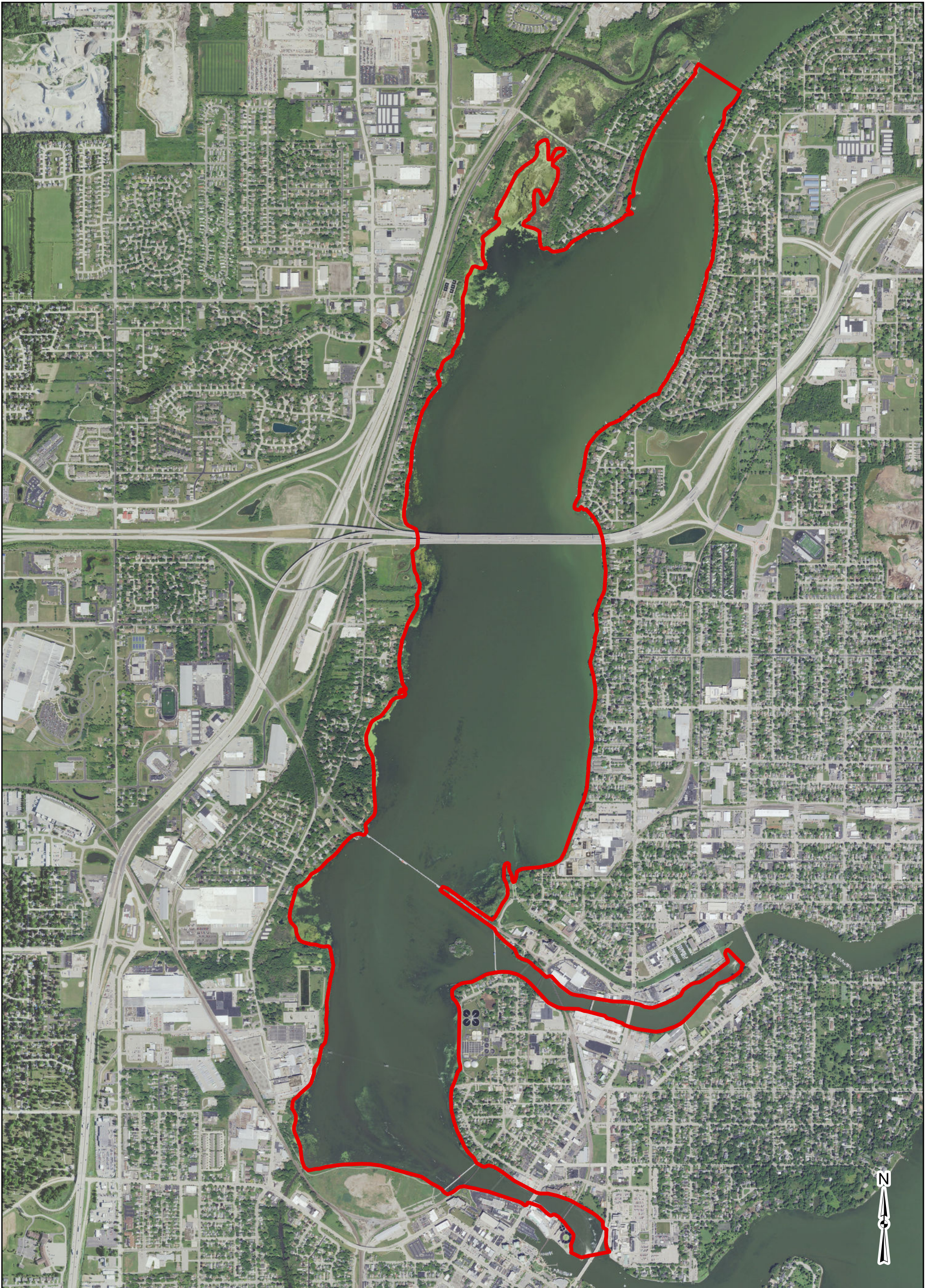
**Legend**  
 Little Lake Butte des Morts AOI (+/- 1,234 acres)


**GEI**   
 Consultants  
 3159 Voyager Drive  
 Green Bay, WI 54311  
 www.geiconsultants.com

**AERIAL IMAGERY REVIEW  
 WDNR AERIAL IMAGERY  
 SUMMER 2015**

CITY OF NEENAH  
 LITTLE LAKE BUTTE DES MORTS MANAGEMENT PROJECT  
 WINNEBAGO COUNTY, WISCONSIN

Drawn: SLC 1/13/2025
Approved: KD 1/13/2025
Scale: AS SHOWN
Project Number: 2403578
Page 8 of 11



**Legend**  
 Little Lake Butte des Morts AOI (+/- 1,234 acres)


**GEI**   
 Consultants  
 3159 Voyager Drive  
 Green Bay, WI 54311  
 www.geiconsultants.com

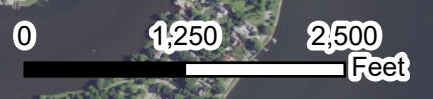
**AERIAL IMAGERY REVIEW  
 WDNR AERIAL IMAGERY  
 SUMMER 2020**

CITY OF NEENAH  
 LITTLE LAKE BUTTE DES MORTS MANAGEMENT PROJECT  
 WINNEBAGO COUNTY, WISCONSIN

Drawn: SLC 1/13/2025
Approved: KD 1/13/2025
Scale: AS SHOWN
Project Number: 2403578
Page 9 of 11



**Legend**  
 Little Lake Butte des Morts AOI (+/- 1,234 acres)

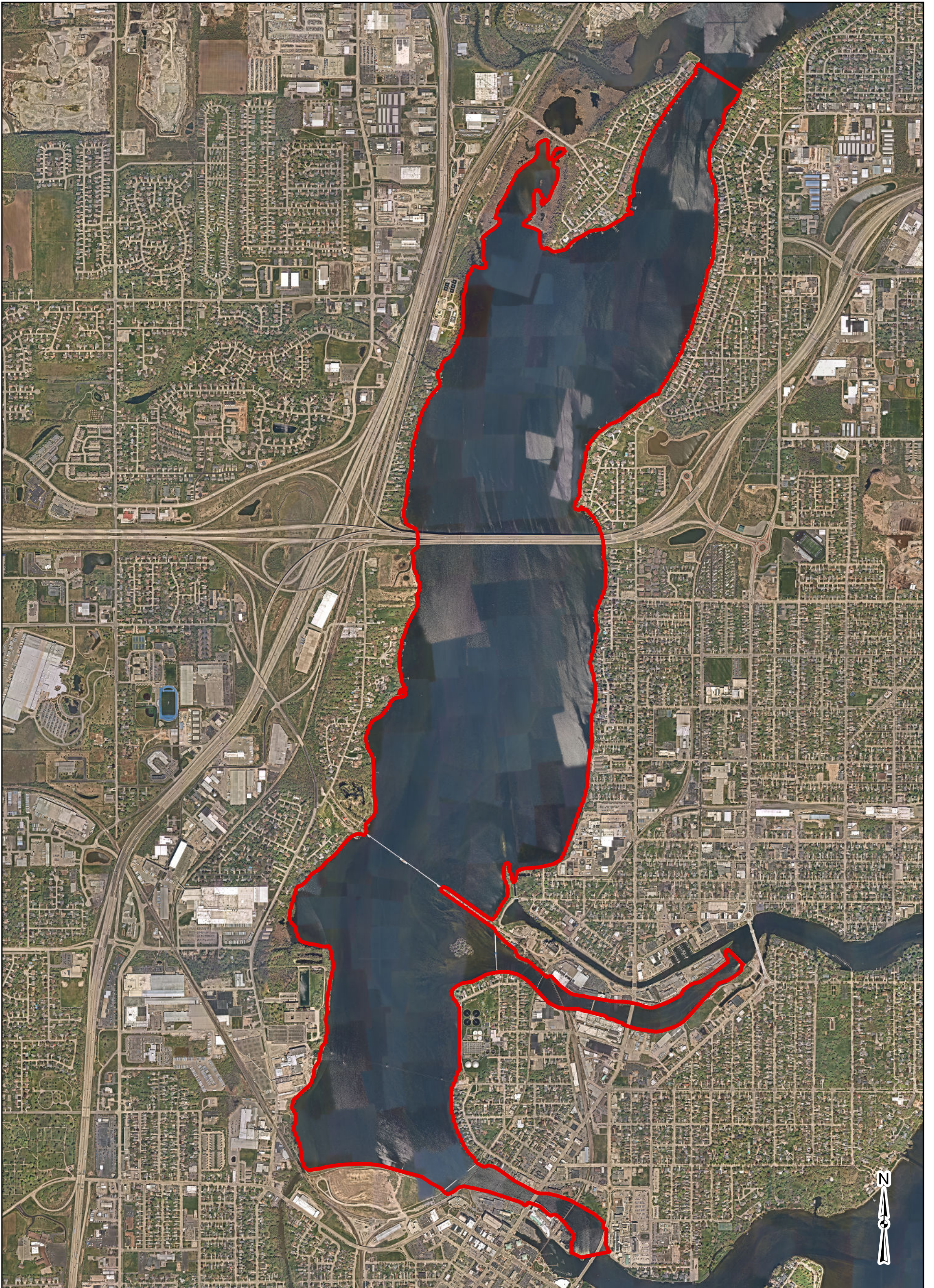




**GEI** Consultants  
 3159 Voyager Drive  
 Green Bay, WI 54311  
 www.geiconsultants.com

**AERIAL IMAGERY REVIEW  
 WDNR AERIAL IMAGERY  
 SUMMER 2022**

CITY OF NEENAH  
 LITTLE LAKE BUTTE DES MORTS MANAGEMENT PROJECT  
 WINNEBAGO COUNTY, WISCONSIN

Drawn: SLC 1/13/2025
Approved: KD 1/13/2025
Scale: AS SHOWN
Project Number: 2403578
Page 10 of 11



**Legend**  
 Little Lake Butte des Morts AOI (+/- 1,234 acres)



**GEI** Consultants  
 3159 Voyager Drive  
 Green Bay, WI 54311  
 www.geiconsultants.com

**AERIAL IMAGERY REVIEW  
 WINNEBAGO COUNTY AERIAL IMAGERY  
 2023**

CITY OF NEENAH  
 LITTLE LAKE BUTTE DES MORTS MANAGEMENT PROJECT  
 WINNEBAGO COUNTY, WISCONSIN

Drawn: SLC 1/13/2025
Approved: KD 1/13/2025
Scale: AS SHOWN
Project Number: 2403578
Page 11 of 11